

## INVERTER

# F510



## Communication - Addendum

CANopen

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## 1.0 CANopen high speed communication expansion card

### 1.0.1 Communication hardware and data structure

This product is the CANopen high-speed communication expansion module; it can perform remote setting and communication functions through the CANopen bus. It can only be used with the TECO A510s/F510 AC motor driver (hereinafter referred to as the “driver”), and allow the driver to operate on the CANopen network.

### 1.0.2 Product specifications

#### CANopen ports

Item	Specifications
Connector	5-pin open pluggable connector; pin spacing 5.08mm
Transmission rate	10kbps, 20kbps, 50kbps, 125kbps, 250kbps, 500kbps, 800kbps, 1Mbps
Network protocols	CANopen communication protocol

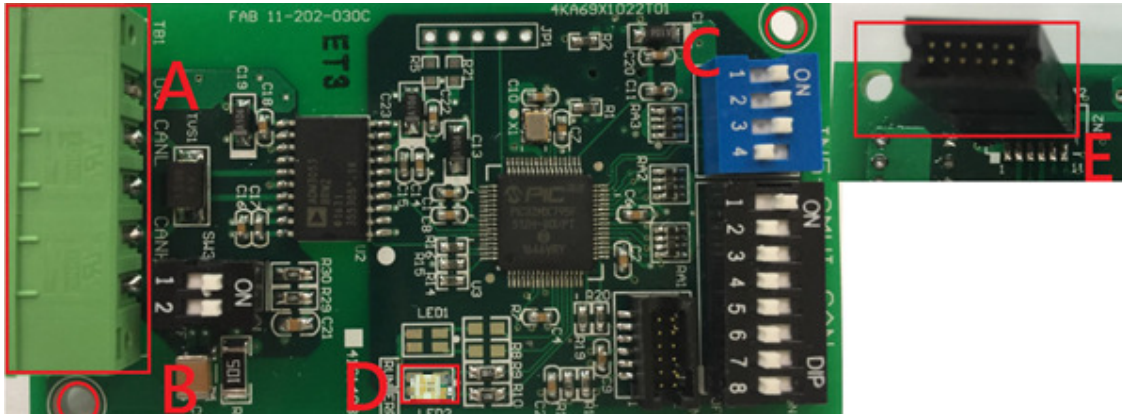
#### AC motor driver port

Item	Specifications
Connector	Control board CN2 connector
Transmission method	SPI high speed communication
Terminal functions	1. The communication module communicates with the AC motor driver through this interface. 2. The AC motor driver provides power to the communication module through this interface.
Communication protocols	TECO communication protocol

### 1.0.3 Installation instructions

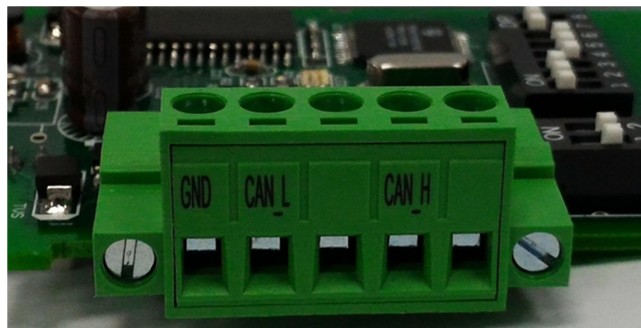
#### Communication module contact description

- As shown in the figure below, A – Terminal block (TB1)
- B, C – Mounting holes
- D - RUN LED
- E - ERR LED
- F – Control board connector (CN2)



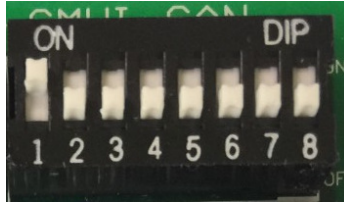
#### Terminal block definition

As shown in the figure below, the contact definitions in the order from left to right are GND, CAN\_L, NC, CAN\_H and NC.

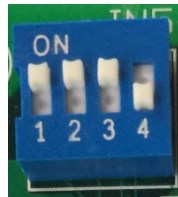


## ID address setting description

As shown in the figure below, ID addresses (1~127) correspond to SW1 b1~b7.



