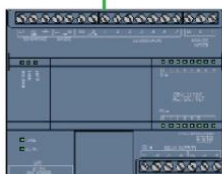


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# OPDE Explorer

Profinet



|           |  |  |
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## 1.1 INTRODUCTION

The purpose of this document is to provide users the necessary knowledge for the communication structure between BDF Digital OPDE and Siemens S7-1200-1500 PLC via ProfiNET interface. The hardware and software configurations necessary for the operation of the interface and the drive will be deeply analyzed in the following chapters.

## 2.1 HARDWARE & SOFTWARE REQUIREMENTS

OPDE o OPDEplus with Profinet Communication Card  
 CPU Siemens S71200 o 1500  
 TIA Portal v17  
 OPDEplorer v2.0.3.0.

The application has been tested using a SIEMENS s7-1200 CPU, catalog code: 6ES7 214-1AG40-0XB0 and a BDF Digital OPDE Drive (3Amps size).

## 3.1 DRIVE SETTINGS

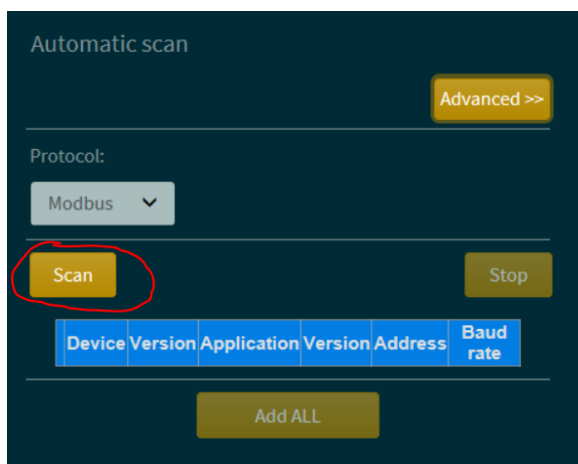
In order to run this example on this hardware, you need to set the following settings using OPDEplorer:

### 3.1.1 FIELD-BUS SETTINGS

Drive Connection setup:

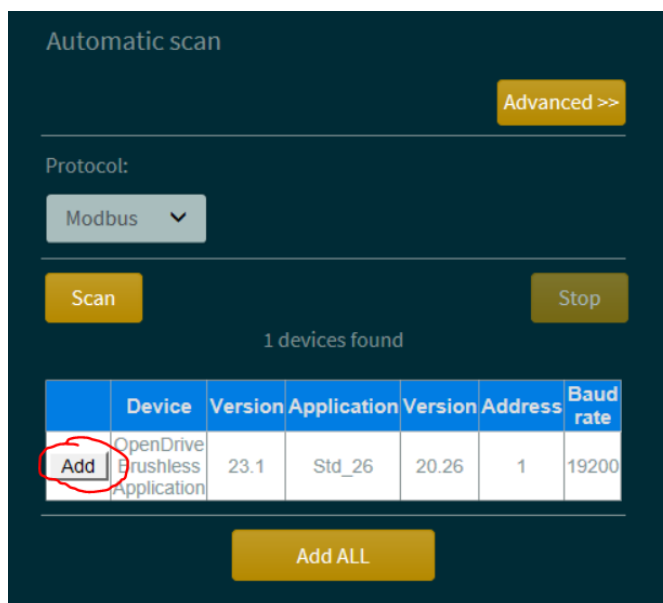
- Connect the PC running OPDEplorer to the drive using the RS485 – USB Adapter
- Click on Advanced>> and set the com port of the USB – RS485 adapter

