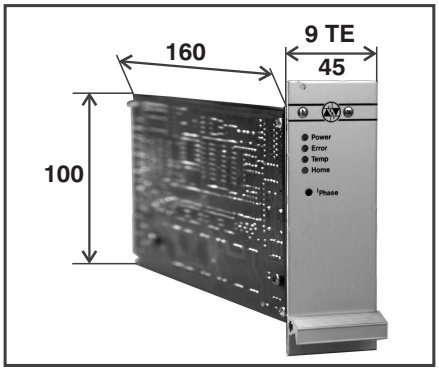
isel Stepper Motor Power Card UME 7008

Introduction

The *isel stepper motor power board* UME 7008 is a micro-step power output stage for bipolar 2(4)-phase stepper motors.
The output stage operates using the bipolar constant current principle and supplies the motor with an adjustable phase current up to 8 A.
A switched-mode power supply operating at approx. 18 kHz provides for low-noise operation and ensures optimum running behaviour of the connected stepper motor.
For controlling, the output stage provides signal inputs for clock, direction, boost and reset. These are designed both as Schmitt trigger inputs (earth reference to supply voltage) and as optically isolated inputs.
The output stages are protected from overtemperature, overcurrent and short-circuit by appropriate protective circuits. The individual operating conditions are indicated by LEDs on the front panel.
For installation into 19" subracks, the modules are provided with connectors to DIN 41612.

Technical specifications

- Microstep power output stage for a bipolar 2(4) phase stepper motor
- Step resolution switch-changeable, 200, 400, 800, 1600 steps/revolution
- MOSFET output stage
  Short-circuit-proof
  - 8 A continuous current
  - 12 A peak current
- Minimum inductivity 1 mH
- Current setting using a potentiometer on the front panel
- Signal inputs
  - Clock
  - Direction
  - Step resolution
  - Reset
  - Boost
- Optional signal inputs
  - CMOS input with Schmitt trigger, pull-up, low-active
  - 5 V opto-coupler inputs (+ 24 V optional)
- Supply voltage
  + 40 V to + 80 V
- Euro-card 100 x 160 mm with 9 TE front panel
- Connector to DIN 41612
  Series F24/H7
- Signal and pin-compatible with the stepper motor power output stage UMS 6

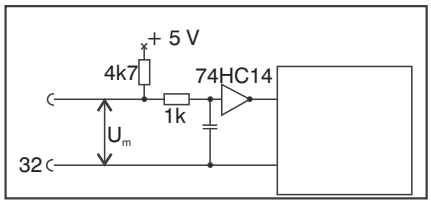


Microstep power output stage UME 7008

Signal description
Inputs

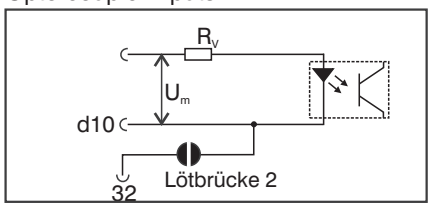
The UME 7008 provides both TTL compabile Schmitt trigger inputs and optically isolated inputs as signal inputs. The signal input stages are defined as follows:

Schmitt trigger inputs:



! For controlling, connect the input to 0 V potential (active low)!

Opto-coupler inputs



! For controlling, connect the signal input to + 5 V potential and the input GND-Opto to earth (active high).

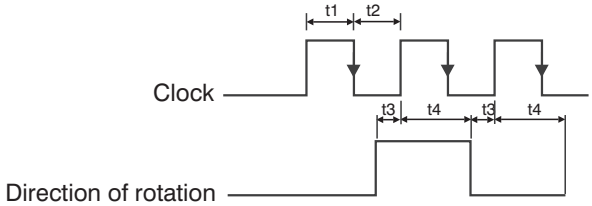
- Upon delivery of the board, soldering jumper 2 is open.
- Upon delivery of the board, the series resistor of the opto-couplers is completed with 330R (signal voltage + 5 V DC).

Technical Specifications

Power supply	+ 40 V DC to + 80 V DC	
Current consumption	typ. 3 A	
Phase current	8 A (continuous current), 12 A (peak current)	
Motor inductivity	min. 1mH	
Signal inputs	CMOS inputs, Schmitt trigger, low-active	
	or alternatively	
	Opto-coupler inputs, + 5 V, high-active	
	- Clock	(Clk/OptoClk)
	- Direction	(Dir/OptoDir)
	- Current boost	(Boost/OptoBoost)
	- Reset	(Reset/OptoReset)
	- Enable	(Enable/OptoEnable)
	- Step resolution 1	(Step1/OptoStep1)
	- Step resolution 2	(Step2/OptoStep2)
Input current		
Opto-coupler	min. 10 mA - max. 25 mA	
Signal outputs	Fault	(Fault)
	Home	(Home)
Controls	Phase current potentiometer	
Display elements	Readiness for operation	(Power)
	Overload	(Error)
	Overtemperature	(Temp)
	Home	(Home)
Protective circuits	Overcurrent, short circuit to earth, short circuit of outputs, overtemperature, overvoltage/undervoltage	
Operating voltage	max. 50 °C	
Shutdown temperature	max. 85 °C	
Dimensions	Euro-card 100 x 160 mm	
Mounting width	9 TE (45.72 mm)	

