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## INTRODUCTION

GS30 drives have a variety of option cards that can be used to expand the functionality of the drive.

### Communication Cards:

- GS30A-CM-EIP1: Provides EtherNet/IP and Modbus TCP communications with 1 Ethernet port.
- GS30A-CM-EIP2: Provides EtherNet/IP and Modbus TCP communications with 2 Ethernet ports.
- GS30A-CM-ECAT: Provides EtherCAT communications.

### I/O Cards:

- GS30A-06CDD: Provides 3-point sinking/sourcing inputs/outputs
- GS30A-2AD2DA: Provides 2-channel current/voltage inputs/outputs
- GS30A-02TRC: Provides 240VAC/30VDC (2) Form B (SPDT) relays
- GS30A-03TRA: Provides 250VAC/30VDC (3) Form C (SPST) relays
- GS30A-FB-LD: Provides line driver (differential) encoder input. Pulse Command and Pulse output
- GS30A-FB-OC: Provides NPN open collector and PNP open collector encoder input, Pulse Command and Pulse output

### Misc. Cards:

- GS30A-BPS: Provides backup power supply.

One I/O and one communication card be installed at the same time. The BPS card can be installed with either an I/O card OR a communication card.

## OPTION CARD INSTALLATION

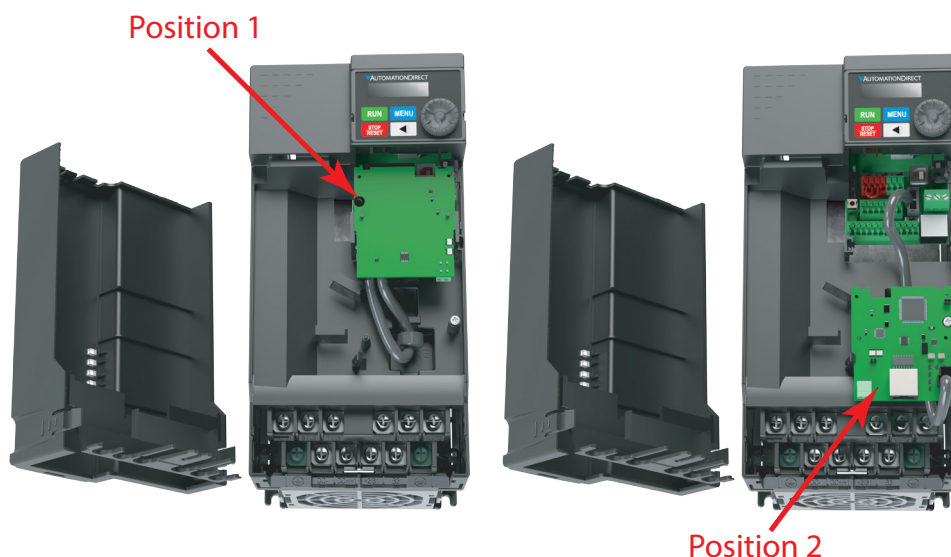
The option cards in this chapter are optional accessories. Select the applicable option cards for your GS30 drive, or contact AutomationDirect for suggestions. The option cards can significantly improve the functionality of the drive. To prevent damage to the GS30 drive during installation, remove the digital keypad and the cover before wiring.

### OPTION CARD LOCATIONS

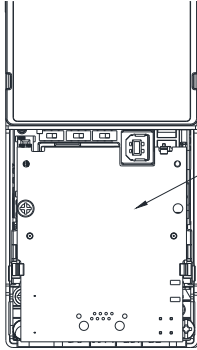
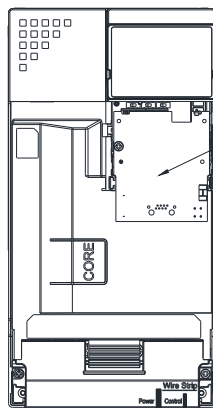
The GS30 drive supports installation of up to two option cards at a time. I/O cards must be installed in position 1. The GS30A-CM-EIP1/EIP2 communication cards and the GS30A-BPS can be installed in position 1 or position 2. The GS30A-CM-ECAT card must be installed in position 2 to comply with ECAT standards. This means you can have one comm card and one I/O card installed, or the GS30A-BPS and either a comm card or an I/O card.



