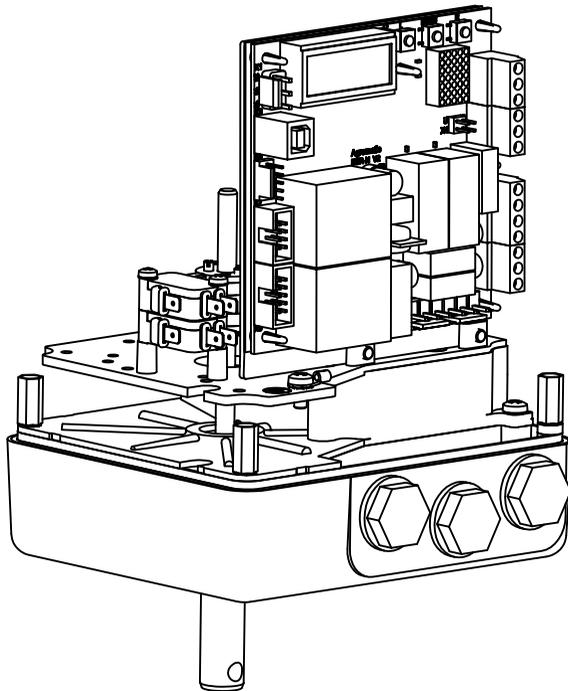


Installation and Operating Manual

(Translation of the German Original)



PROFIBUS-DP for Position Controller ESR-N (Option)

Keep for future reference!

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1 Introduction

This operating manual applies to the PROFIBUS-DP interface, which is available as an extension module for the electronic position controller ESR-N. The manual provides all the information required for a safe and secure installation and trouble-free operation of the device.

This operating manual must be read, understood and applied by all persons responsible for installing, operating, servicing, checking or troubleshooting of the actuator with a position controller and a PROFIBUS interface. This shall apply in particular to the safety instructions provided.

This operating manual is an integral part of the position controller with a PROFIBUS-DP interface. It should be stored in an easily accessible place close to the actuator with integrated position controller during the entire service life of the device.

The following documentation in its current version should also be taken into account:

- the operating manual for the electronic position controller ESR-N
- the operating/installation instructions for the actuator series N, K, KA, and V
- the product catalog, and the General Terms and Conditions of Agromatic Regelungstechnik GmbH.

Special attention should be paid to the operating/installation instructions for the actuator series N, K, KA and V and the following sections:

- Safety
- Transportation and storage
- Decommissioning, disassembly

1.1 Notes and signs used in this document

Special attention should be paid to text statements in this operating manual serving as notes or direct warning of danger. Such statements are identified as shown below:



▲ DANGER

Warning of dangerous electrical voltage!

This warning note indicates risks caused by electricity.

Work on electrical equipment may only be carried out by qualified and authorized electricians.

▲ WARNING

This warning note identifies a possible hazard with a medium risk, which may lead to death or (serious) personal injury if it is not avoided.

NOTE

This warning note identifies a hazard with a low risk, which may lead to material damage if it is not avoided.



Important information!

This sign draws attention to a function or setting of the actuator and instructs to exercise caution while working.



Instructions next to this sign must be completed before commencing other activities.

The following means of representation are used in addition:

- Texts following this mark are list items.
- 1. Text next to this mark describes activities to be carried out in the prescribed order.
- “ ” *Texts in quotes are references to other chapters, sections or documents.*

2 Safety

Carefully read the section “2 Safety” of the installation/operating instructions for the actuator series N, K, KA and V before putting the actuator into service. Also be sure to observe the additional safety instructions in the installation/operating instructions for the position controller ESR-N.

⚠ WARNING
Failure to observe the safety instructions may have serious consequences: <ul style="list-style-type: none">– Danger to persons resulting from electrical and mechanical influences– Failure of essential functions



Always disconnect any machinery and installations that may be affected before starting to work on the actuator.



Before <ul style="list-style-type: none">– switching the actuator on or off,– changing any settings (e.g. rotational direction or swivel range) at the actuator, check whether these actions could cause any dangerous movements within the machine/system or malfunctions of other assemblies!
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NOTE
The technical data mentioned in the section “3.1 Technical data” must be adhered to without exception.

