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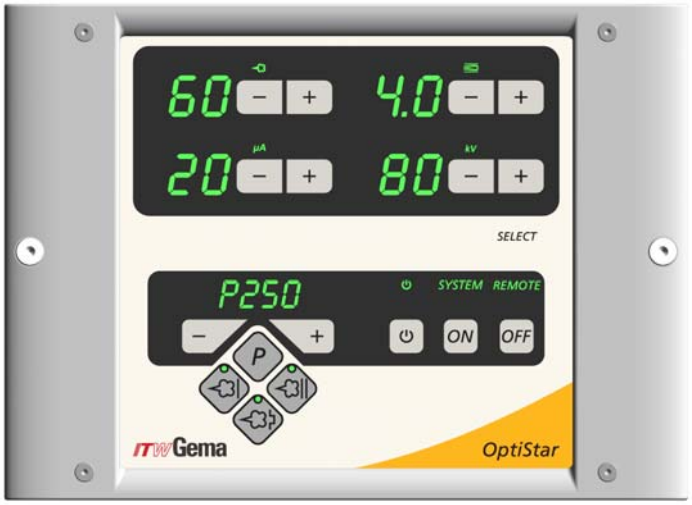
Operating instructions and spare parts list

OptiStar CG06
Automatic gun control unit

ITW Gema



Order no. 1004 067

Documentation OptiStar CG06 Automatic 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 OptiStar CG06 Automatic gun control unit.

These safety regulations must be read and understood before the OptiStar CG06 Automatic gun control unit is used.

Safety symbols (pictograms)

The following warnings with their meanings can be found in the ITW 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 OptiStar CG06 Automatic 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 OptiStar CG06 Automatic gun control unit is to be used for other purposes or other substances outside of our guidelines then ITW Gema AG should be consulted.
3. Observance of the operating, service and maintenance instructions specified by the manufacturer is also part of conformity of

use. The OptiStar CG06 Automatic 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 OptiStar CG06 Automatic gun control unit has been set up and wired according to the guidelines for machinery (98/37 EG). EN 60204-1 (machine safety) must also be observed.
5. Unauthorized modifications to OptiStar CG06 Automatic gun 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) 3 D	IP6x ◀ FM ▶ IP54	T6 (zone 21) T4 (zone 22)

Technical safety regulations for stationary electrostatic powder spraying equipment

General information

The powder spraying equipment from ITW 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 ITW-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 ITW-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. ITW-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 units for the spray guns must only be set up and used in zone 22. The spray guns are permitted in the zone 21 created by them.

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 ITW-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 ITW-Gema workshops. Unauthorized conversions and modifications may lead to injury or damage to machinery. The ITW Gema AG 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 ITW-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	Prevention principles
BGV A3	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)] - Part 1 General requirements - 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 12100-1 EN 12100-2	Machine safety [2)]
EN IEC 60079-0	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)]
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

About this manual

General information

This operating manual contains all the important information which you require for the working with the OptiStar CG06 Automatic 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 - reciprocators, booths, powder gun controls, powder guns etc. - should be referenced to their corresponding documents.

Software version

This document describes the operation of the OptiStar CG06 Gun control unit, with software version starting from 1.05!

Function description

Field of application

The OptiStar CG06 Automatic gun control unit is designed exclusively for controlling the ITW Gema powder coating guns (see also in chapter "Technical Data").

Any other use, beyond the above mentioned is considered non-conforming. The manufacturer is not responsible for any damage resulting from this, the risk for this is assumed by the user alone!

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.

OptiStar CG06 Automatic gun control unit

Typical characteristics

- The OptiStar CG06 Automatic gun control unit is used for automatic electrostatic powder coating equipment.
- The OptiStar CG06 Automatic gun control unit allows the configuration of process parameters (air settings, high voltage settings), system parameters, process data, status information and the powder hose correction values. All air volumes can be controlled centrally by the unit.
- The handling is simple and self-explanatory. The coating personnel can save individual settings, based off personnel experience, in 250 different programs.
- All settings for efficient powder coating are simple to operate and repeatable. The control unit electronics permit the exact amount of powder delivery and the adjusted values can be read on the digital displays.
- Optional bus connections by CAN bus and DigitalBus allow a simple, superordinate control.
- A shaping air option is available, in combination with a flow control for all four air types.
- The OptiStar CG06 unit can be connected to all mains voltages between 100-240VAC, 50-60 Hz, single phase.

Basic functions

- Intuitive operation
- Setting and display of the values on two levels
- Saving/recalling of process parameters in the form of programs
- Remote control option on the manual powder gun (OptiSelect GM02 only)

Additional functions

- Spray current regulation with high voltage limitation
- Control of the air volumes
- Status indications and error diagnosis
- Several input air pressures are definable with parameterization
- Flow control for total air (conveying air plus supplementary air), electrode rinsing air and shaping air (optional)
- Bus connections by CAN bus or DigitalBus (optional)

OptiStar CG06 functions - overview

Setting possibilities

- Setting possibilities for powder rate, total air, spray current, high voltage, electrode rinsing air and shaping air (option)

Correction values

- Correction values for powder offset, powder hose correction value and daily correction value

Request values

- Request values for software version and trigger hours counter

Features

- Keyboard lock, Preset mode, 250 programs, error display and remote control on manual gun (OptiSelect GM02)

Options

- Flow control and shaping air, CAN bus and DigitalBus

Operating modes

The OptiStar CG06 Automatic gun control unit can be operated with two operating modes. According to the selected application mode, spray voltage and spray current are automatically adjusted and limited.

Predefined operating mode (Preset mode)

The OptiStar CG06 Automatic gun control unit provides three predefined application modes (flat parts, complicated parts and recoat parts already painted one time).

In this operating mode, current (**µA**) and high voltage (**kV**) are preset, powder and air volume can be adjusted and saved.

The remaining preset values are not changed by transition to the predefined operating mode, they can be configured furthermore and will be saved in memory.

User-defined operating mode (Program mode)

In this operating mode, 250 individually definable programs (P001-P250) are available. These programs are automatically saved and can be recalled again as the application requires.

The values for current, high voltage, powder output, total air, electrode rinsing air and fluidizing air (if available) can be set as needed for a given application.

Note:
The specified settings in the 250 programs and 3 application modes are saved automatically, without confirmation, after a two second delay and the display changes from preset values to actual values!

Technical Data

OptiStar CG06 Gun control unit

OptiStar CG06 - versions

OptiStar	CAN bus	DigitalBus	FlowControl	Shaping air
CG06				
CG06C	yes			
CG06CF	yes		yes	yes
CG06D		yes		
CG06DF		yes	yes	yes

The equipment designation is indicated on the rear side of the equipment.

Connectable guns

OptiStar CG06 Gun control unit	connectable
OptiSelect GM02 ◀ FM ▶	yes
OptiGun GA02 ◀ FM ▶	yes
PG1 / PG2-A / PG2-AX	yes (no remote control on gun)
PG3-E**	yes
TriboJet* (adapter required)	yes
EasySelect GM01	no

* The gun type must be adjusted (reference chapter "Additional functions")! The Tribo gun is not type approved (ATEX).

** Only for enamel powder, the gun is not type approved (ATEX).

Attention:
The OptiStar CG06 Automatic gun control unit can only be used with the specified gun types!

Electrical data

OptiStar CG06 Gun control unit	
Mains input voltage	100-240 VAC
Operating frequency	50-60 Hz
Input power	40 VA
Nominal output voltage (to the gun)	max. 12 V
Nominal output current (to the gun)	max. 1 A
Protection type	IP6x ◀ FM ▶ IP54
Ambient temperature range	0°C - +40°C (+32°F - +104°F)
Max. operating temperature	85°C (+185°F)
Approvals	CE Ex II (2) 3 D PTB05 ATEX 5009

Pneumatical data

OptiStar CG06 Gun control unit	
Compressed air connection	1/4" male quick release
Input pressures (must be set in the software)	5,5 bar 6,0 bar 6,5 bar
Max. input pressure	10 bar / 145 psi
Min. input pressure (while unit in operation)	6 bar / 87 psi
Max. water vapor content of the compressed air	1.3 g/m³
Max. oil vapor content of the compressed air	0.1 mg/m³

Dimensions

OptiStar CG06 Gun control unit	
Width	248 mm
Depth	250 mm
Height	174 mm
Weight	approx. 5.2 kg

Air flow rates

The total air consists of conveying air and supplementary air, in relation to the selected powder quantity (in %). Hereby, the total air volume is maintained constant. For explanation, see the following examples with correction factor C0=1.8 and conveying air nozzle=1.4 mm.

This table refers to an input pressure of 5.5 bar (system parameter P2=0).

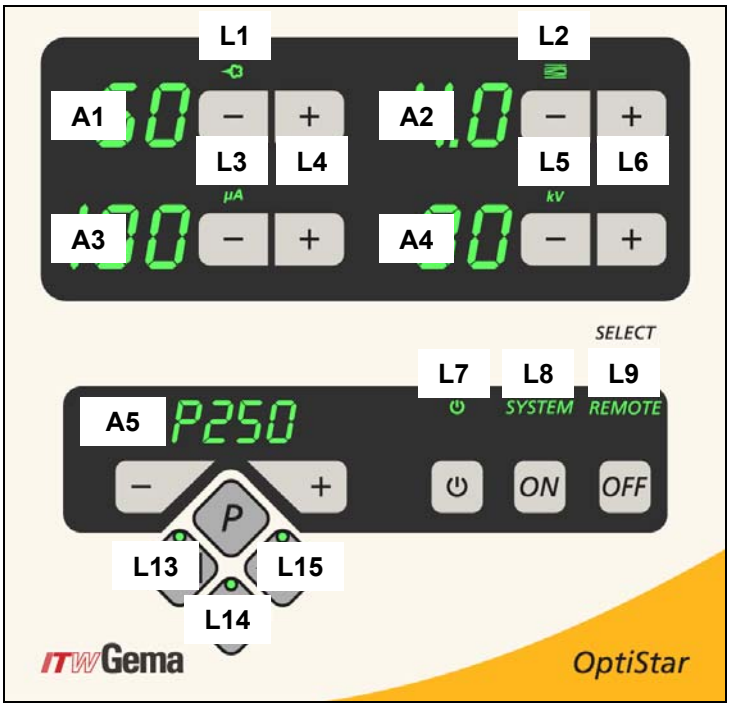
OptiStar CG06 Gun control unit			
Total air	**Powder quantity**	**Conveying air**	**Supplementary air**
6.5 Nm³/h	81 %	5.4 Nm³/h	1.1 Nm³/h
	40 %	3.7 Nm³/h	2.8 Nm³/h
	0 %	1.8 Nm³/h	4.7 Nm³/h
5.5 Nm³/h	100 %	5.5 Nm³/h	0 Nm³/h
	50 %	3.6 Nm³/h	1.9 Nm³/h
	0 %	1.8 Nm³/h	3.7 Nm³/h
4.0 Nm³/h	100 %	4.0 Nm³/h	0 Nm³/h
	50 %	2.8 Nm³/h	1.2 Nm³/h
	0 %	1.8 Nm³/h	2.2 Nm³/h

OptiStar CG06 Gun control unit	
Fluidizing air flow rate	0-5.0 Nm³/h
Electrode rinsing air flow rate	0-3.0 Nm³/h
Conveying air flow rate	0-5.4 Nm³/h
Supplementary air flow rate	0-4.5 Nm³/h

Note:
The total air consumption without FlowControl and shaping air amounts to max. 10.5 Nm³/h (with a parameterized input pressure of 6,5 bar)!
The total air consumption with FlowControl and shaping air amounts to max. 15.5 Nm³/h (with a parameterized input pressure of 6,5 bar)!

Operating and display elements

Display and LEDs

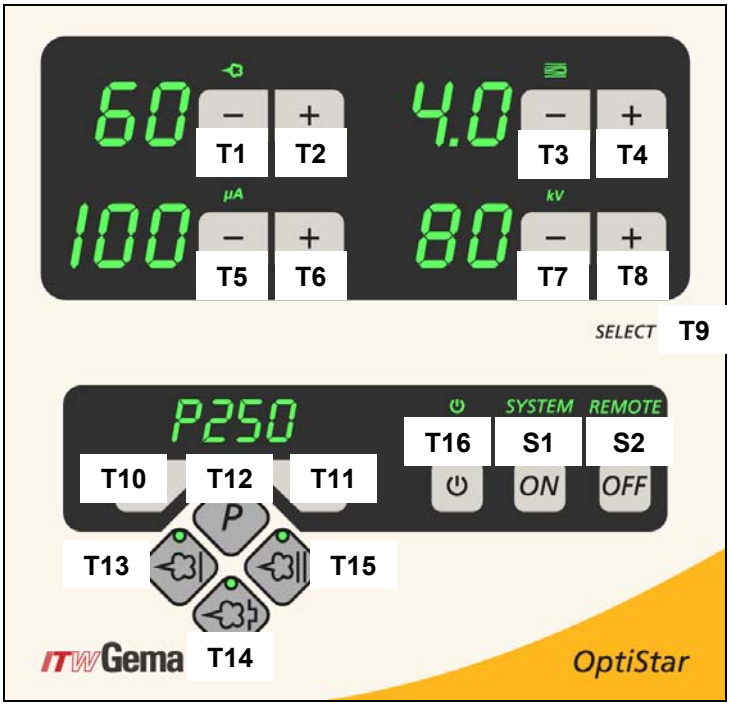


OptiStar CG06 Automatic gun control unit - display and LEDs

Designation	Function
A1-A4	Display of actual values, preset values and system parameters
A5	Display of program numbers, error diagnosis codes and status information
L1	Powder output (display in %)
L2	Total air volume (display in Nm³/h)
L3	Spraying current (display in µA)
L4	Shaping air (display in Nm³/h, if available)
L5	High voltage (display in kV)
L6	Electrode rinsing air (display in Nm³/h)
L7	Gun enable display
L8	External release signal (from superordinated control unit)

Designation	Function
L9	Remote PLC control
L13	Application mode for flat parts is activated
L14	Application mode for complicated parts is activated
L15	Application mode for recoating parts already coated is activated

Input keys and switches



OptiStar CG06 Automatic gun control unit - input keys and switches

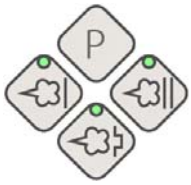
Designation	Function
T1-T8	Input keys for preset values and system parameters
T9 (Select)	Switch between display levels
T10-T11	Program change
T12 (P)	Program selection for user-defined programs (max. 250)
T13	Application mode for flat parts (fixed values)
T14	Application mode for complicated parts with depressions (fixed values)
T15	Application mode for overcoating parts already coated (fixed values)
T16	Switching the gun on and off (system input must be active) Switch to system parameter mode (press for at least 5 seconds)
S1/S2	Power switch On/Off

General information

Displaying the programs

The number of the adjusted program is shown on display **A5**. A **P=Program** is placed in front of the three digit program number as a reference.

Displaying the values



Displaying the actual values

The actual values are shown on the displays **A1-A4**. By operating the keys **T1-T8** and **T12-T15**, preset values display will be switched over.

Display of the preset values/setting values

The preset values are shown on the displays **A1-A4**. If no operation takes place during 3 seconds, the actual values displayed will be switched over.

Edit and save the preset values

The preset values can be adjusted in steps by ± 1 with the keys **T1-T8**. Modified preset values are saved automatically, after 2 seconds, in the current program.

Change between program and application mode

Pressing the keys **T10** and **T11** in one of the three predefined application modes (Preset mode), causes the unit to change to user-defined programs. These keys also allow the change of programs in the program mode.

The simultaneous operation of the **+** and **-** key on the back of the powder gun (OptiSelect gun) causes the control unit to rotate between the Preset mode and the Program mode.