Then Click Scan

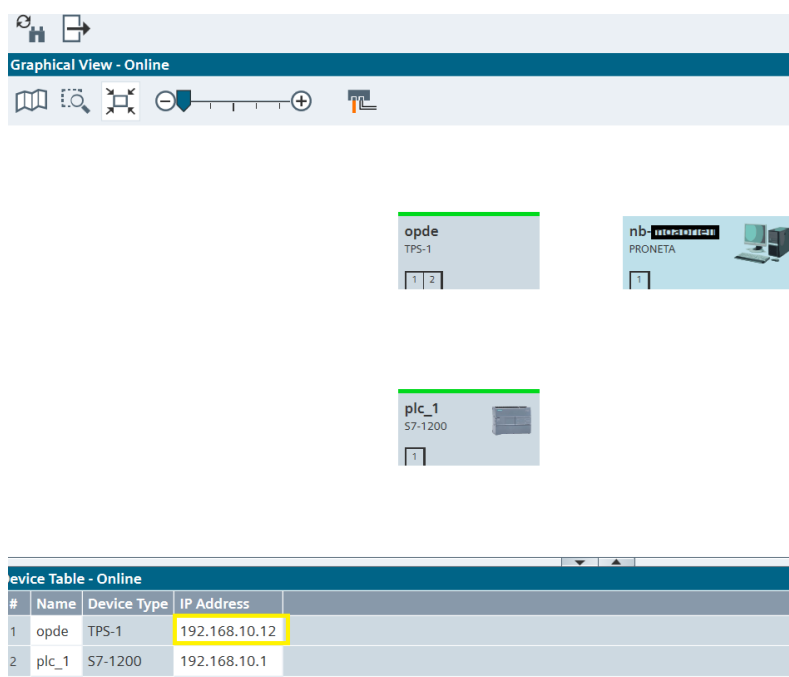


Once the drive has been detected, Click on Add

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- The network ProfiNET Card has the following default IP Address: **192.168.0.1**. By using Proneta software (PRONETA Basic 3.2 Commissioning and Diagnostics Tool for PROFINET) is possible to assign the profinet name and IP address



This operation can be done also in TIA Portal V15.1:

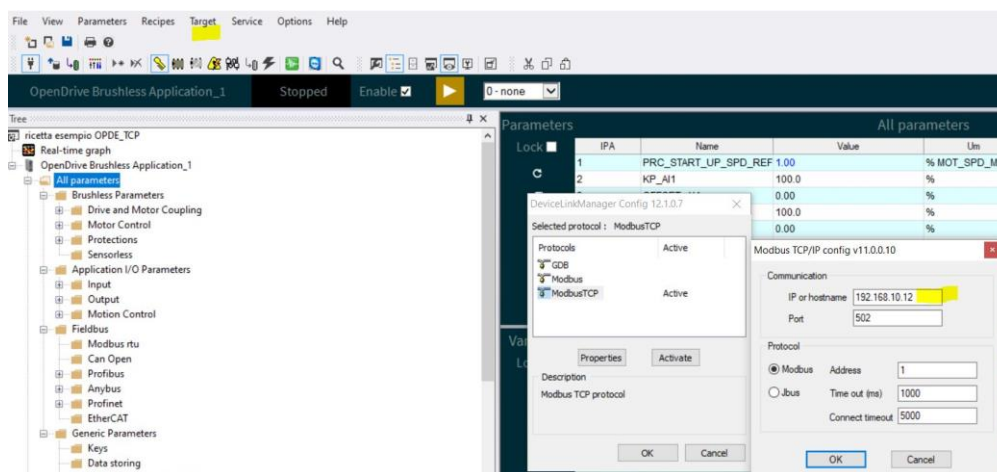
In order to do so, proceed as follows:

- Select hardware devices on the project tree section
- Click on Network view
- Selecting the desired drive
- Right-Click on the drive
- Select Assign profinet name and follow the instructions

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Once the IP address has been set on the drive profiNET Card, is possible to connect to it via OPDExplorer TCP/IP interface as described below:

- Online TCP/IP: Click on Target -> Communication Settings
- Select ModbusTCP and click Activate
- Click on Properties and set the required data as follows:



Pay attention to set also the correct IP and Modbus addresses in this window.

Once you have connected successfully to the drive, click on Filedbus → Profinet → Configuration and State and set the parameters as follows:

(In the IP address settings, set an IP address compatible to the IP address class of the Siemens CPU)



#### **EN\_BIG\_ENDIAN = YES:**

For compatibility reasons, it is suggested to set EN\_BIG\_ENDIAN=YES , by doing this you will need to SWAP the control word and status word, whereas the reference value and all the integer values will be transmitted and received from the drive or PLC without the necessity to swap anything. It could be necessary to implement some scaling functions to convert the received / transmitted from the PLC / drive.

