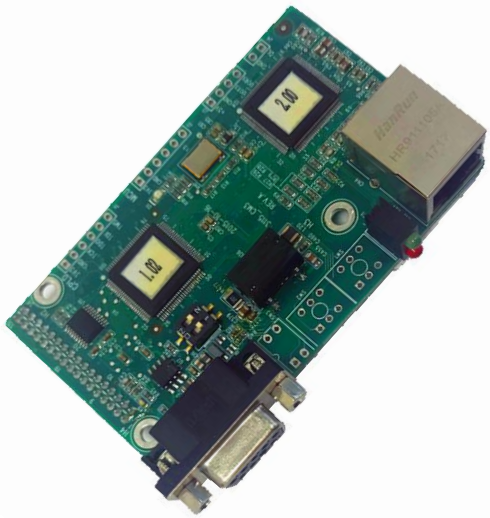
Instruction Manual

CANopen option card

HD1-E-COP



⚠CAUTION

Thank you for purchasing your HD1-E-COP option card.

- This product is designed for setting and programming CANopen communication protocol with HD1 series of inverters
- Improper handling might result in incorrect operation, a short life, or even a failure of this product.
- Deliver this manual to the end user of this product. Keep this manual in a safe place until this product is discarded.
- For how to use an optional device, refer to the instruction and installation manuals for that optional device.

Safety precautions

Before installing and operating the module, operators must receive professional training on electrics and safety as well as pass the test, and they have been familiar with procedures and requirements about installation, commissioning, running and maintenance of the equipment in avoidance of various emergencies.
Before installation, unpacking and operation, carefully read ***Safety precautions*** in this manual and the manual of the inverter to operate safely.
If any physical injury or death, or damage to the devices occurs for ignoring to the safety precautions in the manual, our company will not be responsible for any damage.
Because installing and unpacking the module need to remove the inverter cover, all power supplies must be disconnected to guarantee internal safe voltage. Refer to the inverter manual for specific information. Ignoring the requirement may cause serious physical injury or death.

- ✓ Put the module in places out of dust, humidity, electric shock as well as mechanical pressure.
- ✓ The module is electrostatic. Take measures to avoid electrostatic discharge during relevant operation.
- ✓ Tighten the screws to ensure the tightness and proper grounding.

Note

- ✓ **To enable CANopen, select relevant CANopen channel (except CANopen communication timeout fault time and baud rate). If the inverter manual changes without further notice in this manual, information will be subject to CANopen channel.**

Terms and abbreviations

CAN	Controller Area Network
COB	Communication Object, a transmission unit in CAN network; data are transmitted in the whole network inside COB; one part of CAN information frames
EDS	Electronic Data System; when configuring CANopen, EDS needs to use the special ASCII file for a node and it contatins the general information on nodes and relevant object dictionary.
NMT	Network Management, one of the application-layer service elements of models set by CAN, is in charge of initialization, configuration and trouble shooting.
OD	Object dictionary is used to store all communication objects identified by a certain device in local.
PDO	Process Data Object, one of COBs, is used to transmit process data, such as the control command, set values, state values and actual values.
PDOn Tx	PDO command sent by slave station to master station, n represents 1, 2, 3 and 4
PDOn Rx	PDO command received by slave station from master station, n represents 1, 2, 3 and 4
SDO	Service Data Object, one of COBs, is used to transmit non- time key data, such as parameters.
RO	It indicates read-only visit.
RW	It indicates read or write visit.
SYNC	Synchronous transmission type
Node-ID	Node identity, namely communication card address
0x	It indicates the following digit is hex. For example, 0x10 means decimal 16.

Content

1. Unpacking inspection

Check as follows receiving the products:

- Check that the communication card is not damaged.
- Check the silkscreen model on the PCB board to verify that the communication card is correct, as shown in Table1.
- Check that the accessories in the pakage are correct, as shown in Table1.
- If there is any damage to the communication card, the model is incorrect, or the items are not complete, please contact supplier.
- Contact IMO for EDS or download.eds file from IMO website: www.imopc.com
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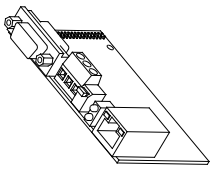
Table1 Accessories

Description	Communication card	Screws(M3)
Pictures		
Qty.	1	3

2. General

1. Thanks for choosing IMO HD1-E-COP communication card. The manual provides product specification, installation, operation and setting as well as introduction on protocols. To ensure correct installation and operation, please carefully read this manual and communication protocol of the inverter before proper use.
2. The manual is only for operating guidance and relevant instructions of HD1-E-COP but not for detailed CANopen protocol. Please refer to relevant professional articles or books for more information about CANopen protocol.
3. HD1-E-COP is defined as CANopen slave station communication card applicable to the inverter that supports CANopen communication.
4. CANopen supports two process quantities of read and write, one by PDO and the other by SDO defined by manufacturer.

3. Features

(1) Functions

- CAN2.0A protocol
- CANopen DS301

(2) Available service

- PDO: four pairs of PDO service (PDO1~PDO4 TX, PDO1~PDO4 RX), PDO1 for read and write inverter parameters, PDO2~PDO4 for realtime control and obtaining actual values.
- SDO: SDO adopts “client/server” mode to configure slave station nodes and visit the object dictionary of each node.
- Emergency service
- NMT node guarding
- Heartbeat producer
- NMT (Network Management)
  - NMT module control
  - NMT broadcast address
  - NMT error control
  - Boot-up
- SYNC (1~240)
- Asynchronous transmission 254 and 255
- Prohibition time
- Event timer
- SDO defined by manufacturer to control, read and write the actual values of the inverter.

(3) Unavailable service

- Power-off save for object dictionary parameters.
- Time Stamp

(4) Address and baud rate

Table 2 Available address and baud rate

Items	Specification
Address	1~127 (decimal)
Baud rate	1000k bps (bit/second)
	800k bps (bit/second)
	500k bps (bit/second)
	250k bps (bit/second)
	125k bps (bit/second)
	100k bps (bit/second)
	50k bps (bit/second)
	20k bps (bit/second)

(5) Environment

Table 3 Environment specification

Items	Specification
Ambient temperature	-10~50℃
Storage temperature	-20~60℃
Humidity	5%~95%
Other weather conditions	No condensation, ice, rain, snow or hail, solar radiation less than 700W/m^2
Pressure	70~106kPa
Vibration and shock	Sinusoidal vibration 9~200Hz, 5.9m/s^2 (0.6g)

4. Parts introduction

See the parts of CANopen communication card in Fig1.

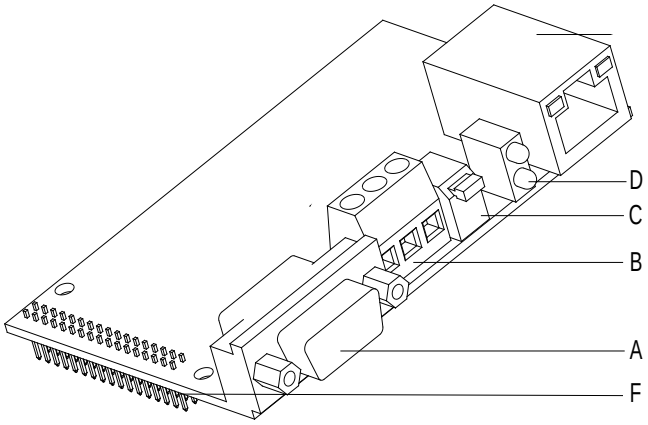


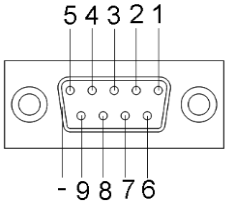
Fig1 Parts of CANopen communication card

A–CANopen communication port (DB9 female)
B–CANopen communication port terminal (3pin)
C–CANopen terminating resistor switch
D–CANopen status indicator light
F–communication card port pin

Note: Two address knobs will not be installed, and the communication address is set by inverter function code.

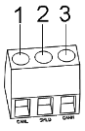
Users can select either of two CANopen communication ports, DB9 female (A) and 3pin open terminal (B).
See the functions of DB9 female communication port in Table 4.