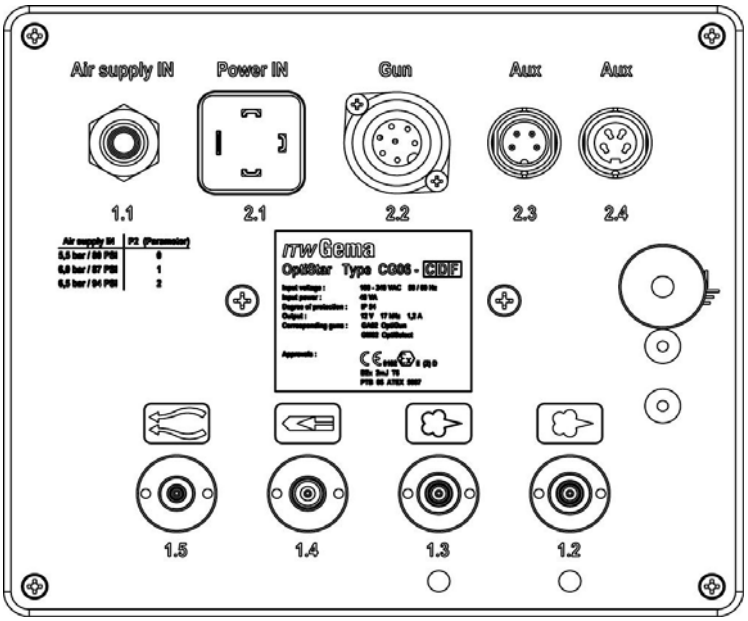
Viewing of preset values

To change from the actual value to the preset value display without changing a preset value at the same time, the corresponding keys must be lightly touched.

Example:
Lightly touching key **T1** indicates the preset values, pushing harder on this key, reduces the powder output. This behavior does not apply to the program select keys, where the program number is directly changed.

Start-up and operation

OptiStar CG06 connections



OptiStar CG06 Automatic gun control unit - connections on the rear wall

Connection	Description
1.1 Air Supply IN	Compressed air connection (6-10 bar / 87-145 PSI)
2.1 Power IN	Mains cable connection (100-240 VAC)
2.2 Gun	Gun cable connection
2.3 Aux	CAN bus connection (OUT)
2.4 Aux	CAN bus connection (IN)
2.4 Aux	DigitalBus connection (option)
1.5	Shaping air connection (option)
1.4	Electrode rinsing air connection
1.3	Supplementary air connection
1.2	Conveying air connection
	Grounding connection

2.3 and 2.4 Aux connections

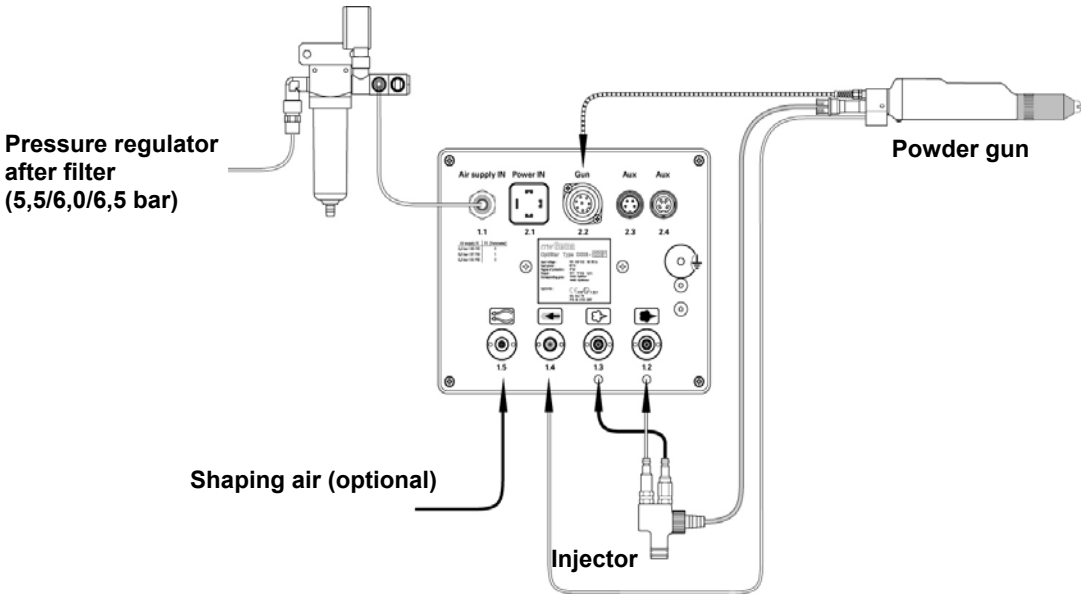
Equipment	Allocation 2.3	Allocation 2.4
CG06	closed	closed
CG06C(F)	CAN bus (OUT)	CAN bus (IN)
CG06D(F)	closed	DigitalBus

Connection guide

1. Connect the compressed air supply from the compressed air circuit to the **1.1 Air supply IN** (1/4" male quick release) connection on the control unit

Note:
The compressed air must be free from oil and water!

2. Connect the grounding cable to the control unit with the grounding screw, and the 5 m long grounding cable with the clamping clip to the booth or the conveyor. Check ground connections with Ohm meter and ensure 1 MOhm or less
3. Connect the gun cable plug to the socket **2.2** on the rear side of the control unit
4. Connect the rinsing air hose to the electrode rinsing air output **1.4** and to the powder gun
5. Insert the injector, connect the powder hose to the injector and to the powder gun
6. Connect the red hose for the conveying air to the corresponding output **1.2** on the rear of the control unit and to the injector
7. 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 (this hose is electrically conductive)
8. Connect the hose for shaping air (optional) to the corresponding output **1.5** on the rear side of the control unit
9. Connect the mains cable to the **2.1 Power IN** plug and screw it on



Connecting guide - overview

Power IN

CG06 pin assignment

Power IN connection

1 Neutral conductor (power supply)
2 Phase conductor (100-240 VAC)
3 Input System ON/OFF (90-240 VAC)
PE Ground PE

Gun

Gun connection

1 Ground
2 Remote control 1 (GM02)
3 Ground
4 Trigger
5 Remote control 2 (GM02)
6 Oscillator
7 Ground PE

Aux

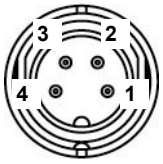
2.4

CG06C(F) pin assignment

CAN IN socket with 4 pins (2.4 Aux)

1 Ground
2 24 VDC
3 CAN high
4 CAN low
Enclosure - shield

Aux



2.3

CAN OUT plug with 4 pins (2.3 Aux)

1 Ground
2 24 VDC
3 CAN high
4 CAN low
Enclosure - shield

CG06D(F) pin assignment

DigitalBus plug with 19 pins (2.4 Aux)

Pin	Bit	Function (binary value)
A	1 IN-D0	Preset values, program number binary value 2^0 (=1)
B	2 IN-D1	Preset values, program number binary value 2^1 (=2)
C	3 IN-D2	Preset values, program number binary value 2^2 (=4)
D	4 IN-D3	Preset values, program number binary value 2^3 (=8)
E	5 IN-D4	Preset values, program number binary value 2^4 (=16)
F	6 IN-D5	Preset values, program number binary value 2^5 (=32)
G	7 IN-D6	Preset values, program number binary value 2^6 (=64)
H	8 IN-D7	Preset values, program number binary value 2^7 (=128)
J	9 IN-A0	Identification number binary value 2^0 (=1)
K	10 IN-A1	Identification number binary value 2^1 (=2)

L	11 IN-A2	Identification number binary value 2^2 (=4)
M	12 IN	System ON/OFF (gun release)
N	13 IN	Strobe (data transfer from data Bus)
O	14 IN	Remote/manual
P	15 IN	Preset values program no. binary value 2^8 (=256) reserve
R	16 IN	GND external
S	1 OUT	Composite error message (signal: Error)
T	2 OUT	System activated
U		24 VDC external
Enclosure		Shield

Initial start-up

Setting the device type

Adjust the corresponding device type (manual device types or automatic device) with the system parameter **P0** (see therefore in chapter "System parameters").

Note:
If the control unit is supplied as a component of an OptiFlex automatic unit, then the corresponding system parameter is set correctly by the factory!
System parameter P0=3

Preparing the powder hopper/container

Prepare the powder hopper or powder box (reference the corresponding operating manual).

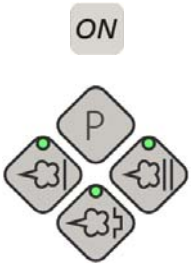
Switch on the booth

Switch on the powder coating booth according to its operating manual.

Daily start up

The daily start-up of the OptiStar CG06 Automatic gun control unit takes place by the following steps:

Select the operating mode

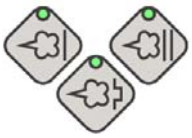


Select the application mode with three predefined modes (Preset mode) or the user-defined program mode with 250 adjustable programs (Program mode).

1. Turn on the gun control unit with the **ON** key
2. Select the corresponding application mode with key **T12** (for Program mode) or keys **T13/T14/T15** (for Preset mode)

The predefined mode automatically set values for high voltage and spraying current:

Presetting	Desired µA	Desired kV
Flat parts	100	100
Complicated parts	22	100
Overcoating	10	100



Starting the predefined operating mode (Preset mode)

Select the preset mode with the application keys **T13/T14/T15**. The LED of the corresponding application key illuminates. No program number will be shown on the display **A5**. The values for powder output and total air volume, indicated before the changeover, are maintained.

Application mode for flat parts

This application mode is suitable for the coating of simple, flat workpieces without larger cavities.

Application mode for complicated parts

This application mode is suitable for the coating of three-dimensional workpieces with complicated shapes (e.g. profiles).

Application mode for recoating parts already coated

This application mode is suitable for the over-coating of workpieces which are already coated.

Exiting the Preset mode

Exit the Preset mode with the keys **T10**, **T11** or **T12**. The preset values of the Program mode used before the Preset mode are displayed by the control unit memory.

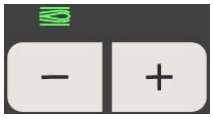
Starting the user-defined operating mode (Program mode)

Select this application mode with the program key **T12**. Here, 250 individually adjustable programs can be defined and saved. The programs 1-250 were loaded with presets by factory. Factory preset values are 60% powder output at 4.0Nm³/h total air and 20µA spray current at 80kV high voltage.

Setting powder output and powder cloud

The powder output is dependent on the selected powder output (in %) and the selected total air volume.

Setting the total air volume



1. Adjust the total air volume with the keys **T3/T4** (see also the injector operating manual)
   - Adjust the total air volume according to the corresponding coating requests

Setting the powder output

2. Adjust the powder output volume (e.g. according to the desired coating thickness)
   - The selection takes place with the keys **T1/T2** on the control unit or with the **+/-** keys on the rear side of the powder gun (OptiSelect gun type). Factory default setting of 60% is recommended for initial spraying. The total air volume is maintained constant automatically

3. Release the OptiStar CG06 control unit by superordinated control unit (external release signal)

4. Activate the gun with the key **T16**, the LED **L7** illuminates
5. If a manual gun is connected, point it into the booth and press the gun trigger

Note:
As a factory default value, a powder rate of 60% and a total air volume of 4 Nm³/h are recommended.
By inserting values, which the equipment cannot convert, the operator is made aware by flashing of the appropriate display and a temporary out of range message!

OptiStar CG06 gun release

In order that the gun can spray powder, no error may be present, which causes the control unit to deactivate the gun. Furthermore, depending on the device, the following conditions must be complied:

OptiStar CG06 with DigitalBus:

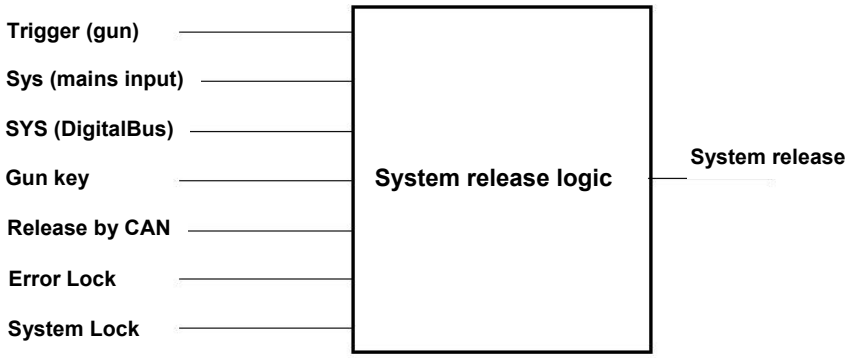
- SYSTEM activated, DigitalBus or SYSTEM (Power In)
- Gun release activated
- Trigger pressed (manual gun only)

OptiStar CG06 with CAN bus:

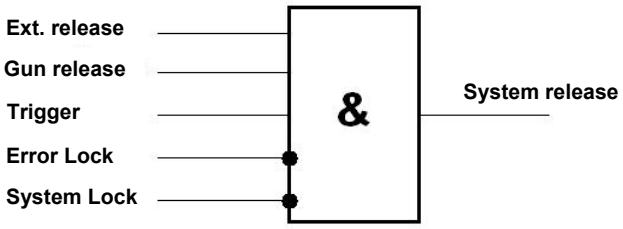
- SYSTEM (Power In)
- Gun release by CAN bus
- Trigger pressed (manual gun only)

OptiStar CG06 without bus connection:

- SYSTEM (Power In)
- Gun release
- Trigger pressed (manual gun only)



Internal signals are derived from input signals, which are logically linked together:



System release

Setting the electrode rinsing air

1. Adjust the correct electrode rinsing air according to the applied nozzles (deflector plate, flat jet nozzle)
   - Press key **T9** (**SELECT**)
     The second display level is switched over
   - Press keys **T7/T8**
     Here, the corresponding air volume value is entered
   - If this display level is not operated for 3 seconds, the first display level is switched over independently

Note:
By using flat jet nozzles, the factory default value is approx. 0.2 Nm³/h, by using round jet nozzles with air-rinsed deflector plates, the factory default value is approx. 0.5 Nm³/h!

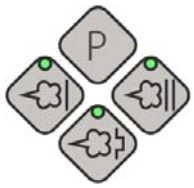
Setting the shaping air (optional)

Procedure:

1. Press key **T9** (**SELECT**)
   The second display level is switched over
2. Adjust the shaping air with the keys **T5/T6**
   - If this display level is not operated for 3 seconds, the first display level is switched over independently

Powder coating

Attention:
Make sure first, that all electrically conductive parts within 5 m of the coating booth are grounded!



1. Point the gun into the coating booth, but do not yet direct it to the object to be coated
2. Select the operating mode:
   Select the operating mode with program key **T12** or application keys **T13/T14/T15**. The LED of the corresponding application key illuminates
3. Coat the objects

Remote control by OptiSelect GM02 manual gun

Various functions can be remotely controlled with the **+** and **-** keys on the rear side of the powder gun (OptiSelect gun type):

- Modify the powder output (press the **+** or **-** key on the gun). The powder output will be increased or decreased accordingly
- Change application modes (Preset mode/Program mode) by pressing the **+** and **-** keys on the gun at the same time. The change takes place counterclockwise. Check by observing the key LEDs on the control unit

Note:
By pressing one of the keys, the preset values will be displayed versus the actual values!

Shut-down

The shut-down of the OptiStar CG06 Automatic gun control unit takes place in following steps:

1. Switch off externally by superordinated control unit, or on the control unit with key **T16** (local operation)
2. In the case of PLC controlled systems, shut-down can take place directly with the key **S2**

Note:
The adjustments for high voltage, powder output, electrode rinsing air and fluidizing remain stored!

