PROFIdrive Example

NFO Sinus Optimal

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1. Introduction

This manual provides information on how to communicate with NFO Sinus inverters through Profinet/Profibus using TIA portal to configure and set up the system. This manual has been tested with TIA portal v15.1 and a Siemens CPU 1212C DC/DC/DC *(212-1AE40-0XB0).* As Profibus DP-Master a CM1243-5 *(243-5DX30-0XE0)* was used.

2. GSD/GSDML File

To configure a device in TIA portal you need a GSD file for that device. GSD files contain information about the basic capabilities of a device. GSDML files are XML-based GSD files and are used with profinet devices. To import a GSD file to TIA portal, go to ***Options > Manage general station description files (GSD)*** and navigate to the folder that contains the GSD file. You can find the devices in the catalog by searching for their GSD file name, see Figure 1. Add the device to the project by dragging and dropping it into *network view*. Which GSD file you need depends on which inverter and Anybus module you have, refer to table 1 for profibus and table 2 for profinet.

Please contact NFO Drives AB for GSD/GSDML files.

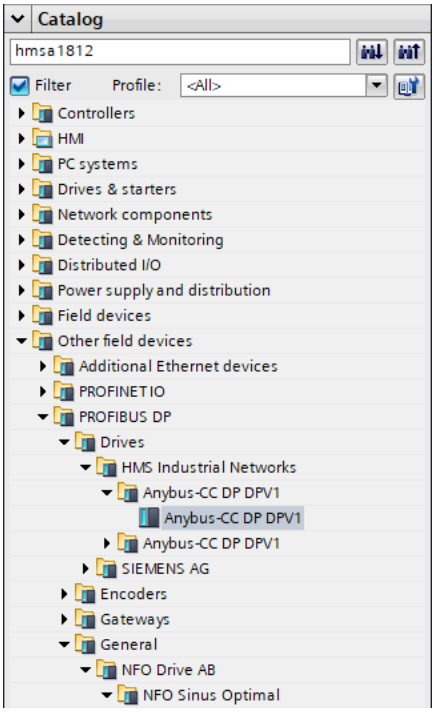


Figure 1, TIA portal catalog.

Inverter	Anybus Module	GSD file
NFO Sinus G2	M30 / AB6270-B	HMSA1812.gsd
NFO Sinus Optimal	M30 / AB6200-B	HMSB1811.gsd
NFO Sinus Optimal	M40 / AB6600-C	HMSA1815.gsd

*Table 1, GSD-files used with **Profibus.***

Inverter	Anybus Module	GSDML file
NFO Sinus Optimal	M40 / AB6605-C	gsdml-v2.34-nfo_drives_ab-optimal-20211116.xml

*Table 2, GSDML-file list used with **Profinet.***

3. Configure drive

3.1. Connect

For the program to communicate with the drive it needs to be correctly configured. Connect drive and PLC/master in network view through profinet/profibus by dragging from one interface to another, see figure 2.