Mounting Positions for Frames A-D



**Mounting Positions for Frames E-I**

GS30 Optional I/O and Communication Cards			
Part Number	Description	Position	Reference Diagram
GS30A-BPS	GS30 series backup power supply module.	1 or 2	 <p>Position 1</p> <p><b>Card Installed in Position 1 of GS30 Frame A-D</b></p>
GS30A-CM-EIP1	GS30 series communication module, EtherNet/IP and ModbusTCP, 1 port, (1) Ethernet (RJ45) port.	1 or 2	
GS30A-CM-EIP2	GS30 series communication module, EtherNet/IP and Modbus TCP, 2 ports, (2) Ethernet (RJ45) port(s).	1 or 2	
GS30A-ECAT	GS30 series communication module, EtherCAT CoE protocol, 2 ports, (2) Ethernet (RJ45) port(s).	2	
GS30A-06CDD	GS30 series discrete combo module, Input: 3-point, 24 VDC, sinking/sourcing selectable, Output: 3-point, 48 VDC, sinking/sourcing selectable, 30mA/point, 50mA resistive output current.	1	
GS30A-2AD2DA	GS30 series analog combo module, Input: 2-channel, current/voltage, 0-20 mA and 4-20 mA, 0-10 VDC, Output: 2-channel, current/voltage, 0-20 mA and 4-20 mA, 0-10 VDC	1	
GS30A-02TRC	GS30 series relay output module, 240 VAC/30 VDC, (2) Form B (SPDT) relays, 1 isolated common(s), 1 point(s) per common. Screw terminal blocks included.	1	
GS30A-03TRA	GS30 series relay output module, 250 VAC/30 VDC, (3) Form C (SPST) relays, 1 isolated common(s), 1 point(s) per common. Screw terminal blocks included	1	 <p>Position 1</p> <p><b>Card Installed in Position 1 of GS30 Frame E-F</b></p>
GS30A-FB-LD	GS30 series encoder module, line driver (differential) encoder input. For use with GS30 series AC drives. Supports 1-phase and 2-phase input	1	
GS30A-FB-OC	GS30 series encoder module, NPN open collector and PNP open collector encoder input. For use with GS30 series AC drives. Supports 1-phase and 2-phase input	1	



