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PROFIBUS-DP

Version Z025.683/01

Operation instructions

Electric part-turn actuators
in version ST 51xx and PROFIBUS-DP interface Operation instructions
interface. Software version: Z025.683/01

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1 Safety instructions

1.1 Range of application

RTK actuators are designed for the operation of industrial valves, e.g. globe valves, gate valves, butterfly valves and ball valves. RTK is not liable for any possible damage resulting from use in other than the designated applications. Such risk lies entirely with the user. Observance of these operation instructions is considered as part of the actuators' designated use.

1.2 Short description

RTK actuators have a modular design. Motor and gearing are mounted in a common housing. The actuators are driven by an electric motor and con-trolled with the electronic controls BS4581 PROFIBUS-DP. The electronic controls are included in the scope of delivery.

1.3 Commissioning

(electrical connection)
During electrical operation certain parts inevitably carry lethal voltages. Work on the electrical system or equipment must only be carried out by a skilled electrician himself or by specially instructed personnel under the control and supervision of such an electrician and in accordance with the applicable electrical engineering rules.

1.4 Maintenance

The maintenance instructions must be strictly observed, otherwise a safe operation of the actuator is no longer guaranteed.

1.5 Warnings and notes

Non-observance of the warnings and notes may lead to serious injuries or damages. Qualified personnel must be thoroughly familiar with all warnings and notes in these operation instructions. Correct transport, proper storage, mounting and installation, as well as careful commissioning are essential to ensure a trouble-free and safe operation. The following references draw special attention to safety-relevant procedures in these operation instructions. Each is marked by the appropriate pictograph.

This pictograph means: Note!
"Note" marks activities or procedures which have major influence on the correct operation. Non-observance of these notes may lead to consequential damage.

This pictograph means: Electrostatically endangered parts (ESD)!
If this pictograph is attached to a printed circuit board, it contains parts which may be damaged or destroyed by electrostatic discharges. If the boards need to be touched during setting, measurement or for exchange, it must be assured that immediately before a discharge through contact with an earthed metallic surface (e.g. the housing) has taken place.

This pictograph means: Warning!
"Warning" marks activities or procedures which, if not carried out correctly, can affect the safety of persons or material.

2 Transport and storage

Transport to place of installation in sturdy packing. Do not attach ropes or hooks to the handwheel for the purpose of lifting by hoist. Store in well-ventilated, dry room. Protect against floor dampness by storage on a shelf or on a wooden pallet. Cover to protect against dust and dirt. Apply suitable corrosion protection agent to bright surfaces.

3 General information about PROFIBUS-DP

For the exchange of information among automation systems and between automation systems and the connected decentral field devices, serial field-buses are mainly used today as the communication system. Thousands of applications have proved impressively that cost savings of up to 40 % in wiring, commissioning and maintenance are achieved by using field bus technology. Just two wires are needed to transmit all relevant information for the field devices, such as input and output signals, parameters and diagnostics data. While in the past

the fieldbuses used were often manufacturer specific and incompatible with other bus systems, the systems employed today are almost exclusively open and standardized. This means that the user is independent of individual suppliers and can choose the best product for the most competitive price. PROFIBUS-DP is the leading open fieldbus system in Europe, which is also used successfully throughout the world. The application range includes automation in the areas of manufacturing, processing and building. PROFI-BUS- DP is an international, open fieldbus standard, which has been standardized in the fieldbus standard EN 50 170. This standardization ensures that the investments of manufacturers and users are protected to the best possible degree and the independence of the manufacturer is guaranteed. These operation instructions cannot provide a general introduction to PRO-FIBUS- DP.

3.1 Basic characteristics

PROFIBUS-DP determines the technical and functional features of a serial fieldbus system with which distributed digital automation devices can be interconnected. PROFIBUS-DP distinguishes between master and slave devices. PROFIBUS-DP is designed for fast data transmission in the field level. Here central control devices, such as a PLC or PC, communicate via a fast serial connection with peripheral field stations such as input/output devices, valves and actuators. The interchange of data among the field devices takes place cyclically. The necessary communication functions are established by the PROFIBUS-DP basic functions according to EN 50 170.
Master devices control the data traffic on the Bus. A master is allowed to send messages without an external request. Masters are also called 'active stations' in the PROFIBUS protocol.
Slave devices such as BS4581 PROFIBUS-DP actuators are peripheral devices. Typical slave devices are input/output devices, valves, actuators and measuring sensors. They do not have bus access, i.e. they may only acknowledge received messages or, at the request of a master, transmit messages to that master. Slaves are also called 'passive stations'.

3.2 Basic functions of PROFIBUS-DP

The master reads the input information from the slaves cyclically and writes the output information cyclically to the slaves. In addition to this cyclic data transfer of the process representation, PROFIBUS-DP also provides powerfull functions for diagnostics and commissioning purposes. The data traffic is monitored through the monitoring functions on the master and slave side.

3.3 Transfer mode

- RS-485 twisted pair cable or fibre optical cable.
- RTK actuators support baudrates up to 1.5 MBits/s

3.4 Bus access

- Token-passing between the masters and polling between master and slave.
- Mono-master or multi-master systems are possible.
- Master and slave stations: max. 126 stations connected to one bus.

3.5 Communication

- Peer-to-peer (net data transfer) or Multicast (control commands to all slaves).
- Cyclic master-slave net data transfer or acyclic master-master datatransfer.

3.6 Functionality

- Cyclic net data transfer between DP slave and DP slaves.
- Dynamic activation or de-activation of individual DP slaves.
- Checking of the configuration of the DP slaves.
- Synchronisation of inputs and/or outputs.

3.7 Protection functions

- All messages are transmitted with Hamming Distance HD=4.
- Watch-dog timer at DP slaves.
- Access protection for the inputs/outputs of the DP slaves.
- Net data transfer monitoring with configurable timer interval at the master.
- Fail safe function.

3.8 Station types

- DP-Master class 2 (DPM2), e.g. programming / configuration devices.
- DP-Master class 1 (DPM1), e.g. central controllers such as PLC, PC, ...
- DP slave, e.g. BS 4581 PROFIBUS-DP devices. Devices with binary or analogue inputs/outputs, actuators, valves.

4 Technical data

Communication protocol	PROFIBUS-DP according to EN 50 170, DIN 19 245
Network topology	Linear (BUS) structure. With repeaters tree structures can also be realised. Coupling and uncoupling of stations during operation without affecting other stations is possible.
Transmission medium	Twisted, screened copper cable according to EN 50 170
Interface	EIA-485 (RS485)
Transmission rate/ Cable length	Baudrate (kbit/s) / Cable length (without repeater) / Cable length (with repeater) 9.6 / 1,200 m / approx. 10 km 19.2 / 1,200 m / approx. 10 km 45.45 / 1,200 m / approx. 10 km 93.75 / 1,200 m / approx. 10 km 187.5 / 1,000 m / approx. 10 km 500 / 400 m / approx. 4 km 1.500 / 200 m / approx. 2 km
Station types	DP Master class 1, e.g. central controllers such as PLC, PC, ... DP Master class 2, e.g. programming / configuration tools DP slave, e.g. devices with binary and/or analogue in-/outputs such as actuators, sensors
Number of stations	32 stations without repeater, with repeater expandable up to 126.
Bus access	Token-passing between the masters and polling for slaves. Mono-master or multi-master systems are possible.

Data of the actuator controls ST 51xx with PROFIBUS-DP interface BS4581:

Electronic controls	all ST 51xx types with potentiometer (1kOhms)
Supported types of operation	Cyclic data exchange, sync mode, freeze mode, fail-safe mode
Baudrate recognition	automatic
Process-representation output (command signals)	- OPEN - STOP - CLOSE - nominal value
Process-representation input (feedback)	- end position OPEN, CLOSED - valve position - selector switch in position LOCAL/ REMOTE - running indication (directional) - limit switch OPEN, CLOSED operated - manual operation by handwheel or local controls - communication channel A or B (redundant channel) active
Process representation input (fault messages)	- motor protection tripped - voltage supply of PROFIBUS-DP board outside of permissible range - loss of an analogue input signal
3-position controller (option)	Max. error and max. dead time programmable via BUS.
Electronic timer (option)	Start and end of stepping mode as well as ON / OFF time can be programmed via the BUS.
Behaviour in case of communication failure or CLEAR state of the master	The behaviour of the actuator is programmable: - stop in current position - move to end position OPEN or CLOSED - move to any intermediate position

Cable redundancy (option)	As an option, a second transmission cable can be connected

5 BS 4581 Profibus DP design

Case of BS 4581 (figure A)

- The logic board links the signals of the actuator with the local controls and the PROFIBUS board and controls the reversing contactors module.
- PROFIBUS connection board with terminals for two-wire system and termination resistors for the bus termination.

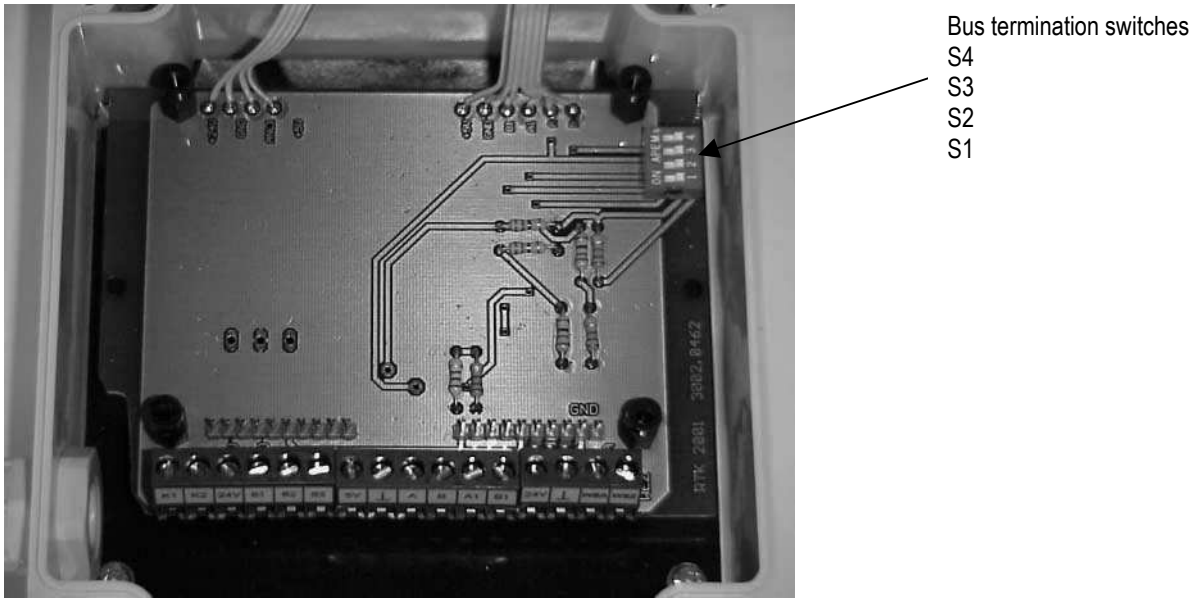
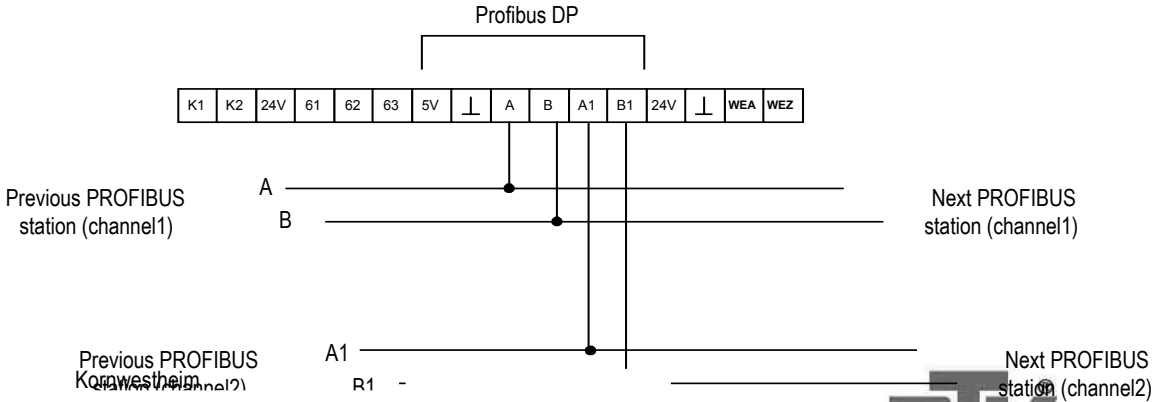


