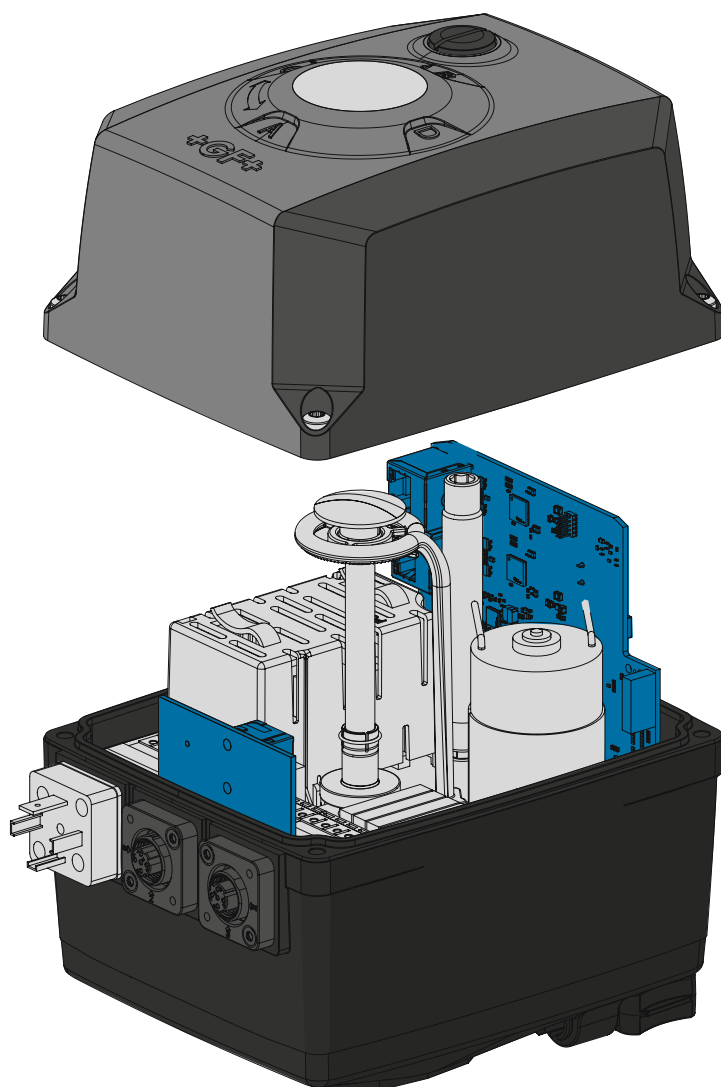


Modbus TCP Interface Card for Electric Actuators Type EA25 - EA250

Interface Description



2033232 EA25-250 Modbus TCP

MA_00140 / EN / 02 (04.2024)

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Original operating manual

Disclaimer

The technical data are not binding. They neither constitutes expressly warranted characteristics nor guaranteed properties nor a guaranteed durability. They are subject to modification. Our General Terms of Sale apply.

Observe instruction manual

The instruction manual is part of the product and an important element within the safety concept.

- ▶ Read and observe instruction manual.
- ▶ Always have instruction manual available by the product.
- ▶ Give instruction manual to all subsequent users of the product.

1 About this document

This document contains all the necessary information to operate the product.

1.1 Other applicable documents

| Code | Document name |
|-----------|--|
| 700671687 | Planning Fundamentals GF Piping Systems Industry |
| 2008328 | Operating Instructions for Electric Actuators EA25-250 |
| 700278223 | Instruction Manual EA25-250 Ethernet Interface Card |

These document can be obtained through the GF Piping Systems representative or at www.gfps.com.

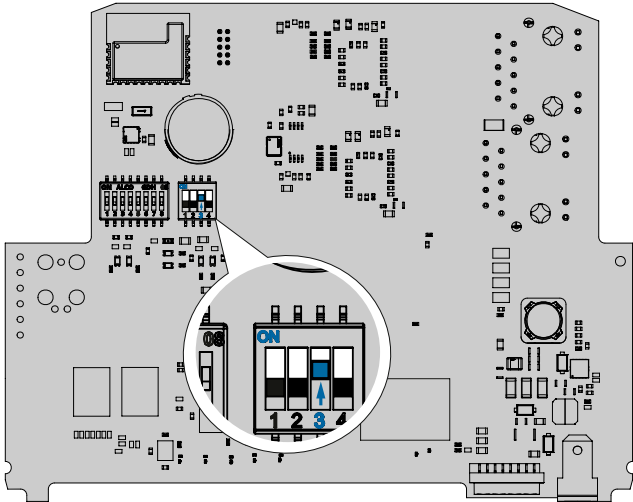
2 Intended use

This document contains the description of the commands for the operation of the EA25-250 with the Modbus TCP interface. It is a supplement to the Operating Instructions for Electric Actuators EA25-250 and Instruction Manual EA25-250 Ethernet Interface Card.

3 IT Security

3.1 Hardening Guidelines

Deactivate web server after commissioning.
There are two options for doing this:

| Option 1 | Option 2 |
|--|---|
| <p>Turning the DIP switch 1 to "ON": On = Webserver OFF Off = Webserver ON</p>  | <p>Writing the Parameter „WebserverEnabled“ (Address 47001) to 0 (disabled)</p> |

Note:
The DIP switch is dominant. If DIP is set to ON (Webserver off) the value of Parameter „WebserverEnabled“ is read-only.

3.2 Secure operation Guidelines

- It is not allowed to connect the actuator directly to the Internet (see Planning Fundamentals Industry, chapter Defense in depth strategy).
- The actuator must not be used to bridge two different network zones.

3.3 Secure disposal guidelines

To ensure that all customer-related data on the device is deleted, it is recommended to carry out a „reset to factory settings“ before disposing of the device.

To reset the actuator to factory:

4. Open housing.
5. Connect the actuator to the power supply.
6. Press the two outer buttons on the EA socket board for at least 3 seconds (see Electric Actuator EA15-250 operating instructions).
7. The actuator acknowledges the factory reset with a „P“ on the 7-segment display.
8. Switch the actuator off.

For a secure destruction of the electronics, it can be sent back to GF Piping Systems. Contact your local GF Piping Systems partner.

3.9 Secure operation guidelines

For secure operation it is recommended to:

- Turn the Webserver off, see chapter „Hardening Guidelines“.
- Regular installation of security updates (see <https://www.gfps.com/cyber-security> for updates). See chapter „Security Update via TFTP“ for further details.

Please indicate any deviations or suspicious behavior at: <https://www.gfps.com/cyber-security>

3.10 Secure Account management

This is not applicable for this product, as only one group account is available.

