

For HOERBIGER Laser Gas Regulator with Piezo-Control  
Series PRE-4 Analog und EtherCAT

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## GENERAL INFORMATION

### Purpose

As an addition to the original operating manual, this quick installation guide only contains the basic information for fast commissioning of the Laser Gas Regulator. For more detailed information please read the original operating manual. This guide does not replace the original operating manual.

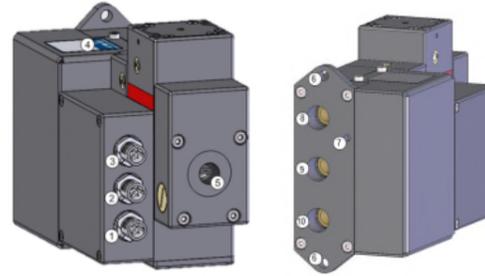
### Concept

Laser Gas Regulators made by HOERBIGER are electronically controlled proportional pressure control valves with maximum three integrated gas selection valves. The control and selection valves as well as the control and communications electronics form a compact unit.

### Intended Use

The Laser Gas Regulator may only be operated with the process gases defined in the data sheet. The laser gas regulator must be operated only with dry, dust and particle-free, pure gases. Measures see chapter 3.4.1 Technical requirements. The Laser Gas Regulator must not be modified or changed in any other manner.

### Main components



- 1 Electrical terminal X1 M12x1
- 2 Electrical terminal X2 M12x1
- 3 Electrical terminal X3 M12x1
- 4 Nameplate
- 5 Outlet G $\frac{1}{4}$ "
- 6 Attachment bore
- 7 Pilot Pressure M5 port
- 8 Gas 1 port G $\frac{3}{8}$ "
- 9 Gas 2 port G $\frac{3}{8}$ "
- 10 Gas 3 port G $\frac{3}{8}$ " (only 3-gas version)

### Type Code

LGR	3V	A	00	30	S	A1
Laser Gas Regulator						
2V = 2 selection valves 3V = 3 selection valves						
A = analog						
00 = voltage 0-10 V						
D = digital						
E = Ethercat						
30 = max. pressure range (bar)						
S = special version with current number						
A1 = series designation						



## Safety

### WARNING

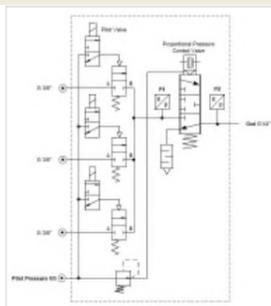
- ▲ Only trained staff is permitted to connect the compressed air and process gas supplies
- ▲ Always wear eye protection according to EN 166 as protection against contact with toxic substances when working on the pneumatic system: lightweight goggles, e.g. clear PC lens, largely chemical-resistant
- ▲ Always wear gloves according to EN 388 as protection against mechanical risks when performing work that requires hand protection.
- ▲ Never repair a defective Laser Gas Regulator yourself.
- ▲ Immediately replace a defective Laser Gas Regulator.
- ▲ Send the defective Laser Gas Regulator for repair to HOERBIGER Automatisierungstechnik Suedliche Roemerstraße 15 86972 Albstadt.
- ▲ Only HOERBIGER or authorized repair facilities are permitted to perform repairs.

## Operation and function

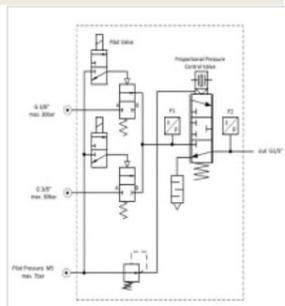
The Laser Gas Regulator is a proportional pressure control valve for controlling the inert gas flow during laser cutting. The Laser Gas Regulator can be integrated with a laser device in a laser cutting machine.

Different process gases (argon, compressed air, oxygen or nitrogen) can be connected to the 2/2 way valves. It is possible to select which of the gases is used for the respective application.

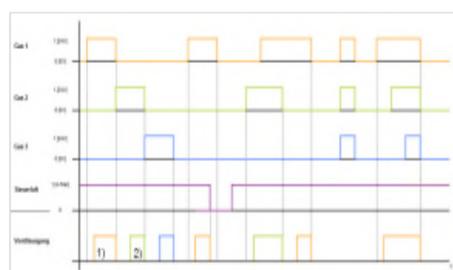
A model with analog interface and a model with EtherCAT interface are available.