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| Parameters |      | Configuration and State |          |    |         |     |       |   |
|------------|------|-------------------------|----------|----|---------|-----|-------|---|
| Lock       | IPA  | Name                    | Value    | Um | Default | Min | Max   | Description                                     |
|            | 265  | EN_FLDBUS               | Profinet |    | No      | 0   | 6     | C64 - Enable fieldbus manage                    |
|            | 2885 | EN_BIG_ENDIAN           | Yes      |    | No      |     |       | Most significant bytes in multi-byte data types |
|            | 2977 | IP_ADDR_00              | 192      |    | 192     | 0   | 255   | Anybus IP Address 00                            |
|            | 2978 | IP_ADDR_01              | 168      |    | 168     | 0   | 255   | Anybus IP Address 01                            |
|            | 2979 | IP_ADDR_02              | 10       |    | 0       | 0   | 255   | Anybus IP Address 02                            |
|            | 2980 | IP_ADDR_03              | 12       |    | 1       | 0   | 255   | Anybus IP Address 03                            |
|            | 2981 | SUBNET_MASK_00          | 255      |    | 255     | 0   | 255   | Anybus Subnet Mask 00                           |
|            | 2982 | SUBNET_MASK_01          | 255      |    | 255     | 0   | 255   | Anybus Subnet Mask 01                           |
|            | 2983 | SUBNET_MASK_02          | 255      |    | 255     | 0   | 255   | Anybus Subnet Mask 02                           |
|            | 2984 | SUBNET_MASK_03          | 0        |    | 0       | 0   | 255   | Anybus Subnet Mask 03                           |
|            | 2985 | GATEWAY_00              | 0        |    | 0       | 0   | 255   | Anybus Gateway 00                               |
|            | 2986 | GATEWAY_01              | 0        |    | 0       | 0   | 255   | Anybus Gateway 01                               |
|            | 2987 | GATEWAY_02              | 0        |    | 0       | 0   | 255   | Anybus Gateway 02                               |
|            | 2988 | GATEWAY_03              | 0        |    | 0       | 0   | 255   | Anybus Gateway 03                               |
|            | 224  | EN_SYNC_REG             | No       |    | No      | 0   | 1     | C23 - Enable SYNC tracking loop                 |
|            | 12   | SYNC_REG_KP             | 5        |    | 5       | 0   | 200   | P11 - SYNC loop regulator Proportional gain     |
|            | 13   | SYNC_REG_TA             | 400      |    | 400     | 0   | 20000 | P12 - SYNC loop regulator lead time constant    |

Click on the Cyclic Mapping folder and set the data as shown from the below image. These data are the exchange words between PLC and Drive likewise. It is suggested to read the profinet manual (downloadable [here](#)) to freely configure the data exchanged based on the application designed.

201F: Input logic function writing via fieldbus

201A: Speed reference as % of nMAX in 16384 reading/writing

2021: Standard logic output reading via fieldbus

200F/SUB INDEX D04: Measured speed % MOT\_SPD\_MAX 163.84

| Parameters |      | IPA  | Name          | Value | Um  | Defai |
|------------|------|------|---------------|-------|-----|-------|
|            | Lock | 2817 | RX0_INDEX     | 201f  | Hex | 0     |
|            |      | 2818 | RX0_SUB_INDEX | 0     | Hex | 0     |
|            |      | 2819 | RX1_INDEX     | 201a  | Hex | 0     |
|            |      | 2820 | RX1_SUB_INDEX | 0     | Hex | 0     |
|            |      | 2821 | RX2_INDEX     | 0     | Hex | 0     |
| R<br>W     |      | 2835 | RX9_INDEX     | 0     | Hex | 0     |
|            |      | 2836 | RX9_SUB_INDEX | 0     | Hex | 0     |
|            |      | 2837 | TX0_INDEX     | 2021  | Hex | 0     |
|            |      | 2838 | TX0_SUB_INDEX | 0     | Hex | 0     |
|            |      | 2839 | TX1_INDEX     | 200f  | Hex | 0     |
|            |      | 2840 | TX1_SUB_INDEX | 4     | Hex | 0     |
|            |      | 2841 | TX2_INDEX     | 0     | Hex | 0     |



**Important notice:** It is reminded that after every modification done to the parameters inside OPDE Explorer has to be written into the drive by clicking on Write (W) button located on the left side of the view window. Moreover it is important to save the parameters written into the drive by clicking on the button shown below in order to save the parameters into the EPROM memory. This makes the setting permanent even if the drive is restarted.

