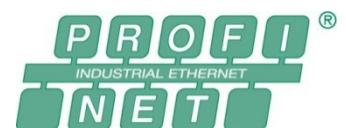# Functional Overview

PROFInet Option Card for Sigma-5

PROFInet Real-Time Class: 2 (RT)

Model: SGDV-OCB03A

Firmware: v0.3

Revision History Following pages	Copy to				Yaskawa Europe GmbH		
	Section	Qty	Section	Qty			
					Approval	Check	Draw
							H.Dedio

Rev	Changed contents	Revised page	Approval	Draw
0.1	1st draft	-	-	H. Dedio 12th Jul, 2013

Contents

1 Specifications

1.1 Overview

The Sigma-V series PROFInet Network Module implements the PROFIdrive drive profile in PROFInet communication (real-time Ethernet communication).

Position, velocity, and torque control can be performed. You can select the appropriate form of control for your system, from simple positioning to high-speed, high-precision locus control.

Moreover, the Sigma-V high servo control performance, advanced tuning function, and wide range of actuator controls can be performed via PROFInet.

1.2 Specification of the PROFInet Network Module

1.2.1 General Specifications

This table lists the general specifications of the PROFInet Network Module

Item	Condition	Specification
Operating ambient Temperature		0 to +55 deg
Preservation ambient Temperature		-20～+85 deg
Altitude		1000m or less
Humidity resistance	No condensation	90%RH or less
Resistance to vibration		4.9 m/s^2
Impact resistance		19.8 m/s^2

Item		Details
Applicable SERVOPACK		All SGDV-****E** models
Installation Method		Mounted on the SGDV SERVOPACK
Basic Specifications	**Power Supply Method**	Supplied from the SGDV control power supply.
	External Dimensions[mm]	80 x 90 mm Refer to PCB specification
Input signals	**Fixed Allocation to CN1 Connector of SERVOPACK**	6 inputs • Negative limit switch or negative over travel (N-OT) • Positive limit switch or positive over travel (P-OT) • Reference switch or home switch (/DEC) • General purpose input (/SI0) • Probe latch inputs (/EXT1,/EXT2) No effect function (Can not be used): • External latch inputs (EXT3)
Output signals	**Fixed Allocation to CN1 Connector of SERVOPACK**	3 outputs Signal allocations and positive / negative logics can be modified. • Positioning completion (/COIN) • Speed coincidence detection (/V-CMP) • Servomotor rotation detection (/TGON) • Servo ready (/S-RDY) • Torque limit detection (/CLT) • Speed limit detection (/VLT) • Brake interlock (/BK) • Warning (/WARN) • NEAR (/NEAR)
Other function	**Fully-closed Loop Control**	Supported

1.2.2 Communication Specifications

Communication profile	Ethernet Profinet IO RT Ver2.3
Physical layer	100BASE-TX(IEEE802.3)
Field-bus connection	2×RJ45; CN11A,CN11B ,Full duplex , Auto-negotiation, Auto-crossover
Baud Rate Setting	100 MBit/s
Supported Protocols	RTC – Real time Cyclic Protocol - Class 1 & Class 2 (unsynchronized) RTA – Real time Acyclic Protocol DCP – Discovery and Configuration Protocol CL-RPC – Connectionless Remote Procedure Call LLDP – Link Layer Discovery Protocol SNMP – Simple Network Management Protocol
Node Address Setting	DCP Rotary switches: S1, S2 – Not in use
Identification & Maintenance functions	Reading I&M0
Topology recognition	LLDP, SNMP V1, MIB2, physical device
Power Supply	5V±5%, 500mA(Max) Supplied internal from Drive CN10
LED indicator	Red (ERR), Green (RUN) Profinet communicating (L/A) x 2
Node type	Axis Drive Unit, PROFInet IO Device
Acyclic parameter access	Read/Write Record
Cyclic messaging	Set of pre-defined Standard telegrams: • ST1, ST2, ST7, ST9 Pre-defined Manufacturer telegram: • Telegram number: 100 Free configurable telegram • Telegram number: 999 • Dynamic telegram mapping with max. 16 signal entries each (input, output)
Alarm Notification PDU	Optional

