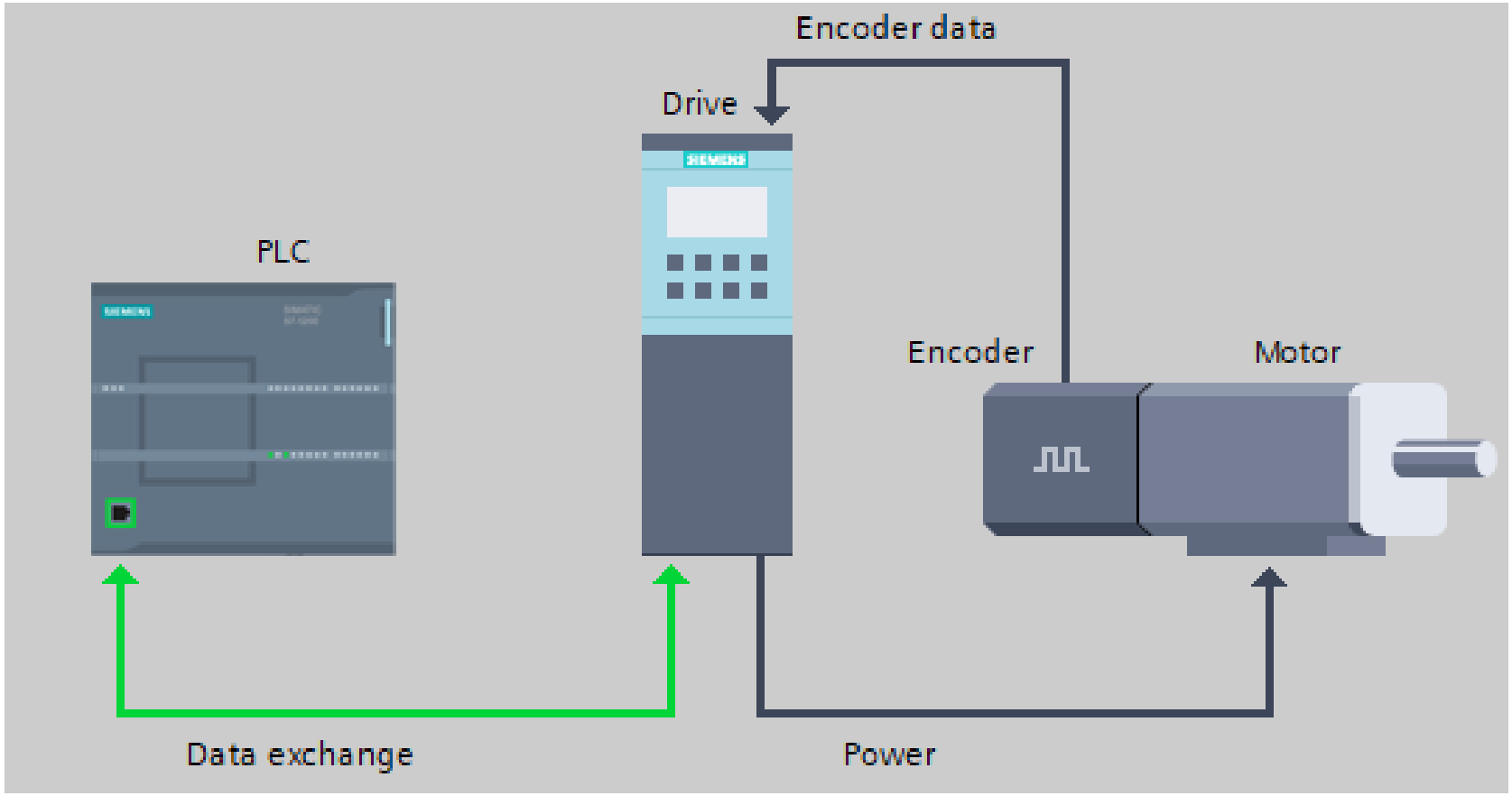
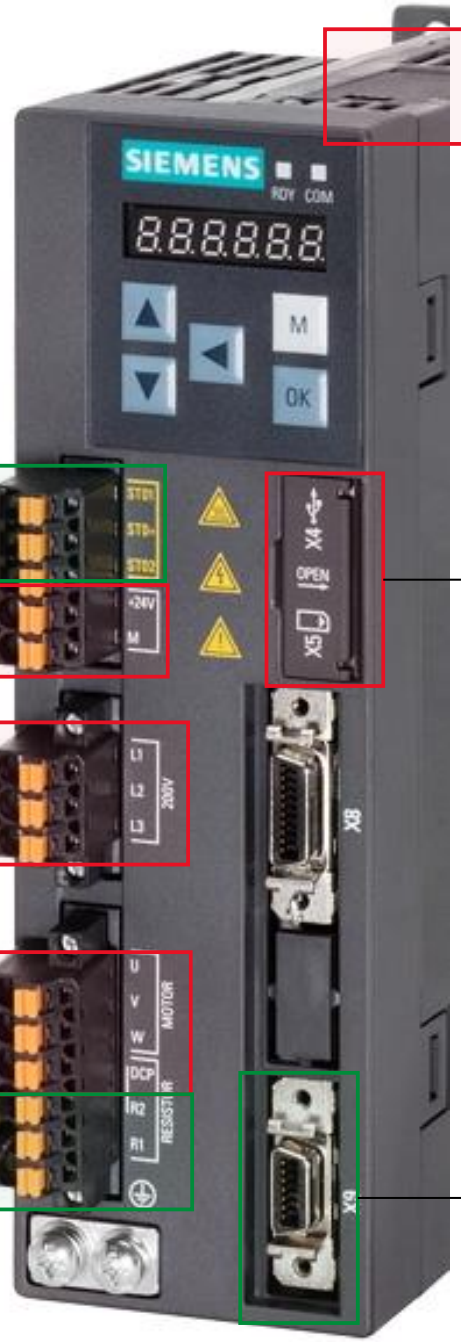
# PLC & Sinamics V90

Tomáš Merva

# S7-1200 + V90






Ethernet konektory

Safety

24V napájanie pre CPU

USB konektor

Vstupné napájanie pre výkonovú časť
(v našom prípade 1f napätie zo siete)

Výstupné napájanie pre motor

Brzdné rezistory

Konektor pre enkóder

# Postup práce

1. Konfigurácia meniča v špeciálnom programe (V-ASSISTANT, Starter, ...)
    1. IP adresa
    2. Telegram
    3. Regulácie, ...

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1. Konfigurácia meniča v špeciálnom programe (V-ASSISTANT, Starter, ...)
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2. Nastavenie komunikácie na strane PLC

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3. „Spojazdnenie driver-u (ovládača) pre menič“

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    3. Regulácie, ...
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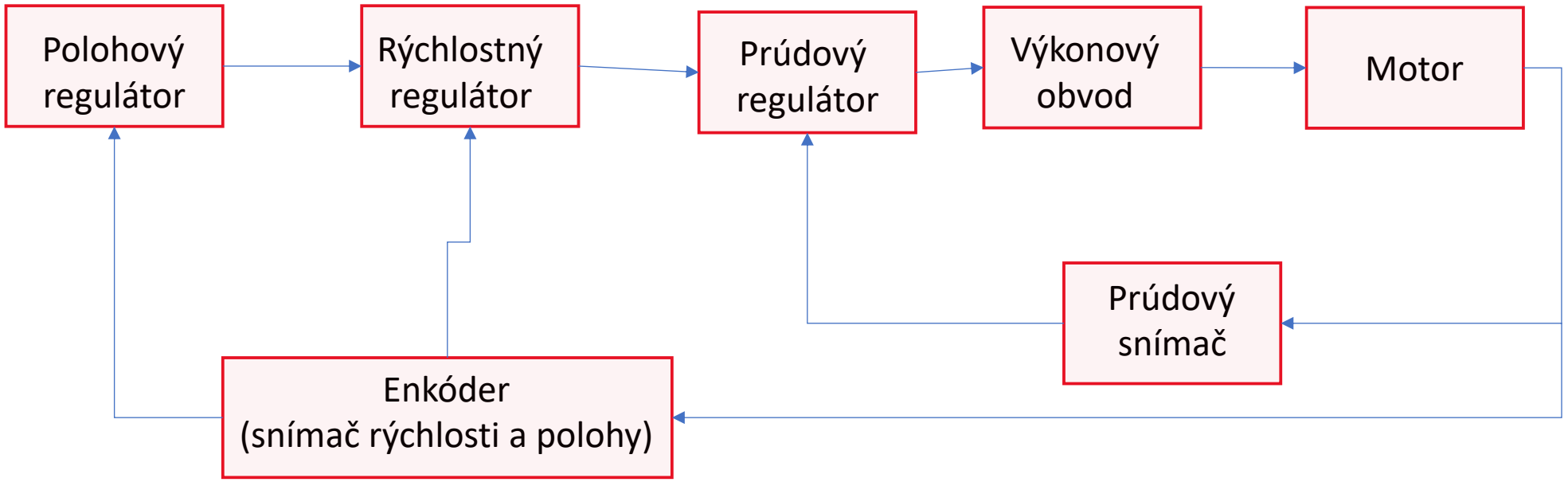
3. „Spojazdnenie driver-u (ovládača) pre menič“
4. Vývoj aplikácie

