



Power Supply for Mobile Systems

Control module with battery holder for *moduhub* modules



Advantages

- Off-grid power supply
- Microprocessor controlled
- Use in mobile systems
- Compact design
- Long service life
- Modular system with many possible combinations
- High process times by powerful battery
- No downtimes due to rechargeable battery
- Fast charging
- Soft start
- Protective functions: electronic current limitation, overcurrent cut-off, detection of blockades, duty cycle detection
- Deep discharge protection
- Charge warning
- Diagnostic signal
- Controlled positioning in stroke end positions and memory positions

Application

The modules are used for power supply for mobile systems in industrial assembly. They are suitable for electro-mechanical lifting modules or linear actuators with 24 V and rotating modules.

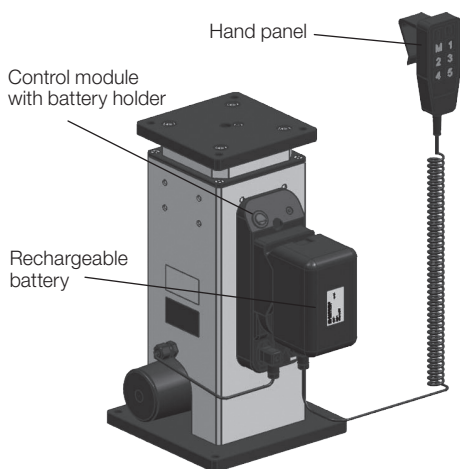
Fixing and installation

The control module with battery holder can be fixed with two screws M8 to the provided threads in the lifting modules Shop-Floor at the outer profiles.

The supply line of the electrical actuator and the operating element are plugged in at the carrier plate of the control module.

Installation example

Single module



Description

A system with different individual components allows a network-independent power supply for electrical lifting modules. A rechargeable battery supplies the drive unit with energy. The battery can be recharged by an external quick battery charger.

To guarantee working without downtime, it is recommended to have a second rechargeable battery.

Control modules with battery holder for a single module are used to control lifting modules. Various operating elements allow an efficient functionality.

The following modules are required for an operational system:

- Rechargeable battery
- Control module with battery holder
- Operating element
- Quick battery charger
- Lifting module

Variants

The standard variant provides the functions "up/down" in touch control.

All variants are designed for the operation with lifting modules with **code letter B or I**.

The integrated electronic ensures in combination with the stroke measuring system of the lifting modules a soft start and stop to protect all components.

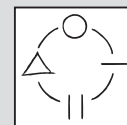
Also, current limitation and duty cycle limitation help to increase the service life.

Further variants of the control modules with battery holder allow the function of storable intermediate positions, see page 2.

Individually pre-programmed end positions can be requested as a special version.

moduhub

Power supply for mobile systems



with single module
without synchronism

Technical data

Voltage	24 V
Capacity	5 Ah / 3 Ah

Part numbers

Rechargeable battery 5 Ah	3822185
Rechargeable battery 3 Ah	3822186
Quick battery charger	3822177
Control module	3821270
with memory function	3821270M

Combinable with the modules

- Lifting module – electro-mechanical as per data sheet M 4.202, M 4.301, M 4.401, M 4.501
with code letter B or I



- Cart module WMS as per data sheet M 5.101



- Linear actuator – electro-mechanical as per data sheet L 1.101
with code letter I

- Electrical operating elements, lines and connectors as per data sheet M 8.203

Materials

All essential elements are made of shock-resistant plastic to obtain a high robustness.

Control module with battery holder for 2 lifting modules in synchronism see page 3.

Attention

Rechargeable battery **3822185** (5000 mAh) must not be shipped by air.

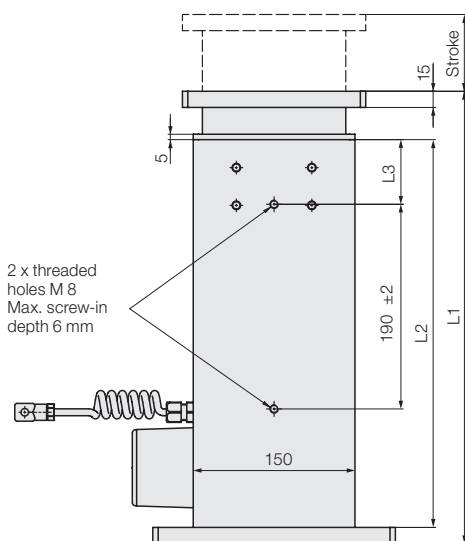
Rechargeable battery **3822186** (3000 mAh) may be shipped by air.

According to UN transport test 38.3.