1.2.3   Drive profile specification

Standard	IEC 61800-7-1/2/3 Committee Draft
Motor type	Servo
Axis Type	Rotary, Linear
Profile Services	Cyclic messaging Acyclic parameter access mechanism Identification & Maintenance functions (I&M0) PROFIdrive parameters Diagnostic and alarm mechanism Fault buffer mechanism
Application Classes	1, 3
PROFIdrive Position Mode	Absolute and relative positioning Supported PROFIdrive position submodes: • MDI submode • Program submode (up to 64 positioning sets) Motion Profile type: Linear
PROFIdrive Velocity Mode	Motion Profile type: Linear
Homing Function	Supported homing methods are: • Homing on the negative limit switch and index pulse • Homing on the positive limit switch and index pulse • Homing on the positive home switch and index pulse • Homing on the negative home switch and index pulse • Homing on the negative limit switch • Homing on the positive limit switch • Homing on the positive home switch • Homing on the index pulse • Homing on the current position Motion profile type: linear Homing persistent in absolute motor encoder
Torque Profile mode	Torque Profile type: Linear

1.3 Telegrams

The option card supports standard telegrams for speed mode and position mode. Further on, a YASKAWA manufacturer telegram can be selected. It is also possible to configure the cyclic communication. Further on, the servopack can be operated without cyclic data

1.3.1 Standard speed telegram (ST1, ST2)

Operating mode PNU930	• 0x0001 (PROFIdrive velocity mode)			
Mode Of Operation (0x6060,0x6061)	• -3 (PROFIdrive velocity mode)			
Telegram	1		2	
Appl.- Class	1		1	
PZD1	STW1	ZSW1	STW1	ZSW1
PZD 2	NSOLL_A	NIST_A	NSOLL_B	NIST_B
PZD 3				
PZD 4			STW2	ZSW2

1.3.2 Standard position telegram (ST7, ST9)

Operating mode PNU930	• 0x0002 (PROFIdrive position mode)			
Mode Of Operation (0x6060,0x6061)	• -2 (PROFIdrive position mode)			
Telegram	7		9	
Appl.- Class	3		3	
PZD1	STW1	ZSW1	STW1	ZSW1
PZD 2	SATZANW	AKTSATZ	SATZANW	AKTSATZ
PZD 3			STW2	ZSW2
PZD 4			MDI_TARPOS	XIST_A
PZD 5				
PZD 6			MDI_VELOCITY	
PZD 7				
PZD 8			MDI_ACC	
PZD 9			MDI_DEC	
PZD 10			MDI_MOD	

1.3.3 Manufacturer specific general telegram (telegram 100)

Operating mode PNU930	• 0x0001 (PROFIdrive velocity mode) • 0x0002 (PROFIdrive position mode) • 0x80FF (Pole detection mode) • 0x8000 (No mode change / assigned) • 0x8004 (Torque profile mode)
Mode Of Operation (0x6060,0x6061)	• -3 (PROFIdrive velocity mode) • -2 (PROFIdrive position mode) • -1 (Pole detection mode) • 0 (No mode change / assigned) • 4 (Torque profile mode)

Telegram	100	
Appl.- Class	1, 3	
PZD 1	STW1	ZSW1
PZD 2	SATZANW	AKTSATZ
PZD 3	STW2	ZSW2
PZD 4	Mode of Operation (6060h)	Mode of Operation Display(6061h)
PZD 5	Target Position (607Ah)	Position actual value (6064h)
PZD 6		
PZD 7	Target Velocity (60FFh)	Velocity actual value (606Ch)
PZD 8		
PZD 9	Target Torque (6071h)	Torque Actual Value (6077h)
PZD 10	Touch Probe Function (60B8h)	Touch Probe Status (60B9h)
PZD 11	Profile acceleration (6083h)	Touch Probe Value (60BAh)
PZD 12		
PZD 13	Profile deceleration (6084h)	Following error actual value (60F4h)
PZD 14		
PZD 15	Profile velocity (6081h)	
PZD 16		

1.3.4 Empty telegram

Only PAP configured. No cyclic PZDs.

