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Operating instructions and spare parts list

# OptiMove CR05
# Axes control unit


Translation of the original operating instructions

Gema

# Documentation OptiMove CR05 Axes control unit



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# General safety regulations

This chapter sets out the fundamental safety regulations that must be followed by the user and third parties using the OptiMove CR05 Axes control unit.

These safety regulations must be read and understood before the OptiMove CR05 Axes control unit is used.

## Safety symbols (pictograms)

The following warnings with their meanings can be found in the Gema operating instructions. The general safety precautions must also be followed as well as the regulations in the operating instructions.

**DANGER!**
Danger due to live electricity or moving parts. Possible consequences: Death or serious injury

**WARNING!**
Improper use of the equipment could damage the machine or cause it to malfunction. Possible consequences: minor injuries or damage to equipment

**INFORMATION!**
Useful tips and other information

## Conformity of use

1. The OptiMove CR05 Axes control unit is built to the latest specification and conforms to the recognized technical safety regulations. It is designed for the normal application of powder coating.
2. Any other use is considered as non-conform. The manufacturer is not responsible for damage resulting from improper use of this equipment; the end-user alone is responsible. If the OptiMove CR05 Axes control unit is to be used for other purposes or other substances outside of our guidelines then Gema should be consulted.
3. Observance of the operating, service and maintenance instructions specified by the manufacturer is also part of conformity of

use. The OptiMove CR05 Axes control unit should only be used, maintained and started up by trained personnel, who are informed about and are familiar with the possible hazards involved.

4. Start-up (i.e. the execution of a particular operation) is forbidden until it has been established that the OptiMove CR05 Axes control unit has been set up and wired according to the guidelines for machinery (2006/42 EG). EN 60204-1 (machine safety) must also be observed.
5. Unauthorized modifications to OptiMove CR05 Axes control unit exempts the manufacturer from any liability from resulting damage.
6. The relevant accident prevention regulations, as well as other generally recognized safety regulations, occupational health and structural regulations are to be observed.
7. Furthermore the country-specific safety regulations must be observed.

| Explosion protection | Protection type | Temperature class |
|---|---|---|
| CE Ex II (2) D | IP54 | T6 (zone 21)<br>T4 (zone 22) |

# Technical safety regulations for stationary electrostatic powder spraying equipment

## General information

The powder spraying equipment from Gema is designed with safety in mind and is built according to the latest technological specifications. This equipment can be dangerous if it is not used for its specified purpose. Consequently it should be noted that there exists a danger to life and limb of the user or third party, a danger of damage to the equipment and other machinery belonging to the user and a hazard to the efficient operation of the equipment.

1. The powder spraying equipment should only be started up and used once the operating instructions have been carefully studied. Improper use of the controlling device can lead to accidents, malfunction or damage to the control itself.
2. Before every start-up check the equipment for operational safety (regular servicing is essential)!
3. Safety regulations BGI 764 and VDE regulations DIN VDE 0147, part 1, must be observed for safe operation.
4. Safety precautions specified by local legislation must be observed.
5. The plug must be disconnected before the machine is opened for repair.
6. The plug and socket connection between the powder spraying equipment and the mains network should only be taken out when the power is switched off.
7. The connecting cable between the controlling device and the spray gun must be set up so that it cannot be damaged during

operation. Safety precautions specified by local legislation must be observed!

8. Only original Gema spare parts should be used, because the explosion protection will also be preserved that way. Damage caused by other parts is not covered by guarantee.
9. If Gema powder spraying equipment is used in conjunction with machinery from other manufacturers then their safety regulations must also be taken into account.
10. Before starting work familiarize yourself with all installations and operating elements, as well as with their functions! Familiarization during operation is too late!
11. Caution must be exercised when working with a powder/air mixture! A powder/air mixture in the right concentration is flammable! Smoking is forbidden in the entire plant area!
12. As a general rule for all powder spraying installations, persons with pacemakers should never enter high voltage areas or areas with electromagnetic fields. Persons with pacemakers should not enter areas with powder spraying installations!

**WARNING!**
**We emphasize that the customer himself is responsible for the safe operation of equipment. Gema is in no way responsible for any resulting damages!**

## Safety conscious working

Each person responsible for the assembly, start-up, operation, service and repair of powder spraying equipment must have read and understood the operating instructions and the “Safety regulations”-chapter. The operator must ensure that the user has had the appropriate training for powder spraying equipment and is aware of the possible sources of danger.

The control devices for the spray guns must only be set up and used in zone 22. Only the spray gun should be used in zone 21.

The powder spraying equipment should only be used by trained and authorized personnel. This applies to modifications to the electrical equipment, which should only be carried out by a specialist.

The operating instructions and the necessary closing down procedures must be followed before any work is carried out concerning the set-up, start-up, operation, modification, operating conditions, mode of operation, servicing, inspection or repairs.

The powder spray equipment can be turned off by using the main switch or failing that, the emergency shut-down. Individual components can be turned off during operation by using the appropriate switches.

## Individual safety regulations for the operating firm and/or operating personnel

1. Any operating method which will negatively influence the technical safety of the powder spraying equipment is to be avoided.
2. The operator should care about no non-authorized personnel works on the powder spraying equipment (e.g. this also includes using the equipment for non-conform work).

3. For dangerous materials, the employer has to provide an operating instructions manual for specifying the dangers arising for humans and environment by handling dangerous materials, as well as the necessary preventive measures and behavior rules. The operating instructions manual has to be written in an understandable form and in the language of the persons employed, and has to be announced in a suitable place in the working area.
4. The operator is under obligation to check the powder spraying equipment at least once every shift for signs of external damage, defects or changes (including the operating characteristics) which could influence safety and to report them immediately.
5. The operator is obliged to check that the powder spraying equipment is only operated when in satisfactory condition.
6. As far as it is necessary, the operating firm must ensure that the operating personnel wear protective clothing (e.g. facemasks).
7. The operating firm must guarantee cleanliness and an overview of the workplace with suitable instructions and checks in and around the powder spraying equipment.
8. No safety devices should be dismantled or put out of operation. If the dismantling of a safety device for set-up, repair or servicing is necessary, reassembly of the safety devices must take place immediately after the maintenance or repair work is finished. The powder spraying device must be turned off while servicing is carried out. The operator must train and commit the responsible personnel to this.
9. Activities such as checking powder fluidization or checking the high-voltage spray gun etc. must be carried out with the powder spraying equipment switched on.

## Notes on special types of hazard

### *Power*

It is necessary to refer once more to the danger of life from high-voltage current if the shut-down procedures are not observed. High voltage equipment must not be opened - the plug must first be taken out - otherwise there is danger of electric shock.

### *Powder*

Powder/air mixtures can be ignited by sparks. There must be sufficient ventilation in the powder coating booth. Powder lying on the floor around the powder spraying device is a potentially dangerous source of slipping.

### *Static charges*

Static charges can have the following consequences: Charges to people, electric shocks, sparking. Charging of objects must be avoided - see "Earthing".

### *Grounding/Earthing*

All electricity conducting parts and machinery found in the workplace (according to DIN VDE 0745, part 102) must be earthed 1.5 meters either side and 2.5 meters around each booth opening. The earthing resistance must amount to maximally 1 MOhm. The resistance must be tested on a regular basis. The condition of the machinery surroundings as well as the

suspension gear must ensure that the machinery remains earthed. If the earthing of the machinery includes the suspension arrangements, then these must constantly be kept clean in order to guarantee the necessary conductivity. The appropriate measuring devices must be kept ready in the workplace in order to check the earthing.

### *Compressed air*

When there are longer pauses or stand-still times between working, the powder spraying equipment should be drained of compressed air. There is a danger of injury when pneumatic hoses are damaged and from the uncontrolled release and improper use of compressed air.

### *Crushing and cutting*

During operation, moving parts may automatically start to move in the operating area. It must be ensured that only instructed and trained personnel go near these parts. The operator should ensure that barriers comply with the local security regulations.

### *Access under exceptional circumstances*

The operating firm must ensure that local conditions are met when repairs are made to the electronic parts or when the equipment is restarted so that there are additional measures such as barriers to prevent unauthorized access.

### *Prohibition of unauthorized conversions and modifications to machines*

All unauthorized conversions and modifications to electrostatic spraying equipment are forbidden for safety reasons.

The powder spraying equipment should not be used if damaged, the faulty part must be immediately replaced or repaired. Only original Gema replacement parts should be used. Damage caused by other parts is not covered by guarantee.

Repairs must only be carried out by specialists or in Gema workshops. Unauthorized conversions and modifications may lead to injury or damage to machinery. The Gema guarantee would no longer be valid.

## Safety requirements for electrostatic powder coating

1. This equipment is dangerous if the instructions in this operating manual are not followed.
2. All electrostatic conductive parts, in particular the machinery within 5 meters of the coating equipment, must be earthed.
3. The floor of the coating area must conduct electricity (normal concrete is generally conductive).
4. The operating personnel must wear electricity conducting footwear (e.g. leather soles).
5. The operating personnel should hold the gun with bare hands. If gloves are worn, these must also conduct electricity.
6. The supplied earthing cable (green/yellow) must be connected to the earthing screw of the electrostatic powder spraying hand appliance. The earthing cable must have a good metallic connec-

tion with the coating booth, the recovery unit and the conveyor chain and with the suspension arrangement of the objects.

7. The electricity and powder supply to the hand guns must be set up so that they are fully protected against heat and chemical damage.
8. The powder coating device may only be switched on once the booth has been started up. If the booth cuts out then the powder coating device must be switched off.
9. The earthing of all electricity conducting devices (e.g. hooks, conveyor chains) must be checked on a weekly basis. The earthing resistance must amount to maximally 1 MOhm.
10. The control device must be switched off if the hand gun is cleaned or the nozzle is changed.
11. When working with cleaning agents there may be a risk of hazardous fumes. The manufacturers instructions must be observed when using such cleaning agents.
12. The manufacturers instructions and the applicable environmental requirements must be observed when disposing of powder lacquer and cleaning agents.
13. If any part of the spray gun is damaged (broken parts, tears) or missing then it should not be used.
14. For your own safety, only use accessories and attachments listed in the operating instructions. The use of other parts can lead to risk of injury. Only original Gema replacement parts should be used.
15. Repairs must only be carried out by specialists and under no circumstances should they be carried out in the operating area. The former protection must not be reduced.
16. Conditions leading to dangerous levels of dust concentration in the powder spraying booths or in the powder spraying areas must be avoided. There must be sufficient technical ventilation available, to prevent a dust concentration of more than 50% of the lower explosion limit (UEG) (UEG = max. permissible powder/air concentration). If the UEG is not known then a value of 10 g/m³ should be used.