3 Product description

The PROFIBUS-DP interface for the electronic position controller is integrated into the actuator housing and has been designed to connect the actuator with a PROFIBUS-DP network. The PROFIBUS interface is used to exchange process data such as the setpoint position and the actual positions between the bus master and the position controller.

3.1 Technical data

Operating voltage

3.3V DC, supplied by the ESR-N

Ambient temperature (of the actuator)

0°C to +60°C (standard)

Up to -15°C with anti-condensate heater (option, consultation required)

Protection class (IP code)

Protection class of the actuator

Fieldbus baud rates

up to 6 MBaud (Autodetect)

Fieldbus functions

all mandatory slave functions according to PROFIBUS-DPV1

4 Start-up

⚠ DANGER

Warning of dangerous electrical voltage!

Working on live electrical devices poses a considerable risk of deadly or serious injuries!

If an actuator is open or operational, there is a risk of coming into contact with live parts (e.g. with a tool or another thin object).

1. The electrical connection may only be established by a qualified electrician.
2. Adhere to the regulations of the VDE (German Association for Electrical, Electronic and Information Technologies) and to the regulations issued by the local utility company.
3. Make sure that no bare wires protrude from the terminals to eliminate the risk of electric shock or short circuits.



The cams of switches SL and SR must be set, the potentiometer must be adjusted and the positioning range must be parameterized in the position controller before putting the actuator into service via the PROFIBUS network.



4.1 Electrical connection

Depending on the position of the actuator and the communication between the actuator and the bus master, the position controller starts to move the actuator in the "AUTO" mode shortly after the operating voltage has been switched on. This may cause possibly dangerous movements of the actuated valve.

Therefore, **always** set the position controller to the **MANU** mode = manual mode before switching on the operating voltage of the actuator!



NOTE

Before connecting the controller and the interface module, **persons and equipment** must be **earthed** to avoid damage caused by **electrostatic discharge (ESD)**.

i **Important information!**

The analogue setpoint specification of the controller is disabled during the PROFIBUS mode.

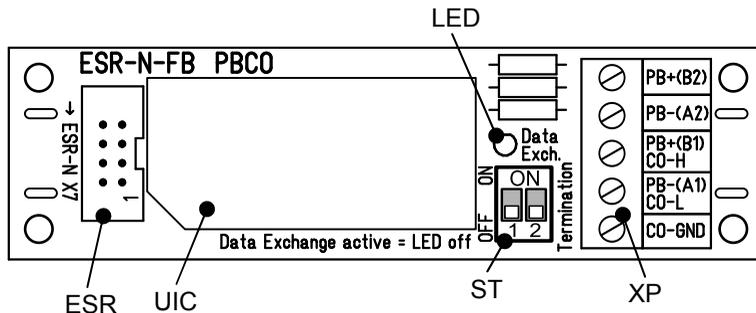


Fig. 4.1: Adapter board with “UNIGATE-IC” interface module

- LED “Fieldbus status” LED
 ESR Plug for connecting the ESR-N controller
 UIC “UNIGATE-IC” interface module
 ST “Termination” sliding switch
 XP Terminal for PROFIBUS

PROFIBUS terminal pin assignment

- | | |
|----------|---|
| PB+ (B2) | Data line positive (red wire; to the next device) |
| PB- (A2) | Data line negative (green wire; to the next device) |
| PB+ (B1) | Data line positive (red wire; from the previous device) |
| PB- (A1) | Data line negative (green wire; from the previous device) |

The fieldbus line is connected to a terminal block on the adapter board within the actuator (see Fig. 4.1: Adapter board with “UNIGATE-IC” interface module).

The line coming from the previous device in the PROFIBUS network is attached to terminals A1 and B1.

Terminals A2 and B2 are available for connecting an additional device.

To ensure secure shielding of the fieldbus line, the fieldbus line must be led into the actuator through an EMC cable gland. The cable gland provides good electric conductivity between the line shield and the earthed actuator housing.

4.2 Controls and indicators

4.2.1 “Fieldbus status” LED

The “fieldbus status” LED indicates the status of the communication between the interface module and the bus master:

- **LED shines:** No communication
- **LED off:** Interface module communicates with the bus master.

4.2.2 “Termination” sliding switch

The “termination” sliding switch can be used to enable the PROFIBUS termination of the interface module.