Control module with battery holder for *moduhub* modules

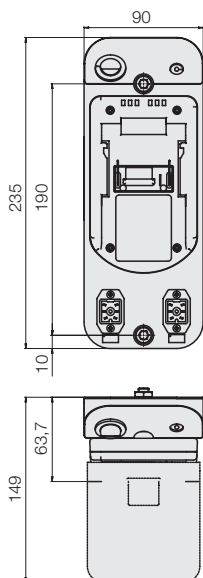


Installation



Stroke [mm]	L1 [mm]	L2 [mm]	L3 [mm]
200	420	360	60
300	520	460	135
400	620	560	185
500	720	660	235
600	820	760	285

Dimensions



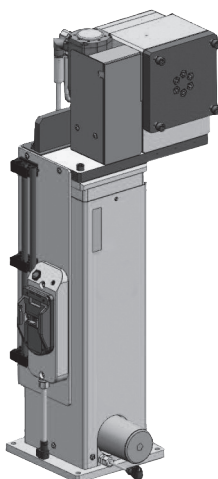
Description

The control module with battery holder is the key element of the system to which all further components are connected. It is suitable for a lifting module with different force levels / stroke lengths and incremental stroke measuring system. The holder for the rechargeable battery is already integrated in the control module and forms a compact unit for supply and control of the drive module. The control unit in the control module has connections for the lifting module, for one operating element and control signals for optional functions.

Optional function:

The memory function allows to store up to five height positions. These can be recalled again and again or can be stored again. Thus, ergonomically reasonable working heights can be obtained for different persons or different working heights within one assembly process can be determined. Operation is made via an operating panel that allows to store the height positions as well as to call them. Due to safety reasons, a movement is always made by touch control.

Application example



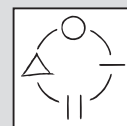
Special version, please contact us.

moduhub

Control module with battery holder

for 1 *moduhub* module
with incremental stroke measuring system

Part no. **3821 270**



Accessories

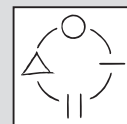
- Electrical operating elements, cables and connectors as per data sheet M 8.203

moduhub

Control module with battery holder

with memory function
for 1 *moduhub* module
with incremental stroke measuring system

Part no. **3821 270M**



Accessories

- Electrical operating elements, cables and connectors as per data sheet M 8.203

Technical data

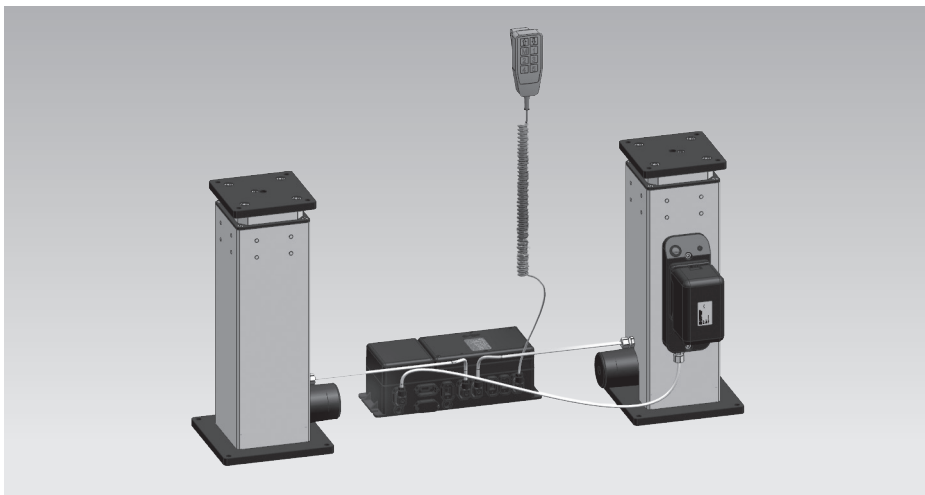
Control module

Operating voltage (battery)	25.2 V
Electronic current limitation	8 A
Duty cycle	15%, 1.5 min ON
Protection class	III
Code class (in mated condition)	IP 30
Standby current consumption	approx. 7 mA
Electrical connections	Plug connection secured by screw
Weight	approx. 700 g

Fixing and installation

Fixation and installation of the control module can be carried out directly at the lifting module in prepared bore holes.

Control module and battery holder for 2 moduhub lifting modules in synchronism



moduhub

Power supply for mobile systems

with 2 lifting modules
in synchronism



Technical data

Voltage	24 V
Capacity	5 Ah / 3 Ah

Part numbers

Rechargeable battery 5 Ah	3822 185
Rechargeable battery 3 Ah	3822 186
Quick battery charger	3822 177
Control module Standard	3821 416B
with memory function	3821 416MB
Battery holder with 1 m cable	3821 276 L1000
Battery holder with 3 m cable	3821 276 L3000

Combinable with the modules

- Lifting module –
electro-mechanical
as per data sheet M 4.202,
M 4.301, M 4.401, M 4.501
with code letter G
- Linear actuator –
electro-mechanical
as per data sheet L 1.101
with code letter I
- Electrical operating elements,
lines and connectors
as per data sheet M 8.203



Description

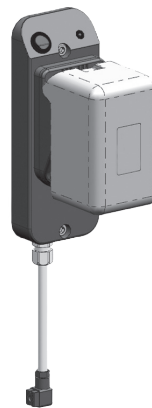
The control module is the key element of the system to which all further components are connected.

