# 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](https://fanyi.so.com/?src=onebox" \l "field" \t "https://www.so.com/_blank) | 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 |

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 |
| 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 type00：slave station01：Not ready to enter the Token Ring master station10：Ready to will enter the token ring's main station11：Has entered the Token Ring's main station |

 | Function code |

### 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) |

|  |  |
| --- | --- |
| 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:

|  |  |  |  |
| --- | --- | --- | --- |
| 1st word | 2nd word | 3rd word | 4th 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 addrssses

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter address | parameter name | PNU parameter group number | Sub index parameter 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 |

|  |  |  |
| --- | --- | --- |
| A 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 |
| 68H | X | X | 68H | 8X | 8X | X | 60 | 62 | 见下表 | X | 16H |

|  |  |  |
| --- | --- | --- |
| DU | Content |  |
| 0 | Site status 1 |

|  |  |  |
| --- | --- | --- |
| Bit | Name |  |
| 0 | The site does not exist |  |
| 1 | The site is not ready |  |
| 2 | Configuration data has errors |  |
| 3 | Expand the diagnostic |  |
| 4 | Does not support current requests or services |  |
| 5 | Illegal slave response |  |
| 6 | The parameter was set incorrectly |  |
| 7 | The host is locked |  |

 |
| 1 | Site status 2 |

|  |  |  |
| --- | --- | --- |
| Bit | Name |  |
| 0 | Parameter setting request |  |
| 1 | The static diagnosis |  |
| 2 | Fixed at 1, set by the slave |  |
| 3 | The watchdog has been opened |  |
| 4 | freeze mode |  |
| 5 | synchronous mode |  |
| 6 | Reserve |  |
| 7 | Inactive |  |

 |
| 2 | Site status 3 |

|  |  |  |
| --- | --- | --- |
| Bit | Name |  |
| 0-6 | Reserve |  |
| 7 | Extended diagnostic overflow |  |
|  |  |  |

 |
| 3 | Host address |  |
| 4 | High byte identification number |  |
| 5 | Low byte identification number |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

### SAP61 set parameter

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SD2 | LE | LEr | SD2 | DA | SA | FC | DSAP | SSAP | DU | FCS | ED |
| 68H | X | X | 68H | 8X | 8X | X | 61 | 62 | As bellow | X | 16H |

|  |  |  |
| --- | --- | --- |
| DU | content | Description |
| 0 | Site status |

|  |  |  |
| --- | --- | --- |
| Bit | name |  |
| 0 | Reserved |  |
| 1 | Reserved |  |
| 2 | Reserved |  |
| 3 | Open WD watchdog |  |
| 4 | Freezing request |  |
| 5 | Synchronous request |  |
| 6 | Unlock request |  |
| 7 | Lock request |  |

 |
| 1 | WD watchdog factor 1 | Watchdog time = watchdog factor 1 \* watchdog factor 2 \* 10ms |
| 2 | WD watchdog factor 2 |
| 3 | Minimum slave response delay time |  |
| 4 | Identification number |  |
| 5 |
| 6 | Group identification |  |
| 7 | DPV1 status word 1 |  |
| 8 | DPV1 status word 2 |  |
| 9 | DPV1 status word 3 |  |
| 10 | Structure length | 23 (user parameter data) +4 (header byte 10-13) |
| 11 | Structure type |  |
| 12 | Slot number |  |
| 13 | Special user parameters |  |
| User parameter data, length 23 bytes |
| 14 | Header byte |  |
| 15 | Deadline |  |
| 16 |
| 17 | Fail safe PZD1 |  |
| 18 |
| 19 | Fail safe PZD2 |  |
| 20 |
| 21 | Fail safe PZD3 |  |
| 22 |
| 23 | Fail safe PZD4 |  |
| 24 |
| 25 | Fail safe PZD5 |  |
| 26 |
| 27 | Fail safe PZD6 |  |
| 28 |
| 29 | Fail safe PZD7 |  |
| 30 |
| 31 | Fail safe PZD8 |  |
| 32 |
| 33 | Fail safe PZD9 |  |
| 34 |
| 35 | Fail safe PZD10 |  |
| 36 |

