APV
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Operating Manual

DELTA CU3 AS-interface 2.1

- Safety Stop (Seat Lift Detection) Control Unit

Read and understand this manual prior to operating or servicing this product.

SPX

Table of Content

1. Information

Symbols
The following symbols are used in the operating manual.

Attention: Indicates information which, if not followed, could result in danger to your health or to the functionality of the machine.

Note : Indicates important additional information, tips and recommendations.

2. Safety instructions

Important Information

Always read the manual BEFORE using the Control Unit.

2.1 General

To ensure that the device functions correctly and will have a long service life, please comply with the information given in this operating manual as well as with the operating conditions and permissible data specified in the data sheets of the control unit for process valves.

- When planning the application of the device, and during its operation, observe the general technical rules!
- Installation and maintenance work may only be carried out by specialist staff using the correct tools!
- Observe the relevant accident prevention and safety regulations applicable for electrical equipment while operating and maintaining the device!
- Always switch off the electrical power supply before carrying out any works on the system!
- Note that piping or valves must not be removed from a system that is under pressure!
- Take suitable measures to prevent unintentional operation or impermissible impairment.
- Following an interruption of the electrical or pneumatic supply, ensure a defined and controlled re-start of the process!
- If these instructions are ignored, liability will not be accepted from our side, and the guarantee on the device and its accessories will expire!

2. Safety instructions

2.2 Safety instructions for AS-Interface

Overvoltage protection

Always use overvoltage protection modules in your AS-i installation.

2.3 Safety instructions for AS-Interface

Earthing

A potential-free operation must be provided for the AS-interface network. See to the general use of insulation monitoring devices to ensure proper earthing conditions.
(If bus wires or connected devices are earthed or provided with external voltage, this will lead to failure of the bus system.)

2.4 Welding

In general, it is recommended to avoid welding work in process plants if the control units are already installed and electrically connected.
If welding is absolutely necessary, switch off power in the complete network and always earth the devices in the welding area.

2.5 Connecting terminals

To connect cables with the terminals at the electronic module only use short wire end ferrules without plastic collar!

2.6 Guarantee

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

Attention !

This guarantee only applies to the Control Unit.
No liability will be accepted, however, for consequential damage of any kind that could arise from the failure or malfunction of the device.

3. General description

The control unit consists of an electronic part which scans the position of the valve and provides the information as signals which are compatible with most AS-i bus control systems.

The solenoid valve is located in the control unit. The solenoid valve which is electrically activated, controls the compressed air. The solenoid valve is equipped with a throttling system for supply and exhaust air, which ensures to decrease the opening and closing speed of the valve.

The control unit for DELTA DE3 / DA3+ valves is available with 1 solenoid valve and with 3 solenoid valves.

The control unit has LEDs which ensure quick visual indication of the valve position, solenoid status and operating voltage.

Connections for air and power supply are installed at the control unit together with a valve which cuts off the air supply for removal of the control unit. The control unit can be removed by release of a quick-acting coupling. This permits fast servicing of the valve.

The whole control unit is encapsulated, and all the cable passages and air supplies are sealed so that the control unit complies with the requirements of IP 67.

3.1 Description of the electronic module CU3 AS-interface 2.1 Safety Stop

The solenoid valve and feedback signals are controlled by an electronic module.

Label

DELTA CU3
AS-Interface - Safety Stop

1	E +/+24 VDC
2	E - 0 VDC
3	Z +
4	Z -
5	5 VDC
6	Sensor 1
7	Sensor 3
8	GND
9	5 VDC
10	Sensor 2
11	Sensor 4
12	GND
13	Asi +
14	Asi -

The electronic module offers safety stop functionality. Therefore in addition to the AS-i communication signal 24VDC (PELV) must be connected to the appropriate terminals. This 24VDC only powers the solenoid valves and can be used for controlled and safe shutdown of the valves to get into safety position. During the break of the 24VDC the AS-I bus communication is uninterruptible working and thus sending the valve feedback positions to the AS-I master and PLC.

Typical application will be personal protection, perhaps during tank inspection. Prevention of uninteted control of process valves.