**REMOVING THE CARD SLOT COVER**

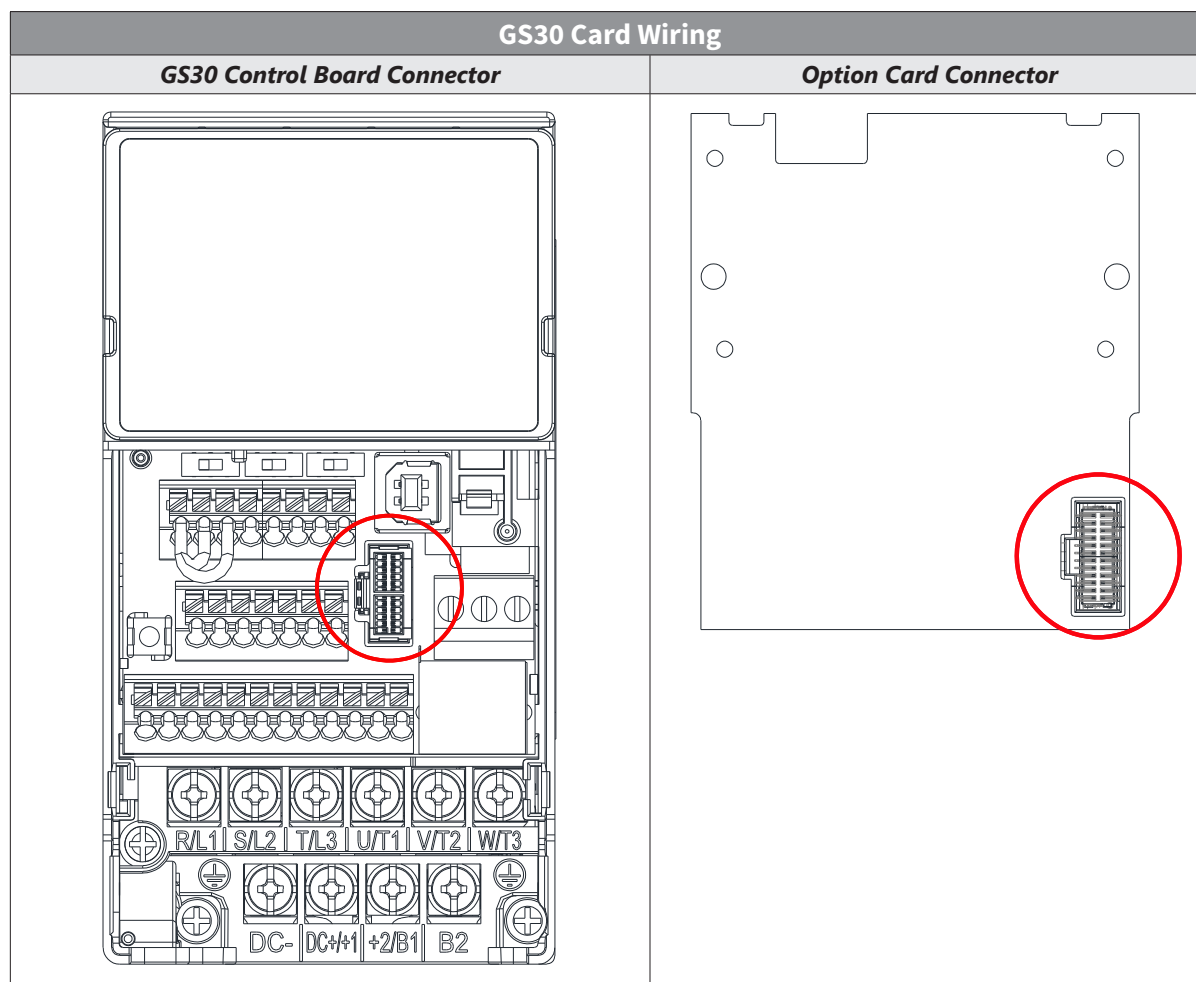
**WARNING:** AC INPUT POWER MUST BE DISCONNECTED BEFORE PERFORMING ANY MAINTENANCE. DO NOT CONNECT OR DISCONNECT WIRES OR CONNECTORS WHILE POWER IS APPLIED TO THE CIRCUIT. MAINTENANCE MUST BE PERFORMED ONLY BY A QUALIFIED TECHNICIAN.



**WARNING:** A CHARGE MAY STILL REMAIN IN THE DC-LINK CAPACITOR WITH HAZARDOUS VOLTAGES, EVEN IF THE POWER HAS BEEN TURNED OFF. TO AVOID PERSONAL INJURY, DO NOT REMOVE THE COVER OF THE AC DRIVE UNTIL ALL “DISPLAY LED” LIGHTS ON THE DIGITAL KEYPAD ARE OFF. PLEASE NOTE THAT THERE ARE LIVE COMPONENTS EXPOSED WITHIN THE AC DRIVE. DO NOT TOUCH THESE LIVE PARTS.



