GTAKE
吉泰科

User Manual

EPC-CM2 PROFIBUS-DP

Industrial Site Bus Adapter

EPC-CM2 Instruction Manual

Preface

Thanks for you to use **EPC-CM2 (Profibus-DP) industrial site bus adapter** manufactured by Jiangsu GTAKE Electric Co., Ltd.
The User Manual introduces the contents in installation of wiring, precautions and applications etc. of EPC-CM2 adapter in details. Before its use, make sure to read the safety precautions of the manual carefully to ensure the safety of people and equipment in using the product.

Readers

Readers of the manual are the personnel in charge of debugging and the users of EPC-CM2 adapter module. The readers need to be qualified with basic electric knowledge, electric wiring experience and knowledge on operation of transmission unit.

Preparations

Before starting the installation of EPC-CM2 adapter, the transmission unit shall be installed and put into use.
In addition to preparation of routine installation tools, the manual of transmission unit shall be prepared as well, for the manual includes a lot of important information without being contained in the user manual. So, it is necessary to read it in the installation process.

Safety instructions

- ◆Electric installation and maintenance of all transmission units shall be finished by qualified electric engineer.
- ◆Transmission unit and its adjacent equipment must be connected to the ground correctly.
- ◆Do not operate transmission device with power on. After cutting off the main power, wait for at least 5min and then operate frequency converter, motor or motor cable after the power of capacitance of the middle loop is discharged completely.
- ◆In connecting the main power, the terminal of motor cable is at hazardous state no matter whether the motor is operated or not. Please do not touch it.

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Chapter 1 Overview

1.1 Profibus criteria

Profibus is a kind of open serial communication standard, which can be adopted to realize mutual exchange of data among various types of automatic elements. Profibus is mainly divided into three types: Profibus-FMS (Fieldbus Message Specification), Profibus-DP (Decentralized Periphery) and Profibus-PA (Process Automation).
The physical transmission media of bus is twisted-pair cable (conform to RS-485 standard). The max length of bus cable is controlled within the range of 100-1200m with its specific length determined by the selected rate of transmission. 31 nodes at most can be connected to the same Profibus network segment without the use of repeater. If the repeater is used, the number of nodes (including repeater and main station) connected to network can be increased to 127.
In Profibus communication, it is the main station that selects the nodes to respond to command of the host, which can issue commands to numerous nodes in the form of broadcast; under such circumstance, it is not necessary for the nodes to send feedback signal to the host.

1.2 Profibus-DP adapter

EPC-CM2 adapter module is an optional equipment of Jiangsu GTAKE Electric Co., Ltd. and it can be used to connect transmission unit with a Profibus network. On Profibus network, the transmission unit is considered as passive equipment. EPC-CM2 adapter can be used to:

- ◆Send control command (such as operating, stop and inching control etc.) to transmission unit
- ◆ Send signal with given frequency to transmission unit
- ◆ Send process data to transmission unit
- ◆ Read status signal and actual value from transmission unit
- ◆ Change the parameter value of transmission unit
- ◆ Reset faults of transmission unit

Chapter 2 Installation and Wiring

2.1 Mechanical and electrical installation

◆Plug three nylon columns into corresponding holes of control panel (it is ok to select any of the two groups on the left or right of GK800)

◆Cover insulated spacer to nylon column flatwise

◆Plug EPC-CM2 card into corresponding slot (it is ok to select any of the two groups on the left or right of GK800), ensure the aligning of three installation holes at nylon columns and fix them with three self-tapping screws

◆Plug bus connector of SIEMENS standard into CN1 of DB9 socket of EPC-CM2 and fix its tail screw

◆Connect grounding terminal J1 of EPC-CM2 card with the shell of frequency converter.