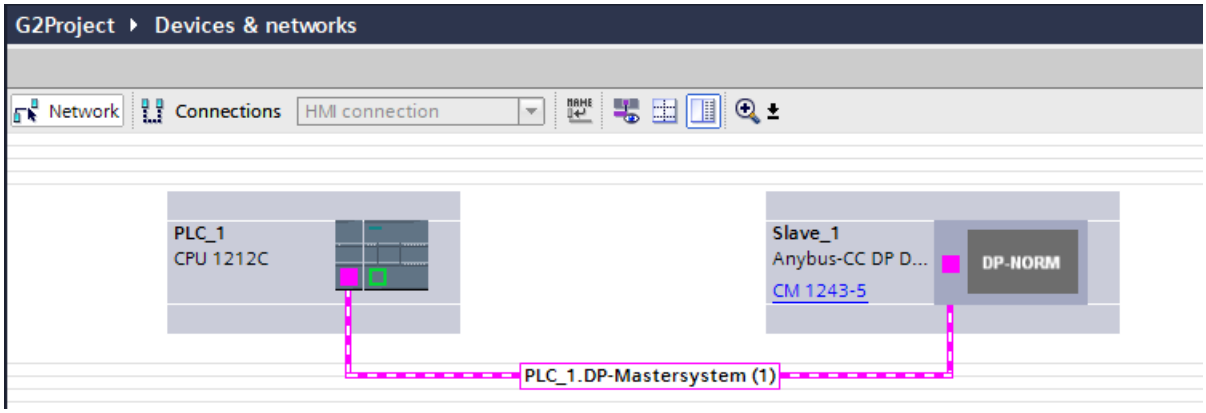


Figure 2, DP-Master and drive connected through profibus.

3.2. Profibus address

The profibus address for the drive in TIA portal must match the address parameter in the NFO sinus inverter. Check/change the address for NFO Sinus optimal through ***Communication > ABCC > Address***, and for NFO Sinus G2 through ***Serial > Address.*** In TIA portal select the module for the drive and go to ***Properties > PROFIBUS address > Parameters***, see Figure 3.

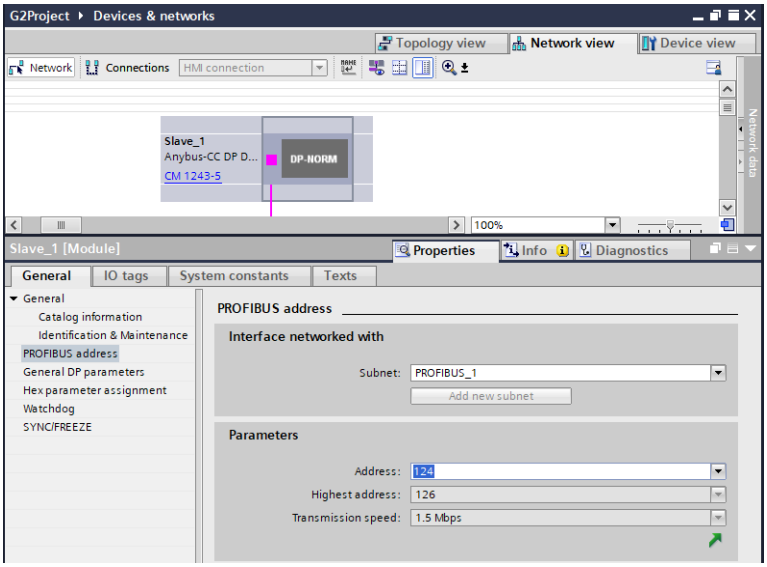


Figure 3, profibus address configuration.

3.3. Profinet address and name

Profinet devices identify each other by names, therefor the name of the device and the *PROFINET interface* need to match. You can open ***Accessible devices*** from the toolbar to search for devices on the network and see their name, see figure 4. By default, the *PROFINET interface* name matches the name of the module, which can be changed in ***Properties > General***, see figure 5. To change the name of the *PROFINET interface* without matching name with the module, select the module and go to ***Properties > PROFINET Interface > Ethernet Addresses > Profinet*** and disable *"Generate PROFINET device name automatically"* then enter PROFINET device name, see figure 6.