For Safety Stop functionality the extra 24VDC will be connected to the terminals E+/E-. If the safety stop functionality isn´t required and there is no need for extra 24VDC the terminals E+/E- must be connected to Z+/Z-, the complete module inclusive the solenoid driver is powered from AS-I bus.
Pls. see chapter 3.2 / Wiring.

! **The certified AS-interface control complies with the AS-interface specification 2.1 and the profile S-7.A.E.**

The corresponding certificate from AS-international will be presented by APV if requested.

3. General description

The Control Unit DELTA CU3 AS-interface is designed for the extended address range. With these devices in the extended address area up to 62 slaves (CUs) can be connected with one AS-interface branch.
Attention: Consider cumulative power consumption and simultaneity factor.

3.1.1 Start-up

In shipping state, the DELTA CU valve head has the address 0.
In the AS-interface network every slave must have an address within the range from **1A** to **31B**.
Addresses must only appear once.
Moreover, it is not permitted to operate one standard slave and one slave with extended address mode on the same address (e.g. slave **17** and slave **17A** or **17B**) in the same network.

3.1.2 Addressing with the address device

Before installation in the AS-interface network, the required address is adjusted with the address device which is connected with the connections ASI + and ASI - of the control unit
(compare with descriptionof address device).

3.1.3 Addressing in the network

Alternatively, the AS-interface DELTA CU valve head can be connected with the AS-interface network and be provided with its set address via the AS-interface Master (in the project mode). In this case, however, observe that only one slave with the address 0 may exist in the network.

