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Operating instructions and spare parts list

# OptiTronic (CG02) Powder gun control unit

**Important!**

Before using this equipment, please carefully read all instructions in this manual. Keep this manual ready to hand on the equipment for future reference!



Translation of the original operating instructions

## Documentation OptiTronic CG02 Powder gun 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 OptiTronic CG02 Powder gun control unit.

These safety regulations must be read and understood before the OptiTronic CG02 Powder gun control unit is used.

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## 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



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## Conformity of use

1. The OptiTronic CG02 Powder gun 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 OptiTronic CG02 Powder gun control unit is to be used for other purposes or other substances outside of our guidelines then Gema Switzerland GmbH should be consulted.
3. Observance of the operating, service and maintenance instructions specified by the manufacturer is also part of conformity of use. The OptiTronic CG02 Powder gun 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 OptiTronic CG02 Powder gun 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 OptiTronic CG02 Powder gun control unit exempt 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
  0102 II (2) D	IP6X ◀ <b>FM</b> ▶ IP54	T6 (zone 21) 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!




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**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!**

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## 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 Switzerland GmbH 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 connection 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/m<sup>3</sup> 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 <sup>1)</sup> - Part 1 General requirements - Part 2 Examples of use

### **Leaflets**

ZH 1/310	Leaflet for the use of tools in locations where there is danger of explosion <sup>1)</sup>
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### **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 EN 292-2	Machine safety <sup>2)</sup>
EN 50 014 to EN 50 020, identical: DIN VDE 0170/0171	Electrical equipment for locations where there is danger of explosion <sup>3)</sup>
EN 50 050	Electrical apparatus for potentially explosive atmospheres - Electrostatic hand-held spraying equipment <sup>2)</sup>
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 <sup>2)</sup>
EN 50 177	Stationary electrostatic spraying equipment for flammable coating powder <sup>2)</sup>
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 <sup>2)</sup>
EN 60 204 identical: DIN VDE 0113	VDE regulations for the setting up of high-voltage electrical machine tools and processing machines with nominal voltages up to 1000 V <sup>3)</sup>

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

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

\*Sources:

- 1) Carl Heymanns Verlag KG, Luxemburger Strasse 449, 5000 Köln 41, or from the appropriate employers association
- 2) Beuth Verlag GmbH, Burggrafenstrasse 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

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## 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

# About this manual

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## General information

This operating manual contains all important information which you require for the working with the OptiTronic CG02 Powder gun 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 - booth, reciprocator, powder gun or powder injector - you will find in the corresponding enclosed documentations.

### Abbreviations in this manual

<b>DB</b>	DigitalBus
<b>EL</b>	Electrode rinsing air
<b>FC</b>	FlowControl
<b>FL</b>	Conveying air
<b>FL_min</b>	Minimum powder output
<b>GL</b>	Total air
<b>HV_BG</b>	High voltage setting
<b>I_BG</b>	Current setting
<b>PA%</b>	Powder output (percent)
<b>SKW%</b>	Correction value
<b>SL</b>	SystemLock
<b>ZL</b>	Supplementary air





# Function description

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## Field of application

The OptiTronic CG02 Powder gun control unit is intended exclusively for the electrostatic coating with organic powders. 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 OptiTronic CG02 Powder gun control unit is the heart of a modern powder coating plant. The optimized and intelligent powder gun control unit is very flexible, in respect to the expendability of the applicable stages in automation.

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## OptiTronic CG02 Powder gun control unit - overview

### The OptiTronic basic unit



The OptiTronic control unit is a complete control unit for one powder gun. The OptiTronic equipment concept permits the operator to adapt his individual solution requirements to his application.

A micro-controller based control electronics makes it possible to expand the functions with corresponding electronic modules at any time (the version-overview table, as well as the modification data you will find in "OptiTronic version table" and "Retrofit parts table").

The basic equipment contains all control functions, which are needed for the control of a powder gun. All coating parameters (nominal values and actual values) have their individual display and input unit to give the highest user-friendly operation.

Up to 255 coating programs can be stored and recalled by the basic equipment. The stored programs help considerably to increase the repeatability of uniform coating results.

The powder volume is set independent from the total air volume. The allocation of conveying air and supplementary air takes place automatically. With a freely selectable high voltage or spraying current, an optimum high voltage generation is guaranteed, also for the highest application demands.

Various diagnostic functions, indicated by LEDs and seven segment displays, make the operation easier.

The most important characteristics of the OptiTronic control unit are:

- 255 stored coating programs possible
- Possible settings for each coating program:
  - High-voltage (kV)
  - Control of the air volumes
  - Spraying current ( $\mu\text{A}$ )
  - Electrode rinsing air ( $\text{Nm}^3/\text{h}$ )
  - Powder output (%)
  - Total air volume (conveying air / supplementary air -  $\text{Nm}^3/\text{h}$ )
- Individual input and display unit for high voltage, spraying current, electrode rinsing air, powder output, total air volume and programs
- High voltage or spraying current setting
- Diagnostic functions
- Modular equipment concept, anytime extensible with FlowControl, DigitalBus or SystemLock
- 24 VDC power supply

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## Optional system extensions

The ingenious equipment concept permits the operator to select a individual automation solution for its application requirements. The possibility to expand the basic equipment with additional system extensions such as FlowControl, DigitalBus or SystemLock will add flexibility and cost optimization to the customers solutions.

### FlowControl module



The FlowControl module, in addition to the basic OptiTronic equipment, permits a most precise measurement and regulation of the conveying air and the supplementary air, up to the injector (injector wear or powder hose clogging are not taken into account).

The air volumes are continuously measured by sensors and automatically regulated to the nominal values. System dependent compressed air and stagnation pressure fluctuations become so automatically compensated. The reproducibility of the setting values for conveying air and supplementary air are increased and lead to more uniform coating results.

- Precise air volume measurement
- Highest regulating dynamics
- Micro controller based air volume calibration
- High air volume regulation range:
  - Conveying air up to  $6.5 \text{ Nm}^3/\text{h}$
  - Supplementary air up to  $6.5 \text{ Nm}^3/\text{h}$

## DigitalBus module



The OptiTronic basic equipment fitted with a DigitalBus opens up the possibility to decentralized automation solutions. An individual process control system, cut to the process requirements, supports the automated and safe plant operation.

- Digital parallel interface connection to a PLC
- Online controlling of all coating parameters:
  - Gun - high voltage, spraying current, electrode rinsing air
  - Injector - powder output, total air (conveying air/supplementary air)
- Controlling of up to 255 peripheral stored coating programs in the OptiTronic control unit

## CAN bus



The OptiTronic powder gun control unit, fitted with a CAN bus interface, is a simple CANopen Slave. It operates in a network with a central control unit (Master).

Communication takes place exclusively between the Master and the Slaves.

The following data can be accessed through CANopen:

- All nominal values (process data)
- All actual values (process data)
- All control values
- All system parameters (except Baud rate and CAN address)
- All error messages
- All special parameters such as software version, daily correction, powder output correction etc.

## SystemLock

The SystemLock option is used for interlocking the OptiTronic operating panel. In addition, the operator has a collective error message available. The signals can be accessed by the 5 pin **Aux - 2.4** socket. Only the following operating functions can be released when the operating panel is interlocked:

- Switching nominal value display / actual value display
- Acknowledgement of error messages

The activation of the operating panel interlocking can be carried out centrally with the aid of a key switch for all OptiTronic control units. The operating panel interlocking is indicated by the green **Remote LED**. The SystemLock option must be initialized with the system parameter P4 = 1 in the control unit.

## System extensions

If the OptiTronic control unit is to be upgraded, first make sure on the basis of the version key, which parts are already contained in the original version. The parts needed for the upgrade can be taken from the Retrofit parts table.




---

**Note:**

**Order only those parts, which are not contained in the original version!**

---

### OptiTronic version table

Version	OptiTronic order no.	Flow Control	System-Lock	DigitalBus	CAN-Bus	G1*	G2*
5	384 569		X				X
6	384 577		X			X	
7	384 585			X			X
8	384 593			X		X	
11	384 623	X		X			X
12	384 631	X		X		X	
15	388 874				X		X
16	388 882				X	X	
17	388 890	X			X		X
18	388 904	X			X	X	

\* **G1** = OptiGun 2 GA02 / PG 1 / PG1-A / PG 2-A

\* **G2** = OptiGun 1 GA 01 / EasySelect GM 01

**Example:**
**Conversion from version 6 to Version 5**

From the version table it is evident, that the version 6 contains a SL (SystemLock) and a G1 (gun).

The parts needed for the conversion to version 5 (according to Retrofit parts table) are: A **Verb. SL** (SystemLock connecting cable) and a **Verb. G2** (G2 gun connecting cable).

Because a SL (SystemLock) and a SL connecting cable are already supplied, a second SL (SystemLock) and SL connecting cable are not necessary, however, a Verb. G2 (G2 gun connecting cable) is required. See therefore the "Retrofit parts table".




---

**Note:**

**Order only those parts, which are not contained in the original version!**

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### Retrofit parts table

Version	Flow Control	Conn. System Lock	DigitalBus	Conn. DigitalBus	CAN bus	Conn. G1	Conn. G2
	379 743	379 891	379 883	379 816	386 227	384 933	379 840
5		X					X
6		X				X	
7			X	X			X
8			X	X		X	
11	X		X	X			X
12	X		X	X		X	
15					X		X
16					X	X	
17	X				X		X
18	X				X	X	

**Abbreviations:**

**SL** = SystemLock

**G1** = Gun 1 = OptiGun 2 GA02 / PG 1 / PG1-A / PG 2-A

**G2** = Gun 2 = OptiGun GA01 / EasySelect GM01

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## Throttle motors for conveying air, supplementary air, rinsing air

After each manual manipulation at the engine throttles, a reference run must be carried out!

If the cable connections are disconnected, take care to not interchange the plugs when reconnecting. It is therefore recommended to mark the plugs (see also the electrical diagrams)

- X11 conveying air
- X12 supplementary air
- X13 rinsing air



# Technical data

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## OptiTronic - Basic equipment

### Electrical data

OptiTronic CG02	
Input voltage	24 VDC
Power consumption	48 VA
Protection type	IP6X ◀ <b>FM</b> ▶ IP54
Temperature range	0 °C to +40 °C

### Pneumatical data

OptiTronic CG02	
Input pressure	5,0 bar
Max. water vapor content	1,3 g/m <sup>3</sup>
Max. oil vapor content	0,1 mg/m <sup>3</sup> (oil/water)
Max. compressed air consumption	11 m <sup>3</sup> /h

### Dimensions

OptiTronic CG02	
Width	203 mm
Height	174 mm
Depth	222 mm
Weight	4,8 kg

## Connectable guns

OptiTronic CG02	
Nominal output voltage	12 V (gun G2) 10 V (gun G1)
Automatic guns	OptiGun 1 GA01* OptiGun 2 GA02* ◀ <b>FM</b> ▶ PG 1-A* / PG 2-A*
Manual guns	EasySelect GM01* ◀ <b>FM</b> ▶ PG 1*
Tribo guns	Connection possible

\* G1 = Gun 1 = OptiGun 2 GA02 / PG 1 / PG 1-A / PG 2-A

\* G2 = Gun 2 = OptiGun 1 GA01 / EasySelect GM 1

## FlowControl (option)

OptiTronic CG02	
Input pressure	5,0 bar
Operating temperature range	0° C to +50° C
Air volume range conveying air (FL)	0-7 Nm <sup>3</sup> /h
Air volume range supplementary air (ZL)	0-7 Nm <sup>3</sup> /h
Air volumes operation area FL	0,5-6,5 Nm <sup>3</sup> /h
Air volumes operation area ZL	0,5-6,5 Nm <sup>3</sup> /h
Resolution	0,01 Nm <sup>3</sup> /h
Accuracy	<±0,1 Nm <sup>3</sup> /h
Reaction time (step 0-100 %)	<400 ms

## OptiTronic type definition and possible options

(see equipment rear wall)

### Example:

Label with version number and order number:

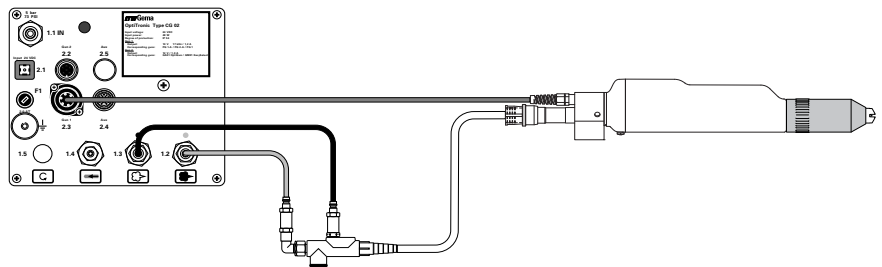
**V 8 384 593** (see OptiTronic version table)



# Start-up and operation

## Plugs and connections

The OptiTronic control unit is supplied ready for use by the manufacturer. Only a few cables and hoses must be connected.



