士林電機
Shihlin Electric

PD301 Instruction Manual

Profibus DP communication expansion card

V 1.00

This instruction manual is only for the Shihlin communication expansion card Profibus DP. Please refer to EN50170 for the detailed description on Profibus DP communication.

Content

1、 OVERVIEW

This chapter contains a short description of the Profibus standard and PD-301 communication expansion card information.

1.1 Profibus standard

Profibus is an open serial communication standard that enables data exchange between all kinds of automation components. Profibus There are three main variations of PROFIBUS: Profibus FMS (Fieldbus Message Specification), Profibus DP (Decentralized Periphery) and Profibus PA (Process Automation).

The physical transmission medium of the bus is a twisted pair cable (according to the RS-485 standard). The maximum length of the bus cable is 100 to 1200 meters, depending on the selected transmission rate. Up to 31 nodes can be connected to the same PROFIBUS network segment without the use of repeaters. With repeaters, it is possible to connect 127 nodes (including repeaters and master station) to the network.

In PROFIBUS communication, the master station (usually a PLC) polls the nodes which respond and take the actions requested by the master. It is also possible to send a command to several nodes at the same broadcast; in this case the nodes do not send a response message to the master. The PROFIBUS protocol family is specified in the EN 50170 standard. For further information on PROFIBUS, refer to the EN 50170 standards.

1.2 PD-301 function

PD-301 is an optional communication expansion device for Shihlin new type inverter which enables the connection of Shihlin inverter to a PROFIBUS network. The PD301 is considered as a slave on the PROFIBUS network. Through the PD301, it is possible to:

1、give control commands to the inverter(Start, Stop, Target frequency, Forward/Reverse rotation, etc.)
2、Send the target frequency
3、Read status information and actual values from the inverter.
4、Read and change the inverter parameter values.
5、Reset at inverter fault.

2、 PRE-OPERATION INSTRUCTIONS

Please read this chapter carefully before connecting PD-301 to ensure the normal use of PD-301.

2.1 Delivery check

Each PD-301 has been checked thoroughly before delivery, and is carefully packed to prevent any mechanical damage. The package should contain the following objects:

- ✓ A PD-301;
- ✓ A simple installation guide;
- ✓ Two screws.

Note: If the PD-301 is different from the objects above, please contact with the agent or distributor.

2.2 Specification

2.2.1 Inverter option specifications

Type	Inverter inboard option
Number of node occupied	One inverter occupies one node
Connection cable	For 12.0Mbps communication (compliant with EIA-485 (RS-485) standard)

2.2.2 Communication specification

Communication speed	Wiring length 1200m maximum	9600bps, 19.2Kbps, 93.75Kbps
	Wiring length 600m maximum	187.5Kbps
	Wiring length 200m maximum	500Kbps, 1.5Mbps
	Wiring length 100m maximum	3.0Mbps, 6.0Mbps, 12.0Mbps

3、INSTALLATION

3.1 Pre-installation instructions

Make sure that the input power of the inverter is off.

Note: With input power on, do not install or remove the plug-in option. Otherwise, the inverter and plug-in option may be damaged.

3.2 Node address setting

Set the node address between "1 to 125" by using node address switches on the PD-301. For the setting larger than 125, the address will be forced to transmitted to 125 by PD-301. When the address is 0, Profibus slave station node address is invalid. The setting is reflected only when power turns on next time. Please refer to the following table for address setting:

Switch number (1-8)	Actual physical address
01111101~11111111	125
……	……
00000010	2
00000001	1
00000000	0(invalid)

Note: The number is "0" when pressing the switch.

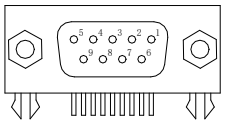
3.3 Node communication baud rate setting

PD-301 can auto detect the baud rate on Profibus without user's setting.

4、WIRING

4.1 DB9 connector

PD-301 adopts DB9 connector to connect to Profibus network, shown as the following:



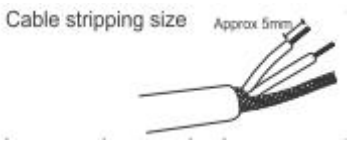
Refer to the table below for the definition of a connect.

Pin No.	Function name	Description and function
1	--	--
2	--	--
3	RXD/TXD-P	Profibus data +
4	CNTR-P	Profibus request signal
5	DGND	5V earth and data reference earth
6	VP	Positive voltage
7	--	--
8	RXD/TXD-N	Profibus data -
9	--	--

4.2 Wiring

(1) Use the network connection cable which supports 12.0Mbps communication.

Strip off the sheath of the Profibus communication dedicated cable and wind wires and shield cables to use. If the length of the sheath pealed is too long, a short circuit may occur among neighboring wires. If the length is too short, cables and shield cables might come off.



Wire the stripped cable after twisting it to prevent it from becoming loose.
In addition, do not solder it.
Use a bar type terminal as required.

(2) Loosen the terminal screw and insert the cable into the terminal.

Tighten each cable with fixing screws to the recommended tightening torque.