Picture 1 - 3-gas schematics



Picture 2 - 2-gas schematics



- 1) Pneumatic switching time of approx. 80 ms without electronic switching delay (e.g. gas 1 in the diagram)
- 2) Pneumatic switching time of +150 ms electronic switching delay. Electronic pulse off time between the switching of two valves (e.g. gas 2 in the diagram)

Picture 3 - Timing of the selection valves by internal control unit

## Mechanical Installation

### WARNING

- ▲ Use a threadlocker for the fixing screws
- ▲ Observe tightening torque
- ▲ Observe the installation position to ensure that interferences from acceleration in the X/Y axis cannot act on the gate valve



- (1) The Laser Gas Regulator must be securely affixed to a mounting plate using two M6 screws. Two boreholes are provided for this purpose on the flange at the back of the Laser Gas Regulator.
- (2) Observe tightening torque: 9.5 ± 0.5 Nm.

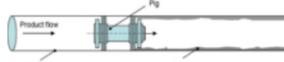
## Pneumatic Installation

### WARNING

- ▲ Do not use compressed air which includes chemicals, synthetic oils containing organic solvents, salts or corrosive gases, etc., as this may cause damage or malfunction.
- ▲ Clean and dry gases must be used. Use air drying equipment. (e.g. Refrigeration air dryers or Adsorption dryers)
- ▲ For each gas, an air filter with a max. mesh size of 5µm must be installed close to the product by machine manufacturer.
- ▲ Improperly connected pressure hoses may cause defects and result in injury. The pressure hoses are subject to a pressure of up to 30 bar. Improperly connected hoses may detach under pressure, flap around and injure operators located in the vicinity.
- ▲ Prior to installation ensure that there is no pressure in the lines and secure pressure lines against being switched back on.
- ▲ The Laser Gas Regulator may only be operated within the performance limits (s. data sheet)
- ▲ No Teflon or liquid seals for connecting pipes or fittings must be used, as parts of it could become loose. Use fittings with O-Rings instead.



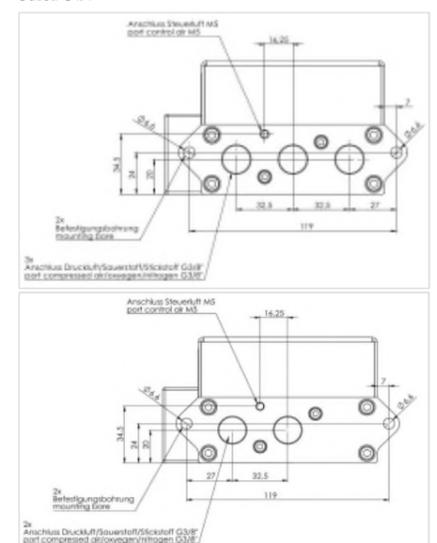
- ▲ Carbon or metal dust or powder from air compressors can damage the product. All compressed air and gas hoses connected to the laser gas regulator must be flushed or pigged right before installation, in order to remove particles and deposits inside the hose.



- (1) Connect gas lines
- (2) Connect the control air supply to the control air port.
- (3) Connect the argon, compressed air, oxygen or nitrogen supply to the ports gas 1, gas 2 resp. gas 3.
- (4) Check connections for proper and tight fit.

### Pneumatic ports

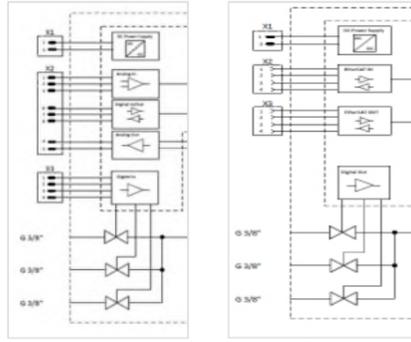
Gas 1: G $\frac{3}{8}$ "  
Gas 2: G $\frac{3}{8}$ "  
Gas 3: G $\frac{3}{8}$ " (only 3-gas version)  
Control air: M5  
Outlet: G $\frac{1}{4}$ "



## Electric Installation

### WARNING

- Never apply more than 24 VDC +/- 10%.
- Check any electrical connection carefully after installation.

