GTAKE

User Manual

EPC-CM34-EtherCAT (Communication cards)

EPC-CM34-EtherCAT Communication Card User Manual

Applicable to GK900

Edition	Change content
A00	First edition released

Disclaimer

This product document is accurate and reliable at the time of publication. GTAKE Electric reserves the right to change the product specifications described in this manual without further notice.

Technical support

If you need help with installation and configuration of the product, please contact GTAKE Electrical.

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1. Introduce

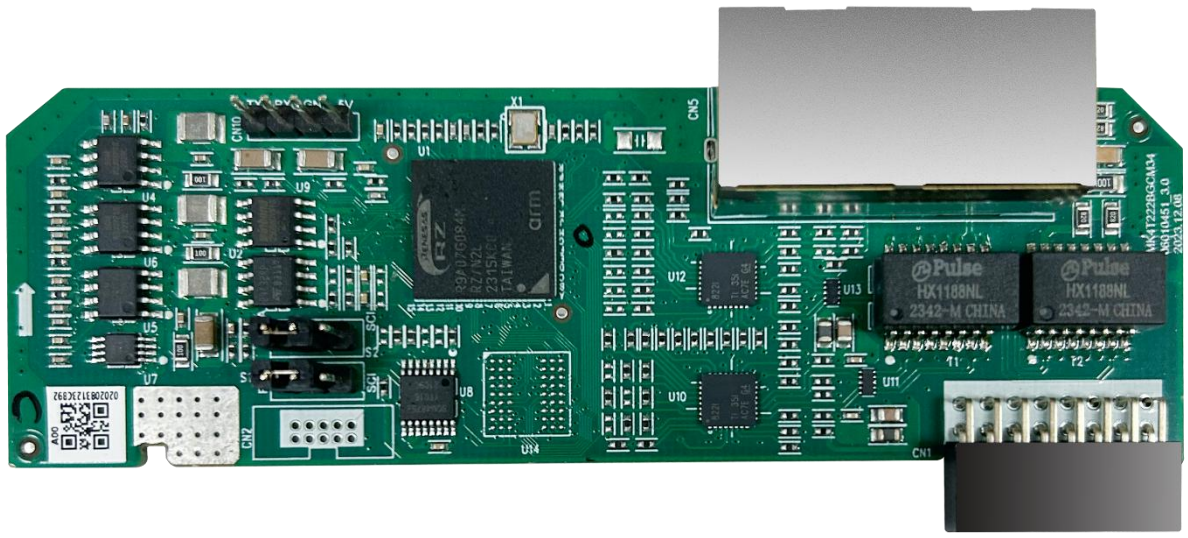
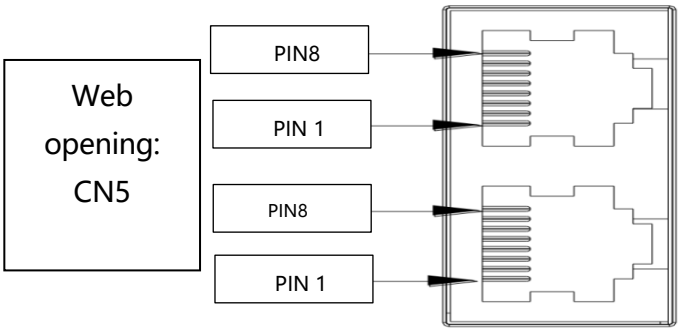


Fig 1.1 Picture of EPC-CM34

1.1 Port definition and jumper switch description

1.1.1 Port definition



1.1.2 Description of jumper switch

Jump switch	functional description	Factory Settings
S1& S2	Flash: Normal mode	Flash
	SCI: Burn mode	

1.2 About this user manual

The function of the frequency converter is to be configured through various instructions or variables, which communicate through serial port or field bus.

This manual describes the various functional configurations of communication through EtherCAT (CoE) in the GK 900 series inverters. This manual is for the reference of skilled technicians who have undergone training on the use of GK900 series inverters.

Before use, please confirm that the inverter model you select supports EtherCAT communication function according to the nameplate information of the inverter.

1.3 EtherCAT Communication specifications

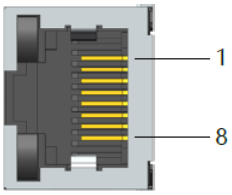
Table 1.1 EtherCAT Communication specification table

Project	Specifications
Communication Standards	IEC61158Type12， IEC61800-7 CiA Drive Profile
Physical layer	100BASE-TX（IEEE802.3）
Junctor	RJ45 *2 (shielded)
	IN: EtherCAT input
	OUT: EtherCAT output
Communications cable	Recommended network cable: twisted pair double layer shielded network cable, CAT.6E and above
Baud rate	100 Mbps
Communication length	The maximum distance between nodes is 100 meters
process data	fixed PDO
	variable PDO
postbox (COE)	SDO request, SDO response
Synchronous mode	DC Synchronization (Sync0Event)
Communication cycle	1000 us– 10000us
Supports CiA 402 mode	Cycle Synchronized Position Mode CSP
	Cycle Synchronized Velocity Mode CSV
	Cycle Synchronized Torque Mode CST

2. Field bus wiring and installation

2.1 EtherCAT Connector

The inverter can be connected to the host computer or multiple slave stations through the EtherCAT communication cable Function Settings

VFD Side	
	
Pin	**Signal Name**
1	TX +
2	TX -
3	RX +
6	RX -
4、5、7、8	-
Cases	PE（Shield）

3. Function setting

3.1 EtherCAT Specifications

GTAKE EtherCAT The specifications of the communication frequency converter are shown in Table 3.1

Table 3.1 Specifications of EtherCAT inverter

Project		Specifications
Physical specifications	Communication Standards	IEC61158Type12， IEC61800-7 CiA Drive Profile
	Physical layer	100BASE-TX（IEEE802.3）
	Junctor	RJ45 *2 (shielded)
	Physical layer	IN: EtherCAT input
	Tie cable	OUT: EtherCAT output
	Communications cable	Recommended network cable: twisted pair double layer shielded network cable, CAT.6E and above
	Baud rate	100 Mbps
	Communication length	The maximum distance between nodes is 100 meters
EtherCAT Function	SyncManager	SM0: Enter the email address
		SM1: Email output
		SM2: TxPDO
		SM3: RxPDO
	Supported application protocols	CoE（PDO、SDO）
	TxPDO	3 groups
	RxPDO	3 groups
	SDO	SDO request, SDO response
	DC	Free Run (Asynchronous), DC-synchronization
	Communication cycle	100 0us– 10000us
	Supports CIA402 mode	Cycle Synchronized Position Mode CSP
		Cycle Synchronized Velocity Mode CSV
		Cycle Synchronized Torque Mode CST

3.2 EtherCAT State machine

GTAKE EtherCAT Communication frequency converter Refer to Figure 2 for the EtherCAT state transition process.