<p>Termination ON: Both switches set to “ON”.</p>	
<p>Termination OFF: Both switches set to “1 2”.</p>	

4.3 Setting the fieldbus address

The fieldbus address used by the bus master in the PROFIBUS network to address the actuator is stored in the controller.

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Important information!

- On delivery, the fieldbus address is set to the value **0**.
- The fieldbus address is displayed as a decimal number on the controller.

When the ESR-N controller is connected to an interface module, the additional menu item “Fieldbus Address” is shown in the parameterization menu of the controller.

1. The **AUTO/MANU** sliding switch can be used to switch on the manual mode (= **MANU**).
2. Press the **MENU** button > 3 sec to enter the parameterization menu.
3. Use the **L** or **R** buttons to navigate to the “Fieldbus Address” menu item.
LED display: “B”
Plain text display: “FB Addr.”
4. Input of the fieldbus address is enabled after briefly pressing the button **MENU**.
5. Use the **L** or **R** buttons to set the fieldbus address.
LED display: The three digits (max.) of the fieldbus address are displayed in sequence at the LED display with a subsequent pause.
Plain text display: The fieldbus address is shown as a decimal number.
6. Press the **MENU** button briefly to confirm the fieldbus address, then exit the parameterization menu by submenu 12 „EXIT“.
7. Set sliding switch **AUTO/MANU** to the position **AUTO** to switch the position controller to automatic mode.

The bus master can then communicate with the actuator using the fieldbus address set, and the actuator position is controlled via the setpoint specification sent by the bus master.

4.4 GSD file

The GSD (“General Station Description”) file contains a description of the PROFIBUS-DP slave features (e.g. the communication parameters).

The current GSD file for the ESR-N position controller and the PROFIBUS interface you can get from the Agromatic Regelungstechnik GmbH Service department.

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5 Process Image

The bus master sends the process image OUTPUT to the ESR-N position controller. The process image OUTPUT includes all the commands used by the position controller to move the actuator. The position controller responds by sending the process image INPUT to the bus master. The process image INPUT includes the actual position of the actuator, among other items.

- Length of the process image OUTPUT: 8 bytes
- Length of the process image INPUT: 8 bytes
- Cycle time process image INPUT: 1000 ms

The structure of the two process images is detailed in the following sections.

5.1 Process image OUTPUT (bus master → ESR-N)

5.1.1 Telegram structure

Byte 0	Trigger byte
Byte 1	Setpoint, high byte of the numerical value (range 0 ... 1000 ‰)
Byte 2	Setpoint, low byte of the numerical value (range 0 ... 1000 ‰)
Byte 3	Commands ¹⁾
Bit 7	Emergency operation
Bit 6	Emergency stop
Bit 5	<i>reserved</i>
Bit 4	<i>reserved</i>
Bit 3	<i>reserved</i>
Bit 2	<i>reserved</i>
Bit 1	Reset “actuator blocking” error
Bit 0	Reset “wrong rotational direction” error
Byte 4	<i>reserved</i>
Byte 5	<i>reserved</i>
Byte 6	<i>reserved</i>
Byte 7	<i>reserved</i>

¹⁾ The following applies to all bits in byte 3: “1” = command active

5.1.2 Byte 0: Trigger byte

The bus master increments the trigger byte whenever changes are made to the process image OUTPUT. This informs the controller that new commands have been provided for processing.

5.1.3 Bytes 1 and 2: Setpoint specification

The setpoint for the position is sent to the controller as a numerical value within the range of 0 ... 1000 ‰ (0x00 0x00 ... 0x03 0xE8). Here, “0 ‰” always corresponds to the left end position of the actuator.

None of the commands provided in byte 3 is required for the normal control mode.

Byte 1: High byte of the setpoint

Byte 2: Low byte of the setpoint

5.1.4 Byte 3: Commands

Each of the commands described below is enabled by setting the appropriate bit to the value “1”. The value “0” cancels the command, and the controller returns to the normal control mode.

Bit 7: Emergency operation

The actuator moves to the position of the setpoint transferred in the same process image, irrespective of whether an overtemperature fault (see byte 4, bit 3) exists.

The “emergency operation” command must not be sent unless an overtemperature fault occurred.

Bit 6: Emergency stop

The “emergency stop” command immediately stops the actuator, irrespective of its current position. With bit 6 = “0” the controller returns to the normal control mode.