Transmission rate corresponds to SW2 b1~b3.



Function	DIP switch position	DIP switch status 7654321	Description
Network address Setting	SW1 b7—b1	0000000	Cannot be used
		0000001	Network address is 1
		0000010	Network address is 2
		0000011	Network address is 3
		.....	.....
		1111110	Network address is 126
		1111111	Network address is 127
CANopen Transmission rate setting	SW2 b3—b1	000	10K
		001	20K
		010	50K
		011	125K
		100	250K
		101	500K
		110	800K
		111	1M

Network address switch setting range: 1~127 (0, 128~255 cannot be used).

Transmission rate switch setting range: 0~7 (8~15 cannot be used).

### 1.0.4 LED indicator descriptions

The module has RUN (green) and ERR (red) indicators built-in used to quickly diagnose and monitor the communication statuses between the module itself and the bus.

#### Module status LED (RUN LED)

Used to monitor whether the equipment is operating normally.

Indicator statuses	Status name	Description
Does not light up	Initial status	Power not supplied
Continuous flashing	Pre-operation	Preparation status
Single flash	Stop	Stopping
Green light lights up	Operation	Operating

#### Error status LED (ERR LED)

Used to monitor the operability of the communication module CANopen network.

Indicator statuses	Status name	Description
Does not light up	No error	Operating
Single flash	Warning	Packet error
Double flash	Error	Guard/Heartbeat error
Red light lights up	Disconnected	Bus closed

### 1.0.5 Driver parameter setting descriptions

Used to monitor the operability of the communication module CANopen network.

Users must first confirm related parameter settings on the driver in order to ensure that the communication module can connect normally.

Parameters	Parameter name	Settings	Settings descriptions
00-02	Operation command source	2	Communication control
00-05	Frequency command source	3	Communication control

## 1.0.6 Connection instructions

### Service data object (SDO)

This module supports 1 SDO server, which means it can provide SDO service, and the SDO uses the sending and receiving COB-ID of the predefined connection, 0x580 + NodeID (sending) and 0x600 + NodeID (receiving).

Each SDO message includes a set of COB-ID (request SDO and response SDO); it allows performing of access actions within two nodes. SDO can transmit any size of data, but segment transmission must be used once it exceeds 4 bytes.

The COB IDs of SDO communication are as follows:

Read: Master to slave (request code 0x40) / Master to slave: 600H + Node ID

COB-ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
(600H) + Node ID	Request code	Object index		Object subindex	Request data			
		LSB	MSB		Reserved			

Read: Slave response / slave to master: 580H + Node ID

COB-ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
(580H) + Node ID	Request code	Object index		Object subindex	Request data			
		LSB	MSB		bit0~bit7	Bit8~bit15	Bit16~bit23	Bit24~bit31

Response code:

43H: Read 4-byte data / 4BH: read 2-byte data / 4FH: read 1-byte data

Write: Master to slave (4-byte data maximum)

COB-ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
(600H) + Node ID	Request code	Object index		Object subindex	Request data			
		LSB	MSB		bit0~bit7	Bit8~bit15	Bit16~bit23	Bit24~bit31

Request code:

23H: Write a 4-byte data entry

2BH: Write a 2-byte data entry

2FH: Write a 1-byte data entry

Write: Slave to master (response code 0x60H)

COB-ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
(580H) + Node ID	Request code	Object index		Object subindex	Request data			
		LSB	MSB		Reserved			

When we use SDO to perform control to the group 25H of the driver control group, corresponding rules are as follows:

Index
25xxH (register address)

For example, when we want to perform write/read to 2501H of the control group, the corresponding SDO object index is the control group register address 2501H. Perform operation with index 2501H directly and the module will automatically convert to the A510s 2501H control group register address to perform operation.