### Plugs and connections



Connect the compressed air supply hose from the compressed air circuit directly to the **1.1 IN** main connection on the back of the control unit.



### Note:

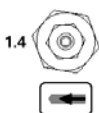
**The compressed air input pressure must be set at 5,0 bar!**  
**The compressed air must be free from oil and water!**



Connect the red hose for conveying air to the corresponding output **1.2** on the rear side of the control unit and to the injector.



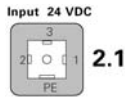
Connect the black hose for supplementary air to the corresponding output **1.3** on the rear side of the control unit and to the injector.



Connect the rinsing air hose to the electrode rinsing air output **1.4** and to the powder gun.



Connect the grounding connection cable with the grounding screw to the control unit, and fix the 5 m long grounding cable with the clamping clip to the booth or to the hanger device.



Connect the mains cable to the socket **2.1 - Input 24 VDC**. This plug may never be disconnected under tension!



**Attention:**

**OptiTronic control units may be operated only with 24 VDC!**  
**A special power main board is used for the power supply of the OptiTronic control units, which can be equipped with a maximum of 12 power modules (1 power module per OptiTronic). When retrofitting the equipment, a further power module must be ordered with each OptiTronic control unit, which can be easily inserted onto the power main board (see spare parts list)!**

Gun 2  
2.2



Connect the gun cable with the 6 pin plug to the **Gun 2 - 2.2** socket on the rear side of the control unit (**GM 01 EasySelect gun / GA 01 OptiGun**) - optional

or



Connect the gun cable with the 7 pin plug to the **Gun 1 - 2.3** socket on the rear side of the control unit (**OptiGun 2 GA02 / PG 1 / PG 1-A / PG 2-A**) - optional



Aux  
2.4

The 19 pin socket **Aux - 2.4** (optionally with **DigitalBus**) is used for connecting a superordinated PLC control unit.

or



Aux  
2.4

The 5 pin socket **Aux - 2.4** (optionally with **SystemLock**) is used for the individual release of the control unit

or



Aux  
2.4

**Aux - 2.4** socket (optionally with **CAN-Bus - Input**) The 4 pin socket takes the input signal coming from a CAN bus compatible device

and



Aux  
2.5

**Aux - 2.5** socket (optionally with **CAN-Bus - Output**)

The 4 pin socket transfers the output signal of the **Aux - 2.4** socket and sends it to further control units connected in series.

## Function description

### Panel and diagnostic LEDs



Each of the coating parameters of the OptiTronic CG02 Powder control unit has its own display and its own operating panel.

The diagnostic LEDs display the equipment malfunctions. The OptiTronic control unit is functioning correctly when the diagnostic LEDs 1, 2, 3 and 4 shine green.

If one or more diagnostic LEDs remain dark, please contact an Gema service center.

### Signification of the diagnostic LEDs:

- 1 green  
Power supply +24 VDC ready for operation
- 2 green  
Internal power supply +15 VDC ready for operation
- 3 green  
Internal power supply +5 VDC ready for operation
- 4 green  
Main solenoid valve control unit ready for operation

### Main push button



The control unit can be activated or deactivated with the main push button. If the control unit is active, the green **OptiTronic** LED (lower left) is illuminated. If the green **System** LED (upper left) is illuminated too, the equipment is released for coating by the external control.

### Displays



**kV display and high voltage adjustment**  
(setting range 0-100 kV)



**µA display and spraying current adjustment**  
(setting range 0-100 µA)

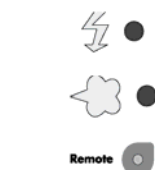


**Electrode rinsing air** → display and electrode rinsing air adjustment  
(setting range 0-2,8 Nm<sup>3</sup>/h, default value: 0,2 Nm<sup>3</sup>/h)

The **Select** key is used for Swirl air  
(setting range 0-6,2 Nm<sup>3</sup>/h, default value: 2,0 Nm<sup>3</sup>/h)



**Powder output** ☘ display and powder output adjustment  
(setting range 0-100 %, or if P7=2 then 0-6,2 Nm<sup>3</sup>/h)



**Total air volume** ≡ display and total air setting  
(setting range 1,8-8,0 Nm<sup>3</sup>/h, or if P7=2 then 0-6,2 Nm<sup>3</sup>/h)

**Program** display and setting of the program number  
(setting range 1-255), as well as display and acknowledgement of fault messages

This LED (red) illuminates, if there is a fault in the high-voltage system.

This LED (red) illuminates, if there is a fault in the pneumatic system.

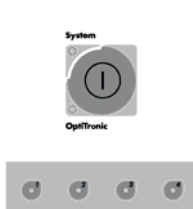
This LED (green) illuminates, if the control unit is telecontrolled by a superordinated PLC control unit.

### Special functions

The special functions are:

- System parameters
- Reference of throttle motors
- Powder output correction
- Software version

The special functions can be activated by pressing any + or - key in the corresponding display area (see below).



## Entering the special functions modes

Press the **main push button** for approx. 10 seconds, until all displays no longer illuminate

All the green **diagnostic LEDs** should illuminate. If not, see "Signification of the diagnostic LEDs:"



## Exiting the special functions mode

Exit the special functions mode by pressing the main push button. The switch-on counter will automatically reset to 30 when exiting the special functions mode, irrespective of the number of times the control unit was switched on previously. The next time the equipment is switched on, an automatic throttle motor referencing will take place.

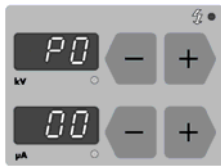


## System parameter mode



1. Press the **main push button** for approx. 10 seconds, until all displays no longer illuminate
2. Enter the system parameter mode by pressing any **+** or **-** key in the **kV** or **µA** display area
3. Select the system parameter (**P00-P08/PE/PL**) with the **+** or **-** key
4. Adjust the system parameter values with the **+** or **-** key (see "System parameter value table")  
After the system parameters are reset, the throttle motors are also referenced by exiting the special functions mode
5. Exit the special function mode by pressing the main push button

## System parameter value table

Parameter (**P00-P09/PE/PL**)

Values

**Abbreviations in table:**







EL = Electrode rinsing air

FL = Conveying air

GL = Total air

PA% = Powder output (in percent)

ZL = Supplementary air

Parameter-Nr.	Description	Values (Default values are marked by <b>bold print</b> )	Remark
P0	Option FlowControl	<b>0</b> : Basis equipment without FlowControl 1: with FlowControl	FlowControl Initialization Error <b>H01</b> after wrong input, acknowledge with +/- and enter the correct value
P1	Gun type	<b>0</b> : Gun type - OptiGun 2 / PG 1: Gun type - EasySelect / OptiGun 1 2: Tribo gun	Gun type selection
P2	Swirl Air (not used)	<b>0</b> : without Swirl Air 1: with Swirl Air	Select key release for Swirl Air
P3	Injector type	(Nozzles in mm)      FL      ZL <b>0</b> : PI3 =                    1,6    1,4 1: PI3 =                    1,8    1,4 2: PI3 =                    2,0    2,0 3: OptiFlow/EasyFlow = 1,6    1,4	Injector type selection Ø 1,6 mm - with notch Ø 1,8 mm - without notch Select injector nozzle and throttle for the corresponding injector
P4	Gun deselection (OptiTronic key) see also "Remote operation"	<b>0</b> : Gun deselection condition is <b>not taken into account</b> in the remote operation 1: Gun deselection condition is <b>taken into account</b> in the remote operation	For normal remote operation Remote operation is used as key locking function Option: SystemLock
P5	System signal	<b>0</b> : Automatic equipment, external system signal in manual and remote operation is necessary 1: Internal system release No external signal necessary (demo unit only) 2-4: not used	
P6	Communication	<b>0</b> : DigitalBus 1: CAN-Bus 2-4 not used	Communication initialization
P7	Display variants	<b>0</b> :  = Pa%,  = GL m³/h 1:  = FL m³/h,  = GL m³/h 2:  = Air 1 m³/h  = Air 2 m³/h	Standard display Display of FL and GL air volumes for checking purposes Separate adjustment of two air channels
P8	Tolerance band (only with FlowControl)	<b>0</b> : 0,05 m³/h 1: 0,1 m³/h 2: 0,2 m³/h	Tolerance band for air volume regulation
P9	Tolerance band Error message FlowControl	3-6: Tolerance band error message for FlowControl in Ndm³/h (e.g. 3 = 0,3 Nm³/h, 6 = 0,6 Nm³/h)	

PE	CAN Baud rate	3: 125 kBaud (default value) 0-7: CAN Baud rate (see the Baud rate settings)	
PL	CAN address	1: 1-100 CAN Node ID (see the Baud rate settings)	

## Throttle motor referencing

The throttle motor referencing should be carried out at the first start-up, after a service work or after the solution of application problems!



1. Press the **main push button** for approx. 10 seconds, until all displays no longer illuminate
2. The throttle motors can be referenced now, that means, zero-setting for conveying air (**FL**), supplementary air (**ZL**), electrode rinsing air (**EL**) The throttle motor referencing can be initiated by pressing the + or - key in the → display area.
3. By pressing the + or - key it is indicated, how often the control unit was switched on since the last throttle motor referencing. The LED on the right, below the display window, blinks. A throttle motor referencing is activated by repeated pressing. There adjusting noises should be audible, one after the other.

*Switch-on counter:*

*A throttle motor referencing will take place automatically after the control unit has been switched on 30 times. The switch-on counter will be reset to zero!*





4. Exit the special function mode by pressing the **main push button**

## Powder output correction

The OptiTronic control unit allows the adjustment of differing powder outputs in the plant, caused by differing powder hose lengths and geometry to the individual guns. The minimum powder output (**FL\_min**) and the maximum powder output (**SKW%**) can be adjusted by two parameters. Powder output corrections are made at the first start-up, after a service work, after the solution of application problems, or by using different hose diameters.

To enter the powder output correction mode, press the **main push button** for approx. 10 seconds, until all displays no longer illuminate.



1. Adjust the correction value for minimum powder output (**FL\_min**) on the  display area with the + or - key
2. Adjust the correction value for maximum powder output (**SKW%**) on the  display area with the + or - key
3. Exit the special function mode by pressing the main push button

## Carrying out a powder output correction

The settings in the following example are carried out for each gun individually.





Powder output corrections are made at the first start-up, after a service work, after the solution of application problems, or by using different hose diameters!

It is recommended to create a table with input fields for each gun (see "Example of a powder output correction table"), so that, if a possible system reset takes place, to these data can be fallen back.

The guide values can be extract from the following table:

<b>Total air (Nm<sup>3</sup>/h)</b>	5
<b>Correction values</b>	
FL_min	1,8
SKW%	100

### Procedure

1. Select program number **001** on the program display
2. Adjust the total air volume to **5,0 Nm<sup>3</sup>/h** on the  display, if not already set.  
Adjust the powder output to **00 (%)** on the  display
3. To enter the special function mode, press the **main push button** for approx. 10 seconds, until all displays no longer illuminate
4. Set the minimum powder output value (**FL\_min**) to **1,8 (Nm<sup>3</sup>/h)** on the  display
5. Set the maximum powder output correction value (**SKW%**) to **100 %** on the  display


Exit the special function mode by pressing the **main push button**.

For the next steps a measuring bag is necessary, for weighing the powder output. If possible, one bag should be used for each gun. Do not forget to note the dead weight of each individual measuring bag.