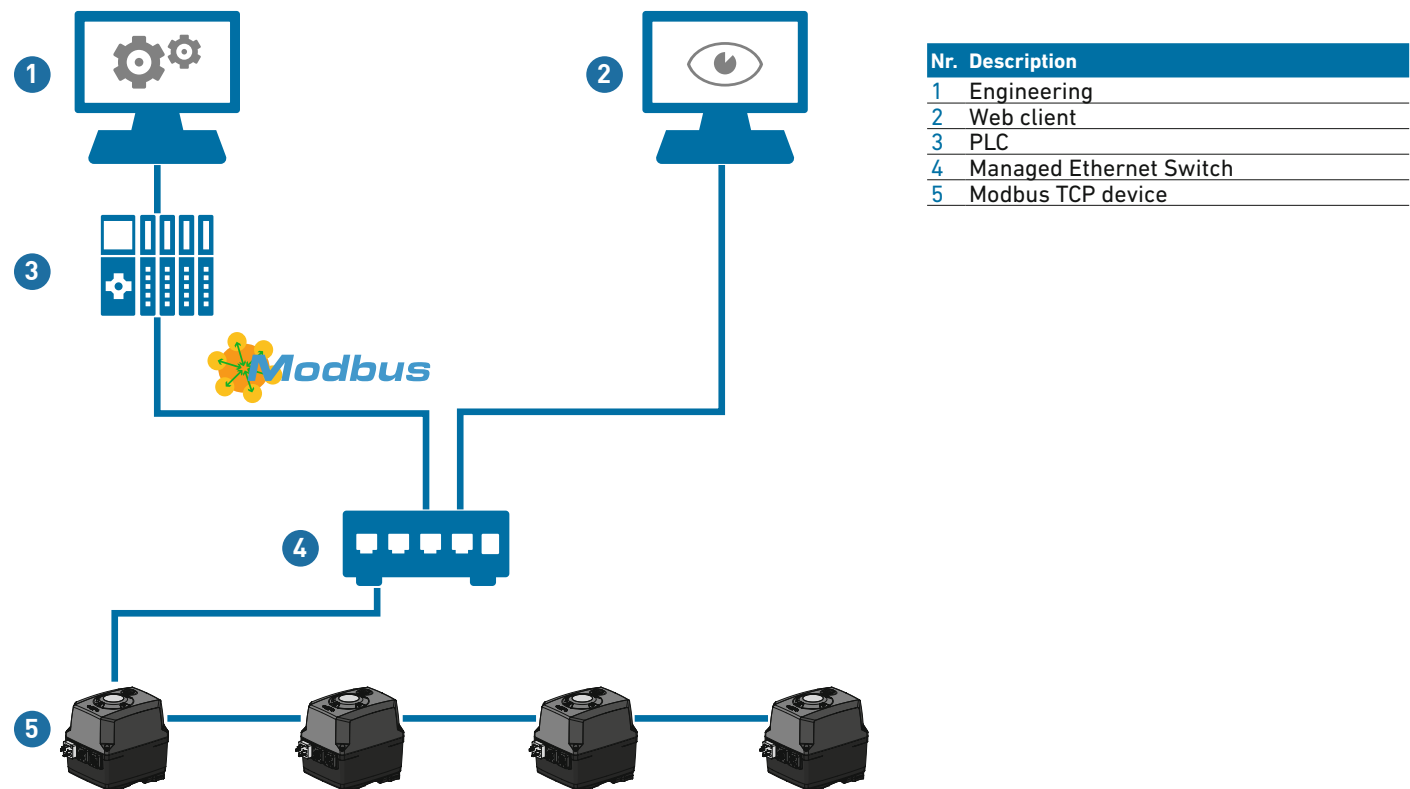
Details on the group accounts can be found in chapter „Technical data“.

4 Prerequisites / Hardware

4.1 Network topology

In general, an Modbus TCP network topology consists of the following components:

- Modbus Master, e.g. programmable logic controller (PLC) including its engineering software
- The PLC is connected to the field level via a switched network using Industrial Ethernet switches, preferable managed switches.
- Modbus Slaves – the Modbus TCP field devices such as the Electric Actuator EA25-250 are connected in a line (using the second Ethernet port of the device).
- The embedded web server of the GF Ethernet-enabled devices is accessible via the Ethernet network with a web client and the IP address of the Ethernet device. Alternatively the web server is also accessible via one of the two Ethernet ports directly at the device. For more details see chapter «Embedded Web Server».



4.2 Cables and connectors


The minimum recommended cable category for Modbus TCP communication is CAT 5e.
The industrial Ethernet cable contains two shielded twisted pairs:

- 1 pair for data transmission (TX+ and TX-)
- 1 pair for data reception (RX+ and RX-)

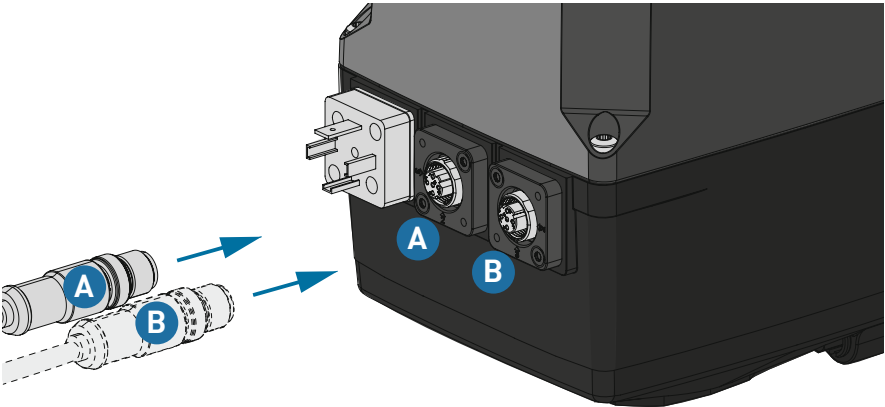
| Pair Assignment | Signal Name | 2 Pair |
|-----------------|-------------|--------------|
| Pair 1 | TX+ | White-orange |
| | TX- | Orange |
| Pair 2 | RX+ | White-green |
| | RX- | Green |

The connection to the Electric Actuator EA25-250 can be realized via:

- Cable glands with internal wiring to the Ethernet accessory board using RJ45 connectors
- M12 D-coded connectors with the optional M12 accessory board

| Pin | Assignment | Plug image |
|-----|------------|---|
| 1 | Transmit + |  |
| 2 | Receive + | |
| 3 | Transmit - | |
| 4 | Receive - | |

The Electric Actuator EA25-250 provides two Ethernet ports. Port A is the connection to the control unit. The optional Port B can be used as connection to further actuators or as local access to the embedded web server.



5 Modbus TCP Interface Description

Modbus is a master-slave system, where the master communicates with one or multiple slaves. The master typically is a PLC (Programmable Logic Controller), DCS (Distributed Control System), HMI (Human Machine Interface), TCP (Remote Terminal Unit) or PC. The Modbus TCP Interface Card fits into the option slot 1 (X6) of the EA25-250 mainboards. It supports the Modbus TCP protocol via standard Industrial Ethernet. A Modbus TCP master may command an actuator fitted with the Modbus board to open, stop, close etc and may read further device parameters for identification or diagnosis. Full list of functions, see chapter Modbus Register Map.

You need physical access to the baseboard and Modbus board only for:

- Installation and internal wiring
- Resetting the EA baseboard and Modbus board to factory defaults
- Viewing the diagnosis LEDs on the Modbus board or failure codes on the 7-segment display located on EA baseboard

All other adjustments to the settings for the Modbus board may be made remotely via Modbus TCP.

