Rexroth

OPTIFEED-FM
CLM1.4
Flying Cutoff

Functional Description: LM1-01VRS

DOK-CONTRL-CLM1.4LM1*1-FK01-EN-P

Rexroth Indramat

Title

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Type of Documentation

Functional Description

Document Typecode

DOK-CONTRL-CLM1.4LM1*1-FK01-EN-P

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Purpose of Documentation

This documentation describes the function of the firmware FWA-CLM1.4-LM1-01VRS-MS

- for description of all functional features

Record of Revisions

Description	Release Date	Notes
DOK-CONTROL-CLM1.4LM1*1-FK01-EN-P	07.02	First release

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1 System Setup

1.1 The CLM at a Glance

The CLM1.4 is a compact, modular control for flying processing applications that can be combined with maintenance-free dynamic Rexroth Indramat AC Servo drives to create an efficient and economical control and drive system.

Combined with maintenance-free, dynamic Rexroth Indramat 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.
- 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 1000 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 Indramat drives.

The CLM1.4 controls 2 axes:

- The first axis synchronizes itself to the material [velocity].
- The second axis is an auxiliary axis and can fulfill different purposes:
  - Analog output for velocity
  - Axis for shear tool
  - Feed-to-length pre-punch
  - Drive for profiling machine
  - Axis synchronous to Axis 1

1.2 Technical Data

Operating Modes:
- Parameter Input
- Manual
- Automatic

Control Characteristics:
- 2 axes
- units can be defined in mm, inches and degrees
- dimensions can be programmed as incremental or absolute
- preselection of velocity in ‰ of Vmax (Axis 2)
- maximum system and manual (jog) velocity programmable via parameters
- feed velocity programmable via the user program

Program Data:
- 1000 Instructions
- 3 NC Tasks
- Any number of subprograms, with nesting levels up to 127

Parallel Interfaces:
- 16 permanent inputs and 16 permanent outputs (system)
- 16 inputs and 16 outputs available (freely-programmable) in the user program
- Optionally, another 64 inputs (of which 8 are permanent and 56 are freely-programmable in the user program) and 32 outputs.

Important: The optional expansion of inputs/outputs (Option E) is required for 2-axis systems (see typecode).

Control Interface:
- Analog inputs +/- 10 V (12-bit resolution)
- 2 analog outputs +/- 10 V (14-bit resolution) - for controlling 2 servo drives

Data Interface:
- serial, RS232C or RS485
- freely-selectable baud rate and transmission format

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

Current Requirements:
- approx. 450 mA - for the CLM without no 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 Indramat 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 Data Storage

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 Functional Description

There are products for which continuous production is most efficient or which can only be continuously produced (e.g.: Rolled steel, welded pipes, particle board, extrusions, etc.).

However, many of these products cannot be rolled up. Therefore, they must be cut to production length immediately after manufacturing, to enable storage.

Because the material is constantly moving and stopping the machinery for cutting is not possible, the separating mechanism (saw, shear, punch, etc.) must be synchronized to the material velocity for the separation.

The moving material is scanned using a stationary measuring wheel with an incremental encoder. This incremental encoder transmits impulses to the CLM1.4 in proportion to the material length feeding through it.

When the desired material length has been fed through, the CLM accelerates the carriage to synchronize with the material speed. To achieve synchronous movement, the drive for the tool carriage must be a servo motor.

The servo motor also drives an incremental or an absolute encoder. With this encoder, the stroke of the tool carriage is detected from the CLM1.4. The microcomputer inside the CLM calculates the position difference between the desired processing location on the material and the actual tool location. In addition, it calculates the material velocity using the arriving impulses and includes this value in the calculation of the target velocity for the carriage. Any fine adjustment of the position to the exact processing location is not linked to the material velocity.

When synchronization is attained, the CLM1.4 initializes the processing of the material. For this purpose, 16 inputs and 16 outputs (optionally, 72 inputs, 48 outputs and Axis 2) are available in the CLM1.4, which are all user-programmable for processing functions.

After the material processing is completed, the carriage moves to its home position at maximum velocity. In the home position, the tool carriage stops without reaching a positive stop.

With this kind of position control, very precise tolerances can be met even at high material velocities.

1.5 System Overview

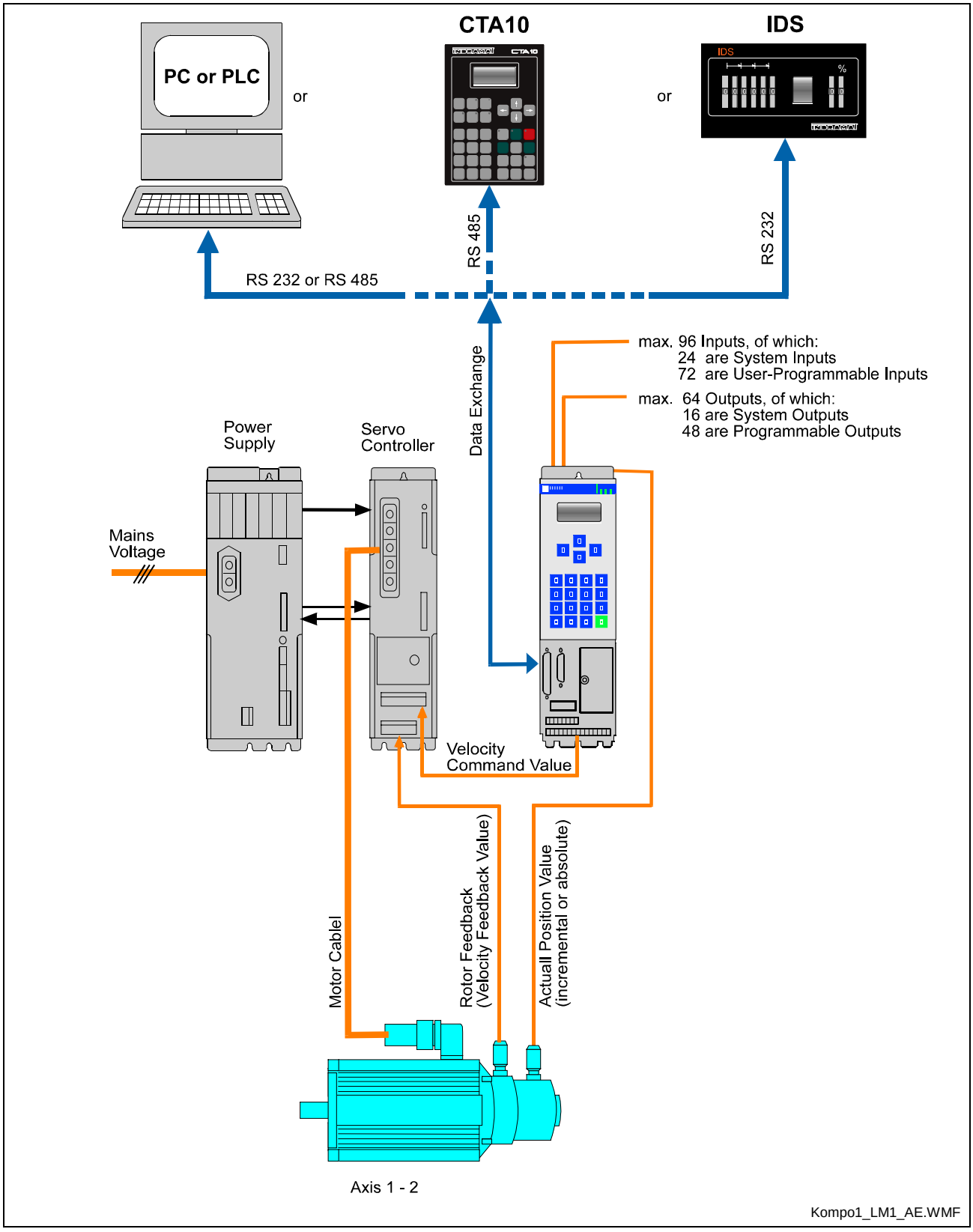


Fig. 1-1: System Overview

Notes

2 Important directions for use

2.1 Appropriate use

Introduction

Rexroth Indramat products represent state-of-the-art developments and manufacturing. They are tested prior to delivery to ensure operating safety and reliability.

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 Indramat, 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 Indramat 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

The CLM1.4-LM1 by Rexroth Indramat defines appropriate use as is designed for precision motion control of up to two axes.

Control and monitoring of (the) CLM1.4-LM1 may require additional sensors and actors.

Note: CLM1.4-LM1 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-LM1 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-LM1 has been developed for use in single or multiple-axis drives and control tasks.

Typical applications of CLM1.4-LM1 are:

- Flying Cutoffs
- Diagonal Saws

The CLM1.4-LM1 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-LM1 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-LM1 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 Indramat 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 Rexroth Indramat 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

- Rexroth Indramat GmbH 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 Indramat 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.

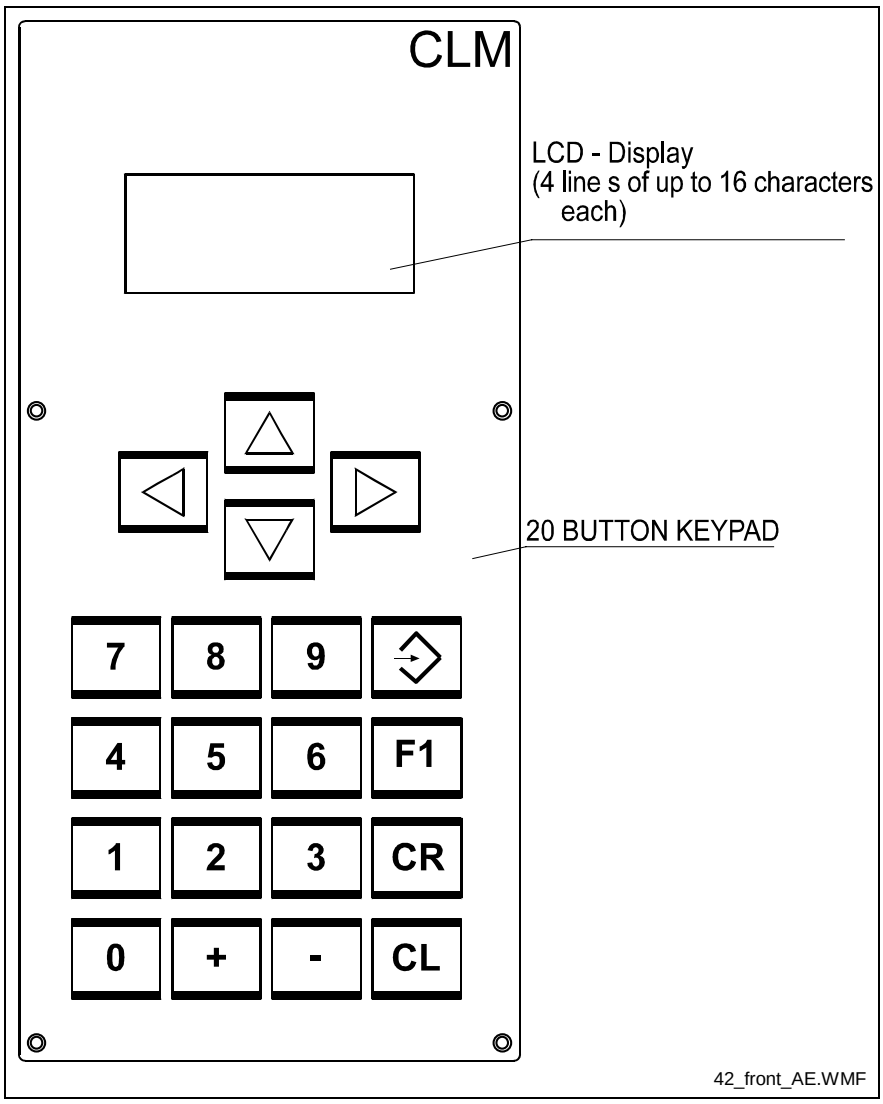


Fig. 4-1: Front Panel

CLM Display System

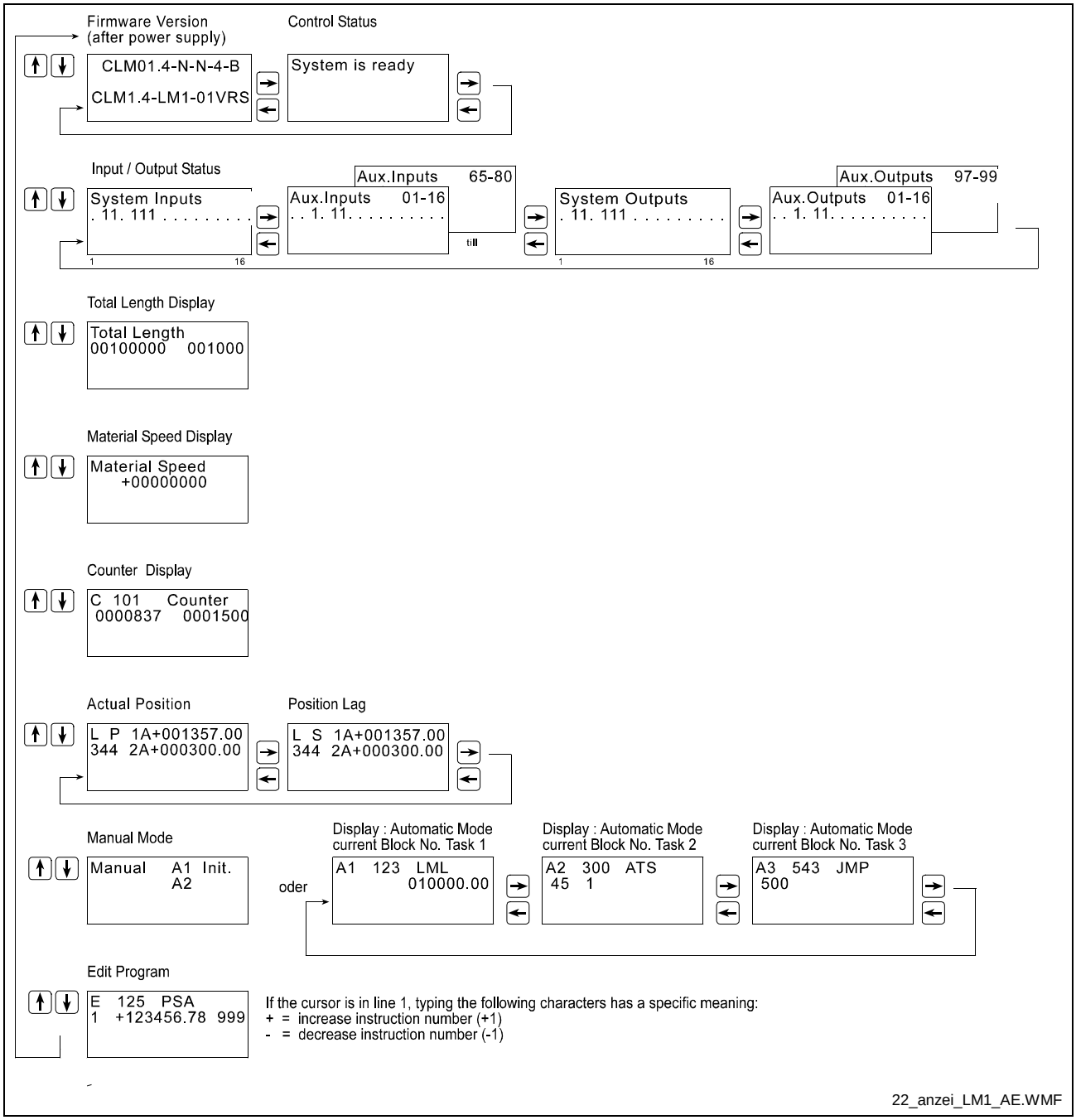


Fig. 4-2: Map of Display Screens

4.2 Description of the Input Keys

Data Entry Keys

0 to 9

These keys allow for the input of program 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 counter number or the parameter number can be quickly edited by ± 1.

Control Keys

CL

Errors can be cleared by pressing `Clear´.

CR

Each time this key is pressed, it moves the cursor back to the base position. Switching between the display modes is only possible from this base position by pressing △ or ▽.

In the display mode `Total Length´, Material Length Counter 2 can be cleared using this key.

◁ or ▷

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

△ or ▽

1. In the cursor's base position, these keys allow the user to switch between display modes.

2. Display Mode `Program Input´:
If the cursor is positioned after the command, the user can use these keys to scroll through the user commands.

Program Input: 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 instruction (current number + 1) is displayed.

0 and CL

If both keys are pressed simultaneously in Manual Mode, the CLM1.4 begins with Instruction 000 when a switch from Manual to Automatic occurs.

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

Operating Mode: Manual

1. CLM Firmware Version / Diagnostics
2. Program Input
3. Manual Mode
4. Display of the Deviation and Actual Length
5. Counter
6. Material Velocity
7. Total Length

Operating Mode: Automatic

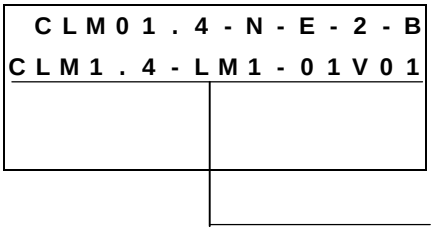
1. CLM Firmware Version / Diagnostics
2. Program Input
3. Automatic Mode
4. Display of the Deviation and Actual Length
5. Counter
6. Material Velocity
7. Total Length

After starting up the control or after clearing an error, the CLM either displays the firmware version or Parameter Input Mode is active (see Operating Mode). The display mode can be changed at any time. In order to do this, the cursor must be returned to the base position: first line, third position. This movement can be made by pressing ▷ and ◁, or, more simply, by pressing CR. Then the display mode can be changed by pressing △ or ▽.

For some display modes, no blinking cursor is shown. In such cases, the cursor is in its base position but it is not visible.

Firmware Version / Status Diagnostics

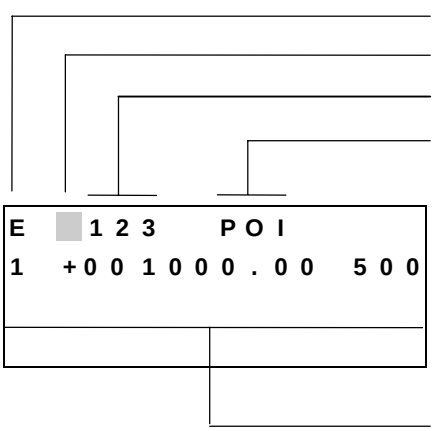
In this display, the user can switch to Status Diagnostics by pressing ▷ or ◁. The diagnostic depends on the operating mode and the status.



Hardware Designation

Firmware Designation

Program Input



Display Mode ‘Operating Mode´

Base Cursor Position

Program Instruction Number

User Command

Data that belongs to the displayed user command

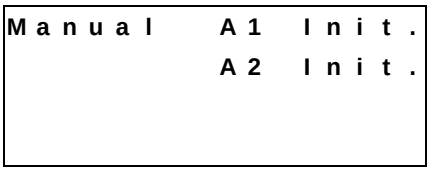
In this display mode, the user program can be changed via manual inputs on the keypad. By overwriting the instruction number, each program instruction between 000 and 999 can be retrieved and edited.

After the cursor has been returned to its base position by pressing ▷ or ◁, or, more simply, by pressing CR, the display mode can be changed again by pressing △ or ▽.

The ability to enter program data via the keypad can be disabled in Parameter 82.

Operating Modes

Manual



Display Mode ‘Manual Mode´

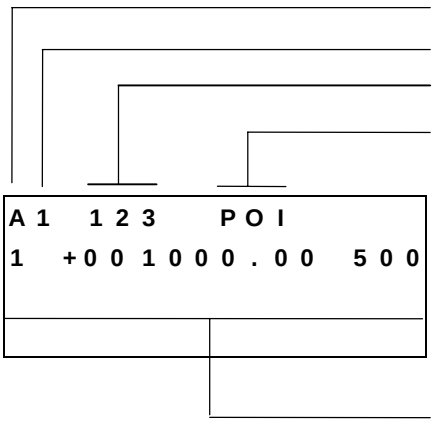
`Init.´

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 only after a homing operation.

`A1´ to `A2´ = Drive 1 to Drive 2

Individual drives are only shown if they are enabled. To accomplish this, the corresponding input `Enable´ (Connector 3/Pin 6 or Connector 12/Pin 28) must be set to +24V.

Automatic



Display Mode `Automatic´ in Automatic Mode

Program Task Number (1 to 3)

Current Program Instruction Number

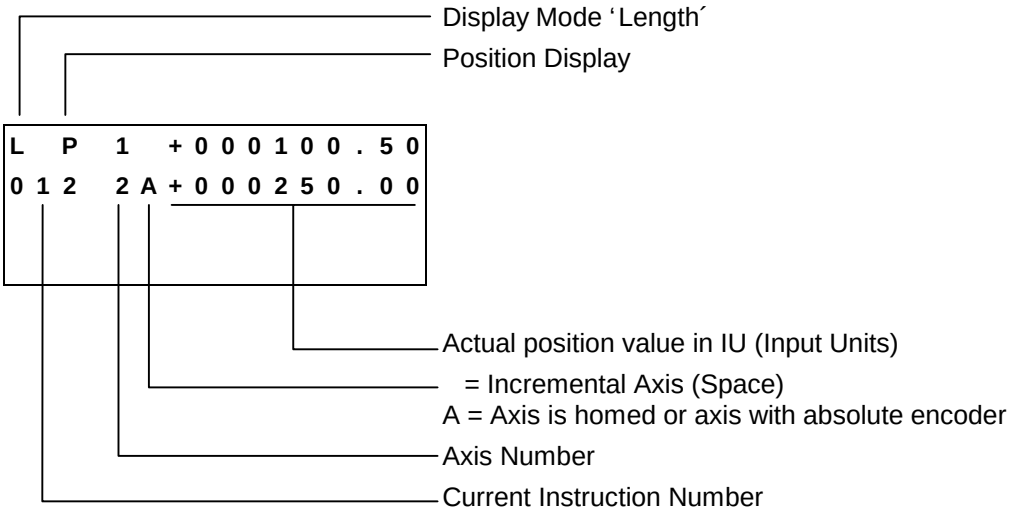
Current User Command

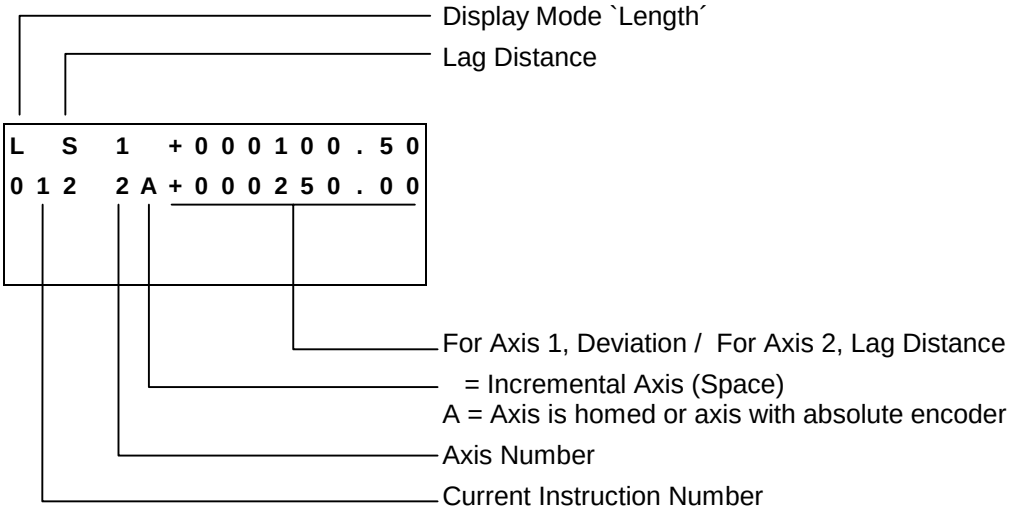
Data that belongs to the displayed user command

In this display mode, the program instruction that is currently being processed is displayed. By pressing ▷ or ◁, the task number can be varied. This way, the program instruction currently being processed can be displayed for each of the 3 possible program tasks.

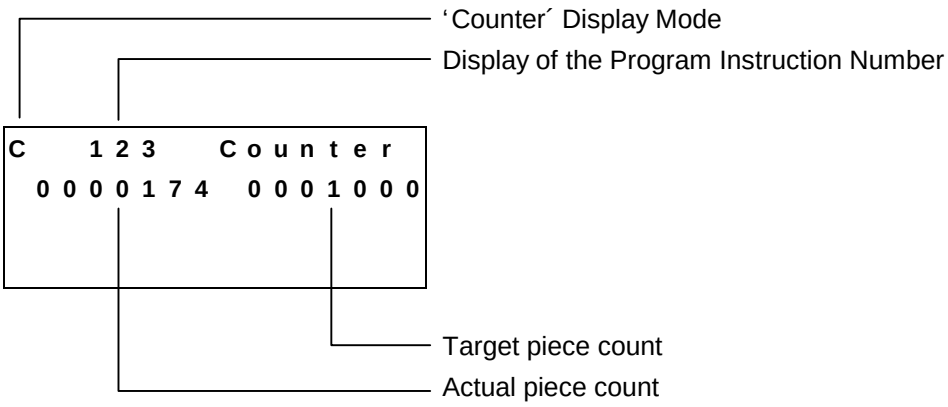
Actual Length Display

In this display mode, display of the deviation (difference between the processing tool and the processing location) or the current position can be selected by pressing ▷ or ◁.





Counter Display

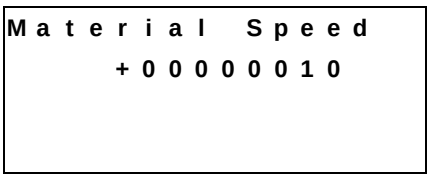


In this display mode, the current status of any programmed counter can be viewed. In the first line, an entry must be made to indicate which instruction has a programmed counter.

To achieve this, the cursor can be moved to the program instruction number by pressing ▷ or ◁ and then entering the desired number using 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 line.

When the cursor is in its base position, the user can leave this display mode. With the cursor in this position, the program instruction number can be increased or decreased in increments of 1 by pressing + or -.

Material Velocity

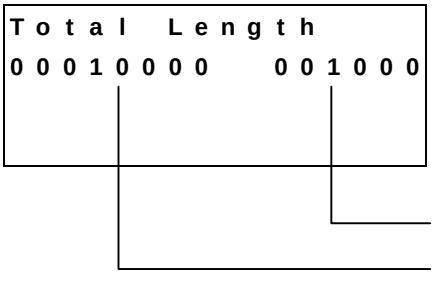


Current material velocity

In this display mode, the current material velocity is displayed. Using a multiplication factor of 1.0 (see Parameter 26), the material velocity is displayed in IU per second.

If `Test Mode´ is activated in Parameter 19, material feed is simulated. The material velocity can be increased or decreased in 32 steps up to the maximum velocity (Parameter 02) by pressing + or -. By pressing CL, the material velocity is immediately set to zero.

Total Length



Material Length 2 in 1000 input units

Material Length 1 in 1000 input units

In this display mode, the length of processed material can be viewed.

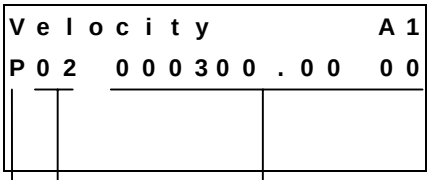
If production length measurement is activated in Parameter 26 and if the material has moved forward by 1000 input units in Automatic Mode, both material length counters are incremented by 1.

If material length measurement is activated in Parameter 26 and if the material has moved forward by 1000 input units in Manual or Automatic Mode, both material length counters are incremented by 1.

Material Length Counter 1 cannot be cleared.

Material Length Counter 2 can be cleared in this display mode by pressing CR or using a control command via the serial interface.

Parameter Input



Parameter Designation in Plain Text

Parameter Data

Parameter Number

Display Mode ‘Parameter Input´

This display mode is available only in the operating mode `Parameter´.

Here, all rating data of a system is input in parameters. This display mode can only be exited by changing the operating mode.

The input of parameters is described in the chapter entitled `Parameters´.

Notes

5 Writing the User Program

5.1 Overview of All User Commands

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 1000 program instructions or commands. Only one command is stored within each program instruction.

In programming, any three-digit program number between `000´ and `999´ is allowed.

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

In both cases, programming 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 has a duration of 2 - 4 ms.

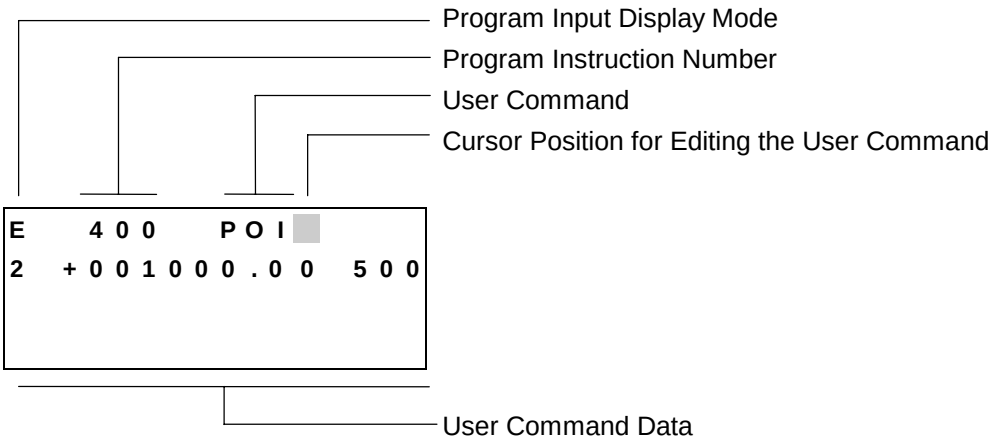
After that, the instruction with the next higher sequence number is processed (unless a jump instruction is given). In the descriptions that follow, this action is called `proceed immediately to next instruction´.

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

5.3 Program Entry

Entry via the Keypad

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



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

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

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

While entering the instruction number, the command assigned to the number is displayed. After entering 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 second row by pressing ▷ or ◁. Here, the data for the command is entered 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 Save ⏎ key.

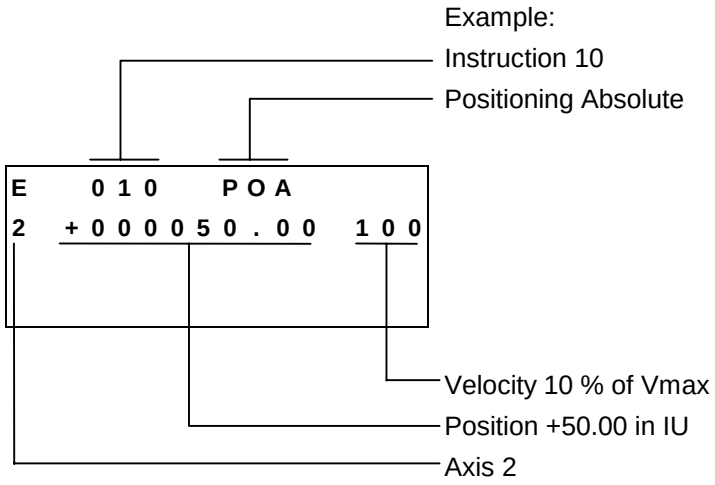
After pressing the Save key ⏎, the information is saved. Then, the next program instruction (+1) is displayed and the cursor is placed after the command.

Cursor Movement

Pressing CR moves the cursor back to its base position.

Advancing to the Next Instruction

As long as the cursor is in the first row, the instruction number can be changed by pressing + and -.



For each command, a predefined input mask is filled in 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 entered is not accepted.

By pressing △ and ▽, the user can change to a different display. To accomplish this, the cursor must be at its base position.

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 80 and 81 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

After a switch from `Manual´ to `Automatic´ Mode, the CLM begins in **the old length instruction minus 1** (`LML´, `LMD´, `LMK´, `LMI´ or `LMR´ command). If it is to begin in program instruction 000, the 0 and CL keys must first be pressed in `Manual´ Mode, the control command `! CL0´ must be issued via the serial interface, or a signal must be applied at the input `Select Start Instruction of the User Program´ (see Parameter 26).

Note: The program only starts when Axis 1 is homed and is located in the home position. If this is not ensured during a switch from `Manual´ to `Automatic´, the Error `Axis 1 not homed´ or `Not homeposition´ is displayed (Exception: Passive Homing, see the chapter entitled `Homing´).

5.5 Programming Example

The CLM programming structure is intentionally modular. With any combination of instructions, solutions can be found for a variety of situations.

For normal flying cutoff operations, a 5-instruction routine can be used. See the following example:

```
000   NOP
001   LML    001000.00
002   JSR    700
003   STZ    +0000000   0000500
004   NOP
005   NOP
006   LML    005000.00
007   JSR    700
008   STZ    +0000000   0000200
009   NOP
etc.
```

Instructions 000 to 004 make up Cutoff Program 1.

Instructions 005 to 009 make up Cutoff Program 2.

etc.

The `NOP´ in the first instruction of the 5-instruction group 000 (005, 010, etc.) is a placeholder. Here, the subroutine with different start requirements can be entered at any time.

In the second instruction of the 5-instruction group 001 (006, 011, etc.), the `LML´ command determines the production length.

Then, the cutoff program follows in the third instruction of the 5-instruction group 002 (007, 012, etc.).

Detection of the piece count is in the fourth instruction of the 5-instruction group 003 (008, 013, etc.). After counting occurs, there is always a jump back by 3, until the preselected piece count is reached (valid only for the `STZ´ command). Then, it goes to the last instruction within the 5-instruction group.

The `NOP´ in the fifth instruction of the 5-instruction group 004 (009, 014, etc.) has the same function as in the first instruction of the 5-instruction group 000 (005, 010, etc.). Here, also, a subroutine with queries for certain requirements can be inserted here at any time.

See also the programming example on the following page.

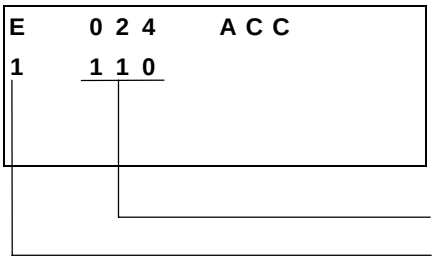
CLM Programming Example

Program Lines	Comment
	Product 1
000 NOP	
001 LML 001000.00	Production length
002 JSR 700	Cutoff program
003 STZ +0000000 0000050	Piece count
004 NOP	
	Product 2
005 NOP	
006 LML 002000.00	Production length
007 JSR 700	Cutoff program
008 STZ +0000000 0000010	Piece count
009 NOP	
	Product 3
010 NOP	
011 LML 003000.00	Production length
012 JSR 700	Cutoff program
013 STZ +0000000 0000010	Piece count
014 NOP	
etc.	
	Cutoff program
700 WAI 00.05	Recovery Time
701 JSR 710	Minimum cutoff stroke
702 JSR 730	Processing
703 JSR 720	Minimum carriage stroke
704 EOS	End of cut process
705 RTS	
710 PST 1 50 +001000.00	Minimum cutoff stroke
711 BCA 710 50 1	
712 RTS	
720 PST 1 50 +002000.00	Minimum carriage stroke
721 BCA 720 50 1	
722 RTS	
730 ???	Processing
. ???	
. ???	
. ???	
. RTS	

Fig. 5-1: Programming Example

5.6 Description of Commands

ACC - Acceleration Change



Acceleration in ‰ of the value programmed in Parameter 44

Axis: 2 only

The new override acceleration value is transferred as soon as any positioning move in process has been completed.

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

After switching from Automatic to Manual Mode, after an error or re-start, the valid acceleration value is always equal to the value programmed in Parameter 44.

Example of how to change the acceleration value:

800	ACC	2 999	- Set acceleration to 100%
801	POI	2 +000200.00 999	- Position, then proceed immediately to next instruction
802	ACC	2 500	- Reduce acceleration to 50%
803	ATS	15 1	- Wait until position is reached
804	WAI	00.10	- Wait until drive unit is stabilized
805	PSI	2 +000300.00 999	- Positioning at 50% acceleration without proceeding to next instruction
806	WAI	02.00	- Wait 2 seconds
807	JMP	800	- Repeat programs

Fig. 5-2: Example of Programming an Acceleration Change

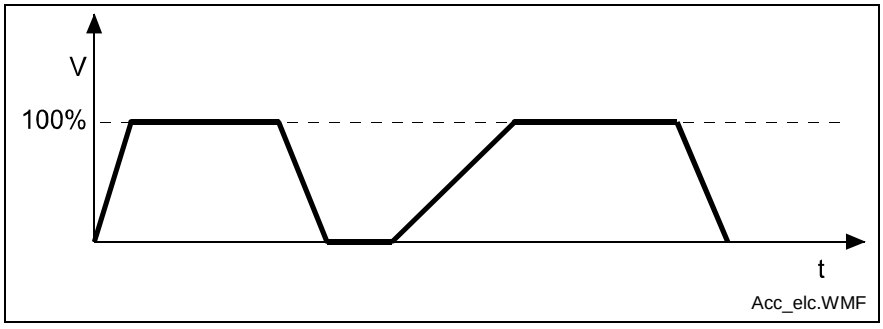
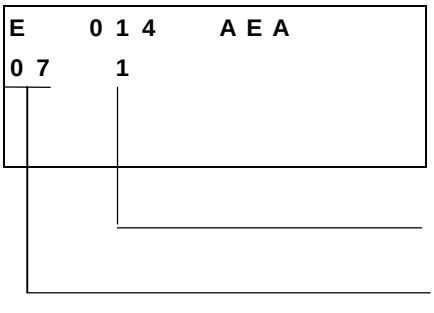


Fig. 5-3: Example Showing Acceleration Change

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

AEA - Auxiliary Output ON/OFF



This command affects the status of the output. Each output from No. 01 to 88 and from 97 to 99 can be enabled/disabled.

Outputs 01 to 16 are part of every type of CLM hardware and can be set by the user.
Outputs 17 to 48 are only available for `Option E´.
All outputs (01 to 99) can be used as marker flags.

Outputs 01 to 72 are cleared after a re-start and after an error.

Outputs 73 to 80 are cleared only when restarting the system.

Outputs 81 to 88 are not automatically cleared, even when a power loss occurs.

Outputs 89 to 96 are processed by the firmware and can only be queried by the user!

Output 89 = `1´ in Manual Mode
Output 90 = `1´ in Automatic Mode
Output 91 = `0´ (reserved)
Output 92 = `0´ (reserved)
Output 93 = `0´ (reserved)
Output 94 = `0´ for errors
Output 95 = `0´ (reserved)
Output 96 = `0´ (reserved)

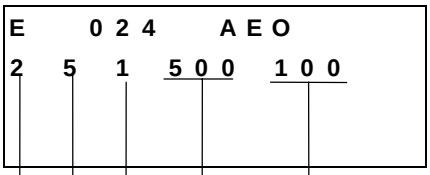
All outputs from 97 to 99 can be edited by the user. They are cleared when a loss of power occurs.

Marker flag 99 can be set by the program and, thus, produces an interrupt, (see Parameter 54).

Output 97 = User-Programmable
Output 98 = User-Programmable
Output 99 = `1´ Causes interrupt at Axis 2

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

AEO - Acceleration Override



Limiting the acceleration and deceleration to a minimum value in promille of Parameter 44 (000 to 999)

Scaling Factor: 000 to 999

Override Update:
1 = Read override value only once when this command is invoked

Override Default Value Settings:
0 = Disable override
5 = Measuring wheel value

Axis: 2 only

With this command, the acceleration of Axis 2 can be changed via the measuring wheel pulse frequency.

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 soon as any positioning move in process has been completed.

The new acceleration via the override is calculated as follows:

Acceleration [IU/s^2] =

$$Parameter\,44 \times \frac{(Meas.Wh.Velocity[IU/s])^2}{(Parameter\,42)^2} \times \frac{Scaling\,Factor}{1000}$$

L: IU = Input Units

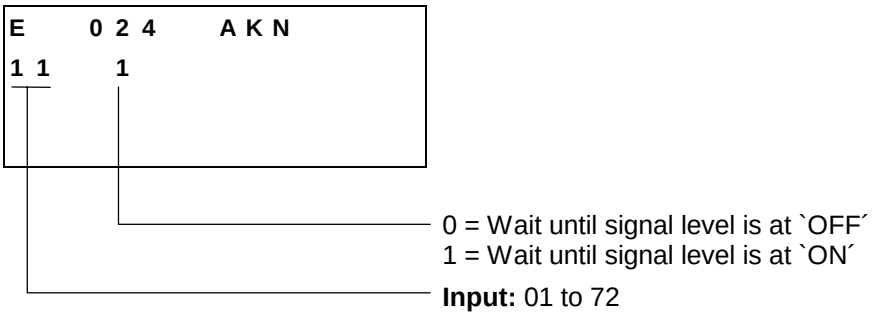
Fig. 5-4: Acceleration Override

Notes: If 999 is entered as the scaling factor, 1000 is used for the internal calculation.

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

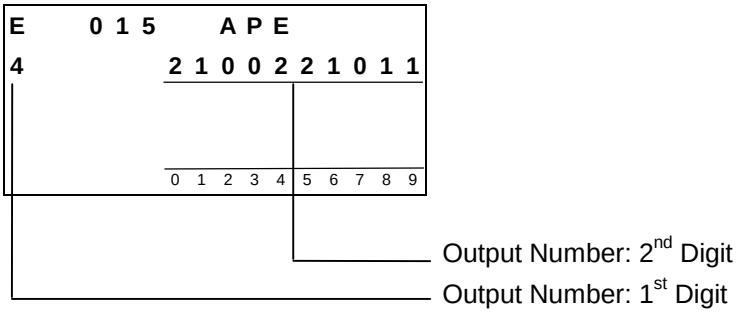
The program proceeds to the next instruction following the time period of one cycle.

AKN - Acknowledge Input



This is where the status of the programmed input is verified. The program proceeds to the next instruction as soon as the input takes on the desired status.

APE - Parallel Output ON/OFF



This command represents an extension of the `AEA´ command. It can be used to switch 10 CLM outputs simultaneously. At the same time, each of the 10 outputs can be controlled independently.

Three different conditions are possible:

0 = The output is set to the OFF signal level
1 = The output is set to the ON signal level
2 = The status of the output remains unchanged

The output number is determined as follows:

Output Number = (1st digit * 10) + (2nd digit)

Any output between 01 and 99 can therefore be accessed.

Example a):

008_APE_4_ _ _ _ _	**2**	**1**	**0**	**0**	**2**	**2**	**1**	**0**	**1**	**1**
	0	1	2	3	4	5	6	7	8	9
Output Number	40	41	42	43	44	45	46	47	48	49

Outputs 42, 43 and 47 are set to `OFF´.
Outputs 41, 46, 48 and 49 set to `ON´.
Outputs 40, 44 and 45 are not changed.

Example b):

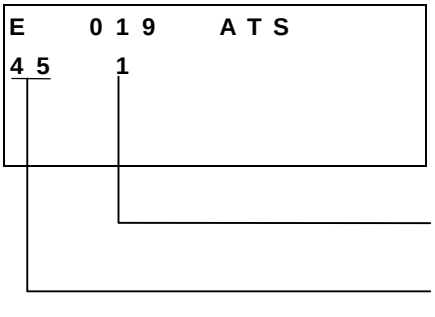
008_APE_0_ _ _ _ _	1	1	1	1	0	0	0	2	2	2
	0	1	2	3	4	5	6	7	8	9
Output Number	00	01	02	03	04	05	06	07	08	09

Outputs 04, 05 and 06 are set to `OFF´.
Outputs 01, 02 and 03 are set to `ON´.
Outputs 07, 08 and 09 are not changed.

Note: The outputs are numbered beginning with 01. Any entry for output 00 is therefore meaningless and is ignored**.**

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

ATS - Acknowledge Output Status



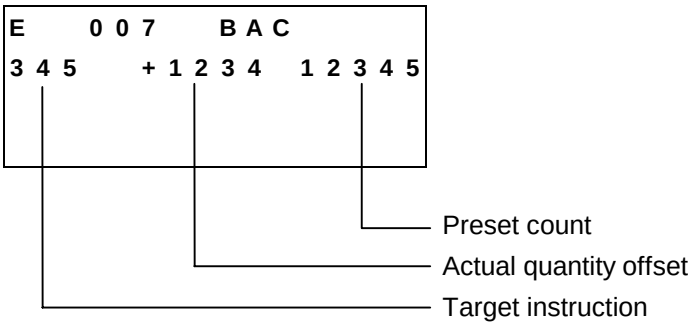
0 = The output is checked to see if it is `OFF´.
1 = The output is checked to see if it is `ON´.

Number of the output to be checked

The status of the output programmed here is queried. The program proceeds to the next instruction if the condition is true.

All outputs from 01 to 99 can be queried. For Output 17 and beyond (or 49 for `Option E´) all outputs are used as marker flags, because they do not exist in the hardware.

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.

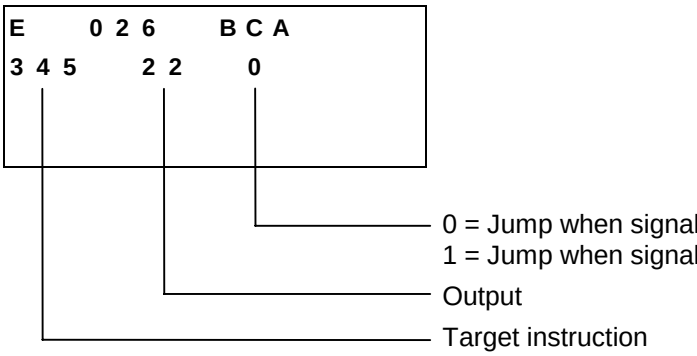
Example: Count following the event

```
000     NOP
001     LML              001000.00
002     JSR     800
003     BAC     001  +0000  00010
004     . . .    . .
```

After 10 processing operations, the CLM continues the program at instruction number 004.

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

BCA - Branch Conditional on Acknowledgment

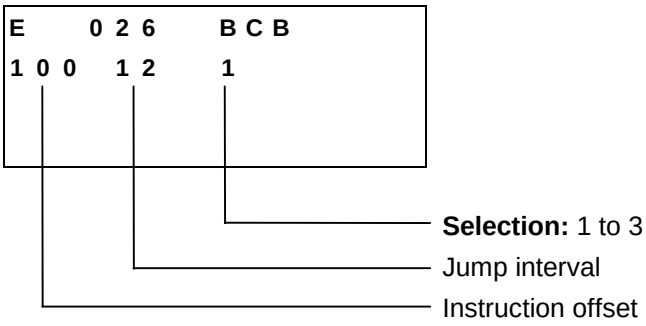


The jump is executed if the programmed output has met the preselected condition.

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.

