Assembly and operating manual

VCU

Valve control unit

Superior Clamping and Gripping

SCHUNK®

Imprint

Technical changes:

We reserve the right to make alterations for the purpose of technical improvement.

Document number: 89413

Version: 02.00 | 29/07/2019 | en

Dear Customer,

thank you for trusting our products and our family-owned company, the leading technology supplier of robots and production machines.

Our team is always available to answer any questions on this product and other solutions. Ask us questions and challenge us. We will find a solution!

Best regards,

Your SCHUNK team

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Table of Contents

1 General

1.1 About this manual

This manual contains important information for a safe and appropriate use of the product.

This manual is an integral part of the product and must be kept accessible for the personnel at all times.

Before starting work, the personnel must have read and understood this operating manual. Prerequisite for safe working is the observance of all safety instructions in this manual.

Illustrations in this manual are provided for basic understanding and may differ from the actual product design.

In addition to these instructions, the documents listed under Link Mitgeltende Unterlagen are applicable.

1.1.1 Presentation of Warning Labels

To make risks clear, the following signal words and symbols are used for safety notes.

⚠ DANGER

Danger for persons!

Non-observance will inevitably cause irreversible injury or death.

⚠ WARNING

Dangers for persons!

Non-observance can lead to irreversible injury and even death.

⚠ CAUTION

Dangers for persons!

Non-observance can cause minor injuries.

CAUTION

Material damage!

Information about avoiding material damage.

1.1.2 Applicable documents

- General terms of business
- SCHUNK catalog Gripping modules
- Assembly and Operating manuals of the accessories
- Assembly and operating manual for the PPU-P pick and place unit
- Software manual (motion control)

The documents listed up here, can be download on our homepage schunk.com

1.1.3 Terms used in this manual

Term	Description
Cycle	One cycle of a movement program
VCU	Valve control unit
EAMV	Electrical actuation of the magnetic valves
PPU-P	Pick and place unit Applicable documents [▶ 6]
VE	Sensor for rear end position (home position) -> extension arm returned
VA	Sensor for front end position -> extension arm returned
UH	Switching point for horizontal drive
UV	Switching point for vertical drive
Complete module	VCU + PPU-P + baseplate, including sensors and hosing

1.2 Warranty

If the product is used as intended, the warranty is valid for 24 months from the ex-works delivery date under the following conditions:

- Observe the specified maintenance and lubrication intervals
- Observe the ambient conditions and operating conditions

Parts touching the workpiece and wear parts are not included in the warranty.

1.3 Scope of delivery

The scope of delivery includes

- 2-finger gripper for small components Typenbezeichnung A-MVCU in the ordered model:
  - PROFIBUS (4 valves) ID no. 0314750
  - PROFIBUS (5 valves) ID no. 0314751
  - PROFIBUS (6 valves) ID no. 0314752
  - PROFIBUS (7 valves) ID no. 0314753
  - PROFIBUS (8 valves) ID no. 0314754
  - PROFIBUS (9 valves) ID no. 0314755
  - CAN bus (4 valves) ID no. 0314756
  - CAN bus (5 valves) ID no. 0314757
  - CAN bus (6 valves) ID no. 0314758
  - CAN bus (7 valves) ID no. 0314759
  - CAN bus (8 valves) ID no. 0314760
  - CAN bus (9 valves) ID no. 0314761
- USB-mini type B (only for service)
- Accessory pack PROFIBUS
  - Y-distributor PROFIBUS ID no. 9957972
  - Cable ST SG1204-PB-A-A ID no. 0349650
  - VCU cable with connection plug M12 ID no. 9957681
- Accessory pack CAN BUS
  - T-piece CAN BUS ID no. 9957727
  - Cable ST SG1204-CN-A-A ID no. 0349660
  - VCU cable with connection plug M12 for power supply ID no. 9957681

1.4 Accessories

The following accessories, which must be ordered separately, are required for the product:

- PROFIBUS cable:
  - PROFIBUS DP 1.5 m ID no. 0349750
  - PROFIBUS DP 3 m ID no. 0349751
  - PROFIBUS DP 5 m ID no. 0349752
  - PROFIBUS DP 10 m ID no. 0349753
- T-piece for PROFIBUS DP, 4-pin, ID no. 9957535

Optional

- CAN BUS cable
  - CAN BUS 1.5 m ID no. 0349770
  - CAN BUS 3 m ID no. 0349771
  - CAN BUS 5 m ID no. 0349772
  - CAN BUS 10 m ID no. 0349773

A wide range of accessories are available for this product

For information regarding which accessory articles can be used with the corresponding product variants, see catalog data sheet.

1.4.1 Sensors

Operating the VCU requires a minimum number of sensors.

Some of the sensors are contained in the handling module's scope of delivery. However, some must be ordered separately.

- Check the scope of delivery of the handling modules used.

NOTE

The number and connection positions of the sensors are clearly specified Applicable documents [▶ 6].

- Exact type designation of the compatible sensors see catalog.
- Information on handling sensors is available at schunk.com or from SCHUNK contact persons.

2 Basic safety notes

2.1 Intended use

The product may exclusively be used for controlling compressed air.

- The product is intended for installation in a machine/system. The applicable guidelines must be observed and complied with.
- The product may only be used within the scope of its technical data, Technical Data [▶ 12].

Any other use or use exceeding that specified is regarded as inappropriate use. The manufacturer assumes no liability for any resulting damage.

2.2 Inappropriate use

The product is not a safety component in accordance with the EC Machine Directive 2006/42/EC and must not be used in safety-relevant parts of machine control units.

2.3 Environmental and operating conditions

Required ambient conditions and operating conditions

Incorrect ambient and operating conditions can make the product unsafe, leading to the risk of serious injuries, considerable material damage and/or a significant reduction to the product's life span.

- Make sure that the product is used only in the context of its defined application parameters, Technical Data [▶ 12].
- Make sure that the environment is free from splash water and vapors as well as from abrasion or processing dust. Exceptions are products that are designed especially for contaminated environments.

2.4 Constructional changes

Implementation of structural changes

By conversions, changes, and reworking, e.g. additional threads, holes, or safety devices can impair the functioning or safety of the product or damage it.

- Structural changes should only be made with the written approval of SCHUNK.

2.5 Personnel qualification

Inadequate qualifications of the personnel

If the personnel working with the product is not sufficiently qualified, the result may be serious injuries and significant property damage.

- All work may only be performed by qualified personnel.
- Before working with the product, the personnel must have read and understood the complete assembly and operating manual.
- Observe the national safety regulations and rules and general safety instructions.

The following personal qualifications are necessary for the various activities related to the product:

Trained electrician	Due to their technical training, knowledge and experience, trained electricians are able to work on electrical systems, recognize and avoid possible dangers and know the relevant standards and regulations.
Qualified personnel	Due to its technical training, knowledge and experience, qualified personnel is able to perform the delegated tasks, recognize and avoid possible dangers and knows the relevant standards and regulations.
Instructed person	Instructed persons were instructed by the operator about the delegated tasks and possible dangers due to improper behaviour.
Service personnel of the manufacturer	Due to its technical training, knowledge and experience, service personnel of the manufacturer is able to perform the delegated tasks and to recognize and avoid possible dangers.

2.6 Notes on particular risks

⚠ WARNING

Risk of injury if the unit falls during transport or assembly!

⚠ WARNING

Risk of injury if compressed air hoses are pulled off "under pressure". Compressed air with a pressure of 6 bar will escape from these connections.

⚠ DANGER

Danger from electric voltage!

Touching live parts may result in death.

- Switch off the power supply before any assembly, adjustment or maintenance work and secure against being switched on again.
- Only qualified electricians may perform electrical installations.
- Check if de-energized, ground it and hot-wire.
- Cover live parts.

3 Technical Data

More technical data is included in the catalog data sheet.
Whichever is the latest version.

Number of valves	4	5	6	7	8	9
Mechanical operating data						
Weight per valve [g]	30					
Weight [g]	1750	1775	1800	1850	1900	1950
Protection class	III					
IP rating	IP50					
Dimensions (w x h x d) [mm]	62 x 131 x 100					
Cycle duration [ms] with 1 kg mass (incl. swivel-gripper unit)	580					
Valve switch-on time without overexcitation [s]	0.009					
Valve switch-on time with overexcitation [s]	0.007					
Valve switch-on time without overexcitation [s]	0.010					
Valve switch-on time with overexcitation [s]	0.009					
Operating temperature [°C]	5 - 80					
Ambient temperature [°C]	5 - 55					
Operating data for compressed air connection						
Pressure medium	Compressed air, compressed air quality as per ISO 8573-1: **6 4 4**					
Min. pressure [bar]	2					
Max. pressure [bar]	6					
Minimal flow rate [Nl/min]	250					
Central air connection	Hose: Ø 8 mm, ¼“ screw-in thread					
Exhaust air	lead to the exterior via ¼“ sound absorber					
Electrical operating data						
Rated voltage [VDC]	24					
Max. current [A] During shutdown	0.9					
Max. current [A] During operation	1.7	1.9	2.1	2.3	2.5	2.7
Integrated electronics [A]	0.1					
Number of digital inputs (24V)	3					
Number of digital outputs (24V)	3					
Maximum number of proximity switches to be connected	10 ☞ PPU-P Assembly and Operating Manual					