It is suitable for two lifting modules with different force levels / stroke lengths and incremental stroke measuring system. The system for 2 lifting modules in synchronism uses a battery holder with 1 m or 3 m cable and connector. The control module has connections for 2 lifting modules, for 1 operating element, for a battery holder and control signals for optional functions.

The following modules are required for an operational system with 2 lifting modules in synchronism:

- Rechargeable battery
- Control module
- Operating element
- 2 lifting modules, version G
- Battery holder
- Quick battery charger

Battery holder



Dimensions see page 2.

Optional function:

The memory function allows to store up to five height positions.

These can be recalled again and again or can be stored again. Thus, ergonomically reasonable working heights can be obtained for different persons or different working heights within one assembly process can be determined.

Operation is made via an operating panel that allows to store the height positions as well as to call them. Due to safety reasons, a movement is always made by touch control.

Fixing and installation

Fixation and installation of the battery holder can be carried out directly at a lifting module in prepared bore holes.

During the first start up, the setting mode has to be activated by the user. The control automatically adapts itself to the connected lifting module.

The process in detail, see operating manual.

Control module



Dimensions see data sheet M 8.200.

Attention

Holders for control modules can be requested as a special version.

Technical data

Control module

Operating voltage (battery)	25.2 V
Electronic current limitation	10 A
Duty cycle	15 %, 1.5 min ON
Protection class	III
Code class (in mated condition)	IP 30
Standby current consumption	approx. 7 mA
Electrical connections	Plug connection secured by screw
Weight	2.5 kg

Important note

Operation of electrical lifting modules in synchronism see data sheet M 4.005

Rechargeable battery and quick battery charger



Capacity of the rechargeable battery


Based on the following diagrams, the possible number of cycles with a completely charged battery (5000 mAh) can roughly be determined. They are presented as a function of the different force levels and stroke lengths using an individually-operated lifting module as an example.

Attention!

When using 2 lifting modules in synchronism, the number of cycles determined must be halved. When using the rechargeable battery with 3000 mAh, multiply the number of cycles determined by a factor of 0.67. Lifting modules for a max. load of 1000 N are not suitable for synchronism.



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Rechargeable battery



Part no. **3822 185** (5 Ah)
 Part no. **3822 186** (3 Ah)

Description

The rechargeable battery is a Li-Ion battery and is used with its 25.2 V and 5000 mAh (alternatively 3000 mAh) for ROEMHELD lifting modules as an energy source. The high capacity in a compact housing allows an efficient and flexible use.

Important notes

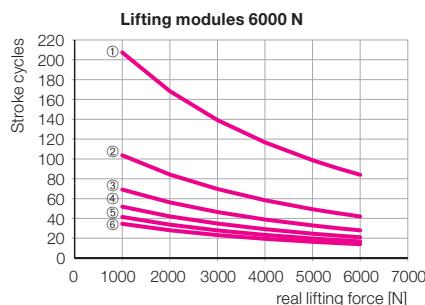
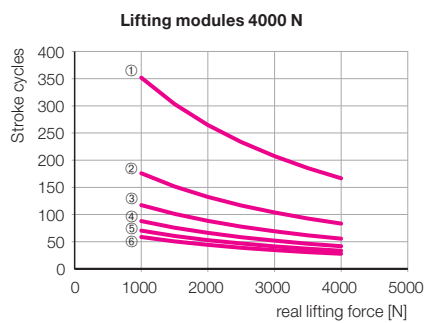
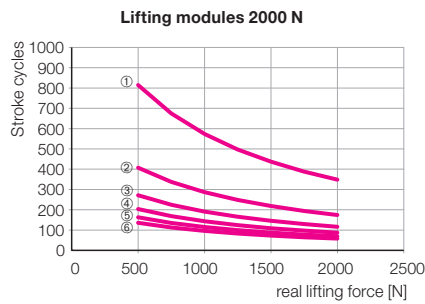
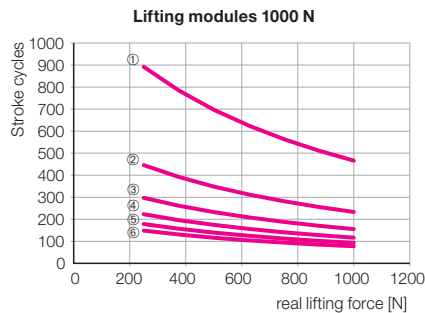
For charging of the batteries exclusively the quick battery charger part-no. **3822 177** from ROEMHELD may be used.

Technical data 3822 185

Nominal voltage	25.2 V
Nominal capacity	5000 mAh
Charging current	max. 3A
Operating temperature	
Charging	10 °C ... +40 °C
Operating	
Discharging	0 °C ... +50 °C
Storage temperature	-20 °C ... +35 °C
Dimensions (Lx WxH)	135x85x91 mm
Weight	approx. 860 g


Technical data 3822 186

Nominal voltage	25.2 V
Nominal capacity	3000 mAh
Charging current	max. 3A
Operating temperature	
Charging	10 °C ... +40 °C
Operating	
Discharging	0 °C ... +50 °C
Storage temperature	-20 °C ... +35 °C
Dimensions (Lx WxH)	135x85x91 mm
Weight	approx. 860 g



- ① = 100 mm stroke
- ② = 200 mm stroke
- ③ = 300 mm stroke
- ④ = 400 mm stroke
- ⑤ = 500 mm stroke
- ⑥ = 600 mm stroke

moduhub
Quick battery charger



Part no. **3822 177**

Description

The quick charger is used for recharging the re-chargeable battery.