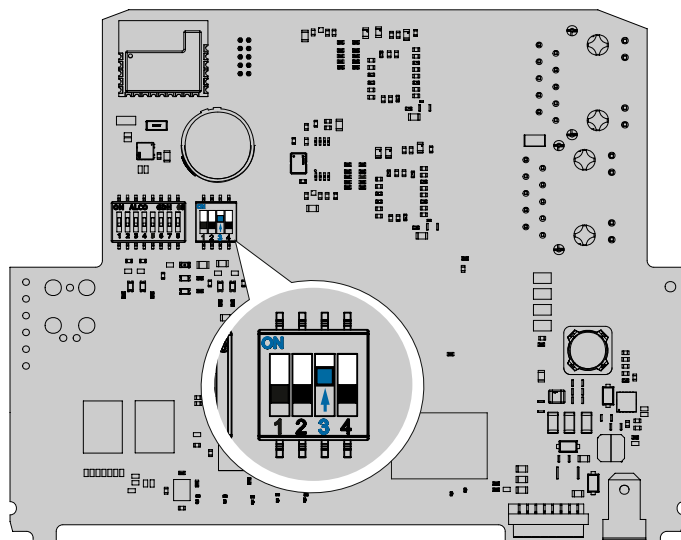
6 IP address assignment

Each Modbus TCP device in the network needs an unique IP address. The default IP address is 192.168.1.111

The IP address can be changed via following possibilities:

- Automatic assignment via DHCP server in the network
- Static assignment via web server
- Addressing via Modbus register (see chapter «EthernetSettings»)

For maintenance or service purposes, it is possible to activate the DIP switch 3 on the Ethernet accessory board to assign the GF default IP address (192.168.1.111) temporarily.



7 Modbus TCP Register Map

This chapter describes the format of the data contained in the supported Modbus messages.

Device address 40001 refers to holding register 0x0000.

7.1 Supported Function Codes

| Command | Function code |
|---|---------------|
| Read holding/ analog output registers | 03 |
| Read input registers (2 Bytes per register) | 04 |
| Write single register (2 Bytes) | 06 |

7.2 DeviceIdentification

| Device Parameter | Device address | Reg. Size | Read/ Write | Unit | Type |
|--------------------|----------------|-----------|-------------|------|--------|
| VendorName | 40001 | 20 | RD | - | STRING |
| DeviceName | 40021 | 15 | RD | - | STRING |
| ProductCode | 40036 | 15 | RD | - | STRING |
| ModelNumber | 40051 | 10 | RD | - | STRING |
| SoftwareVersion | 40061 | 8 | RD | - | STRING |
| VendorURL | 40069 | 15 | RD | - | STRING |
| ProductInstanceURL | 40084 | 50 | RD | - | STRING |
| ProductGeneration | 40134 | 5 | RD | - | STRING |
| SerialNumber | 40139 | 8 | RD | - | STRING |
| ManufacturingDate | 40147 | 5 | RD | - | STRING |
| HardwareVersion | 40152 | 5 | RD | - | STRING |

7.3 DeviceParameters

| Device Parameter | Device address | Reg. Size | Read/ Write | Unit | Type | Device Parameter Link |
|------------------|----------------|-----------|-------------|------|-------|---------------------------------|
| ActualPosition | 31001 | 1 | RD | % | UINT8 | „ActualPosition“ on page „12“ |
| NamurStatus | 31002 | 1 | RD | - | UINT8 | „NamurStatus“ on page „12“ |
| PositionSetpoint | 41001 | 1 | RD/WR | % | UINT8 | „PositionSetpoint“ on page „12“ |

7.4 OperationData

| Device Parameter | Device address | Reg. Size | Read/ Write | Unit | Type | Device Parameter Link |
|-----------------------|----------------|-----------|-------------|------|--------|--------------------------------------|
| Type | 32001 | 1 | RD | - | UINT8 | „Type“ on page „13“ |
| Voltage | 32002 | 1 | RD | - | UINT8 | „Voltage“ on page „13“ |
| LimitSwitchState | 32003 | 1 | RD | - | BOOL | „LimitSwitchState“ on page „13“ |
| ActuatorMoving | 32004 | 1 | RD | - | BOOL | „ActuatorMoving“ on page „14“ |
| TeachinActiv | 32005 | 1 | RD | - | BOOL | „TeachinActiv“ on page „14“ |
| ReadyToOperateState | 32006 | 1 | RD | - | BOOL | „ReadyToOperateState“ on page „14“ |
| Current | 32007 | 1 | RD | mA | UINT16 | „CurrentMonitoring“ on page „14“ |
| TemperatureCelsius | 32008 | 1 | RD | °C | SINT16 | „TemperatureCelsius“ on page „16“ |
| TemperatureFahrenheit | 32009 | 1 | RD | °F | SINT16 | „TemperatureFahrenheit“ on page „16“ |
| Cycles | 32010 | 2 | RD | - | UINT32 | „Cycles“ on page „16“ |
| ErrorFlags | 32012 | 2 | RD | - | UINT32 | „ErrorFlags“ on page „17“ |
| ControlByte | 42001 | 1 | RD/WR | - | UINT8 | „ControlByte“ on page „18“ |
| AckReset | 42002 | 1 | RD/WR | - | UINT16 | „AckReset“ on page „18“ |
| CurrentMonitoring | 42003 | 1 | RD/WR | - | UINT8 | „CurrentMonitoring“ on page „14“ |
| CycleTimeExtension | 42004 | 1 | RD/WR | - | UINT8 | „CycleTimeExtension“ on page „15“ |
| CycleTimeMonitoring | 42005 | 1 | RD/WR | - | UINT16 | „CycleTimeMonitoring“ on page „15“ |
| ActionOnSignalLoss | 42006 | 1 | RD/WR | - | UINT8 | „ActionOnSignalLoss“ on page „21“ |

7.5 EthernetSettings

| Device Parameter | Device address | Reg. Size | Read/ Write | Unit | Type | Device Parameter Link |
|------------------|----------------|-----------|-------------|------|-------|--|
| Ip0 | 43001 | 1 | RD/WR | - | UINT8 | „Ip0-Ip3“ on page „22“ |
| Ip1 | 43002 | 1 | RD/WR | - | UINT8 | „Ip0-Ip3“ on page „22“ |
| Ip2 | 43003 | 1 | RD/WR | - | UINT8 | „Ip0-Ip3“ on page „22“ |
| Ip3 | 43004 | 1 | RD/WR | - | UINT8 | „Ip0-Ip3“ on page „22“ |
| Subnet0 | 43005 | 1 | RD/WR | - | UINT8 | „Subnet0-Subnet3“ on page „22“ |
| Subnet1 | 43006 | 1 | RD/WR | - | UINT8 | „Subnet0-Subnet3“ on page „22“ |
| Subnet2 | 43007 | 1 | RD/WR | - | UINT8 | „Subnet0-Subnet3“ on page „22“ |
| Subnet3 | 43008 | 1 | RD/WR | - | UINT8 | „Subnet0-Subnet3“ on page „22“ |
| StdGateway0 | 43009 | 1 | RD/WR | - | UINT8 | „StdGateway0-StdGateway3“ on page „22“ |
| StdGateway1 | 43010 | 1 | RD/WR | - | UINT8 | „StdGateway0-StdGateway3“ on page „22“ |
| StdGateway2 | 43011 | 1 | RD/WR | - | UINT8 | „StdGateway0-StdGateway3“ on page „22“ |
| StdGateway3 | 43012 | 1 | RD/WR | - | UINT8 | „StdGateway0-StdGateway3“ on page „22“ |

7.6 TimeDateConfiguration

| Device Parameter | Device address | Reg. Size | Read/ Write | Unit | Type | Device Parameter Link |
|------------------|----------------|-----------|-------------|------|--------|-----------------------|
| Date | 44001 | 5 | RD/WR | - | STRING | „Date“ on page „23“ |
| Time | 44006 | 4 | RD/WR | - | STRING | „Time“ on page „23“ |