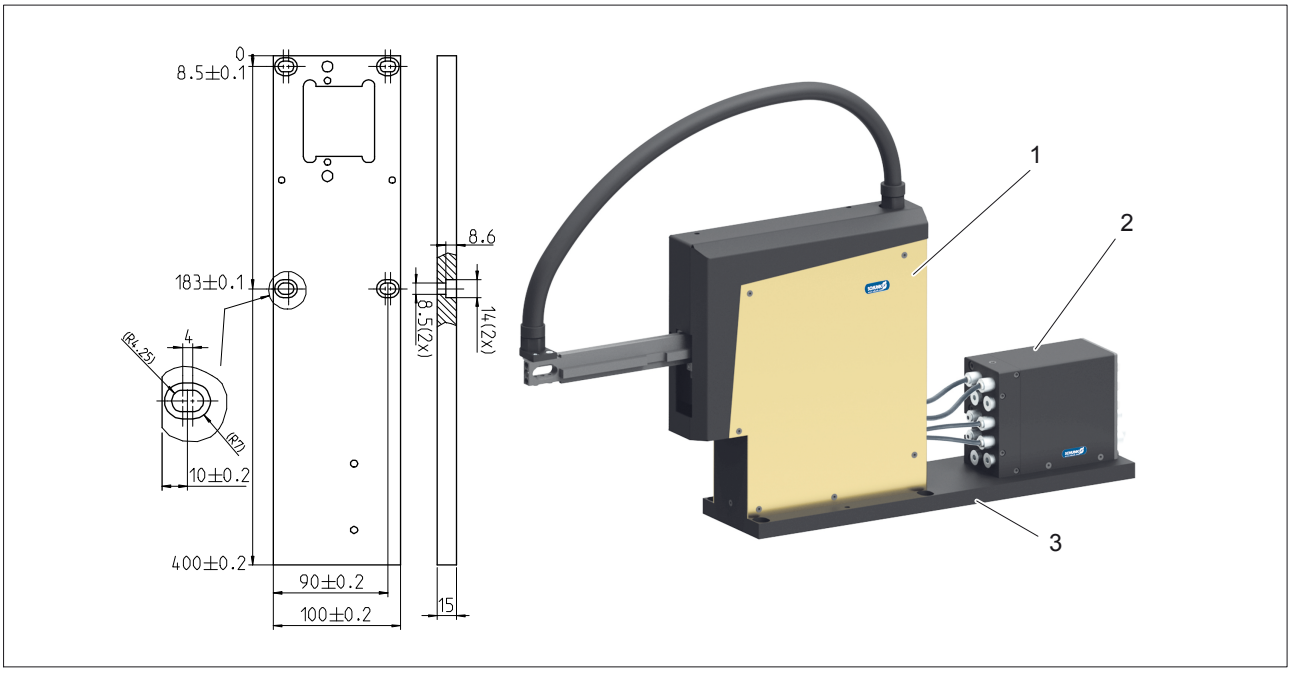
Number of valves	4	5	6	7	8	9
Level control connection possible	Yes ☞ PPU-P Assembly and Operating Manual					
Communication interface	DP Profibus, alternatively CAN bus					
Service, configuration, parameterization	USB-mini type B					
LED display (3 pc.)	Status LEDs Status LEDs [▶ 35]					
Earth	via screw M3 x 5					
Details on the software						
Sequential programs (description of the sequential programs Sequential programs [▶ 46])	Program 1: PPU cycle without gripping / turning					
	Program 2: PPU cycle with gripping and without turning					
	Program 3: PPU cycle with gripping and turning					
Firmware update	Install basic software via USB or CAN					
SMP SCHUNK motion protocol	Yes					
Profibus special features	System integration [▶ 37]					
New or modified commands	Additional or modified commands [▶ 40]					
VCU and PPU-P specific SMP commands	VCU and PPU-P specific SMP commands [▶ 42]					

4 Assembly

4.1 Mechanical connection

⚠ WARNING

Risk of injury when the machine/system moves unexpectedly!
Switch off power supply.



Screw connection diagram for the baseplate / Overview of VCU with PPU-P

Item	Description
1	PPU-P pick & place unit
2	VCU
3	Baseplate

Delivery of complete module: VCU 025 fully assembled on a baseplate with PPU-P, hosing and required sensors in the ordered variant

4.2 Air connection

⚠ WARNING

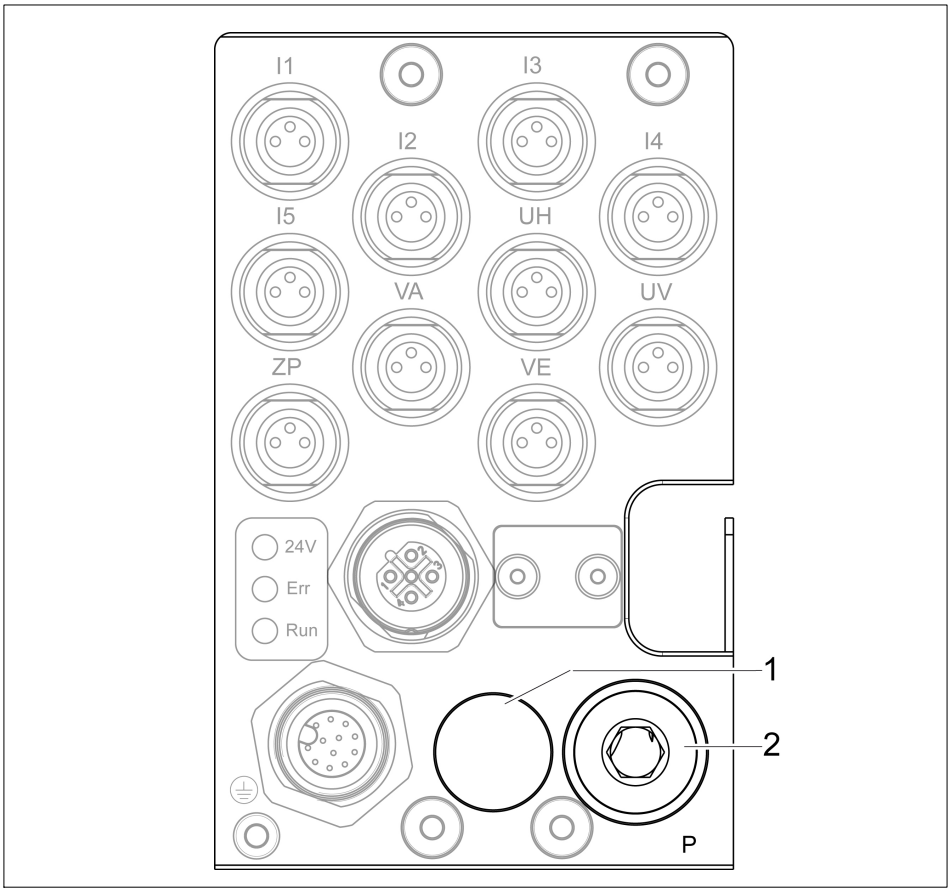
Risk of injury due to unexpected movements!

If the power supply is switched on or residual energy remains in the system, components can move unexpectedly and cause serious injuries.

- Before starting any work on the product: Switch off the power supply and secure against restarting.
- Make sure, that no residual energy remains in the system.

Operating data for compressed air connection: Technical Data [▶ 12]

Position of front air connections

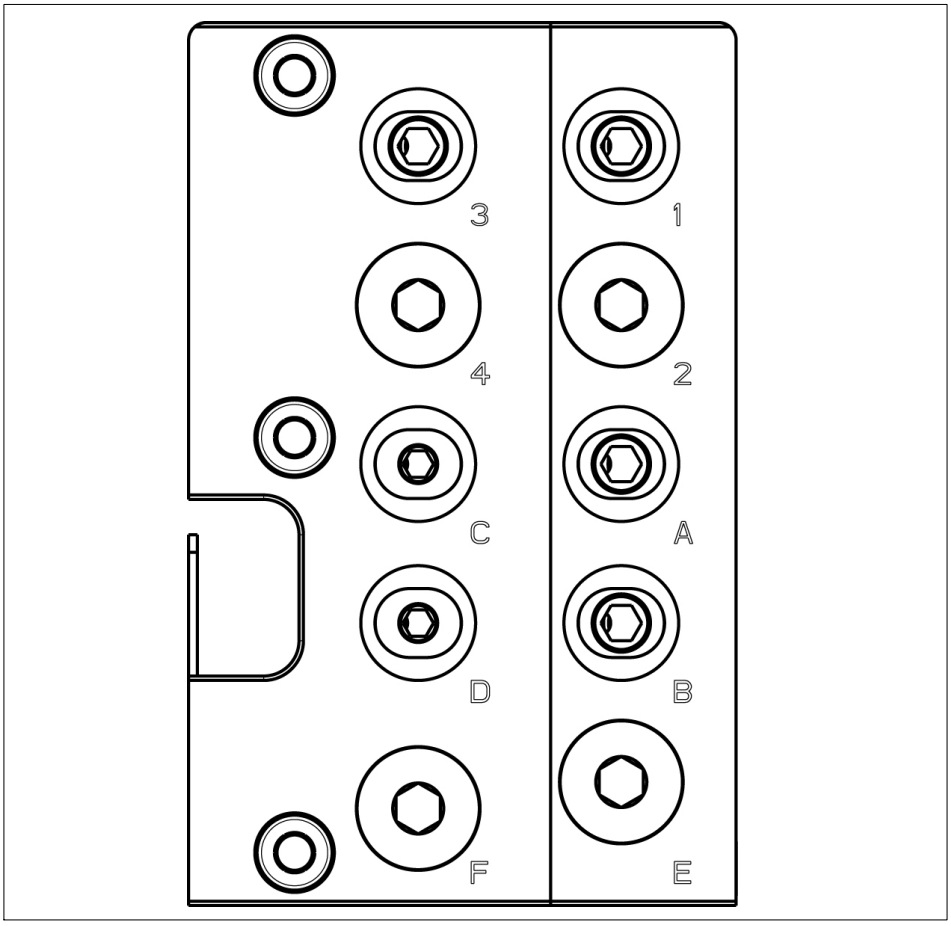


Front air connections

Central air connection and exhaust air sound absorber

Item	Description
1	Exhaust air noise absorber ¼“
2	Central air connection for 8 mm hose diameter, ¼“ screw-in thread

Position of rear air connections



Rear air connections

4.2.1 Allocation of air connections to valves

Allocation of air connections to valves

PPU-P	VCU		
Connection A	Connection A	Valve 5	Hose Ø 6 mm
Connection B	Connection B	Valve 7	Hose Ø 6 mm
Connection C	Connection C	Valve 4	Hose Ø 4 mm
Connection D	Connection D	Valve 6	Hose Ø 4 mm
Connection E	Connection E	Valve 9 (not connected)	Hose Ø 6 mm
Connection F*	Connection F	Valve 8	Dummy screw connection
Connection 1*	Connection 1	Valve 1	Hose Ø 4 mm
Connection 2*	Connection 2	Valve 3	Hose Ø 4 mm
Connection 3*	Connection 3	Valve 0	Hose Ø 4 mm
Connection 4*	Connection 4	Valve 2	Hose Ø 4 mm

* Connections are only available with certain versions

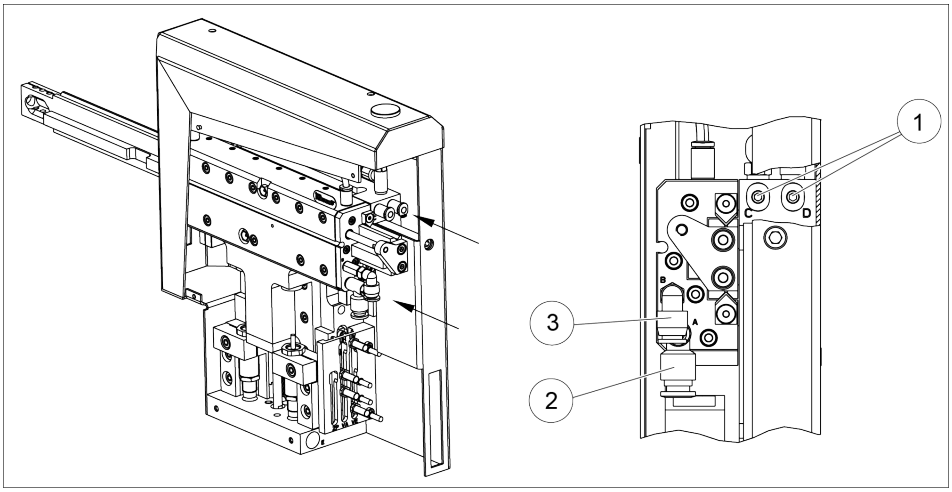
Example: VCU with 9 valves

Rear air connections of a VCU with 9 valves

Air connection	Description
Connection 1	Gripper closed
Connection 3	Gripper open
Plug 2	Optionally for rotary module (I.U.Z)
Plug 4	Optionally for rotary module (G.U.Z)
Connection A	Actuation PPU-P
Connection C	PPU-P actuation
Connection B	Actuation PPU-P
Connection D	Actuation PPU-P
Plug E	Optionally for air feed-through to PPU-P
Plug F	Optionally for intermediate position

