

igus® motion Plastics®

dryve D7, Step/Direction Stepper Motor Control System

Manual V 1.2



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1 Safety Instructions, Protective Measures and Guidelines

1.1 Important Instructions

Read this manual carefully before operating the motor controller. Familiarise with the safety instructions and ensure that the required safety measures are followed.

This manual was created according to the best of our knowledge and belief. It is used for technical documentation and for assisting the user during the initial operation. The warnings, cautions and instructions issued by igus® regarding the motor controller must in any case be passed on to the end user if the motor controller is used as part of an overall system.

igus® undertakes warranties only for igus® products in accordance with the standards, norms and specifications given in this manual. The guarantee covers only the replacement or repair of a defective motor controller. There is no liability for consequential damage and consequential errors. igus® does not take any responsibility for the integration of the motor controller into the overall system. The responsibility for it lies with the plant designer or the end user. Please observe the instructions under "**Qualified Personnel**". igus® assumes no liability for personal injury or damage to property resulting from misuse or unauthorised technical modification of the motor controller.

igus® reserves the right to make changes and improvements to the product or the technical documentation at any time without prior notice.

The motor controller must only be used if:

- All information and safety instructions in this manual have been observed.
- No changes have been made to the motor controller and it is in a technically flawless condition.
- The operating limits that are specified in technical data are complied with.
- Necessary measures, if called for, have been taken for radio interference suppression depending on the operating environment.
- All connection cables used are strain relieved.

1.2 Qualified Personnel

The operation of the product must only be carried out by qualified personnel.

Personnel must:

- Have read and understood this manual and documentation on the installed motor, axis and accessories.
- Be familiar with all relevant applicable standards, provisions and accident prevention regulations.
- Be able, due to their training, to anticipate or recognise any hazards that may arise when using the control system.
- Ensure the safety of persons and objects when using the motor control system in the overall system.

1.3 Maintenance

The motor controller is maintenance-free.

Never open the housing of the motor controller independently, even in the event of a malfunction.

Opening the housing will void the warranty.

1.4 Safety Instructions

1.4.1 Classification of Information

The degree and type of hazard are assigned to one of the following classes.

	DANGER!
Safety instructions marked with DANGER indicate an imminently hazardous situation. A disregard of the notice inevitably leads to a serious or even fatal accident.	

	WARNING!
Safety instructions marked with WARNING indicate a potential hazardous situation. Failure to observe this notice is likely to result in a serious or fatal accident or property damage.	

	CAUTION!
Safety instructions marked with CAUTION indicate potential danger. Failure to comply with the notice may possibly result in an accident or property damage.	

	NOTE
Safety instructions marked with NOTE indicate a potential hazardous situation. Disregard of the notice may possibly result in property damage.	

1.5 Electromagnetic Compatibility

	WARNING!
Risk of injury due to interference with signals and devices Disturbed signals can cause unforeseen device reactions. Carry out the wiring in accordance with the EMC measures. Failure to follow these instructions can result in death, serious injury, or material damage	

	Measures for EMC	Effect
Device assembly	Use cable clamps for the shield support, connect metal parts over a large area.	Good conductivity due to surface contact.
	Switching devices such as contactors, relays or solenoid valves with interference suppression units or spark suppressors (e.g. diodes, varistors, RC elements)	Reduce mutual interference couplings.
Wiring	Keep cables as short as possible.	Avoid capacitive and inductive interference.

2 Product Overview

This motor controller can control stepper motors with up to 2.7 A continuous current at a supply voltage of up to 48 V.

Ready for immediate use

Connect the voltage source, control signals and motor and you're ready to go. No complicated software installation or time-consuming wiring of various additional switches and sensors.