# V-ASSISTANT

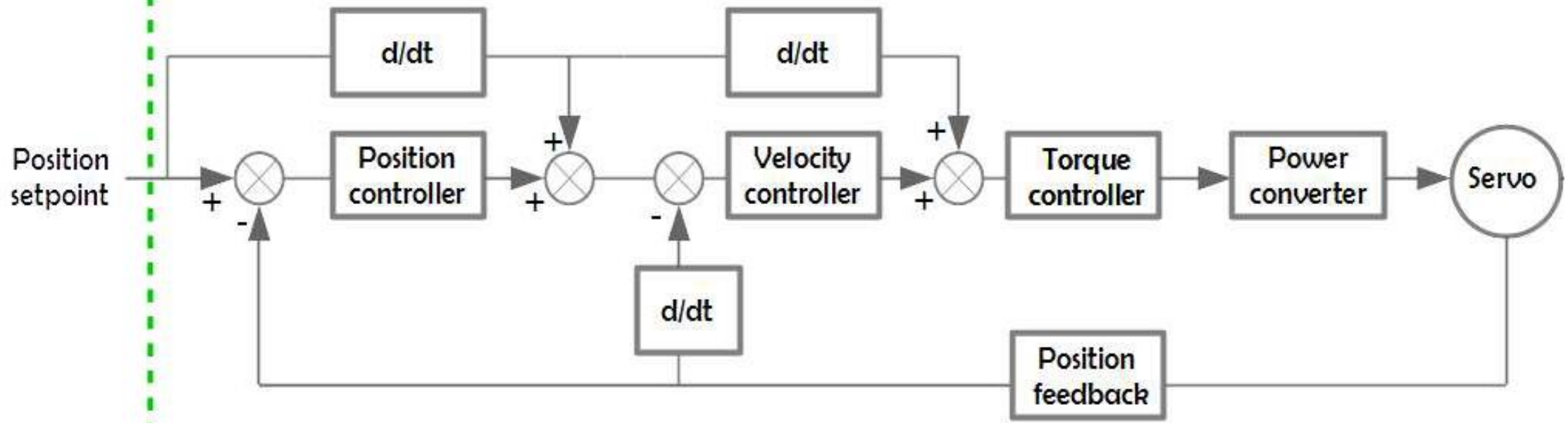
(Konfigurácia pomocou USB)

