**JAT** *JENAER ANTRIEBSTECHNIK*



**PROFIBUS**®

%DB1
"ECOVARIO_DB"

%FB1
"ECOVARIO"

EN          ENO

# ECOVARIO®, ECOSTEP®
# Use of the JAT Function Blocks for
# Profibus® Servo Amplifiers acc. to DS402

Revisions:

| Edition | Comment |
|---|---|
| November 2019 | First English edition |
| January 2020 | Chapter 5.2: Correction of the utilized controls |

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# 1    About this document

This manual describes the integration procedure of the servo amplifers ECOVARIO® and ECOSTEP® according to DS402 with PROFIbus® interface into a PROFIbus® network (master: Siemens Simatic controller S7) with the help of the JAT function blocks.

**The requirement is an existing physical connection between servo amplifier and the PROFIbus® master** via the **interface X22** (ECOVARIO® 114xx-[G,F][J,L]-xxx-xxx, ECOVARIO® 214xx-[G,F]J-xxx-xxx, ECOVARIO® 414xx-[G,F]J-xxx-xxx, ECOVARIO®616xx-[G,F]J-xxx-xxx) or **X1**.

**Further information:**

■   Hardware installation: installation and commissioning manual ECOVARIO® and ECOSTEP®

■   Documentation by Siemens for the program package STEP 7 and the TIA portal

■   Software commissioning: ECOSTUDIO® manual or online help

■   Programming: Software tool ECOSTUDIO®, Manual Object Dictionary ECOVARIO®, ECOSTEP®, etc.


Requirements to personnel handling ECOVARIO® or ECOSTEP®:

| | |
|---|---|
| **Transport** | Personnel trained in handling electrostatic-sensitive devices. |
| **Installation** | Electro-technically trained personnel who know the security directives of electrical engineering and automation. |
| **Commissioning** | Qualified personnel with a broad knowledge of electrical engineering, automation and drives. |

Knowledge of the use of the STEP7 PLC program package is required for the functional integration of the servo drives in a Profibus® network.

| ⚠ **WARNING** |
|---|
| **Failure to observe the safety instructions when handling the drive system**<br>Risk of life or injury<br>➢   When handling the drive system, it is essential to observe the safety instructions in the above manuals. |

**INFORMATION**

The examples listed are only to be understood as such and reflect the basic procedure for integrating the drive. In the specific application, the user must check whether all functional and safety-relevant conditions have been met.


# 2    About CAN DS402

The profile specifications CAN DS 402 standardize the behaviour of controller and servo drive functions. Additionally, various operating modes and their corresponding configuration parameters are defined. The profile description contains a Finite-State-Automaton (FSA) that defines the internal and external device behaviour for every status. The status of the servo amplifier regulates which commands are accepted. Changes of state are triggered when a control word is received by the host controller or by internally happening events. The actual state is represented by the status word. The control word and various command values (e.g. velocity) are mapped to standard Rx PDOs (Receive Process Data Objects). The status word and various actual values (e.g. position) are mapped to Tx PDOs (Transmit Process Data Objects).

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# 3     About PROFIbus® DP

PROFIbus® is a non-proprietary, open fieldbus standard with a wide scope in the manufacturing and process automation. Die European standard EN 50170 describes three PROFIbus® forms: FMS, DP and PA.

PROFIbus® DP (Decentralized Peripherals) is optimized for speed, efficiency and low connection costs and is especially designed for the communication between automation systems and decentralized peripherals. Therefore, it is perfectly fit for controlling highly-dynamic drives such as ECOVARIO® and ECOSTEP® through a higher-level control system.

PROFIbus® DP operates according to the master / slave principle with overlayed token passing between different masters, if required. The master / slave communication is strictly cyclical, whereby the bus' time monitoring ensures that a failure of either master or slave is recognized almost instantly. Additionally, a standardized slave analysis through a master is implemented, offering extensive possibilities to transmit error and status information. A PROFIbus® DP device is identified through a configurable address. Furthermore, every device class has a so called *ID number* that is identical for all devices of the same type.

# 4     Requirements for use

Controlling the JAT drives via PROFIbus® requires the following components (if deviations occur, please contact us):

■ Servo amplifier ECOVARIO® or ECOSTEP® with PROFIbus® interface

■ Siemens SIMATIC control system S7-1500 / S7-300

■ Suitable communication processors (CP) for the S7-1200 / S7-1511 control system

■ Software suite *Totally Integrated Automation Portal* (TIA portal), V 15.1 or higher by Siemens

■ Service PC with commissioning tool ECOSTUDIO® V 3.2.0.0 or higher

■ Additional S7-SCL package by Siemens (JAT building blocks are programmed with SCL). If the additional package is not available, the JAT building blocks can still be used, but there is no possibility for adjustment

■ The current GSD file, e.g. as [download from our website](#)

■ The JAT package *FB PROFIbus®* (function blocks ECOVARIO®, ECOSTEP®) which contains the elements listed in chapter 6

For wiring the components via PROFIbus®, please consider the *Installation manual* ECOVARIO® or ECOSTEP® as well as the *SIMATIC control documentation*.

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# 5    Installation procedure

## 5.1    Exemplary projects

To develop an understanding of the drive management, the function blocks package *FB PROFIBUS®* (function blocks ECOVARIO® and ECOSTEP®) contains the following exemplary projects for integration into the TIA-Portal

- YYYYMMDD_S7-1200CP_DP_DS402_V15_1.zap15_1
- YYYYMMDD _S7-1500CP_DP_DS402_V15_1.zap15_1
- YYYYMMDD _S7-1516_DP_DS402_V15_1.zap15_1
- YYYYMMDD _S7-300_DP_DS402_V15_1.zap15_1

To integrate into the programming environment STEP 7, use the following project

- YYYYMMDD _S7-300_DP_DS402_classic.zip

## 5.2    Utilized controls

- S7-314-2 PN / DP
- S7-1215 C DC/DC/DC + CM 1243-5
- S7-1511-1 PN + CP 1542-5
- S7-1516-3 DP/PN

## 5.3    Project set-up

- Load an exemplary project → unpack project
- Adjust to the control environment → adjust device configuration
- Configuration overview → within the projects, there are a ECOVARIO®, a ECODUAL (ECOVARIO® 114D / 616D) and a ECOSTEP® listed
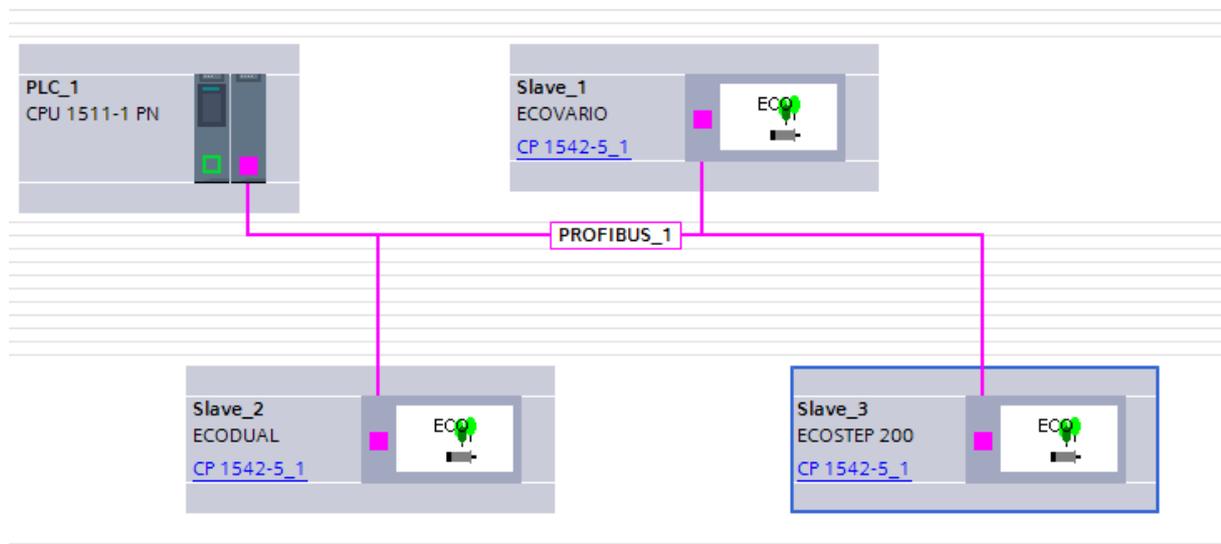


*Figure 1: Exemplary system configuration*

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# 6 Function blocks descriptions