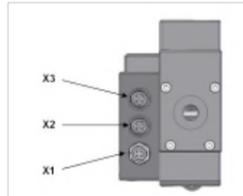


Analog

EtherCAT

	Analog	EtherCAT
Rated voltage	24 ± 10% V DC	
Rated output	8 W	
Max. residual ripple	10%	
Power consumption	300 mA	
Communication	EtherCAT	
Electrical connection	X1 power supply: M12x1 A-coded 4-pin connector X2 control signals: M12x1 A-coded 8-pin connector X3 gas selection: M12x1 B-coded 5-pin connector	X1 power supply: M12x1 A-coded 4-pin connector X2 EtherCAT input: M12x1 D-coded 4-pin socket X3 EtherCAT output: M12x1 D-coded 4-pin socket

- Connect the 24 V power supply to the X1 terminal.
- Connect the cable for the control signals (respectively EtherCAT) to the X2 terminal.
- Connect the cable for the gas selection (respectively EtherCAT) to the X3 terminal.
- Check the plug connection to ensure correct fit.
- Shield of Cable (Conn. X1, X2, X3) shall be connect direct to Machine Ground (Improves EMC resistance to interferences)



Cable specifications	Connection	PIN assignment
X1 Power supply M12x1 A-coded 4-pin connector		1: 24 VDC 2: UART Rxt (do not connect) 3: GND 4: UART Txt (do not connect)
X2 EtherCAT input M12x1 D-coded 4-pin socket		1: Tx + 2: Rx + 3: Tx - 4: Rx -
X3 EtherCAT output M12x1 D-coded 4-pin socket		1: Tx + 2: Rx + 3: Tx - 4: Rx -

Cable specification Ethercat

Cable specifications	Connection	PIN assignment
X1 Power supply M12x1 A-coded 4-pin connector		1: 24 V; 2: UART Rxt (do not connect) 3: GND; 4: UART Txt (do not connect)
X2 Control signals M12x1 A-coded 8-pin connector		1: + Set value (0 to 10V / input) 2: - Set value (Gnd / input) 3: Gnd 4: Inlet pressure P1 (0 to 10 V = 0 to 30 bar / output) 5: Outlet pressure P2 (0 to 10 V = 0 to 30 bar output) 6: Digital_IO1 (Ready [0/24V output]) 7: Digital_IO2 (pressure reached [0/24 V output]) 8: Digital_IO3 (calibration [0/24 V input])
X3 Gas selection M12x1 B-coded 5-pin connector		1: Gas 1 (0/24 V input) 2: Gas 2 (0/24 V input) 3: Gnd 4: Gas 3 (0/24 V input) 5: n.c.

Cable specification analog

## Commissioning & Operation

### WARNING

- Ensure that electrical cables and gas lines are correctly connected to the proper terminals and ports.
- Never apply more than 24 VDC +/- 10%.
- Activate the self-calibration after every pallet change to compensate for temperature influences and achieve maximum control precision

### Preparation

- Activate the compressed air supply, control air and process gases at the primary air and gas supply systems.  
Switch on the 24 V power supply.

### Activation, Self-Calibration

- Activate the 24 V power supply at the Laser Gas Regulator.  
**Result:** The equipment self-calibration process will start. After approximately 15 seconds, the Laser Gas Regulator reports its operational readiness.  
**Analog:** X2 terminal, digital output "Ready"  
**EtherCAT:** via PDO GAS\_STA Bit 1.  
The Laser Gas Regulator switches to the operating state predefined by the input signals.

### Deactivation

- Deactivate the 24 V power supply at the Laser Gas Regulator.  
**Result:** The bleeding of the outlet of the Laser Gas Regulator then starts.

### Selecting the gas inlet

- Analog:** Activate the desired selection valve at the X3 terminal via the digital input.
- EtherCAT:** Use PDO GAS\_SEL to set the appropriate bit for the desired selection valve.

### Setting the pressure set value

- Analog:** Set the target value to the X2 terminal by applying voltage to the analog input.
- EtherCAT:** Set the target value via PDO P\_SOLL.

### Changing the assist gas

- Disconnect the active gas selection valve from the machine using control signals.
- If the inlet pressure has dropped to below 5 bar: set the target value to 0 bar using control signals from the machine.
- Activate the selection valve for the desired process gas.
- Establish the new target value using control signals from the machine.

### Triggering self-calibration during operation (offset outlet pressure)

- Deactivate all selection valves using control signals from the machine.

- Set the target value for the outlet pressure "0 bar".
- Apply the calibration signal.  
**Analog:** Set X2 terminal, digital input "Calibration". When the "Ready" signal shows the value "0", reset the "Calibration" digital input.  
**EtherCAT:** Set PDO GAS\_SEL Bit 3. When PDO GAS\_STA Bit1 shows the value "0" or Bit4 shows the value "1", reset PDO GAS\_SEL Bit 3.  
**Result:** After approximately 15 seconds, the self-calibration process is completed.  
The Laser Gas Regulator reports the "Ready" state of operational readiness.