Saving programs

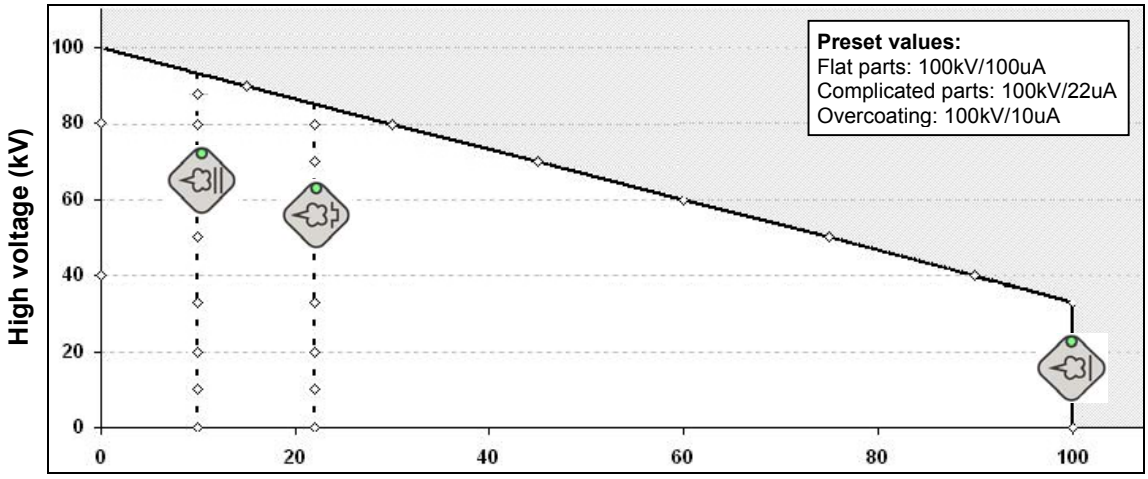
Note:
The values in programs 1-250 and the 3 preset application modes are saved automatically, without confirmation!

Technical explanations concerning high voltage and spray current

Characteristic curves of Preset mode

The preset values for high voltage and spray current in the predefined operation mode (Preset mode) are to be taken as reference points. The modification of these values has effects on the characteristic curve of the gun (see diagram). The operator can optimize the application within the possible 3 ranges.

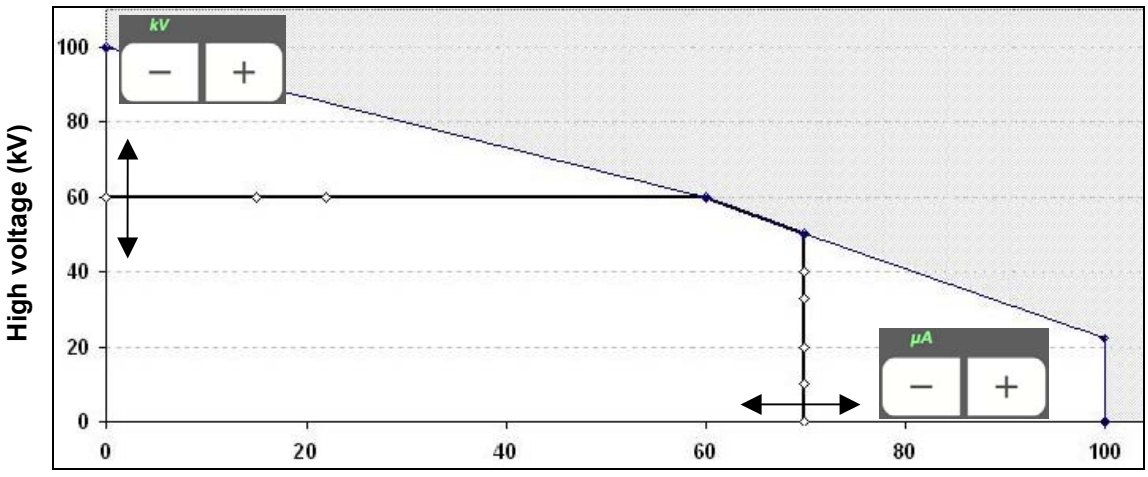
Characteristic curves of Preset mode



Characteristic curve of Program mode

In the user-defined operating mode (Program mode), the values for high voltage and spray current are adjustable. The operator can optimize the values for his application by utilizing the ranges below (see diagram).

Characteristic curve of Program mode



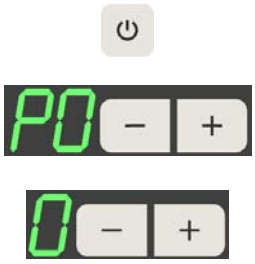
Additional functions

System parameters

The OptiStar CG06 Automatic gun control unit is configured with the system parameters. The values will be saved in the equipment memory. These values can be adjusted and requested manually or by remote interface (CAN).

The system parameters are shown on the display **A5** with additional alphanumeric abbreviated designations (for function and condition).

Entering the system parameters



1. To enter the system parameter mode, press and hold the key **T16** until the display changes (approx. 5 seconds)
2. The system parameter number is shown in the display **A1** with a **P** placed in front
3. Adjust the corresponding system parameter value (device type) with the keys **T5/T6**.
   The value of the adjusted system parameter appears on display **A3**
4. The system parameter **P0** must be set to **A** (automatic device) before access to system parameters **P1-P9**

Name	Description	Values	Display
P0	Device type	0 - Fluidizing device (type F) 1 - Box device (vibrator) (type B) 2 - Agitator device (type S) **3 - Automatic device** 4 - Manual device w. fluidization	F B S **A** S Fd
P1	FlowControl	0 - Without FlowControl **1 - Automatic recognition**	F C 0 **F C 1**
P2	Input pressure	0 - P on = 5,5 bar **1 - P on = 6 bar** 2 - P on = 6,5 bar	P 5.5 **P 6.0** P 6.5
P3	Keyboard lock	**0 - Remote operation mode, no local operation possible** 1 - Remote operation mode is used as keyboard lock, reduced operation is possible 2 - Gun release = SYSTEM	**L 0** L 1 L 2

P4	Interface type	0 - Deactivated **1 - Automatic recognition**	B C 0 **B C 1**
P5	CAN Baud rate	0 - 20 kBit/s 1 - 50 kBit/s 2 - 100 kBit/s **3 - 125 kBit/s** 4 - 250 kBit/s 5 - 500 kBit/s 6 - 800 kBit/s 7 - 1 MBit/s	2 0 5 0 1 0 0 **1 2 5** 2 5 0 5 0 0 8 0 0 1 0 0 0
P6	CAN Node ID	1-127	N O D E
P7	Shaping air	0 - Deactivated **1 - Activated**	S H A 0 **S H A 1**
P8	ERROR Digital-Bus polarity	**0: ERROR=0: error** 1: ERROR=1: error	EPOL
P9	Supplementary air offset	**0: 0 Nm³/h** 40: 4,0 Nm³/h	AOFS

Default values are marked by **bold** print.

Exiting the system parameter mode

Exit the system parameter mode with the key **T16**, and the actual values display is switched over. The modified values will be saved in the equipment memory.

If the equipment is switched off while in the system parameters mode, any changes made will not be stored by the equipment memory!

Trigger counter and software request

The status information can be indicated on display **A5** by pressing a combination of two different keys as shown. First press and hold key **T12**, then press either key **T10** or **T11** depending on requested information.

Status information	Key combination
Trigger hours counter (total time in hours of gun trigger time). Trigger counter can't be reset!	**T12** with **T10**
Software version	**T12** with **T11**

The status display is shown as long as a key is held.

Keyboard lock

The OptiStar CG06 Automatic Gun control unit contains a keyboard lock, which prevents changing individual values for each parameter (kV, µA etc.) within an application mode (Preset or Program). The following is not affected by the keyboard lock and will still operate under normal conditions:

- Program selection
- Display of preset values of the current program
- Display of the actual values
- Error acknowledgement
- Power On/Off

The keyboard lock is activated and deactivated by pressing and holding key **T9** (**SELECT**) and then key **T11**, the LED **L11** (**REMOTE**) flashes. The keyboard lock status remains stored, when switching the equipment off and on. If a memory reset takes place, the keyboard lock will be cancelled.

On the OptiStar CG06 Automatic gun control unit (automatic device), an external interlocking by remote input can also be utilized. These two locking features are independent, that means, if the local interlocking is deactivated, the external interlocking remains activated and vice versa.

Operation with other guns

Configuration of the Tribo gun

The Tribo gun can be configured by holding the keys **T7** and **T8** when switching on. The selected adjustment remains stored, when the device is switched off. To deactivate the Tribo gun, repeat the steps above.

Operation of the Tribo gun without adapter

For continuous operation, the Tribo gun can be operated without corresponding adapter to the OptiStar CG06 Automatic gun control unit (automatic and manual equipment). Therefore, the wiring in the Tribo gun plug must be changed. Move the wire from Pin 5 to Pin 1.

Attention:
This activity must be absolutely carried out by a specialist! Inappropriate operation can lead to damage to the control unit! ITW Gema AG is in no way responsible for any resulting damages!

Note:
The EasySelect (GM01) manual powder gun can not be controlled by OptiStar control units!

Powder output/powder hose correction

The OptiStar CG06 Automatic gun control unit can be adjusted with correction values optimal to local conditions (for example the adjustment of different powder outputs in the plant, caused by different powder hose lengths and geometry to the guns.)

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 table for powder output/powder hose correction"), 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:

Corr.-value	Description	Range	Default value (manual/automatic)
C0	Powder output (dm³/h)	5-30	1.8 (Autom. device) 1.0 (Manual device)
C1	Powder hose correction value	40-100	100
C2	Daily correction value	50-150	100

Procedure (powder output correction)

1. Set the total air to **5.0** (Nm³/h) on the **A2** display. Set the powder output to **00** (%) on the **A1** display
2. To enter the system parameter mode, press the key **T16** longer than 5 seconds. The correction factor number is shown in the display **A2** with a **C** placed in front
3. Set the correction value for minimum powder output **C0** to **1.8** (Nm³/h) on the **A4** display with the keys **T7/T8**. The default value for manual equipment is 1.0 (powder hose = 6m) and for automatic equipment 1.8 (powder hose = 20m)
4. Set the correction value for maximum powder output **C1** to **100** (%) on the **A4** display.

Exit the system parameter mode by pressing the key **T16**.

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.

5. Put the measuring bag over the gun nozzle and fasten it. Switch on the gun for 60 seconds
6. 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

7. If no powder is expelled from the gun, return to the system parameter mode and increase the minimum powder output value **C0** (range **0.5-3.0** dm³/h)
8. Repeat steps 5 and 6, until the powder output amounts to 10-15 g. Annotate the adjusted minimum powder output value **C0** in the table

Exit the system parameter mode by pressing the key **T16**.

Procedure (powder hose correction)

1. Set the powder output value to **80** (%) on the **A1** display
2. Put the measuring bag over the gun nozzle and fasten it. Switch on the gun for 60 seconds
3. Switch off the gun after 60 seconds, remove the measuring bag and weigh it
4. Annotate the powder output in **g/min** in the table

Calculate the powder output correction according to following formula:

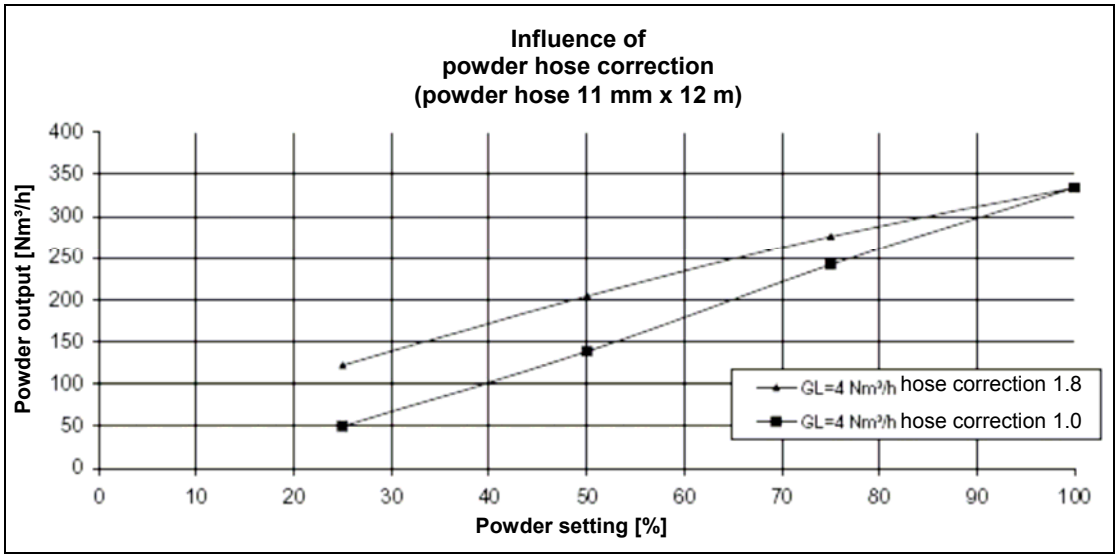
$$\textbf{C1 (\%)} = \frac{\textbf{smallest powder output}}{\textbf{measured powder output}} \times \textbf{100}$$

5. Annotate the calculated values (**C1**) for each individual gun in the table and enter the values to the control unit (therefore, repeat the steps 2 and 3)

Example table for powder output/powder hose correction

Gun	Powder output correction						Powder output without correction	Powder output with correction
Nr.	C0 (dm³/h)	C1 (%)	Precorrection		Recorrection		Powder output on 80%	
1	1,7	100%	1,8	20 gr.	1,7	12 gr.	200 g/min	200 g/min
2	1,8	(200/250) x 100 = 80%	1,8	10 gr.	1,8	12 gr.	250 g/min	200 g/min
3	2,6	(200/280) x 100 = 71%	1,8	0 gr.	2,6	12 gr.	280 g/min	200 g/min
etc.								

Correction factor - diagram



Correction factor - diagram

Note:
The hose length correction factor is chosen in such a way, that no powder is visible if the powder portion is 0%, by increasing the value, the powder becomes visible then. This behavior depends on the hose length and the hose diameter!

RAM reset

The RAM reset enables a restore of factory settings of the OptiStar CG06 gun control unit. All user-defined values in Program and Preset mode will be set to factory default. The adjusted device type in system parameter **P0** remains stored in memory and an active keyboard lock will be deactivated.

⏻ ON

Execute the RAM reset by pressing the key **T16** and the **ON** switch for 5 seconds.

Note:
By resetting the RAM, all user-defined values in Program and Preset mode will be set to factory default!

Cleaning mode

The cleaning mode enables blowing off powder accumulations in the powder hose with preset air pressure. This function is a two steps process to activate.

First press and hold (approx. 3 seconds) program key **T12** until a circulating luminous segment is shown in display **A5**. Then press the gun trigger and powder hose cleaning will start.

The powder hose cleaning mode can be activated also by an optional bus connection such as DigitalBus or CAN bus.

Note:
The injector must be disconnected from the pickup tube or powder hopper prior to cleaning procedure!

The cleaning mode is terminated by pressing the program key **T12**.

Options

FlowControl module

The FlowControl module, in addition to the basic OptiStar 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 preset values.

The reproducibility of the setting values for conveying air and supplementary air will be increased and result in more uniform coating results.

- Precise air volume measurement
- Highest regulating dynamics
- Micro controller based air volume calibration
- High air volume regulation range - total air up to 6.5 Nm³/h (C0 = 1.8 dm³/h, powder output = 80%)

FlowControl module

DigitalBus

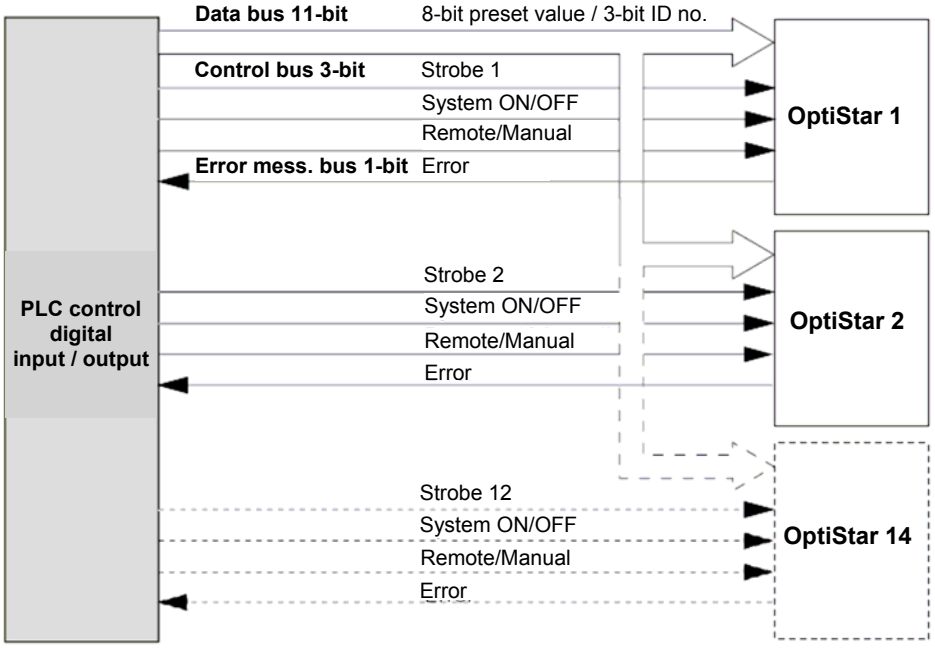
The DigitalBus module, in addition to the basic OptiStar equipment, introduces the possibility for decentralized automation solutions. A process control system, individually fitted to the process requirements, supports the automated and safe plant operation.