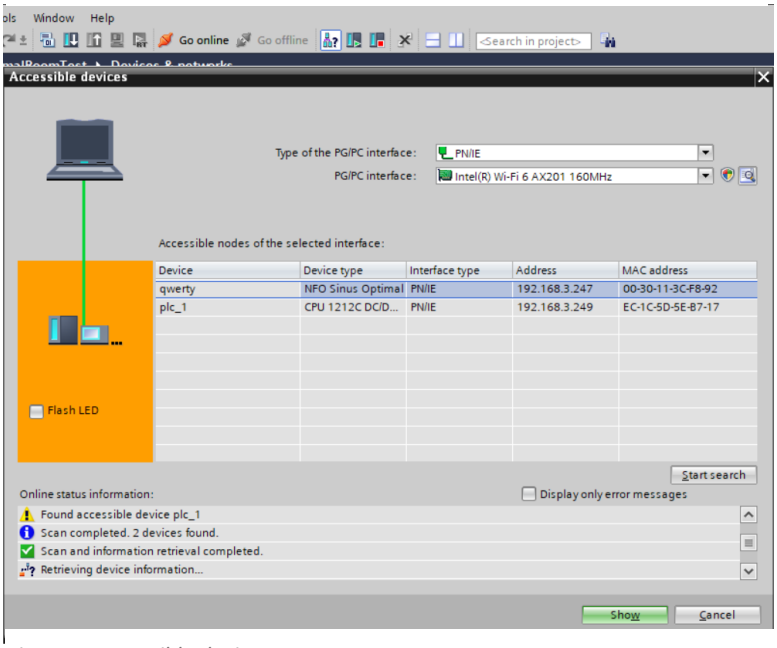


Figure 4, accessible devices.

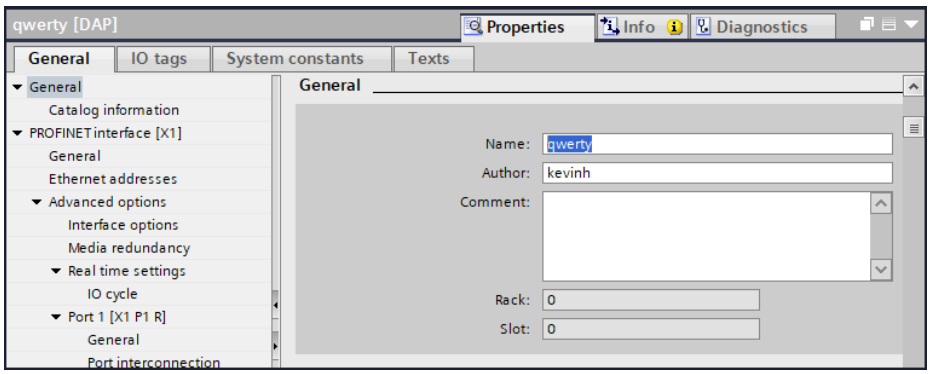


Figure 5, Changing name of module.

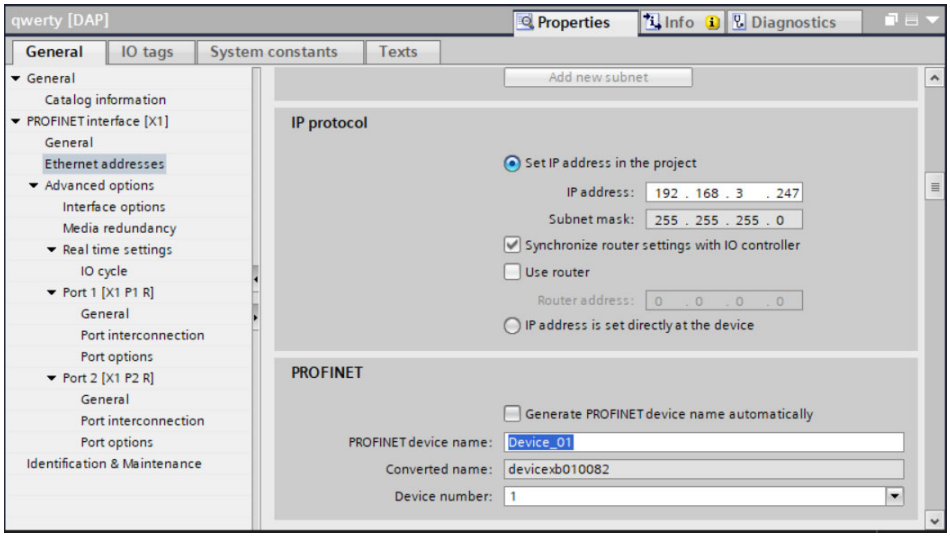


Figure 6, changing name of PROFINET interface and setting IP address

The device name can be changed to match the *PROFINET interface* name by right clicking the PROFINET interface in the Network view and select *"Assign device name"* from the context menu. Then find the device and click *"Assign name"*, see figure 7.