## A summary of the rules and regulations

The following is a list of relevant rules and regulations which are to be observed:

### *Guidelines and regulations, German professional association*

| | |
|---|---|
| BGV A1 | General regulations |
| BGV A2 | Electrical equipment and material |
| BGI 764 | Electrostatic coating |
| BGR 132 | Guidelines for the avoidance of the dangers of ignition due to electrostatic charging (Guideline “Static Electricity”) |
| VDMA 24371 | Guidelines for electrostatic coating with synthetic powder[1)]<br>- Part 1 General requirements<br>- Part 2 Examples of use |

## *EN European standards*

| | |
|---|---|
| RL94/9/EC | The approximation of the laws of the Member States relating to apparatus and safety systems for their intended use in potentially explosive atmospheres |
| EN 292-1<br>EN 292-2 | Machine safety [2)] |
| EN 50 014 to EN 50 020, identical: DIN VDE 0170/0171 | Electrical equipment for locations where there is danger of explosion [3)] |
| EN 50 050 | Electrical apparatus for potentially explosive atmospheres - Electrostatic hand-held spraying equipment [2)] |
| EN 50 053, part 2 | Requirements for the selection, installation and use of electrostatic spraying equipment for flammable materials - Hand-held electrostatic powder spray guns [2)] |
| EN 50 177 | Stationary electrostatic spraying equipment for flammable coating powder [2)] |
| PR EN 12981 | Coating plants - Spray booths for application of organic powder coating material - Safety requirements |
| EN 60 529, identical: DIN 40050 | IP-Type protection: contact, foreign bodies and water protection for electrical equipment [2)] |
| EN 60 204 identical: DIN VDE 0113 | VDE regulations for the setting up of high-voltage electrical machine tools and processing machines with mains voltages up to 1000 V [3)] |

## *VDE (Association of German Engineers) Regulations*

| | |
|---|---|
| DIN VDE 0100 | Regulations for setting-up high voltage equipment with mains voltages up to 1000 V [4)] |
| DIN VDE 0105 | VDE regulations for the operation of high voltage equipment [4)] |
| part 1 | General regulations |
| part 4 | Supplementary definitions for stationary electrical spraying equipment |
| DIN VDE 0147 part 1 | Setting up stationary electrostatic spraying equipment [4)] |
| DIN VDE 0165 | Setting up electrical equipment in locations in areas with danger of explosion [4)] |

*****Sources:

[1)] Carl Heymanns Verlag KG, Luxemburger Strasse 449, 5000 Köln 41, or from the appropriate employers association

[2)] Beuth Verlag GmbH, Burgrafenstrasse 4, 1000 Berlin 30

[3)] General secretariat, Rue Bréderode 2, B-1000 Bruxelles, or the appropriate national committee

[4)] VDE Verlag GmbH, Bismarckstrasse 33, 1000 Berlin 12

# Product specific security measures

- The installation work, to be done by the customer, must be carried out according to local regulations
- Before starting up the plant a check must be made that no foreign objects are in the booth or in the ducting (input and exhaust air)
- It must be observed, that all components are grounded according to the local regulations, before start-up

# Special security measures

1. It must be ensured, that all components are earthed according to the local regulations before start-up.
2. The OptiMove CR05 Axes control unit should be switched on and operated only after carefully reading these operating instructions. Incorrect operation of the axes control unit can lead to accidents, malfunctions or damage to the plant.
3. **WARNING!**
   The power of the reciprocators/axes is very much stronger than that of a human being! All axes must be secured against access during operation (see local regulations). Never stand under the Z-carriage when the reciprocator is not operating!
4. The installation work to be done by the customer must be carried out according to local regulations.
5. The plug-in connections between the OptiMove CR05 Axes control unit and the power section in the reciprocator may only be removed when the power supply is switched off.
6. The connecting cables between the control unit and the reciprocator must be laid in such a way that they cannot be damaged during axes operation. Safety precautions specified by local legislation must be observed!
7. The **maximum upper stroke limit** of the reciprocator must always be set with reference to the **maximum height of the booth gun slots**. If an incorrect (too high) stroke limit is set, this can lead to **damage** to the reciprocator and/or the booth!

**Attention:**
**During a test run, it must be guaranteed that the unit is not damaged by the test! In particular, the limitations of the stroke range have to be observed (for more details, please refer to section "System parameter P1 - setting the upper stroke limit")!**

8. The voltage supply of the reciprocator is guaranteed by the OptiMove CR05 Axes control unit. The supply voltage amounts to 230 VAC and must always be conducted in the emergency stop circuit. In case of an emergency, the voltage supply to the motor may be interrupted with the emergency stop switch.
9. When repairing the reciprocator, both the CR05 Axes control unit and the reciprocator must be disconnected from the mains according to the local safety regulations!

10. Repairs may be done only by authorized Gema Service Centers! Arbitrary, unauthorized repairs can lead to injuries and damages to the equipment! The Gema Switzerland GmbH guarantee would no longer be valid.
11. We alert that the customer himself is responsible for the safe operation of equipment. Gema will not be responsible for any resulting damage!

# About this manual

## General information

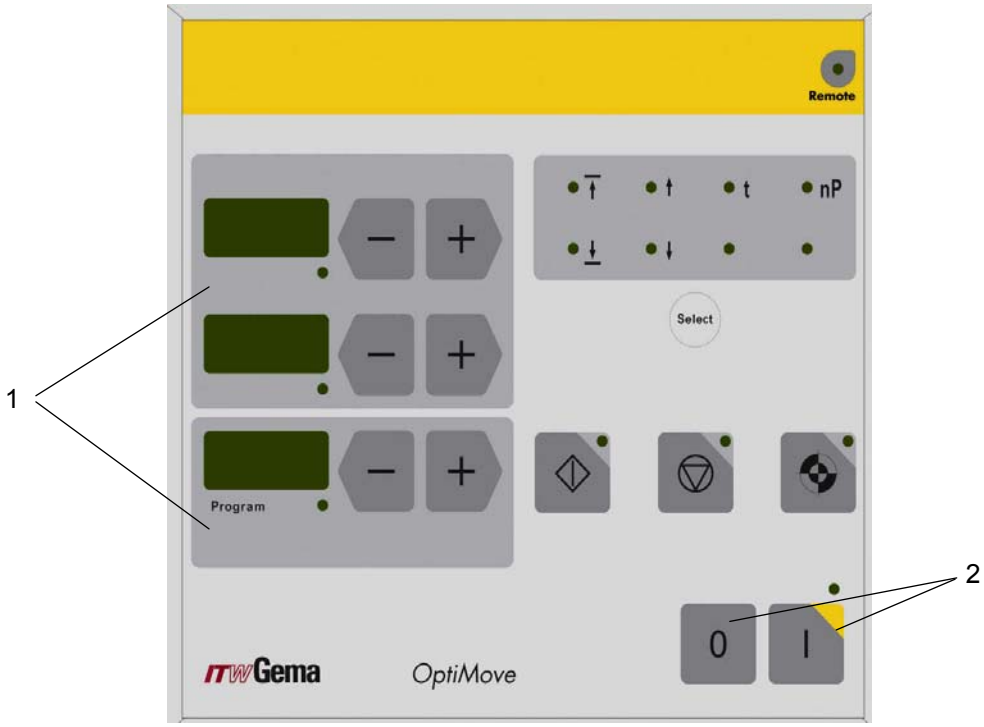
This operating manual contains all the important information which you require for the working with the OptiMove CR05 Axes control unit. It will safely guide you through the start-up process and give you references and tips for the optimal use of your new powder coating system.

Information about the function mode of the individual system components - reciprocators, booths, powder gun controls, powder guns etc. - should be referenced to their corresponding documents.

# Function description

## OptiMove CR05 Axes control unit

### Operating panel




*OptiMove CR05 - operating panel*

1 Operating and display elements

2 Power switch ON/OFF

## Field of application

TheOptiMove CR05 Axes control unit OptiMove CR05 Axes control unit is designed exclusively for operating electrically driven reciprocators/axes in electrostatic powder coating plants. Any other use is considered as non-conform. The manufacturer is not responsible for any damage resulting from this - the risk for this is assumed by the user alone!

The start-up (i.e. the start of intended operation) is forbidden until it is determined that the control unit and the equipment are installed and connected according to the machine guideline (2006/42/EG). EN 60204-1 (machine safety) must also be observed.

For a better understanding of the relationships in powder coating it is recommended to read the operating instructions of other components, thoroughly, so as to be familiar with their functions also.

# Technical data

## OptiMove CR05 Axes control unit

### General data

| OptiMove CR05 | |
|---|---|
| Number of axes/reciprocators per control unit | 1 |
| Maximum available programs | 255 |
| Max. stroke height (theoretical) | 5 m |
| Maximum speed | 0.6 m/s |
| Minimum speed | 0.08 m/s |
| Acceleration | 0.1-2.0 m/s² |

### Electrical data

| OptiMove CR05 | |
|---|---|
| Nominal input voltage | 230 VAC |
| Tolerance | +10% / -10% |
| Operating frequency | 50/60 Hz |
| Control current circuit | 24 VDC |
| Fuse F1 | 10 AT |
| Power consumption | 1.1 kW |
| Protection type | IP54 |
| Operating temperature | 0°C - +40°C<br>(+32°F - +104°F) |
| Storing temperature | -20°C - +70°C<br>(-4°F - +158°F) |

### Dimensions

| OptiMove CR05 | |
|---|---|
| Width | 205 mm |
| Depth | 180 mm |
| Height | 175 mm |
| Weight | 2.4 kg |

# Structure and function

## OptiMove CR05 Axes control unit - structure

The OptiMove CR05 Axes control unit is installed at the front side or on the mounting plate into the ICS cabinet.