7.7 ModbusSettings

| Device Parameter | Device address | Reg. Size | Read/ Write | Unit | Type | Device Parameter Link |
|------------------------------------|----------------|-----------|-------------|------|--------|--|
| ModbusTcpPort | 45001 | 1 | RD/WR | - | UINT16 | „ModbusTcpPort“ on page „24“ |
| ModbusEndianess | 45002 | 1 | RD/WR | - | BOOL | „ModbusEndianess“ on page „24“ |
| ModbusRegisterOrder | 45003 | 1 | RD/WR | - | BOOL | „ModbusRegisterOrder“ on page „24“ |
| ModbusStringFlipEndianess | 45004 | 1 | RD/WR | - | BOOL | „ModbusStringFlipEndianess“ on page „25“ |
| ModbusIcmpSignalization | 45005 | 1 | RD/WR | - | BOOL | „ModbusIcmpSignalization“ on page „25“ |
| EnableConnectionWatchdog | 45006 | 1 | RD/WR | - | BOOL | „EnableConnectionWatchdog“ on page „25“ |
| ConnectionWatchdogTimeoutMs | 45007 | 1 | RD/WR | - | UINT16 | „ConnectionWatchdogTimeout“ on page „26“ |

7.8 MACAddress

| Device Parameter | Device address | Reg. Size | Read/ Write | Unit | Type | Device Parameter Link |
|-------------------|----------------|-----------|-------------|------|-----------------|---------------------------|
| PrimaryMAC | 46001 | 9 | RD | - | StringContainer | „PrimaryMAC“ on page „26“ |

7.9 Security Settings

| Device Parameter | Device address | Reg. Size | Read/ Write | Unit | Type | Device Parameter Link |
|--------------------------------|----------------|-----------|-------------|------|-------|--|
| WebserverEnabled | 47001 | 1 | RD/WR | - | UINT8 | „WebserverEnabled“ on page „27“ |
| CommissioningModeActive | 47002 | 1 | RD/WR | - | UINT8 | „CommissioningModeActive“ on page „27“ |
| TftpSwUpdateEnabled | 47003 | 1 | RD/WR | - | UINT8 | „TftpSwUpdateEnabled“ on page „27“ |

7.10 Device Parameter Description

7.10.1 DeviceIdentification

No detailed parameter description for static parameters with data type STRING required.

7.10.2 DeviceParameters

ActualPosition

The actual position shows the valve position as a percentage value.

| ActualPosition | | | | | | | |
|-------------------------|-------|-------|-------|-------|-------|-------|-------|
| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| <position_actual_value> | | | | | | | |

<position_actual_value>

range = 0...100%

0 = position_closed

100 = position_open

255= position_invalid

NamurStatus

The NAMUR NE107 status displays the device status.

| NamurStatus | | | | | | | |
|-------------|-------|-------|-------|-------------|-------|-------|-------|
| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| reserved | | | | Namur state | | | |

Namur state

0 – diagnostics passive

1 – diagnostics active

2 – maintenance required

3 – out of specification

4 – function check

5 – failure

PositionSetpoint

The PositionSetpoint is active, if positioner mode is enabled, see register ControlByte.

| PositionSetpoint | | | | | | | |
|---------------------------------------|-------|-------|-------|-------|-------|-------|-------|
| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| position_setpoint in percent 0...100% | | | | | | | |

position_setpoint

0...100 = setpoint range

0 = closed position

100 = open position

101...255 = invalid value (no action)

7.10.3 OperationData

Type

Information about electric actuator type variant. Does not change during normal operation.

| Byte-Name: Type | | | | | | | |
|-----------------|-------|-------|-------|-----------|-------|-------|-------|
| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| reserved | | | | <ea_type> | | | |

<ea_type>
 0 = EA25
 1 = EA45
 2 = EA120
 3 = EA250
 4 = EA15
 8 = EAMT25
 9 = EAMT50
 10 = EAMT80
 11 = EAMT100
 12 = EAMT15
 13 = EAMT80B
 14 = EAMT100B

Voltage

Information about electric actuator voltage variant. Does not change during normal operation.

| Byte-Name: Voltage | | | | | | | |
|--------------------|-------|-------|-------|--------------|-------|-------|-------|
| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| reserved | | | | <ea_voltage> | | | |

<ea_voltage>
 0 = 24 VDC / 24 VAC
 1 = 230 VAC

LimitSwitchState

Information about actuators final positions. Indicates weather an endpoint is reached (+/- 2%).

| Byte-Name: LimitSwichState | | | | | | | |
|----------------------------|-------|-------|-------|---------------------|-------------------|---------------------|-------|
| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| reserved | | | | limit_switch_middle | limit_Switch_open | limit_switch_closed | |

<limit_switch_open>
 1 = Actuator reached open position

<limit_switch_close>
 1 = Actuator reached open position

<limit_switch_middle>
 1 = Actuator is in middle position

ActuatorMoving

Indicates actuator movement.

| Byte-Name: ActuatorMoving | | | | | | | |
|---------------------------|-------|-------|-------|-------|-------|-------|-----------------|
| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| reserved | | | | | | | actuator_moving |

<actuator_moving>

1 = Actuator is moving

TeachinActiv

Indicates teaching state. Note: During teaching the actuator is not ready to operate.

| Byte-Name: ActuatorMoving | | | | | | | |
|---------------------------|-------|-------|-------|-------|-------|-------|----------------|
| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| reserved | | | | | | | teachin_active |

<teachin_active>

1 = Actuator in teaching state. Not ready to operate.

ReadyToOperateState

Indicates actuator is ready for operation.

| Byte-Name: ReadyToOperate | | | | | | | |
|---------------------------|-------|-------|-------|-------|-------|-------|-------------|
| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| reserved | | | | | | | ready_relay |

<ready_relay>

1 = Actuator is ready to operate.

CurrentMonitoring

Current monitoring option.

| Byte-Name: ReadyToOperate | | | | | | | |
|---------------------------|-------|-------|-------|-------------------|-------|-------|-------|
| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| reserved | | | | <current_mon_bcd> | | | |

<current_mon_bcd>

Min. 0

Max: 9

Default: 9

Description:

Set threshold current for the current monitoring feature.

This setting is dependent on EA-type - same as setting on monitoring board.

CycleTimeExtension

Cycle time extension monitoring option.

Byte-Name: CycleTimeExtension

| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|----------|-------|-------|-------|--------------------|-------|-------|-------|
| reserved | | | | <cyc_time_ext_bcd> | | | |

<current_time_ext_bcd>

Min. 0

Max: 9

Default: 9

Description:

Set threshold current for the current monitoring feature.

This setting is dependent on EA-type - same as setting on monitoring board.

CycleTimeMonitoring

Cycle time monitoring option.

Byte-Name: CycleTimeMonitoring

| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|----------|-------|-------|-------|--------------------|-------|-------|-------|
| reserved | | | | <cyc_time_mon_bcd> | | | |

<current_time_mon_bcd>

Min. 0

Max: 9

Default: 4

Description:

Set threshold time for maximum accepted positioning time until target position is reached.

This setting is dependent on EA-type – same as setting on monitoring board.

StateFlags

Information about current actuator position status.

StateFlags

| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|----------|-------------|----------------|-----------------|---------------------|-------------------|---------------------|-------|
| reserved | ready_relay | teachin_active | actuator_moving | limit_switch_middle | limit_switch_open | limit_switch_closed | |

Current

The current word holds the absolute value of motor current in milliamps.

Current

| Bit 15 | Bit 14 | Bit 13 | Bit 12 | Bit 11 | Bit 10 | Bit 9 | Bit 8 | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|-----------------|--------|--------|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| <motor_current> | | | | | | | | | | | | | | | |

<motor_current>

Absolute value of motor current in milliamps.