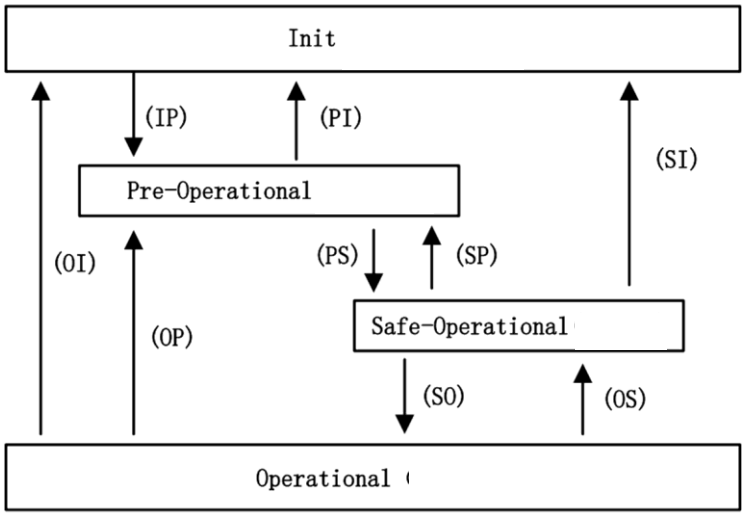


Fig 3.1 EtherCAT State

The inverter, as a slave device, must support the above four basic states. The master station and the slave station complete the data interaction management through the state switching of the state machine. The description of each state of the state machine is referred to Table 3.2

Table 3.2 EtherCAT, state machine states

State	Communicating actions			operate
	SDO	RXPDO	TxPDO	
Init (initialization)	nonsupport	nonsupport	nonsupport	Communication part is initialized, but communication is not possible
Init->Pre-OP				The master station is configured with the address of the slave node; the mailbox channel is configured; Configure the DC distributed clock; Request Pre-OP.
Pre-Operational (Pilot run)	support	nonsupport	nonsupport	The master station configures the slave station through SDO
Pre-OP->Safe-OP（PS）				The master station is configured with PDO mapping through SDO; The master station is configured with PDO, using SM channel;

				The master station is configured with FMMU; Request Safe-OP.
Safe-Operational (safe in operation)	support	nonsupport	support	Support SDO communication, and the station is allowed to send PDO data
Safe-OP->OP（SO）				The master station requests the OP status
Operational (Operation)	support	support	support	All SDO, TXPDO, RXPDO are valid
PI SI OI	nonsupport	nonsupport	nonsupport	Turn off all communication functions (SDOPDO); Switch to Init state
SP OP	support	nonsupport	nonsupport	Turn off the PDO function; Switch to Pre-OP state
OS	support	nonsupport	support	Close RXPDO; Switch to Safe-OP state

3.3 Distribute clock and communication cycle

The EtherCAT communication version supports the Sync0 (Distributed Clocks, or DC synchronization) mode. When the DC mechanism is used in a network with multiple inverter slave nodes, all nodes can share a common system clock. Each slave generates synchronization signals based on this shared clock, enabling high-precision control in multi-axis systems.

The master defines the communication cycle by setting the output period of the Sync0 signal. When using DC synchronization, the Sync0 period is the communication cycle.

Please ensure that the synchronization cycle is set to an integer multiple of 1 ms..

3.4 CiA402 Function Settings

3.4.1 VFD status control

The EtherCAT communication inverter follows the standard CiA402 protocol-defined process to switch between operating states. The object 0x6040 (Control Word) is used to command the inverter's state transitions, while 0x6041 (Status Word) is used to confirm whether the state transition was successful.

It is important to note that any state transition depends on internal or external conditions of the inverter. For example, if the inverter's power control board is not powered, the inverter cannot enter the

"Operation Enabled" state, which corresponds to motor shaft lock.

For detailed control logic, please refer to Figure 3.2.

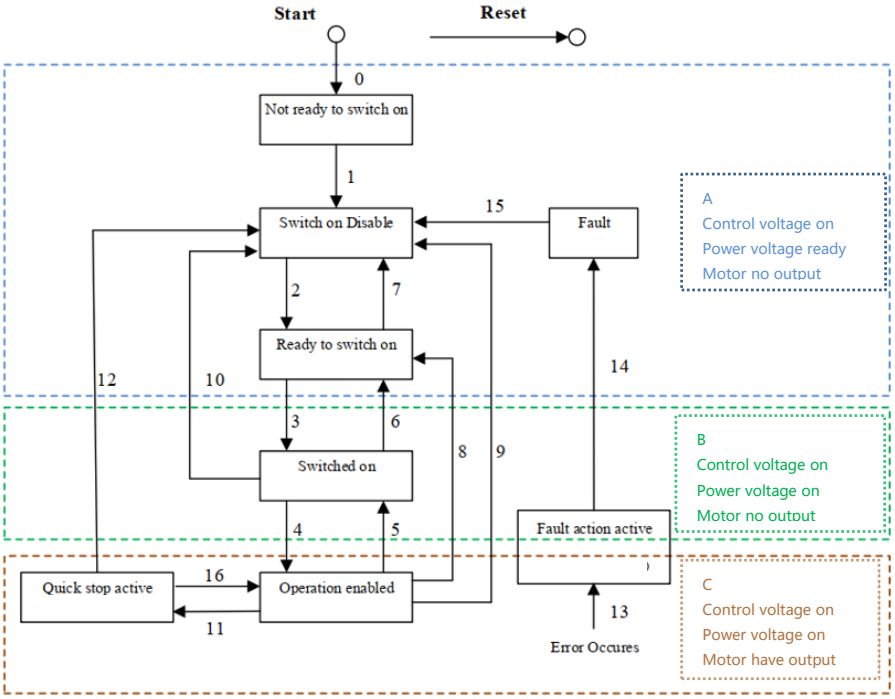


Figure 3.2 CiA402 State machine

Before entering the **"Operation Enabled"** state, please ensure that all parameters are correctly configured. In this state, the motor torque is already being output, so incorrect parameter settings may lead to unexpected motor behavior.

If any alarm condition occurs, the state machine will automatically switch to the **"Fault"** state.

Detailed reference table 3.3 on 0x6040 control words.

Index(Hex)	Subindex (Hex)	Name	Data type	Scale	SDO	PDO	Control model	Default
6040	00	ControlWord	UINT16	0~65535	RW	RxPDO	All modes	0

Table 3.3 0x6040 Control word Settings

Bit No.	Name	Explain
0	Switch On ready for operation	0- of no avail; 1- valid
1	Enable Voltage Connect power	0- of no avail; 1- valid
2	Quick Stop Quick shutdown	0- valid; 1- of no avail
3	Enable Operation Servo enable	0- of no avail; 1- valid
4~6	Operation mode specific Related to the operating mode	Related to each operating mode *

7	Fault Reset Fault reset	For recoverable faults or warnings, Perform the reset operation,
8~15	Reserved	——

*Each operation mode refers to the control mode specified in the object dictionary 0x6060 of CiA402.

See detailed reference table 3.4 for 0x6041 state words.

Index of matrix (Hex)	Subindex (Hex)	Name	Data type	Scale	SDO	PDO	Control model	Default
6041	00	StatusWord	UINT16	0~65535	RO	TxPDO	All modes	0

Table 3.4 Interpretation of 0x6041 status words

Bit No.	Name	Explain
0	Ready to Switch ON Servos are ready	0-invalid; 1-valid
1	Switch ON Servos can be run	0-invalid; 1-valid
2	Operation Enabled Servo has been enabled	0-invalid; 1-valid
3	Fault hitch	0-invalid; 1-valid
4	Voltage Enabled Servos can enable	0-invalid; 1-valid
5	Reserved	
6	Switch On Disable Can enable servo	0-invalid; 1-valid
7	Warning warn	0-invalid; 1-valid
8	Manufacturer Specific	Unassigned status
9	Reserved	
10	Target Reach Goal achieved	0-invalid; 1-valid
11-15	Continue to have	

3.4.2 Probes function

The probe function refers to the function of the frequency converter to record the position of the encoder by triggering the high-speed DI signal or motor Z signal from the external input.