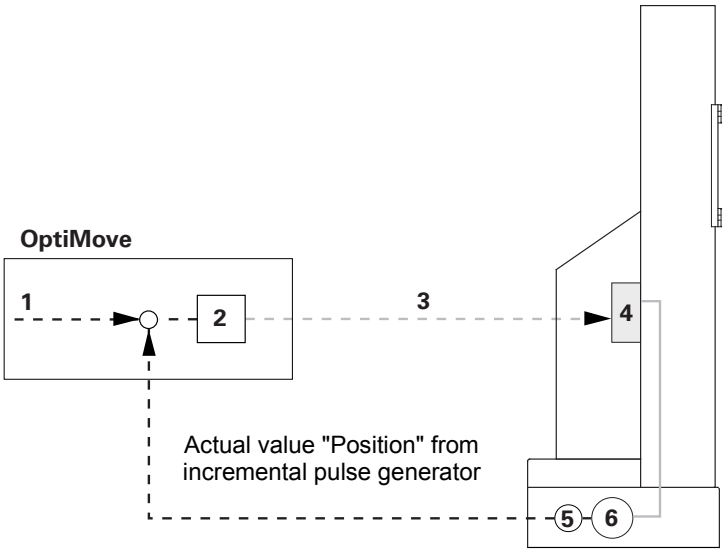

*OptiMove CR05 Axes control unit - structure*

## Function description

The OptiMove CR05 Axes control unit is used in axis control systems. A complete axis control system consists of an OptiMove axes control unit, a frequency converter and a reciprocator with AC motor. The frequency converter receives the supply voltage and the control signals directly from the OptiMove axes control unit.

The OptiMove axes control unit contains the regulation, visualization and input unit and is responsible for the exact positioning adjustment of the carriage by evaluating the signal from the reciprocator incremental pulse generator in the reciprocator.

The drive motor is equipped with an electrical retaining brake. When the axis control unit holds an axis position (axis standstill), the holding brake will be activated and the frequency transformer released with a time delay (motor without current).




*OptiMove CR05 Axes control unit - function*

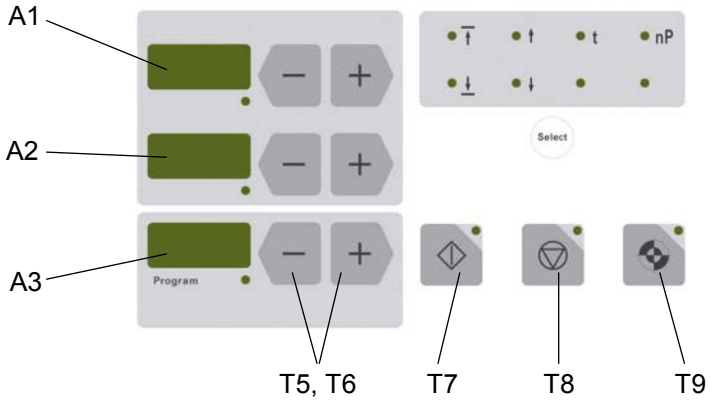
1 Desired position value
2 Regulator
3 RPM preset value
4 Frequency converter
5 Incremental pulse generator
6 AC motor

# Operating and display elements, operating modes

## Display and input buttons

The control unit is operated by a membrane keypad with input and display elements. All displays (**A1-A3**) are 7 segment displays and all LEDs are green.

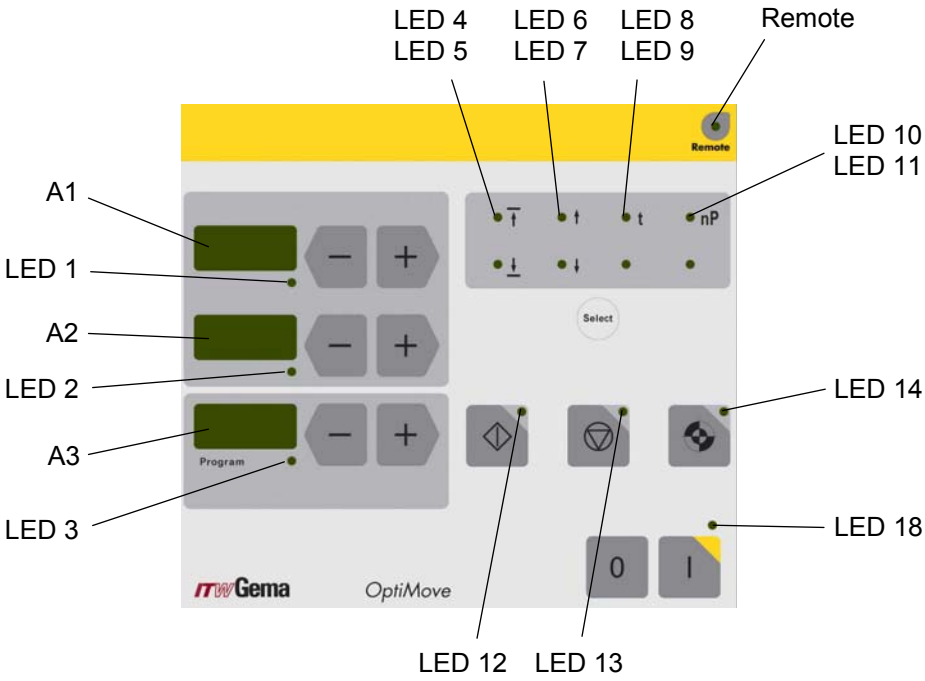
In the **Manual** operating mode, all operation functions are released with the foil keyboard. In the **Remote** operating mode, only visualization functions are available.




**Attention:**
**The keys of the input field should only be pressed with fingertips and under no circumstances with fingernails or hard objects!**

| Display | Meaning |
|---|---|
| **A1** | Actual value display (axis position)<br>Desired value input (position above, speed upwards, dwell time, program address) |
| **A2** | Actual value display (axis speed)<br>Desired value input (position below, speed downwards) |
| **A3** | Displays the selected program number or the error code |

| Keys | Meaning |
|---|---|
|  | Start axis (T7) |
|  | Stop axis (T8)<br>press for 5 seconds = system parameter |
|  | Start reference point travel (T9) |
|  | Input keys for preset values and system parameters (increase value) |
|  | Input keys for preset values and system parameters (decrease value) |
| **T5, T6** | Input keys for program number, error acknowledgment |
| **Select** | Activate display mode (select desired value input LED 4 - LED 11) |




| LED | Meaning |
|---|---|
| **1**<br>**2**<br>**3** | Preset- actual value mode<br>(dark = actual value mode / green = preset value mode) |
| **4 - 11** | Parameter selection display |
| **12** | Axis started |
| **13** | Axis stopped |
| **14** | Axis referencing |
| **Remote** | Remote, semiautomatic, keyboard lock |
| **18** | Power switch ON |

# Operating modes

The OptiMove CR05 Axes control unit provides following operating modes:

- Manual
- Remote
- Semiautomatic
- Keyboard lock

The OptiMove CR05 Axes control unit enables the simply creation of 255 programs with the help of the necessary parameters.

## Manual operating mode

The manual operation permits the selection and the start of the travel programs by the operator on the panel. In addition, the operator has the possibility to change the program number or directly modify the running program.

In this operating mode, all display and operating functions are possible by the operating panel, such as:

- Program numbers selection
- Input mode/display mode selection
- Preset value setting in the input mode (only in pendulum operation)
- Start/stop
- Error messages acknowledgement
- System parameter mode

## Remote operating mode

In the remote operating mode, the control unit is controlled by CAN bus or DigitalBus.

Only a limited operation is possible by the operating panel, namely:

- Input mode/display mode selection (preset values and actual values visualization)
- Acknowledgement of error messages

The remote operating mode is displayed on the operating panel by lighting-up of the green **Remote** LED. In the remote operating mode, the start and the stop keys are out of function.

## Keyboard lock

In the **Keyboard lock** operating mode, the control unit operating panel is locked. The prerequisite for it is that the **System parameter P9** must already have been correctly set (**P9=1**, for more see "Setting the system parameters“).

If the systems parameter **P9=1** is set, the keyboard lock function can be activated through the remote digital input. This is displayed on the operating panel by lighting-up of the green **Remote** LED.

Then, only a limited operation is possible by the operating panel, namely:

- Start, stop, referencing axes
- Input mode/display mode selection (preset values and actual values visualization)
- Error messages acknowledgement

# Start-up

## Connections - rear side


*Connections - rear side*

**2.1** Power supply line

**2.2** Reciprocator power supply

**2.3** Reciprocator control signals

**2.4** DigitalBus parallel interface

**2.5** CAN bus input

**2.6** CAN bus output

The cable connections have different plugs and cannot be wrongly connected on assembly.

**Attention:**
**Before disconnecting the cables from the sockets, always switch off the equipment and disconnect the mains cable!**

# Initial start-up

## Measures before initial start-up

All devices are parameterized and marked on delivery (station, axis and address definition), however, they can be adapted according to client's plant specifications.

**Note:**
**All changed values have absolutely to be entered into the parameter table (therefore, see the appendix)!**

## Electrical wiring and screening concept

All CAN bus users are to be wired in accordance to the enclosed electrical diagrams.

**Attention:**
**The control unit must be connected to the EMERGENCY STOP power circuit, i.e. when an EMERGENCY STOP takes place, the reciprocator brake is activated, and the control unit will be switched off!**

- Assembly and fitting of electric devices may only be done by an electrics specialist!
- For trouble-free operation with high data transmission rates, a clear grounding concept is mandatory. A uniform grounding potential is a prerequisite for this!
- Exclusively screened cables are to be used for the wiring. The cable shield must be connected at both sides largely to the ground!

**Attention:**
**Both ends of the cable shield must generally, or as often as possible, be connected to ground, otherwise malfunctions can occur! Furthermore, the reliability of the unit and the normal processing procedure could be reduced!**

# Setting the system parameters

The OptiMove CR05 Axes control unit is adapted with the system parameters to the reciprocator type and the plant specific characteristics.