Figure A

6 Bus connection

- Connect bus cable to channel 1 according to connection diagram (figure B)
- The termination resistors for (channel 1) and (channel 2) are switched in via switches (S1,S2) and (S3,S4) (figure A).
- Both switches are supplied in position 'OFF'. Only connect the termination resistors (position 'ON') if the actuator is the final station in the PROFIBUS segment.

Figure B: Connection diagram



6.1 Redundant bus connection

BS 4581 PROFIBUS-DP devices can be connected with a second (redundant) PROFIBUS cable. If the bus on channel 1 fails, e. g. through cable break, the slave automatically switches to channel 2. Connect redundant bus cable to channel 2 (figure B) according to connection diagram (same as channel 1, figure B). The termination resistor for channel 2 is connected through linking the terminals A - B and A1 - B1. The setting of the redundant bus connection is realised via the parameters 4 and 5

6.2 Bus cables

Only cables according to standards DIN 19245 or EN 50170-2, cable type A, may be used for PROFIBUS-DP wiring. A maximum of up to 32 PROFIBUS stations may be connected in one segment. If more stations are to be connected to one PROFIBUS, several segments must be connected with repeaters. The bus cable must be laid at a distance of at least 20 cm from other cables. It should be laid in a separate, conductive and earthed cable trunking. It must be ensured that there are no potential differences between the individual stations on the PROFIBUS.

Transmission rate in kBit/s	<=93.75	187.5	500	1500
Maximum segment length in m	1200	1000	400	200

Cable specification cable type A for PROFIBUS-DP

Impedance: 135 to 165 Ohm, at a frequency of 3 to 20 MHz.
Cable capacity: 30 pF per meter
Cable diameter 0.64mm
Core diameter: 0.34 mm², corresponds to AWG 22
Loop resistance: 110 Ohm per km
Screening: CU shielding braid or shielding braid and shielding foil

6.3 Setting of the bus address

The bus address is set on the PROFIBUS-DP board. .Loosen screws of BS 4581 and remove cover . Only addresses from 0 to 125 may be set. .Set the required address with rotary switches (S5) and (S6) (figure C). Switch (S5) for setting the units digit. Switch (S6) for setting the tens digit. Example:

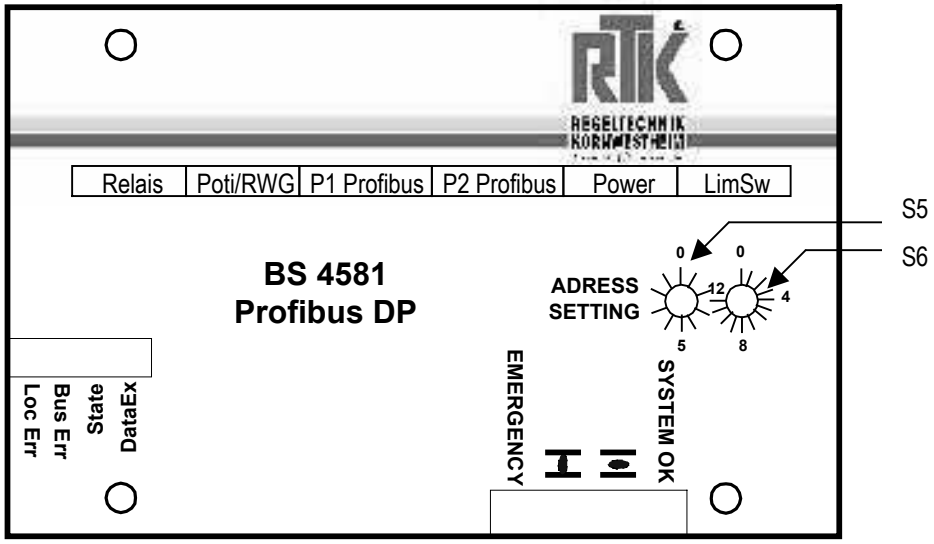


Figure C: PROFIBUS-DP BOARD.

The address ‘65’ is set as follows: (S5) on position 5 (5 * 1 = 5)
(S6) on position 6 (6 * 10 = 60)

7 Commissioning with controls

7.1 Introduction

When commissioning a PROFIBUS-DP network, the stations on the PROFI-BUS-DP must be parameterized and configured with the programming software of the controls (PROFIBUS configurator). The programming software first reads the GSD file (**G**eräte**S**tamm**D**aten = Device database) of the individual actuators. The GSD file contains information about the properties of the device which are needed by the master. The GSD file RTK1.GSD is supplied with the PROFIBUS-DP actuators. Afterwards the user can configure and parameterize each station on the PROFIBUS-DP. This information is then stored in the controls (DP master) and sent to the actuators (DP slaves) each time communication is started. The control is executed via the process representation input and output bytes. If a configuration with consistent data is chosen, special functional elements for the control of the PROFIBUS-DP slaves must be used with some PLCs.

7.2 Programming

The parameterization is partly determined in the PROFIBUS standard, e.g. a bit for switching bus monitoring on and off (watchdog). The BS4581 PROFIBUS-DP control can additionally receive up to 100 bytes of ‘user parameters’, in which BS4581specific parameters can be set. The BS4581 specific parameters are divided into 50 parameters with 2 bytes each per parameter. The first byte is high-order byte. The parameters can be changed via the programming software of the controls. New programming software supports the setting of the parameters via text and menu selection. When using older software the values of the parameters must be entered using hexadecimal numbers. The meaning of the individual BS4581 specific parameters is explained in subclause 7.5 .

7.3 Configuration

During configuration it is determined how many input and output bytes for each device are reserved in the memory of controls. Additionally it is deter-mined if the data are processed consistently or non-consistently.

Only the number of bytes determined in the configuration is transferred between the DP-master and the DP slave.

Number of input bytes	Number of output bytes
1	1
2	1
2	2
4	4
6	1
6	2
6	4
8	4
12	4
16	8

All these configurations (except for 1 In, 1 Out), can be chosen either as consistent or not consistent.

The number of input bytes states how many of the maximum 16 bytes the DP slave sends to the DP master.
The number of output bytes states how many of the maximum 8 bytes the DP master sends to the DP slave.
If, for example, the configuration with 8 bytes input is selected, only the first 8 bytes are sent from the DP slave to the DP-master. In this case the master does not have access to the bytes 9 to 12. In this way the master saves memory space, since it only has to reserve 8 input bytes for the actuator. The data of the actuators are to be processed consistently by the DP-master. This ensures that the value of a 2 byte variable (electronic position transmitter) does not change after the read-out of the first byte and does not distort the value. If a master does not offer the possibility to use consistent configurations, a non-consistent configuration can be chosen. The values for the electronic position transmitter and the customer analogue inputs should then be transferred in 1 byte format (0-100%, parameter 2 = 0, parameter 22 = 0, parameter 25 = 0).

7.4 Communication start-up

When the DP master is switched on, it first sends a parameter and configuration telegram to each DP slave. If parameters and configuration are correct, the PROFIBUS-DP actuator assumes the state 'Data exchange'. The net data between controls and actuator are exchanged. The DP master can control the DP slave and read its current state via the process representation. If communication is interrupted (e.g. through the switching off of the slave or the breaking of the PROFIBUS cable), it is resumed automatically by the DP master when the cause of the fault is eliminated.

7.5 Description of user parameters

Parameter 1 "position transmitter"
Default value (standard setting): 1
0: The actuator does not have a position transmitter.
1: The actuator is equipped with a potentiometer without RWG.
2: The actuator is equipped with an RWG 0-20 mA. For this position transmitter, the monitoring of signal interruption is not active.
3: The actuator is equipped with an RWG 4-20 mA.
For this position transmitter, the monitoring of signal interruption is active.

Parameter 2 "Data code position transmitter"
Default value: 0
0: 0 to 100 percent, resolution is 1%
The value of the position transmitter is stated in byte 4 of the process representation input. Byte 3 is fixed to value 0. The set point is determined via byte 4 of the process representation output. Byte 3 has to be set to 0.
1: 0 to 1000 per mil, resolution is 0.1%
The value of the position transmitter is read with bytes 3 and 4 of the process representation input.
The set point is determined via bytes 3 (high byte) and 4 (low byte) of the process representation output.

Parameter 3 "Reversing prevention in ms"
Default value: 200
lowest value: 100 (0.1s)
highest value: 1000 (1 s)
Parameter for setting of the pause time in between a change of direction.
If necessary, adjust the value to the mechanics to prevent destruction through a change of direction performed too fast.

Parameter 4 "Redundancy"
Default value: 0
0: no cable redundancy (only the first channel is used for communication).
1: cable redundancy switched on (first and second channel cabled) The watchdog must be activated, otherwise the parameter set is rejected by the DP slave.

Parameter 5 "Time for channel changing in 0.1 s"
Default value: 50
lowest value: 50 (5 s)
highest value: 6000 (10 min)
States the time after which the channel is changed if no net data are transmitted (no state 'Data Exchange' or DP-Fail-Safe). This parameter is only effective if the cable redundancy (parameter 4) is switched on.

Parameter 6 "Safety behaviour"
Default value: 0
0: Safety behaviour switched off (parameter 7,8,9 insignificant)
1: Simple safety behaviour switched on. A safety operation will only be started if a connection to the master (net data transmission) was already available.
2: Extended safety behaviour switched on.

If extended safety behaviour is switched on, a safety operation can be triggered immediately after the actuator is

switched on.