6. Place the measuring bag over the gun nozzle and fasten it. Switch on the gun for 60 seconds
7. After this time has elapsed, switch off the gun, remove the measuring bag and weigh it. The powder output should be between 10-15 g
8. If no powder is expelled from the gun, return to the special function mode and increase the minimum powder output value to **1,8-2,4 (Nm<sup>3</sup>/h)**
9. Repeat steps 6 and 7, until the powder output is within 10-15 g. Note the adjusted minimum powder output value **FL\_min** in the table





10. Exit the special function mode by pressing the **main push button**
11. Adjust the powder output to **80 (%)** on the  display
12. Place the measuring bag over the gun nozzle and fasten it. Switch on the gun for 60 seconds
13. Switch off the gun after 60 seconds, remove the measuring bag and weigh it
14. Enter the powder output in **g/min** to the table

Calculate the powder output correction according to following formula:

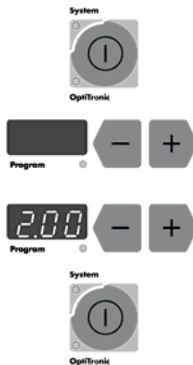
$$SKW\% = \frac{\text{lowest powder output}}{\text{measured powder output}} \times 100$$

15. Enter the calculated values (**SKW%**) for each individual gun to the table and to the control unit (therefore repeat steps 3 and 5)

### Example of a powder output correction table

Gun	Powder output correction		Powder output without correction
Nr.	FL_min (Nm <sup>3</sup> /h)	SKW (%)	Powder output is 80 %
1	1,7	100 %	200 g/min
2	1,8	(200/250) x 100 = 80 %	250 g/min
3	2,6	(200/280) x 100 = 71 %	280 g/min
etc.			

## Software version



1. To verify the software version of the OptiTronic operating system, press the **main push button** for approx. 10 seconds, until all displays no longer illuminate
2. Software version number is called up by pressing the **+** or **-** key on the **Program** display area
3. Software version number of the OptiTronic operating system is displayed
4. Exit the special function mode by pressing the **main push button**

Different memory modules are installed for the different print versions. Therefore, the correct order number must be given when ordering:

Serial no. 14101.XXXXX - software version 1.03 EPROM 27C256-70 - **Order no. 380 873**

Serial no. 14102.XXXXX - software version 2.XX EPROM 27C512-70 - **Order no. 387 037**



## System reset

A system reset is done at the first start-up or if function faults happen!



### Attention:

**A system reset overwrites all 255 programs with default values and the system parameters are returned to their original factory settings!**

1. Switch off the OptiTronic control unit with the **main power switch** on the control cabinet
2. Hold the **main push button** pressed and turn on the **main power switch**. After approx. 15 seconds, the programs are individually reset to the factory default values, and this is shown in the **Program** display by the current program number 1-255. As soon as the program numbers start to run through in rapid succession, release the main push button.  
The diagnostic LED 4 do not illuminate during the system reset!  
After the **system reset**, the system parameters must be examined for their correctness.

## Daily correction value for powder output

The daily correction value for powder output can be set by the DigitalBus with the PLC control unit. The daily correction value can be addressed with the identification number 7. The value range is from 50 to 150 %.

This means, that the actual powder output value is multiplied with the correction value X, e.g.

Powder output value PA% = 50 %  
Daily correction value = 60 %

corresponds to the new powder output value of 30 % ( $50 \times 0,6 = 30$ ). The values outside this value range are rejected with the error message H31.

If the correction value, multiplied with the powder output nominal value, is higher than 100 %, the output is limited to 100 % and displayed with the error message H09.

This verification takes place at program changes and when a new correction value is set.

After switching on the equipment, the correction value is 100%. The correction value is not saved in the EEPROM. After each power-up, the PLC control unit must associate the daily correction value on the OptiTronic.

The daily correction value for the powder output can be displayed on the OptiTronic.

### Displaying the correction value

Press the **OptiTronic** key and hold it down, then press POWDER KEY + or POWDER KEY -. The value is displayed, until no key is pressed anymore. All displays are dark, except the powder output display with the daily correction value.



# CAN bus

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## Function

The OptiTronic powder gun control unit, fitted with a CAN bus interface, is a simple CANopen Slave. It operates in a network with a central control unit (Master). Communication takes place exclusively between the Master and the Slaves. The CANopen implementation on the OptiTronic is held to an absolute minimum.

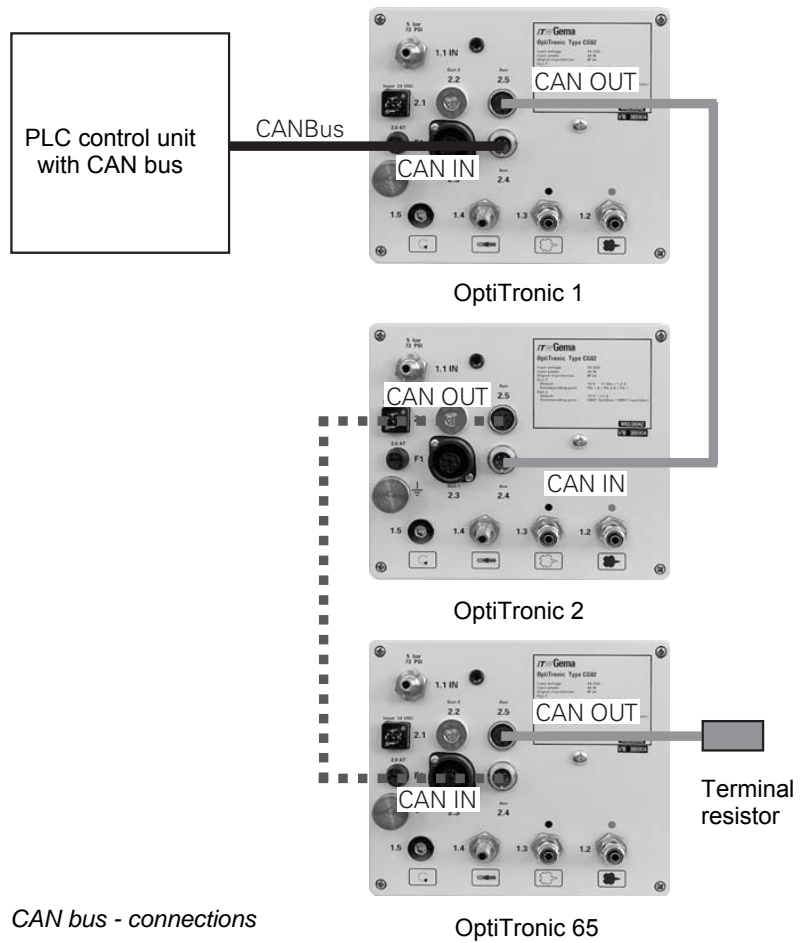
Following data can be accessed by CANopen:

- All nominal values (process data)
- All actual values (process data)
- All control values
- All system parameters (except Baud rate and CAN address)
- All error messages
- All special parameters such as software version, daily correction, powder output correction etc.

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## Hardware

The OptiTronic control units are connected to the central PLC control unit by 4 pole CAN bus cables. The last bus client is fitted with a terminal plug with a terminal resistor in order to terminate the network correctly. A maximum of up to 127 OptiTronic control units can be operated in a network.

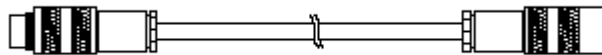


CAN bus - connections

## CAN bus cable

### Pin allocation

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



## System release in network operation

The release of the OptiTronic powder gun control unit in network operation is released by the **System** digital input (LED system ON - power module X4) for safety reasons.

The gun triggering is released by a CAN command through the CANopen interface (LED OptiTronic ON).

## Determining user address (Node-ID) and Baud rate

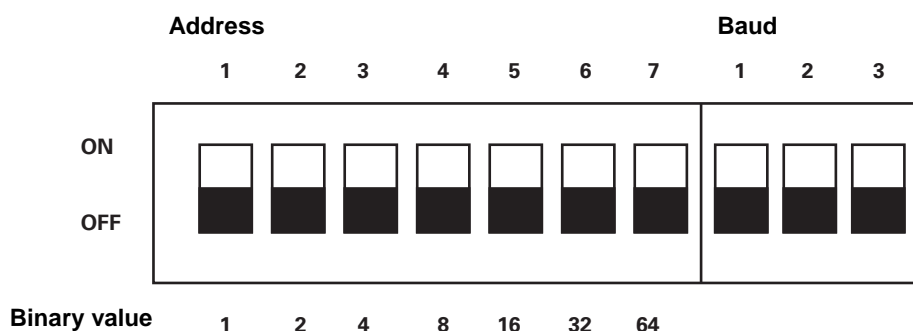
Each OptiTronic gun control unit, which operates in the CAN network, must have assigned an individual user address (Node-ID). The Baud rate setting enables the transmission speed setting.

### System parameter for user address (Node-ID) and Baud rate

The Node-ID and the Baud rate are principally set in the system parameters of the OptiTronic PL = Node-ID and PE = Baud rate. The DIP switches (S1) on the CAN bus interface must be set to zero (OFF), so that the values of the Node-ID and the Baud rate can be accepted by the system parameters PL and PE.

Node-ID and Baud rate are determined by starting the equipment. If a modification takes place, the equipment must be switched off and on again to activate the new settings.

#### DIP switches (S1) for Node-ID and Baud rate



Basic setting, so that the address and Baud rate can be taken from the system parameters PL and PE.

#### Setting the user address (Node-ID) with system parameter PL

System parameter PL (1-100 user address)

#### Setting the Baud rate with system parameter PE

System parameter PE, allocation PE - Baudrate

Setting PE	CAN Baud rate
0	20 kBit/s
1	50 kBit/s
2	100 kBit/s
3	<b>125 kBit/s (Default)</b>
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 user. If longer cables are used, a lower bit rate is to be selected.

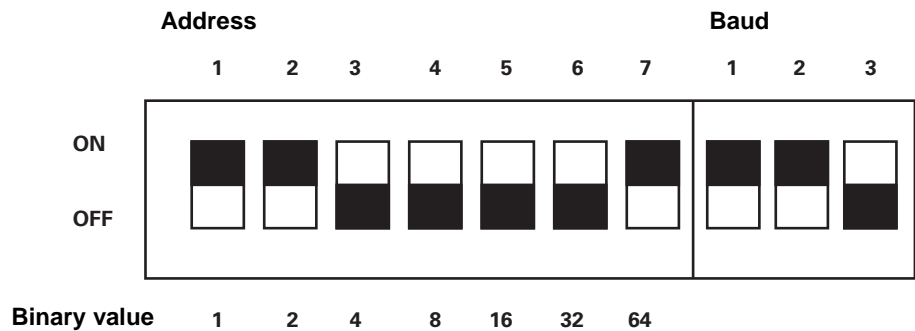
**DIP switches for user address (Node-ID) and Baud rate**

The Node-ID and the Baud rate are principally set in the OptiTronic system parameters PL = Node-ID and PE = Baud rate. The DIP switches (S1) on the CAN bus interface are only used, if no input unit is present on the OptiTronic (front panel), and the input of system parameters is not possible. The Node-ID and Baud rate can be set with the DIP Switch S1 on the Interface board.

The Node-ID must be within the range of 1 to 127. The Node-ID set is the sum of the binary values of all switches which are **ON**. The switch setting is displayed in the system parameter PL.

Node-ID and Baud rate are determined by starting the equipment. If a modification takes place, the equipment must be switched off and on again to activate the new settings.

**Example Node-ID (67 = 64+2+1)**



**Settings for Baud rate**

Baud rate	1	2	3
20k	OFF	OFF	OFF
50k	ON	OFF	OFF
100k	OFF	ON	OFF
<b>125k*</b>	ON	ON	OFF
250k	OFF	OFF	ON
500k	ON	OFF	ON
800k	OFF	ON	ON
1000k	ON	ON	ON

\* Default value

# Troubleshooting

## Error codes



Error code  
no.

If a fault 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!