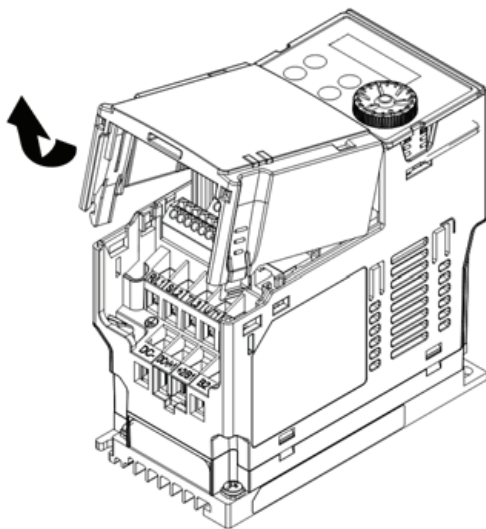
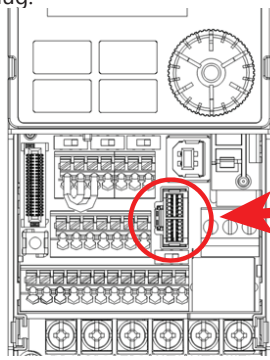
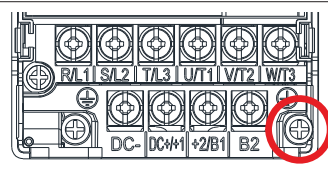
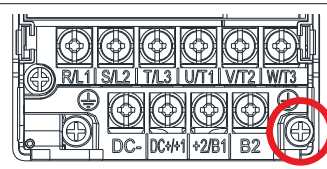
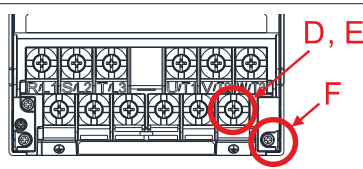
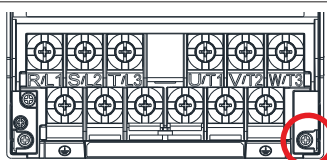
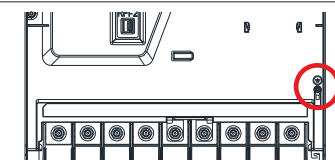
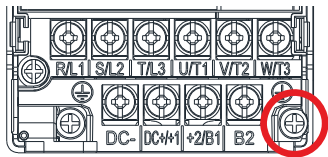
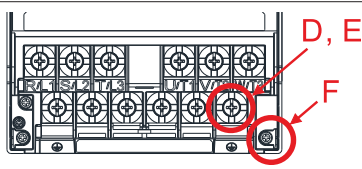
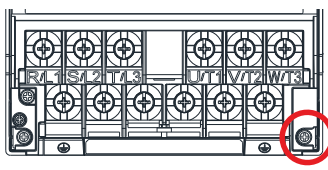
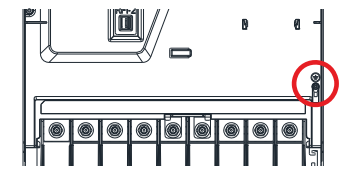
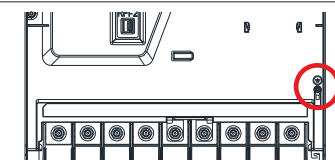
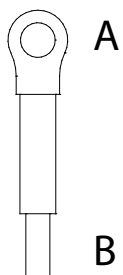
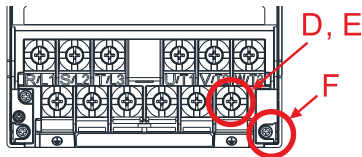
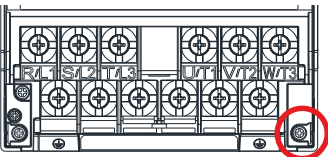
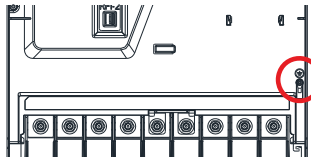
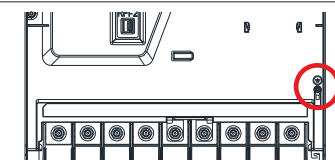
**NOTE:** To prevent damage during installation, remove the digital keypad and cover before option card installation. See “Chapter 2: Installation and Wiring” for instructions.