Safety operation on failure of connection (no status Data_Exchange or DP-Fail-Safe). The parameters set in the most recent connection also apply to the safety behaviour after an interruption in the supply voltage. If the parameter is set back to values 1 or 2, the watchdog must to be activated, otherwise the parameter set is rejected by the DP slave.

Parameter 7 "Time of initiation safety operation 0.1 s"
Default value: 30
lowest value: 0 (actuator reacts immediately)
highest value: 12000 (actuator reacts after 20 minutes)
Time of initiation for the safety operation in 0.1 s.
Indicates the down time of initiation of the net data transmission after which a safety operation will be started. If transmission is restored during this time no safety operation will be performed.

Parameter 8 "Safety operation"
Default value: 0
0: Actuator remains in its position.
1: Actuator runs CLOSE.
2: Actuator runs OPEN.
3 Actuator runs to the safety position (refer to parameter 9).
If no position transmitter is installed (Parameter 1 = 0), value 3 is not permitted. In this case the parameter set is rejected.

Parameter 9 "Safety position in per mil"
Default value: 0
lowest value: 0 end position CLOSED
highest value: 1000 end position OPEN
Actuator runs to the set safety position. This parameter is only effective if parameter 8 (safety operation) is set to value 3 and if parameter 6 (safety behaviour) is not 0.

Parameter 10 "Output speed safety operation percentage"
Default value: 100
lowest value: 0 (minimum output speed)
highest value: 100 (maximum output speed)
Running speed with which the safety position will be approached.
Only effective if parameter 8 (safety operation) and parameter 6 (safety behaviour) are not set to 0.

Detailed descriptions of the parameters 11 to 14 see subclause 10.2

Parameter 11 "Dead time positioner in 0.1 s"
Default value: 0
lowest value: 0 (actuator reacts immediately)
highest value: 600 (actuator delays reaction by 1 minute max.)
Indicates the time which has to be maintained between two motor starts. In case the controls issue a command before that time, the actuator delays reaction until dead time has expired.

It must be ensured via the controls that the maximum number of starts of the actuator is not exceeded.

Parameter 12 "Overrun direction OPEN in per mil"
Default value: 5
lowest value: 0 (no overrun in direction OPEN)
highest value: 100 (10 % overrun in direction OPEN)
The motor is switched off as soon as the distance between the actuator position and the nominal position arrives at this value. This is only valid for operations in direction OPEN. This parameter must be smaller than the value in parameter 14 (max. error in per mil).

Parameter 13 "Overrun direction CLOSE in per mil"
Default value: 5
lowest value: 0 (no overrun in direction CLOSE)

highest value: 100 (10 % overrun in direction CLOSE)
The motor is switched off as soon as the distance between the actuator position and the nominal position arrives at this value. This is only valid for operations in direction CLOSE. This parameter must be smaller than the value in parameter 14 (max. error in per mil).

Parameter 14 " max. error in per mil"
Default value: 10
lowest value: 1 (0.1% error).
highest value: 100 (10% error).
The actuator will only run if the deviation between the nominal position and the actual position is at least equal to this value. Corresponds to the outer dead zone. This parameter must be higher than the value in parameter 12 (overrun in direction OPEN) and parameter 13 (overrun in direction CLOSE).

The parameter must be set sufficiently high to ensure a stable function of the positioner. If the value is set too low, the actuator moves continuously within nominal value range, which leads to a reduction of life time of the actuator.

Parameter 15 "Proportional operation active"
Default value: 0
0: no soft start/ soft stop (proportional operation)
1: soft start/ soft stop (proportional operation)

Parameter 15 - 19 reserved for adjustable output speed actuators
Soft start/ soft stop is only possible together with adjustable output speed actuators (type AS, ASR and SARV). This parameter has no influence on non-output speed adjustable actuators.

Parameter 16 "Proport. range stop in per mil"
Default value: 100
lowest value: 0 (soft stop ineffective)
highest value: 1000 (soft stop over the whole travel)
Proportional range of the nominal position in per mil (soft stop). If the difference between nominal and actual actuator position is smaller than this value the running speed will decrease proportionally to the difference in nominal/ actual position. Through this the nominal position can be approached gently. Only effective if parameter 15 (proportional operation active) and parameter 1 (position transmitter) are not set to 0.

Parameter 17 "Stop speed in percent"
Default value: 0
lowest value: 0 (actuator moves to nominal position with min. speed)
highest value:100 (actuator moves to nominal position with max speed).
Running speed with which the nominal position will be approached. Only effective if parameter 15 (proportional operation active) and parameter 1 (position transmitter) are not set to 0.

Parameter 18 "Proport. range start in per mil"
Default value: 40
lowest value: 0 (soft start ineffective)
highest value: 1000 (soft start over the whole travel)
Proportional range of the start position in per mil (soft start) If the difference between start position and actual actuator position is smaller than this value the running speed will increase proportionally to the difference in nominal/ actual position. Through this the actuator leaves the start position 'gently'. Only effective if parameter 15 (proportional operation active) and parameter 1 (position transmitter) are not set to 0.

Parameter 19 "Starting speed in percent"
Default value: 50
lowest value: 0 (minimum starting speed)
highest value: 100 (maximum starting speed)
Running speed with which the start position will be departed. Only effective if parameter 15 (proportional operation active) and parameter 1 (position transmitter) are not set to 0.

Parameter 20 "Start analogue 2 in 0.1 mA" (in ST51xx actuators not available)
Default value: 0

lowest value: 0 (value for sensor with 0-20 mA output)
highest value: 150
Current at which the measuring range of input analogue 2 (option) begins. This value must be smaller than the value in parameter 21 (end analogue 2 in 0.1 mA). If the sensor is connected with 4..20 mA to analogue 2, the value must be set to 40.

Parameter 21 "End analogue 2 in 0.1 mA" (in ST51xx actuators not available)
Default value: 200
lowest value: 50
highest value: 200 (Value for sensor with 0-20 mA or 4-20 mA output)
Current at which the measuring range of input analogue 2 (option) ends. This value must be higher than the value in parameter 20 (start analogue 2 in 0.1 mA).

Parameter 22 "Code analogue 2" (in ST51xx actuators not available)
Default value: 0
0: 0 to 100 percent
1: 0 to 1000 per mil
2: 0 to 1023 (raw value of analogue-digital converter, not standardised)

Parameter 23 "Start analogue 3/4 in 0.1 mA" (in ST51xx actuators not available)
Default value: 0
lowest value: 0 (value for sensor with 0-20 mA output)
highest value: 150
Current at which the measuring range of input analogue 3/4 begins. This value must be smaller than the value in parameter 24 (end analogue 3/4). If the sensor is connected with 4..20 mA to analogue 3/4, the value must be set to 40.

Parameter 24 "End analogue 3/4 in 0.1 mA" (in ST51xx actuators not available)
Default value: 200
lowest value: 50
highest value: 200 (Value for sensor with 0-20 mA or 4-20 mA output)
Current at which the measuring range of input analogue 3/4 ends. This value must be higher than the value in parameter 23 (start analogue 3/4).

Parameter 25 "Code analogue 3/4" (in ST51xx actuators not available)
Default value: 0
0: 0 to 100 percent
1: 1 to 1000 per mil
2: 0 to 1023 (raw value of analogue-digital converter, not standardised)

Stepping mode increases the number of starts of the actuator. It must be ensured that the maximum number of starts are also not exceeded in stepping mode.

Parameter 26 "Stepping direction OPEN active":
Default value: 0
0: Stepping mode in direction OPEN switched off
1: Stepping mode in direction OPEN switched on
This parameter is only effective if parameter 1 (position transmitter) is not 0. Otherwise the parameter set will be rejected.

Parameter 27 "Stepping operating time OPEN in 0.1 s"
Default value: 10
lowest value: 1 (Actuator runs 0.1 s per stepping period)
highest value: 36000 (Actuator runs 1 hour per stepping period)
Stepping operating time direction OPEN in 0.1 s This parameter is only effective if parameter 26 (stepping direction OPEN active) is not 0.

Parameter 28 "Stepping pause time OPEN in 0.1 s"
Default value: 50
lowest value: 1 (Actuator stationary 0.1 s per stepping period)

highest value: 36000 (Actuator stationary 1 hour per stepping period)
Stepping pause time direction OPEN in 0.1 s This parameter is only effective if parameter 26 (stepping direction OPEN active) is not 0.

Parameter 29 "Stepping start OPEN in per mil"
Default value: 0
lowest value: 0 (stepping mode in direction OPEN starts at 0,
end position CLOSED)
highest value: 999
Start of stepping distance in direction OPEN. Indication of position in per mil This value must be smaller than the value in parameter 30 (stepping end OPEN in per mil). Otherwise the parameter set will be rejected. This parameter is only effective if parameter 26 (stepping direction OPEN active) is not 0.

Parameter 30 "Stepping end OPEN in per mil"
Default value: 1000
lowest value: 1
highest value: 1000 (Stepping mode in direction OPEN ends at position 1000 end position OPEN)
End of stepping distance in direction OPEN. Indication of position in per mil This value must be higher than the value in parameter 29 (stepping start OPEN in per mil). Otherwise the parameter set will be rejected. This parameter is only effective if parameter 26 (stepping direction OPEN active) is not 0.

Parameter 31 "Stepping direction CLOSE active"
Default value: 0
0: Stepping mode in direction CLOSE switched off
1: Stepping mode in direction CLOSE switched on
This parameter is only effective if parameter 1 (position transmitter) is not 0. Otherwise the parameter set will be rejected.

Parameter 32 "Stepping operating time CLOSE in 0.1 s"
Default value: 10
lowest value: 1 (Actuator runs 0.1 s per stepping period)
highest value: 36000 (Actuator runs 1 hour per stepping period)
Operating time for stepping mode in direction CLOSE. Indication in 0.1 seconds. This parameter is only effective if parameter 31 (stepping direction CLOSE active) is not 0.

Parameter 33 "Stepping pause time CLOSE in 0.1 s"
Default value: 50
lowest value: 1 (Actuator stationary 0.1 s per stepping period)
highest value: 36000 (Actuator stationary 1 hour per stepping period)
Pause time for stepping mode in direction CLOSE. Indication in 0.1 seconds This parameter is only effective if parameter 31 (stepping direction CLOSE active) is not 0. Otherwise the parameter set will be rejected.

Parameter 34 "Stepping start CLOSE in per mil"
Default value: 1000
lowest value: 1
highest value: 1000 (Stepping mode in direction CLOSE starts at position 1000, end position OPEN)
Start of stepping distance in direction CLOSE. Indication of position in per mil. This value must be higher than the value in parameter 35 (stepping end CLOSE in per mil). Otherwise the parameter set will be rejected. This parameter is only effective if parameter 31 (stepping direction CLOSE active) is not 0.

Parameter 35 "Stepping end CLOSE in per mil"
Default value: 0
lowest value: 0 (stepping mode in direction CLOSE ends at position
0, end position CLOSED)
highest value: 999
End of stepping distance in direction CLOSE. Indication of position in per mil. This value must be higher than the value in parameter 34 (stepping start CLOSE in per mil). This parameter is only effective if parameter 31 (step-ping direction CLOSE active) is not 0. Otherwise, the total parameter set will be rejected.