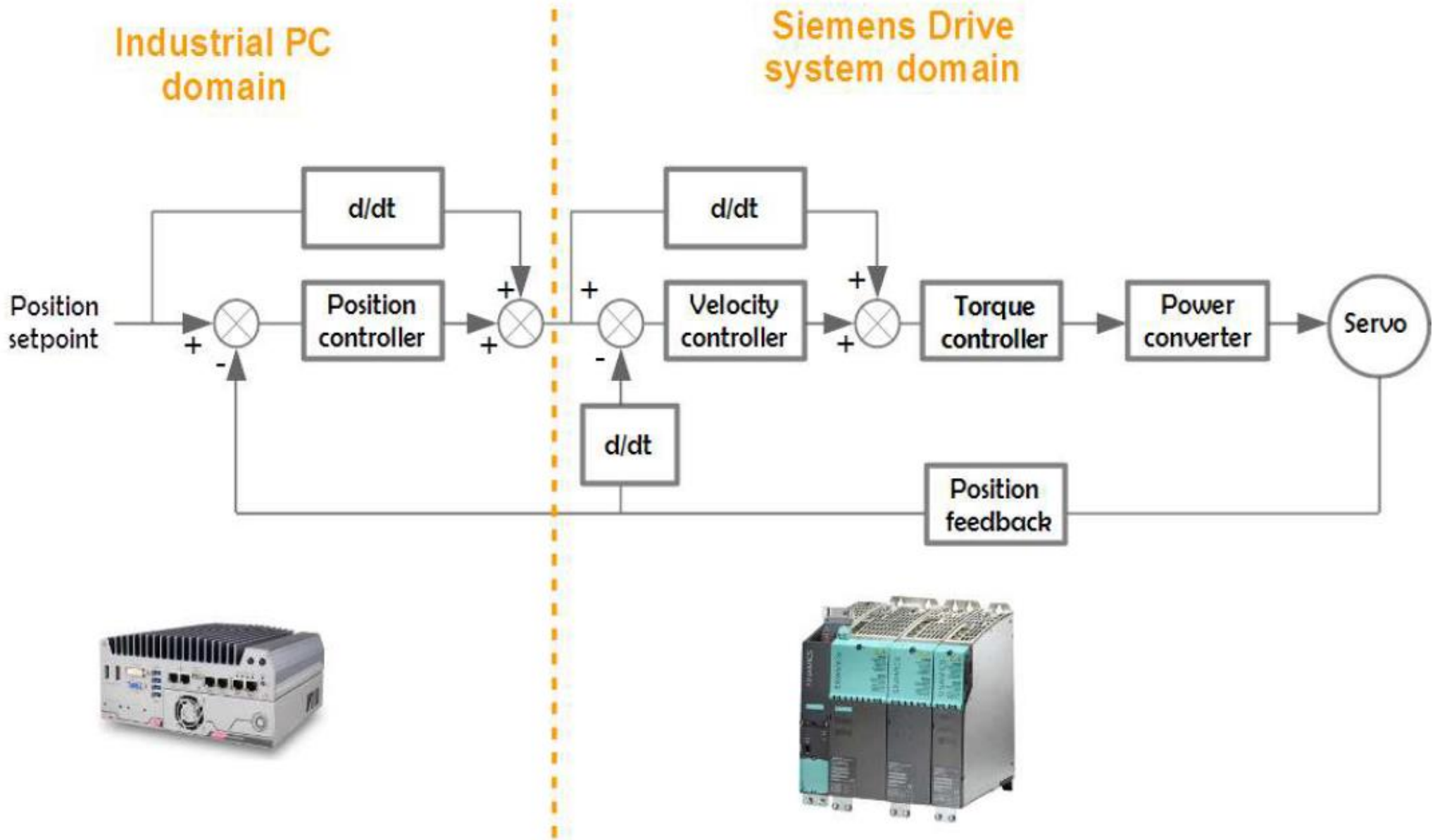
# Kaskádna štruktúra regulátorov

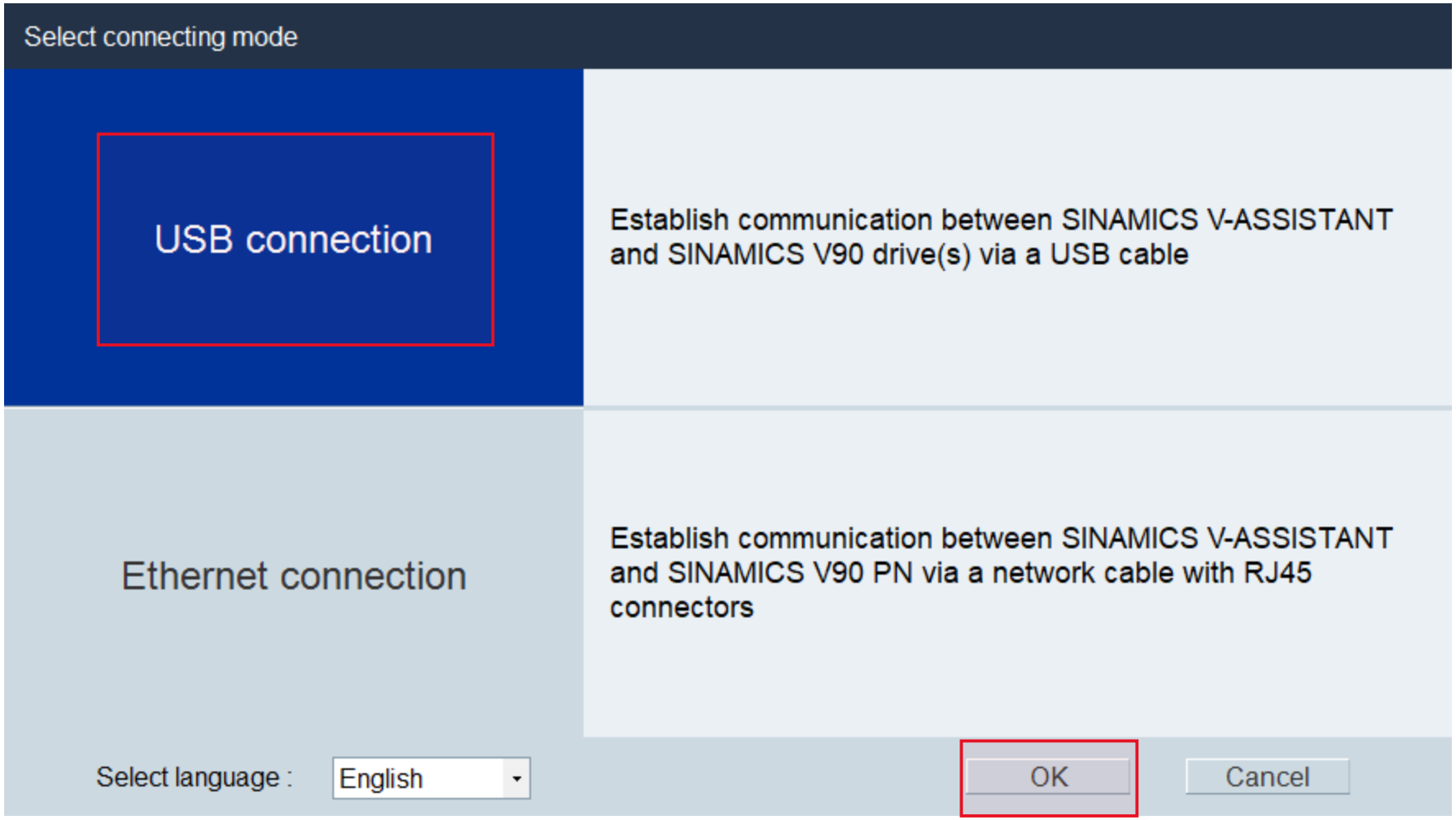


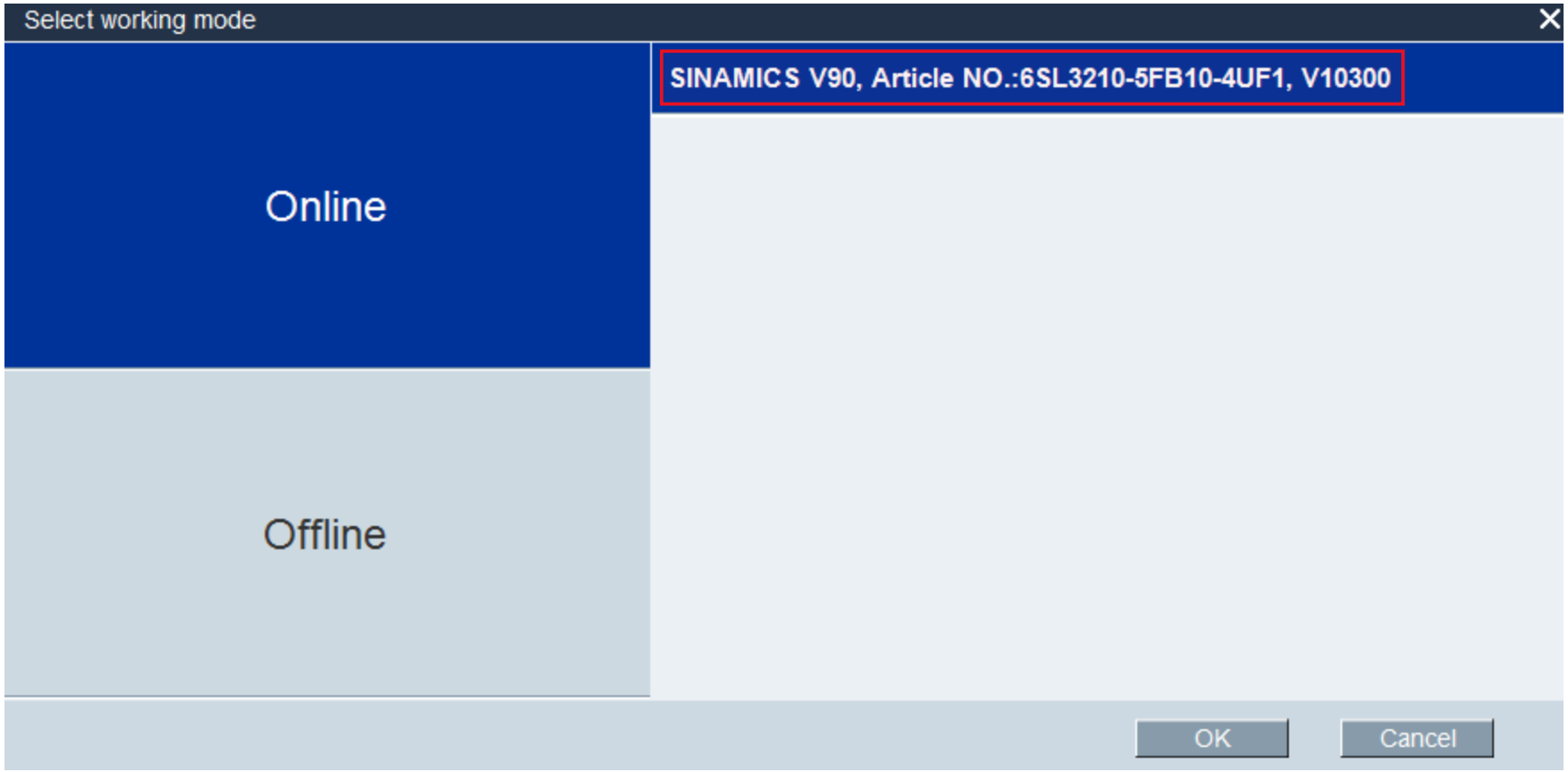
Industrial PC domain

Siemens Drive system domain





Industrial PC domain
Siemens Drive system domain
d/dt
d/dt
Position setpoint
Position controller
Velocity controller
Torque controller
Power converter
Servo
d/dt
Position feedback


Select connecting mode
USB connection
Establish communication between SINAMICS V-ASSISTANT and SINAMICS V90 drive(s) via a USB cable
Ethernet connection
Establish communication between SINAMICS V-ASSISTANT and SINAMICS V90 PN via a network cable with RJ45 connectors
Select language :
English
OK
Cancel


Select working mode
SINAMICS V90, Article NO.:6SL3210-5FB10-4UF1, V10300
Online
Offline
OK
Cancel

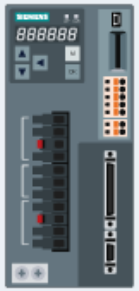
SIEMENS SINAMICS V-ASSISTANT

Project Edit Switch Tools Help

Task Navigation

- Select drive
- Set PROFINET
- Parameterize
- Commission
- Diagnostics

## Drive Selection



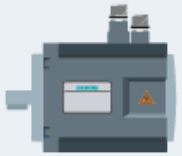
A Siemens SINAMICS V90 drive with the following article number is selected.

6SL3210-5FB10-4UF1

| | |
|---|---|
| Line supply: | 230 V |
| Rated power: | 0.4 kW |
| Rated current: | 2.6 A |

Select drive

## Motor Selection



A Siemens SIMOTICS motor with the following article number is selected.