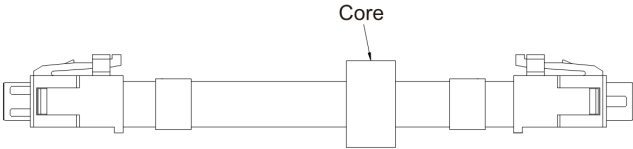
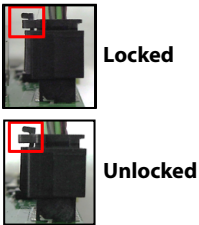
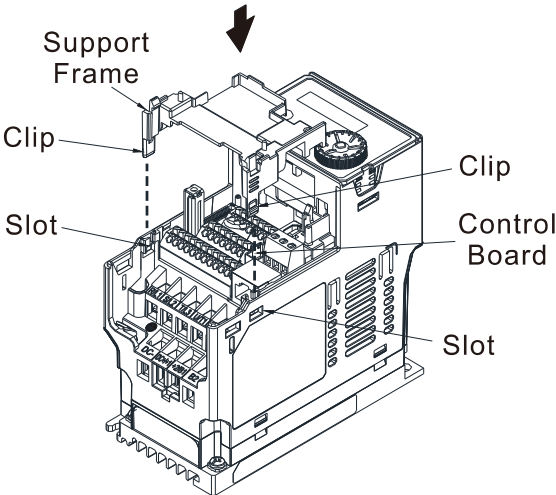
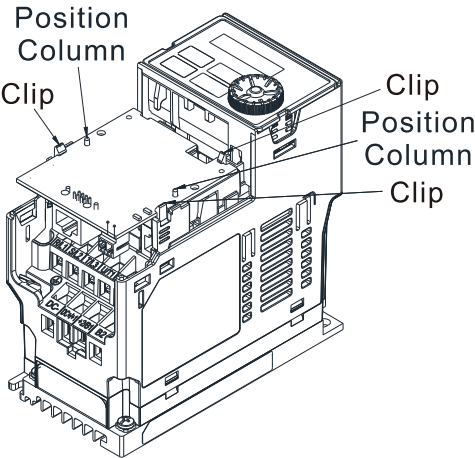
**OPTION CARD WIRING**

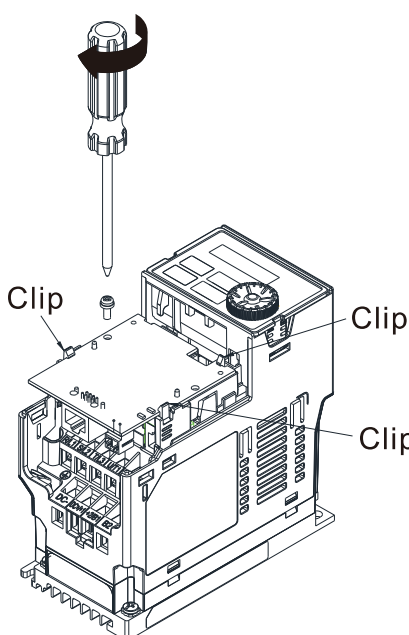
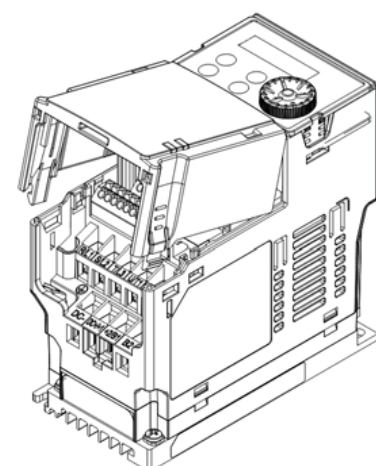
**WARNING:** PLEASE READ THE DESCRIPTIONS ON THE CONNECTING CABLES AND INSTALL CAREFULLY. USING INCORRECT CABLES CAN DAMAGE THE OPTION CARD OR THE DRIVE.

