APV CU4 Direct Connect

CONTROL UNIT

READ AND UNDERSTAND THIS MANUAL PRIOR TO OPERATING OR SERVICING THIS PRODUCT.
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IT IS ESSENTIAL TO READ THIS INSTRUCTION MANUAL BEFORE USE OF THE CONTROL UNIT!
1. Abbreviations and Definitions

A
AWG
CE
CU
DI
DO
EMV
EU
GND
IP
LED
N
NEMA
P
PWM
Y

Exhaust air
American Wire Gauge
Communauté Européenne
Control Unit
Digital Input
Digital Output
Electromagnetic Compatibility
European Union
Ground/mass potential
International Protection
Luminous diode
Pneumatic Air Connection NOT element
National Electrical Manufacturers Association
Supply Air Connection
Pulse-width modulation
Pneumatic Air Connection

2. Safety Instructions

2.1. Sentinels

Meaning:

Danger! Direct danger which can lead to severe bodily harm or to death!

Caution! Dangerous situation which can lead to bodily harm and/or material damage.

Attention! Risk as a result of electric current.

Note! Important technical information or recommendation.

These special safety instructions point directly to the respective handling instructions. They are accentuated by the corresponding symbol. Carefully read the instructions to which the sentinels refer. Continue handling the control unit only after having read these instructions.
2. Safety Instructions

2.2. Intended Use
The CU4 control unit is only intended for use as described in chapter 3.1. Use beyond that described in chapter 3.1. does not comply with the regulations and SPX FLOW shall not be responsible for any damage resulting from this non-observance. The operator bears the full risk. Prerequisites for proper and safe operation of the control unit are the appropriate transport and storing as well as the professional assembly. Intended use also means the observance of operating, service and maintenance conditions.

2.3. General Regulations for Careful Handling
To ensure a faultless function of the unit and a long service life, the information given in this instruction manual as well as the operating conditions and permissible data specified in the data sheets of the control unit for process valves should be strictly adhered to.

- The operator is committed to operating the control unit in faultless condition, only.
- Observe the general technical rules while using and operating the unit.
- Observe the relevant accident prevention regulations, the national rules of the user country as well as your company-internal operating and safety regulations during operation and maintenance of the unit.
- Switch off the electric power supply before carrying out any work on the system!
- Note that piping or valves that are under pressure must not be removed from a system!
- Take suitable measures to prevent unintentional operation or impermissible impairment.
- Following an interruption of the electric or pneumatic supply, ensure a defined and controlled re-start of the process!
- If these instructions are not observed, SPX FLOW will not accept any liability. Warranties on units, devices and accessories will expire!
2. Safety Instructions

2.4. Welding instructions
It is generally recommended to avoid welding work in process installations in which control units are installed and connected. If welding is nonetheless required, earthing of the electric devices in the welding area is a necessity.

2.5. Persons
- Installation and maintenance work may only be carried out by qualified personnel and by means of appropriate tools.
- The qualified personnel must get a special training with regard to possible risks and must know and observe the safety instructions indicated in the instruction manual.
- Work at the electrical installation may only be carried out by personnel skilled in electrics!

2.6. Warranty
This document does not contain any warranty acceptance. We refer to our general terms of sale and delivery. Prerequisite for a guarantee is the correct use of the unit in compliance with the specified conditions of application.

Note!
This warranty only applies to the Control Unit. No liability will be accepted for consequential damage of any kind arising from failure or malfunction of the device.
3. General Terms

3.1. Purpose of use
The CU4 Direct Connect Control Unit is designed for the control of process valves used in the food and related industries.

The CU4 control unit operates as interface between process control and process valve and controls the electric and pneumatic signals.

The pneumatic control of valves is undertaken via the solenoid valves. The control unit controls the valve positions, open and closed, via integrated and external sensors. The electronic module undertakes the task to process the switching signal from the control and to control the corresponding solenoid valves. The electronic module also provides for potential-free contacts. The corresponding light signals in the control unit provide for an external indication of the valve positions.

3.2. Design of CU4 Direct Connect (fig. 3.2.)

The CU4 Direct Connect Control Unit mainly consists of the following components:

1. The Control Unit base with integrated air channels and electric and pneumatic connections as well as viewing windows with type label.
2. 1 or 3 solenoid valves for the control of the valve actuators and for the seat lifting of double seat valves.
   - 1 solenoid valve with 1 logic NOT element for the control of the valve actuators.
3. Sensor module with 2 integrated Hall sensors or 2 external proximity switches to detect the valve position.
4. Electronic module for the electric supply, communication with the control, evaluation of feedback signals and control of solenoid valves as well as the valve position indication through LED.
5. Clamp ring to fasten the CU4 on the adapter.
6. Cover with LED optics.

The cable/s by means of which the solenoid valves are connected with the electronic module must be guided through the cable guide at the rear side of the electronic module. (fig. 3.2.1)
3. General Terms

3.3. Function of the individual components

The installation of the control unit is undertaken by special adapters which are available for the different valve types, see chapter 5. Adapter. The snap connectors for supply air and pneumatic air to the individual cylinders of the valves are located at the outside of the control unit. In case of control units for valves with turning actuator, the pneumatic air is transferred internally to the actuator. The air supply of the control unit is equipped with an exchangeable air filter. Observance of the required compressed air quality is imperative. Please also see chapter 4.5.