- Digital parallel interface connection to a PLC
- Online controlling of all coating parameters (high voltage, spray current and electrode rinsing for the gun, powder output and total air for the injector)
- Controlling of up to 250 peripheral stored coating programs in the OptiStar control unit

DigitalBus module

The DigitalBus connects the gun control unit to a superordinated control unit. The DigitalBus has a 16-bit parallel interface. The result is a star shaped bus structure.

Controlling the OptiStar control units by a superordinated control unit



Controlling by a superordinated control unit

The interface consists of 15 digital inputs and 1 digital output. The digital inputs are split to a data bus, consisting of 12 bits and a control bus, consisting of 3 bits. The digital output is an error message bit for composite error messages of the equipment.

Structure of the 16 bit parallel bus

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

Data bits (Data)

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

Control bits (Control)

For inputs, there are 3 control bits available:

- **Strobe** - Activate data transfer
- **System** - System release OptiStar
- **Remote** - Operating mode

Status bits (Status)

For output, there is 1 status bit available:

- **Error** - Digital output composite error message, indicates all errors which are present in the control unit (error list, can be deleted locally). Error=0 - Error is present

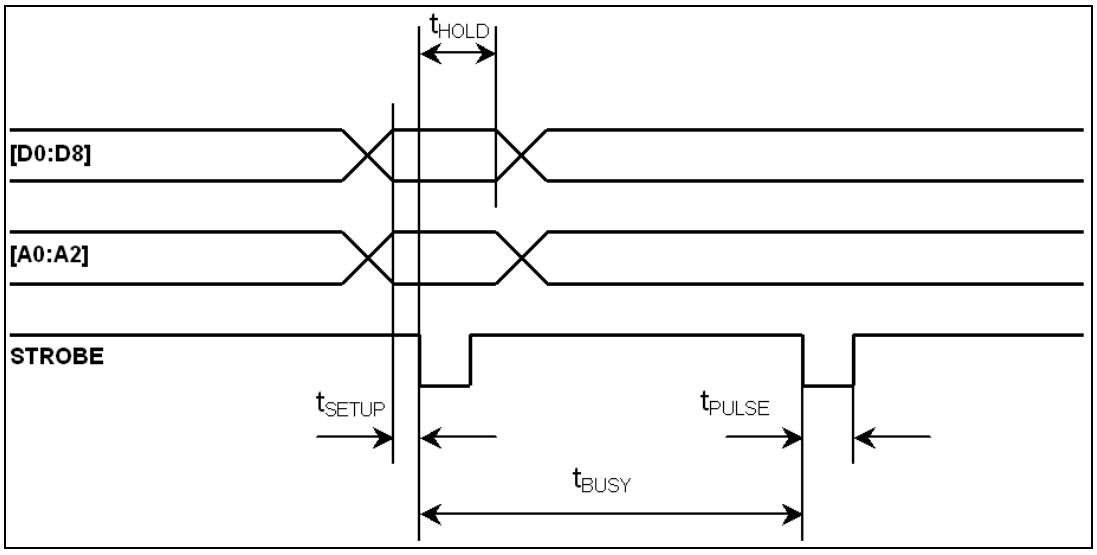
Command table and value ranges

Opcode [A0:A2]	Command	Value range [D0:D8*]	Unit
0	Setting preset PA (powder output)	0 - 100%	%
1	Setting preset GL (total air)	18 - 65 @ Pin=5.5bar (= 0-6.5m³/h) 18 - 70 @ Pin=6.0bar (= 0-7.0m³/h) 18 - 75 @ Pin=6.5bar (= 0-7.5m³/h)	dm³/h
2	Setting preset EL (electrode rinsing air)	0 - 30 (= 0 - 3.0m³/h)	dm³/h
3	Setting preset SHA (shaping air)	0 - 50 (= 0 - 5.0m³/h)	dm³/h
4	Setting preset kV (high voltage limitation)	0 - High voltage Off 10 - 100	kV
5	Setting preset µA (spray current limitation	0 - 100	µA
6	Program change	1 - 250	
6	Program "Flat parts"	251	Program selection
6	Program "Complicated parts"	252	Program selection
6	Program "Overcoat"	253	Program selection
6	Cleaning mode "Max. conveying, supplemental and rinsing air"	254	Hose rinsing
6	Cleaning mode "Max. rinsing and supplementary air"	255	Hose rinsing
7	Setting C2 (daily correction factor)	50 - 150	%

(D8 is not needed for these value ranges, must be left on 0)

Timing diagram

The following timing must be respected by the external control when communicating by DigitalBus:



Timing diagram

Parameter	Description	Value
t_{SETUP}	Data Setup Time Data and command must be stable during the time before STROBE goes to zero	min. 1 ms
t_{HOLD}	Data Hold Time Data and command must remain stable during the time after the negative flank of STROBE	min. 2 ms
t_{BUSY}	Command Execution Time Minimum time between two batched commands	min. 5 ms
t_{PULSE}	Minimum STROBE pulse length	min. 1 ms

The data transmission from a superordinated control unit (PLC) to the gun control unit can be controlled by the data bus (12 bits) and the control bus (3 bits). All preset values can be transmitted in binary code with the first 9 bits (bit 0-8) of the data bus (value range 0-250, D8 is not used, set to 0). The identification number is transmitted in binary code with the last 3 bits (bit 9-11) of the data bus (value range 0-7). The data reception from the data bus is initiated by a negative flank of the **Strobe** control signal.

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

Example:
Setting preset kV to 75kV by DigitalBus:

Activate remote operation, set Strobe to **high** (because data reception by negative flank)

Remote = 1, Strobe = 1

Apply the value and the opcode:

[A2:A0] = 100 (Preset kV)

[D8:D0] = 0 0100 1011 (75)

Wait until data remains stable, e.g. 2 ms

wait_2ms_for_stable_data();

Initiate data reception with the negative flank of the Strobe signal, minimum pulse length 200 µs (2 ms)

Strobe = 0;

wait_strobe_pulse_500 µs();

Strobe = 1;

If a following command wants to be sent, a break of at least 5 ms must take place.

DigitalBus - allocation

Pin	Bit
A	D0
B	D1
C	D2
D	D3
E	D4
F	D5
G	D6
H	D7
J	A0
K	A1
L	A2
M	SYSTEM
N	STROBE
O	REMOTE
P	D8
R	GND
S	ERROR
T	ACTIVE
U	24V

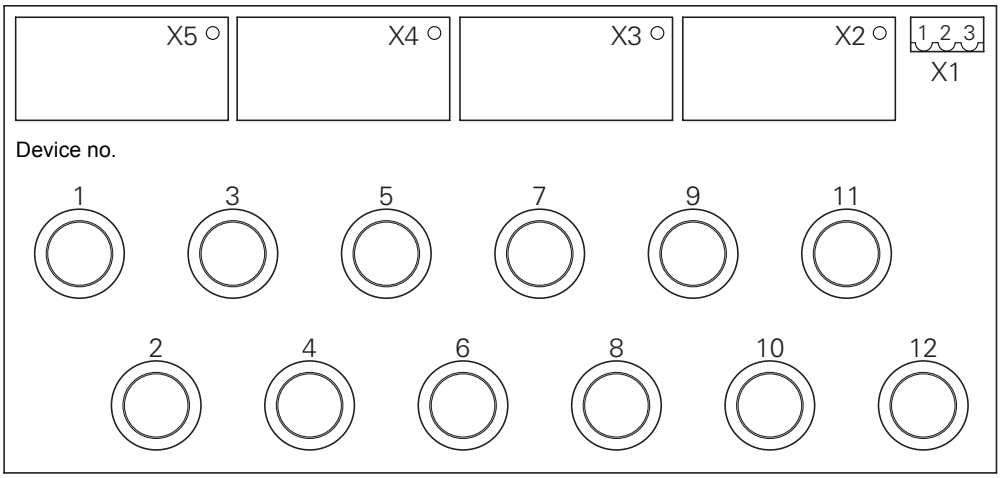
Note:
I and Q are not intended as plug annotation by plug supplier!

Digital Connector CD02 with connection designations

The interface between the OptiStar CG06 Automatic gun control unit and the PLC control unit 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	empty	1-12	empty	1-8/13-20 D0-D7	1: GND
13-24	Gun release	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

The OptiStar 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.

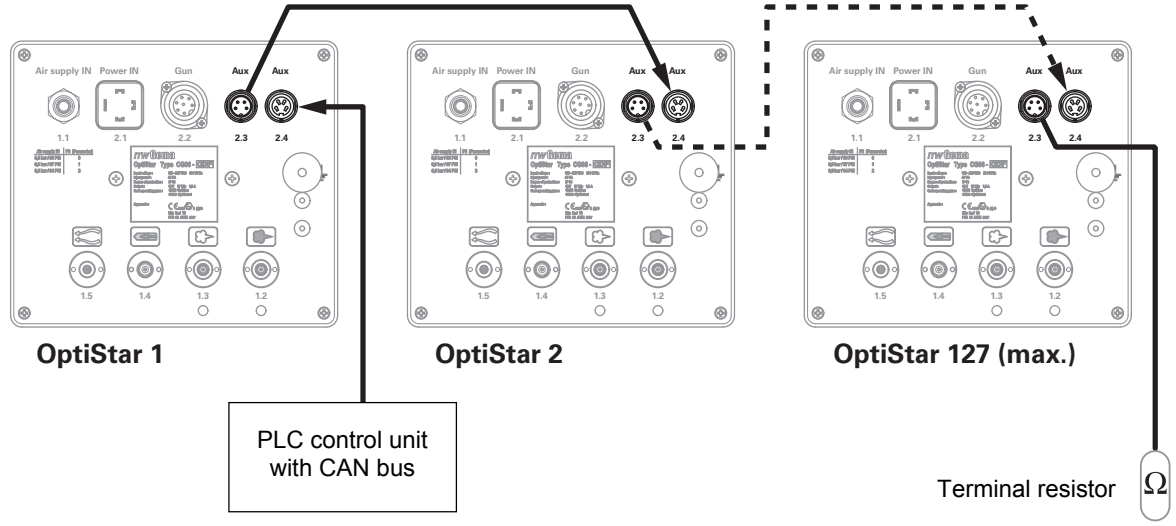
CAN bus interface

Following data can be accessed by CANopen:

- All preset 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.

Hardware

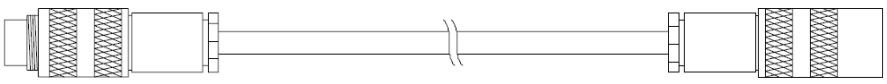
The OptiStar control units are connected to the central PLC control unit by 4 pin CAN bus cables. The last bus client is fitted with a terminal plug with terminal resistor in order to terminate the network correctly. A maximum of up to 127 OptiStar control units can be operated in a network.



CAN bus - connections

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

System release in network operation

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

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

Determining user address (Node-ID) and Baud rate

Each OptiStar 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. The Baud rate value can be set by editing the system parameter P5, and the Node ID value can be set by editing the system parameter P6.

Baud rate - system parameter P5

Value P5	Baud rate
0	20 kBit/s
1	50 kBit/s
2	100 kBit/s
3	125 kBit/s
4	250 kBit/s
5	500 kBit/s
6	800 kBit/s
7	1 Mbit/s