Allocation of the air connections to the valves:
Allocation of air connections to valves [▶ 17]
Allocation of inductive proximity sensors [▶ 21]

Position of air connections PPU-P



Position of the air connections PPU-P

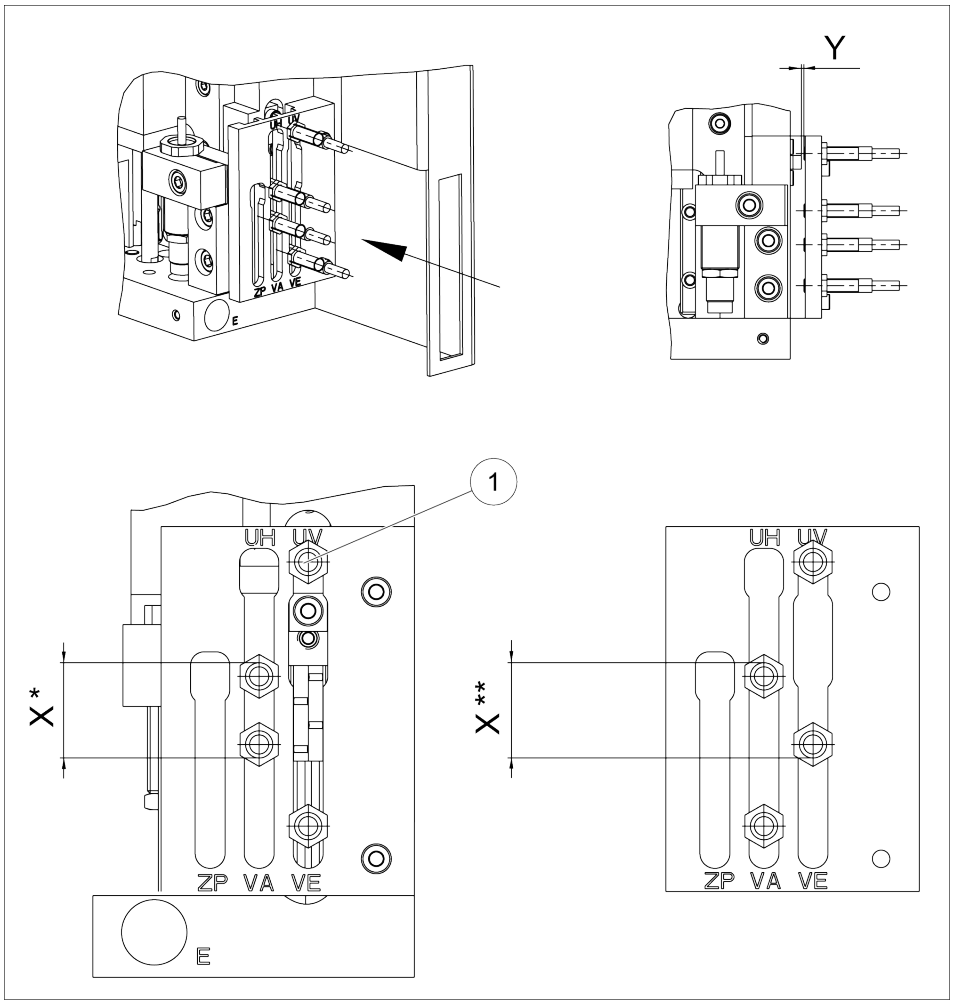
Air connections PPU-P

Item	Connection	Plug-in connection for hose Da [mm]
1	Compressed air connection C / D: Horizontal drive actuation (C-retracting / D-extending)	4
2	Compressed air connection A: actuate vertical drive lift	6
3	Compressed air connection B: lower vertical drive	6

NOTE

☞ Other applicable documents:
Assembly and operating manual for the pick and place unit PPU-P

Attaching and adjusting the IN sensors



Attaching and adjusting the IN sensors

** Case 2 (shown on bottom right): VE = upper end position, VA = lower end position

Adjusting the IN sensors

Item	Designation	Value
1	IN sensor	
X* [mm]	Distance between UH and VA sensor (upper end position)	15
X** [mm]	Distance between UH and VE sensor (upper end position)	15
Y [mm]	Switching distance	approx. 0.8

Sensor assignment

Sensor	Description
VE	Sensor for rear end position (home position) ➔ extension arm returned
VA	Sensor for front end position ➔ extension arm extended
UH	Switching point for horizontal drive
UV	Switching point for vertical drive

NOTE

☞ Other applicable documents:
Assembly and operating manual for the pick and place unit PPU-P

4.2.2 Allocation of inductive proximity sensors

Allocation of inductive proximity sensors to digital EAs on the VCU

PPU-P	VCU	engraved	Param.
Sensor I1	Sensor I1 (gripper closed)	I1	IN0
Sensor I2	Sensor I2 Optionally for rotary module (I.U.Z)	I2	IN1
Sensor I3	Sensor I3 (gripper open)	I3	IN2
Sensor I4	Sensor I4 Optionally for rotary module (G.U.Z)	I4	IN3
Sensor I5	Sensor I5 *) Optional: Enable for start position VE	I5	IN4
Sensor UH	Sensor UH	UH	IN5
Sensor VA	Sensor VA	VA	IN6
Sensor UV	Sensor UV	UV	IN7
Sensor ZP	Sensor ZP *) Optional: Enable for end position VA	ZP	IN8
Sensor VE	Sensor VE	VE	IN9
	*) I5 and ZP can optionally be used for external enabling		

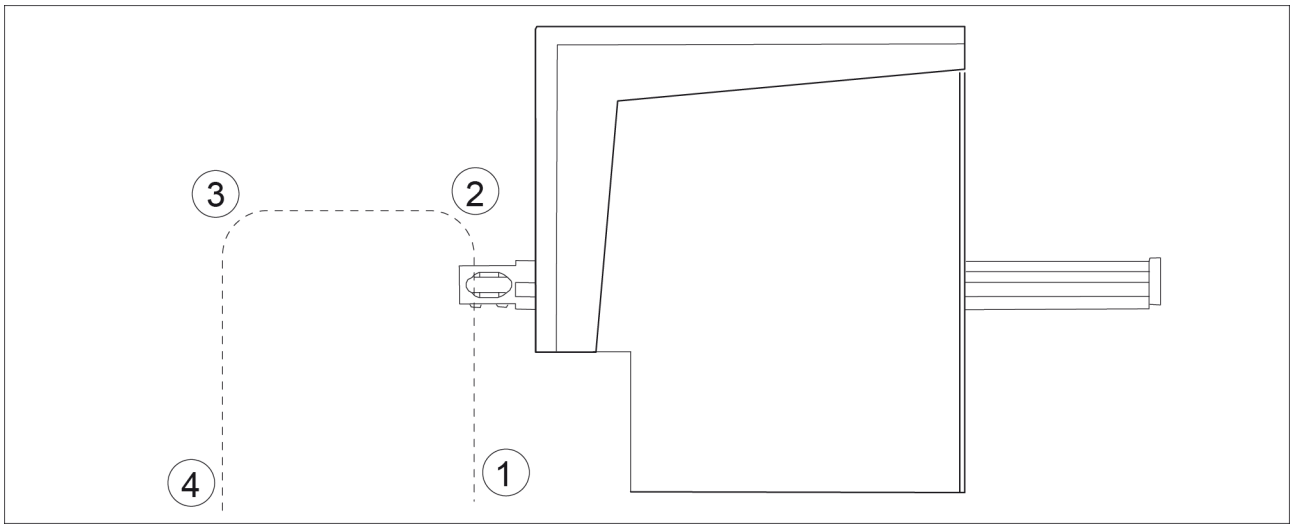
The sensors UH, VA, UV, ZP and VE are required to monitor the PPU-P's basic functions. Sensors I1 – I5 are optionally required to monitor a gripper and a rotary module.

NOTE

The positions of the sensor plug connectors are labeled on the front of the VCU (engraved)

Position of the plug connectors [▶ 24]

4.2.3 Movement when valves are switched



Movement when valves are switched

Item	Movement	Connection A	Connection B	Connection C	Connection D	Connection E
1	Start position VE (A)	off	on	on	off	-
2	Position UH	on	off	on	off	-
3	Position UV	on	off	off	on	-
4	End position VA	off	on	off	on	-
	Gripper open	-	-	-	-	-
	Gripper closed	-	-	-	-	-
	Rotary module to the right	-	-	-	-	-
	Rotary module to the left	-	-	-	-	-
	Intermediate position on	-	-	-	-	on
	Intermediate position off	-	-	-	-	off

Movement when valves are switched

Item	Movement	Connection 1	Connection 2	Connection 3	Connection 4
1	Start position VE	-	-	-	-
2	Position UH	-	-	-	-
3	Position UV	-	-	-	-
4	End position VA	-	-	-	-
	Gripper open	off	-	on	-
	Gripper closed	on	-	off	-
	Rotary module to the right	-	on	-	off
	Rotary module to the left	-	off	-	on
	Intermediate position on	-	-	-	-
	Intermediate position off	-	-	-	-

4.3 Electrical connection

⚠ WARNING

Risk of injury when the machine/system moves unexpectedly!

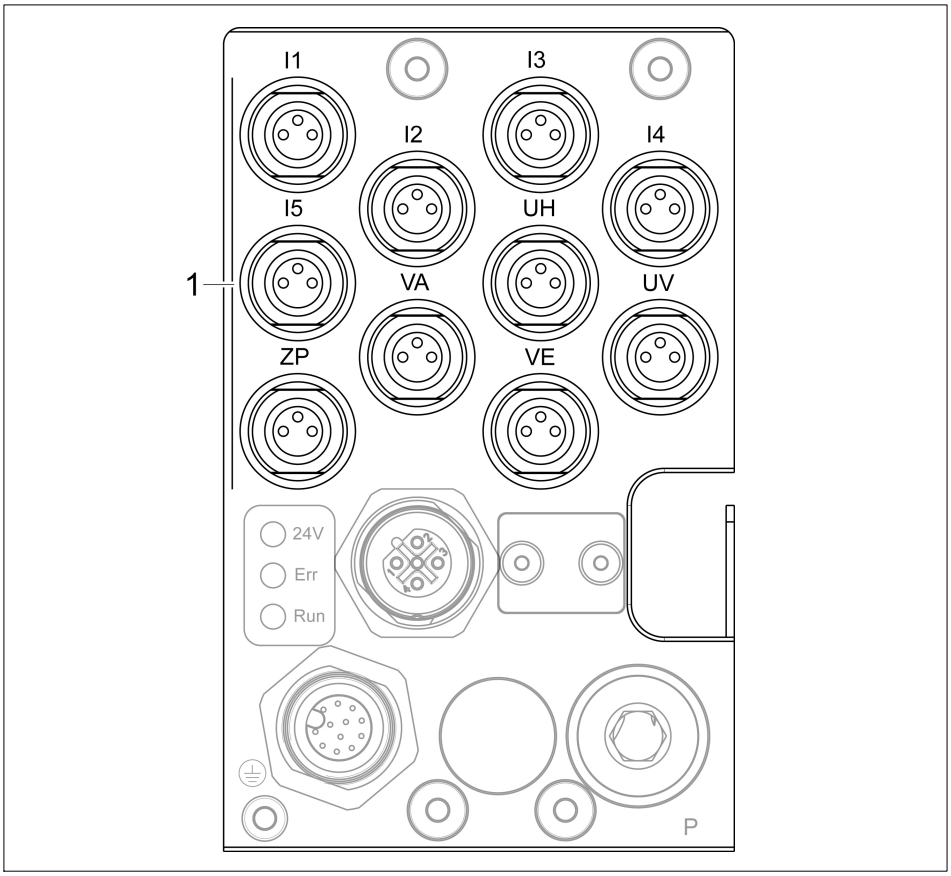
Switch off power supply.