The number of the solenoid valves installed in the CU4 depends on the valve actuators to be controlled. Single seat and butterfly valves and double seat valves without seat lift function require 1 solenoid valve. Control units for double seat valves are equipped with 3 solenoid valves. For the manual actuation, the solenoid valves are provided with a safe handle which is easy to operate.

The electronic module installed in the control unit has the task to process the electric signals from the control, to control the solenoid valves and to evaluate the feedback signals from the feedback unit. Moreover, the signalling and indication of the valve positions as well as additional diagnostic functions are undertaken via the electronic module.

A feedback unit is required to detect the valve position. The CU4 Direct Connect is equipped with 2 adjustable Hall effect sensors. These are activated by a valve control rod installed on the operating cam. In this way, the open and closed valve position can be detected.

The 2 Hall effect sensors are continuously adjustable over an additional range. Thus, feedback messages for different valves with different stroke lengths can be adjusted properly. Alternatively, external proximity switches can be connected instead of the integrated Hall effect sensors when the valve position indication is undertaken direct at the process valve.
3. General Terms

3.3. Function of the individual components

The luminous diodes are arranged at the front side of the electronic module. Their signals are visibly indicated to the outside by an optical window in the cover of the control unit. Beside the open and closed valve position, the existence of the operating voltage as well as different diagnostic information are indicated. Chapter 6.5. “LED indication” contains more details.

The complete control unit has been designed on the building block principle. By exchange of the electronic module, the control type can be changed, e.g. from direct control (Direct Connect) to communication with AS-interface.

**Note!** Wiring must also be changed.
4. Mechanics and Pneumatics

4.1. Air connection for valves with turning actuators

4.1.1. Function

CU41-T-DC
- Design for valve with turning actuator, e.g. butterfly valves
- P: Air supply with integrated particle filter
- Y1: Bore to transfer control air to turning actuator
- A1: Exhaust air, with exhaust silencer

4.2. Air connections for seat valves and double seat mix proof valves

4.2.1. Function

CU41-S-DC / CU41-M-DC / CU41-D4
- Design for seat valves and double seat mix proof valves without seat lift
- P: Air supply with integrated particle filter
- Y1: Control air connection for main actuator
- A1: Exhaust air, with exhaust silencer

CU41N-S-DC
- Design for seat valves with NOT element
- P: Air supply with integrated particle filter
- Y1: Control air connection for main actuator
- N: Pneumatic air connection for the spring support of the actuator by compressed air, via NOT element
- A1: Exhaust air, with exhaust silencer

CU43-M-DC / CU43-D4
- Design for double seat mixproof valves with seat lift
- P: Air supply with integrated particle filter
- Y1: Control air connection for main actuator
- Y2: Pneumatic air connection for seat lift actuator of upper seat lifting
- Y3: Pneumatic air connection for seat lift actuator of lower seat lifting
- A1/A2: Exhaust air, with exhaust silencer
4. Mechanics and Pneumatics

4.3. Pressure relief valve

The base of the control unit is equipped with a pressure relief valve which prevents an inadmissible pressure build-up in the inner control unit.

If required, the pressure relief vents into the clearance between the base and the adapter of the control unit.

The pressure relief valve must not be mechanically blocked under any circumstances.
The picture shows a standard NC (spring to closed) valve. If a NO (spring to open) valve is used, the sensor wiring can be different.
4. Mechanics and Pneumatics

4.4.2. CU41N Direct Connect

Functional description - block diagram

The picture shows a standard NC (spring to closed) valve. If a NO (spring to open) valve is used, the sensor wiring can be different.
4. Mechanics and Pneumatics

4.4.3. CU41-D4 Direct Connect for D4 double seat mix proof valve

Functional description - block diagram

The picture shows a standard NC (spring to closed) valve.

M1 - magnet upper shaft
M2 - magnet lower shaft

Sensor 2 "Valve open"

Sensor 3 "Valve closed"

Solenoid valve
Throttle valves

P / Air supply
A / Exhaust air
4. Mechanics and Pneumatics

4.4.4. CU43 Direct Connect for DE3, DA3+ double seat mix proof valve

Functional description - block diagram

The picture shows a standard NC (spring to closed) valve.
4. Mechanics and Pneumatics

4.4.5. CU43-D4 Direct Connect for DA4 / D4 SL double seat mix proof valves

Functional description - block diagram

The picture shows a standard NC (spring to closed) valve.

M1 - magnet upper shaft
M2 - magnet lower shaft
4. Mechanics and Pneumatics

4.5. Technical Data / Standards

Material: PA6.6

Ambient temperature: -20°C to +70°C

EU: EMC 2014/30/EU (89/336/EEC)

Standards and environmental audits: 
- protection class IP 67
- EN 60529
- complies with NEMA 6
- EN 61000-6-2
- EMC interference resistance
- EN 61000-6-4
- EMC emitted interference
- safety of machinery
- DIN EN ISO 13849-1
- EN 60068-2-6

Air hose: 6 mm / ¼” OD

Pressure range: 6–8 bar

Compressed air quality: quality class acc. to DIN ISO 8573-1

content of solid particles: quality class 3,
- max. size of solid particles per m³:
  - 10000 of 0,5 µm < d < 1,0 µm
  - 500 of 1,0 µm < d < 5,0 µm

content of water: quality class 3,
- max. dew point temperature -20°C
- For installations at lower temperatures or at higher altitudes, consider additional measures to reduce the pressure dew point accordingly.

content of oil: quality class 1,
- max. 0,01 mg/m³

The oil applied must be compatible with Polyurethane elastomer materials.
4. Mechanics and Pneumatics

4.6. Solenoid valves

In the base of the control unit max. 3 solenoid valves are installed. The 3/2-way solenoid valves are connected with the electronic module by moulded cables and plug connectors.

control: effeceted by pwm-signal
handle: rotary switch at valve

4.7. Throttling function

The operating speed of the valve actuator can be varied or reduced. This may be necessary to slacken the actuation of the valve in order to prevent pressure hammers in the piping installation.