Parameters 36 to 50 are spare parameters.
They are reserved for extensions.
Default value: 0
Value range: 0 to 65535

8 Process representation input

Via the process representation input, the master (control) can read the state of the slave (actuator).

8.1 Process representation input (Default process representation)

Byte 1: Logical operation

Fault	Warning	Runs CLOSE	Runs OPEN	-	Is NOMINAL	Is CLOSED	Is OPEN
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Byte 2: Actuator switches

DSR	DÖL	WSR	WÖL	WSO	WSF	STE	TH
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Byte 3

Position transmitter high byte

Byte 4

Position transmitter low byte

Byte 5: Fault

-	CLEAR state	DSR-fault	DÖL-fault	STER-fault	Thermo-fault	Sel. Sw. not REMOTE	Incorrect command
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Byte 6: Warning

-	-	No reference operation	Hw-fault	Conn. fault pos transm.	Sig.inter. pos. transm.	Channel 2 active	Failure 24 V supply
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Byte 7: Physical operation

Local CLOSE	Local OPEN	REMOTE CLOSE	REMOTE OPEN	Stepping range entered	Step pause	Proportion. Operation	Revs. Prev./ dead time
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Byte 8: Options

-	Sig. int. cust. anal. 2	Sig. int. cust. anal. 1	-	Dig Input 3	Dig Input 2	Dig Input 1	Dig Input 0
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Byte 9

High byte First customer analogue input (Wiring diagram analogue 2)

Byte 10

Low byte First customer analogue input (Wiring diagram analogue 2)

Byte 11

High byte Second customer analogue input (Wiring diagram analogue 3/4)

Byte 12

Low byte Second customer analogue input (Wiring diagram analogue 3/4)

Byte 13

Spare

Byte 14

Spare

Byte 15

Spare

Byte 16

Spare

Important:

The Profibus DP Interface PCB is a development of the Werner Riester GmbH & Co. KG. Not all functions are supported in connection with RTK actuators Series ST51xx. In the following it is described which data bits will be used.

8.2 Process signification input

Byte 1: Logic run
Important signals from the actuator concerning errors, warnings, operations:

Bit	Designation	Value	Description
0	**Is OPEN** Limit seating in end position OPEN	1	1 Limit switch in OPEN direction operated.
		0	otherwise
1	**Is CLOSED** Limit seating in end position CLOSED	1	Limit switch in CLOSE direction operated.
		0	otherwise
	Is CLOSED Torque seating in end position CLOSED	1	Torque switch and limit switch in direction CLOSE operated.
		0	otherwise
2	**Is NOMINAL**	1	Nominal value position is within max. error variable (outer dead band). Signal occurs only if PROFIBUS master has set nominal operation
		0	otherwise
3	Not used		Reserved for extensions
4	**Runs OPEN**	1	Run command (OPEN or NOMINAL) from PROFIBUS in direction OPEN is executed. For operation in stepping mode, this signal is also active during an off-time, the dead time and the reversing prevention.
		0	No operation is carried out via the PROFIBUS.
5	**Runs CLOSE**	1	Run command (CLOSE or NOMINAL) from PROFIBUS in direction CLOSE is executed. For operation in stepping mode, this signal is also active during an off-time, the dead time and the reversing prevention.
		0	No operation is carried out via the PROFIBUS.
6	**Warning**	1	One or several warnings have been given (at least one bit set in warning-byte)
		0	No warnings are active (all bits cancelled in warning byte).
7	**Faults**	1	One or several faults have occurred so that the actuator can no longer be controlled via PROFIBUS (at least one bit set in fault-byte).
		0	No faults are active (all bits cancelled in fault-byte).

Byte 2: Actuator switch
Basic signals originating from the logic

Bit	Designation	Value	Description
0	**Th (not used in ST51xx actuators)**	1	A thermal fault (motor thermal protection) has occurred.
		0	No thermal fault has occurred.
1	1 **STE (power failure)**	1	A power failure has occurred: Phase failure
		0	No power failure has occurred.
2	**Selector sw REMOTE**	1	Selector switch in position REMOTE.
		0	Selector switch not in position REMOTE.
3	**Selector sw. LOCAL** .	1	Selector switch in position LOCAL
		0	Selector switch not in position LOCAL.

4	**WÖL**	1	Limit switch OPEN left operated.
		0	Limit switch OPEN left not operated.
5	**LSC (WSR)**	1	Limit switch CLOSE right active.
		0	Limit switch CLOSE right not active.
6	**DÖL**	1	Torque switch OPEN left operated (storing).
		0	Torque switch OPEN left not operated.

Byte 3: Position transmitter high byte
Position of actuator

Condition	Value
Parameter 2 (data code from position transmitter) = 0	Value without effect
Parameter 2 (data code from position transmitter) = 1	High byte of value 0..1000

Byte 4: Position transmitter low byte
Position of actuator, complete value or low byte

Condition	Value
Parameter 2 (data code from position transmitter) = 0	Range 0..100
Parameter 2 (data code from position transmitter) = 1	Low byte of value 0..1000

Byte 5: Fault
(not ready for remote operation if bit 7 of byte 1 is set)

Bit	Value	Description
0	1	Incorrect command: A bit combination was issued which cannot be executed more than one operation bit (OPEN, CLOSE, NOMINAL) set at the same time, nominal value outside value range 0.. 100 or 0.. 1000 or nominal operation before reference operation.
	0	otherwise
1	1	Selector switch not in position REMOTE.
	0	otherwise
2	1	Thermo fault (motor protection tripped). **(not used in ST51xx actuators)**
	0	otherwise
3	1	Power failure, phase failure: incorrect phase sequence.
	0	otherwise
4	1	DÖL fault: Unexpected torque in direction OPEN..
	0	otherwise
5	1	DSR-fault: Unexpected torque in direction CLOSE.
	0	otherwise
6	1	Slave is in CLEAR state
	0	Slave is in OPERATE state.

Bit 7 is not used (reserved for extensions).

Byte 6: Warning
(bit 6 of byte 1 set):

Bit	Value	Description
0	1	Power failure 24 V power supply
	0	otherwise
	1	Channel 2 active

1	0	otherwise
2	1	Signal interrupted at position transmitter RWG: For recognition the parameter 1 must be set to value 3 (RWG 4-20 mA).
	0	otherwise
3	1	Potentiometer fault: for end position CLOSED highest value is signali-sed, for end position OPEN lowest value.
	0	otherwise
4	1	Hardware fault: If this bit is set the PROFIBUS board must be checked.
	0	otherwise
5	1	No reference operation: The values of the position transmitter cannot be used as long as the reference operation (end position OPEN, end position CLOSED) has not been performed. A nominal operation is not possible.
	0	otherwise

Bits 6 and bit 7 are not used (reserved for extensions).

Byte 7: Physical operation

Bit	Value	Description
0	1	Reversing prevention/ dead time warning. The actuator does not start when reversing prevention or dead time is still active. The bit is set if a run command is available which cannot be executed immediately. The bit is cancelled as soon as the actuator starts.
	0	otherwise
1	1	Proportional section reached (soft start or soft stop) **(not used in ST51xx actuators)**
	0	otherwise
2	1	Step pause
	0	otherwise
3	1	Stepping range reached: Position transmitter is within stepping range. Conditions: Position transmitter is provided, stepping mode is active, remote operation performed
	0	otherwise
4	1	Remote operation via PROFIBUS in direction OPEN (remote operation bit for logic board set and movement of potentiometer detected). Signalling of this bit requires a position transmitter.
	0	otherwise
5	1	Remote operation via PROFIBUS in direction CLOSE (remote operation bit for logic board set and movement of potentiometer detected). Signalling of this bit requires a position transmitter.
	0	otherwise
6	1	Actuator runs locally in direction OPEN (local control or handwheel). Signalling of this bit requires a position transmitter.
	0	otherwise
7	1	Actuator runs locally in direction CLOSE (local control or handwheel). Signalling of this bit requires a position transmitter.
	0	otherwise

Byte 8: Options
Digital inputs and signal interruption at analogue inputs

Bit	Value	Description
0	1	Digital input no. 1 = 1 (switch closed) **(not used in ST51xx actuators)**
	0	Digital input no. 1 = 0 (switch open) **(not used in ST51xx actuators)**
1	1	Digital input no. 2 = 1 (switch closed) **(not used in ST51xx actuators)**
	0	Digital input no. 2 = 0 (switch open) **(not used in ST51xx actuators)**
2	1	Digital input no. 3 = 1 (switch closed) **(not used in ST51xx actuators**
	0	Digital input no. 3 = 0 (switch open) **(not used in ST51xx actuators)**
3	1	Digital input no. 4 = 1 (switch closed) **(not used in ST51xx actuators**
	0	Digital input no. 4 = 0 (switch open) **(not used in ST51xx actuators)**
5	1	Signal interrupted at analogue input 2 (first free analogue input) i.e. the measured value is more than 0.2 mA lower than the set minimum value. **(not used in ST51xx actuators)**
	0	no signal interruption analogue input 2 detected **(not used in ST51xx actuators)**
6	1	Signal interrupted at analogue input 3/4 (second free analogue input) i.e. the measured value is more than 0.2 mA lower than the set mini-mum value.
	0	no signal interruption analogue input 3/4 detected **(not used in ST51xx actuators)**

Bits 4 and bit 7 are not used (reserved for extensions).

Byte 9: High byte first analogue customer input (wiring diagram designation analogue 2) (not used in ST51xx actuators)

Byte 10: Low byte first analogue customer input (wiring diagram designation analogue 2) (not used in ST51xx actuators)

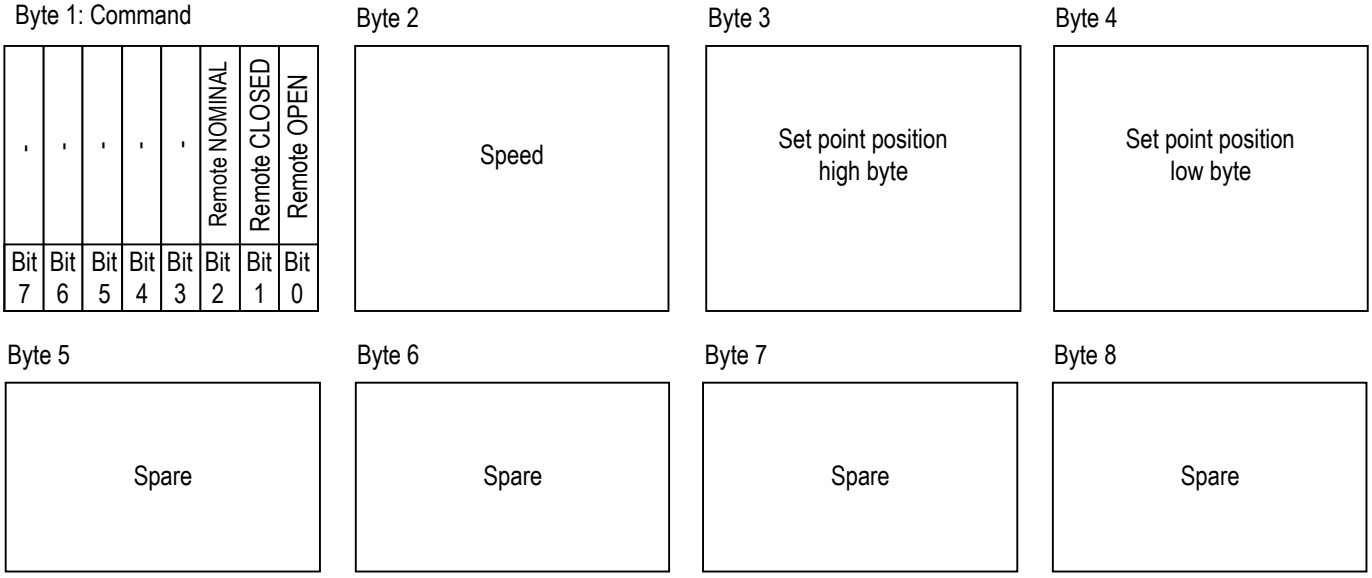
Byte 11: High byte second analogue customer input (wiring diagram designation analogue 3/4) (not used in ST51xx actuators)

Byte 12: Low byte second analogue customer input (wiring diagram designation analogue 3/4) (not used in ST51xx actuators)

Byte 13 to 16: reserved for extensions

9 Process representation output

Via the process representation output, the master (control) can control the slave (actuator).