NOTE

Observe the maximum electrical energy values "Technical data" Technical Data [▶ 12]

4.3.1 Position of the plug connectors

Position of the sensor plug connectors

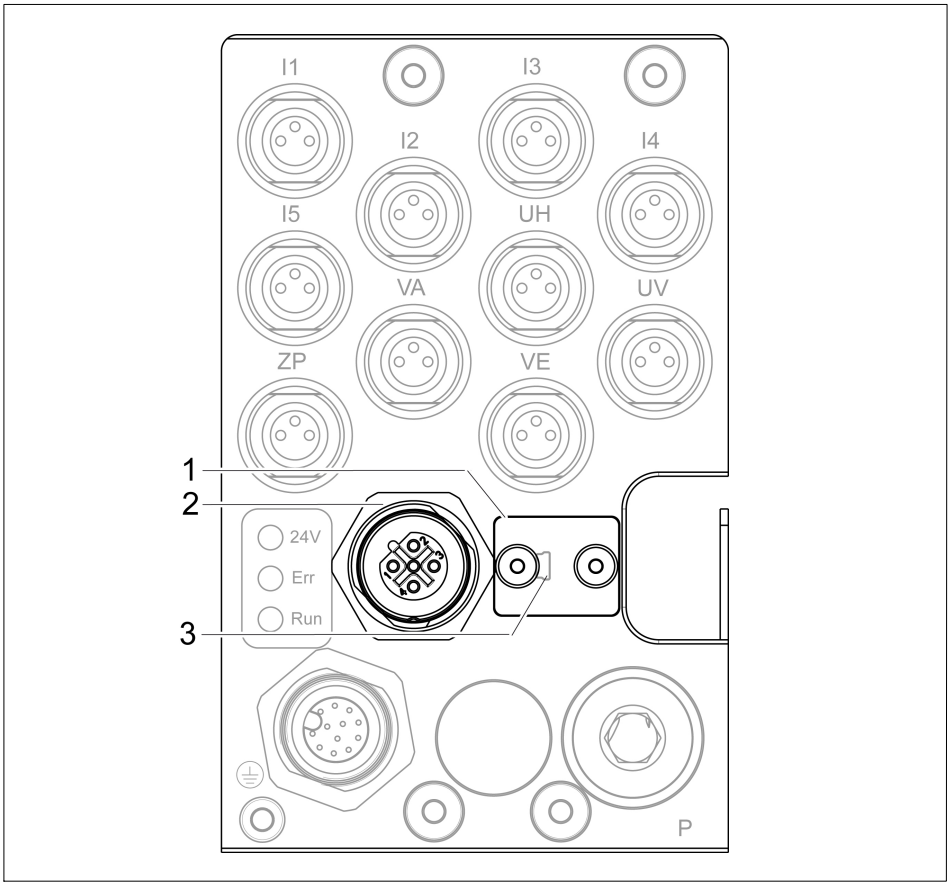


Position of the sensor plug connectors

Allocation of the inductive sensors to the digital inputs

Allocation of inductive proximity sensors [▶ 21]

Position of Profibus and USB

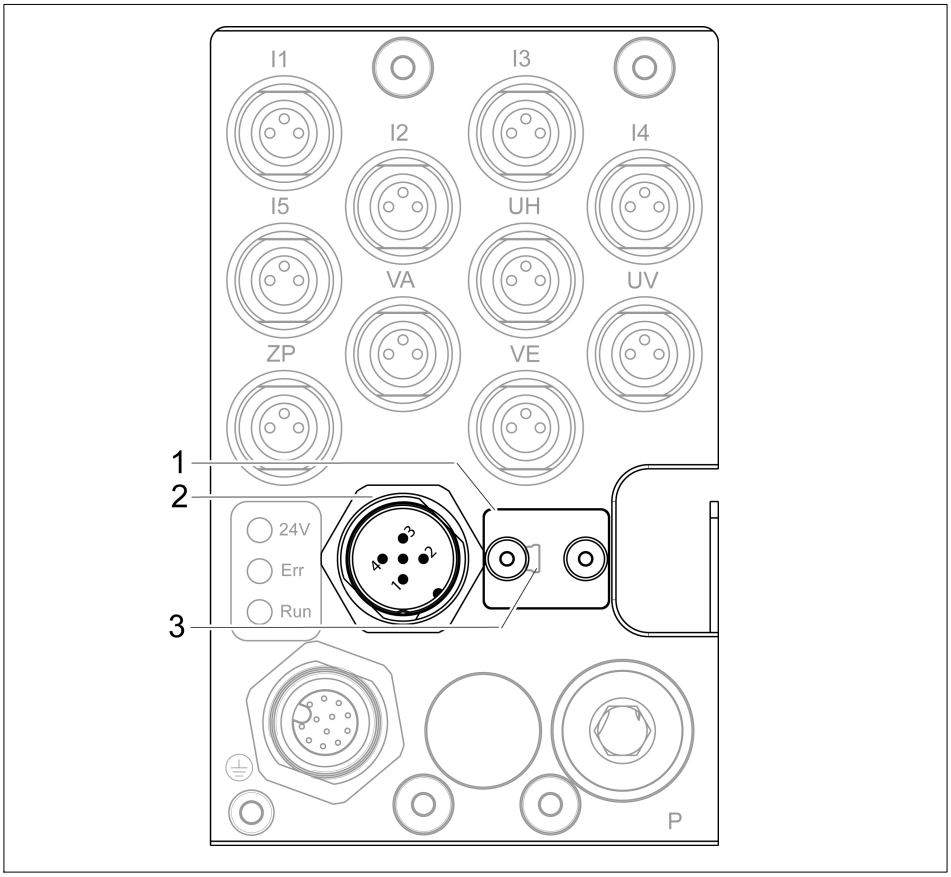


Position of the Profibus socket and the USB socket

Position of Profibus and USB bus

Item	Description
1	Cover for USB interface
2	Communication interface Profibus DP socket 4-pin M 12 Pin allocation of the plug connectors [▶ 31]
3	USB-mini type B interface for service Pin allocation of the plug connectors [▶ 35] **Note** USB-mini type B is **not** suitable as fieldbus.

Position of CAN bus and USB alternatively

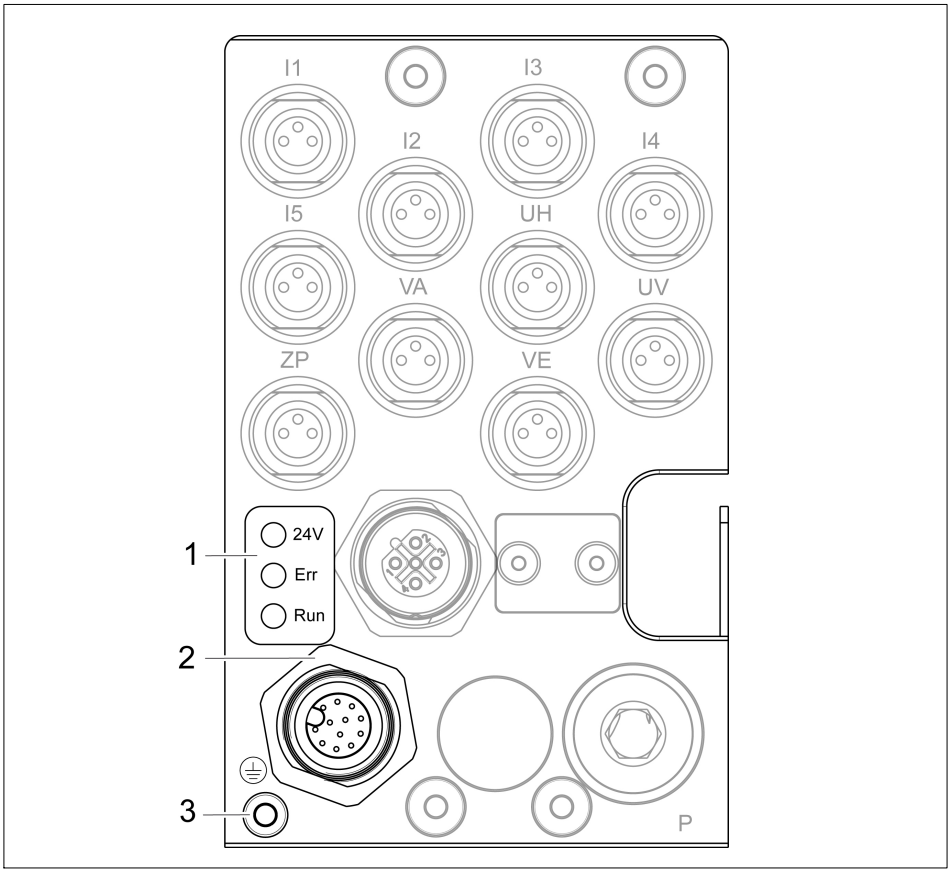


Position of CAN bus connection plug and USB socket

Position of Profibus and USB bus

Item	Description
1	Cover for USB interface
2	Communication interface Profibus DP socket 5-pin M 12 Link to dimensional diagram and pin allocation for Profibus T-piece [▶ 33]
3	USB-mini type B interface for service Pin allocation of the plug connectors [▶ 35] **Note** USB-mini type B is **not** suitable as fieldbus.