## 6.1 Project overview

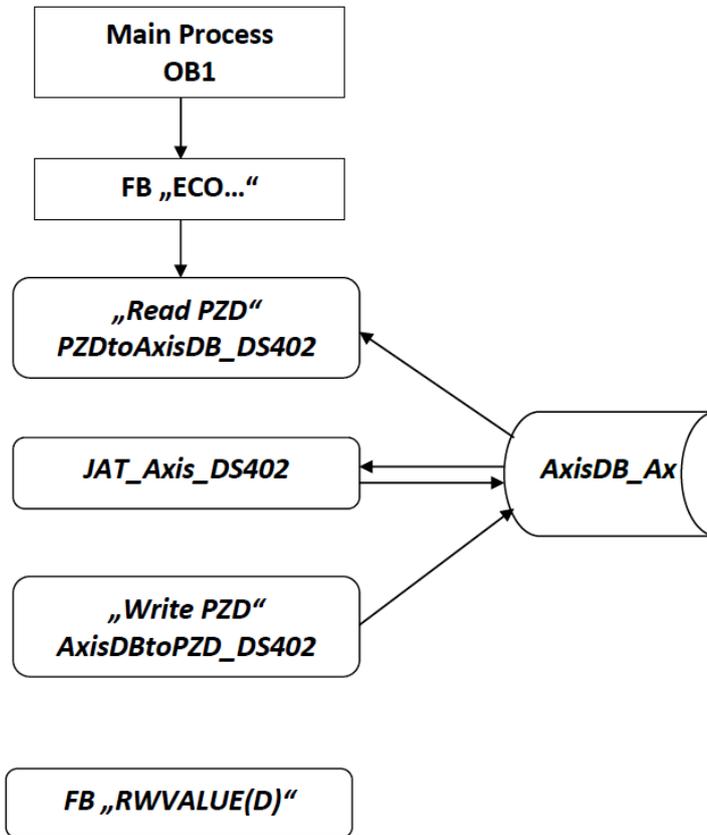Access to JAT axes according to DS402 in a SIEMENS control system via PROFIbus®:



*Figure 2: Project overview*

ECOVARIO®, ECOSTEP®
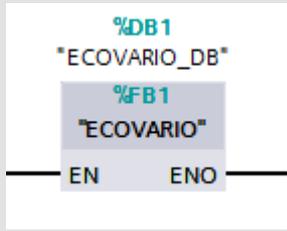**Use of the JAT Function Blocks for
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## 6.2    Specific project blocks

*Table 1: List of specific project blocks*

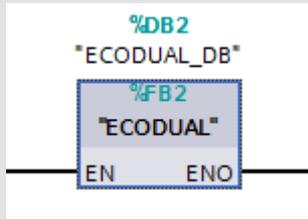| Type | Symbolic name | Description |
|---|---|---|
| OB1 | *Main* | Main program *organisation block*, is executed permanently |
| DB | AxisDB_DS402_Ax | Storage space for axis image |
| FB | ECOVARIO | Application example for the function blocks for 1-axis ECOVARIO® |
| FB | ECODUAL | Application example for the function blocks for ECOVARIO® DUAL (2-axis: 114D / 616D) |
| FB | ECOSTEP | Application example for the function blocks for ECOSTEP® |
| FB | JAT-Axis_DS402 | Function block to control the JAT servo amplifier (according to DS402) |
| FB | RWVALUE | Acyclical reading /writing of parameters for 1-axis servo amplifiers |
| FB | RWVALUED | Acyclical reading /writing of parameters for 2-axis servo amplifiers |
| FC | PZDtoAxisDB_DS402 | Read axis data from process image |
| FC | AxisDBtoPZD_DS402 | Write axis data into process image |
| UDT | UDT_Axis_Control_DS402 | Input data type axis-status |
| UDT | UDT_Axis_Status_DS402 | Output data type axis-status |
| UDT | UDT_PAE_DS402 | Input data type process data |
| UDT | UDT_PAA_DS402 | Output data type process data |
| DB | CTRLRW | Data for acyclical reading / writing of ECOVARIO® parameters |
| DB | CTRLRWD | Data for acyclical reading / writing of ECOVARIO® DUAL parameters |
| DB | CTRLRWS | Data for acyclical reading / writing of ECOSTEP® parameters |

*Table 2: Used abbreviations*

| Abbreviation | Meaning |
|---|---|
| OB | Organisation block |
| DB | Data block (data storage area) |
| FB | Function block |
| FC | Function |
| UDT | User-defined data type |

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## 6.3 FB ECOVARIO

| Name | JAT-FB_SFC | |
|---|---|---|
| Type | Function block | |
| | | |
| Input parameter | Data type | Comment |
| | | |
| | | |
| Output parameter | Data type | Comment |
| | | |
| | | |
| Graphical representation |  | |
| Function description | Exemplary FB application for ECOVARIO® | |

## 6.4 FB ECODUAL

| Name | JAT-FB_SFC | |
|---|---|---|
| Type | Function block | |
| | | |
| Input parameter | Data type | Comment |
| | | |
| | | |
| Output parameter | Data type | Comment |
| | | |
| | | |
| Graphical representation |  | |
| Function description | Exemplary FB application for ECOVARIO® DUAL | |

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## 6.5   FB ECOSTEP

| Name | JAT-FB_SFC | |
|---|---|---|
| Type | Function block | |
| | | |
| Input parameter | Data type | Comment |
| | | |
| | | |
| Output parameter | Data type | Comment |
| | | |
| | | |
| Graphical representation |  | |
| Function Description | Exemplary FB application for ECOSTEP® | |

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## 6.6    PZDtoAxisDB_DS402

| Name | PZDtoAxisDB_DS402 |
|---|---|
| Type | Function |

| Input parameter | Data type | Comment |
|---|---|---|
| PAE_PZD1_STATUS | Word | ZSW from Drive (from variable table) |
| PAE_PZD2_TARGET_POS | DWord | Target pos from Drive (from variable table) |
| PAE_PZD3_POS_ACT_VALUE | DWord | Pos actual value from Drive (from variable table) |
| PAE_PZD4_DETECT_FAULT | DWord | detect fault from Drive (from variable table) |
| PAE_PZD5_MODES_OF_OP_DISPLAY | Byte | Modes of Operation Display from Drive |

| Output parameter | Data type | Comment |
|---|---|---|
| Axis_DB | *UDT_PAE_DS402* | to *Axis_DB_Ax* for axis no x |

| Graphical representation | |
|---|---|
| | **%FC90**<br>**"PZDtoAxisDB_DS402"**<br>EN — ENO<br>%IW2 "ECO R statusword [6041,0]" — PAE_PZD1_STATUS<br>Axis_DB — "AxisDB_DS402_A1".PZD_Input<br>%ID12 "ECO R target_position [607A,0]" — PAE_PZD2_TARGET_POS<br>%ID8 "ECO R position_actual_value [6063,0]" — PAE_PZD3_POS_ACT_VALUE<br>%ID4 "ECO R detected_faults_2 [2600,2]" — PAE_PZD4_DETECT_FAULT<br>%IB16 "ECO_R_modes_of_op_display[6061,0]" — PAE_PZD5_MODES_OF_OP_DISPLAY |

| Function description | Read drive process data |
|---|---|
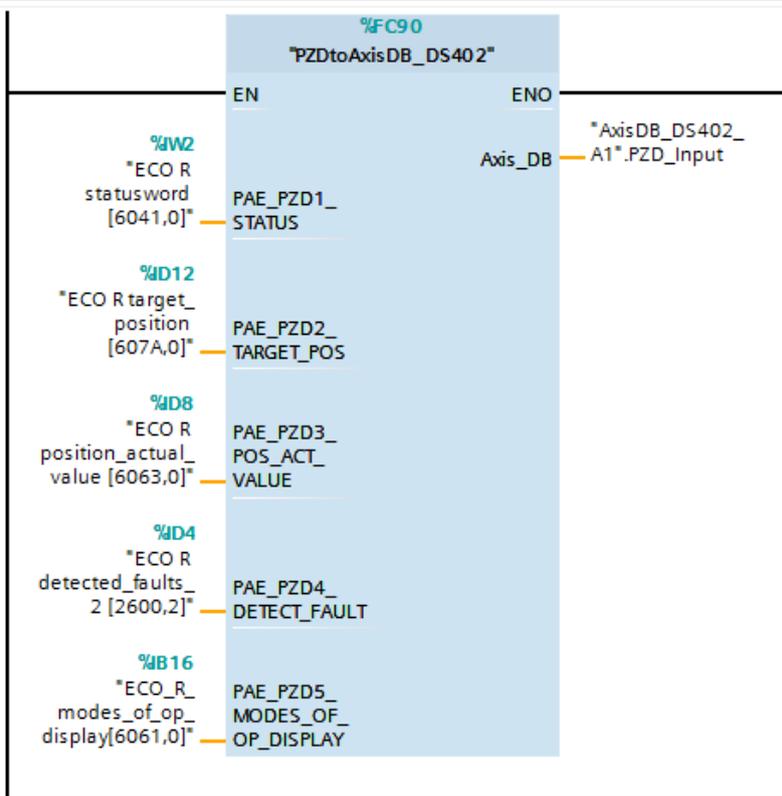
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## 6.7 AxisDBtoPZD_DS402

| Name | AxisDBtoPZD_DS402 |
|---|---|
| Type | Function |

| Input parameter | Data type | Comment |
|---|---|---|
| Axis_DB | *UDT_PAE_DS402* | from *Axis_DB_Ax* for axis no x |