Screw size	Tightening torque	Cable size	Screwdriver
M2	0.22N· m-0.25N· m	0.3mm^2-0.75mm^2	Small flat-blade screwdriver (Tip thickness: 0.4mm /tip width: 2.5mm)

Note:

After wiring, wire offcuts must not be left in the inverter. They may cause an error, failure or malfunction.

5、INVERTER SETTING

5.1 Parameter setting list

After connecting PD-301 to the inverter correctly, PD-301 can’t work immediately. User should first confirm the parameter value below.

Parameter Number	Name	Setting range	Factory value	Remark	Setting value
79	Operation mode selection	0-8,99999	0		Valid
52	Number of communication retries	0-10	1		Valid
53	Communication check time interval	0、9999、0.1-999.8	9999	0-999.8: Use the set value for the communication overtime test. 9999: No communication overtime test.	Valid
153	Communication error handling	0、1	0	0: Warn and call to stop. 1: No warning and keep running.	Valid

5.2 Operation mode setting

The inverter mounted with PD-301 has three operation modes.

(1) PU operation.....Controls the inverter from the key of the operation panel mounted on the inverter.

(2) External operation...Controls the inverter by switching on/off external signals connected to the control circuit terminals of the inverter. (The inverter is factory-set to this mode.)

(3) Network operation…Controls the inverter with instructions from the network via the communication option.

Before switching the operation mode, check that:

(1) The inverter is at a stop.

(2) The P.79 Operation mode selection setting is correct.

(3) P.79 cannot be modified during communication.

5.3 Serial baud rate, communication protocol, frame format

PD-301 and the inverter adopt the Modbus format communication data. Communication speed is 9600bps, communication frame format is 1,8,N,2 (1 bit is the start bit, 8 data bits, no parity check and 2 stop bits). PD-301 is regarded as the inverter Modbus master station.

5.4 Operation at communication error occurrence

(1) Number of communication retries

P.52 is used to set the number from when a communication line error occurs until it is recognized as a communication error. The value of P.52 determines the way of communication error displaying.

Parameter number	Name	Setting range	Initial value
52	Number of communication retries	0 ～ 10	1

(2) Communication check time interval

P.53 is used to set the communication check time between PD-301 and the inverter communication. After exceeding the time, the inverter will do the corresponding processing.

Parameter number	Name	Setting range	Initial value
53	Communication check time interval	0, 9999, 0.1-999.8	9999

(3) Communication error handling

P.153 is used to set the handing mode after detecting the error. If you want to stop the inverter after communication error occurrence, you can set the value to 0.

Parameter number	Name	Setting range	Initial value
153	Communication error handling	0、1	0

6、GSD FILE

6.1 GSD file description

GSD file is designed to recognize the features and functions of Profibus-DP. GSD file is a text file which can identify Profibus-DP device (master station or slave station). GSD file contains the necessary data information on the standard DP master station equipped with a DP slave station. GSD file contains the vendor information, support of communication transmission speed, timing information, support features and accessories and available I/O signal. GSD file is the basic structure of the master station parameter record. When editing this file, use a text editor. For installation instructions, refer to the instruction manual of the Profibus-DP configuration software. The following is the GSD text used by PD-301 and the text name is SEECODOF.GSD. User can copy the text to save it to .GSD file for use.

Also, user can download it from http://www.shihlin-elec.com/down.asp

```
============================================================
; GSD-File for Shihlin INV Profibus DP Adapter
;
; Auto_Baud_supp, 12MBaud
;
;============================================================
#Profibus_DP
ExtUserPrmData = 1 "dpv1 status 1"
Unsigned8 0 0-0
EndExtUserPrmData

ExtUserPrmData = 2 "dpv1 status 2"
Unsigned8 0 0-0
EndExtUserPrmData

ExtUserPrmData = 3 "dpv1 status 3"
Unsigned8 0 0-0
EndExtUserPrmData

ExtUserPrmData = 4 "Data Input 1"
Unsigned16 0x1001 0-65535
EndExtUserPrmData
```

ExtUserPrmData = 5 "Data Input 2"

Unsigned16 0x1002 0-65535

EndExtUserPrmData

ExtUserPrmData = 6 "Data Input 3"

Unsigned16 0x0000 0-65535

EndExtUserPrmData

ExtUserPrmData = 7 "Data Input 4"

Unsigned16 0x0000 0-65535

EndExtUserPrmData

ExtUserPrmData = 8 "Data Output 1"

Unsigned16 0x1001 0-65535

EndExtUserPrmData

ExtUserPrmData = 9 "Data Output 2"

Unsigned16 0x1003 0-65535

EndExtUserPrmData

ExtUserPrmData = 10 "Data Output 3"

Unsigned16 0x1004 0-65535

EndExtUserPrmData

ExtUserPrmData = 11 "Data Output 4"

Unsigned16 0x1005 0-65535

EndExtUserPrmData

ExtUserPrmData = 12 "Reserved 1"

Unsigned16 0x0000 0-65535

EndExtUserPrmData

ExtUserPrmData = 13 "Reserved 2"