Position of power socket, status LEDs, earth



Position of power plug, LED, earth

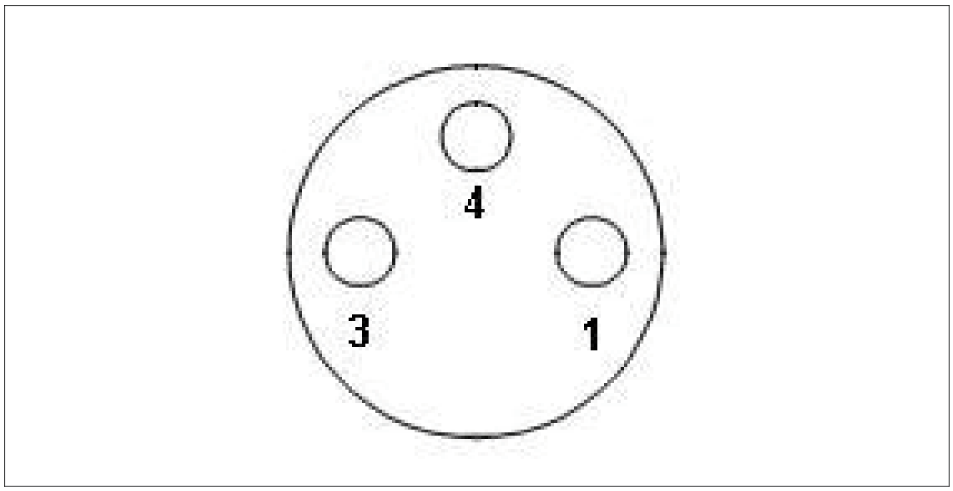
Position of power plug, LEDs, earth

Item	Description
1	Status LEDs Status LEDs [▶ 35]
2	Power socket 12-pin M 12 sensor plug connector A encoding Pin allocation of the plug connectors [▶ 29]
3	Earth via screw M3x5

4.3.2 Pin allocation of the plug connectors

Pin allocation of the sensor sockets

The connection assignment of an M8 sensor socket on the VCU corresponds to the standard connection assignment of a 3-pin sensor.

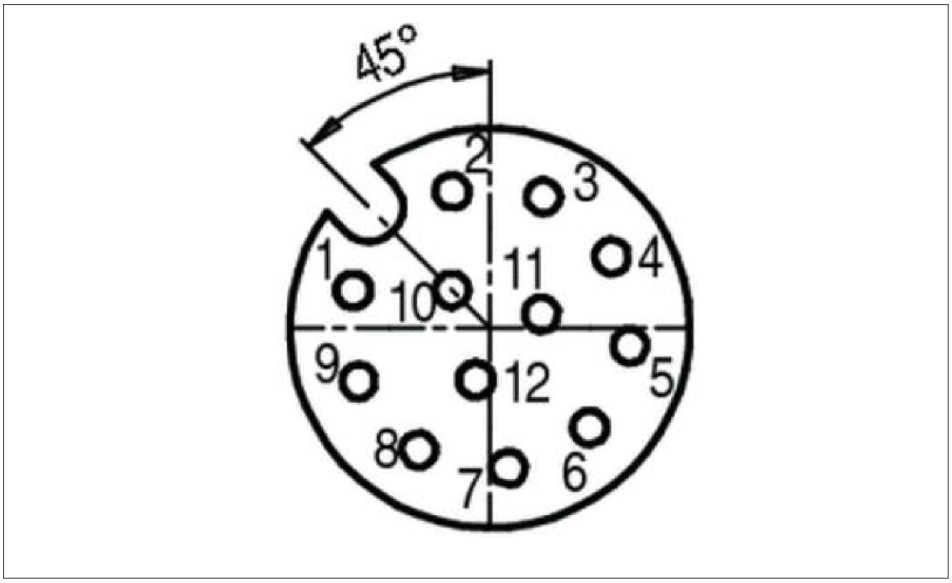


Sensor socket view on plug side

Pin allocation of sensor sockets

VCU		Cable connector		
Pin	**Value**	**Pin**	**Value**	**Color**
Pin 1	24 V	Pin 1	24 V	Brown
Pin 2	GND	Pin 2	GND	Blue
Pin 3	Signal	Pin 3	Signal	Black

Pin allocation for power socket



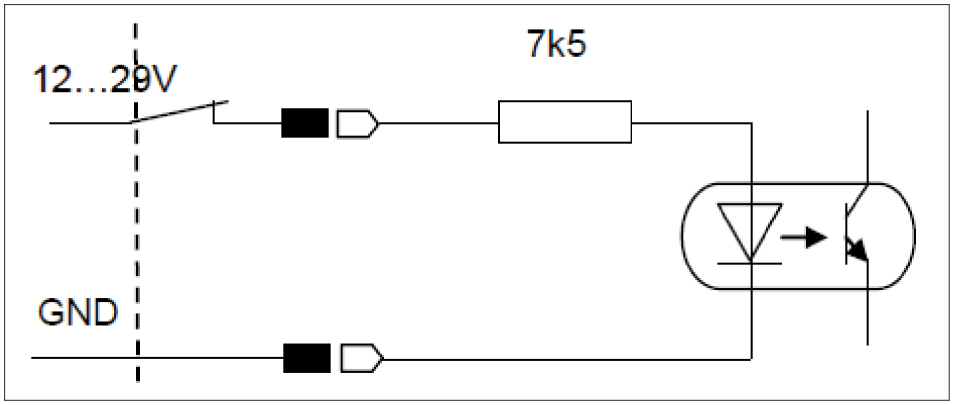
Pin allocation for power socket

Pin allocation for power socket

Pin	Color	Function
1	brown	Digital input 1
2	blue	Digital input 2
3	white	Digital input 3
4	green	Digital output 1
5	pink	Digital output 2
6	yellow	Digital output 3
7	black	+ 24V
8	gray	+ 24V
9	red	GND
10	purple	GND
11	gray/pink	GND
12	red/blue	GND

Commands via digital inputs

The following figure shows the internal circuitry of the digital inputs:



Connection diagram of a digital input

Commands via digital inputs

Description	DI3	DI2	DI1	DO3	DO2	DO1
Enable	0	0	0	0	0	0
Referencing	0	0	1	0	0	1
Program 1	0	1	0	0	1	0
Program 2	0	1	1	0	1	1
Program 3	1	0	0	1	0	0
Acknowledge error	1	0	1	0	0	0
Fast stop	1	1	1	1	1	1

NOTE

If an error occurs, and after activating the "Acknowledge error" command, all the digital inputs (DI1 - DI3) must all be set to "0" (enable) in order to be able to set new commands. If an error occurs:

- Acknowledge error by activating command "Acknowledge error"
- Enable digital inputs DI1 to DI3 by setting all inputs to "0"
  ⇨ New commands can now be activated.

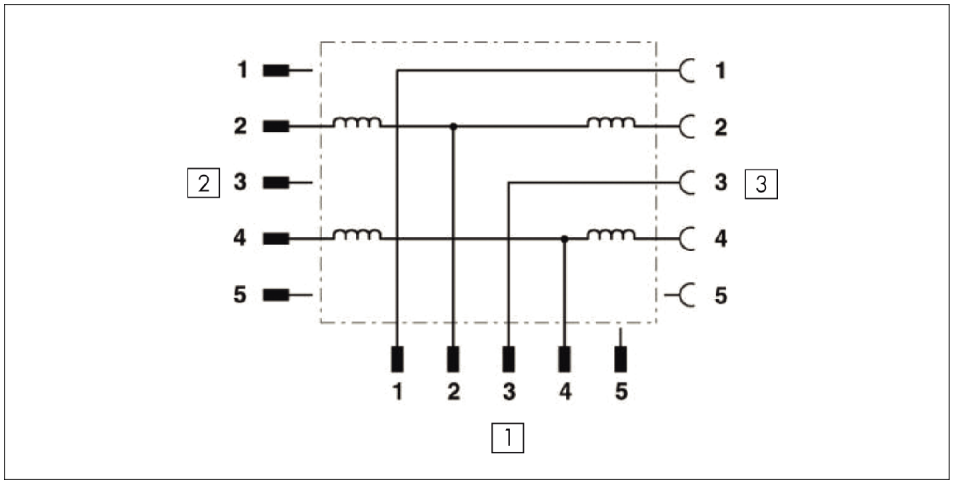
Profibus DP T-piece

For the connection of the Profibus communication you require:

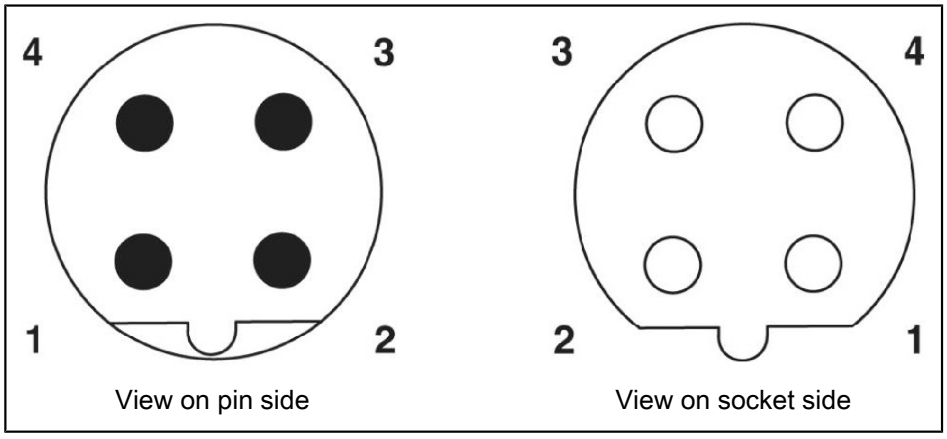
- T-piece for Profibus DP, 4-pin
- Terminating resistor for Profibus DP, 4-pin plug

NOTE

T-piece and terminating resistor are contained in the accessory pack.



Dimensional diagram and pin allocation for Profibus T-piece



Pin diagram plug M12, 4-pin, B-encoded

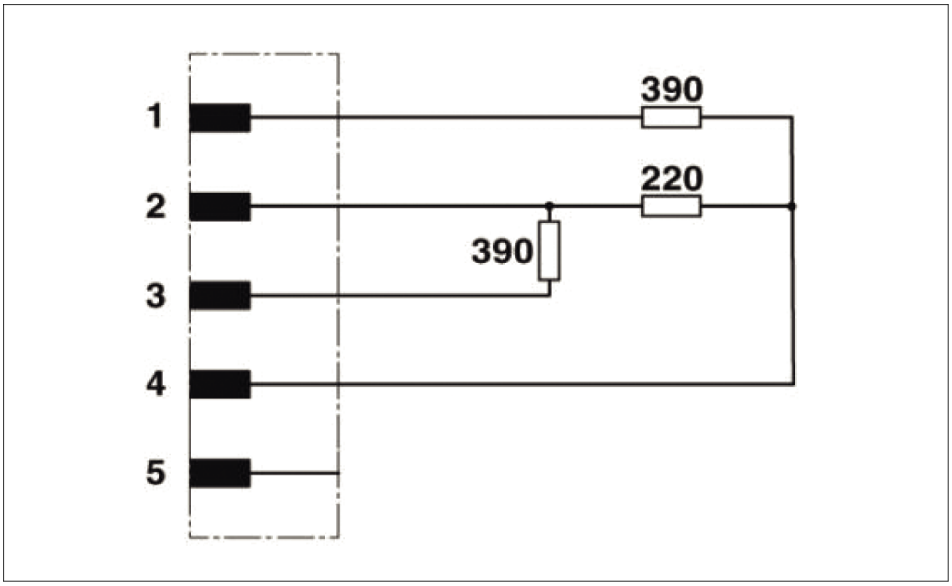
Pin allocation Profibus DP socket (FE = functional earth)

Pin	Value
Pin 1	+5V
Pin 2	PB A
Pin 3	GND
Pin 4	PB B
Pin 5	n.c.