BCB - Binary Conditional Branch (Inputs)



The command is valid only for inputs 1 to 4 or 1 to 8.

With this command, a jump is executed to a target instruction calculated from the states of several inputs. Three different options can be selected.

Selection 1 =	Input Number	:	4	3	2	1			
	Binary Value	:	2^3	2^2	2^1	2^0			
	Decimal Value	:	8	4	2	1			
Selection 2 =	Input Number	:	8	7	6	5			
	Binary Value	:	2^3	2^2	2^1	2^0			
	Decimal Value	:	8	4	2	1			
Selection 3 =	Input Number	:	8	7	6	5	4	3	2	1
	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

In processing this command, the target instruction is calculated as follows, depending on the current status of the inputs:

$$Target\ Instruction = Instr.Offset + (Value \times Jump\ Interval)$$

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

Selecting 1 or 2 provides 16 different jump destinations, and selecting 3 provides 256 different jump destinations.

If a target location of >999 is produced, the error message ‘Invalid Block #´ is generated.

Examples:

Input	:	8	7	6	5	4	3	2	1
Current Status	:	0	1	0	1	1	0	0	1

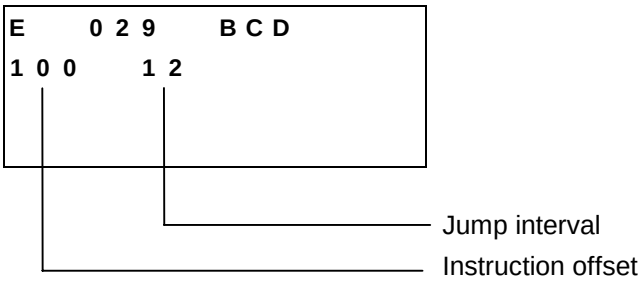
1) Entry : BCB 0100 12 1
Current Status : (8 + 0 + 0 + 1) = 9
Target Instruction : 9 * 12 + 100 = 208

2) Entry : BCB 0200 15 2
Current Status : (0 + 4 + 0 + 1) = 5
Target Instruction : 5 * 15 + 200 = 275

3) Entry : BCB 0300 10 3
Current Status : (0 + 64 + 0 + 16 + 8 + 0 + 0 + 1)= 89
Target Instruction : 89 * 10 + 300 = 1190
➔ Error Message `Invalid Block #´

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

BCD - BCD Conditional Branch



Like the `BCB´ command, this command executes a jump to a calculated target instruction. However, weighting of the BCD-encoded digits is handled via inputs 1 to 8.

The status at inputs 8 to 5 is considered the first digit, and at inputs 4 to 1 the second digit. Since the decimal system uses only the digits 0 to 9, a value of greater than 9 results in the error message `BCD Input Error´.

Input	:	8	7	6	5	4	3	2	1
Decimal value	:	80	40	20	10	8	4	2	1

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

Fig. 5-6: Calculation of Target Instruction with BCD Output Logic

Any number of programs can be stored at the target locations. A total of 100 jump destinations are possible. A jump destination of >999 results in the error message ‘Invalid Block #´.

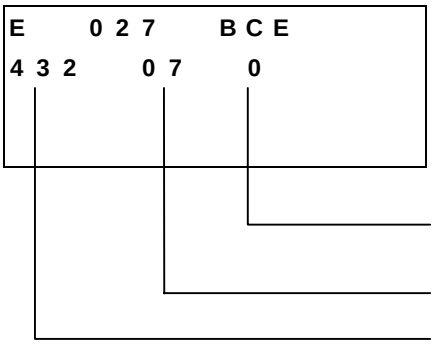
Examples:

Entry	:	BCD 0100 12							
Input	:	8	7	6	5	4	3	2	1
Decimal Value	:	80	40	20	10	8	4	2	1
1) Current Status	:	0	0	0	0	0	0	0	0
Target Instruction:		100 + (0 * 12)							= 100
2) Current Status	:	0	0	0	0	0	0	0	1
Target Instruction:		100 + (1 * 12)							= 112
3) Current Status	:	0	1	0	1	1	0	0	1
Target Instruction:		100 + ((40+10+8+1) * 12)							= 808

Note: The sums of the values present at inputs 1 to 4 and 5 to 8 must not exceed the values of 9 and 90, respectively. Otherwise, the error message `BCD Input Error´ is generated.

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

BCE - Branch Conditional on Input



0 = Jump when signal level indicates `OFF´
1 = Jump when signal level indicates `ON´

Input

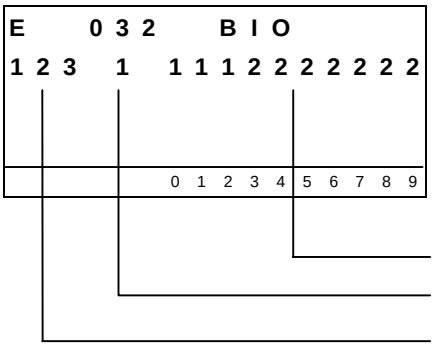
Target Instruction

The jump is executed if the programmed input 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.

BIO - Branch by Input/Output Compare



Input Number: 2nd Digit

Input Number: 1st Digit

Target Instruction

With this command, the program checks to see that the state of the inputs labeled with a `1´ is `ON´ and those labeled with a `0´ is `OFF´. At the same time, outputs with the same numbers are also checked to see if their status is `1´ or `0´.

Inputs or outputs labeled with `2´ are not checked.

The jump to the target location is executed when the entire condition has been met. If this is not the case, the program proceeds to the next instruction.

Example:

032_BIO_123_1_	**1**	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**2**	**2**
	0	1	2	3	4	5	6	7	8	9
Input Number	10	11	12	13	14	15	16	17	18	19
Output Number	10	11	12	13	14	15	16	17	18	19

Inputs and outputs numbered 10 to 17 are checked.

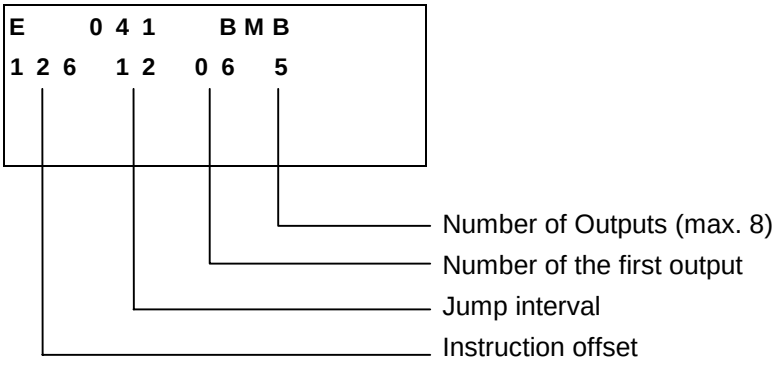
Input/Output No.	:	10	11	12	13	14	15	16	17	18	19
Condition	:	1	1	1	1	0	0	0	0	2	2
Output Status	:	1	0	1	0	0	0	1	1	not	
Input Status	:	1	0	0	1	0	1	0	1	checked	
Condition	:	X	-	-	-	X	-	-	-		

X = the condition has been met
\- = the condition has not been met

The entire condition has not been met, so the jump is not executed.

The program continues after the time period of one cycle.

BMB - Branch on Multiple Binary Outputs



With this command, a jump is always executed. The target depends on the state of the programmed outputs.

The target instruction is calculated as follows:

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

Fig. 5-7: Calculation of Target Instruction with Binary Output Logic

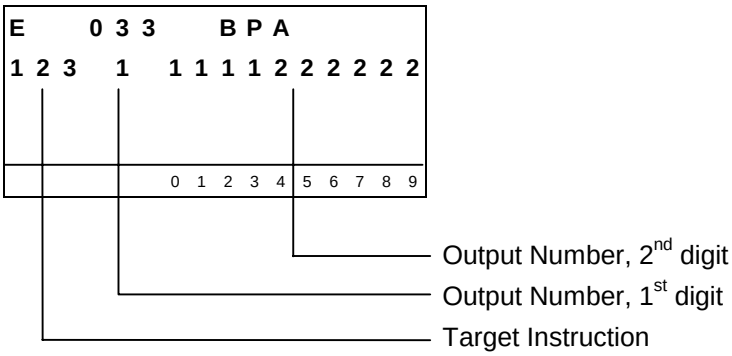
Example:

```
041  BMB  100  02  05  8
```

Output	:	12	11	10	9	8	7	6	5
Weighted value	:	128	64	32	16	8	4	2	1
Output status	:	0	0	1	1	0	0	1	1
Target instruction	:	(0 +	0 +	32 +	16 +	0 +	0 +	2 +	1) = 51
		51 * 2 + 100							= 202

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

BPA - Branch Conditional on Parallel Outputs



This command represents an extension of the `BCA´ command. Here, 10 outputs can be checked simultaneously to see if a condition has been met. At the same time, the condition can be stipulated separately for each output. The jump to the target instruction is executed only if all 10 outputs have met their programmed conditions. Otherwise, the program proceeds to the next instruction.

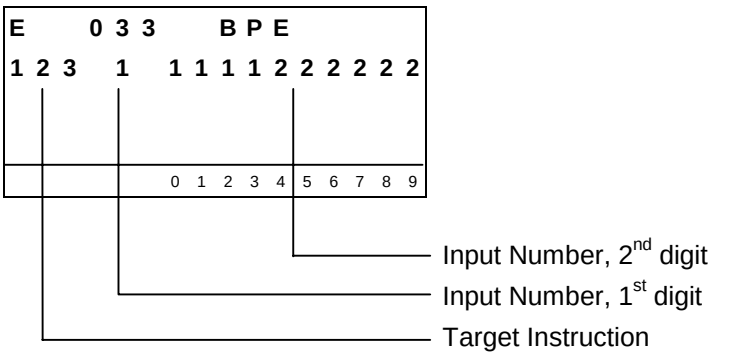
Three different conditions are possible:

0 = The condition is true if the output is set to `OFF´
1 = The condition is true if the output is set to `ON´
2 = The output is not checked.

See also the `BPE´ command.

The program continues after the time period of one cycle.

BPE - Branch Conditional on Parallel Inputs



This command represents an extension of the `BCE´ command. Here, 10 inputs can be checked simultaneously to see if a condition has been met. At the same time, the condition can be stipulated separately for each input. The jump to the target instruction is executed only if all 10 inputs have met their programmed conditions. Otherwise, the program proceeds to the next instruction.

Three different conditions are possible:

0 = The input is checked to see if the signal level is set to `OFF´
1 = The input is checked to see if the signal level is set to `ON´
2 = The input is not checked. The status can be `OFF´ or `ON´.

The input number is determined as follows:

Input Number = (1st digit * 10) + (2nd digit)

Examples:

1)

022_BPE_200_2_	**1**	**2**	**1**	**1**	**0**	**0**	**0**	**2**	**2**	**1**
	0	1	2	3	4	5	6	7	8	9
Input Number	20	21	22	23	24	25	26	27	28	29

Inputs 20, 22, 23 and 29 are checked to see if they are `ON´.
Inputs 24, 25 and 26 are checked to see if they are `OFF´.
Inputs 21, 27 and 28 are not checked.

2)

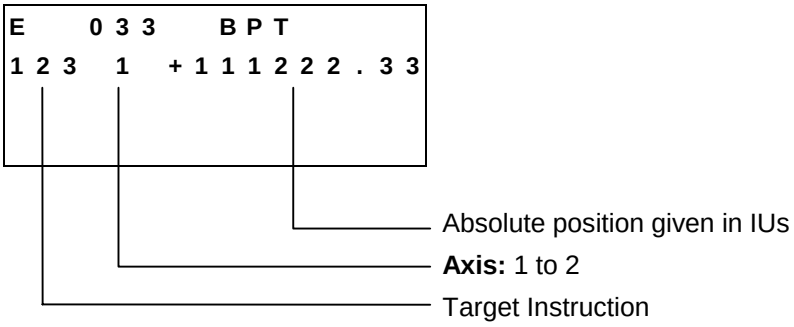
008_BPE_200_0_	**2**	**1**	**1**	**1**	**1**	**0**	**0**	**2**	**2**	**2**
	0	1	2	3	4	5	6	7	8	9
Input Number	00	01	02	03	04	05	06	07	08	09

Inputs 01, 02, 03 and 04 are checked to see if they are `ON´.
Inputs 05 and 06 are checked to see if they are `OFF´.
Inputs 07, 08 and 09 are not checked.

Note: Any entry for Input 00 is meaningless and is ignored**.**

The program continues after the time period of one cycle.

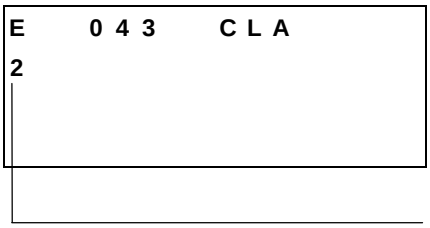
BPT - Branch on Position reached



This command is used to check absolute positions. If the axis is in the programmed position (± switching threshold), the program jumps to the target instruction. Otherwise, the program proceeds to the next instruction. If the corresponding axis is not homed, the program continues at the instruction with the next higher number.

The program continues after the time period of one cycle.

CLA - Clear Axis (Absolute Encoder Value)



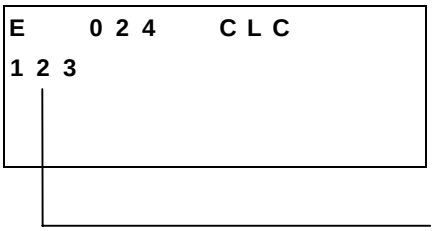
Axis: 2 only

With this command, the absolute position detection is set to zero. Afterward, the axis is considered `homed´ and is enabled for absolute movement with an incremental encoder.

The position at which the axis was when the `CLA´ command was loaded is the new zero position. If an offset dimension is programmed in Parameter 49, it is taken into account.

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

CLC - Clear Counter

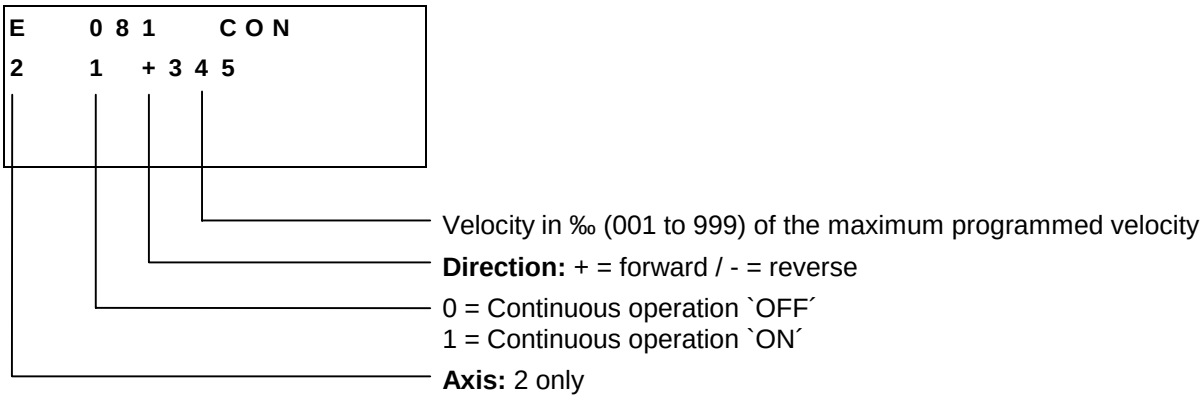


Instruction number of the counter to be set to zero

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

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

CON - Continuous Operation



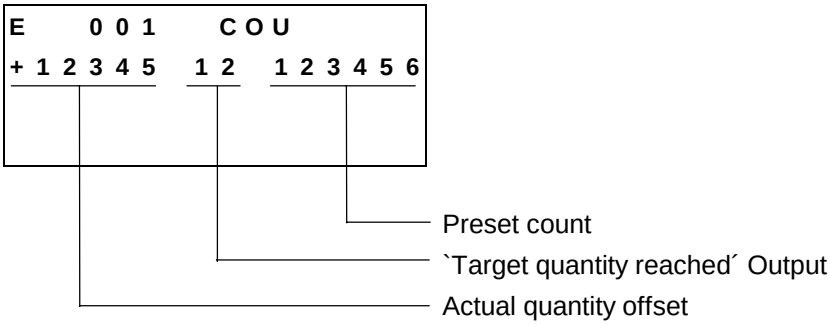
The `CON´ command can also be used if there is an established reference point (after homing or during position detection with an absolute encoder). In that case, however, the position limit values (Parameters 51 and 52) must be noted.

Within the program, continuous operation can be switched off only using this command.

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

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

COU - Count



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 output is activated and the actual quantity is set to zero.

The programmed output is only enabled here. If it is necessary for this output 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:

```
000     AEA     08  0
001     LML             001000.00
002     JSR     800
003     COU     +00000  08  00010
004     WAI     01.00
005     BCA     001  08  0
006     . . .    . .
```

Positioning is executed ten times. Then, Output 08 is set, and the CLM continues with Instruction 006 of the program.

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

The counter display can be used to check the status of the counter (see chapter entitled `Display´). The actual quantity is not apparent within the command itself. Once a `COU´ command (`BAC´ command) has been stored, the actual quantity can be manipulated. To accomplish this, the actual quantity offset must be entered. Using 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 stored. 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 the production cycles, 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 stored, 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.

Note: The current actual quantity of every counter is retained even in the event of an error, emergency stop, change of operating mode or shutdown of the CLM!

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

CST - Change Subroutine Stack

```
E    0 5 4    C S T
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

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 using 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 the error `RTS nesting´.

Example:

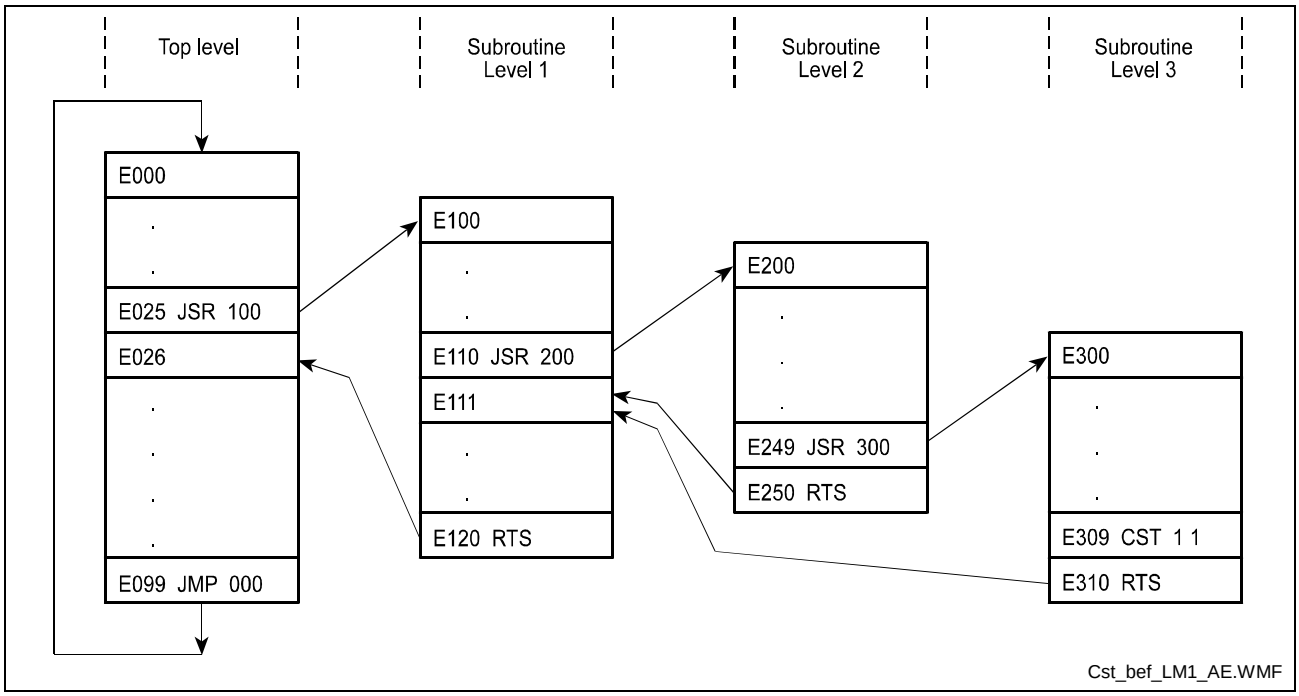


Fig. 5-8: Example Overview of Subroutine Stack Levels

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

EOS - End of Synchronization

```
E    003    EOS
```

A processing program must always end with this command.

If a program to move the tool away from the material is present, this program must also end with the `EOS´ command (see also Parameter 15).

FAK - Correction Factor for Measuring Wheel Feed constant

```
E    003    FAK
1    1.23456
```

Multiplication Factor
Entry: from 0.00000 to 1.99999

Axis: 1 only

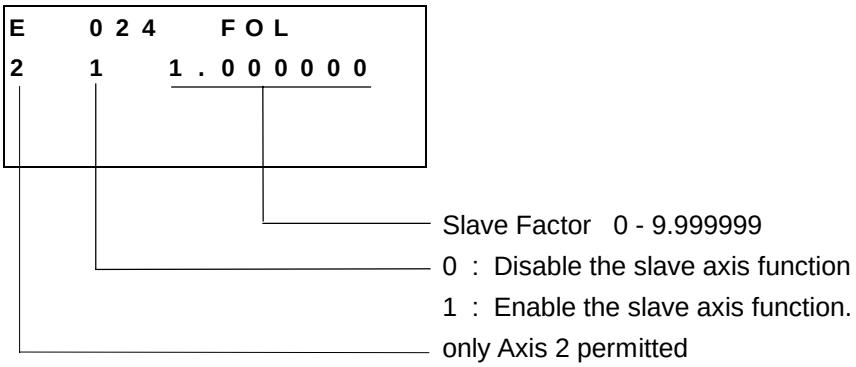
With this command, the measuring wheel feed constant (Parameter 38) is multiplied by the multiplication factor. The parameter remains unchanged.

After each re-start, clearing of an error and after exiting Parameter Mode, the factor is internally set to a value of 1.00000.

Note: For factors greater than 1.00000, the processing length becomes shorter.

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

FOL - Slave Axis



The functionality `Axis 2 follows the measuring wheel´ is active only in Automatic Mode. If a switch from `Automatic´ to `Manual´ Mode occurs, the slave axis function is turned off. The slave factor sets the ratio at which Axis 2 will follow the measuring wheel.

Axis 2 follows the measuring wheel position precisely. When the measuring wheel accelerates rapidly, the control loop monitoring of Axis 2 may produce errors (Drive Runaway, Position Lag).

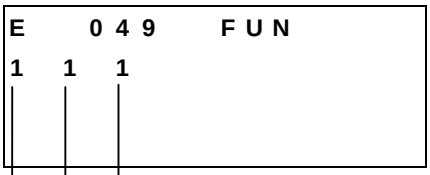
Turning this function on and off requires that there be no limitations to acceleration. Therefore, it should only be done when the measuring wheel is motionless.

Note: To keep the following distance to a minimum, a following error compensation value can be set in Parameter 59.

Caution: The functions `Slave Axis´ and `Override´ cannot be activated at the same time!

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

FUN - Functions



Length measurement of the material processed through the tool. The movements of the carriage and the material movements are detected.
- 0 = Clear and buffer; query via Status 31
- 1 = Clear current measurement and turn on again
- 2 = No change

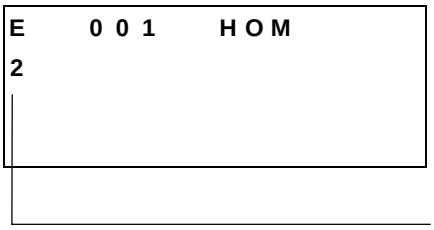
Time Measurement 2
- 0 = Save time and turn off measurement; query via Status 81
- 1 = Clear and turn on time measurement
- 2 = No change

Time Measurement 1
- 0 = Save time and turn off measurement; query via Status 80
- 1 = Clear and turn on time measurement
- 2 = No change

Note: Querying Status 31 during length measurement is not functional for Test Mode.

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

HOM - Home Axis



Axis: 2 only

This command produces an absolute measurement reference. What occurs basically corresponds to homing in Manual Mode. To accomplish this, Parameters 48 to 50 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 `Invalid Prg Cmd´ 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 50.

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

Example:

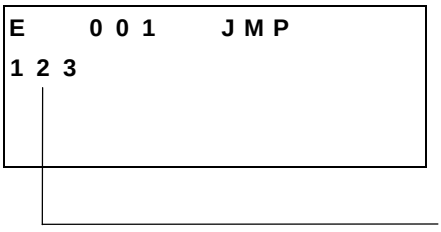
Entry in Parameter 50 = 01_02_03

711	HOM	2	- Home Axis 2
712	ATS	03 1	- Wait until homing is completed
713	POA	2 +000100.00 999	- Positioning, Absolute

A more detailed description of the homing routine is provided in the chapter entitled `Homing´.

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

JMP - Jump Unconditional



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

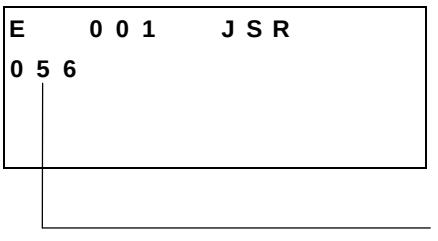
This allows the programmer to jump directly to another part of the program. This enables the main program to be divided up into fixed program blocks, which can be of great help when making changes or additions.

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



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

Thus, a program can be structured more clearly and concisely.

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 is 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 CLM generates the error message `RTS nesting´.

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

LMD - Part Length via Decade Switch

E 0 2 1 L M D

The function of this command is equivalent to that of the `LML´ command.

The material length is the length loaded via the `IDS01´ decade switch (see chapter entitled `Decade Switch IDS01´).

If the loaded the material length has been processed, the program proceeds to the next instruction. If a cut width of the cutting tool is programmed in Parameter 16, the entered material length is increased by the width of the cutting tool.

If decade switch querying is not enabled in Parameter 80, this instruction is skipped.

Note: The `LMD´ command may not be stored in Instruction 000.

The program proceeds to the next instruction when synchronization has been achieved.

LMI - Part Length via Binary Inputs

E 0 2 1 L M I

The function of this command is equivalent to that of the `LML´ command.

The material length is loaded here as a binary value (in input units, without decimal places), via Inputs 17 to 32. With a signal at Input 33, the CLM must be informed that the information present at Inputs 17 to 32 is valid. When the loaded material length has been processed, the program proceeds to the next instruction.

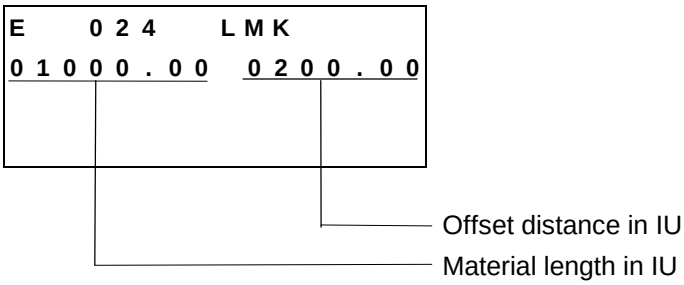
If a cut width of the cutting tool is programmed in Parameter 16, the entered material length is increased by the width of the cutting tool.

Notes: The `LMI´ command may not be stored in Instruction 000.

The `Load material length via Inputs´ function must be activated in Parameter 27.

The program proceeds to the next instruction when synchronization has been achieved.

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 Pulse´ 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 ± the light barrier offset must be greater than the acceleration path.

If the raster signal is detected when the carriage is returning to its original position, the offset length ± the light barrier offset must be greater than 4x the acceleration path (see also description of the `LMR´ command).

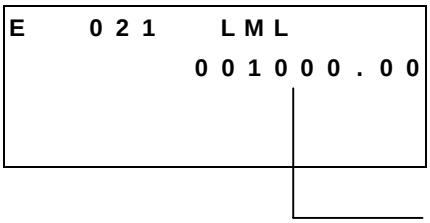
Notes: If a correction occurs via the input `Raster Pulse´, the width of the cutting tool (Parameter 16) is ignored.

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

The `LMK´ command may not be stored in Instruction 000.

The program proceeds to the next instruction when synchronization has been achieved.

LML - Part Length



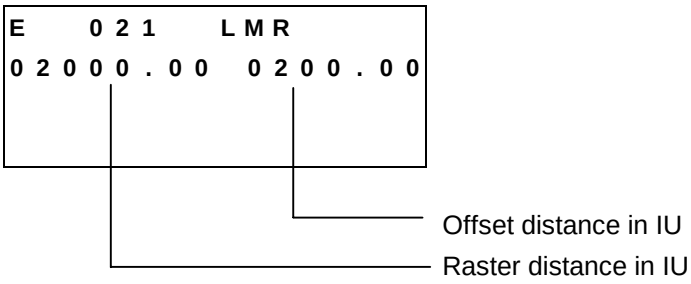
Material Length in IU

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 16, the entered material length is increased by the width of the cutting tool.

Note: The `LML´ command may not be stored in Instruction 000.

The program proceeds to the next instruction when synchronization has been achieved.

LMR - Part Length with Registration



When using this command, the carriage synchronizes its movement with the material, according to a marked location on the material. After the material has moved as far as the raster distance from the last processing location, the `Raster Pulse´ input (Connector X3/Pin 16) is enabled by the CLM. If the raster detection occurs next, the entered offset distance is set as the new distance. The carriage accelerates such that synchronization is achieved at the desired location and processing can be carried out.

The raster distance is detected as follows:

- Raster Distance = Distance between the raster detection unit and the mark (raster) to be detected, when the processing tool is located above the processing location.

or

- Raster Distance = Distance between the marks to be detected minus the entered offset distance.

All marks on the material that are not to be registered, are masked by the programmed raster distance. The offset distance ± light barrier offset must be greater than the acceleration path (see formula). If the mark is detected when the carriage is returning to its original position, the offset length ± the light barrier offset must be greater than 4x the acceleration path.

$$s_a = \frac{V_{max}^{\ 2}}{2 * a * F}$$

L: s_a = Acceleration Path
V_{max} = Velocity Parameter 02
a = Acceleration Parameter 04
F = Gain Factor Parameter 05

Fig. 5-9: Calculation of the Acceleration Path

Notes: Using the `LMR´ command, the width of the cutting tool (Parameter 16) is ignored.

The `LMR´ command is intended for use with incremental encoders.

The `LMR´ command may not be stored in Instruction 000.

In the following examples, the following lengths are known:

Light Barrier Offset	= 100 mm
Distance between marks	= 1000mm
Offset	= 300 mm

Example 1:

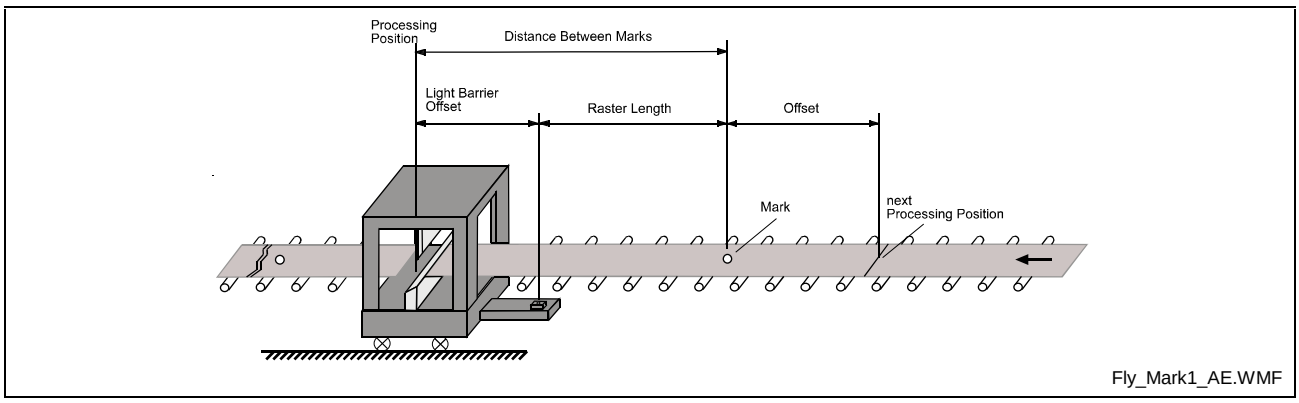


Fig. 5-10: `LMR´ Command Example 1

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:

Raster Distance = Distance between marks - Light Barrier Offset

1000 mm - 100mm = 900 mm

Offset Distance = Offset + Light Barrier Offset

300mm + 100mm =400mm

Example 2:

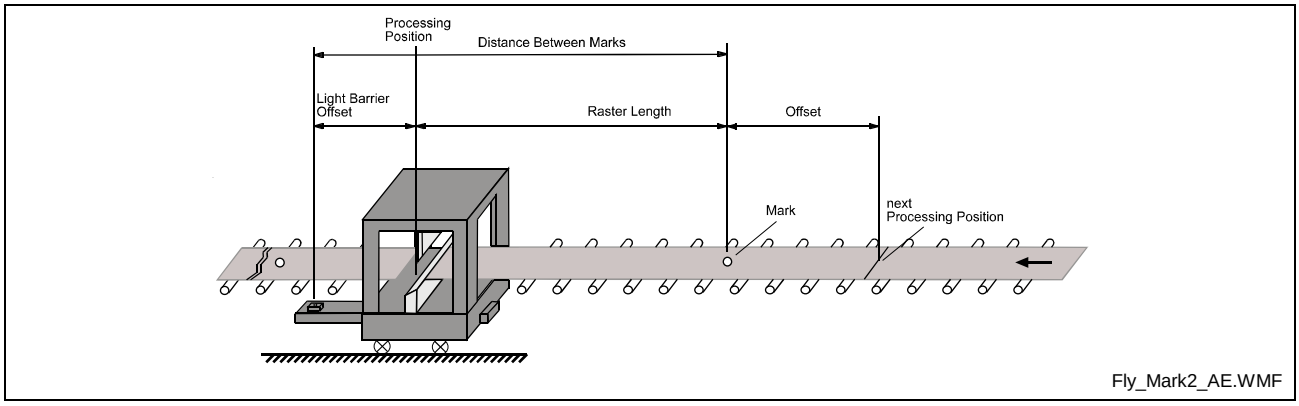


Fig. 5-11: LMR´ Command Example 2

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:

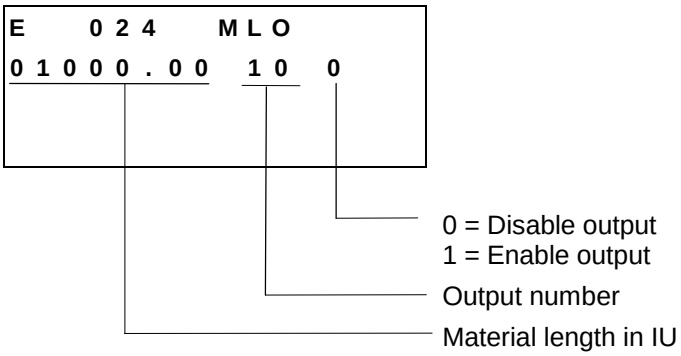
Raster Distance = Distance between marks + Light Barrier Offset

1000 mm + 100mm = 1100 mm

Offset Distance = Offset - Light Barrier Offset

300mm - 100mm =200mm

MLO - Material Length Output



Using the `MLO´ command, an output can be enabled or disabled in Automatic Mode, depending upon the length of the material that has been processed.

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.

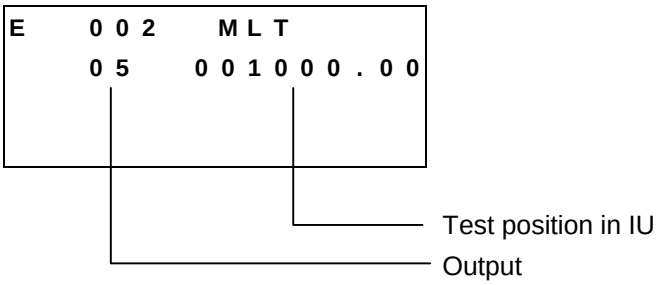
If the command is accessed again during a measurement, the new material length is processed immediately and the output is set accordingly.

Notes: If the already processed length of material is longer than the programmed value when the command is loaded, the output is enabled or disabled and the length measurement restarts.

After evaluation of the output, it must be reset by the user program.

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

MLT - Material Length Test



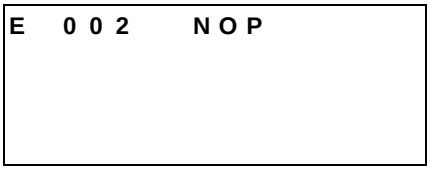
Using this command, the material length that has been processed through the tool can be tested. Once this command has been executed, a declaration is made at the specified output as to whether the processed material length is larger or smaller than the programmed value .

The status assumed by the programmed output is `1´ if the processed material length is smaller than the programmed value. Proceeding to the next instruction occurs immediately after loading the command.

Note: In order to use the `MLT´ command, the `FUN´ command with length measurement must be programmed in the processing program or the manual cut program.

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

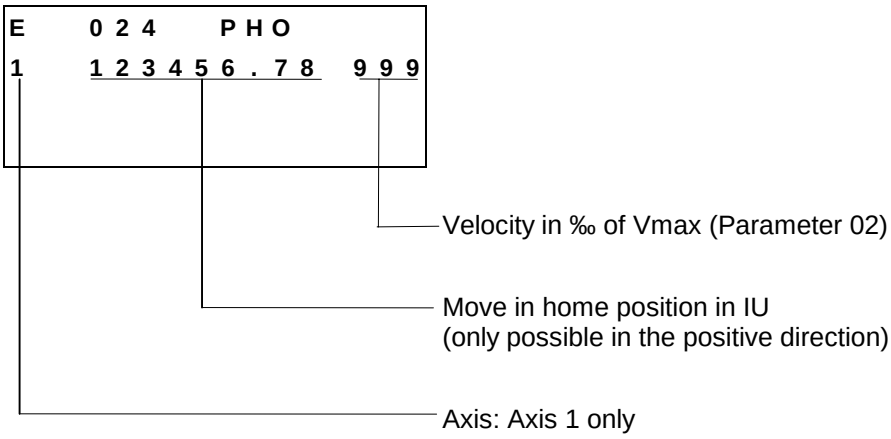
NOP - No Operation



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.

PHO - Move Home Position



With this command, the starting position for the shear carriage (Axis 1) can be changed in Automatic Mode.

This command should be used only in conjunction with Parameter 28 (Change Saw Blade). (velocity is evaluated only when the function is activated).

After switching from `Manual´ to `Automatic´, Axis 1 must be homed and is then located at its home position. When invoking this command, the carriage moves to the designated position using the pre-set velocity.

Notes: The carriage can always move forward, but it can only move as far as the next shear position.

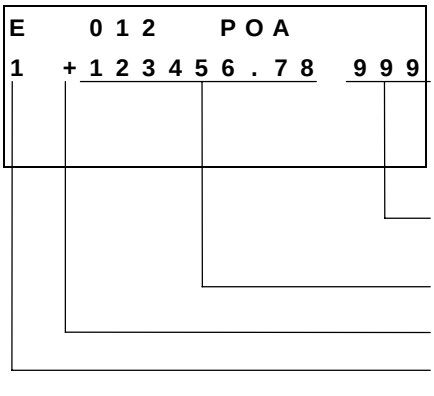
Following an error, the use of Parameter Mode or switching to Manual Mode, the offset is cleared.

WARNING

⇒ **If the command is issued during synchronization and a position greater than the actual position is indicated, the carriage accelerates!**

⇒ **A position of less than the actual position does not affect the synchronization!**

POA - Positioning, Absolute



Feedrate in ‰ (001 to 999) of the maximum velocity in the assigned parameter

Absolute position in IU (input units)

Operational sign of the position (+/-)

Axes 1 to 2

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

Example: 1) Current Position = -100.00

```
800      POA     2 +00200.00  999
```

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

Example: 2) Current Position = +400 mm

```
811      POA     1 +00200.00  999
```

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

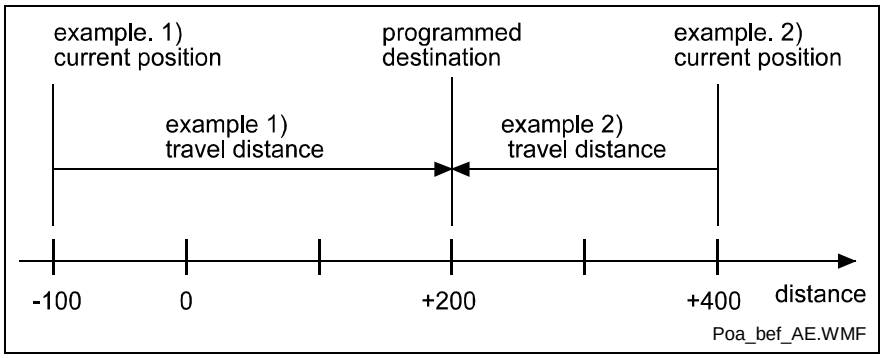


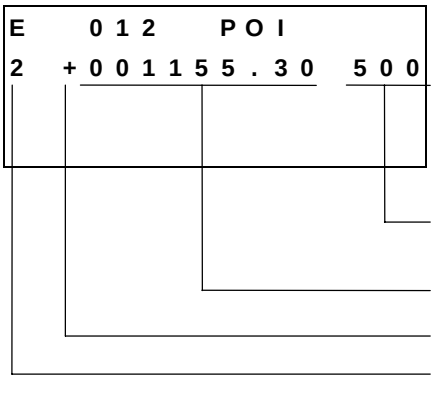
Fig. 5-12: Example of Position, Absolute

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.

Note: If the`POA´ command is used for Axis 1, the maximum velocity (Parameter 02) is **always** used as the feed rate.

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

POI - Positioning, Incremental



Feedrate in ‰ (001 to 999) of the maximum velocity in the assigned parameter

Feed length in IU (input units)

Direction of movement (+ = forward / - = reverse)

Axes 1 to 2

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:

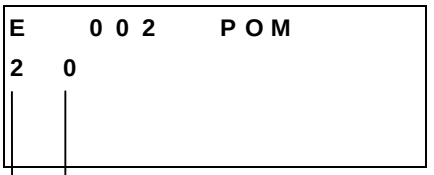
700	POI	2 -000100.00 999
701	PSI	2 +000200.00 999

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

Note: If the `POI´ command is used for Axis 1, the maximum velocity (Parameter 02) is **always** used as the feed rate.

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

POM - Positioning to Decade Switch Position



Mode 0 = Position, incremental
1 = Positioning using absolute measurement

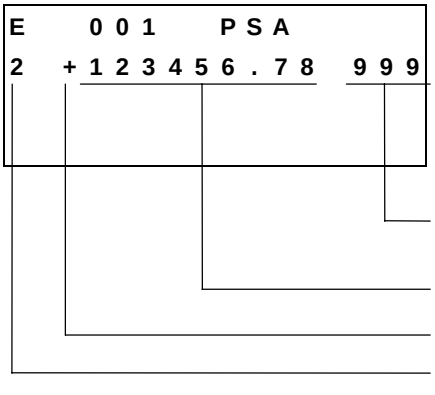
2 = Axis 2 - Forward
4 = Axis 2 - Reverse

The function of this command is equivalent to that of the `POI´ command.

The positioning measurement in IU and the velocity in percent were loaded into the CLM via the IDS01 decade switch unit.

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

PSA - Positioning, Absolute with In-Position



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 `Switching Threshold´ (see Parameter 07 or 47) for the programmed position.

Example:

Current Position	=	+ 100.00
Switching Threshold, Parameter 47	=	0,20
Positioning Window	=	± 0.20

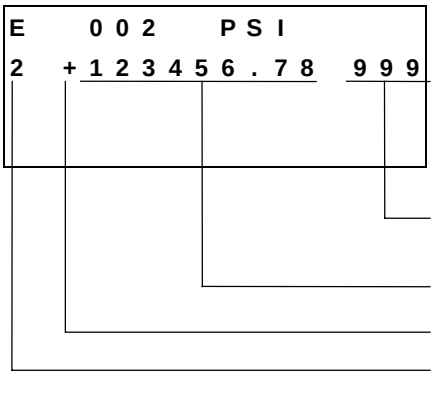
```
100      PSA     2 +000200.00  999
```

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

Notes: 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.

If the `PSA´ command is used for Axis 1, the maximum velocity (Parameter 02) is **always** used as the feed rate.

PSI - Positioning, Incremental with In-Position



Feedrate in ‰ (001 to 999) of the maximum velocity in the assigned parameter

Feed length in IU (input units)

Direction of movement (+ = forward / - = reverse)

Axes 1 to 2

This command corresponds to the `POI´ command. However, the program proceeds to the next instruction only after the positioning procedure has been completed (In-Position). This procedure is completed as soon as the drive unit has traversed the programmed feed length within the `Switching Threshold´ (Parameter 07 or 47). Adjustment for the highest accuracy takes place even after the program has gone on to the next instruction.

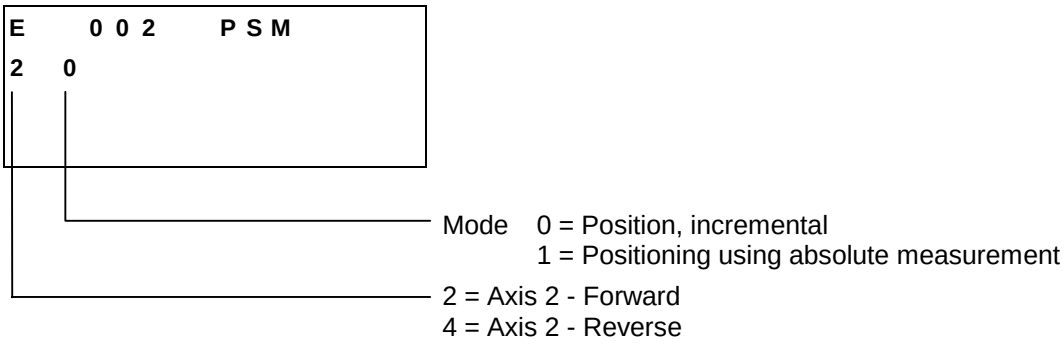
Example:

100	PSI	2 +000100.00 999
101	WAI	00.50
102	AEA	02 1

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 02 is activated.

Note: If the `PSI´ command is used for Axis 1, the maximum velocity (Parameter 02) is **always** used as the feed rate.

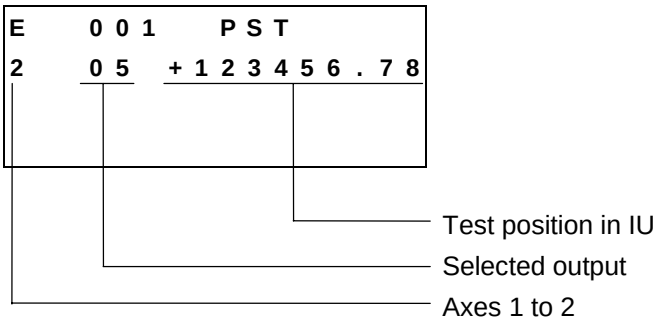
PSM - Positioning to Decade Switch Position, with In-Position



The function of this command is equivalent to that of the `PSI´ command. The positioning measurement in IU and the velocity in percent were loaded into the CLM via the IDS01 decade switch unit.

The program proceeds to the next instruction only after the positioning procedure has been completed.

PST - Position Test



This command is used to check positions which are not dependent on the position setpoint. Once this command has been executed, a declaration is made at the specified output as to whether the current actual position value is larger or smaller than the programmed position value .

The status assumed by the programmed output is `1´ if the actual position value is smaller than the value entered here.

Example 1:

```
001      PST      1  05 +000100.00
```

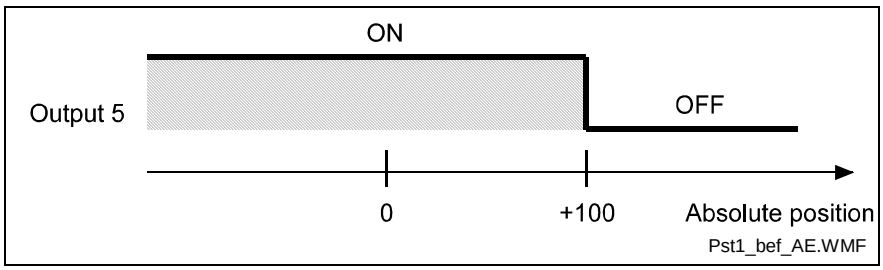


Fig. 5-13: Example 1 for Position Test

Example 2:

```
001      PST      1  05 -000050.00
```

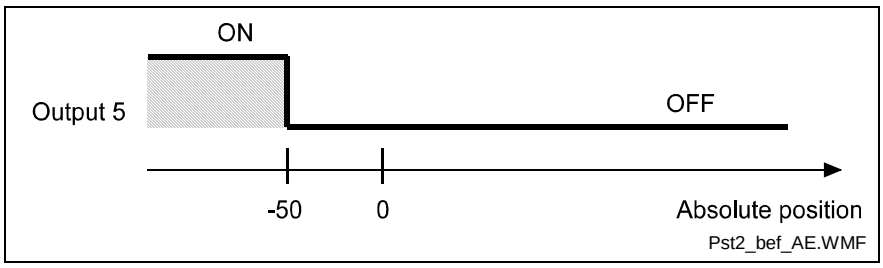
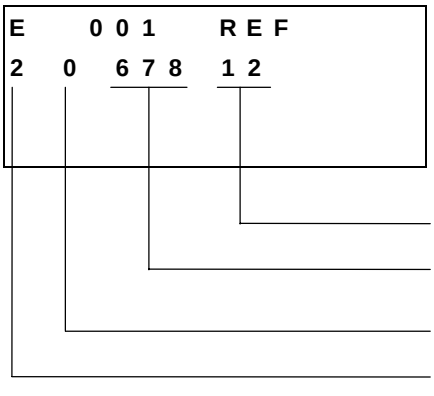


Fig. 5-14: Example 2 for Position Test

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

REF - Referencing (Detect Registration Mark Input)



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

As soon as the CLM detects the reference mark, the program proceeds to the next instruction.

If a value of 00 is programmed for the reference mark input (only possible for Axis 1!), system input 16 (Raster Input, Connector 3 / Pin 16) is selected as the reference mark input. This input has no hardware debouncing. This input can also initiate an interrupt. This input is therefore able to detect the reference mark 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 by means of an incremental positioning command immediately following the `REF´ command.

Only the `POI´ and `PSI´ (positioning incremental) commands are used as the positioning commands for the offset dimension.

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

Note: No new absolute measurement reference (zero point) is created using the `REF´ command. This is possible only through the `Homing´ function.

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

$$\frac{Search\,Velocity\,in\,IU\,/\,s}{Control\,Cycles\,/\,s}$$

L: IU = Input Units
s = seconds

Fig. 5-15: Calculation of the Search Velocity

Example of Movement to a Reference Mark:

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

```
800      REF     2 0 500 10
```

The search velocity is 200 IU/s * 500 ‰ = 100 IU/s. The accuracy is > 0.4 mm.

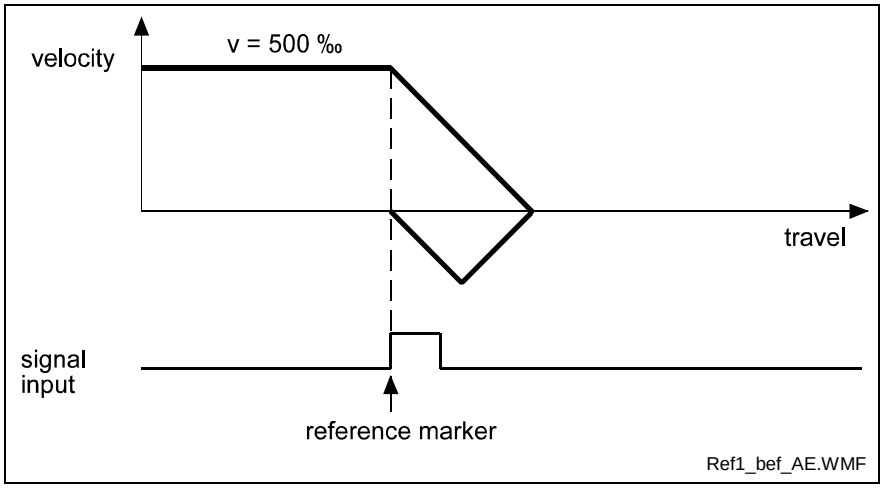


Fig. 5-16: Example of Movement to a Reference Mark

Example of moving to a reference mark with offset programming:

```
800      REF     2 0 500 10
801      PSI     2 +000200.00 100
```

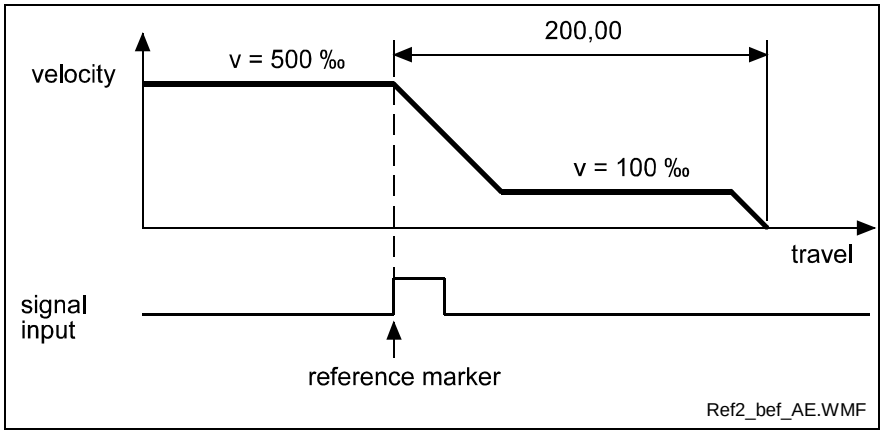
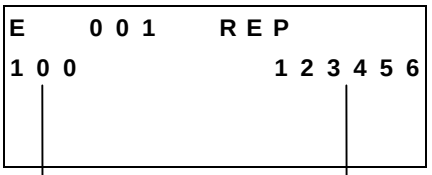


Fig. 5-17: Example of Moving to a Reference Mark with Offset Programming

REP - Registration Position Limit



Max. search distance for `REF´ command in IU

Jump to target location if search distance is exceeded

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

If the maximum search distance entered here is exceeded without finding a reference mark, 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 be executed immediately after the `REF´ command. A `REP´ command alone will result in the error message `Invalid Prg Cmd´ when the program is executed.

The following command combinations are permissible:

1) Move to reference point without offset dimension and without limitation of the search distance.

```
820     REF     2 0 050 05
```

2) Move to a reference point with an offset dimension, without limitation of the search distance.

```
830     REF     2 0 500 10
831     PSI     2 +000200.00 100
```

3) Moving to the reference point is programmed in the `REF´ command. A limit of max. 500 mm is programmed in the `REP´ command.

```
830     REF     1 0 100 12
831     REP     900   000500
```

4) Moving to a reference point with search distance limitation and offset dimension.

```
855     REF     2 1 222 11
856     REP     900   000500
857     POI     2 +000123.00 999
```

Moving to the reference point is programmed in the `REF´ command.
A limit of max. 500 mm is programmed in the `REP´ command.
An offset dimension of 123 mm is programmed into the `POI´ command.

Notes: The `REP´ command and the positioning command (`POI´ or `PSI´) are processed within the same controller cycle as the `REF´ command.

When selecting 3 decimal places (Parameter 82), the search distance must be entered in tenths of IU.

RTS - Return from Subroutine

E 0 0 1 R T S

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:

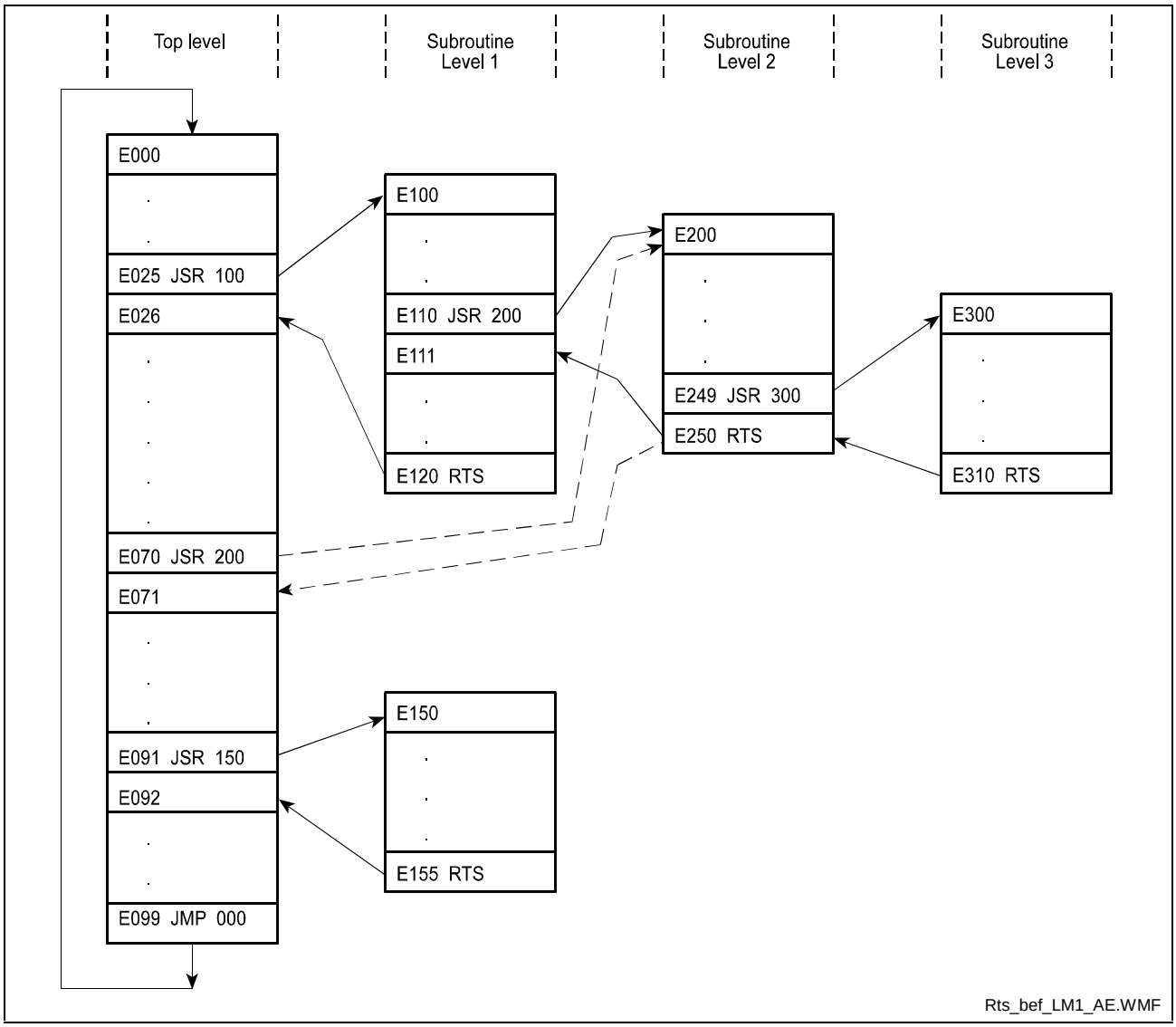


Fig. 5-18: Example of Return from Subroutine Levels

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

SAC - Set Absolute Position Counter

```
E    0 0 1    S A C
2  0      + 1 2 3 4 5 6 . 7 8
```

Absolute position or offset in IU

0 = Absolute zero offset relative to the home position after homing
1 = Set new absolute position relative to the command position
2 = Set new absolute position relative to the actual position

Axis: 2 only

The axis must be homed, otherwise the error message `Axis not homed´ is generated. The command is executed correctly only when the axis signals `Position reached´.

Notes: The operational sign is only considered when using an incremental encoder.

When using an absolute encoder, the operational sign is ignored, because an offset is only possible in the positive direction.

Example for absolute encoder with 1024 revolutions:

Offset = 300 (Parameter 49)
Travel limit value, min. = 200 (Parameter 51)
Travel limit value, max. = 700 (Parameter 52)

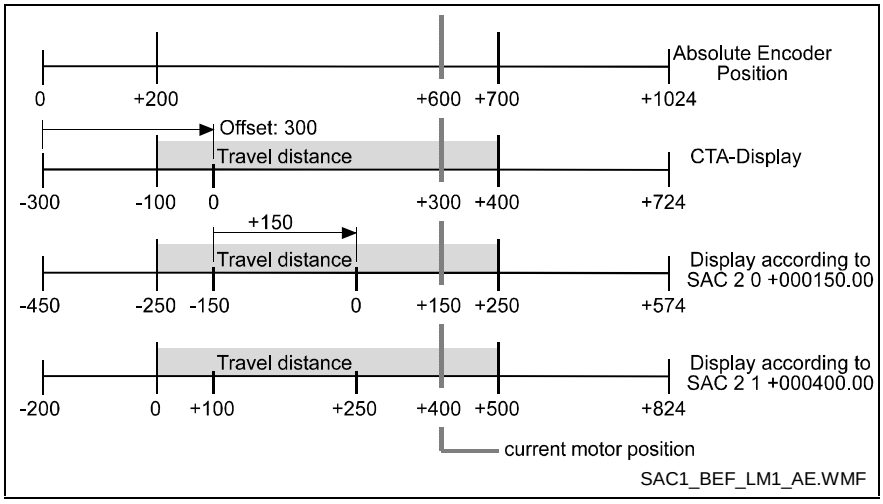


Fig. 5-19: Example: `SAC´ Command with Absolute Encoder

Example for incremental measuring systems:

Offset = 300 IU in positive direction (Parameter 49)
Travel Limit Value, Min. = -400 IU (Parameter 51)
Travel Limit Value, Max. = + 900 IU (Parameter 52)

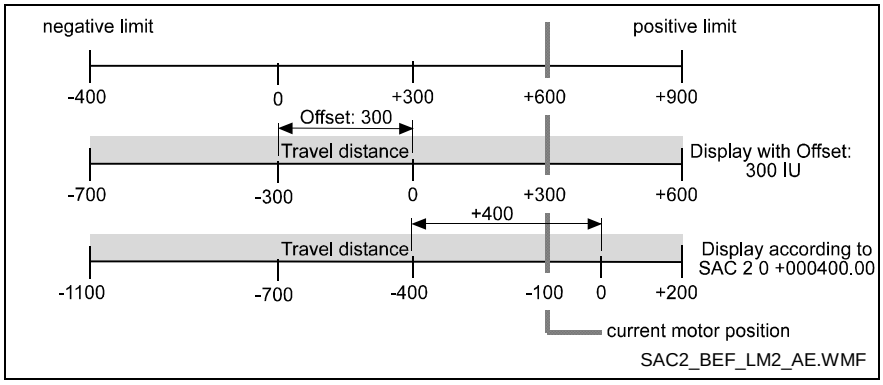


Fig. 5-20: Example 1: `SAC´ Command with Incremental Encoder

Example for incremental encoders:

Offset = 300 IU in positive direction (Parameter 49)
Travel Limit Value, Min. = -400 IU (Parameter 51)
Travel Limit Value, Max. = + 900 IU (Parameter 52)

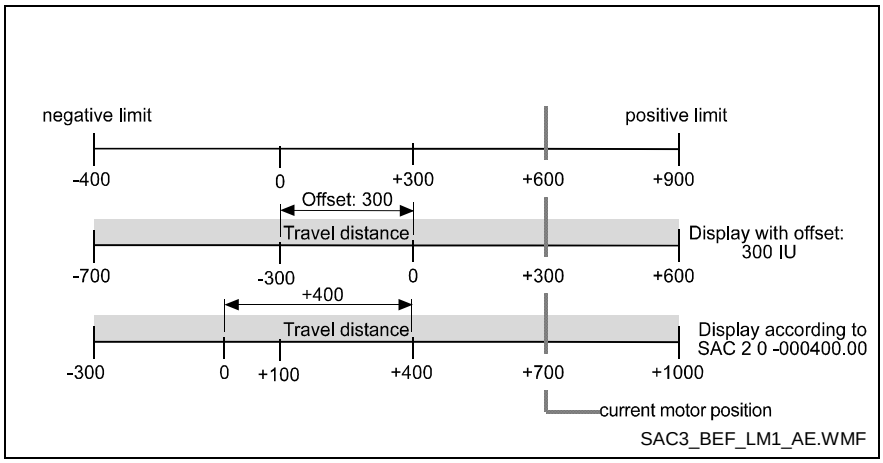
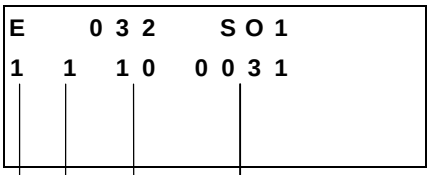


Fig. 5-21: Example 2: `SAC´ Command with Incremental Encoder

Another `SAC_2_0_+000000.00´ command sets the current motor position back to +300 IU.

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

SO1 - Loading Data via Inputs



Target instruction (for Mode 1 or 2).

Start input no.: XX (only for Mode 0)

Four inputs are evaluated, beginning with xx BCD.

Input XX	- has the weighted value $2^0 = 1$
Input XX + 1	- has the weighted value $2^1 = 2$
Input XX +2	- has the weighted value $2^2 = 4$
Input XX +3	- has the weighted value $2^3 = 8$

Position with the information block (only for Mode 0)

Position	Weighted Value
1	beginning 1st place from the right
2	beginning 2nd place from the right
:	:
:	:
8	beginning 8th place from the right
9	Operational sign `+´ = 1, `-´ = 0

Mode:

0	=	Read information
1	=	Conversion and saving of value 1 in the target instruction.
2	=	Conversion and saving of value 2 in the target instruction.

Using the `SO1´ command, data can be loaded via programmable inputs that are processed as length, position, velocity, factor or piece count in the user program.

Overview of the changes in data using SO1:

Command Type	Mode 1	Mode 2
POA, POI, PSA, PSI, VCC	Position	Velocity
LML	Material Length	.....
PST	Position	.....
FAK	Factor	.....
BCA, COU, STZ	.....	Preset count
LMR	Raster Length	Offset Distance
LMK	Material Length	Offset Distance

One of the commands listed above must be already programmed in the target instruction. Dummy tetrads are interpreted as `0´.

The decade switch IDS01 can be used at the same time.

The operational sign is output at Start Input `xx´. In this case, 0V corresponds to `-´ and 24V corresponds to `+´.

Digits that were not transmitted become 0 in the target instruction. If the operational sign is not transmitted, it remains unchanged in the target instruction.

After saving a value in the target instruction, all decades (positions 1-9) are reset to 0.

For the lengths, the following is valid for the programming in Parameter 82:

2 decimal places: place 1 represents 1/100 IU
3 decimal places: place 1 represents 1/1000 IU

Example:

Content of instruction 500 =

500	PSI	2 +999999.99 333

Set value at the decades = 1 2 3 4 5

Loading of the 1st value (position)

SO1 0 1 05 0500	Load 1st digit (decade switch value 5)
SO1 0 2 05 0500	Load 2nd digit (decade switch value 4)
SO1 0 3 05 0500	Load 3rd digit (decade switch value 3)
SO1 0 4 05 0500	Load 4th digit (decade switch value 2)
SO1 0 5 05 0500	Load 5th digit (decade switch value 1)

SO1 1 0 00 0500 Conversion and loading as 1st value

The content of instruction 500 is now =

500	PSI	2 +000123.45 333

Set value at the decades = 5 4 7

Loading of the 2nd value (velocity)

SO1 0 1 05 0500	Load 1st digit (decade switch value 7)
SO1 0 2 05 0500	Load 2nd digit (decade switch value 4)
SO1 0 3 05 0500	Load 3rd digit (decade switch value 5)

(For velocity, only 3 digits are read.)

SO1 2 0 00 0500 Conversion and loading as 2nd value

The content of instruction 500 is now =

500	PSI	2 +000123.45 547

With a series of `SO1´ commands, length information can be loaded using decade switches or via the PLC control.

Example:

Each set of length information must be loaded into instruction 300 with 3 places before the decimal and 1place following the decimal.

Hardware:

Connection for an external decade switch group (4 decades).

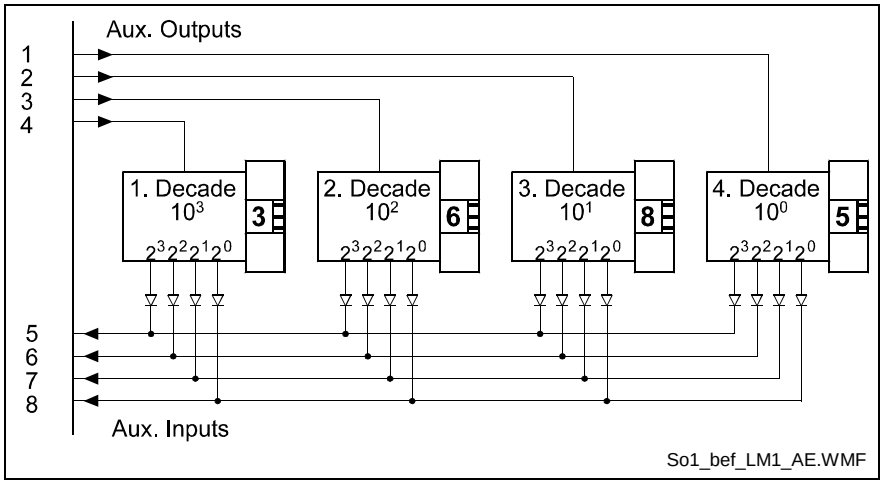


Fig. 5-22: Decade Switch Group

The outputs are set using the `APE´ command.
The inputs are read using the `SO1´ command.
Instruction 300 initially reads `PO1_2_+123456.78_999´.

Software:

Programming Example

900	APE	0 0100022222	- Select 4th decade
901	WAI	00.02	- wait until level is stable to the input
902	SO1	0 2 05 0000	- Load value of the 4th decade
903	APE	0 0010022222	- Select 3rd decade
904	WAI	00.02	- wait until level is stable to the input
905	SO1	0 3 05 0000	- Load value of the 3rd decade
906	APE	0 0001022222	- Select 2nd decade
907	WAI	00.02	- wait until level is stable to the input
908	SO1	0 4 05 0000	- Load value of the 2nd decade
909	APE	0 0000122222	- Select 1st decade
910	WAI	00.02	- wait until level is stable to the input
911	SO1	0 5 05 0000	- Load value of the 1st decade
912	SO1	1 0 00 0300	- save the loaded information to the target instruction
913	JMP	900	- Begin a new loading cycle

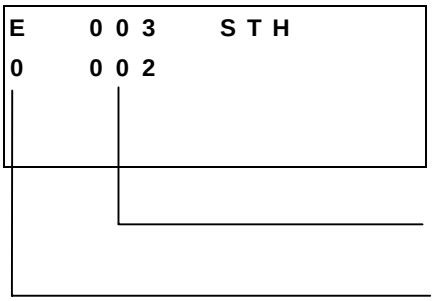
After the program runs, instruction 0300 reads:

300	POI	2 +000368.50 999

To shorten cycle time, it is useful to run a program with `SO1´ commands in Task 3, and not in the main program.

Proceeding to the next instruction occurs when the information has been loaded into the target instruction (after 10-100 ms).

STH - Transmit Information via the Serial Port (RS 232 only)



Number of the Status Information (see the chapter entitled `Serial Interface´).

Information Type
0 = Status Output (all except Status 01 and Status 04)
1 = Status 04

This command causes data to be output via the serial interface, as directed by the user program. To accomplish this, the interface must be activated in Parameter 80/81; otherwise the program proceeds to the next instruction without an output.

Definitions for the status messages are provided in the chapter entitled `Serial Interface´.

Note: For Status 06 and 07, the first digit of the number designates the range of inputs or outputs.

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

Example 1:

034	STH	0 000

Status `00´ (Actual position of Axes 1 and 2) is output via the serial interface.

Example 2:

073	STH	0 206

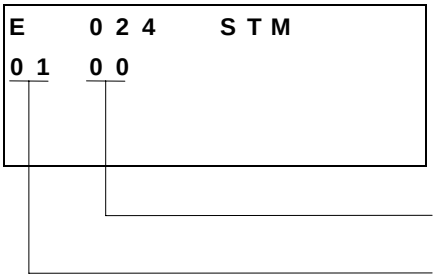
Output of Status Message 06 (Status of inputs 17 to 32).

Example 3:

054	STH	1 341

Output of Status Message `04´ via the serial interface (target and actual piece count for the counter, which is saved in Instruction Number 341).

STM - Store to Memory

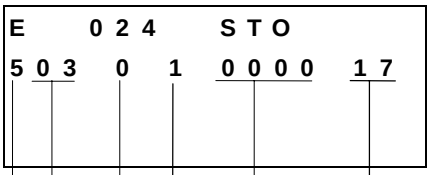


This command causes information to be buffered, as directed by the user program. The buffered information can be requested via the serial interface (Status 90) at a later time. For buffering the information, ten buffer locations are available: When a piece of information is saved, the marker flag that corresponds to the buffer location is set to 1 (see Status 90).

Note: After a re-start, error or using `Parameter´ Mode, the buffers are cleared.

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

STO - Data Output via Outputs (4-bit BCD-coded)



Starting output number: XX

Four outputs are set using decimals (0-9).

Output XX has the weighted value 2^0
Output XX+1 has the weighted value 2^1
Output XX+2 has the weighted value 2^2
Output XX+3 has the weighted value 2^3

Instruction number (saved for counting commands)

Position within the information:

Position	Weighted Value
1	1
2	10
3	100
4	1000
5	10000
6	100000
7	1000000
8	10000000
9	Operational sign

For the operational sign, `1´ is output for minus and `0´ for plus.

Mode:
0 = Save current data
1 = Output saved data via system outputs

Data type:
01 = Absolute position
02 = Counter contents
03 = Material length that has been processed

Axis number:
0 = General data (counter reading)
1, 2 = Axis 1 or 2
5 = Measuring wheel

Using this command, data (positions, counter readings, processed material lengths) is output via 4 system outputs in BCD-coded format. Internally, only one piece of information (position, counter reading or processed material length) can be saved.

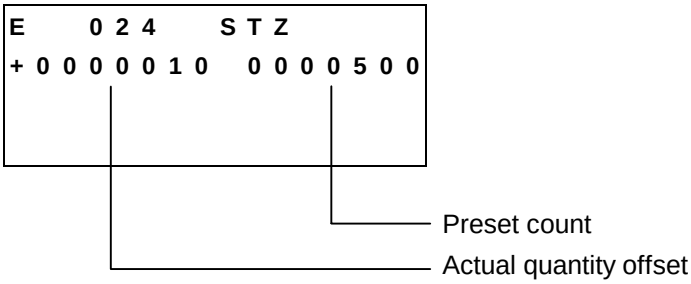
Note: For the output of processed material length, the `FUN´ command must be programmed in the flying shear program.

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

Example: The current position of Axis 1 = +98.76 IU is to be output via outputs 17 to 36.

```
900  STO 101 0 0 0000 00   save current position
901  STO 101 1 1 0000 17   output 6
902  STO 101 1 2 0000 21   output 7
903  STO 101 1 3 0000 25   output 8
904  STO 101 1 4 0000 29   output 9
905  STO 101 1 9 0000 33   output operational sign
```

STZ - Count on Branch Conditional



In the same way as the `BAC´ 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 back 3 instruction numbers. If the target quantity is reached, the actual quantity is reset to zero and the program proceeds to the next instruction.

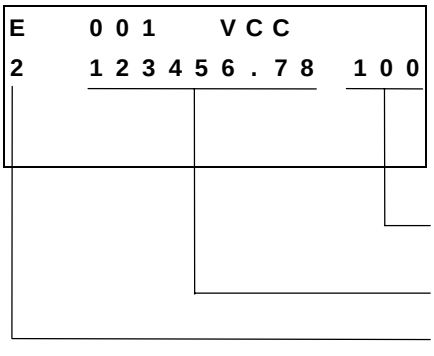
Example:

```
000   NOP
001   LML              001000.00
002   JSR   800
003   STZ   +0000000  0000010
004   .....  .....
```

After 10 processing operations, the CLM continues the program at instruction number 004.

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

VCC - Velocity Change



New Velocity in ‰ (001 to 999) of the maximum velocity in the assigned parameter (Parameter 42)

Distance traveled in IU prior to change in velocity

Axis: 2 only

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 In-Position (POI, POA, POM).

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.

800	POI	2 +000100.00 999	- Move 100 mm and proceed to next instruction
801	VCC	2 000050.00 250	- after 50mm, change to 25% velocity
802	VCC	2 000075.00 500	- after 75mm, change to 50% velocity
803	VCC	2 000090.00 100	- after 90mm, change to 10% velocity
804	ATS	15 1	- Wait until target position is reached
805	WAI	01.00	- End of cycle, wait 1 second
806	JMP	800	- Repeat program

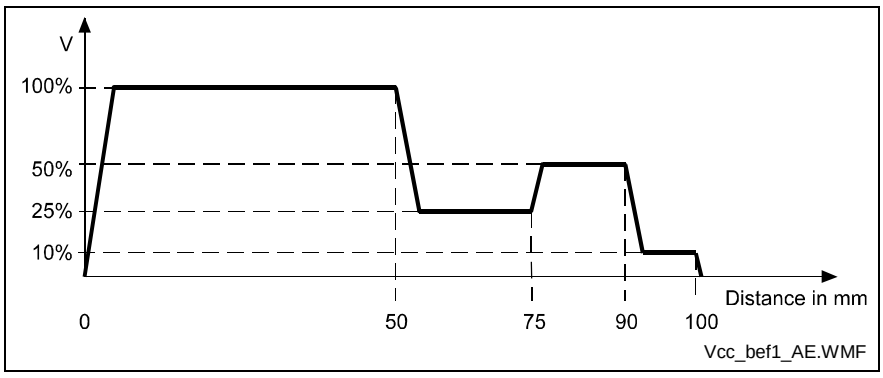
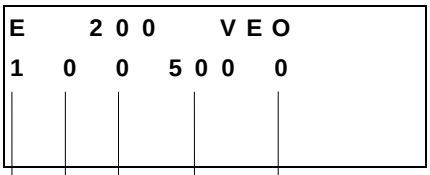


Fig. 5-23: Change Velocity

VEO - Velocity Override



Function

0 = Override as factor
1 = Override as limit

Override value

This value is significant only in mode 4.
Override value in ‰ (from 001 to 999)

0 = Read in new override value in each controller cycle (2 to 4 milliseconds)
1 = Read override value only once when command is invoked

Override default value
0 = Override disabled, or as programmed in Parameter 87
2 = Analog value of 0...+10 volts at analog input 2
2 = Binary value at inputs 09 to 16
3 = Gray code at inputs 13 to 16
4 = Override value from `VEO´ command (see above)
5 = Default value via measuring wheel encoder

Axes 1 to 2

Axis 1 Using the `VEO´ command, the reverse velocity for Axis 1 can also be reduced.

The reverse velocity is calculated by multiplying the override value by the maximum velocity from Parameter 02. If the default override value is turned off, the maximum velocity from Parameter 02 will be used as the reverse velocity.

For the default override value, only Mode 0 and Mode 4 (override value from `VEO´ command) are allowed.

For reducing the reverse velocity, only the information about the override value and the default override value are relevant.

Note: After a re-start, error or use of `Parameter´ Mode, the reverse velocity is the maximum velocity from Parameter 02.

Axis 2 This command produces a reduction in the velocity of all of the programmed traversing commands for Axis 2.

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

For the `Override as limit´ function, the override value is multiplied by the programmed velocity from Parameter 42 and thus limits the velocity. Activation of an override function using the `VEO´ command has priority over activation of any function within Parameter 87.

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.

For the default override value via measuring wheel encoder, the override value is calculated as follows:

$$Override\,Value = \frac{Meas.Wh.Velocity\left[IU\_Meas.Wh./s\right]}{Maximum\,Velocity\left[IU\_Motor/s\right]}$$

L: IU - Input Units

Fig. 5-24:Formula for Default Values via Measuring Wheel Encoder

Notes: 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.

If the default override value is provided by the measuring wheel encoder, the override value is loaded during each controller cycle regardless of the programming in the `VEO´ command.

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

Examples: `VEO´ - Velocity Override

800	BPE	804 0 2102222222	- Input 1 selected, jump to program A
801	BPE	806 0 2012222222	- Input 2 selected; jump to program B
802	BPE	808 0 2112222222	- Input 3 selected; jump to program C
803	JMP	800	- Input 0 selected; wait loop
804	VEO	2 4 1 999 1	- Program A; velocity unchanged
805	JMP	809	- Execute positioning function
806	VEO	2 4 1 700 1	- Program B; velocity limited
807	JMP	809	- Execute positioning function
808	VEO	2 4 1 500 0	- Program C; reduce velocity
			- Execute positioning function
809	POI	2 +000100.00 999	- Move 100 mm and proceed to next instruction
810	VCC	2 000035.00 800	- after 35mm, change to 80% velocity
811	VCC	2 000050.00 600	- after 50mm, change to 60% velocity
812	VCC	2 000065.00 400	- after 65mm, change to 40% velocity
813	VCC	2 000080.00 200	- after 80 mm, change to 20% velocity
814	ATS	15 1	- Wait until switching threshold is reached
815	WAI	01.00	- At end of cycle, wait 1 second
816	JMP	800	- Jump to program selection

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

1) Program A - Unaffected Velocity Profile

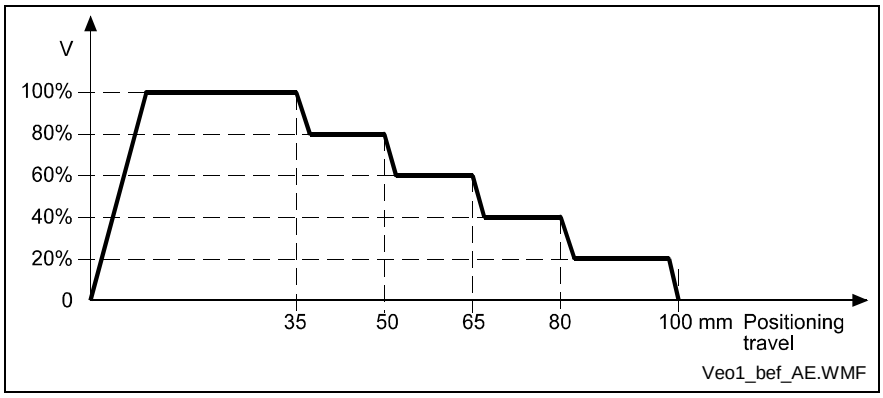


Fig. 5-25: VEO Command - Change Velocity

2) Program B - Velocity Limited to 70% by Instruction Number 806

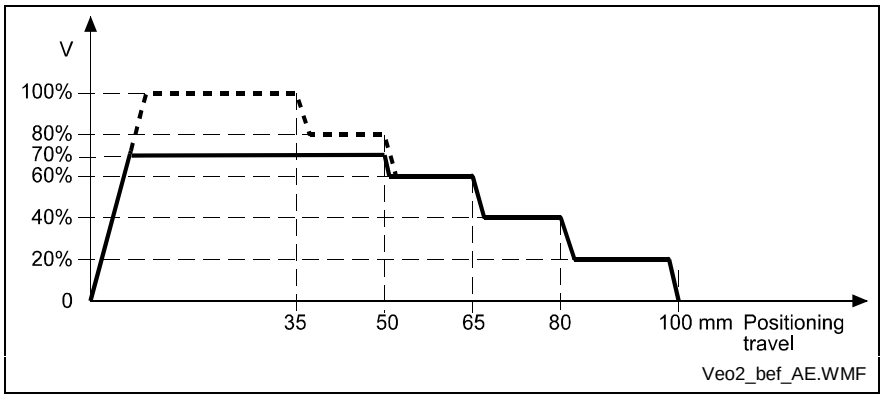


Fig. 5-26: VEO Command - Limit Velocity

3) Program C - Multiplication by Factor of ’500’ from Instruction Number 808

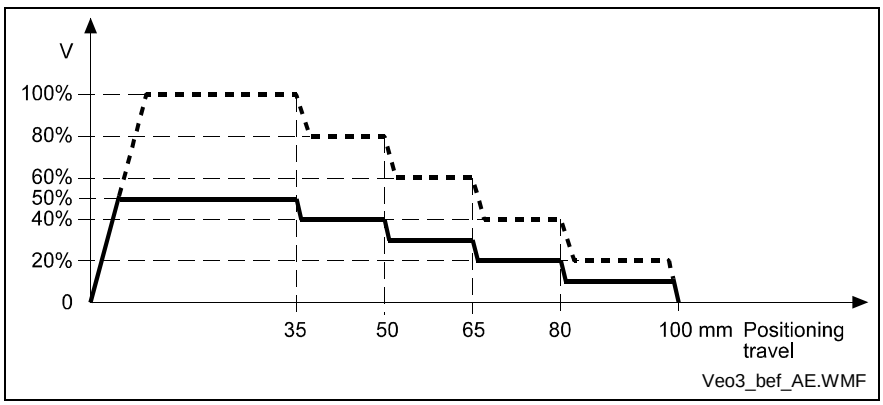
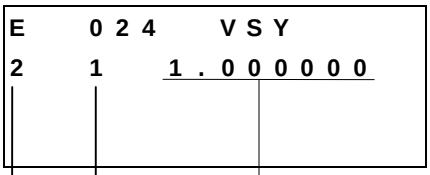


Fig. 5-27: VEO Command - Multiplication by a Factor

VSY - Synchronous Axis



Multiplication factor (0 - 9.999999)

Mode: 0 = Velocity synchronization off

1 = Velocity synchronization on (to Axis 1)

2 = Velocity synchronization on (to measuring wheel)

Axis: 2 only

Axis 2 should have the same velocity profile as the measuring wheel or Axis 1.

Modes 1 and 2: The system deviation (position lag) of Axis 2 is immediately set to 0 and remains at 0. The position loop for Axis 2 is immediately opened and remains open. Activating this mode should therefore only occur when the velocity is close to that of Axis 1 or the measuring wheel. This is the case when Axis 1 is synchronized with the material.

Defaulting the synchronous velocity occurs directly at the analog output. The velocity of the measuring wheel or the Axis 1 motor is multiplied by the factor set in the `VSY´ command and set as the default command velocity of Axis 2.

Using the formula $Factor = \frac{V_{max1}}{V_{max2}} = \frac{Parameter02}{Parameter42}$,

velocity synchronization is attained.

With additional `VSY´ commands in this mode, the multiplication factor can be edited at any time.

The velocity changes when powering on or when the factor is changed are output without an acceleration/deceleration.

As long as synchronization is enabled using the `VSY´ command, no position lag error or drive runaway monitoring occurs for Axis 2.

Mode 0 Synchronization is disabled.

Starting with the last current velocity of Axis 1 or the measuring wheel, the velocity of Axis 2 is ramped down to 0 using the acceleration (deceleration) programmed in Parameter 44. Only then is the position loop closed again.

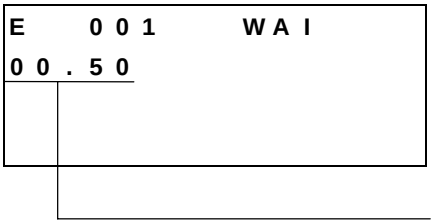
Notes: Axis 2 must be programmed as a tool axis.

If synchronization is enabled using the `VSY´ command, no `FOL´ commands may be processed.

Use this command only in Automatic Mode.

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

WAI - Wait (Time Delay)



Wait time in seconds

The CLM delays execution of the next instruction until the programmed time has elapsed, i.e., the program proceeds to the next instruction after the wait time has elapsed.

6 Inputs and Outputs

6.1 Inputs

The CLM has 32 inputs.

For a CLM with the optional expansion of inputs/outputs (Option E), the number of inputs can be increased to a maximum of 96.

All CLM input signals are galvanically isolated from the control using an opto-electronic coupler.

The signal voltage of the inputs is +24 V external voltage. 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.

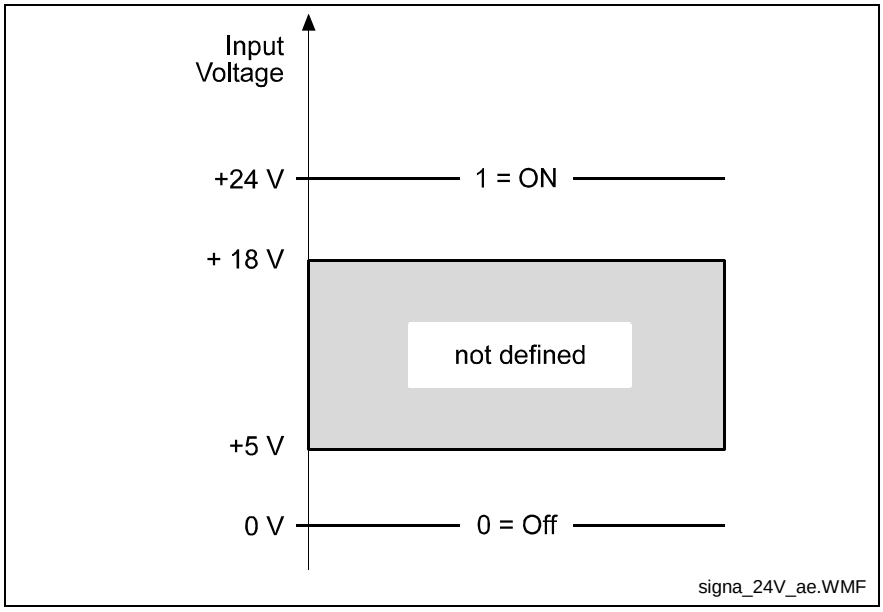


Fig. 6-1: Signal Level of the Inputs

The terms `1´, `On´ or `Activated´ can all be defined by a signal level of +24 V.

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 six groups, depending upon their definitions:

	Input Signal	Pre-Programmed	User-Programmable
1.	Safety Inputs	E-Stop	Interrupt A2 Feed Angle Monitoring A2
2.	Start-Up Information	Enable Axis 1 Enable Axis 2	
3.	Operating Modes	Parameter Automatic / Manual	
4.	Commands	Rapid Stop External clear Jog Forward Axis 1 Jog Reverse Axis 1 Jog Forward Axis 2 Jog Reverse Axis 2 Immediate Cut Cut Inhibit	Homing Manual Vector
5	Messaging Inputs	Initiator Home Position Raster Pulse	
6.	Inputs		01 to 16 01 to 72 (for Option E)

Fig. 6-2: 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´.

The following inputs are available:

Type	CLM	CLM with Option E
System Inputs	16	additional 8
Inputs	16	additional 56

Fig. 6-3: Inputs

Safety Inputs

E-Stop Connector No.: 3 / Pin No.: 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 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.

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).

The two following safety inputs are only valid for Axis 2:

Interrupt A2	User-Programmable Input (see Parameter 54)
Feed Angle Monitoring A2	User-Programmable Input (see Parameter 54)

Start-Up Information

Enable Axis 1	Connector No.: 3 / Pin No.: 6
Enable Axis 2	Connector No.:12 / Pin No.: 28

The axis enable inputs are used to enable each of the two axes individually. If an enable signal is not present, the control enable output and the brake output of the axis in question are off.

When activating Automatic Mode, the axis enable signal for Axis 1 must be present. If Axis 2 is programmed as a tool axis (see Parameter 40), the axis enable signal for Axis 2 must also be present. Otherwise, the error message `Drive not ready´ is generated.

When the signal `Enable Axis X´ is cleared, an axis that has been homed using an incremental encoder loses its absolute measurement reference. The axis is no longer homed.

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 entry is possible in Manual Mode!

Operating Modes

Parameter Input	Connector No.: 3 / Pin No.: 1
Automatic / Manual	Connector No.: 3 / Pin No.: 2

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 `Invalid mode !´ is issued.

Switching Example for Operating Modes:

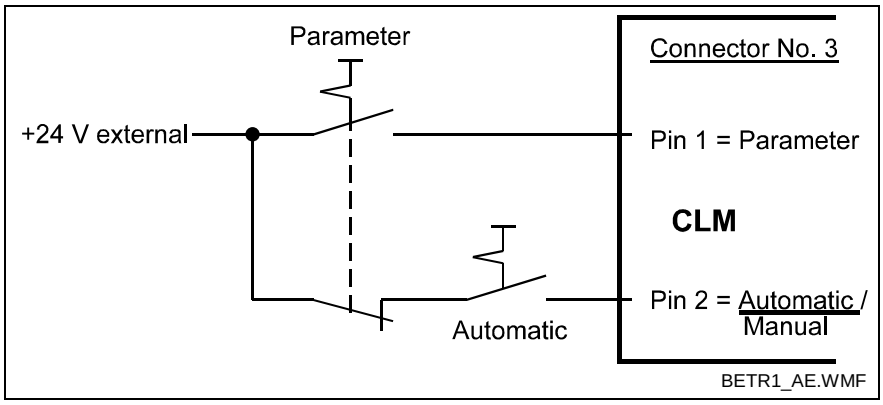


Fig. 6-4: Example of Operating Mode Switch

Operating Mode: ‘Parameter Input´

In this mode, users can program the parameters .

Operating Mode: `Automatic´

‘Automatic´ Mode is possible when the corresponding signal and the axis enable inputs are present. A diagnostic error message is issued.

The following commands are accepted:

- Rapid Stop (Axis 1)
- Immediate Cut (Axis 1)
- Cut Inhibit (Axis 1)
- External Clear

Operating Mode: ‘Manual´

‘Manual´ Mode is possible if neither of the other two operating modes is active and all other preconditions have been met. A diagnostic error message is issued.

During homing, the following commands are accepted:

- Immediate Cut
- External Clear
- Jog forward, Axis 1 / Jog reverse, Axis 1
- Jog forward, Axis 2 / Jog reverse, Axis 2 (if tool axis)

The following commands are still accepted if they are programmed:

- Homing
- Manual Vector

Commands

Rapid Stop Connector No.: 3 / Pin No.: 5

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 a rapid stop program. The start instruction for this program is set in Parameter 15. This program must end with an `EOS´ command. As long as this program is being processed, synchronization is maintained. Then, the target values are set to 0V without a transition, all outputs are cleared and the `Rapid Stop´ error message is displayed. If synchronization is not present and the material is not being processed, the program to move the tool away is not processed. The carriage stops immediately.

If no program is required to move the tool away from the material, Instruction `000´ must be designated as the start instruction in Parameter 15.

Note: A signal at the `Rapid Stop´ input is only accepted in Automatic Mode.

External Clear Connector No.: 3 / Pin No.: 8

When a positive edge is present at the input `External Clear´, any displayed error is cleared. This input is only queried from the firmware for `E-Stop´ and `Error´. When the program or parameters are lost, the clear function is only available by pressing the key `CL´.

Jog Forward Axis 1 Connector No.: 3 / Pin No.: 9

Jog Forward Axis 2 Connector No.: 12 / Pin No.: 29

If a signal is present at the `Jog Forward Axis 1 or 2´ input, the drive moves forward (positive direction) in Manual Mode at the velocity entered in Parameter 02 or 42. The axis enable signals must be present.

Jog Reverse Axis 1 Connector No.: 3 / Pin No.: 10

Jog Reverse Axis 2 Connector No.: 12 / Pin No.: 30

If a signal is present at the `Jog Reverse Axis 1 or 2´ input, the drive moves in reverse (negative direction) in Manual Mode at the velocity entered in Parameter 02 or 42. The axis enable signals must be present.

Immediate Cut Connector No.: 3 / Pin No.: 11

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 Parameter 20.

The processing program must end with an `RTS´ command. While the processing program is running, the `Jog forward´ and `Jog reverse´ inputs are disabled.

If the CLM is in ´Automatic´ Mode and a signal is present at the `Immediate Cut´ input, the carriage immediately accelerates to the material velocity, regardless of the default length, and the processing program for the length instruction is started. However, the signal at the input is only accepted if the carriage is at the start position. The signal must be a pulse (> 10 msec).

Cut Inhibit Connector No.: 3 / Pin No.: 12

If the CLM is in `Automatic´ Mode and Axis 1 is not yet in the flying motion, synchronization is suppressed when a signal is applied to the `Cut Inhibit´ input. The signal must be a pulse (> 10 msec). The process is reinitialized by immediately cutting the material, but only when a signal is present at the `Immediate Cut´ input.

When switching from `Automatic´ to `Manual´, the `Cut Inhibit´ function is canceled.

Messaging Inputs

Initiator Home Position Connector No.: 3 / Pin No.: 4

The initiator home position can be found in the rear section of the carriage base. It is only used for the ‘Homing´ function.

Raster Pulse Connector No.: 3 / Pin No.: 16

The `Raster Pulse´ input is used when the carriage synchronization is to occur at a particular location on the material, depending on a marked position on the material (Raster) The marked position on the material must be detected by appropriate equipment, e.g. light barrier or pilot pin. Detection must be communicated to the CLM without time delay by applying a signal at the `Raster Pulse´ input. The signal is detected by the CLM after approx. 100 - 150 µsec. The evaluation of the `Raster Pulse´ input is accomplished using the `LMK´ or `LMR´ command.

Note: The `Raster Pulse´ may only be used with incremental encoders.

User-Programmable Inputs

Inputs 01 to 16	Connector No.: 3 / Pin No.: 17 to 32
Inputs 17 to 48	Connector No.: 11 / Pin No.: 1 to 32
Inputs 49 to 72	Connector No.: 12 / Pin No.: 1 to 24

All user-programmable outputs can be cleared via the user-programmable inputs.

The inputs can also be used for the following functions (if programmed accordingly):

$\overline{\text{Interrupt A2}}$	- Parameter 54
$\overline{\text{Feed Angle Monitoring A2}}$	- Parameter 54
Homing	- Parameter 10 / 50
Manual Vector	- Parameter 86

6.2 Outputs

The CLM has 32 outputs .

For a CLM with the optional expansion of inputs/outputs (Option E), the number of outputs can be increased to a maximum of 64.

To attain a high resistance to errors, 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 five groups, depending upon their definitions:

	Output Signal	**Pre-Programmed**	**User-Programmable**
1.	Safety Outputs	Error Message	
2.	Start-Up Information	Drive Enable Axis 1 Drive Enable Axis 2 Brake Axis 1 Brake Axis 2	Position Reached Presignaling Axis homed Home Position, Axis 1 Error Message via Outputs
3.	Operating Modes	Parameter Automatic Manual	
4	Messaging Outputs	Cut Inhibit Test Mode	
5.	Outputs Marker Flags (Outputs)		01 to 16 01 to 48 (for Option E) 17 to 99 49 to 99 (for Option E)

Fig. 6-5: 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´.

The following outputs are available:

Type	**CLM**	**CLM with Option E**
System Outputs	16	
Outputs	16	additional 32

Fig. 6-6: Outputs

Safety Outputs

$\overline{\text{Error Message}}$ Connector No.: 4 / Pin No.: 6

In the event of an error, the output is immediately deactivated.

An error can only be cleared via the input ‘External Clear´, CL, or via the serial interface.

Start-Up Information

Drive Enable Axis 1 Connector No.: 4 / Pin No.: 4 or
Connector No.: 7 / Pin No.: 1 (max. 10 mA)

Drive Enable Axis 2 Connector No.: 4 / Pin No.: 14

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

In case of an error or after clearing the Enable signal for the axes, Drive Enable is immediately disabled. For a direct connection to a drive controller with the same +24V voltage potential, enabling the drives is also available on the X7 terminal strip. (load capacity, approx. 10 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). Otherwise, the error message `Drive not ready´ is generated.

Brake Axis 1 Connector No.: 4 / Pin No.: 5

Brake Axis 2 Connector No.: 4 / Pin No.: 15

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 an error 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:

Position Reached	- Parameter 07 / 47
Presignaling	- Parameter 13 / 53
Axis Homed	- Parameter 10 / 50
Home Position, Axis 1	- Parameter 10
Error Number via Outputs:	- Parameter 82

Operating Modes

Parameter Input Connector No.: 4 / Pin No.: 3

If the operating mode ‘Parameter Input´ is accepted by the CLM, this output is powered.

Automatic Connector No.: 4 / Pin No.: 2

If the operating mode `Automatic´ is accepted by the CLM, this output is powered.

Manual Connector No.: 4 / Pin No.: 1

If the operating mode `Manual´ is accepted by the CLM, this output is powered.

Messaging Outputs

Cut Inhibit Connector No.: 4 / Pin No.: 8

If the CLM has accepted the input message ‘Cut Inhibit´, this output is set.

Test Mode Connector No.: 4 / Pin No.: 7

If `Test Mode´ is activated in Parameter 19 and the CLM has accepted `Automatic´ operating mode, this output is set.

User-Programmable Outputs

Outputs 01 to 16	Connector No.: 4 / Pin No.: 17 to 32
Outputs 17 to 48	Connector No.: 13 / Pin No.: 1 to 32

All outputs are user-definable in the user program.

Moreover, these user-definable outputs can be used for different functions.

In addition to the above-mentioned outputs which are present in the hardware, all outputs from 01 to 99 can be used as marker flags.

Note: Marker flags No. 89 to 99 are permanently assigned to a function.

Marker Flags

The CLM has both user-definable hardware outputs and user-definable software outputs.

These software outputs are called `marker flags´.

The `marker flags´ function as outputs in the commands.

The programmed outputs and marker flags are handled differently by the CLM.

Output / Marker Flag: 01 to 72 The outputs or marker flags are cleared each time the system is switched on, when entering Parameter Mode or when there is an error.

Output / Marker Flag: 73 to 80 The marker flags are cleared each time the system is switched on.

Output / Marker Flag: 81 to 88 The marker flags are not cleared.

Output / Marker Flag: 89 to 96

These marker flags are processed by the firmware and can only be queried by the user!

Marker Flag 89 = `1´ in Manual Mode
Marker Flag 90 = `1´ in Automatic Mode
Marker Flag 91 = `0´ (reserved)
Marker Flag 92 = `0´ (reserved)
Marker Flag 93 = `0´ (reserved)
Marker Flag 94 = `0´ for errors
Marker Flag 95 = `0´ (reserved)
Marker Flag 96 = `0´ (reserved)

Output / Marker Flag: 97 to 99

The marker flags are cleared when a loss of power occurs.

Marker Flag 97 = User-Programmable
Marker Flag 98 = User-Programmable
Marker Flag 99 = `1´ causes an interrupt at Axis 2

Marker flag 99 can be set by the program and, thus, produces an interrupt, as described for Parameter 54.

Note: An interrupt is cancelled if the marker flag is set to `0´ and any programmed `Interrupt´ input is at +24V!

Monitoring Inputs and Outputs

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!

7 Functions

7.1 Operating Modes

Parameter Mode

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

In Parameter Mode, the power is turned off and all tasks are halted. 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 using the Jog forward (Jog+) or Jog reverse (Jog-) functions.

NC Task 3 is running. The following functions can also be called up.

- Homing
- Manual Vector

Automatic Mode

In Automatic Mode, NC Tasks 1and 2 are directly activated.

Task 1 begins in the old length instruction minus -1 (`LMD´, `LMI´, `LMK´, `LML´ or `LMR´ command).

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

Test Mode

The CLM is able to simulate automatic processing. In order to do this, `Test Mode´ must be activated in Parameter 19. In `Automatic´ Mode, the material feed is simulated by an clock generator inside the CLM and the system output `Test Mode´ (Connector No. 4/Pin No. 7) is turned on.

In `Material Velocity´ display mode, the material velocity can be increased or decreased in 32 steps between zero and the maximum velocity (Parameter 02) by pressing + or -.

If the CLM is in `Material Velocity´ display mode, the material velocity can be immediately set to zero by pressing CL.

Note: When switching from `Automatic´ to `Manual´ Mode, the material velocity is set to zero.

7.2 Decade Switch `IDS01´

The decade switch ‘IDS01´ is designed for installation in a front panel. This decade switch can be used to enter 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 80 causes continuous monitoring of the decade switch transmission in Automatic Mode. If the transmission contains errors or there is no transmission, the error message `IDS01-Break-Error´ is issued.

In the program structure, the IDS01 information can be processed with commands `LMD´, `POM´, and `PSM´.

Example:

```
010   NOP
011   LMD
012   JSR   500
013   JMP   000
014   .......
```

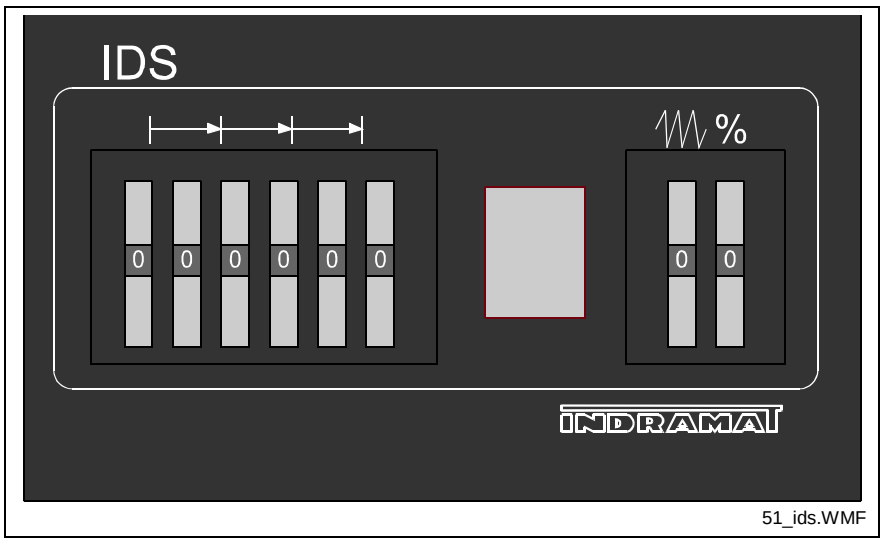


Fig. 7-1: IDS01 - Front View

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

7.3 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).

For Axis 1, 3 different homing types are available and for Axis 2, 1 homing type is available.

Homing Axis 1

Automatic Homing

Processing of the Homing Routine

1. ‘Automatic Homing´ is started using an input signal at the `Homing´ input (Parameter 10).
2. If the carriage is not located on the `Home Position´ initiator (Connector No. 3/Pin No. 4), it is moved to the initiator at the homing velocity specified in Parameter 08.
3. As soon as the initiator is attenuated, the carriage reverses and moves off the initiator at 1/4 of the velocity programmed in Parameter 08.
   After leaving the initiator, the carriage is reversed again and moved to the initiator at 5000 increments per second, until the first marker pulse from the incremental encoder has been evaluated.
   Now, the carriage direction is reversed again, and moved to the exact position of the marker pulse (± 1 increment) at 500 pulses per second. If this position has been found, the carriage stops and Axis 1 is homed.
4. If an offset dimension was programmed in Parameter 09, the carriage moves the additional distance of the offset dimension at maximum velocity (Parameter 02) before it stops.

Remarks:

a) If the carriage is positioned on the initiator when the homing routine is initialized, it is moved off the initiator at 1/4 the velocity designated in Parameter 08. Then, the same process as described in 3. is followed.

b) If an offset dimension is programmed in Parameter 09, the minimum travel limit value (Parameter 11) must be programmed as a higher value than the offset dimension. Because the offset dimension is not calculated with the travel limit, when the position offset dimension + the min. travel limit value is too low, the error message `Min. Travel Lmt´ is issued.

Configuration of the ‘Home Position´ Initiator

As described above, the zero position of the tool carriage is determined by contact with the initiator.

The initiator must be attenuated during additional reverse motion up to the travel limit of the unit. This is necessary to indicate to the control the direction the carriage must travel to approach the zero position.

The zero position can also be set in increments of one motor revolution each through the activation position of the initiator. If no marker pulse is detected from the encoder within one encoder revolution, the CLM enters error mode with the error message ‘No Marker Pulse´.

The CLM diagnostics ensure that the initiator 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 initiator is closer than 1/16 motor revolution to the marker pulse, the control does not complete the homing routine but enters error mode with the error message `Marker Pulse ?´.

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

Termination of the Homing Routine

If the operating mode is changed while in `Manual´ Mode, the cycle is terminated and must be called again.

Schematic of the Homing Routine Process

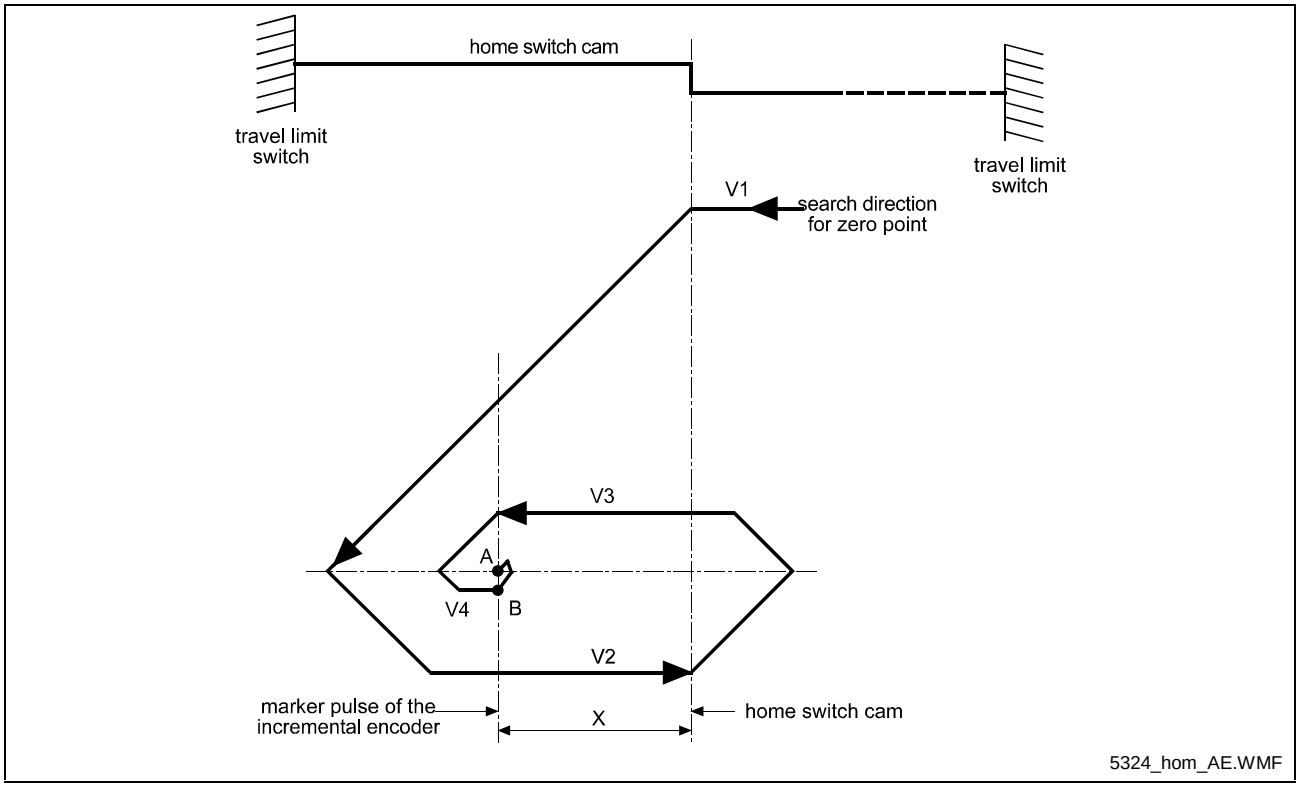


Fig. 7-2: Schematic of the Homing Routine Process

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 = 5000 increments/controller cycle (system velocity)
V4 = 500 increments/controller cycle (system velocity)
X = > 1/16 and < 15/16 Feed Constant

Homing with Jog Reverse

The carriage is moved toward the home position by pressing ‘Jog Reverse, Axis 1´. As soon as the `Home Position´ initiator is attenuated, the offset dimension set in Parameter 09 is accepted as the absolute position. Axis 1 has been homed.

If no offset dimension is programmed, the carriage stops immediately. Otherwise, the carriage moves back to Position `0´ when the `Jog Reverse, Axis 1´ signal continues to be active.

Remarks:

a) If the carriage is not homed when it is on the `Home Position´ initiator, the `Jog Reverse, Axis 1´ key is inactive until the carriage is moved off of the initiator.

b) If an offset dimension is programmed in Parameter 09, the minimum travel limit value (Parameter 11) must be programmed as a higher value than the offset dimension. Because the offset dimension is not calculated with the travel limit, when the position offset dimension + the min. travel limit value is too low, the error message `Min. Travel Lmt´ is issued.

Passive Homing

If the carriage is located on the `Home Position´ initiator and if `Jog forward, Axis 1´ is pressed, the offset dimension entry in Parameter 09 is accepted as the absolute position as soon as the carriage moves off of the initiator. Axis 1 has been homed.

If the carriage is not located on the `Home Position´ initiator and if `Jog Reverse, Axis 1´ is pressed, the offset dimension entry in Parameter 09 is accepted as the absolute position as soon as the carriage moves on to the `Home Position´ initiator. Axis 1 has been homed.

If the carriage is positioned on the `Home Position´ initiator, switching from `Manual´ to `Automatic´ is permitted. As soon as the carriage is synchronized and moves off of the `Home Position´ initiator, the offset dimension set in Parameter 09 is accepted as the absolute position. Axis 1 has been homed.

Remarks:

a) If the carriage is not homed when it is on the `Home Position´ initiator, the `Jog Reverse, Axis 1´ key is inactive until the carriage is moved off of the initiator.

b) If an offset dimension is programmed in Parameter 09, the minimum travel limit value (Parameter 11) must be programmed as a higher value than the offset dimension. Because the offset dimension is not calculated with the travel limit, when the position offset dimension + the min. travel limit value is too low, the error message `Min. Travel Lmt´ is issued.

Homing Axis 2

Processing of the Homing Routine

1. Homing is possible in 2 operating modes:
   a) Manual Mode via input signal (see Parameter 50)
   b) Automatic Mode: via the `HOM´ command
2. 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 48.
3. As soon as the cam switch is activated, the carriage reverses and moves off the cam using 1/4 of the velocity set in Parameter 48. After leaving the cam, the carriage is reversed again and moved to the cam at 5000 increments per second, until the first marker pulse from the incremental encoder has been evaluated. Now, the carriage is reversed again, and moved to the exact position of the marker pulse at 500 pulses per second (± 1 Increment).
4. If the carriage is positioned on the cam when the homing routine is initialized, it is moved off the cam at 1/4 the velocity designated in Parameter 48. Then, the same process as described in 3. is followed.
5. If an offset dimension is programmed in Parameter 49, this offset dimension is accepted as the absolute position. This absolute position is positive with an offset dimension in reverse direction and negative with an offset dimension in the forward direction.

Placement of the Home Switch

As described above, the zero position of the 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 home 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 error mode with the error message `Marker Pulse ?´.

The home switch must then 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 the reverse motion.

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 location of the home switch is dependent upon machine construction, the homing direction can also be set in Parameter 48.

If no marker pulse is detected from the encoder within one encoder revolution, the CLM enters error mode with the error message ‘No Marker Pulse´.

Termination of the Homing Routine

If an interrupt, feed monitoring or mode change command is received in `Manual´ Mode, the cycle is terminated and must be called again. In `Automatic´ Mode, the homing cycle is immediately restarted after the interrupt is cleared.

If an error occurs during the homing routine, the cycle must be called again.

7.4 Vector Programming

Manual Vector

This function 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 86). If `00_1_XXX´ 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: Entry in Parameter 86

```
P86          13  1  400
```

Entry in the programming instruction

```
400   APE   0  2000000000
401   APE   1  0002222222
402   RTS
```

Outputs 1 to 12 are cleared when the manual vector is called.

7.5 Multitasking

The control can process 3 cycles simultaneously (Task). The user can enter a program in each of these 3 tasks. In each task, one instruction (command) is processed within the controller cycle time (Parameter 88).

When programming Tasks 1 through 3, take note of the following:

- Subroutines 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. After a switch from ‘Manual´ to `Automatic´ Mode, the program processing begins in the old length instruction minus 1 (`LML´, `LMD´, `LMI´, `LMK´, or `LMR´ command).

Normally, only Task 1 is in operation.

Example:

```
000   NOP
001   LMD
002   AEA   05   1
003   WAI   02.00
004   AEA   05   0
005   COU   +00000   22   000100
006   JMP   000
```

Task 2 Task 2 is equivalent to Task 1. Task 2 is activated only if it has been enabled in parameter 84. That is also where the start instruction is entered that begins the program in Task 2, after switching from `Manual´ to `Automatic´.

Example: Entry in Parameter 84

```
P84          1   200   0   800
```

Entry in the programming instruction

```
200   ATS   22  1
201   AEA   22  0
202   PSI   2  +000500.000  999
203   APE   0   0011110011
204   WAI   00.50
205   APE   0   2211111111
206   WAI   00.80
207   APE   0   0000000002
208   WAI   02.00
209   COU   +00000   24   000010
210   JMP   200
```

Task 3

Task 3 is also enabled in Parameter 84, as is the start instruction. Program execution of Task 3 begins automatically immediately after the CLM has been powered up (even in Manual Mode).

Task 3 is deactivated only in Parameter Mode and during an error. Task 3 continues to run, even in the event of an emergency stop.

Lockouts can therefore also be monitored via this cycle.

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

Example: Entry in Parameter 84

P84	0 200 1 800

Entry in the programming instruction

800	AKN	02 1
801	APE	0 0000000000
802	WAI	02.00
803	AEA	25 1
804	ATS	24 1
805	AEA	24 0
806	AEA	20 1
807	WAI	00.10
808	AEA	20 0
809	JMP	802

7.6 Velocity Override

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

Note: The ‘Override´ function can only be used for Axis 2.

Override via Analog Input

The override is controlled by applying a voltage to Analog Input 2 AE2 (X5/14 and X5/15).

This function can be enabled in Parameter 87.

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

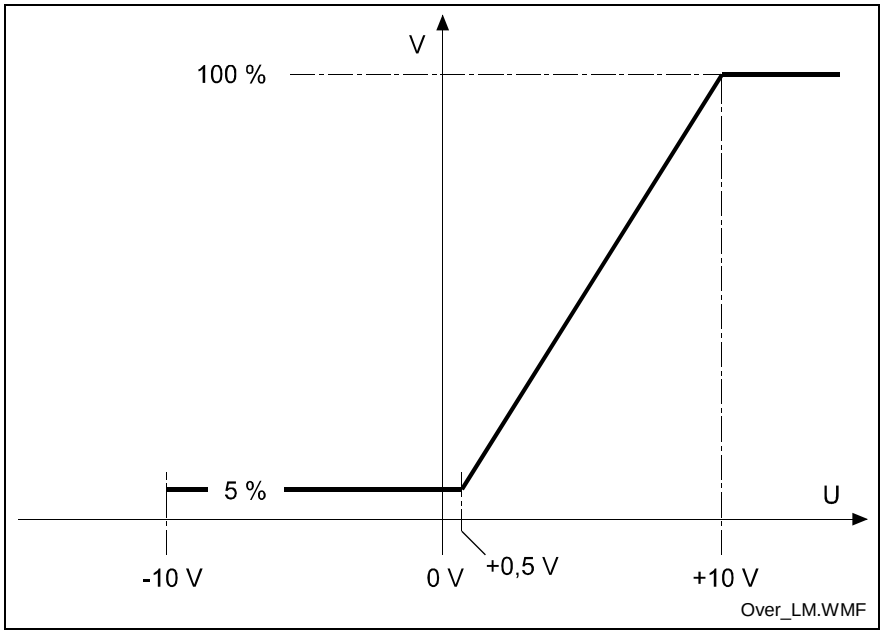


Fig. 7-3: Analog Override

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

$$Vo = Vp \times F$$

L:	Vo	=	Velocity
	Vp	=	Traversing velocity
	F	=	Override factor

Fig. 7-4: Velocity Calculation with Override

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

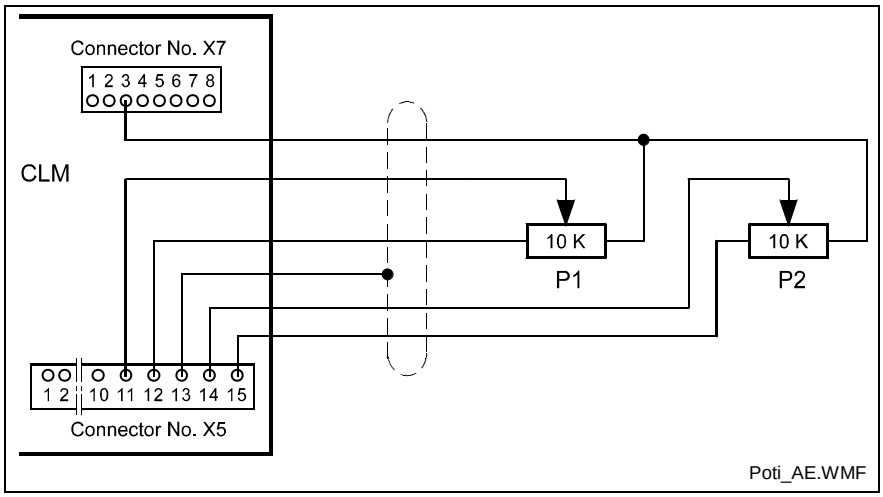


Fig. 7-5: Example for Analog Override

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 13 to 16. This function is turned on in Parameter 87.

The set velocity always references the currently programmed velocity.

Input No.	**13**	**14**	**15**	**16**	**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 42.

P42	000500.00	10

The following program instruction is processed.

800	PSI	2	+001000.00	500

Input 13 = weighted value of 1
Input 14 = weighted value of 1
Input 15 = weighted value of 0
Input 16 = weighted value of 0

The max. velocity is 500 mm/s.

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 87, the velocity is 0.02 x 250 = 5 mm/s.

Notes

8 Serial Interface

8.1 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.

8.2 Interface Connection

RS232C - V.24 Interface:

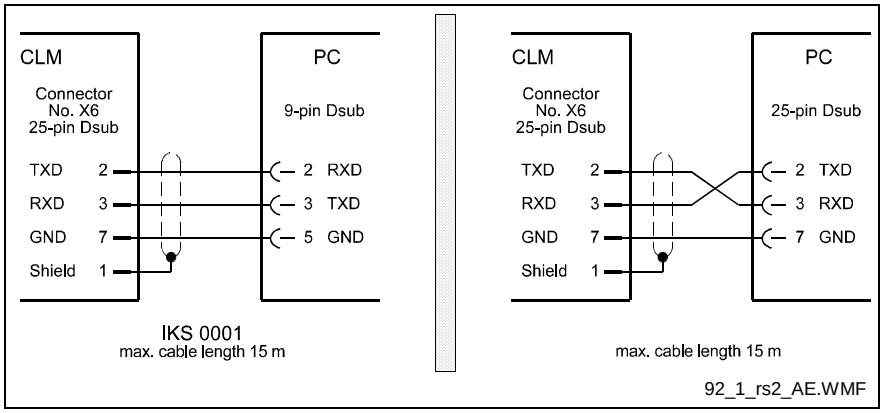


Fig. 8-1: Serial Interface Connection

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:

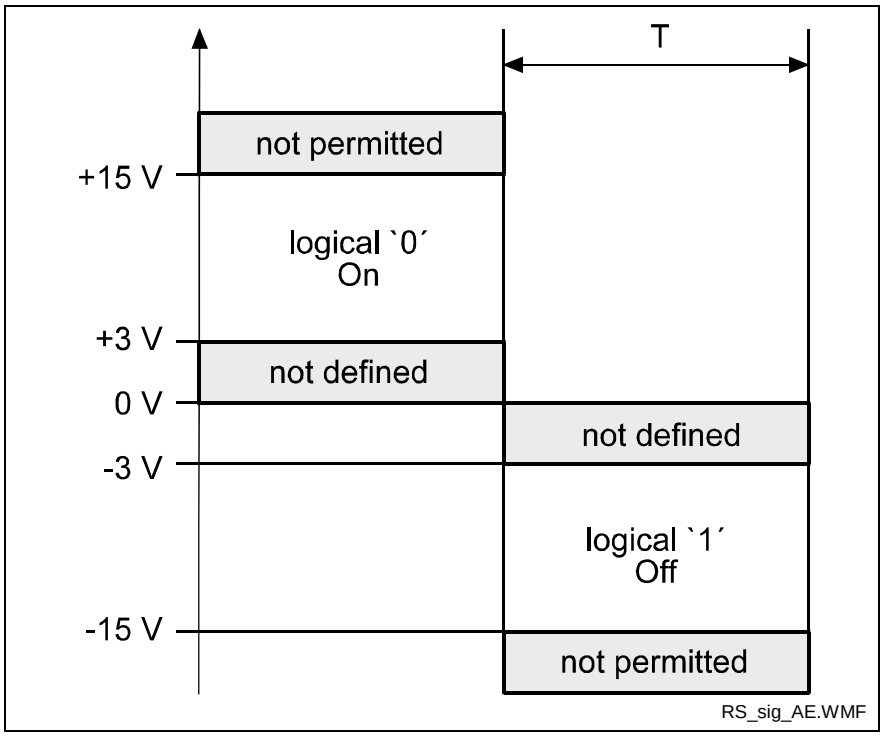


Fig. 8-2: Signal Levels for Interface

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

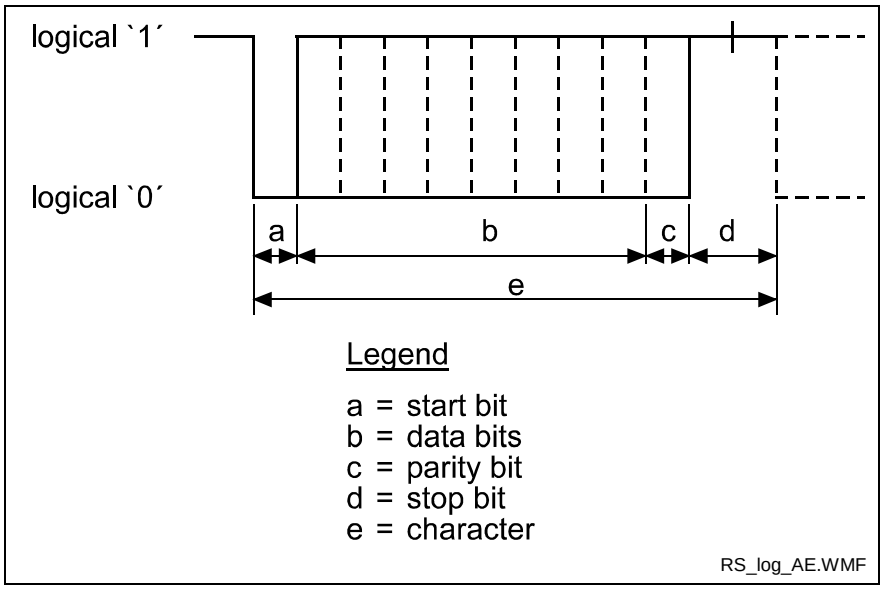


Fig. 8-3: Data Format

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:

```
?AN_000CR LF
```

Response from the CLM:

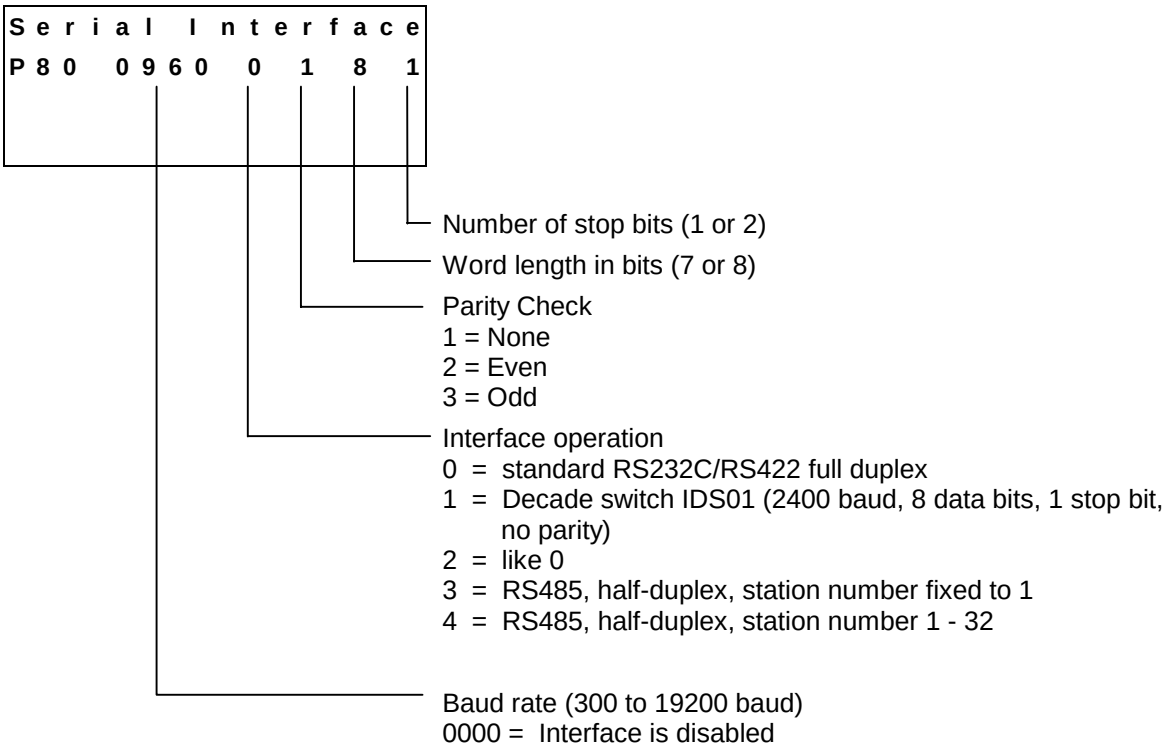
```
#AN_000_Instruction Contents CR LF
```

For further information, see description for Parameters 80 and 81.

The data transmission format for the serial interface is set in Parameters 80 and 81. Here, it is also determined whether the interface operates as a data interface or as an interface to the decade switch unit `IDS01´.

8.3 Interface Parameters

P80 Interface



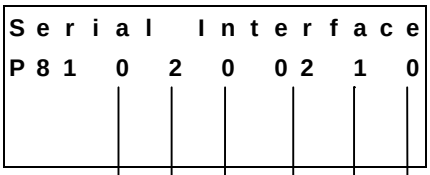
Here, the data for initializing the serial interface are input. The desired baud rates can be selected from the following list of values:

Input	Baud Rate
0030	300
0060	600
0120	1200
0240	2400
0480	4800
0960	9600
1920	19200

Fig. 8-4: Baud Rate

If decade switch querying is selected, the remaining data are not required in Parameter 80. In Parameter 81, the data format of the IDS01 decade switch must be programmed.

P81 Interface



0 = No function
1 = Interface Confirmation (Y CR LF)

Handshake / Checksum:
0 = Checksum on – Hardware handshake RTS/CTS off
1 = Checksum off – Hardware handshake RTS/CTS off
2 = Checksum on – Hardware handshake RTS/CTS on
3 = Checksum off – Hardware handshake RTS/CTS on

Station number 1-32 (only for Interface Mode 4 from Parameter 80)

0 = No error message sent via RS232 interface for error (only for Interface Mode 0 or 2 from Parameter 80)

1 = Error message sent via RS 232 interface for error (only for Interface Mode 0 or 2 from Parameter 80)

Data format at IDS01 decade switch:
0 = 6 places before decimal, none after
1 = 5 places before decimal, 1 after
2 = 4 places before decimal, 2 after
3 = 3 places before decimal, 3 after

Response delay in RS 485 Mode
0 = No delay
1 = 2 msec delay
2 = 4 msec delay
3 = 6 msec delay
4 = 8 msec delay
5 = 10 msec delay
6 = 15 msec delay
7 = 20 msec delay
8 = 30 msec delay
9 = 40 msec delay

Interface Confirmation

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 a program or parameter set, `Y CR LF´ is sent via the serial interface as a confirmation.

Handshake / Checksum

If checksum validation is not activated, the checksum is unnecessary in the transmission. In this case, `CR LF´ is sufficient instead of `$hh CR LF´.

A hardware handshake with RTS/CTS is only possible if the interface type is programmed as RS232 / RS422 (see Parameter 80).

Response Delay

In RS485 Mode, once the CLM receives the last character of a request (Linefeed: ASCII Code 10), it immediately switches to Send Mode.

With various RS-485 PC driver cards, this leads to problems if the cards are unable switch to Receive Mode quickly enough.

The interface can delay the switch from Receive to Send Mode by a defined amount of time (response delay). The PC driver should be able to switch reliably from Send to Receive Mode within this time limit.

The response delay is rounded up to whole number multiples of the controller cycle time.

8.4 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 **3 F** / Character for data query

If the control receives a `?´, the requested information (program instruction, parameter, status message) is output.

2) **#** Hexadecimal **2 3** / Characters for program transmission

If the CLM receives a `#´, the following characters are read into the corresponding instruction number of the program memory.

3) **!** Hexadecimal **2 1**

If the control receives a `!´, the following characters are picked up as the control command or as parameter data.

4) **:** Hexadecimal **3 A**

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 81), 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 **4 E** / Character for instruction number

The information following the `N´ is interpreted as a program instruction.

2) **K** Hexadecimal **4 B** / Character for parameter

The information following the `K´ is interpreted as a parameter.

3) **X** Hexadecimal **5 8** / Character for status information

Other Control Characters:

1) **$** Hexadecimal **2 4** / 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 **0 D** / Character for carriage return (Carriage Return)

LF Hexadecimal **0 A** / 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 **3 0** through **3 9**

A through **Z** Hexadecimal **4 1** through **5 A**

The numerals `0´ through `9´ and the letters `A´ through `Z´ are available for command and data input.

2) **_** Hexadecimal **2 0** / Space (space bar)

To produce the desired format, the space is used at various points within the data string.

3) **+** Hexadecimal **2 B** / Operational sign for data

- Hexadecimal **2 D** / Operational sign for data

4) **.** Hexadecimal **2 E**

, Hexadecimal **2 C**

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 **1 1**

X-OFF Hexadecimal **1 3**

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.

8.5 Generating the Checksum

Examples: 1. #_N_000_POI _ 2_+123456.78_999_ $

2. #5N_123_NOP _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ $

Character	Hex	∑ Hex		Character	Hex	∑ Hex
#	23	23		#	23	23
_	20	43		5	35	58
N	4E	91		N	4E	A6
_	20	B1		_	20	C6
0	30	E1		1	31	F7
0	30	111		2	32	129
0	30	141		3	33	15C
_	20	161		_	20	17C
P	50	1B1		N	4E	1CA
O	4F	200		O	4F	219
I	49	249		P	50	269
_	20	269		_	20	289
2	32	29B		_	20	2A9
_	20	2BB		_	20	2C9
+	2B	2E6		_	20	2E9
1	31	317		_	20	309
2	32	349		_	20	329
3	33	37C		_	20	349
4	34	3B0		_	20	369
5	35	3E5		_	20	389
6	36	41B		_	20	3A9
.	2E	449		_	20	3C9
7	37	480		_	20	3E9
8	38	4B8		_	20	409
_	20	4D		_	20	429
9	39	511		_	20	449
9	39	54A		_	20	469
9	39	583		_	20	489
_	20	5A3		_	20	4A9

Fig. 8-5: 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: #_N_000_POI _ 2_+123456.78_999_ $**58**

Sum: 5A3 ➔ 05 + A3 = A8. The Two´s Complement of A8 is **58**.

Example 2: #5N_123_NOP _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ $**53**

Sum: 4A9 ➔ 04 + A9 = AD. The Two´s Complement of AD is **53**.

8.6 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:

```
#sN_bbb_ccc_ddddddddddddddd_$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 16 characters)

Examples of data transmissions to the CLM:

```
#_N_000_NOP_________________$6E CR LF
#_N_001_LML________001000.00_$E5 CR LF
#_N_002_JSR_900_____________$31 CR LF
#_N_003_STZ_+0000000_0000100_$6A CR LF
#_N_004_JMP_000_____________$40 CR LF
```

Data Field with 16 characters

Read Program Instructions Out of the CLM:

Example of querying an instruction from the CLM:
Format:

```
?sN_bbb$hh CR LF
```

The character sequence `? s N´ always comes first. An entry must always be concluded with `CR LF´.

In response to this query, the CLM sends the contents stored in the queried program instruction 'bbb.'

```
#sN_bbb_ccc_ddddddddddddddd_$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 16 characters)

Parameter Transmission

Read Parameters Out of the CLM:

Parameters can be read out in any operating mode.

Format:

```
?sK__xx CR LF
```

In response to this query, the CLM sends the contents stored in the queried parameter ‘xx´.

```
Ksxx__ddddddddddddd_$hh CR LF
```

Meaning of the characters used:

- s = Blank space for RS232C or station number for RS485
- x = Parameter number
- d = Instruction information (data field with 12 characters)

Examples:

Query	Response
?_K__00 CR LF	K_00_____0050.0000_$BF CR LF
?_K__05 CR LF	K_05___0.950_0.950_$95 CR LF

Transmit Parameters to the CLM:

To store parameters, the CLM must be in `Parameter´ Mode!

Format:

```
!sK_xx__ddddddddddddd_$hh CR LF
```

Meaning of the characters used:

- s = Blank space for RS232C or station number for RS485
- x = Parameter number
- d = instruction information (data field with 12 characters)

If no checksum validation function has been programmed prior to entering Parameter Mode, this function remains disabled, even though Parameter 81 has been overwritten, until Parameter Mode is exited.

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´	=	Counter
Status `05´	=	Firmware Version
Status `06´	=	Status of the inputs
Status `07´	=	Status of the outputs
Status `08´	=	Current instructions and return instruction numbers of Tasks 1 to 3
Status `19´	=	Hardware and firmware version
Status `30´	=	Current material length information
Status `31´	=	Last cut length
Status `32´	=	Current cutoff program data
Status `50´	=	Status of the system inputs and system outputs (hexadecimal)
Status `51´	=	Status of the inputs (hexadecimal)
Status `52´	=	Status of the outputs (hexadecimal)
Status `53´	=	Error message
Status `54´	=	Processed material length
Status `55´	=	Material Velocity
Status `56´	=	Total piece counter
Status `80´	=	Time measurement 1
Status `81´	=	Time measurement 2
Status `90´	=	Get saved information from `STM´ command

Status `00´ Actual position of Axes 1 and 2 in IU

The status query:

```
?sX__00_ CR LF
```

produces the message:

```
Xs00_evmmmmmm.mm_evnnnnnn.nn_$hh CR LF
```

Meaning of the characters used:

- s = Blank space for RS232C or station number for RS485
- 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

With 3 decimal places (Parameter 82), the decimal point moves to the right by one place for the actual position for Axes 1 and 2.

Status `01´ Transmission error

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_tttttttttttttttttttt_$hh CR LF
```

Meaning of the characters used:

- s = Blank space for RS232C or station number for RS485
- f = Error number
- t = Error text (always 20 characters)

Below is a list of the error numbers and their meanings:

Error No.	Error 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	RS Para # Wrong	The transmitted parameter number is not a decimal number.
07	RS Para # too large	The transmitted parameter number is too large.
08	RS Status # Wrong	The number given in a status request is not a decimal number.
09	Invalid Status #	An attempt was made to query status information that was not present in the CLM.
10	Invalid Prg Command	An invalid command was transmitted to the CLM.