Unsigned16 0x0000 0-65535

EndExtUserPrmData

ExtUserPrmData = 14 "Reserved 3"

```
Unsigned16 0x0000 0-65535
EndExtUserPrmData

ExtUserPrmData = 15 "Reserved 4"
Unsigned16 0x0000 0-65535
EndExtUserPrmData

ExtUserPrmData = 16 "Reserved 5"
Unsigned16 0x0000 0-65535
EndExtUserPrmData

; Unit-Definition-List:
GSD_Revision        = 1
Vendor_Name         = "Shihlin Electronics"
Model_Name          = "INV Profibus DP Adapter"
Revision            = "Rev. 1"
Ident_Number        = 0x0D0F
Protocol_Ident      = 0         ; Profibus DP
Station_Type        = 0         ; DP-slave
FMS_supp            = 0
Hardware_Release    = "V1.0"
Software_Release    = "V1.0"
Redundancy          = 0
Repeater_Ctrl_Sig   = 2
24V_Pins            = 0

; Supported baudrates
9.6_supp            = 1
19.2_supp           = 1
45.45_supp          = 1
93.75_supp          = 1
187.5_supp          = 1
500_supp            = 1
1.5M_supp           = 1
3M_supp             = 1
6M_supp             = 1
```

```
12M_supp            = 1
MaxTsdr_9.6         = 60
MaxTsdr_19.2        = 60
MaxTsdr_45.45       = 60
MaxTsdr_93.75       = 60
MaxTsdr_187.5       = 60
MaxTsdr_500         = 100
MaxTsdr_1.5M        = 150
MaxTsdr_3M          = 250
MaxTsdr_6M          = 450
MaxTsdr_12M         = 800

; slave specific values
OrderNumber      = "Shihlin Profibus DP-301"
Slave_Family        = 1@TdF@Shihlin INV Drivers
Implementation_Type = "VPC3+C"
Bitmap_Device       = "SA3 DP"
Bitmap_SF           = "SA3 DP"
Freeze_Mode_supp    = 1
Sync_Mode_supp      = 1
Fail_Safe        = 1
Auto_Baud_supp      = 1
Set_Slave_Add_supp  = 0
Min_Slave_Intervall = 6

; Module-Definitions:
Modular_Station     = 1
Max_Module          = 1
Modul_Offset        = 0
Max_Input_Len       = 32
Max_Output_Len      = 32
Max_Data_Len        = 64
Max_Diag_Data_Len   = 16
WD_Base_ims_supp    = 1
Publisher_supp      = 0
```

```
;specify the user parameters:
Max_User_Prm_Data_Len      = 29
Ext_User_Prm_Data_Const(0) = 0x00,\
                             0x00,\
                             0x00,\
                             0x10,0x01,\
                             0x10,0x02,\
                             0x00,0x00,\
                             0x00,0x00,\
                             0x10,0x01,\
                             0x10,0x03,\
                             0x10,0x04,\
                             0x10,0x05,\
                            0x00,0x00,\
                           0x00,0x00,\
                          0x00,0x00,\
                           0x00,0x00,\
                           0x00,0x00

Module = "4 PKW,  2 PZD  (PPO 1)        " 0xF3,0xF1
EndModule
Module = "0 PKW,  2 PZD  (PPO 3)        " 0x00,0xF1
EndModule
Module = "4 PKW,  4 PZD                 " 0xF3,0xF3
EndModule
Module = "0 PKW,  4 PZD                 " 0x00,0xF3
EndModule

Ext_User_Prm_Data_Ref(0) = 1
Ext_User_Prm_Data_Ref(1) = 2
Ext_User_Prm_Data_Ref(2) = 3
Ext_User_Prm_Data_Ref(3) = 4
Ext_User_Prm_Data_Ref(5) = 5
Ext_User_Prm_Data_Ref(7) = 6
Ext_User_Prm_Data_Ref(9) = 7
Ext_User_Prm_Data_Ref(11) = 8
```

```
Ext_User_Prm_Data_Ref(13) = 9

Ext_User_Prm_Data_Ref(15) = 10

Ext_User_Prm_Data_Ref(17) = 11

Ext_User_Prm_Data_Ref(19) = 12

Ext_User_Prm_Data_Ref(21) = 13

Ext_User_Prm_Data_Ref(23) = 14

Ext_User_Prm_Data_Ref(25) = 15

Ext_User_Prm_Data_Ref(27) = 16

;============ END of GSD file for INV ====================
```

6.2 User parameter setting

In GSD file, user parameter is used in Profibus network configuration. For the description, please refer to the table below.

Item	Name	Description	Factory setting
1	Data In 1	Modbus communication address, the first character of cyclic output data PZD will be sent to this address.	0x1001
2	Data In 2	Modbus communication address, the second character of cyclic output data PZD will be sent to this address.	0x1002
3	Data In 3	Reserve	0x0000
4	Data In 4	Reserve	0x0000
5	Data Out 1	Modbus communication address, PD-301 will monitor this address and copy the return data to the first character of cyclic input data PZD.	0x1001
6	Data Out 2	Modbus communication address, PD-301 will monitor this address and copy the return data to the second character of cyclic input data PZD.	0x1003
7	Data Out 3	Modbus communication address, if "4 PKW, 4 PZD" module is selected, PD-301 will monitor this address and copy the return data to the third character of cyclic input data PZD.	0x1004
8	Data Out 4	Modbus communication address, if "4 PKW, 4 PZD" module is selected, PD-301 will monitor this address and copy the return data to the fourth character of cyclic input data PZD.	0x1005

Parameter 1~8 sets the Modbus address for PD-301 monitoring the inverter parameter. When user sets these values, the corresponding PPO will adopt this Modbus address to set the parameter values for PD-301 monitoring the inverter. The detailed setting methods varied from different PC configure software. The instruction here is not described for details.