Operating mode PNU930	• 0x0001 (PROFIdrive velocity mode) • 0x0002 (PROFIdrive position mode) • 0x80FF (Pole detection mode) • 0x8000 (No mode change / assigned) • 0x8004 (Torque profile mode)
Mode Of Operation (0x6060,0x6061)	• -3 (PROFIdrive velocity mode) • -2 (PROFIdrive position mode) • -1 (Pole detection mode) • 0 (No mode change / assigned) • 4 (Torque profile mode)
Telegram	-
Appl.- Class	-

1.3.5 Free configurable telegram

PZDs 2 to 16 can be freely selected. See chapter "IO Data Signals" for parameters to be selected. A second way is to read parameter PNU923 (List of all the parameters for signals).

The specific set points/actual values can be freely configurable by selecting telegram number P922=0. If P922 is changed to 0, the previous setting of P915[x], P916[x] is kept and the signals configuration is allowed by setting P915[x], P916[x] with the desired signals. Activating the telegram and validity check is done by setting P922=999.

Operating mode PNU930	• 0x0001 (PROFIdrive velocity mode), • 0x0002 (PROFIdrive position mode), • 0x80FF (Pole detection mode), • 0x8000 (No mode change / assigned), • 0x8004 (Torque profile mode)	
Mode Of Operation (0x6060,0x6061)	• -3 (PROFIdrive velocity mode), • -2 (PROFIdrive position mode), • -1 (Pole detection mode), • 0 (No mode change / assigned), • 4 (Torque profile mode)	
Telegram	999	
Appl.- Class	1,3	
PZD 1	STW1	ZSW1
PZD 2	Freely selectable	Freely selectable
PZD 3		
PZD 4		
PZD 5		
PZD 6		
PZD 7		
PZD 8		
PZD 9		
PZD 10		
PZD 11		
PZD 12		
PZD 13		
PZD 14		
PZD 15		
PZD 16		

1.4 IO Data Signals

The following table is an overview about the values to be mapped into the free configurable telegram 999.

Signal No.	Significance	Abbreviation	TPZD / RPZD	Data Type (*)	Normalization	Interconnection parameter Normalized (Unnormalized)
1	Control word 1	STW1	RPZD	U16		0x6040
2	Status word 1	ZSW1	TPZD	U16		0x6041
3	Control word 2	STW2	RPZD	U16		0x2503
4	Status word 2	ZSW2	TPZD	U16		0x2504
5	Speed setpoint A	NSOLL_A	RPZD	I16 (N2)	4000h => 100% of (0x607F/2)	0x2505(0x60FF)
6	Speed actual value A	NIST_A	TPZD	I16 (N2)	4000h => 100% of (0x607F/2)	0x2506 (0x606C)
7	Speed setpoint B	NSOLL_B	RPZD	I32 (N4)	40000000h => 100% of (0x607F/2)	0x2507 (0x60FF)
8	Speed actual value B	NIST_B	TPZD	I32 (N4)	40000000h => 100% of (0x607F/2)	0x2508 (0x606C)
21	Input (digital)	E_DIGITAL	TPZD	U16		0x2521
22	Output (digital)	A_DIGITAL	RPZD	U16		0x2522
27	Position setpoint value A	XSOLL_A	RPZD	I32	No	0x60C1
28	Position actual value A	XIST_A	TPZD	I32	No	0x6064
32	Traversing block selection	SATZANW	RPZD	U16		0x2532
33	Actual traversing block	AKTSATZ	TPZD	U16		0x2533
34	MDI target position	MDI_TARPOS	RPZD	I32	No	0x607A
35	MDI velocity	MDI_VELOCITY	RPZD	U32	No	0x6081
36	MDI acceleration	MDI_ACC	RPZD	U16	FFFFh => 100% of 0x60C5	0x2536 (0x6083)
37	MDI deceleration	MDI_DEC	RPZD	U16	FFFFh => 100% of 0x60C6	0x2537 (0x6084)
38	MDI mode	MDI_MOD	RPZD	U16		0x2538
100	Modes of operation		RPZD	I16		0x6060
101	Modes of operation display		TPZD	I16		0x6061
102	Position demand value		TPZD	I32		0x6062
103	Position actual internal value		TPZD	I32		0x6063
104	Velocity demand value		TPZD	I32		0x606B
105	Velocity actual value		TPZD	I32		0x606C
106	Target torque		RPZD	I16		0x6071
107	Torque demand		TPZD	I16		0x6074
108	Torque actual value		TPZD	I16		0x6077
109	Profile acceleration		RPZD	U32		0x6083
110	Profile deceleration		RPZD	U32		0x6084
111	Torque slope		RPZD	U32		0x6087
???	Target position in range		TPZD	I32		0x2401
???	Actual position in range		TPZD	I32		0x2402
???	Quick stop deceleration		RPZD	U32		0x6085
???	Following error actual value		TPZD	I32		0x60F4
???	Position demand value -inc		TPZD	I32		0x60FC
???	Target velocity		RPZD	I32		0x60FF
???	Touch probe function		RPZD	U16		0x60B8
???	Touch probe status		TPZD	U16		0x60B9
???	Touch probe pos 1 pos value		TPZD	I32		0x60BA
???	Touch probe pos 2 pos value		TPZD	I32		0x60BC