For this purpose, the supply and exhaust air of the first solenoid valve can be adjusted via the throttling screws respectively allocated in the interface of the solenoid valve.

By turning the screws in anticlockwise direction, the inlet or outlet air is throttled.

4.8. NOT element

Through the installation of the logic NOT element, the closing force of the valve actuator can be increased by additional compressed air.

The NOT element conveys the compressed air via an external reducing valve (max. 5 bar) to the spring side of the valve actuator.

The pressure reducing valve is fixed to 5 bar.

Note!
The air connection of the NOT element is equipped with an integrated non-return valve.

The air hose must be slid into the air connection until it stops - in order to open the non-return valve.

The NOT element is also used for air/air actuators.
5. Adapter

Adapter for different process valves

5.1. Valves with turning actuator, e.g. butterfly valves

5.2. Single seat valves

5.3. Double seat mix proof valves DE3, DA3+

5.4. Double seat mix proof valves D4, D4 SL, DA4
6. Electronic module

6.1 Function / Block diagram

The electronic module CU4 Direct Connect operates as interface between superordinated control (PLC) and is connected direct by parallel wiring, i.e. every individual signal is on a separate line. The large input voltage range from 15 to 48VDC provides for versatile connections. All operating ranges within the electronic module such as the control of the solenoid valves, position feedback and LED indication are separated galvanically and can, thus, be operated with different voltages. Control of the solenoid valves is effected in energy-saving manner via pwm-signals.

Electronic module with sensors for all SPX FLOW APV valves

Electronic module with sensors for SPX FLOW APV / WCB D4 valves
### 6. Electronic module

#### 6.2. Functional description of connections

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Designation</th>
<th>Functional description for all valve types</th>
<th>Functional description for D4, D4 SL and DA4 valve types</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power</td>
<td>Operating voltage</td>
<td>Operating voltage</td>
</tr>
<tr>
<td>2</td>
<td>Power</td>
<td>Operating voltage</td>
<td>Operating voltage</td>
</tr>
<tr>
<td>3</td>
<td>DO Closed Valve</td>
<td>Digital potential-free output for closed valve position</td>
<td>Digital potential-free output for closed valve position</td>
</tr>
<tr>
<td>4</td>
<td>DO Open Valve</td>
<td>Digital potential-free output for open valve position</td>
<td>Digital potential-free output for open valve position</td>
</tr>
<tr>
<td>5</td>
<td>DO Common</td>
<td>Common potential for digital output to valve position indication</td>
<td>Common potential for digital output to valve position indication</td>
</tr>
<tr>
<td>6</td>
<td>DI Main Valve</td>
<td>Digital input to control 1st solenoid valve (valve open)</td>
<td>Digital input to control 1st solenoid valve (valve open)</td>
</tr>
<tr>
<td>7</td>
<td>DI Upper Seat Lift</td>
<td>Digital input to control 2nd solenoid valve (seat lifting of upper valve seat)</td>
<td>Digital input to control 2nd solenoid valve (seat lifting of upper valve seat)</td>
</tr>
<tr>
<td>8</td>
<td>DI Lower Seat Lift</td>
<td>Digital input to control 3rd solenoid valve (seat lifting of lower valve seat)</td>
<td>Digital input to control 3rd solenoid valve (seat lifting of lower valve seat)</td>
</tr>
<tr>
<td>9</td>
<td>DI Common</td>
<td>Common potential for digital inputs to control valve</td>
<td>Common potential for digital inputs to control valve</td>
</tr>
<tr>
<td>10</td>
<td>5 VDC</td>
<td>Voltage supply for valve sensor</td>
<td>Voltage supply for valve sensor</td>
</tr>
<tr>
<td>11</td>
<td>Sensor 1</td>
<td>Sensor signal 1 (closed valve position)</td>
<td>Connection Hall sensor 3 (closed valve position)</td>
</tr>
<tr>
<td>12</td>
<td>GND</td>
<td>Mass potential for sensor supply</td>
<td>Mass potential for sensor supply</td>
</tr>
<tr>
<td>13</td>
<td>5 VDC</td>
<td>Voltage supply for valve sensor</td>
<td>Voltage supply for valve sensor</td>
</tr>
<tr>
<td>14</td>
<td>Sensor 2</td>
<td>Sensor signal 2 (open valve position)</td>
<td>Connection Hall sensor 2 (open valve position)</td>
</tr>
<tr>
<td>15</td>
<td>GND</td>
<td>Mass potential for sensor supply</td>
<td>Mass potential for sensor supply</td>
</tr>
</tbody>
</table>
6. Electronic module