Index of matrix (Hex)	Subindex (Hex)	Name	Data type	Scale	Unit	SDO attribute	PDO attribute	Effective Mode	Default
60B8	0	Probes function	UINT16	0~ 0xFFFF	——	rw	RPDO	——	0
60B9	0	Probe status	UINT16	0~ 0xFFFF	——	ro	TPDO	——	0

60BA	0	Probe 1 rises Position latching along the line	INT32	0x80000000~ 0x7FFFFFFF	Directive unit	ro	TPDO	——	0
60B8	0	Probes function	UINT16	0 ~ 0xFFFF	——	rw	RPDO	--	0

Refer to Table 3.5 for detailed Settings of probe function control words.

Table 3.5 Detailed description of probe function control words

Bit No.	Detailed explanation of 60B8
0	- Close probe 1 - Enable probe 1
1	1-Probe 1 Continuous trigger
2	1-Z signal as probe 1 trigger signal
3	NA
4	- Probe 1 does not latch the rising edge - Probe 1 rising edge latch
2- 15	NA

Index (Hex)	Sub index (Hex)	Name	Data class mould	Scale	Unit	SDO attribute	PDO attribute	Effective mode	Default
60B9	0	Probe status	UINT16	0~ 0xFFFF	——	ro	TPDO	——	0

When the probe function control word is set, the probe function status word can be read to confirm the probe working status, refer to Table 3.6 for detailed Settings.

For example, set the probe 1 to trigger on rising edge and trigger continuously, that is, 0x60B8 = 1 5 h, 0x60B 9 = 3h, when reading 0x60BA is the position value of latching.

Table 3.6 Detailed description of probe function status words

Bit No.	60B9 details
0	0- Probe 1 is closed 1- Probe 1 enabled
1	0- Probe 1 rising edge not latched position 1- Probe 1 goes up on the rising edge latch position
2- 15	NA

3.5 Basic function Settings

3.5.1 Control mode Settings

Before using the EtherCAT function of GK900 inverter, it is necessary to manually configure the inverter parameters so that the inverter and motion controller can establish communication smoothly, which mainly includes control mode and other settings. Users can set the inverter parameters through the operation panel and the debugging software of the upper computer.

3.5.2 Set the rotation direction

	Name	Scale	Unit	Factory value	Effective method
b1-02	Operation direction selection	0~1	1	0	Immediate effect

Set the rotation direction of motor shaft:

0: Counterclockwise (CCW) is the positive rotation direction (A leads B);
1: Clockwise (CW) is the positive rotation direction (reverse mode, A lags B).

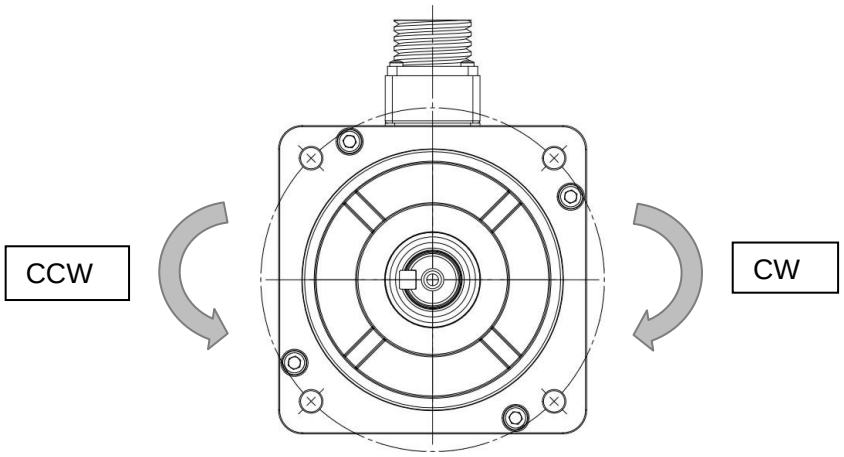


Figure 3.3 Setting of the motor rotation direction

3.5.3 Brake resistor setting

	Name	Scale	unit	Factory value	Effective method
b1-18	Dynamic Brake	0~ 1		0	Immediate effect
b1-19	Dynamic Brake Voltage	650 ~ 750	V	720	Immediate effect

During the deceleration and braking process of the motor, energy is transferred from the load side to the DC bus. If the amount of regenerated energy is too large, a braking resistor is required to dissipate the excess energy; otherwise, the inverter may trigger an alarm or even become damaged.

The braking method varies depending on the power rating. Please refer to the specific inverter specifications when configuring this parameter.

3.6 Communications target

EtherCAT communication supports multiple application layer protocols, including CoE (CANopen over EtherCAT), SoE (Servo drive over EtherCAT), and FoE (File access over EtherCAT).
The inverter uses the IEC 60870-7-200 CANopen motion control protocol (commonly known as CiA402). Under the CiA402 protocol, the main communication objects used for data transmission are:

- **SDO** (Service Data Object)
- **TxPDO** (Transmit Process Data Object – cyclic data sent from the slave to the master)
- **RxPDO** (Receive Process Data Object – cyclic data sent from the master to the slave)

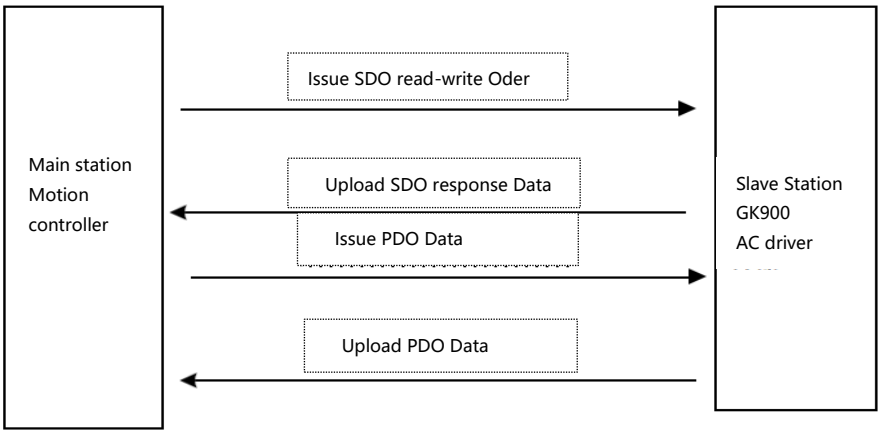


Figure 3.4 Communication objects

In Figure 3.4, the **SDO read/write command** refers to the master actively sending a read or write instruction to the slave. Upon receiving the command, the slave responds with the requested data. There is no requirement for a fixed communication cycle in SDO communication.

On the other hand, **PDO data** is exchanged cyclically: in each communication cycle, the master sends one **RxPDO** (Receive PDO) to the slave, and the slave uploads one **TxPDO** (Transmit PDO) to the master. The data content within the PDOs can be configured either automatically or manually during the initialization phase of the master.

3.6.1 Email data SDO

Mailbox data via SDO is used to transmit non-cyclic data, where timing is not critical. For example, the master may configure the drive parameters only once during initialization—there’ s no need for continuous configuration once the device is running. Alternatively, the master might read or write parameters such as inverter temperature or DC bus voltage at longer intervals, such as once every hour.

3.6.2 Process data PDO

Process data refers to the data exchanged in every communication cycle. The PDO sent by the master is called **RxPDO**, while the PDO sent by the slave is called **TxPDO**.