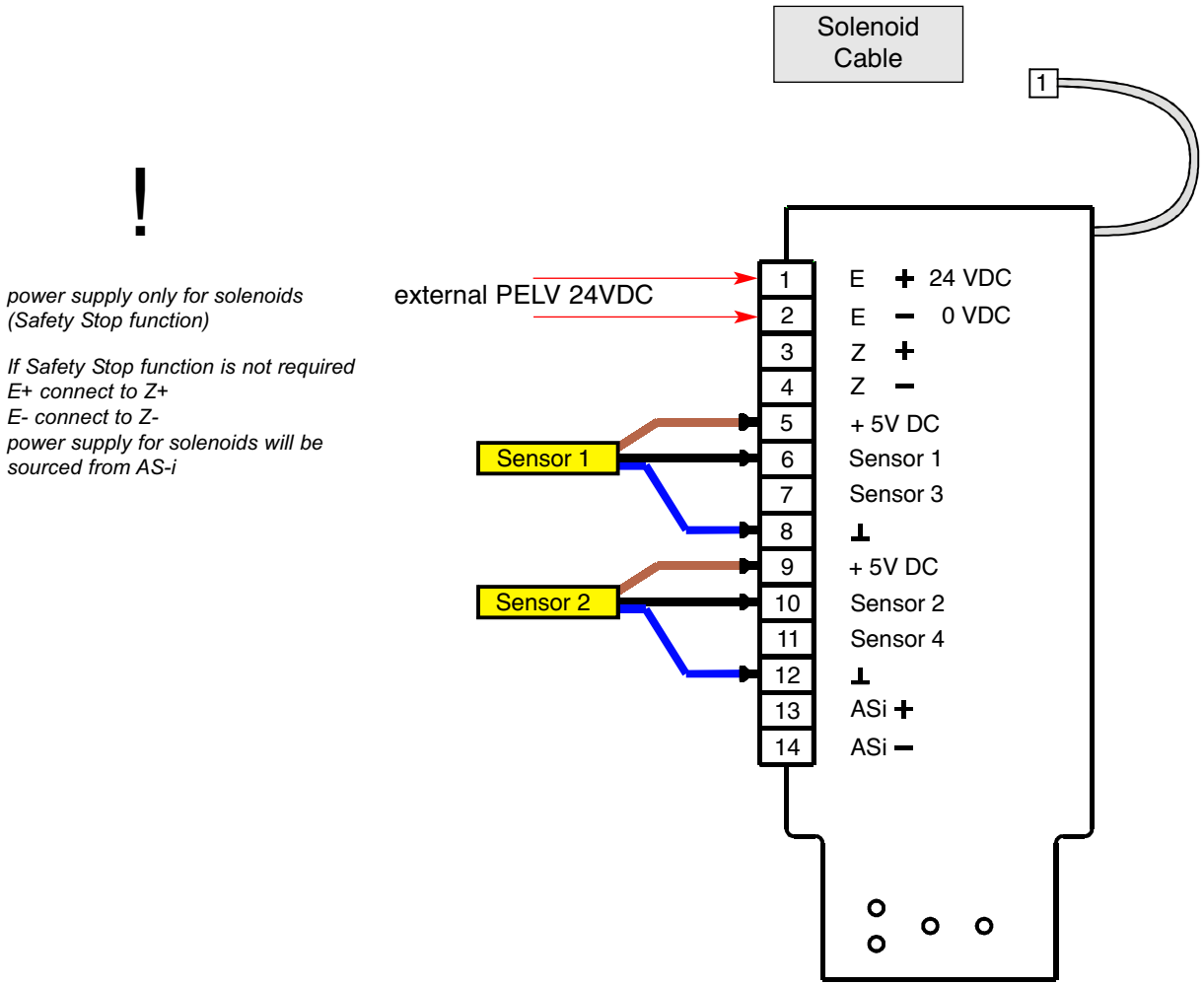
3. General description

3.2 Electronic module, 1 solenoid valve

For control units with 1 solenoid valve and 2 internal or external sensors the below wiring diagram is used.

Wiring diagram:

electrical connection
CU31 ASi Safety Stop / 2 Sensors

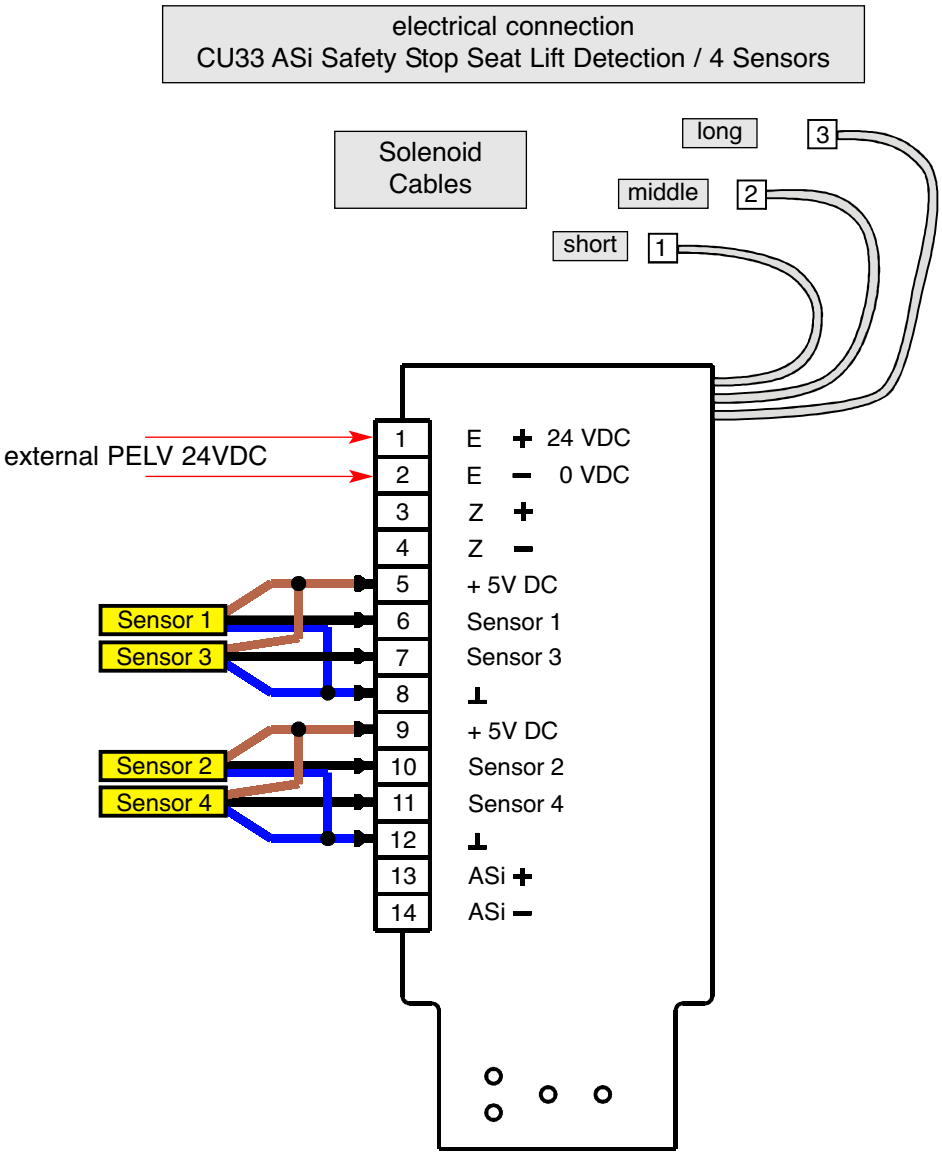


3. General description

3.2.1 Electronic module, 3 solenoid valves

For control units for DELTA DA3+ valves with 3 solenoid valves and external sensors the following wiring diagram is used.

Wiring diagram:



!

power supply only for solenoids (Safety Stop function)

If Safety Stop function is not required
E+ connect to Z+
E- connect to Z-
power supply for solenoids will be sourced from AS-i

3.2.2 Programming

The control unit must be programmed to the required AS-i slave address.
This can be done via the AS-i master module or via an AS-i hand held terminal.

Connection

The control unit is supplied with a PG 9 gland for insertion of the AS-i cable.

As an option the PG connection can be replaced by an AS-i piercing clamp or an M12 plug for connection with the AS-i bus.

3. General description

3.3 Solenoid valve

The solenoid valve is equipped with a manual override.
The override handle cannot be locked.
Two throttling seat valves provide for the change of te opening and closing speed. Please note that the seat valve controlling the air supply must never be completely closed. An inner air filter protects the solenoid valve against dust.
For further details, see section 4.2, 4.3 and 4.8.

Air supply for solenoid valves.
Air pressure: 6 - 8 bar
Important see chapter technical data

3.4 NOT element

The spring force of the aire actuator can be increased with additional compressed air by installing a logical NOT element which directs the compressed air to the spring side of the actuator.
For correct positioning, see section 8.5

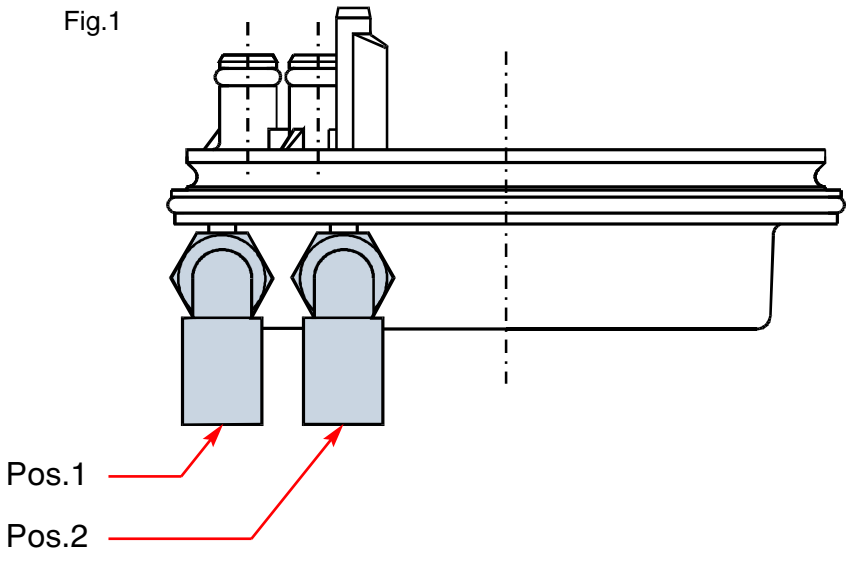
3.5 Adapter

The complete control unit is composed of a control unit top and an adapter unit. The adapter unit consists of an adapter and an actuator screw which are different from valve to valve.
Since the control unit can be installed to different types of valve, different adapter units are necessary. It depends on the valve type which respective adapter type is combined with the control unit top.