Table 4 Functions of CANopen DB9 female communication port

CANopen communication port (DB9 female)	Pin	Function	Description
	1	-	
	2	CAN_L	CANopen bus low level signal
	3	-	
	4	-	
	5	CAN_SHLD	CANopen bus shielding
	6	-	
	7	CAN_H	CANopen bus high level signal
	8	-	
	9	-	
	-	CAN_SHLD	CANopen bus shielding

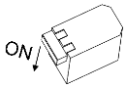
See the functions of 3pin open terminal communication port in Table 5.

Table 5 Functions of 3pin open terminal communication port

3pin open terminal	Pin	Function	Description
	1	CAN_L	CANopen bus low level signal
	2	CAN_SHLD	CANopen bus shielding
	3	CAN_H	CANopen bus high level signal

See the functions of terminating resistor switch in Table 6.

Table 6 Functions of terminating resistor switch

Terminating resistor switch	Direction	Function	Description
	Up	OFF	No terminating resistor connected with CAN_H and CAN_L
	Down	ON	120Ω terminating resistor connected with CAN_H and CAN_L

5. Wiring

Select either DB9 female (A) or 3pin open terminal (B) for communication terminals and try to choose shielding wire for bus cable. Customers are advised to connect the shielded cable to the PE terminal of the inverter when using switch on terminating resistor when the communication card becomes terminating slave station.
See the wiring diagram in Fig 2.

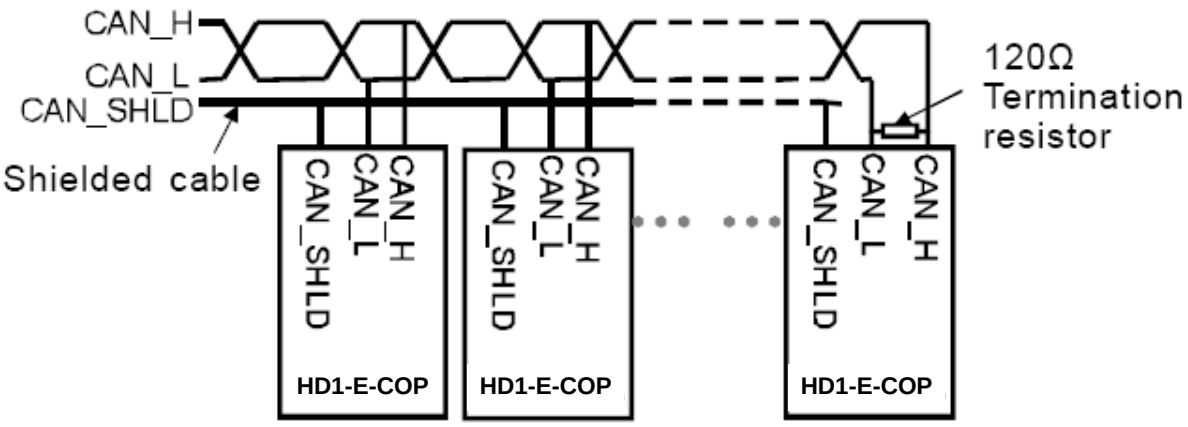


Fig 2 Wiring diagram

6. Installation

Procedures for installing HD1-E-COP communication card:

1. Disconnect all power supplies applied to the inverter to ensure safe voltage in the inverter.
2. Remove the cover of the inverter and find the control board.
3. Plug communication card pin in expansion slot of the control board.
4. Fasten three screws.
5. Connect and fix the communication cable.
6. Install the cover of the inverter.

Fig 3 shows the schematic diagram of the communication card installed on HD1-18.5A-43 inverter.

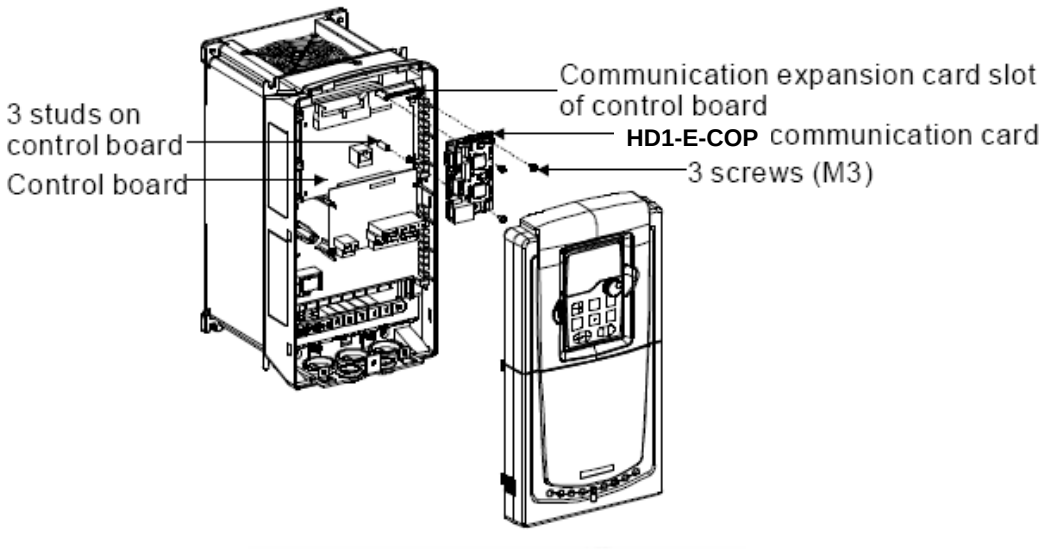
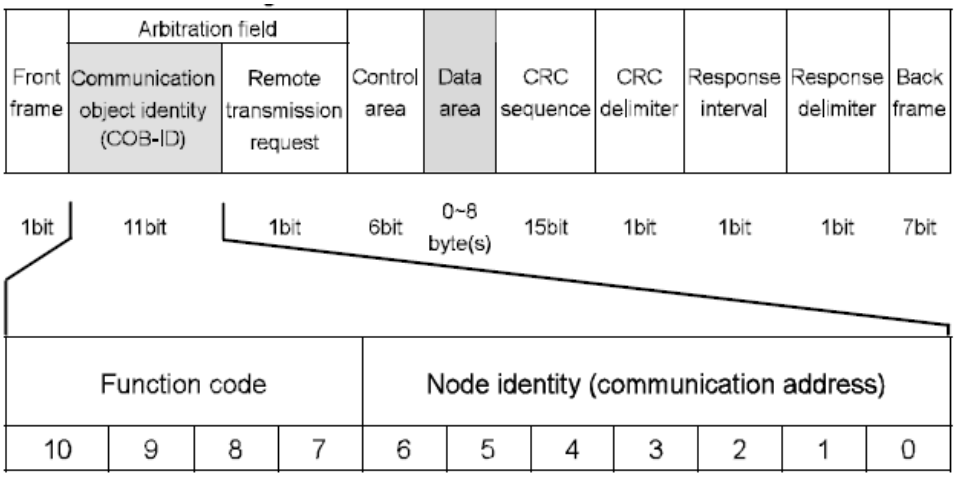


Fig 3 Installation diagram of communication card

7. Communication

7.1 Message structure

CAN2.0A message transmits data between the master station and bus nodes via data frame. The message structure is shown as follows:



Communication object	Function code (binary)	COB-ID (hexadecimal)
NMT	0	0x00
SYNC	1	0x80
EMCY	1	0x81 ~ 0xFF
PDO1 Tx	11	0x181 ~ 0x1FF
PDO1 Rx	100	0x201 ~ 0x27F
PDO2 Tx	101	0x281 ~ 0x2FF
PDO2 Rx	110	0x301 ~ 0x37F
PDO3 Tx	111	0x381 ~ 0x3FF
PDO3 Rx	1000	0x401 ~ 0x47F
PDO4 Tx	1001	0x481 ~ 0x4FF
PDO4 Rx	1010	0x501 ~ 0x57F
SDO Tx	1011	0x581 ~ 0x5FF
SDO Rx	1100	0x601 ~ 0x67F
Node guarding	1110	0x701 ~ 0x77F

COB-ID is different with different communication addresses, but its range is definite at the same command.
Note: If the command does not refer to the remote frame, it will be the data frame.

7.2 State shift

HD1-E-COP supports start-up sequence defined by CANopen communication protocol. The following diagram is about NMT state shift of HD1-E-COP.