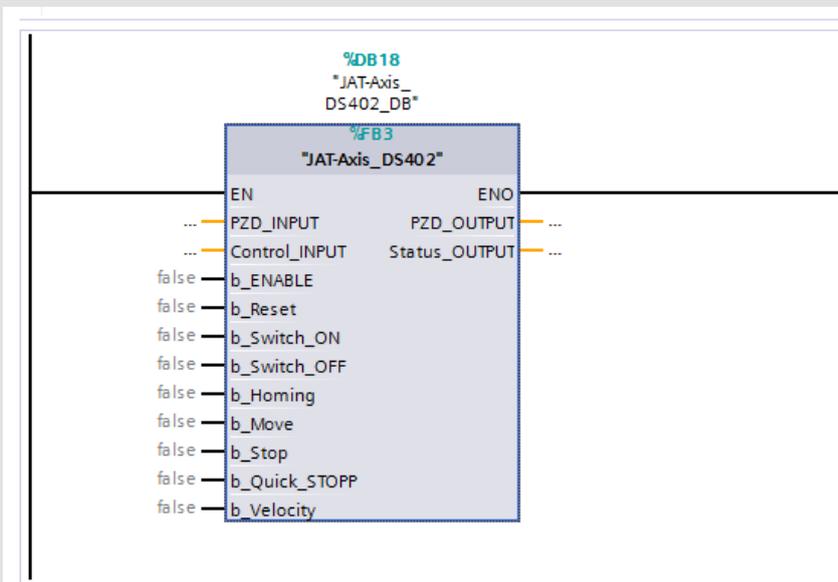| Output parameter | Data type | Comment |
|---|---|---|
| PAA_PZD1_CONTROLWORD | Word | STW to Drive (from variable table) |
| PAA_PZD2_TARGET_VEL | DWord | Target velo to Drive (from variable table) |
| PAA_PZD3_TARGET_POS | DWord | Target Pos to Drive (from variable table) |
| PAA_PZD4_PROFIL_VEL | DWord | Profil velo to Drive (from variable table) |
| PAA_PZD5_MODES_OP | Byte | Mode of Operation to Drive (from variable table) |

| Graphical representation | |
|---|---|
| | %FC92<br>"AxisDBtoPZD_DS402"<br><br>EN ENO<br><br>"AxisDB_DS402_A1".PZD_Output — Axis_DB<br><br>PAA_PZD1_CONTROLWORD — %QW2 "ECO W controlword [6040,0]"<br><br>PAA_PZD2_TARGET_VEL — %QD13 "ECO W target_velocity [60FF,0]"<br><br>PAA_PZD3_TARGET_POS — %QD5 "ECO W target_position [607A,0]"<br><br>PAA_PZD4_PROFIL_VEL — %QD9 "ECO W profile_velocity [6081,0]"<br><br>PAA_PZD5_MODES_OP — %QB4 "ECO W modes_of_operation [6060,0]" |

| Function description | Write drive process data |
|---|---|
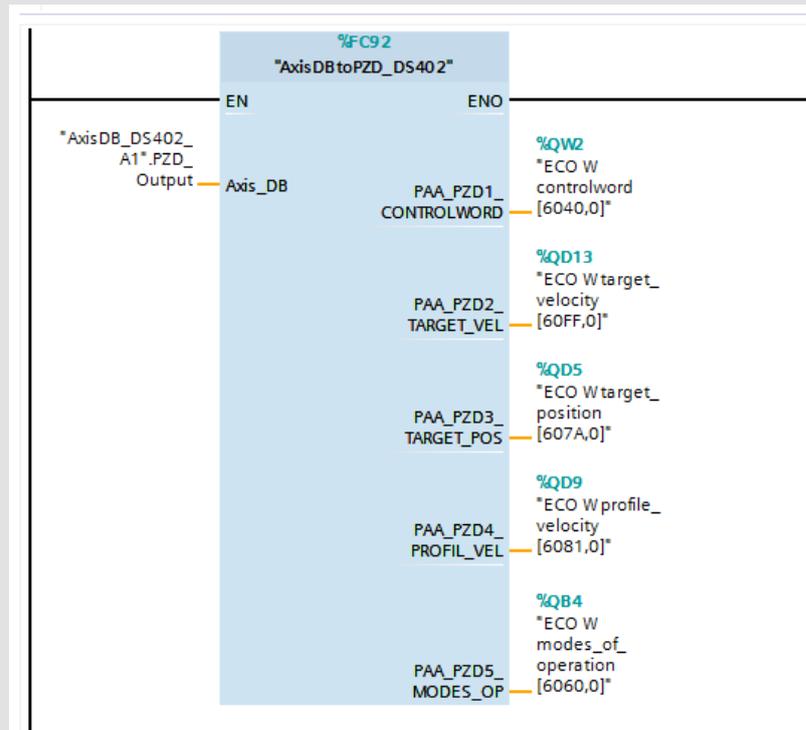
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## 6.8    JAT-Axis_DS402

| Name | JAT-Axis_DS402 |
|------|----------------|
| Type | Function block |
| | |

| Input parameter | Data type | Comment |
|-----------------|-----------|---------|
| PZD_INPUT | *UDT_PAE_DS402* | Input axis process data |
| Control_INPUT | *UDT_control_DS402* | Input axis status image |
| b_ENABLE | Bool | enable FB state machine |
| b_Reset | Bool | reset Drive |
| b_Switch_ON | Bool | switch on drive |
| b_Switch_OFF | Bool | swith off drive |
| b_Homing | Bool | run homing |
| b_Move | Bool | move drive |
| b_Stop | Bool | stop |
| b_Quick_STOPP | Bool | quick stop |
| b_Velocity | Bool | velocity |

| Output parameter | Data type | Comment |
|------------------|-----------|---------|
| PZD_OUTPUT | *UDT_PAA_DS402* | Output axis process data |
| Status_OUTPUT | *UDT_status_DS402* | Output axis status image |

| Graphical representation | |
|--------------------------|--|
| |  |

| Function description | FB to control JAT servo amplifiers (DS402) |
|----------------------|--------------------------------------------|

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## 6.8.1  Extended input signal function description

| Signal | Description | Control |
|--------|-------------|---------|
| b_ENABLE | Switch on / off internal state machine of FB | static at high level |
| b_Reset | Servo amplifier reset (output stage shut down) | Edge |
| b_Switch_ON | Switch on output stage | Edge |
| b_Switch_OFF | Switch off output stage | Edge |
| b_Homing | Execute homing procedure depending on controller settings | Edge |
| b_Move | Execute absolute or relative movement, depending on configuration (see AxisDB_DS402) | Edge |
| b_Stop | Stop current movement | Edge |
| b_Quick_STOPP | Stop axis with quickstop, behaviour dependent on controller configuration | Edge |
| b_Velocity | Axis in velocity mode (BA3) | Static |

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## 6.8.2 AxisDB_DS402_Ax

*Table 3: AxisDB_DS402_Ax, PZD_Input*

| Name | Data type | Starting value | Observed value | Remanence | Accessible | Visible | Settings | Comment |
|------|-----------|----------------|----------------|-----------|------------|---------|----------|---------|
| **PZD_Input** | UDT_PAE_DS402 | | | F | T | T | T | |
| R_STATUSWORD | Word | 16#0 | 16#0040 | F | T | T | T | Status word (Object 6041) |
| R_TARGET_POS | DWord | 16#0 | 16#0000_0000 | F | T | T | T | Read target position (Object 607A) |
| R_POS_ACT_VALUE | DWord | 16#0 | 16#0000_0000 | F | T | T | T | Actual position value(Object 6063) |
| R_DETECT_FAULTS | DWord | 16#0 | 16#0000_0000 | F | T | T | T | Actual error status (Object 2600) |
| R_MODE_OF_OP_DISPLAY | Byte | 16#0 | 16#00 | F | T | T | T | |

\*) T = True, F = False

*Table 4: AxisDB_DS402_Ax, Control_In*

| Name | Data type | Starting value | Observed value | Remanence | Accessible | Visible | Settings | Comment |
|------|-----------|----------------|----------------|-----------|------------|---------|----------|---------|
| **Control_In** | UDT_control_DS402 | | | F | T | T | T | |
| r_TARGET_VEL_DINT | Real | 0.0 | 0.0 | F | T | T | T | Next target velocity (°/s or mm/s) |
| r_TARGET_POS_DINT | Real | 0.0 | 0.0 | F | T | T | T | Next target position (° or mm) |
| r_PROFIL_VEL_DINT | Real | 0.0 | 0.0 | F | T | T | T | Next profile velocity (°/s or mm/s) |
| b_rel_abs | Bool | False | False | F | T | T | T | 0 = rel or 1 = abs positioning |
| b_abs3F | Bool | False | False | F | T | T | T | Direct absolute positioning (3F) |
| b_InkGeber | Bool | True | True | F | T | T | T | 1 = with incremental encoder |
| r_mechanic | Real | 1000.0 | 1000.0 | F | T | T | T | inc/° oder inc/mm |

\*) T = True, F = False

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*Table 5: AxisDB_DS402_Ax, Status_out*

| Name | Data type | Starting value | Observed value | Remanence | Accessible | Visible | Settings | Comment |
|---|---|---|---|---|---|---|---|---|
| **Status_out** | UDT_status_DS402 | | | | | | | |
| L_DETECT_FAULTS_OLD | DWord | 16#0 | 16#0000_0000 | F | T | T | T | Last error |
| b_RUN | Bool | False | False | F | T | T | T | Run operation |
| b_DONE | Bool | False | False | F | T | T | T | Operation done |
| b_ERROR | Bool | False | False | F | T | T | T | Error during operation |
| s_Step | String[20] | '' | ' ' | F | T | T | T | Debug String |
| w_ZSW1 | Word | 16#0 | 16#0040 | F | T | T | T | |
| di_XIST_Position | Dint | 0 | 0 | F | T | T | T | Actual position as DINT |
| r_XIST_Position | Real | 0.0 | 0.0 | F | T | T | T | Actual position as REAL |
| b_00_Ready_to_switch_on | Bool | False | False | F | T | T | T | Status word Bits (ZSW1) |
| b_01_Switched_on | Bool | False | False | F | T | T | T | |
| b_02_Operation_enable | Bool | False | False | F | T | T | T | |
| b_03_Fault | Bool | False | False | F | T | T | T | |
| b_04_Voltage_enable | Bool | False | False | F | T | T | T | |
| b_05_Quick_stop_not_activated | Bool | False | False | F | T | T | T | |
| b_06_Switch_on_disable | Bool | False | False | F | T | T | T | |
| b_07_Warning | Bool | False | False | F | T | T | T | |
| b_08_Manufacturer_specific | Bool | False | False | F | T | T | T | |
| b_09_Reserved | Bool | False | False | F | T | T | T | |
| b_10_Target_position_reached | Bool | False | False | F | T | T | T | |
| b_11_Internal_limit_active | Bool | False | False | F | T | T | T | |
| b_12_Reserved | Bool | False | False | F | T | T | T | |
| b_13_Reserved | Bool | False | False | F | T | T | T | |
| b_14_Commutation_found | Bool | False | False | F | T | T | T | |
| b_15_Reference_found | Bool | False | False | F | T | T | T | |
| Error | Word | 16#0 | 16#0000 | F | F | F | F | from_GET_ER_ID() local error |