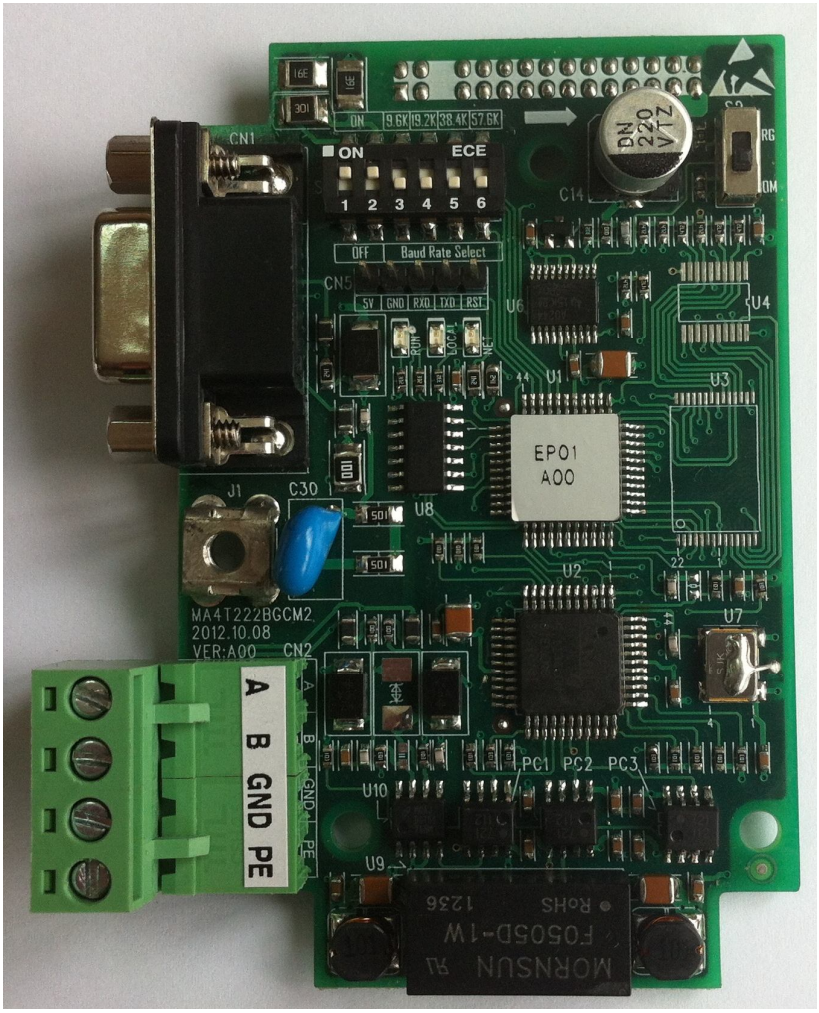


Figure 2.1 EPC-CM2 adapter

2.2 DIP switch

The one indicated in Figure 2.2 is the DIP switch. DIP 1 and DIP 2 bits are correspondent with the terminal resistance of Profibus bus. When it is dialed to “ON”, the terminal resistance will be effective. The ones from DIP 3 to DIP 6 bits are correspondent with the options of MODBUS communication Baud rate, or 9600bps, 19200bps, 38400bps and 57600bps respectively. If the DIP switch of certain Baud rate is at “ON” state and the other three DIP are of “OFF” state, it means the selection of the Baud rate. If the ones from 3 to 6 cannot meet the requirement of above combination, the Baud rate of communication is defaulted to be 19200bps.

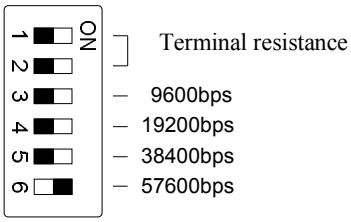


Figure 2.2 DIP switch

2.3 Bus interface

EPC-CM2 adapter is qualified with two Profibus DP interfaces: “terminal” or “standard DB9 connector”; and users may select wiring method according to actual situations.
Terminal is a 4-Pin socket and its pin signals’ correspondence relations are indicated in Table 2.1.

Table 2.1 Terminal signals

4-Pin terminal		Instructions
1	A	Cathode of data line
2	B	Anode of data line
3	GND	Communication data ground
4	PE	Protection ground

The configuration of signals with standard DB9 connector shall meet Profibus standard as indicated in Figure 2.3.