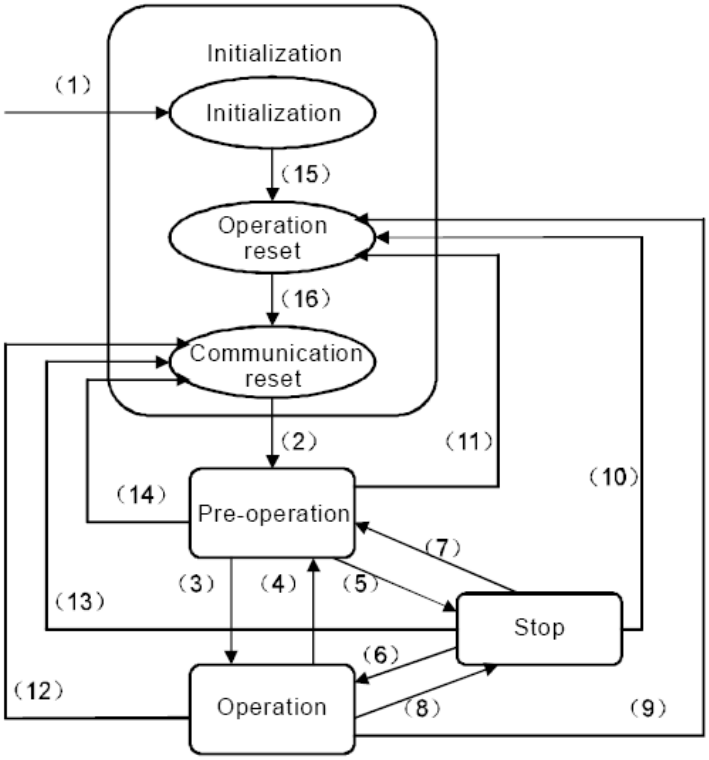


Fig 4 NMT state shift

Table7 NMT state shift

State shift	Trigger action in need
(1)	Automatically initialize after powering on
(2)	Automatically shift after initialization
(3) (6)	NMT master station starts remote node command
(4) (7)	NMT master station enters pre-operation state command
(5) (8)	NMT master station enters stop state command
(9) (10) (11)	Reset remote node command of NMT master station
(12) (13) (14)	Reset remote node communication parameter command of NMT master station

HD1-E-COP supports different services in different states, as shown in Table 8.

Table 8 Avaliable service in various NMT states

Service	Pre-operation state	Operation state	Stop state
PDO	No	Yes	No
SDO	Yes	Yes	No
SYNC	Yes	Yes	No
EMCY	Yes	Yes	No
NMT	Yes	Yes	No
Error control	Yes	Yes	Yes

7.3 NMT

The function is available for NMT when master station controls slave station node.

- **Command**

Master station→slave station

COB-ID	Byte 0	Byte1
0x000	Command word (CS)	Node-ID (Node identity)

- **Instruction**

COB-ID is fixed as 0x00. If Node-ID =0, broadcast the command to all CANopen slave stations, each slave station must execute NMT command. See the functions of command words (CS) in Table 9.

Table 9 Functions of command words

NMT Command word (CS)	NMT service (control action)
0x01	Start slave station devices
0x02	Stop slave station devices
0x80	Enable slave station into pre-operation
0x81	Reset slave station
0x82	Reset node communication

- **Example**

Enable HD1-E-COP of node ID=3 into per-operation. The command is shown as follows:

COB-ID	Byte0	Byte1
0x000	0x80	0x03

Start all HD1-E-COP nodes in CANopen network. The command is shown as follows:

COB-ID	Byte0	Byte1
0x000	0x01	0x00

7.4 NMT node guarding

By node guarding, NMT main node can detect the current state of each node.

- **Command**

Request: master station (remote frame) →slave station

COB-ID	No data
0x700 + Node-ID	

Response: slave station →master station

COB-ID	Byte0 (state value)
0x700 + Node-ID	Bit7: trigger bit, Bit0~Bit6 state

- **Instruction**

The highest bit7 of Byte0 (state value) for response command is the trigger bit; that is to say, 0 and 1 will alternate for the response to show the differences of frames when the slave station sends out a frame. Bit0~Bit6 are the states of the slave station, as shown in Table10:

Table10 Node guarding state value

State value (Byte0: Bit0~Bit6)	State
0x00	Initializing
0x04	Stopped
0x05	Operational
0x7F	Pre-operational

- **Example**

The master station will detect the state of slave station3, as shown below:

Master station (remote frame) →slave station

COB-ID	No data
0x703	

The slave station will respond as follows after receiving power saving command from the master station.

COB-ID	Byte0 (state value)
0x703	0x85

If Bit7=1 and state=0x05, node 3 slave station is in operation. If the slave station receives a node guarding command, it will respond a command of 0x05 state value to the master station because Bit7 of Byte0 alternates into 0.

7.5 Heartbeat producer

Sometimes, to know the realtime state of the slave station, the master station requires the slave station should automatically send heartbeat producer every interval defined in object dictionary 0x1017 (16bit data length, unit: ms). If time=0, the slave station will not send heartbeat producer. The default heartbeat time of HD1-E-COP is 0.

- **Command**

Slave station→master station

COB-ID	Byte0
0x700 + Node-ID	State value

- **Instruction**

The formats for heartbeat producer and node guarding response are the same, but there is no trigger bit alternative variation (always 0) for heartbeat producer. The state values are shown in Table10.

- **Example**

For example, when slave station address=3, the slave station is in operation. If the parameter in 0x1017 is set to 100, the slave station will send a heartbeat producer every 100ms.

COB-ID	Byte0
0x703	0x05

SDO can be used to diable heartbeat producer. Send 2B 17 10 00 00 00 00 00 (time=0).
Note: The same time node guarding and heartbeat producer are not available simultaneously for the communication card.

7.6 NMT boot-up

When the communication card finishes boot-up, it will send a start-up message.

- **Command**

Slave station→master station

COB-ID	Byte0
0x700 +Node-ID	0x00

- **Example**

For example, when communication card node=3, the start-up message sent by the communication card after boot-up is shown as follows:

COB-ID	Byte0
0x703	0x00

7.7 SYNC

Without any data, SYNC signals that CANopen master station usually cycles and sends are mainly used to request the slave station node to respond process quantity for PDO Tx of synchronous transmission. 0x1005 of object dictionary defines COB-ID that is used to receive SYNC and connected set to be 0x80. Each PDO Tx 1~240 is synchronous transmission type.

- **Command**

Master station →slave station

COB-ID	No data
0x80	

7.8 EMCY

When an error occurs in the communication card or inverter or the error clears, EMCY will be sent.

- **Command**

Slave station→master station

COB-ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x80 + Node-ID	Emergency error code		Error register	Inverter error code				
	LSB	MSB		bit7-0	bit15-8	bit23-16	bit31-24	bit39-32

- **Instruction**

Emergency error code contains two bytes with low Byte0 and high Byte1 while inverter error code consists of five bytes with low Byte3 and high Byte7.
Emergency error code refers to specific current error type, as shown in Table11. EMCY error type can be figured out via current error type in error register, as shown in Table12.
Refer to inverter manual for inverter error code which is given by function code P07.27 in Appendix2.

Table11 Emergency error code

Emergency error code (hex)	Description of functions
00xx	Error Reset or No Error
10xx	Generic Error
20xx	Current
21xx	Current, device input side
22xx	Current, inside the device
23xx	Current, device output side
30xx	Voltage
31xx	Mains voltage
32xx	Voltage inside the device
33xx	Output voltage
40xx	Temperature
41xx	Ambient temperature
42xx	Device temperature
50xx	Device hardware
60xx	Device software
61xx	Internal software
62xx	User software
63xx	Data set
70xx	Additional modules
80xx	Monitoring
81xx	communication
8110	CAN overrun
8120	Error Passive
8130	Life Guard Error or Heartbeat Error
8140	Recovered from Bus-Off
82xx	Protocol Error
8210	PDO no processed Due to length error
8220	Length exceed
90xx	External error
F0xx	Additional functions
FFxx	Device specific

Table12 Bits of error register

Bit of error register (bit)	Error type
0	Generic or no error
1	Current
2	Voltage
3	Temperature
4	Communication
5	Device profile specific
6	Reserved (=0)
7	Manufacturer specific

- **Example**

For example, when inverter unit U-phase protection fault (OUT1) occurs to the slave station of node 3 and fault type is 1 (inverter error code=1), HD1-E-COP will send EMCY as follows:

COB-ID	Emergency error code		Error register	Inverter error code				
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x83	0x00	0x30	0x04	0x01	0x00	0x00	0x00	0x00

From the command, emergency error code=0x3000 indicates voltage error; error register=0x04, that is to say, the second bit is 1, indicates voltage error; when inverter error code=0x0000000001, refer to HD1 inverter manual for inverter unit U-phase protection fault (OUT1).