Default value of system parameter P5 = 3

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

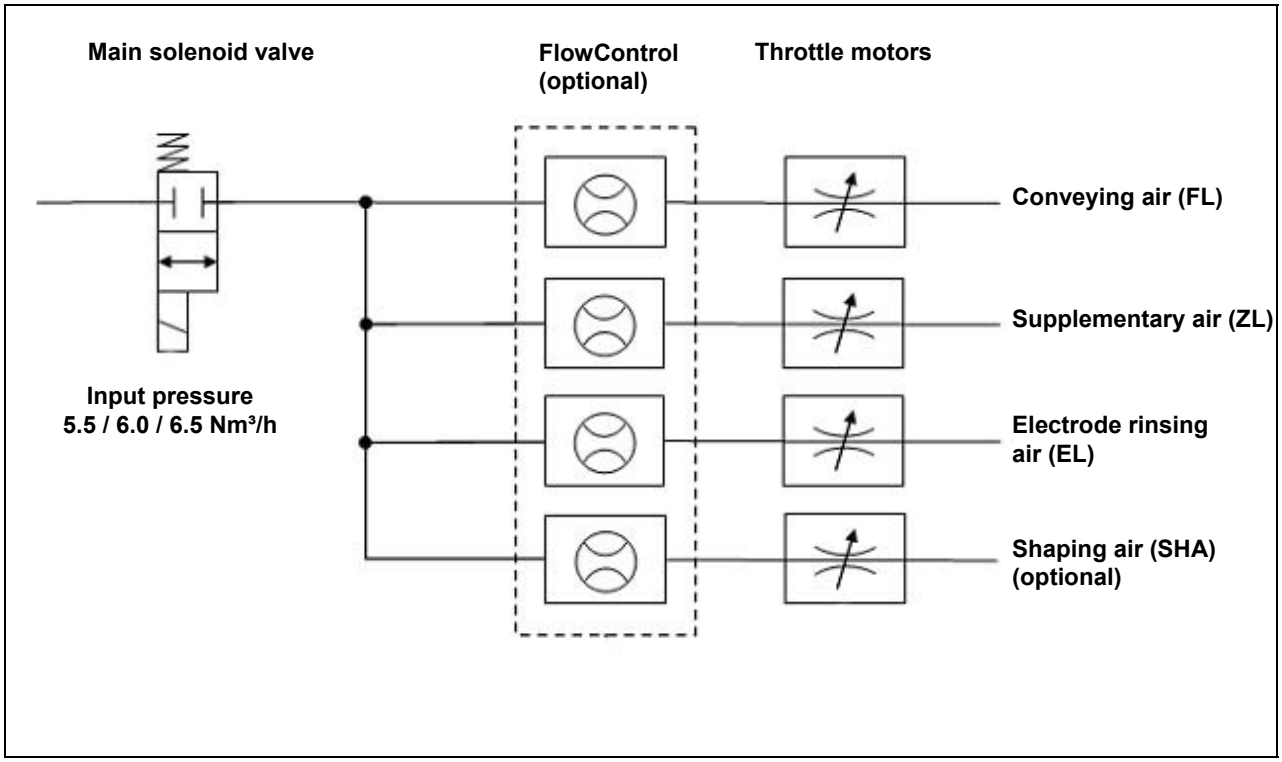
Node ID - system parameter P6

CAN Node-ID 1-127

Value P6	CAN Node-ID
1-127	1-127

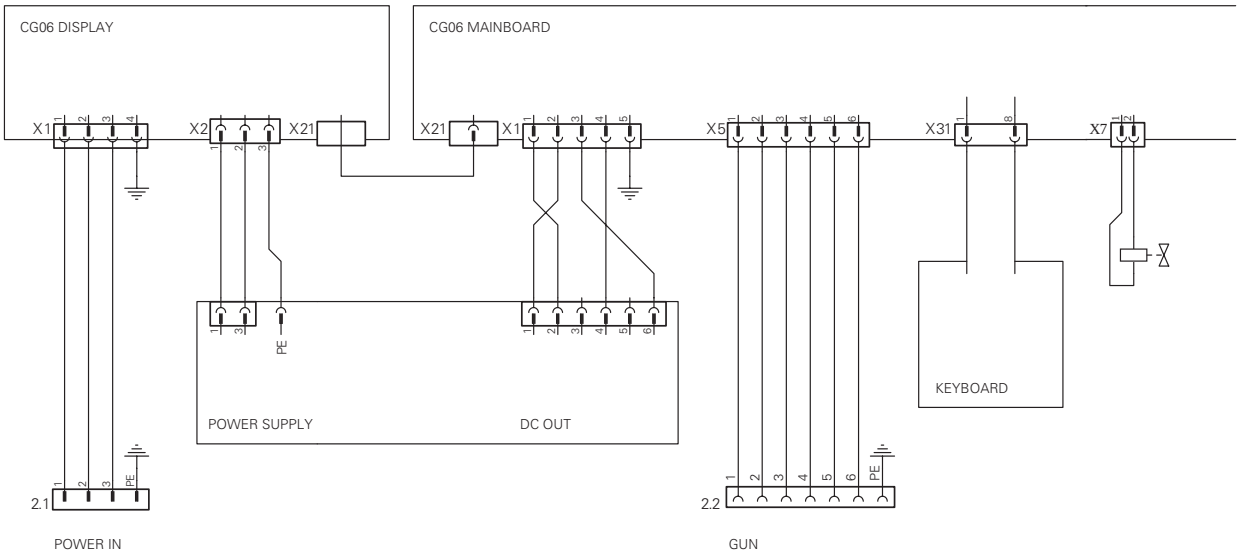
Schematic diagrams

OptiStar CG06 - pneumatical diagram

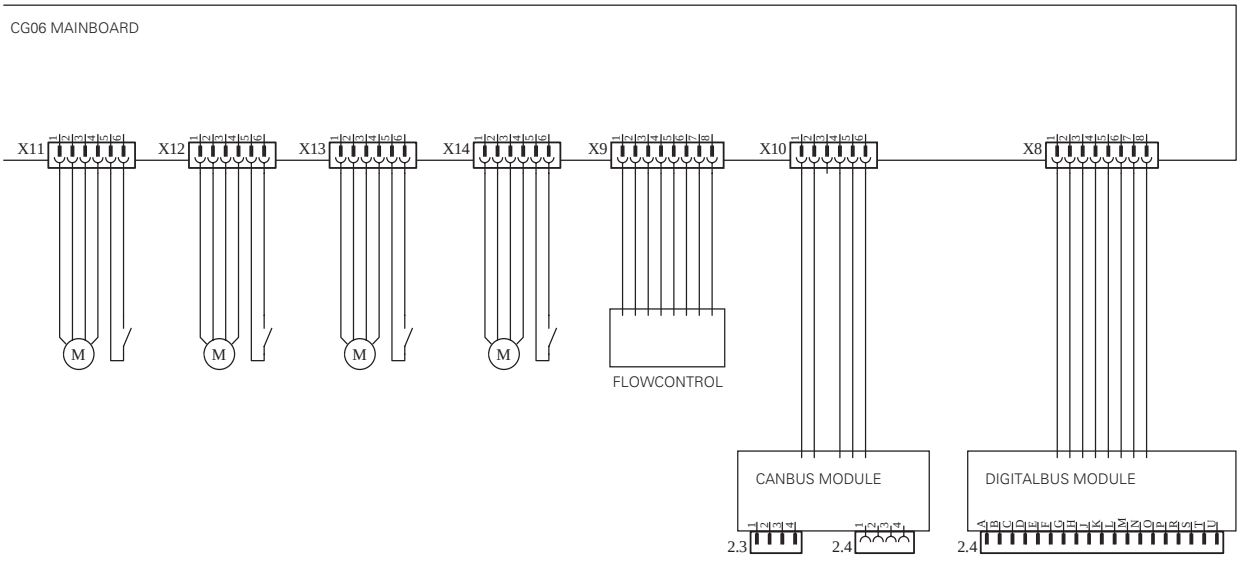


OptiStar CG06 - pneumatical diagram

OptiStar CG06 - electrical diagram



OptiStar CG06 - electrical diagram - part 1



OptiStar CG06 - electrical diagram - part 2

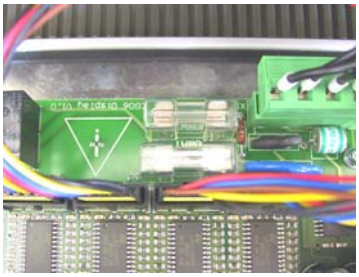
Troubleshooting

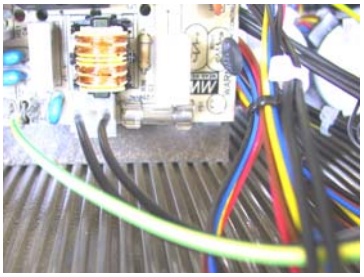
Repairing the electrical part of the control unit

Attention, Danger!
Before starting work on the control unit, disconnect the mains plug!

Replacing the fuse(s)

1. Loosen the screws on the front side of the enclosure
2. Hold the front plate with one hand, remove the fuse(s) (quick-acting) from the fuse holder and replace with a new one





Fuse(s)

3. Reattach the front plate
4. Reconnect the mains cable

Replacing the power supply board

1. Loosen the screws on the front side of the enclosure
2. Disconnect the plugs on the defective board
3. Squeeze the standoffs with a pointed pliers and remove the power supply board. Replace the defective standoffs
4. Place the new board on the standoffs, press them into the board and snap into mounting bracket within enclosure. Re-connect the plugs
5. Reassemble the control unit in reverse order as described and install it
6. Reconnect the mains cable

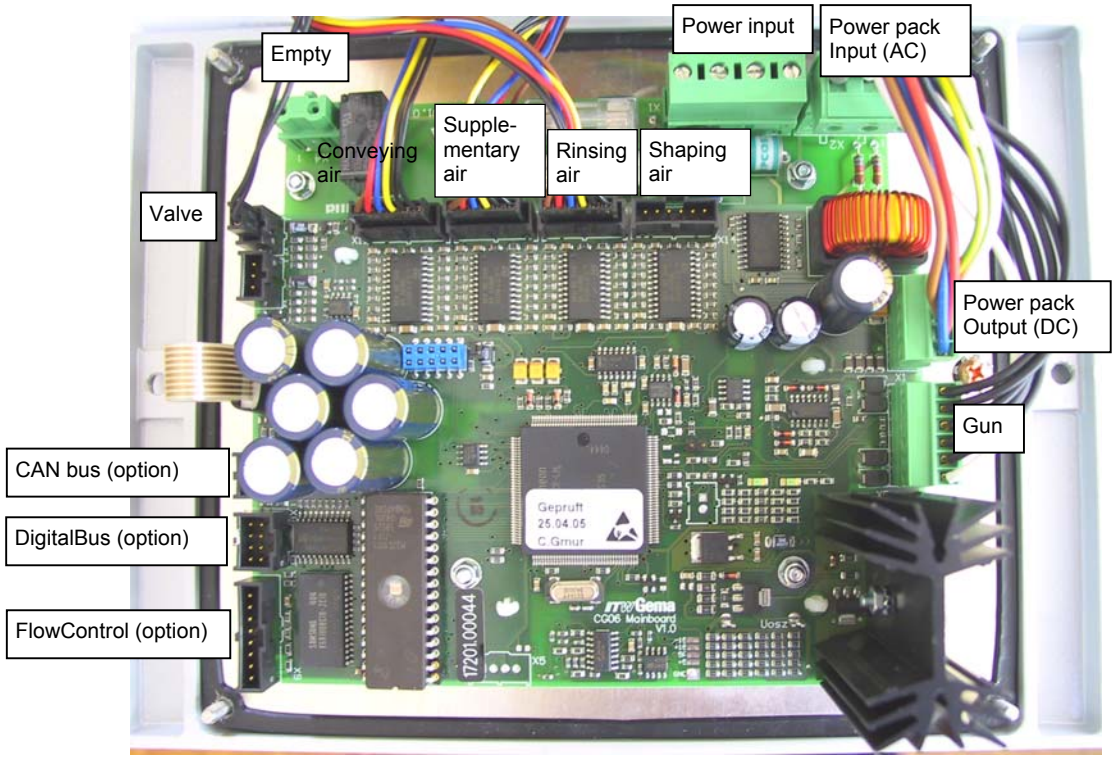
Replace the front plate

1. Loosen the screws on the front side of the enclosure
2. Disconnect all plugs from the front plate
3. Replace the front plate
4. Reassemble the front plate and the control unit in reverse order as described and install it

Attention:
The motor plugs are to be put in according to the annotation!

5. Reconnect the mains cable

Note:
If there are any problems or uncertainties, please contact a ITW Gema service center!



OptiStar CG06 - mainboard configuration

Repairing the pneumatic part

Replacing the pneumatic part

1. Remove every electric and pneumatic connection on the rear side of the control unit (disconnect mains cable and remove compressed air supply)
2. Loosen the screws on the rear side of the enclosure
3. Remove the pneumatic hoses from the part to be replaced (see chapter "Removing the pneumatic hoses")
4. Dismantle the defective part and replace it
5. Reconnect the pneumatic hoses (see chapter "Fitting the pneumatic hoses")
6. Reassemble the control unit in reverse order as described and install it

Removing the pneumatic hoses

Before replacing a pneumatic part, all corresponding pneumatic hoses should always be disconnected first. This happens by pressing the ring on the quick release coupling of the hose. The hose can be pulled out easily.

Fitting the pneumatic hoses

In order to reconnect the pneumatic hoses, proceed as follows:

- Insert the hose in the quick release coupling up to the end stop. The hose is held firmly again.

Note:
If there are any problems or uncertainties, please contact a ITW Gema service center!

Error diagnosis of the software

General information

The correct function of the OptiStar CG06 Automatic gun control unit is constantly monitored. If the equipment software determines a fault, an error message is indicated with an error code. Following is monitored:

- High voltage technology
- Pneumatic system
- Power supply

Help codes

The error diagnosis codes (help codes) are shown in the display **A5**. The error codes are stored in an error list in the order of their appearance. Each error in the list must be individually acknowledged with the keys **T10** or **T11**.

The error codes are shown with the format **Hnn**, whereby **nn** is the numeric code, if necessary with a leading zero.

The errors are displayed in the order of their appearance. The keys **T10** and **T11** cannot be used for other functions, as long as an error code is shown on **A5**.

Here is the complete listing of all error codes possible for the OptiStar CG06 Gun control unit:

Code	Description	Criteria	Remedy
Pneumatics:			
H01	FlowControl module error		FlowControl module defective, check system parameter P0 and set it to basis equipment without FlowControl (P0=0)
H02	Conveying air control loop cannot maintain preset value. Conveying air flow control does not work correctly	Input pressure too low, throttle defective	Check system parameter P0 and set it to basis equipment without FlowControl (P0=0)
H03	Supplementary air control loop cannot maintain preset value	Input pressure too low, throttle defective	Check system parameter P0 and set it to basis equipment without FlowControl (P0=0)
H04	Electrode rinsing air control loop cannot maintain preset value	Input pressure too low, throttle defective	Check system parameter P0 and set it to basis equipment without FlowControl (P0=0)
H05	Shaping air control loop cannot maintain preset value	Input pressure too low, throttle defective	Check system parameter P0 and set it to basis equipment without FlowControl (P0=0)
H06	Trigger valve (main solenoid valve)	Solenoid coil current lower than preset limiting value Valve defective, main board or cable defective	Main solenoid valve error, connection cable from main solenoid valve to basic electronics is missing, check main solenoid valve
H07	Supplementary air volume too high (total air setting on display)	The preset value for supplementary air is too high compared to your conveying air setting	Reduce supplementary air value or increase conveying air value to balance air volume to injector and clear help code
H08	Conveying air volume too high (powder % setting on display)	The preset value for conveying air is too high compared to your supplementary air setting	Reduce conveying air value or increase supplementary air value to balance air volume to injector and clear help code
H09	Powder output higher than 100%	The powder output multiplied with the powder hose length factor and the daily correction value is larger than 100% Daily correction value too large	Reduce powder output Reduce daily correction value
H10	Conveying air range lower deviation	The theoretical value for conveying air falls below minimum Total air is smaller than minimum	Limit conveying air to conveying air minimum

Code	Description	Criteria	Remedy
High voltage:			
H11	Gun error	No oscillation Cable broken, oscillator or gun defective	Replace gun cable, cascade etc.
Power supply:			
H20	Overvoltage +15V supply	Power pack defective or overloaded	Replace the power pack, if error is permanent
H21	Undervoltage +15V supply	Power pack defective or overloaded	Replace the power pack, if error is permanent
H22	Undervoltage -15V supply	Power pack defective or overloaded	Replace the power pack, if error is permanent
H23	Undervoltage +5V supply	Power pack defective or overloaded	Replace the power pack, if error is permanent
EEPROM (equipment memory):			
H24	EEPROM content invalid	EEPROM error	Load factory settings, initialize EEPROM (see therefore chapter "RAM reset")
H25	Timeout during EEPROM writing	EEPROM error	Load factory settings, initialize EEPROM (see therefore chapter "RAM reset")
H26	Values not correctly stored in EEPROM during switching off	EEPROM error	Load factory settings, initialize EEPROM (see therefore chapter "RAM reset")
Parallel interface:			
H30	Invalid command	The sent command is not supported	Reject data
H31	Parameter value outside the value range	The sent parameter value is outside the allowed value range	Reject data
H32	Overflow on data reception	A new command is received, before the previous was processed. Commands follow too fast one after another	Reject data
CAN bus:			
H40	Permanent CAN bus error	CAN CONTROLLER changes into BUS OFF condition. No power supply or cable is not connected	
H41	High error rate when transmitting/receiving	CAN CONTROLLER changes into ERROR_PASSIVE condition	
H42	Overflow on data reception	The message to be received has no more place in the receiver buffer. Messages are sent faster than they can be processed	
H43	Overflow on transmission	The message to be sent has no more place in the transmission buffer. Messages are produced faster than they can be sent	
H44	Master failed	Node Guarding message is missing longer than 2 seconds. Connection to master failed	

Code	Description	Criteria	Remedy
H45	Parameter value outside the value range	The sent parameter value is outside the allowed value range	Reject data
H46	Invalid Node ID set	The Node ID is not between 1 and 127	Set Node ID to 127
H47	No CAN interface installed	CAN interface is selected in the system parameters, but no interface is installed	
Value range:			
H50	Parameter value outside the value range	A preset value is outside the allowed value range. A preset value is outside of the at present possible settings	Limit on minimum/maximum
Throttle motors:			
H60	Conveying air reference position not found	Throttle motor or needle blocked, limit switch defective, throttle motor error	Calibrate again, replace throttle valve
H61	Supplementary air reference position not found	Throttle motor or needle blocked, limit switch defective, throttle motor error	(see above)
H62	Electrode rinsing air reference position not found	Throttle motor or needle blocked, limit switch defective, throttle motor error	(see above)
H63	Shaping air / fluidizing air reference position not found	Throttle motor or needle blocked, limit switch defective, throttle motor error	(see above)
H64	Zero point signal is blocked	Short circuit in limit switch, throttle motor defective	(see above)
H65	Supplementary air throttle does not move	Short circuit in limit switch, throttle motor defective	(see above)
H66	Electrode rinsing air throttle does not move	Short circuit in limit switch, throttle motor defective	(see above)
H67	Shaping air / fluidizing air throttle does not move	Short circuit in limit switch, throttle motor defective	(see above)
H68	Conveying air position lost	Lost steps, limit switch defective, throttle motor defective	(see above)
H69	Supplementary air position lost	Lost steps, limit switch defective, throttle motor defective	(see above)
H70	Electrode rinsing air position lost	Lost steps, limit switch defective, throttle motor defective	(see above)
H71	Shaping air / fluidizing air position lost	Lost steps, limit switch defective, throttle motor defective	(see above)

Help codes list

The last appeared four errors are stored in a list by the software. If an error appears, which is already in the list, it will not be listed again. If the list is full, no more new entries are added.