6.3. Technical data for electronic module

CU4 Direct Connect

Operating voltage: 15 – 24VDC

Supply of solenoid valve: pwm-signal from electronic module

Dig. input (DI): 15 – 48VDC
    I_max. 1mA/24VDC

Dig. output (DO): U_max. 48VDC
    I_max. 150mA
    RI 5.6Ohm / 100mA

Voltage supply of sensors: 5VDC (+/-5%)

Power consumption

Minimum about 20mA, at 24VDC
(Power ON, 2 LED, no solenoid valve)

Typically about 35mA, at 24VDC
(Power ON, 2 LED, 1 solenoid valve)

Maximum about 55 mA, at 24VDC
(Power ON, 3 LED, 2 solenoid valves)

Connecting terminals: conductor cross section
0,5-1,5 mm²
(with conductor sleeve)
complying with AWG 20-16
6. Electronic module

6.4. Connections

Sensors to detect the valve positions:

**Internal sensors:** Hall effect sensors  
(APV valves): H320385  
(APV / WCB D4 valves): H337014  
UB 4,75-5,25 VDC  
operating distance according to  
SPX FLOW specification

**External sensors:** Inductive proximity switches: H208844  
UB 4,75-5,25 VDC  
operating distance according to  
SPX FLOW specification
6. Electronic module

6.5. LED indication

<table>
<thead>
<tr>
<th>External luminous displays</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Valve Open</strong></td>
</tr>
<tr>
<td>colour green, permanent light</td>
</tr>
<tr>
<td>valve in open position</td>
</tr>
<tr>
<td><strong>Valve Closed</strong></td>
</tr>
<tr>
<td>colour orange, permanent light</td>
</tr>
<tr>
<td>valve in closed position</td>
</tr>
<tr>
<td><strong>Power Diagnose</strong></td>
</tr>
<tr>
<td>colour green, permanent light</td>
</tr>
<tr>
<td>operating voltage at module - faultless</td>
</tr>
<tr>
<td>colour green, flashing</td>
</tr>
<tr>
<td>failure solenoid valve (wire fracture)</td>
</tr>
<tr>
<td><strong>Solenoid Main</strong></td>
</tr>
<tr>
<td>colour blue, permanent light</td>
</tr>
<tr>
<td>main solenoid valve (1) controlled</td>
</tr>
<tr>
<td><strong>Solenoid Main</strong></td>
</tr>
<tr>
<td>colour blue, 1 blink</td>
</tr>
<tr>
<td>solenoid valve (2) for upper seat lift controlled</td>
</tr>
<tr>
<td>colour blue, 2 blinks</td>
</tr>
<tr>
<td>solenoid valve (3) for lower seat lift controlled</td>
</tr>
<tr>
<td>colour blue, permanent blink</td>
</tr>
<tr>
<td>solenoid valves (2) + (3) for diagnosis, only</td>
</tr>
</tbody>
</table>

| Internal luminous displays                       |
| Luminous diode 1                                |
| 1st solenoid valve (1) controlled               |
| Luminous diode 2                                |
| 2nd solenoid valve (2) controlled               |
| Luminous diode 3                                |
| 3rd solenoid valve (3) controlled               |

![Diagram](image_url)
6. Electronic module

6.6. Wiring examples

Example 1

15 - 48 VDC
DC Gnd

1
4
7
10

Power
DO Valve closed
DO Valve open
DO Common
DI Main Valve
DI upper seat lift
DI lower seat lift
DI Common

5/7 cable required
DC supply
DC valve signal
2 feedback to SPS
common DC mass

Example 2

15 - 48 VDC
DC Gnd

1
4
7
10

Power
DO Valve closed
DO Valve open
DO Common
DI Main Valve
DI upper seat lift
DI lower seat lift
DI Common

5/7 cable required
DC supply
DC valve signal
2 feedback to SPS
common DC mass

Example 3

15 - 48 VDC
DC Gnd

1
4
7
10

Power
DO Valve closed
DO Valve open
DO Common
DI Main Valve
DI upper seat lift
DI lower seat lift
DI Common

7/9 cable required
DC supply
DC valve signal
2 feedback to SPS
separated DC mass, functional units
galvanically isolated

Example 4

15 - 48 VDC
Gnd

1
4
7
10

Power
DO Valve closed
DO Valve open
DO Common
DI Main Valve
DI upper seat lift
DI lower seat lift
DI Common

7/9 cable required
DC supply
DC valve signal
2 feedback to SPS
separated DC mass, functional units
galvanically isolated
7. Feedback unit

7.1. General terms
For the internal registration of the valve position indication, the feedback unit with 2 Hall effect sensors is applied. It is used when single seat and butterfly valves are installed. The control of these sensors is effected by magnets assembled on the valve shaft rod. The Hall effect sensors are installed on a movable threaded rod. By means of this assembly, the sensors can be adjusted via a large range, in accordance with the valve stroke.

7.2. Sensors
Hall effect sensors (APV valves): H320385
Hall effect sensors (APV / WCB D4 valves): H337014
UB 4,75-5,25 VDC
Operating distance according to SPX FLOW specification

7.3. Adjustment of valve position feedback
By turning of the adjustment screws on which the Hall effect sensors are installed, the sensors can be moved into the respectively required position to detect the valve position. The o-rings on the adjusting screws prevent accidental displacement of these positions. After the installation of the control unit, check the correct adjustment of the position of the Hall sensor.