7、COMMUNICATION FUNCTION

7.1 Profidrive communication protocol

Communication protocol means the way of transmitting control order (control word, status word, given value and actual value) between the master and the slave. PD-301 adopts Profidrive dpv0 protocol. The following introduces the control word, status word, given value and actual value in Profidrive communication protocol. PD-301 doesn’t adopt the control word and status word stated in Profidrive. It gives a detailed description on the status word and its structure in PD-301.

7.1.1 The control word and the status word

The control word is the principal means for the master station controlling the slave station from a fieldbus system. It is sent by the fieldbus master station to the inverter, the PD-301 module acting as a gateway. The inverter switches between its states according to the bit-coded instructions on the control word, and returns status information to the master in the status word. The structure of the control word and the status word adopted by PD-301 is shown as the figure below, and the corresponding inverter Modbus address is: 0x1001.

Control word STW:

b0	Reserve
b1	Forward rotation
b2	Reverse rotation
b3	Low speed
b4	Medium speed
b5	High speed
b6	The second function
b7	Inverter sudden stop
b15-b8	Reserve

Status word ZSW:

b0	In rotation
b1	Forward rotation
b2	Reverse rotation
b3	Frequency arrival
b4	Over load
b5	End of parameter restored to default value
b6	Frequency detection
b7	Abnormal occurrence
b15-b12	Reserve

7.1.2 Given values

Shihlin inverter can receive control information from multiple sources including external terminal analog signal given, PU panel given and communication module given, etc. For Profibus controlling the inverter, PD-301 should be defined as given controlling information source. At this point, Profibus bus passing speed given value will be mapped to the corresponding Modbus communication address, the value is 0x1002.

7.1.3 Actual values

Actual Values are words containing information on the operation of the inverter. The functions to be monitored are selected by a PC network with configuration software. PC gets the present inverter operation status through reading the value. The monitoring Modbus address is 0x1003.

7.2 Communication information

The PD-301 supports the Profibus DP (DP-V0) protocol according to IEC 61784 and EN 50170 standard. Profibus DP-V0/DP-V1 is a distributed I/O system which enables the master to use a large number of peripheral modules and field devices. The data transfer is mainly cyclic: the master reads the input information from the slaves and sends the output information back to the slaves. The PD-301 uses so-called PPO (Parameter/Process Data Objects, i.e. parameter / process data object) in cyclic communication, supporting standard message1, message2. It also adopts custom expansion message structure.

7.2.1 Service Access Points (SAPs)

The services of the Profibus data link layer (Layer 2) are used by Profibus-DP through Service Access Points (SAPs). Precisely defined functions are assigned to individual SAP. For further information on Service Access Points, please refer to the EN 50170 and IEC 61784 standards. The following introduces SAP in Profibus.

SAP No.	Short name	Name
Default SAP	Data_Exch	Transfer Input and Output Data
SAP 55	Set_Slave_Address	Set Slave Address (Not supported)
SAP 56	Read_Inputs	Read Out Inputs
SAP 57	Read_Outputs	Read Out outputs
SAP 58	Global_Control	Global Control Service
SAP 59	Get_Cfg	Get Configuration Data
SAP 60	Slave_Diag	Read Slave Diagnostic Information
SAP 61	Set_Prm	Send Parameter Data
SAP 62	Chk_Cfg	Check Configuration Data

SD2 is usually used to DP communication in Profibus. The structure of a piece of SD2 message is as the table below:

DP header										DP tailer	
SD	LE	LEr	SD	DA	SA	FC	*DSAP	*SSAP	DU	FCS	ED
68h	x	x	68h	xx	xx	x	xx	xx	x…	xx	16h

SD = Start Delimiter

LE = Length

LEr = Length Repeated

DA = Destination Address

SA = Source Address

FC = Function Code

*DSAP = Destination Service Access Point

*SSAP = Source Service Access Point

DU = Data Unit for DP services

FCS = Frame Checking Sequence

ED = End Delimiter

* For SAP 0, no item.

7.2.1.1 SAP 0 (Data_Exchange)

Profibus allows the master to send output data to a slave station and to simultaneously request input data from the same station.

Outp_Data (Output Data)

DU Length: 4 to 28 (depending on the selected PPO information / standard message type)

Inp_Data (Input Data)

DU Length: 4 to 28 (depending on the selected PPO information / standard message type)

Note: Except SAP 0, any data can use "Read_Inputs" (SAP 56) and "Read_Outputs" (SAP 57) message to read I/O data on any slave at any time. Besides DSAP and SSAP, these messages are the same as cyclic data exchange messages. In these messages, MSB of DA and SA is set to 1 to show the DSAP/SSAP in message header.