\*) T =True, F =False

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*Table 6: AxisDB_DS402_Ax, PZD_Output*

| Name | Data type | Starting value | Observed value | Remanence | Accessible | Visible | Settings | Comment |
|---|---|---|---|---|---|---|---|---|
| **PZD_Output** | **UDT_PAA_DS402** | | | F | T | T | T | |
| W_CONTROLWORD | Word | 16#0 | | F | T | T | T | Control word(object 6040) |
| W_TARGET_VEL | DWord | 16#0 | | F | T | T | T | Target velocity in inc/64s (object 60FF) |
| W_TARGET_POS | DWord | 16#0 | | F | T | T | T | Target position in inc (object 607A) |
| W_PROFIL_VEL | DWord | 16#0 | | F | T | T | T | Profile velocity in inc/64s (object 6081) |
| W_MODES_OP | Byte | 16#0 | | F | T | T | T | Operating mode (object 6060) |
| *) T = True, F = False | | | | | | | | |

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## 6.9   JAT SDO Tunnel (FB RWVALUE/FB RWVALUED)

This configuration enables sending and receiving SDO messages. They are transmitted in the following format (Modul R/W Registers (9Byte DI/DO) and R/W Registers (8Byte DI/DO)):

- Byte 0: Index High byte
- Byte 1: Index Low byte
- Byte 2: Subindex
- Byte 3: Command
- Byte 4: Data byte 3
- Byte 5: Data byte 2
- Byte 6: Data byte 1
- Byte 7: Data byte 0
- Byte 8: Axis index (only used with multi-axis devices)

With 1-axis devices in the state *Data Exchange*, 8 bytes of data are exchanged in both directions. Multi-axis devices use 9 bytes, the last byte of a message transmission contains the axis index.

**Special module JAT SDO tunnel for 1-axis devices**

*R/W Registers (8 Byte DI/DO)* format in check_config package: 0xC3, 0x87, 0x87, 0x00, 0x00, 0x00

Example: Use in state *Data Exchange*

- 0x60 0x40 0x00 0x20 0x00 0x00 0x00 0x86 (reset device error / x20 = write)
- 0x21 0x00 0x01 0x40 0x00 0x00 0x00 0x00 (read universal variable 00 / x40 = read)

**Special module JAT SDO tunnel for multi-axis devices**

*R/W Registers (9 Byte DI/DO)* format in check_config package: 0xC3, 0x88, 0x88, 0x00, 0x00, 0x00

Example: Use in state *Data Exchange*

- 0x60 0x40 0x00 0x20 0x00 0x00 0x00 0x86 0x00 (reset device error axis 1)
- 0x21 0x00 0x05 0x40 0x00 0x00 0x00 0x00 0x01 (read variable unimappv_4 axis 2)

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## 6.9.1 RWVALUE

| Name | RWVALUE |
|------|---------|
| Type | Function block |

| Input parameter | Data type | Comment |
|-----------------|-----------|---------|
| unimode | Int | Peripheral address INPUT UNIVERSALE MODULE |
| unimoda | Int | Peripheral address OUTPUT UNIVERSALE MODULE |
| object | Word | Parameter object number in ECOVARIO® |
| objectsub | Byte | Parameter subindex in ECOVARIO® |
| wvalue | DWord | Value to be written |
| operation | Bool | Read = 0; Write = 1 |
| start | Bool | Starting reading |

| Output parameter | Data type | Comment |
|------------------|-----------|---------|
| rvalue | DWord | Read value |
| run | Bool | Feedback from FB state machine |
| done | Bool | Feedback from FB state machine |
| error | Bool | Feedback from FB state machine |

| Graphical representation | |
|--------------------------|---|
| |  |

| Function description | Acyclical reading / writing of parameters (SDO) for 1-axis devices |
|----------------------|---|
| | Input signal: start → 1 = start writing with edge FALSE → TRUE |
| | Output data: rvalue → read value; 0x00000000 with writing operation |
| | Output signals: |
| | ■ run → 1 = FB operates |
| | ■ done → 1 = Operation successful |
| | ■ error → 1 = Error during operation |
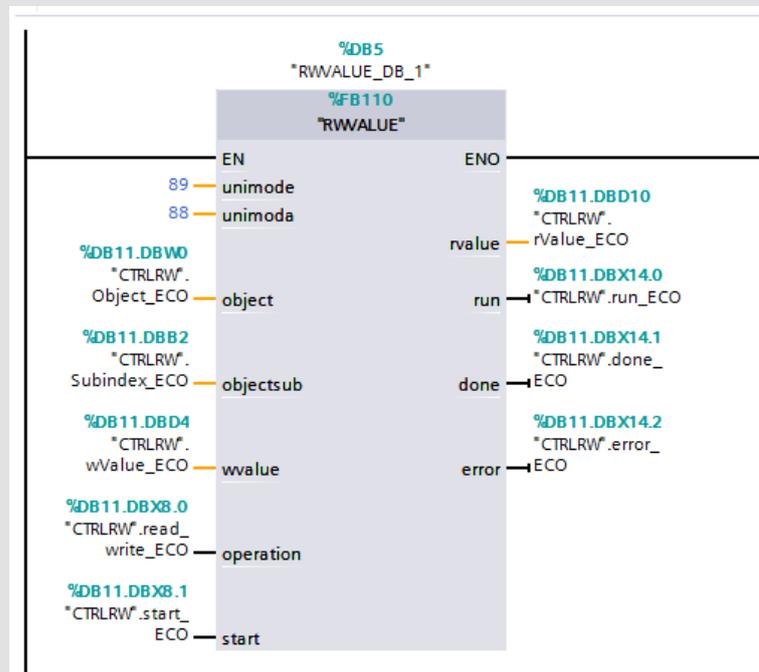
## 6.9.2 RWVALUED

| Name | JAT-RDWR_PAP |
|------|--------------|
| Type | Function Block |

| Input parameter | Data type | Comment |
|-----------------|-----------|---------|
| unimode | Int | Peripheral address INPUT UNIVERSALE MODULE |
| unimoda | Int | Peripheral address OUTPUT UNIVERSALE MODULE |
| object | Word | Parameter object number in ECOVARIO® |
| objectsub | Byte | Parameter subindex in ECOVARIO® |
| wvalue | DWord | Value to be written |
| operation | Bool | Read = 0; Write = 1 |
| axisnum | Bool | Axis number: FALSE → 0, TRUE → 1 |
| start | Bool | Start reading |

| Output parameter | Data type | Comment |
|------------------|-----------|---------|
| rvalue | DWord | Read value |
| run | Bool | Feedback from FB state machine |
| done | Bool | Feedback from FB state machine |
| error | Bool | Feedback from FB state machine |

| Graphical representation | |
|---|---|



| Function description | |
|---|---|
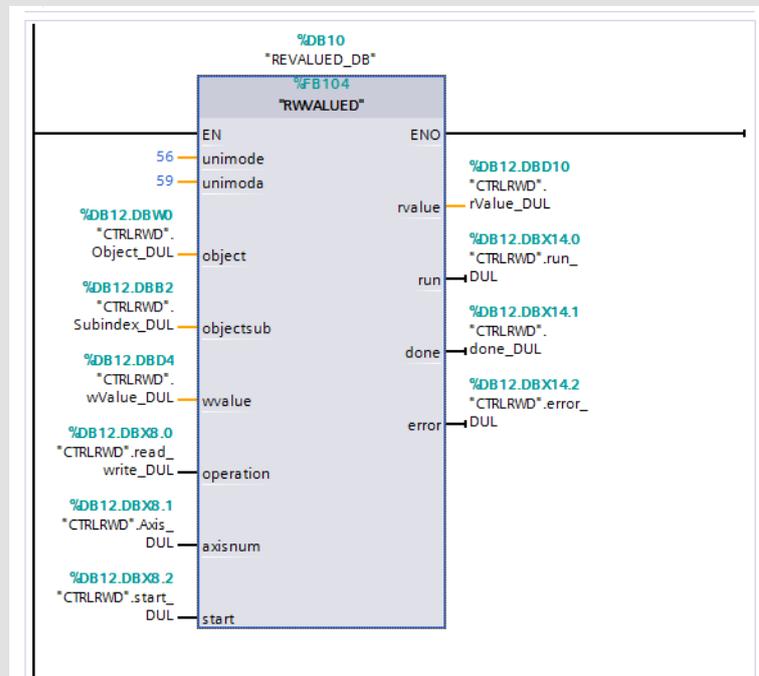
Acyclical reading / writing of parameters (SDO) for 2-axis devices

Input signal: start → 1 = start writing with edge FALSE → TRUE

Output data: rvalue → read value; 0x00000000 with writing operation

Output signals:

- run → 1 = FB operates
- done → 1 = Operation successful
- error → 1 = Error during operation

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## 6.10 JAT CAN tunnel

The ECODUAL 2-axis servo drive additionally the **CAN tunnel module** R/W CAN-Reg (9Byte DI/DO_1). This encodes the data into the format seen below. The **function blocks RWVALUE / RWVALUED do not support this module**.