Pneumatic system error code	Fault description
H01	FlowControl not installed Connecting cable from FlowControl to base electronics is missing Wrong FlowControl software configuration: Check system parameter P0
H02 (only if FlowControl is installed)	Conveying air (FL) fault: <ol style="list-style-type: none"> <li>1. Check conveying air hose to injector</li> <li>2. Disconnect the conveying air hose from the control unit and acknowledge the fault</li> <li>3. If a fault is still present after acknowledgement, deselect the FlowControl module with the system parameter P0 = 0</li> <li>4. Contact an Gema service center</li> </ol>
H03 (only if FlowControl is installed)	Supplementary air (ZL) fault: <ol style="list-style-type: none"> <li>1. Check the supplementary air hose to injector</li> <li>2. Disconnect the supplementary air hose from the control unit and acknowledge the fault</li> <li>3. If a fault is still present after acknowledgement, deselect the FlowControl module with the system parameter P0 = 0</li> <li>4. Contact an Gema service center</li> </ol>
H04	EL1 solenoid valve error, set system parameter P5 = 0 for automatic equipment, P5 = 1 for Demo equipment
H05	The desired total air is too small. Increase the programmed value for the total air or decrease FL_min of the powder output correction
H06	Main solenoid valve fault: Connecting cable from main solenoid valve to basic electronics is missing Check main solenoid valve
H07	The desired supplementary air volume is too large (ZL_max) Decrease the programmed value for the total air volume and/or increase the programmed value for the powder output volume
H08	The desired conveying air volume is too large (FL_max) Decrease the programmed value for the total air volume and/or the programmed value for the powder output volume
H09	The daily correction value multiplied with the desired value of the powder output is greater than 100 % (Acknowledge fault and decrease the daily correction value with PLC)

High voltage error code	Fault description
H10	High voltage generator produces a too high voltage (only on Gun 1) Check basic electronics and gun
H11	Check system parameter P1 (gun type) Check gun cable for cable break Replace the gun
H19	EL2 solenoid valve error (is not used)
H20	Check 24 VDC power supply The input voltage is higher than the nominal voltage 24 VDC +10%
H21	Check 24 VDC power supply The input voltage is lower than the nominal voltage 24 VDC -10%
H22	Faulty 15 VDC power supply on basic electronics Contact an Gema service center
H23	EEPROM error Contact an Gema service center
H24	Write EEPROM timeout Contact an Gema service center
DigitalBus/CAN bus error code	Fault description
H30	Data validation fault: Selection fault from the superordinated control (PLC) Correct the PLC program
H31	Nominal value not in value range Selection fault from the superordinated control (PLC) Correct the PLC program
H40	Permanent CAN bus error (BUS_OFF), i.e. no external power supply or cable is not connected
H41	Number of transmission errors overstep limit value (ERROR_PASSIVE)
H42	Overflow on data reception
H43	Overflow on transmission
H44	Master failed
H45	Nominal value not within value range (only PDO transfer)
H46	Invalid Node ID set
H47	No CAN interface card installed



# Additional functions

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## Operating modes

The OptiTronic control unit differs between two operating modes, **manual** and **remote**.

### Manual operating mode

In the manual operating mode, all operation functions are released by the operating panel.

dig. Input remote / manual = low - **manual** operating mode

For technical safety reasons, the OptiTronic control unit should only be released after fulfilling all the required safety conditions. The release is activated by the system ON/OFF digital input.

dig. Input system ON/OFF = high - system release OptiTronic

The control unit is ready for coating operation if:

dig. Input system ON/OFF = high - (LED System green) **and** control unit chosen (LED OptiTronic green) **and** trigger gun activated

### Remote operating mode

If the control unit runs in the remote operating mode, this is indicated by the **green Remote LED**.

In the remote operating mode, only the following operating functions are possible by the operating panel:

- Shift nominal value display / actual value display
- Acknowledgement of error messages

dig. Input remote / manual = high - **remote** operating mode

For technical safety reasons, the OptiTronic control unit should only be released after fulfilling all the required safety conditions. The release is activated by the system ON/OFF digital input.

dig. Input system ON/OFF = high - system release OptiTronic

The control unit is ready for coating operation if:

dig. Input system ON/OFF = high - (LED System green / LED OptiTronic green) **and** trigger gun activated

Remote



## Remote operation

### System parameter P4

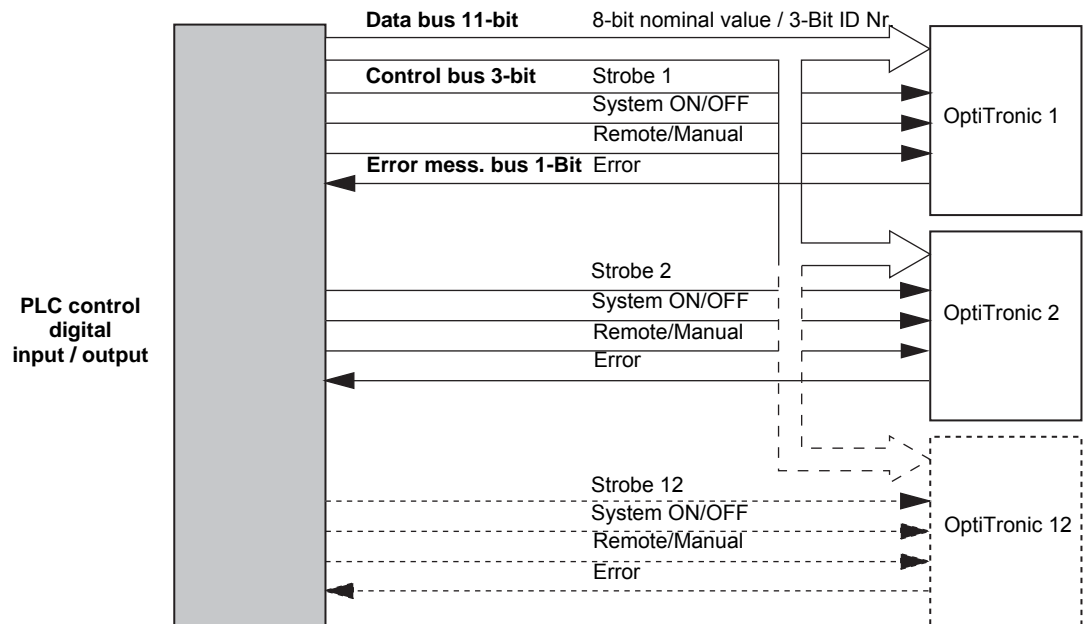
P4 = 0 - Setting for normal remote operation

P4 = 1 - Remote operation is used as key lock function

With the system parameter P4 = 1 it is communicated to the OptiTronic unit, that the logging-off key (main push button) condition is maintained by changing the operation mode from **Manual** to **Remote**. Selected or deselected control units are also maintained in their previous condition by changing from manual to remote mode.

## DigitalBus parallel interface

The gun control unit is connected to a superordinated control by Digital-Bus. The DigitalBus has a 16-bit parallel interface. The interface consists of 14 digital inputs and 1 digital output. The digital inputs are divided into a data bus, consisting of 11 bits and a control bus, consisting of 3 bits. The digital output is an error message bit.



DigitalBus parallel interface

### Data bus

The data bus width is 11 bits. The first 8 bits are used to transfer the data for the different operating parameters (nominal values) to the control unit. The data for the corresponding desired values (powder output, total air, electrode rinsing air, high voltage limiting value, current limiting value, program number) are assigned with an identification number consisting of 3 bits.

## Data transmission byte (bit 1-8)

Binary values	Designation	Value range	Resolution
	PA [%]	0-100	1
	Air 1 [m <sup>3</sup> /h] #	0-8	0,1
	GL [m <sup>3</sup> /h]	1.8 to 8	0,1
	Air 2 [m <sup>3</sup> /h] #	0-8	0,1
	EL, [m <sup>3</sup> /h]	0-2.8	0,1
	SWA* [m <sup>3</sup> /h]	0-6.4	0,1
	HV_BG [kV]	0 / 10-100	1
	I_BG [μA]	0-100	1
	Program Nr. PGN	1-255	1
	Daily correction powder output [%]	50-150	1
* not used	# if P7 = 2		

## Data identification (Bit 9-11)

Identification number 3 bits (binary code)	Allocation	Allocation if P7=2
0	PA [%]	Air 1 [m <sup>3</sup> /h]
1	GL [m <sup>3</sup> /h]	Air 2 [m <sup>3</sup> /h]
2	EL [m <sup>3</sup> /h]	EL [m <sup>3</sup> /h]
3	SWA* [m <sup>3</sup> /h]	SWA* [m <sup>3</sup> /h]
4	HV_BG [kV]	HV_BG [kV]
5	I_BG [μA]	I_BG [μA]
6	Program Nr. PGN	Program Nr. PGN
7	Daily correction powder output [%]	Daily correction powder output [%]
* not used		

## Control bus

The control bus consists of 3 bits:

- Strobe                                      Activate data transfer
- System ON/OFF                            OptiTronic system release
- Remote/manual                            Operating mode

## Digital output composite error message

The composite error message **Error** shows all errors, which are present in the control unit.

Dig. Output

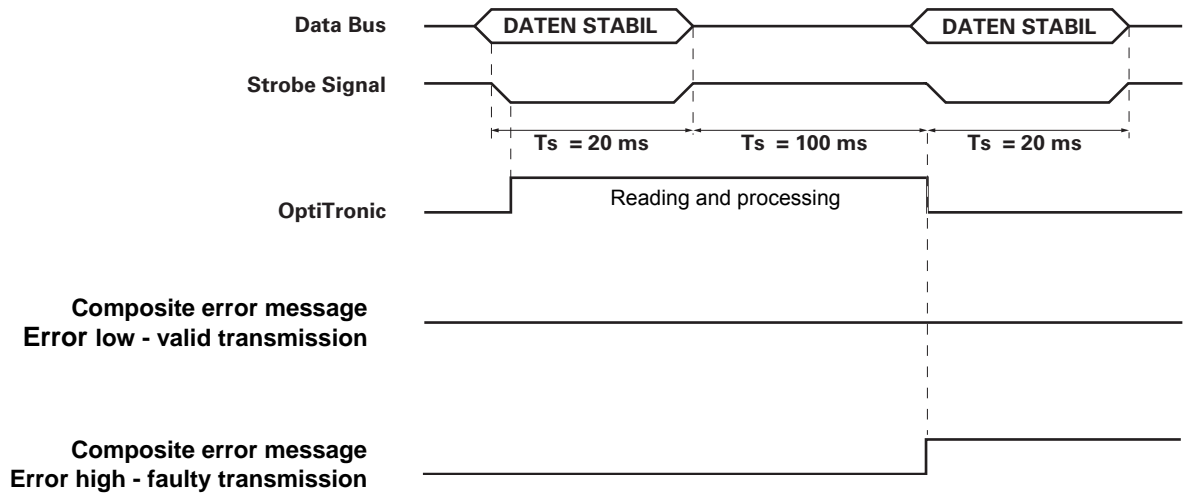
Error = high

Composite error  
Control unit

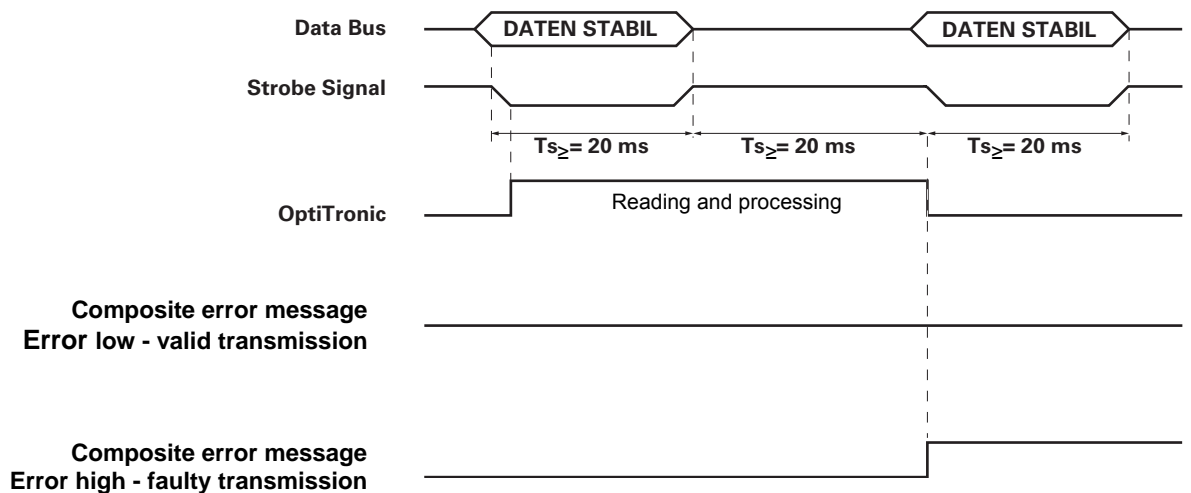
## Bus control

The data transmission from a superordinated control (PLC) to the gun control unit is done by the Data bus (11 bit) and the Control bus (3 bit). All the desired values can be transmitted with the first 8 bits (bit 1-8) of the data bus in binary code (value range 0-255). The identification number is transmitted in binary code (value range 0-7) with the last 3 bits (bit 9-11) of the data bus. The data reception from the Data Bus is initiated by a negative flank of the Strobe control signal.