NOTE

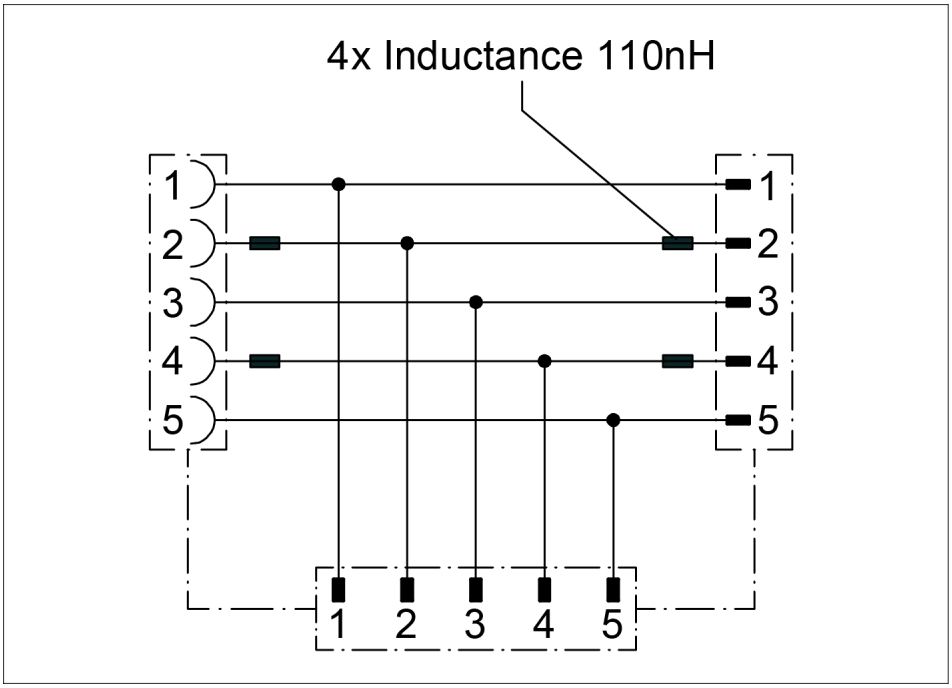
FE is not connected to the Profibus line via the T-piece. The connection must be established by the customer.

Profibus DP terminating resistor



Dimensional diagram and pin allocation for Profibus terminating resistor

Profibus Y distributor



Profibus Y distributor (Conec)

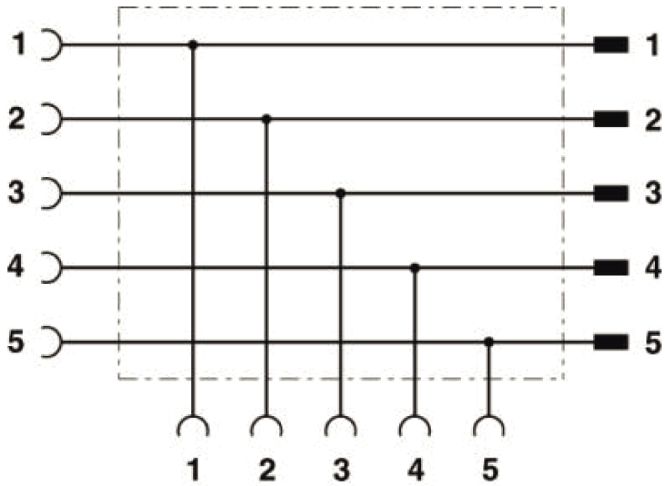
CAN bus T-piece alternatively

For the connection of the CAN bus communication you require:

- T-piece CAN bus, 5-pin
- Terminating resistor for CAN bus, 5-pin plug

NOTE

T-piece and terminating resistor are contained in the accessory pack.

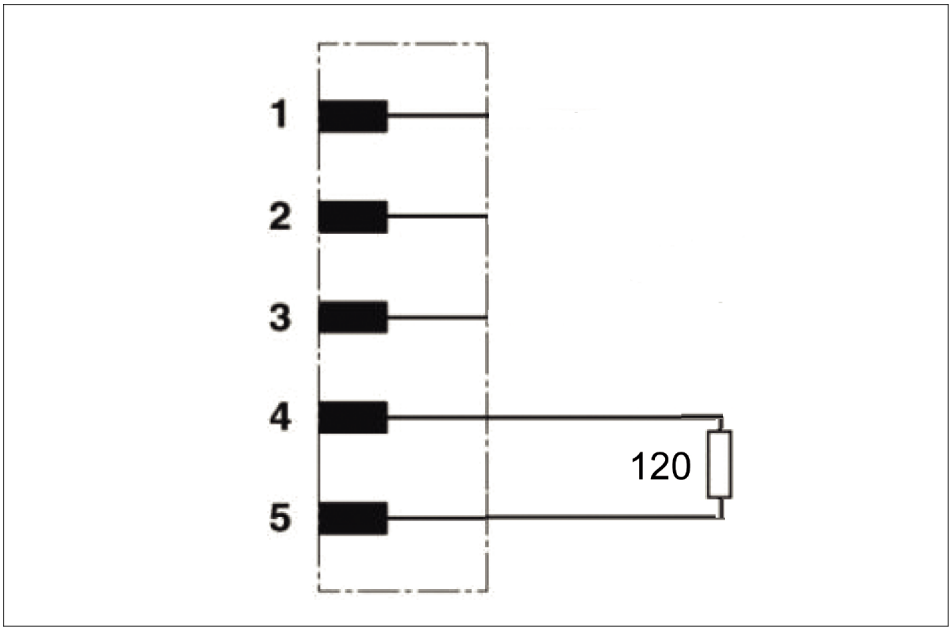


Pin allocation CAN bus T-piece

Pin allocation CAN bus socket (FE = functional earth)

Pin	Value
Pin 1	FE
Pin 2	n.c.
Pin 3	GND
Pin 4	CAN H
Pin 5	CAN L

CAN bus terminating resistor alternatively



Pin allocation CAN bus terminating resistor

USB-mini type B

⚠ DANGER

Risk of injury when the machine/system moves unexpectedly due to incorrect programming or interruption of the communication!

→ Only specialist personnel or specially trained staff should carry out settings and enter parameters.

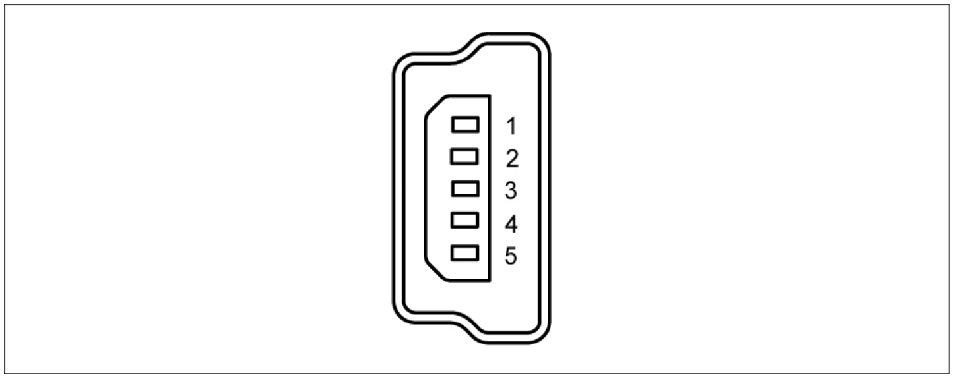
→ When switching the valves via USB, there is a risk of the communication being interrupted.

The USB interface is purely a service interface for the following functions:

- Parameterization of the VCU
- Error diagnostics
- Installing firmware updates

The USB interface **is not suitable for actuating valves.**

The USB port is a USB-mini type B socket. The commercially available mini-USB cables are suitable for use.

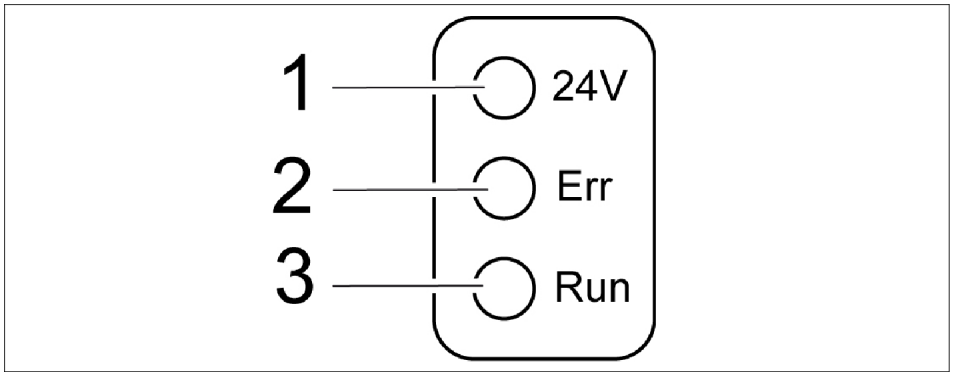


Pin allocation interface USB-mini type B

Pin allocation USB-mini type B

Pin	Name	Color	Description
1	VCC	red	+ 5V
2	D-	white	Data -
3	D+	green	Data +
4	ID	none	Type B mini: not connected
5	GND	black	Mass

4.3.3 Status LEDs



Arrangement of the status LEDs

Meaning of the status LEDs

Item	LED	Color	no error
1	24V	green	continuously on
2	Err	red	continuously off
3	Run	green	flickers

Signaling according to SMP protocol

LED signaling

LED3 green Run	LED2 red Err	Meaning
permanently on	permanently on	The module is in flash mode or no bus system is active.
on	flashes	New firmware is being transmitted (from V1.20)
briefly on	briefly on	Module booting
on	off	The module is ready for operation and the bus system is active.
flickers	off	Data is being exchanged.
off	off	Logic supply voltage is not present. If the two LEDs were previously briefly on (boot phase), then the initialization of the connected bus system has not yet been successful. Please check the bus cable. Is the master active?
off	on / flashes	An error has occurred in the module.
off / on	on / off	Profibus is active, but not yet in the "Data exchange" mode, or automatic interface detection
		is active.
flickers	flashing / flickering	Data from the "Main interface'' is being exchanged. At the same time, the diagnosis interface is active and data is also being exchanged through this.
off / on quickly	on / off quickly	Firmware is in an undefined state. (Should never happen!)