Section 5.3 spare parts lists shows which adapter is used with the respective valve type.

The adapter for DELTA SV/SVS and DELTA DKR valves has an internal air connection.
Pos. 1 and pos. 2 contain two blind plugs.

Fig.1

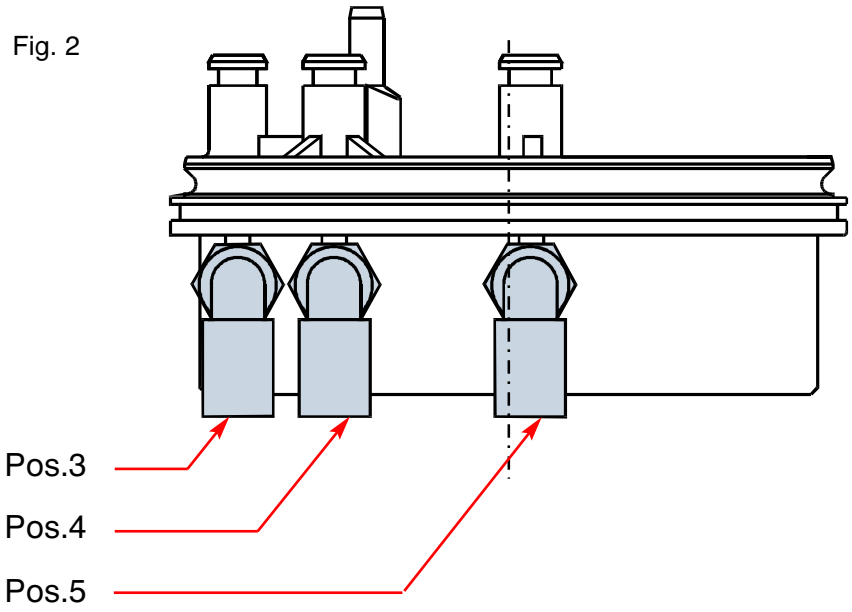


3. General description

The adapter shown in figure 2 is for the double seat valves DELTA DA3+ and DE3. It is either equipped with one (for DELTA DE3 with one solenoid valve) or three air connections (for DELTA DA3+ with three solenoids).
If fitted with one air connector pos. 4 and 5 are closed with a blind plug.

Pos. 3 air supply to open valve
Pos. 4 air supply to lift lower seat
Pos. 5 air supply to lift upper seat

Fig. 2

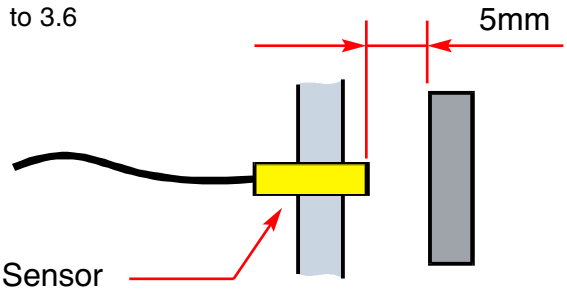


3. General description

3.6 External sensor

A 5V DC NPN sensor must be used.
Operating distance: 5 mm.

Fig. to 3.6



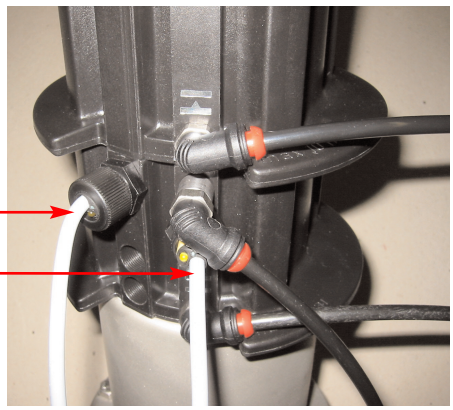
CU3 AS-i Safety Stop / Seat Lift Detection
Connection of 4 feedback sensor at the DA3+ valve

Sensor 2
(internal Hall Sensor)

Sensor 1
(internal Hall Sensor)

Sensor 3
(external Proximity Sensor)

Sensor 4
(external Proximity Sensor)