Simple control

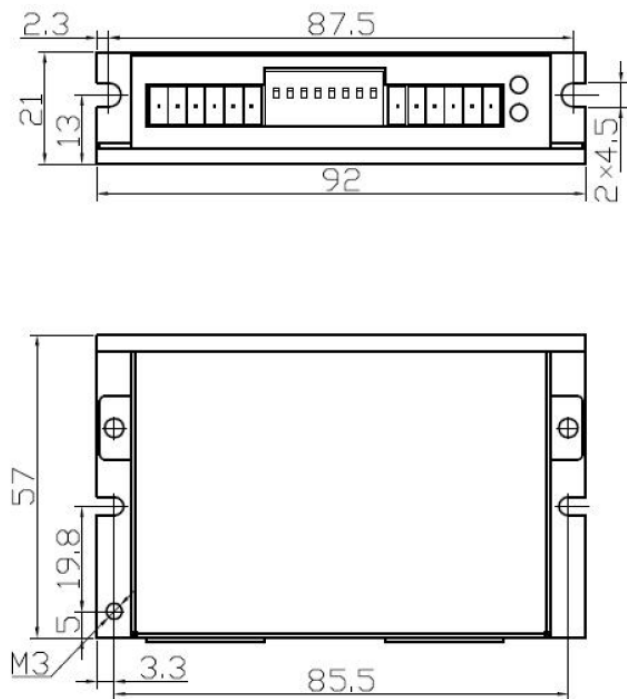
With the JOG mode, a pre-selected speed can be started by simply applying a signal. The rotational direction can be changed by connecting a second signal.

Precise positioning

When using the Pulse Mode, simple clock signals can be used for highly precise positioning. In combination with a PLC or a microcontroller, even highly complex applications can be realised.

2.1 Technical Data

2.1.1 Dimensions



2.1.2 Mechanical Data

D x W x H motor controller in mm	57 x 21 x 92
Weight	150 g

2.1.3 Electrical Data

Power supply	24 V up to 48 V, ± 2 V
Motor type	Stepper motor
Standstill current	0,25 A up to 1,98 A
Continuous motor current	0,5 A up to 2,2 A
Peak motor current	0,7 A up to 3 A
Current Drain Logic	40 mA at 24 V
	26 mA at 48 V
Voltage Step/Direction inputs	5 up to 24 V, -0,5 V + 2 V
Input frequency	2 Hz up to 1 MHz
Step input signal width	Min. 250 ns
Direction input signal width	Min 50 μ s
Dissipation Loss	Max. 144 W
Digital Inputs/Outputs	Galvanically Separated by Optocoupler
Boot up time	2 s.
Cable length	Max.30 m
Allowed Cable Cross Sections	0,34 mm ² up to. 1,0 mm ²
	AWG 22 up to AWG 17

2.1.4 Environmental conditions

Ambient temperature	Operation	0°C to +40 °C
	Transport	-10 °C to +70 °C
	Bearing	-10 °C to +70 °C
Relative humidity	≤ 90 %, non-condensing	
Protection class	IP 20	
Shock	Max. 5,9 m/s ²	
Degree of soiling according to EN 61010	1	

3 Installation

3.1 Mechanical Installation

	WARNING!
• Danger of malfunction • Fire hazard • Explosion hazard Never operate the motor controller in water or in an aggressive, flammable, or explosive atmosphere. Always pay attention to the environmental conditions	

	CAUTION!
The length of the screw for fastening the top-hat rail clip must not exceed 4 mm, otherwise the controller might be destroyed	

- The installation in a switch cabinet can be performed on a TS 35 mounting rail (EN 50022) by mounting a separately available top-hat rail clip – [Accessories](#) (p.14).
- An M3x4 screw is required to fix the top-hat rail clip - the screw must not be longer than 4 mm
- The distance to neighbouring components must be at least 10 mm.
- The heated air flow of other units and components must not be routed through the area of the motor control unit
- The device must be aligned vertically. For horizontal alignment, the maximum power must be reduced by 30% to prevent overheating

3.2 Electrical Installation

The dryve D3 motor controller is constructed for use with direct currents.
Every voltage mentioned in this manual can be regarded as direct current.