☞ Other applicable documents, software manual (motion control)

4.4 Sensor positions

4.4.1 Attaching and adjusting the IN sensors

☞ PPU-P Assembly and Operating Manual

4.4.2 Attachment and adjustment of optional MMS sensors

☞ PPU-P Assembly and Operating Manual

4.5 System integration

4.5.1 SCHUNK motion protocol

Data format

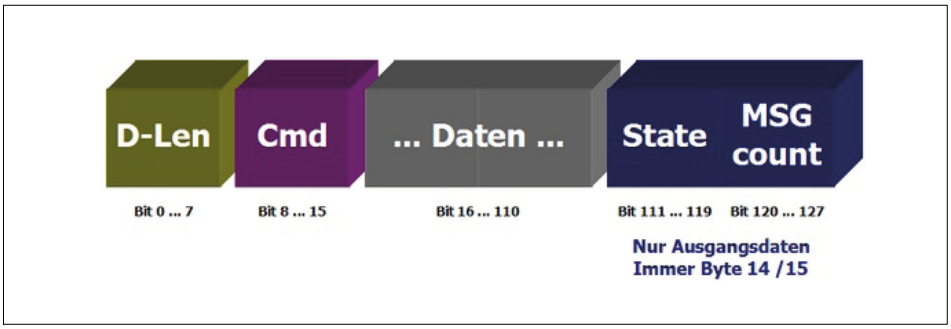
Data is sent from the modules in the Intel format (little-endian format) and interpreted in this same format when being received. Using the SCHUNK motion protocol for actuating the VCU with PPU-P requires various adjustments which are described below.

Profibus special features

There are the following special features with Profibus DPV0:

- The maximum length of the data to be transmitted all at once from the master to the module is limited to 10 bytes.

This is sufficient to fully operate a module
(A maximum of 7 bytes are required for a message from the master to the module).



Data frame for Profibus

The maximum length of the data sent from the module to the master (response) is limited to 12 bytes (GSD file). If you need to send/receive larger quantities of data, a fragmentation may be necessary.

☞ Other applicable documents, software manual (motion control)

The longest message arising in normal operation from the module to the master can be accommodated in 12 bytes. There will even be 2 bytes still remaining. These 2 bytes, which are always at the end of the Profibus message (byte 10, byte 11), contain:

- the actual status of the module (byte 10) and
- a so-called message count (MsgCount) (byte 11). With fragmented messages, these two bytes are used for data.

NOTE

Only the upper 8 bits of the status word are written. The error code is not used. You can use the extended diagnosis under Profibus for this on the one hand, and on the other, the error code is displayed in the output data in the event of an error.

If a message is sent from the master to the module, then with Profibus the MsgCount is increased by 1 in addition to the response. This ensures that every request is confirmed despite possible spontaneous messages.

NOTE

A spontaneous message does not increase the MsgCount!

If, for example, you want to move to a position where the module is currently located, the module will signal "Command understood" and "Position reached" immediately in the next Profibus cycle. Since in some circumstances a control unit connected to the Profibus does not query the data in every Profibus cycle, the acknowledgement of (response to) the motion command could go missing. The MsgCount ensures that a confirmation of the request was received. Status byte (byte 10) is used to constantly receive the current information on the status of the present module.

NOTE

The last bit for MsgCount can be evaluated as a toggle bit (module to master). During data transmission from the master to the module the byte 8 not used can be used as toggle byte, or bit 63 as toggle bit.

Groups are fully supported by the SYNC / FREEZE mechanism implemented in Profibus. Changing the address is possible at any time via the "Set slave address'' (SAP 55) service. "Real no add change" is saved in the group byte. A set "Real no add change" (0xFF) can thus be deleted again using a new configuration of the group byte.

If consistent data transmission is not possible, then the following options can be used to operate the module:

- Use SYNC, UNSYNC.
- Set D-Len to "0". Populate all data and set the D-Len as soon as all data are present.

4.5.2 Additional or modified commands

CMD SET DIO

Command code: 0xEA

Description: Digital outputs can be written or valves set.

3 types of requests are possible:

- On the VCU type 1 is mainly used. Type 1: The status of all digital outputs / valves is written.

Parameters (Master → Slave): Bit vector (4 bytes).

Response (Slave → Master): if successful: "OK" (0x4F4B) (2 bytes)

Output 1/Valve 1	Bit 1	0x01 0x00 0x00 0x00
Output 2/valve 2	Bit 2	0x02 0x00 0x00 0x00
Output 3/valve 3	Bit 3	0x04 0x00 0x00 0x00
Output 4/valve 4	Bit 4	0x08 0x00 0x00 0x00
Output 5/valve 5	Bit 5	0x10 0x00 0x00 0x00
Output 6/valve 6	Bit 6	0x20 0x00 0x00 0x00
Output 7/valve 7	Bit 7	0x40 0x00 0x00 0x00
Output 8/valve 8	Bit 8	0x80 0x00 0x00 0x00
Output 9/valve 9	Bit 9	0x00 0x01 0x00 0x00

Examples 1: type 1

Example for CMD SET DIO

	D-Len	Cmd	Param	Meaning
M→S	0x05	0xEA	0x00 0x00 0x00 0x00	Type 1: Set all outputs/valves to 0
S→M	0x03	0xEA	0x4F 0x4B	"OK": Outputs were set

Examples 2: type 1

Example for CMD SET DIO

	D-Len	Cmd	Param	Meaning
M→S	0x05	0xEA	0x01 0x00 0x00 0x00	Type 1: Set output 1 or valve 1 to 1
S→M	0x03	0xEA	0x4F 0x4B	"OK": Outputs were set

Example for CMD SET DIO

	D-Len	Cmd	Param	Meaning
M→S	0x05	0xEA	0xFF 0x01 0x00 0x00	Type 1: Set all outputs or valves to 1
S→M	0x03	0xEA	0x4F 0x4B	"OK": Outputs were set

CMD GET DIO

Digital inputs/outputs can be read. 3 types of requests are possible which differentiate in the number of transmitted parameters and in the type and number of requested digital inputs/outputs. Differing responses are also returned by the module depending on the type (1-3) of request.

- On the VCU type 1 is mainly used. Type 1: The current status of all digital inputs is read as a bit vector.

		Input (byte 1 – byte 2)	**Output (byte 3 – byte 4)**
Input I1/Output 1	IN0/Bit1	0x01 0x00	0x01 0x00
Input I2/Output 2	IN1/Bit2	0x02 0x00	0x02 0x00
Input I3/Output 3	IN2/Bit3	0x04 0x00	0x04 0x00
Input I4/Output 4	IN3/Bit4	0x08 0x00	0x08 0x00
Input I5/Output 5	IN4/Bit5	0x10 0x00	0x10 0x00
Input UH/Output 6	IN5/Bit6	0x20 0x00	0x20 0x00
Input VA/Output 7	IN6/Bit7	0x40 0x00	0x40 0x00
Input UV/Output 8	IN7/Bit8	0x80 0x00	0x80 0x00
Input ZP/Output 9	IN8/Bit9	0x00 0x01	0x00 0x01
Input VE	IN9	0x00 0x02	Output 1 – output 9

Examples 1: type 1

Example for CMD SET DIO

	D-Len	**Cmd**	**Param**	**Meaning**
M→S	0x01	0xE9		Type 1: Read all inputs
S→M	0x05	0xE9	0x01 0x00 0x01 0x00	Type 1: Input 1 (IN0) and output 1/valve 1 are set

Examples 2: type 1

Example for CMD SET DIO

	D-Len	**Cmd**	**Param**	**Meaning**
M→S	0x01	0xE9		Type 1: Read all inputs
S→M	0x05	0xE9	0x41 0x00 0x0F 0x00	Type 1: Input 1 (IN0), 7 (IN6) output 1, 2, 3, 4/valve 1, 2, 3, 4 are set

4.5.3 VCU and PPU-P specific SMP commands

CMD REFERENCE

Command code: 0x92

Description: A reference movement is completed.

Parameters (Master → Slave): None

Response (Slave → Master): if successful: "OK" (0x4F4B).
The module executes the command.

Example 1: Type 1

Examples for CMD REFERENCE

	D-Len	Cmd	Param	Meaning
M→S	0x01	0x92		
S→M	0x03	0x92	0x4F 0x4B	

CMD FAST STOP

Command code: 0x90

Description: The **PPU-P** is stopped as quickly as possible.
All valves are deenergized.

Parameters (Master → Slave): None

Response (Slave → Master): Error message "ERROR FAST STOP" is triggered.

Miscellaneous: Can only be reset by "CMD ACK".

Example for CMD FAST STOP

	D-Len	Cmd	Param	Meaning
M→S	0x01	0x90		
S→M	0x03	0x88	0xD9	EMERGENCY STOP performed

⚠ WARNING

Risk of injury!

The **PPU-P** can "stall" since the valves are deenergized in the event of a quick stop!

CMD ACK

Command code: 0x88

Description: Acknowledgement of a pending error message

Parameters (Master → Slave): None

Response (Slave → Master): "OK" (0xF4B)

Miscellaneous: When all errors have been successfully acknowledged, an info message
"INFO NO ERROR" is sent after sending "OK" (0x4F4B).

Examples for CMD ACK

	D-Len	Cmd	Param	Meaning
M→S	0x01	0x8B		
S→M	0x03	0x8B	0x4F 0x4B	

EXE PHRASE0

Command code: 0xD0

Description: Special command, only 1 byte in size, for calling up sequential program "1".

Parameters (Master → Slave): None

Response (Slave → Master): Sequential program "1" (UInt16) with contained command PRG_EXE (0xCF) is sent, and the corresponding sequential program "1" is executed.

Examples for EXE PHRASE0

	D-Len	Cmd	Param	Meaning
M→S	0x01	0xD0	0xD0	Execute sequential program "1".
S→M	0x04	0xD0	0x00 0x00 0xCF	Sequential program "1" is executed.

EXE PHRASE1

Command code: 0xD1

Description: Special command, only 1 byte in size, for calling up sequential program "2".

Parameters (Master → Slave): None

Response (Slave → Master): Sequential program "2" (UInt16) with contained command PRG_EXE (0xCF) is sent, and the corresponding sequential program "2" is executed.

Examples of EXE PHRASE1

	D-Len	Cmd	Param	Meaning
M→S	0x01	0xD1	0xD1	Execute sequential program "2".
S→M	0x04	0xD1	0x01 0x00 0xCF	Sequential program "2" is executed.

EXE PHRASE2

Command code: 0xD2

Description: Special command, only 1 byte in size, for calling up sequential program "3".

Parameters (Master → Slave): None

Response (Slave → master): sequential program "3" (UInt16) with contained command PRG_EXE (0xCF) is sent, and the corresponding sequential program "3" is executed.

Examples of EXE PHRASE2

	D-Len	Cmd	Param	Meaning
M→S	0x01	0xD2	0xD2	Execute sequential program "3".
S→M	0x04	0xD2	0x02 0x00 0xCF	Sequential program "3" is executed.

MOVE POS (0xB0)

Command code: 0xB0

Description: Effects an external start, for moving the PPU-P further out of the wait position (if configured) at rear/front.

Optionally you can also use the sensors (I5, ZP) for an external start.

Two wait positions can be approached:

- Rear wait position: Is located above the rear end position (home position). Can only be actuated from the rear end position.
- Front wait position: Is located above the front end position. Can only be actuated from the front end position.