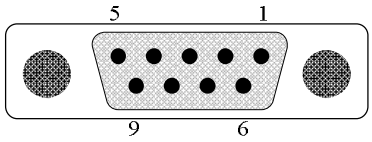


Figure 2.3 DB9 connector

Its pin signals are listed in Table 3.2

Table 3.2 Contrast of DB9 connector's signals

Standard DB9 connector		Instructions
1	NC	Unused
2	NC	Unused
3	B	Anode of data line
4	RTS	Send request signal
5	GND	Isolator
6	+5V	Isolated 5V DC voltage power supply
7	NC	Unused
8	A	Cathode of data line
9	NC	Unused

2.4 Connection of bus

The following figure is about the connection of terminal and the cable shield layer shall be connected to the ground; users may select the best grounding way according to actual situation on site.

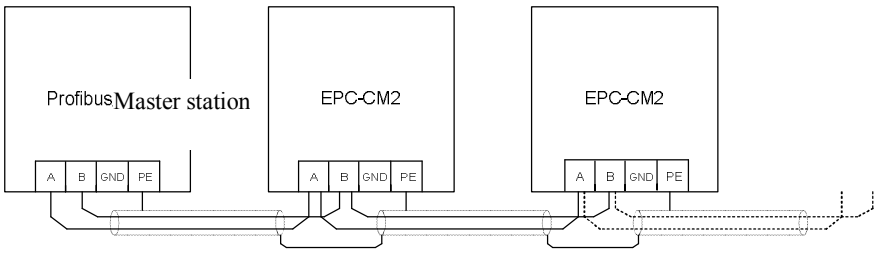


Figure 2.4 Connection of bus

For wiring of DB9 connector, refer to DB9 wiring instructions of SIEMENS. If the Baud rate of bus is more than 187.5kbps, carry out wiring in strict accordance with wiring standards of Profibus.

Note: in Profibus network, the terminal resistance of the stations at the head and end of bus needs to be started, but the terminal resistance of middle station shall be closed.

For the Profibus communication wire's type and transmission distance to be adopted, please refer to data in the following table.

Electric parameters of transmission wires

Parameters	A type wire	B type wire
Impedance/Ω	135~165	100~130
Capacitance of unit length /(PF/M)	<30	<60
Loop resistance/(Ω/km)	110	-
Diameter of wire core/mm	0.64	>0.53
Section of wire core/mm^2	>0.34	>0.22

Contrast on the relations of transmission distance of bus with the Baud rate of communication.

Transmission rate (kbps)	9.6	19.2	93.75	187.5	500	1500	12000
A type wire (m)	1200	1200	1200	1000	400	200	100
B type wire(m)	1200	1200	1200	600	200	-	-

2.5 Instructions on applications

1. PE terminal of EPC-CM2 shall be connected to the ground reliably and copper core wire above 3.5mm^2 shall be adopted as the grounding wire with its grounding resistance less than 10Ω as well;
2. Three screws on the adapter shall be fixed well to ensure their reliable connection with frequency converter;
3. When the transmission rate of bus reaches 187.5kbps, please use special Profibus communication line and DB9 connector of SIEMENS and carry out wiring in strict accordance with Profibus wiring standard;
4. If the terminal resistance of adapter is adopted, ensure the opening of terminal resistance at the two ends of bus and closing of terminal resistance at the middle node.

Chapter 3 Communication Data

EPC-CM2 adapter supports Profibus-DP (DP-V0) protocol conforming to EN50170 standard. Profibus-DP communication visits the services of data link layer through service access point and each service access point (SAP) in Profibus has clear definition. Specifically, please refer to user manual of main site of related Profibus.
In cyclic communication, Profibus-DP Protocol adopts the type of PPO (Parameter/Process Data Object) as the data transmission format and different PPO types are composed of different data as indicated in Figure 3.1.

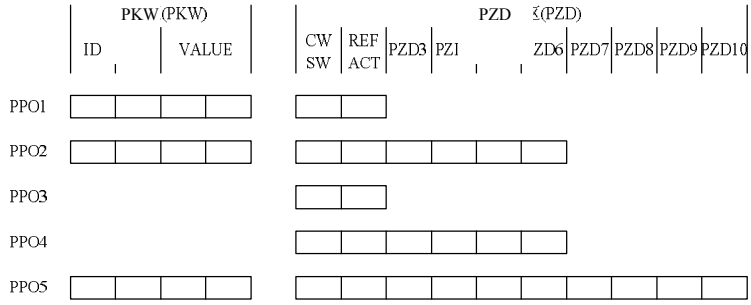


Figure 3.1 PPO Data Format

At present, EPC-CM2 adapter supports the above five kinds of PPO types with the definition of data described below:

Parameter district (PKW):
ID- parameter identification number
IND- parameters' index
VALUE- parameter value (4 bytes as the longest)
Process data district (PZD):
CW- Control word (from the master to the passive)
SW- Status word (from the passive to the master)
REF- Given value (from the master to the passive)
ACT- Actual value (from the passive to the master)
PZD3~10- Process data (determined by users)

3.1 PKW

From Figure 3.1, it can be seen that the data of parameters is transmitted in message types PPO1, PPO2 and PPO5 and it consists of 8 bytes as indicated in Figure 3.2.

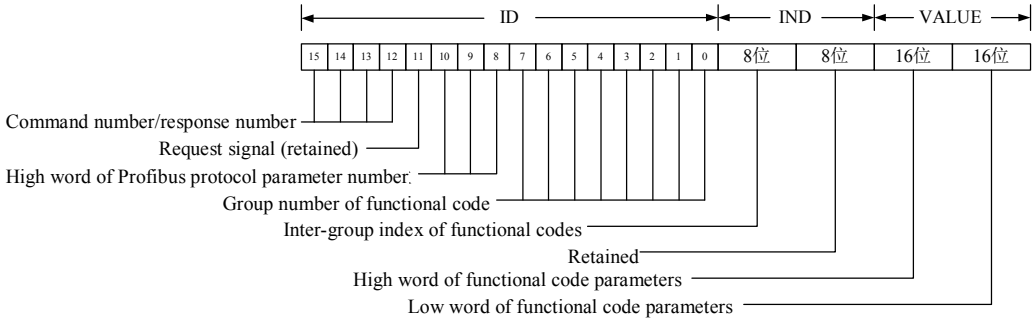


Figure 3.2 Data Format of PKW

ID includes two bytes, of which command number/response number ranks at the high four positions. The visit of PKW is divided into two types: Profibus protocol parameters and parameters of functional code of frequency converter. Profibus protocol's parameter number is correspondent with the low 11 bits of ID and ID low bytes and IND high bytes are combined for visit to parameters of functional code. If the parameters of functional code are visited, the high bit of Profibus protocol parameter number (bits from ID8-10) must be 0; otherwise, the response package will report the error of illegal parameter number. According to PROFIDRIVE routine, the adapter selects command/response number to meet specific requirements as indicated in Table 3.1.

Table 3.1 ID Command/Response Number

Command number	Description of functions
0	No task
1	Request for reading the parameter data of functional code
2	Request for changing the parameter data of functional code
14	Request for modifying the parameter data of functional code and store it to EEPROM
Other	Retained
Response number	Description of contents
0	No response
1	Correct operation to parameters of functional code (reading or modification)
7	Impossible execution with wrong information returned at the middle and low bytes in VALUE
Other	Retained

In case of error occurring to operation of parameters, the code of error will be returned in the low bytes of VALUE and the contents of error code are defined in Table 3.2.

Table 3.2 Operation Error Number

Error number	Description of contents
0	Illegal parameter number
1	Setting of parameters is not allowed (read only)
2	The value of parameter exceeds the limit
12	Wrong password
101	Impossible modification to parameter data (impossible modification in its operation)
102	Communication fault
104	Failed modification to functional code or data exceeding limit
105	Illegal command number
Other	Reserved

EPC-CM2 provides partial reading and visits of Profibus protocol parameters as indicated in Table 3.3.

Table 3.3 Profibus Protocol Parameters

Parameter number	Name of parameter	Instructions	Property
918	Address of site	Address of passive station	Read only
929	PPO type	Current PPO type	Read only
963	Baud rate of communication	Current Profibus communication Baud rate	Read only

In visiting the functional code of frequency converter, the group number of corresponding functional code for low byte of ID and the relations between them are indicated in Table 3.4, and the high byte of IND is correspondent with the inter-group index one-to-one and low byte of IND is retained to be 0 all the time.