This module allows to process SDO messages as if it were a CAN bus. Data are transmitted in the following format:

- Byte 0: Command
- Byte 1: Index low byte
- Byte 2: Index high byte
- Byte 3: Subindex
- Byte 4: Data byte 0
- Byte 5: Data byte 1
- Byte 6: Data byte 2
- Byte 7: Data byte 3
- Byte 8: Axis index (only in use on multi-axis devices)

**Special module JAT CAN Tunnel for 1-axis devices**

*R/W Registers (8 Byte DI/DO1)* format in check_config package: 0xC3, 0x87, 0x87, 0x00, 0x00, 0x01
Example: Use in state *Data Exchange*

- 0x20 0x40 0x60 0x00 0x86 0x00 0x00 0x00 (Rücksetzen der Gerätefehler)

**Special module JAT CAN Tunnel for multi-axis devices**

*R/W Registers (9 Byte DI/DO1)* format in check_config package: 0xC3, 0x88, 0x88, 0x00, 0x00, 0x01
Example: Use in state *Data Exchange*

- 0x20 0x40 0x60 0x00 0x86 0x00 0x00 0x00 0x01 (reset device errors axis 2)
- 0x40 0x00 0x21 0x05 0x00 0x00 0x00 0x00 0x00 (read variable unimappv_4 from axis 1)

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# 7 User-defined data types

## 7.1 UDT_PAE_DS402

**UDT_PAE_DS402**

| | Name | Datentyp | Defaultwert | Erreichbar a.. | Schrei... | Sichtbar i... | Einstellwert | Kommentar |
|---|---|---|---|---|---|---|---|---|
| 1 | R_STATUSWORD | Word | 16#0 | ☑ | ☑ | ☑ | ☐ | Statuswort (Objekt 6041) |
| 2 | R_TARGET_POS | DWord | 16#0 | ☑ | ☑ | ☑ | ☐ | read Target Postion (Objekt 607A) |
| 3 | R_POS_ACT_VALUE | DWord | 16#0 | ☑ | ☑ | ☑ | ☐ | Position actual Value (Objekt 6063) |
| 4 | R_DETECT_FAULTS | DWord | 16#0 | ☑ | ☑ | ☑ | ☐ | current error (Objekt 2600) |
| 5 | R_MODE_OF_OP_DISPLAY | Byte | 16#0 | ☑ | ☑ | ☑ | ☐ | |

*Figure 3: Read axis process data*

## 7.2 UDT_PAA_DS402

**UDT_PAA_DS402**

| | Name | Datentyp | Defaultwert | Erreichbar a.. | Schrei... | Sichtbar i... | Einstellwert | Kommentar |
|---|---|---|---|---|---|---|---|---|
| 1 | W_CONTROLWORD | Word | 16#0 | ☑ | ☑ | ☑ | ☐ | Controlwort (Objekt 6040) |
| 2 | W_TARGET_VEL | DWord | 16#0 | ☑ | ☑ | ☑ | ☐ | Target velocity in Inkr./64s (Objekt 60FF) |
| 3 | W_TARGET_POS | DWord | 16#0 | ☑ | ☑ | ☑ | ☐ | Target position in Inkr. (Objekt 607A) |
| 4 | W_PROFIL_VEL | DWord | 16#0 | ☑ | ☑ | ☑ | ☐ | Profil velocity in Inkr./64s (Objekt 6081) |
| 5 | W_MODES_OP | Byte | 16#0 | ☑ | ☑ | ☑ | ☐ | Modes of Operation (Objekt 6060) |

*Figure 4: Output axis process data*

## 7.3 UDT_control_DS402

**UDT_control_DS402**

| | Name | Datentyp | Defaultwert | Erreichbar a.. | Schrei... | Sichtbar i... | Einstellwert | Kommentar |
|---|---|---|---|---|---|---|---|---|
| 1 | r_TARGET_VEL_DINT | Real | 0.0 | ☑ | ☑ | ☑ | ☐ | next Target velocity (°/s or mm/s) |
| 2 | r_TARGET_POS_DINT | Real | 0.0 | ☑ | ☑ | ☑ | ☐ | next Target position (° or mm) |
| 3 | r_PROFIL_VEL_DINT | Real | 0.0 | ☑ | ☑ | ☑ | ☐ | next Profil veocity (°/s or mm/s) |
| 4 | b_rel_abs | Bool | false | ☑ | ☑ | ☑ | ☐ | 0= rel. or 1 = abs. positioning |
| 5 | b_abs3F | Bool | false | ☑ | ☑ | ☑ | ☐ | direct absolut positioning (3F) |
| 6 | b_InkGeber | Bool | false | ☑ | ☑ | ☑ | ☐ | 1 = with Incremental Encoder |
| 7 | r_mechanic | Real | 0.0 | ☑ | ☑ | ☑ | ☐ | inc/° or inc/mm |

*Figure 5: Image read axis status*

## 7.4 UDT_status_DS402

**UDT_status_DS402**

| | Name | Datentyp | Defaultwert | Erreichbar a.. | Schrei... | Sichtbar i... | Einstellwert | Kommentar |
|---|---|---|---|---|---|---|---|---|
| 1 | L_DETECT_FAULTS_OLD | DWord | 16#0 | ☑ | ☑ | ☑ | ☐ | last error |
| 2 | b_RUN | Bool | false | ☑ | ☑ | ☑ | ☐ | operation run |
| 3 | b_DONE | Bool | false | ☑ | ☑ | ☑ | ☐ | operation done |
| 4 | b_ERROR | Bool | false | ☑ | ☑ | ☑ | ☐ | operation with error |
| 5 | s_Step | String[20] | '' | ☑ | ☑ | ☑ | ☐ | debug string |
| 6 | w_ZSW1 | Word | 16#0 | ☑ | ☑ | ☑ | ☐ | |
| 7 | di_XIST_Position | DInt | 0 | ☑ | ☑ | ☑ | ☐ | current position as DINT |
| 8 | r_XIST_Position | Real | 0.0 | ☑ | ☑ | ☑ | ☐ | current position as REAL |
| 9 | b_00_Ready_to_switch_on | Bool | false | ☑ | ☑ | ☑ | ☐ | bit from Statusword (ZSW1) |
| 10 | b_01_Switched_on | Bool | false | ☑ | ☑ | ☑ | ☐ | bit from Statusword (ZSW1) |
| 11 | b_02_Operation_enable | Bool | false | ☑ | ☑ | ☑ | ☐ | bit from Statusword (ZSW1) |
| 12 | b_03_Fault | Bool | false | ☑ | ☑ | ☑ | ☐ | bit from Statusword (ZSW1) |
| 13 | b_04_Voltage_enabled | Bool | false | ☑ | ☑ | ☑ | ☐ | bit from Statusword (ZSW1) |
| 14 | b_05_Quick_stop_not_activa... | Bool | false | ☑ | ☑ | ☑ | ☐ | bit from Statusword (ZSW1) |
| 15 | b_06_Switch_on_disable | Bool | false | ☑ | ☑ | ☑ | ☐ | bit from Statusword (ZSW1) |
| 16 | b_07_Warning | Bool | false | ☑ | ☑ | ☑ | ☐ | bit from Statusword (ZSW1) |
| 17 | b_08_Manufacturer_specific | Bool | false | ☑ | ☑ | ☑ | ☐ | bit from Statusword (ZSW1) |
| 18 | b_09_Reserved | Bool | false | ☑ | ☑ | ☑ | ☐ | bit from Statusword (ZSW1) |
| 19 | b_10_Target_postion_reached | Bool | false | ☑ | ☑ | ☑ | ☐ | bit from Statusword (ZSW1) |
| 20 | b_11_Internal_limit_active | Bool | false | ☑ | ☑ | ☑ | ☐ | bit from Statusword (ZSW1) |
| 21 | b_12_Reserved | Bool | false | ☑ | ☑ | ☑ | ☐ | bit from Statusword (ZSW1) |
| 22 | b_13_Reserved | Bool | false | ☑ | ☑ | ☑ | ☐ | bit from Statusword (ZSW1) |
| 23 | b_14_Commutation_found | Bool | false | ☑ | ☑ | ☑ | ☐ | bit from Statusword (ZSW1) |
| 24 | b_15_Reference_found | Bool | false | ☑ | ☑ | ☑ | ☐ | bit from Statusword (ZSW1) |
| 25 | Error | Word | 16#0 | ☐ | ☐ | ☐ | ☐ | from GET_ER_ID() local Error handing |

*Figure 6: Output image axis controller*

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# 8 Troubleshooting

## 8.1 Warnings

The objects used for warning messages and a list thereof are described in the manual *Object directory ECOVARIO® and ECOSTEP®*.

## 8.2 Errors

The objects used for error messages and a list thereof are described in the manual *Object directory ECOVARIO® and ECOSTEP®*.