Technical data

Dimensions

Supply voltage	220 ... 240 V ± 10 %
Frequency of the supply voltage	50 ... 60 Hz
Output voltage	9.6 ... 28.8 V
Charging current	2.9 A ± 10 %
Power limitation	max. 55 ... 70 W
Charging time for 5 Ah	approx. 2 h
Ambient temperature	
Storage	-20 °C ... +60 °C
Operation	+5 °C ... +40 °C
Protection class	II
Code class	IP30
Dimensions (Lx WxH)	152x86x76 mm
Weight	approx. 500 g

Variants

Quick battery charger for use at 100 ... 120 V AC 50 ... 60 Hz

Part no. 3822 182

Important notes

The battery charger is equipped with a Euro plug. A plug adaptor is country-specific required.



Rotating modules DMHe 200 / DMVe 600 - electrically-operated max. load 2,000 N / 6,000 N, max. torque 120 Nm



Advantages

- Versions for horizontal or vertical axis of rotation
- Rotating in both directions
- Auto stop
- Low-backlash gear
- Self-locking in any position
- Compact design
- Sturdy design
- Convertible
- Ergonomic working
- Safe and quick handling in assembly processes
- Long service life
- Checked in compliance with DIN EN 1570 with quadruple static overload

Principal use

- Assembly of automotive parts
- Motor assembly
- Gear assembly
- Pump construction

Operation

The module is operated with touch control by means of an optionally available hand panel or foot switch with two push-buttons. It can safely stop in every angular position. An automatic stop is preset at all 90° positions.

The zero position of the automatic stop can be preset to any position by pushing both push-buttons.

Description

Rotating modules are used in assembly and handling processes to transform electrical energy into a rotating movement.

When using the rotating module, component parts can be rotated rationally, quickly and safely and can be assembled ergonomically from all sides.

The strongly reduced worm gear allows high holding torques in standstill.

The double-bearing driven shaft compensates high axial and radial forces.

The rotating module is designed for a long service life. The electronically commutated DC motor is virtually wear-free.

The mechanical components and sealing elements are designed for 1,000,000 indexing cycles within the indicated load limits.

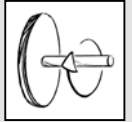
The rotating modules – horizontal axis and vertical axis are nearly identical in construction, thus the axis alignment can be retrofitted for different applications.

moduhub rotating modules electrically operated

- horizontal axis DMHe 200

Part no. 6508 02 36 E

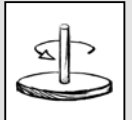
Max. load: 2,000 N



- vertical DMVe 600

Part no. 6509 10 36 E

Max. load: 6,000 N



Technical data

Angle of rotation:	360°
Max. torque:	120 Nm
Max. holding torque:	350 Nm
Max. torque:	800 Nm
Rotation:	any
Index:	90° standard optionally 45°/60°/180°

Operations

- Foot switch
- Hand panel



Combinable with the modules

Lifting modules

- Shop Floor Telescope: as per data sheet M 4.202
- Range: as per data sheet M 4.203
- Shop-Floor: as per data sheet M 4.301
- Strong: as per data sheet M 4.401
- Solid: as per data sheet M 4.402

moduhub interfaces

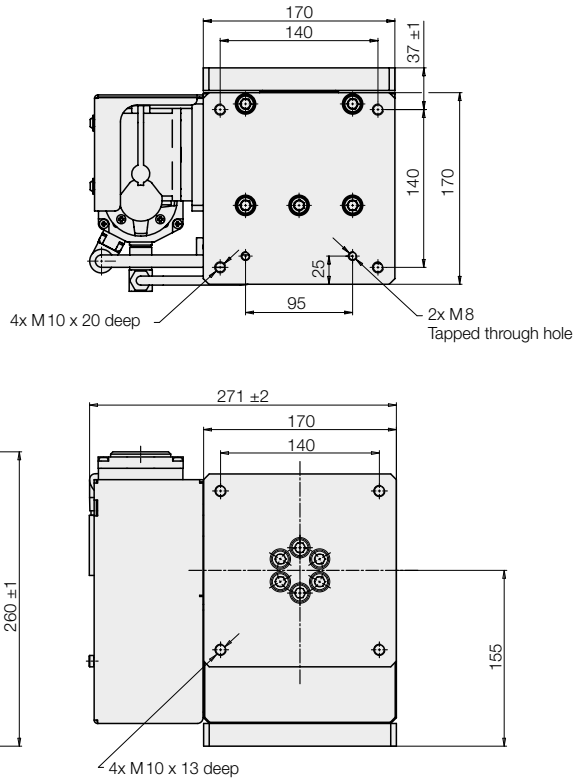
- Flange plate: 140 x 140 - M10
- Body: 140 x 140 - M10

Accessories

- Switching power supply Part no. 6863 020
- Hand panel as per data sheet M 8.203
- Foot switch as per data sheet M 8.203

Rotating module – horizontal axis DMHe 200

Dimensions



Part no.