When the fault resets, HD1-E-COP will send following EMCY to inform of the master station that the slave station has no fault.

COB-ID	Emergency error code		Error register	Inverter error code				
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x83	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00

7.9 SDO

Service data object is mainly adopted to transmit non-time key data and it can read and write the content of object dictionary.

- **Command**

Request: master station →slave station

COB-ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x600+ NodeID	Request code	Object index		Sub-index	Response data			
		LSB	MSB		bit7-0	bit15-8	bit23-16	bit31-24

Response: slave station→master station

COB-ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x580+ NodeID	Response code	Object index		Sub-index	Response data			
		LSB	MSB		bit7-0	bit15-8	bit23-16	bit31-24

- **Instruction**

The object index contains two bytes with low Byte1 and high Byte2. Refer to the object dictionary in appendix for object index and sub-index. The request codes consist of read type and write type.

Write request codes are different according to different character lengths of items in object dictionary while read request codes are fixed into 0x40. See Table13.

Successful read response codes are different according to different character lengths of items in object dictionary while successful write response codes are fixed into 0x80. See Table14.

Table13 SDO request codes and data

Type	**Request codes**	**Instruction**	**Request data**			
			Byte4	**Byte5**	**Byte6**	**Byte7**
Write	0x23	Write 4 bytes	bit7-0	bit15-8	bit23-16	bit31-24
	0x2B	Write 2 bytes	bit7-0	bit15-8	-	-
	0x2F	Write 1 byte	bit7-0	-	-	-
Read	0x40	Read data	-	-	-	-

Table14 SDO response codes and data

Type	**Response codes**	**Instruction**	**Response data**			
			Byte4	**Byte5**	**Byte6**	**Byte7**
Read	0x43	Read 4 bytes	bit7-0	bit15-8	bit23-16	bit31-24
	0x4B	Read 2 bytes	bit7-0	bit15-8	-	-
	0x4F	Read 1 byte	bit7-0	-	-	-
Write	0x60	Write succeeded	-	-	-	-
Read/ Write	0x80	Read and write failed	Terminating error code			
			bit7-0	bit15-8	bit23-16	bit31-24

Note: “-” in Table13 and Table14 stands for reserved and ineffective.

Table15 shows terminating error code.

Table15 Terminating error code

Termination code	Description of code functions
0503 0000	No alternative variation for trigger bit
0504 0000	SDO protocol overtime
0504 0001	Illegal or unknown client or server
0504 0002	Invalid block size
0504 0003	Invalid serial number
0504 0004	CRC error
0504 0005	Memory overflow
0601 0000	The object does not allow visit.
0601 0001	Try to read write-only object.
0601 0002	Try to write read-only object.
0602 0000	The object in object dictionary does not exist.
0604 0041	The object cannot map to PDO.
0604 0042	The quantity and length of mapping objects exceed those of PDO.
0604 0043	Generic parameters are incompatible.
0604 0047	Generic internal parts are incompatible.
0606 0000	Hardware error causes object visit failure.
0607 0010	Neither data type nor service parameter length matches.
0609 0011	Sub-index in object dictionary does not exist.
0609 0030	Out of range of parameters
0609 0031	Write parameter is too high.
0609 0032	Write parameter is too low.
0609 0036	The maximum value is smaller than the minimum value.
0800 0000	Generic error
0800 0020	Data cannot be transmitted or saved to application.
0800 0021	Due to local control, data cannot be transmitted or saved to application.
0800 0022	Due to current state, data cannot be transmitted or saved to application.
0800 0023	The object dictionary dynamically causes errors or it does not exist.

- **Example**

For example, when slave station address is 3, conduct read and write operation on the object of 0x1801 index and 03 sub-index. (Refer to Appendix1 for the object of 0x1801 index and 03 sub-index. The object indicates the prohibition time of PDO2 Tx.)
Write example: To modify the prohibition time of PDO2 Tx into 1000ms, write command of the master station goes as follows.

COB-ID	Request code	Object index		Sub-index	Request data			
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x603	0x2B	0x01	0x18	0x03	0xe8	0x03	0x00	0x00

After receiving the command from the master station, the slave station will respond the following command if the modification succeeds.

COB-ID	Response code	Object index		Sub-index	Response data			
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x583	0x60	0x01	0x18	0x03	0x00	0x00	0x00	0x00

Read example: To read the prohibition time of PDO2 Tx, read command of the master station goes as follows.

COB-ID	Request code	Object index		Sub-index	Request data			
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x603	0x40	0x01	0x18	0x03	0x00	0x00	0x00	0x00

After receiving the command from the master station, the slave station will respond the following command if the prohibition time of PDO2 Tx is 1000ms.

COB-ID	Response code	Object index		Sub-index	Response data			
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x583	0x43	0x01	0x18	0x03	0xe8	0x03	0x00	0x00

Example of read and write error: The read command of the master station for the object dictionary where read does not exist (0x6000 index, 0x00 sub-index) goes as follows.

COB-ID	Request code	Object index		Sub-index	Request data			
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x603	0x40	0x00	0x60	0x00	0x00	0x00	0x00	0x00

Because the object does not exist, the slave station responds read and write error command.

COB-ID	Response code	Object index		Sub-index	Response data			
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x583	0x80	0x00	0x60	0x00	0x00	0x00	0x02	0x06

0x06020000 error code for response indicates that the object dictionary does not exist.

8. PDO

The communication card defines four of PDO Tx (0x1800~0x1803) and four of PDO Rx (0x1400~0x1403) for usage. PDO Rx is the PDO command that the slave station receives from the master station while PDO Tx is the PDO command that the slave station sends to the master station.
The control word, state word, set value and return value of each PDO are defined with object dictionary defined by manufacturer. The purpose is to monitor the process quantity of the inverter either by PDO or by SDO. The following PDO commands are marked with object dictionary defined by manufacturer in format 0xXXXX.HH. XXXX and HH separately stand for index and sub-index in hexadecimal.

8.1 Trigger modes of PDO Tx

Each PDO Tx is defined with transmission type, prohibition time and event timer. They separately correspond to sub-indexes 0x02, 0x03 and 0x05. Therefore, the object dictionary index the transmission type of PDO2 Tx corresponds to is 0x1801, the sub-index is 0x02, similarly for other PDO Tx. Refer to Appendix object dictionary for detailed information. The unit of prohibition time and event timer is millisecond.
Synchronous trigger: When the transmission type is set to 1~240, PDO Tx is synchronous transmission. For example, set PDO2 Tx transmission type to n (1≤n≤240). Then the slave station will send a PDO2 Tx command once it receives n of SYNC, similarly for other PDO Tx.
Asynchronous trigger (254): When the event timer is non-zero, the slave station will send PDO Tx regularly. For example, the event timer of PDO2 Tx is set to 200, the slave station will send a PDO2 Tx every 200ms. When the event timer is zero, the slave station will send the PDO Tx as long as corresponding PDO Tx data change. However, the interval for sending is limited by prohibition time. The same PDO Tx can be sent only once in prohibition time to reduce the load of bus efficiently. When the prohibition time is less than 50ms, work according to 50ms.
Asynchronous trigger (255): When the event timer is non-zero, the slave station will send PDO Tx regularly. For example, the event timer of PDO2 Tx is set to 200, the slave station will send a PDO2 Tx every 200ms. When the event timer is zero, the slave station will send the PDO Tx as long as it receives corresponding PDO Rx. For example, the slave station will send a PDO2 Tx after receiving a PDO2 Rx.

Table16 Avaliable trigger modes

Trigger mode	Transmission type(decimal)	Event trigger	PDO1 TX	PDO2 TX	PDO3 TX	PDO4 TX
Syn	1~240	/	Not available	Available	Available	Available
Asyn	254	Event timer	Not available	Available	Available	Available
		Prohibition time	Not available	Available	Available	Available
	255	Event timer=0	Available	Available	Available	Available
		Event timer	Not available	Available	Available	Available

Table17 PDO Tx default values

	PDO1 TX	PDO2 TX	PDO3 TX	PDO4 TX
Transmission type	255	254	254	254
Event timer (ms)	0	0	0	0
Prohibition time (ms)	500	500	500	500

Please refer to SDO for information on how to set trigger types of PDO Tx.