### Additional functions, analog and digital feedback

#### Analog version

- Feedback 'inlet pressure': X2 terminal (analog output)
- Feedback 'outlet pressure', X2 terminal (analog output)
- Feedback 'outlet pressure reached': X2 terminal (digital output)  
Criteria for 'pressure switching condition is reached: |actual pressure - target pressure| < 4% of the target pressure value + 0.21 bar

#### EtherCAT

- Feedback 'actual pressure': PDO P\_IST
- Feedback 'admission pressure (inlet pressure)': PDO PV\_IST
- Feedback 'control value controller output': PDO REG\_ST
- Feedback 'outlet pressure reached': PDO GAS\_STA Bit 0
- Feedback 'low inlet pressure < 1.1 \* target value': PDO GAS\_STA Bit 2
- Feedback 'low inlet press. < 1.05 \* target value': PDO GAS\_STA Bit 3
- Feedback 'calibration': PDO GAS\_STA Bit 4
- Configuration window "Pressure reached" PDO PR\_RE  
The PDO PR\_RE copies the value from the control output "PR\_RE" to the control input "PR\_RE". This PDO can be used to test the EtherCAT functional readiness.

### Restoring the energy supply

When the electric or pneumatic power supply fails, the outlet of the Laser Gas Regulator is bled within 200 ms to prevent the process gases from leaking. The Laser Gas Regulator remains depressurized at the outlet and any further supply of gas is prevented.

When the supply of energy is restored, the Laser Gas Regulator returns to the operating state defined by the input signals. If the electrical power supply was interrupted, the Laser Gas Regulator is first initialized for 15 seconds.

- Check the energy supply to the Laser Gas Regulator to ensure proper functioning.
- Restore any interrupted energy supply to the Laser Gas Regulator.

## EtherCAT Process data objects

Objects	I/O	Size	Description
P_Soll: Target value	I	1 Word	Target value Selection of target value 0 to 30000 [mbar]
P_Ist: Actual value	O	1 Word	Actual value Feedback of actual pressure 0 to 30000 [mbar]
PV_IST: Admission pressure	O	1 Word	Admission pressure Feedback of admission pressure 0 to 40000 [mbar]
REG_ST: Control value derivative control unit	O	1 Word	Control output pressure control circuit 0 to 10000
SER_NR	O	1 Word	Serial number Equipment serial number format: decimal 1 to 9999
SW_VER	O	1 Word	Software version Software version format: hexadecimal Example: SW ver. (dec.): 01.00.00.01 corresponds to 0x1001
DATA_1	O	1 Word	Reserve No data content
DATA_2	O	1 Word	Reserve No data content
DATA_3	O	1 Word	Reserve No data content
PR_RE : Pressure Achieved [%]	O	1 Word	Target value Measurement window pressure reached Format: 0x0000
GAS_SEL: Gas selection	I	1 Word	Bit 0: Gas selection 1 Switch 1 selection valve 0/1 Bit 1: Gas selection 2 Switch 2 selection valve 0/1 Bit 2: Gas selection 3 Switch 3 selection valve 0/1 Bit 3: Calibration request Request for self-calibration Offset outlet pressure
GAS_STA: Gas status	O	1 Word	Bit 0: Pressure reached Feedback pressure reached 0/1 Bit 1: Control unit status Feedback control unit ready 0/1 Bit 2: Gas warning Feedback supply gas < 110% * target 0/1 Bit 3: Gas error Feedback supply gas < 105% * target 0/1 Bit 4: Calibration running Self-calibration (offset outlet pressure) is carried out
PR_RE: Pressure reached [%]	I	1 Word	Higher byte (or 0xFF00) 0 to 17.0% of pressure target value reached above 0 to 170 (or 0xAA) Lower byte (or 0x00FF) 0 to 17.0% of pressure target value reached below 0 to 170 (or 0xAA)

## Malfunctions

Malfunction / message	Potential cause	Remedy
No process gas pressure	Failure of the electrical or pneumatic power supply system Contamination	Restore the energy supply Consider 'Warning'-section in chapter 'Pneumatic Installation'
The "Ready" signal does not shows "high" after 24V power up	Failure of the electrical power supply system or insufficient power supply Failure Pressure sensor	Check the electrical power supply Replace LGR
The "Ready" signal does not shows "high" after finish "Calibration"	Failure or not enough pneumatic energy supply (pilot pressure) Failure Pressure sensor	Check pilot pressure and restart Calibration Replace LGR
The "Ready" signal shows "low" during operation	Failure of the electrical power supply system or insufficient power supply	Check the electrical power supply
"Pressure reached" signal is not switching	Failure of not enough pneumatic energy supply (pilot pressure and/or medium gas) Contamination	Restore energy supply Consider 'Warning'-section in chapter 'Pneumatic Installation'