## 1.0.7 Object index list

### Basic index

Index	Sub	Name	Default value	R/W	Size	Remarks
1000H	0	Device type	00010192H	R	U32	
1001H	0	Error register	0	R	U8	
1005H	0	COB-ID SYNC message	80H	R	U32	
1006H	0	Communication cycle period	0	RW	U32	
1008H	0	Manufacturer device name	A510	R	U32	
1009H	0	Manufacturer hardware version	1.0	R	U32	
100AH	0	Manufacturer software version	1.00	R	U32	
1014H	0	COB-ID emergency	00000080H+Node-ID	R	U32	
1015H	0	Inhibit time EMCY	0	RW	U16	
1016H	0	number of entries	1	R	U8	
	1	Consumer heartbeat time	0	RW	U32	Not supported
1017H	0	Producer heartbeat time	0	RW	U16	
1018H	0	number of entries	3	R	U8	
	1	Vender ID	00000373H	R	U32	
	2	Product code	00000100H	R	U32	
	3	Revision	00010000H	R	U32	
1200H	0	Server SDO Parameter	2	R	U8	
	1	COB-ID Client Server	0000600H+Node-ID	R	U32	
	2	COB-ID Client Server	0000580H+Node-ID	R	U32	
1400H	0	Number of entries	2	R	U8	
	1	COB-ID used by PDO	00000200H+Node-ID	RW	U32	
	2	Transmission Type	0xFF	RW	U8	
1401H	0	Number of entries	2	R	U8	
	1	COB-ID used by PDO	00000300H+Node-ID	RW	U32	
	2	Transmission Type	0xFF	RW	U8	
1600H	0	Number of entries	2	RW	U8	
	1	1.Mapped Object	60400010H	RW	U32	
	2	2.Mapped Object	60420010H	RW	U32	
	3	3.Mapped Object	0	RW	U32	
	4	4.Mapped Object	0	RW	U32	

Index	Sub	Name	Default value	R/W	Size	Remarks
1601H	0	Number of entries	2	RW	U8	
	1	1.Mapped Object	604F0010H	RW	U32	
	2	2.Mapped Object	60500010H	RW	U32	
	3	3.Mapped Object	0	RW	U32	
	4	4.Mapped Object	0	RW	U32	
1800H	0	Number of entries	5	R	U8	Number of entries
	1	COB-ID used by PDO	180H+Node-ID	RW	U32	
	2	Transmission Type	0xFF	RW	U8	Transmission type
	3	Inhibit time	0x64	RW	U16	Inhibit time
	4	CMS-Priority Group	0	RW	U8	
	5	Event timer	0x64	RW	U16	Event timer
1801H	0	Number of entries	5	R	U8	Number of entries
	1	COB-ID used by PDO	00000280H+Node-ID	RW	U32	
	2	Transmission Type	0xFF	RW	U8	
	3	Inhibit time	0x64	RW	U16	Inhibit time
	4	CMS-Priority Group	0	RW	U8	
	5	Event timer	0x64	RW	U16	Event time
	4	CMS-Priority Group	0	RW	U8	
	5	Event timer	0x64	RW	U16	Event time
	2	Transmission Type	0xFF	RW	U8	
	3	Inhibit time	0x64	RW	U16	Inhibit time
	4	CMS-Priority Group	0	RW	U8	
	5	Event timer	0x64	RW	U16	Event time
1A00H	0	Number of entries	2	RW	U8	
	1	1.Mapped Object	60400010	RW	U32	
	2	2.Mapped Object	60420010	RW	U32	
	3	3.Mapped Object	0	RW	U32	
	4	4.Mapped Object	0	RW	U32	
1A01H	0	Number of entries	2	RW	U8	
	1	1.Mapped Object	604F0010	RW	U32	
	2	2.Mapped Object	60500010	RW	U32	
	3	3.Mapped Object	0	RW	U32	
	4	4.Mapped Object	0	RW	U32	

## DS402 part

Index	Sub-Index	Name	Default value	R/W	Size	Unit	PDO MAP
603F	0	Error code	0	RO	U16		Yes
6040	0	Control word	0	RW	U16		Yes
6041	0	Status word	0	RO	U16		Yes
6042	0	vl target velocity	0	RW	S16	Hz	Yes
6043	0	vl velocity demand	0	RO	S16	Hz	Yes
604F	0	vl ramp function time Acceleration time	100	RW	U16	0.1S	Yes
6050	0	vl slow down time Deceleration time	100	RW	U16	0.1S	Yes