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# 9 Comparison TIA portal / Classic world

## 9.1 STEP7 classic world

Every part of the program has its own window with different design.

- STEP 7
- DriveES
- WinCC Flexible
- PDM
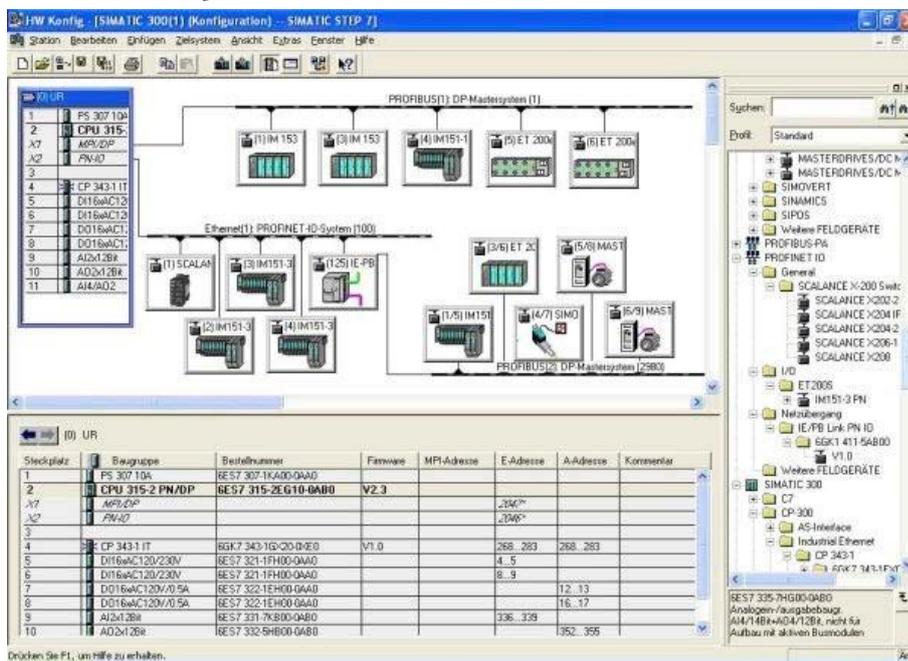- Starter

### 9.1.1 Description



*Figure 7: SIMATIC STEP 7 Software*

STEP 7 Professional is the compilation of the following software packages:

- STEP7 Basic software
- S7 - Graph
- S7 - SCL
- S7 - PLCSIM

Compared to the also individually available software packages, the suite offers a substantial price advantage, as well as a reduced installation effort and the possibility to use a single software update service for the whole suite.

There are directories included that show which versions are compatible.

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## 9.2 TIA portal world

All programs and functions are **combined into a uniform interface**. Thus, independent of which program part is installed first, the central program is always a part of the installation process. **Only the exactly same versions of the program parts are compatible**.

The V12 Professional version therefore requires the compatible HMI in version 12, otherwise basic panels cannot be programmed with V12 Professional (which is possible without explicit WinCC Compact / Comfort / Advanced V12)



*Figure 8: TIA portal interface*

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# 10 Manual integration of JAT drives

**Connect JAT servo amplifiers**

1.  Start the program suite STEP 7

2.  Open an existing project or create a new one

3.  Integrate the appropriate .GSD file. There are 2 different .GSD files provided:

    ➢ **ECOVARIO.GSD:** for all 1-axis servo amplifiers, meaning ECOSTEP® 100, ECOSTEP® 200, ECOVARIO® 114, ECOVARIO® 214, ECOVARIO® 414

    ➢ **ECODUAL.GSD:** for 2-axis servo amplifiers, e. g. ECOVARIO® 114D. The 2-axis servo amplifier acts as any 1 -axis servo amplifier at the PROFIbus®. The second axis is realized by additional project modules.

Project the PROFIbus®. JAT drives can be found in **Further field devices \ Drives \ JAT**.
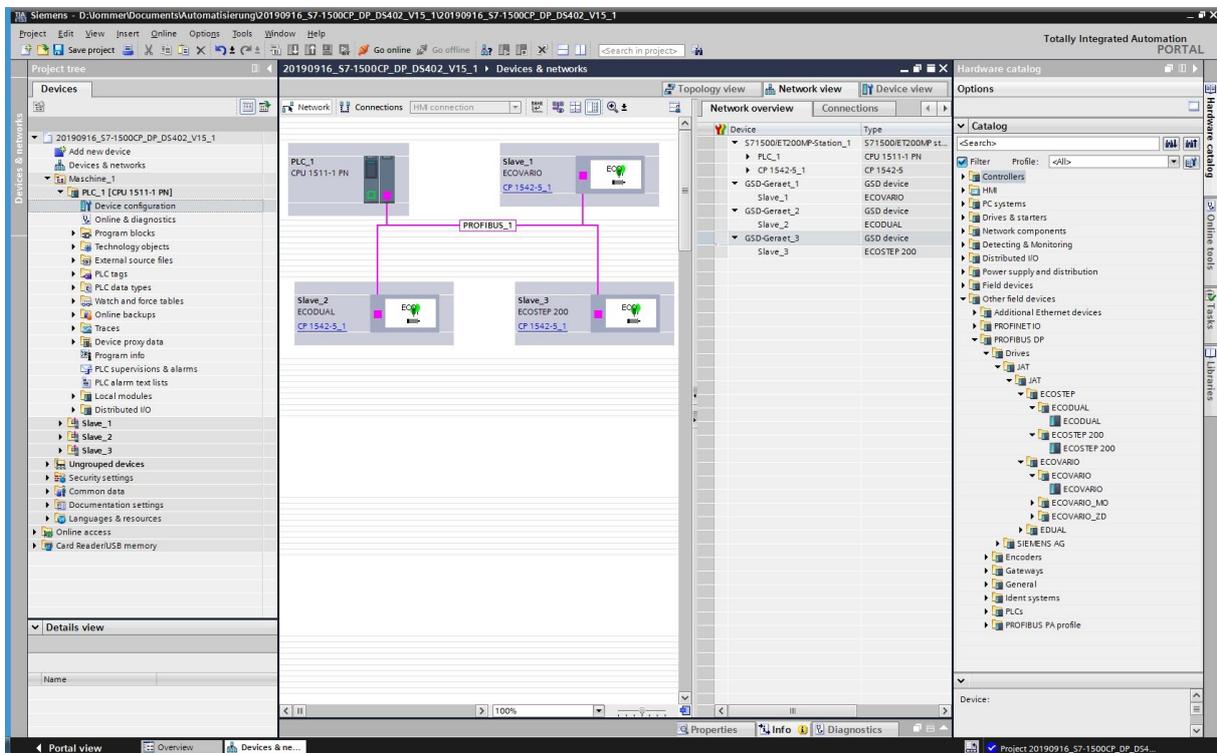


*Figure 9: PROFIbus® projecting devices and networks*

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**Profibus® Servo Amplifiers acc. to DS402**

## 10.1   1-axis drive

For driving a single axis, the following modules need to be projected:

*Table 7: 1-axis drive modules overview*

| R / W | Module | Description |
|-------|--------|-------------|
| W | controlword | Control word (object 6040) |
| W | modes_of_operation | Operating mode (object 6060) |
| W | target_position | Target position in increments (object 607A) |
| W | profile_velocity | Profile velocity in positioning mode in inc / 64 s (object 6081) |
| W | target_velocity | Target velocity in velocity mode in inc / 64 s (object 60FF) |
| R | statusword | Status word (object 6041) |
| R | detected_faults | Current error status (object 2600) |
| R | position_actual_value | Actual position (object 6063) |
| R | target_position | Target position in increments (object 607A) |
| R | modes_display | Display operating mode (object 6061) |
| R / W | Registers (8 Byte DI/DO) | Optional, see below |

The following figure shows an examplary projected 1-axis servo amplifier within its interface. The addresses are not fix, but can be found in different directories in dependence of the used S7 controler.

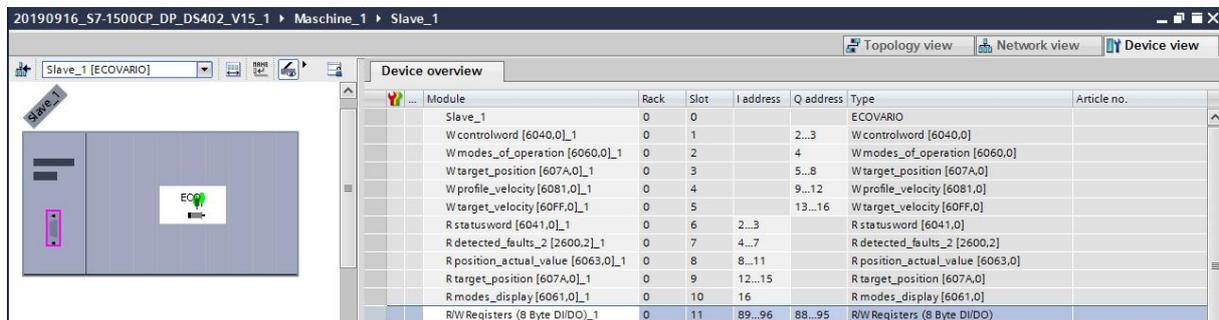The module *R/W Registers (8 Byte DI/DO)* is required for the function block RWVALUE.