For example, if the communication cycle is set to 2 milliseconds, then a pair of PDOs (TxPDO and RxPDO) will be exchanged every 2 milliseconds.

This highlights that only data with **high real-time requirements** should be mapped to PDOs. For data that doesn't require high real-time performance, **SDO** transmission is sufficient.

The process of configuring which data is included in a PDO is called **PDO mapping**.

Frequency converter assigned PDO mapping reference table 8

Table 3.7 Group 1 PDO mapping-content can be added

	Index (Hex)	Sub index (Hex)	Index content				
1st TxPDO	1A00	00	07H				
			Index	Size	Offset	Name	Type
		01	6041	2.0	0.0	Status Word	UINT16
		02	6064	4.0	2.0	Position Actual Value	DINT32
		03	606C	4.0	6 .0	Velocity Actual Value	INT32
		04	6077	2.0	10 .0	Torque Actual Value	INT16
		0 5	60B9	2.0	12 .0	Touch Probe Status	UINT16
		0 6	60BA	4.0	14 .0	Touch Probe pos1 Pos Value	INT32
		0 7	6061	1.0	1 8 .0	Modes of Operation Display	INT8
1st RxPDO	Index (Hex)	Sub index	Index content				
	1600 The index content is variable	00	0 6 H				
			Index	Size	Offset	Name	Type
		01	6040	2.0	0.0	Control Word	UINT16
		02	607A	4.0	2.0	Target Position	INT32
		03	60FF	4.0	6.0	Target Velocity	INT32
		04	6071	2.0	10.0	Target Torque	INT16
		05	6060	1.0	12.0	Modes of Operation	INT8
		0 6	60B8	2.0	13 .0	Touch Probe Function	UINT16

The content of the second to fourth group of PDO mapping is retained.

4. control model

The GK900 inverter supports the three control modes defined by **CiA402**, as shown in **Table 4.1**.

- The control mode is selected via object **0x6060 (Modes of Operation)**.
- The currently active mode is indicated by **0x6061 (Modes of Operation Display)**.

Table 4.1 Control modes supported by GK900 inverter

0x6060 set value	GK900 Control mode	Explain in detail
0-7	Reserved	
8	Cyclic Synchronous Position mode (CSP)	The controller sends the position command in each communication cycle, and the inverter only executes it
9	Cyclic Synchronous Velocity mode (CSV)	The controller sends speed commands in each communication cycle, which are executed only by the frequency converter
10	Cyclic Synchronous Torque mode (CST)	The controller sends the torque command in each communication cycle and the frequency converter only executes it

4.1 Periodic Synchronous Positioning Mode (CSP-Cycle Synchronized PositionMode)

In **CSP (Cyclic Synchronous Position)** control mode, the controller periodically sends the position command to the inverter via object **0x607A** within each communication cycle. After receiving the updated position command, the inverter internally performs position, velocity, and torque regulation. In each communication cycle, the inverter synchronously feeds back the current position value via object **0x6064**.

For detailed control block diagrams, please refer to **Figure 4.1**.

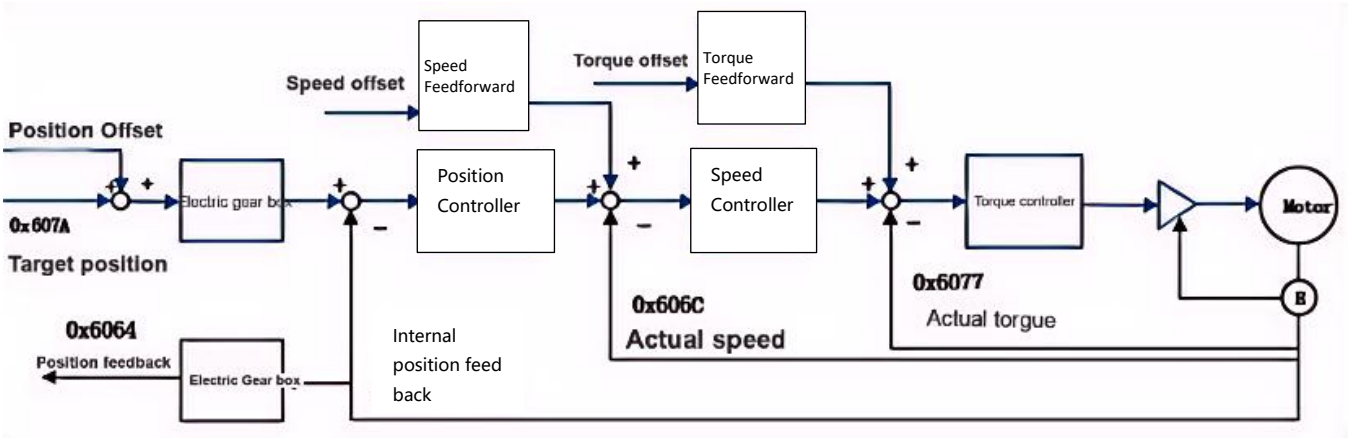


Figure 4.1 CSP control block diagram

4.1.1 Control words and status words

1) CSP mode control word setting (0x6040)

Table 4.2 Description of 0x6040 in CSP Mode

CSP mode-0x6040 control word description		
Bit No.	Name	Explain
0	Switch On	0-invalid; 1-valid
1	Enable Voltage	0-invalid; 1-valid
2	Quick Stop	0-Rapid shutdown; 1-Normal operation
3	Enable Operation	1-Enablement
7	Fault Reset	For recoverable faults or warnings, perform the reset Operation, rising edge is valid

2) CSP mode status word interpretation (0x6041)

Table 4.3 Description of 0x6041 in CSP Mode

CSP mode-0x6041 state word		
Bit No.	Name	Explain
0	Ready to Switch ON	0-invalid; 1-valid
1	Switch ON	0-invalid; 1-valid
2	Operation Enabled	0-invalid; 1-valid
3	Fault	0-invalid; 1-valid
4	Voltage Enabled	0-invalid; 1-valid
5	Quick Stop	0-valid; 1-Invalid
6	Switch On Disable	0-invalid; 1-valid
7	Warning	0-invalid; 1-valid

4.1.2 CSP mode for all object dictionaries

The object dictionary entries related to CSP mode can be found in Table 4.4.

For detailed functional settings of specific object dictionary entries, please refer to the section "CiA402 Function Settings." Table 4.4 Dictionary of all objects associated with CSP mode

Table 4.4 – Object Dictionary Entries Related to CSP Mode

Index (Hex)	Sub index (Hex)	Name	Data class mould	Unit	SDO	PDO	Windows default
603F	00	Error code	UINT16	——	RO	TPDO	0
6040	00	control word	UINT16	——	RW	RPDO	0
6041	00	status word	UINT16	——	RO	TPDO	0
6060	00	control model	INT8	——	RW	RPDO	0
6061	00	Control mode display	INT8	——	RO	TPDO	0
6064	00	User location feedback	INT32	Directive unit	RO	TPDO	——
606C	00	User speed feedback	INT32	Instructions per unit/s	RO	TPDO	——
6077	00	Actual torque	INT16	0.10%	RO	TPDO	0
607A	00	target location	INT32	Directive unit	RW	RPDO	0

4.1.3 Operating Procedure for CSP Mode

The operating procedure for **CSP mode** can be referenced in **Table 4.5**.