1FL6034-2AF2x-xAA\Gx

| | |
|---|---|
| Rated power: | 0.4 kW |
| Rated current: | 2.6 A |
| Rated speed: | 3000 rpm |
| Rated torque: | 1.27 Nm |
| Encoder: | Incremental TTL 2500 ppr |
| Brake availability: | No |

Select motor

## Control Mode

Basic positioner control (EPOS)

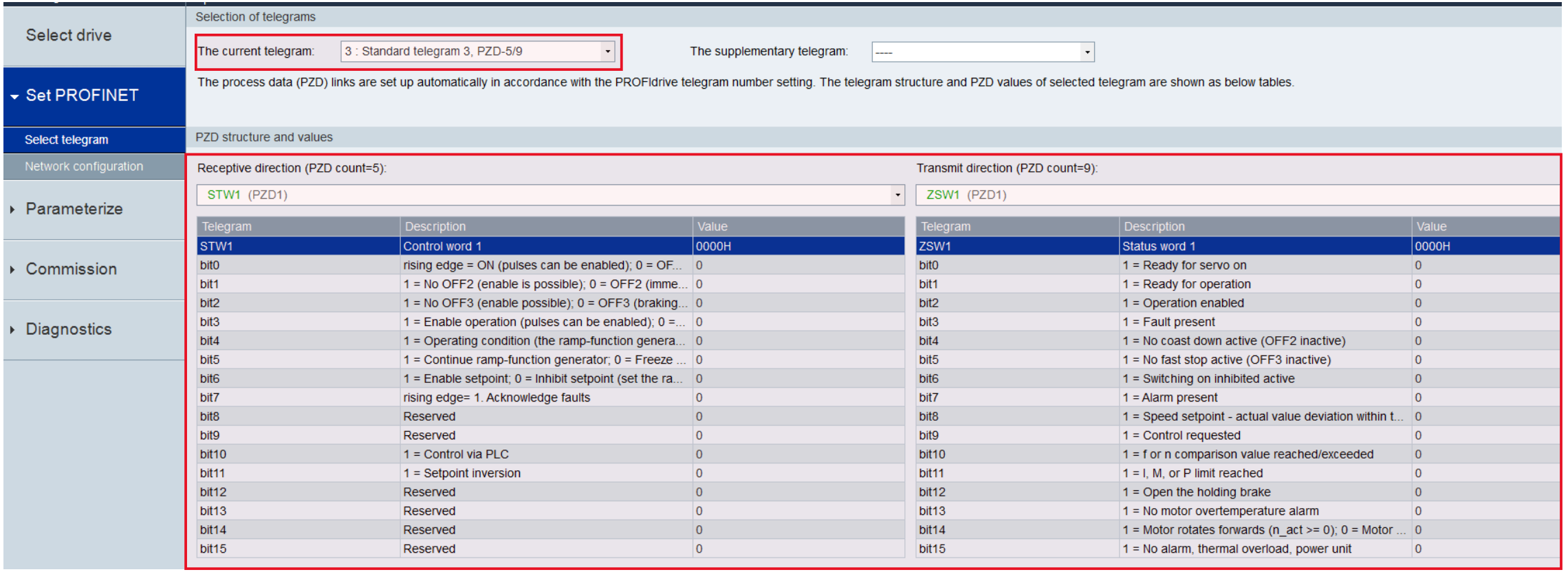
Positioning control is executed in the drive, positioning requests are transmitted to the drive by means of PROFINET.

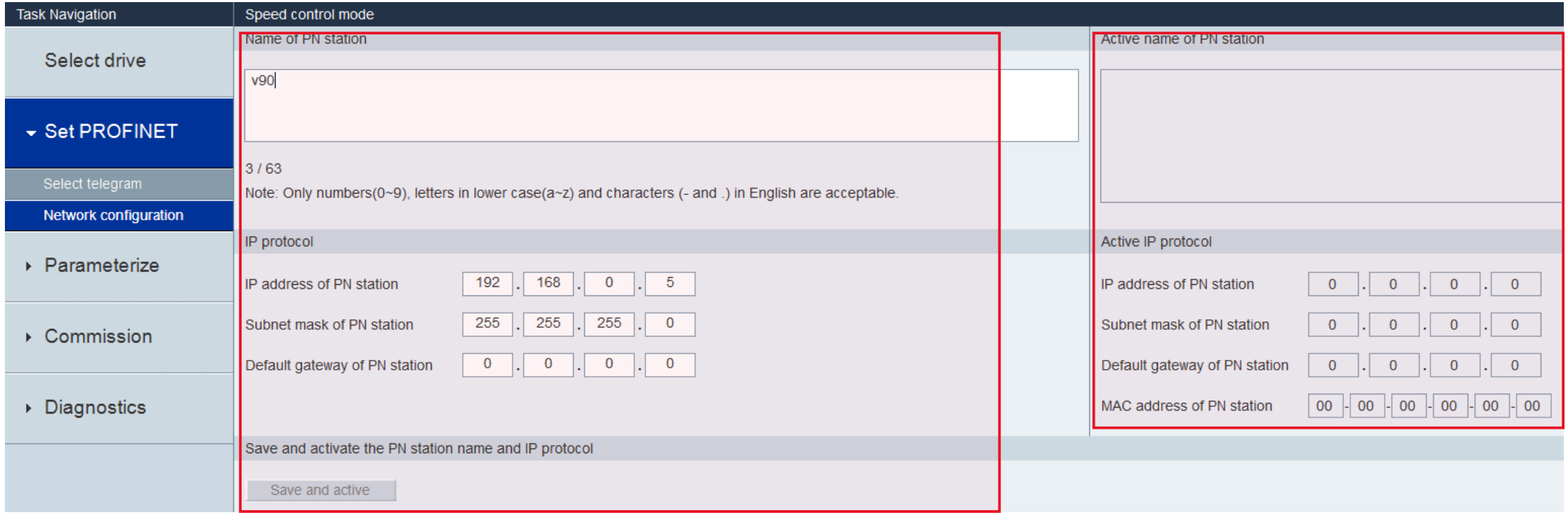
## Jog

Servo on

Speed 0 rpm

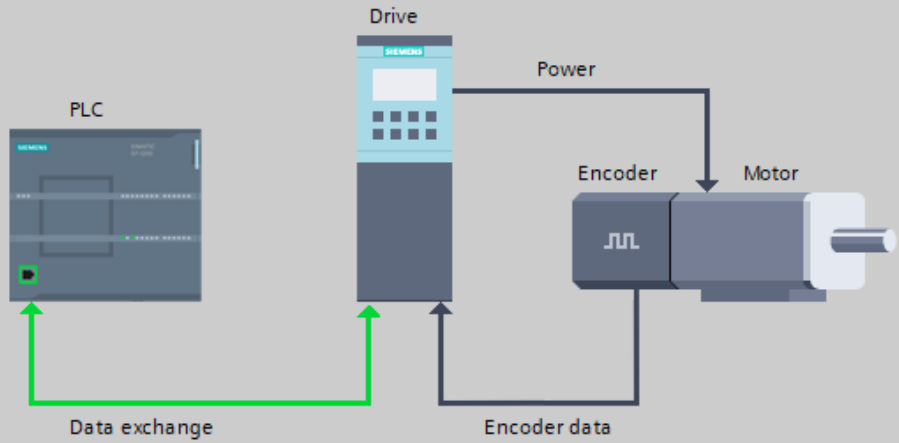
| Actual speed (rpm) | Actual torque (Nm) | Actual current (A) | Actual motor utilization (%) |
|---|---|---|---|
| 0.0000 | -0.0001 | 0.0008 | 0.0001 |