Appearance of errors

It is possible that an error appears just shortly, but after the acknowledgement it will disappear. In this case, switch off the OptiStar control unit and switch it on again (reset by restarting).

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** OptiStar CG06 Automatic 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)

WARNING!
Only original ITW-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 ITW Gema guarantee conditions!

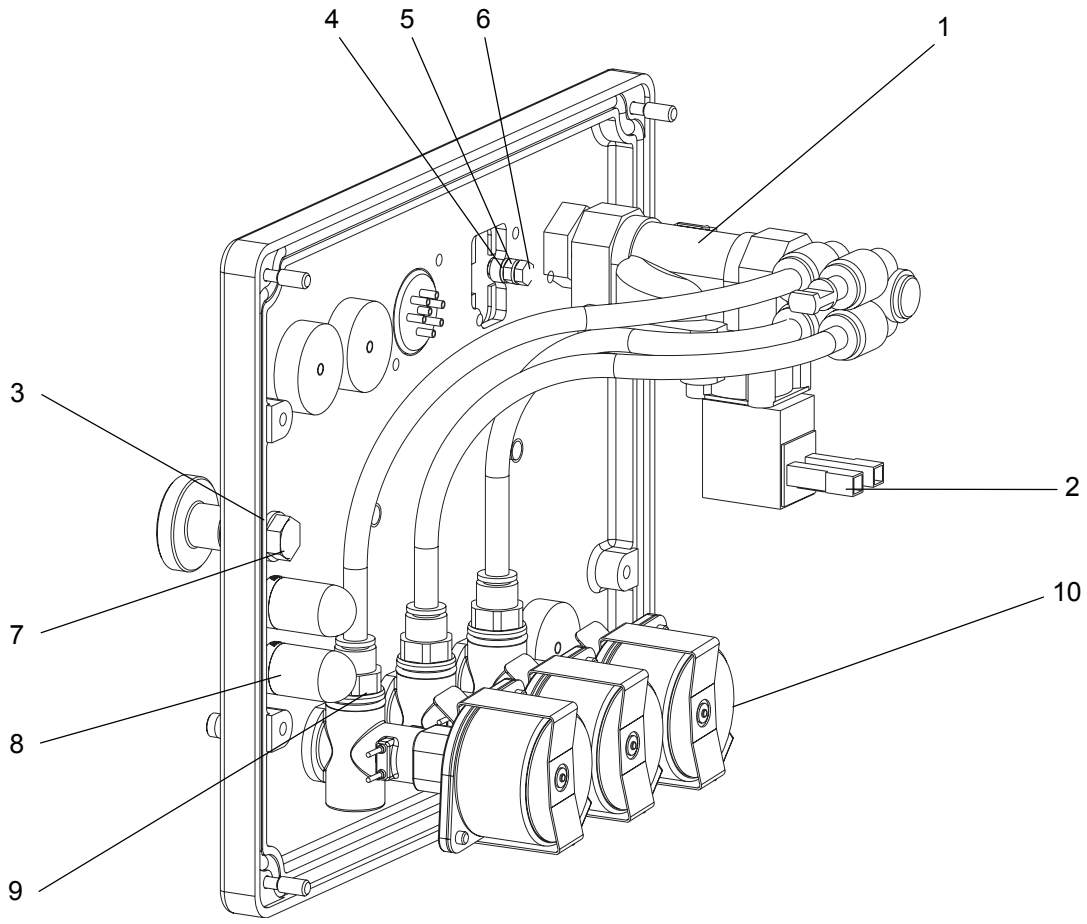
OptiStar CG06 Automatic gun control unit - general

	OptiStar CG06 Automatic gun control unit - complete	1001 459
	OptiStar CG06-C Gun control unit - complete (with CAN bus)	1001 460
	OptiStar CG06-CF Gun control unit - complete (with CAN bus / FlowControl)	1001 461
	OptiStar CG06-D Gun control unit - complete (with DigitalBus)	1001 462
	OptiStar CG06-DF Gun control unit - complete (with DigitalBus / FlowControl)	1001 463
1	Front plate - see corresponding spare parts list	
2	Enclosure and power pack - see corresponding spare parts list	
3	Rear wall - see corresponding spare parts lists	
	Shock protection (not shown)	1001 058
	Connecting cable (power supply) for the operation with 2 control units (not shown)	1001 867

OptiStar CG06 Automatic gun control unit

OptiStar CG06 Automatic gun control unit - inside rear wall

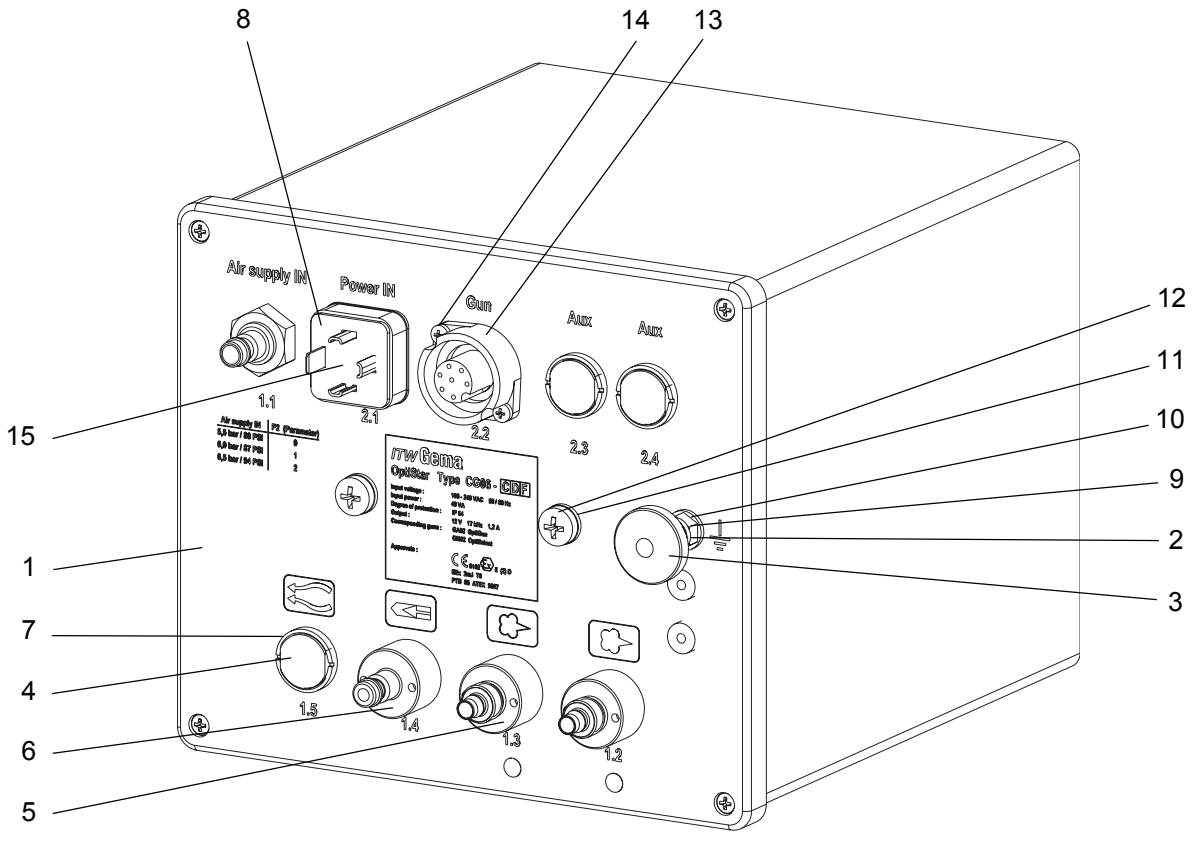
1	Pneumatic group - complete	1001 469
2	Valve cable - CG06	1001 410
3	Washer - Ø 6.4/12.5x1.6 mm	1001 686
4	Lock washer - M3 R	201 880
5	Hexagon nut - M3	202 142
6	Cylinder screw - M3x16 mm	221 074
7	Hexagon screw - M6x30 mm	215 279
8	Fluidizing pad - 1/8"a	237 264
9	Screw-in nipple - 1/8"a, Ø 6 mm	262 315
10	Throttle motor - complete	1000 064



OptiStar CG06 Automatic gun control unit - inside rear wall

OptiStar CG06 - outside rear wall

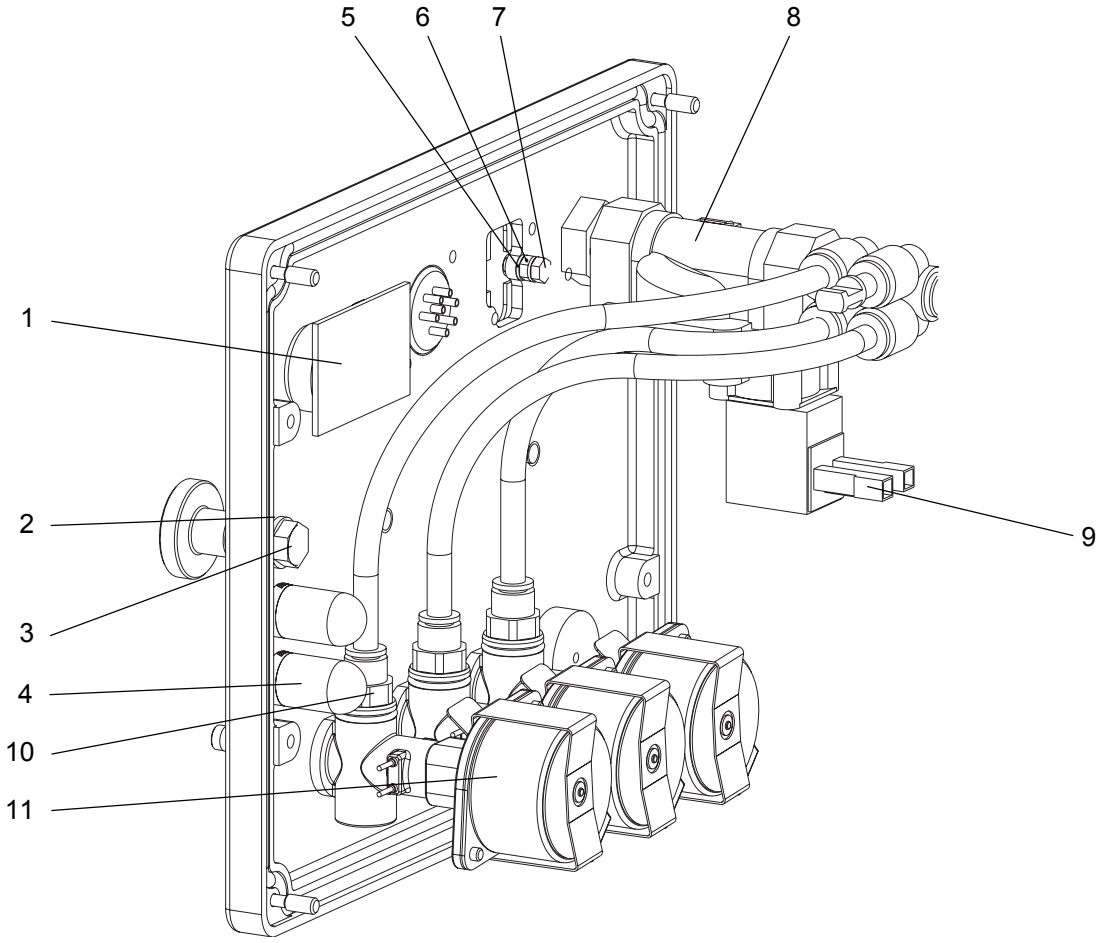
	Rear wall CG06 - complete	1001 454
1	Rear wall	1000 070
2	Shake proof washer - A type, M6	200 450
3	Milled nut - M6	200 433
4	Screw plug - complete	1001 789
5	Hose connection - complete, Ø 8/6 mm	1001 519
6	Rectus quick release connection - complete	1001 517
7	Lock nut - M18x0.75 mm	1001 799
8	Mains connection CG06	1001 176
9	Washer - Ø 6.4/12.5x1.6 mm	200 476
10	Hexagon nut - M6	200 417
11	Washer - Ø 6.4/12.5x1.6 mm	1001 686
12	Cap screw - M6x10 mm	205 214
13	Gun connection CG06	1001 179
14	Cap screw - M3x8 mm	202 363
15	Cap screw - M3x10 mm	216 739
	Protection cap for 2.2 Aux connector socket (not shown)	206 474



OptiStar CG06 - outside rear wall

OptiStar CG06-C - inside rear wall

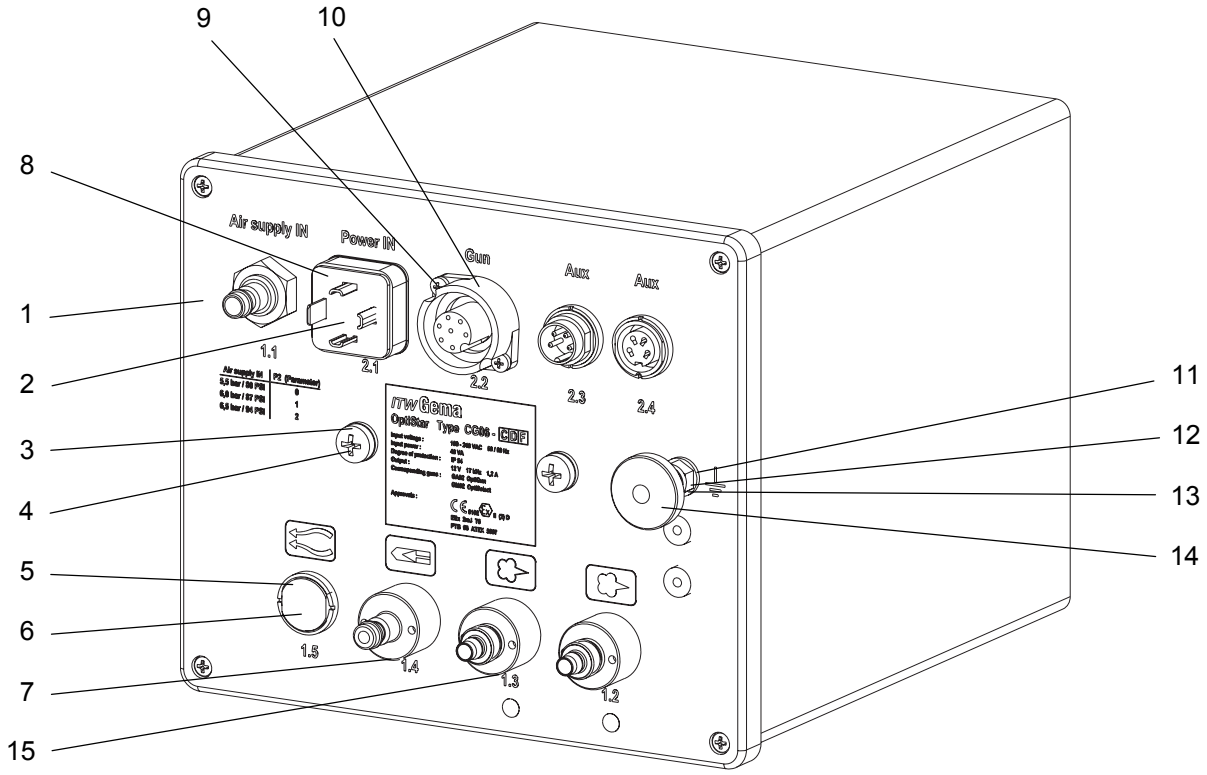
1	CAN bus module - complete	1001 274
2	Washer - Ø 6.4/12.5x1.6 mm	1001 686
3	Hexagon screw - M6x30 mm	215 279
4	Fluidizing pad - 1/8"a	237 264
5	Lock washer - M3 R	201 880
6	Hexagon nut - M3	202 142
7	Cylinder screw - M3x16 mm	221 074
8	Pneumatic group - complete	1001 469
9	Valve cable - CG06	1001 410
10	Screw-in nipple - 1/8"a, Ø 6 mm	262 315
11	Throttle motor - complete	1000 064