Table 4.5 Operating Procedure for CSP Mode

Function	0bject dictionary	PDO/SDO attribute	Explain
Control mode Settings	0x6060	RPDO or SDO write	The master sets mode **8**.
	0x6061	TPDO or SDO read	The slave reports back, and the master verifies whether the mode is **8**.
Inverter Status Monitoring and Control	0x6040	RPDO	**Enable sequence:** set **6** → **7** → **15** in order. **Fault reset:** send **128**.
	0x6041	TPDO	During and after the inverter enabling process, the inverter status is continuously monitored. If an abnormal status is detected, the enable signal will be immediately disengaged.
	0x603F	TPDO	
Sending Position Command	0x607A	RPDO	Location commands issued by the master station on a periodic basis.
Location command upload	0X6064	TPDO	The master periodically monitors the inverter to ensure that execution is accurate and synchronized.

4.1.4 PDO configuration suggestions

The table below lists only the essential object dictionary entries required for CSP mode. Actual usage can be adjusted as needed.

Table 4.6 - Recommended Configuration for CSP Mode

PDO category nature	object dictionary	remarks
RPDO	0x6040 Control word	must
	0x607A Target position	must
	0x6060 Control mode	selectable
TPDO	0x6041 state word	must
	0x6064 Actual location	must
	0x6061, control mode display	selectable

4.2 Periodic synchronization speed mode (CSV-Cycle Synchronized VelocityMode)

In **CSV (Cyclic Synchronous Velocity)** control mode, the controller periodically sends the velocity command to the inverter via object **0x60FF** within each communication cycle. After receiving the updated command, the inverter internally performs velocity and torque regulation. In each communication cycle, the inverter synchronously feeds back the current velocity value via object **0x606C**.

For detailed control block diagrams, please refer to **Figure 4.2**.

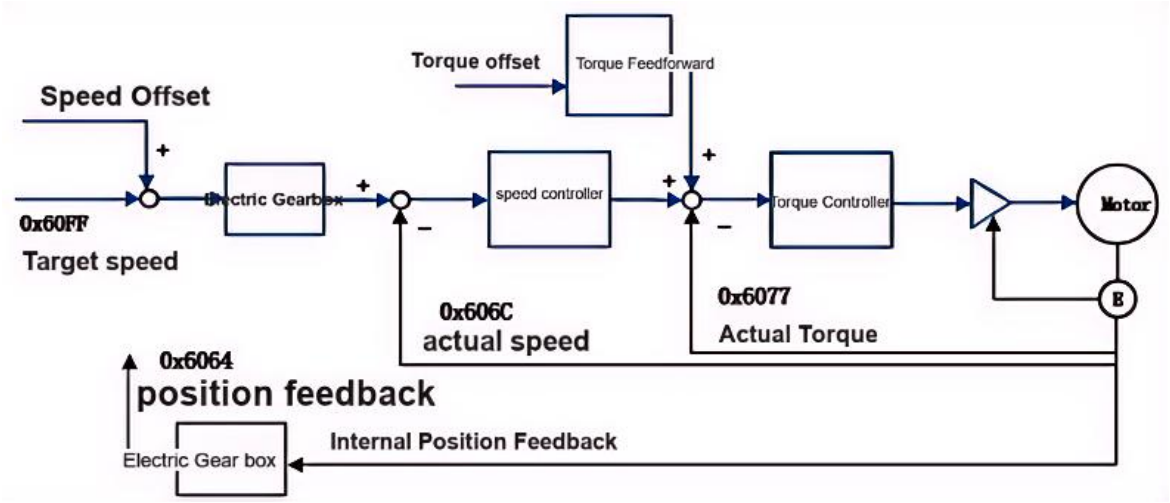


Figure 4.2 CSV control block diagram

4.2.1 Control words and status words

1) CSV mode control word Settings (0x6040)

Table 4.7 Description of 0x6040 in CSV Mode

CSV mode-0x6040 control word description		
Bit No.	Name	Explain
0	Switch On	0-invalid; 1-valid
1	Enable Voltage	0-invalid; 1-valid
2	Quick Stop	0-Rapid shutdown; 1-Normal operation
3	Enable Operation	1. Enablement
7	Fault Reset	For recoverable faults or warnings, perform reset Operation, rising edge is valid

2) CSV mode status word interpretation (0x6041)

Table 4.8 Description of 0x6041 in CSV Mode

CSV mode-0x6041 status word		
Bit No.	Name	Explain
0	Ready to Switch ON	0-invalid; 1-valid
1	Switch ON	0-invalid; 1-valid
2	Operation Enabled	0-invalid; 1-valid
3	Fault	0-invalid; 1-valid
4	Voltage Enabled	0-invalid; 1-valid
5	Quick Stop	0-valid; 1-Invalid
6	Switch On Disable	0-invalid; 1-valid
7	Warning	0-invalid; 1-valid
10	Target Reach	0-invalid; speed is not equal to zero 1-Effective target speed reached; speed is zero

4.2.2 CSV mode for all object dictionaries

The object dictionary entries related to **CSV mode** can be found in **Table 4.9**.
For detailed functional settings of specific object dictionary entries, please refer to the section **"CiA402 Function Settings."**

Table 4.9 – Object Dictionary Entries Related to CSV Mode

Index (Hex)	Sub index (Hex)	Name	Data type	Unit	SDO	PDO	Default
603F	00	Error code	UINT16	——	RO	TPDO	0
6040	00	control word	UINT16	——	RW	RPDO	0
6041	00	status word	UINT16	——	RO	TPDO	0
6060	00	control model	INT8	——	RW	RPDO	0
6061	00	Control mode displayed	INT8	——	RO	TPDO	0
606C	00	User speed feedback	INT32	Instructions per unit/s	RO	TPDO	——
60FF	00	Target speed	INT32	Instructions per unit/second Turns / minutes	RW	RPDO	0

4.2.3 Operating Procedure of CSV Mode

The operating procedure for **CSV mode** can be referenced in **Table 4.10**.

Table 4.10 CSV Mode Operating Procedure

Function	Object dictionary	PDO/SDO attribute	Explain
Control mode Settings	0x6060	RPDO perhaps SDO write	Main station setup mode 9
	0x6061	TPDO perhaps SDO a slight pause in reading	From the station feedback, the master station determines whether it is 9
Inverter Status Monitoring and Control	0x6040	RPDO	**Enable sequence:** set **6** → **7** → **15** in order. **Fault reset:** send **128**.
	0x6041	TPDO	During and after the inverter enabling process, the inverter status is continuously monitored. If an abnormal status is detected, the enable signal will be immediately disengaged.
	0x603F	TPDO	
Sending Position	0x60FF	RPDO	Speed command issued by the master station in

Command			a cycle.
Speed command upload	0X606C	TPDO	The master station monitors the actual execution of the frequency converter in a cycle accuracy.

4.2.4 PDO configuration suggestions

The configuration in the table below is only necessary object dictionary for CSV mode, and can be modified as needed.

Table 4.11 Configuration of recommended CSV mode

PDO attribute	Object dictionary	Remarks
RPDO	0x6040 Control word	must
	0x60FF target speed	must
	0x6060 Control mode	selectable
TPDO	0x6041 state word	must
	0x606C Actual speed	must
	0x6061, control mode display	selectable

4.3 Periodic synchronous torque mode (CST-Cycle Synchronized TorqueMode)

In **CST (Cyclic Synchronous Torque)** control mode, the controller periodically sends the torque command to the inverter via object **0x6071** within each communication cycle. After receiving the updated command, the inverter internally performs torque regulation. In each communication cycle, the inverter synchronously feeds back the current torque value via object **0x6077**.