In order to set the system parameters, proceed as follows:

1. To enter the system parameter mode, press and hold the  key for 5 seconds. The LEDs **L1-L3** illuminate
2. Select the desired parameter **P1-P12** on the display **A1** by using the  and  keys
3. Set the corresponding parameter values on the display **A2** by using the  and  keys

4. Press the  key in order to exit the system parameter mode

## System parameters - overview

| Name | Description | Values | Remarks |
|---|---|---|---|
| **P1** | Upper stroke limit | 0.00 - 5.00 m<br>**0.30 m** | |
| **P2** | Operating mode | **1 - Pendulum operation**<br>2 - Sequence program<br>3 - Semiautomatic pendulum operation<br>4 - X-GunClean sequence program | |
| **P3** | Acceleration | 0.10 - 2.00 m/s$^2$<br>**1.50 m/s$^2$** | Horizontal axis 0.10 m/s$^2$ |
| **P4** | Max. speed | 0.08 - 0.60 m/s<br>**0.60 m/s** | Horizontal axis 0.10 m/s |
| **P5** | Open loop gain | 10 - 100<br>**40** | |
| **P6** | Incremental pulse generator adjustment | 10 - 1500 impulse/cm<br>**750** | Horizontal axis 1012<br>(displayed as .0.1.2) |
| **P7** | Compensation of holding brake delay time | 0 - 500 ms<br>**100** | |
| **P8** | Communication | **0 - Digital Bus Error = 1**<br>1 - CAN Open<br>2 - Digital Bus Error = 0 | from software version 1.06 |
| **P9** | Keyboard lock | **0 - Keyboard lock inactive**<br>1 - Keyboard lock activated | Activate keyboard lock by signal Remote=1<br>Exception: Start, stop, axes referencing, error acknowledgement, preset value display |
| **P10** | Referencing mode | **0 - Proximity switch**<br>1 - Running into end buffer | ZA06 and XT11are referenced with proximity switch |
| **P11** | CAN Baud rate | 0 - 7<br>**3 - 125 kBit/s** | |
| **P12** | CAN address | 0 - 127<br>**1** | |

Default values are printed in **bold**

**Attention:**
**If an incorrect system parameter is set, this can lead to damage to the axes and/or the booth!**

## System parameter P1 - setting the upper stroke limit

If the OptiMove CR05 Axes control unit operates with an Gema reciprocator, all system parameters are already set to the values for this axis. The only system parameter which must be set, is the upper stroke limit.

The maximum stroke height (max. travel) is limited by the upper stroke limit. The maximum stroke height is limited by the corresponding height of the used reciprocator or by the maximum height of the gun slots in the booth. The upper stroke limit of the OptiMove CR05 Axes control unit is always set at 0.3 meters by the factory.

In order to set the upper stroke limit (system parameter 1), proceed as follows:

1. To enter the system parameter mode, press and hold the  key for 5 seconds.
   The LEDs **L1-L3** illuminate
2. Select the parameter **P1** on the display **A1** using the  and  keys
3. Set the upper stroke limit value on the display **A2** using the  and  keys

**Attention:**
**Always pay attention to the gun positions and the maximum height of the gun slots in the booth! If an incorrect (too high) stroke limit is set, this can lead to damage to the reciprocator and/or the booth!**

4. Press the  key in order to exit the system parameter mode

# Operation

## Operating the axes control unit

Up to 255 programs can be entered and/or recalled with the OptiMove CR05 Axes control unit. Each program contains data about the speeds and the positions of the axis movements.

## Switch on/off the axes control unit

1. Press the I key
   The LED above the key illuminates

By first switch on of the equipment, the preselected factory settings are displayed:

xxx on the display **A1** = value for position

xxx on the display **A2** = value for speed

xxx on the display **A3** = program number

2. Press the 0 key
   The device is switched off

By switching off the equipment (also when the equipment is disconnected from the mains), the actual settings are retained.

## Travel to reference point

In order that the OptiMove CR05 Axes control unit can enter the position of the axis as accurately as possible during operation, the triggered axis must first travel to the reference point each time it is switching on. The prerequisite for this is that the reference point is already set correctly (see also the corresponding instructions in the respective axis operating manual).

**Note:**
**The axis must also be referenced again after each axis-specific error (H01, H02, H03, H04). If the axis is referenced, it can not be referenced a second time unless the above conditions are given!**

1. Press the key
   The LED of the key blinks, for indicating, that the reference point travel has not been carried out yet
2. Press the key
   The control unit starts the reference travel
3. At the end of the reference travel, the LED of the key expires and the axis is referenced

**Note:**
**If the axis can collide somewhere, or the guns are incorrectly mounted, or the lower reversing point is situated too low, the axis can be stopped by pressing the key! By pressing the key again, the reference travel will continue!**

The procedure described above relates to the reference point traveling in manual operation. In the automatic operation mode, the reference point traveling is triggered with ID no. 7 by the DigitalBus, and with the corresponding command by the CAN bus.

# Start/stop the reciprocator

1. Switch on the axes control unit
2. If necessary, change to another program (see chapter "Program change")
3. Press the key
   The reciprocator is started, and the selected program is activated. The corresponding LED illuminates
4. Press the key
   The reciprocator is stopped
   - The display **A1** shows the actual axis position. The corresponding LED remains unlit

# Program change

The program change can be done by keyboard (manually) or through external control signals. In addition, a program change can be made either during operation or at a standstill. In both cases the modifications are stored in the program memory, i.e. after restarting the OptiMove control unit, the last entered axis programs are available again.

**Note:**
**If a program change is made during operation, the axis terminates the old command, which is still in the memory, and takes over the new program (positions or speed) by the next cycle change!**

1. Select the desired program number in the **Program** keypad using − or +
   - The LED illuminates for 3 seconds and then deletes, i.e. the program change has been accepted. The new program number is shown on the display **A3**
   - The display **A1** shows the axis position. The corresponding LED remains unlit
   - The display **A2** shows the axis speed. The corresponding LED remains unlit

# Displaying the cycle time

**Only possible in pendulum mode / semiautomatic mode!**

1. Start the reciprocator (see also "Start/stop the reciprocator“)
2. Press − or + in the display field **A2** and keep it pressed. The display **A2** shows the cycle time of the actual program sequence in seconds (from 00.0 to 99.9). If the axis is restarted, then the cycle time 00.0 seconds is displayed. Only when a cycle (whole pendulum movement) has been traveled, the measured cycle time is shown and updated after each further cycle (pendulum movement)
3. Read off the cycle time and use it in the program for the calculation of the optimal sine curve

# Edit programs

In the **Edit** program mode, the input parameter values can be selected or changed.

**Note:**
**All program data must be determined. Therefore, use the program tables in the appendix of this operating manual!**

The programs can be edited during operation and also at a standstill.

**Note:**
**If the system parameter P2 is set to "2" or "4", editing is only possible at a standstill!**

In both cases the modifications are stored in the program memory, i.e. after restarting the OptiMove CR05 Axes control unit, the last entered program values are available again.

**Note:**
**If a program is edited during operation, the axis terminates the old command, which is still in the memory, and takes over the new program values (positions or speed) by the next cycle change!**

**Note:**
**The input mode is locked in Remote operating mode!**

# Axes operating modes

## General information

The OptiMove CR05 Axes control unit is universally used for all Gema axes. To be ideally equipped for all conditions, the operating mode can be set in the system parameter mode **P2**. The following axes operating modes can be selected:

- Pendulum operation
- Sequence program
- Semiautomatic pendulum operation
- X-GunClean sequence program

In the following chapter, the different axis operating modes are described in detail.

## Pendulum operating mode

In this operating mode, the axis executes a continuous stroke movement according to the adjusted parameters. The different values, as well as start and stop functions, can be set in a user-friendly way by keyboard.

The operator can read the set and current data directly on the display. To be equipped for all operating processes, up to 255 different programs can be stored.

**Note:**
**The system parameter P2 must be set on 1 (pendulum operating mode)!**

The equipment is operated by the operating panel. The following possibilities are available:

- Referencing axes
- Start/stop
- Edit programs
- Program change
- Selection input mode/display mode
- Acknowledgement of error messages

## Editing/setting

1. Select the desired program number in the **Program** keypad using − and + (see also "Program change").
   The display **A3** shows the program number
2. Press the **Select** key:
   The LEDs in the display area **A1** and **A2**, and the LEDs and illuminate green
3. Input the desired value for the upper reversing point on the display **A1** using the keys − and +
4. Input the desired value for the lower reversing point on the display **A2** using the keys − and +

**Note:**
**If a same value is selected for the input of the upper and the lower position, this results in a positioning command, i.e. the axis stops in this position!**

5. Press the **Select** key again:
   LEDs and illuminate green
6. Input the desired value for the speed upwards on the display **A1** using the keys − and +
7. Input the desired value for the speed downwards on the display **A2** using the keys − and +
8. Press the **Select** key again, or press or , in order to exit the **Editing** mode

# Sequence program

A sequence program is created by joining a number of individual program steps. The program steps are then processed in a certain order. A sequence program can consist of a single program step, if only one position is to be approached, i.e. when positioning the X axis.