Status `02´ Current program instruction number (Task 1)

The status query:

```
?sX__02_ CR LF
```

produces the message:

```
Xs02_nnn_uuu_$hh CR LF
```

Meaning of the characters used:

s = Blank space for RS232C or station number for RS485
n = Current instruction number with three decimal places
u = instruction number after the first `JSR´ command in Main Program (Task 1)

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
```

Actual position of Axis 2 in increments (hexadecimal)

Actual position of Axis 1 in increments (hexadecimal)

The actual position in IU is calculated as follows:

1) Example for incremental encoders:

Parameter 01 = 00_1500_0000
Parameter 00 = 0010.0000
Actual position in increments = 000C14FA (hexadecimal)
This corresponds to a decimal value of 791802.

From these, the actual position in IU is calculated:

$$Actual\ Position\ in\ IU = \frac{Actual\ Position\ in\ Increments \times Parameter\ 00}{Parameter\ 01 \times 4}$$

$$Actual\ Position = \frac{791802 \times 10.0000}{1500 \times 4} = 1319.67\ IU$$

Fig. 8-6: Calculation of the Actual Position with an Incremental Encoder

2) Example for absolute encoders:

Parameter 01 = 00_4096_0512
Parameter 00 = 0020.0000
Actual Position in Increments = 000A39CD
This corresponds to a decimal value of 670157.

From these, the actual position in IU is calculated:

$$Actual\ Position\ in\ IU = \frac{Actual\ Position\ in\ Increments \times Parameter\ 01}{Resolution\ from\ Parameter\ 00}$$

$$Actual\ Position = \frac{670157 \times 20.0000}{4096} = 3272.25\ IU$$

Fig. 8-7: Calculation of the Actual Position with an Absolute Encoder

Status `04´ Counter

The status query:

```
?sX__04_nnn_CR LF
```

produces the message:

```
Xs04_nnn_iiiiii_zzzzzzz_____$hh CR LF
```

Meaning of the characters used:

s = Blank space for RS232C or station number for RS485
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__vvvvvvvvvvvvvvvv_$hh CR LF
```

Meaning of the characters used:

s = Blank space for RS232C or station number for RS485
v = Firmware version (also appears on the CLM display)

Status `06´ Status of the inputs

The status query:

```
?sX__06_b_CR LF
```

produces the message:

```
Xs06_b_eeeeeeeeeeeeeeee_$hh CR LF
```

ascending input number →

Meaning of the characters used:

s = Blank space for RS232C or station number for RS485

b = 0 - System inputs 1 - 16
1 - Inputs 1 - 16
2 - Inputs 17 - 32
3 - Inputs 33 - 48
4 - Inputs 49 - 64
5 - Inputs 65 - 80

e = 0 - Level 0V
1 - Level +24V

Status `07´ Status of the outputs

The status query:

```
?sX__07_b_CR LF
```

produces the message:

```
Xs07_b_aaaaaaaaaaaaaaaa_$hh CR LF
```

ascending output number →

Meaning of the characters used:

s = Blank space for RS232C or station number for RS485

b = 0 - System outputs 1 - 16
1 - Outputs 1 - 16
2 - Outputs 17 - 32
3 - Outputs 33 -48
4 - Outputs 49 -64
5 - Outputs 65 -80
6 - Outputs 81 -96
7 - Outputs 97 -99

a = 0 - Level 0V
1 - Level +24V

Status `08´ Current instruction numbers and return instruction numbers to the main program of Tasks 1 to 3

The status query:

```
?sX__08_CR LF
```

produces the message:

```
Xs08_aaa_bbb_ccc_ddd_eee_fff_$hh CR LF
```

Meaning of the characters used:

s = Blank space for RS232C or station number for RS485

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.

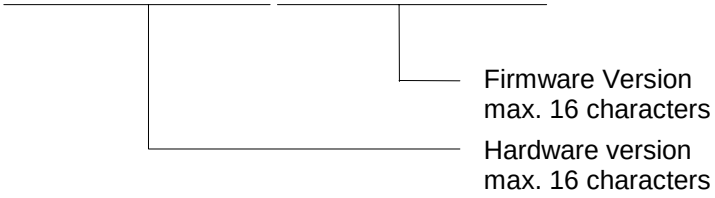
Status `19´ Hardware and firmware version

The status query:

```
?sX__19_CR LF
```

produces the following message, e.g.,:

```
Xs19_CLM01.4-N-E-2-BCLM1.4-LM1-01V01$hh CR LF
```



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 firmwares. This way, the RS485 bus master can detect the firmware type of all connected controls.

Status `30´ Current material length information

The status query:

```
?sX__30_CR LF
```

produces the message:

```
Xs30_vAAAAAA.AA_vBBBBBB.BB_$hh CR LF
```

Meaning of the characters used:

s = Blank space for RS232C or station number for RS485
v = Operational sign
A **=** Current processed length
B **=** Length yet to be processed

This information is only valid if the length measurement has been enabled in the `FUN´ command of the cutoff command.

In Manual and Automatic Mode, the current processed length is constantly changing due to movement of the carriage or the material. The length yet to be processed is equal to `0´ in Manual Mode.

While an error is present, the information `processed length´ remains intact, but it is no longer changing due to material or carriage movements. After the error is cleared, the information is lost.

With 3 decimal places (Parameter 82), the decimal point moves to the left by one place for the lengths.

Note: This status query produces incorrect values in Test Mode.

Status `31´ Last cut length

The status query:

```
?sX__31_CR LF
```

produces the message:

```
Xs31_vAAAAAA.AA _$hh CR LF
```

Meaning of the characters used:

s = Blank space for RS232C or station number for RS485
v = Operational sign
A **=** Last cut length from the buffer

This information is only accurate in Automatic Mode, when the `FUN´ command is used in a cutoff program. If a cut has not occurred after a restart of Automatic Mode, the information is incorrect.

With 3 decimal places (Parameter 82), the decimal point moves to the left by one place for the lengths.

Note: This status query produces incorrect values in Test Mode.

Status `32´ Current cutoff program data

The status query:

```
?sX__32_CR LF
```

produces the message:

```
Xs32_NNN_ZZZZZZZ_BB_VVVVVVVV_$hh CR LF
```

Meaning of the characters used:

s = Blank space for RS232C or station number for RS485
N **=** Instruction number for the current length instruction
Z **=** Corresponding piece count
B = Operating Mode 00 = Manual Mode
01 = Automatic Mode
02 = Parameter Mode,
03 = Test Mode
FF **=** Error or CLM initialization
V = Material Velocity (without operational sign)

Status `50´ Status of the system inputs and outputs (hexadecimal)

The status query:

```
?sX__50_CR LF
```

produces the message:

```
Xs50_eeeeaaaa$hh CR LF
```

Meaning of the characters used:

s = Blank space for RS232C or station number for RS485
e = 4 System inputs (hexadecimal)
a = 4 System outputs (hexadecimal)

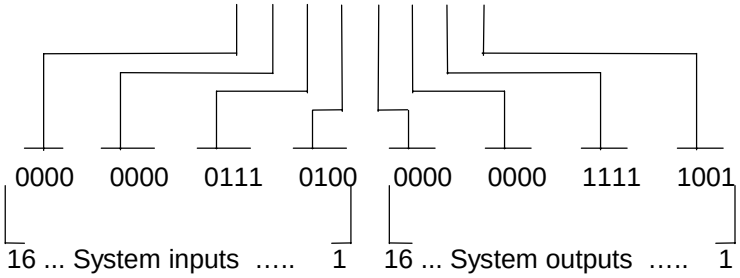
Each `e´ or `a´ stands for a hexadecimal digit. Each of these digits contains the information from 4 inputs or outputs.

The significance for each of the 4 inputs or outputs is shown below:

2^3	2^2	2^1	2^0	I/O
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	A
1	0	1	1	B
1	1	0	0	C
1	1	0	1	D
1	1	1	0	E
1	1	1	1	F

Example:

```
Xs50_ 0 0 7 4 0 0 F 9 $hh CR LF
```



In this example, the following are true:

- At system inputs 3, 5, 6 and 7, a level of +24V is applied
- System inputs 1, 4, 5, 6, 7 and 8 are at a level of +24V

Status `51´ Status of the inputs

The status query:

```
?sX__51_CR LF
```

produces the message:

```
Xs51_eeeeeeeeeeeeeeeeeeeee $hh CR LF
```

← Ascending input number

X_51_	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	$hh CR LF
Input Number	80	76	72	68	64	60	56	52	48	44	40	36	32	28	24	20	16	12	8	4	**Value 2^3**
	79	75	71	67	63	59	55	51	47	43	39	35	31	27	23	19	15	11	7	3	**Value 2^2**
	78	74	70	66	62	58	54	50	46	42	38	34	30	26	22	18	14	10	6	2	**Value 2^1**
	77	73	69	65	61	57	53	49	45	41	37	33	29	25	21	17	13	9	5	1	**Value 2^0**

Fig. 8-8: Status of the Inputs

Meaning of the characters used:

s = Blank space for RS232C or station number for RS485
e = 4 Inputs, status hex-coded

Status `52´ Status of the outputs (hexadecimal)

The status query:

```
?sX__52_CR LF
```

produces the message:

```
Xs52_aaaaaaaaaaaaaaaaaaaaaaaa $hh CR LF
```

← Ascending output number

X_52_	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	$hh CR LF
Output Number:	96	92	88	84	80	76	72	68	64	60	56	52	48	44	40	36	32	28	24	20	16	12	8	4	**Value 2^3**
	95	91	87	83	79	75	71	67	63	59	55	51	47	43	39	35	31	27	23	19	15	11	7	3	**Value 2^2**
	94	90	86	82	78	74	70	66	62	58	54	50	46	42	38	34	30	26	22	18	14	10	6	2	**Value 2^1**
	93	89	85	80	77	73	69	65	61	57	53	49	45	41	37	33	29	25	21	17	13	9	5	1	**Value 2^0**

Fig. 8-9: Status of the Outputs

Meaning of the characters used:

s = Blank space for RS232C or station number for RS485
e = 4 Outputs, status hex-coded

Status `53´ Error Message

The status query:

```
?sX__53_CR LF
```

produces the message:

```
Xs53_nn_ttttttttttttttt_$hh CR LF
```

Error description in plain text (16 characters)

Error code (hexadecimal)

For error texts and codes, see Parameter 82 and the chapter entitled Diagnostic Messages.

This status information is automatically sent by the CLM when an error has occurred and the automatic output is activated in Parameter 81.

Status `54´ Processed Material Length

The status query:

```
?sX__54_CR LF
```

produces the message:

```
Xs54_mmmmmmmmm_nnnnnn_$hh CR LF
```

Material Length 2 in 1000 IU

Material Length 1 in 1000 IU

Status `55´ Material Velocity

The status query:

```
?sX__55_CR LF
```

produces the message:

```
Xs55_vvvvvvvv_$hh CR LF
```

Material Velocity

The format of the material velocity is dependent on the multiplication factor programmed in Parameter 26. If `01.000´ is programmed for the multiplication factor in Parameter 26, the material velocity is output in IU/s without a decimal point. Using a multiplication factor not equal to `01.000´, the material velocity is output with a decimal point (see also Parameter 26). In Parameter Mode and when an error is present, the material velocity value that is output is always 0.

Status `56´ Total Piece Counter

The status query:

```
?sX__56_CR LF
```

produces the message:

```
Xs56_zzzzzzz_yyyyyyy_$hh CR LF
```

Total Piece Counter 2

Total Piece Counter 1

Each time the `STZ´ command is accessed by the program, both total piece counters are incremented by 1.

The first counter cannot be cleared. The second counter can be cleared using a control command via the serial interface.

Status `80´ Time Measurement 1

The status query:

```
?sX__80_CR LF
```

produces the message:

```
Xs80_TTTTTT_$hh CR LF
```

Time Measurement 1 in milliseconds

Time measurement 1 is controlled using the `FUN´ command.

Status `81´ Time Measurement 2

The status query:

```
?sX__81_CR LF
```

produces the message:

```
Xs81_TTTTTT_$hh CR LF
```

Time Measurement 2 in milliseconds

Time measurement 2 is controlled using the `FUN´ command.

**Status `90´** Get saved information from the `STM´ command

The status query:

```
?sX__90_nn_CR LF
```

Memory location number

produces the message:

```
Xs90_00_0_00000011111_$hh CR LF
```

Information (length of the information is dependent on the type of information)

Marker Flag

0 = The information in storage location nn was already retrieved via the serial interface.

1 = The information in storage location nn was not yet retrieved via the serial interface.

Information Type
00 = Actual position of Axis 1 in IU

Station Number

in RS-232 Mode: No Operation (Blank Block)

in RS-485 Mode: 1-W

Note: If the information saved to the memory location is retrieved via the serial interface, the corresponding marker flag is set to zero.

Interface Commands

For all commands, it is necessary for the checksum transmission to be independent of the programming in Parameter 81!

Start at NC Instruction 000

!sCL0_$hh CR LF

After a switch from ‘Manual´ to `Automatic´ Mode, the CLM begins in the old length instruction minus 1 (`LML´, `LMD´, `LMI´, `LMK´, or `LMR´ command). If program processing is to begin in program instruction 000, the control command above must be transmitted via the serial interface. This is only permitted in `Manual´ Mode. If the control 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 Total Length

!sCLL_$hh CR LF

Using this control command, material length counter 2 (right-side length counter in the display level `Total Length´) can be cleared.

Clear Total Piece Counter

!sCLZ_$hh CR LF

With this control command, the total piece counter (see Status 56) can be cleared.

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	=	Error code (hexadecimal) For a list of errors, see the `Parameter´ chapter, Parameter 82.

Notes

9 Parameters

9.1 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 entered into the CLM as parameters.

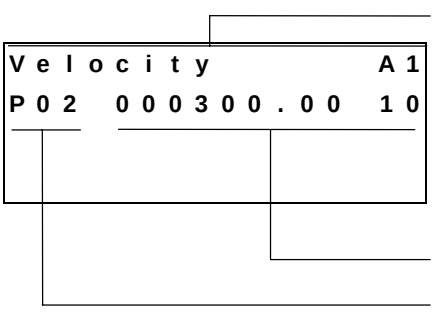
Parameters are entered in Parameter Mode. For most parameter numbers, only one piece of information can be stored.

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

After start-up, pressing `Clear´ for errors, or loading parameters, the parameters are checked. For erroneous or missing parameters, a 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 by pressing Save ⎆.



In the first display line, the parameter description is always displayed.

In the second display line, the parameter number and the parameter data are displayed.

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

Parameter Mode

The parameters are organized in 3 groups. The parameter identifier consists of the two-digit parameter number:

Parameter Identification	Parameter Number
Axis 1 Parameters	00 to 39
Axis 2 Parameters	40 to 79
General Parameters	80 to 99

The inputs and outputs listed in the parameter description, as well as all input values shown are only examples.

The position of the decimal point is shown for selecting 2 decimal places (see Parameter 82).

Note: Double assignment of inputs and outputs results in malfunctions and must be avoided.

Parameter Input

When entering Parameter Mode, Parameter 00 is displayed.

The individual parameters can be selected in Parameter Mode by directly entering the parameter number or scrolling using + and -

Using ▷ and ◁, the cursor can be placed on the parameters. There, the new parameter number can be entered directly using the numbered keys.

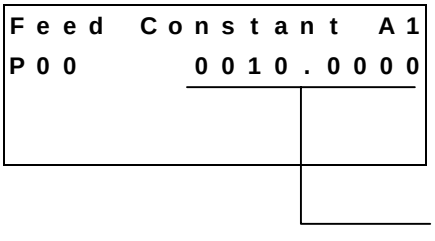
Using the data keys, the data are entered or edited. Editing data can be aborted at any time. By pressing CR, the cursor returns to the first position of the parameter number and the previously saved contents of the parameter are redisplayed. If the edited data are to be stored, press Save ◇. After storing a parameter, the next parameter is shown.

For each parameter, an input mask that must be completed with data is predefined. For each incorrectly programmed character, a `*´ is displayed. A parameter is correctly programmed when no `*´ characters appear in the parameter after pressing `save´ ◇.

A validity check of the parameters is performed after leaving Parameter Mode. Erroneous parameters are displayed and must be corrected.

9.2 System Parameters

P00 Feed Constant, Axis 1



Note: This is where the IU is defined for Axis 1.

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.

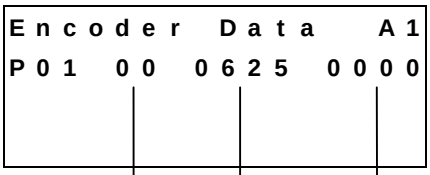
The entry can be in any desired dimension (e.g. mm, cm, m, inch, degrees, etc. and is referred to below as the input unit (IU).

It is important that all other measurements entered be referenced to this same unit.

The entry has four decimal places.

Input range: from 0.1000 to 1000.0000 in IU

P01 Encoder Data, Axis 1



Entry for absolute encoder = Number of revolutions
Entry for incremental encoders = Undefined

Entry for absolute encoder = Resolution in steps/360^0
Entry for incremental encoders = Pulses per revolution

00 = Incremental encoder
24 = Multi-turn absolute encoder with 24 data bits
(e.g. Stegmann AG 101)
21 **=** Multi-turn absolute encoder with 21 data bits
(e.g. Stegmann AG 100 MSSI)
12 = Single-turn absolute encoder with 12 data bits
(e.g. Stegmann AG 110)

Input range for incremental encoders:

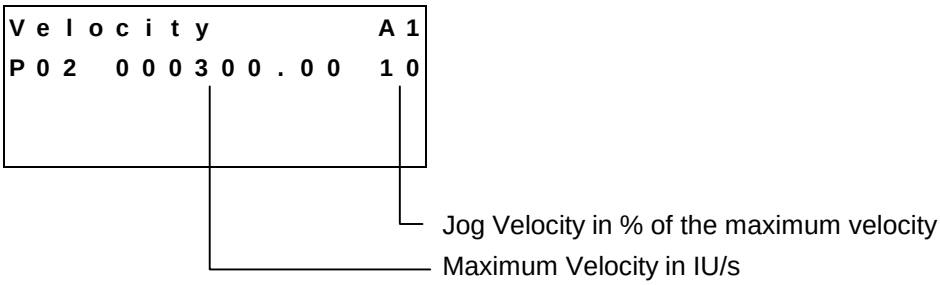
Pulses per Revolution **=** from `0100´ to `5000´

Input range for absolute encoders:

Number of revolutions =	0001	0002	0004	0008
	0016	0032	0064	0128
	0256	0512	1024	2048
	4096			

Resolution in steps/360^0=	0016	0032	0064	0128
	0256	0512	1024	2048
	4096			

P02 Velocity, Axis 1



The maximum velocity entered here is the highest velocity to be used for travel.

The material velocity may never exceed this velocity in Automatic Mode.

The maximum velocity may not be larger than the maximum possible velocity, which is calculated as follows:

$$\text{Vmaxpossible} = \frac{\text{Rpm(P03)}}{60} \times \text{Feed Rate Constant (P00)}$$

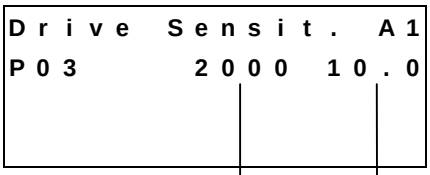
L: Vmax = Maximum Velocity
RPM = Revolutions per Minute

Fig. 9-1: Maximum Velocity, Axis 1

If the velocity is larger than `Vmax possible´, the error message `Invalid Input´ is shown on the display.

Input range: from 0.10 to 5000.000 in IU/s

P03 Drive Sensitivity, Axis 1



Command voltage at maximum velocity in volts, with 1 decimal place (05.0 to 10.0)

Max. encoder velocity in Rpm (0001 to 9999)

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.

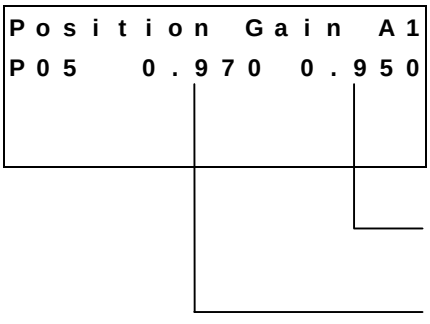
P04 Acceleration, Axis 1

Acceleration in IU/s^2

The drive accelerates and decelerates using the values derived from the position control. If the resulting acceleration or deceleration is larger than the value entered here, the value entered here is used as the acceleration or deceleration factor.

Input range: from 1 to 99999.99 in IU/s^2

P05 Position Gain, Axis 1



During initial system setup, these values must be output exactly, where the theoretical maximum value is `1.000´. The practical value is normally smaller.

With the Gain Factor, the position gain is defined. The theoretical maximum value, at which no overshoot occurs, is `1.000´. Because of unknown mechanical influences, the optimal gain factor must be output by the system. This optimization must occur at maximum material velocity in Test Mode.

The gain factor `Synchronization´ determines the acceleration into synchronized movement and acceleration and deceleration at the return point.

The gain factor `Home Position´ determines braking that is applied to arrive at the home position.

Input range for both gain factors from 0.500 to 1.000.

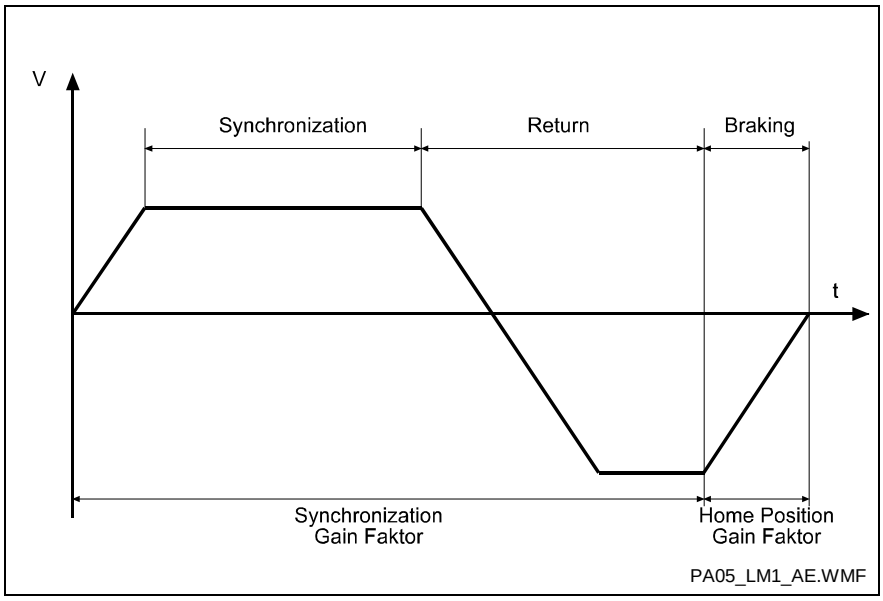
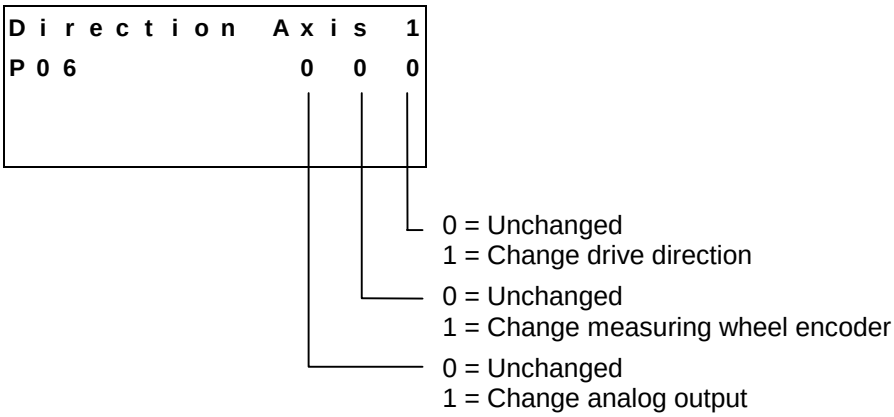


Fig. 9-2: Gain Factor

P06 Direction, Axis 1

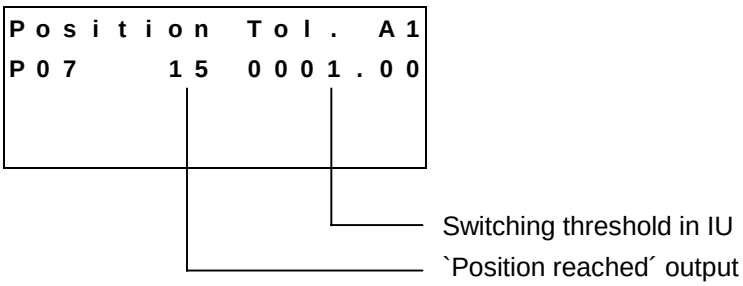


If the motor no longer stops but accelerates to the maximum velocity in Manual Mode and after releasing `Jog forward´, the analog output must be changed.

If the carriage moves in the direction of the home position when `Jog forward´ is pressed, the drive direction must be changed.

If the carriage stops in Automatic Mode when the measuring wheel is applied, after the set material length has moved through the measuring wheel, the measuring wheel direction must be changed.

P07 Switching Threshold, Axis 1



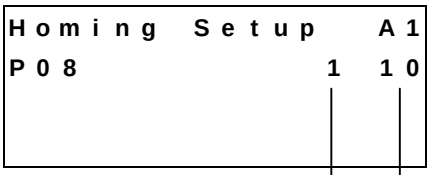
The drive cannot reach the exact synchronization point under all circumstances. (e.g. because of friction, drive rigidity, etc.).

Ts entry represents how close the approach must be to the synchronization point for the CLM to generate the `Position reached´ message.

The first two digits stand for the output (01 to 99) that issues the `Position reached´ message. When they are set to `00´, no output is programmed.

Entry of the switching threshold is in input units (IU) with two decimal places.

P08 Homing Axis 1



Search velocity in % of the maximum velocity

0 = Homing using `Jog reverse´
1 = Automatic homing via command input `Homing´
2 = Homing using `Jog forward´ or `Jog reverse´

`Automatic Homing using Command Input´

The input `Homing´ must be activated in Parameter 10. Otherwise, the error message `Invalid input´ is displayed.

The outputs `Homed´ and `Home position´ in Parameter 10 do not have to be programmed.

The zero point is sought at the set search velocity. As soon as it is signaled, the direction is reversed and the point at which the carriage left the home position initiator is sought at slow velocity. If this position has been found, the carriage stops and Axis 1 is homed.

If an offset dimension was programmed in Parameter 09, after homing the carriage moves the additional distance of the offset dimension at maximum velocity before it stops.

`Homing with Jog Reverse´

The carriage is moved toward the home position using `Jog Reverse´. As soon as the carriage finds the home position initiator, the offset dimension set in Parameter 09 is accepted as the absolute position. Axis 1 has been homed.

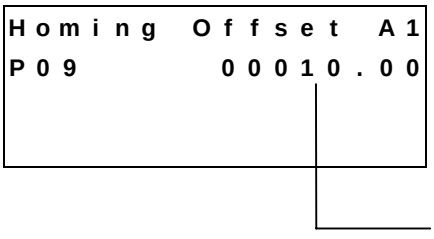
If no offset dimension is programmed in Parameter 09, the carriage stops immediately. Otherwise, the carriage moves back to Position `0´ if the `Jog Reverse´ signal continues to be active.

`Homing with Jog Forward or Reverse´

If the carriage is located on the home position initiator and if `Jog forward´ is pressed, the offset dimension entered in Parameter 09 is accepted as the absolute position as soon as the carriage moves off of the home position initiator. Axis 1 has been homed. `Homing with jog reverse´ occurs as described above.

Note: For the function `Homing with jog forward or reverse´, a switch from `Manual´ to `Automatic´ Mode when the drive is not homed is permitted if the carriage is located on the home position initiator. As soon as the carriage is synchronized and moves off of the home position initiator, the offset dimension set in Parameter 09 is accepted as the absolute position. Axis 1 has been homed.

P09 Homing Offset, Axis 1



Example, when using an incremental encoder:

For incremental encoders, the home position shifts in the negative direction from the home switch.

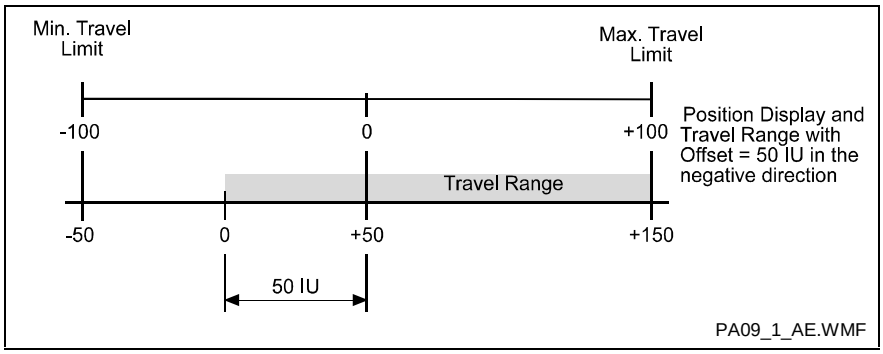


Fig. 9-3: Travel Range with Incremental Encoder

Example, when using an absolute encoder:

For absolute encoders, the home position always shifts in the positive direction from the encoder home position.

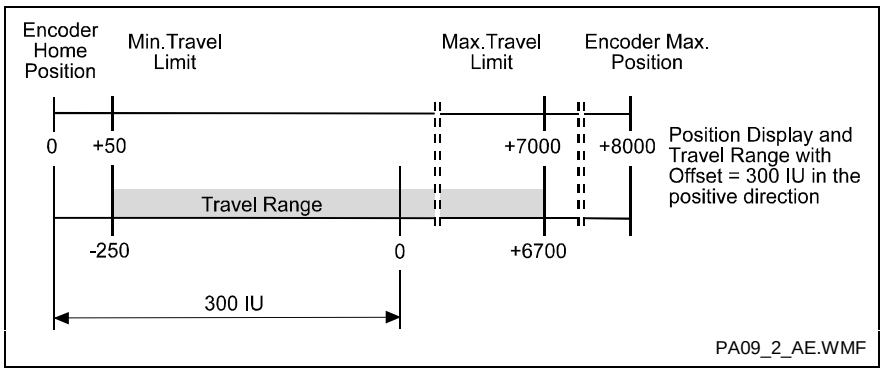
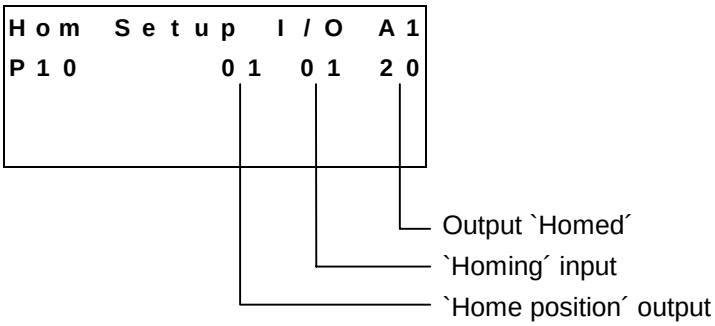


Fig. 9-4: Travel Range with Absolute Encoder

P10 Homing Input/Output, Axis 1

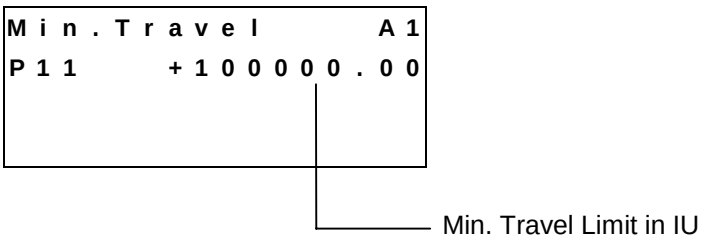


When this is set to `00´, the input or the outputs are not programmed. If no `Homing´ input is programmed and automatic homing via command input is selected in Parameter 08, `Invalid input´ is displayed.

After switching the operating mode from `Manual´ to `Automatic´, the carriage must be in the home position if an absolute encoder is used.

Using the output `Home Position´, one can determine if the carriage is in the home position.

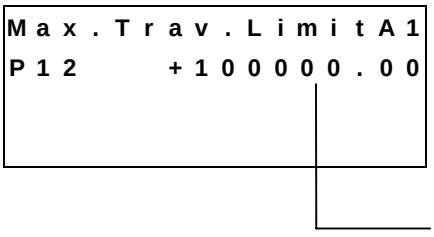
P11 Minimum Travel Limit, Axis 1



Here, the minimum allowable travel limit value is entered. Limiting is active only if Axis 1 has been homed.

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 1´ is issued. The travel range value is measured from the home position and is not calculated using the offset dimension from Parameter 09.

P12 Maximum Travel Limit, Axis 1



Max. Travel Limit in IU

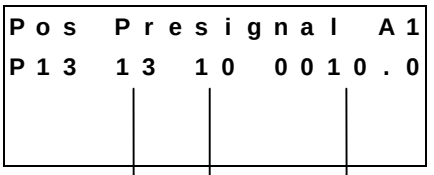
Here, the maximum allowable travel limit value is entered. Limiting is active only if Axis 1 has been homed.

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 1´ is output.

The travel range value is measured from the home position and is not calculated using the offset dimension in Parameter 09.

P13 Presignaling, Axis 1



Distance in IU to the next processing location

Time in 0.1 s
00 = Output as continuous signal

`Presignaling´ output
00 = `Presignaling´ function not enabled

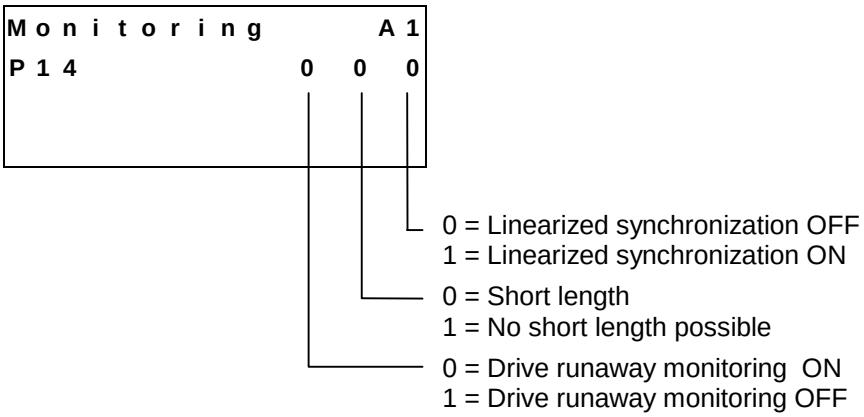
A presignaling function can be programmed here.

If the distance between the flying processing tool and the next theoretical processing location is smaller than the value entered in Parameter 13, the programmed output is enabled for the time period set.

The output remains enabled continuously or for the programmed time period.

The output is disabled each time a new length instruction (e.g. `LML´) or a new feed instruction (e.g. `PSI´) is accessed.

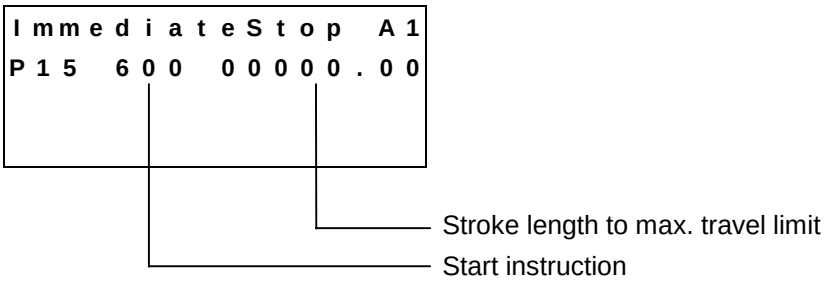
P14 Monitoring, Axis 1



Note: If `Linearized synchronization´ or `Knee point´ (Parameter 17) is programmed, the short length may not be programmed, because uncontrolled oscillation can occur.

The functions `Linearized synchronization´ and `Knee Point´ may not be activated at the same time!

P15 Rapid Stop, Axis 1



Here, it is determined how the carriage can be stopped while synchronization is in process. 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 a different program. The start instruction for this program is set in Parameter 15. This program must end with an `EOS´ command. As long as this program is being processed, synchronization is maintained. Then, the target values are set to 0V without a transition, all outputs are cleared and the `Rapid Stop´ error message is displayed. If synchronization is not present and the material is not being processed, the program to move the tool away is not processed. The carriage stops as quickly as possible.

If no program is required to move the tool away from the material, Instruction `000´ must be designated as the start instruction.

If the material is being processed during synchronized movement, and if a stroke length is programmed, a processing program for moving the tool away from the material is started up if the difference between the carriage and the maximum travel limit is smaller than the programmed stroke (see example).

If `000´ is entered as the start instruction, the carriage stops as quickly as possible. In both cases, the message `Maximum Stroke´ is displayed. This program for moving the tool away from the material must end with an `EOS´ command.

Example:

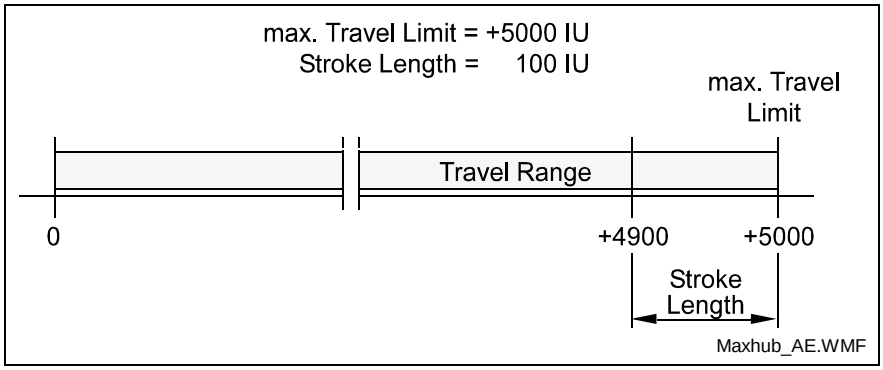
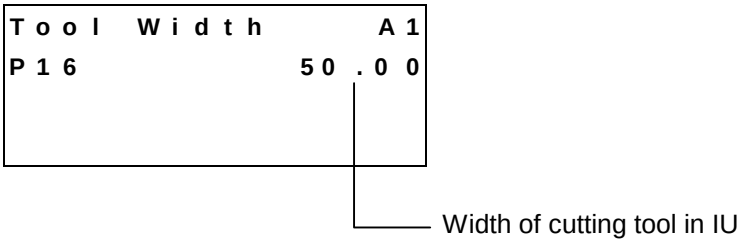


Fig. 9-5: Maximum Stroke

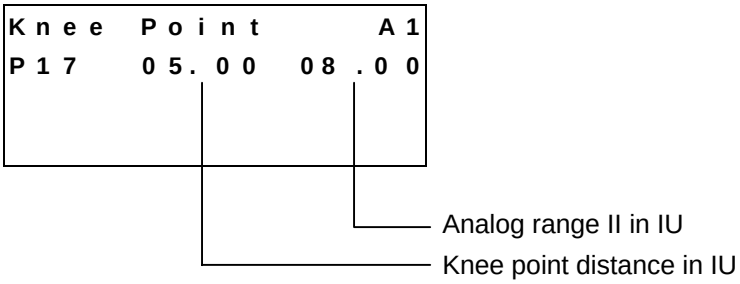
Note: If the maximum travel limit is reached before the processing program for moving the tool away from the material is finished, the command values are set to 0V without a transition and the carriage stops as quickly as possible.

P16 Tool Width, Axis 1



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´, `LMI´ and `LMD´ commands. In the `LMK´ and ´LMR´ commands, the width of the cutting tool is not processed.

P17 Knee Point, Axis 1



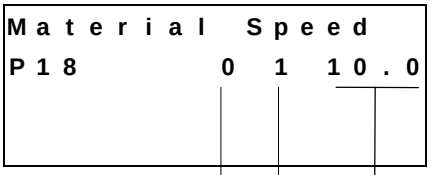
To obtain high-precision positioning over the material during synchronization control, the position gain defined in Parameter 05 can be increased again shortly before synchronization is reached.

The increase in position gain only makes sense if the distance between the processing tool and the next theoretical processing position on the material is very small. If this distance is smaller than the value defined as the knee point, the analog range II is processed until synchronization is cancelled. The smaller the analog range II, the larger the position gain.

If `00.00´ is entered as the knee point distance, the function `Knee point´ is turned off.

Note: If the `Knee point´ function is activated, the `Short Length´ and the `Linearized synchronization´ may not be programmed in Parameter 14.

P18 Material Velocity, Axis 1



Voltage at maximum material velocity

0 = Function `Material velocity via analog output 2´ OFF
1 = Function `Material velocity via analog output 2´ ON

Material velocity, binary via outputs

0 = Function disabled
1 = Velocity via outputs 01- 08
2 = Velocity via outputs 09-16
3 = Velocity via outputs 17-24
4 = Velocity via outputs 25-32
5 = Velocity via outputs 33-40
6 = Velocity via outputs 41-48

Material Velocity via Outputs

The material velocity can now also be issued in binary form via outputs. At maximum material velocity (Parameter 02), the value $FF is output.

Weighted value of the outputs:

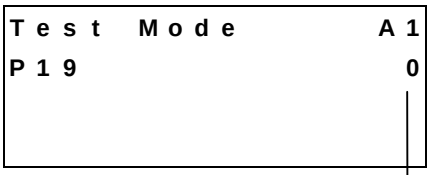
Number	Weighted Value
XX	2^0
XX + 1	2^1
XX +2	2^2
XX +3	2^3
XX +4	2^4
XX +5	2^5
XX +6	2^6
XX +7	2^7

Material Velocity via Analog Output 2

This function enables issuing the material velocity via analog output 2 in `Automatic´ Mode. The polarity of this output can be changed in Parameter 46.

Note: Issuing the material velocity via analog output 2 can only be activated if single-axis operation is programmed in Parameter 40. Otherwise, the error message `Invalid Input´ is generated.

P19 Test Mode, Axis 1



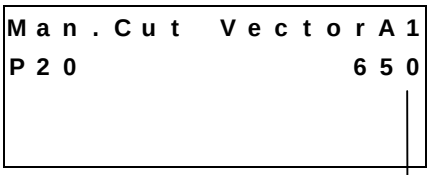
0 = Automatic Mode
1 = Test Mode ON

In `Test´ Mode, automatic processing is simulated. The material feed is simulated by an internal clock generator in the CLM. `Test´ Mode is activated if the CLM is in Automatic Mode and Test Mode is turned on in Parameter 19. The `Test Mode´ output (Connector X4 / Pin 7) is turned on.

In `Material Velocity´ display mode, the material velocity can be increased or decreased in 32 steps up to the maximum velocity (Parameter 02) by pressing + or -. If CL is pressed, the material velocity is immediately set to zero.

Note: When switching from `Automatic´ to `Manual´ Mode, the material velocity is set to zero.

P20 Manual Cut Vector, Axis 1

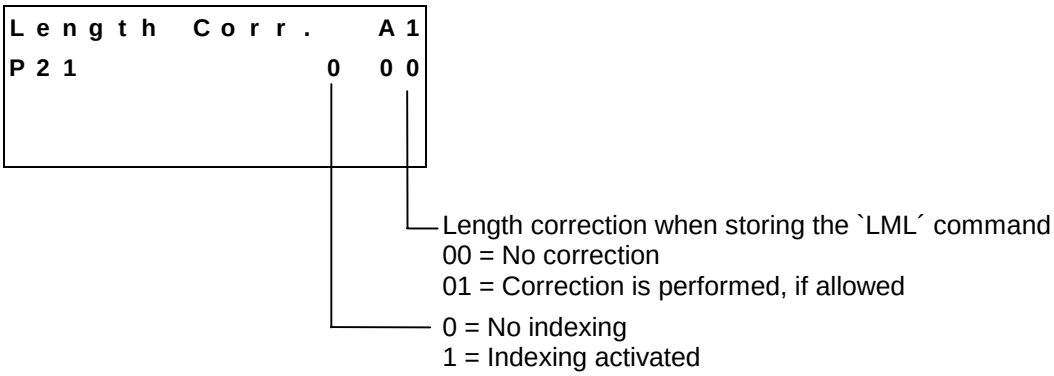


Start Instruction `Cut Program´

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.

Subroutines with the `JSR´ and `RTS´ commands can be integrated into the processing program. The program ends with an `RTS´ command if no further subroutine is called (the stack is empty).

P21 Length Correction, Axis 1



Length Correction

If the CLM is in Automatic Mode and the production length is edited via the RS232 interface in the current `LML´ command, and if the correction function is enabled, the system monitors whether the production length can still be edited.

If a correction is possible, the message `A_01_Correction´ is sent via the serial interface.

If no correction is possible, the message `A_00_No_Correction´ is sent via the serial interface.

If the production length is stored using the front panel, no messages are issued about whether or not the correction was carried out.

If no correction is possible, the old programmed production length is processed again.

Example: 5000 mm = Old production length

2000 mm = New, desired production length

If, for example, 3000 mm have already passed through the tool during storage of the length, no correction is possible.

Indexing

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.

Example: A manual cut is executed in `Manual´ Mode, with a carriage position of `+1000mm´.

Afterward, the carriage is moved back to its home position. After switching to `Automatic´ Mode, a production length of 5000 mm is to be processed (length in `LML´ command = 005000.00).

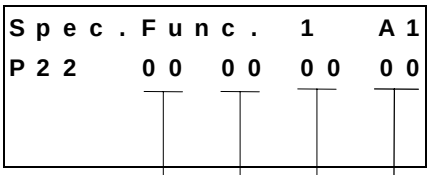
If indexing is activated, the 1000 mm (see above) are included in the calculation, which means that the first cut piece has a length of 5000 mm.

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

Notes: In order to use `Length Correction´ and `Indexing´, the `FUN´ command with length measurement must be programmed in the processing program or the manual cut program.

`Length Correction´ and `Indexing´ produce incorrect values in Test Mode.

P22 Special Functions, Axis 1



Axis 1 ‘Meter Pulse´ Output
00 = Not programmed

Axis 1 `Repeat Cut´ Output
00 = Not programmed

Axis 1 `Repeat Cut´ Input
00 = Function disabled

`Current Cut Length Wrong´ Output
00 = Not programmed

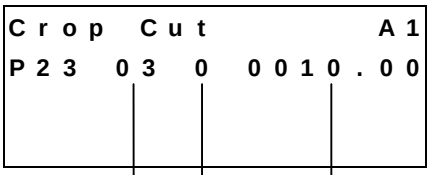
If the function `Meter Pulse´ is programmed, for every processed meter of material in Automatic Mode, a 100ms pulse is issued at the programmed output.

For the function `Repeat Cut´, the last processed material length can be repeated if the STZ command is used. To do this, a signal must be applied at the programmed input. The repeated piece is not counted when using the `STZ´ command. The programmed output remains enabled during the repeat cut process. If a movement to another instruction has taken place (another Lxx command), no repeat cut is executed.

When moving to another instruction and an active `Repeat Cut´ input, the instruction is **not** repeated and no immediate cut is executed.

Note: During the repeat cut operation, the functions `Immediate Cut´ or `Cut inhibit´ and `Crop Cut´ may not be triggered. Otherwise, the piece count will not be correctly executed.