Only one operation bit may be set at any given time. If several operation bits are set at the same time, the actuator stops and signals the fault "wrong command"

Byte 1: Commands
Operation bits and digital outputs

Bit	Designation	Value	Description
0	**Remote OPEN**	1	Run OPEN
		0	Do not Run OPEN
1	**Remote CLOSED**	1	Run CLOSE
		0	Do not Run CLOSE
2	**Remote NOMINAL**	1	Run to nominal value Can only be set if position transmitter (potentiometer / RWG (options)) is available.
		0	Do not run to nominal value

Bits 3-7 are reserved for extensions and must be set to 0.

Byte 2: Nominal output speed: **This byte is not used in ST51xx actuators**
Value range: 0..100:
Minimum speed: 0 (actuator runs with min. set output speed)
Maximum output speed: 100 (actuator runs with max. set output speed)

Byte 3: Set point (position) high byte

Conditions	Values
Parameter 2 (data code from position transmitter) = 0	This byte must be set to 0.
Parameter 2 (data code from position transmitter) = 1	This byte states the higher value part (High byte) of the nominal value.

Byte 4: Set point (position) low byte

Conditions	Values
Parameter 2 (data code from position transmitter) = 0	Range 0..100
Parameter 2 (data code from position transmitter) = 1	This byte states the lower value part (Low byte) of the nominal value.

Byte 5 to 8: reserved for extensions, must be set to 0.

10 Description of actuator functions

10.1 Operation commands for OPEN / CLOSE operation

Operation commands are determined by operation command bits and the nominal value (set point) of the DP process representation input. Only one command bit may be set at any given time. If several command bits are set, no operation is performed and the fault signal 'incorrect command' is given. To avoid placing too much strain on the mechanics the actuator is equipped with a (programmable) delay when changing direction (reversing prevention).
The following operation command bits are required for OPEN / CLOSE operation:
Remote OPEN
Remote CLOSE

Remote operation OPEN / STOP
Remote OPEN = 1 The actuator runs in direction OPEN.
Remote OPEN = 0 The actuator stops.
The actuator is switched off automatically when the final position OPEN is reached (limit switch LSO (WÖL) set). Faults (thermal protection, power failure, torque) stop the operation.

Remote operation CLOSE / STOP
Remote CLOSE = 1 The actuator runs to position CLOSED.
Remote CLOSE = 0 The actuator stops.
The actuator is switched off automatically if the final position CLOSED is reached (limit switch LSC (WSR) for limit seating or LSC (WSR) and TSC (DSR) for torque seating). Faults (thermal protection, power failure, torque) stop the operation.

Remote operation to nominal position (NOMINAL) / STOP
The positioner can only function when the actuator is equipped with a position transmitter, e.g. potentiometer / RWG (option).

Remote NOMINAL = 1 The actuator moves to the set nominal value.
Remote NOMINAL = 0 The actuator stops.
The nominal position can be set in % or in ‰. To switch from percent to per mil use parameter 2 (Data code from position transmitter). Faults (thermal protection, power failure, torque) halt the operation via the positioner. With a set point of 0 % or 0 ‰ the actuator runs to the end position CLO-SED With a set point of 100 % or 1000 ‰ the actuator runs to the end position OPEN In case the set point is more than 100 % or 1000 ‰ , no operation is performed

10.2 Positioner

The positioner is activated via the bit 'Remote Nominal'. The positioner is a three-position-controller. Via the 'NOMINAL' position in the process representation input, the nominal value of the position is transmitted cyclically to the actuator as nominal variable (cycle time = bus cycle time DP). The positioner integrated in the controls BS4581 provides the position signal for controlling the motor depending on the nominal and actual position value. The feedback signal (actual value of actuator position) is produced internally within the actuator. The position transmitter compares the nominal value of the position set in the controls to the locally measured actual value of the position. If the difference between nominal value and actual value is higher than the max. error (parameter 14), the positioner drives the motor, depending on the error, either in direction OPEN or direction CLOSE.

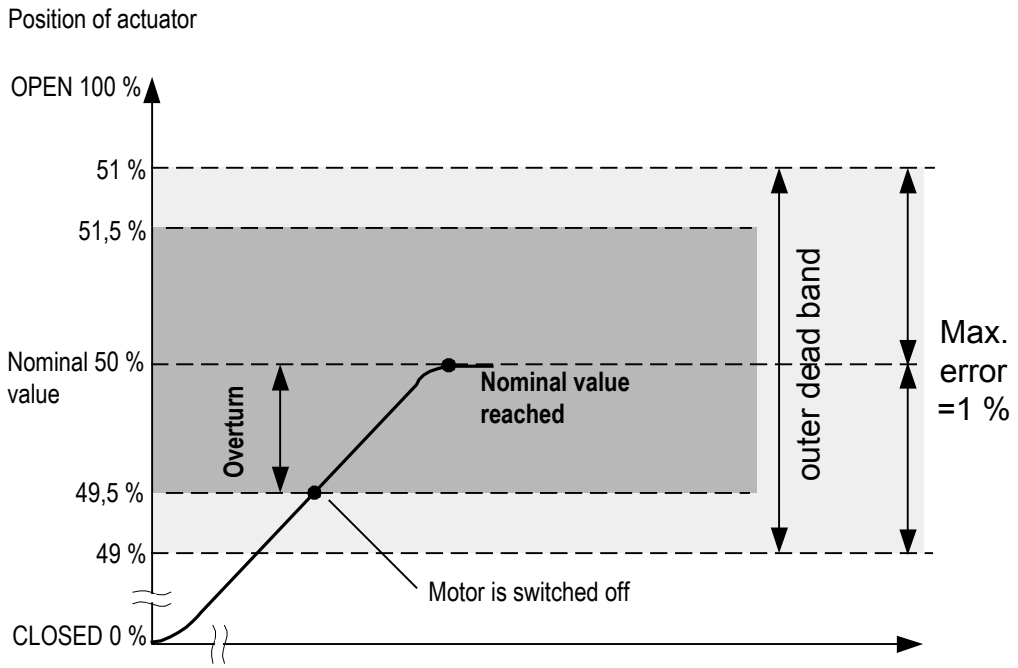


Figure D: Modulating duty: Nominal operation after 50 %

Overrun (inner dead band)
The inner dead band determines the switching-off point of the actuator. The tripping point in both directions can be set via the parameters 12 and 13 (page 18), so that the actuator stops as close as possible to the nominal value.

Max. error (outer dead band)
The outer dead band determines the switching-on point of the actuator. If the error or a change in nominal value is higher than the max. error set with parameter 14 (page 10), the motor is started.
The parameter must be set sufficiently high to ensure a stable function of the positioner. If the value is set too low, the number of starts is likely to be too high. Thus, the end of the lifetime of the actuator and valve will be reached sooner.

Dead time (t-off)
The dead time prevents the operation to a new nominal position within a pre-determined time. The time can be between 0 and 1 minute and is set in parameter 11.
It must be ensured via the controls that the maximum number of starts of the actuator is not exceeded. This can be achieved by setting the parameter 11 to a sufficiently high value.

10.3 Stepping mode

Stepping mode requires a position transmitter (option).The stepping mode slows down the operating time for a part or all of the travel.

Setting of operation and pause times
The operation and pause times (stepping times) in opening or closing direction are set with the parameters 27 to 33. An individual operation and pause time can be set for each direction.

Indication of operation in stepping mode
The states of the operation in stepping mode are indicated by the bits 2 and 3 in byte 7 of the process representation output.

11 Safety function

The safety function permits the start of emergency operations in case of special events, e.g. when communication between the actuator and the master is interrupted. This function is set with the parameters 6 to 10. The safety function can only be set off when the watchdog function is activated in the master. When the actuator is in safety mode, it tries to reach the set safety position by performing an electrical operation. If the actuator is afterwards moved from the safety position (e.g. by manual operation) it independently tries to reach the safety position again when in local control setting 'Remote'.
The following events can trigger the safety mode:

- The connection to the master is interrupted.
- The master goes into Clear state and sends:

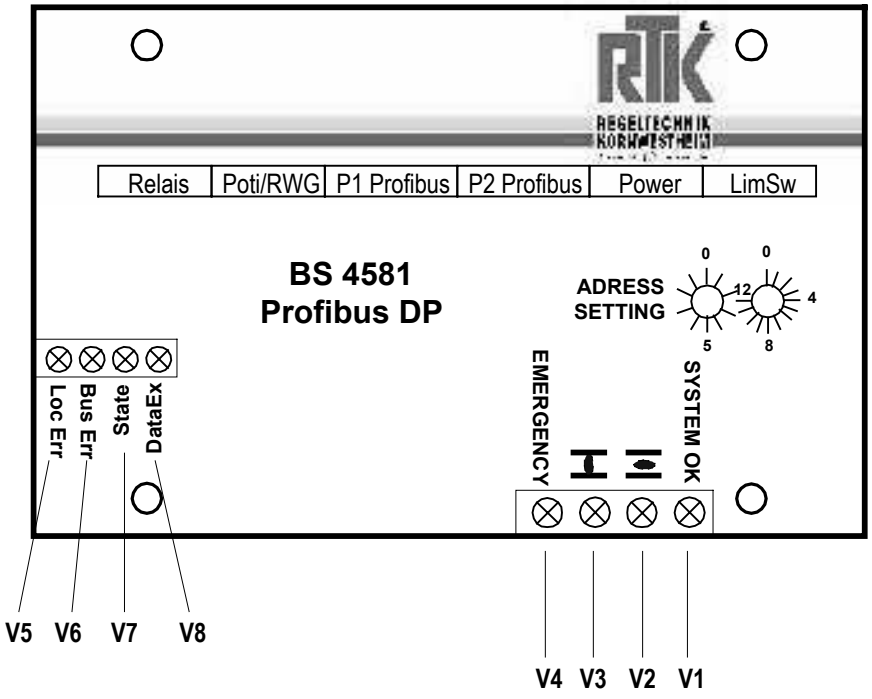
Either a) global control telegrams with the content Clear.
or b) data telegrams of the length 0 (DP fail safe mode).