Bits 2 to 5:

Bits 2 to 5 are reserved for future extensions and have no function at present.

Bit 1: Reset the “actuator blocking” error

Precondition: Blocking protection activated in the controller parameterization menu.

When the blocking protection is triggered, the controller switches to the error mode and stops the actuator. The “Reset” command is used to acknowledge the error, and the controller returns to the control mode.

Bit 0: Reset “wrong rotational direction” error

Precondition: Monitoring of rotational direction activated in the controller parameterization menu.

When the monitoring of rotational direction is triggered, the controller switches to the error mode and stops the actuator. The “Reset” command is used to acknowledge the error, and the controller returns to the control mode.

5.1.5 Bytes 4 to 7: reserved

Bytes 4 to 7 of the process image OUTPUT are reserved for future extensions and have no function at present.

5.2 Process image INPUT (ESR-N → bus master)

5.2.1 Telegram structure

Byte 0	Trigger byte
Byte 1	Actual value, high byte of the numerical value (range 0 ... 1000 ‰)
Byte 2	Actual value, low byte of the numerical value (range 0 ... 1000 ‰)
Byte 3	Status messages ²⁾
Bit 7	Emergency operation
Bit 6	Emergency stop
Bit 5	AUTO operating mode
Bit 4	Setpoint position reached
Bit 3	Right end position reached
Bit 2	Left end position reached
Bit 1	CW rotation active
Bit 0	CCW rotation active
Byte 4	Error messages ³⁾
Bit 7	Process data invalid
Bit 6	<i>reserved</i>
Bit 5	<i>reserved</i>
Bit 4	<i>reserved</i>
Bit 3	Admissible temperature exceeded
Bit 2	Parameterization error (e.g. end positions not parameterized), control mode not possible
Bit 1	“Actuator blocking” error
Bit 0	“Wrong rotational direction” error
Byte 5	Controller temperature, numerical value (range 0 °C ... +128 °C)
Byte 6	<i>reserved</i>
Byte 7	Error code (hexadecimal values) 00 = communication with ESR-N without errors 09 = communication with ESR-N interrupted C9 = setpoint invalid (outside the range of 0 ... 1000 ‰) D5 = command cannot be executed in the current status FD = communication with ESR-N with error (data length) FE = communication with ESR-N with error (checksum)

²⁾ The following applies to all bits in byte 3: “1” = status active

³⁾ The following applies to all bits in byte 4: “0” = no error

5.2.2 Byte 0: Trigger byte

The controller increments the trigger byte with every process image INPUT sent, even if the process data has not been changed. This enables the bus master to detect that

- the communication between the interface module and the controller is sound
- the communication between the interface module and the bus master is sound
- the data received by the bus master is up to date.

5.2.3 Bytes 1 and 2: Actual position

The actual value for the position is sent to the bus master as a numerical value within the range of 0 ... 1000 ‰ (0x00 0x00 ... 0x03 0xE8). Here, “0 ‰” always corresponds to the left end position of the actuator.

Byte 1: High byte of the actual value

Byte 2: Low byte of the actual value

5.2.4 Byte 3: Status messages

Each of the status messages described below is active if the relevant bit has the value “1”.

Bit 7: Emergency operation

The “emergency operation” status is active until the setpoint position for the move has been reached (see also the “emergency operation” command in the process image OUTPUT).

Bit 6: Emergency stop

The “emergency stop” status is active until the bus master has canceled the “emergency stop” command in the process image OUTPUT).

Bit 5: AUTO operating mode (control mode)

Bit 5 = “1”: The **AUTO** status is active when the mode switch of the controller is in the **AUTO** position. In this status the controller is in control mode and accepts commands from the bus master.

Bit 5 = “0”: When the mode switch of the controller in the **MANU** position, the actuator can only be moved by pressing the **L** or **R** button of the controller.

Bit 4: setpoint position reached

The “setpoint position reached” status becomes active as soon as the actuator reaches the setpoint position and the motor is switched off.

Bit 3: Right end position

The “right end position” status becomes active as soon as the actuator reaches the setpoint position and the motor is switched off.

Bit 2: Left end position

The “left end position” status becomes active as soon as the actuator reaches the setpoint position and the motor is switched off.

Bit 1: CW rotation

The “CW rotation” status is active as long as the actuator moves in the right direction due to a setpoint specification.