(*) N2,N4 –Data normalized according to PROFIdrive N2,N4 data normalization.
The acceleration signal MDI_ACC and MDI_DEC are normalized in the X2 format (x = 16 is equal to 100% Means 0x60C6 value.).

1.1 Object Dictionary List

The following objects can be accessed via the acyclic parameter access meachnism (Base mode parameter access mechanism):

1.1.1 General objects

- Drive unit identification (964)
- Profile identification number (965)
- Drive reset (972)
- Base mode parameter access service identification (974)
- DO identification (975)
- Load device parameter set (976)
- Transfer in non-volatile memory (global) (977)
- NameOfStation (61000)
- IpOfStation (61001)
- MacOfStation (61002)
- StandardGatewayOfStation (61003)
- SubnetMaskOfStation (61004)

1.1.2 Communication objects

- DOIO set point data configuring (915)
- DO IO actual value data configuring (916)
- Telegram selection (922)
- List of all parameters for signals (923)
- PROFIdrive operating mode (930)
- Fault message counter (944)
- Fault number (947)
- Fault situation counter (952)
- Parameters list (980)

1.1.3 Manufacturer specific objects

- Get parameter- Parameter identify (2100h)
- Get parameter- Parameter value (2101h)
- Set parameter- Parameter identify (2102h)
- Set parameter- Parameter value (2103h)
- User Parameter Configuration (2300h)
- Position user unit (2301h)
- Velocity user unit (2302h)
- Acceleration user unit (2303h)
- Position range limit designation (2400h)
- Target Position In Range (2401h)
- Actual Position In Range (2402h)

1.1.4 Device control

- STW1 (controlword) (6040h)
- ZSW1 (statusword) (6041h)
- Quick stop option code (605Ah)
- Halt option code (605Dh)
- Modes of operation (6060h)
- Modes of operation display(6061h)
- STW2 (controlword 2) (2503h)
- ZSW2 (statusword 2) (2504h)

1.1.5 PROFIdrive position mode

- Traversing block selection (2532h)
- Traversing block selected (2533h)
- MDI acceleration (2536h)
- MDI deceleration (2537h)
- MDI mode (2538h)
- Traversing block task mode (2610h)
- Traversing block target position (2611h)
- Traversing block profile velocity (2612h)
- Traversing block profile acceleration (2613h)
- Traversing block profile deceleration (2614h)
- Target position / MDI target position (607Ah)
- Position range limit (607Bh)
- Software position limit (607Dh)
- Max profile velocity (607Fh)
- Profile velocity / MDI velocity (6081h)
- Profile acceleration (6083h)
- Profile deceleration (6084h)
- Quick stop deceleration (6085h)
- Max Acceleration (60C5h)
- Max deceleration (60C6h)

1.1.6 Homing function

- Home offset (607Ch)
- Home method (6098h)
- Home speed (6099h)
- Homing acceleration (609Ah)

1.1.7 Position control function

- Position demand value (6062h)
- Position actual value -inc (6063h)
- Position actual value -units (6064h)
- Following error window (6065h)
- Following error time out (6066h)
- Position window (6067h)
- Position window time (6068h)
- Following error actual value (60F4h)
- Position demand value -inc (60FCh)

1.1.8 PROFIdrive velocity mode

- Velocity demand value (606Bh)
- Velocity actual value (606Ch)
- Velocity window (606Dh)
- Velocity window time (606Eh)
- Velocity threshold(606Fh)
- Target velocity (60FFh)