Set the IP address for the module under ***Properties > PROFINET interface > Ethernet*** addresses ***> IP Protocol,*** see figure 6. You can see the IP address of the device by opening ***Accessible devices***, see figure 4.

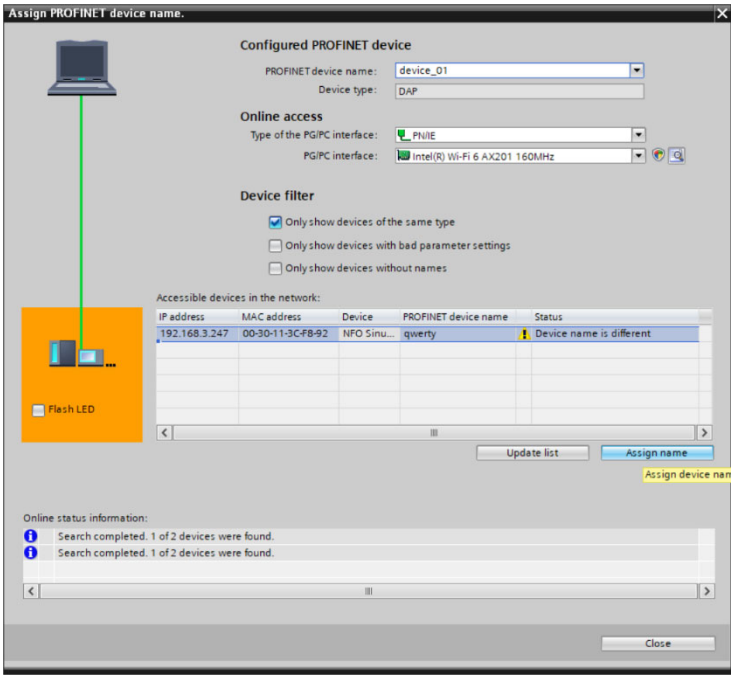


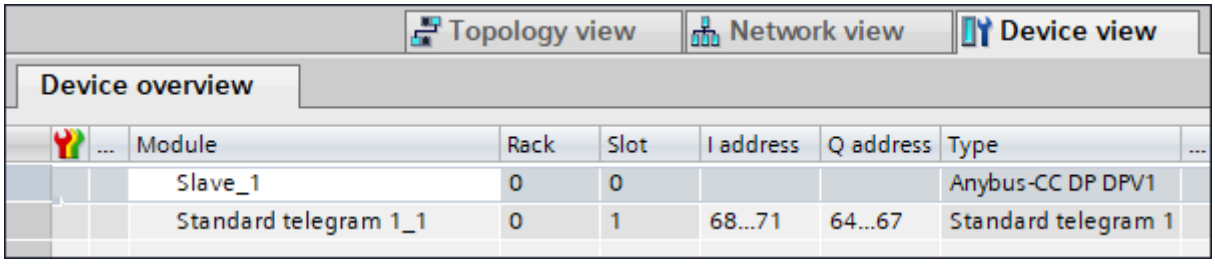
Figure 7, Assign profinet device name.