P23 Crop Cut, Axis 1



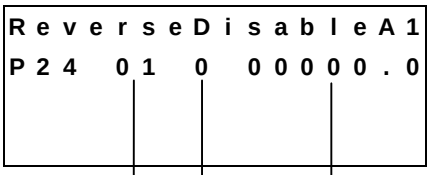
Length of crop cut in IU

0 = No crop cut when a switch from Manual to Automatic Mode occurs
1 = Crop cut each time a switch from Manual to Automatic Mode occurs

`Crop Cut´ input
00 = function disabled

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.

P24 Reverse Inhibit, Axis 1



Position where the carriage is placed after processing is completed
(in preparation)

Evaluation of the Input
0 = Level
1 = Rising edge
(in preparation)

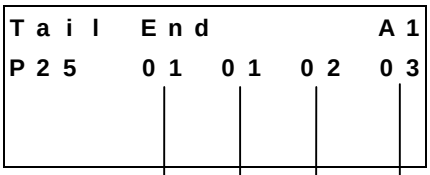
`Reverse Inhibit´ input
00 = Reverse inhibit deactivated

When processing is finished (`EOS´ command in the tool program), the carriage brakes, stops and waits for a signal at the `Reverse Inhibit´ input.

If a signal is applied at the input, the carriage returns to the home position.

The reverse signal is not validated and processed until the `EOS´ command is reached.

P25 Tail End Processing, Axis 1



`Tail End > Maximum Length´ output from the `LML´ command in Instruction 981

`Tail End < Maximum Length´ output from the `LML´ command in Instruction 981

`Tail End < Minimum Length´ output from the `LML´ command in Instruction 982

`No Material´ input (falling edge)
00 = Tail end processing deactivated

To properly process the tail end, the end of the material must be signaled as a falling edge by an initiator. The distance between the initiator and the carriage home position is entered as an `LML´ command in Instruction 980.

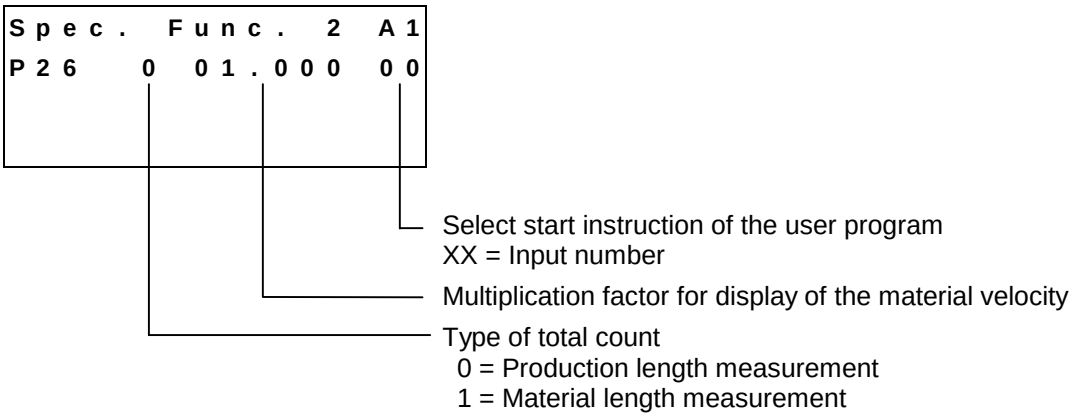
The maximum length must be entered as an ´LML´ command in Instruction 981; the minimum length must be entered as an `LML´ command in Instruction 982.

If the material end is signaled by the input, the CLM outputs whether the set length can still be processed. If it can, the length is separated and the programmed outputs are set independently of the programmed minimum or maximum lengths. If the set length can no longer be processed, the material is separated so that the length of the material end piece is half as long as the minimum length.

After the separation, cutting is internally inhibited. The next processing sequence is started with a crop cut or an immediate cut operation.

Note: Material end processing is only supported for the `LMD´ or `LML´ command.

P26 Special Functions 2, Axis 1



Type of Total Count

If production length measurement is activated, the material length fed in Automatic Mode is added to the total length.

During the time period when the `Cut Inhibit´ function is activated, the fed material length is not added to the total length.

If material length measurement is activated, the material length fed in `Manual´ and `Automatic´ Mode is always added (even when the `Cut Inhibit´ function is active).

Multiplication Factor

By the introduction of the multiplication factor, the display of the material velocity has become more variable.

If a multiplication factor of `01.000´ is entered, the material velocity is displayed as previously, in IU per second without a decimal point.

If a multiplication factor not equal to `01.000´ is entered, the material velocity is displayed with a decimal point.

The above description is also valid for Status 32 or Status 55 information. This means that for a factor of `01.000´, the material velocity is output as previously, without a decimal point, and a factor not equal to `01.000´ is output with a decimal point.

Example: If millimeters are selected as the input unit and if the material velocity is to be displayed meters per minute, the value `00.060´ is entered (60/1000) as the multiplication factor.

If inches are selected as the input unit and if the material velocity is to be displayed feet per minute, the value `05.000´ is entered (60/12) as the multiplication factor.

Note: If `00.000´ is entered as the multiplication factor, the display of the material velocity responds as if `01.000´ had been entered.

Start Instruction of the User Program

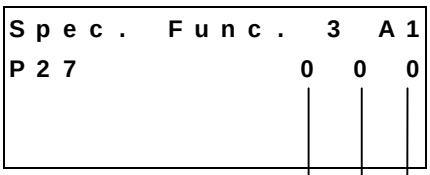
If a signal is applied to the programmed input in `Manual´ Mode, the CLM begins with Instruction 000 when a switch to `Automatic´ occurs.

If an input number of 00 is entered, the CLM begins in the old length instruction – 1 when a switch from `Manual´ to `Automatic´ occurs.

If an input number of 99 is entered (Input 99 is not physically present on the CLM), the CLM begins with Program Instruction 000 when a switch from `Manual´ to `Automatic´ occurs.

Note: The input is only monitored in `Manual´ Mode.

P27 Special Functions 3, Axis 1



Issue last cut length
0 = Function deactivated
1 = Issuing the last cut length as a binary value in input units without decimal places, via Outputs 17-32

Load material length via inputs
0 = Function deactivated
1 = Load material length via Inputs 17-32 as a binary value in input units for the `LMI´ command.

Raster detection

0 = Detection by level (+24 Volt)

1 = Detection by edge (rising edge)

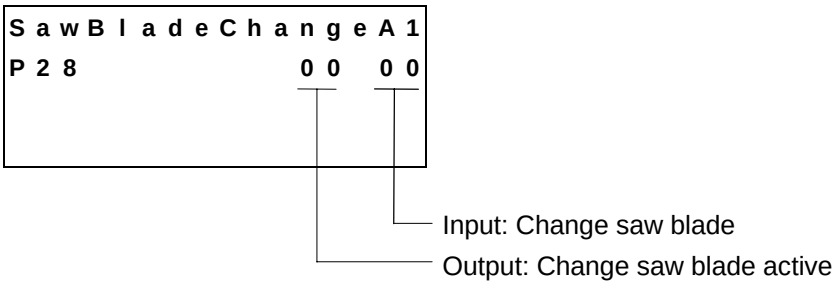
If the material length is to be loaded via the inputs, the CLM must be informed with a signal at Input 33 that the information present at Inputs 17-32 is valid.

Number	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
Weighted Value	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}

Fig. 9-6: Weighted Value of the Inputs or Outputs

Note: For the output of the last cut length, the `FUN´ command must be programmed in the cutoff program.

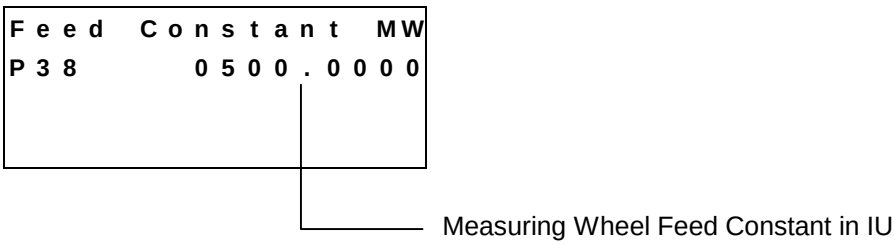
P28 Change Saw Blade, Axis 1



If the programmed input is active, a ‘Cut inhibit´ operation is initiated when the next length command (`LML´, `LMD´, `LMI´) is issued. The output is set after this time. The task remains active until the command is revoked in the length instruction.

If the input is deactivated, the next cut is executed so that the product length is a whole number multiple of the actual length (including blade width).

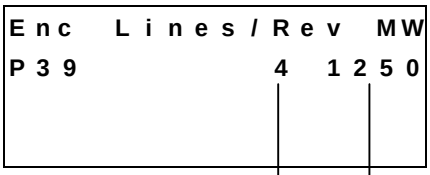
P38 Measuring Wheel Feed Constant, Axis 1



The measuring wheel feed constant indicates the material stroke that results from the circumference of the measuring wheel for one measuring wheel revolution.

Input range from `0000.1000´ to `1000.0000´ IU

P39 Measuring Wheel Encoder Data, Axis 1



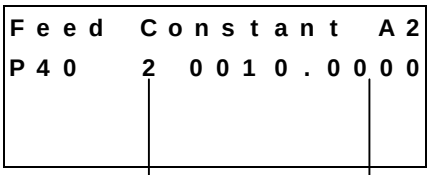
Pulses per measuring wheel revolution

Averaging of measuring wheel values
0 = No averaging
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
8 = Averaging of 256 values
9 = Averaging of 512 values

The function `Averaging of Measuring Wheel Values´ smoothes the measuring wheel encoder pulses. If an irregular material flow is present, this function can achieve regular carriage movement during the synchronization phase. The averaging is done so the velocity can be matched. Position control is always accomplished without averaging.

Input range from `0100´ to `5000´ pulses

P40 Feed Constant, Axis 2



Feed Constant in IU

0 = Axis 2 not operating
1 = Axis 2 as synchronous axis
2 = Axis 2 as tool axis

For single-axis operation, Parameters 40 through 57 must set to zero. If Axis 2 is functioning as a synchronous axis, Parameters 40-46, 54 and 58 must be programmed. When using absolute encoders, Parameter 49 must also be programmed.

If Axis 2 is selected as a tool axis, Parameters 40 through 57 must be entered.

Note: This is where the IU is defined for Axis 2.

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.

Entry can be in any desired dimension (e.g. mm, cm, m, inch, degrees, etc.) and is referred to below as the input unit (IU).

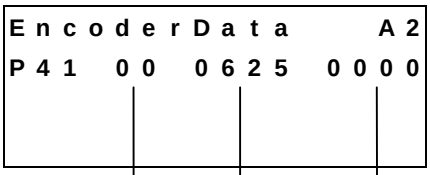
It is important that all other measurements entered be referenced to this same unit.

The input has four decimal places.

Input Range: from 0.1000 to 1000.0000 in IU

Note: If Axis 2 is functioning as a synchronous axis, the feed constants for Axis 1 and Axis 2 must be identical. Otherwise, the error message `Invalid Input´ is displayed.

P41 Encoder Data, Axis 2



Entry for absolute encoder = Number of revolutions
Entry for incremental encoders = undefined

Entry for absolute encoder = Resolution in steps/360^0
Entry for incremental encoders = Pulses per revolution

00 = Incremental encoder
24 = Multi-turn absolute encoder with 24 data bits
(e.g. Stegmann AG 101)
21 **=** Multi-turn absolute encoder with 21 data bits
(e.g. Stegmann AG 100 MSSI)
12 = Single-turn absolute encoder with 12 data bits
(e.g. Stegmann AG 110)

Input range for incremental encoders:

Pulses per revolution **=** from `0100´ to `5000´

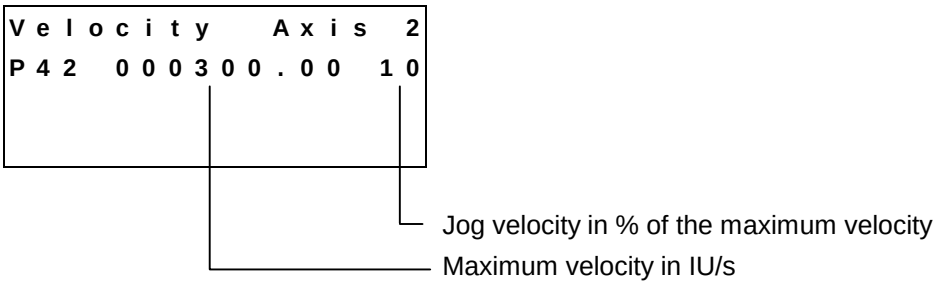
Input range for absolute encoders:

Number of revolutions =	0001	0002	0004	0008
	0016	0032	0064	0128
	0256	0512	1024	2048
	4096			

Resolution in steps/360^0=	0016	0032	0064	0128
	0256	0512	1024	2048
	4096			

Note: If Axis 2 is functioning as a synchronous axis, the encoder data for Axis 1 and Axis 2 must be identical. No monitoring or error message occurs.

P42 Velocity, Axis 2



The maximum velocity entered 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:

$$Vmaxpossible = \frac{RPM(P43)}{60} \times Feed\,Constant\ (P40)$$

L: Vmax = Maximum Velocity
RPM = Revolutions per Minute

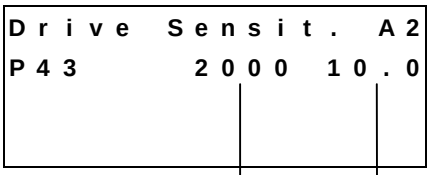
Fig. 9-7: Maximum Velocity, Axis 1

If the velocity is larger than `Vmax possible´, the error message `Invalid Input´ is shown on the display.

Input Range: from 0.10 to 5000.000 in IU/s

Note: If Axis 2 is functioning as a synchronous axis, the velocities for Axis 1 and Axis 2 must be identical. Otherwise, the error message `Invalid Input´ is displayed.

P43 Drive Sensitivity, Axis 2

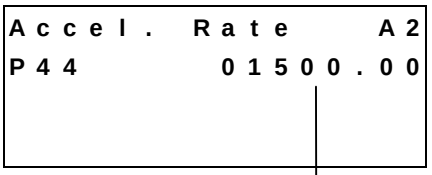


Command voltage at maximum velocity in volts, with 1 decimal place (05.0 to 10.0)

Max. encoder velocity in Rpm (0001 to 9999)

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.

P44 Acceleration, Axis 2

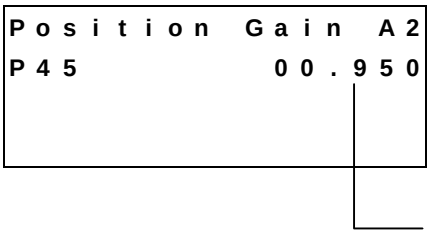


Acceleration in IU/s^2

The drive accelerates and decelerates using the value set here.

Input Range: from 1 to 99999.99 in IU/s^2

P45 Kv Factor, Axis 2



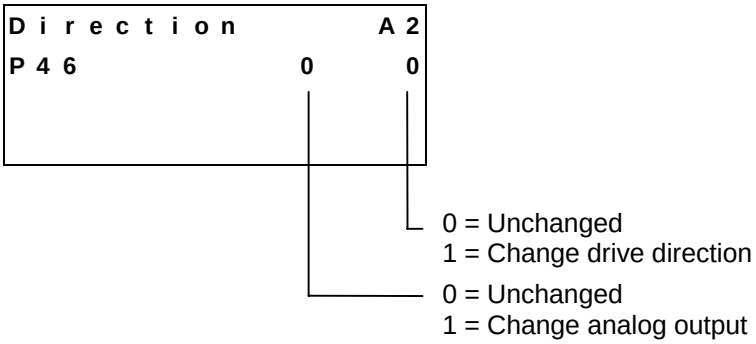
With the `Kv Factor´, the position gain is defined. The `Kv Factor´ determines the position lag that would be calculated at maximum velocity.

Kv = 1 corresponds to a position lag of 1 mm at a velocity of 1m/min.

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, it is best to begin with `Kv Factor´ = 1,000.

Input range for the Kv Factor is from 0.500 to 9.999.

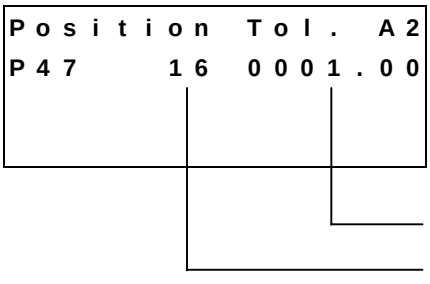
P46 Drive Direction, Axis 2



If the motor no longer stops but accelerates to the maximum velocity in Manual Mode and after releasing `Jog forward´, the analog output must be changed.

If the carriage moves in the direction of the home position when `Jog forward´ is pressed, the drive direction must be changed.

P47 Switching Threshold, Axis 2



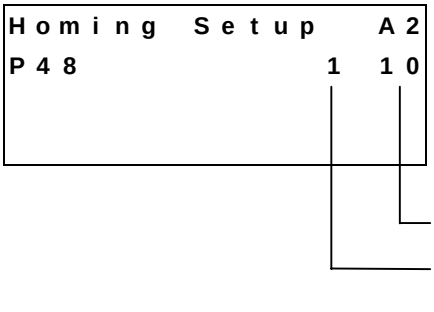
The drive cannot reach the exact synchronization point under all circumstances. (e.g. because of friction, drive rigidity, etc.).

Here, the entry reflects how close the approach must be to the target position for the CLM to generate the `Position reached´ message.

The first two digits stand for the output (01 to 99) that issues the `Position reached´ message. When this is set to `00´, no output is programmed.

Entry of the switching threshold is in input units (IU) with two decimal places.

P48 Homing Axis 2

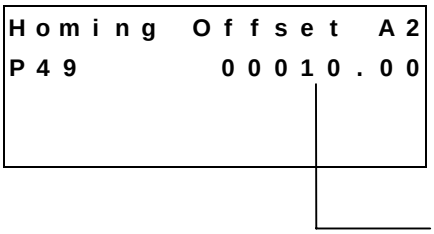


The inputs `Homing´ and `Home position´ must be activated in Parameter 50. Otherwise, the error message `Invalid input´ is displayed.

The home position is sought at the set search velocity. As soon as it is signaled, the direction is reversed and the point at which the carriage left the home position initiator is sought at slow velocity. If this position has been found, the carriage stops and Axis 2 is homed.

If an offset dimension is programmed in Parameter 49, this offset dimension is accepted as the absolute position. This absolute position is positive with an offset dimension in reverse direction and negative with an offset dimension in the forward direction.

P49 Homing Offset, Axis 2



Homing offset in IU

Example, when using an incremental encoder:

When using an incremental encoder, depending upon programming, the home position shifts in the positive or negative direction from the home switch.

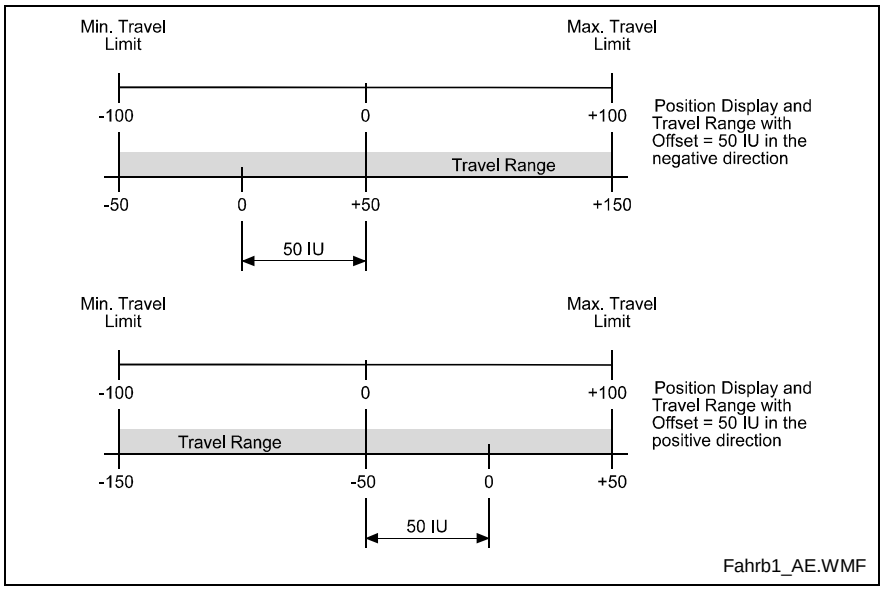


Fig. 9-8: Travel Range with Incremental Encoder

Example, when using an absolute encoder:

For absolute encoders, the home position always shifts in the positive direction from the encoder home position.

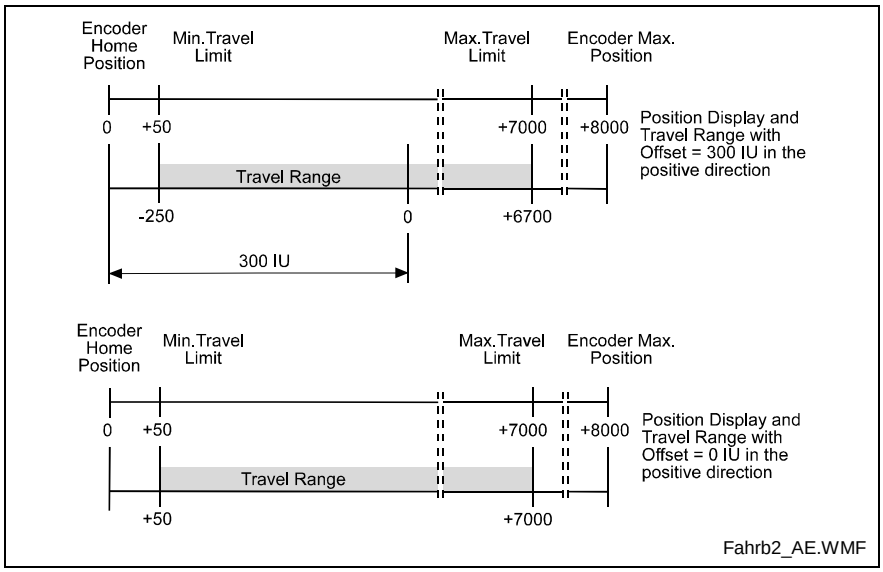
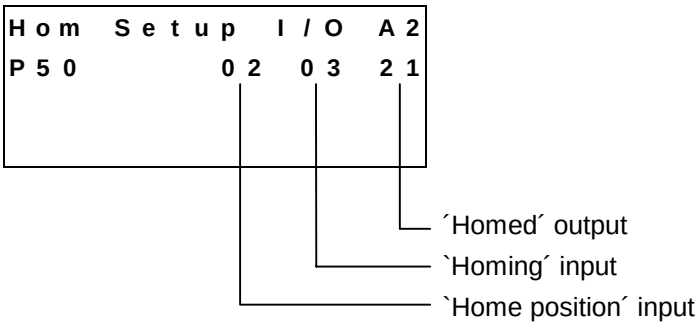


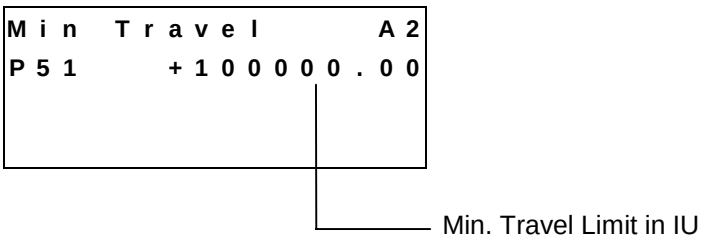
Fig. 9-9: Travel Range with Absolute Encoder

P50 Homing Input/Output, Axis 2



With an entry of `00´, the input or the outputs are not programmed.

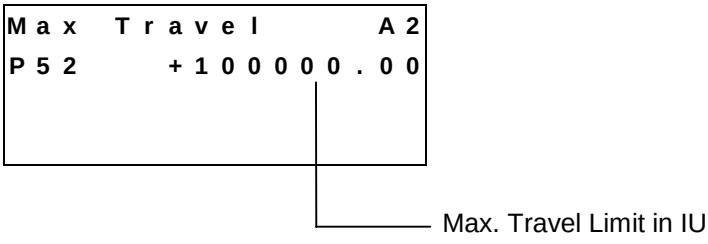
P51 Minimum Travel Limit, Axis 2



Here, the minimum allowable travel limit value is entered. Limiting is active only if Axis 2 has been homed.

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 message `Min. Travel Lmt 2´ is issued. The travel range value is measured from the home position and is not calculated using the offset dimension in Parameter 49.

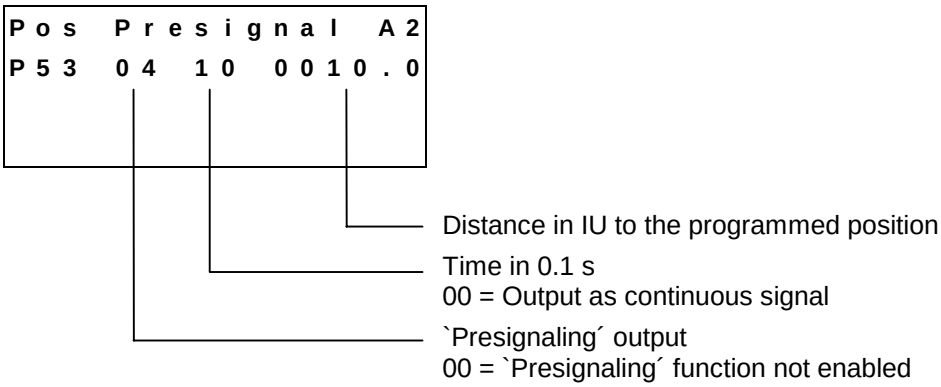
P52 Maximum Travel Limit, Axis 2



Here, the maximum allowable travel limit value is entered. Limiting is active only if Axis 2 has been homed.

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 2´ is issued. The travel range value is measured from the home position and is not calculated using the offset dimension in Parameter 49.

P53 Presignaling, Axis 2

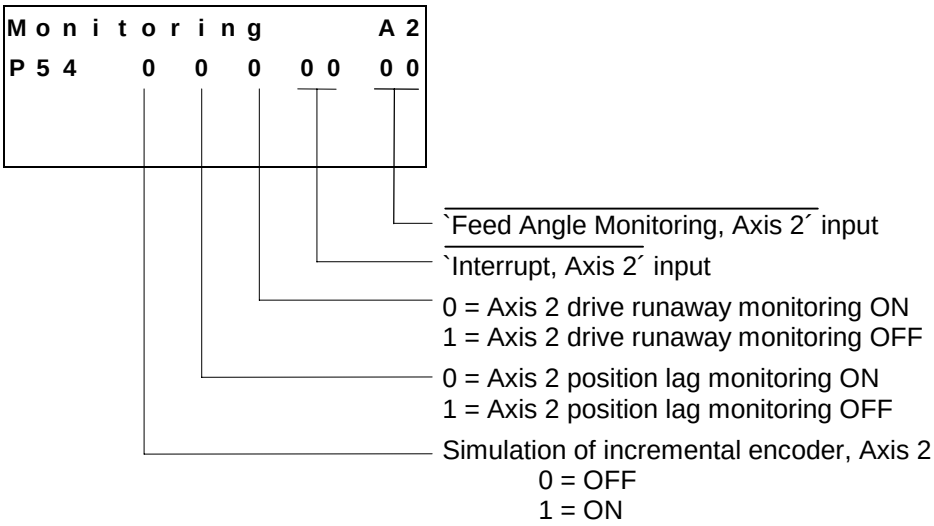


The presignaling function programmed in this parameter applies for every positioning command (`POI´, `PSI´, `POA´, `PSA´).

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.

P54 Monitoring, Axis 2



Here, the monitoring functions for Axis 2 that are activated can be entered.

Feed Angle Monitoring

Using this function, positioning motions for Axis 2 can be monitored. If an input for feed angle monitoring is programmed and no signal is present at the specified input, Axis 2 does not move.

The CLM processes all instructions that do not contain a feed length. As soon as the program encounters an instruction containing a feed length for Axis 2, the CLM stops at this instruction until a signal is applied at the input. If the signal is lost when Axis 2 moves, the error message `Feed Angle lost 2´ is displayed and the CLM faults.

If `00´ is set for the input, the feed movements for Axis 2 are not monitored.

If Axis 2 is functioning as a synchronous axis, this function is not active.

Interrupt

Here, the entry represents whether or not a running program can be interrupted. If the signal at the programmed input is lost, any initiated positioning functions for Axis 2 are not executed, or positioning movements in progress for Axis 2 are stopped. All instructions containing no feed lengths continue to be processed as usual.

As soon as the program encounters an instruction containing a feed length for Axis 2, the CLM stops at this instruction. If the operating mode remains the same, the feed movement is executed or continues as soon as a signal is present at the input. If `00´ is set for the input, the function `Interrupt´ is not active.

If Axis 2 is functioning as a synchronous axis, this function is not active.

Simulation of the Incremental Encoder

For simulation of the incremental encoder, no repositioning using the encoder is available. (controlled axis).

The outputs `Drive Enable, Axis 2´ and `Brake Axis 2´ are controlled as follows:

a) `Incremental Encoder Simulation´ and `Axis 2 follows Measuring Wheel´ active:

`Drive Enable, Axis 2´ and `Brake Axis 2´ are always set to +24V.

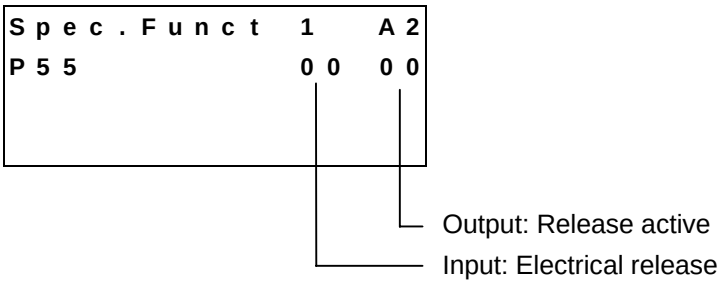
b) `Incremental Encoder Simulation´ active:

`Drive Enable, Axis 2´ and `Brake Axis 2´ are immediately set to +24V before a movement and immediately set to 0V after completion of the movement (value less than Switching Threshold, Parameter 47).

Note: Position Lag (Following Error) and Drive Runaway monitoring may only be turned off during the start-up phase. Other protective measures may need to be taken.

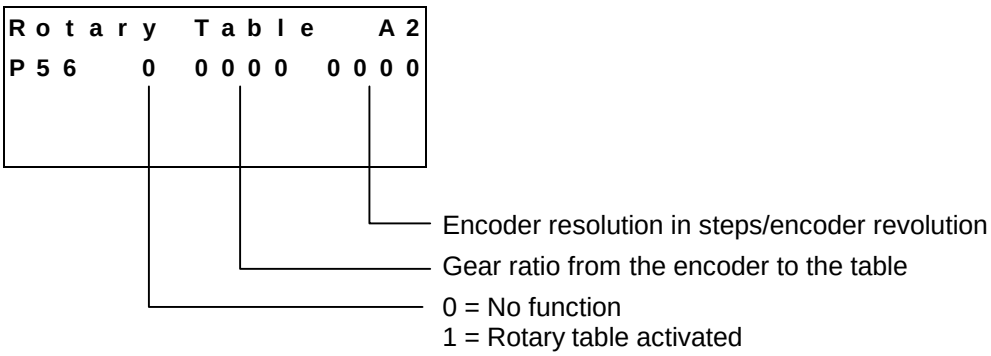
P55 Special Functions, Axis 2

In preparation

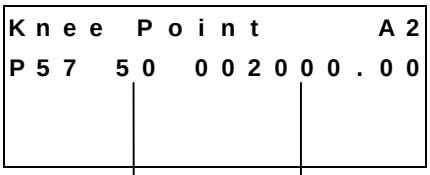


P56 Rotary Table, Axis 2

In preparation



P57 Knee Point, Axis 2



2. Acceleration in IU/s^2, above the knee point velocity

Velocity in % of Vmax from Parameter 42
At values above this velocity, the 2nd acceleration sets in.
00 = Function OFF

This function enables a velocity profile with a bend in the curve. The first acceleration, which is operable below the knee point velocity, is programmed in Parameter 44. Because the second acceleration value may be greater than that of the first acceleration, the larger of the two values is considered the maximum acceleration.

As long as the `Knee point´ function is activated, the `ACC´ command (Acceleration Change) has no effect.

If `00.00´ is entered as the velocity, the function `Knee point' is turned off.

Examples for attainable velocity profiles:

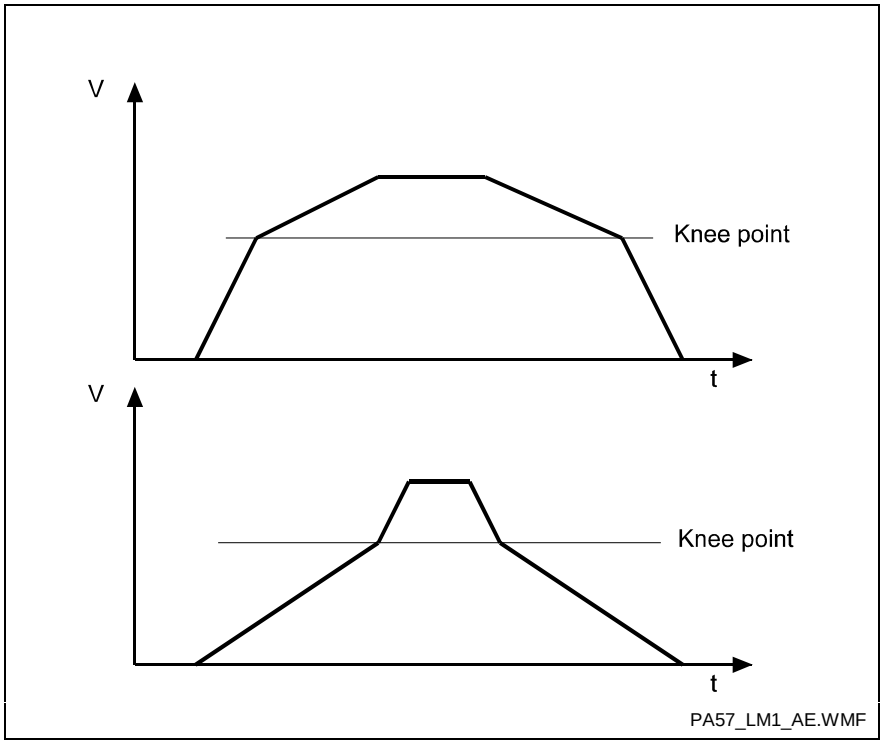
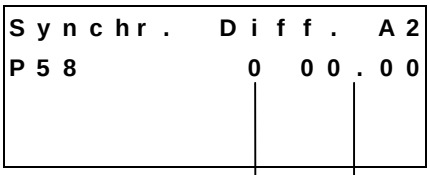


Fig. 9-10: Velocity Profiles

P58 Synchronization Difference, Axis 2



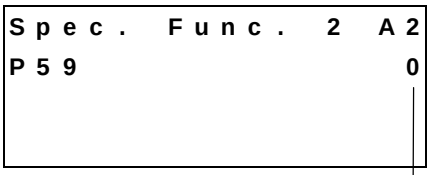
Maximum allowable synchronization difference in IU

0 = Synchronization difference with ramp
1 = Synchronization difference without ramp

Here, the maximum allowable synchronization difference is entered. If the position difference between the two axes is greater than the value programmed here, the command values are set to 0V without ramping, all outputs are cleared and the message `Synchr Diff. A2´ is displayed. If `Synchronization difference without ramp´ is programmed, the difference is eliminated immediately. If `Synchronization difference with ramp´ is programmed, the difference is eliminated by ramping up or down.

Note: This parameter is active only if Axis 2 has been programmed as a synchronous axis.

P59 Special Functions, Axis 2



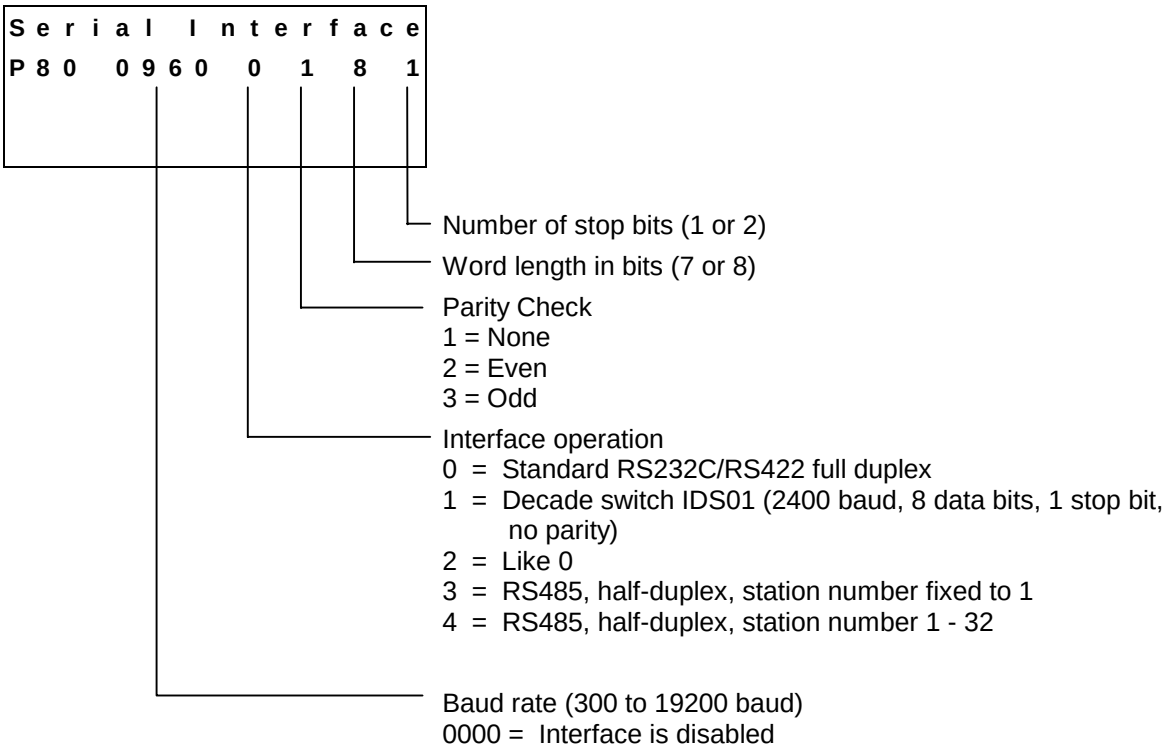
Position lag (following error) compensation for slave axis:

(refer to `FOL´ command)

0 = OFF
1 = ON without average values for command pulses
>1 = ON with average 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

Note: Position lag (following error) compensation is only active for the function `Axis 2 follows the measuring wheel´ (`FOL´ command).

P80 Serial Interface



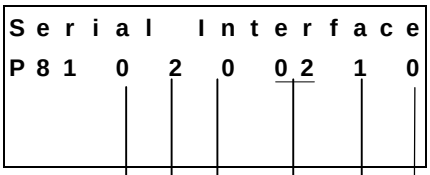
Here, the data for initializing the serial interface are entered. The desired baud rates can be selected from the following list of values:

Entry	Baud Rate
0030	300
0060	600
0120	1200
0240	2400
0480	4800
0960	9600
1920	19200

Fig. 9-11: Baud Rate

If decade switch querying is selected, the remaining data are not required in Parameter 80. In Parameter 81, the data format of the IDS01 decade switch must be programmed.

P81 Serial Interface



0 = No function
1 = Interface Confirmation (Y CR LF)

Handshake / Checksum:
0 = Checksum on – Hardware handshake RTS/CTS off
1 = Checksum off – Hardware handshake RTS/CTS off
2 = Checksum on – Hardware handshake RTS/CTS on
3 = Checksum off – Hardware handshake RTS/CTS on

Station number 1-32 (only for Interface Mode 4 from Parameter 80)

0 = No error message sent via RS232 interface for error (only for Interface Mode 0 or 2 from Parameter 80)

1 = Error message sent via RS 232 interface for error (only for Interface Mode 0 or 2 from Parameter 80)

Data format at IDS01 decade switch:
0 = 6 places before decimal, none after
1 = 5 places before decimal, 1 after
2 = 4 places before decimal, 2 after
3 = 3 places before decimal, 3 after

Response delay in RS 485 Mode
0 = No delay
1 = 2 msec delay
2 = 4 msec delay
3 = 6 msec delay
4 = 8 msec delay
5 = 10 msec delay
6 = 15 msec delay
7 = 20 msec delay
8 = 30 msec delay
9 = 40 msec delay

Data entry 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 the interface confirmation `Y CR LF´ is selected and if the CLM has completely and correctly received a program or parameter set, `Y CR LF´ is sent via the serial interface as a confirmation.

If checksum validation is not activated, the checksum is unnecessary in the transmission.

A software handshake with `XON/XOFF´ or a hardware handshake with RTS/CTS is only possible if the interface type is programmed as RS232 / RS422 (see Parameter 80).

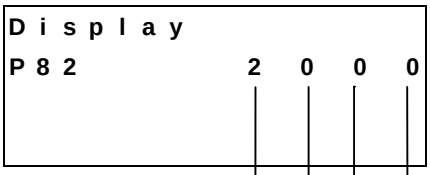
Response Delay

In RS485 Mode, once the CLM receives the last character `LF´ of an request (Linefeed: ASCII Code 10), it immediately switches to Send Mode. With various RS-485 PC driver cards, this leads to problems if the cards are unable switch to Receive Mode quickly enough.

The interface can delay the switch from Receive to Send Mode by a defined amount of time (response delay).

The PC driver should be able to switch reliably from Send to Receive Mode within this time limit. The response delay is rounded up to whole number multiples of the controller cycle time (see Parameter 88).

P82 Display



0 = No write protection
1 = Write protection for commands and their data
2 = Edit protection for commands, editing command data possible

0 = Display in German
1 = Display in English
2 = Display in French

0 = No error number via outputs
1 = Error number via outputs 01 - 08
2 = Error number via outputs 09 - 16
3 = Error number via outputs 17 - 24
4 = Error number via outputs 25 - 32
5 = Error number via outputs 33 - 40
6 = Error number via outputs 41 - 48

Decimal places (2 or 3)

Write Protection

Write protection or edit protection programmed here prevents the entry or editing of program data via the keypad. Pressing the data keys or `Save´ does not effect any changes to the program commands or the program data.

Note: Data entry via the serial interface is possible independently of the programming in Parameter 82!

Error Number via Outputs: If the function `Error Number via Outputs´ is activated, an error number is output as a BCD number in the event of a problem.

Following is a list of the error numbers:

00 = No error
01 = System failure
02 = Invalid Parameter input
03 = Emergency Stop
04 = `Invalid mode´ error
05 = `A1 not homed´ error
06 = `A1 not in home position´ error
07 = `Drive not ready´ error
08 = `Marker pulse position A1´ error
09 = `No marker pulse A1´ error
10 = `Min. travel limit A1´ error
11 = `Max. travel limit A1´ error
12 = `Maximum stroke A1´ error
13 = `Immediate stop A1´ error
14 = `Invalid Block number´ error
15 = `Invalid program command´ error
16 = `BCD input´ error
17 = `JSR nesting´ error
18 = `Missing EOS command´ error
19 = `RTS nesting´ error
20 = `Invalid axis number´ error
21 = `Drive runaway A2´ error
22 = `Excess. Position lag A2´ error
23 = `Absolute encoder A1´ error
24 = `Absolute encoder range A1´ error
25 = `Absolute encoder A2´ error
26 = `Absolute encoder range A2´ error
27 = `Decade switch IDS´ error
28 = `Division by zero´ error
29 = `Parameters lost´ error
30 = `Program lost´ error
31 = `Feed angle lost A2´ error
32 = `Marker pulse position A2´ error
33 = `No marker pulse A2´ error
34 = `Min. travel limit A2´ error
35 = `Max. travel limit A2´ error
36 = `A2 not homed´ error
37 = `Drive runaway A2´ error
38 = `Synchronization difference A2´ error
39 = `Index length´ error
40 = `Battery is low´ error
41 = `Invalid I/O number´ error
43 = `VEO command´ error

Decimal Places

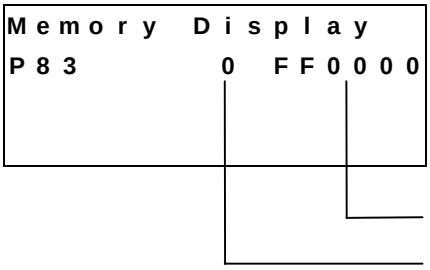
Here, it is determined where the decimal point is placed for the positioning commands and the parameters.

Parameter Number	Number of Decimal Places when Entering:	
	2 in Parameter 82	3 in Parameter 82
P00; P38; P40	4	5
P02; P04; P07;P09; P11 P12; P15; P16; P17; P23 P42; P44; P47; P49; P51 P52; P57; P58	2	3
P13; P24; P53	1	2

Fig. 9-12: Decimal Places

Note: After changing the decimal places, the parameter and the user program must be checked.

P83 Memory Display



Address in hexadecimal format

0 = Memory display OFF
Only numbers from 0 – 9 may be entered.
A save can occur with the cursor at any position.

1 = Memory display ON
The letters A – F may also be entered. Saving is only possible when the cursor is placed on the parameter number.

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 83 is a default address that is shown on the display after turning on the CLM or after an error.

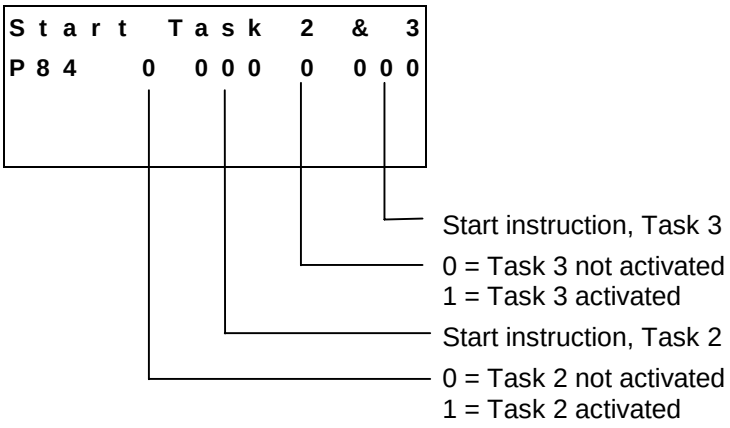
However, the address may be changed during operation by directly overwriting it.

By pressing `plus´ and `minus´, 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 and 1 = A
Save and 2 = B
Save and 3 = C
Save and 4 = D
Save and 5 = E
Save and 6 = F

P84 Tasks 2 and 3



Program execution of Task 3 begins immediately after power-up of the CLM. The only situations in which Task 3 is not processed are in Parameter Mode, during an error and during an E-Stop. Axis movements may not be processed in Task 3.