7.2.1.2 SAP 58 (Global_Control)

This SAP is used to send special command to single slave, a group of special slaves or send once to all slaves (broadcast).

Global_Control data type: Octet String consists of 8 octets / Length: 2	
DU (Byte)	Description
0	GC_Command MSB | 0 | 0 | X1 | X2 | X3 | X4 | X5 | 0 | LSB 0: Reserve X1: Clear data(0 = Not clear output, 1 = clear output) X2-x3: Unfreeze - freeze (00 = No function; 10 = Activate; x1 = Forbid) X4-x5: Sync(00 = No function; 10 = Activate; x1 = Forbid)
1	Group_Select 0 to 255.This value should correspond to the Group Identification of SAP 61 (DU byte 6).

7.2.1.3 SAP 61 (Set_Prm)

This SAP is used to set the parameters of the slave.

Byte	Character								Function
	7	6	5	4	3	2	1	0	
0	Lock Req	Unlo Req	Sync Req	Free Req	WD on	Res	Res	Res	Station status
1									WD_Fact_1
2									WD_Fact_2
3									MinTSDR
4									Ident_Number_High
5									Ident_Number_Low
6									Group_Ident
7	0	0	0	0	0	0	0	0	dpv1 status 1
8	0	0	0	0	0	0	0	0	dpv1 status 2
9	0	0	0	0	0	0	0	0	dpv1 status 3
10-243									User_Prm_Data

The extended parameter data bytes are configured via the PROFIBUS network configuration tool. The functions are defined in the GSD file.

7.2.1.4 SAP 62 (Chk_Cfg)

In this message, the master sends the selected data exchange(read write) message type to the slave SAP 62. The table below gives the Hex values (DU byte 0 to n) that must be sent to the slave to select the PPO type or standard message type(ST).

Message name	Cyclic message length(Unit: character)	The default code of information type
PPO 1	4 PKW + 2 PZD input / output	F3 F1
PPO 3	0 PKW + 2 PZD input / output	00 F1
ST 1	4 PKW + 4 PZD input / output	F3 F3
ST 2	0 PKW + 4 PZD input / output	00 F3

7.2.1.5 SAP 60 (Slave_Diag)

This SAP gives diagnostic information on the slave station.

Diag_Data (Diagnostic Data): 8 bits of octet string - Length: 6 (standard)

DU byte	Description
0	Station_Status_1 MSB | X7 | X6 | X5 | X4 | X3 | X2 | X1 | X0 | LSB X0: Diag.Station_Non_Existent (Set by Master, reset by Slave) Slave not found X1: Diag.Stagion_Not_Ready (Set by Slave) Slave not ready for data exchange X2: Diag.Cfg_Fault (Set by Slave) Received configuration data does not match original config. data X3: Diag.Ext_Diag (Set by Slave) Diagnostic entry present in slave-specific diagnostic area X4: Diag.Not_Supported (Set by Slave) Service not supported by slave X5: Diag.Invalid_Slave_Response (Set by Master, reset by Slave) Invalid response by slave X6: Diag.Prm_Fault (Set by Slave) Invalid parameter or parameter value X7: Diag.Master_Lock (Set by Master, reset by Slave) Slave is parameterised by another master
1	Station_Status_2 MSB | X7 | X6 | X5 | X4 | X3 | X2 | X1 | X0 | LSB X0: Diag.Prm_Req (Set by Slave) Slave requires re-configuration and re-parameterization X1: Diag.Stat_Diag (Set by Slave) Static diagnosis. Slave (temporarily) unable to provide valid data
DU byte	Description
1	X2: Always set to 1 by slave X3: Diag.WD_On (Set by Slave) Watchdog on

	X4：Diag.Freeze_Mode (Set by Slave) Freeze command received by slave X5：Diag.Sync_Mode (Set by Slave) Sync command received by slave X6：Reserved X7：Diag.Deactivated (Set by Master, reset by Slave) Slave is inactive
2	Station_Status_3 MSB | X7 | X6 | X5 | X4 | X3 | X2 | X1 | X0 | LSB X0 – X6：Reserved. Read to 0. X7：Diag.Ext_Diag_Overflow (Set by Slave)
3	Diag.Master_Add: The address of the master that parameterised this slave
4 - 5	Ident_Number
6	Device diagnoses data length
7-10	Device diagnoses data content

7.2.2 PPO message types

Shihlin inverter adopts two PPO types and meanwhile defines two kinds of expanded standard message types to satisfy commands. Refer to the table below for details:

PKW			PZD									
PKE	IND	PWE	PZD1 STW ZSW	PZD2 HSW HIW	PZD3	PZD4	PZD5	PZD6	PZD7	PZD8	PZD9	PZD10
PPO1												
			PPO3									
4PKE+4PZD												
			4PZD									

PKW=PKE+IND+2PWE, in total 4WORD, control data is used to control or read the status and parameter of the inverter

PKE: Parameter Identification ID, used to identify to write (2) or read (1)

IND: Subindex, index the parameter address

PWE: Parameter value, to read or write the value.