	WARNING!
• Risk of injury Make sure that an emergency shutdown can be performed at all times.	

	CAUTION!
• Danger of electrical voltage • Danger of electric arcs Always turn off the power before disconnecting or making electrical connections in the system. Secure the power supply against restart. After switching the device off, wait at least 5 minutes. Check for the absence of voltage before working on the system. Danger of improperly mounted electrical connections. Do not allow cables to be unmounted and ensure that all connections are secure.	

	CAUTION!
• Electromagnetic alternating fields Electromagnetic fields around the live wires may cause interference. Lay the supply and motor cables separately from the control cables. Use the shortest possible cable lengths. Follow the instructions for Electromagnetic Compatibility (p. 4)	

	NOTE
An operating voltage above the voltage specified in the technical data, as well as a voltage reversal might destroy the motor controller. Select an operating voltage within the voltage range specified in the technical data.	

3.2.1 Pin Assignment

The connectors must be wired according to your application.

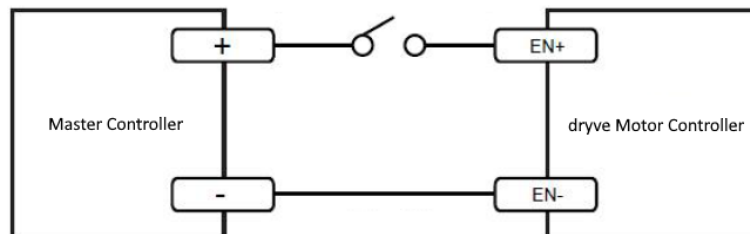
Pin	Description	Voltage limits
V +	Power supply	24 V up to 48 V
V -	Power supply ground	0 V
A +	Motor A	-
A -	Motor A/	-
B +	Motor B	-
B -	Motor B/	-
STEP +	Motion input	5 V up to 24 V
STEP -	Motion input ground	0 V
DIR +	Motion input	5 V up to 24 V
DIR -	Motion input ground	0 V
EN +	Enable signal	5 V up to 24 V
EN -	Enable signal ground	0 V

NOTE

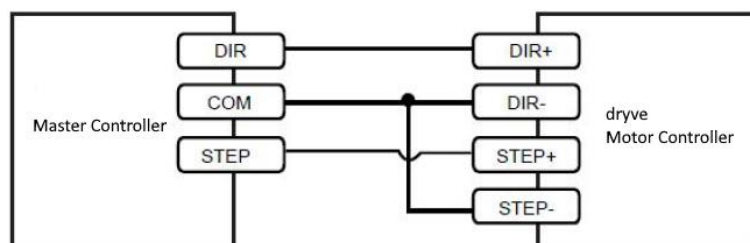
If different power supplies are used for the supply of the motor (terminal V+ and V-) and the supply of the signal transmitter (terminal STEP+, STEP-, DIR+, DIR- and EN+ and EN-), a ground potential equalisation of the power supplies must be performed

3.2.2 Connection Scheme Signal In/Output

Enable signal „EN“



Motion signal „STEP“ and „DIR“



3.3 Integration into Safety Circuits

The integration into a safety circuit must always be in accordance with the applicable regulations.

The following options are available

Measures	Advantages	Disadvantages
Switching off the load supply voltage	Direct de-energisation of the motor	Uncontrolled coasting of the motor
Switching off control signals "STEP" and "DIR"	Generation of a braking torque by emitting a holding current	No voltage-free status of the motor
Switching off the enable signal "EN"	Direct de-energisation of the motor	Uncontrolled coasting of the motor. Motor could remain energised in a fault condition.
Switching off the control signals at "STEP" and "DIR" and delayed switching off of the enable signal "EN"	Generation of a braking torque by output of the holding current	No direct de-energisation of the motor. Motor could remain energised in a fault condition.
Switching off the control signals at "STEP" and "DIR" and delayed switching off of the load supply voltage	Generation of a braking torque by emitting a holding current with subsequent de-energisation of the motor	No direct de-energisation of the motor.