### Control sequence for shifting the program number (identification number 6)



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

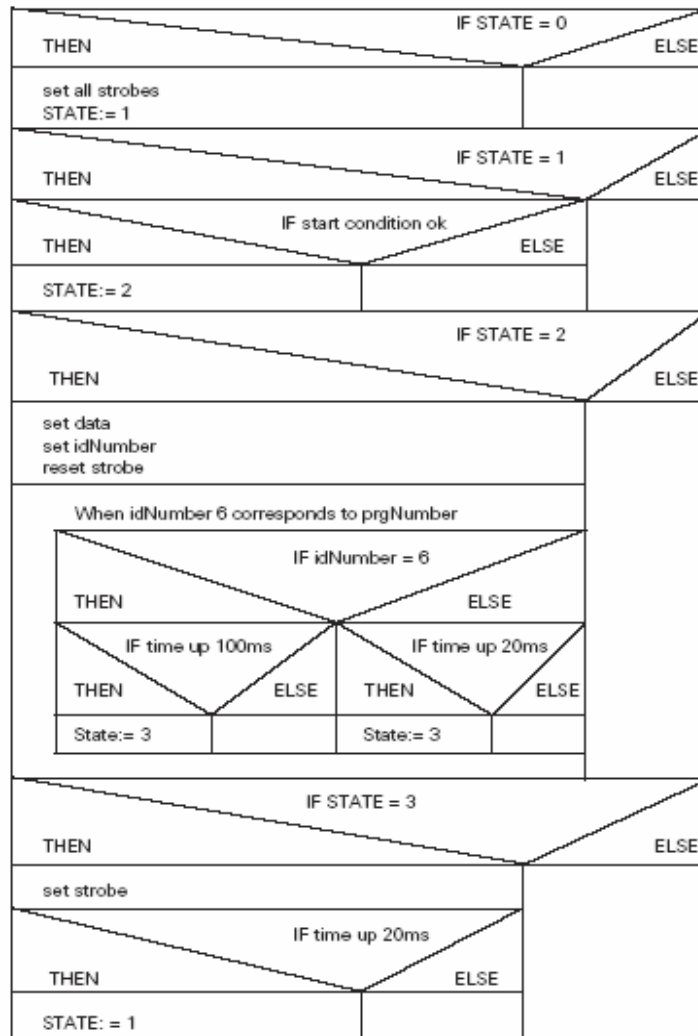


# Software

## Software description

There is one strobe signal and one error signal per gun. The data signals and identification number signals are parallel. If the same data is sent to the guns simultaneously, the strobe signal for the corresponding guns can also be deleted simultaneously and reset again.

BEGIN



END



# Guide values - application

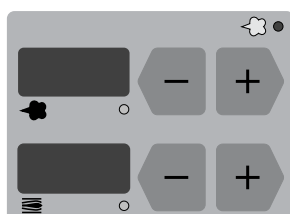
## General information



All values in these tables are guide values. Different ambient conditions, wear and different powder types can alter the values in the tables.

## General conditions for OptiFlow / EasyFlow / PI 3 injectors

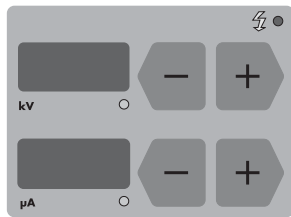
Powder type	Epoxy/polyester	
Powder hose length	[m]	10
Powder hose Ø	[mm]	11
Input pressure	[bar]	5,0
Conveying air nozzle Ø - OptiFlow / EasyFlow / PI 3	[mm]	1,6
Supplementary air nozzle Ø - OptiFlow / EasyFlow / PI 3	[mm]	1,4

## Guide values for OptiFlow / EasyFlow / PI 3 injectors



Total air 		4 Nm <sup>3</sup> /h	5 Nm <sup>3</sup> /h	6 Nm <sup>3</sup> /h
		Powder output [g/min]		
Powder output  [%]	10	30	35	45
	20	60	75	90
	30	85	100	120
	40	110	130	150
	50	130	160	175
	60	150	180	210
	70	175	200	235
	80	200	240	270
	90	215	260	
	100	235	290	

## Spraying current limitation guide values



Spraying current limitation enables:

- Greater stability the coating process
- Constant current values, because only the high voltage varies
- Greater reproducibility of coating results

The spraying current is displayed in the **µA** window and can be adjusted with the **+** or **-** keys (setting range 0-100 µA).

High voltage	with SuperCorona	without SuperCorona
100 kV	<i>Flat parts:</i> 50 µA (± 20)	<i>Flat parts:</i> 15 µA (± 10)
100 kV	<i>Profiles:</i> 60 µA (± 10)	<i>Profiles:</i> 25 µA (± 5)
100 kV	<i>Repairs:</i> 20 µA (± 10)	<i>Repairs:</i> 5 µA (± 5)



# Manual coating with EasySelect

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## Remote control by gun

Various functions are remotely controlled with the + and - keys on the rear side of the gun.

### Select the application settings - programs 1 to 3

Press the + and - keys on the gun simultaneously

- Press 1x - program 1 - LED red
- Press 2x - program 2 - LED green
- Press 3x - program 3 - LED red/green flashing (ca. 1 Hz)

On OptiTronic control unit:

- Program number (4-255) - LED red/green flashing (ca. 2 Hz)

All settings can be checked by observing the LED display on the gun.

### Change the powder output

Press the + or - key on the gun. The powder output will be correspondingly increased or decreased.

The powder output is checked visually with the powder cloud.

### Locking the remote control

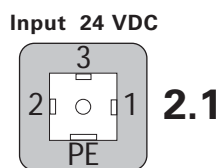
The remote control can be locked for the following reasons:

- Local operation takes place
- OptiTronic control unit remote operation (the red and the green LED illuminates)
- Error, displayed on error message display



# Pin allocations

## Mains cable socket 2.1



Pin	Function
1	GND 24 VDC (power supply)
2	+24 VDC (power supply)
3	System ON/OFF (gun release)
PE	Ground PE

## Socket 2.2 - Gun 2 (EasySelect / OptiGun 1 powder gun plug)

Pin	Function
1	+15 VDC Gun electronics supply
2	Oscillator control 0-10 VDC
3	GND / Trigger connection 1
4	Trigger connection 2
5	Remote control
6	Ground PE
Housing	Shield

## Socket 2.3 - Gun 1 (GA02 OptiGun 2 / PG 1 / PG 1-A / PG 2-A powder gun plug)

Pin	Function
1	GND Oscillator signal
2	-----
3	Trigger connection 1
4	Trigger connection 2
5	Tribo electrode
6	Oscillator signal
7	Ground PE

## Option DigitalBus - 19 pin socket Aux - 2.4

Pin	Bit	Function (binary value)	
A	1 IN - D0	Nominal values, Progr. no.	Binary value $2^0$ (=1)
B	2 IN - D1	Nominal values, Progr. no.	Binary value $2^1$ (=2)
C	3 IN - D2	Nominal values, Progr. no.	Binary value $2^2$ (=4)
D	4 IN - D3	Nominal values, Progr. no.	Binary value $2^3$ (=8)
E	5 IN - D4	Nominal values, Progr. no.	Bin. value $2^4$ (=16)
F	6 IN - D5	Nominal values, Progr. no.	Bin. value $2^5$ (=32)
G	7 IN - D6	Nominal values, Progr. no.	Bin. value $2^6$ (=64)
H	8 IN - D7	Nominal values, Progr. no.	Bin. value $2^7$ (=128)
J	9 IN - A0	Identification number	Bin. value $2^0$ (=1)
K	10 IN - A1	Identification number	Bin. value $2^1$ (=2)
L	11 IN - A2	Identification number	Bin. value $2^2$ (=4)
M	12 IN	System ON/OFF (gun release)	
N	13 IN		
O	14 IN	Remote/manual	
P	15 IN	Reserve - IN	
R	16 IN	GND external	
S	1 OUT	Composite error message (signal: Error)	
T			
U		24 VDC external	
Housing		Shield	

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## Option SystemLock - 5 pin socket Aux - 2.4

Pin	Function
1	GND external
2	24 VDC external
3	System ON/OFF (gun release)
4	SystemLock (keyboard release ON/OFF
	System parameter P4 = 1 (signal: Remote / Manual)
5	Composite error message (signal: Error)
Housing	Shield

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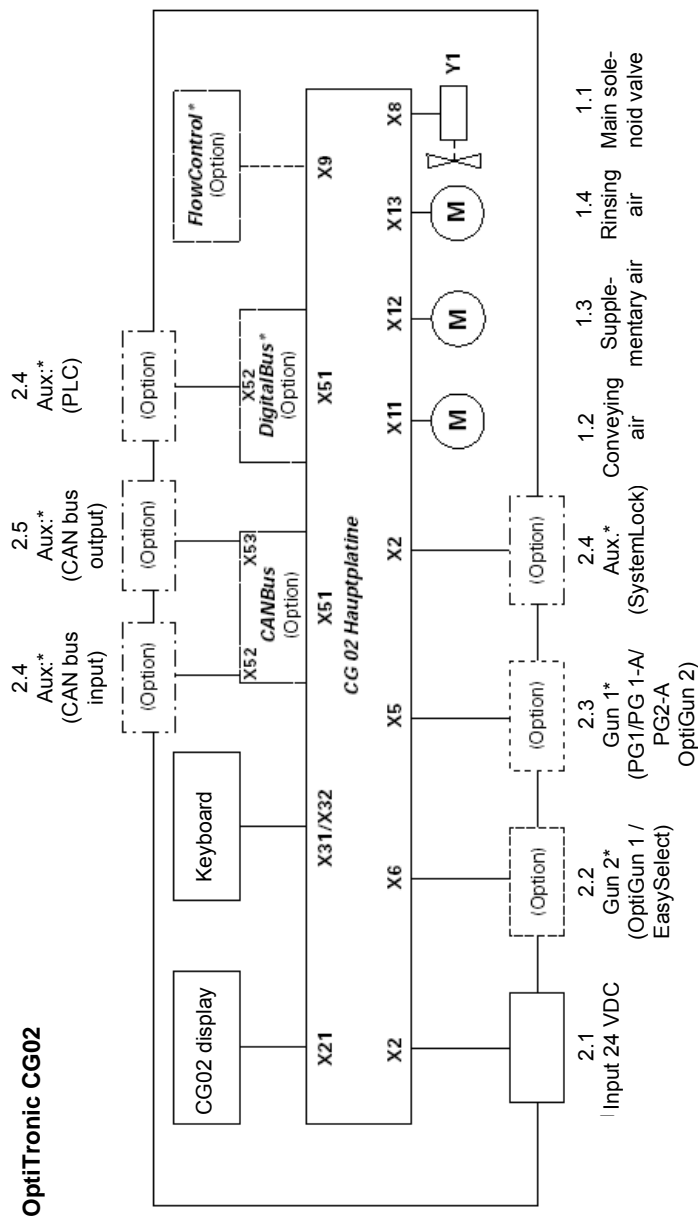
## Option CAN bus - 4 pin socket Aux - 2.4 (input) and Aux - 2.5 (output)