PZD: Three formats: 10PZD (optional), STW+HSW and ZSW+HIW

STW: Control word, corresponding to modbus communication address 0x1001

HSW: Host setting value, corresponding to modbus communication address 0x1002

ZSW: Inverter status, corresponding to modbus communication address 0x1001

HIW: Host instruction frequency, corresponding to modbus communication address 0x1003

Note: PP01 and PP03 are common PP0 types, and the others are custom standard data message.

7.2.3 Parameter handling

In Profibus communication, data handling consists of two parts: Parameter read / write (PKW) and process data exchange (PZD).

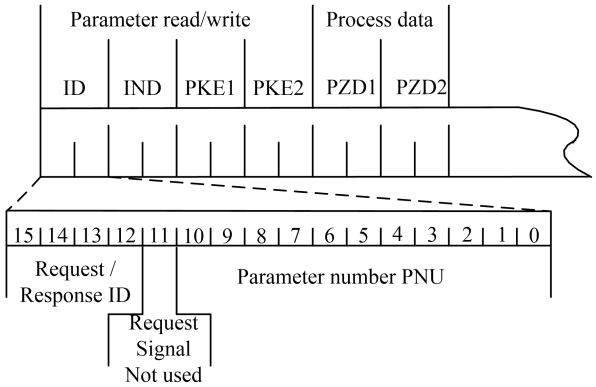
7.2.3.1 Parameter read / write

PKW read and write inverter parameter, for the request and response mechanisms, the master cannot send new request message until receives the corresponding response.

PKW area includes four words, see below:

Word 1	Parameter ID (PKE)		
	15…12	11	10…0
	AK (Request or response identification ID)	SPM (Not used)	Parameter number (PNU)
Word 2	Parameter subindex (IND)		
Word 3	PWE1 reserved		
Word 4	PWE2 read/write parameter value		

The structure shown as the figure:



Request identification ID adopted by PD-301 shown as the table below:

Request label (from the master to the slave)		Response label	
Request	Function	Confirmation (+)	Confirmation (-)
0	No task	0	-
1	Request parameter value	1, 2	7

2	Change parameter value(word)	1	7, 8

Response identification ID adopted by PD-301 shown as the table below:

Response label (from the slave to the master)	
Confirmation	Function
0	No response
1	Transfer parameter value (word)
7	Task cannot be executed, followed by error number 0 = Illegal parameter number 1 = Parameter value cannot be changed 2 = Lower or upper limit violated 11 = No parameter change rights 102 = Request not supported
8	No parameter change rights for PKW interface

IND structure with PPOs cyclic communication

15	14	13	12	11-8	7 0
Parameter Page selection				Not used	
2^0 2^3 2^2 2^1				0	

Parameter Page Selection function shown as the table below:

Basic parameter No.(PNU) (B.PNU bit 10-0 of PKE)	PNU page No. selection (P.PNU)	Complete PNU＝Basic parameter No. (PNU)+PNU page No. selection *2000 (B.PNU+P.PNU*2000)
0…1999	0	0…1999
0…1999	1	2000…3999
0…1999	2	4000…4999
…	…	…
0…1999	15	30000…31999

Note: 1、In IND, the weight of bit 15 is 2^0, so when parameter number is from 2000 to 3999, bit 15 should be 1.

2、All of parameters in Shihlin inverter are 16-bit value, and 16-bit parameter value is transferred by PWE2 (the fourth character), Profibus-DP master station should set PWE1 (the third character) to 0.

7.2.3.2 Process data

There are two kinds of PZD in PD-301: 2word PZD and 4word PZD. PROFIdrive makes a clear bit definition on control word and status word. However, PD-301 doesn't adopt this definition. For the definition of PD-301, please refer to the table below.

The structure of 2word PZD is shown as the below:

Direction	PZD1	PZD2
Out	Control word	Speed given value
In	Status word	Speed actual value

The structure of 4word PZD is shown as the below:

Direction	PZD1	PZD2	PZD3	PZD4
Out	Control word	Speed given value	Reserve	Reserve
In	Status word	Speed actual value	Actual current	Actual voltage

Note: The direction in the two tables above is for the master. Out represents the data is from the master to the slave; In represents the data is from the slave to the master

7.2.4 Parameter transport example

7.2.4.1 PKW read / write inverter parameter example

Example 1: Read the value of P.18.

Step 1: Request parameter ID is 1;

Step 2: Confirm PNU, P.18 corresponding MODBUS address is 0x0012, decimal is 18, so IND is 0000, PNU=18-0*2000=18, transferred to HEX is 0x012;

Step 3: Confirm command code: 1012 0000 0000 0000;

Step 4: Lower computer response: If P.18 is 1200, the response code is: 1012 0000 0000 04B0.

Therefore, the exchange data between the master and PD-301 can be listed as the table below:

Req	DP header	10	12	00	00	00	00	00	00	00	00	00	00	DP tailer
Resp		10	12	00	00	00	00	04	B0	XX	XX	XX	XX	

Note: Resp is the inverter current operation status word and the actual value, replaced by XX.