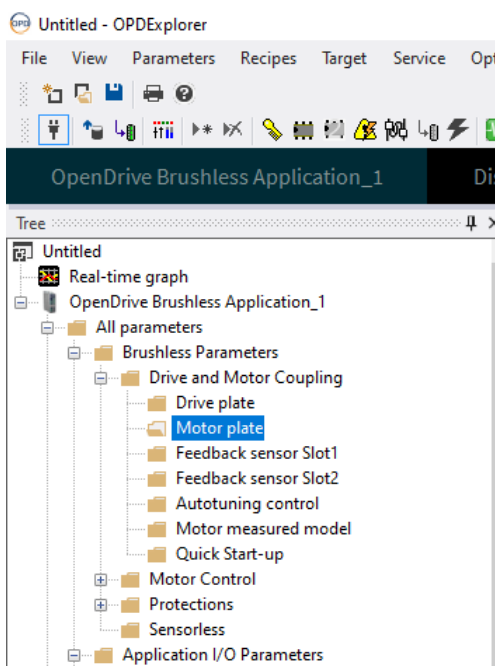


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### 3.2.1 MOTOR TUNING

In order to tune the motor, it is necessary to configure some parameters:

Click on Drive and Motor Coupling → Motor Plate



Set the motor data in the fields highlighted below:

| Parameters |     | Motor plate      |       |                 |         |      |        |  | Description                       |
|------------|-----|------------------|-------|-----------------|---------|------|--------|--|-----------------------------------|
| Lock       | IPA | Name             | Value | Um              | Default | Min  | Max    |  |                                   |
|            | 62  | PRC_MOT_I_NOM    | 100.0 | % DRV_I_NOM     | 100.0   | 10.0 | 100.0  |  | P61 - Rated motor current         |
|            | 63  | MOT_V_NOM        | 380.0 | Volt            | 380.0   | 30.0 | 1000.0 |  | P62 - Rated motor voltage         |
|            | 182 | PRC_MOT_BEMF_NOM | 100.0 | % MOT_V_NOM     | 100.0   | 0.0  | 200.0  |  | P181 - Rated motor BEMF           |
|            | 64  | MOT_SPD_NOM      | 3000  | rpm             | 3000    | 30   | 60000  |  | P63 - Rated motor speed           |
|            | 65  | PRC_MOT_V_MAX    | 100.0 | % MOT_V_NOM     | 100.0   | 1.0  | 200.0  |  | P64 - Max. operating voltage      |
|            | 66  | MOT_SPD_MAX      | 3000  | rpm             | 3000    | 30   | 60000  |  | P65 - Max. operating speed        |
|            | 68  | MOT_POLE_NUM     | 6     |                 | 6       | 1    | 160    |  | P67 - Number of motor poles       |
|            | 71  | PRC_MOT_I_THERM  | 100.0 | % PRC_MOT_I_NOM | 100.0   | 10.0 | 110.0  |  | P70 - Motor thermal current       |
|            | 72  | MOT_TF_THERM     | 600   | s               | 600     | 1    | 2400   |  | P71 - Motor thermal time constant |
|            | 67  | MOT_POLAR_PITCH  | 0     | mm              | 0       | 0    | 60000  |  | P66 - Motor polar pitch           |

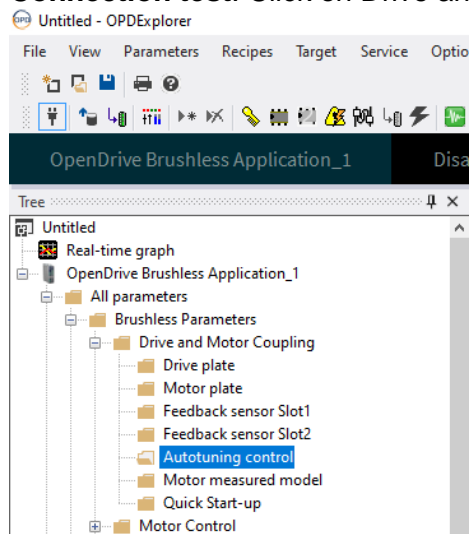
Enable the Quick Startup commands:

EN\_START\_UP\_APPL YES  
SW\_RUN\_CMD NO

| Parameters |      | Quick Startup        |          |               |          |         |        |
|------------|------|----------------------|----------|---------------|----------|---------|--------|
| Lock       | IPA  | Name                 | Value    | Um            | Default  | Min     | Max    |
|            | 2790 | EN_START_UP_APPL     | Yes      |               | No       | 0       | 1      |
|            | 2791 | START_UP_SPD_SEL     | 0 - None |               | 0 - None | 0       | 4      |
|            | 1    | PRC_START_UP_SPD_REF | 1.00     | % MOT_SPD_MAX | 0.00     | -100.00 | 100.00 |
|            | 2793 | START_UP_EN_REF      | Yes      |               | Yes      | 0       | 1      |
|            | 2792 | START_UP_RUN_SEL     | 4 - I4   |               | 4 - I4   | 0       | 8      |
|            | 2794 | START_UP_EN_LIN_RAMP | Yes      |               | Yes      | 0       | 1      |
|            | 222  | SW_RUN_CMD           | No       |               | Yes      | 0       | 1      |

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**Connection test:** Click on Drive and Motor Coupling → Autotuning control:



**EN\_TEST\_CONN:** connection test (phase test)

**EN\_AUTOTUNNING:** autotuning procedure enable

Set Yes on the parameter corresponding to the desired test:

| Parameters |      |                      |                                       |             |                | Autotuning |       |     |
|------------|------|----------------------|---------------------------------------|-------------|----------------|------------|-------|-----|
| Lock       | IPA  | Name                 | Value                                 | Um          | Default        | Min        | Max   |     |
|            | 241  | EN_AUTO_TOT          | No                                    |             | No             | 0          | 1     | C4  |
|            | 115  | PRC_I_TEST_CONN      | 100.0                                 | % DRV_I_NOM | 100.0          | 0.0        | 100.0 | P1: |
|            | 242  | EN_TEST_CONN         | No                                    |             | No             | 0          | 3     | C4  |
|            | 243  | EN_AUTOTUNNING       | No                                    |             | 0 - No         | 0          | 3     | C4  |
|            | 276  | DIS_DEF_START_AUTO   | Yes                                   |             | No             | 0          | 1     | C7  |
|            | 130  | PRC_I_TEST_DELTA_VLS | Yes, without sens<br>Yes, Start Angle | % MOT_I_NOM | 20.0           | 0.0        | 100.0 | P1: |
|            | 2786 | EN_TEST_SPD          | 0 - Not Enabled                       |             | 0 - Not Enable | 0          | 2     | U0  |
|            | 131  | TEST_SPD_T_MAX       | 40.0                                  | % MOT_T_NOM | 40.0           | 0.0        | 100.0 | P1: |

For diagnostic pourpose, add the following parameters into the Monitor window by dragging and dropping them from the main window:

| Monitor               |          |        |        |                      |
|-----------------------|----------|--------|--------|----------------------|
| Device                | Name     | Value  | Um     | Description          |
| OpenDrive Brushles... | PRC_M... | -0.02  | % M... | D04 - Speed reading  |
| OpenDrive Brushles... | MOT_I    | 0.00   | A rms  | D11 - Current module |
| OpenDrive Brushles... | DC_BUS   | 527.94 | V      | D24 - Bus voltage    |

On the drive display will appear CRun. Wait until the end of the tuning. When the test is finished the drive will display CEnd.



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Display: OpenDrive Brushless Application\_1

test Conn

Connection Test

test Auto

Auto tuning servo drive

On the drive display it will appear Arun, wait until the end of the tuning. When the tuning is finished the drive will display AEnd.