7.4. Use of external sensor
Instead of the internal Hall effect sensors, also 2 external proximity switches can be connected to the CU4 DC, e.g. for the valve position indication at double seat valves.

Proximity switch: H208844
UB 4,75-5,25 VDC
Operating distance according to SPX FLOW specification
8. CU Assembly and Startup

8.1. Valves with turning actuator, e.g. butterfly valves

Caution!
The permanent magnet is made of fragile material and must be protected against mechanical load. – Risk of fracture! The magnetic fields can damage or delete data carrier or influence electronic and mechanic components.

Assembly of the Control Unit on the valve

1. Assembly of the adapter on the turning actuator. Fasten with 3 screws. See to the right positioning of the O-rings on the lower side of the adapter and in the groove of the air transfer stud.

2. Install operating cam with shaft rod prolongation. Secure with Loctite semi-solid and fasten it.

3. Place the control unit via the operating cam onto the adapter. Observe alignment!

4. Attach the clamp rings and fasten them with the screws.
8. CU Assembly and Startup

8.1.1. Pneumatic connection

Supply air:

**Caution!**
Shut off the compressed air supply before connecting the air hose!
Make sure that the air hose is professionally cut to length. Use a hose cutter for this purpose.

**Pneumatic air for valve actuator:**
For the assembly of the control unit on the turning actuator with integrated air transfer, air hosing between the control unit and the actuator is not required.

**Exhaust air:**
As a standard, the exhaust air connection is equipped with a silencer. If required, the silencer can be removed and the exhaust air can be hosed separately when it must be led off to the exterior, for example.

8.1.2. Electric connection

**Attention!**
Electric connections shall only be carried out by qualified personnel!

Make sure that the operating voltage is correct!

After determining the connecting variant according to chapter 6.6. Wiring Examples, select the corresponding cable.

Guide the cable through the cable gland and connect it according to the Wiring Diagram. Preferably use wire terminations!

Tighten the cable gland in order to ensure the corresponding protective class.
8. CU Assembly and Startup

8.1.3 Startup

After proper assembly and installation of the control unit, start-up can be undertaken as described below:

1. Switch on the air supply.
2. Switch on the voltage supply.
3. Check the solenoid valves by turning the handle on the upper side of the valve by 90°.
4. Check the valve position indicator and adjust feedbacks for open and closed valve position as described below.

For valves in normally closed (air-to-raise, spring-to-lower) /normally open (air-to-lower, spring-to-raise) design with turning actuator, the following allocation applies:

**Closed valve position feedback – sensor 1 controlled**

For the adjustment, Hall sensor 1 with non-controlled (controlled) solenoid valve 1 is moved into the required position by turning the adjustment screw 1. The LED Valve Closed lights up.

**Open valve position feedback – sensor 2 controlled**

For the adjustment of Hall sensor 2, at first, the (non-controlled) solenoid valve 1 is controlled. This can optionally be made manually or electrically. The open valve position and the corresponding feedback can be adjusted. This is undertaken by turning the adjustment screw 2 until the required position is reached and the LED Valve Open lights up.

Observe the switching hysteresis of the Hall effect sensors! Therefore, adjust the switch-point of the sensors with overlap in order to permit small variations and, thus, to prevent failures!
8. CU Assembly and Startup

8.2. Single seat valves

**CAUTION!**
The permanent magnet is made of fragile material and must be protected against mechanical load. – Risk of fracture!
The magnetic fields can damage or delete data carrier or influence electronic and mechanic components.

**Assembly of the Control Unit on the valve**

1. Assembly of the adapter on the single seat valve. Fasten with 4 screws.

2. Secure operating cam with Loctite semi-solid and fasten it.

3. Place the control unit via the operating cam onto the adapter. Observe alignment.

4. Attach the clamp rings and fasten them with the screws.
8. CU Assembly and Startup

8.2.1. Pneumatic connection

Supply air:

Caution!
Shut off the compressed air supply before connecting the air hose!

Make sure that the air hose is professionally cut to length. Use a hose cutter for this purpose.

Pneumatic air for valve actuator:
Connect the pneumatic air connection Y1 with the valve actuator.

- For the CU41N (with logic NOT element), the pneumatic air connection N must be connected with the spring side of the actuator.
  
  Take note of the spring side of the actuator during the assembly of the pressure-reducing valve.

Exhaust air:
As a standard, the exhaust air connection is equipped with a silencer. If required, the silencer can be removed and the exhaust air can be hosed separately when it must be led off to the exterior, for example.

8.2.2. Electric connection

Attention!
Electric connections shall only be carried out by qualified personnel.

Make sure that the operating voltage is correct!

After determining the connecting variant according to chapter 6.6 Wiring Examples, select the corresponding cable.

Guide the cable through the cable gland and connect it according to the Wiring Diagram. Preferably use wire terminations! Tighten the cable gland in order to ensure the corresponding protective class.
8. CU Assembly and Startup

8.2.3. Startup
After proper assembly and installation of the control unit, start-up can be undertaken as described below:

1. Switch on the air supply
2. Switch on the voltage supply.
3. Check the solenoid valves by turning the handle on the upper side of the valve by 90°.
4. Check the valve position indicator and adjust feedbacks for open and closed valve position as described below.

For single seat valves in normally closed (normally open) the following allocation applies:

Closed valve position feedback – sensor 1 controlled

For the adjustment, Hall sensor 1 with non-controlled (controlled) solenoid valve 1 is moved into the required position by turning the adjustment screw 1. The LED Valve Closed lights up.