Example 2: Change the value of P.80 to 2 (valid) or to 100(invalid).

Step 1: Request parameter ID is 2;

Step 2: Confirm PNU, P.80 corresponding MODBUS address is 0x0050, decimal is 80, so IND is 0, PNU = 80-0*2000=80, transferred to HEX is 0x050;

Step 3: Confirm command code: 2050 0000 0000 0002 (changed to 2);

2050 0000 0000 0064(changed to 100);

Step 4: Lower computer response: 1050 0000 0000 0002(changed to 2);

7050 0000 0000 0002 (parameter exceeds the range)

So, when change the value of P.80 to 2, the exchange data between the master and PD-301 can be listed as the table below:

Req	DP header	20	50	00	00	00	00	00	02	00	00	00	00	DP tail er
Resp		10	50	00	00	00	00	00	00	XX	XX	XX	XX	

When change the value of P.80 to 100, the exchange data between the master and PD-301 can be listed as the table below:

Req	DP header	20	50	00	00	00	00	00	64	00	00	00	00	DP tail er
Resp		70	50	00	00	00	00	00	02	XX	XX	XX	XX	

Example 3: Execute inverter abnormal clear, P.996.

Step 1: Confirm parameter ID is 2;

Step 2: Confirm PNU, P. 996 corresponding MODBUS address is 0x1102, decimal is 4354, between 4000 and 4999, so PNU page number is 2, the calculation IND by weight is 1000, PNU = 4354 - 2*2000 = 354, transferred to HEX is 0x162;

Step 3: Confirm command code: 2162 1000 0000 A5A5;

Step 4: Lower computer response: 1162 1000 0000 A5A5.

So, the exchange data between the master and PD-301 can be listed as the table below:

Req	DP header	21	62	10	00	00	00	A5	A5	00	00	00	00	DP tail er
Resp		11	62	10	00	00	00	A5	A5	XX	XX	XX	XX	

Note: The value written into the information here must be A5A5, the inverter cannot execute the

function if it is any other value.

Example 4: Execute inverter Reset command.

Step 1: Confirm parameter ID is 2;

Step 2: Confirm PNU, P.997 corresponding MODBUS address is 0x1101, decimal is 4353, between 4000 and 4999, so PNU page number is 2, the calculation IND by weight is 1000, PNU = 4353 - 2*2000 = 353, transferred to HEX is 0x161;

Step 3: Confirm command code: 2161 1000 0000 9696;

Step 4: Lower computer response: 1161 1000 0000 9696.

So, the exchange data between the master and PD-301 can be listed as the table below:

Req	DP header	21	61	10	00	00	00	96	96	00	00	00	00	DP tailer
Resp		11	61	10	00	00	00	96	96	XX	XX	XX	XX	

Note: 1. The value written into the information here must be 9696, the inverter cannot execute the function if it is any other value.

2. PD-301 doesn't support the reset function of all parameters. Therefore, it is necessary to select correct Modbus address and value when executing reset function, or PD-301 will respond the corresponding error.

7.2.4.2 PZD modifies and changes the inverter current operation status

In Section PROFIdrive protocol, it comes to the control word, status word, given value and actual value, and gives the sense of the corresponding word. This section will describe the actual operation methods of these values.

In the Profibus system actual operation process, PKW and PZD transfer in one message, so in the process of reading parameter, it can go with status control. When adopting ppo1 or ppo3 to exchange data, PZD is only 2Word, consisting of control word and given value.

Example 5: Inverter rotates forward at 40HZ.

According to the definition of control word, turn the forward rotation to 1.

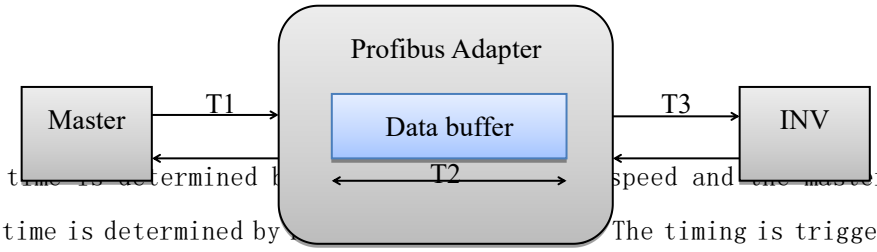
The exchange data between the master and PD-301 can be listed as the table below:

Req	DP header	00	00	00	00	00	00	00	00	00	02	0F	A0	DP tailer
Resp		00	00	00	00	00	00	00	00	00	0B	0F	A0	

Note: Resp message changes real-time with the inverter status. The message is listed here when in normal steady state operation.

7.3 PD-301 response time

PD-301 response (refresh) time consists of three parts:



T1 t[illegible]termined b[illegible]speed and [illegible]r category in use;

T2 time is determined by [illegible] The timing is triggered to send the corresponding data group to the inverter each 50ms. And user cannot change the interval time;

T3 time is determined by Modbus communication speed between PD-301 and the inverter.