8.2 PDO1

PDO1 is used to read and write inverter parameters. PDO1 has similar functions as SDO, SDO for object dictionary read and write while PDO1 for inverter parameters read and write.
Note: PDO1 Tx only supports asynchronous transmission 255, so do not set the transmission into other types, nor set the event timer for sending the master station PDO1 Tx regularly.

8.2.1 PDO1 Rx

- **Command**

Request: master station →slave station

COB-ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5
0x200+NODE-ID	Request code		Parameter address		Request data	
	0x2100.00		0x2100.01		0x2100.02	

- **Instruction**

The request code has two bytes with low Byte0 and high Byte1. The object dictionary defined by manufacturer is: index 0x2100, sub-index 0x00. See the functions of the request code in Table18.

Table18 Functions of request code

Request code	Function
0	No task
1	Read parameters
2	Modify parameters [only RAM]
4	Modify parameters [both RAM and EEPROM] (reserved)

The parameter address made up of two bytes with low Byte2 and high Byte3 indicates read or modified data address.

Parameter address of HD1 series inverters: The high byte is the number in front of decimal point of the function code while the low byte is the number behind decimal point; the address should be converted into hexadecimal. Take P10.01 for example, 0x0A for the high bit of parameter address due to 10 in front of decimal, 0x01 for the low bit of parameter address due to 01 behind decimal point, so the address of the function code is 0x0A01.

Table19 Parameter address of GD series inverters

Function code	Name	Detailed instruction of parameters	Setting range	Default value	Modify
P10.00	Simple PLC	0: Stop after once running 1: Keep running at final value after once running 2: Cycle running	0~2	0	○
P10.01	Simple PLC memory	0: No memory after powering-off 1: Memorize after powering-off	0~1	0	○

Parameter address of CHV series inverters: The value that the serial number of each function code corresponds to in the appendix of list of function parameters is the parameter address. It has to be converted into hexadecimal. For example, the serial number of function code Pd.14 is 1314, the address is 0x522 (1314 for decimal).
The request data made up of two bytes with low Byte4 and high Byte5 indicates modified data. For read command, the request data will be meaningless.
Note: Data area of PDO1 Rx must have six bytes; otherwise, the communication card will send EMCY.

8.2.2 PDO1 Tx

- **Command**

Response: slave station→master station

COB-ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x180+NODEID	Response code		Error code		Response data		0x00	0x00
	0x2000.00		0x2000.01		0x2000.02		-	-

- **Instruction**

Byte6 and Byte7 are reserved to be 0x00.
The response code has two bytes, Byte0 for low byte, Byte1 for high byte, and its functions are shown in Table20.

Table20 Functions of response code

Response code	Function
0	No response
1	Read and write succeeded
3	Read and write error, refer to Table21 for error code

Response data have four bytes, Byte4 for low byte, Byte7 for high byte. For write command response, the response data will be modified data while for read command response, the response data will be read data.
The error code has two bytes, Byte2 for low byte, Byte3 for high byte, and it is valid only when the response code equals to 3. Refer to Table21 for reasons that error code cannot respond PDO1 Rx.

Table 21 Error codes

Code	Name	Meaning
00H	No error	
01H	Illegal command	The request code does not allow the operation. It is possible that the function code is only available for a new device but unavailable for this device, or the slave station deals with the request in error condition.
02H	Illegal data address	The device of slave station does not allow the parameter address on the request of master station; specially, the combination between register address and transmitted bytes is invalid.
03H	Illegal value	Received data field includes illegal value indicating the error on remaining structure of combination request. Note: The value does not mean that there is a value out of application expectation for the storing data items in register.
04H	Operation failed	Write operation is invalid to parameter setting. For example, the function input terminal cannot be set repeatedly.
05H	Password error	The password for password check address is different from the password set by users.
06H	Data frame error	In the information sent by the upper computer, the length of data frame is incorrect, or the calculations of CRC check in RTU format and lower computer verification are asynchronous.
07H	Read-only parameters	The parameters modified in write operation for master station are read-only.
08H	Unmodifiable parameters in running	The parameters modified in write operation for master station are unmodifiable in running.
09H	Password protection	During master station read or write, if setting user password but not unlocking according to password, it will report the system is locked.

- **Example**

For example, when slave station address=3, set the function code of HD1 inverter P15.13=1.
Command: The parameter address of P15.02 is 0x0F02. According to the protocol, the request code, parameter address and request data of PDO1 Rx are seperately 0x02, 0x0F0D and 0x01, so PDO1 Rx sent by master station is shown as follows.

COB-ID	Request code		Parameter address		Request data	
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5
0x203	0x02	0x00	0x02	0x0F	0x01	0x00

If the inverter parameters are modified successfully, PDO1 Tx in response is as follows.

COB-ID	Response code		Error code		Response data		-	
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x183	0x01	0x00	0x00	0x00	0x01	0x00	0x00	0x00

8.3 PDO2 Rx

PDO2 Rx is used to modify control word and realtime process quantities (set value1, 2 and 3). The control word is for controlling start-up/stop of the inverter while set values are for controlling realtime running values such as set frequency.

- **Command**

Master station →slave station

COB-ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x300+NODEID	Control word		Set value1		Set value2		Set value3	
	0x2101.00		0x2100.03		0x2100.04		0x2100.05	

- **Instruction**

The control word has two bytes, Byte0 for low byte, Byte1 for high byte. The definition of control word for HD1 inverter is shown in Table22. As other models, please refer to related inverter manuals.

Table22 Definition of control word for HD1 inverter

Bit	Name	Value	Instruction
0~7	Communication control command	1	Forward running
		2	Reverse running
		3	Forward jogging
		4	Reverse jogging
		5	Stop
		6	Coast to stop (Emergency stop)
		7	Fault reset
		8	Jogging stop
8	Reserved		
9~10	Motor group selection	00	MOTOR GROUP 1 SELECTION (select motor1)
		01	MOTOR GROUP 2 SELECTION (select motor2)
		02	MOTOR GROUP 3 SELECTION (select motor3)
		03	MOTOR GROUP 4 SELECTION (select motor4)
11	Torque control selection	1	Torque control enable
		0	Torque control disable
14	Reserved	1	
		0	
15	Reserved	1	
		0	

The function of each set value can be set by the function codes in the same way as PZD receiving of CANOPEN communication. Please refer to the inverter manual. The set value1, 2 and 3 seperately correspond to PZD2, PZD3 and PZD4 receiving. It is only necessary to select “1: set frequency” for PZD2 receiving to set the set value1 to set frequency, similarly for functions of other set values. When multiple set values are enabled at the same time, there will be no influence on other values setting if a value setting fails (for example, out of range).

- **Example**

When the slave address=3, adopt CANopen communication to control HD1 inverter and set the running frequency at 50Hz.
Command: At first, set start mode of the inverter to CANopen communication (P00.01=2, P00.02=1) and frequency reference way to CANopen communication (P00.06=9). Then use the set value2 to give running frequency (P15.03=1, that is to say, select “1: set frequency” for PZD3.)
Control word=0x01 indicates to run the inverter. The frequency is set to 50Hz, so the set value2 equals to 5000, that is to say, 0x1388.
PDO1 Rx command sent by master station is as follows.

COB-ID	Control word		Set value1		Set value2		Set value3	
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x303	0x01	0x00	0x00	0x00	0x88	0x13	0x00	0x00

8.4 PDO2 Tx

PDO2 Tx, the command sent by the inverter to master station, contains state word and realtime process quantity (set value1, 2 and 3). The state word is to report the state of the inverter and the return value is to send realtime running values of the inverter, such as running frequency.
The default transmission type of PDO2 Tx is 254. PDO2 Tx will be sent as long as the state word or any return value changes.

- **Command**

Slave station →master station

COB-ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x280+NODEID	State word		Return value1		Return value2		Return value3	
	0x2001.00		0x2000.03		0x2000.04		0x2000.05	

- **Instruction**

The state word has two bytes with Byte0 for low byte and Byte1 for high byte. The definition of the state value for HD1 inverter is shown in Table23. As other models, please refer to related inverter manuals.