### SAP62 Check configuration

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SD2 | LE | LEr | SD2 | DA | SA | FC | DSAP | SSAP | DU | FCS | ED |
| 68H | X | X | 68H | 8X | 8X | X | 62 | 62 | As bellow | X | 16H |

|  |  |  |
| --- | --- | --- |
| DU | content | Description |
| 0 | PKW Configuration Data |  |
| 1 | PZD Configuration Data |  |

|  |  |  |
| --- | --- | --- |
| bit | name | Description |
| 0-3 | Data length | 0: 1 data unit, 1: 2 data units, ..., 15: 16 data units |
| 4-5 | Input/output type | 00: special format, 01: input, 10: output, 11: input and output |
| 6 | Minimum data unit | 0: The minimum data unit is byte (8 bits), 1: the smallest data unit is word (16 bits) |
| 7 | consistency |  |

For example, the configuration data of PPO 1 is F3F1H, the configuration data of PPO 5 is F3F9H, and the configuration data of PPO 6 is 00F9H.

### DP state machine



|  |  |
| --- | --- |
| State status |  |
| Reset | Offline |  |
| Wait Prm | Parameterization |  |
| Wait Cfg | Pending configuration |  |
| Data Exch | Data exchange |  |

## Transmission control Configuration parameter

|  |  |  |  |
| --- | --- | --- | --- |
| 10.00 | Control 1 boot function | 5，Fieldbus | 5 |
| 10.11 | Fault clear input | P.06.05.08（Fieldbus control word, bit 8, reset） | P.06.05.08 |
| 21.00 | Speed reference1 | P.02.15（Fieldbus ref 1） | P.02.15 |
| 50.00 | Fieldbus enable | 0，Disable1，Enable | 1 |
| 50.05 | Data In 1 | P.54.07（status word） | P.54.07 |
| 50.06 | Data In 2 | P.01.00（motor speed） | P.01.00 |
| 50.07-50.16 | Data In 3-12 |  |  |
| 50.17 | Data Out 1 | P.54.06（control word） | P.54.06 |
| 50.18 | Data Out 2 | P.00.02（Fieldbus ref 1） | P.00.02 |
| 50.19-50.28 | Data Out 3-12 |  |  |
| 54.00 | Node address | 2~126 | 3 |
| 54.01 | baud rate | 0，9.6kbit/s1，19.2kbit/s2，45.45kbit/s3，93.75 kbit/s4，187.5kbit/s5，500kbit/s6，1.5Mbit/s7，3Mbit/s8，6Mbit/s9，12Mbit/s | 6 |
| 54.02 | PPO type | 1，PPO1（4PKW + 2PZD）2，PPO2（4PKW + 6PZD）3，PPO3（0PKW + 2PZD）4，PPO4（0PKW + 6PZD）5，PPO5（4PKW + 10PZD）6，PPO6（0PKW + 10PZD） | 5 |
| 54.03 | DP Site status | 0，Parameterization1，Pending configuration2，Data exchange3，Offline | 3 |
| 54.04 | PROFIdrive state machine | 0，Start not ready1，Prohibit startup2，Ready to start3，Started4，Operational permission5，fault | 1 |
| 54.05 | Diagnostic information |

|  |  |  |
| --- | --- | --- |
| Bit | Name | Cause Analysis |
| 0 | Parameter setting error |  |
| 1 | Configuration data error |  |

