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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 XMLbased 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.					
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			



Profile: <All>

✓ Catalog hmsa1812

Filter

Table 1, GSD-files	used with	Profibus.
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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.

G2Project > [Devices & ne	tworks					
Network	Connections	HMI connection		5 🔣 🛄 🔍	±		
	PLC_1				Slave_1	and the second s	
	CPU 1212C				Anybus-CC DP D	DP-NORM	
					<u>CIVI 1245-5</u>		
			PLC_1.DP-M	astersystem (1	1)	-	

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.

G2Project Devices & network	ks	
	🛃 Topology view 🛛 👪 Network view 🛛 👔 Devic	ce view
Network	connection 💌 🗱 🏥 🛄 🍳 ±	
		^
Slave_1		-
Anybus-	-CC DP D DP-NORM	
<u>CW 124</u> .		
		~
	> 100%	- 1
Slave_1 [Module]	🖳 Properties 🚺 Info 🚺 🗓 Diagnostics	
General IO tags Syst	tem constants Texts	
- General		
Catalog information		
Identification & Maintenance	Interface networked with	
PROFIBUS address		
Hex parameter assignment	Subnet: PROFIBUS_1	
Watchdog	Add new subnet	
SYNC/FREEZE	Paramatara	
	rarameters	
	Address: 124	•
	Highest address: 126	
	Transmission speed: 1.5 Mbps	
		~
		-

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 3, profibus address configuration.

s Window Help	💋 Go online 🚀 Go offlin	ne 🛃 🖪 🔳 🤉	📃 🛄 <ear< th=""><th>ch in project> 🛛 👫</th><th></th><th></th></ear<>	ch in project> 🛛 👫		
Accessible devices	e & potworke					1
Accessible devices						1
	Туре	of the PG/PC interfac PG/PC interfac	e: PN/IE e: Dintel(R) Wi-	Fi 6 AX201 160MHz	•	
	Accessible nodes of the sel	lected interface:	Interface tune	Address	MAC address	
	owerty	NEO Sinus Ontimal	PN/IF	192 168 3 247	00-30-11-3C-F8-92	-
	plc 1	CPU 1212C DC/D	PN/IE	192.168.3.249	EC-1C-5D-5E-87-17	-
1 •						
Flash LED						
					<u>Start search</u>	
Online status information:				Display only er	ror messages	
🔒 Found accessible dev	rice plc_1				-	•
Scan completed. 2 de	vices found.					a
Scan and information	retrieval completed.					
"? Retrieving device info	rmation					1
				s	ho <u>w</u> <u>C</u> ancel	5

Figure 4, accessible devices.



qwerty [DAP]		🔍 Proper	ties 🚺 Info 🔒 🗓 Diagnostics	
General IO tags	System constants	Texts		
▼ General	General			~
Catalog information				
▼ PROFINET interface [X1]		Mamai		
General		Name:	gwerty	
Ethernet addresses		Author:	kevinh	
 Advanced options 		Comment:		~
Interface options				
Media redundancy				
 Real time settings 				~
IO cycle		Back:	0	
 Port 1 [X1 P1 R] 	-			
General		Slot:	U	
Port interconnection	on -			

Figure 5, Changing name of module.

qwerty [DAP				Rroperties	🗓 Info 🚺 🗓 Diagnostics	
General	IO tags	System constants	Texts			
▼ General		Π		Add new subn	et	^
Catalog in	nformation					
▼ PROFINET int	terface [X1]	IP protoco	d i			
General						
Ethernet	addresses			Set IP address in t	he project	
 Advanced 	d options			IP address:	192 168 3 247	≡
Interfa	ce options				192 . 100 . 5 . 247	
Media	redundancy			Subnet mask:	255 . 255 . 255 . 0	
🔻 Real ti	me settings			Synchronize route	r settings with IO controller	
10 0	cycle			Use router		
 Port 1 	[X1 P1 R]	-		Router address		
Ger	neral					
Por	t interconnectio	n		O IP address is set d	irectly at the device	
Por	t options					
 Port 2 	[X1 P2 R]	PROFINET				
Ger	neral			_		
Por	t interconnectio	n		Generate PROFINE	T device name automatically	
Por	t options	PF	OFINET device name:	Device_01		
Identification	n & Maintenance	e	Converted name:	devicexb010082		
			Device number:	1		
						~

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.