3.7 Air connections / elbow unions

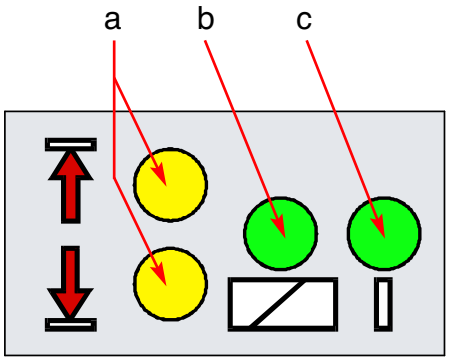
The elbow unions for the control unit and adapter have a cylindrical thread. For their replacement against other unions, take care that the new union has a cylindrical thread.

4. Functional description

4.1 LED indication

There are four LEDs which have the following functions:

Fig. to 4.1



a) **<u>Valve</u> <u>position</u> <u>indication</u>**. The LED lights up and indicates the valve position. This is used to provide information during operation and to adjust the position sensors.
CU3 AS-I Safety Stop with 2 sensors (see chapter 4.5)
According to valve design NO or NC the LED show open or closed valve position.

Upper LED	ON	open valve (NC)	closed valve (NO)
Lower LED	ON	closed valve (NC)	open valve (NO)

CU3 AS-I Safety Stop with 4 sensors for Seat Lift Detection
Based on the DA3+ valve the following signal will be shown:

Upper LED	ON	valve closed
Lower LED	ON	valve open
Upper LED	1 blink	lower seat lift active
Upper LED	2 blink	upper seat lift active

b) Control of the solenoid valves / green

1) solenoid valve (main control)	**permanent green**
2) solenoid valve for lower seat lifting	**1 flash / 2sec.**
3) solenoid valve for upper seat lifting	**2 flash / 2sec.**

(priority has 1 before 2 and 2 before 3)

<u>Attention:</u>
Max. 2 solenoid valves may be activated simultaneously.
Which 2 valves are activated can, however, be selected freely.

c) Power supply AS-interface - green
Inidication peripheral failure - red flashing

Peripheral failures can be released in the following cases:
- short circuit or overload at the sensor entries
- short circuit or cable parting in the solenoid valve control
- overload as a result of simultaneous control of all 3 solenoid valves **(Permitted is the simultaneous control of max. 2 solenoid valves!)**

As-interface Diagnosis Indication

Under all other conditions the LED output operates as a status indicator. The LED will display the following status information:

<u>LED Off:</u>
- **RESET:** Either DSR pin is static low or the IC is executing its reset/initialisation procedure. This procedure takes approximately 2 ms. The initialisation procedure will be performed after an power-on reset, a software reset (call RES), or an external reset.
- **Communication ON:** The slave can respond to DEXG master calls if its data exchange disable flag (*DATAEXCHG_DIS*) has been cleared.
The *DATAEXCHG_DIS* is set during initialisation of the A²SI.
It will be cleared by the first write parameter request (WPAR) addressing the considered slave.

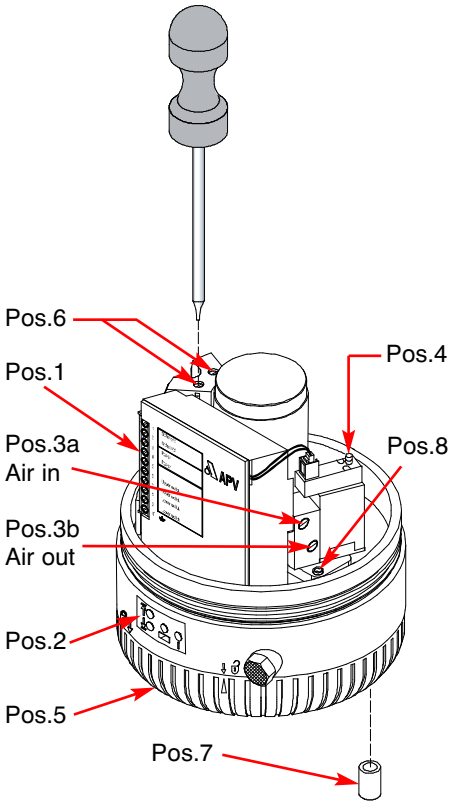
4. Functional description

LED Constant On:

- **Communication OFF:** After an IC reset, the *data exchange disable flag (DATAEXCHG_DIS)* is set and causes the LED to become constant on. Following scenarios may cause an IC reset:
  - o power-on reset, external reset, execution of a software reset (call RES, BR01)
  - o reset caused by the integrated watchdog
  - o an access to a non-implemented EEPROM register
  - o The LED is also constant on if the IR-addressing channel was selected and no communication takes place.
    A turned on LED represents the logical high level of the MAN2-coded output signal.