TemperatureCelsius

Temperature in ° Celsius measured on EA-Baseboard.

| TemperatureCelsius | | | | | | | |
|--------------------|-------|-------|-------|-------|-------|-------|-------|
| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| <temperature_base> | | | | | | | |

<temperature_base>

Temperature in DEG-Celsius (-20...100°C).

TemperatureFahrenheit

Temperature in ° Fahrenheit measured on EA-Baseboard.

| TemperatureFahrenheit | | | | | | | |
|-----------------------|-------|-------|-------|-------|-------|-------|-------|
| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| <temperature_base> | | | | | | | |

<temperature_base>

Temperature in DEG-Fahrenheit (-4...212°F).

Cycles

The cycles double word holds the absolute cycles of the EA.

| Cycles | |
|----------------------|----------------------|
| High Word | Low Word |
| Reg.# 40007 (Adr. 6) | Reg.# 40006 (Adr. 5) |

<cycle_counter>

Number of movement cycles since last "cycle_counter_reset"

ErrorFlags**ErrorFlags**

High Word

Low Word

Reg.# 40009 (Adr. 8)

Reg.# 40008 (Adr. 7)

<error_flags>

0 means no error/warning asserted.

Else:

| Bit | Name | Seven segment display | Description |
|---------|---------------------------|-----------------------|---|
| 0 | undervoltage | 'U' | Undervoltage condition |
| 1 | over_temp_case | 'O' | Over temperature inside EA |
| 2 | max_positioning_time | 'S' | Time monitoring |
| 3 | heating | 'H' | Heating defect |
| 4 | position_detection_failed | 'e' | Position learn required |
| 5 | position_out_of_range | 'P' | Position out of range: The actual measured actuator position is outside position out of range |
| 6 | manual_actuation | 'E' | Manual actuation via handle detected |
| 7 | accessory_no_reply | '9' | Accessory option board no answer / communication timed out |
| 8 | powerfail_action | | Powerfail board is in active state |
| 9 | powerfail_accu_lvl_warn | 'L' | Power fail intern accu level warning |
| 10 | powerfail_accu_defect | 'A' | Power fail intern accu defect error |
| 11 | watchdog_recovery | | Restart of EA through watchdog timer warning. |
| 12 | Motor current overflow | 'I' | max motor current monitoring tripped (max_current_supervisor) |
| 13 | mot_driver_overload | 'b' | error mot driver |
| 14 - 31 | reserved | | |

ControlByte

Electric Actuator Control Byte

| ControlByte | | | | | | | | |
|-------------|----------|----------|--------------------|-------|--------|-------|-------|-----------------|
| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 | Action |
| reserved | reserved | reserved | positioner enabled | stop | middle | open | close | |
| X | X | X | 0 | X | 0 | 0 | 0 | STOP |
| X | X | X | 0 | X | X | X | 1 | CLOSE |
| X | X | X | 0 | X | X | 1 | 0 | OPEN |
| X | X | X | 0 | X | 1 | 0 | 0 | MIDDLE |
| X | X | X | 1 | X | X | X | X | POSITIONER_MODE |

Close is dominant as it is in operation with setpoint via power input terminals.

AckReset

Control Byte to acknowledge error and reset cycle counter.

| AckReset | | | | | | | | |
|----------|----------|----------|----------|----------|----------|------------------|-----------|---------------------|
| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 | Action |
| reserved | reserved | reserved | reserved | reserved | reserved | cycle_cntr_reset | error_ack | |
| X | X | X | X | X | X | 1 | X | reset_cycle_counter |
| X | X | X | X | X | X | X | 1 | error_ack |

BcdSet

This setting reproduces the functionality of the monitoring board hardware.

Note that the Bytes bcdSet0 and bcdSet1 are combined to the 16-Bit-Register bcdSet.

| BcdSet | |
|-----------|----------|
| High Byte | Low Byte |
| BCDSET1 | BCDSET0 |

The default value after factory reset is 0940(hex) respectively 2368.

BcdSet0

Cycle time extension and cycle time monitoring.

| BcdSet0 | | | | | | | |
|--------------------|-------|-------|-------|--------------------|-------|-------|-------|
| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| <cyc_time_mon_bcd> | | | | <cyc_time_ext_bcd> | | | |

<cyc_time_ext_bcd>

Min: 0

Max: 9

Default: 0

Description:

The cycle time extension extends the cycle time of the electric actuator. To do this, the actuator is moved continuously into the end positions (OPEN or CLOSE). For the corresponding value please refer to the table below. These values are valid for 90° actuation. The cycle time is given in seconds.

| | BCD | EA25 | EA45 | EA120 | EA250 |
|--------------------------|---------------------|------|------|-------|-------|
| Cycle Time Extension [s] | 0 (factory setting) | 7 | 7 | 25 | 27 |
| | 1 | 10 | 10 | 28 | 35 |
| | 2 | 13 | 13 | 32 | 40 |
| | 3 | 15 | 15 | 38 | 45 |
| | 4 | 18 | 18 | 42 | 50 |
| | 5 | 20 | 20 | 48 | 55 |
| | 6 | 23 | 23 | 52 | 60 |
| | 7 | 25 | 25 | 58 | 65 |
| | 8 | 28 | 28 | 62 | 70 |
| | 9 | 30 | 30 | 67 | 75 |

<cyc_time_mon_bcd>

Min: 0

Max: 9

Default: 4

Description:

The cycle time monitoring monitors the duration of a preset cycle time of the electric actuator. As soon as the cycle exceeds the preset time, an error is reported. For the corresponding value please refer to the table below. These values are valid for 90° actuation. The cycle time is given in seconds.

| | BCD | EA25 | EA45 | EA120 | EA250 |
|---------------------------|---------------------|------|------|-------|-------|
| Cycle Time Monitoring [s] | 0 | 8 | 7 | 20 | 30 |
| | 1 | 11 | 10 | 30 | 40 |
| | 2 | 14 | 13 | 35 | 45 |
| | 3 | 17 | 16 | 40 | 50 |
| | 4 (factory setting) | 20 | 19 | 45 | 55 |
| | 5 | 23 | 22 | 50 | 60 |
| | 6 | 26 | 25 | 55 | 65 |
| | 7 | 29 | 28 | 60 | 70 |
| | 8 | 32 | 31 | 65 | 80 |
| | 9 | 36 | 34 | 75 | 90 |

BcdSet1

The Bit numbering refers to the bcdSet-Byte since this is the High Byte of the 16-Bit-bcdSet-Register. The corresponding bit numbers in bcdSet-Register are from 8 to 15.

The lower nibble of bcdSet contains the setting for the current monitoring functionality.

The high nibble is reserved for future use.

| BcdSet1 | | | | | | | |
|----------|-------|-------|-------|-------------------|-------|-------|-------|
| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| reserved | | | | <current_mon_bcd> | | | |

<current_mon_bcd>

Min: 0

Max: 9

Default: 9

Description:

The current monitoring function monitors the motor current. If the motor current is higher than the pre-set value, an error is reported and the actuator will remain in place.

| | BCD | EA25 | EA45 | EA120 | EA250 |
|-------------------------------|---------------------|------|------|-------|-------|
| Motor Current Monitoring [mA] | 0 | 25 | 25 | 50 | 50 |
| | 1 | 100 | 300 | 300 | 400 |
| | 2 | 150 | 350 | 400 | 500 |
| | 3 | 200 | 400 | 500 | 600 |
| | 4 | 250 | 450 | 600 | 700 |
| | 5 | 300 | 500 | 700 | 800 |
| | 6 | 400 | 600 | 800 | 1000 |
| | 7 | 500 | 700 | 900 | 1200 |
| | 8 | 600 | 900 | 1000 | 1500 |
| | 9 (factory setting) | 700 | 1100 | 1200 | 1800 |

Remarks:

This command is stored nonvolatile. This means: After changing one of these registers, a Power-On-Reset of the actuator is required before these changes take effect.