*Figure 10: 1-axis drive exemplary projecting*

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## 10.2   2-axis drive

For operating a 2-axis drive (e.g. ECOVARIO® 114D), the following modules need to be projected. The second axis' modules are indicated by an additional _1 at the end of their module names.

*Table 8: 2-axis drive modules overview*

| R / W | Module | Beschreibung |
|---|---|---|
| W | controlword | Control word axis 1 (object 6040) |
| W | controlword_1 | Control word axis 2 (object 6040) |
| W | modes_of_operation | Operating mode axis 1 (object 6060) |
| W | modes_of_operation_1 | Operating mode axis 2 (object 6060) |
| W | target_position | Target position axis 1 in increments (object 607A) |
| W | target_position_1 | Target position axis 2 in increments (object 607A) |
| W | profile_velocity | Profile velocity axis 1 in positioning mode in inc / 64 s (object 6081) |
| W | profile_velocity_1 | Profile velocity axis 2 in positioning mode in inc / 64 s (object 6081) |
| W | target_velocity | Target velocity axis 1 in velocity mode in inc / 64 s (object 60FF) |
| W | target_velocity_1 | Target velocity axis 2 in velocity mode in inc / 64 s (object 60FF) |
| R | statusword | Status word axis 1 (object 6041) |
| R | statusword_1 | Status word axis 2 (object 6041) |
| R | detected_faults | Current error status axis 1 (object 2600) |
| R | detected_faults_1 | Current error status axis 2 (object 2600) |
| R | position_actual_value | Actual position axis 1 (object 6063) |
| R | position_actual_value_1 | Actual position axis 2 (object 6063) |
| R | target_position | Target position in increments axis 1 (object 607A) |
| R | target_position_1 | Target position in increments axis 1 (object 607A) |
| R | modes_display | Display operating mode axis 1 (object 6061) |
| R | modes_display_1 | Display operating mode axis 2 (object 6061) |
| R / W | Registers (9 Byte DI/DO) | Optional, see below |

The following figure shows an exemplary projecting for a 2-axis servo amplifier within its interface. The addresses are not fix, but can be found in different directories in dependence of the used S7 controller. The module *R/W Registers (9 Byte DI/DO)* is required for the function block RWVALUED.
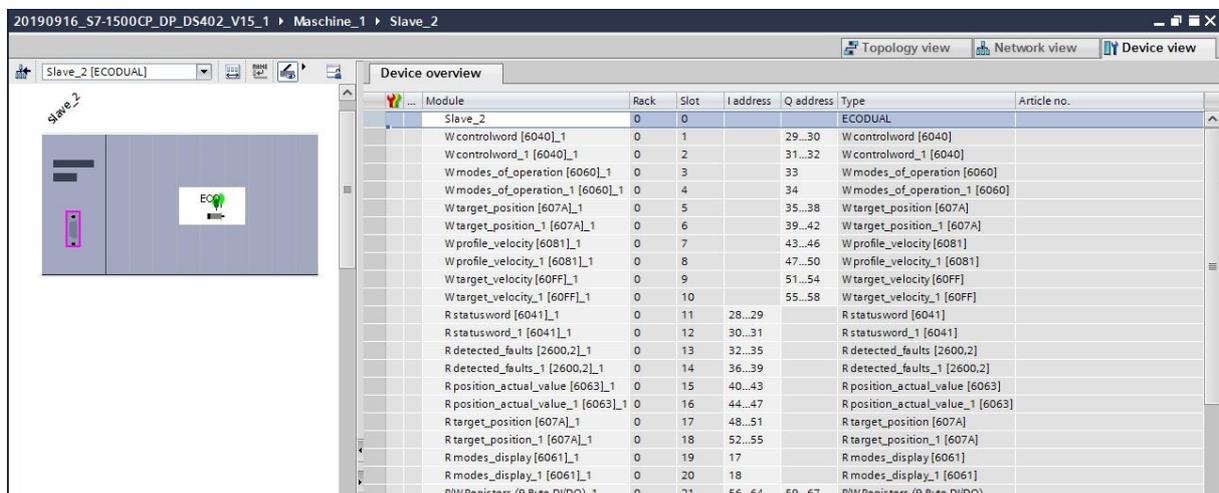


*Figure 11: 2-axis drive exemplary projecting*

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# 11 General information regarding JAT with PROFIbus®

■ The baud rate is determined automatically

■ The DP address is set via the CAN address

■ With DUAL devices, only the first axis' address is addressed

■ With DUAL devices, the second axis is addressed via the first axis (*x6000 + x800*)

■ Theoretically, DUAL devices allow to address 2 • 127 axes (see above). Consider the transmission rate / bus load

■ The configuration telegram's maximal size is 160 byte (1 module requires 6 byte)

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# 12 Information regarding the universal module in SIEMENS controllers

The universal module is a freely configurable I/O module in the HW catalogue included into the respective device.

SIEMENS creates the universal module automatically in the HW catalogue. It is included in the catalogue independent of the .GSD file.
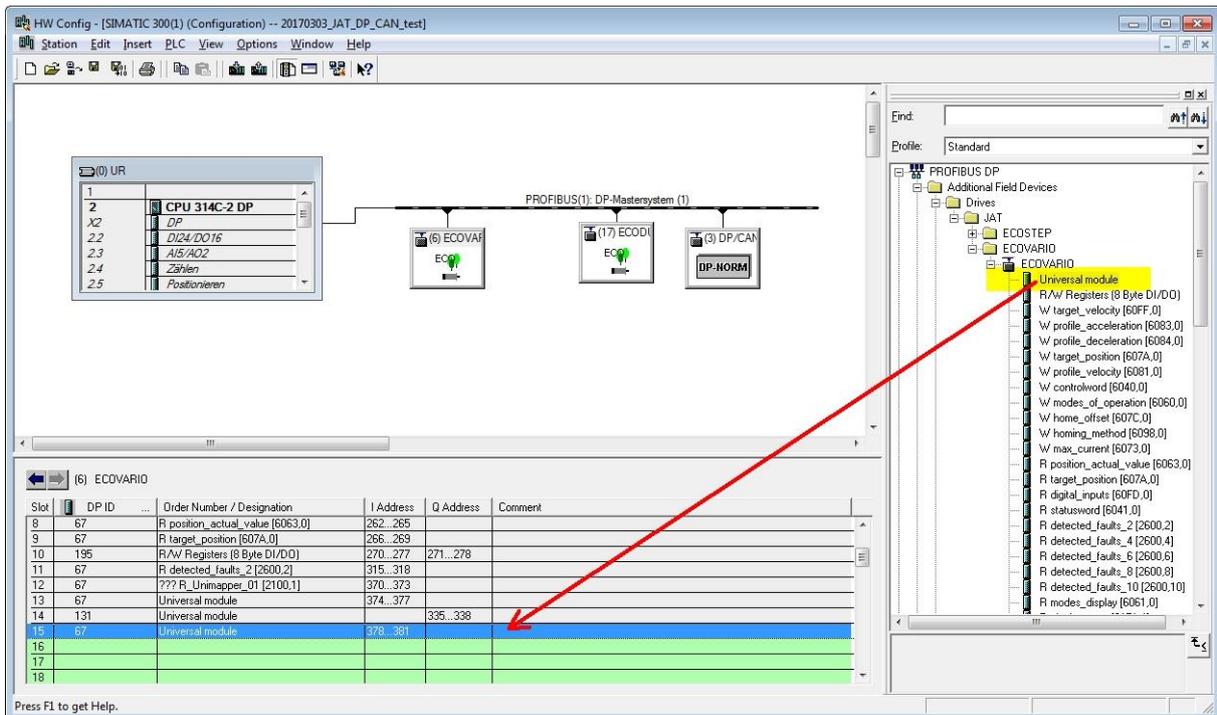


*Figure 12: Universal module configuration*

The univeral module is created through drag & drop in a free slot for the respective drive. Double-clicking the universal module allows it to be set as input, output, out- / input or be left empty.
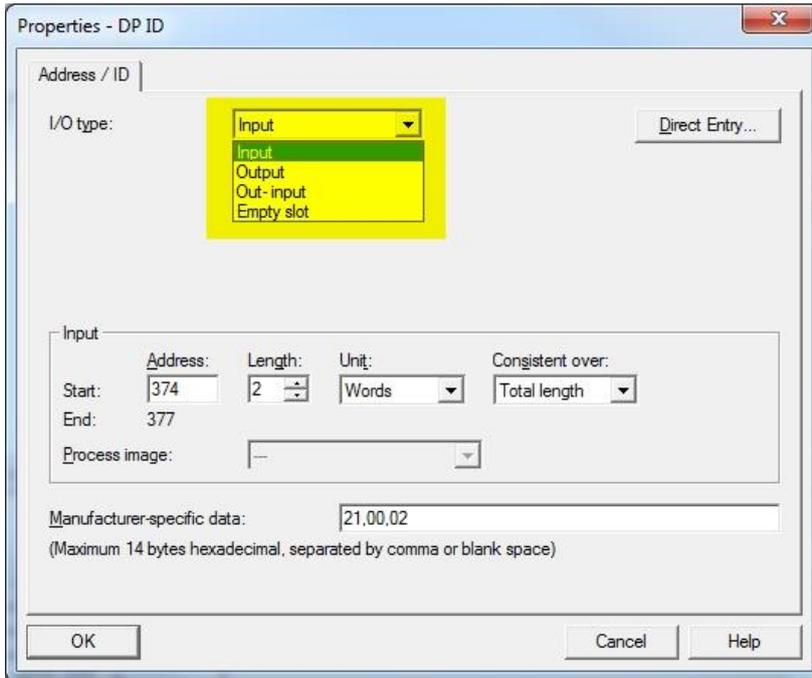
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*Figure 13: Setting the I/O type*

The input addresses and output addresses are set according to the I/O type and the device object (length).