LED Flashing (2Hz):

- **Periphery Fault:** In case of a periphery fault the LED flashes with a frequency of 2Hz. Since the FID signal has higher priority than the *Communication OFF* state, the LED will remain flashing even if the Communication is off (*data exchange disable flag* is set).



4.2 Throttling function (Pos. 3a and 3b)

The inlet and outlet air can be adjusted at the soleniod valve by the two throttling valves (pos. 3a / IN and pos. 3b. / OUT).
By turning the screws in anticlockwise direction, the inlet or outlet air is throttled. The required adjustment must be determined by the operator himself. Please note that the throttling valve controlling the inlet and outlet air must never be completely closed.

4.3 Manual activation of the solenoid valve (Pos. 4)

The solenoid valve can be activated manually by turning the handle placed on the top of the solenoid valve. This function is used to adjust the Hall sensor or to by-pass the control system to activate the valve.

4.4 Removal of control unit from valve (Pos. 5)

The control unit is released by turning the ribbed ring from the “lock” to the “un-lock” symbol. Then the control unit can easily be lifted off. The removal of the control unit shuts off air supply.

4.5 Adjustment of feed-back position (Pos. 6)

After dismantling of the CU, check that the position of the Hall sensors are properly adjusted.

The procedure is as follows:
The Hall sensors must be adjusted to transmit a signal respectively for activated valve position and not-activated valve position.
In this case it is an advantage to use manual activation **(Pos. 4)**.

Turn the adjusting screws **(Pos. 6)** up/down until the correct LED just lights up. Check if it is in fact the correct LED that lights up.
To allow for small fluctuations, turn the adjusting screws two revolutions in the direction in which the LED remains lit.

Control units for DELTA DA3+ and DE3 valves are fitted with external proximity switches.

4. Functional description

Valves in normally closed (NC) design

The Hall sensor for activated valve position is fitted on a screw marked ↑

The Hall sensor for not-activated valve position is fitted on a screw marked ↓

The LED for “activated” valve sensor is marked ↑ (open valve)

The LED for “not-activated” valve sensor is marked ↓ (closed valve)

Valves in normally open (NO) design and DELTA DA3+ and DELTA DE3 double-seat valves, DELTA SV/SVS buttefly valves and DELTA DKR double-seat ball valves - independent of normally closed or normally open design

The Hall sensor for activated valve position is fitted on a screw marked ↓

The Hall sensor for not-activated valve position is fitted on a screw marked ↑

The LED for “activated” valve sensor is marked ↓ (closed valve)

The LED for “not-activated” valve sensor is marked ↑ (open valve)

4.6 Pressure relief valve (Pos. 7)

The pressure relief valve ensures that no pressure builds up in the cap.

4.7 Removal of the electronic box (pos. 1)

The electronic box can be removed by loosening two screws. One screw is placed between the two guides for the Hall sensors, and the other is placed on the right side of the electronic box. Remove the cable (plug) from the solenoid valve.
During assembly ensure that the wires for the hall sensors are not tangled, preventing them from sliding up and down unobstructedly in the wire tracks.