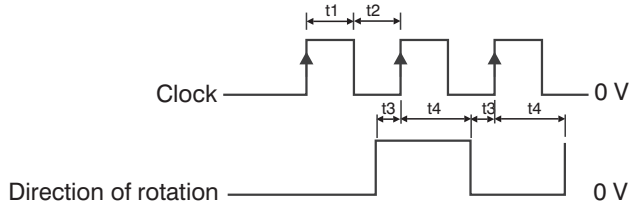
Signal times of the Schmitt trigger

t1 = pulse width	> 5 µs (10 µs at OC)
t2 = interpulse period	> 5 µs
t3 = set-up time direction	> 5 µs (10 µs at OC)
t4 = hold-time direction	> 5 µs (10 µs at OC)
tr = rising edge	< 0.2 µs
tf = falling edge	< 0.2 µs



Signal times of the opto-couplers

t1 = pulse width	> 5 µs
t2 = interpulse period	> 10 µs
t3 = set-up time direction	> 10 µs
t4 = hold time direction	> 10 µs
tr = rising edge	< 0.2 µs
tf = falling edge	< 0.2 µs



Clock (Clk) z6
(ClkOpto) z10
Every clock pulse with a minimum width of 10 μs results in a defined step angle motion.
The step angle depends on the set resolution and can have the following values:

Full-step mode	1.8 °/pulse
Half-step mode	0.9 °/pulse
1/4-step-mode	0.45 °/pulse
1/8-step mode	0.225 °/pulse

Direction (Dir) b2
(DirOpto) b10
Signal input for defining the desired direction of rotation of the motor.
H signal - positive direction of rotation of stepper motor (CCW)
L signal - negative direction of rotation of stepper motor (CW)

De-excitation (Ena) z4
(EnaOpto) b12
An active control signal will disable the stepper motor. The holding torque of the motor will thus be lost; you can turn the motor shaft manually.
The input may only be activated with the motor stopped.

Reset b6
(ResetOpto) d14
An active control signal will disable the processing of the step pulse and will set the step counter to a defined position (Home position).

Current boost (Boost) b4
(BoostOpto) z12
An active control signal will raise the motor current and thus the torque in step mode.
If no external protective elements are connected to the input, the current is limited depending on the set phase current.

Step resolution
(Step1, 2) z2, d4
(StepOpto1, 2) b14, d12
These inputs are used to define the number of steps of a stepper motor per revolution. For a standard 1.8° motor, the following assignment results:

Schmitt trigger inputs

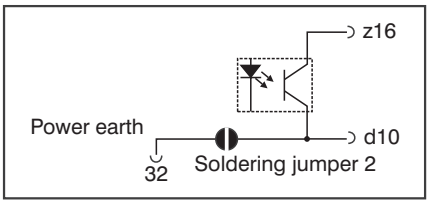
Input Step1	Input Step2	Number of steps/ Revolution
0 V	5 V	200 (full step)
5 V	5 V	400 (1/2-step)
0 V	0 V	800 (1/4-step)
5 V	0 V	1600 (1/8-step)

Opto-coupler inputs

Input OptoStep1	Input OptoStep2	Number of steps/ Revolution
5 V	0 V	200 (full step)
0 V	0 V	400 (1/2-step)
5 V	5 V	800 (1/4-step)
0 V	5 V	1600 (1/8-step)

Signal description - outputs

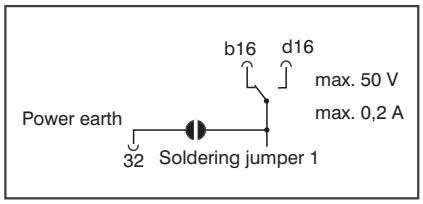
Home z16



The opto-coupler output indicates a defined phase position of the stepper motor.
Depending on the step resolution set, the output will close with every
- 4th clock pulse - full step
- 8th clock pulse - half step
- 16th clock pulse - ¼ step
- 32nd clock pulse - 1/8 step

Pin d10 (GND-Opto) is defined as the reference earth.

Fault



The board signals a fault using the Fault relay switch contact. The following error conditions are monitored:
- short-circuit between earth and phase
- short-circuit between the phases
- overtemperature > 85 °C
- undervoltage/overvoltage

If no fault is present, the relay will pick up approx. 1 sec. after the operating voltage has been turned on, closing the contact z14 - d16.

Phase current
The potentiometer I_{phase} on the front panel can be used for linear setting of the phase current.
The control range is between 1.0 A and 8.0 A in normal mode.
For torque compensation in half-step mode, the phase current is raised automatically.

You can measure the phase current using an AC measuring instrument. To do so, connect the instrument in series in one of the stepper motor lines. With a programmed step frequency of approx. 400 Hz in half-step mode, the measuring instrument will display:

$I_{meas} = I_{phase} \times 0.7 => I_P = I_M / 0.7$

To determine the phase current using a multimeter, connect the multimeter to a motor phase and measure the phase current at standstill (directly after switching on the unit; the Home LED will light).

Application notices

- In case of a fault, the stepper motor output stage is disabled immediately.
  The fault is indicated by the *Error LED* on the front panel and signalled at the fault output. The fault condition remains stored. To reset the fault, turn off the power supply and on again.

- At higher phase currents or higher ambient temperatures, the power output stage must be ventilated externally. To do so, carry an air stream over the cooling face of the board. If the heat sink exceeds a temperature of 85 °C, the output stage is switched off.

- The signal earth of opto-coupler inputs (Pin d10), Home output (Pin z16) and fault output are potential-free. They can, however, be connected to the power earth by connecting the soldering jumpers BR.1 and BR.2.

- The signal earth of the Schmitt trigger inputs refers to the power earth (Pin z32).

Pin connector assignment - DIN 41612, series F24/H7