ActionOnSignalLoss

Action on loss of signal (setup of busfault reaction).

| ActionOnSignalLoss | | | | | | | |
|--------------------|----------|----------|----------|----------|----------|----------------------|-------|
| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| reserved | reserved | reserved | reserved | reserved | reserved | <signal_loss_action> | |

<signal_loss_action>

| Value | Action / Description |
|-------|-------------------------------------|
| 0 | STOP / EA stops. |
| 1 | CLOSE / EA moves to CLOSE-Position. |
| 2 | OPEN / EA moves to OPEN-Position. |
| 3 | reserved |

If the MODBUS-signal is lost the EA performs the selected "signal_loss_action".

Remarks:

This command is stored nonvolatile. This means: After changing one of these registers, a Power-On-Reset of the actuator is required before these changes take effect.

7.10.4 EthernetSettings

Remarks:

These commands are stored nonvolatile. This means: After changing one of these registers, a Power-On-Reset of the actuator is required before these changes take effect.

Ip0-Ip3

The bytes ip0-ip3 holds the four blocks of the IP address of the device.

| Ip0-Ip3 | | | | | | | | | | | | | | | |
|------------|--------|--------|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Bit 15 | Bit 14 | Bit 13 | Bit 12 | Bit 11 | Bit 10 | Bit 9 | Bit 8 | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| <reserved> | | | | | | | | <ip0> | | | | | | | |
| <reserved> | | | | | | | | <ip1> | | | | | | | |
| <reserved> | | | | | | | | <ip2> | | | | | | | |
| <reserved> | | | | | | | | <ip3> | | | | | | | |

<ip0>; <ip1>; <ip2>; <ip3>

Default: 192.168.1.111

Subnet0-Subnet3

The bytes Subnet0-Subnet3 holds the four blocks of the subnet mask of the device.

| Subnet0-Subnet3 | | | | | | | | | | | | | | | |
|-----------------|--------|--------|--------|--------|--------|-------|-------|-----------|-------|-------|-------|-------|-------|-------|-------|
| Bit 15 | Bit 14 | Bit 13 | Bit 12 | Bit 11 | Bit 10 | Bit 9 | Bit 8 | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| <reserved> | | | | | | | | <subnet0> | | | | | | | |
| <reserved> | | | | | | | | <subnet1> | | | | | | | |
| <reserved> | | | | | | | | <subnet2> | | | | | | | |
| <reserved> | | | | | | | | <subnet3> | | | | | | | |

<subnet0>; <subnet1>; <subnet2>; <subnet3>

Default: 255.255.255.0

StdGateway0-StdGateway3

The bytes StdGateway0-StdGateway3 holds the four blocks of the default gateway of the device.

| StdGateway0-StdGateway3 | | | | | | | | | | | | | | | |
|-------------------------|--------|--------|--------|--------|--------|-------|-------|---------------|-------|-------|-------|-------|-------|-------|-------|
| Bit 15 | Bit 14 | Bit 13 | Bit 12 | Bit 11 | Bit 10 | Bit 9 | Bit 8 | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| <reserved> | | | | | | | | <stdgateway0> | | | | | | | |
| <reserved> | | | | | | | | <stdgateway1> | | | | | | | |
| <reserved> | | | | | | | | <stdgateway2> | | | | | | | |
| <reserved> | | | | | | | | <stdgateway3> | | | | | | | |

<stdgateway0>; <stdgateway1>; <stdgateway2>; <stdgateway3>

Default: 192.168.1.111

7.10.5 TimeDateConfiguration

Date and time settings for the internal real time clock (RTC). Since the data format is string, valid values for all these registers are: 0 – 9 (ASCII decimal 48 – 57).

Date

Format: „YYYY-MM-DD“

| Date | | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Byte 9 | Byte 8 | Byte 7 | Byte 6 | Byte 5 | Byte 4 | Byte 3 | Byte 2 | Byte 1 | Byte 0 |
| Y | Y | Y | Y | - | M | M | - | D | D |

Example: 2022-12-21

Time

Format: „HH-MM-SS“

| Time | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|
| Byte 7 | Byte 6 | Byte 5 | Byte 4 | Byte 3 | Byte 2 | Byte 1 | Byte 0 |
| H | H | - | M | M | - | S | S |

Example: 14-30-11

7.10.6 ModbusSettings

ModbusTcpPort

TCP Port which is used for Modbus communication.

| ModbusTcpPort | | | | | | | | | | | | | | | |
|---------------|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| <Port> | | | | | | | | | | | | | | | |

<Port>: 0-65535
Default: 502

ModbusEndianess

Boolean to toggle the endianness.

| ModbusEndianess | | | | | | | | | | | | | | | |
|-----------------|--------|--------|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Bit 15 | Bit 14 | Bit 13 | Bit 12 | Bit 11 | Bit 10 | Bit 9 | Bit 8 | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| <reserved> | | | | | | | | | | | | | | | b |

b = 0: Big Endian
b = 1: Little Endian
Default: 0

Example: 0x1234
With Big Endian (default) 0x12 is transferred before 0x34:

Result:
Big Endian (b=0): 0x1234
Little Endian (b=1): 0x3412

ModbusRegisterOrder

Boolean to toggle the register order.

| ModbusRegisterOrder | | | | | | | | | | | | | | | |
|---------------------|--------|--------|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Bit 15 | Bit 14 | Bit 13 | Bit 12 | Bit 11 | Bit 10 | Bit 9 | Bit 8 | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| <reserved> | | | | | | | | | | | | | | | b |

b = 0: Higher Register first
b = 1: Lower Register first
Default: 0

Example Value (UINT32): 0x11223344

Result:
High Reg. first (b=0): 0x11223344
Low Reg. first (b=1): 0x33441122

ModbusStringFlipEndianness

Boolean to toggle the string order.

| ModbusStringFlipEndianness | | | | | | | | | | | | | | | |
|----------------------------|--------|--------|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Bit 15 | Bit 14 | Bit 13 | Bit 12 | Bit 11 | Bit 10 | Bit 9 | Bit 8 | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| <reserved> | | | | | | | | | | | | | | | b |

b = 0: Higher String value first

b = 1: Lower String value first

Default: 0

Example Value: 0x4746 (,G',F')

Result:

High String value first (b=0): 0x4746 (,G',F')

Low String value first (b=1): 0x4647 (,F',G')

ModbusIcmpSignalization

Boolean to enable the visualization of the ICMP package (ping).

| ModbusIcmpSignalization | | | | | | | | | | | | | | | |
|-------------------------|--------|--------|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Bit 15 | Bit 14 | Bit 13 | Bit 12 | Bit 11 | Bit 10 | Bit 9 | Bit 8 | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| <reserved> | | | | | | | | | | | | | | | b |

b = 0: Feature off: ICMP package has no impact.

b = 1: Feature on: each ICMP package (ping) is signalized by blue flashing LED.