Bit 0: CCW rotation

The “CCW rotation” status is active as long as the actuator moves in the left direction due to a setpoint specification.

5.2.5 Byte 4: Error messages

Bit 7: Process data invalid

If bit 7 is set, the process data is invalid and may not be used. This is the case when the communication between the interface module and the controller is faulty.

Bits 4 to 6:

Bits 5 to 6 are reserved for future extensions and have no function at present.

Bit 3: Overtemperature

As soon as the permitted controller temperature has been exceeded for more than 5 minutes, the “overtemperature” error becomes active. In this status the actuator cannot be moved unless the “emergency operation” is issued.

As an alternative it is possible to move the actuator locally by enabling the **MANU** mode.

Bit 2: Parameterization error

If the controller parameterization is incorrect, e.g. no end positions have been programmed, then the control mode is not possible and the “parameterization error” is issued.

Bit 1: “Actuator blocking” error

Precondition: Blocking protection is activated in the controller parameterization menu.

If the actuator becomes blocked while moving, the controller detects this condition because the actual position does not vary although the motor is running. The blocking protection then triggers the error, and the motor is switched off.

The actuator cannot continue to move unless the error has been acknowledged. The error can be acknowledged by:

- Command: Reset the “actuator blocking” error
- Setpoint specification causing the actuator to move in the opposite direction.

Bit 0: “Wrong rotational direction” error

Precondition: Monitoring of rotational direction is activated in the controller parameterization menu.

If the drive output shaft of the actuator is caused to rotate opposite to the nominal direction of rotation by an external torque during the movement, then the controller detects this position because the actual position changes in the incorrect direction while the motor is running. Monitoring of the rotational direction then triggers the error, and the motor is switched off.

The actuator cannot continue to move unless the error has been acknowledged. The error can be acknowledged by:

- Command: Reset the “wrong rotational direction” error

5.2.6 Byte 5: Controller temperature

The temperature of the controller board is sent to the bus master as a numerical value within the range of 0 °C ... +128 °C (0x00 ... 0x80).

5.2.7 Byte 6: reserved

Byte 6 of the process image INPUT is reserved for future extensions and has no function at present.

5.2.8 Byte 7: Error code

Using the error code, the interface module informs the bus master about the status of the communication with the controller and about messages coming from the controller.

Error code	Meaning
00	Communication with the controller error-free, commands will be executed.
09	Communication between the interface module and the controller has been interrupted.
C9	Setpoint sent is outside the range of 0 ... 1000 ‰.
D5	In the current status, the command cannot be executed (e.g. new setpoint specified while the controller is in the MANU mode).
FD	communication with ESR-N with error (data length)
FE	communication with ESR-N with error (checksum)

6 Safety functions

6.1 Safe position

This is the parameterized end position with the analogue setpoint 0(4) mA or 0(2) V assigned to it (default: left end position). Moving to the safe position therefore corresponds to the behavior of a controller driven in analogue manner when a broken wire in the setpoint line is present.

6.2 Communication interrupt

If the controller does not receive a valid command from the interface module for more than 10 sec, it moves the actuator to the safe position.

This also occurs if the interface module is not connected to the bus master.

If an analog signal is present at the setpoint input (terminal 51-52) in this condition, the controller follows the analog setpoint.

As soon as the communication is safely re-established, the control mode via the PROFIBUS interface is resumed.

6.3 Switching on the operating power in the AUTO mode

If the controller does not receive a valid command from the interface module for more than 5 sec after power on, it moves the actuator to the safe position.

If an analog signal is present at the setpoint input (terminal 51-52) in this condition, the controller follows the analog setpoint.

As soon as the communication between the interface module and the controller is safely re-established, the control mode via the PROFIBUS interface is resumed.

7 Malfunctions and repair

Please contact our Service department if malfunctions occur with the actuator:

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Important information!

Make sure to **always** quote the serial number on the **nameplate** located **inside the actuator**.

Do **not** use the serial number indicated on the nameplate attached to the outside of the hood.

Before returning an Agromatic actuator for repairs, request an RMA (“Return Material Authorization”) number from the Agromatic Regelungstechnik GmbH Service department (address see above).

The provided RMA number must be attached to the actuator to facilitate fast and smooth execution of the repairs.

If a claim is raised, the original invoice must also be provided with the actuator.

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