Select drive
Set PROFINET
Select telegram
Network configuration
Parameterize
Commission
Diagnostics
Selection of telegrams
The current telegram:
3 : Standard telegram 3, PZD-5/9
The supplementary telegram:
----
The process data (PZD) links are set up automatically in accordance with the PROFIdrive telegram number setting. The telegram structure and PZD values of selected telegram are shown as below tables.
PZD structure and values
Receptive direction (PZD count=5):
STW1 (PZD1)
Telegram Description Value
STW1 Control word 1 0000H
bit0 rising edge = ON (pulses can be enabled); 0 = OF... 0
bit1 1 = No OFF2 (enable is possible); 0 = OFF2 (imme... 0
bit2 1 = No OFF3 (enable possible); 0 = OFF3 (braking... 0
bit3 1 = Enable operation (pulses can be enabled); 0 =... 0
bit4 1 = Operating condition (the ramp-function genera... 0
bit5 1 = Continue ramp-function generator; 0 = Freeze ... 0
bit6 1 = Enable setpoint; 0 = Inhibit setpoint (set the ra... 0
bit7 rising edge= 1. Acknowledge faults 0
bit8 Reserved 0
bit9 Reserved 0
bit10 1 = Control via PLC 0
bit11 1 = Setpoint inversion 0
bit12 Reserved 0
bit13 Reserved 0
bit14 Reserved 0
bit15 Reserved 0
Transmit direction (PZD count=9):
ZSW1 (PZD1)
Telegram Description Value
ZSW1 Status word 1 0000H
bit0 1 = Ready for servo on 0
bit1 1 = Ready for operation 0
bit2 1 = Operation enabled 0
bit3 1 = Fault present 0
bit4 1 = No coast down active (OFF2 inactive) 0
bit5 1 = No fast stop active (OFF3 inactive) 0
bit6 1 = Switching on inhibited active 0
bit7 1 = Alarm present 0
bit8 1 = Speed setpoint - actual value deviation within t... 0
bit9 1 = Control requested 0
bit10 1 = f or n comparison value reached/exceeded 0
bit11 1 = I, M, or P limit reached 0
bit12 1 = Open the holding brake 0
bit13 1 = No motor overtemperature alarm 0
bit14 1 = Motor rotates forwards (n_act >= 0); 0 = Motor ... 0
bit15 1 = No alarm, thermal overload, power unit 0


Task Navigation
Speed control mode
Select drive
Set PROFINET
Select telegram
Network configuration
Parameterize
Commission
Diagnostics
Name of PN station
v90
3 / 63
Note: Only numbers(0~9), letters in lower case(a~z) and characters (- and .) in English are acceptable.
IP protocol
IP address of PN station 192 . 168 . 0 . 5
Subnet mask of PN station 255 . 255 . 255 . 0
Default gateway of PN station 0 . 0 . 0 . 0
Active name of PN station
Active IP protocol
IP address of PN station 0 . 0 . 0 . 0
Subnet mask of PN station 0 . 0 . 0 . 0
Default gateway of PN station 0 . 0 . 0 . 0
MAC address of PN station 00 - 00 - 00 - 00 - 00 - 00
Save and activate the PN station name and IP protocol
Save and active

- Basic parameters
  - General
  - Drive
  - Encoder
- Extended parameters
  - Mechanics
  - Modulo
  - Position limits
  - Dynamics
    - General
    - Emergency stop
  - Homing
    - Active
    - Passive
  - Position monitoring
    - Positioning monitoring
    - Following error
    - Standstill signal
  - Control loop

## Drive




### Select PROFIdrive drive

Data connection: Drive

Drive: SINAMICS-V90-PN.Drive_1

### Data exchange with the drive

Drive telegram: Standard telegram 3

Input address: %I68.0

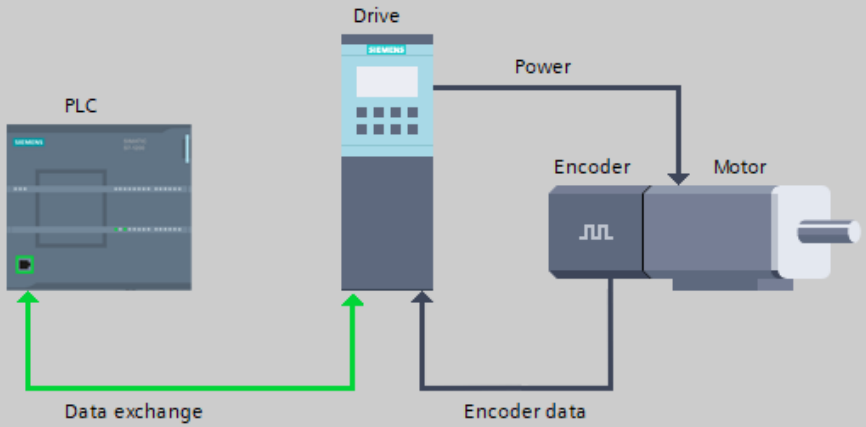
Output address: %Q68.0

Invert drive direction

Automatically apply drive values at runtime (online)

Reference speed: 3000.0 1/min

Maximum speed: 5000.0 1/min




## Encoder connection

- (•) Encoder on PROFINET/PROFIBUS
- ( ) Encoder on high-speed counter (HSC)

## Encoder selection

| | |
|---|---|
| Data connection: | Encoder |
| PROFIdrive encoder: | SINAMICS-V90-PN.Drive_1_Encoder1 |

## Data exchange with encoder

| | | |
|---|---|---|
| Encoder telegram: | Standard telegram 3 | |
| Input address: | | %I68.0 |
| Output address: | | %Q68.0 |

- [ ] Invert encoder direction
- [x] Automatically apply encoder values at runtime (online)

## Encoder type

| | |
|---|---|
| Encoder type: | Rotary incremental |
| Steps per revolution: | 2500 |

# Úloha 1.

Dopravník má uložené 3 polohy (poloha A = 250 mm, poloha B = 750 mm, poloha C = 1000 mm). Po reštartovaní CPU je potrebné zapnúť os a motor „home-ovať“.

Program:

1. Dopravník najprv ide do polohy A s v = 50mm/s
2. Čaká 10 sekúnd.
3. Dopravník ide do polohy B s v = 30 mm/s
4. Čaká 5 sekúnd.
5. Dopravník ide do polohy C s v = 20 mm/s
6. Čaká 7 sekúnd a program sa opakuje.

# Úloha 1.b – Použite 1 časovač

Dopravník má uložené 3 polohy (poloha A = 250 mm, poloha B = 750 mm, poloha C = 1000 mm). Po reštartovaní CPU je potrebné zapnúť os a motor „home-ovať“.

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# 2. Spôsob riadenia z PLC

# Vyskladanie si telegramu a nepoužívanie „technology object“

- Použijeme: Standard telegram 1, PZD 2/2
  - Rýchlostný telegram (najjednoduchší)
  - Posielame z PLC do meniča -> 2x Word = 4x Byte
  - Posiela menič do PLC -> 2x Word = 4x Byte

# Prvé kontrolné slovo

STW1 (PZD1)

| Telegram | Description | Value |
|---|---|---|
| STW1 | Control word 1 | 0000H |
| bit0 | rising edge = ON (pulses can be enabled); 0 = OF... | 0 |
| bit1 | 1 = No OFF2 (enable is possible); 0 = OFF2 (imme... | 0 |
| bit2 | 1 = No OFF3 (enable possible); 0 = OFF3 (braking... | 0 |
| bit3 | 1 = Enable operation (pulses can be enabled); 0 =... | 0 |
| bit4 | 1 = Operating condition (the ramp-function genera... | 0 |
| bit5 | 1 = Continue ramp-function generator; 0 = Freeze ... | 0 |
| bit6 | 1 = Enable setpoint; 0 = Inhibit setpoint (set the ra... | 0 |
| bit7 | rising edge= 1. Acknowledge faults | 0 |
| bit8 | Reserved | 0 |
| bit9 | Reserved | 0 |
| bit10 | 1 = Control via PLC | 0 |
| bit11 | 1 = Setpoint inversion | 0 |
| bit12 | Reserved | 0 |
| bit13 | Reserved | 0 |
| bit14 | Reserved | 0 |
| bit15 | Reserved | 0 |

# Druhé kontrolné slovo

Receptive direction (PZD count=2):

NSOLL_A (PZD2)

| Telegram | Description | Value |
|---|---|---|
| NSOLL_A | Speed setpoint A (16-bit) | 0000H |