For detailed control block diagrams, please refer to **Figure 4.3**.

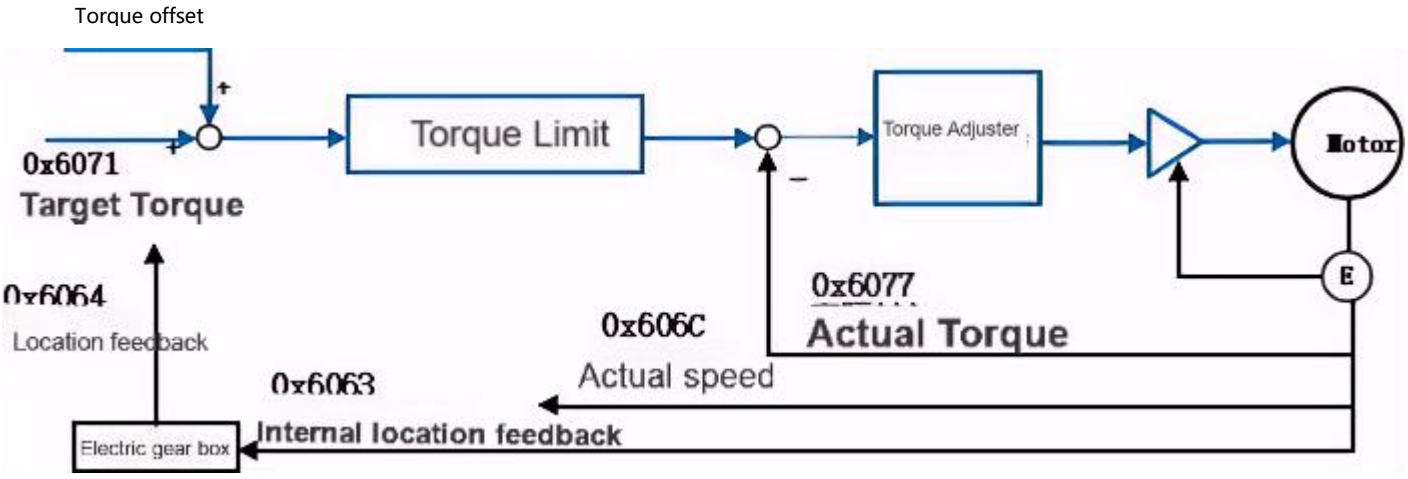


Figure 4.3 CST control block diagram

4.3.1 Control words and status words

1) CST mode control word Settings (0x6040)

Table 4.12 Description of 0x6040 in CST Mode

CST mode-0x6040 control word description		
Bit No.	Name	Explain
0	Switch On	0-invalid; 1-valid
1	Enable Voltage	0-invalid; 1-valid
2	Quick Stop	0-Quick shutdown; 1-Normal operation
3	Enable Operation	1. Enablement
7	Fault Reset	For recoverable faults or warnings, perform the reset Operation, rising edge valid

1) CST mode status word interpretation (0x6041)

Table 4.13 CST, mode time 0x6041 description

CST mode-0x6041 status word		
Bit No.	name	explain
0	Ready to Switch ON	0-invalid; 1-valid
1	Switch ON	0-invalid; 1-valid
2	Operation Enabled	0-invalid; 1-valid
3	Fault	0-invalid; 1-valid
4	Voltage Enabled	0-invalid; 1-valid
5	Quick Stop	0-valid; 1-Invalid
6	Switch On Disable	0-invalid; 1-valid
7	Warning	0-invalid; 1-valid

4.3.2 CST mode for all object dictionaries

All object dictionary entries related to **CST mode** are listed in **Table 4.14**.

The objects listed in the table are supported in CST mode. For detailed functional settings of each object dictionary entry, please refer to the section **"CiA402 Function Settings."**

Table 4.14 Dictionary of all objects associated with the CST model

Index (Hex)	Sub index (Hex)	Name	Data type	Unit	SDO	PDO	Windows default
603F	00	Error code	UINT16	——	RO	TPDO	0
6040	00	control word	UINT16	——	RW	RPDO	0
6041	00	status word	UINT16	——	RO	TPDO	0
6060	00	control model	INT8	——	RW	RPDO	0
6061	00	Control mode display	INT8	——	RO	TPDO	0
606C	00	User speed feedback	INT32	Instructions per unit/second	RO	TPDO	0
6071	00	Target torque	INT16	0.10%	RW	RPDO	0
6077	00	Actual torque	INT16	0.10%	RO	TPDO	0

4.3.3 Operating Procedure of CST Mode

The operating procedure for **CST mode** can be referenced in **Table 4.15**.

Table 4.15 CST mode operation steps

Function	Object dictionary	PDO/SDO attribute	Explain
Control mode Settings	0x6060	RPDO perhaps SDO write	Main station setup mode 10
	0x6061	TPDO perhaps SDO a slight pause in reading	From the station feedback, the master station determines whether it is 10
Inverter Status Monitoring and Control	0x6040	RPDO	**Enable sequence:** set **6** → **7** → **15** in order. **Fault reset:** send **128**.
	0x6041	TPDO	During and after the inverter enabling process, the inverter status is continuously monitored. If an abnormal status is detected, the enable signal will be immediately disengaged.
	0x603F	TPDO	
Sending torque command	0x6071	RPDO	The main station periodically issues the speed torque command.
Torque command uploaded	0X6077	TPDO	The master station monitors the actual execution of the frequency converter in a cycle accuracy.

4.3.4 PDO configuration suggestions

The configuration in the table below is only necessary for the use of the CST mode object dictionary, and can be modified as needed.

Table 4.16 Configuration recommended for CST mode

PDO attribute	Object dictionary	Remarks
RPDO	0x6040 Control word	must
	0x6060 Control mode	must
	0x6071 target torque	must
TPDO	0x6041 state word	must
	0x6077 actual torque	must
	0x6061, control mode display	selectable

5. Detailed explanation of object dictionary

5.1 Manufacturer-Specific Objects

5.1.1 Basic Parameters

Parameter / reference number	Name	Scale	Unit	Factory value	Setting method	Effective mode
b1-02	Operation direction	0~1	1	0	Stop Settings	Takes effect upon next power-on

Setting the motor shaft rotation direction:

0: Counterclockwise (CCW) is defined as the positive rotation direction (A leads B);

1: Clockwise (CW) is defined as the positive rotation direction (reverse mode, A lags B).

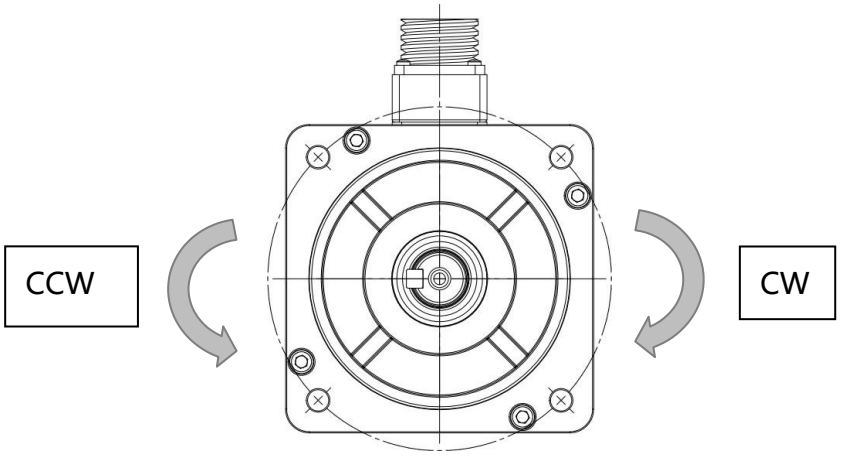


Figure 5.1 Setting of Motor Rotation Direction

5.2 CiA402 Parameter details (6000h ~ 6FFFh)

Index (Hex)	Sub index (Hex)	Name	Data type	Scale	Unit	SDO attribute	PDO attribute	Effective mode	Default
603F	0	Error code	UINT16	0~ 0xFFFF	——	ro	TPDO	All	——

Displays the highest-level fault code at the current moment, consistent with the inverter' s panel. For detailed fault analysis, please refer to Chapter 7 "Fault Code Overview" in the inverter user manual.