Table 3.4 Correspondence relations of ID low byte with group number of functional code

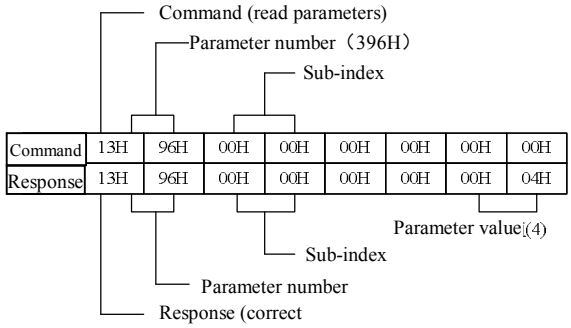
Low 8 bits of ID	Group number of functional code	Low 8 bits of ID	Group number of functional code
0x00	A0	0x11	E0
0x01	A1	0x12	E1
0x02	b0	0x13	F0
0x03	b1	0x14	F1
0x04	b2	0x15	F2
0x05	C0	0x16	F3
0x06	C1	0x17	F4
0x07	C2	0x18	F5
0x08	C3	0x19	F6
0x09	C4	0x1A	H0
0x0A	d0	0x1B	H1
0x0B	d1	0x1C	H2
0x0C	d2	0x1D	L0
0x0D	d3	0x1E	L1
0x0E	d4	0x1F	U0
0x0F	d5	0x20	U1
0x10	d6	0x21	U2

Parameter value of functional code of frequency converter only occupies two bytes. So, the high bit in VALUE is retained and the parameter value is returned in low bytes.

Examples of parameters' data transmission

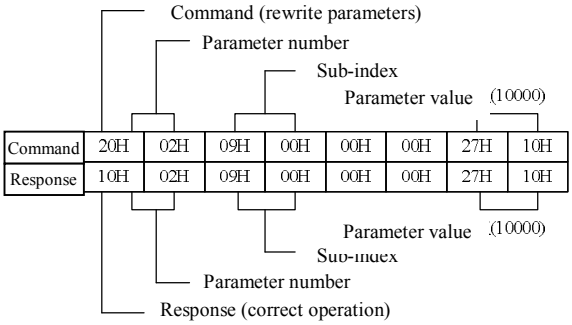
Example 1: read the parameters of Profibus protocol

In order to run the parameters of Profibus protocol, low 11 bits of ID are adopted for identification of parameter number. As the adapter only provides the reading operation for the ones with parameter number to be 918, 929 and 963 at present, the index value IND is 0 all the time. For example, for reading parameter 918, switch the parameter number into 396H in hexadecimal system with the returned parameter value to be 4, or the address of the station. The specific transmission of data is indicated as follows:

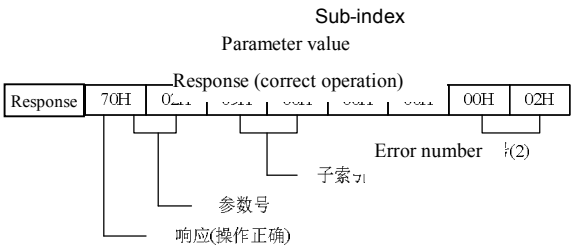


Example 2: rewrite the parameters of functional code

The parameter of functional code will perform addressing in combining low byte of ID with high byte of IND; at this moment, the ones from ID8 to ID10 must be 0. For example, modify the upper frequency b0-09 of the system into 100.00HZ with corresponding parameter number to be 0209H and parameter value to be 2710H (10000) as well as command and response format indicated as follows:



If the parameter is set to exceed the limit, the following format will be returned.



3.2 PZD

Control word and status word

◆Control word is the main channel for site bus system to control transmission unit; as the control word is sent to transmission unit by the host of site bus through adapter. Then, the transmission unit will, according to code command of control word bit to take corresponding actions and return the status information to the host through status word. The bits of control word and status word are defined as the ones in Table 3.5 and Table 3.6 respectively.