# Prvé stavové slovo

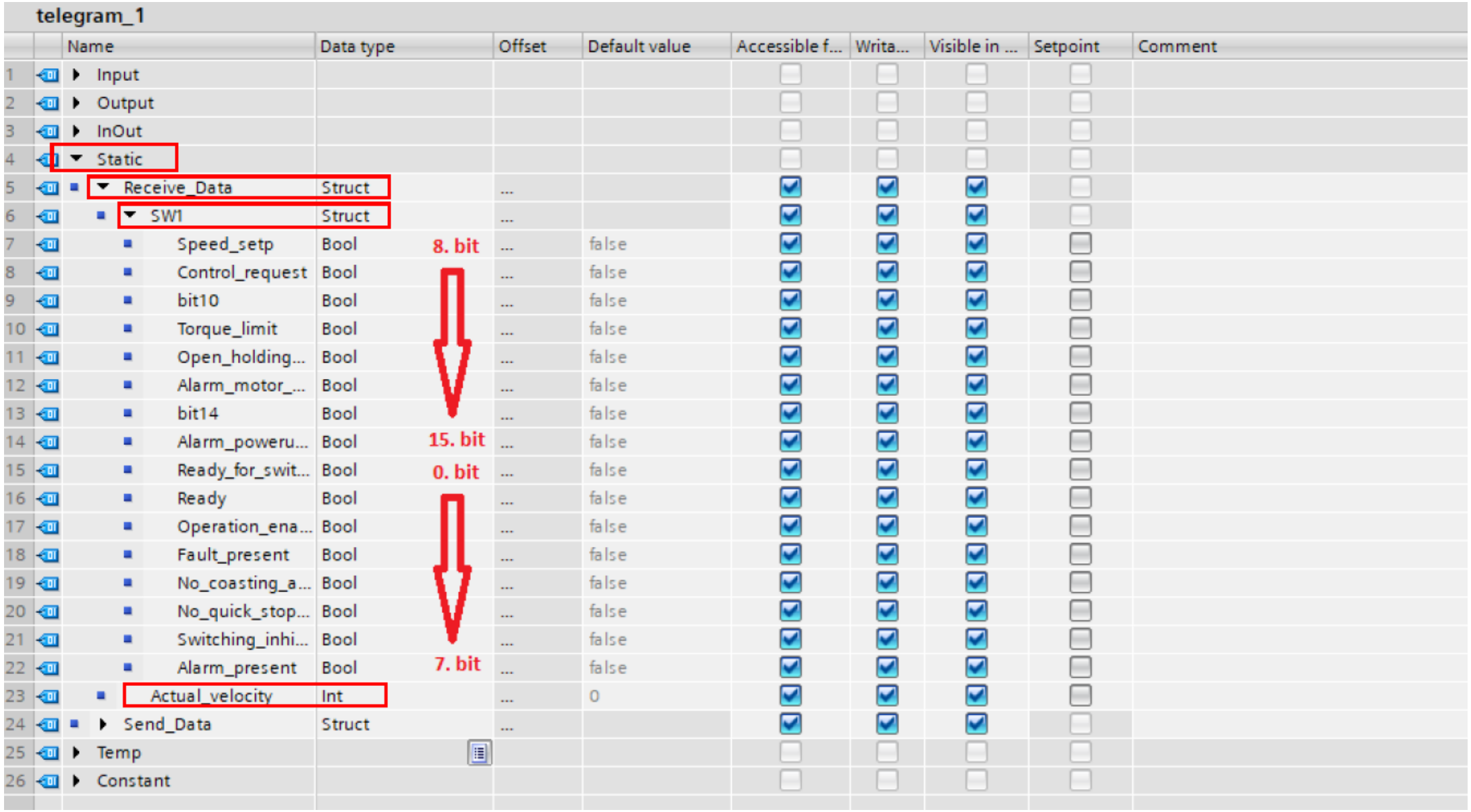
ZSW1 (PZD1)

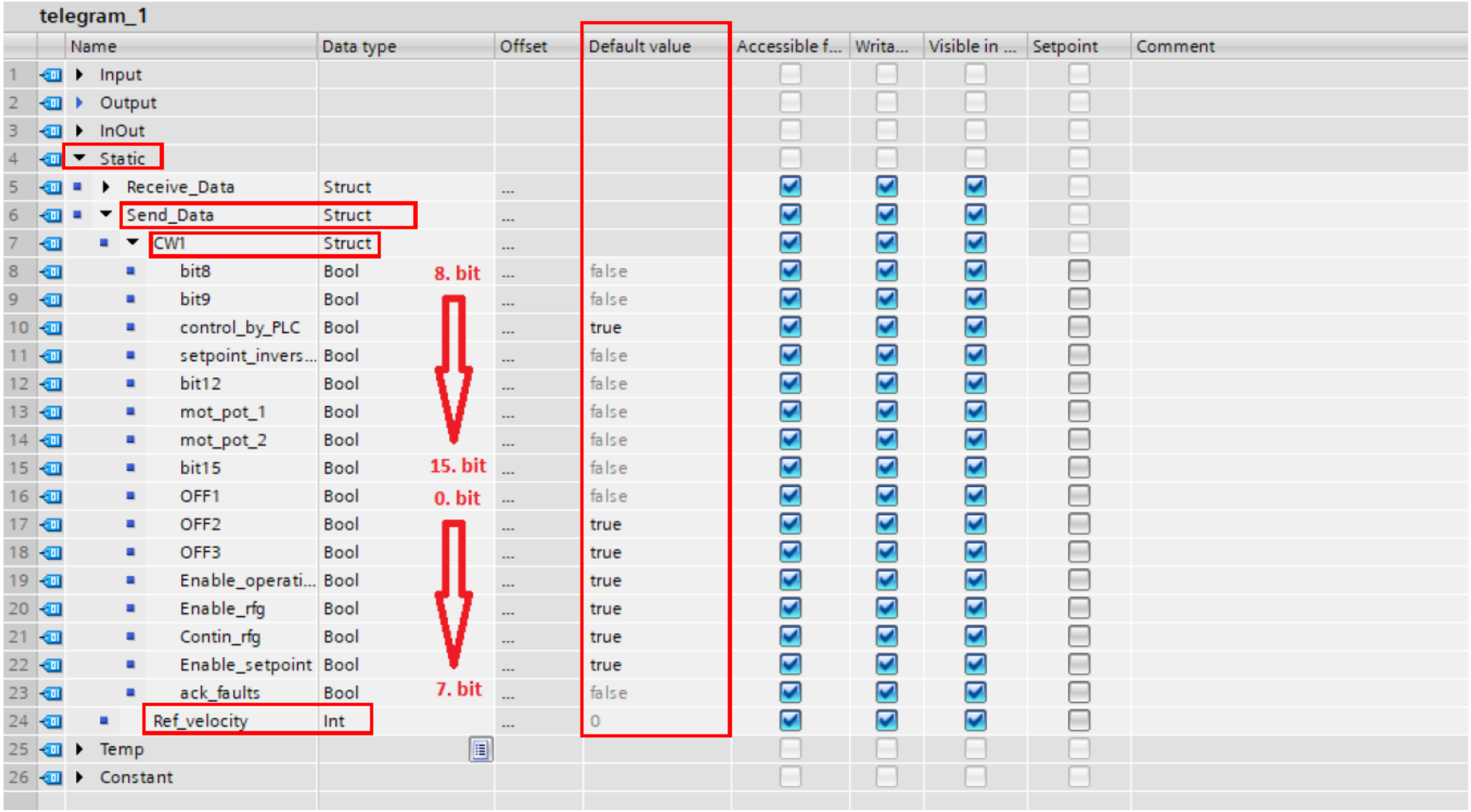
| Telegram | Description | Value |
|---|---|---|
| ZSW1 | Status word 1 | 0000H |
| bit0 | 1 = Ready for servo on | 0 |
| bit1 | 1 = Ready for operation | 0 |
| bit2 | 1 = Operation enabled | 0 |
| bit3 | 1 = Fault present | 0 |
| bit4 | 1 = No coast down active (OFF2 inactive) | 0 |
| bit5 | 1 = No fast stop active (OFF3 inactive) | 0 |
| bit6 | 1 = Switching on inhibited active | 0 |
| bit7 | 1 = Alarm present | 0 |
| bit8 | 1 = Speed setpoint - actual value deviation within t... | 0 |
| bit9 | 1 = Control requested | 0 |
| bit10 | 1 = f or n comparison value reached/exceeded | 0 |
| bit11 | 1 = I, M, or P limit reached | 0 |
| bit12 | 1 = Open the holding brake | 0 |
| bit13 | 1 = No motor overtemperature alarm | 0 |
| bit14 | 1 = Motor rotates forwards (n_act >= 0); 0 = Motor ... | 0 |
| bit15 | 1 = No alarm, thermal overload, power unit | 0 |