4. Telegrams

4.1. Configuration

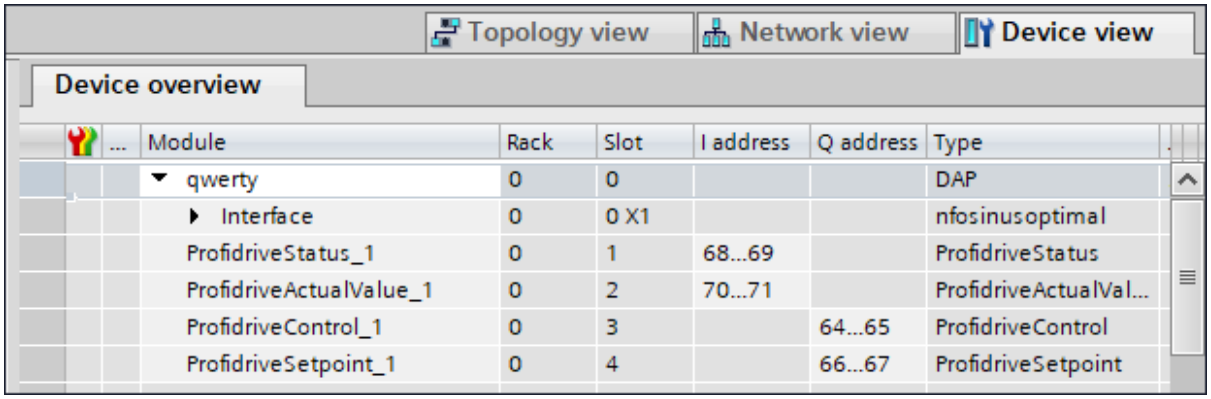
Profinet/profibus uses telegrams to communicate between devices, the telegrams are 16-bit words or values. These telegrams need to be set up in the device. NFO Sinus inverters uses telegram 1. Double click the inverter in *Network view* to open the *Device view*. Drag the correct telegrams from the catalog into the correct order in the *Device overview*. See figures 8 and 9 for telegram configuration for *NFO Sinus G2 with Profibus* and *NFO Sinus Optimal with Profinet* respectively. PLC tags are set up in the same way for G2 and optimal, the

tags addresses are based on the addresses of the telegrams. For optimal each telegram module corresponds to a PLC tag with the same starting address. Figure 10 shows how to create PLC tags for the telegrams.



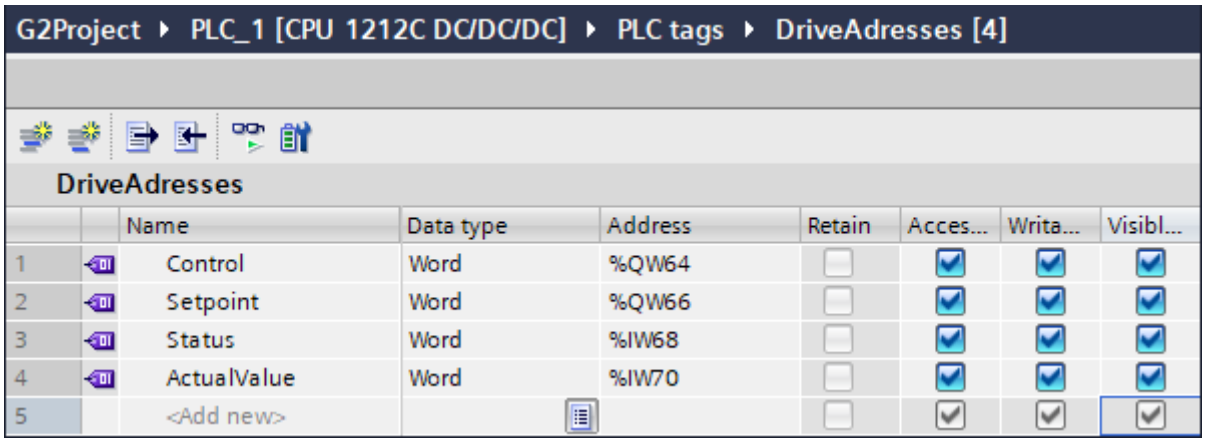
Module	Rack	Slot	I address	Q address	Type
Slave_1	0	0			Anybus-CC DP DPV1
Standard telegram 1_1	0	1	68...71	64...67	Standard telegram 1