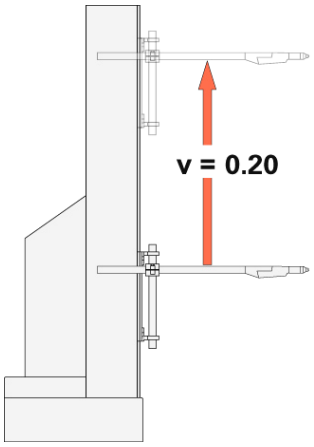
**Note:**
**The prerequisite for the programming of sequence programs is that the system parameter P2 is already set correctly P2=2 (see also "Setting the system parameters")!**

## Structure of a program step (procedure step)

| Display | Input parameter | Input range |
|---|---|---|
|  | Travel position [m] | 0.00 - P_max.<br>(P_max. is set with system parameter **P1**) |
|  | Speed [m/s] | 0.08 - V_max.<br>(V_max. is set with system parameter **P4**) |
|  | Dwell time (in the travel position) [sec.] | 0-5.00 |
|  | Following program address | 0-255 |
| **Display A3** | Program number | 1-255 |

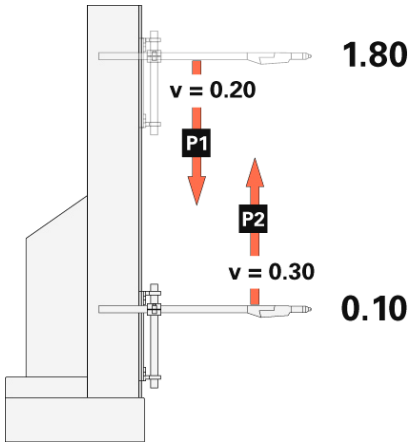
1. Select the desired program number in the **Program** keypad using  and  (see chapter "Program change").
   The display **A3** shows the program number
2. Press the **Select** key:
   LED  illuminates green. The LED in the display area **A1** illuminates green too. The display **A2** remains dark
3. Input the desired value for the desired position on the display **A1** using the keys  and 
4. Press the **Select** key again:
   LED  illuminates greenInput the desired speed value on the display **A1** using the keys  and 
6. Press the **Select** key again:
   LED  illuminates green
7. Input the desired dwell time value on the display **A1** using the keys  and 
8. Press the **Select** key again:
   LED  illuminates green
9. Input the address of the following program on the display **A1** using the keys  and 
   **0** = no further program step
10. Press the **Select** key again, or press  or  , in order to exit the **Editing** mode

## Programming example - positioning



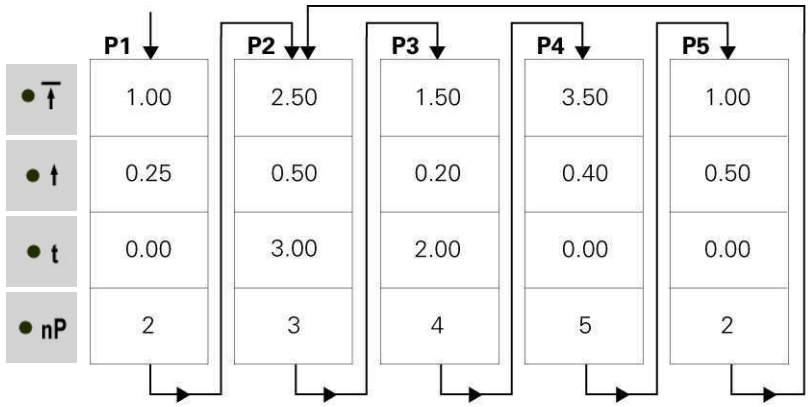

| | Program no. 1 |
|---|---|
| Display | Input value |
| ● $\overline{\uparrow}$ | 1.00 m |
| ● ↑ | 0.20 m/s |
| ● t | 0 s |
| ● nP | 0 |

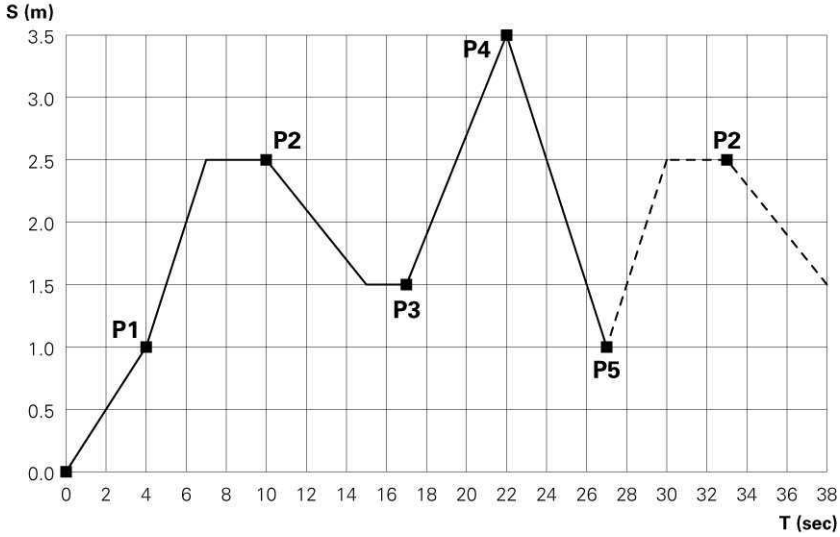
## Programming example - pendulum movements




| | Program no. 1 | Program no. 2 |
|---|---|---|
| Display | Input value | Input value |
| ● $\overline{\uparrow}$ | 0.10 m | 1.80 m |
| ● ↑ | 0.20 m/s | 0.30 m/s |
| ● t | 0 s | 0 s |
| ● nP | 2 | 1 |

# Programming example with path-time diagram



# Semiautomatic pendulum operating mode

Basically, the semiautomatic pendulum operating mode operates in the same way as the standard pendulum operating mode. However, the axis can be started or stopped by a control signal. In this operating mode, the pendulum movement is completely executed and the travel stops at the lower reversing point. As a result, a sequence control with object recognition and "Axis start/stop“ can be realized in a simple way.

**Note:**
**The system parameter P2 must be set on 3 (semiautomatic pendulum operating mode)!**

The start release takes place by pin 3 at plug **2.1 Mains connection** or the parallel interface at plug **2.4** (for more details, see section "Pin assignment"). During operation, the axis can not be stopped with the stop key.

Only a limited operation is possible by the operating panel, namely:

- Referencing axes
- Program editing when axis is moving
- Program change when axis is moving
- Input mode/display mode selection (preset values and actual values visualization)
- Error messages acknowledgement

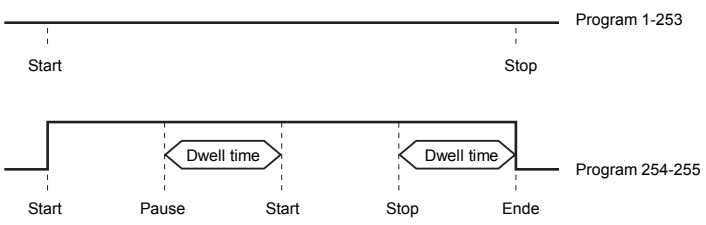
The program editing requires the same procedures as in the standard semiautomatic operating mode.

# Sequence program X-GunClean

The X-GunClean sequence program is based in terms of function and operation on the sequence program. This program is used to execute a gun cleaning with the X axis. The programs 1-253 allow to travel to different positions. Thereby, the digital output 2 always remains on **low**. The programs 254 and 255 actuate the digital output 2 (see graph). The operator has now the possibility to trigger a gun cleaning with these two positions.

**Note:**
**The system parameter P2 must be set on 4 (X-GunClean sequence program)!**

**P2 = 4 X-GunClean sequence program**




The program editing requires the same procedure as in the sequence program.

# Setup

If an object is hanging in the booth, it is very advantageous if the upper and lower reversing point (or travel positions in sequence programs) can be directly taken from the object to be coated in a Teach-In procedure. The program parameters of the present program can be set, and the axis travels with this modification. It is also possible to select the program number.

## Setup mode by keyboard (pendulum operating mode / semiautomatic mode)

1. Press the **Select** and the key simultaneously
   The corresponding LED blinks
2. Press or in the display area **A1**, in order to start the axis
   - LED **1** blinks
   - Axis travels to the upper reversing point
3. Adjust the upper reversing point on display **A1** using the keys and
   - Axis travels with the modification
   - The position of the upper reversing point is programmed
4. Press or in the display area **A2** in order to start the axis
   - LED **2** blinks
   - Axis travels to the lower reversing point
5. Adjust the lower reversing point on display **A2** using the keys and
   - Axis travels with the modification
   - The position of the lower reversing point is programmed
6. Select the desired program number in the **Program** keypad using or . The display **A3** shows the program number
7. Press the key in order to exit the setup mode

## Setup mode by keyboard (sequence program)

1. Press the **Select** and the key simultaneously
   The corresponding LED blinks
2. Press or in the display area **A1**, in order to start the axis
   - The axis travels to the position of the first program step
3. On the display **A1**, adjust the positions using the and keys
   - LED **1** blinks

- Axis travels with the modification
- The position of the first program step is programmed

4. Press to select the next program step
   - Display **A3** shows - - -
5. Select the desired program number in the **Program** keypad using or . The display **A3** shows the program number
6. Repeat the steps 2-5 for further programs
7. Press the key, in order to exit the setup mode

# RAM reset

On a RAM reset all preset values and system parameters are loaded with default values.

## Enter the RAM reset mode

1. Switch off the reciprocator control by pressing the 0 key
2. Keep pressed the key and at the same time switch on the reciprocator control with I. Keep pressed down for 10 seconds.
   The value **255** appears on the display **A3**, and the LED **L3** blinks. All other displays are not illuminated
3. Press the key, in order to exit the RAM reset mode

## Default values after RAM reset

| Name | Default value |
|---|---|
| **Preset values** | |
| Position above [m] | **0.30** |
| Position below [m] | **0.00** |
| Speed upwards [m/s] | **0.20** |
| Speed downwards [m/s] | **0.20** |
| **System parameters** | |
| P1 - Upper stroke limit (also applied as travel position for horizontal axis) | **0.30** |
| P2 - Operating mode | **1** |
| P3 - Acceleration [m/s$^2$] | **1.50** |
| P4 - Max. speed [m/s] | **0.60** |
| P5 - Open loop gain | **40** |
| P6 - Incremental pulse generator adjustment [pulse/cm] | **750** |
| P7 - Compensation of holding brake delay time [ms] | **100** |
| P8 - Communication | **0** |
| P9 - Keyboard lock | **0** |