65080236 E

Technical data

Max. total F_x/F_y	[N]	2,000
Max. F_z	[N]	1,000
Max. driving torque M_z	[Nm]	120
Max. holding torque M_z	[Nm]	350

Max. total of all torques $M_x/M_y/M_z$ [Nm] 800

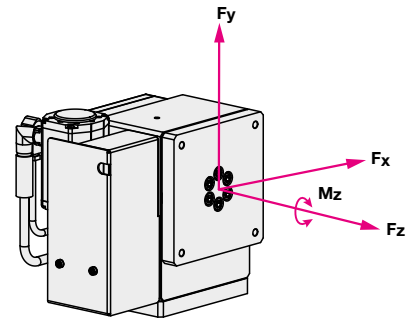
Max. cycle time (ED)	25 %, 60s On
Code class	IP 50
Current consumption	[A] 6... 16
Max. admissible current consumption	[A] 20
Supply voltage	[V DC] 24–30
Weight	[kg] 28

Adjust the speed of rotation by trimming potentiometer 2.5 to 7.5 rpm.

Adjust the indexing angles 45, 60, 90 and 180 degree by trimming potentiometer.

Adjust the soft stops by trimming potentiometer.

Maximum admissible load



Maximum admissible forces:

$F_x = \pm 2,000$ N
 $F_y = \pm 2,000$ N
 $F_z = \pm 1,000$ N

Maximum admissible torques:

M_x or $M_y = 800$ Nm
 $M_z = 350$ Nm (in standstill)

The total of all occurring forces or torques must not exceed the highest single value.

The rotating module is checked in compliance with DIN EN 1570 with quadruple static overload.

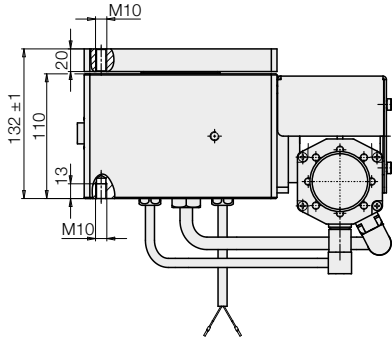
Part no. 65080236 E

Installation

The rotating module has a moduhub interface 140x140 mm and can be mounted by 4 screws M10 onto a fixture or another module. The power supply is made by the separately available switching power supply. An electronic control is integrated.

Rotating module - vertical axis DMVe 600

Dimensions

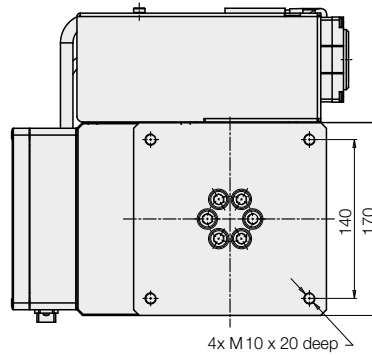
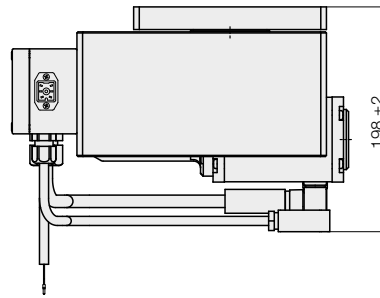
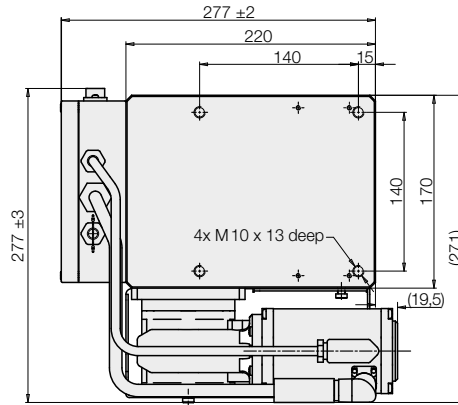


Part no. 6509 1036 E

Installation

The rotating module has a *moduhub* interface 140x140 mm and can be mounted by 4 screws M10 onto a fixture or another module. The power supply is made by the separately available switching power supply. An electronic control is integrated.

When mounting onto a flat surface an elevation of the module has to be provided because of protruding components.