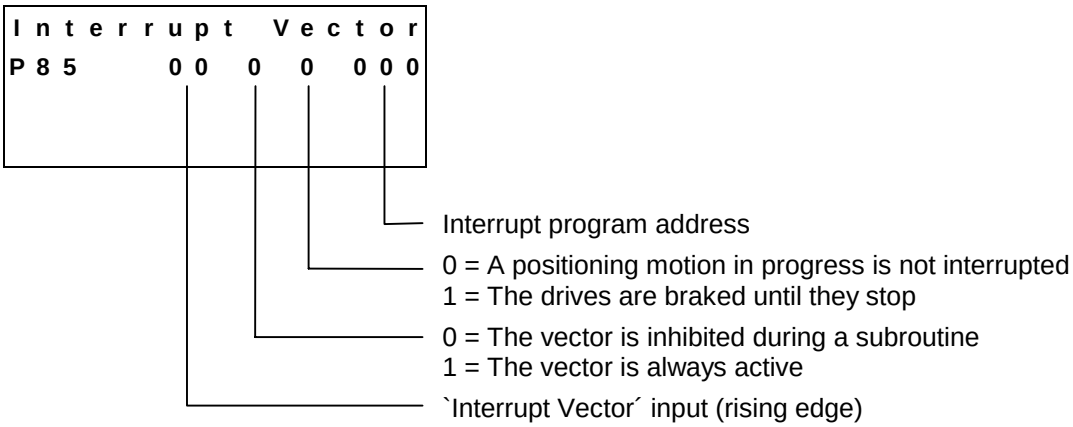
For programming, the following basic points must be observed:

a) The same subroutine may not be called up by more than one task at the same time.

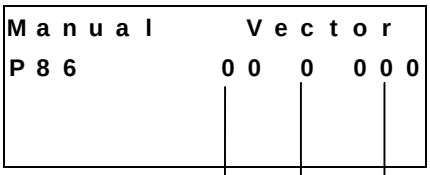
b) Axis movement commands, which reference the same axis, may not be executed by multiple tasks.

P85 Program Interrupt Vector

In preparation



P86 Manual Vector



Start instruction for the `Manual Vector Program´

0 = Start only via input signal
1 = Jump to vector program even when changing from `Automatic´ to `Manual´ Mode

`Manual Vector´ input (rising edge)

Using the manual vector, it is possible to run a program in `Manual´ Mode. Subroutines with the `JSR´ and `RTS´ commands are possible. The manual 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.

If a manual vector program is being processed, a switch from `Manual´ to `Automatic´ Mode is only accepted after the manual vector program is finished.

During `Jogging´ or `Homing´ in `Manual´ Mode, no manual vector program can be started.

No `Jogging´ or `Homing´ is possible while the manual vector program is running.

In Parameter 40, if single-axis mode is programmed, or if Axis 2 is programmed as a synchronous axis, a signal must be present at the `Enable 1´ input, so that a manual vector program may be started. In Parameter 40, if Axis 2 is programmed as a tool axis, a signal must be present at the `Enable 1´ and the `Enable 2´ inputs, so that a manual vector program may be started.

The `Manual Vector´ function is not activated if `Start via Input Signal´ is selected and programmed for Input `00´.

P87 Various Functions

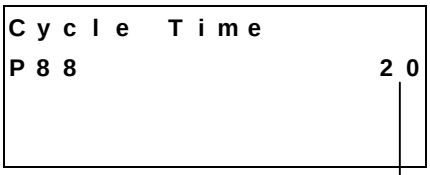
Override Axis 2
0 = Override OFF
1 = Override via analog output AE2
2 = Override via Gray-Code inputs
at Inputs 13 to 16

For further information, see `Override´.

Input No.:	13	14	15	16	**Velocity in %**
Weighted Value:	2^0	2^1	2^2	2^3	
	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

Fig. 9-13: Gray-Code

P88 Cycle Time



Cycle time
20 = 2 milliseconds
25 = 2.5 milliseconds
30 = 3 milliseconds
35 = 3.5 milliseconds
40 = 4.0 milliseconds

For all other values as listed above, the CLM automatically sets the cycle time to the default value of 2 milliseconds.

If the message `IRQ unterbrochen´ is displayed during operation of the CLM, the cycle time value is too short.

The value selected in Parameter 88 must be increased.

9.3 List of CLM Parameters

Software : _ _ _ _ _ _ _ _._ _ Com. No. : _ _ _ _ _ _ _ _ _ _ _
Date : _ _ _ _ _ _ _ _ _ _ Client/End user: _ _ _ _ _ _ _ _ _ _
Prep. by : _ _ _ _ _ _ _ _ _ _ Serial No. : _ _ _ _ _ _ _ _ _ _

Designation	No.	Unit	Data
Feed Constant, Axis 1	00*	IU	_ _ _ _ . _ _ _ _
Encoder Data, Axis 1	01*		_ _ _ _ _ _ _ _ _ _
Velocity, Axis 1	02*	IU/s	_ _ _ _ _ _ . _ _ _ _
Drive Sensitivity, Axis 1	03		_ _ _ _ _ _ . _
Acceleration, Axis 1	04	IU/s^2	_ _ _ _ _ . _ _
Position Gain, Axis 1	05		_ . _ _ _ _ . _ _ _
Direction, Axis 1	06		_ _ _
Switching Threshold, Axis 1	07	IU	_ _ _ _ _ _ _ . _ _
Homing Axis 1	08*		_ _ _
Homing Offset, Axis 1	09*	IU	_ _ _ _ _ . _ _
Homing Input/Output, Axis 1	10		_ _ _ _ _ _
Minimum Travel Limit, Axis 1	11*	IU	_ _ _ _ _ _ _ . _ _
Maximum Travel Limit, Axis 1	12*	IU	_ _ _ _ _ _ _ . _ _
Presignaling, Axis 1	13	IU	_ _ _ _ _ _ _ _ _ . _
Monitoring, Axis 1	14		_ _ _
Rapid Stop, Axis 1	15	IU	_ _ _ _ _ _ _ _ . _ _
Tool Width, Axis 1	16	IU	_ _ . _ _
Knee Point, Axis 1	17	IU	_ _ . _ _ _ _ . _ _
Material Velocity, Axis 1	18		_ _ _ . _
Test Mode, Axis 1	19		_
Manual Cut Vector, Axis 1	20		_ _ _
Length Correction, Axis 1	21		_ _ _
Special Functions, Axis 1	22		_ _ _ _ _ _ _ _
Crop Cut, Axis 1	23		_ _ _ _ _ _ . _ _
Reverse Inhibit, Axis 1	24		_ _ _ _ _ _ _ _ _ . _ _
Tail End Processing, Axis 1	25		_ _ _ _ _ _ _ _
Special Functions 2, Axis 1	26		_ _ _ . _ _ _ _ _
Special Functions 3, Axis 1	27		_ _
Change Saw Blade, Axis 1	28		_ _ . _ _
Measuring Wheel Feed Constant, Axis 1	38	IU	_ _ _ _ . _ _ _ _
Measuring Wheel Encoder Data, Axis 1	39		_ _ _ _ _

Fig. 9-14: Parameter List - Axis 1 and Measuring Wheel

Note: The parameters designated with `*´ may only be altered with permission of the machine builder or drive manufacturer!

Designation	No.	Unit	Data
Feed Constant, Axis 2	40*	IU	_ _ _ _ _ _ . _ _ _ _
Encoder Data, Axis 2	41*		_ _ _ _ _ _ _ _ _ _ _
Velocity, Axis 2	42*	IU/s	_ _ _ _ _ _ _ . _ _ _ _
Drive Sensitivity, Axis 2	43		_ _ _ _ _ _ _ . _
Acceleration, Axis 2	44	IU/s^2	_ _ _ _ _ _ . _ _
Kv Factor, Axis 2	45		_ _ . _ _ _
Drive Direction, Axis 2	46		_ _
Switching Threshold, Axis 2	47	IU	_ _ _ _ _ _ _ . _ _
Homing Axis 2	48*		_ _ _
Homing Offset, Axis 2	49*	IU	_ _ _ _ _ _ _ . _ _
Homing Input/Output, Axis 2	50		_ _ _ _ _ _
Minimum Travel Limit, Axis 2	51*	IU	_ _ _ _ _ _ _ . _ _
Maximum Travel Limit, Axis 2	52*	IU	_ _ _ _ _ _ _ . _ _
Presignaling, Axis 2	53	IU	_ _ _ _ _ _ _ _ _ . _
Monitoring, Axis 2	54		_ _ _ _ _ _ _ _
Special Functions, Axis 2	55		_ _ _ _
Rotary Table, Axis 2	56		_ _ _ _ _ _ _ _ _
Knee Point, Axis 2	57	IU/s^2	_ _ _ _ _ _ _ _ . _ _
Synchronization Difference, Axis 2	58	IU	_ _ _ _ . _ _
Special Functions, Axis 2	59		_
Serial Interface	80		_ _ _ _ _ _ _ _ _
Serial Interface	81		_ _ _ _ _ _ _ _
Display	82		_ _ _ _
Memory Display	83		_ F F _ _ _ _
Tasks 2 and 3	84		_ _ _ _ _ _ _ _
Program Interrupt Vector	85		_ _ _ _ _ _ _
Manual Vector	86		_ _ _ _ _ _
Various Functions	87		_
Cycle Time	88		_ _

Fig. 9-15: Parameter List - Axis 2 and General Parameters

Note: The parameters designated with `*´ may only be altered with permission of the machine builder or drive manufacturer!

10 Diagnostic Messages

10.1 General Information

If the CLM detects an error, the system outputs and outputs 1 to 72 are cleared and the CLM displays an error.

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.

Following is a list of all error messages:

Error Axis 1 not Homed	When switching into Automatic Mode, Axis 1 was not homed.
Error Axis 2 not Homed	In Automatic Mode, an absolute position is to be targeted, without Axis 2 being homed for that purpose.
Error Abs. Enc. Error1	No absolute encoder is connected, or data transmission from the encoder to the CLM is interrupted
Error Abs. Enc. Error2	No absolute encoder is connected, or data transmission from the encoder to the CLM is interrupted.
Error Abs.Range Error1	Values are outside the measuring range of the absolute encoder.

E r r o r **A b s . R a n g e E r r o r 2**	Values are outside the measuring range of the absolute encoder.
E r r o r **I n v a l i d M o d e !**	More than one operating mode is preselected.
E r r o r **I n v a l i d I n p u t**	The contents of a parameter were entered incorrectly.
E r r o r **D r i v e n o t r e a d y**	In Automatic Mode, one of the enable signals was skipped.
E r r o r **I D S L n g t h F o r m a t**	If an IDS01 decade switch is connected, check wiring and cables to the decade switch. Max. cable length = 15m
E r r o r **I D S C h a r F o r m a t**	If an IDS01 decade switch is connected, wiring and cables to the decade switch must be checked. Max. cable length = 15m
E r r o r **I D S C h e c k s u m E r r**	If an IDS01 decade switch is connected, wiring and cables to the decade switch must be checked. Max. cable length = 15m

E r r o r **I n v a l i d d P r g C m d**

While executing the NC user program, the CLM has reached an instruction that contains erroneous data, or the instruction is invalid.

E r r o r **J S R N e s t i n g**

The nesting for subroutine programming (JSR command) exceeds 127.

E r r o r **B C D I n p u t E r r o r**

The entry at Inputs 1 to 8 is not in BCD format.

E r r o r **N o M a r k e r P u l s e 1**

During the homing routine, no marker pulse was detected within one revolution of the encoder.

E r r o r **N o M a r k e r P u l s e 2**

During the homing routine, no marker pulse was detected within one revolution of the encoder.

E r r o r **M a x T r a v e l L m t 1**

In Automatic Mode with a homed absolute axis, a command position outside the travel limit was preset.

E r r o r **M a x T r a v e l L m t 2**

In Automatic Mode with a homed absolute axis, a command position outside the travel limit was preset.

Error **Min Travel Lmt 1**

In Automatic Mode with a homed absolute axis,
a command position outside the travel limit was preset.

Error **Min Travel Lmt 2**

In Automatic Mode with a homed absolute axis,
a command position outside the travel limit was preset.

Error **Drive Runaway A2**

The direction for the encoder or the analog output is wrong.

Error **EMERGENCY STOP**

The E-Stop signal at Connector 3 / Pin 3 is missing

Error **Marker Pulse 1 ?**

The switching point of the initiator ‘Home Position´ is closer than 1/16 encoder revolution at the encoder marker pulse or the marker pulse is continuously active (turn marker pulse cable).

Error **Marker Pulse 2 ?**

The switching point of the home switch is closer than 1/16 encoder revolution at the encoder marker pulse or the marker pulse is continuously active (turn marker pulse cable).

Error **Parameters lost**

The contents of all parameters must be checked.
If the error occurs after each re-start of the CLM,
the internal battery must be changed.

E r r o r **P r o g r a m l o s t**	The contents of all NC instructions must be checked. If the error occurs after each re-start of the CLM, the internal battery must be changed.
E r r o r **R S B r e a k - E r r o r**	The reception from the IDS01 decade switch has been interrupted.
E r r o r **R T S N e s t i n g**	NC Program Error: RTS command without JSR command
E r r o r **E x c e s s P o s L a g 2**	The servo drive cannot comply with the default velocity and does not exactly comply with the command value.
E r r o r **S y s t e m F a i l u r e !**	Check external wiring. See Installation Instructions!
E r r o r **I n v a l i d B l o c k #**	The combination of offset and jump distance in the `BCB´ and `BCD´ commands result in an NC target instruction greater than 999.
E r r o r **F e e d A n g l e l o s t 2**	The signal (Parameter 54) was lost during a movement of Axis 2.

E r r o r **N o t H o m e p o s i t i o n**	When switching to Automatic Mode, Axis 1 was not in the home position.
E r r o r **M a x i m u m S t r o k e**	Axis 1 was approaching the maximum stroke (Parameter 15).
E r r o r **I m m e d i a t e S t o p**	In Automatic Mode, a signal was applied at Connector 3, Pin 5 (‘Rapid Stop´).
E r r o r **M i s s i n g E O S C m d**	The processing program did not end with the `EOS´ command.
E r r o r **I n v a l i d A x i s #**	When processing the NC user program, the CLM arrived at an NC instruction with an illegal axis selection.
E r r o r **D r i v e R u n a w a y A 1**	The direction of the encoder or the analog output is wrong.
E r r o r **S y n c h r . D i f f . A 2**	Axis 2 is programmed as a synchronous axis and the position difference between the two axes was greater than the programmed value in Parameter 58.

E r r o r **I n d e x L e n g t h**

After the last manual cut, more material has run through the processing position than currently set in the length instruction.

E r r o r **I n v a l i d I / O #**

A command with an invalid input or output number was called.

10.2 Error Messages via the RS Interface

If the CLM detects an error, Status Message 53 is output via the serial interface.

If an error occurs during transmission via the interface, Status Message 01 is output via the serial interface.

Following is a list of all error messages for Status 01:

RS Block # Wrong The transmitted instruction number is not between `000´ and `999´, or it is not a decimal value.

RS Format Error The format of the transmitted data is incorrect.

RS Block Data Error The transmitted instruction data are incorrect.

RS Checksum Error The transmitted checksum is incorrect.

Invalid Mode

1) An attempt was made to transmit parameter data to the CLM. The control was not in `Parameter´ Mode at the time.
2) An attempt was made to transmit the control command `!_CL0_$hh´ to the CLM. The control was not in `Parameter´ Mode at the time.

RS-Para # Wrong The transmitted parameter number is not a decimal number.

RS-Para # too large The transmitted parameter number is too large.

RS-Status # Wrong For status messages, the number is not between `00´ and `99´.

Invalid Status # An attempt was made to query status information that was not present in the CLM.

Invalid Prg Command An invalid command was transmitted to the CLM.

11 Dimensions, Accessories and Typecodes

11.1 CLM 1.4 Dimensions and Connector Layout

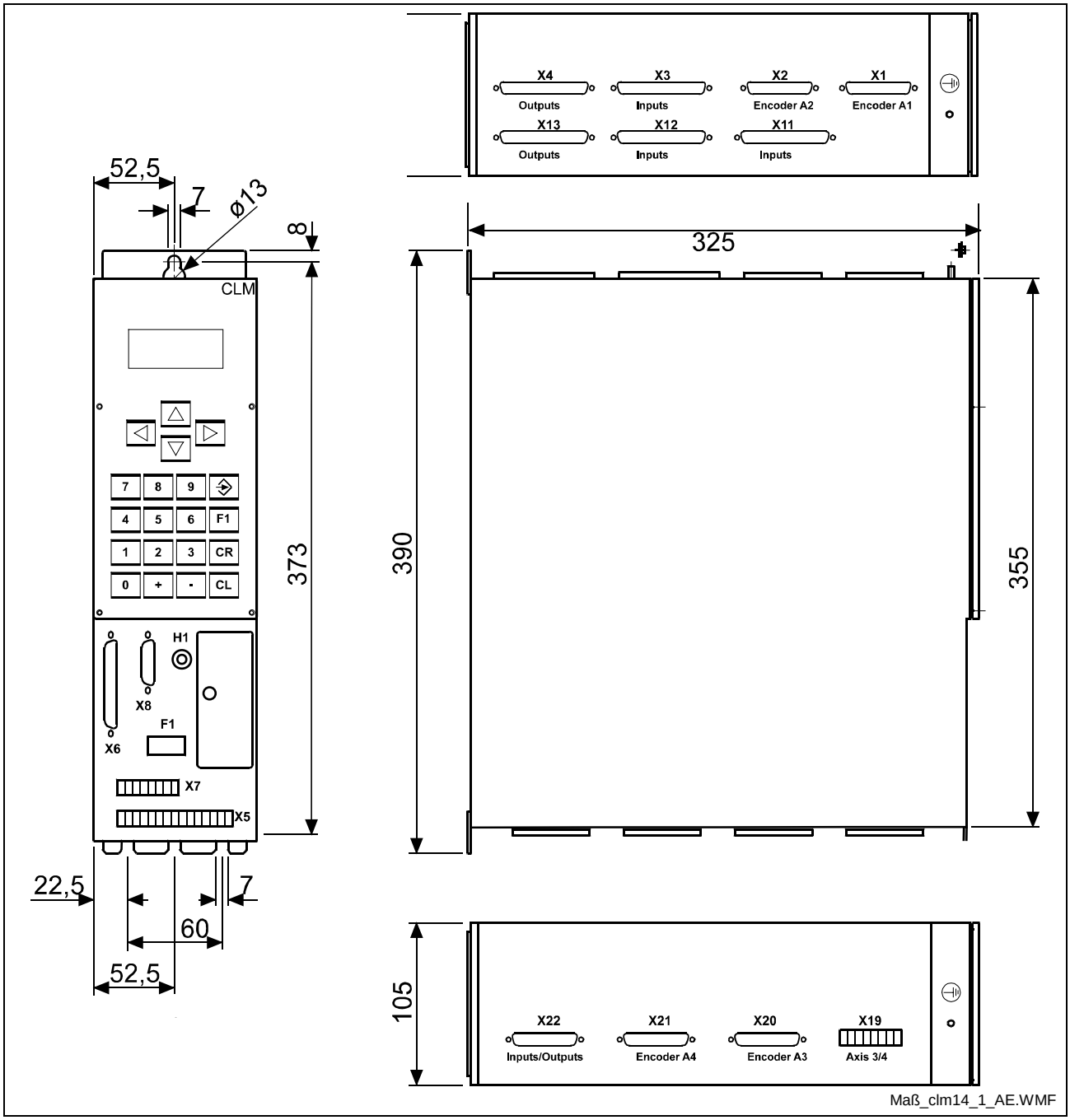


Fig. 11-1: CLM 1.4 Dimensions and Connector Layout

11.2 Separately mounted Keypad (CTA)

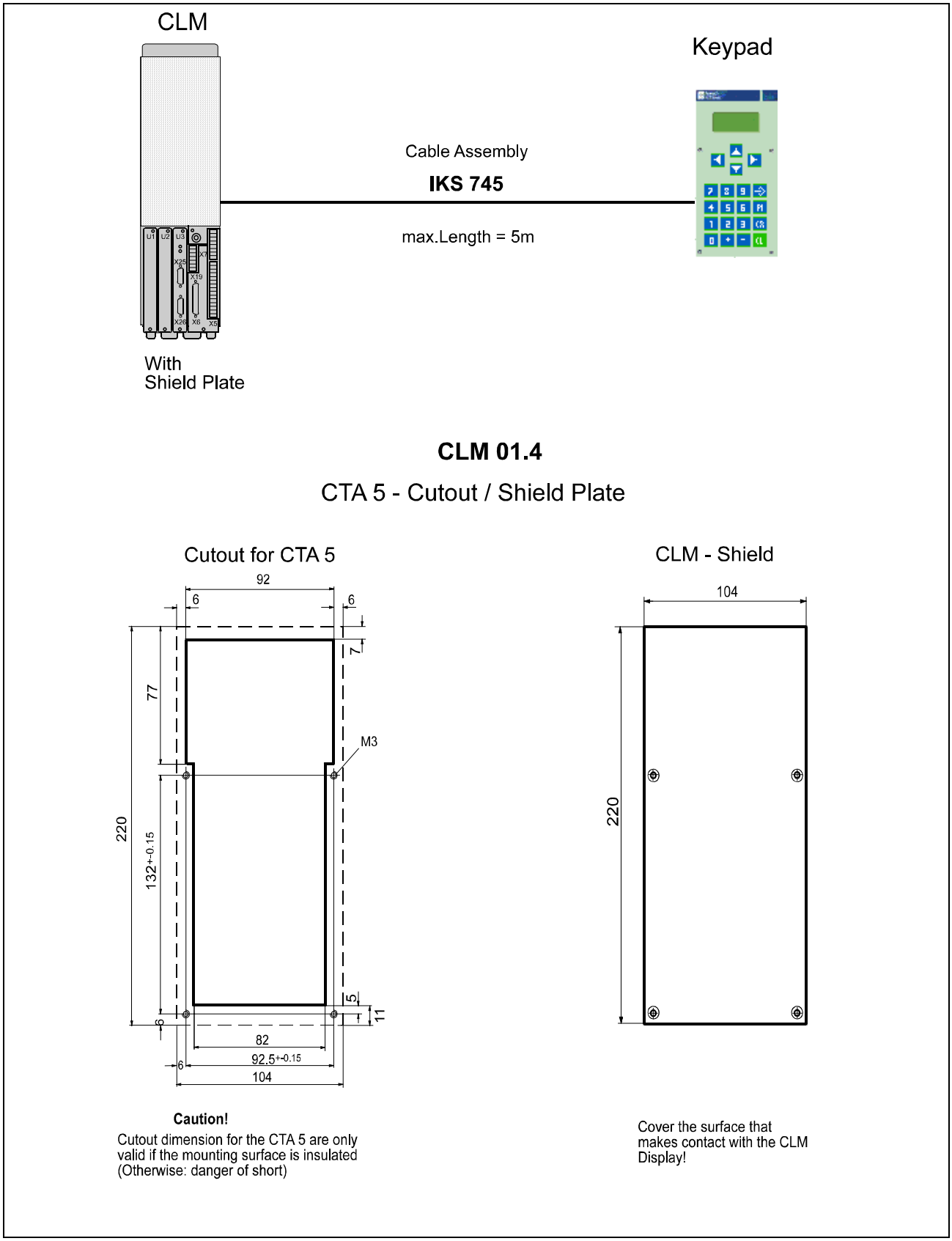


Fig. 11-2: Separately mounted Keypad

11.3 IDS01 Decade Switch Dimensions

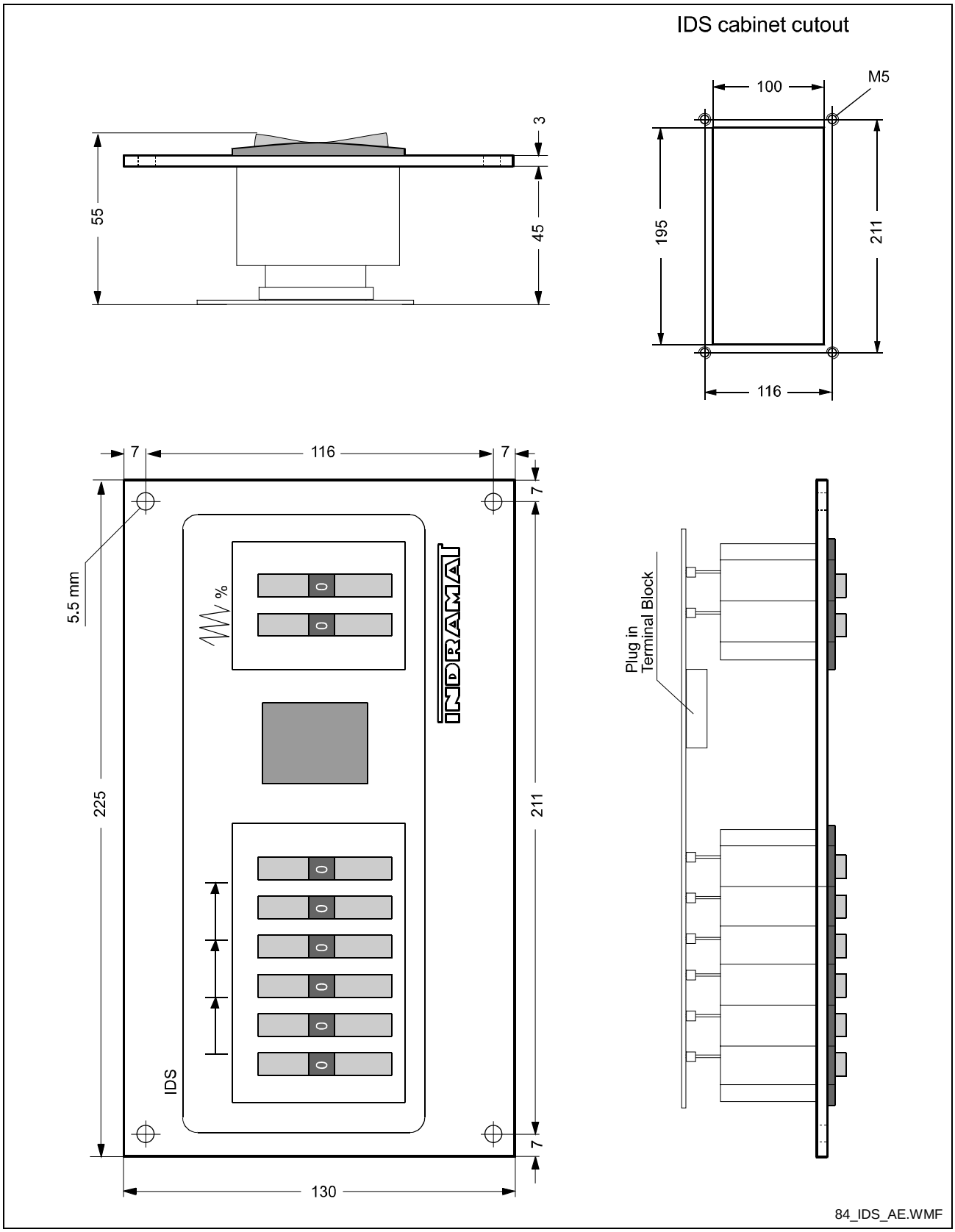


Fig. 11-3: IDS01 Decade Switch Dimensions

11.4 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. 11-4: 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. 11-5: 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. 11-6: CLM 1.4 Accessories

Connectors designated with an `*´ have two outgoing feeder cables.