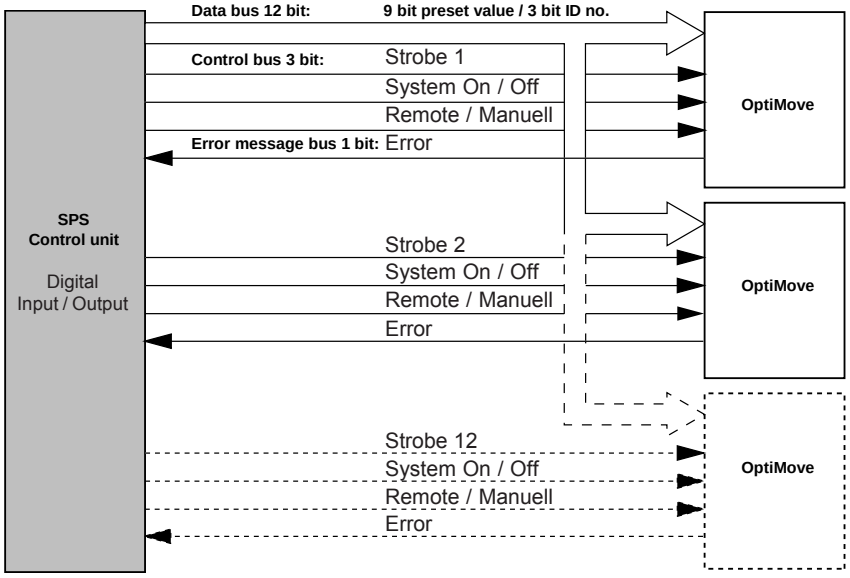
| Name | Default value |
|---|---|
| P10 - Referenzierungsart | **0** |
| P11 - CAN-Baud rate | **3** |
| P12 - CAN address | **1** |

**Note:**
**These default values are valid from software version V1.06!**

# DigitalBus parallel interface

## Overview

The axes control unit is connected to a superordinated control (PLC) by DigitalBus. The DigitalBus has a 17 bit parallel interface. The interface includes 15 digital inputs and 2 digital outputs. The digital inputs are subdivided into a data bus, consisting of 12 bits and a control bus, consisting of 3 bits. The digital outputs consist of the error message bit and the program active bit.




*Controlling by superordinated control unit*

## 16 bits parallel bus structure

| D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | A2 | A1 | A0 | Remote | System | Strobe | Error | Program active |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Value | | | | | | | | | Command | | | Input | | | Output | Output |
| Data | | | | | | | | | | | | Control | | | Status | |

### *Data bits (Data)*

The data bus width is 12 bits. The first 9 bits are used to transfer the data for the different operating parameters to the control unit. The data for the corresponding preset values are assigned with an identification number, consisting of 3 bits.

### *Control bits (Control)*

For inputs, there are 3 control bits available:

- **Axis Start** - Start/Stop reciprocator
- **Strobe** - Data transfer activation
- **Remote** - Operating mode

### *Status bits (Status)*

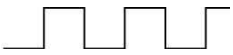
For outputs, there are 2 status bits available:

- **Error** - Axis not referenced
- **Program active**

**Status bit 1:**

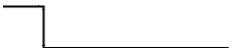
Status bit 1 has assigned two functions:

1. After switching on, an impulse of 0,1 s is present, that means, the axis has to be referenced:

   **OptiMove ON** 

2. The composite error message indicates all errors which are present in the control unit. Error function according to system parameter **P8**:

   **P8=0 - Error** 

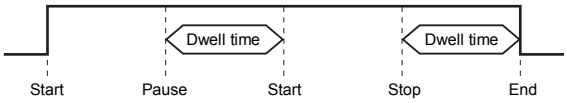
   **P8=2 - Error** 

**Status bit 2:**

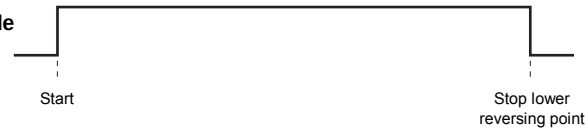
Status bit 2 indicates the operating status of the reciprocator. The following diagram shows how the output reacts in the different operating modes:

**P2 = 1 Pendulum operating mode**

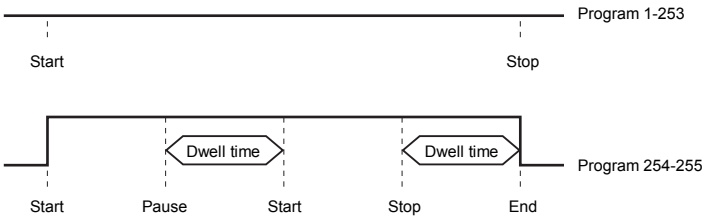

**P2 = 2 Sequence program**




**P2 = 3 Pendulum operating mode semiautomatic**




**P2 = 4 X-GunClean sequence program**




**Note:**
**By traveling to a reference point, the output always remains on "low"!**

# Command table and value ranges

| Command code A0:A2 | Designation | Value range | Unit | Resolution | Pendulum operation P2=1 P2=3 | Sequence program P2=2 P2=4 |
|---|---|---|---|---|---|---|
| 0 | Upper position | 0.00 - 5.00 | m | 0.01 | X | X |
| 1 | Lower position | 0.00 - 5.00 | m | 0.01 | X | X |
| 2 | Speed | 0.08 - 0.60 | m/s | 0.01 | X | X |
| 3 | Speed | 0.08 - 0.60 | m/s | 0.01 | X | |
| 4 | Dwell time | 0 - 5.00 | s | 0.01 | | X |
| 5 | Following program address | 0 - 255 | - | 1 | | X |
| 6 | Program no. | 1 - 255 | - | 1 | X | X |
| 7 | Start travel to reference point | 0 - 1 | - | 1 | X | X |

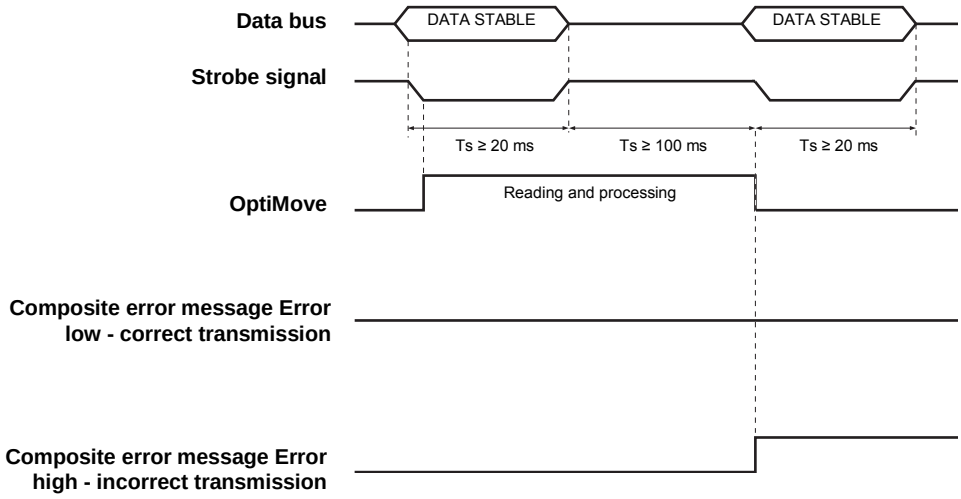
X = is used in the respective mode

**Note:**
**If a program is edited during operation, the axis terminates the old command, which is still in the memory, and takes over the new program values (positions or speed) by the next cycle change!**

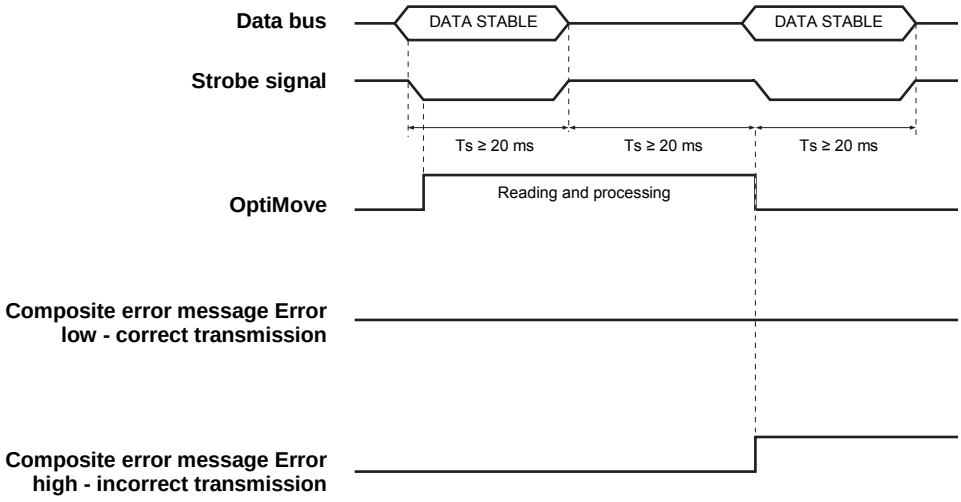
**Note:**
**If the system parameter P2 is set on "2" or "4", editing is only possible at a standstill!**

# Control sequence

## Control sequence for program number change (identification number 6)




## Control sequence for program parameter (identification numbers 0-5)




## Data transfer

The data transfer from the data bus is initiated by a negative flank of the **Strobe** control signal.

The Data bus is read in for data validation 3 times and the results compared, after every negative **Strobe** flank. If an error occurs, the digital output **Error** is set at **high** and the error message **H30** is shown on display **A3**.