Part no. **6509 1036 E**

Technical data

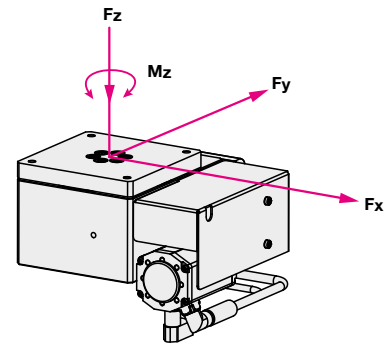
Max. total F_x/F_y	[N]	2,000
Max. F_z	[N]	6,000
Max. driving torque M_z	[Nm]	120
Max. holding torque M_z	[Nm]	350
Max. total of all torques $M_x/M_y/M_z$	[Nm]	800
Max. cycle time (ED)	25 %, 60 s On	
Code class		IP 50
Current consumption	[A]	6...16
Max. admissible current consumption	[A]	20
Supply voltage	[V DC]	24-30
Masse	[kg]	28

Adjust the speed of rotation by trimming potentiometer 2.5 to 7.5 rpm.

Adjust the indexing angles 45, 60, 90 and 180 degree by trimming potentiometer.

Adjust the soft stops by trimming potentiometer.

Maximum admissible load



Maximum admissible forces:

$F_x = \pm 2,000$ N

$F_y = \pm 2,000$ N

$F_z = + 6,000$ N

Maximum admissible torques

M_x or $M_y = 800$ Nm

$M_z = 350$ Nm (in standstill)

The total of all occurring forces or torques must not exceed the highest single value.

The rotating module is checked in compliance with DIN EN 1570 with quadruple static overload.



Lifting Modules Shop-Floor

Max. lifting force 1,000 to 6,000 N, stroke from 200 to 600 mm, manual-hydraulic and electro-mechanical version



Advantages

- Simple and intuitive operation
- Working in ergonomically optimum height
- Sturdy industrial design
- Increase of quality in manufacturing and assembly processes
- Increase of assembly throughput and productivity
- High level of safety against static overloads

Application

Lifting module for workshop and assembly applications in the industry.

Principal use

- Industrial assembly working places
- Height adjustment of assembly working places in workshops
- Service
- Assembly fixtures
- Adjusting systems in supply processes of mid-sized objects
- Handling systems for product packing and transfer

Fixing and installation

For fixing of *moduhub* modules or other components of the user at the top plate, the lifting module has an interface 140 x 140.

For fixing of *moduhub* modules at the bottom plate, the lifting module has an interface 200 x 200. This plate can also be used to fix the lifting module on a flat level floor. For fixing, 4 screws M10 of property class 10.9 as well as heavy-duty plugs are to be used.

For increased stability, a base plate, which can be mounted to the bottom plate, is available as accessory. Fixing on the floor is made by means of the base plate.

Description

The lifting module Shop-Floor is particularly suitable for lifting and lowering assembly fixtures, working tables and demonstration objects in industrial applications as well as for medical treatment equipments in medical applications.

In general, lifting modules are used as a base unit of devices for controlled lifting and lowering of loads or for height adjustment only.

Material

Lifting profile: aluminium, naturally anodised
 Top and bottom plate: aluminium, black anodised

moduhub

Lifting module



Part no. 8915-0X-X0-X

Technical data






Max. lifting force: 1,000 to 6,000 N
 Max. bending moment: 500 Nm
 Stroke: 200 to 600 mm

Operation

- Foot pedal
- Foot switch
- Hand panel



Combinable with the modules

- Rotating modules – horizontal axis
 DMH 200 as per data sheet M 1.101,
 DMHe 200 as per data sheet M 1.201 
- Tilting modules
 KMB 100 as per data sheet M 2.101
 KME 100 as per data sheet M 2.201 
- Rotating modules – vertical axis
 DMV 600 as per data sheet M 1.301,
 DMVe 600 as per data sheet M 1.201 
- Cart modules
 WMS as per data sheet M 5.101 
- Floor modules
 as per data sheet M 6.101 

moduhub interfaces

- Top plate: 140 x 140 - Ø 10.5 mm
- Bottom plate: 200 x 200 - Ø 10.5 mm

Accessories

- Electronic control modules for 1, 2, 3 or 4 lifting modules as per data sheet M 8.200
- Control modules with battery holder as per data sheet M 8.201
- Electrical operating elements, lines and connectors as per data sheet M 8.203
- Base and adaptor plates as per data sheet M 8.100 and M 8.110
- Table plates as per data sheet M 8.130 and M 8.131

Manual-hydraulic version operation with foot pedal



Description

The stroke movement is obtained by a hydraulic lifting drive with single-lever actuation, with oil being pumped by means of a piston pump into a plunger cylinder.

During retraction the oil returns due to the weight of the load from the cylinder back to the reservoir. A defined speed reduction is effected, independent of the load.

The manual-hydraulic variant is particularly sturdy and durable. This variant meets high safety demands and withstands jerking and knocking loads in applications.

According to the application 3 different force levels can be selected. The number of pump strokes depends on the force level.