## Driver control group command index

Command DATA (allows reading and writing)

Register address	Bit	Content
2500H		Reserved
2501H	0	Operation command      1: Operate      0: Stop
	1	Reverse command      1: Reverse      0: Forward
	2	External error      1: Error
	3	Error reset      1: Reset
	4	Reserved
	5	Reserved
	6	Multi-function terminal S1      1: "ON"
	7	Multi-function terminal S2      1: "ON"
	8	Multi-function terminal S3      1: "ON"
	9	Multi-function terminal S4      1: "ON"
	A	Multi-function terminal S5      1: "ON"
	B	Multi-function terminal S6      1: "ON"
	C	Multi-function terminal S7      1: "ON"
	D	Multi-function terminal S8      1: "ON"
E	Controller mode      1: "ON"	
F	Communication setting torque command      1: "ON"	
2502H		*Frequency command (Unit: 0.01Hz)
2505H		AO1 (0.00V ~ 10.00V)
2510H		G12-00 H-WORD
2511H		G12-00 L-WORD

Monitor DATA (read only)

Register address		Bit	Content	
2520H	Status signal	0	Operation status	1: Operate 0: Stop
		1	Direction status	1: Reverse 0: Forward
		2	Frequency converter operation preparation status	1: Preparation complete 0: Preparation not yet complete
		3	Error	1: Abnormal
		4	Warning	1: "ON"
		5	Zero speed	1: "ON"
		6	Model 440	1: "ON"
		7	Frequency reached	1: "ON"
		8	Any frequency reached	1: "ON"
		9	Frequency detection one	1: "ON"
		A	Frequency detection two	1: "ON"
		B	Low voltage	1: "ON"
		C	Frequency converter no output	1: "ON"
		D	Frequency not according to communication	1: "ON"
		E	Operation not according to communication	1: "ON"
		F	Over-torque	1: "ON"
2521H	Error description	0	Reserved	31 Reserved
		1	UV (Under-voltage)	32 Reserved
		2	OC (Over-current)	33 Reserved
		3	OV (Over-voltage)	34 Reserved
		4	OH1 (Heat sink overheat)	35 Reserved
		5	OL1 (Motor overload)	36 Reserved
		6	OL2 (Frequency converter overload)	37 Reserved
		7	OT (Over-torque)	38 CF07 (Motor control fault)
		8	UT (Under-torque)	39 Reserved
		9	SC (Short circuit)	40 Reserved
		10	GF (Ground fault)	41 Reserved
		11	FO	42 Reserved
		12	IPL (Input phase loss)	43 Reserved
		13	OPL (Output phase loss)	44 Reserved
		14	OS	45 Reserved
		15	PGO	46 OH4 (Motor overheat)

Register address		Bit	Content				
		16	DEV		47	Reserved	
		17	EF1		48	Reserved	
		18	EF2		49	MtrSw (DI Motor Switch Fault)	
		19	EF3		50	OCA (Acceleration over-current)	
		20	EF4		51	OCD (Deceleration over-current)	
		21	EF5		52	OCC (Operation over-current)	
		22	EF6		53	CF08	
		23	EF7		54	PTCLS	
		24	EF8		55	PF (Protection fault)	
		25	FB (PID feedback signal error)		56	TOL	
		26	OPR(Keypad Removed)		57	STO2 (Safety switch 2)	
		27	Reserved		58	Reserved	
		28	CE		59	Reserved	
		29	STO (Safety switch 1)		60	Reserved	
30	Reserved		61	Reserved			
2522H	DI status	0	Multi-function terminal S1	4	Multi-function terminal S5	8~F Reserved	
		1	Multi-function terminal S2	5	Multi-function terminal S6		
		2	Multi-function terminal S3	6	Multi-function terminal S7		
		3	Multi-function terminal S4	7	Multi-function terminal S8		
2523H		Frequency command (0.01Hz)					
2524H		Output frequency (0.01Hz)					
2526H		DC voltage command (0.1V)					
2527H		Output current (0.1A)					
2528H	Warning description	0	No alarm	30	RDE	60	Reserved
		1	OV	31	WRE	61	RETRY
		2	UV	32	FB	62	SE07
		3	OL2	33	VRYE	63	Reserved
		4	OH2	34	SE01	64	Reserved
		5	Reserved	35	SE02	65	OH1
		6	OT	36	SE03	66	FIRE
		7	Reserved	37	Reserved	67	ES