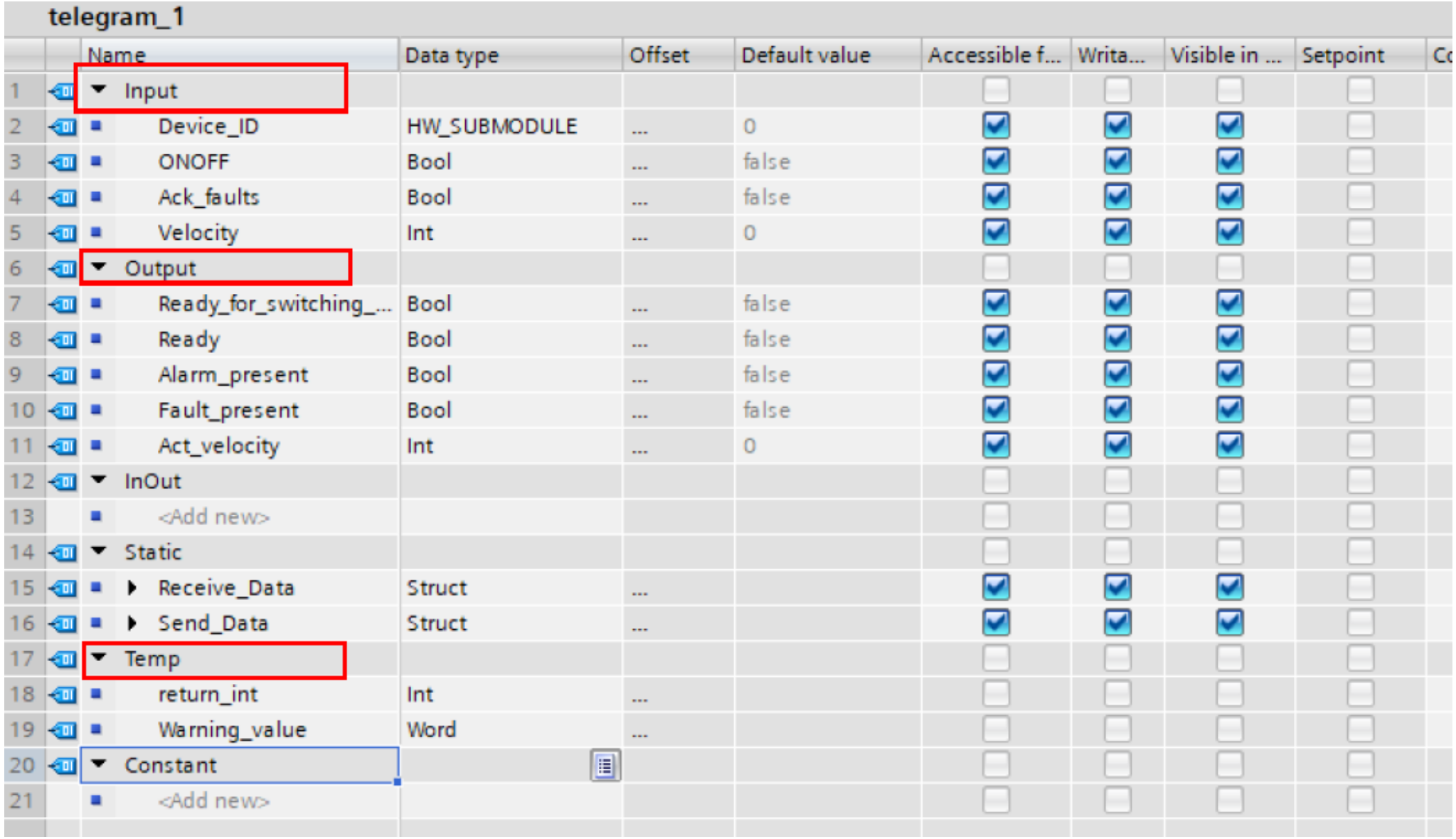
# Druhé stavové slovo

NIST_A (PZD2)

| Telegram | Description | Value |
|---|---|---|
| NIST_A | Speed actual value A (16-bit) | 0000H |

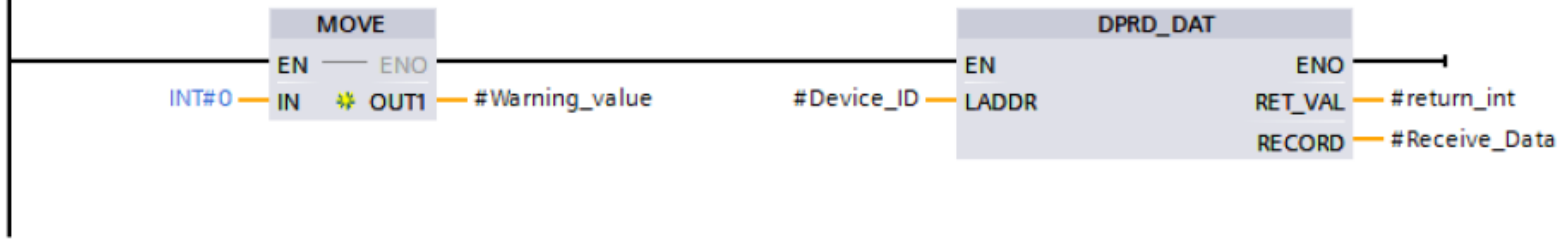

telegram_1
Name
Data type
Offset
Default value
Accessible f...
Writa...
Visible in ...
Setpoint
Comment
1 Input
2 Output
3 InOut
4 Static
5 Receive_Data Struct ...
6 SW1 Struct ...
7 Speed_setp Bool ... false
8 Control_request Bool ... false
9 bit10 Bool ... false
10 Torque_limit Bool ... false
11 Open_holding... Bool ... false
12 Alarm_motor_... Bool ... false
13 bit14 Bool ... false
14 Alarm_poweru... Bool ... false
15 Ready_for_swit... Bool ... false
16 Ready Bool ... false
17 Operation_ena... Bool ... false
18 Fault_present Bool ... false
19 No_coasting_a... Bool ... false
20 No_quick_stop... Bool ... false
21 Switching_inhi... Bool ... false
22 Alarm_present Bool ... false
23 Actual_velocity Int ... 0
24 Send_Data Struct ...
25 Temp
26 Constant
8. bit
15. bit
0. bit
7. bit


telegram_1
Name
Data type
Offset
Default value
Accessible f...
Writa...
Visible in ...
Setpoint
Comment
1 Input
2 Output
3 InOut
4 Static
5 Receive_Data Struct ...
6 Send_Data Struct ...
7 CW1 Struct ...
8 bit8 Bool ... false
9 bit9 Bool ... false
10 control_by_PLC Bool ... true
11 setpoint_invers... Bool ... false
12 bit12 Bool ... false
13 mot_pot_1 Bool ... false
14 mot_pot_2 Bool ... false
15 bit15 Bool ... false
16 OFF1 Bool ... false
17 OFF2 Bool ... true
18 OFF3 Bool ... true
19 Enable_operati... Bool ... true
20 Enable_rfg Bool ... true
21 Contin_rfg Bool ... true
22 Enable_setpoint Bool ... true
23 ack_faults Bool ... false
24 Ref_velocity Int ... 0
25 Temp
26 Constant
8. bit
15. bit
0. bit
7. bit


telegram_1
Name
Data type
Offset
Default value
Accessible f...
Writa...
Visible in ...
Setpoint
1 Input
2 Device_ID HW_SUBMODULE ... 0
3 ONOFF Bool ... false
4 Ack_faults Bool ... false
5 Velocity Int ... 0
6 Output
7 Ready_for_switching_... Bool ... false
8 Ready Bool ... false
9 Alarm_present Bool ... false
10 Fault_present Bool ... false
11 Act_velocity Int ... 0
12 InOut
13 <Add new>
14 Static
15 Receive_Data Struct ...
16 Send_Data Struct ...
17 Temp
18 return_int Int ...
19 Warning_value Word ...
20 Constant
21 <Add new>