Code for part numbers

Part no. 8915-0X-X0-H

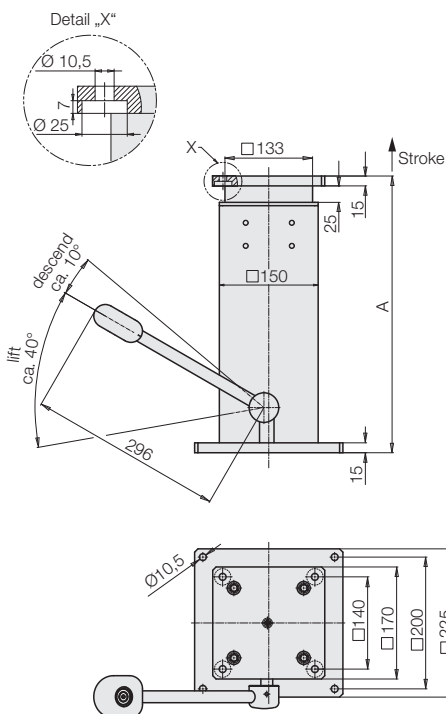
Maximum lifting force

2 = 2,000 N
4 = 4,000 N
6 = 6,000 N

Stroke

2 = 200 mm
3 = 300 mm
4 = 400 mm
5 = 500 mm
6 = 600 mm

Dimensions

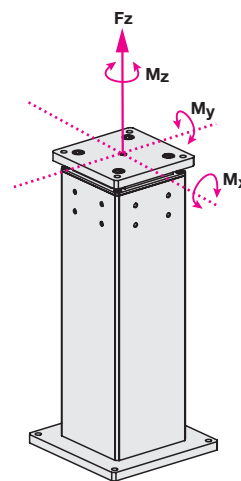


Operation

To lift the load, the foot pedal has to be depressed by approx. 40° several times. The pedal returns to its off-position by means of a return spring.

To lower the load, the foot pedal has to be moved upwards by approx. 10°.

Maximum lifting force and maximum admissible torque load



Stroke [mm]	A [mm]	A + stroke [mm]	Weight [kg]
200	420	620	15
300	520	820	20
400	620	1,020	25
500	720	1,220	30
600	820	1,420	35

Lifting force [N]	Pump strokes per 100 mm	Descent speed [mm/s]
2,000	5	approx. 45
4,000	7	approx. 22
6,000	9	approx. 22

Maximum lifting force Fz

Optionally 2,000 N, 4,000 N or 6,000 N (1,000 N only for the electro-mechanical version)

Maximum torque load:

Total M_{x/y}: 500 Nm
M_z: 300 Nm

Accessories

- Base plate for increased stability as per data sheet M 8.100

Important notes

To descend the lifting module a minimum load of approx. 200 N is required.

The lifting module must only be pressure loaded. The centre of gravity should be within the traverse of the fixing screws. If the centre of gravity is outside, the dowelled joint with the floor has to be dimensioned correspondingly. In such cases it is recommended to use a larger base plate.

In case of eccentric load of more than 250 mm, the column cannot descend automatically because of too high friction forces.

The lifting module is designed for applications within closed rooms.

The hydro-manual lifting drive can not be operated with synchronization control.

In the case of eccentric loads, it is recommended to compensate these by counterweights. In off-position, the indicated maximum torques may occur.

The forces and torques have to be considered by the operator. **During the lifting motion, only 50 % of the maximum values are admitted.**



Description

The lifting motion is generated by an electric motor with a spindle lifting gear. The electrically operated variant is particularly suitable for positioning and adjusting tasks of working tables as well as for material supply and transport. They excel by a smooth running.

Operation

Lifting and lowering with hand panels or foot switches as per data sheet M 8.203 is triggered by touch control. After release of the push-button, the motion will be immediately stopped. The hand panel with memory function allows to store 5 positions, which can be approached via corresponding position push-buttons. (for detailed description see data sheet M 8.203)

Synchronization

Up to 4 lifting modules can be operated with synchronization control by a corresponding control module. For example complete lifting platforms can be designed.

The versions with 4 or 6 kN lifting force are only suitable for synchronization control with the code letter G due to the control modules. The variants with 2 kN lifting force can be operated in synchronization control in version G as well as B and I.

Please also pay attention to the instructions for the operation of lifting modules in synchronism on data sheet M 4.005. Control units with synchronization control for 2, 3, or 4 lifting modules are available.

Technical data

Electric connection	Plug
Duty cycle	15 % ED
Code class	IP 54
Control voltage	24 V DC

Variant E, I and B

Lifting force	Lifting speed (load-dependent)	Current consumption (load dependent)
[N]	[mm/s]	[A]
1,000	32...28	7
2,000	18...16	5
4,000	10...8	6
6,000	7...5	7.5

Variant G

Lifting force	Lifting speed (load-dependent)	Current consumption (load dependent)
[N]	[mm/s]	[A]
2,000	18...16	5
4,000	8...6	4.5
6,000	6...4	5.5

Important notes

Maximum admissible torque load as per manual-hydraulic version (see page 2) . The maximum pull force of the electro-mechanical version is 80% of the push force!