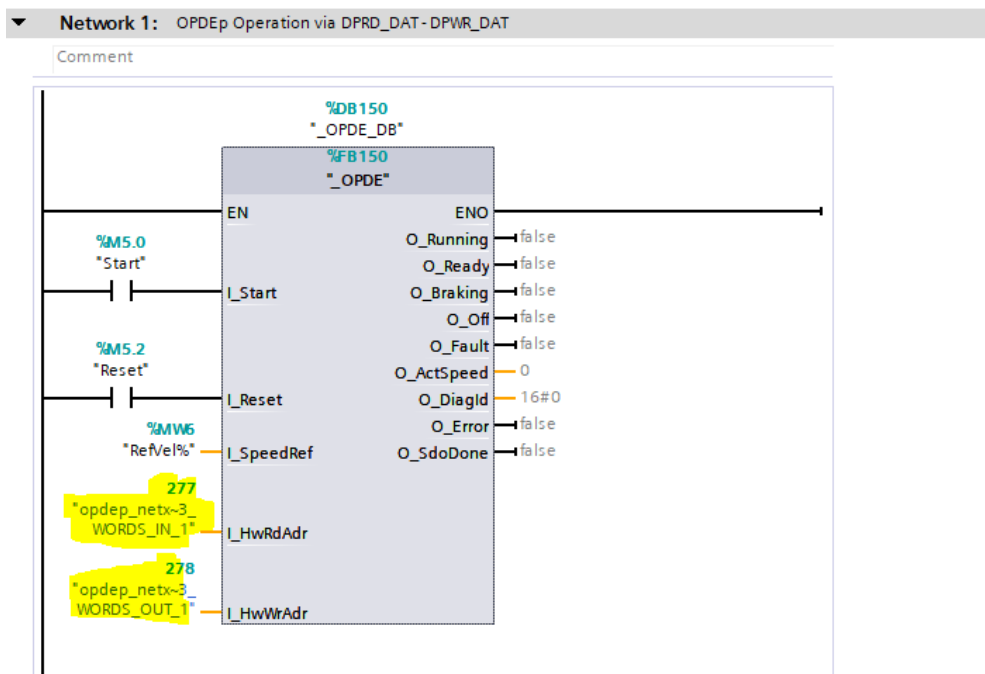
Restore the start comands on the drive:

EN\_START\_UP\_APPL NO  
SW\_RUN\_CMD YES

Once all the tuning tests are executed successfully, is possible to run the PLC program.

## 4.1 PLC STRUCTURE

In OB1 task are called two different routines:



The first example, in order to transfer a consistent buffer between the drive and the PLC, reads and writes from and to the drive with DPRD\_DAT / DPWR\_DAT routines:

|    |        |                |                 |                                     |                                     |                                     |                          |
|----|--------|----------------|-----------------|-------------------------------------|-------------------------------------|-------------------------------------|--------------------------|
| 24 | Input  | *Input<-OPDE*  | Non a ritenz... | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 25 | Output | *Output->OPDE* | Non a ritenz... | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

It is necessary to specify the hardware addresses related to the mapping done during the configuration of the device.

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OPDEPNetX\_Example ▸ Ungrouped devices ▸ opdep\_netx [OPDE]

Topology view | Network view | Device view

opdep\_netx [OPDE]

Device overview

| Module        | Rack | Slot | I address | Q address | Type        |
|---------------|------|------|-----------|-----------|-------------|
| opdep_netx    | 0    | 0    |           |           | OPDE        |
| PN-IO         | 0    | 0 X1 |           |           | opde        |
| 3 WORDS IN_1  | 0    | 1    | 100...105 |           | 3 WORDS IN  |
| 3 WORDS OUT_1 | 0    | 2    |           | 100...105 | 3 WORDS OUT |

3 WORDS IN\_1 [3 WORDS IN]

General | IO tags | System constants | Texts

Show hardware system constant ▾

| Name                    | Type         | Hardware identi. | Used by | Comment |
|-------------------------|--------------|------------------|---------|---------|
| opdep_netx~3_WORDS_IN_1 | Hw_SubModule | 277              | PLC_1   |         |

You can command the motor by using the watch table named: OPDE\_Command, use comments as reference:

OPDEProfinet-S71200 ▸ PLC\_1 [CPU 1214C DC/DC/DC] ▸ Tabella di controllo e di forzamento ▸ OPDE\_Command

|   | Nome    | Indirizzo  | Formato visualizz.. | Valore di controllo | Valore di comando        | Commento                          | Commento ... |
|---|---------|------------|---------------------|---------------------|--------------------------|-----------------------------------|--------------|
| 1 | *Tag_1* | %M5.0      | Bool                |                     | <input type="checkbox"/> | start/stop                        |              |
| 2 | *Tag_3* | %M5.2      | Bool                |                     | <input type="checkbox"/> | reset                             |              |
| 3 | *Tag_4* | %MW6       | DEC+/-              |                     | <input type="checkbox"/> | speed reference as % of max_speed |              |
| 4 | *Tag_5* | %M7.0      | Bool                |                     | <input type="checkbox"/> | Read SDO Command                  |              |
| 5 | *Tag_6* | %M7.1      | Bool                |                     | <input type="checkbox"/> | Write SDO Command                 |              |
| 6 | *Tag_7* | %MB8       | DEC                 |                     | <input type="checkbox"/> | Drive Modbus address              |              |
| 7 | *Tag_8* | %M7.2      | Bool                |                     | <input type="checkbox"/> | SDO Transfer done                 |              |
| 8 |         | <Aggiungi> |                     |                     | <input type="checkbox"/> |                                   |              |