4 Initial Operation

The following describes the initial operation, which makes the start easy.

Connect the whole system according to [Electromagnetic Compatibility](#) (p. 4)

Minimum equipment

To control a motor with the D3 drive, a minimum equipment has to be provided by the user:

1. Power supply with 24 V up to 48 V and connecting cables
2. Stepper motor with suitable cable
3. Switches/signa generator/microcontroller/PLC

	DANGER!
• Danger of falling load Never work under unsecured vertical axes and loads. Secure the axis or load against falling by a mechanical safety device or other approved safety method.	

	WARNING!
• Fire hazard Faulty settings of the motor controller can lead to extremely high motor temperatures.	

	NOTE
A faulty connection can damage or destroy the motor controller.	

4.1 Configuration

8 dip switches (SW) are available for configuring the motor control.

These can be used to preselect the emitted motor current during a movement, the step mode, the emitted current at standstill and the fixed motor speed in jog mode as well as executing the autotuning.



4.1.1 Motor Current

The motor current output during a movement can be adjusted depending on the connected motor by combining switches SW1 to SW3. To output the desired motor current, the switches must be combined using the following table.

Peak	RMS	SW1	SW2	SW3
0,7 A	0,5 A	ON	ON	ON
1,0 A	0,7 A	OFF	ON	ON
1,3 A	0,9 A	ON	OFF	ON
1,6 A	1,1 A	OFF	OFF	ON
1,9 A	1,3 A	ON	ON	OFF
2,2 A	1,6 A	OFF	ON	OFF
2,7 A	1,9 A	ON	OFF	OFF
3,0 A	2,2 A	OFF	OFF	OFF

4.1.2 Standstill Current and Autotuning

If the enable signal is set but no motion command is present, the motor current set via switches SW1 to SW3 is reduced to 50% (SW7 ON) or 90% (SW7 OFF) at standstill.

The auto-tuning function allows the motor controller to be optimally adapted to the connected motor. If this is performed, the internal control parameters are tuned to ensure a high torque output even at high rpm, as well as generally quiet and low-vibration operation.

If autotuning is started, the green status LED switches off for the duration of the parameter determination. Autotuning has been successfully performed when the green status LED lights up again. This process takes approx. 3 seconds.

Standstill Current	SW7
50 % of preselected Motor Current-	ON
90 % of preselected Motor Current-	OFF
Start Autotuning	OFF – ON – OFF within 1 second

NOTE

Autotuning can only be started if switch SW7 has been set to OFF for at least 1 second.

NOTE

Autotuning should always be performed when:

- The motor control unit is used for the first time.
- The motor controller's supply voltage changes
- A different motor is connected to the motor controller

4.1.3 Micro-Stepping

If the motor controller is used in [Pulse Mode](#) (p.12), the desired micro step mode must be preselected by the combination of switch SW4 to SW6 and SW 8.

By preselecting the micro steps per motor revolution, the precision, the resulting vibrations, and the noise of the motor can be directly influenced.

The higher the micro steps, the better the precision and at the same time vibrations and noise are reduced to a minimum.

Micro Step	Step mode	SW4	SW5	SW6	SW8
200	1/1 Full Step	ON	ON	ON	ON
400	1/2 Step	OFF	ON	ON	ON
800	1/4 Step	ON	OFF	ON	ON
1600	1/8 Step	OFF	OFF	ON	ON
3200	1/16 Step	ON	ON	OFF	ON
6400	1/32 Step	OFF	ON	OFF	ON
12800	1/64 Step	ON	OFF	OFF	ON
25600	1/128 Step	OFF	OFF	OFF	ON

Note
If the Pulse Mode (p.12) is used, the selection of the executed micro steps per motor revolution in the master controller and in the motor controller must be the identical. If, for example, 200 micro steps per motor revolution are set in the motor controller, but 400 micro steps per motor revolution are set in the master controller, and the master controller issues the movement command for one motor revolution, the motor will execute 2 revolutions. The reason for this is that instead of the 200 pulses expected by the motor controller for one motor revolution, 400 pulses were now emitted by the master controller and these were converted into 2 motor revolutions.