 |  |
| 54.06 | Control word |  |  |
| 54.07 | Status word |  |  |
| 54.08 | Safe PZD1 |  |  |
| 54.09 | Safe PZD2 |  |  |
| 54.10 | Safe PZD3 |  |  |
| 54.11 | Safe PZD4 |  |  |
| 54.12 | Safe PZD5 |  |  |
| 54.13 | Safe PZD6 |  |  |
| 54.14 | Safe PZD7 |  |  |
| 54.15 | Safe PZD8 |  |  |
| 54.16 | Safe PZD9 |  |  |
| 54.17 | Safe PZD10 |  |  |
| 54.18 | SPC3 Watchdog status | 0，Baud rate search1，Baud rate control2，DP control |  |
| 54.19 | Parameter lock | 0, Unlock (can modify parameters via PKW)1,Locked(cannot modify parameters via PKW) | 0 |
| 54.20 | Firmware version |  |  |
| 54.21 | Equipment Identity |  |  |
| 54.22 | Communication disconnection statistics | 0-65535 | 0 |
| 54.23 | SPC3 offline statistics | 0-65535 | 0 |
| 54.24 | Site reset | 0，no1，yes | 0 |
| 54.25 | Frame reception count | 0-65535 | 0 |
| 54.26 | Frame sending count | 0-65535 | 0 |
| 54.27 | Check error count | 0-65535 | 0 |
| 54.28 | Error flag |  | 0 |

## Control word

|  |  |  |
| --- | --- | --- |
| **No.** | **name** | **Description** |
| **0** | Ramp stop | 1：Keep current state，0：ramp stop |
| **1** | Coast stop | 1：Keep current state，0：free stop |
| **2** | Quick Stop | 1：Keep current state，0：Emergency stop |
| **3** | Enable Operation | 1：allow work，0：Prohibited work |
| **4** | Ramp Out 0 | 1:RFG (ramp function generator) output force 0 |
| **5** | Ramp Hold | 1：RFG (Ramp Function Generator) output hold |
| **6** | Ramp In 0 | 1：RFG (ramp function generator) input forced 0 |
| **7** | Reset Fault | 0->1：fault reset |
| **8** | Inching 1 | 1：Jog command 1 |
| **9** | Inching 2 | 1：Jog command 2 |
| **10** | Remote | 1：remote control |
| **11** | Ext\_ctrl\_loc | 0：select exxternal control1， 1：select external control2 |
| **12-15** | retain |  |
| Note: Send 0x0406 0x0407 0x040F to the inverter first. |

## Status word

|  |  |  |
| --- | --- | --- |
| **No.** | **name** | **Description** |
| **0** | Ready to Switch On | 1：start ready |
| **1** | Switched On | 1：started |
| **2** | running | 1：have been allowed to work |
| **3** | Fault | 1：fault |
| **4** | Coast stop | 1：free stop |
| **5** | Quick Stop | 1：emergency stop |
| **6** | Switch On Disabled | 1：start inhibit |
| **7** | Warning | 1：warning |
| **8** | Ref Inverted | 1：set to negative |
| **9** | Remote | 1：remote control |
| **10** | Target Reached | 1：reach set speed |
| **11** | Internal Limit Active | 1：internal limit |
| **12-15** | remain |  |

## PROFIdrive state machine



|  |  |  |
| --- | --- | --- |
| State | status |  |
| Not Ready to Switch On | Start not ready |  |
| Switch On Disabled | Prohibit start |  |
| Ready to Switch On | Ready to start |  |
| Switched On | started |  |
| Operation Enable | Operational permission |  |
| Fault Reaction Active | Response error |  |
| Fault | fault |  |
| Quick Stop Active | Emergency stop |  |

## PROFIdrive Status Indicator

|  |  |  |  |
| --- | --- | --- | --- |
|  | Constant extinguish | Constant light | Flicker（1Hz） |
| LED1 | indicator light damaged , power supply is abnormal. | Expansion card and control board communication interrupted normally | Profibus Dp card communicates with the control board |
| LED2 | indicator light damaged , power supply is abnormal. | MCU and SPC3 communicate abnormally | MCU and SPC3 communicate normally |
| LED3 | SPC3 initialization failed | SPC3 is in the process of data exchange | SPC3 parameterization or match |
| LED4 | SPC3Not entering data exchange status  | SPC3 has entered the data exchange status  |  |