		Online access Type of the PGIPC i PGIPC i Device filter Only show Only show Only show	vice type: interface: interface: devices of the devices with	device_01 DAP PIVIE Intel(R) Wi-Fi 6 AX201 1 e same type bad parameter settings	60MHz V C
		Online access Type of the PGIPC i PGIPC i Device filter I only show	interface: interface: interface: interface: interface: interface: interface:	Ph/IE Intel(R) Wi-Fi 6 AX201 1 e same type bad parameter settings	COMHZ V C
		Online access Type of the PGIPC i PGIPC i Device filter I only show Only show	interface: interface: devices of th devices with	PN/IE Intel(R) Wi-Fi 6 AX201 1 e same type bad parameter settings	60MHz V C
		Type of the PGIPC i PGIPC i Device filter Only show Only show	interface: interface: devices of th devices with	PN/E Intel(R) Wi-Fi 6 AX201 1 e same type bad parameter settings	60MHz 💌 🖲
		PGIPC i Device filter Only show Only show Only show Only show	interface: devices of th devices with	e same type bad parameter settings	60MHz 💌 🖲 🔍
Ar		Device filter Only show Only show Only show Only show	devices of the	e same type bad parameter settings	
Ar		Only show	devices of the	e same type bad parameter settings	
Ar		Only show	devices with	bad parameter settings	
Ar		Onlyshow	devices with		
Âr		Onlyshow		outnamer	
Ac			devices with	ournames	
	cessible devic	es in the network:			
IP	address	MAC address	Device	PROFINET device name	Status
10	92.168.3.247	00-30-11-3C+8-92	NFO Sinu	qwerty	Device name is different
Flash LED					
7	1			10	
	•				
				Up	date list Assign name

4. Telegrams

4.1. Configuration

Figure 7, Assign profinet device name.

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.

	불 Торо	ology vie	ew 🛛	h Networ	k view	🛐 Device view]
Device overview							
Module	1	Rack	Slot	I address	Q address	Туре	
Slave_1		0	0			Anybus-CC DP DPV1	
Standard te	legram 1_1	0	1	6871	6467	Standard telegram 1	
Standard te	legram 1_1	0	1	00/1	0407	standard telegram i	

Figure 8, G2 telegrams, profibus,

	🖉 T.	opology	view	A Netw	ork view	🛿 Device view			
Device	Device overview								
**	Module	Rack	Slot	I address	Q address	Туре			
	 qwerty 	0	0			DAP	~		
	Interface	0	0 X1			nfosinusoptimal			
	ProfidriveStatus_1	0	1	6869		ProfidriveStatus			
	ProfidriveActualValue_1	0	2	7071		ProfidriveActualVal			
	ProfidriveControl_1	0	3		6465	ProfidriveControl			
	ProfidriveSetpoint_1	0	4		6667	ProfidriveSetpoint			

Figure 9, Optimal telegrams, profinet

G2Project → PLC_1 [CPU 1212C DC/DC/DC] → PLC tags → DriveAdresses [4]									
🛫 😴 🖶 🙄 🛍									
D	DriveAdresses								
		Name	Data type	Address	Retain	Acces	Writa	Visibl	
1	-	Control	Word	%QW64		\checkmark			
2	-	Setpoint	Word	%QW66		~	~		
3	-	Status	Word	%IW68		\checkmark	\checkmark		
4	-	ActualValue	Word	%IW70		\checkmark	\checkmark		
5		<add new=""></add>						>	

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 $-24576 - +24576 (\pm 150Hz \text{ or } \pm 3 \times \text{Nnom})$. 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	Bit	Name	Description
0	Switch on	Run command (run signal must be active)	8	Jog 1 ON	N/A
1	EnableVoltage	No Coast Stop	9	Jog 2 ON	N/A
2	DisableQuickStop	No Quick Stop	10	PLC control	PLC takes control (must precede Enable)
3	EnableOp	Enable command (must precede Run cmd)	11	Not used	-
4	EnableRfg	Enable Ramp Generator	12	Not used	-
5	UnlockRfg	Unfreeze Ramp Gen.	13	Not used	-
6	UseRefForRfg	Enable Setpoint	14	Not used	-
7	Fault ack	Fault acknowledge on 0 to 1 transition	15	Not used	-

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



Bit	Name	Description	Bit	Name	Description
0	Ready	Ready to receive enable command	8	SpeedError	Speed Error Within Limits
1	Operating	Inverter output stage is active	9	Control requested	Inverter is in bus mode
2	Enabled	Enabled, ready to receive run command	10	Setpoint reached	F Or n Reached
3	Fault active	Fault condition active (may require ack)	11	Not used	-
4	Voltage Enabled	N/A	12	Not used	-
5	QuickStopDisabled	N/A	13	Not used	-
6	Disabled	Switching On Inhibited	14	Not used	-
7	Alarm active	Alarm condition active (not require ack)	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 ($0x047E \rightarrow 0x0480 \rightarrow 0x047E$). To start operation, set bit 1 to one ($0x047E \rightarrow 0x047F$). 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

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	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	-

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".

			Na	me	Data type	Start value	Retain	Accessible f	Writa	Visible in	Setpoint
	1	-	•	Static							
	2	-	•	Idle	Word	16#47E				\checkmark	
3	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.