OptiStar CG06-C - inside rear wall

OptiStar CG06-C - outside rear wall

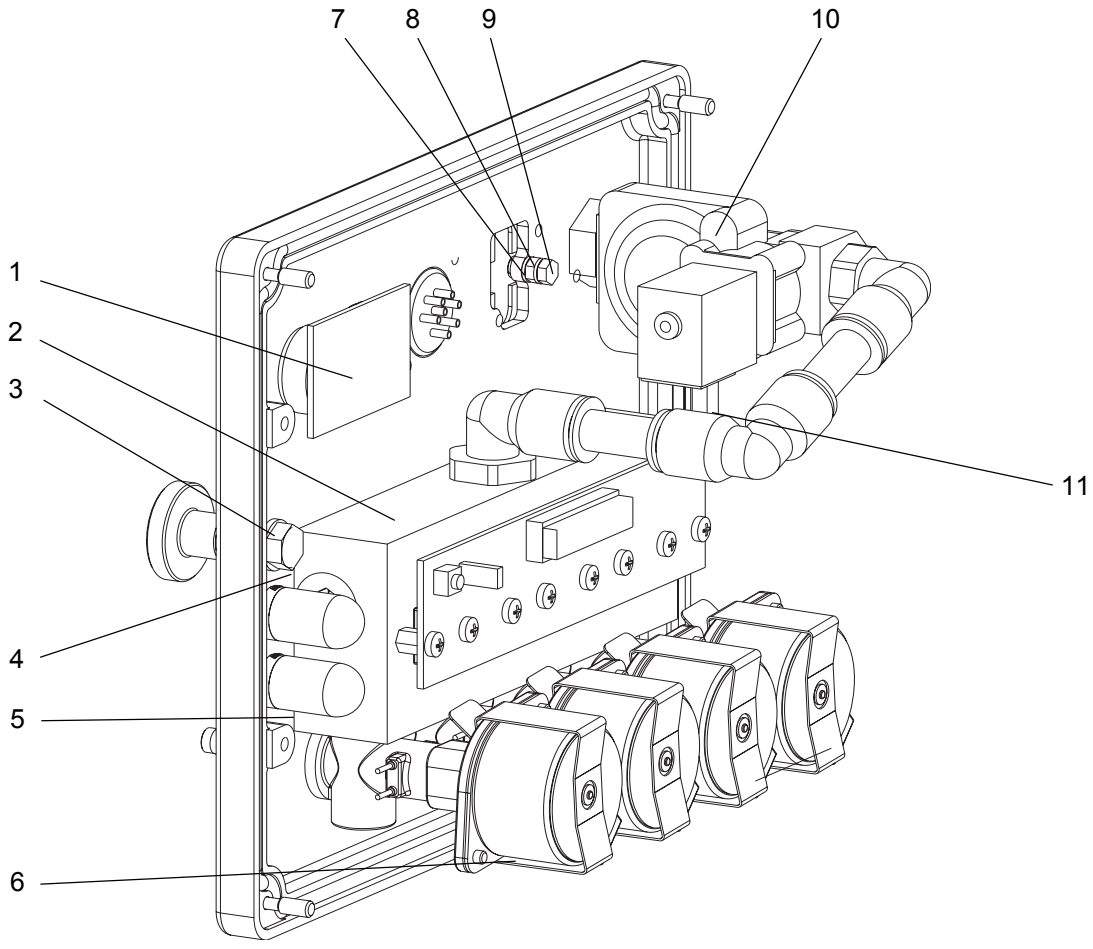
	Rear wall CG06-C - complete	1001 455
1	Rear wall	1000 070
2	Cap screw - M3x10 mm	216 739
3	Washer - Ø 6.4/12.5x1.6 mm	1001 686
4	Cap screw - M6x10 mm	205 214
5	Lock nut - M18x0.75 mm	1001 799
6	Screw plug - complete	1001 789
7	Rectus quick release connection - complete	1001 517
8	Mains connection CG06	1001 176
9	Cap screw - M3x8 mm	202 363
10	Gun connection CG06	1001 179
11	Washer - Ø 6.4/12.5x1.6 mm	200 476
12	Hexagon nut - M6	200 417
13	Shake proof washer - A type, M6	200 450
14	Milled nut - M6	200 433
15	Hose connection - complete, Ø 8/6 mm	1001 519
	Protection cap for 2.2 Aux connector socket (not shown)	206 474



OptiStar CG06-C - outside rear wall

OptiStar CG06-CF - inside rear wall

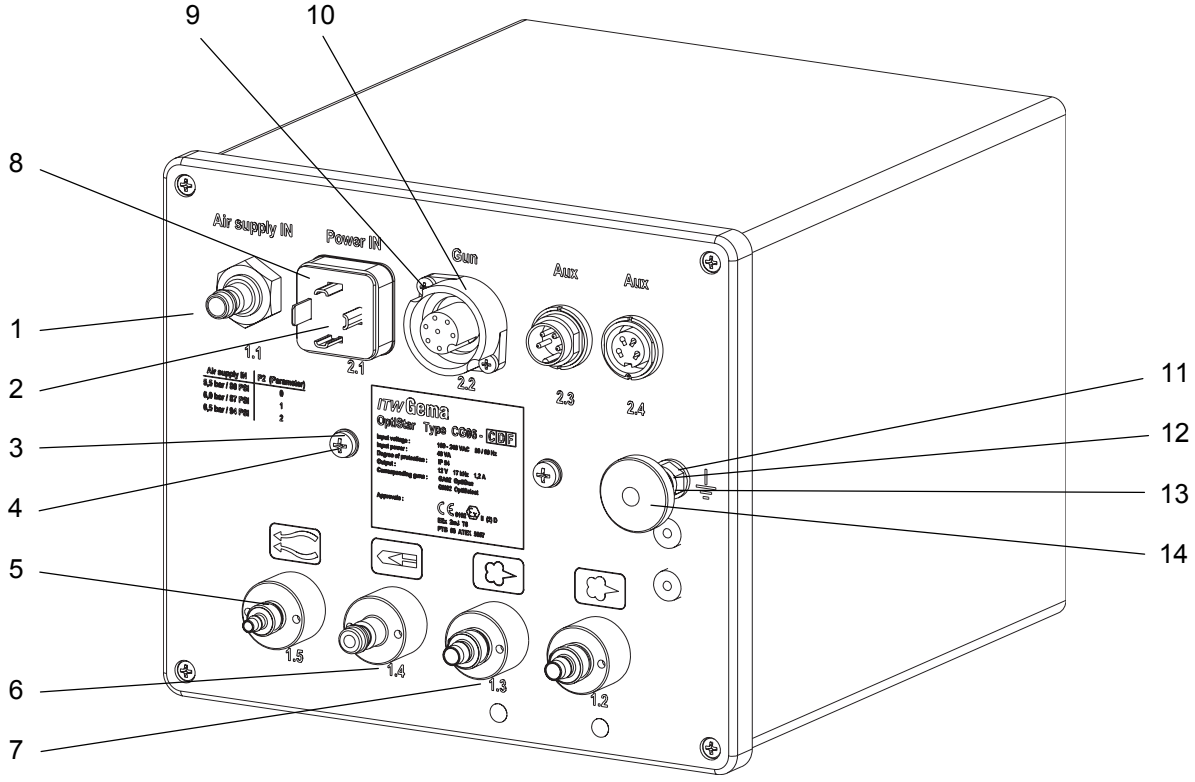
1	CAN bus module - complete	1001 274
2	FlowControl - complete	1000 076
3	Washer - Ø 6.4/12.5x1.6 mm	1001 686
4	Hexagon screw - M6x30 mm	215 279
5	Fluidizing pad - 1/8"a	237 264
6	Throttle motor - complete	1000 064
7	Lock washer - M3 R	201 880
8	Hexagon nut - M3	202 142
9	Cylinder screw - M3x16 mm	221 074
10	Pneumatic group - complete	1001 470
11	Valve cable - CG06	1001 410



OptiStar CG06-CF - inside rear wall

OptiStar CG06-CF - outside rear wall

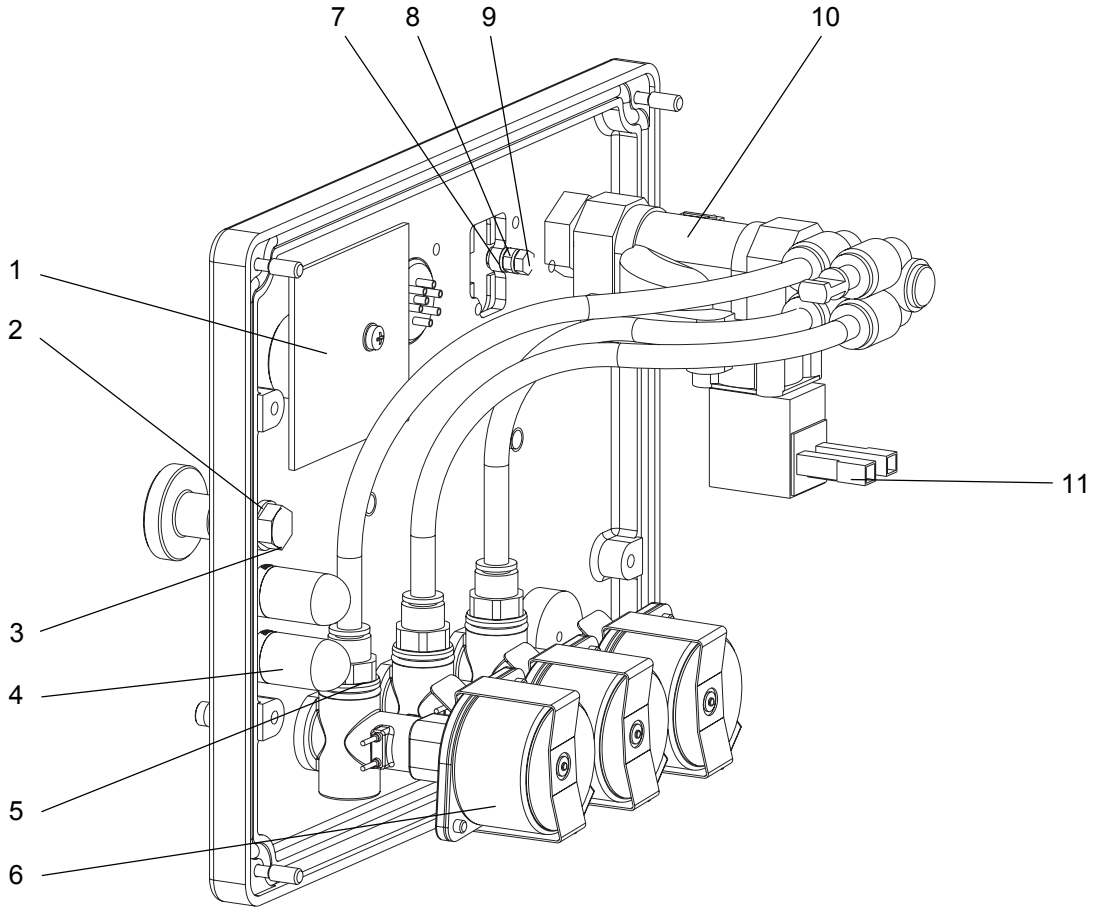
	Rear wall CG06-CF - complete	1001 456
1	Rear wall	1000 070
2	Cap screw - M3x10 mm	216 739
3	Washer - Ø 4.3/9x0.8 mm	1002 093
4	Cap screw - M4x12 mm	216 798
5	Hose connection - complete, Ø 6/4 mm	1001 520
6	Rectus quick release connection - complete	1001 517
7	Hose connection - complete, Ø 8/6 mm	1001 519
8	Mains connection CG06	1001 176
9	Cap screw - M3x8 mm	202 363
10	Gun connection CG06	1001 179
11	Washer - Ø 6.4/12.5x1.6 mm	200 476
12	Hexagon nut - M6	200 417
13	Shake proof washer - A type, M6	200 450
14	Milled nut - M6	200 433
	Protection cap for 2.2 Aux connector socket (not shown)	206 474



OptiStar CG06-CF - outside rear wall

OptiStar CG06-D - inside rear wall

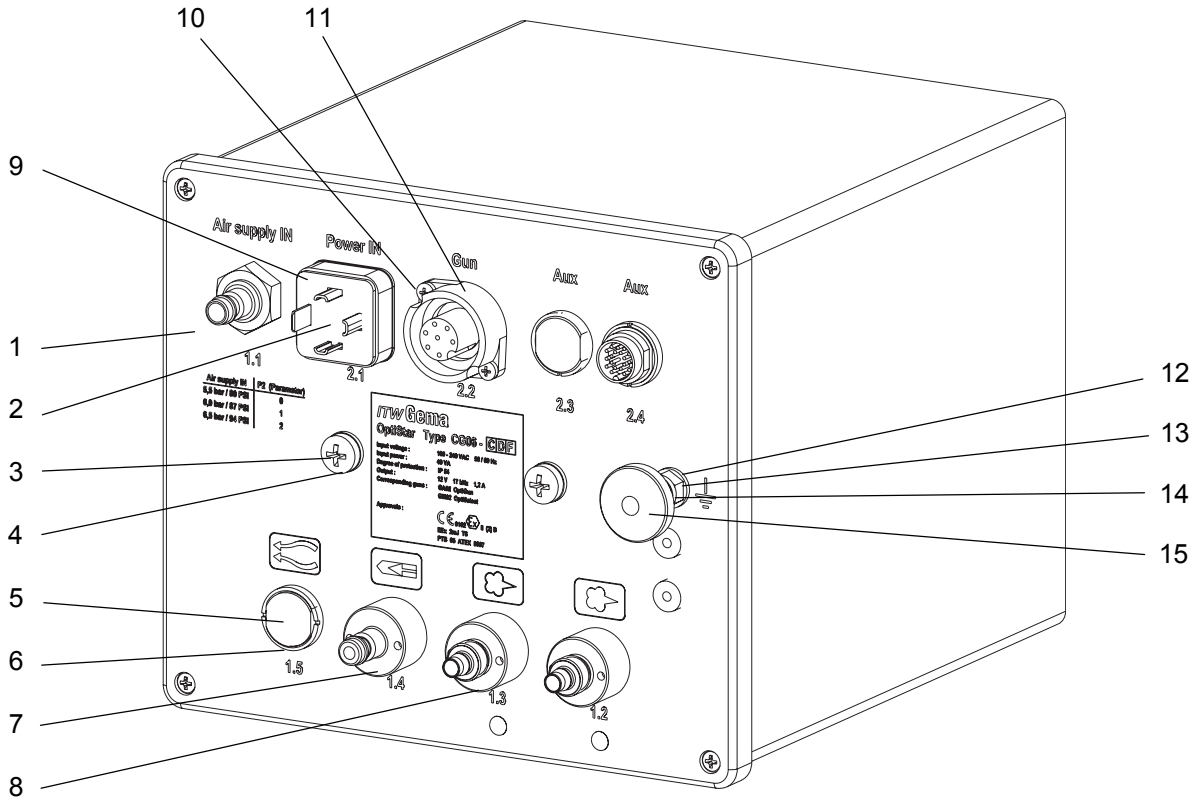
1	DigitalBus module - complete	1001 309
2	Washer - Ø 6.4/12.5x1.6 mm	1001 686
3	Hexagon screw - M6x30 mm	215 279
4	Fluidizing pad - 1/8"a	237 264
5	Screw-in nipple - 1/8"a, Ø 6 mm	262 315
6	Throttle motor - complete	1000 064
7	Lock washer - M3 R	201 880
8	Hexagon nut - M3	202 142
9	Cylinder screw - M3x16 mm	221 074
10	Pneumatic group - complete	1001 469
11	Valve cable - CG06	1001 410