Table 23 Definition of state word for HD1 inverter

Bit	Name	Value	Instruction
0~7	Byte of running state	1	Inverter forward running
		2	Inverter reverse running
		3	Inverter stop
		4	Inverter fault
		5	Inverter POFF
8	Bus voltage set up	1	Ready for running
		0	Not ready for running
9~10	Motor group feedback	0	Motor1 feedback
		1	Motor2 feedback
		2	Motor3 feedback
		3	Motor4 no feedback
11	Motor type feedback	1	Synchronous motor
		0	Asynchronous motor
12	Overload pre-alarm feedback	1	Overload pre-alarm
		0	Non-overload pre-alarm
13	In exciting	1	In exciting
		0	Set up magnetic flux
14	Reserved	1	
		0	
15	Reserved	1	
		0	

The function of each return value can be set by the function codes of the inverter in the same way as PZD sending of CANopen communication. Please refer to the inverter manual. The return value1, 2 and 3 seperately correspond to PZD2, PZD3 and PZD4 sending. It is only necessary to select “1: set frequency” for PZD2 sending to set the return value1 to running frequency, similarly for functions of other return values. Multiple return values can be enabled at the same time.

- **Example**

For example, the inverter model is HD1 inverter and the slave address is 3. If the inverter is running, its running frequency equals to 50.00Hz. Set the return value1 to running frequency function, the return value2 to output voltage function and the return value3 to no function.

Command: Set the return value1 to inverter running frequency (P15.13=1), the return value2 to inverter output voltage (P15.14=4) and the return value3 to invalid (P15.15=0).

Because the inverter is running forward, and the bus voltage has been set up, the state word=0x0101; due to 50.00Hz running frequency, the return value1=5000, that is to say 0x1388. If the output voltage is 380V, the return value2=0x017C.

PDO1 Tx command sent by the inverter is as follows.

COB-ID	State word		Return value1		Return value2		Return value3	
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x283	0x01	0x01	0x88	0x13	0x7C	0x01	0x00	0x00

8.5 PDO3 Rx and PDO4 Rx

PDO3 Rx and PDO4 Rx are used to modify realtime process quantity of the inverter, such as set frequency.

- **PDO3 Rx command**

Master station →slave station

COB-ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x400+NODEID	Set value4		Set value5		Set value6		Set value7	
	0x2100.06		0x2100.07		0x2100.08		0x2100.09	

- **PDO4 Rx command**

Master station →slave station

COB-ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x500+NODEID	Set value8		Set value9		Set value10		Set value11	
	0x2100.0a		0x2100.0b		0x2100.0c		0x2100.0d	

- **Instruction**

The usage of PDO3 Rx and PDO4 Rx is the same as that of PDO2 Rx. The corresponding relations between the set values and CANOPEN PZD are shown in Table24.

8.6 PDO3 Tx and PDO4 Tx

PDO3 Tx and PDO4 Tx are used for the inverter to send realtime process quantity to master station, such as running frequency.

PDO3 Tx or PDO4 Tx will be sent as long as the return value in the same command changes.

- **PDO3 Tx command**

Slave station →master station

COB-ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x380+NODEID	Return value4		Return value5		Return value6		Return value7	
	0x2000.06		0x2000.07		0x2000.08		0x2000.09	

- **PDO4 Tx command**

Slave station →master station

COB-ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x480+NODEID	Return value8		Return value9		Return value10		Return value11	
	0x2000.0a		0x2000.0b		0x2000.0c		0x2000.0d	

- **Instruction**

The usage of PDO3 Tx and PDO4 Tx is the same as that of PDO2 Tx. The corresponding relations between the return values and ANopen PZD are shown in Table25.

9. SDO

Besides PDO, SDO can be also used to monitor the process quantity of the inverter. Users can choose PDO or SDO freely. SDO monitors the inverter by reading object dictionary defined by manufacturer.
Please refer to PDO for the definition and usage of the control word, state word, set value and return value in object dictionary defined by manufacturer, and SDO for SDO instruction. Do not try to read and write inverter parameters via SDO.
The object dictionary defined by manufacturer is shown in Table24 and Table25.

Table24 Control section of object dictionary defined by manufacturer

Index (hex)	Sub-index (hex)	Function	Access right	Data length	Description
2100	0	Request code (Do not use.)	RW	2 Byte	
	1	Parameter address (Do not use.)	RW	2 Byte	
	2	Request data (Do not use.)	RW	2 Byte	
	3	Set value1	RW	2 Byte	Correspond to PZD2 receiving
	4	Set value2	RW	2 Byte	Correspond to PZD3 receiving
	5	Set value3	RW	2 Byte	Correspond to PZD4 receiving
	6	Set value4	RW	2 Byte	Correspond to PZD5 receiving
	7	Set value5	RW	2 Byte	Correspond to PZD6 receiving
	8	Set value6	RW	2 Byte	Correspond to PZD7 receiving
	9	Set value7	RW	2 Byte	Correspond to PZD8 receiving
	A	Set value8	RW	2 Byte	Correspond to PZD9 receiving
	B	Set value9	RW	2 Byte	Correspond to PZD10 receiving
	C	Set value10	RW	2 Byte	Correspond to PZD11 receiving
	D	Set value11	RW	2 Byte	Correspond to PZD12 receiving
	E	Reserved	RW	2 Byte	
	F	Reserved	RW	2 Byte	
2101	0	Control word	RW	2 Byte	

Table25 State section of object dictionary defined by manufacturer

Index (hex)	Sub-index (hex)	Function	Access right	Data length	Description
2000	0	Response code (Do not use.)	RO	2 Byte	
	1	Error code (Do not use.)	RO	2 Byte	
	2	Response data (Do not use.)	RO	2 Byte	
	3	Return value1	RO	2 Byte	Correspond to PZD2 sending
	4	Return value2	RO	2 Byte	Correspond to PZD3 sending
	5	Return value3	RO	2 Byte	Correspond to PZD4 sending
	6	Return value4	RO	2 Byte	Correspond to PZD5 sending
	7	Return value5	RO	2 Byte	Correspond to PZD6 sending
	8	Return value6	RO	2 Byte	Correspond to PZD7 sending
	9	Return value7	RO	2 Byte	Correspond to PZD8 sending
	A	Return value8	RO	2 Byte	Correspond to PZD9 sending
	B	Return value9	RO	2 Byte	Correspond to PZD10 sending
	C	Return value10	RO	2 Byte	Correspond to PZD11 sending
	D	Return value11	RO	2 Byte	Correspond to PZD12 sending
	E	Reserved	RO	2 Byte	
	F	Reserved	RO	2 Byte	
2001	0	State word	RO	2 Byte	

- **Example**

Example 1: When the inverter at address 3 runs forward, the master station will send following SDO command.

COB-ID	Request code	Object index		Sub-index	Request data			
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x603	0x2B	0x01	0x21	0x00	0x01	0x00	0x00	0x00

Example 2: If the slave address=3 and the set value1 is defined to be set frequency, set the frequency to 50.00Hz (set value1=0x1388). The master station will send following SDO command.

COB-ID	Request code	Object index		Sub-index	Request data			
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x603	0x2B	0x00	0x21	0x03	0x88	0x13	0x00	0x00

Example 3: To read the running state of the inverter at address 3, the master station will send following SDO command.

COB-ID	Request code	Object index		Sub-index	Request data			
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x603	0x40	0x01	0x20	0x00	0x00	0x00	0x00	0x00

If the inverter is running forward, the master station will return following SDO command.

COB-ID	Request code	Object index		Sub-index	Request data			
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x583	0x4B	0x01	0x20	0x00	0x01	0x01	0x00	0x00

Example 4: The slave address is 3 and the set value1 is defined to be running frequency. To read the running frequency of the inverter, the master station will send following SDO command.

COB-ID	Request code	Object index		Sub-index	Request data			
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x603	0x40	0x00	0x20	0x03	0x00	0x00	0x00	0x00

If the running frequency is 50.00Hz, SDO command returned to the master station is as follows.

COB-ID	Request code	Object index		Sub-index	Request data			
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x583	0x4B	0x00	0x20	0x03	0x88	0x13	0x00	0x00

10. Baud rate and communication address

10.1 Baud rate setting

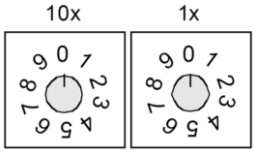
The setting of CANopen baud rate and communication address is not valid until reboot.
CANopen baud rate is set by the function code parameters of the inverter. Please refer to the inverter manual for function code addresses. The baud rate corresponding to the function code parameters is shown in Table 26.