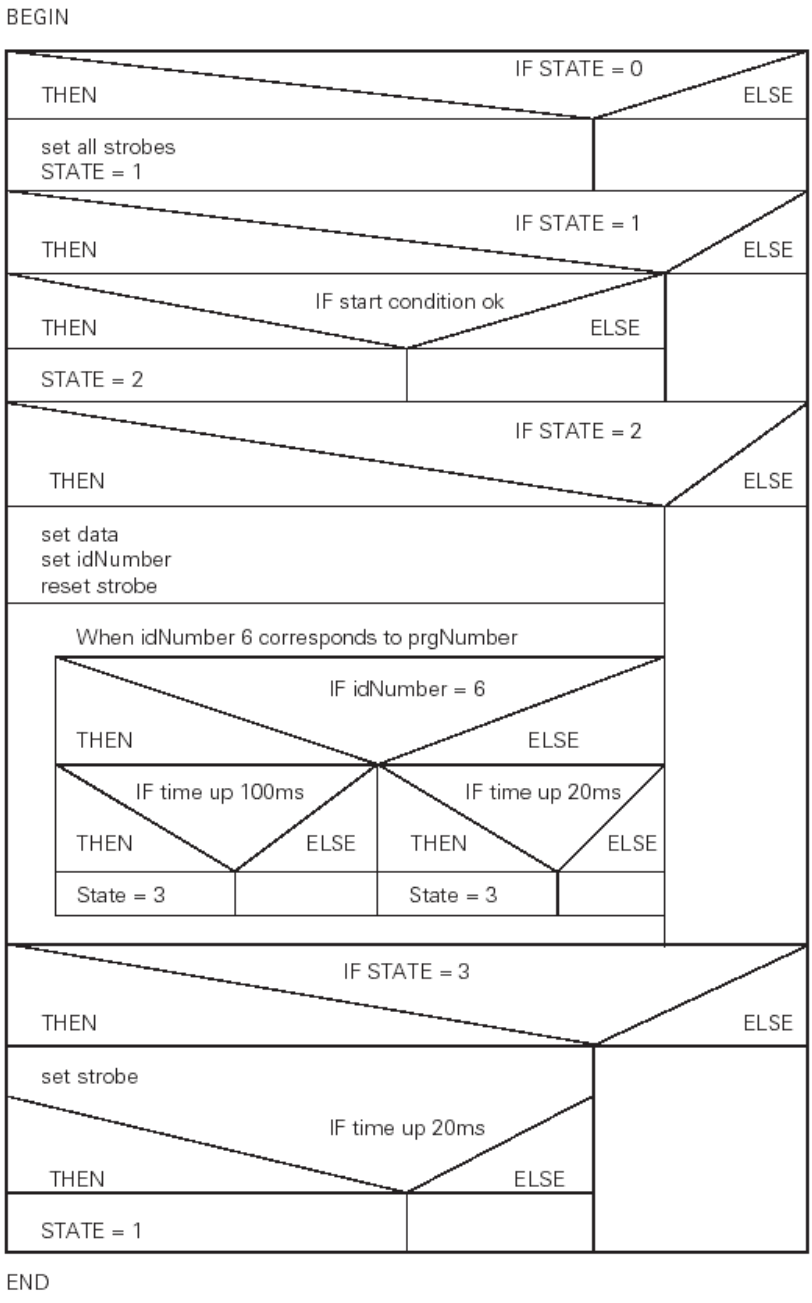
# Software description

For each OptiMove Axes control unit, one strobe signal and one error signal exists. The data signals and the identification number signals are used in common for all OptiMove control units. The OptiMove takes over the data with the negative flank of the strobe signal.

**Explanation:**
The simultaneous transmission of identical data to all OptiMove units only occurs to the negative flank of all strobe signals.

Example of a PLC program:

## Program procedure diagram

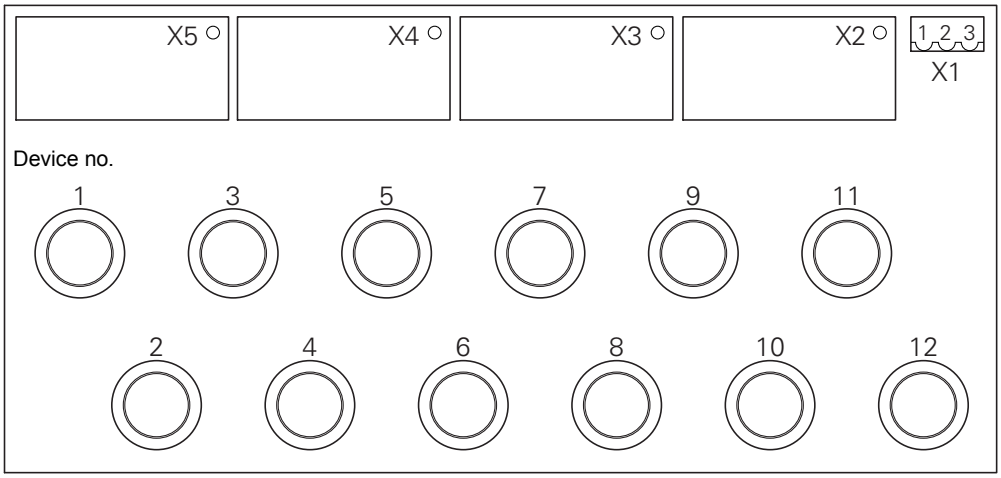


# Digital Connector CD02 with connection designations

The interface between the OptiMove CR05 Axes control unit and the PLC is given by the Digital Connector CD02. All parallel interface signals of up to 12 devices are fed connection-friendly on plugs.

The exact plug assignment for the connection to the PLC is evident in the following illustration:

| **X5** | | **X4** | | **X3** | | **X2** | **X1** |
|---|---|---|---|---|---|---|---|
| 1-12 | Strobe | 1-12 | D8 | 1-12 | Prog. active | 1-8/13-20 D0-D7 | 1: GND |
| 13-24 | Axis start | 13-24 | Remote/man. | 13-24 | Error/not ref. | 9-11/21-23 A0-A2 | 2: +24 VDC |
| | | | | | | | 3: PE |




*Digital Connector CD02*

# CAN bus

## General information

The OptiMove CR05 Axes control unit is fitted with a CAN bus interface as standard, and can be operated as a simple CANopen-Slave in a network with a central control unit (Master).

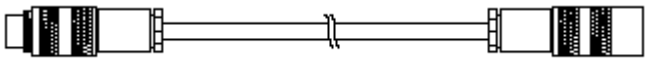
The communication between the users in the network takes place by CAN bus, therefore each existent component must be classified with a individual user address (Node-ID = identification number). The allocation is described in the section "Setting the user address (ID number)". The transmission speed setting is determined by adjusting the Baud rate (see therefore "Setting the Baud rate").

## Hardware

The OptiMove control units are connected to the central PLC control unit with 4 pin CAN bus cables. The last bus client is fitted with a terminal plug with terminal resistor in order to terminate the network correctly. A maximum of up to 125 users can be connected in a network.

### CAN bus cable - plug assignment

| Pin | Signal | Color |
|---|---|---|
| 1 | GND | white |
| 2 | +24 VDC | brown |
| 3 | CAN H | green |
| 4 | CAN L | yellow |



*CAN bus cable*

## Setting the user address (ID Number)

1. To enter the system parameter mode, press and hold the key for 5 seconds. The LEDs **L1-L3** illuminate
2. Select the parameter **P12** on the display **A1** using the − or + key
3. Select an address between **1** and **127** on the display **A2** using the − or + key
4. Press the key, in order to exit the system parameter mode

**Attention:**
**The selected address in the system parameter P12 may never be "0", the address must be unique and may not conflict with the numbers of other existing users!**

## Setting the Baud rate

1. To enter the system parameter mode, press and hold the key for 5 seconds
   The LEDs **L1-L3** illuminate
2. Select the parameter **P11** on the display **A1** using the − or + key
3. Select a value between **0** und **7** on the display **A2** using the − or − key

| Set value - P11 | CAN Baud rate |
|---|---|
| 0 | 20 kbit/s |
| 1 | 50 kbit/s |
| 2 | 100 kbit/s |
| **3** | **125 kbit/s (Default)** |
| 4 | 250 kbit/s |
| 5 | 500 kbit/s |
| 6 | 800 kbit/s |
| 7 | 1 Mbit/s |

The Baud rate is selected with 125 kbits as default. This setting permits a maximum cable length of approx. 500 m from the first to the last CAN bus client. If longer cables are used, select a lower Baud rate.

4. Press the key, in order to exit the system parameter mode

**Note:**
**For details of the CANopen interface, please refer to the separate "OM function specifications" operating manual!**

# Troubleshooting

## General information

All error messages are displayed as an error code (**H01-H99**) on the seven segment display **A3** (instead of the program number).

If an error is present in the system, the cause must be eliminated, before further operation is possible.

If the fault has been eliminated, this must be acknowledged by pressing the − or + key on the **Program** keypad.

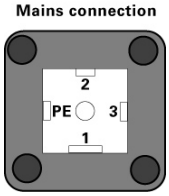
| Error code | Description | Action |
|---|---|---|
| **Axis** | | |
| **H01** | Upper end stop (system parameter P1) overrun | Emergency stop<br>Axis can only travel downwards<br>Axis must be referenced again |
| **H02** | Tracking error too large | In order to prevent a larger tracking error, the speed must be reduced. |
| **H03** | Encoder cable broken | Emergency stop<br>Axis must be referenced again |
| **H04** | Wrong encoder rotating direction | Emergency stop<br>Axis must be referenced again |
| **H05** | Desired travel position is larger then the defined end position (system parameter P1) | Limit the travel position according to system parameter P1 |
| **H06** | Lower end stop overrun | Emergency stop<br>Axis can only travel upwards<br>Axis must be referenced again |
| **H07** | Proximity switch signal is permanent active during the reference travel | Referencing not successful |
| **H08** | No proximity switch signal during the reference travel | Referencing not successful |
| **H09** | Speed value larger than system parameter P4 | Limit speed according to system parameter P4 |
| **H10** | Axis position not correctly stored during switching off | Axis position = Upper end stop - axis can only travel downwards |
| **H11** | Frequency converter error | Emergency stop |

| Error code | Description | Action |
|---|---|---|
| **H12** | Axis cannot be started, because not referenced | |
| **H13** | Axis cannot be referenced, because already referenced | |
| **H15** | Parameter input in sequence program not possible, because program is running | |
| **H16** | Axis cannot be started during reference travel | |
| **Hardware** | | |
| **H20** | 24 VDC supply voltage too high (26.5 VDC) | Stop axis (soft stop) |
| **H21** | 24 VDC supply voltage too low (20.8 VDC) | Emergency stop<br>Store axis position, current program number and axis status<br>Stop the system |
| **H23** | EEPROM content invalid | Load factory configuration |
| **DigitalBus** | | |
| **H30** | Data validation error | Reject data |
| **H31** | Data outside the value range | Reject data |
| **H32** | Data reception overflow | Reject data |
| **CAN bus** | | |
| **H40** | Permanent CAN bus error (BUS_OFF), i.e. no power supply or cable is not connected | |
| **H41** | Too many errors during sending (ERROR_PASSIVE) | |
| **H42** | Overflow on reception | |
| **H43** | Overflow on transmission | |
| **H44** | Master failed | Stop axis (soft stop) |
| **H45** | Data outside the value range | Reject data |
| **H46** | Invalid Node ID set | Node ID=127 |