To illustrate, three examples follow.

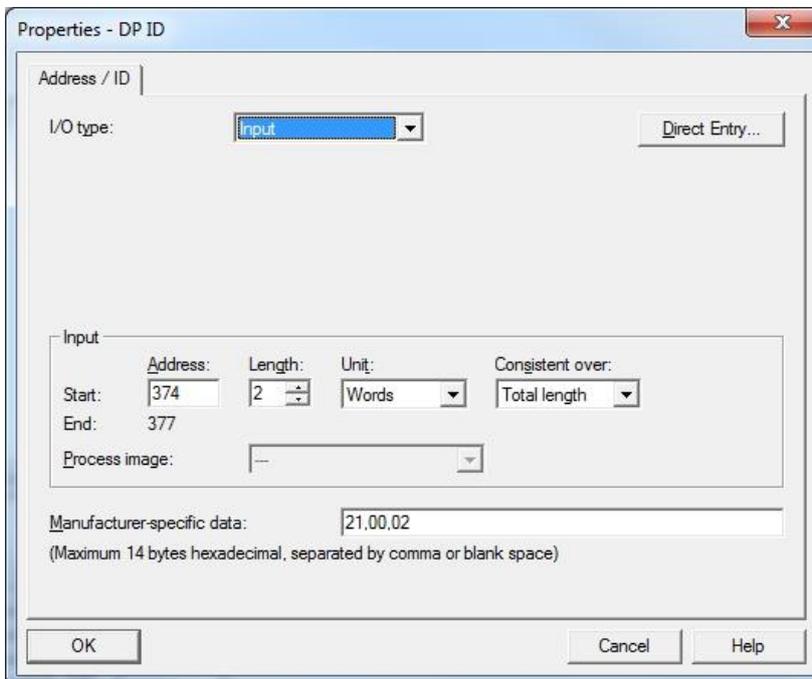**Read object 0x2100:02 universal variable 02**



*Figure 14: Read object 0x2100:02 universal variable 02*

ECOVARIO®, ECOSTEP®
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**Profibus® Servo Amplifiers acc. to DS402**

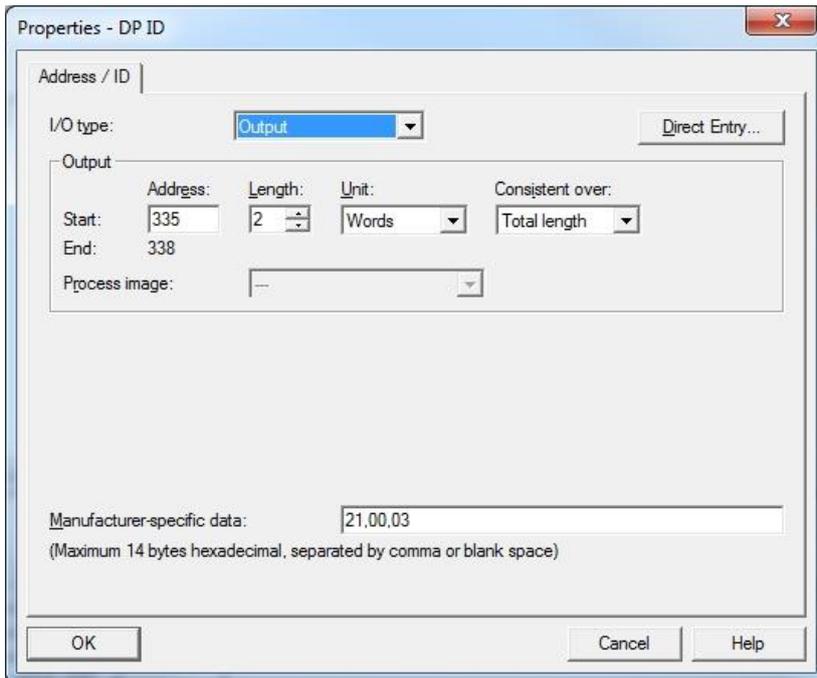**Write object 0x2100:03 universal variable 03**



*Figure 15: Write object 0x2100:03 universal variable 03*

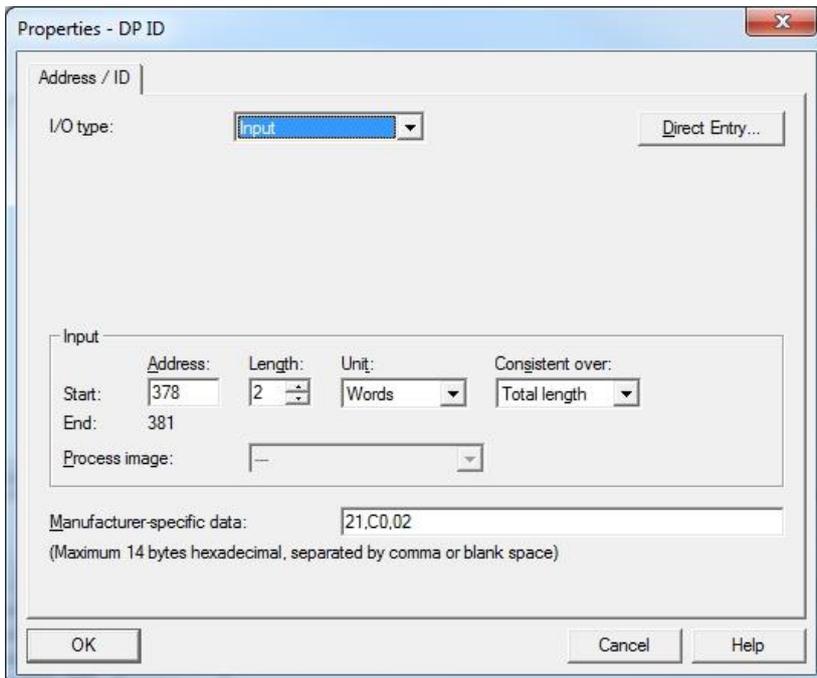**Read object 0x21C0:02 positiong capturing strobe counter**



*Figure 16: Read object 0x21C0:02 positiong capturing strobe counter*

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**Comparison VAT in STEP7 and variables table in ECOSTUDIO®**

| 18 | // Universalmodul | | | | |
|----|----|----|----|----|----|
| 19 | PQD 335 | | HEX | | DW#16#00000002 |
| 20 | PID 374 | | HEX | DW#16#0000000B | |
| 21 | PID 378 | | HEX | DW#16#0000000A | |

*Figure 17: VAT in STEP 7*

User Defined Variables

| | 210002 | unimappv_01 | 0000000B hex |
|----|----|----|----|
| ... | 210003 | unimappv_02 | 00000002 hex |
| ... | 21C002 | position_capture_count | 0000000A hex |

*Figure 18: Variables table in ECOSTUDIO®*

**Information regarding 2-axis devices**

Consider the axis index (axis 1 = 00, axis 2 = 01).

Properties - DP ID

Address / ID

I/O type: Input     Direct Entry...

Input

Address:  Length:  Unit:  Consistent over:
Start:  382  2  Words  Total length
End:  385
Process image:  --

Manufacturer-specific data:  21,00,02,00
(Maximum 14 bytes hexadecimal, separated by comma or blank space)
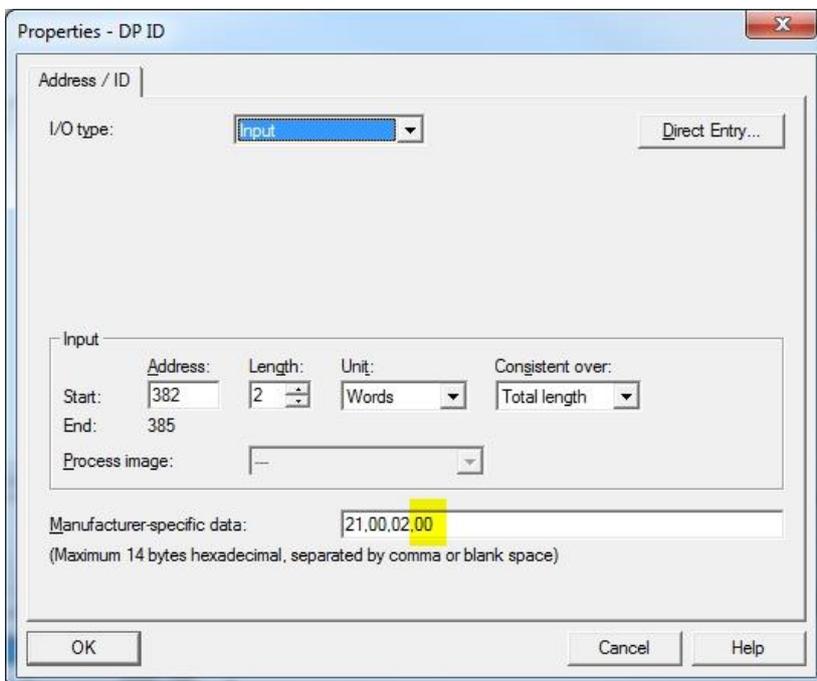
OK     Cancel     Help

*Figure 19: Axis index configuration*

**General information**

The E/A type out- / input is only available for the R/W registry.