Table 3.6 Definitions of Control Words' Bit

Control word (bit)	Value	Meaning	Description of functions
BIT0	0	Failed operation command	Stop frequency converter
	1	Effective operation command	Start frequency converter
BIT1	1	Inversion	Set the operation command to be effective and the operating direction in inching
	0	Forward	
BIT2	1	Inching	
	0	Failed inching	
BIT3	0→1	Effective reset command	Effective rise
	0	Failed reset command	
BIT4	1	Effective free parking	
	0	Failed free parking	
BIT5	1	Effective control of master station	The current control word and set value of operation issued by the master station are effective
	0	Failed control of master station	As the current control word and set value of operation issued by the master station are failed, the frequency converter is kept for operation based on parameters of the previous one.
BIT6~BIT15	Undefined	Reserved	

Table 3.6 Definition of Status Word Bits

Status word (bit)	Value	Meaning	Description of functions
BIT0	1	Operation of frequency converter	Whether the frequency converter is at operating status; in inching, the bit is set as well.
	0	Stopping of frequency converter	
BIT1	1	Inversion of frequency converter	Status bit of operating direction
	0	Forward of frequency converter	
BIT2	1	Reach the master setting	
	0	Without reaching master setting	
BIT3	1	Effective free parking	Whether the command of free parking is effective. If it is effective, prohibit its operation
	0	Failed free parking	
BIT4	1	Inching operation	
	0	Non-inching operation	
BIT5	1	Faults of frequency converter	Status bit of faults to frequency converter
	0	No fault of frequency converter	
BIT6	1	Faults of adapter	
	0	Normal adapter	
BIT7	1	Effective selection of communication with command source	
	0	Failed selection of communication with command source	
BIT8~BIT15	Undefined	Reserved	

REF/ACT/PZDx

In PPO1 and PPO3, PZD2 is defaulted to be given main frequency and feedback of operating frequency in the speed control model. In other PPO, PZD2-10 can be set to be specific functional code' parameter, control parameter and status parameter according to the needs of users; and their correspondence relations can be set in functional codes of group H1 as indicated in Table 3.7.

Table 3.7 Selection of functional code for data transmission of PZD

Functional code	Name	Scope	Ex-factory value	Property
H1-02	PZD2_OUT(the master →the passive)	0: none Its property as writable functional code 0x6200~0x6214	0	Δ
H1-03	PZD3_OUT(the master →the passive)	0: none Its property as writable functional code 0x6200~0x6214	0	Δ
H1-04	PZD4_OUT(the master →the passive)	0: none Its property as writable functional code 0x6200~0x6214	0	Δ
H1-05	PZD5_OUT(the master →the passive)	0: none Its property as writable functional code 0x6200~0x6214	0	Δ
H1-06	PZD6_OUT(the master →the passive)	0: none Its property as writable functional code 0x6200~0x6214	0	Δ
H1-07	PZD7_OUT(the master →the passive)	0: none Its property as writable functional code 0x6200~0x6214	0	Δ
H1-08	PZD8_OUT(the master →the passive)	0: none Its property as writable functional code 0x6200~0x6214	0	Δ
H1-09	PZD9_OUT(the master →the passive)	0: none Its property as writable functional code 0x6200~0x6214	0	Δ
H1-10	PZD10_OUT(the master →the passive)	0: none Its property as writable functional code 0x6200~0x6214	0	Δ
H1-11	PZD2_IN(the passive →the master)	0: none A0-00~U2-xx 0x6200~0x6214 0x6300~0x6323	0	Δ
H1-12	PZD3_IN(the passive →the master)	0: none A0-00~U2-xx	0	Δ

		0x6200~0x6214 0x6300~0x6323		
H1-13	PZD4_IN(the passive →the master)	0: none A0-00~U2-xx 0x6200~0x6214 0x6300~0x6323	0	Δ
H1-14	PZD5_IN(the passive →the master)	0: none A0-00~U2-xx 0x6200~0x6214 0x6300~0x6323	0	Δ
H1-15	PZD6_IN(the passive →the master)	0: none A0-00~U2-xx 0x6200~0x6214 0x6300~0x6323	0	Δ
H1-16	PZD7_IN(the passive →the master)	0: none A0-00~U2-xx 0x6200~0x6214 0x6300~0x6323	0	Δ
H1-17	PZD8_IN(the passive →the master)	0: none A0-00~U2-xx 0x6200~0x6214 0x6300~0x6323	0	Δ
H1-18	PZD9_IN(the passive →the master)	0: none A0-00~U2-xx 0x6200~0x6214 0x6300~0x6323	0	Δ
H1-19	PZD10_IN(the passive →the master)	0: none A0-00~U2-xx 0x6200~0x6214 0x6300~0x6323	0	Δ

Chapter 4 Instructions on Applications

After correct wiring and connection of hardware, the master station and the passive station in Profibus-DP network must be configured with appropriate parameters to ensure normal operation of the system.