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



# Electrical diagrams

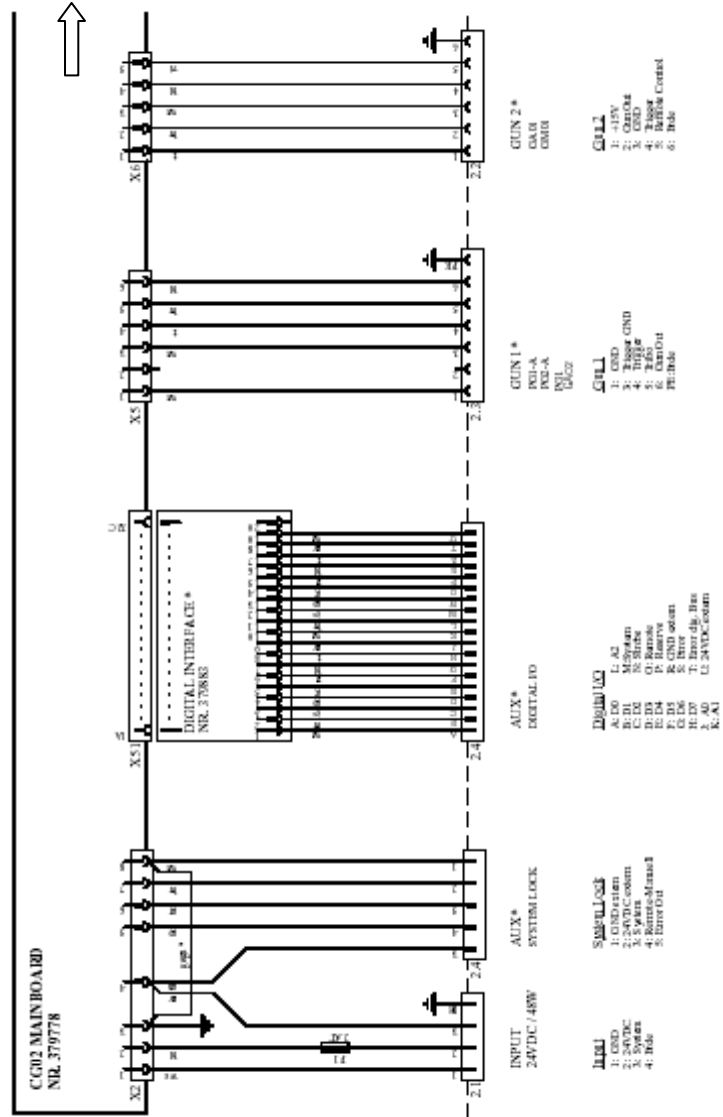
## OptiTronic control unit - block diagram