Figure 8, G2 telegrams, profibus,



Module	Rack	Slot	I address	Q address	Type
qwerty	0	0			DAP
Interface	0	0 X1			nfosinusoptimal
ProfidriveStatus_1	0	1	68...69		ProfidriveStatus
ProfidriveActualValue_1	0	2	70...71		ProfidriveActualVal...
ProfidriveControl_1	0	3		64...65	ProfidriveControl
ProfidriveSetpoint_1	0	4		66...67	ProfidriveSetpoint

Figure 9, Optimal telegrams, profinet



	Name	Data type	Address	Retain	Acces...	Writa...	Visibl...
1	Control	Word	%QW64		☑	☑	☑
2	Setpoint	Word	%QW66		☑	☑	☑
3	Status	Word	%IW68		☑	☑	☑
4	ActualValue	Word	%IW70		☑	☑	☑
5	<Add new>				☑	☑	☑

Figure 10, PLC tags for telegram, notice the addresses corresponds to the addresses of the telegram modules in Figure 8 and 9.

4.2. Usage

Actual and Setpoint values are scaled so that the range -8192 – +8192 corresponds to either -50Hz – +50Hz (when in Frequency mode), or -Nnom – +Nnom, e.g. -1500 rpm – +1500 rpm for a four-pole motor (when in Speed mode). A negative number corresponds to reverse rotation. Maximum range is -24576 – +24576 (± 150Hz or ± 3 × Nnom). To control the inverter (Start/Stop, etc) from a fieldbus interface, the run signal (terminal DIN1) must be active. A common installation would be to strap the run signal to +24V and set parameter Autostart = Off. Then the inverter will not start by itself when powered on, but it allows control from bus. NFO Sinus Optimal and NFO Sinus G2 have slightly different bit fields, see below.

Bit	Name	Description
0	Switch on	Run command (run signal must be active)
1	EnableVoltage	No Coast Stop
2	DisableQuickStop	No Quick Stop
3	EnableOp	Enable command (must precede Run cmd)
4	EnableRfg	Enable Ramp Generator
5	UnlockRfg	Unfreeze Ramp Gen.
6	UseRefForRfg	Enable Setpoint
7	Fault ack	Fault acknowledge on 0 to 1 transition

Bit	Name	Description
8	Jog 1 ON	N/A
9	Jog 2 ON	N/A
10	PLC control	PLC takes control (must precede Enable)
11	Not used	-
12	Not used	-
13	Not used	-
14	Not used	-
15	Not used	-

*Table 3, **G2** Profidrive control bit field description*

Bit	Name	Description
0	Ready	Ready to receive enable command
1	Operating	Inverter output stage is active
2	Enabled	Enabled, ready to receive run command
3	Fault active	Fault condition active (may require ack)
4	Voltage Enabled	N/A
5	QuickStopDisabled	N/A
6	Disabled	Switching On Inhibited
7	Alarm active	Alarm condition active (not require ack)

Bit	Name	Description
8	SpeedError	Speed Error Within Limits
9	Control requested	Inverter is in bus mode
10	Setpoint reached	F Or n Reached
11	Not used	-
12	Not used	-
13	Not used	-
14	Not used	-
15	Not used	-

*Table 4, **G2** Profidrive status bit field description*

G2 Example: To "connect" to the NFO we use Control word = 0x047E. To reset fault/alarm, change bit 7 to one and back to zero (0x047E -> 0x0480 -> 0x047E). To start operation, set bit 1 to one (0x047E -> 0x047F). Note that the setpoint should first have been given a value different from zero, so that there is a value to accelerate up to.

Bit	Name	Description
0	Switch on	Run command (run signal must be active)
1	Not used	(value echoed to drive status bit 4)
2	Not used	(value echoed to drive status bit 5)
3	Enable	Enable command (must precede Run cmd)
4	Not used	-
5	Not used	-
6	Not used	-
7	Fault ack	Fault acknowledge on 0 to 1 transition

Bit	Name	Description
8	Not used	-
9	Not used	-
10	PLC control	PLC takes control (must precede Enable)
11	Not used	-
12	Not used	-
13	Not used	-
14	Not used	-
15	Not used	-