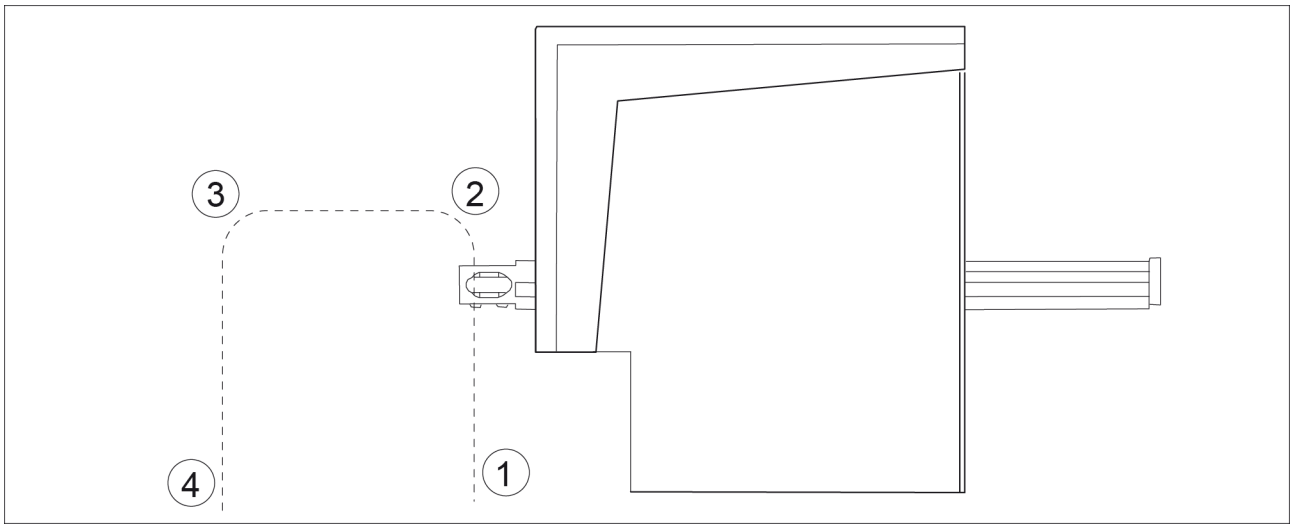
Parameters (Master → Slave): None

Response (Slave → master): "OK" (0x4F4B) if successful. The module executes the command.

Examples of EXE PHRASE2

	D-Len	Cmd	Param	Meaning
M→S	0x01	0xB0		
S→M	0x03	0xB0	0x4F4B	

5 Sequential programs



Description of the sequential programs

Program 1: PPU cycle without gripping / turning
(2) (Referencing position "start position") →
(1) (Unit in rear end position and extension arm returned) →
(2) (Referencing position) →
(3) (Extension arm extended) →
(4) (Unit in front end position. Extension arm extended and lowered) →
(3) (Start return stroke from PPU cycle)

Description of the sequential programs

Program 2: PPU cycle with gripping and without turning
(2) (Referencing position "start position" [gripper open]) →
(1) (Unit in rear end position and extension arm returned [close gripper]) →
(2) (Referencing position) →
(3) (Extension arm extended) →
(4) (Unit in front end position. Extension arm extended and lowered [open gripper] →
(3) (Start return stroke from PPU cycle)
Program 3: PPU cycle with gripping and turning
(2) (Referencing position "start position" [gripper open]) →
(1) (Unit in rear end position and extension arm returned [close gripper]) →
(2) (Referencing position [turn rotary actuator]) →
(3) (Extension arm extended) →
(4) (Unit in front end position. Extension arm extended and lowered [open gripper] →
(3) (Start return stroke from PPU cycle [turn rotary actuator])

6 Troubleshooting

6.1 VCU troubleshooting

Possible cause	Remedial measures
Pressure below minimum	Check air supply Air connection [▶ 15]
Compressed air lines incorrectly connected	Check compressed air lines Air connection [▶ 15]
Proximity switch defective or incorrectly set	Repair proximity switch ☞ separate proximity switch manual
Nonrequired air connections open	Close nonrequired air connections
Sensor is defective or not connected	Check sensors and replace if necessary, or connect
Air hose is defective or not connected	Check air hose and replace if necessary, or connect
Connection sequence of air connections or sensors is wrong	Ensure correct connection sequence with the help of the operating manual
Power supply is dropped short of or exceeded	Set correct power supply (24V)
Sequence is blocked by an interfering contour (workpieces, chips, etc.)	Remove interfering contour
Communication via CAN, Profibus or USB no longer possible	Contact Schunk Support
Digital inputs not reacting	Enable program in EEPROM
Digital outputs not reacting	Switch on outputs in EEPROM
Gripper unit not working	Activate gripper unit in EEPROM
Gripping-turning unit not working	Activate gripping-turning unit in EEPROM
Power of power supply unit too low	Use power supply unit with correct power

6.2 PPU-P troubleshooting

☞ Applicable documents: PPU-P Assembly and Operating Manual

6.3 Electrical signals are not transmitted?

Possible cause	Remedial measures
Cables not connected correctly	Check that the pin terminal and the two miniature blade connectors are positioned correctly.
Wire strands mixed up	Check whether wire strands are mixed up. Observe pin allocation: ☞ x y.
Bus signals should be transmitted	Bus signals cannot be transmitted. Please get in touch with your SCHUNK contact person.

7 Maintenance and care

When keeping to the pressure media and ambient temperatures specified in the technical data Technical Data [▶ 12]
, the VCU is maintenance-free.

In case of damage, send the entire VCU and a repair order to SCHUNK.

8 Translation of original declaration of incorporation

in terms of the Directive 2006/42/EG, Annex II, Part 1.B of the European Parliament and of the Council on machinery.

Manufacturer/ Distributor	SCHUNK GmbH & Co. KG Spann- und Greiftechnik Bahnhofstr. 106 – 134 D-74348 Lauffen/Neckar

We hereby declare that on the date of the declaration the following partly completed machine complied with all basic safety and health regulations found in the directive 2006/42/EC of the European Parliament and of the Council on machinery. The declaration is rendered invalid if modifications are made to the product.

Product designation:	Valve control unit / VCU / electric
ID number	0314750 ... 0314761

The partly completed machine may not be put into operation until conformity of the machine into which the partly completed machine is to be installed with the provisions of the Machinery Directive (2006/42/EC) is confirmed.

Applied harmonized standards, especially:

EN ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction

The manufacturer agrees to forward on demand the relevant technical documentation for the partly completed machinery in electronic form to national authorities.

The relevant technical documentation according to Annex VII, Part B, belonging to the partly completed machinery, has been created.

Person authorized to compile the technical documentation:
Robert Leuthner, Address: see manufacturer's address

Signature: see original declaration

Lauffen/Neckar, July 2019

p.p. Ralf Winkler, Manager for development of gripping system components

8.1 Annex to Declaration of Incorporation

according 2006/42/EG, Annex II, No. 1 B

1.Description of the essential health and safety requirements pursuant to 2006/42/EC, Annex I that are applicable and that have been fulfilled with:

Product designation	Valve control unit
Type designation	VCU
ID number	0314750 ... 0314761

To be provided by the System Integrator for the overall machine			⇓
Fulfilled for the scope of the partly completed machine		⇓	
Not relevant	⇓		

1.1	**Essential Requirements**			
1.1.1	Definitions		X	
1.1.2	Principles of safety integration		X	
1.1.3	Materials and products		X	
1.1.4	Lighting		X	
1.1.5	Design of machinery to facilitate its handling		X	
1.1.6	Ergonomics		X	
1.1.7	Operating positions			X
1.1.8	Seating			X

1.2	**Control Systems**			
1.2.1	Safety and reliability of control systems		X	
1.2.2	Control devices		X	
1.2.3	Starting		X	
1.2.4	Stopping		X	
1.2.4.1	Normal stop		X	
1.2.4.2	Operational stop		X	
1.2.4.3	Emergency stop		X	
1.2.4.4	Assembly of machinery		X	
1.2.5	Selection of control or operating modes		X	
1.2.6	Failure of the power supply			X

1.3	**Protection against mechanical hazards**			
1.3.1	Risk of loss of stability			X
1.3.2	Risk of break-up during operation			X
1.3.3	Risks due to falling or ejected objects			X
1.3.4	Risks due to surfaces, edges or angles		X	
1.3.5	Risks related to combined machinery			X
1.3.6	Risks related to variations in operating conditions			X

1.3	Protection against mechanical hazards			
1.3.7	Risks related to moving parts		X	
1.3.8	Choice of protection against risks arising from moving parts			X
1.3.8.1	Moving transmission parts		X	
1.3.8.2	Moving parts involved in the process			X
1.3.9	Risks of uncontrolled movements			X

1.4	Required characteristics of guards and protective devices			
1.4.1	General requirements			X
1.4.2	Special requirements for guards			X
1.4.2.1	Fixed guards			X
1.4.2.2	Interlocking movable guards			X
1.4.2.3	Adjustable guards restricting access			X
1.4.3	Special requirements for protective devices			X

1.5	Risks due to other hazards			
1.5.1	Electricity supply		X	
1.5.2	Static electricity		X	
1.5.3	Energy supply other than electricity		X	
1.5.4	Errors of fitting		X	
1.5.5	Extreme temperatures			X
1.5.6	Fire			X
1.5.7	Explosion			X
1.5.8	Noise			X
1.5.9	Vibrations			X
1.5.10	Radiation	X		
1.5.11	External radiation	X		
1.5.12	Laser radiation	X		
1.5.13	Emissions of hazardous materials and substances			X
1.5.14	Risk of being trapped in a machine	X		
1.5.15	Risk of slipping, tripping or falling	X		
1.5.16	Lightning			X

1.6	Maintenance			
1.6.1	Machinery maintenance		X	
1.6.2	Access to operating positions and servicing points		X	
1.6.3	Isolation of energy sources		X	
1.6.4	Operator intervention		X	
1.6.5	Cleaning of internal parts		X	

1.7	**Information**			
1.7.1	Information and warnings on the machinery		X	
1.7.1.1	Information and information devices		X	
1.7.1.2	Warning devices		X	
1.7.2	Warning of residual risks		X	
1.7.3	Marking of machinery	X		
1.7.4	Instructions	X		
1.7.4.1	General principles for the drafting of instructions	X		
1.7.4.2	Contents of the instructions	X		
1.7.4.3	Sales literature	X		

	The classification from Annex 1 is to be supplemented from here forward.			
2	Supplementary essential health and safety requirements for certain categories of machinery			X
2.1	Foodstuffs machinery and machinery for cosmetics or pharmaceutical products			X
2.2	Portable hand-held and/or guided machinery			X
2.2.1	Portable fixing and other impact machinery			X
2.3	Machinery for working wood and material with similar physical characteristics			X
3	Supplementary essential health and safety requirements to offset hazards due to the mobility of machinery		X	
4	Supplementary essential health and safety requirements to offset hazards due to lifting operations		X	
5	Supplementary essential health and safety requirements for machinery intended for underground work			X
6	Supplementary essential health and safety requirements for machinery presenting particular hazards due to the lifting of persons		X	