As soon as the cause for triggering the safety mode is eliminated (connection restored, master in state Operate), the run commands from the master can again be executed.

12 Trouble shooting and corrective actions

12.1 Optical signals during operation

Figure E: PROFIBUS-DP board



LED 'SYSTEM OK' (V1) This LED shows the correct voltage supply to the PROFIBUS DP board. Is continuously illuminated: Power supply available at PROFIBUS-DP board. is blinking: No Eprom used or Eprom defective. Is not illuminated: No voltage at the DP board.

LED (V2) This LED indicates a run command in direction OPEN. Is continuously illuminated: Run command in direction OPEN is being executed. Is not illuminated: No run command in direction OPEN active.

LED (V3) This LED indicates a run command in direction CLOSE. Is continuously illuminated: Run command in direction CLOSE is being executed. Is not illuminated: No run command in direction CLOSE active.

LED 'LocErr' (V5)

This LED indicates local faults in the actuator. A fault with higher blinking frequency is more serious than a fault with lower blinking frequency.
Blinking once: TH fault (Thermo fault) actuator has stopped, motor overheating (motor protection**).**
Blinking twice: STE fault (electrical fault) phase failure
Blinking 3 times: DÖL fault (torque switch opening left) Unexpected torque in direction OPEN.
Blinking 4 times: DSR fault (torque switch closing right) Unexpected torque in direction CLOSE.
Blinking 5 times: Supply voltage failure (24V) Supply voltage of the PROFIBUS-DP board higher than 30 V or lower than 18 V.
Blinking 6 times: Slave is in CLEAR state

LED 'Data Ex' (V8)

When LED is illuminated, the PROFIBUS-DP board has entered 'Data Ex-change' state. Only in this state the actuator can be controlled by the DP master and the state of actuator can be read.

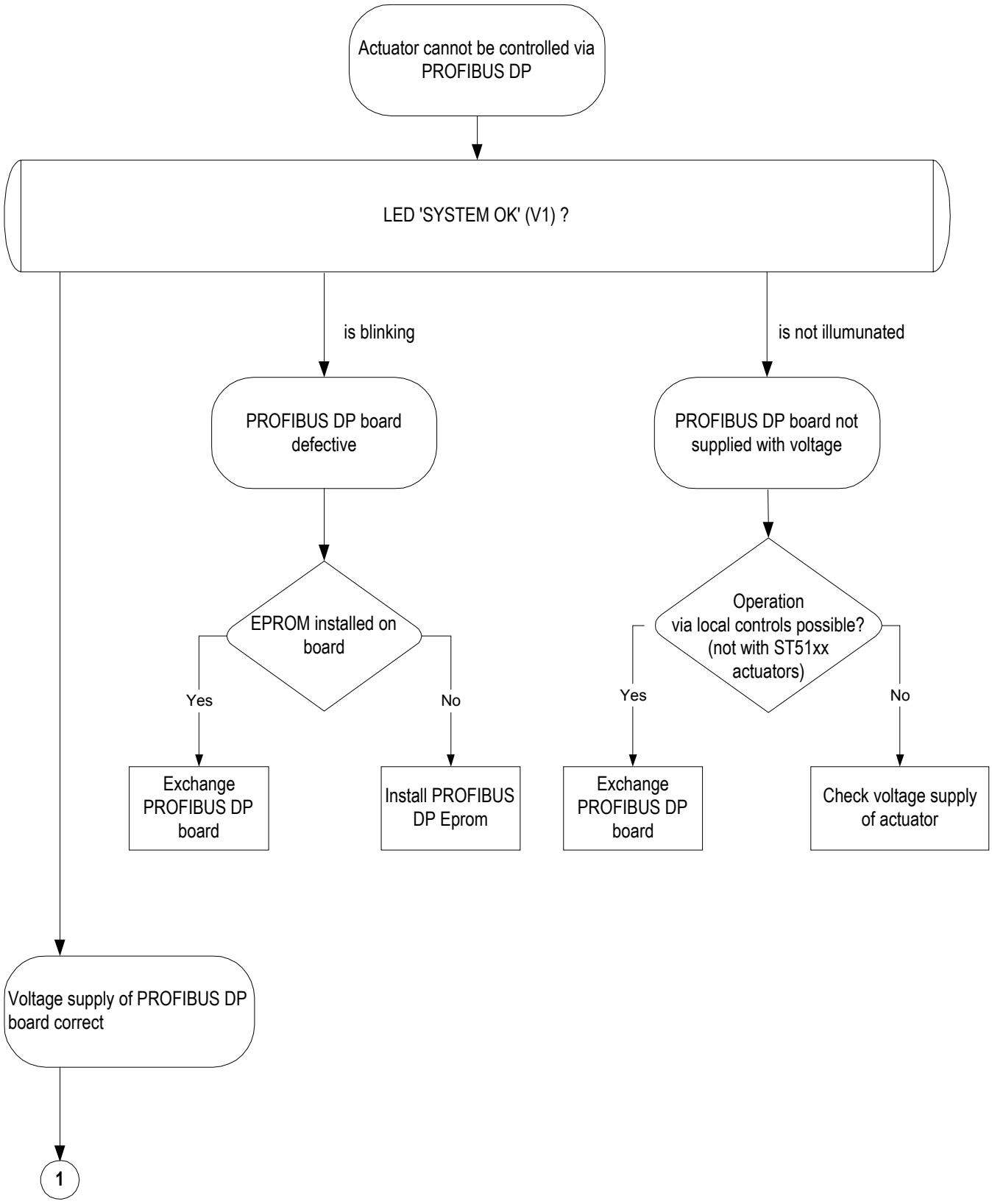
LED 'State' (V7)

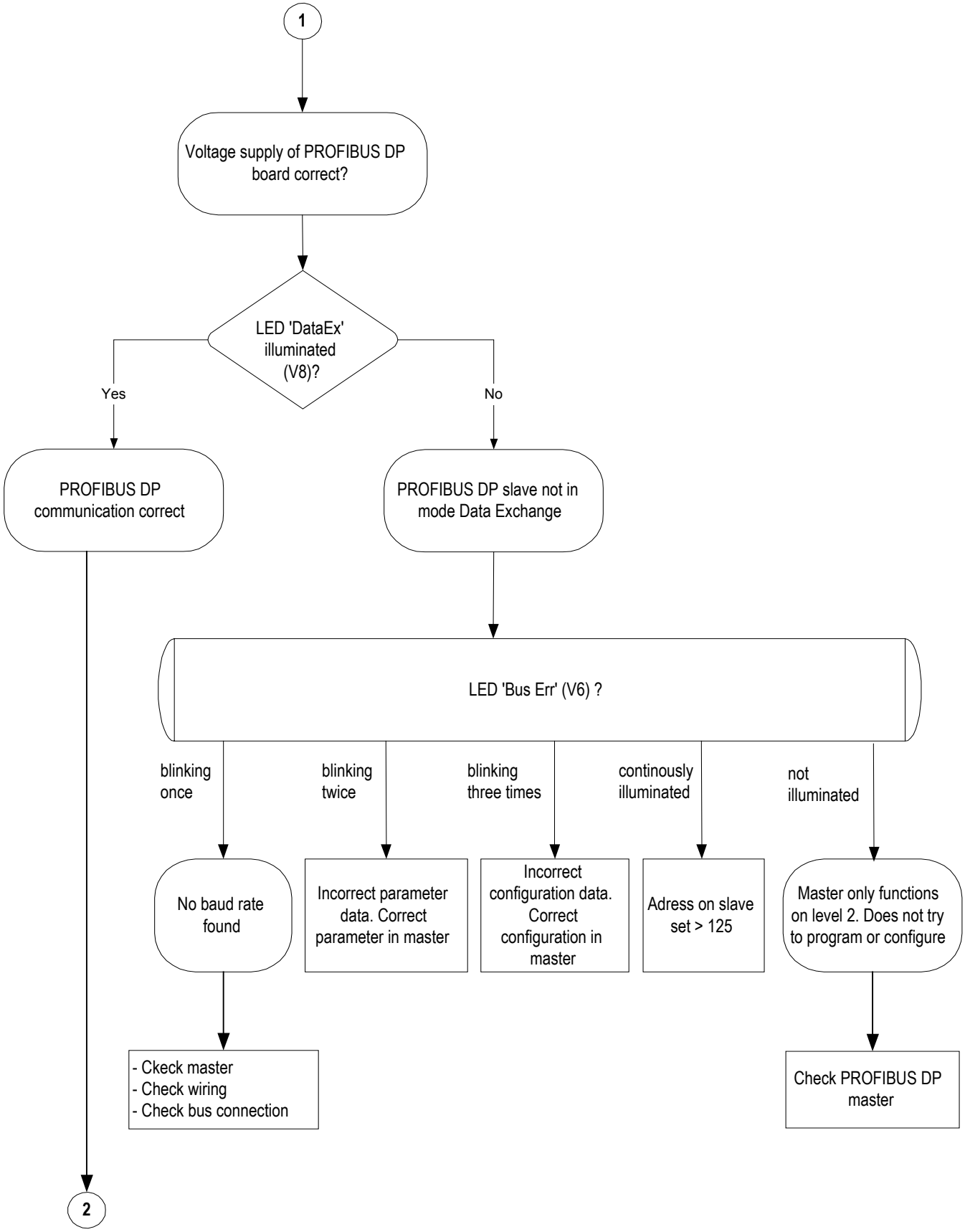
Is illuminated or not illuminated: PROFIBUS-DP board is not ready
Blinking once: Program on the PROFIBUS-DP board is being executed.
Blinking twice: Actuator is in safety mode.
Regular blinking of the LED during operation indicates correct operation of the DP board.