4.8 Removal of the solenoid valve (pos. 8)

Remove the cable (plug) from the solenoid valve. Loosen the two screws which are fixing the solenoid valve, distributor and gasket.
During assembly make sure that the gasket is positioned very precisely between the edges at the distributor. The torque for the two screws of the solenoid valve is **1,3 Nm, max. 1,6 Nm.**

5. Technical data

5.1 General technical data

Ambient temperature:	-20°C to + 70°C
Enclosure rating:	IP 67
CE:	EMC 89/336/EEC
Control air :	quality acc. to DIN/ISO 8573-1
- **solid particel content :**	quality class 3, maximum number of particels per m³ 10 000 of size 0,5µm < d < 1,0µm 500 of size 1,0µm < d < 5,0µm
- **water content :**	quality class 4, max. pressure dew point +3°C (for installations at lower temperatures or higher altitudes additional measures must be considered to reduce the pressure dew point accordingly)
- **oil content :**	quality class 1, max. 0,01mg/m^3 (the used oil must be compatible with Polyurethan elastomer materials)

5.2 Electrical data

AS-Interface profile:	S-7.A.E.
extended addressing mode:	is supported
serial communication mode:	----------
reverse battery protection:	exists
peripheral failure bit:	activated
watchdog:	not activated
display “power”:	LED C (green)
display “fault”	LED C (red)
AS-Interface voltage range:	26,5....31,6V
max. current consumption:	≤ 160 mA
Power consumption of electronic module	
controlled without solenoid valve:	40 mA
controlled with 1 solenoid valve:	70 mA
controlled with 2 solenoid valves:	100 mA
(respectively 1 sensor controlled)	

5. Technical data

5.3 Standards

AS-Interface specification: 2.1

AS-Interface certificate: No. of the certification document 70401

Standards:
EN 50295
IEC 62026-2:2000
EN 55022 (A/B)
EN 61000-4-4
EN 61000-4-6
EN 61000-4-3
EN 61000-4-2

5.4.1 Communication data for CU3 AS-interface 2.1 Safety Stop / 2 feedback sensors The use of data bits is shown in the following table:

Data bit	Info	Port	Level
DO0	0	Main control valve	Low (no current)
(output)	1		High (current)
DO1	0	Option for mixproof valves (lower seat lift)	Low (no current)
(output)	1		High (current)
DO2	0	Option for mixproof valves (upper seat lift)	Low (no current)
(output)	1		High (current)
DO3		Not used	
(output)			
DI0	0	Position sensor 1 (activated valve position)	Low (no current)
(input)	1		High (current)
DI1	0	Position sensor 2 (not-activated valve position)	Low (no current)
(input)	1		High (current)
DI2	1		------
(input)			
DI3	1		------
(input)			

5. Technical data

5.4.2 Communication data for CU3 AS-interface 2.1 safety Stop with seat Lift Detection / 4 feedback sensors The use of data bits is shown in the following table:

Data bit	Info	Port	Level
DO0 (output)	0 1	Main control valve	Low (no current) High (current)
DO1 (output)	0 1	Lower seat lift	Low (no current) High (current)
DO2 (output)	0 1	Upper seat lift	Low (no current) High (current)
DO3 (output)		Not used	
DI0 (input)	0 1	Sensor 1	Low (no current) High (current)
DI1 (input)	0 1	Sensor 2	Low (no current) High (current)
DI2 (input)	0 1	Sensor 3	Low (no current) High (current)
DI3 (input)	0 1	Sensor 4	Low (no current) High (current)

pls. see table below, how to use the sensor signals !

5.4.2.1 CU3 AS-interface 2.1 safety Stop with seat Lift Detection / 4 feedback sensors Valve signals :

feedback Sensor		**sensor 1** internal hall sensor	**sensor 2** internal hall sensor	**sensor 3** external proximity sensor	**sensor 4** external proximity sensor
valve position	**LED indication**				
closed	upper LED ON	0	1	1	1
open	lower LED ON	1	0	0	0
upper seat lift	upper LED 2 blink	0	1	1	0
lower seat lift	upper LED 1 blink	0	0	1	1
AS-i signal		input DI 0	input DI 1	input DI 2	input DI 3

To ensure the appropriate valve feedback position detection the signal must be used as shown in the table !

→ *To learn more about the LED indication pls. study chapter 4.1 at page 11!*

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WHERE IDEAS MEET INDUSTRY

Your local contact:

APV
Zechenstraße 49
D-59425 Unna

Phone: +49(0) 23 03/ 108-0 Fax: +49(0) 23 03 / 108-210

For more information about our worldwide locations, approvals, certifications, and local representatives, please visit www.apv.com.

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