Register address	Bit	Content				
	8	Reserved	38	SE05	68	STP1
	9	UT	39	HPERR	69	BDERR
	10	OS	40	EF	70	EPERR
	11	PGO	41	Reserved	71	Reserved
	12	DEV	42	Reserved	72	Reserved
	13	CE	43	RDP	73	STP0
	14	CALL	44	Reserved	74	Reserved
	15	Reserved	45	OL1	75	STP2
	16	EF0	46	Reserved	76	RUNER
	17	EF1	47	Reserved	77	LOC
	18	EF2	48	Reserved	78	PTCLS
	19	EF3	49	BB1	79	Sys Init
	20	EF4	50	BB2	80	FBLSS
	21	EF5	51	BB3		
	22	EF6	52	BB4		
	23	EF7	53	BB5		
	24	EF8	54	BB6		
	25	Reserved	55	BB7		
	26	Reserved	56	BB8		
	27	Reserved	57	Reserved		
28	Reserved	58	Reserved			
29	Reserved	59	Reserved			
2529H		DO status				
252AH		AO1				
252BH		AO2				
252CH		AI 1 input (0.1%)				
252DH		AI 2 input (0.1%)				
252FH		L510(s)/ E510(s)/ A510(s)/ F510 Check				

## 1.0.8 Troubleshooting

There are two indicators on top of the CANopen communication module; when malfunction occurs, the cause of the malfunction can be confirmed based on the indicator statuses, and troubleshoot the error by following the descriptions below.

### Indicator troubleshooting

#### Module status LED (RUN LED)

Indicator statuses	Status name	Troubleshooting method
Does not light up	Power not supplied to the communication module	1. Confirm whether the driver power is normal. 2. Confirm whether the power terminal of the communication module is connected to the driver.

#### Error status LED (ERR LED)

Indicator statuses	Status name	Description
Single flash	CANopen packet error	Poor connection quality with the CANopen host terminal or host not connected when powered on. Continue transmission or power off inspection can be selected. Two results can be expected with continue transmission 1) Packet transmission returns to normal and the red light no longer flashes 2) Packet continues to have errors causing disconnection. When the power is off, check whether the TB1 terminal and cable are firmly connected, and whether the transmission rate, maximum transmission distance and cable length comply with ODVA specifications.
Double flash	Guard/Heartbeat error	User sends periodic heartbeat messages. If a message is not received after a specific time, please disconnect the power and check the connection status of that node.
Red light lights up	Disconnected	Cannot connect with the CANopen host terminal; disconnect the power and check whether the TB1 terminal and cable is firmly connected, and whether the transmission rate, maximum transmission distance and cable length comply with ODVA specifications.

### **1.0.9 EDS file**

When using the CANopen communication module, if the EDS description file (JN5-CMHI-CAN\_V (latest version).eds) is needed, please download it from the TECO official website (<http://globalsa.teco.com.tw>) or TWMC official website (<https://www.tecowestinghouse.com/drives-and-controls/> ).



## 2.0 I/O expansion card

### 2.0.1 Hardware and data structure

This product is an I/O expansion module; it allows performing of I/O expansion functions through the SPI bus. Used with the TECO A510s/F510 AC motor driver (hereinafter referred to as a driver).

### 2.0.2 Product specifications

I/O ports

Item	Specifications
Connector	TB1 7 external contacts

### AC motor driver port

Item	Specifications
Connector	Control board CN2 connector/CN5 connector
Transmission method	SPI high speed communication
Terminal functions	TB1 7 external contacts

**TECO**   **Westinghouse**

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***INVERTER***

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