# Hardware

## Pin allocations

2.1




### Plug 2.1 - Mains connection

| Pin | Function |
|---|---|
| 1 | Neutral conductor |
| 2 | Phase (230 VAC) |
| 3 | Axis start (230 VAC) |
| PE | Ground |


### Plug 2.2 - Drive supply

| Pin | Function |
|---|---|
| 1 | Neutral conductor |
| 2 | Phase |
| 3 | Not connected |
| PE | Ground |


### Plug 2.3 - Drive I/O

| Pin | Function |
|---|---|
| 1 | GND frequency converter |
| 2 | 24 V frequency converter |
| 3 | Frequency converter error |
| 4 | RPM preset value |
| 5 | Motor right running (UP) |
| 6 | Motor left running (DOWN) |
| 7 | Reserve |
| 8 | Reserve |
| 9 | 24 VDC OptiMove |
| 10 | Motor brake |
| 11 | Proximity switch |
| 12 | Reserve |
| 13 | B+ |
| 14 | B- |


| Pin | Function |
|---|---|
| 15 | A- |
| 16 | A+ |
| 17 | O+ |
| 18 | O- |
| 19 | GND OptiMove |
| Enclosure | Shield |

## Plug 2.4 - DigitalBus parallel interface


| Pin | Bit | Function |
|---|---|---|
| A | D0 | Preset values, program no. Binary value 1 |
| B | D1 | Preset values, program no. Binary value 2 |
| C | D2 | Preset values, program no. Binary value 3 |
| D | D3 | Preset values, program no. Binary value 4 |
| E | D4 | Preset values, program no. Binary value 5 |
| F | D5 | Preset values, program no. Binary value 6 |
| G | D6 | Preset values, program no. Binary value 7 |
| H | D7 | Preset values, program no. Binary value 8 |
| I | A0 | Identification number Binary value 1 |
| K | A1 | Identification number Binary value 2 |
| L | A2 | Identification number Binary value 3 |
| M | 12 IN | Axis_Start |
| N | 13 IN | Strobe (data reception from data bus) |
| O | 14 IN | Remote/manual |
| P | D8 | Preset values, program no. Binary value 9 |
| R | GND_External | GND |
| S | 1 OUT | Error, axis not referenced |
| T | 2 OUT | Program_Active |
| U | 24VDC_External | 24 VDC digital outputs |
| Enclosure | Shield | Shield |

## Plug 2.5 - CAN bus IN


| Pin | Function |
|---|---|
| 1 | GND |
| 2 | 24 VDC |
| 3 | CAN_H |
| 4 | CAN_L |
| Enclosure | Shield |

## Plug 2.6 - CAN bus OUT


| Pin | Function |
|---|---|
| 1 | GND |
| 2 | 24 VDC |
| 3 | CAN_L |
| 4 | CAN_H |
| Enclosure | Shield |

# Spare parts list

## Ordering spare parts

When ordering spare parts for powder coating equipment, please indicate the following specifications:

- Type and serial number of your powder coating equipment
- Order number, quantity and description of each spare part

**Example:**

- **Type** OptiMove CR05 Axes control unit,
  **Serial number** 1234 5678
- **Order no.** 203 386, 1 piece, Clamp - Ø 18/15 mm

When ordering cable or hose material, the required length must also be given. The spare part numbers of this yard/meter ware is always marked with an *****.

The wear parts are always marked with a #.

All dimensions of plastic hoses are specified with the external and internal diameter:

**Example:**

Ø 8/6 mm, 8 mm outside diameter (o/d) / 6 mm inside diameter (i/d)

**WARNING!**
**Only original Gema spare parts should be used, because the hazardous location approval will be preserved that way! The use of spare parts from other manufacturers will invalidate the Gema guarantee conditions!**

# OptiMove CR05 Axes control unit - spare parts list

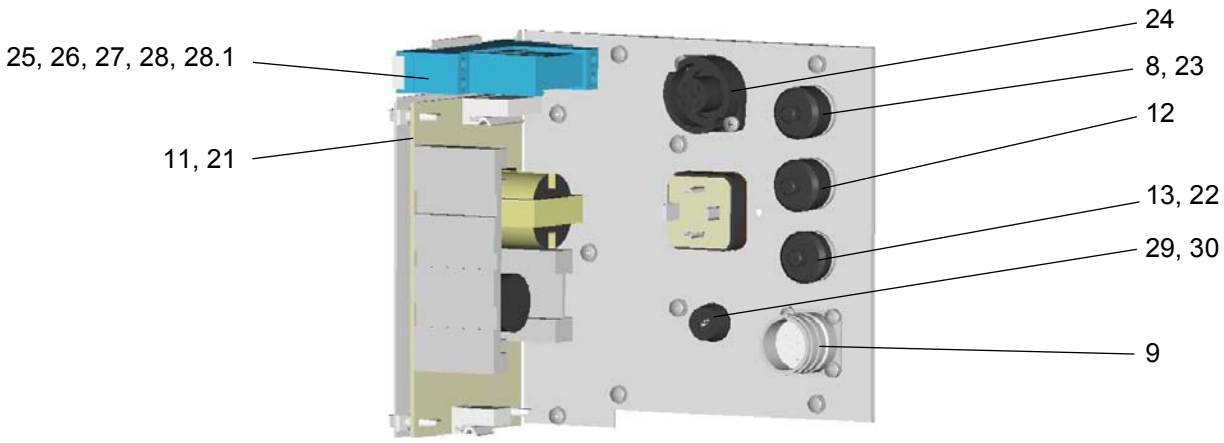
| | | |
|---|---|---|
| | **OptiMove CR05 Axes control unit - complete** | **1001 752** |
| | Front plate - complete (incl. pos. 1, 2, 3 and 4) | 1001 914 |
| 1 | Main board - complete | 1000 202 |
| 2 | Power board - complete | 1000 245 |
| 3 | EPROM - program version x.x (current software) | 1000 610 |
| 4 | Flat keyboard with frame - complete | 1000 581 |
| 8 | DigitalBus connection - complete | 1001 885 |
| 9 | Reciprocator control signals connection - complete | 1001 886 |
| 11 | Power pack - 24 VDC | 389 277 |
| 11.1 | Mini fuse - 4 AT, for pos. 11 | 262 897 |
| 12 | CAN bus IN connection - complete | 1001 883 |
| 13 | CAN bus OUT connection - complete | 1001 884 |
| 21 | Spacer | 263 508 |
| 22 | Dust protection cap for enclosure | 265 446 |
| 23 | Dust protection cap for plug | 265 438 |
| 24 | Connection to reciprocator power supply - complete | 1001 888 |
| 25 | Free-wheeling diode for relay | 258 075 |
| 26 | Relay socket | 251 135 |
| 27 | Safety strap for relay socket | 1001 063 |
| 28 | Relay - 24 VDC 1UK (until serial number 15802.00174) | 1001 062 |
| 28.1 | Relay - 24 VDC 2UK (from serial number 15802.00175) | 1002 915 |
| 29 | Fuse - 10 AT | 200 174 |
| 30 | Fuse holder | 200 131 |
| | ZA04 mains cable - 20 m | 1000 280 |
| | ZA04 signal cable - 20 m | 1000 281 |

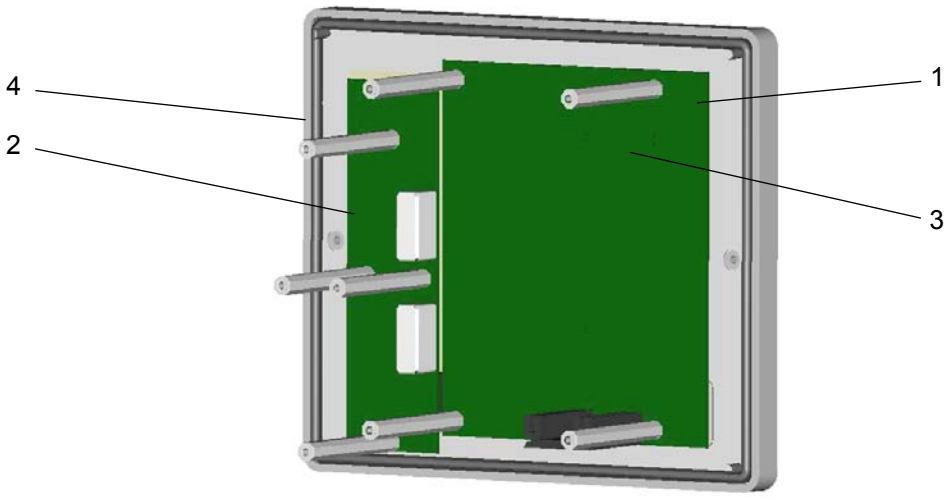
**Optional features (not shown)**

| | | |
|---|---|---|
| | Digital Connector CD02 (CR05-PLC interface) | 382 825 |
| | Digital cable 19-poles - 1.50 m | 1001 500 |
| | Digital cable 19-poles - 3.50 m | 1000 933 |
| | Digital cable 19-poles - 4.50 m | 1000 934 |
| | Digital cable 19-poles - 5.50 m | 1000 935 |
| | Digital cable 19-poles - 6.50 m | 1000 936 |
| | CAN hub - complete | 1001 787 |

# OptiMove CR05 Axes control unit - spare parts

| | |
|---|---|
| CAN bus cable - 0.50 m | 1002 655 |
| CAN bus cable - 4.50 m | 387 592 |
| CAN bus cable - 5.50 m | 388 521 |
| CAN bus cable - 6.50 m | 388 530 |
| Bus terminal resistor | 387 606 |




*OptiMove CR05 Axes control unit - spare parts*

# Appendix - program table

| Prog.-no. | Upper position | Lower position | $V_{UP}$ | $V_{DOWN}$ | t * | nP * |
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| **120** | X position | | | | | |
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