1.1.9 Profile torque mode

- Target torque (6071h)
- Max torque (6072h)
- Torque demand (6074h)
- Torque actual value (6077h)
- Torque slope (6087h)

1.1.10 Touch probe function

- Touch probe function (60B8h)
- Touch probe status (60B9h)
- Touch probe pos1 pos value (60BAh)
- Touch probe pos2 pos value (60BCh)

1.1.11 Digital Inputs /Outputs

- Digital inputs (2521h)
- Digital outputs (2522h)

1.1 Alarms

1.1.1 AlarmNotification-PDU

When a fault or alarm situation occurs in the drive, the Option card will send an alarm notification, which the master station must acknowledge.

Alarm Notification Structure	
Attribute	**Description**
BlockHeader	-
AlarmType	Diagnosis Apperas/Disappear
API	0x3A00 (PROFIdrive profile)
SlotNumber	Slot number of the Drive Object (DO)
SubslotNumber	Sub-slot number of the sub-slot to which the diagnosis object is related
ModuleIdentNumber	Module Indent number of the DO
SubmoduleIdentNumber	0xFFFF
AlarmSpecifier	Diagnosis type
UserStructureIdentifier	0x8000 (Channel Diagnosis Data)
ChannelNumber	0x8000 (whole submodule)
ChannelProperties.Type	0
ChannelProperties.Reserved	0
ChannelProperties.MaintenanceRequired	0 = no maintenance required 1 = maintenance required
ChannelProperties.MaintenanceDemanded(*1)	0 = no warning 1 = warning present
ChannelProperties.Specifier(*1)	0 = no fault 1 = fault present
ChannelProperties.Direction	0
ChannelProperties.Type	0
ChannelErrorType	Error code of drive fault or drive alarm

1.1.2 ChannelErrorType

The ChannelErrorType of the Alarm Notification PDU is coded like follows:

ChannelErrorType	Name/Description
0x1yyy	yyy: Other Sigma5 Alarm & Warning code. For details, refer to chapters "Alarm List for SERVOPACKs with Command Option Attachable Type" and "List of the PROFInet Network Module Alarms.
0x2001	Motion buffer full warning
0x2007	Wrong Sync period – The Sync messages arrival are not fit with interpolation time period(0x60C2/1)
0x2009	Abnormal control state
0x200B	Impermissible traversing block data
0x3006	Warning :Wrong value received via PZDO
0x3008	Read/Write EEPROM error
0x3009	Communication Error

Fault code (Same as Display A.xxx)	Meaning	Description
0x00xx…0Dxx	Alarm/Warning from Sigma-5	Same code of Sigma-5 Alarm/Warning A.xxx
0x0E00	Command Option Module IF Initialization Timeout Error	Communications initialization failed between the SERVOPACK and the command option module.
0x0E02	Command Option Module IF Synchronization Error 1	A synchronization error occurred between the SERVOPACK and the command option module.
0x0E03	Command Option Module IF Communications Data Error	An error occurred in the data of communications between the SERVOPACK and the command option module.
0x0E70	Command Option Module Detection Failure Alarm	Detection of the command option module failed.
0x0E73	Unsupported Command Option Module Alarm	A non-supported command option module was connected.
0x0E80	Command Option Module Detection Disagreement Alarm	The command option module was replaced with a different model.

1.1.4   List of the PROFInet Network Module Alarms

This table lists the alarms of the PROFInet Network Module.

Fault code (Same as Display A.xxx)	Meaning	Description
0x0EA0	Command-Option IF Servo Unit Initial Error	The initial sequence between the EtherCAT (CoE) Network Module and the SERVOPACK was not completed within 10s.
0x0EA1	Command-Option IF Memory Check Error	The communication memory of the EtherCAT (CoE) Network Module and the SERVOPACK is broken.
0x0EA2	Command-Option IF Servo Synchronization Error	The data exchange between the EtherCAT (CoE) Network Module and the SERVOPACK was not synchronized. Gr
0x0EA3	Command-Option IF Servo Data Error	The communication data between the EtherCAT (CoE) Network Module and the SERVOPACK was inappropriate.
0x0A10	Device Error	