Open valve position feedback – sensor 2 controlled

For the adjustment of Hall sensor 2, at first, the (non-controlled) solenoid valve 1 is controlled. This can optionally be made manually or electrically. The open valve position and the corresponding feedback can be adjusted. This is undertaken by turning the adjustment screw 2 until the required position is reached and the LED Valve Open lights up.

Observe the switching hysteresis of the Hall effect sensors! Therefore, adjust the switch-point of the sensors with overlap in order to permit small variations and, thus, to prevent failures!
8. CU Assembly and Startup

8.3. Double seat mix proof valves DE3, DA3+

Assembly of the Control Unit on the valve

1. Assembly of the adapter on the double seat valve. Fasten with 4 screws.

2. Align air connections of the control unit to the valve actuator.

3. Place the control unit onto the adapter. Observe alignment!

4. Attach the clamp rings and fasten them with the screws.

5. Assemble the external proximity switches at the actuator.
8. CU Assembly and Startup

8.3.1. Pneumatic connection

Supply air:

**Caution !**
Shut off the compressed air supply before connecting the air hose!

Make sure that the air hose is professionally cut to length. Use a hose cutter for this purpose.

**Pneumatic air to valve actuator:**
Connect pneumatic air connection **Y1** with the valve actuator. Main actuator

Connect pneumatic air connection **Y2** with the valve actuator. (seat lifting - upper valve seat)

Connect pneumatic air connection **Y3** with the valve actuator. (seat lifting – lower valve seat)

**Exhaust air:**
As a standard, the exhaust air connections **A1** and **A2** are equipped with a silencer. If required, the silencer can be removed and the exhaust air can be hosed separately when it must be led off to the exterior, for example.

8.3.2 Electric connection

**Attention!**
Electric connections shall only be carried out by qualified personnel!

Make sure that the operating voltage is correct!

After determining the connecting variant according to chapter 6.6. Wiring Examples, select the corresponding cable.

Guide the cable through the cable gland and connect it according to the Wiring Diagram. Preferably use wire terminations!

Tighten the cable gland in order to ensure the corresponding protective class.
8. CU Assembly and Startup

8.3.3 Connection of external proximity switches
The electric connection of the proximity switches specified by SPX FLOW is undertaken according to the terminal layout described in chapter 6.1. The mechanic assembly of the proximity switches is carried out at the actuator of the corresponding double seat valves. Observance of the instruction manual for double seat valves is essential!

8.3.4 Startup
After proper assembly and installation of the control unit, start-up can be undertaken as described below:

1. Switch on the air supply
2. Switch on the voltage supply.
3. Check the solenoid valves by turning the handle on the upper side of the valve by 90°.
4. Check the valve position indicator.
   The proximity switches are installed at the double seat valves with a mechanical stop. Adjustment is not required!
   
The following allocation applies for double seat valves:

- **Closed valve position feedback – sensor 1 controlled**

- **Open valve position feedback – sensor 2 controlled**

Check the proper fit of the proximity switches to provide for the accurate transfer of the signals for the corresponding valve position.
8. CU Assembly and Startup

8.4. Double seat mix proof valves D4, D4 SL, DA4

Assembly of the Control Unit on the valve

1. Assemble the magnet M2 on the upper shaft under the stop screw.
2. Assemble the adapter with the 4 screws on the double seat valve.
3. Assemble the operating cam M1 with guide rod extension on the guide rod.
4. Place the control unit onto the adapter. Observe alignment!
5. Attach the clamp rings and fasten them with the 2 screws.
6. Align air connections of the control unit to the valve actuator.
8. CU Assembly and Startup

8.4.1 Pneumatic connection

Supply air:

**Caution!**
Shut off the compressed air supply before connecting the air hose!

Make sure that the air hose is professionally cut to length. Use a hose cutter for this purpose.

**Pneumatic air to valve actuator:**
Connect pneumatic air connection **Y1** with the valve actuator. Main actuator

Connect pneumatic air connection **Y2** with the valve actuator. (seat lifting - upper valve seat)

Connect pneumatic air connection **Y3** with the valve actuator. (seat lifting – lower valve seat)

**Exhaust air:**
As a standard, the exhaust air connections **A1** and **A2** are equipped with a silencer. If required, the silencer can be removed and the exhaust air can be hosed separately when it must be led off to the exterior, for example.

8.4.2 Electric connection

**Attention!**
Electric connections shall only be carried out by qualified personnel!

Make sure that the operating voltage is correct!

After determining the connecting variant according to chapter 6.6. Wiring Examples, select the corresponding cable.

Guide the cable through the cable gland and connect it according to the Wiring Diagram. Preferably use wire terminations!

Tighten the cable gland in order to ensure the corresponding protective class.
8. CU Assembly and Startup

8.4.3 Connection of external proximity switches
The electric connection of the proximity switches specified by SPX FLOW is undertaken according to the terminal layout described in chapter 6.1. The mechanic assembly of the proximity switches is carried out at the actuator of the corresponding double seat valves. Observance of the instruction manual for double seat valves is essential!

8.4.4 Startup
After proper assembly and installation of the control unit, start-up can be undertaken as described below

1. Switch on the air supply
2. Switch on the voltage supply.
3. Check the solenoid valves by turning the handle on the upper side of the valve by 90°.
4. Check the valve position indicator. The proximity switches are installed at the double seat valves with a mechanical stop. Adjustment is not required!

