

Introduction to PROFIBUS DP

PROFIBUS defines the specifications of Layer 1 (physical layer) and Layer 2 (data link layer) and Layer 7 (application layer) in the OSI seven-layer reference model, including three sub-protocols: DP, PA, and FMS. This manual only describes the information that the DP sub-protocol applies to the drive control industry. For a detailed description of the DP sub-protocol, please refer to the following documents:

- 1、 PROFIBUS Specification
- 2、 PROFIBUS Profile Guidelines Part 3 Diagnosis, Alarms and Time Stamping
- 3、 PROFIBUS Guideline Interconnection Technology
- 4、 Specification for PROFIBUS Device Description and Device Integration, Volume 1: GSD

UART data format

The DP sub-protocol data link layer is based on the UART universal serial transceiver. Each character is fixed at 11 bits in the following format:

Start bit	b0	b1	b2	b3	b4	b5	b6	b7	Check bit	Stop bit
1 bit	8-bit data							1 bit	1 bit	

DP frame format

The basic unit of the DP sub-protocol is one byte, and the frame format is as follows:

SD2	LE	LEr	SD2	DA	SA	FC	DSAP	SSAP	DU	FCS	ED
1	1	1	1	1	1	1	1	1	Variable length	1	1

field	appellation	Description
SD2	Frame header (Note 1)	68H
LE	Length	DA,SA,FC,DSAP,SSAP,DU Sum of data lengths
LEr	Duplicate length	
DA	Target address (note 2)	The site address where the message will be received
SA	Source address (Note 2)	The site address where the message was sent
FC	function code	
DSAP	Target SAP	
SSAP	Source sap	
DU	Data unit	Usually 1-32 bytes, up to 244 bytes
FCS	Frame check sequence	DA, SA, FC, DSAP, SSAP, and the sum of DU data

ED	End of frame	16H
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Note:

1. There are four types of frame headers, which correspond to 4 types of message frames, but only one type of frame ends. The values of SD1~SD4 are equal to 10H, 68H, A2H, and DCH, respectively.

2. The address range is 0-127. Only the lower 7 bits are used. The 8th bit is equal to 1 to indicate that the message frame contains DSAP and SSAP. If it is equal to 0, the message does not contain DSAP and SSAP.。

FC function code

b7	b6	b5	b4	b3	b2	b1	b0
Reserved	b6		b5	b4	Function code		
	Frame type	Equal to 0 means: request frame, send and request data frame	Frame count flip bit	Frame count valid bit			
		Equal to 1 means: Answer frame, return data frame	Site type 00: slave station 01: Not ready to enter the Token Ring master station 10: Ready to will enter the token ring's main station 11: Has entered the Token Ring's main station				

Function code

Code	requesting
3	Send data, need to answer, low priority
4	Send data, no need to respond, low priority
5	Send data, need to answer, high priority
6	Send data, no need to respond, high priority
7	Retain or request diagnostic data
9	Request to return FDL status
12/C	Send and request data, low priority
13/D	Send and request data, high priority
14/E	Request return ID (for FMA 1/2 only)

15/F	Request to return LSAP status (FMA 1/2 dedicated)
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Code	Response
0	Normal data
1	Error, the reason is FDL user error, interface error
2	Error, the reason is there is not enough resource/memory space to send data
3	Error, Service is not activated, so current SAP is not supported
8	Return FDL or FMA 1/2 data, low priority, send data successfully
9	Error, no FDL or FMA 1/2 response data, successful data transmission
10/A	Return FDL status, high priority, send data successfully
12/C	Return FDL status, low priority, insufficient resources to send data
13/D	Return FDL status, high priority, enough resources to send data

SAP service access code

SAP	Name	dea	是否支持
0	Data exchange	数据交换	是
55	Set slave address	设置从机地址	是
56	Read inputs	读取输入数据	否
57	Read outputs	读取输出数据	否
58	Global control	全局控制	是
59	Get configuration	获取配置	是
60	Slave Diagnosis	从机诊断	是
61	Set parameter	设置参数	是
62	Check configuration	检查配置	是

SAP0 data exchange

SD2	LE	LEr	SD2	DA	SA	FC	DU	FCS	ED
68H	X	X	68H	X	X	X	Data exchange	X	16H

The exchange data of SAP0 consists of two parts: PKW and PZD, The former is fixed to 4 words (one word is 16 bits) for reading or rewriting parameters. The latter has a maximum length of 10 words and for reading or write process data, which is determined by the PPO type.