Index	Sub index	Name	Data type	Scale	Unit	SDO	PDO	Effective	Default

(Hex)	(Hex)					attribute	attribute	mode	
6040	0	control word	UINT16	0~0xFFFF	——	rw	RPDO	All	——

Used to control the inverter to work in EtherCAT mode, the main functions are: inverter enable, fault reset, motion command setting under each control mode.

Table 5.1 Control word details

Bit No.	Name	Explain
0	Switch On	0: Invalid; 1: Valid
1	Enable Voltage	0: Invalid; 1: Valid
2	Quick Stop	0-Rapid shutdown; 1-Normal operation
3	Enable Operation	1-Enable
4~6	Operation mode specific	Related to each operating mode *
7	Fault Reset	For recoverable faults or warnings, Perform the reset operation,
8~15	Reserved	——

Index (Hex)	Sub index (Hex)	Name	Data type	Scale	One Positions	SDO attribute	PDO attribute	Effective mode	Default
6041	0	status word	UINT16	0~ 0xFFFF	—	rw	TPDO	All	——

Used to indicate the current status of the inverter and to reflect special function states for each control mode.

Table 5.2 Detailed description of status words

Bit No.	Name	Explain
0	Ready to Switch ON	0-invalid; 1-valid
1	Switch ON	0-invalid; 1-valid
2	Operation Enabled	0-invalid; 1-valid
3	Fault	0-invalid; 1-valid
4	Voltage Enabled	0-invalid; 1-valid
5	Reserved	
6	Switch On Disable	0-invalid; 1-valid
7	Warning	0-invalid; 1-valid
8	Manufacturer Specific	Unassigned status

9	Reserved	
10	Target Reach	0-invalid; 1-valid
11-15	Reserved	

Index (Hex)	Sub index (Hex)	Name	Data type	Scale	Unit	SDO attribute	PDO attribute	Effective model	Default
6060	0	control model	INT8	0~ 10	——	rw	RPDO	All	0
6061	0	Control mode display	INT8	0~ 10	——	Ro	TPDO	All	0

Refer to the supported control modes table.

0x6060 is used to set the control mode, while **0x6061** is used to confirm whether the control mode has been set correctly.

Please do not assign any value to **0x6060** other than those listed in the table below.

Table 5.3 Control modes supported by the GK900 inverter

0x6060 set value	**GK900 control mode**	**Explain**
0-7	Reserved	
8	Cyclic Synchronous Position Mode – **CSP**	The controller sends the position command in each communication cycle, and the frequency converter only executes it
9	Cyclic Synchronous Velocity Mode – **CSV**	The controller sends speed commands in each communication cycle, which are executed only by the frequency converter
10	Cyclic Synchronous Torque Mode – **CST**	The controller sends the torque command in each communication cycle, and the frequency converter only executes it

Index (Hex)	Sub index (Hex)	Name	Data type	Numerical range	Unit	SDO attribute	PDO attribute	Effective mode	Default
6064	0	position feedback	INT32	——	Order sheet Positions	ro	TPDO	CSP	——

Feedback of actual position value, command units.

Index (Hex)	Sub index (Hex)	Name	Data type	Numerical range	Unit	SDO attribute	PDO attribute	Effective mode	Default
606C	0	actual velocity feedback	INT32	——	Command unit: units/second	ro	TPDO	All	——

Actual speed feedback, command unit.

Index (Hex)	Sub index (Hex)	Name	Data type	Numerical range	Unit	SDO attribute	PDO attribute	Effective mode	Default
6071	0	Target Toque	INT16	3000~3000	0.10%	ro	RPDO	CST	——

In the torque control mode, set the command torque.

Index (Hex)	Sub index (Hex)	Name	Data type	Numerical range	Unit	SDO attribute	PDO attribute	Effective mode	Default
6077	0	Actual torque	INT16	-3000~ 3000	0.10%	ro	TPDO	All	0

Displays the actual torque feedback when the servo is running.

Index (Hex)	Sub index (Hex)	Name	Data type	Numerical range	Unit	SDO attribute	PDO attribute	Effective mode	Default
607A	0	target location	INT32	0x80000000 ~ 0x7FFFFFFF	Directive unit	rw	RPDO	CSP	0

Used to set target locations.

6. Object dictionary overview table

6.1 Object dictionary 1000H, group parameter list

	Index (Hex)	Subindex (Hex)	Index content				
1st TxPDO	1A00	00	07H				
			Index	Size	Offset	Name	Type
		01	6041	2.0	0.0	Status Word	UINT16
		02	6064	4.0	2.0	Position Actual Value	DINT32
		03	606C	4.0	6 .0	Velocity Actual Value	INT32
		04	6077	2.0	10 .0	Torque Actual Value	INT16
		0 5	60B9	2.0	12 .0	Touch Probe Status	UINT16
		0 6	60BA	4.0	14 .0	Touch Probe pos1 Pos Value	INT32
		0 7	6061	1.0	1 8 .0	Modes of Operation Display	INT8
	Index (Hex)	Subindex (Hex)	Index content				
1st RxPDO	1600 The index content is variable	00	0 6 H				
			Index	Size	Offset	Name	Type
		01	6040	2.0	0.0	Control Word	UINT16
		02	607A	4.0	2.0	Target Position	INT32
		03	60FF	4.0	6.0	Target Velocity	INT32
		04	6071	2.0	10.0	Target Torque	INT16
		05	6060	1.0	12.0	Modes of Operation	INT8
		0 6	60B8	2.0	13 .0	Touch Probe Function	UINT16

The content of the second to fourth group of PDO mapping is retained.