So the complete response (refresh) time is: the maximum response (refresh) time = **T1 + T2 + T3**

In fact, the actual response (refresh) time is less than the maximum response (refresh) time, when data reach to PD-301, PD-301 will store the data into Data Buffer. If timing operates just over the time, the data will be sent to the inverter at once.

8、FAULT TRACING AND TROUBLESHOOTING

8.1 LED indications

PD-301 has two LED indications (SP LED and NET LED), separately indicating the connecting state between PD-301 and INV, and the connecting state between PD-301 and Profibus master.

8.1.1 NET LED indication

The state of NET LED shown as the table below:

State	Function	Improvement and measures
OFF	No power supply	1. Check the power connection. 2. Check whether the terminal for power connection is loosened.
Flickering Green	User setting parameter error	User’s Profibus address setting error (address is 0)

State	Function	Improvement and measures
Lit Red (ON)	Profibus network connection error	1. Check whether the network installation is normal. 2. Check whether the PLC is normally run. 3. Check whether the GSD file is installed.
Lit Green (ON)	Cyclic data is exchanging and in normal process	---

8.1.2 SP LED indication

The state of SP LED shown as the table below:

State	Function	Improvement and measures
OFF	No power supply	1. Check the power connection. 2. Check whether the terminal for power connection is loosened.
Flickering red	CRC check error Inverter return error code	Check the parameter reading or writing error
Lit Red (ON)	Connection failure, or no connection	1. Check the connection between inverter and RS-485 in PD-301. 2. Check the inverter type and version. Not all inverter types are supported by PD-301.
Lit Green (ON)	Normal	---

8.2 INV indication error

When the communication error between inverter and PD-301 leads to the abnormal communication process, INV panel will display OPT alarm. At this point, it is necessary to check whether the communication between the inverter and PD-301 is interfered, or there is error in communication line.

9、PROFIBUS LINK SPECIFICATION

Compatible devices: All devices compatible with the PROFIBUS

Medium: Shielded, twisted pair RS-485 cable (Recommend Profibus approved cable)

- Termination: 220Ω, or the main cable ends with power terminal circuit cable (PD-301 without built-in terminal resistance)
- Specifications:

Parameter	Line A Profibus DP	Line B DIN 19245 Part 1	Unit
Impedance	135 ～ 165 (3 ～ 20 MHz)	100 ～ 130 (f ＞ 100 kHz)	Ω
Capacitance	＜ 30	＜ 60	pF/m
Resistance	＜ 110	-	Ω/km
Wire specification	＞ 0.64	＞ 0.53	mm
Conductor area	＞ 0.34	＞ 0.22	mm^2

- Maximum bus length:

Transfer rate (kbit/s)	≤ 93.75	187.5	500	1500	3000	6000	12000
Line A (m)	1200	1000	400	200	100	100	100
Line B (m)	1200	600	200	-	-	-	-

Topology: The main cable, allowing the voltage drop. With repeaters at most 127 nodes (Each 31 codes + 1 repeater)

Transfer rate: Maximum 12 Mb/s, PD-301 automatic testing

Serial communication type: Asynchronous, half Duplex RS-485

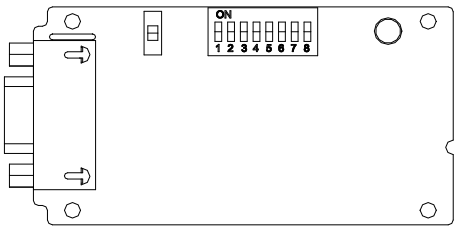
Protocol: Profibus DP

PROFIBUS COMMUNICATION EXPANSION CARD(PD-301) USER MANUAL

✧ Profibus is the registered trademark of Profibus international.

- ✧ Please read this manual carefully before using to ensure using the product in a safe and right way.
- ✧ Shihlin electric reserves the right to modify this user manual. For the latest version, please consult the dealer or refer to website for downloading: http://www.shihlin-elec.com/down.asp

I. Product appearance



1) SP LED: Connection state indication between the inverter and PD-301.
2) NET LED: Connection state indication between PD-301 and Profibus DP
3) Address setting switch: Set the communication address of PD-301 on Profibus DP network
4) Nine-hole port: Used to connect to Profibus DP network

II. User setting

1) Inverter parameter setting

P.79 can set the corresponding parameters according to the using mode.

2) Address setting

PD-301 provides eight-bit switch to set the address. The address effective value is 1 to 125, and the lowest bit is the No.8 switch.0 and 126 above are all ineffective.

3) Baud rate setting

PD-301 can automatically identify the Profibus DP network baud rate. So there is no need for user to set.

III. Power supply

PD-301 adopts the power supply from the connected inverter, using 24 pin connector to transport. When the inverter is power on, the power can be input into PD-301.

IV. GSD file using

GSD file is needed when Profibus configurator add PD-301 to Profibus DP network. The corresponding file can be access from PD-301 instruction, and can also be downloaded from the Shihlin website: http://www.shihlin-elec.com/down.asp

Note:

1、 Before connecting PD-301, please ensure the inverter power is totally off.

2、 This manual is a brief installation guide. For the functions in detail, please refer to PD-301 instruction manual.