OptiStar CG06-D - inside rear wall

OptiStar CG06-D - outside rear wall

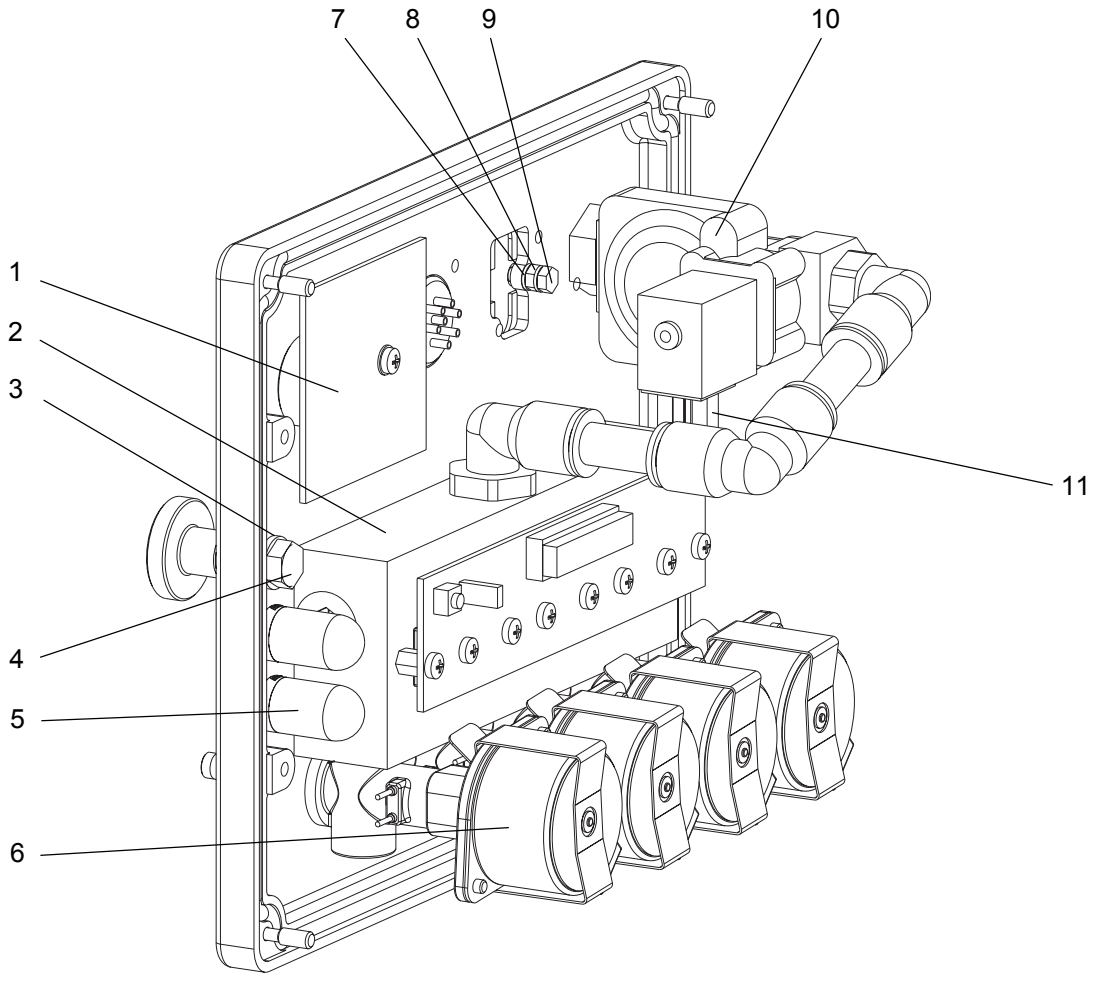
	Rear wall CG06-D - complete	1001 457
1	Rear wall	1000 070
2	Cap screw - M3x10 mm	216 739
3	Cap screw - M6x10 mm	205 214
4	Washer - Ø 6.4/12.5x1.6 mm	1001 686
5	Screw plug - complete	1001 789
6	Lock nut - M18x0.75 mm	1001 799
7	Rectus quick release connection - complete	1001 517
8	Hose connection - complete, Ø 8/6 mm	1001 519
9	Mains connection CG06	1001 176
10	Cap screw - M3x8 mm	202 363
11	Gun connection CG06	1001 179
12	Washer - Ø 6.4/12.5x1.6 mm	200 476
13	Hexagon nut - M6	200 417
14	Shake proof washer - A type, M6	200 450
15	Milled nut - M6	200 433
	Protection cap for 2.2 Aux connector socket (not shown)	206 474



OptiStar CG06-D - outside rear wall

OptiStar CG06-DF - inside rear wall

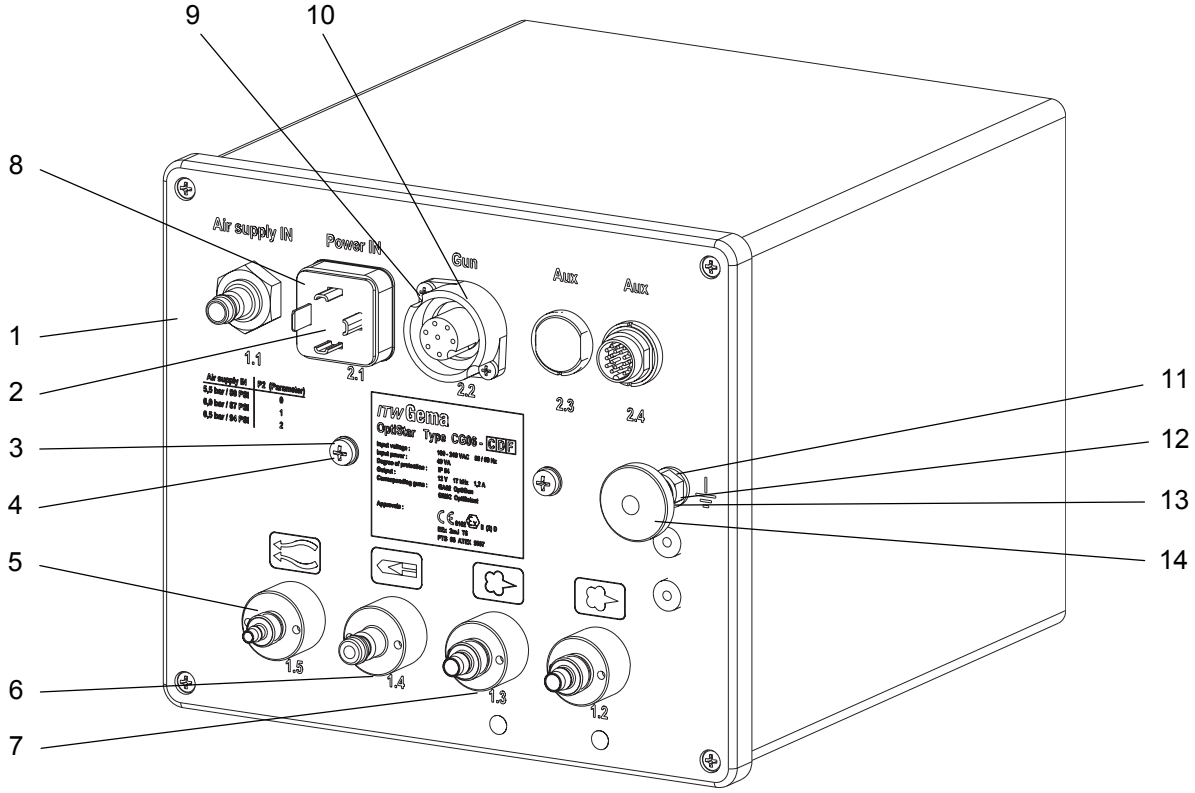
1	DigitalBus module - complete	1001 309
2	FlowControl - complete	1000 076
3	Washer - Ø 6.4/12.5x1.6 mm	1001 686
4	Hexagon screw - M6x30 mm	215 279
5	Fluidizing pad - 1/8"a	237 264
6	Throttle motor - complete	1000 064
7	Lock washer - M3 R	201 880
8	Hexagon nut - M3	202 142
9	Cylinder screw - M3x16 mm	221 074
10	Pneumatic group - complete	1001 470
11	Valve cable - CG06	1001 410



OptiStar CG06-DF - inside rear wall

OptiStar CG06-DF - outside rear wall

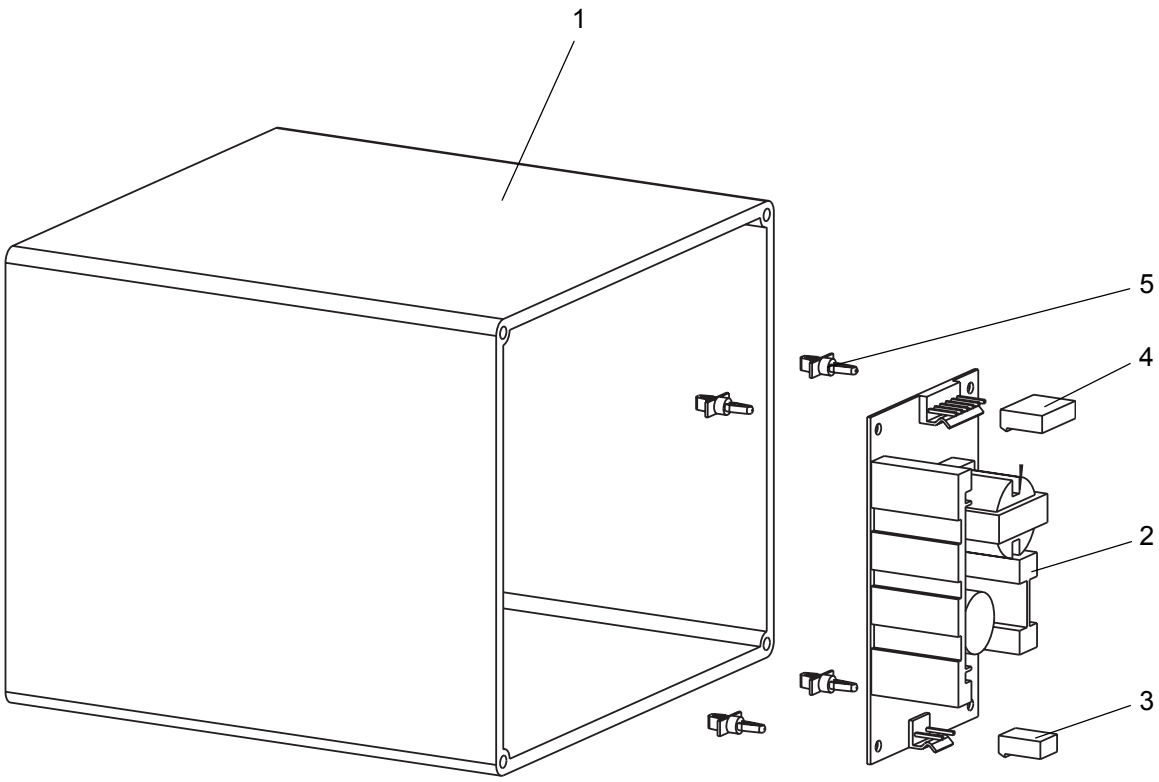
	Rear wall CG06-DF - complete	1001 458
1	Rear wall	1000 070
2	Cap screw - M3x10 mm	216 739
3	Washer - Ø 4.3/9x0.8 mm	1002 093
4	Cap screw - M4x12 mm	216 798
5	Hose connection - complete, Ø 6/4 mm	1001 520
6	Rectus quick release connection - complete	1001 517
7	Hose connection - complete, Ø 8/6 mm	1001 519
8	Mains connection CG06	1001 176
9	Cap screw - M3x8 mm	202 363
10	Gun connection CG06	1001 179
11	Washer - Ø 6.4/12.5x1.6 mm	200 476
12	Hexagon nut - M6	200 417
13	Shake proof washer - A type, M6	200 450
14	Milled nut - M6	200 433
	Protection cap for 2.2 Aux connector socket (not shown)	206 474



OptiStar CG06-DF - outside rear wall

OptiStar CG06 - enclosure and power pack

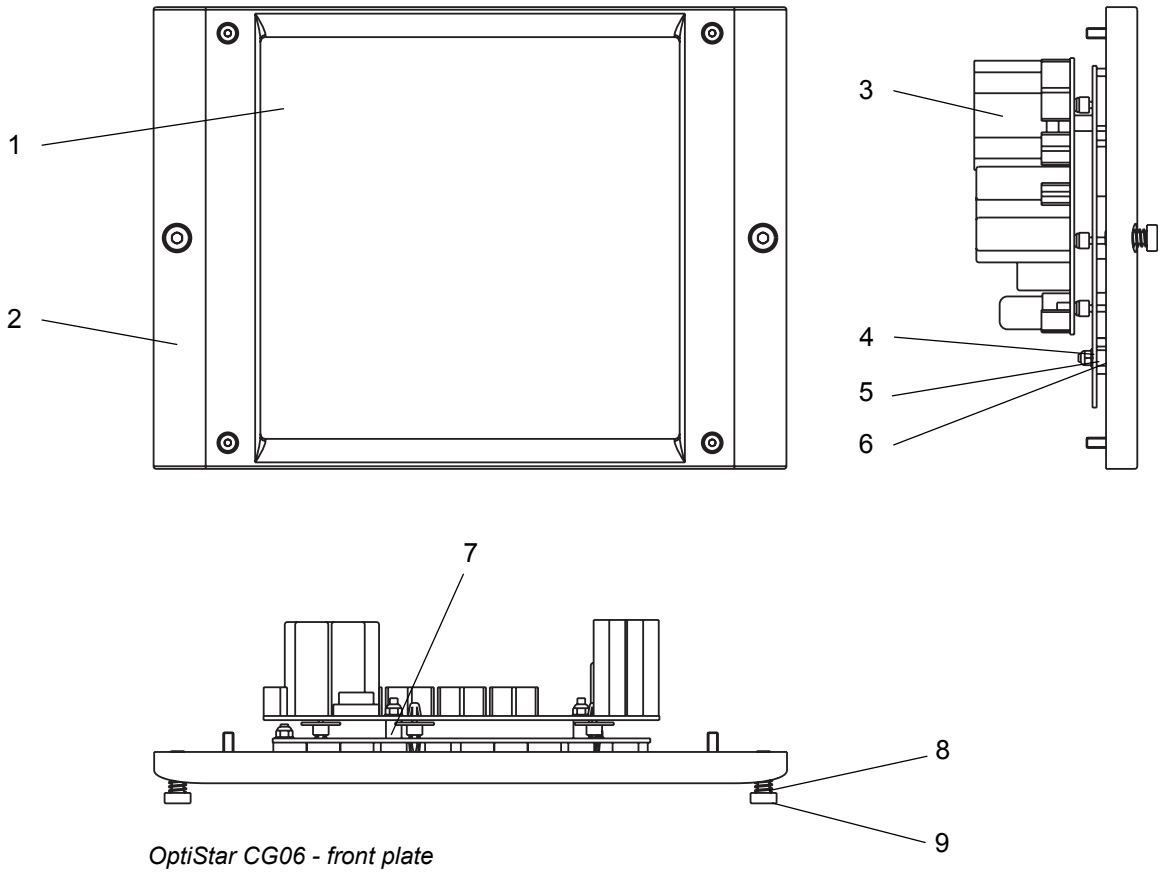
1	Enclosure - CG06 control unit	1001 435
2	Power pack - 15 VDC	374 059
3	Mainboard power supply	1000 388
4	Mainboard power supply	1001 178
5	Spacer - Ø 4, Ø 4.8/4.8 mm, PA	263 508



OptiStar CG06 - enclosure and power pack

OptiStar CG06 - front plate

	Front plate - complete	1000 395
1	Front plate with foil keyboard	1000 394
2	Front shield - complete	1000 528
3	OptiStar mainboard V1.0 - complete, with display	1000 875
4	Locknut - M3	262 498
5	Washer - Ø 3.2/7x0.5 mm	201 944
6	Spacer sleeve - Ø 3.2/6x6 mm	1001 925
7	Spacer sleeve - Ø 3.2/6x15 mm	1001 926
8	Compression spring - 0.5x6.3x13.5 mm	230 251
9	Special screw	1000 400



OptiStar CG06 - front plate