PPO type

PPO1

1	2	3	4	5	6
PKW				PZD1	PZD2

PPO2

1	2	3	4	5	6	7	8	9	10
PKW				PZD1	PZD2	PZD3	PZD4	PZD5	PZD6

PPO3

1	2
PZD1	PZD2

PPO4

1	2	3	4	5	6
PZD1	PZD2	PZD3	PZD4	PZD5	PZD6

PPO5

1	2	3	4	5	6	7	8	9	10	11	12	13	14
PKW				PZD1	PZD2	PZD3	PZD4	PZD5	PZD6	PZD7	PZD8	PZD9	PZD10

PPO6

1	2	3	4	5	6	7	8	9	10
PZD1	PZD2	PZD3	PZD4	PZD5	PZD6	PZD7	PZD8	PZD9	PZD10

PZD

PKW

PKW (parameter identification) consists of three parts: PKE (id), IND (array index), PWE, where PWE is the parameter value read or written, and the format is as follows:

1 st word	2 nd word	3 rd word	4 th word
PKE	IND	PWE	

PKE

The PKE consists of three parts: PNU and AK and reserved bits 11, where PNU is the parameter group number and AK is the request or response identifier in the following format:

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
AK				0	PNU										

AK request identifier

AK	request identifier
0	No request
1	Read the PROFIdrive parameter value
2	Rewrite the PROFIdrive parameter value (16 bits)
3	
4	
6	Request array parameter value

7	Change the array parameter value (16 bits)
8	
9	Read the number of parameters of the specified parameter group
Note: Group number (PNU) and index number (IND) must be converted to hexadecimal	

AK response identifier

AK	Response identifier
0	No response
1	Return parameter value (16 bits)
2	
3	
4	Return array parameter value (16 bits)
6	Returns the number of parameters of the specified parameter group
7	Cannot process request, followed by error code
8	

Error code

Code	Description	Cause Analysis
0	Illegal parameter group number	
1	Parameter value cannot be modified	
2	The parameter value exceeds the limit	
3	Illegal parameter index	
11	Not enough permissions to modify the specified parameters	
17	Cannot process current request at runtime	
18	Current requests are not supported	

IND

The IND high byte is the sub index, which is the parameter index, and the low byte is the manufacturer-specific information. The format is as follows:

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
sub index								Manufacturer specific information							

- Argument Addresses

Argument addresses

Parameter	parameter name	PNU	Sub index parameter
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address		parameter group number	index
0001	Fieldbus control word	0	1
0002	fieldbus is given 1	0	2
0003	Fieldbus given 2	0	3
0004	Fieldbus status word	0	4
0005	Fieldbus actual value 1	0	5
0006	Fieldbus actual value 2	0	6
0007	Fieldbus module input 1	0	7
0008	Fieldbus module input 2	0	8
...
0018	Fieldbus module input 12	0	18
0019	Fieldbus module output 1	0	19
0020	Fieldbus module output 2	0	20
...			
0030	Fieldbus module output 12	0	30

Argument Addresses	PNU parameter group number	Sub index parameter index
1.00	1	0
1.01	1	1
...		
1.10	1	10
...		
2.00	2	0
...		
10.00	10	0
...		
63.00	63	0

SAP55 sets the slave address

SD2	LE	LEr	SD2	DA	SA	FC	DSAP	SSAP	DU	FCS	ED
68H	9	9	68H	8X	8X	X	55	62	See the table below	X	16H

DU	Content	Description
0	New slave address	0-125
1	Identification number high byte	
2	Identification number low byte	
3	Lock slave address	0: unlock, 1: lock

SAP58 global control

SD2	LE	LEr	SD2	DA	SA	FC	DSAP	SSAP	DU	FCS	ED
68H	X	X	68H	8X	8X	X	62	58	See the table below	X	16H

DU	Content	Description	
0	control command	Bit	Name
		0	Reserve
		1	Clear output data
		2	unfreeze
		3	Freeze
		4	Remove synchronization
		5	synchronization
		6	Reserve
7	Retain		
1	Group identification		

SAP59 Get configuration

The frame format of the SAP59 acquisition configuration is the same as the frame format of the SAP62 check configuration. SAP60 Slave diagnosis

SD2	LE	LEr	SD2	DA	SA	FC	DSAP	SSAP	DU	FCS	ED
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