The following allocation applies for double seat valves:

Closed valve position feedback – sensor 3 controlled
Open valve position feedback – sensor 2 controlled

Check the proper fit of the proximity switches to provide for the accurate transfer of the signals for the corresponding valve position.
9. Accessories and Tools

Assembly/disassembly - adapter on valve actuator:
• hexagon socket wrench 6 mm
• screwdriver 4 mm

Assembly/disassembly – CU on adapter:
• hexagon socket wrench 3 mm

Assembly/disassembly – electronic module:
• torx wrench TX20
• screwdriver 3.5 mm

Assembly/disassembly – feedback unit:
• torx wrench TX15

Assembly/disassembly – electronic modules:
• torx wrench TX20

Assembly/disassembly – air connections:
• jaw wrench M13

Assembly/disassembly – pressure relief valve:
• torx wrench TX10

Loctite semi-solid
10. Service

10.1. Disassembly
Before disassembly, verify the following items:
• The valve must be in safety position and must not be controlled!
• Shut off air supply!
• Cut off current to control unit, i.e. interrupt the supply voltage

Solenoid valve (4, 5, 6)
+ Open the CU cover by turning in anticlockwise direction.
+ Release the plug connection at the electronic module for the corresponding solenoid valve.
+ Release and remove the 2 screws (20) TX20.
+ Replace the solenoid valve.
+ Assembly in reverse order.

See to a proper fit of the flat seal!

Electronic module (2)
Before releasing the cable connections make sure that all lines are switched off!
+ Open the CU cover by turning in anticlockwise direction.
+ Release the plug connection of the solenoid valves.
+ Release the cable from the terminal strip, all terminals 1-8.
+ Release and remove the 3 screws (20) TX20.
+ Replace the electronic module.
+ Assembly in reverse order.

Feedback unit
Before releasing the cable connections make sure that all lines are switched off!
+ Open the cover.
+ Release the cable for the Hall effect sensors from the terminal strip, terminals 3-8.
+ Release the clamp ring and lift the CU4 from the adapter.
+ Remove the 4 screws (9) TX15 at the lower side of the CU base (1).
+ Take out the feedback unit to the bottom.

Hall effect sensors
The Hall effect sensors can only be replaced at the dismantled feedback unit.
+ Remove the 3 screws (14) TX10.
+ Remove the tower lid (13).
+ Remove the O-ring (11)
+ Dismantle the sensors by turning the adjusting screw (12).

To simplify adjustment of feedbacks:
+ Mark the position of the sensor on the adjusting screw!
+ Assembly in reverse order.
+ Check the correct position of the Hall effect sensors and their functions as described in chapter 8 „CU assembly and start-up“.
## 11. Trouble Shooting

<table>
<thead>
<tr>
<th>General Failures</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve position is not indicated.</td>
<td>Re-adjust Hall sensors.</td>
</tr>
<tr>
<td></td>
<td>Check fastening of magnetic operating cam.</td>
</tr>
<tr>
<td></td>
<td>Check cabling of the Hall sensors to the electronic module.</td>
</tr>
<tr>
<td>Feedback via proximity switches is missing</td>
<td>Check positioning of proximity switches.</td>
</tr>
<tr>
<td></td>
<td>Check operating voltage.</td>
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<tr>
<td></td>
<td>Check cabling to the electronic module.</td>
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<tr>
<td>LED indication is missing</td>
<td>Check operating voltage.</td>
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<td>Check cabling to the electronic module.</td>
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<tr>
<td></td>
<td><strong>Control Unit CU41 installed on Butterfly valves</strong></td>
</tr>
<tr>
<td>Movement of valve flap is missing with actuated solenoid valve.</td>
<td>Check if right control unit is installed. Check label in type window of control unit: <strong>CU41-T-Direct Connect (1 EMV/solenoid valve)</strong></td>
</tr>
<tr>
<td></td>
<td>Check valve movement with manual at solenoid valve.</td>
</tr>
<tr>
<td></td>
<td>Check cabling between electronic module and solenoid valve.</td>
</tr>
<tr>
<td></td>
<td>Check compressed air (min. 6 bar).</td>
</tr>
<tr>
<td>Air leakage at lower side of adapter.</td>
<td>Check o-rings of adapter.</td>
</tr>
</tbody>
</table>

Air leakage at lower side of adapter.

Check o-rings of adapter.
## 11. Trouble Shooting

### Control Unit CU41 installed on Single seat and Double seat valves

<table>
<thead>
<tr>
<th>Failure</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve position movement is missing with actuated solenoid valve.</td>
<td>Check if right control unit is installed. Check label in type window of control unit: <strong>CU41-S-Direct Connect (1 EMV/solenoid valve)</strong> <strong>CU41-M-Direct Connect</strong> <strong>CU41-D4-Direct Connect</strong> Check valve movement with manual lever at solenoid valve. Check cabling between electronic module and solenoid valve. Check compressed air (min. 6 bar). Check control air connection between the CU41 and the valve actuator.</td>
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### Control Unit CU43 installed on Double seat valves

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<th>Failure</th>
<th>Remedy</th>
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<tbody>
<tr>
<td>Valve position movement is missing with actuated solenoid valve.</td>
<td>Check if right control unit is installed. Check label in type window of control unit: <strong>CU43-M-Direct Connect (3 EMV/solenoid valves)</strong> <strong>CU43-D4-Direct Connect</strong> Check valve movement with manual lever at solenoid valve. Check cabling between electronic module and solenoid valve. Check compressed air (min. 6 bar). Check control air connection between the CU43 and the DA3 / DA4 / D4 SL actuator.</td>
</tr>
</tbody>
</table>
12. Spare Parts Lists

The reference numbers of spare parts for the different control unit designs and adapters are included in the attached spare parts drawings with corresponding lists.