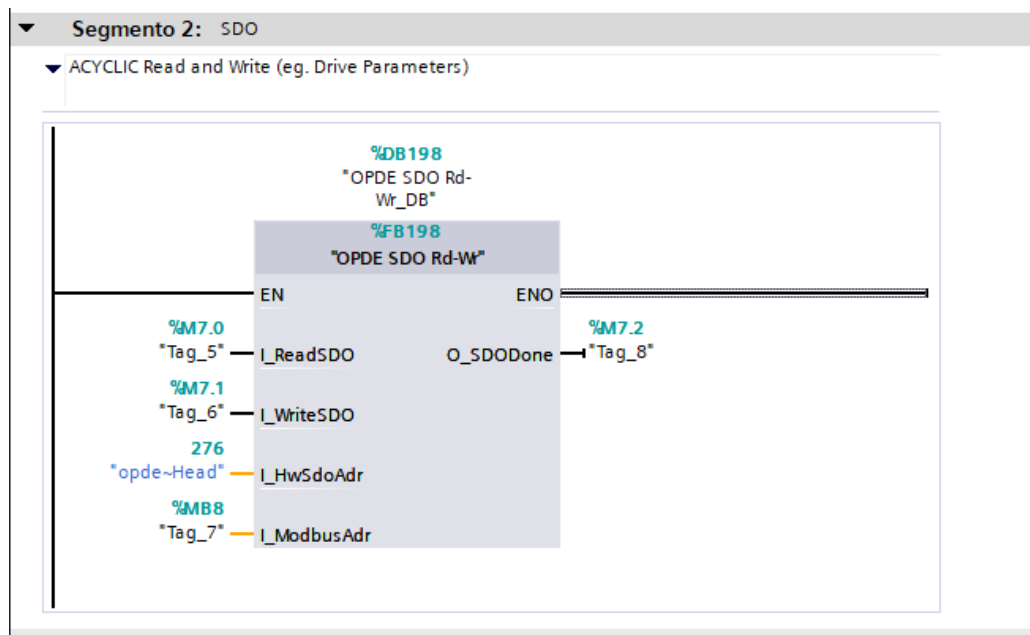
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### 4.1.1 ACYCLIC ACCESS

In parallel with the cyclic communication, the example covers the Acyclic communication between drive and plc in order to exchange parameters via SDO.

To launch the write process, the bit M7.1 has to be rised.

To launch the reading process, the bit M7.0 has to be rised.



```

REGION SDOWrite

IF #I_WriteSDO THEN

    //Write pxx
    #DriveSdoList.IWrite := TRUE; // Req Write
    #DriveSdoList.IRead := FALSE;
    #DriveSdoList.Data := 6;
    #DriveSdoList.IAdrHW := #I_HwSdoAdr;
    #DriveSdoList.IAdrParam := 16#1f; //P31 - Kp speed control *****
    #DriveSdoList.IAdrModbus := #I_ModbusAdr; //Modbus drive Address
    #DriveSdoList.ILength := 8; //Packet sent length in bytes
    #DriveSdoList.INumRegisters := 1; //Number of register in the drive
    #DriveSdoList.IExecute := TRUE; //Execution

    #DriveSdoList();

    IF #DriveSdoList.ODone THEN
        #DriveSdoList.IExecute := FALSE;
    END_IF;

END_IF;

END_REGION
  
```

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In order to read or write an arbitrary parameter, the settings into del FB198 has to be modified as follows:

**IAddrParam** → is the hexadecimal conversion from IPA – 1 parameter address (from OPDEplorer);

**IAddrModbus** → is the modbus drive address;

**ILength** → is the size of the packet sent to the drive: 8 if 1 word has to be transferred, 12 if 2 words has to be transferred;

**INumRegisters** → is the space occupied by the trasferred parameter into the drive memory (1 if the parameter is 1 word, 2 if the parameter is 2 words long)