Table 26 Baud rate

Function code parameters	Baud rate (bit/second)
0	1000k
1	800k
2	500k
3	250k
4	125k
5	100k
6	50k
7	20k

10.2 Communication address setting

There are two ways to set CANopen communication address.
One is hardware address. That is to say, when the address of the knob on the communication card equals to non-zero, knob address will be communication address. Hardware address is binary digit in the range of 00~99.
Communication address=10xhigh address knob number+low address knob number

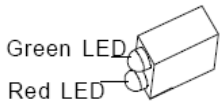


The other is software address. When the address of the knob on the communication card equals to 00, the inverter address is the address set by function codes. Please refer to the inverter manual for detailed information.
If two address knobs are not installed, the default hardware address is 00 and communication address can be only set by function codes.

11. State LED

Names of CANopen state LED are shown in Table 27.

Table 27 Names of CANopen state LED

State LED	Name	Color
	Running LED (RUN)	Green
	Error LED (ERROR)	Red

The descriptions of running LED and error LED are shown in Table 28 and Table 29.

Table 28 Description of error LED (ERROR)

No.	Error	State	Description
1	Off	No error	Components in working state
2	On	Bus switched off or inverter fault	CAN controller bus switched off or inverter fault
3	Flickering	Initialization error	Address setting error
4	Flickered and off	Frame error	Receiving frame loss or error

Table 29 Description of running LED (RUN)

No.	Run	State	Description
1	Flickered and off	Stop	Components in stop state
2	Flickering	Pre-operation	Components under pre-operation
3	On	Operation	Components under operation
4	Off	Fault	Check whether the connection of reset pins and power supply is correct.

Appendix 1 OD

Index(hex)	Sub-index	Description	Access right	Data type	Default value
1000	0	Device type	RO	Unsigned32	0x0000 0000
1001	0	Error register	RO	Unsigned8	
1003	**Error code register**				
	0	Sub-index number	RW		
	1	Error code	RO	Unsigned32	
1005	0	COB-ID SYNC	RW	Unsigned32	
1006	0	Communication cycle period	RW	Unsigned32	
1007	0	Synchronous window length	RW	Unsigned32	
1008	0	Manufacturer and device name	CONST	String	IMO CANopen
1009	0	Hardware version	CONST	String	V1.00
100A	0	Software version	CONST	String	V1.00
100C	0	Protection time	RW	Unsigned16	0
100D	0	Life cycle factor	RW	Unsigned16	0
1016	**Heartbeat time of customers**				
	0	Sub-index number	RO	Unsigned8	
	1	Heartbeat time of customers	RW	Unsigned32	
1017	0	Heartbeat time of manufacturer	RW	Unsigned16	0
1018	**Object identification**				
	0	Sub-index number	RO	Unsigned8	4
	1	Supplier ID	RO	Unsigned32	0x0000 0000
	2	Product code	RO	Unsigned32	0x0000 0000
	3	Revision number	RO	Unsigned32	0x0000 0000
	4	Serial number	RO	Unsigned32	0x0000 0000
1200	**Server SDO**				
	0	Sub-index number	RO	Unsigned8	
	1	COB-ID client -> server (Rx)	RO	Unsigned32	600H+node ID
	2	COB-ID server -> client (Tx)	RO	Unsigned32	580H+node ID
1280	**Client SDO**				
	0	Sub-index number	RO	Unsigned8	
	1	COB-ID client -> server (Rx)	RO	Unsigned32	
	2	COB-ID server -> client (Tx)	RO	Unsigned32	
	3	Node ID of server SDO	RO	Unsigned8	
1400	**PDO1 Rx communication parameters**				
	0	Avaliable maximum sub-index	RO	Unsigned8	
	1	COB-ID used by PDO	RW	Unsigned32	
	2	Transmission type	RW	Unsigned8	
	3			Unsigned16	
	4			Unsigned8	
	5	Event timer	RW	Unsigned16	
1401	**PDO2 Rx communication parameters**				
	0	Avaliable maximum sub-index	RO	Unsigned8	
	1	COB-ID used by PDO	RW	Unsigned32	
	2	Transmission type	RW	Unsigned8	
	3			Unsigned16	
	4			Unsigned8	
	5	Event timer	RW	Unsigned16	
1402	**PDO3 Rx communication parameters**				
	0	Avaliable maximum sub-index	RO	Unsigned8	
	1	COB-ID used by PDO	RW	Unsigned32	

Index(hex)	Sub-index	Description	Access right	Data type	Default value
	2	Transmission type	RW	Unsigned8	
	3			Unsigned16	
	4			Unsigned8	
	5	Event timer	RW	Unsigned16	
	PDO4 Rx communication parameters				
	0	Avaliable maximum sub-index	RO	Unsigned8	
	1	COB-ID used by PDO	RW	Unsigned32	
1403	2	Transmission type	RW	Unsigned8	
	3			Unsigned16	
	4			Unsigned8	
	5	Event timer	RW	Unsigned16	
	PDO1 Rx mapping parameters				
	0	Mapping application objects in PDO	RW	Unsigned8	3
1600	1	The 1st mapping object	RW	Unsigned32	0x21000010
	2	The 2nd mapping object	RW	Unsigned32	0x21000110
	3	The 3rd mapping object	RW	Unsigned32	0x21000210
	PDO2 Rx mapping parameters				
	0	Mapping application objects in PDO	RW	Unsigned8	4
1601	1	The 1st mapping object	RW	Unsigned32	0x21010010
	2	The 2nd mapping object	RW	Unsigned32	0x21000310
	3	The 3rd mapping object	RW	Unsigned32	0x21000410
	4	The 4th mapping object	RW	Unsigned32	0x21000510
	PDO3 Rx mapping parameters				
	0	Mapping application objects in PDO	RW	Unsigned8	4
1602	1	The 1st mapping object	RW	Unsigned32	0x21000610
	2	The 2nd mapping object	RW	Unsigned32	0x21000710
	3	The 3rd mapping object	RW	Unsigned32	0x21000810
	4	The 4th mapping object	RW	Unsigned32	0x21000910
	PDO4 Rx mapping parameters				
	0	Mapping application objects in PDO	RW	Unsigned8	4
1603	1	The 1st mapping object	RW	Unsigned32	0x21000a10
	2	The 2nd mapping object	RW	Unsigned32	0x21000b10
	3	The 3rd mapping object	RW	Unsigned32	0x21000c10
	4	The 4th mapping object	RW	Unsigned32	0x21000d10
	PDO1 Tx communication parameters				
	0	Avaliable maximum sub-index	RO	Unsigned8	
	1	COB-ID used by PDO	RW	Unsigned32	
1800	2	Transmission type	RW	Unsigned8	255
	3	Prohibition time	RW	Unsigned16	500
	4	Reserved	RW	Unsigned8	
	5	Event timer	RW	Unsigned16	0
	PDO2 Tx communication parameters				
	0	Avaliable maximum sub-index	RO	Unsigned8	
	1	COB-ID used by PDO	RW	Unsigned32	
1801	2	Transmission type	RW	Unsigned8	254
	3	Prohibition time	RW	Unsigned16	500
	4	Reserved	RW	Unsigned8	
	5	Event timer	RW	Unsigned16	0
1802	**PDO3 Tx communication parameters**				
	0	Avaliable maximum sub-index	RO	Unsigned8	