4.1.4 Selection Constant Speed

If the motor controller is used [Jog Mode](#) (p.13), the desired speed must be preselected by the combination of switches SW4 to SW6 and SW8.

Acceleration and deceleration are set to a fixed time value of 250 ms.

The Micro Stepping is set to 25600 (1/128 Step).

RPM	SW4	SW5	SW6	SW8
50	ON	ON	ON	OFF
100	OFF	ON	ON	OFF
150	ON	OFF	ON	OFF
200	OFF	OFF	ON	OFF
250	ON	ON	OFF	OFF
300	OFF	ON	OFF	OFF
400	ON	OFF	OFF	OFF
500	OFF	OFF	OFF	OFF

4.1.5 Drive Mode

The desired operating mode is set via switch SW8.

Drive Mode	SW8
Pulse Mode – Step/Direction	ON
Jog Mode – Constant Speed	OFF

4.2 Motor Direction

For a proper operation, it is necessary that the motor rotates in a defined direction.
For determination, please use the following procedure:

1. View onto drive shaft
2. Executing a motion
 - a. Pulse Mode: Apply a step signal at STEP+
 - b. Jog Mode: Apply a constant signal at STEP+
3. Clockwise rotation corresponds to a right-hand rotation

If the motor rotates counter clockwise, the polarity of the motor connecting cables must be changed.



5 Execution of Movements

5.1 Pulse Mode – Step/Direction

To execute a movement in pulse mode, a 5 V to 24 V signal must be permanently applied to the EN+ input.

If a square wave signal is applied to the STEP+ input, a clockwise motor step is executed with each negative signal edge. To execute a counter clockwise movement, a 5 V to 24 V signal must be applied to DIR+.

A 5 ms delay must be implemented between setting the EN+ input high and emitting a signal to the STEP+ input.

To be able to change the rotation direction, the frequency signal at STEP+ must be dropped to a zero signal (0 V, 0 frequency) and a 5 V to 24 V signal must be applied to DIR+ at least 5 μ s before a frequency signal is output to STEP+ again.

Rotation direction	Signal at STEP+	Signal at DIR+
Clockwise	Frequency signal, 5 V up to 24 V	0 V
Counter clockwise	Frequency signal, 5 V up to 24 V	5 V up to 24 V

5.2 Jog Mode – Constant Rotation Speed

	Note
	It is recommended to use this mode only for pitches/feed rates ≤ 60 mm per drive shaft revolution. For higher pitches/feed rates, acceleration values of > 2000 mm/s² can be achieved due to the fixed acceleration and deceleration time. Applications that are to be operated in this mode must be approved by the customer.

To execute a movement in jog mode, a 5 V to 24 V signal must be permanently applied to the EN+ input.

If a 5 V to 24 V signal is applied to the STEP+ input, a clockwise rotation is executed at the pre-set speed. To execute a counter clockwise movement, a 5 V to 24 V signal must be applied to DIR+.

A 5 ms delay must be implemented between setting the EN+ input high and emitting a signal to the STEP+ or DIR+ input.

Acceleration like deceleration is set to a fixed time value of 250 ms.

Rotation direction	Signal at STEP+	Signal at DIR+
Clockwise	5 V up to 24 V	0 V
Counter clockwise	0 V	5 V up to 24 V
No Movement/Stop	0 V	0 V
No Movement/Stop	5 V up to 24 V	5 V up to 24 V

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