4.1 Configuration of master station

Network configuration can be realized with STEP7 software. In configuration, it is necessary to provide corresponding GSD file. GSD file of EPC-CM2 adapter will be provided in delivery of product or users may download it from the official website of our company. GSD file is named as EPC0689.gsd.

In configuration of hardware, firstly install GSD file and update directory so that EPC-CM2 device will appear in equipment directory “PROFIBUS DP”. Then, add it to the network. Specifically, refer to STEP7’s Use Instructions.

4.2 Configuration of frequency converter

After finishing configuration of network, correctly set parameters of H1 group according to configuration situation of master station.

Functional code	Name	Scope	Instructions
H1-00	Address of the site	1~127	0 is usually used as the address of class 2 master station 127 as the address of broadcast
H1-01	PPO type	0: Profibus failed 1: PPO1 2: PPO2 3: PPO3 4: PPO4 5: PPO5	PPO type shall be set to be one type of PPO1-5.

Note: H1-00 and H1-01 do not support online modification; after modification, it will be put into effect only with re-powering on.

For realizing the communication control of master station, the following functional codes shall be set:

Functional code	Name	Value	Instructions
b1-00	Given method of operating command	2	Communication control
H0-00	Selection of 485 port's terminal resistance	1	Make expansion card input
H0-02	Address of 485 port's communication computer	5	The address of the computer is fixed to be 5.

According to DIP switch of EPC-CM2, select appropriate Baud rate of local communication

Functional code	Name	Scope	Instructions
H0-01	Communication configuration of 485 port	The unit: the selection of Baud rate 1: 9600bps 2: 19200bps 3: 38400bps 4: 57600bps The tens: format of data 0: 1-8-2-N format, RTU Hundreds: wiring method 0: direct cable connection	Data format: 1-8-2-N, RTU; Direct cable connection; Baud rate: 9600~57600bps optional

If PPO1 or 3 is adopted as the transmission type, PZD2 is fixed with given main frequency so that it is applicable to speed control model. At this moment, set corresponding functional code as follows:

Functional code	Name	Value	Instructions
b0-01	Main given method of frequency	9	Communication input

In other PPO types, the correspondence relation of PDZ2-10 with the functional code, control parameter and status parameters can be set in H1-02~ H1-19; and it can be changed online. Please set it correctly.

EPC-CM2 supports the test of bus faults, users may set the process mode of faulted frequency converter through H1-20 functional codes and corresponding fault or warning code (PFS) will be presented on the operating panel.

Functional code	Name	Scope	Instructions
H1-20	Process mode to faults of bus	0: fault with free parking 1: warning with continuous operation	The process mode to faults of bus is adopted to set the process mode of frequency converter in case of faults occurring to bus.

4.3 Transmission ratio

The value of functional code of frequency converter is equipped with five types of precision: 1, 0.1, 0.01, 0.001 and 0.0001; and the transmission ratio is the reciprocal of corresponding precision.

For example, the main given number of frequency sets the precision of b0-02 to be 001; then, the transmission ratio will be 100; if it is set to be 50.00HZ, the transmission value of bus will be 5000 (1388H)

If the precision of Ti1 d2-02 of ASR high-speed integral time; then, transmission ratio will be 1000; if it is set to be 0.500, the transmission value of bus will be 500 (1F4H).

Appendix Status Indications

EPC-CM2 adapter is set with three signal lamps: Run, Local and Network, whose status will indicate the current working situation of adapter with the specific ones indicated in Table 4.1.

Table 4.1 Status Indications

LED1 green （Run）	LED2 green （Local）	LED3 green （Network）	Status
Off	Off	Off	No power for Profibus card
On	Twinkle	Twinkle	Abnormal test of RAM
On	Off	On	Local faults
On	On	Twinkle	In establishing communication
On	On	Off	Faults of bus
On	On	On	Normal

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