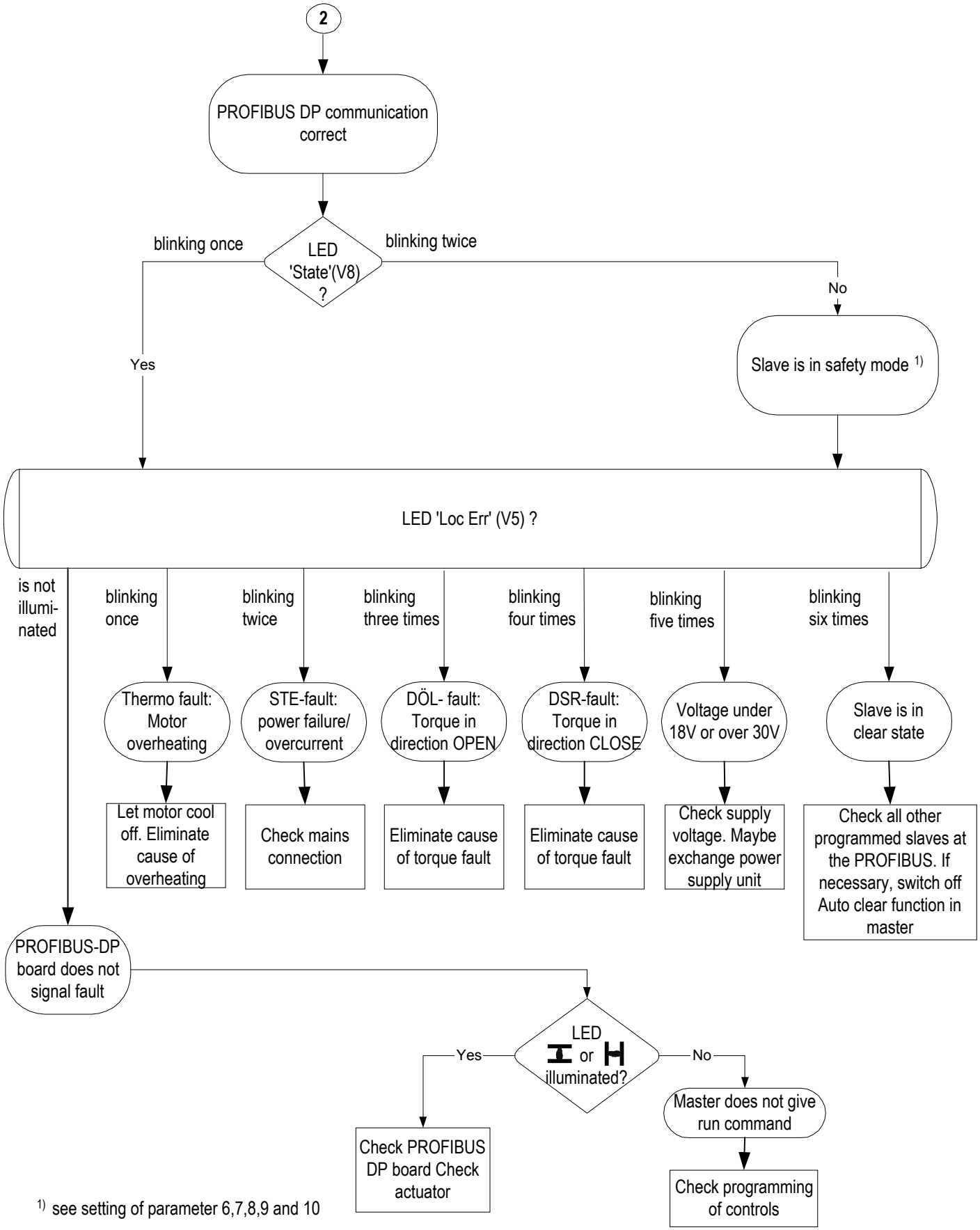
LED 'BusErr' (V6)

This LED shows bus related faults. A fault with higher blinking frequency is more serious than a fault with lower blinking frequency, continual illumination covers all blinking signals. Is continuously illuminated: Invalid address (higher than 125) set.
Blinking once: No baudrate on bus.
Blinking twice: Incorrect parameter data.
Blinking 3 times: Incorrect configuration data.

12.2 Actuator can not be controlled by PROFIBUS DP




1
Voltage supply of PROFIBUS DP board correct?
LED 'DataEx' illuminated (V8)?
Yes
No
PROFIBUS DP communication correct
PROFIBUS DP slave not in mode Data Exchange
LED 'Bus Err' (V6) ?
blinking once
blinking twice
blinking three times
continously illuminated
not illuminated
No baud rate found
Incorrect parameter data. Correct parameter in master
Incorrect configuration data. Correct configuration in master
Adress on slave set > 125
Master only functions on level 2. Does not try to program or configure
- Ckeck master
- Check wiring
- Check bus connection
Check PROFIBUS DP master
2



1) see setting of parameter 6,7,8,9 and 10

12.3 Position feedback does not function

Check if the voltage at terminal (61 (-)and 62 (+)) on the BS 4581 PROFIBUS-DP board, rises linearly when driving to OPEN and falls linearly when driving to CLOSED. The value for position CLOSED should be in the range 0 to 2 V. The value for position OPEN should be in the range 3 to 5 V. The voltage difference between CLOSED and OPEN should be over 3 V.

12.4 Measuring of the PROFIBUS signals with an oscilloscope

On the PROFIBUS board the signal from PROFIBUS channel 1 pin (A) and pin (B) can be checked with a digital oscilloscope.
The off-load voltage between pin A (+) and pin B (-) must be positive and in the range between 0.8 V and 1.4 V.