6.2 Object dictionary 2000H set of parameter lists (inverter parameter set)

Function code group	Start function code index number	Sub index
A0: System parameters	0x2000	0
A1: User-defined display function code	0x2040	0
b0: Frequency given	0x2080	0
B1: Start/stop control	0x20C0	0
b2: acceleration and deceleration parameters	0x2100	0
C0: Switch input	0x2140	0
C1: Switch output	0x2180	0
C2: Analog and pulse input	0x21C0	0

C3: Analog and pulse output	0x2200	0
C4: Automatic correction of analog input	0x2240	0
d0: Motor 1 parameter	0x2280	0
D1: Motor 1 V/f control parameters	0x22C0	0
D2: Vector control parameters of motor 1	0x2300	0
D3: Motor 2 parameters	0x2380	0
D4: Motor 2 V/f control parameters	0x23C0	0
D5: Motor 2 vector control parameters	0x2400	0
E0: Enhanced features	0x24C0	0
E1: Protection parameters	0x2500	0
E2: Motor control enhancement parameters	0x2540	0
F0: Process PID	0x2580	0
F1: Multiple frequency segments	0x2600	0
F2: Simple PLC	0x2680	0
F 4: Position control	0x2780	0
H0: Communication parameters	0x2900	0
H 1: Communication parameters	0x2940	0
L0: Operation panel buttons	0x29C0	0
L1: LED display Settings	0x2A00	0
U0: Status monitoring	0x2A40	0
U1: Fault record	0x2AC0	0
U2: Inverter version information	0x2B00	0
Control word groups	0x2B40	0
Status word group	0x2B80	0

6.3 Object dictionary 6000H, group parameter list

Index (Hex)	Sub index (Hex)	Name	Data type	Scale	Unit	SDO attribute	PDO category nature	Default
603F	0	Error code	UINT16	0~ 0xFFFF	——	ro	TPDO	——
6040	0	control word	UINT16	0~ 0xFFFF	——	rw	RPDO	0
6041	0	status word	UINT16	0~ 0xFFFF	——	ro	TPDO	——
6060	0	operator schema	INT8	0~ 10	——	rw	RPDO	0
6061	0	The operation mode is	INT8	——	——	ro	TPDO	0

		obvious show						
6064	0	current location	INT32	——	Directive unit	ro	TPDO	——
606C	0	actual velocity	INT32	——	Directive unit / second	ro	TPDO	——
6071	0	Target torque	INT16	-3000~3000	0.10%	rw	RPDO	——
6077	0	Actual torque	INT16	0~3000	0.10%	ro	TPDO	——
607A	0	target location	INT32	0x80000000 ~ 0x7FFFFFFF	Directive unit	rw	RPDO	——

Index (Hex)	Sub index (Hex)	Name	Data type	scale	unit	SDO attribute	PDO attribute	Default
60B8	0	Probes function	UINT16	0~ 0xFFFF	——	rw	RPDO	0
60B9	0	Probe function status word	UINT16	0~ 0xFFFF	——	ro	TPDO	0
60BA	0	Probe 1 rising edge position Set the latch value	INT32	0x80000000 ~ 0x7FFFFFFF	Directive unit	ro	TPDO	0

Index (Hex)	Subindex (Hex)	Name	Data type	scale	unit	SDO attribute	PDO attribute	Default
60FF	0	Target speed	INT32	0x80000000 ~ 0x7FFFFFFF	Directive unit	rw	RPDO	0

7. Electrical connection description

As shown in **Figure 7.1**, the connection must follow a **bottom-in (IN), top-out (OUT)** configuration. Reverse connection is not allowed.

The **EPC-CM34** module uses a standard **Ethernet RJ45 connector** to connect with the EtherCAT master. The pin definitions are fully compatible with standard Ethernet pins, and both **crossover** and **straight-through cables** are supported.

The **EPC-CM34** module supports various network topologies, including **bus**, **star**, and **tree** structures. By making effective use of switches, a wide variety of network configurations can be achieved.

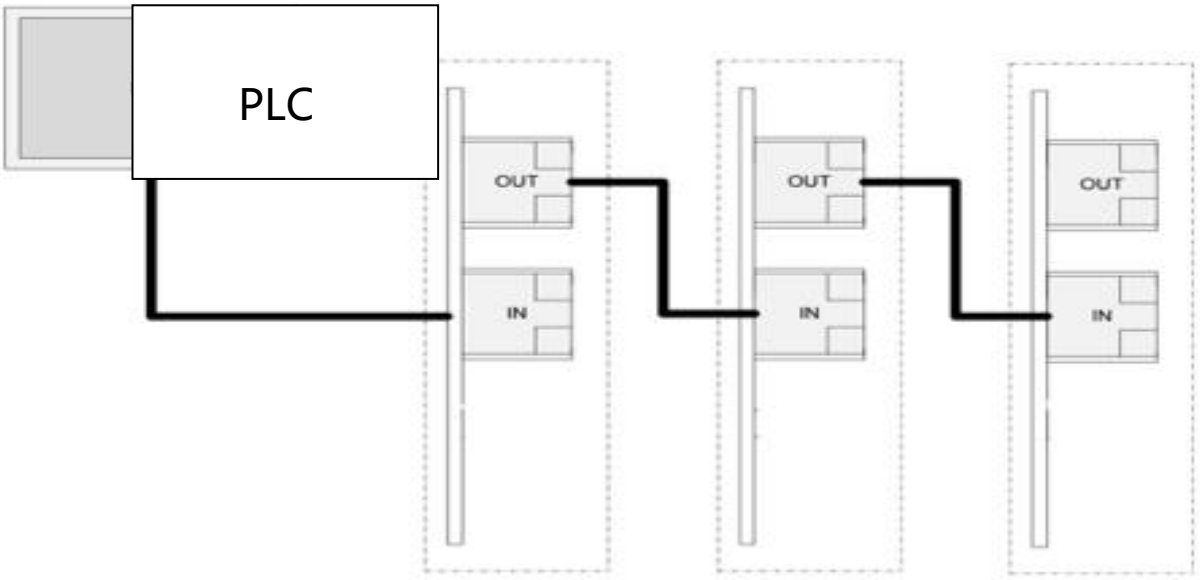


Figure 7.1 Bus topology diagram

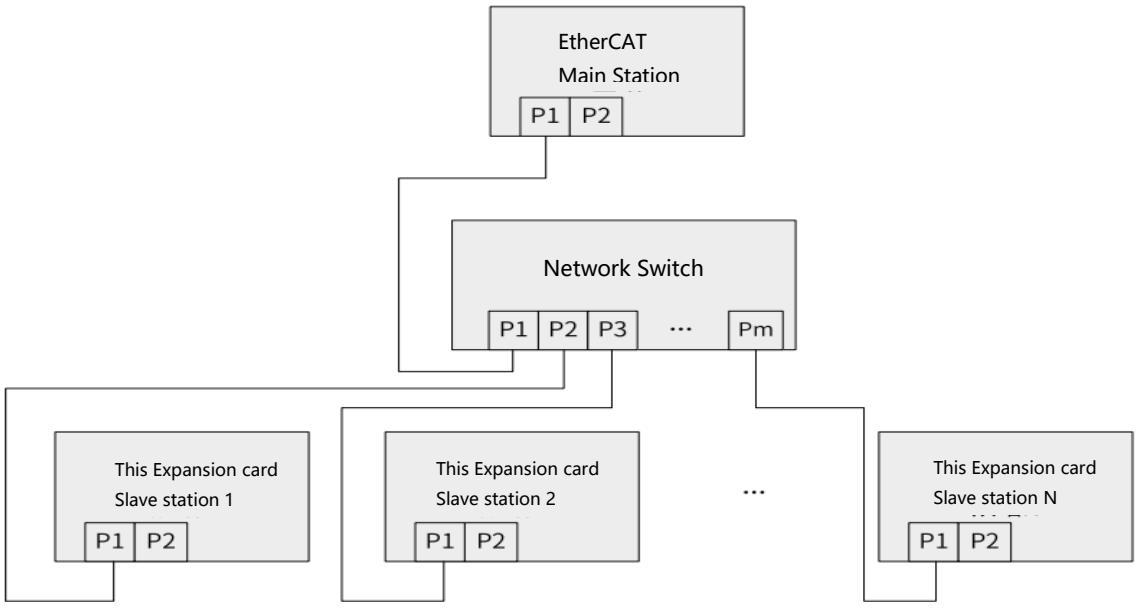


Figure 7.2 Star topology diagram

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