OptiTronic control unit - block diagram

# OptiTronic control unit - internal connections

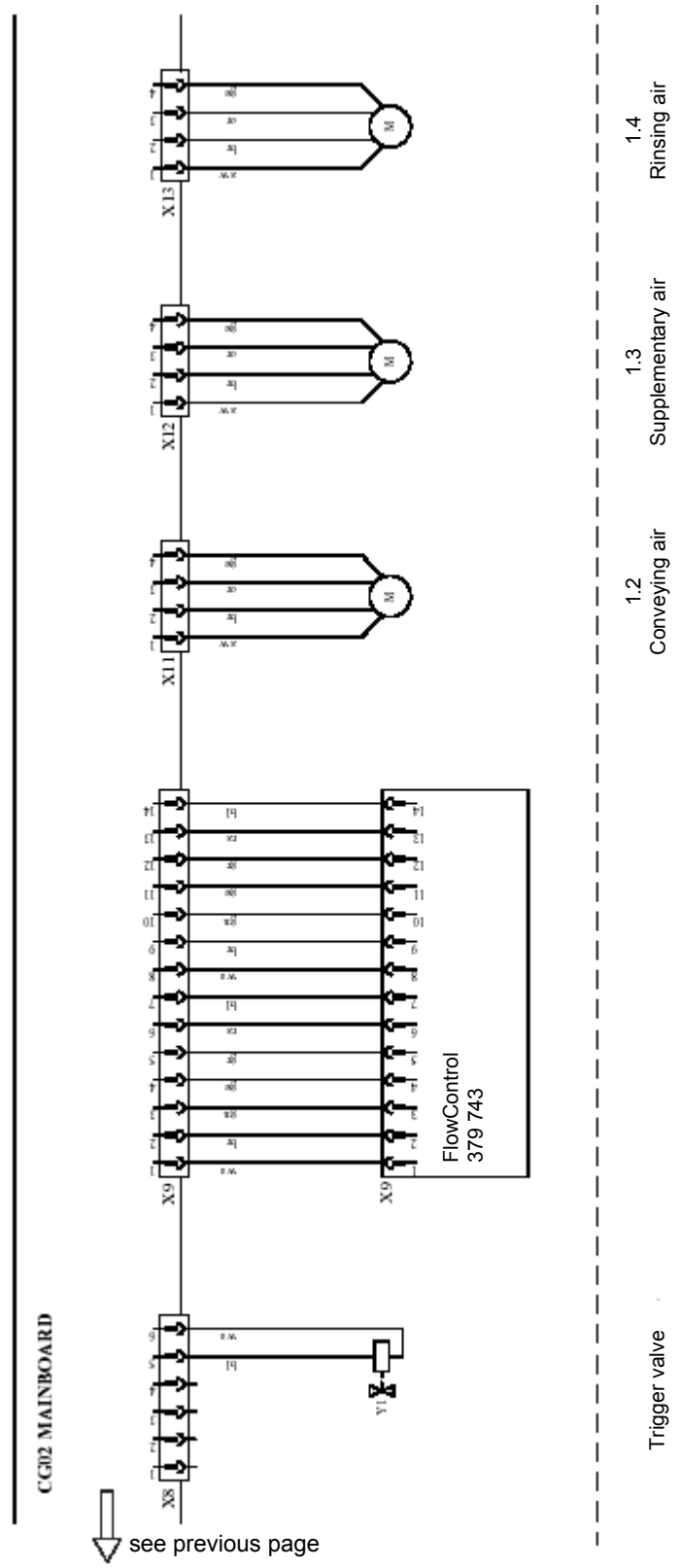
see next page



OptiTronic control unit - internal connections

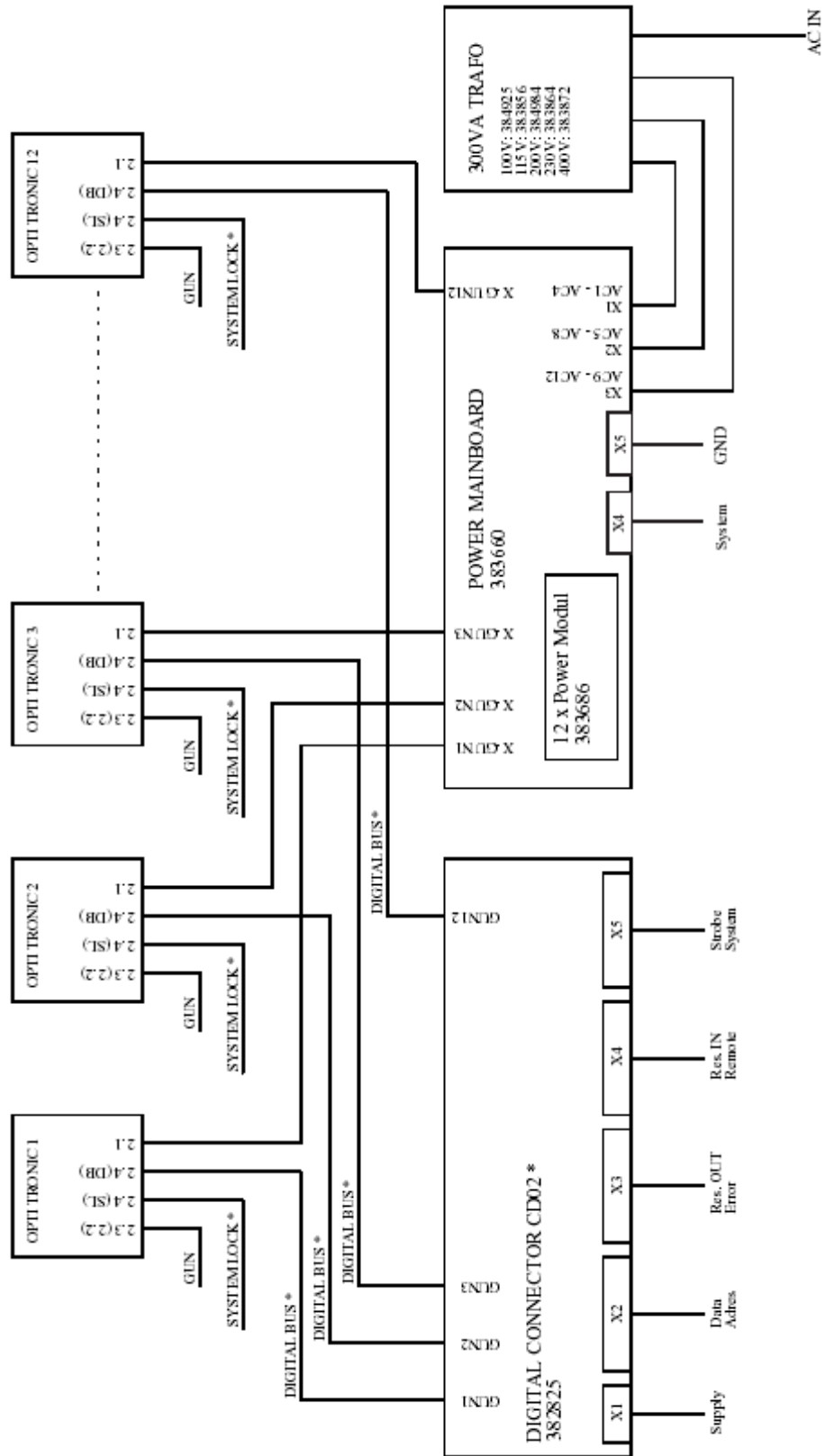


# OptiTronic control unit - internal connections



OptiTronic control unit - internal connections

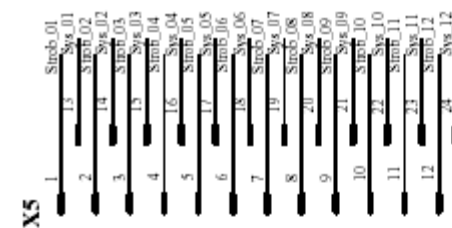
# OptiTronic system - block diagram



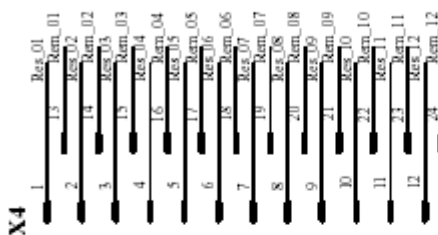
\* OPTION

OptiTronic system - block diagram

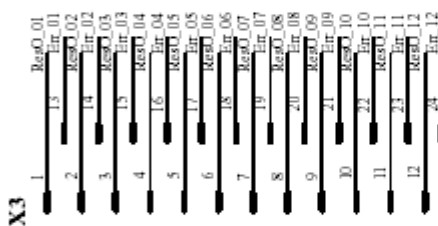
# CD02 Digital Connector - plugs X1-X5



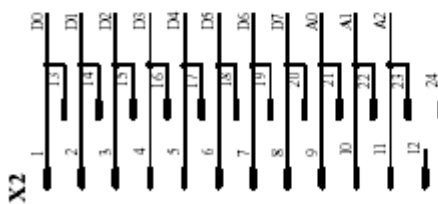
Guns 1-12  
System ON/OFF  
Strobe



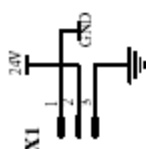
Guns 1-12  
Remote / manual



Guns 1-12  
Composite error messages



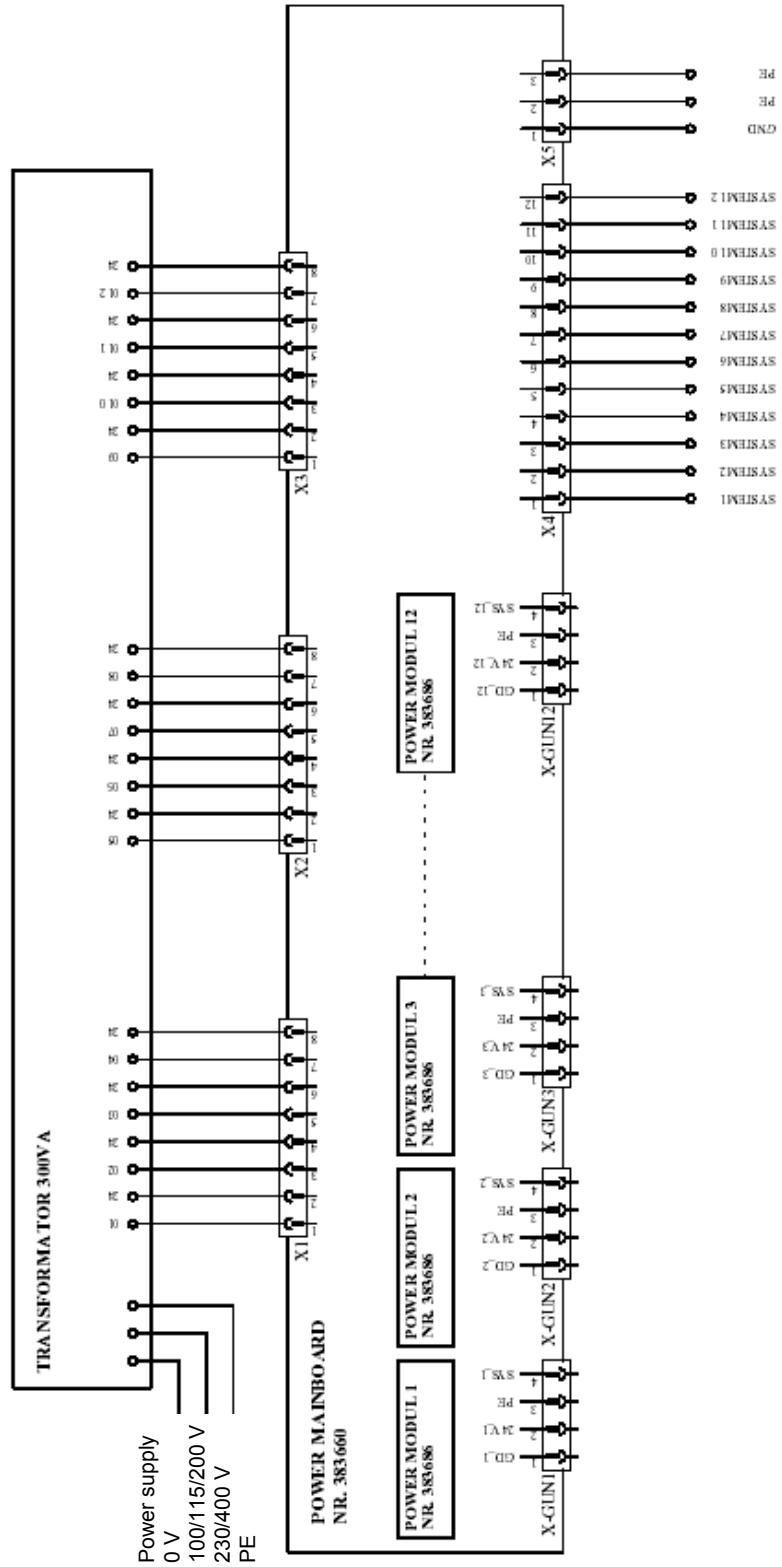
Data bus 11 bit  
8 bit nominal values  
3 bit ID no.



External power supply  
24 VDC  
for each digital  
input/output

CD02 Digital Connector - plugs X1-X5

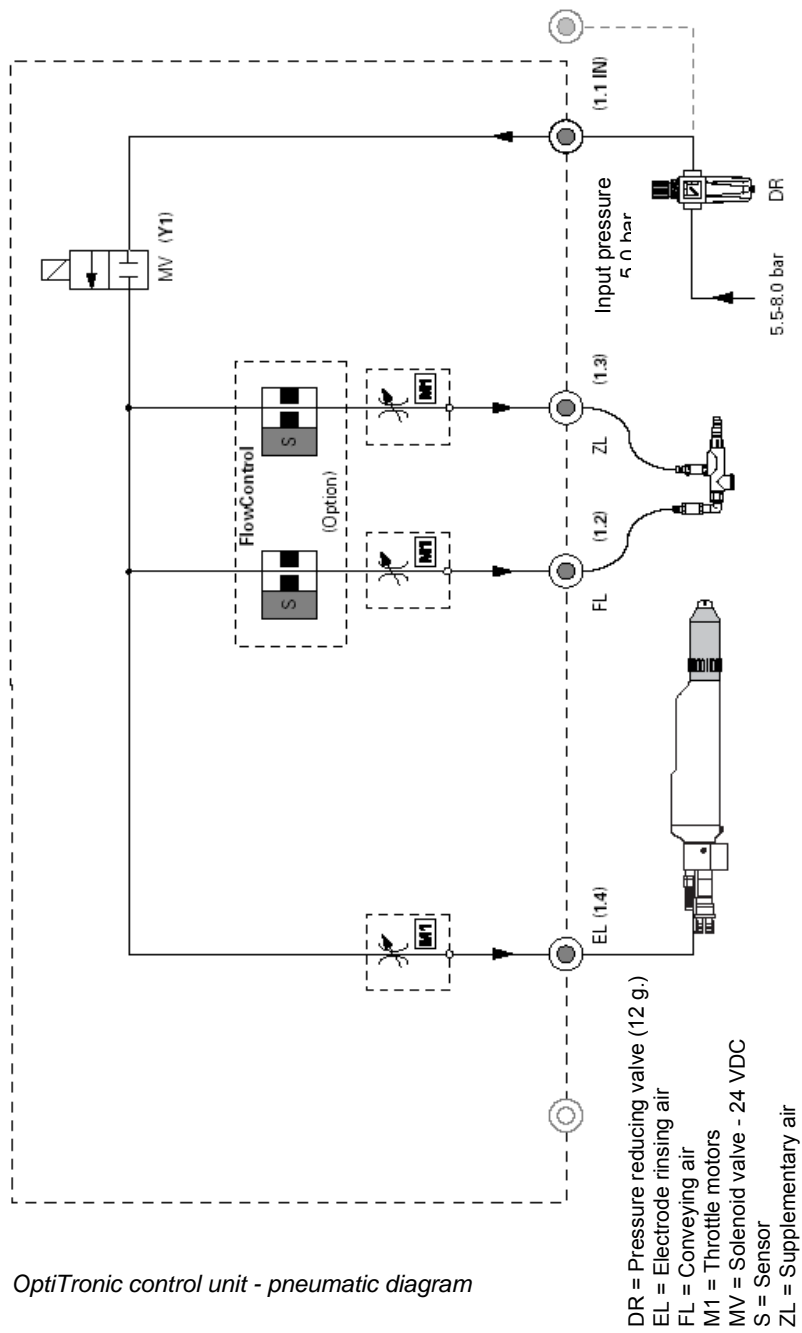
# OptiTronic control unit - block diagram "Power main board"



OptiTronic control unit - block diagram "Power main board"

# Pneumatic diagram

## OptiTronic control unit





# Spare parts list

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## 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** OptiTronic CG02 Powder gun 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)



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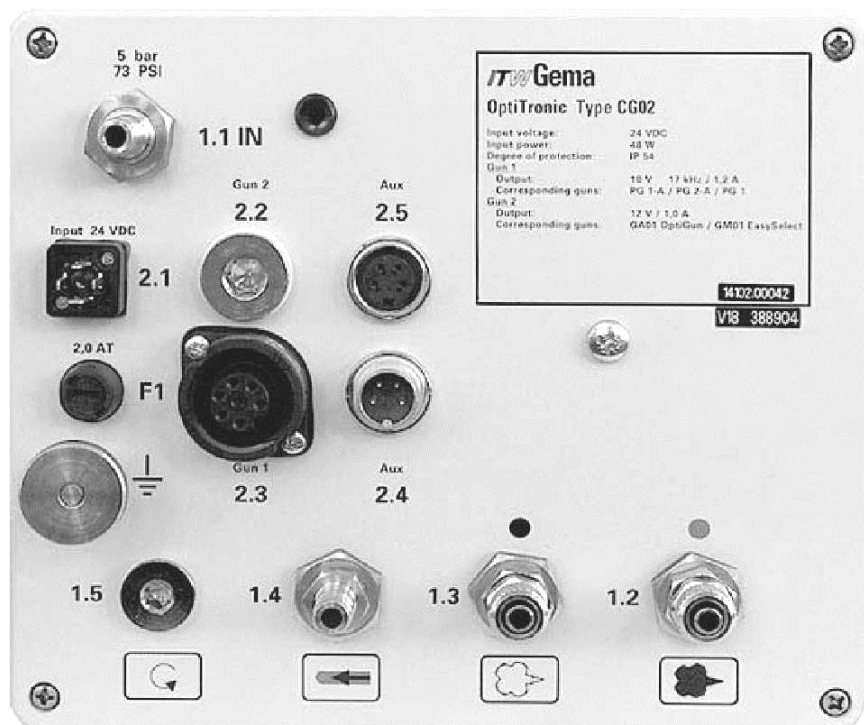
**WARNING!**

**Only original Gema spare parts should be used, because the explosion protection will also be preserved that way. The use of spare parts from other manufacturers will invalidate the Gema guarantee conditions!**

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## OptiTronic control unit

Version 5 - GA or GM guns, SystemLock	384 569
Version 6 - PG guns, SystemLock	384 577
Version 7 - GA or GM guns, DigitalBus	384 585
Version 8 - PG guns, DigitalBus	384 593
Version 11 - GA or GM guns, FlowControl, DigitalBus	384 623
Version 12 - PG guns, FlowControl, DigitalBus	384 631
Version 15 - GA or GM guns, CAN bus	388 874
Version 16 - PG guns, CAN bus	388 882
Version 17 - GA or GM guns, FlowControl, CAN bus	388 890
Version 18 - PG guns, FlowControl, CAN bus	388 904



*Example:*

*CG02 Powder gun control unit, version 18 - rear side with connections (see also "OptiTronic version table" and "Retrofit parts table")*

### Abbreviations:

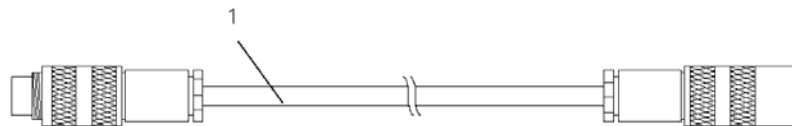
**G1** = Gun 1 = OptiGun 2 GA02 / PG 1 / PG 1-A / PG 2-A

**G2** = Gun 2 = OptiGun 1 GA01 / EasySelect GM01

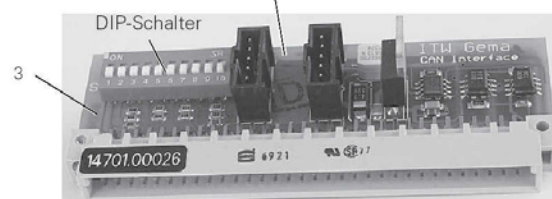
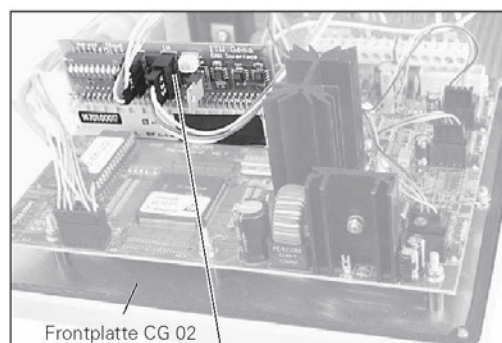


## OptiTronic control unit - optional extension

FlowControl - complete	379 743
Internal connecting cable - SystemLock	379 891
External connecting cable - SystemLock	
L=3,5 m - complete	387 070
L=4,5 m - complete	386 189
L=5,5 m - complete	386 197
DigitalBus interface	379 883
Connecting cable (DigitalBus)	379 816
Connecting cable (PG guns - gun 1)	384 933
Connecting cable (GA or GM guns - gun 2)	379 840