*Table 5, **Optimal** Profidrive control bit field description*

Bit	Name	Description
0	Ready	Ready to receive enable command
1	Operating	Inverter output stage is active
2	Enabled	Enabled, ready to receive run command
3	Fault active	Fault condition active (may require ack)
4	Not used	(returns value of drive control bit 1)
5	Not used	(returns value of drive control bit 2)
6	Disabled	Run signal not present on terminal DIN1
7	Alarm active	Alarm condition active (not require ack)

Bit	Name	Description
8	Not used	-
9	Control requested	Inverter is in bus mode
10	Setpoint reached	Output frequency has reached setpoint
11	Limit active	Inverter has reached current limit
12	Sleep active	Output is suspended in sleep mode
13	Stop mode brake	Inverter will brake/ramp to stop
14	Reverse	Actual rotation is reverse
15	Stopping	Inverter is decelerating towards a stop

*Table 6, **Optimal** Profidrive status bit field description*

Optimal Example: Master sets the PLC control bit and then waits for inverter to respond with Control requested bit in status word. Then bus master sets the Enable bit and waits for inverter to respond with Enabled. Now the bus master may start the motor using the Switch on command bit, and inverter will respond with bit Operating.

When master clears the Switch on bit, inverter will decelerate towards a stop. When fully stopped, the Operating bit will be cleared. Motor is now stopped, and inverter is ready for a new start command. For other status bits and their meaning, see table above.

5. Example LAD program

This example program is made for G2 and uses LAD (ladder logic). The program simply utilizes a switch at terminal 0.0 on the PLC to turn on/off the motor at a pre-set speed.

First create a new *Data Block* in the Project Tree by clicking *"Add new block"* under your PLC's *Program blocks* folder. Select *Data block* and click ok. Create two new entries as seen on figure 11, the values are taken from *the G2 Example* under chapter *"4.2. Usage"*.

		Name	Data type	Start value	Retain	Accessible f...	Writa...	Visible in ...	Setpoint
1		Static			☐	☐	☐	☐	☐
2		Idle	Word	16#47E	☐	☑	☐	☑	☐
3		Start	Word	16#47F	☐	☑	☐	☑	☐

Figure 11, data block for simple G2 control

Next add another new block, select *Organization* block and then from the list of organization blocks select *Startup,* make sure the language is set to *LAD* and click ok. The setpoint for the inverter must be set in order for the drive to start, in this small program we simply set the setpoint at start, then we “connect” the drive by sending/moving our *Idle* word from our data block to our *Control PLC tag*, see Figure 12.

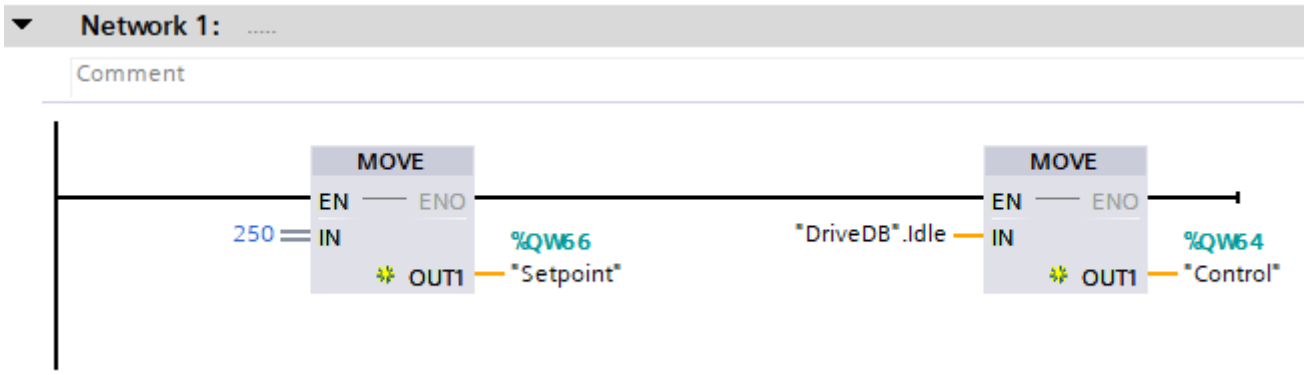


Figure 12, startup organization LAD block, prepares the inverter for use.