13 Appendix A GSD file

```
#Profibus_DP
GSD_Revision = 1
;
;
Vendor_Name = “RTK GmbH”
Model_Name = “BS4581”
Revision = “BS4581/1”
Ident_Number = 0x0732
;
Protocol_Ident = 0
Station_Type = 0
FMS_Supp = 0
Hardware_Release = “Z023.241"
Software_Release = “K100DX, Z025.683/01-01"
;
9.6_supp = 1
19.2_supp = 1
45.45_supp = 1
93.75_supp = 1
187.5_supp = 1
500_supp = 1
1.5M_supp = 1
;
MaxTsdr_9.6 = 60
MaxTsdr_19.2 = 60
MaxTsdr_45.45 = 250
MaxTsdr_93.75 = 60
MaxTsdr_187.5 = 60
MaxTsdr_500 = 100
MaxTsdr_1.5M = 150
;
Redundancy = 1
Repeater_Ctrl_Sig = 0
24V_Pins = 0
Freeze_Mode_Supp = 1
Sync_Mode_Supp = 1
Auto_Baud_supp = 1
Set_Slave_Add_supp = 0
Slave_Family = 0
Fail_Safe = 1
Implementation_Type= “SPC3"
Bitmap_Device = “RTK”
```

```
;
User_Prm_Data_Len = 100
;
User_Prm_Data = \
0x00, 0x01, \
0x00, 0x00, \
0x00, 0xC8, \
0x00, 0x00, \
0x00, 0x32, \
0x00, 0x00, \
0x00, 0x1E, \
0x00, 0x00, \
0x00, 0x00, \
0x00, 0x64, \
0x00, 0x00, \
0x00, 0x05, \
0x00, 0x05, \
0x00, 0x0A, \
0x00, 0x00, \
0x00, 0x00, \
0x00, 0x28, \
0x00, 0x32, \
0x00, 0x00, \
0x00, 0xC8, \
0x00, 0x00, \
0x00, 0x00, \
0x00, 0xC8, \
0x00, 0x00, \
0x00, 0x00, \
0x00, 0x0A, \
0x00, 0x32, \
0x00, 0x00, \
0x03, 0xE8, \
0x00, 0x00, \
0x00, 0x0A, \
0x00, 0x32, \
0x03, 0xE8, \
0x00, 0x00, \
0x00, 0x00, \
0x00, 0x00
```

```
Modular_Station = 1
Max_Module = 1
Max_Input_Len = 20
Max_Output_Len = 12
Max_Data_Len = 32
Max_Diag_Data_Len = 6
;
Module = “1 Byte Input, 1 Byte Output” 0x10, 0x20
EndModule
;
Module = “4 Byte In, 4 Byte Out,consistent” 0x93, 0xA3
EndModule
;
Module = “8 Byte In, 4 Byte Out,consistent” 0x97, 0xA3
EndModule
;
Module = “12 Byte In,4 Byte Out,consistent” 0x9B, 0xA3
EndModule
;
Module = “16 Byte In,8 Byte Out,consistent” 0x9F, 0xA7
EndModule
;
Module = “16 Byte In, 8 Byte Out” 0x1F, 0x27
EndModule
;
; Here the new configuration start, which only work
; for Eprom version Z025.683/01-01 and later.
; The following configurations DO NOT work
; with the Eprom version K10000x.DX.000!

Module = “4 byte in, 4 byte out” 0x13, 0x23
EndModule
;
Module = “8 byte in, 4 byte out” 0x17, 0x23
EndModule
;
Module = “12 byte in, 4 byte out” 0x1B, 0x23
EndModule
;
Module = “2 Byte In, 1 Byte Out,consistent” 0x91, 0x20
EndModule
;
Module = “2 byte in, 1 byte out” 0x11, 0x20
EndModule
;
Module = “2 Byte In, 2 Byte Out,consistent” 0x91, 0xA1
EndModule
;
Module = “2 byte in, 2 byte out” 0x11, 0x21
EndModule
;
Module = “6 Byte In, 1 Byte Out,consistent” 0x95, 0x20
EndModule
;
Module = “6 byte in, 1 byte out” 0x15, 0x20
EndModule
```

```
;
Module = “6 Byte In, 2 Byte Out,consistent” 0x95, 0xA1
EndModule
;
Module = “6 byte in, 2 byte out” 0x15, 0x21
EndModule
;
Module = “6 Byte In, 4 Byte Out,consistent” 0x95, 0xA3
EndModule
;
Module = “6 byte in, 4 byte out” 0x15, 0x23
EndModule
;
;
; Prm-Text-Def-List:
;
PrmText = 1
Text(0) = “no position transm. available”
Text(1) = “potentiometer”
Text(2) = “0-20 mA position transmitter”
Text(3) = “4-20 mA position transmitter”
EndPrmText
;
PrmText = 2
Text(0) = “0 to 100 per cent”
Text(1) = “0 to 1000 per mil”
EndPrmText
;
PrmText = 3
Text(0) = “off”
Text(1) = “simple safety”
Text(2) = “enlarged security”
EndPrmText
;
PrmText = 4
Text(0) = “No”
Text(1) = “Yes”
EndPrmText
;
PrmText = 5
Text(1) = “actuator running Close”
Text(2) = “actuator running Open”
Text(3) = “actuator running to nominal position”
EndPrmText
;
PrmText = 6
Text(0) = “0 to 100 percent”
Text(1) = “0 to 1000 per mil”
Text(2) = “0 to 1023 raw value A/D converter”
EndPrmText
;
; Ext-User-Prm-Data-Def-List:
;
; User_Prm_Data_Definition 1
ExtUserPrmData = 1 “position transmitter”
Unsigned16 1 0-3
```

```
Prm_Text_Ref = 1
EndExtUserPrmData
;
; User_Prm_Data_Definition 2
ExtUserPrmData = 2 “data code position transmitter”
Unsigned16 0 0-1
Prm_Text_Ref = 2
EndExtUserPrmData
;
; User_Prm_Data_Definition 3
ExtUserPrmData = 3 “ reversing prevention in ms”
Unsigned16 200 100-1000
EndExtUserPrmData
;
; User_Prm_Data_Definition 4
ExtUserPrmData = 4 “redundancy”
Unsigned16 0 0-1
Prm_Text_Ref = 4
EndExtUserPrmData
;
; User_Prm_Data_Definition 5
ExtUserPrmData = 5 ‘time for channel changing in 0.1 s’:
Unsigned16 50 50-6000
EndExtUserPrmData
;
; User_Prm_Data_Definition 6
ExtUserPrmData = 6 “safety behaviour”
Unsigned16 0 0-2
Prm_Text_Ref = 3
EndExtUserPrmData
;
; User_Prm_Data_Definition 7
ExtUserPrmData = 7 “time of initiation safety operation 0.1 s”:
Unsigned16 30 0-12000
EndExtUserPrmData
;
; User_Prm_Data_Definition 8
ExtUserPrmData = 8 “safety behaviour”
Unsigned16 0 0-3
Prm_Text_Ref = 5
EndExtUserPrmData
;
; User_Prm_Data_Definition 9
ExtUserPrmData = 9 “safety position in per mil”
Unsigned16 0 0-1000
EndExtUserPrmData
;
; User_Prm_Data_Definition 10
ExtUserPrmData = 10 “output speed safety operation percentage”
Unsigned16 100 0-100
;
; User_Prm_Data_Definition 11
ExtUserPrmData = 11 “dead time positioner in 0.1 s”:
Unsigned16 0 0-600
EndExtUserPrmData
;
```

```
; User_Prm_Data_Definition 12
ExtUserPrmData = 12 “overrun dir. OPEN in per mil”:
Unsigned16 5 0-99
EndExtUserPrmData
;
; User_Prm_Data_Definition 13
ExtUserPrmData = 13 “overrun dir. CLOSE in per mil”:
Unsigned16 5 0-99
EndExtUserPrmData
;
; User_Prm_Data_Definition 14
ExtUserPrmData = 14 “max. error in per mil”
Unsigned16 10 1-100
EndExtUserPrmData
;
; User_Prm_Data_Definition 15
ExtUserPrmData = 15 “proportional operation active”
Unsigned16 0 0-1
Prm_Text_Ref = 4
EndExtUserPrmData
;
; User_Prm_Data_Definition 16
ExtUserPrmData = 16 “proport. range stop in per mil”
Unsigned16 100 0-1000
EndExtUserPrmData
;
; User_Prm_Data_Definition 17
ExtUserPrmData = 17 “stop speed in percent”
Unsigned16 0 0-100
EndExtUserPrmData
;
; User_Prm_Data_Definition 18
ExtUserPrmData = 18 “proport. range stop in per mil”
Unsigned16 40 0-1000
EndExtUserPrmData
;
; User_Prm_Data_Definition 19
ExtUserPrmData = 19 “starting speed in percent”
Unsigned16 50 0-100
EndExtUserPrmData
;
; User_Prm_Data_Definition 20
ExtUserPrmData = 20 “start analogue 2 in 0.1 mA”:
Unsigned16 0 0-150
EndExtUserPrmData
;
; User_Prm_Data_Definition 21
ExtUserPrmData = 21 “end analogue 2 in 0.1 mA”:
Unsigned16 200 50-200
EndExtUserPrmData
;
; User_Prm_Data_Definition 22
ExtUserPrmData = “code analogue 2"
Unsigned16 0 0-2
Prm_Text_Ref = 6
EndExtUserPrmData
```

```
;
; User_Prm_Data_Definition 23
ExtUserPrmData = 23 “start analogue 3/4 in 0.1 mA”:
Unsigned16 0 0-150
;
; User_Prm_Data_Definition 24
ExtUserPrmData = 24 “start analogue 3/4 in 0.1 mA”:
Unsigned16 200 50-200
EndExtUserPrmData
;
; User_Prm_Data_Definition 25
ExtUserPrmData = “code analogue 3/4"
Unsigned16 0 0-2
Prm_Text_Ref = 6
EndExtUserPrmData
;
; User_Prm_Data_Definition 26
ExtUserPrmData = 26 ‘stepping direction OPEN active’:
Unsigned16 0 0-1
Prm_Text_Ref = 4
EndExtUserPrmData
;
; User_Prm_Data_Definition 27
ExtUserPrmData = 27 “step. operat. time OPEN in 0.1 s”:
Unsigned16 10 1-36000
EndExtUserPrmData
;
; User_Prm_Data_Definition 28
ExtUserPrmData = 28 “stepping pause time OPEN in 0.1 s”:
Unsigned16 50 1-36000
EndExtUserPrmData
;
; User_Prm_Data_Definition 29
ExtUserPrmData = 29 ‘stepping start OPEN in per mil’
Unsigned16 0 0-999
EndExtUserPrmData
;
; User_Prm_Data_Definition 30
ExtUserPrmData = 30 ‘stepping end OPEN in per mil’
Unsigned16 1000 1-1000
EndExtUserPrmData
;
; User_Prm_Data_Definition 31
ExtUserPrmData = 31 ‘stepping direction CLOSE active’:
Unsigned16 0 0-1
Prm_Text_Ref = 4
EndExtUserPrmData
;
; User_Prm_Data_Definition 32
ExtUserPrmData = 32 “stepping operating time CLOSE in 0.1 s”:
Unsigned16 10 1-36000
EndExtUserPrmData
;
; User_Prm_Data_Definition 33
ExtUserPrmData = 33 “stepping pause time CLOSE in 0.1 s”:
Unsigned16 50 1-36000
```

```
EndExtUserPrmData
;
; User_Prm_Data_Definition 34
ExtUserPrmData = 34 'stepping start CLOSE in per mil'
Unsigned16 1000 1-1000
EndExtUserPrmData
;
; User_Prm_Data_Definition 35
ExtUserPrmData = 35 'stepping end CLOSE in per mil'
Unsigned16 0 0-999
EndExtUserPrmData
;
; User_Prm_Data_Definition 36
ExtUserPrmData = 36 "spare parameters"
EndExtUserPrmData
;
; User_Prm_Data_Definition 37
ExtUserPrmData = 37 "spare parameters"
Unsigned16 0 0-65535
EndExtUserPrmData
;
; User_Prm_Data_Definition 38
ExtUserPrmData = 38 "spare parameters"
Unsigned16 0 0-65535
EndExtUserPrmData
;
; User_Prm_Data_Definition 39
ExtUserPrmData = 39 "spare parameters"
Unsigned16 0 0-65535
EndExtUserPrmData
;
; User_Prm_Data_Definition 40
ExtUserPrmData = 40 "spare parameters"
Unsigned16 0 0-65535
EndExtUserPrmData
;
; User_Prm_Data_Definition 41
ExtUserPrmData = 41 "spare parameters"
Unsigned16 0 0-65535
EndExtUserPrmData
;
; User_Prm_Data_Definition 42
ExtUserPrmData = 42 "spare parameters"
Unsigned16 0 0-65535
EndExtUserPrmData
;
; User_Prm_Data_Definition 43
ExtUserPrmData = 43 "spare parameters"
Unsigned16 0 0-65535
EndExtUserPrmData
;
; User_Prm_Data_Definition 44
ExtUserPrmData = 44 "spare parameters"
Unsigned16 0 0-65535
EndExtUserPrmData
;
```

```
; User_Prm_Data_Definition 45
ExtUserPrmData = 45 “spare parameters”
Unsigned16 0 0-65535
EndExtUserPrmData
;
; User_Prm_Data_Definition 46
ExtUserPrmData = 46 “spare parameters”
Unsigned16 0 0-65535
EndExtUserPrmData
;
; User_Prm_Data_Definition 47
ExtUserPrmData = 47 “spare parameters”
Unsigned16 0 0-65535
EndExtUserPrmData
;
; User_Prm_Data_Definition 48
ExtUserPrmData = 48 “spare parameters”
Unsigned16 0 0-65535
EndExtUserPrmData
;
; User_Prm_Data_Definition 49
ExtUserPrmData = 49 “spare parameters”
Unsigned16 0 0-65535
EndExtUserPrmData
; User_Prm_Data_Definition 50
ExtUserPrmData = 50 “spare parameters”
Unsigned16 0 0-65535
EndExtUserPrmData
;
Max_User_Prm_Data_Len = 100
;
Ext_User_Prm_Data_Ref(0) = 1
Ext_User_Prm_Data_Ref(2) = 2
Ext_User_Prm_Data_Ref(4) = 3
Ext_User_Prm_Data_Ref(6) = 4
Ext_User_Prm_Data_Ref(8) = 5
Ext_User_Prm_Data_Ref(10) = 6
Ext_User_Prm_Data_Ref(12) = 7
Ext_User_Prm_Data_Ref(14) = 8
Ext_User_Prm_Data_Ref(16) = 9
Ext_User_Prm_Data_Ref(18) = 10
Ext_User_Prm_Data_Ref(20) = 11
Ext_User_Prm_Data_Ref(22) = 12
Ext_User_Prm_Data_Ref(24) = 13
Ext_User_Prm_Data_Ref(26) = 14
Ext_User_Prm_Data_Ref(28) = 15
Ext_User_Prm_Data_Ref(30) = 16
Ext_User_Prm_Data_Ref(32) = 17
Ext_User_Prm_Data_Ref(34) = 18
Ext_User_Prm_Data_Ref(36) = 19
Ext_User_Prm_Data_Ref(38) = 20
Ext_User_Prm_Data_Ref(40) = 21
Ext_User_Prm_Data_Ref(42) = 22
Ext_User_Prm_Data_Ref(44) = 23
Ext_User_Prm_Data_Ref(46) = 24
Ext_User_Prm_Data_Ref(48) = 25
```

Ext_User_Prm_Data_Ref(50) = 26
Ext_User_Prm_Data_Ref(52) = 27
Ext_User_Prm_Data_Ref(54) = 28
Ext_User_Prm_Data_Ref(56) = 29
Ext_User_Prm_Data_Ref(58) = 30
Ext_User_Prm_Data_Ref(60) = 31
Ext_User_Prm_Data_Ref(62) = 32
Ext_User_Prm_Data_Ref(64) = 33
Ext_User_Prm_Data_Ref(66) = 34
Ext_User_Prm_Data_Ref(68) = 35
Ext_User_Prm_Data_Ref(70) = 36
Ext_User_Prm_Data_Ref(72) = 37
Ext_User_Prm_Data_Ref(74) = 38
Ext_User_Prm_Data_Ref(76) = 39
Ext_User_Prm_Data_Ref(78) = 40
Ext_User_Prm_Data_Ref(80) = 41
Ext_User_Prm_Data_Ref(82) = 42
Ext_User_Prm_Data_Ref(84) = 43
Ext_User_Prm_Data_Ref(86) = 44
Ext_User_Prm_Data_Ref(88) = 45
Ext_User_Prm_Data_Ref(90) = 46
Ext_User_Prm_Data_Ref(92) = 47
Ext_User_Prm_Data_Ref(94) = 48
Ext_User_Prm_Data_Ref(96) = 49
Ext_User_Prm_Data_Ref(98) = 50

14 Appendix B Literature references

1. As an introduction to PROFIBUS-DP:

Manfred Popp: PROFIBUS-DP, Grundlagen, Tips und Tricks für Anwender.
Hüthig Verlag, ISBN 3-7785-2676-6
2. Guidelines for the electrician
Installation guide PROFIBUS-DP/FMS order no. 2.111
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