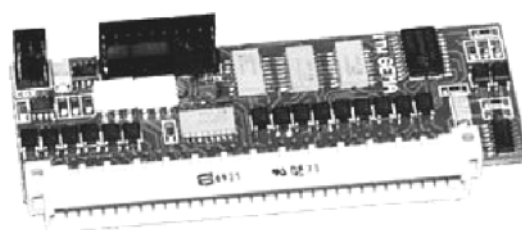
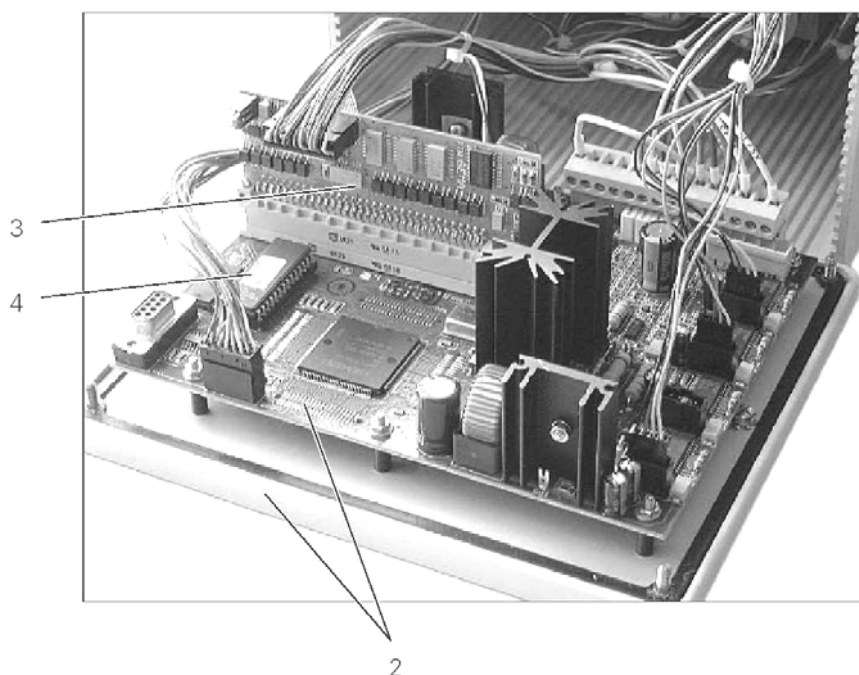
1	CAN bus cable- 4 pin, complete, L=0,5 m	1002 655
	L=2,5 m	1005 428
	L=4,5 m	387 592
	L=5,5 m	388 521
	L=6,5 m	388 530
	L=10 m	1003 409
	L=20 m	389 560
	Terminal resistor (not shown)	387 606
3	CAN bus interface	386 227



Detail - CAN bus (option), complete

## OptiTronic control unit - complete

2	Front plate - complete (without pos. 3)	379 794
3	DigitalBus (option)	379 883
4	EPROM 27C256-70 - software version 1.03* (for control units with serial number 14101.xxxxx)	380 873
	EPROM 27C512-70 - Software-Version 2.xx* (for control units with serial number 14102.xxxxx)	387 037

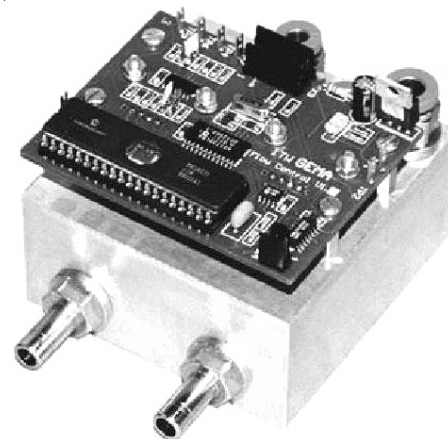
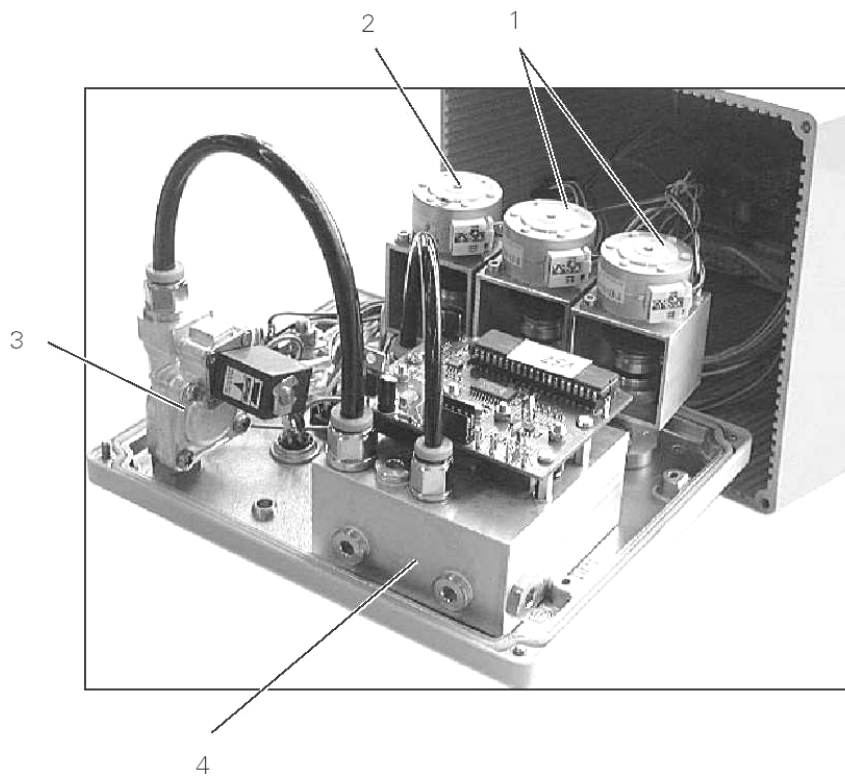


*Detail - DigitalBus (option), complete*

\* Different memory modules are installed for the different print versions. In order to avoid ordering mistakes, please check that the order number is correct before ordering.

## Pneumatics

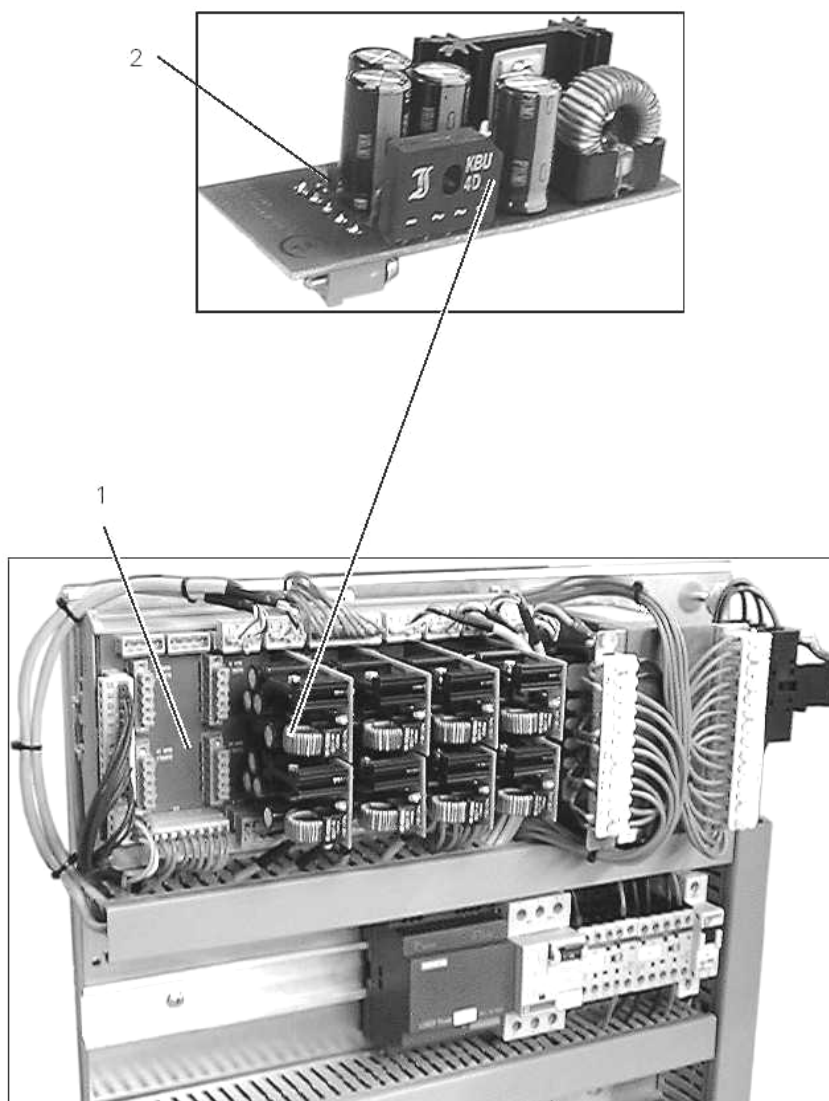
1	Throttle motor - FL or ZL	380 555
2	Throttle motor - EL	380 563
3	Main solenoid valve - 24 VDC, complete	262 455
4	FlowControl - complete (option)	379 743
	Fuse - 2 AT	221 872



*Detail - FlowControl (option) - complete*

## Power pack "Power main board"

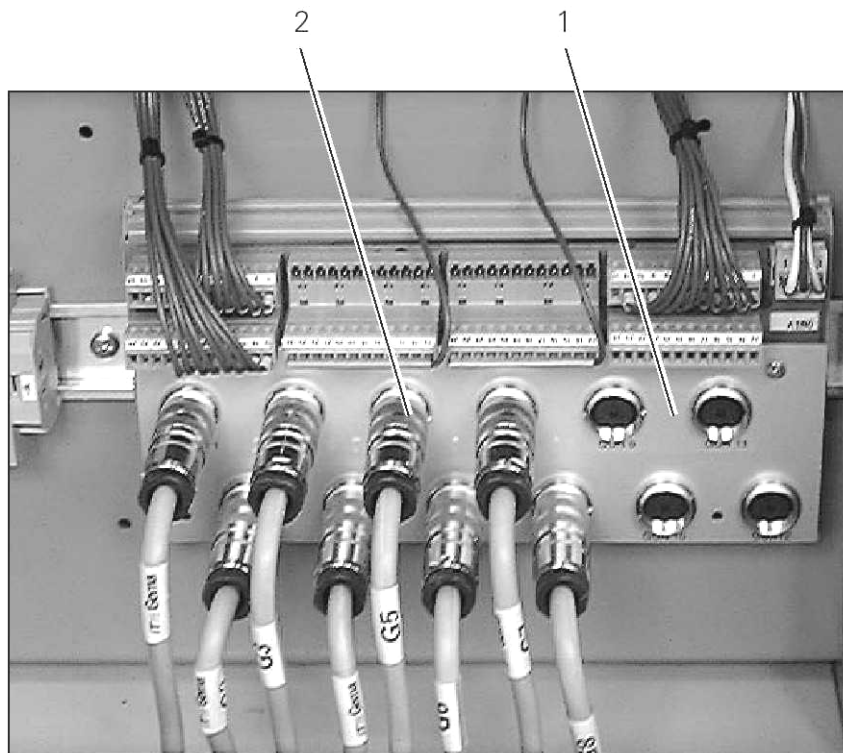
1	Power pack "Power Main Board" - for 12 guns	383 660
2	Power board "Power module" - 1 for each gun	383 686
	Transformer 300 VA (prim. 100 V) - for 12 guns	384 925
	Transformer 300 VA (prim. 115 V) - for 12 guns	383 856
	Transformer 300 VA (prim. 200 V) - for 12 guns	384 984
	Transformer 300 VA (prim. 230 V) - for 12 guns	383 864
	Transformer 300 VA (prim. 400 V) - for 12 guns	383 872
	CG02 power supply cable - L=5 m	381 756
	CG02 power supply cable - L=20 m	382 000



Power pack "Power main board"

## CD02 DigitalConnector

1	DigitalConnector CD02 - for 12 guns	382 825
2	Connecting cable 19 pin - L=1,5 m	1001 500
	Connecting cable 19 pin - L=3,5 m	1000 933
	Connecting cable 19 pin - L=4,5 m	1000 934
	Connecting cable 19 pin - L=5,5 m	1000 935
	Connecting cable 19 pin - L=6,5 m	1000 936



*CD02 DigitalConnector*