Default: 1

EnableConnectionWatchdog

If watchdog is enabled, a message from the master is expected within milliseconds specified in „ConnectionWatchdogTimeout“, see below. If the Modbus board is not addressed with telegrams from Modbus master for this time, the watchdog triggers and the signal loss action is executed (see ActionOnSignalLoss).

| EnableConnectionWatchdog | | | | | | | | | | | | | | | |
|--------------------------|--------|--------|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Bit 15 | Bit 14 | Bit 13 | Bit 12 | Bit 11 | Bit 10 | Bit 9 | Bit 8 | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| <reserved> | | | | | | | | | | | | | | | b |

b = 0: Watchdog disabled

b = 1: Watchdog enabled

Default: 0

ConnectionWatchdogTimeout

Register ConnectionWatchdogTimeout holds the signal loss watchdog time in milliseconds.

| ConnectionWatchdogTimeout | | | | | | | | | | | | | | | |
|---------------------------|--------|--------|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Bit 15 | Bit 14 | Bit 13 | Bit 12 | Bit 11 | Bit 10 | Bit 9 | Bit 8 | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| <WatchdogTime> | | | | | | | | | | | | | | | |

Note: Use together with enable/disable (EnableConnectionWatchdog)

<WatchdogTime>: 1 – 65535 [ms]

1 ... 65535 = 1ms ... 65535ms

Default: 2500 [ms]

It is possible to configure a maximal time without telegrams from Modbus master before the Modbus board triggers the configured signal loss action (see ActionOnSignalLoss).

Note: Use together with enable/disable (see EnableConnectionWatchdog).

7.10.7 MACAddress

PrimaryMAC

The primary MAC registers hold the primary MAC address of the device.

| PrimaryMAC | | | | | | | | |
|--------------------|---------|---------|--------------------|---------|---------|--------------------|---------|-----------------|
| Byte 17 | Byte 16 | Byte 15 | Byte 14 | Byte 13 | Byte 12 | Byte 11 | Byte 10 | Byte 9 |
| MAC address part 1 | | - | MAC address part 2 | | - | MAC address part 3 | | - |
| Byte 8 | Byte 7 | Byte 6 | Byte 5 | Byte 4 | Byte 3 | Byte 2 | Byte 1 | Byte 0 |
| MAC address part 4 | | - | MAC address part 5 | | - | MAC address part 6 | | 0 (termination) |

<MAC1>; <MAC2>; <MAC3>; <MAC4>; <MAC5>; <MAC6>;

Example: 7C-45-F9-70-00-00

7.10.8 Security Settings

WebserverEnabled

Decides whether the Webserver is enabled, same functionality as Hardware DIP switch number 1.

| WebserverEnabled | | | | | | | |
|------------------|-------|-------|-------|-------|-------|-------|-------|
| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| reserved | | | | | | | b |

b = 0: Webserver disabled

b = 1: Webserver enabled

Default: 1

Note: The Hardware DIP-Switch is dominant. If the Hardware DIP disables this function the setting has no influence.

CommissioningModeActive

Decides whether the Commissioning Mode is enabled, same functionality as Hardware DIP switch number 2.

| CommissioningModeActive | | | | | | | |
|-------------------------|-------|-------|-------|-------|-------|-------|-------|
| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| reserved | | | | | | | b |

b = 0: Inactive

b = 1: Active

Default: 0

Note: The Hardware DIP-Switch is dominant. If the Hardware DIP disables this function the setting has no influence.

TftpSwUpdateEnabled

Decides whether the TFTP server is enabled, same functionality as Hardware DIP switch number 3.

| TftpSwUpdateEnabled | | | | | | | |
|---------------------|-------|-------|-------|-------|-------|-------|-------|
| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| reserved | | | | | | | b |

b = 0: Disabled

b = 1: Enabled

Default: 0

Note: The Hardware DIP-Switch is dominant. If the Hardware DIP disables this function the setting has no influence.

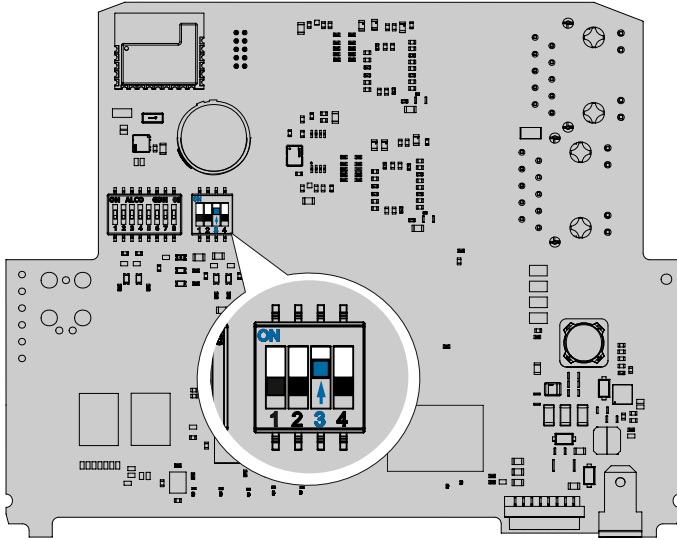
See chapter «Security Update via TFTP» for further details.

8 Embedded Web Server

8.1 Pre-requisites

To connect to the embedded web server, make sure that the following pre-requisites are fulfilled:

1. DIP switch 1 on Ethernet board is inactive (DIP Switch down)



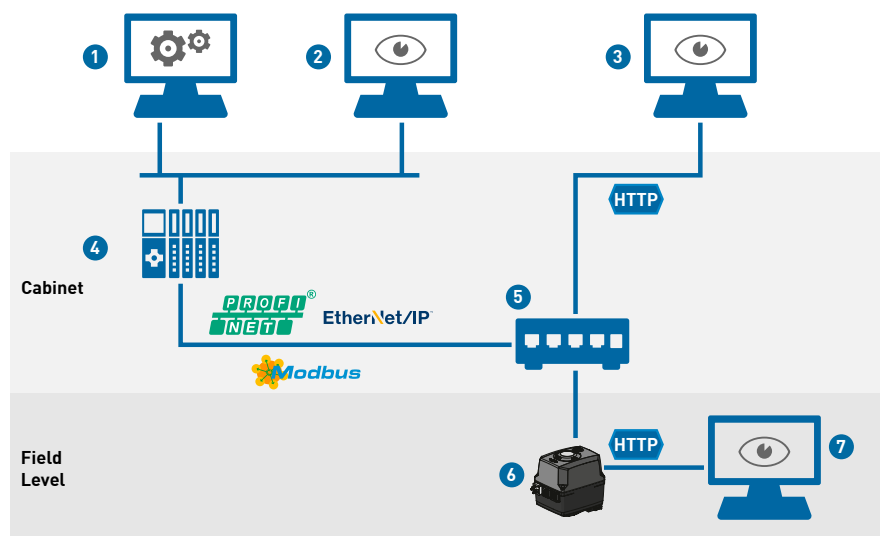
2. Web server is not deactivated via software (see chapter «Security Settings»)
3. Network settings
The network settings of the device (IP address, subnet mask) need to be known in order to establish a connection to the embedded web server.