11.5 CLM 1.4 Typecodes

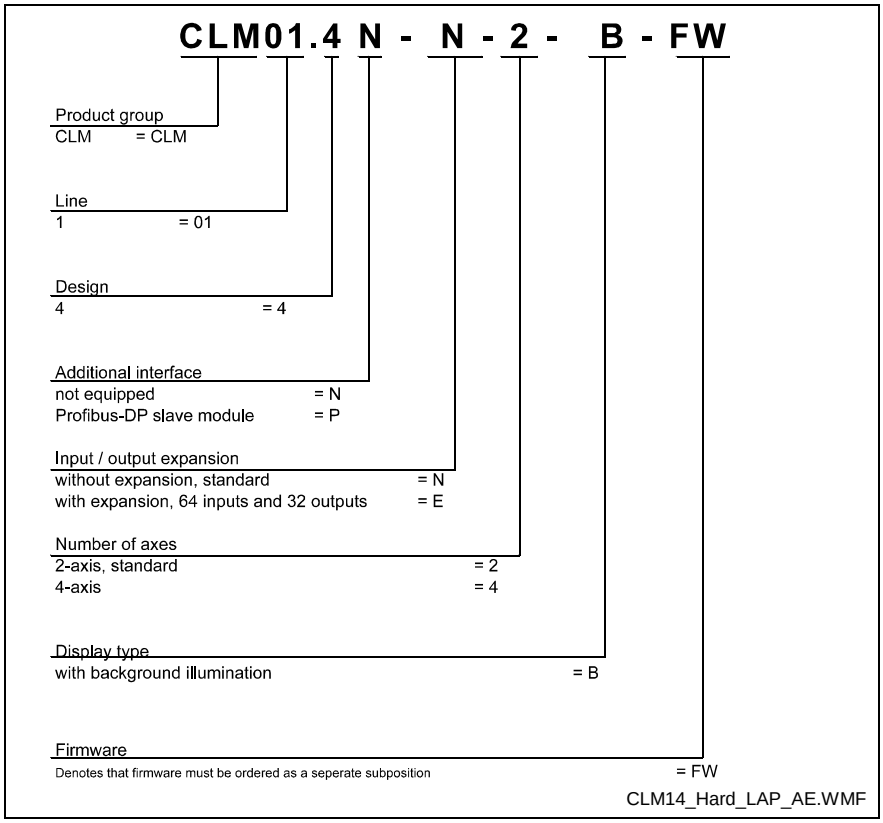


Fig. 11-7: CLM1.4 Hardware Typecodes

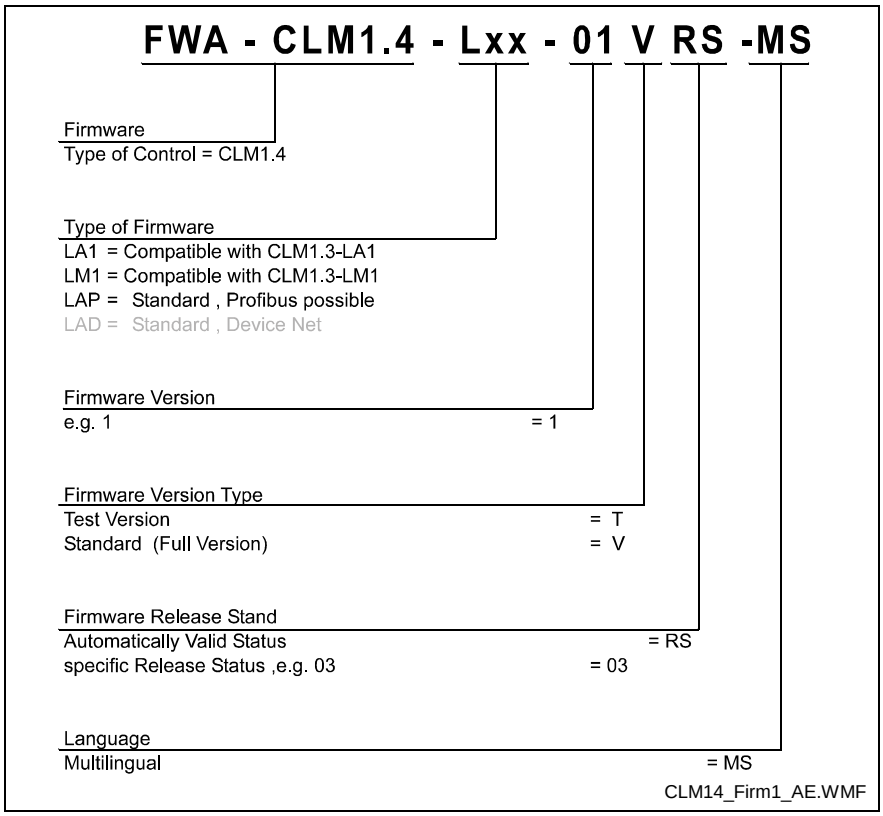


Fig. 11-8: CLM1.4 Firmware Typecodes

11.6 IDS01 Decade Switch Typecodes

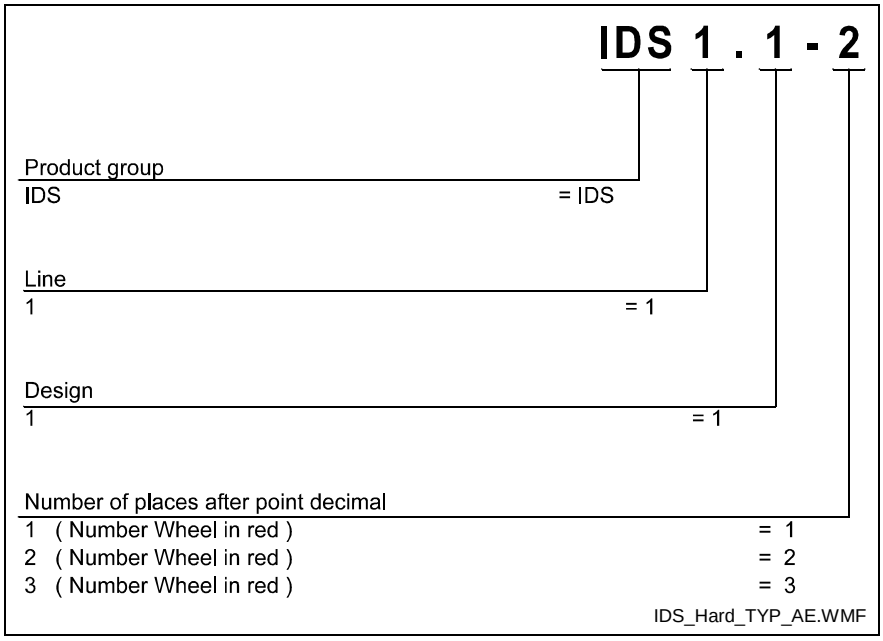


Fig. 11-9: IDS01 Decade Switch Typecodes

12 Terminal Connection Diagrams

12.1 Overview

12.2 Power Supply and System Signals for Axes 1 and 2

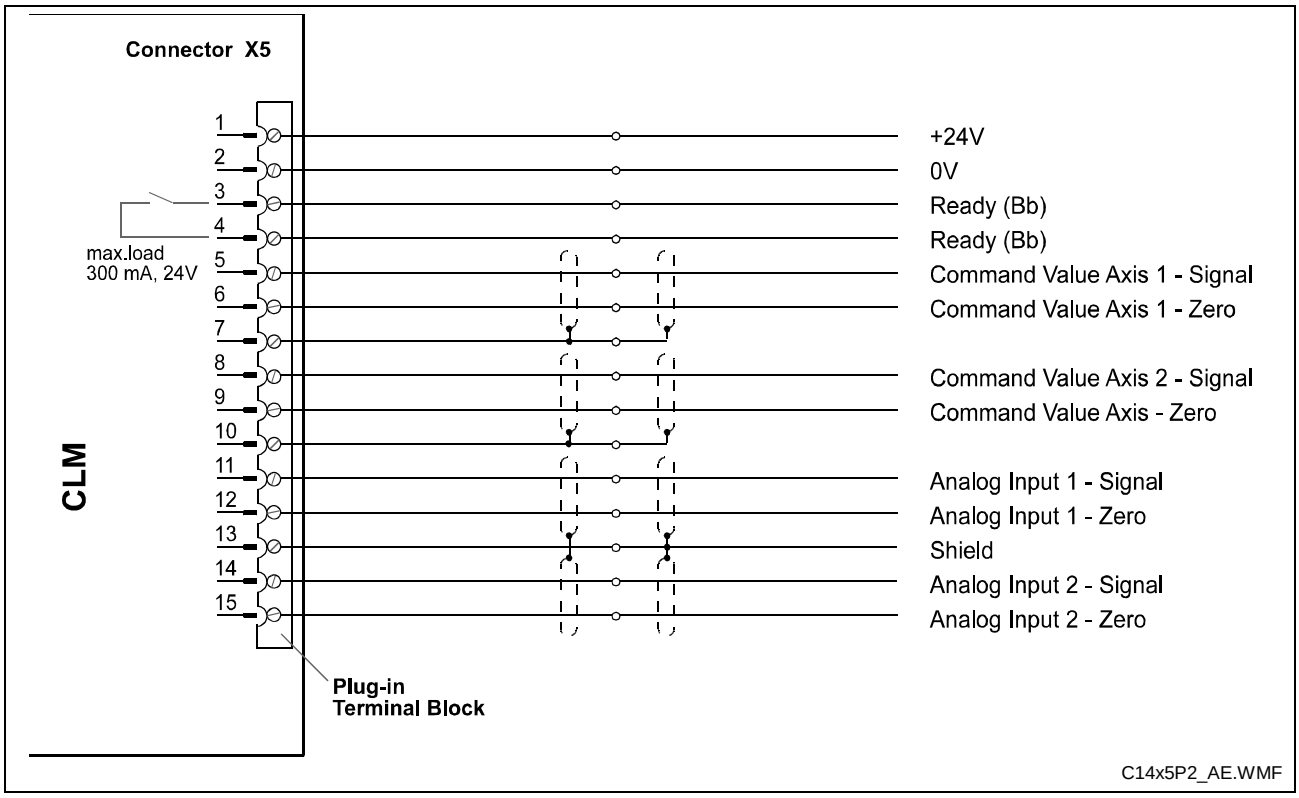


Fig. 12-1: Connector X5 - Power Supply and System Signals, A1 & 2

12.3 System Signals for Axes 1 to 2

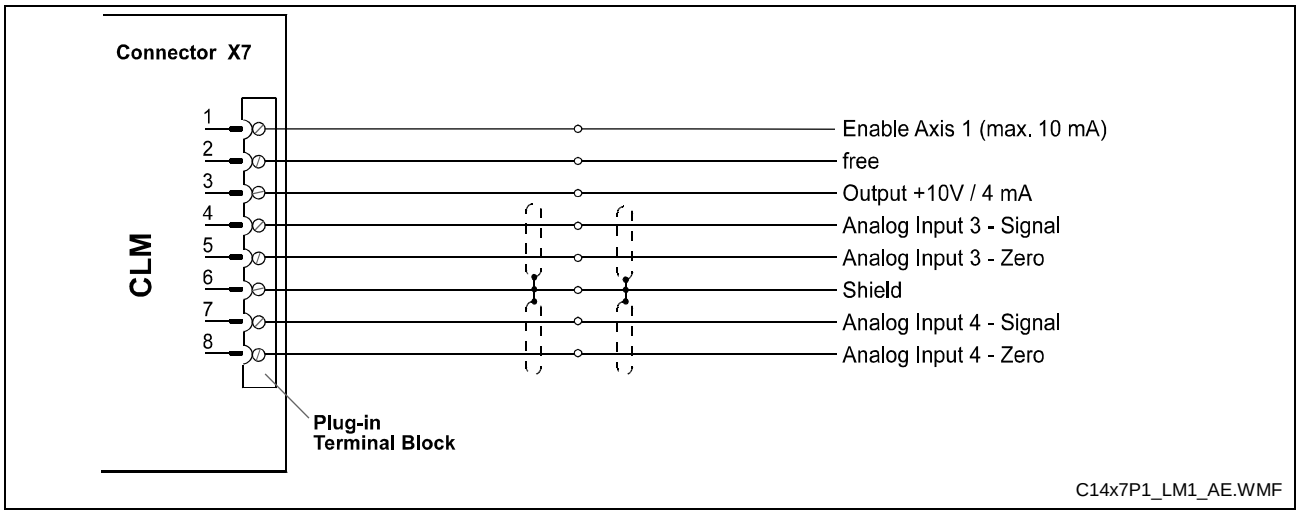


Fig. 12-2: Connector X7 - System Signals A1 to A2

12.4 Data Interface - Serial Channel A

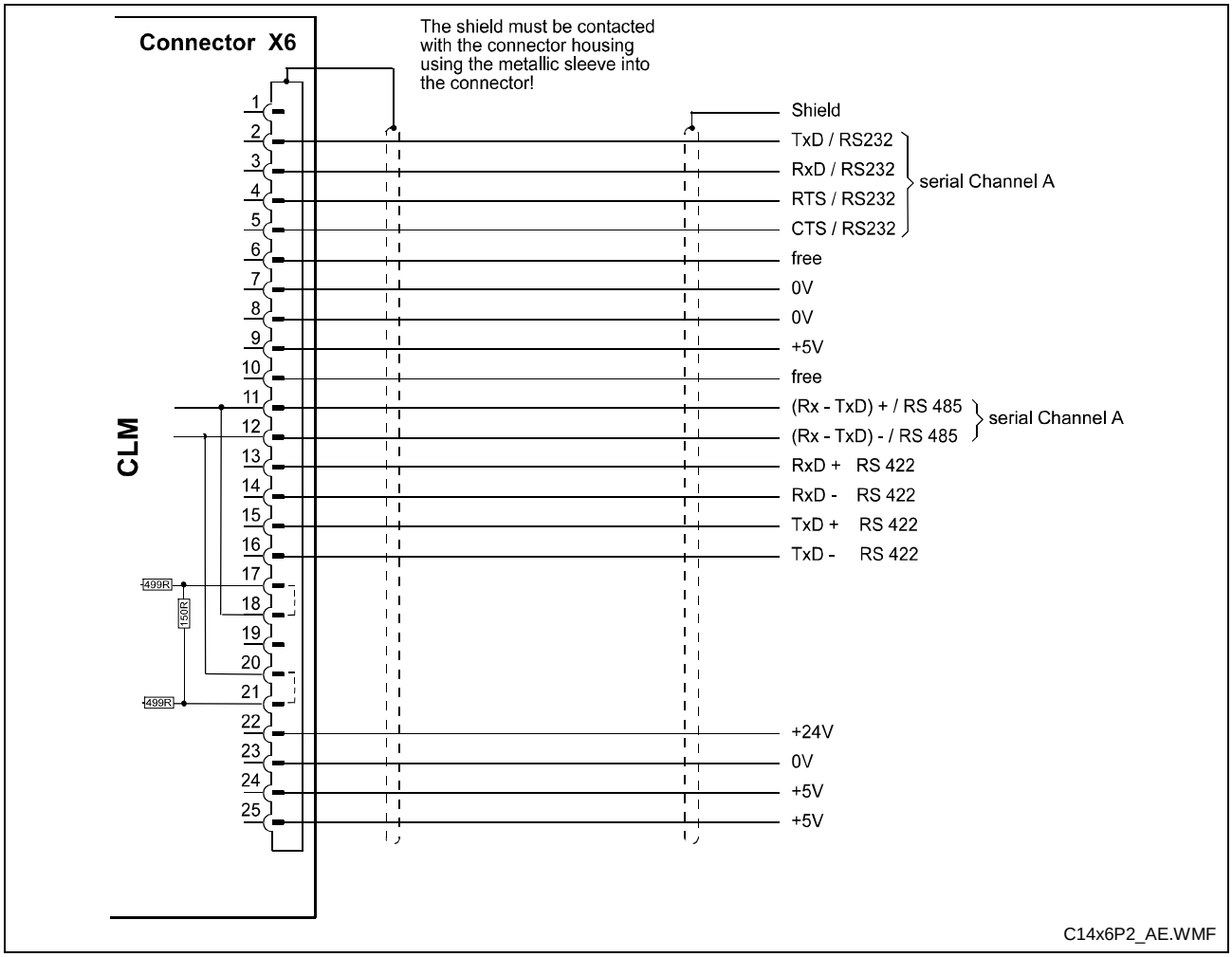


Fig. 12-3: Connector X6 - Data Interfaces, General Overview

12.5 RS232C/RS485 Data Interface - Serial Channel A

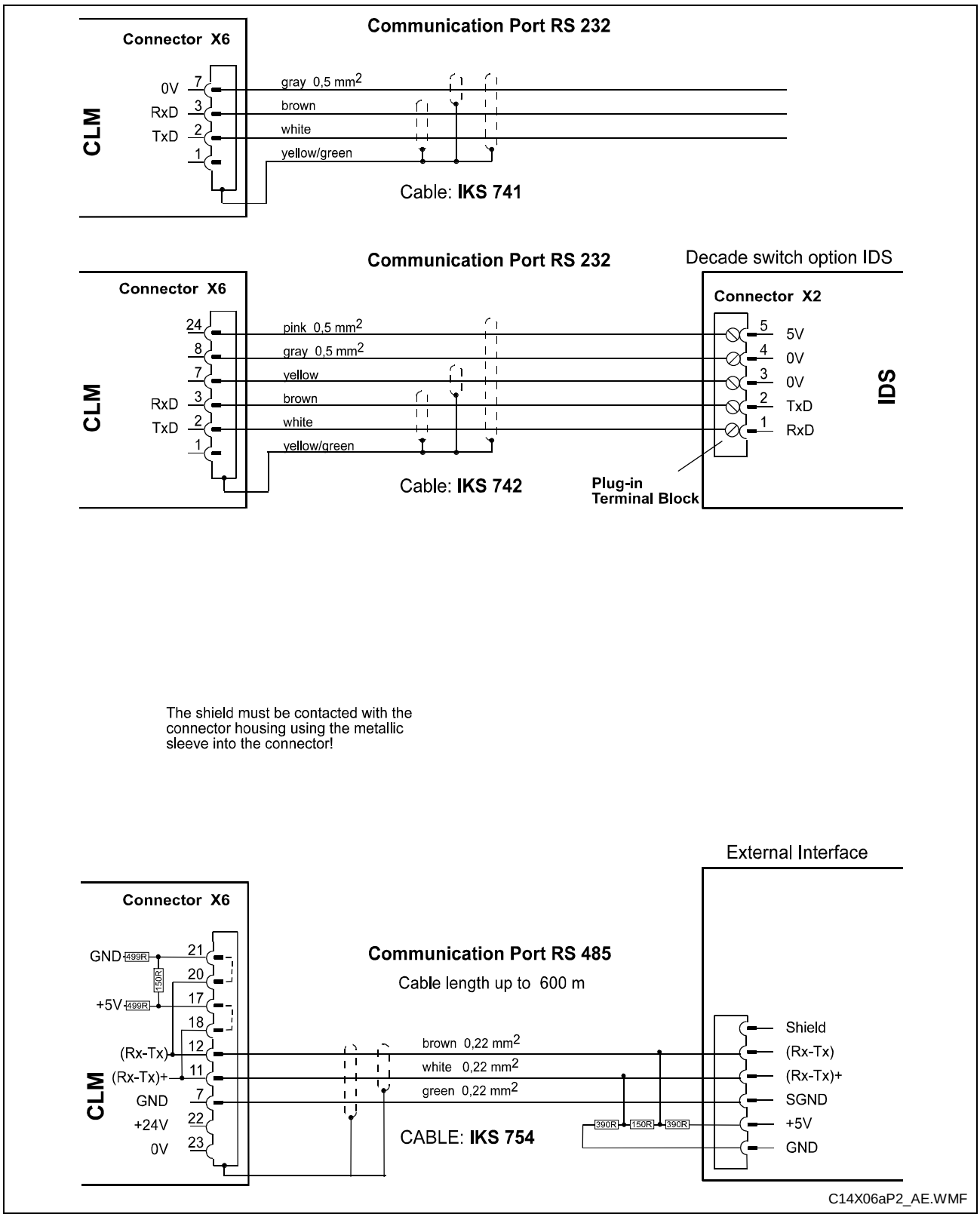


Fig. 12-4: Connector X6 - RS232C/RS485 Data Interface - Channel A

12.6 RS485 Data Interface - Serial Channel A

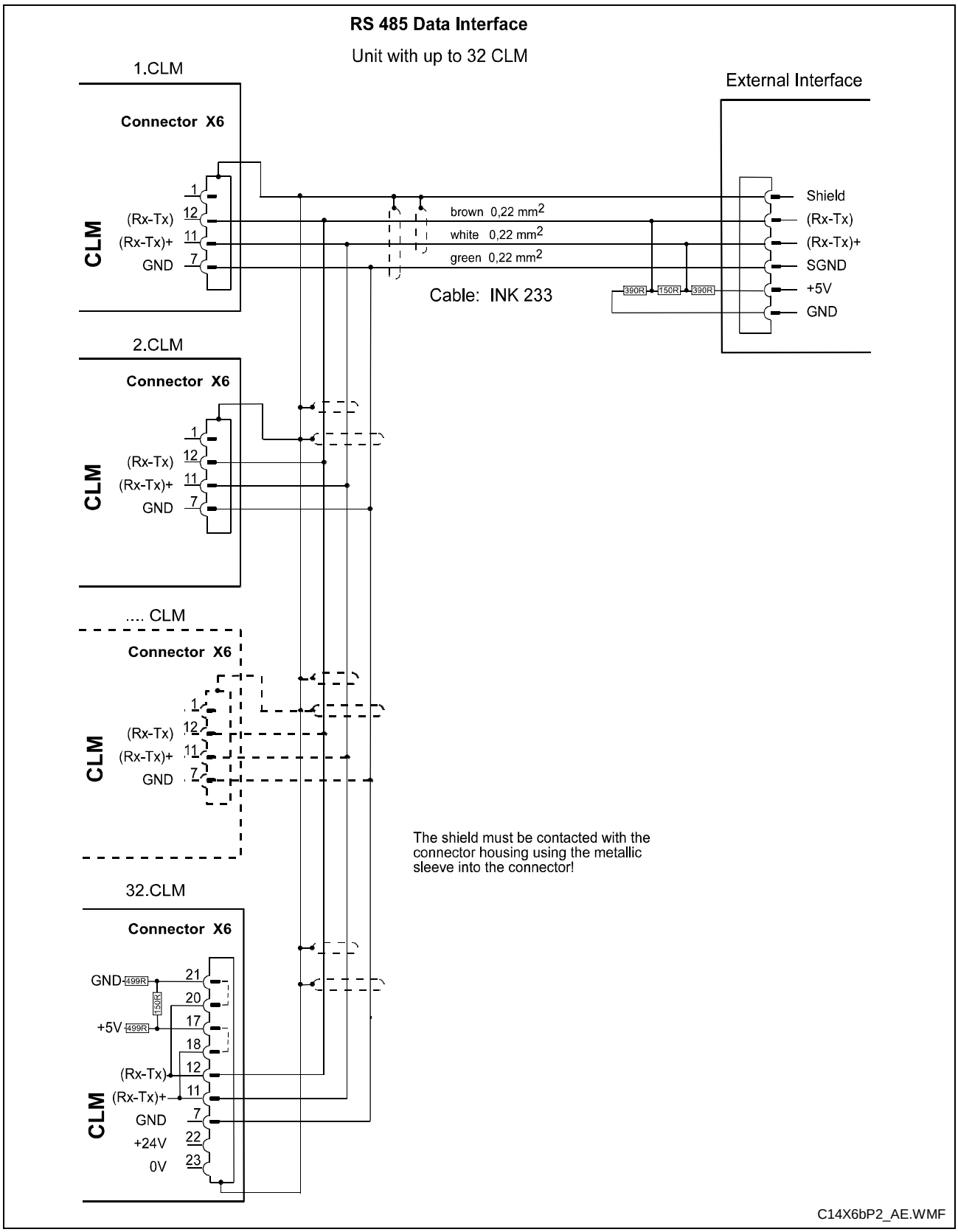


Fig. 12-5: Connector X6 - RS485 Data Interface - Channel A

12.7 Axis 1 Encoder Inputs

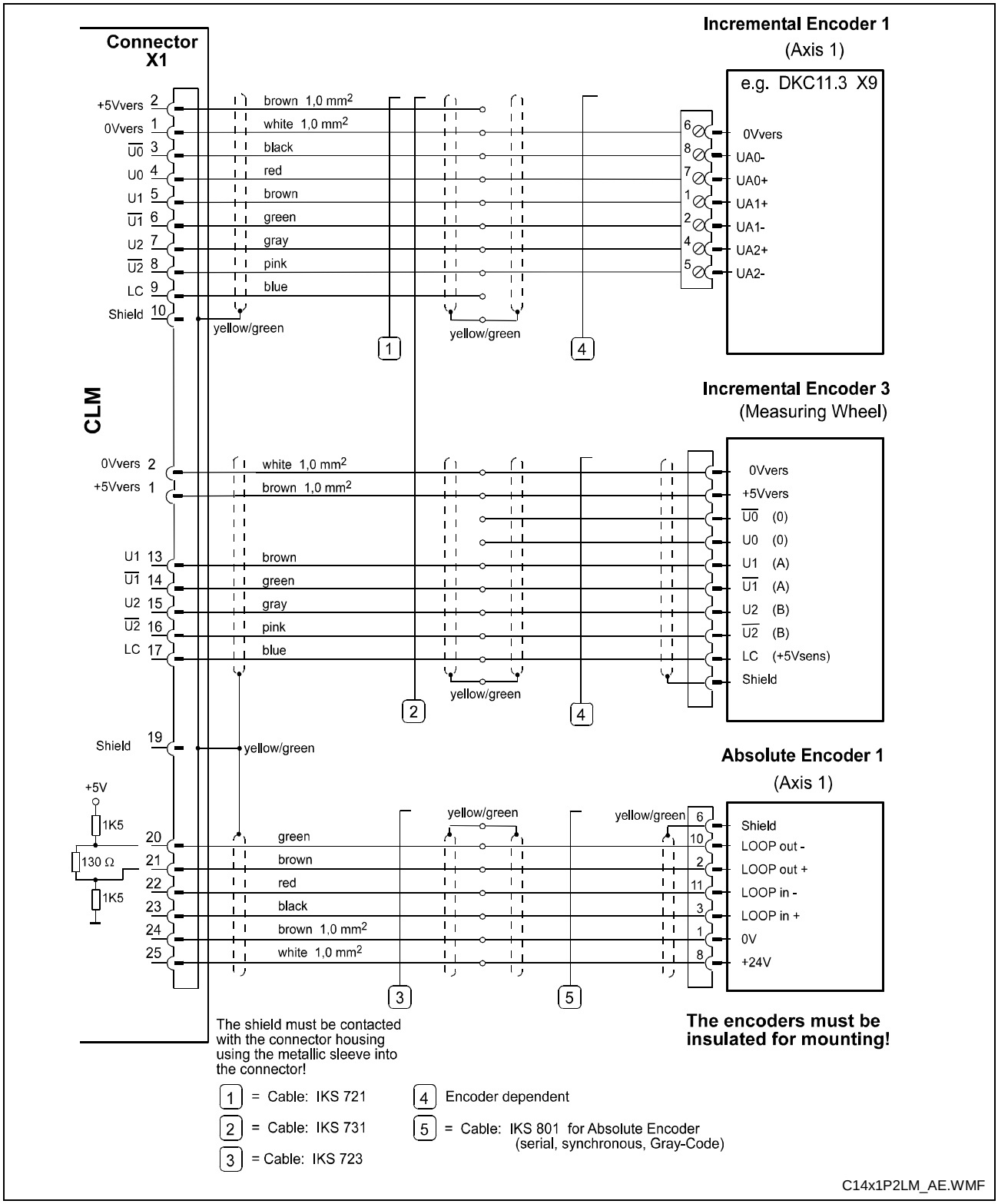


Fig. 12-6: Connector X1 - Axis 1 Encoder Inputs

12.8 Axis 2 Encoder Inputs

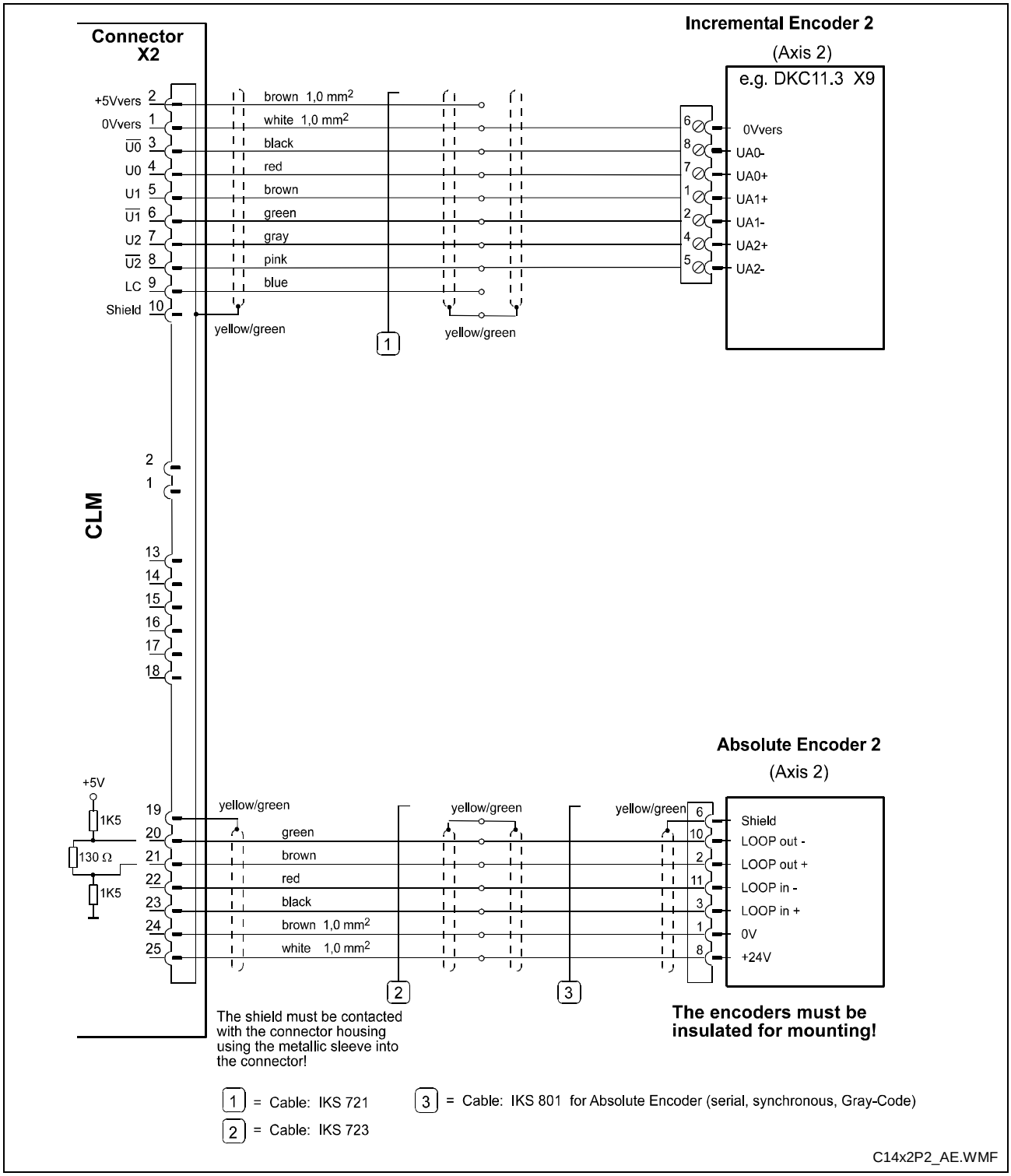


Fig. 12-7: Connector X1 - Axis 2 Encoder Inputs

12.9 Inputs - Part 1

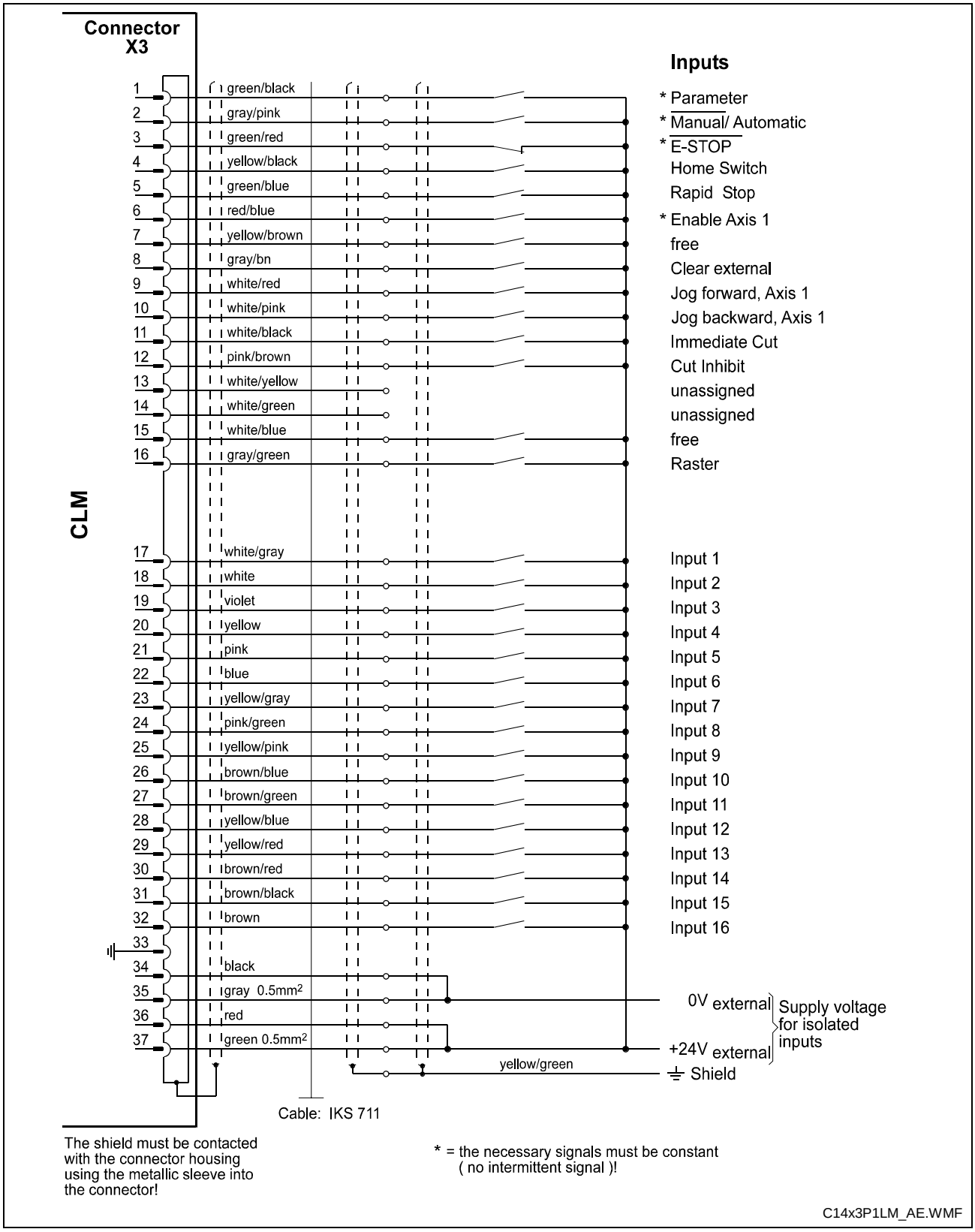


Fig. 12-8: Connector X3 - Inputs - Part 1

12.10 Inputs - Part 2 (I/O Expansion)

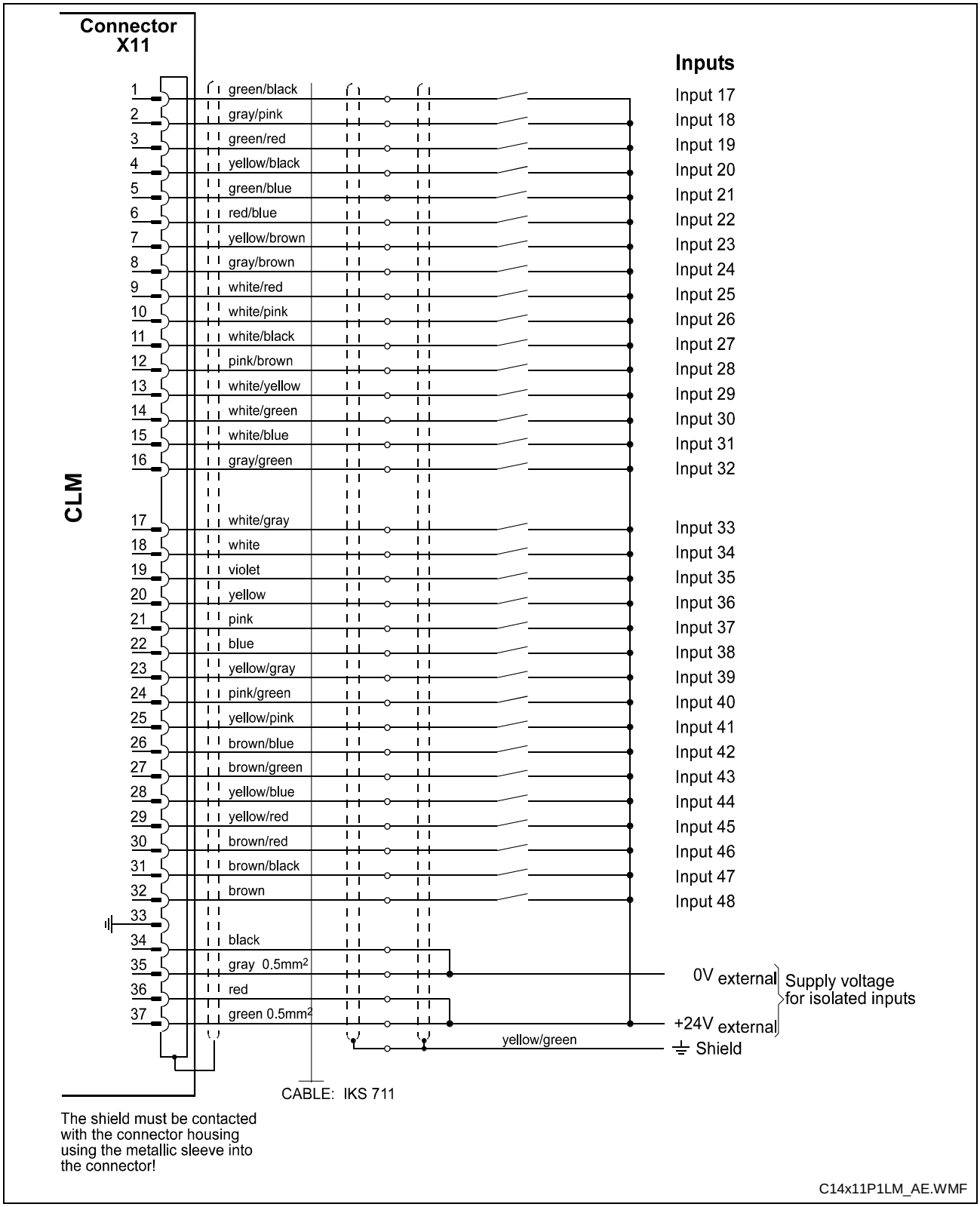


Fig. 12-9: Connector X11 - Inputs - Part 2 (I/O Expansion)

12.11 Inputs - Part 3 (I/O Expansion)

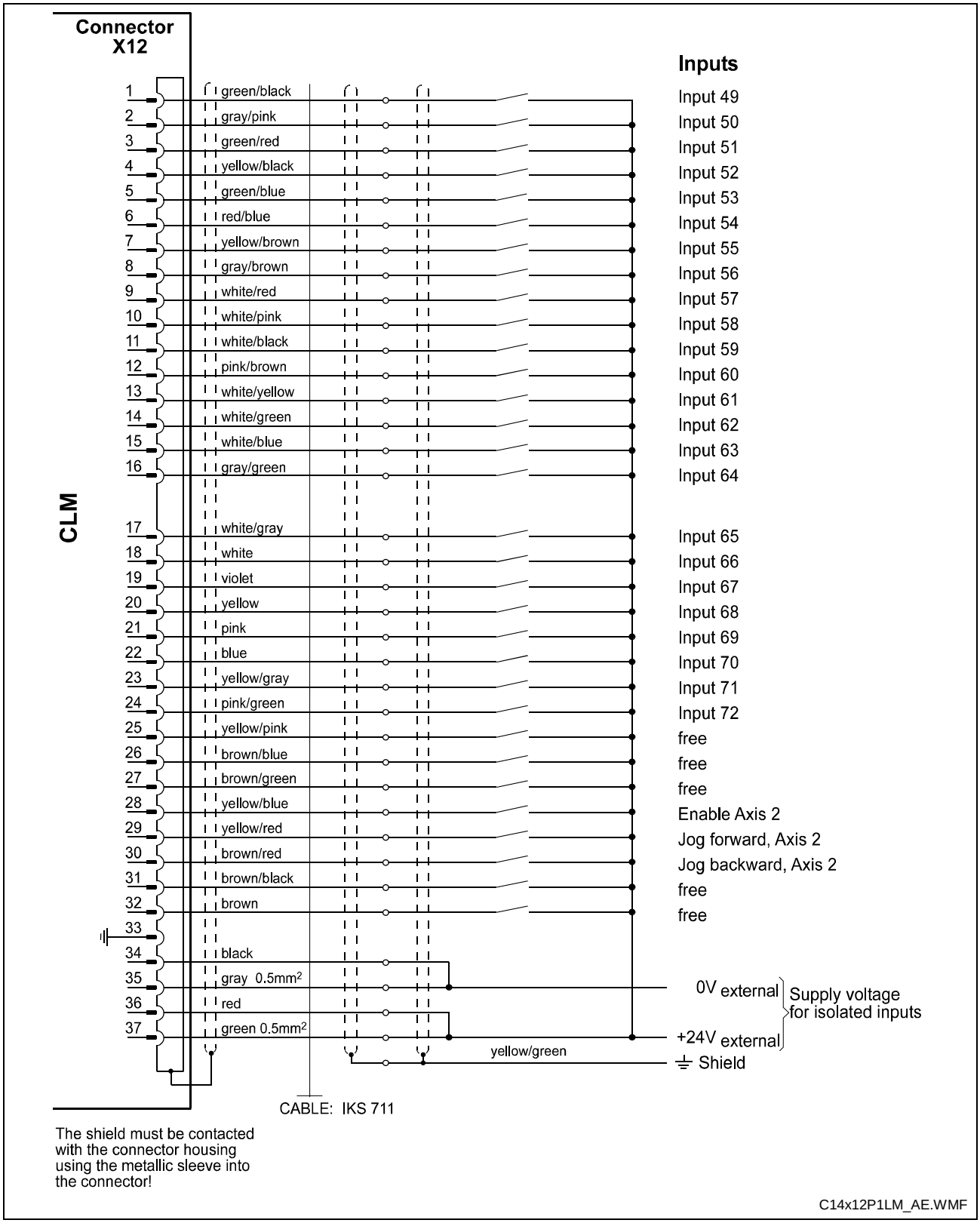


Fig. 12-10: Connector X12 - Inputs - Part 3 (I/O Expansion)

12.12 Outputs - Part 1

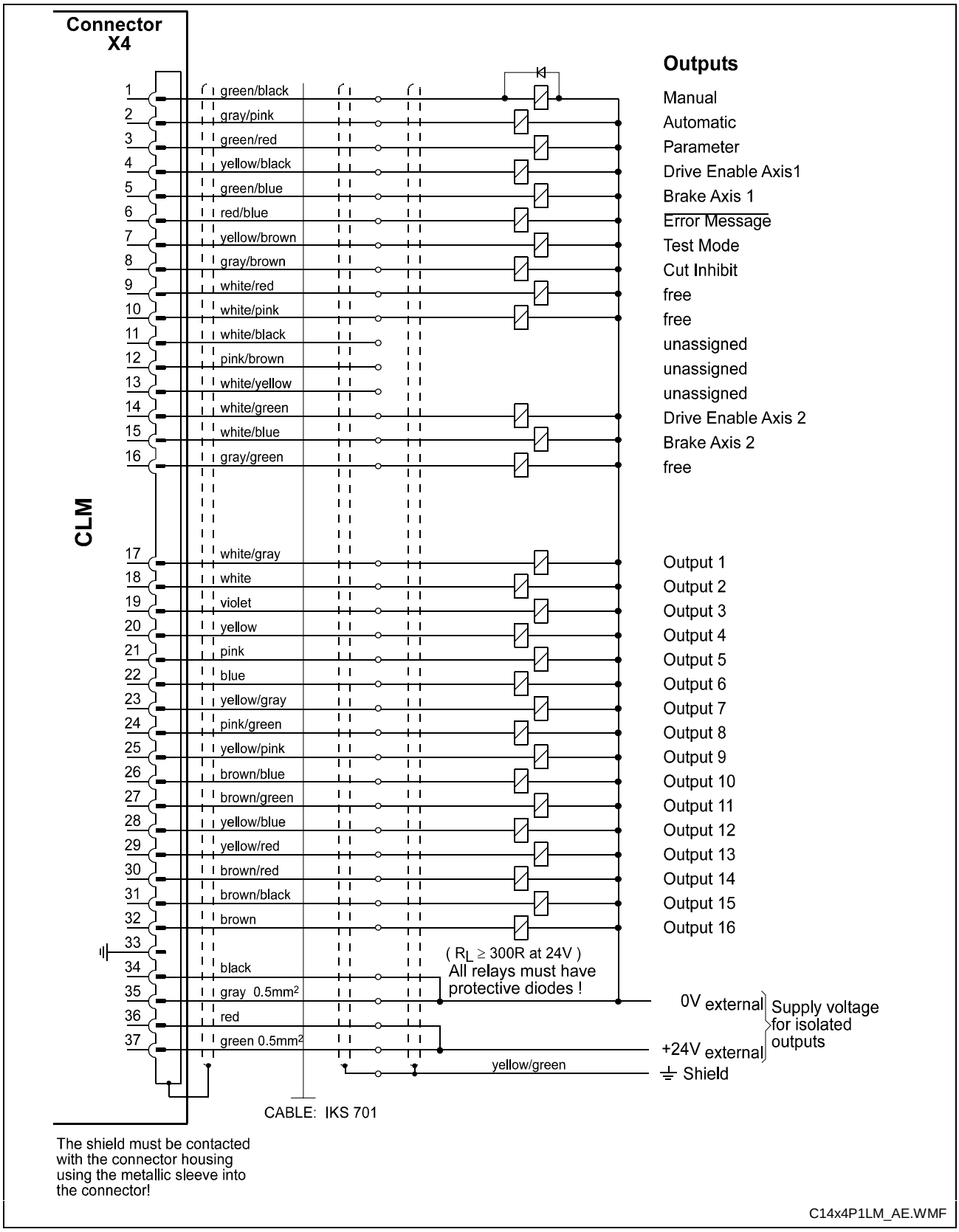


Fig. 12-11: Connector X4 - Outputs - Part 1

12.13 Outputs - Part 2 (I/O Expansion)

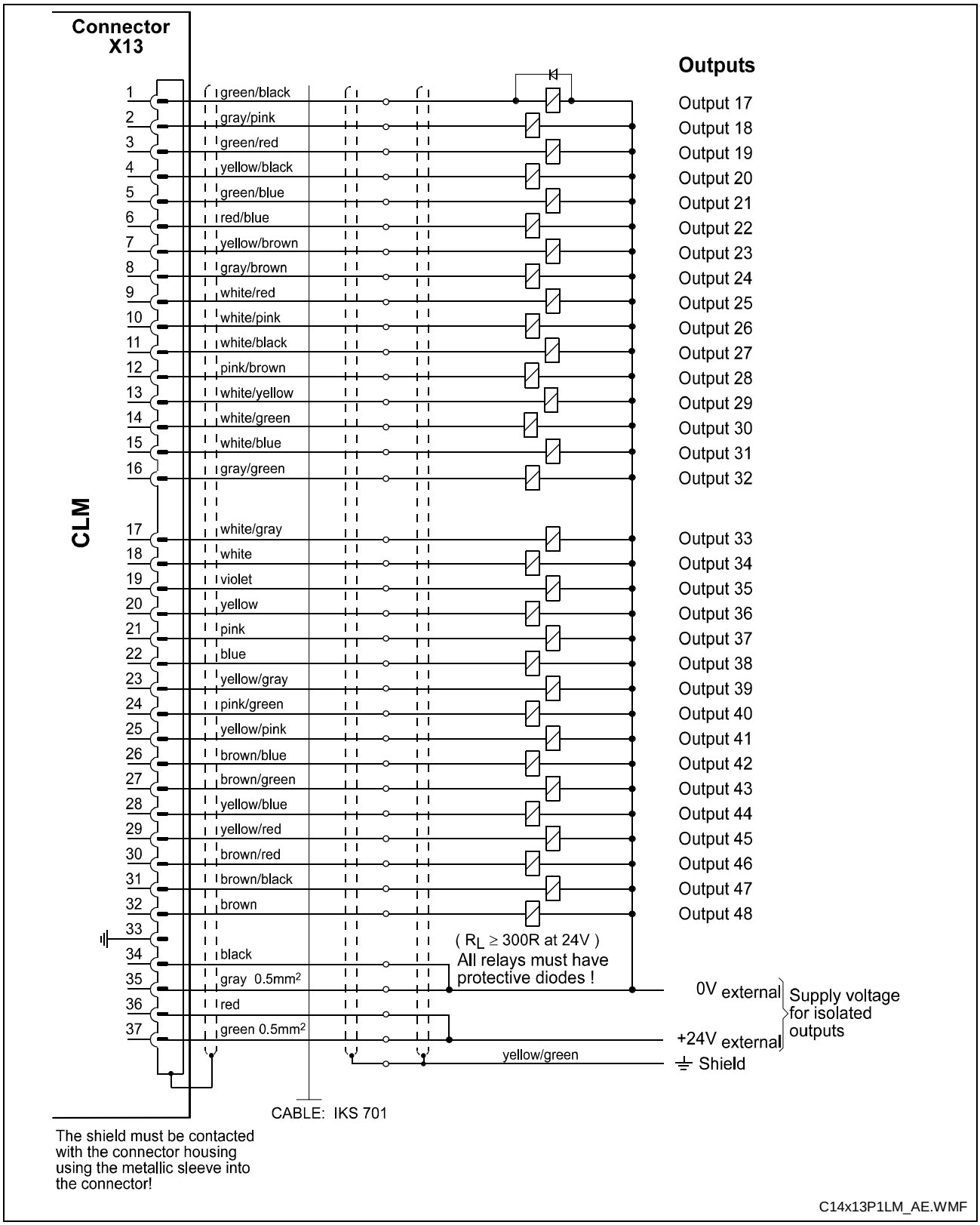


Fig. 12-12: Connector X13 - Outputs - Part 2 (I/O Expansion)

12.14 CLM to DKC11.3 Connection (Incremental Encoder, Axis 1)

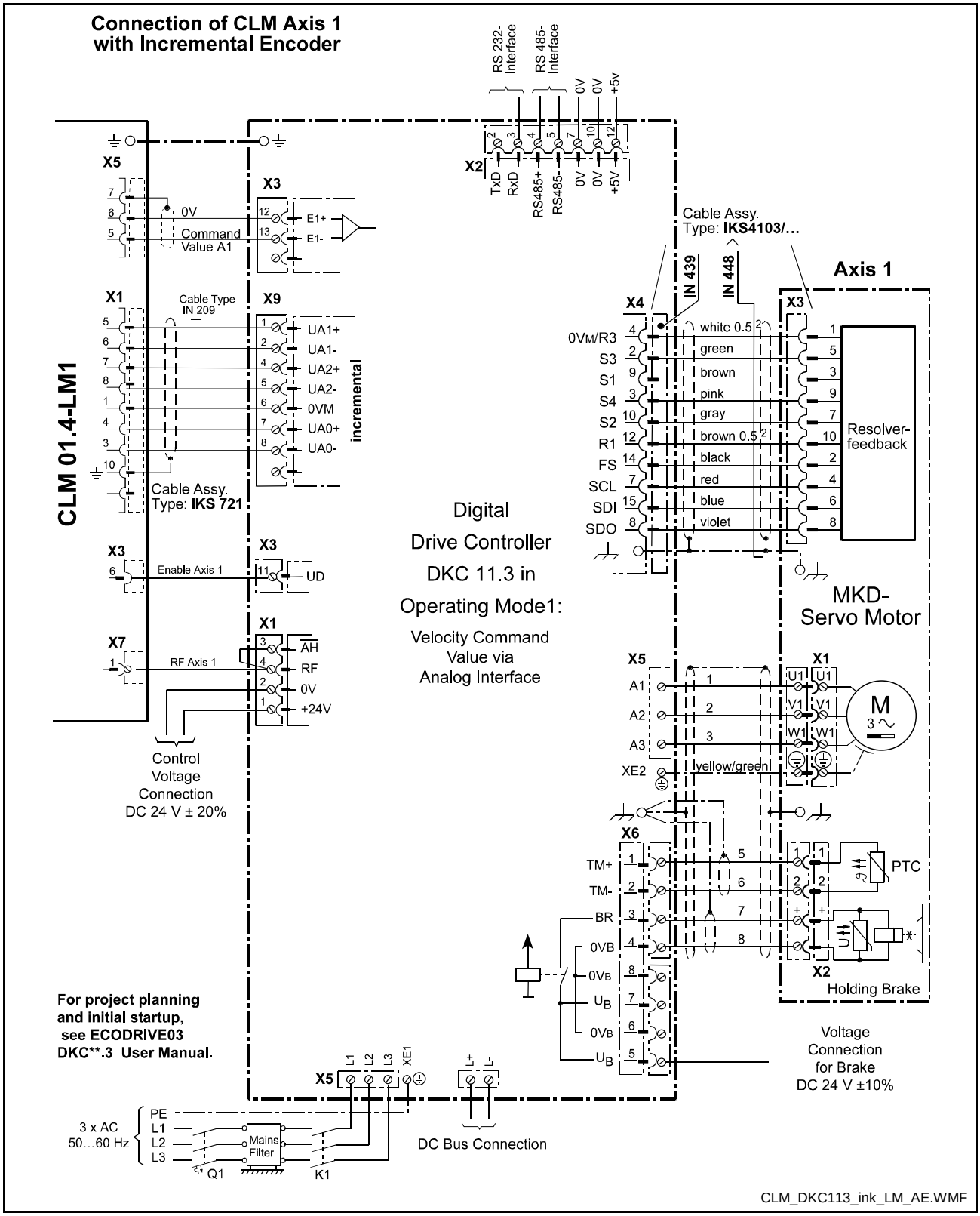


Fig. 12-13: CLM to DKC11.3 Connection (Incremental Encoder, Axis 1)

12.15 CLM to DKC11.3 Connection (Absolute Encoder, Axis 2)

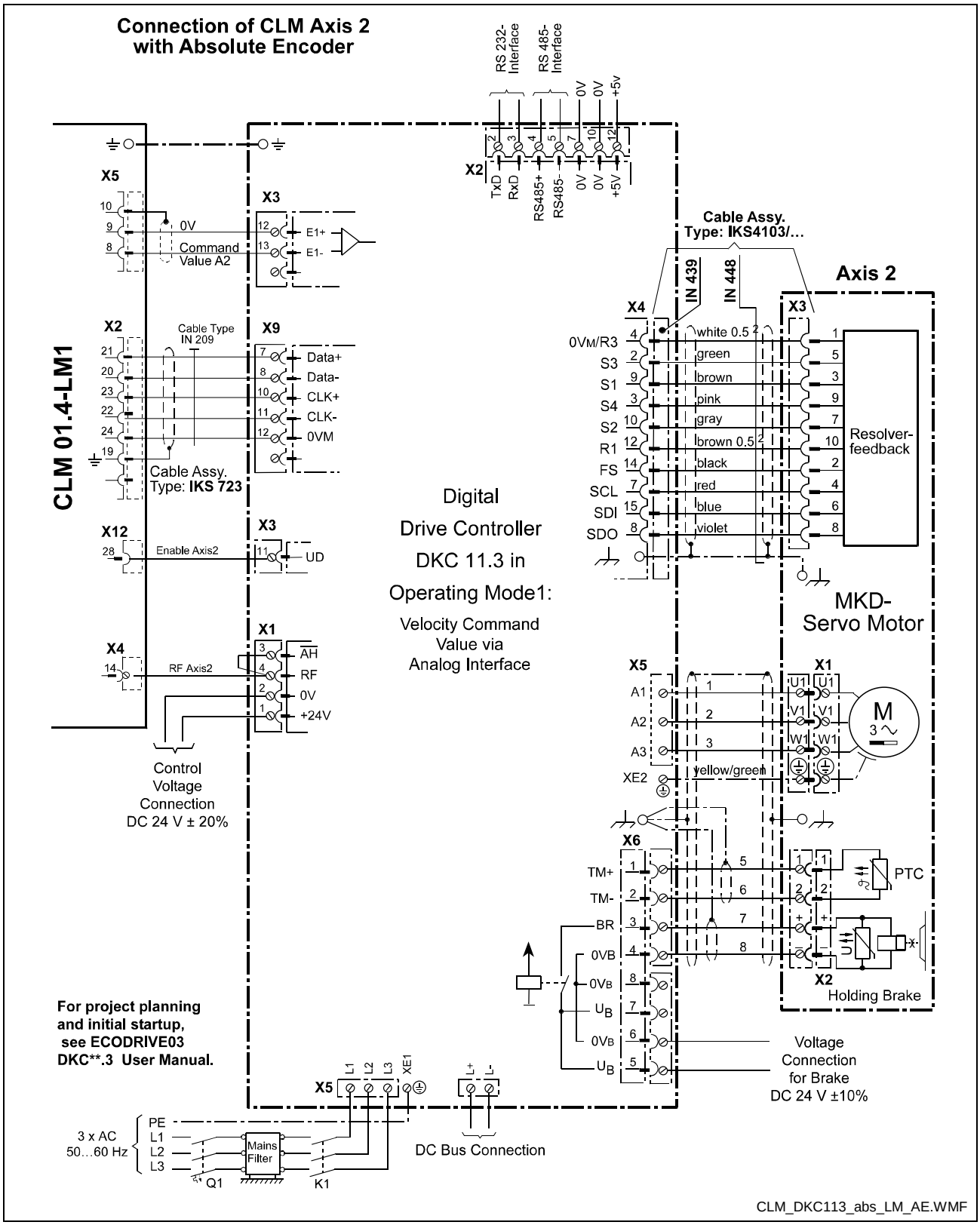


Fig. 12-14: CLM to DKC11.3 Connection (Absolute Encoder, Axis 2)

13 Installation Notes

13.1 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 13.1, ‘Interference Protection´.

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 error-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, error (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.

13.2 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 40º 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 40º 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. 13-1)!

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. 13-2).

Note: No water must be allowed to drip on the installed control units! Furthermore, the correct temperature of the cooling units must be observed!

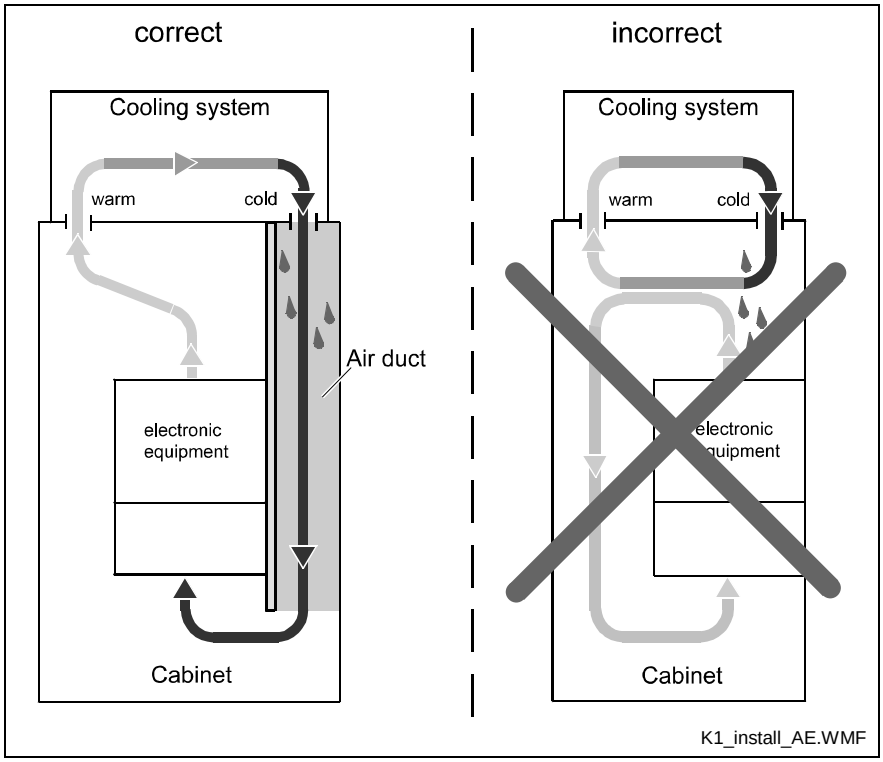


Fig. 13-1: Arrangement of the Cooling Unit on the Top of the Control Cabinet

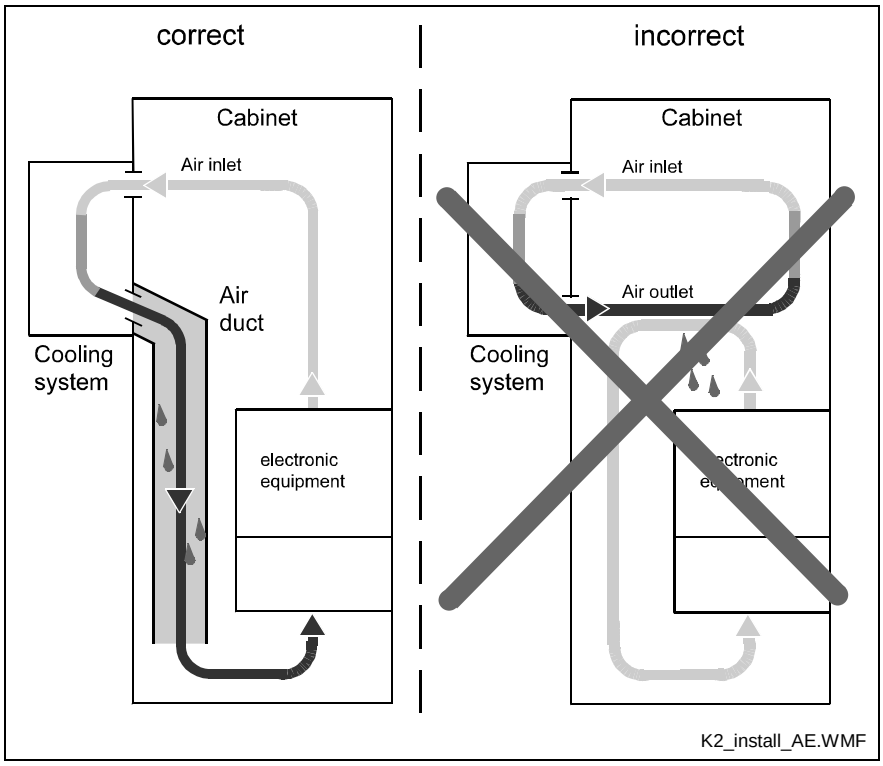


Fig. 13-2: Arrangement of the Cooling Unit on the Front of the Control Cabinet

Notes

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15 Service & Support

15.1 Helpdesk

Unser Kundendienst-Helpdesk im Hauptwerk Lohr am Main steht Ihnen mit Rat und Tat zur Seite. Sie erreichen uns

- telefonisch: **+49 (0) 9352 40 50 60**
  über Service Call Entry Center Mo-Fr 07:00-18:00
- per Fax: **+49 (0) 9352 40 49 41**
- per e-Mail: **service@indramat.de**

Our service helpdesk at our headquarters in Lohr am Main, Germany can assist you in all kinds of inquiries. Contact us

- by phone: **+49 (0) 9352 40 50 60**
  via Service Call Entry Center Mo-Fr 7:00 am - 6:00 pm
- by fax: **+49 (0) 9352 40 49 41**
- by e-mail: **service@indramat.de**

15.2 Service-Hotline

Außerhalb der Helpdesk-Zeiten ist der Service direkt ansprechbar unter

+49 (0) 171 333 88 26
oder **+49 (0) 172 660 04 06**

After helpdesk hours, contact our service department directly at

+49 (0) 171 333 88 26
or **+49 (0) 172 660 04 06**

15.3 Internet

Unter **www.indramat.de** finden Sie ergänzende Hinweise zu Service, Reparatur und Training sowie die **aktuellen** Adressen *) unserer auf den folgenden Seiten aufgeführten Vertriebs- und Servicebüros.

Verkaufsniederlassungen
Niederlassungen mit Kundendienst

Außerhalb Deutschlands nehmen Sie bitte zuerst Kontakt mit unserem für Sie nächstgelegenen Ansprechpartner auf.

*) http://www.indramat.de/de/kontakt/adressen
Die Angaben in der vorliegenden Dokumentation können seit Drucklegung überholt sein.

At **www.indramat.de** 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.

sales agencies
offices providing service

Please contact our sales / service office in your area first.

*) http://www.indramat.de/en/kontakt/adressen
Data in the present documentation may have become obsolete since printing.

15.4 Vor der Kontaktaufnahme... - Before contacting us...

Wir können Ihnen schnell und effizient helfen wenn Sie folgende Informationen bereithalten:

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.

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

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.

15.5 Kundenbetreuungsstellen - Sales & Service Facilities

Deutschland – Germany

vom Ausland: (0) nach Landeskennziffer weglassen!
from abroad: don't dial (0) after country code!

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