CU4 Direct Connect          RN 01.044.4
CU4 Adapter                RN 01.044.3

When you place an order for spare parts, please indicate the following data:
- number of parts required
- reference number
- parts designation

Data are subject to change.
CU4 Direct Connect

Datum: 07/08 08/08 11/08 02/10 06/10 04/18
Name: Peters Peters Peters D.Schulz C.Keil
Geprüft: D.Schulz D.Schulz

Ersatzeilliste: spare parts list

SPX FLOW
Germany

RN 01.044.4
## Ersatzteilliste: spare parts list

### CU4 Direct Connect

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<th>Menge</th>
<th>Beschreibung</th>
<th>Material</th>
<th>CU41-S</th>
<th>CU41-T</th>
<th>CU41-M</th>
<th>CU41N-S</th>
<th>CU41N-T</th>
<th>CU43-M</th>
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## CU4 Direct Connect

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### CU4 Direct Connect

- **CU4 Luftfilter**: PE-porös
- **CU4 air filter**: 08-10-005/93

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**Ersatzeiliste: spare parts list**

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<th>08/08</th>
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<td>D.Schulz</td>
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**Datum:** 06/10 01/11 04/18 07/08 08/08 11/08 02/10

**Blatt:** 3 von 7

**RN 01.044.4**
### CU4 Direct Connect

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<th>Material</th>
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* gültig bis 12/2010 -- valid until 12/2010
** gültig ab 01/2011 -- valid from 01/2011
*** gültig ab 01/2013 -- valid from 01/2013
## CU4 Direct Connect

### Ersatzteilliste: spare parts list

**CU4 Direct Connect**

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   - CU4 Base
   - CU4 base
   - CU4 E-Modul Direct Connect
   - CU4 e-module Direct Connect
   - CU4 E-Modul DC kpl. (Version 2) 6x1
   - CU4 e-module DC cpl. (version 2) 6x1

2. **CU4 Base PA6.6 GF30**
   - CU4 Direct Connect kpl. (6x1)
   - CU4 Direct Connect cpl. (6x1)
   - CU4 Direct Connect kpl. (1/4"OD)
   - CU4 Direct Connect cpl. (1/4"OD)

3. **CU4 Haube kpl.**
   - CU4 cover cpl.

4. **Magnetventilblock 1 EMV**
   - Solenoid valve 1 solenoid
   - Magnetventilblock 3 EMV
   - Solenoid valve 3 solenoids

5. **CU4 Sensor tower**
   - CU4 sensor tower

6. **O-Ring 45,6 x 2,4**
   - O-ring 45,6 x 2,4
   - Ejot Delta PT Schraube WN5452 35x14
   - Ejot Delta PT screw WN5452 35x14

7. **Hall-Sensor**
   - Hall sensor

8. **O-Ring 3x2**
   - O-ring 3x2

---

Date: 05.04.18
Name: C. Keil
Geprüft:  
Datum:  
Blatt 5 von 7
Name:  
Geprüft:  
RN 01.044.4
# Ersatzteilliste: spare parts list

**CU4 Direct Connect**

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# CU4 Direct Connect

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Ersatzteiliste: spare parts list

CU4 Adapter

CU4 D4 – Adapter

CU4 M – Adapter

CU4 T – Adapter

CU4 S – Adapter

Datum: 11/08 01/09 03/09 11/10
Name: Peters Peters Trytko Schulz
Geprüft: Spliethoff Spliethoff Peters Spliethoff

Datum: 03/13 11/14 05/18
Name: Trytko Trytko C. Keil
Geprüft: Schulz

RN 01.044.3
## CU4 Adapter

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### Geprüfte:

- Peters
- Trytko
- Schulz

### Datum:

- 01/09 03/09
- 03/09 05/18
- 11/08 01/09
- 11/10 03/09
- 11/08 01/09
- 05/18 11/14
- 03/08 11/14
- 01/09 03/09
- 03/09 05/18

### Zylinderschraube M4x40

- Cyl. screw M4x40

### HS 06.99/93

- 58-06-059/83
- 58-06-059/83
- 58-06-059/83
- 58-06-059/83

### Material

- PA6.6 GF30
- PA6.6 GF30
- PA6.6 GF30
- PA6.6 GF30
- PA6.6 GF30
- Grivory GH-5H1
- Grivory GH-5H1
- Grivory GH-5H1
- Grivory GH-5H1

### O-Ring 101,27x2,62

- NBR
- NBR
- NBR
- NBR

### Zytel HTN

- Zytel HTN
- Zytel HTN
- Zytel HTN
- Zytel HTN

### SPX FLOW, Germany

- Germany
- Germany
- Germany
- Germany

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## CU4 Adapter

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*Note: Further information and disclaimers are present on the image.*
### CU4 Adapter

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