Code for part numbers

Part no. **8915-0X-X0-X**

Maximum lifting force

- 1** = 1,000 N (only for variant **E + B**)
- 2** = 2,000 N
- 4** = 4,000 N
- 6** = 6,000 N

Stroke

- 2** = 200 mm
- 3** = 300 mm
- 4** = 400 mm
- 5** = 500 mm
- 6** = 600 mm

Electronics

- E** = integrated stroke end disconnection (not suitable for synchronization control) with smooth connecting cable, 2.5 m
- G** = with incremental stroke measuring system (suitable for synchronization control) with smooth connecting cable, 2.5 m
- I** = with incremental stroke measuring system (suitable for memory function) with smooth connecting cable, 2.5 m
- B** = with incremental stroke measuring system (suitable for memory function and battery mode) with smooth connecting cable, 1.0 m

In case of the version with a lifting force of 2,000 N, the electronic version **G** is identical with the version **I**. Delivered will be always version **G**, which is suitable for memory function as well as for synchronization.

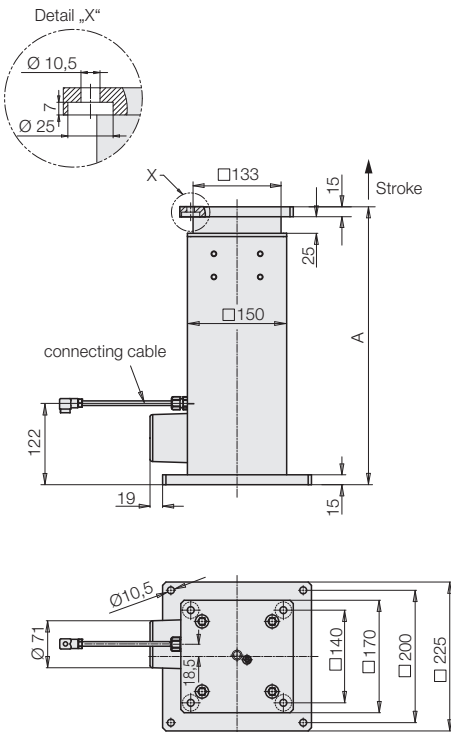
Delivery

The lifting modules are delivered ready for connection. The connecting cable from the lifting module to the control module is included in the delivery. Operating elements as well as control modules and mains cables can be ordered separately as an accessory.

Electrical accessories required for a functional system:

- Control module as per data sheet M 8.200 or
- Control module with battery holder as per data sheet M 8.201
- Hand panels, foot switch and mains cable as per data sheet M 8.203

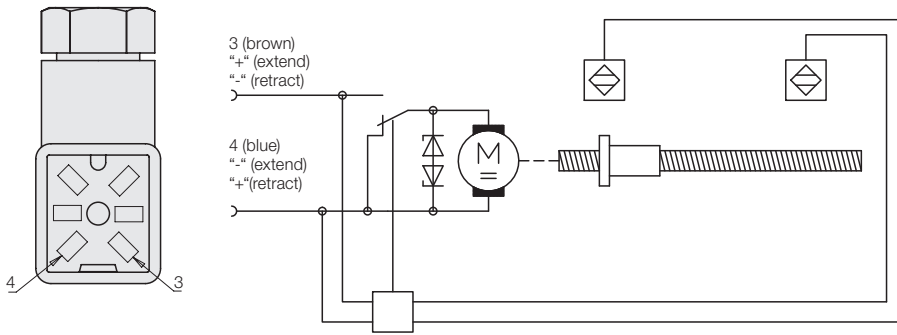
Dimensions



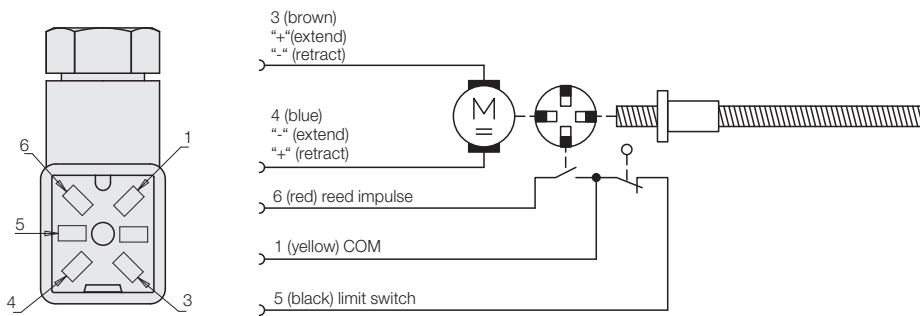
Accessories

- Base plate for increased stability as per data sheet M 8.100

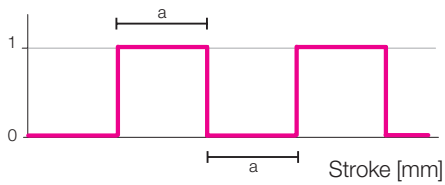
Circuit diagram and connection
plug-type connectors for lifting modules with stroke end disconnection (with last digit E)



Circuit diagram and connection
plug-type connectors for lifting modules with incremental stroke measuring system (with last digit I, B and G)



Resolution of the
incremental stroke measuring system



- 1 kN: a = 0.75 mm stroke
- 2 kN: a = 0.75 mm stroke
- 4 kN: a = 0.5 mm stroke
- 6 kN: a = 0.375 mm stroke