**Network 1:** .....

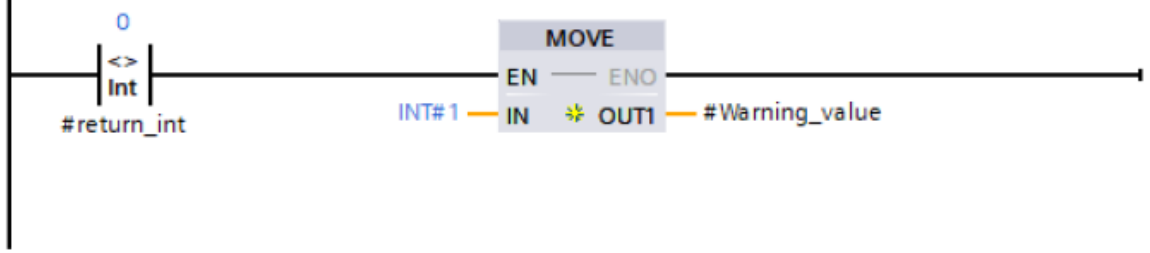
Comment




Prijatie dát z meniča

**Network 2:** .....

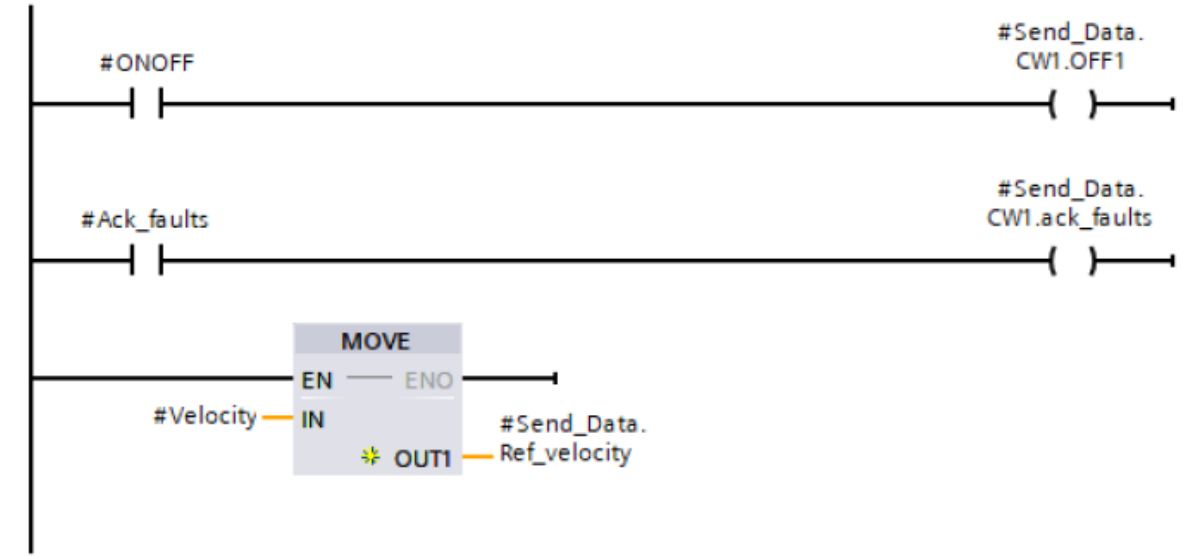
Comment




Kontrola komunikácie

**Network 3:** .....

Comment

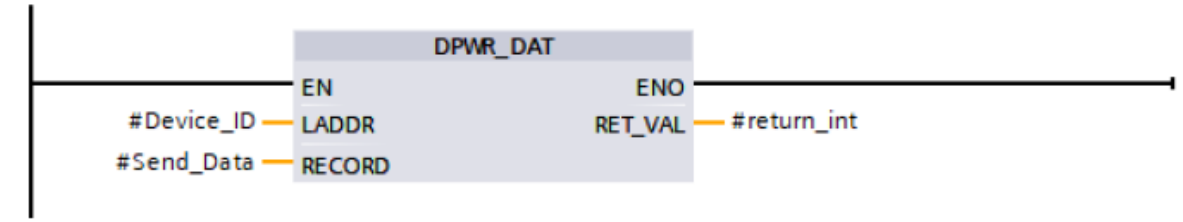



Prevzatie údajov zo

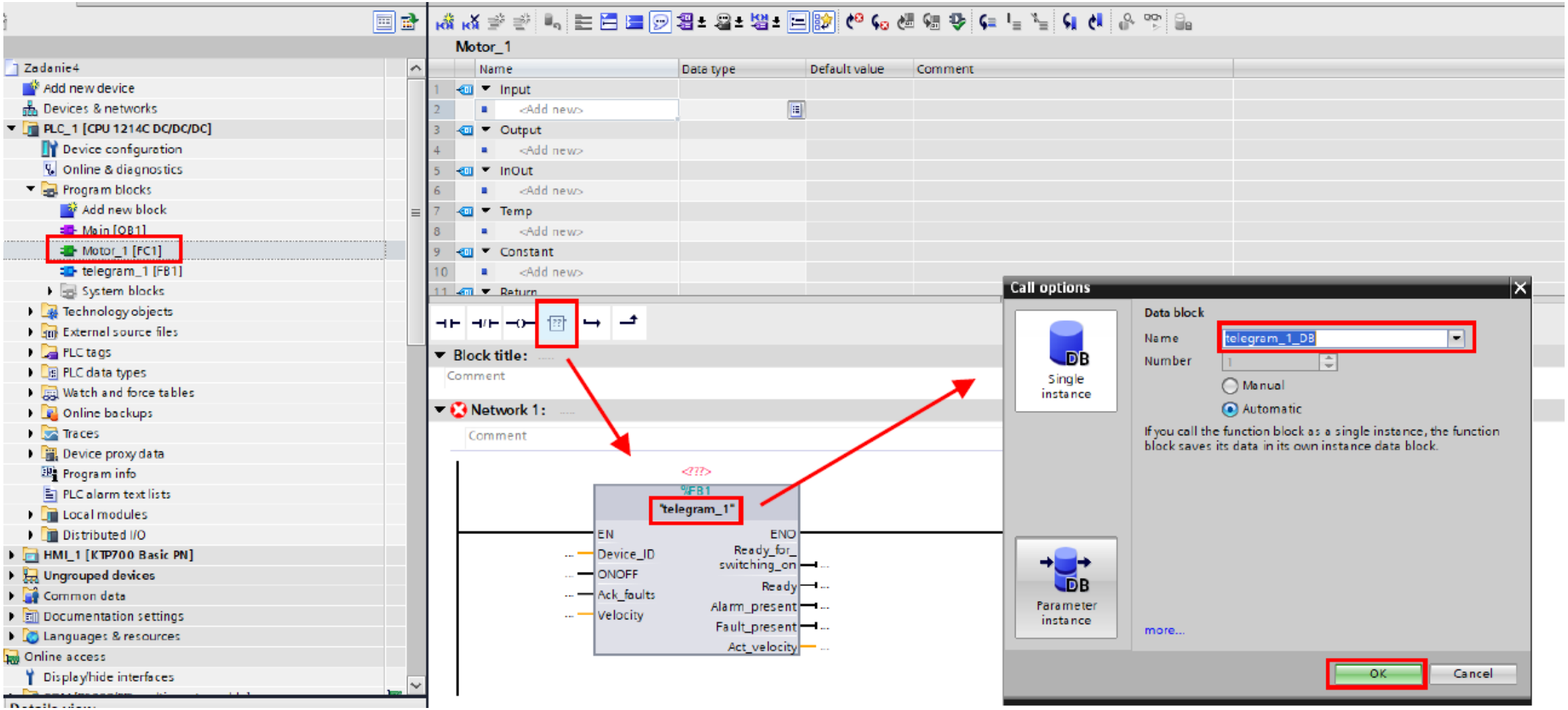
vstupov do štruktúry

**Network 5:** .....

Comment




Odoslanie dát do meniča


Zadanie4
Add new device
Devices & networks
PLC_1 [CPU 1214C DC/DC/DC]
Device configuration
Online & diagnostics
Program blocks
Add new block
Main [OB1]
Motor_1 [FC1]
telegram_1 [FB1]
System blocks
Technology objects
External source files
PLC tags
PLC data types
Watch and force tables
Online backups
Traces
Device proxy data
Program info
PLC alarm text lists
Local modules
Distributed I/O
HMI_1 [KTP700 Basic PN]
Ungrouped devices
Common data
Documentation settings
Languages & resources
Online access
Display/hide interfaces
Motor_1
Name
Data type
Default value
Comment
Input
Output
InOut
Temp
Constant
Return
<Add new>
Block title:
Comment
Network 1:
Comment
%FB1
"telegram_1"
EN
ENO
Device_ID
ONOFF
Ack_faults
Velocity
Ready_for_switching_on
Ready
Alarm_present
Fault_present
Act_velocity
Call options
Single instance
Parameter instance
Data block
Name
telegram_1_DB
Number
Manual
Automatic
If you call the function block as a single instance, the function block saves its data in its own instance data block.
more...
OK
Cancel

# Setpoint – je v % a nie v ot/min!!!

100% rýchlosť = 16#4000

50% rýchlosť = 16#2000

25% rýchlosť = 16#1000

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200% rýchlosť = 16#8000

-200% rýchlosť = 16#7FFF