Index(hex)	Sub-index	Description	Access right	Data type	Default value
	1	COB-ID used by PDO	RW	Unsigned32	
	2	Transmission type	RW	Unsigned8	254
	3	Prohibition time	RW	Unsigned16	500
	4	Reserved	RW	Unsigned8	
	5	Event timer	RW	Unsigned16	0
1803	**PDO4 Tx communication parameters**				
	0	Avaliable maximum sub-index	RO	Unsigned8	
	1	COB-ID used by PDO	RW	Unsigned32	
	2	Transmission type	RW	Unsigned8	254
	3	Prohibition time	RW	Unsigned16	500
	4	Reserved	RW	Unsigned8	
	5	Event timer	RW	Unsigned16	0
1A00	**PDO1 Tx mapping parameters**				
	0	Mapping application objects in PDO	RW	Unsigned8	3
	1	The 1st mapping object	RW	Unsigned32	0x20000010
	2	The 2nd mapping object	RW	Unsigned32	0x20000110
	3	The 3rd mapping object	RW	Unsigned32	0x20000210
1A01	**PDO2 Tx mapping parameters**				
	0	Mapping application objects in PDO	RW	Unsigned8	4
	1	The 1st mapping object	RW	Unsigned32	0x20010010
	2	The 2nd mapping object	RW	Unsigned32	0x20000310
	3	The 3rd mapping object	RW	Unsigned32	0x20000410
	4	The 4th mapping object	RW	Unsigned32	0x20000510
1A02	**PDO3 Tx mapping parameters**				
	0	Mapping application objects in PDO	RW	Unsigned8	4
	1	The 1st mapping object	RW	Unsigned32	0x20000610
	2	The 2nd mapping object	RW	Unsigned32	0x20000710
	3	The 3rd mapping object	RW	Unsigned32	0x20000810
	4	The 4th mapping object	RW	Unsigned32	0x20000910
1A03	**PDO4 Tx mapping parameters**				
	0	Mapping application objects in PDO	RW	Unsigned8	4
	1	The 1st mapping object	RW	Unsigned32	0x20000a10
	2	The 2nd mapping object	RW	Unsigned32	0x20000b10
	3	The 3rd mapping object	RW	Unsigned32	0x20000c10
	4	The 4th mapping object	RW	Unsigned32	0x20000d10

Appendix 2 Function codes (HD1 inverter)

Function code	Name	Detailed instruction of parameters	Setting range	Default value	Modify
P00.01	Running command channel	0: Keypad running command channel (LED off) 1: Terminal running command channel (LED flickering) 2: Communication running command channel (LED on)	0~2	0	○
P00.02	Communication running command channel	0: MODBUS communication channel 1: CANOPEN communication channel 2: Ethernet communication channel 3: CAN communication channel	0~3	0	○
P00.06	A frequency command	9: CANOPEN communication setting	0~12	0	○
P00.07	B frequency command		0~12	1	○
P03.11	Torque setting way	8: CANOPEN communication setting torque	0~10	0	○
P03.14	Forward upper limit frequency setting source of torque control	7: CANOPEN communication setting upper limit frequency	0~9	0	○
P03.15	Reverse upper limit frequency setting source of torque control		0~9	0	○
P03.18	Electric torque upper limit setting source	6: CANOPEN communication setting torque upper limit	0~8	0	○
P03.19	Braking torque upper limit setting source		0~8	0	○
P04.27	Voltage setting channel	8: CANOPEN communication setting voltage	0~10	0	○
P05.12	Virtual terminal setting	2: CANOPEN communication virtual terminals are valid.	0~4	0	◎
P06.01	Y output	24: CANOPEN communication virtual terminal output	0~40	0	○
P06.02	HDO output		0~40	0	○
P06.03	Relay RO1 output		0~40	1	○
P06.04	Relay RO2 output		0~40	5	○
P06.14	AO1 output	16: CANOPEN communication set value1 17: CANOPEN communication set value2	0~30	0	○
P06.15	AO2 output		0~30	0	○
P06.16	HDO high speed pulse output		0~30	0	○
P07.27	Current fault type	0: No fault 1: Inverter unit U-phase protection (out1) 2: Inverter unit V-phase protection (out2) 3: Inverter unit W-phase protection (out3) 4: ACC overcurrent (OC1) 5: DEC overcurrent (OC2) 6: Constant speed overcurrent (OC3) 7: ACC overvoltage (OV1) 8: DEC overvoltage (OV2) 9: Constant speed overvoltage (OV3) 10: Bus undervoltage (UV) 11: Motor overload (OL1) 12: Inverter overload (OL2) 13: Phase loss of input side (SPI) 14: Phase loss of output side (SPO) 15: Rectifier module overheat (OH1) 16: Inverter module overheat (OH2) 17: External fault (EF) 18: 485 communication error (CE) 19: Current detection fault (ItE) 20: Motor autotuning error(tE) 21: EEPROM operation failure (EEP) 22: PID feedback offline (PIDE) 23: Braking unit fault (bCE) 24: Running time arrival (END) 25: Electronic overload (OL3) 26: Panel communication error (PCE) 27: Upload parameter error (UPE) 28: Download parameter error (DNE) 29: CANOPEN communication error (E-DP) 30: Ethernet communication error (E-NET) 31: CAN communication error (E-CAN) 32: Short circuit to earth fault1 (ETH1)			●
P07.28	Last one fault type				●
P07.29	Last two fault types				●
P07.30	Last three fault types				●
P07.31	Last four fault types				●
P07.32	Last five fault types				●

Function code	Name	Detailed instruction of parameters	Setting range	Default value	Modify
		33: Short circuit to earth fault2 (ETH2) 34: Speed deviation fault (dEu) 35: Detuning fault (STo) 36: Underload (LL) 37: Encoder offline (ENC1O) 38: Encoder reverse direction fault (ENC1D)			
P09.00	PID reference source	7: CANOPEN communication setting	0~9	0	○
P09.02	PID feedback source	5: CANOPEN communication feedback	0~7	0	○
P15.01	Module address	0~127	0~127	2	◎
P15.02	PZD2 receiving	0: Invalid 1: Set frequency 2: PID reference 3: PID feedback 4: Torque set value 5: Set value of forward upper limit frequency 6: Set value of reverse upper limit frequency 7: Upper limit of electric torque 8: Upper limit of braking torque 9: Virtual input terminal command 10: Virtual output terminal command 11: Voltage set value 12: AO output set value1 13: AO output set value2	0~20	0	○
P15.03	PZD3 receiving		0~20	0	○
P15.04	PZD4 receiving		0~20	0	○
P15.05	PZD5 receiving		0~20	0	○
P15.06	PZD6 receiving		0~20	0	○
P15.07	PZD7 receiving		0~20	0	○
P15.08	PZD8 receiving		0~20	0	○
P15.09	PZD9 receiving		0~20	0	○
P15.10	PZD10 receiving		0~20	0	○
P15.11	PZD11 receiving		0~20	0	○
P15.12	PZD12 receiving		0~20	0	○
P15.13	PZD2 sending	0: Invalid 1: Running frequency (*100, Hz) 2: Set frequency (*100, Hz) 3: Bus voltage (*10, V) 4: Output voltage (*1, V) 5: Output current (*10, A) 6: Output torque actual value (*10, %) 7: Output power actual value (*10, %) 8: Rotating speed (*1, RPM) 9: Linear speed (*1, m/s) 10: Ramp reference frequency 11: Fault code 12: AI1 value (*100, V) 13: AI2 value (*100, V) 14: AI3 value (*100, V) 15: PULSE frequency (*100, kHz) 16: Terminal input state 17: Terminal output state 18: PID reference (*100, %) 19: PID feedback (*100, %) 20: Motor rated torque	0~20	0	○
P15.14	PZD3 sending		0~20	0	○
P15.15	PZD4 sending		0~20	0	○
P15.16	PZD5 sending		0~20	0	○
P15.17	PZD6 sending		0~20	0	○
P15.18	PZD7 sending		0~20	0	○
P15.19	PZD8 sending		0~20	0	○
P15.20	PZD9 sending		0~20	0	○
P15.21	PZD10 sending		0~20	0	○
P15.22	PZD11 sending		0~20	0	○
P15.23	PZD12 sending		0~20	0	○
P15.26	Fault time of CANopen communication timeout	0.0 (invalid), 0.1~60s	0.0~60.0	0.0	○
P15.27	CANopen communication baud rate	0: 1000k 1: 800k 2: 500k 3: 250k 4: 125k 5: 100k 6: 50k 7: 20k	0~7	0	○

Note: Select related CANOPEN channel to enable CANopen functions. If the inverter manual changes, information will be subject to CANopen channel.

CANopen option card.

HD1-E-COP

Instruction Manual

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IMO Precision Controls Ltd

The purpose of this instruction manual is to provide accurate information for setting and programming CANopen communication protocol with HD1 series of inverters. Please feel free to send your comments regarding any errors or omissions you may have found, or any suggestions you may have for generally improving the manual.

In no event will IMO Precision Controls Ltd. be liable for any direct or indirect damages resulting from the application of the information in this manual.

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