Lastly, open the *Main [OB1]* block, this block runs many times per second (~1000 times per second, depending on settings and PLC). Here we listen for a change in the Digital Input *%I0.0* on the PLC and then either send *Start* or *Idle* depending on if the signal from the input is on or not. *P_TRIG* are used to ensure that the next block only triggers once after the value of the input changes. See figure 13 for the program.

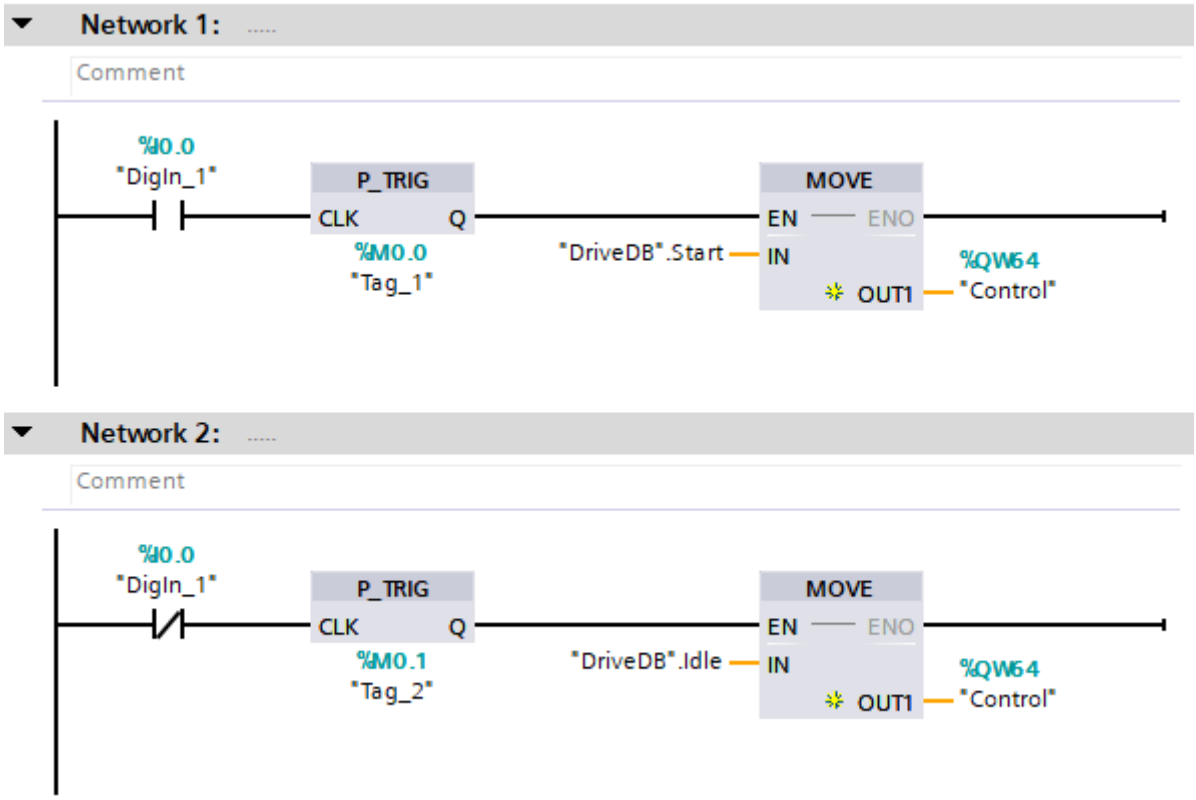


Figure 13, Main OB1, the main program cycle, this block enables a switch connected to the digital input 1 for the PLC to start/stop the drive.