Default network settings

IP address: 192.168.1.111

Subnet mask: 255.255.255.0

4. Connection to the device



| Nr. | Description |
|-----|---|
| 1 | Engineering System (PLC software) |
| 2 | Operator/Maintenance systems (SCADA, HMI, etc.) |
| 3 | Web Server (locally connected to switch) |
| 4 | PLC |
| 5 | Managed Ethernet Switch |
| 6 | EtherNet/IP device |
| 7 | Web Server (connected to 2nd port of device) |

1. Locally

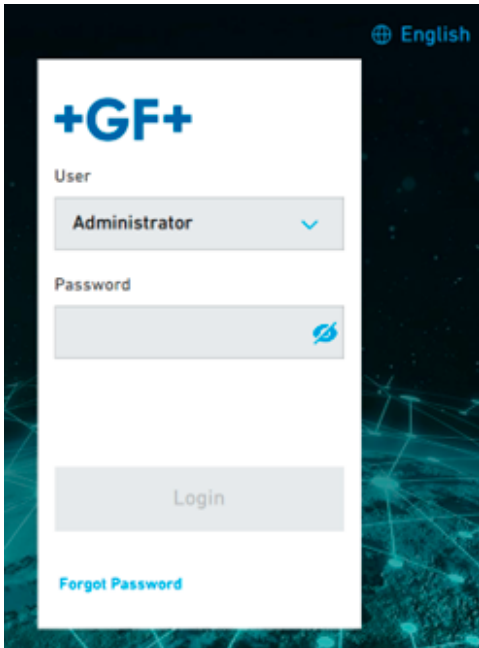
- ▶ Only possible if one of the two Ethernet ports of the Electric Actuator is free
- ▶ Connect the operating tool (e.g. laptop) to one of the free ports of the device using an Industrial Ethernet cable
- ▶ Ensure that the network settings of the operating tool match to the network settings of the device (same IP address range and matching subnet mask)
- ▶ Open a web browser and enter the IP address of the device
- ▶ Continue with the operation of the web server as described in chapter "Web Server User Interface"

2. Via network

- ▶ Ensure that the network settings of the operating tool match to the network settings of the device (same IP address range and matching subnet mask)
- ▶ Open a web browser and enter the IP address of the device
- ▶ Continue with the operation of the web server as described in chapter "Web Server User Interface"

8.5 Web Server User Interface

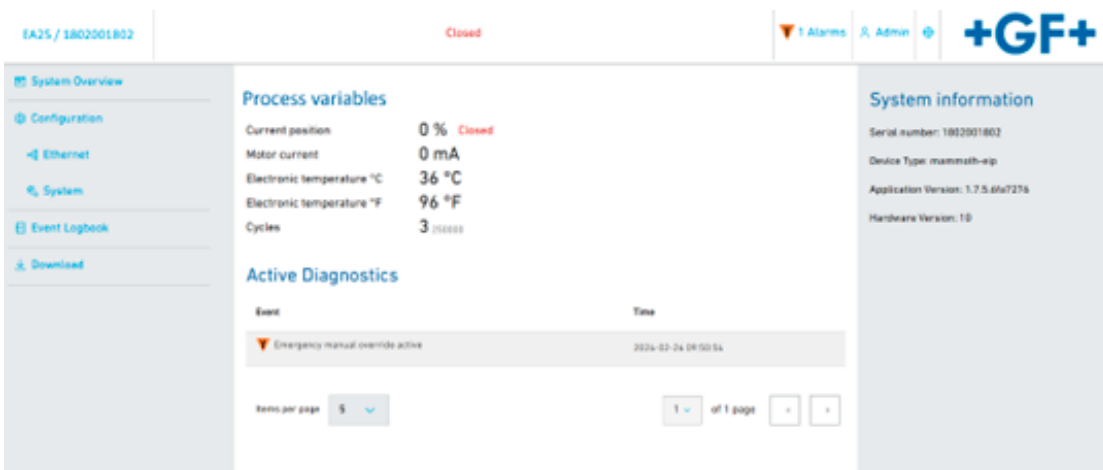
8.5.1 Login



- The default password for the first login is the same as the name of the selected user role:
"Operator" for role "Operator"
"Administrator" for role "Administrator"
- The system enforces the change of the default password after the first login.
- In case of forgotten passwords, a factory reset is required

8.5.2 General structure of UI

The user interface is divided into the following areas



1. Header

Consists of most important device information: Device name, current valve position, global device status (NE107), Logout, Language selection

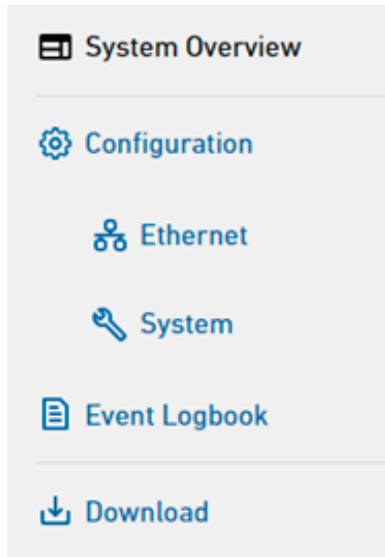
2. Menu navigation

Provides the possibility to browse through the menu to get access to parameters and functionalities

3. Content area

Shows the content of the selected menu, see details in chapter "Menus and Functionalities"

8.5.3 Menus and Functionalities



System overview

This menu provides a general overview of most important information:

- Process variables (e.g. valve position, motor current)
- Identification information about the device (e.g. serial number)
- Current diagnostics (all currently active diagnostic events)

Configuration

These menus provide the configuration of the device:

- General device settings, e.g. Action on signal loss, motor current monitoring
- Ethernet settings, e.g. IP address
- System settings, e.g. session timeout, reset, software update

Event logbook

This menu provides an historical overview of events (general system events, diagnostic events, parameter changes). Maximum 5000 events are stored within the logbook. After-wards, the oldest entries are deleted.

Note: In the menu „Download“, it is possible to download the current state of the event log-book to a PDF file.

Download

This menu provides the possibility to download the following files from the device:

- Device Report: generates a PDF report with all device information
- Event logbook: generates a PDF report with the latest 5000 historical events
- Provides the device driver for PLC integration
- Register map: provides the Modbus register map for PLC integration
- User manual: provides the user manual of the Electric Actuator

9 Security Update via TFTP

To update the device, use the files located in the GF download center:

- <https://www.gfps.com/is-software>

Precondition for the PC to execute the update:

- TFTP must be activated/available on the PC
- The PowerShell Execution Policy should be set to: "RemoteSigned"

Steps to perform the software update

1. Disconnect the device from power
2. Activate the TFTP Enable Dip Switch No. 4
3. Power the device, the actuator will blink and signal ||| in the seven segment display
4. Open a Powershell Console and navigate to the Electrical Actuator Update Package
5. If the device is configured with the GF standard IP address (192.168.1.111) you can start the update script directly without further parameters
 - a. To configure the device temporarily with the standard IP, Dip switch 3 can be activated. A reboot of the device is required for the configuration to become effective.
 - b. It is possible to set an IP address, in case the device is configured to different IP address, therefore provide the parameter "-Ip XXX.XXX.XXX.XXX" to the script
6. The script will provide feedback similar to this output:

```
PS C:\Users\GeorgIloTLab\Downloads\TFTP_Update_Package_1.7.6.2bcbd4d> .\ElectricalActuatorStartUpdate.ps1
Transcript started, output file is .\log\update.log
Connecting to Device on IP: 192.168.1.111
Detected Variant is XXX
Starting Update
Update Finished successfully
Transcript stopped, output file is C:\Users\GeorgIloTLab\Downloads\TFTP_Update_Package_1.7.6.2bcbd4d\log\update.log
```

7. If the output of the script is "Update Finished successfully" all steps succeeded.
 - a. In case of any errors please check the files in the log folder for questions to the support
8. Disable Dip Switch 3 and 4 and reboot the device.

10 Troubleshooting

| Green LED (Activity) | Red LED (Failure) | Blue LED (Signaling) | Description |
|----------------------|-------------------|----------------------|-------------------------------|
| Blinking | - | - | Normal operation |
| - | - | Blinking | DCP Signaling (ping received) |
| - | Steady on | Blinking | Contact service |

Local support around the world

Visit our webpage to get in touch with your local specialist:

www.gfps.com/our-locations



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