**INSTALL THE COMMUNICATION CARD IN POSITION 1**

Installation method: Back-mount the option card by connecting flat cables to the control board.

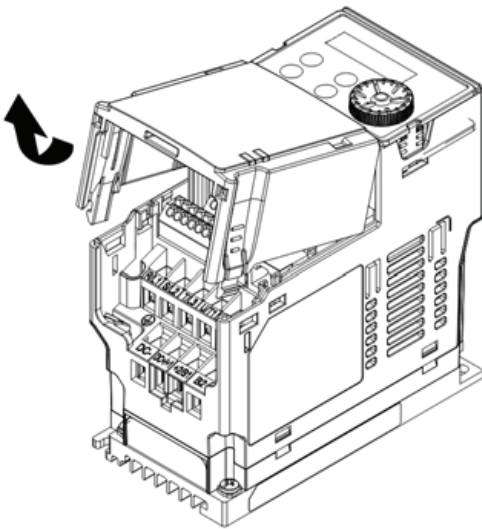
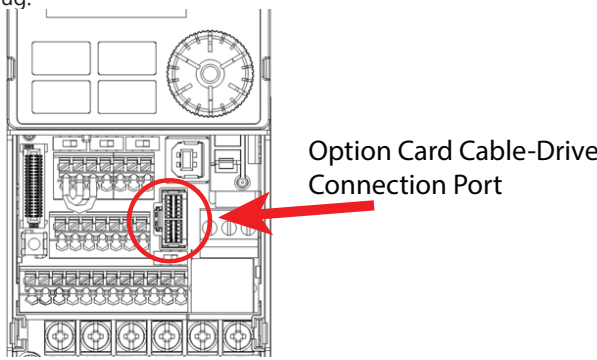
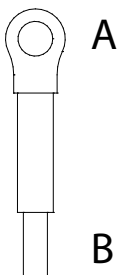
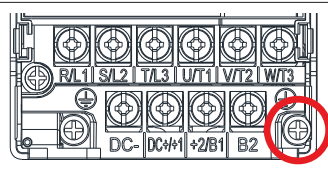
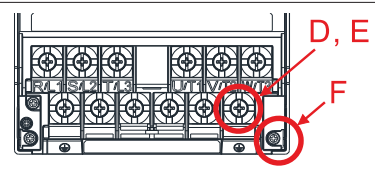
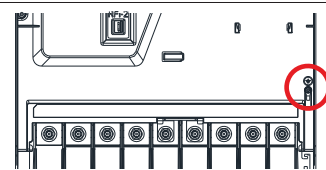
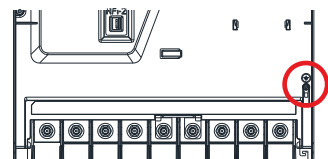
GS30 Communication Card Installation Steps (Position 1)										
Step	Description									
1	Turn off the drive power and remove the front cover. <div></div>									
2	Remove the plug terminal cover from the drive control board. A small screwdriver can be used to pry the cover from the plug. <div><div>Option Card Cable-Drive Connection Port</div></div>									
3	The communication card must be grounded before wiring. A ground terminal wire is included with the card. The A side of the ground terminal connects to the PE on the drive as indicated by the red circles below. The B side of the ground terminal connects to the green terminal block labeled PE on the option card. Connect the wire then plug the terminal block back into the option card. Note, for E-I frames, snip the "A" ring of the ground terminal wire to fit the connector around the ground screw.									
<table><tr><th>Ground Terminal Wire</th><th>Frame A-C</th><th>Frame D-F</th></tr><tr><td rowspan="2"><div></div><div>A</div></td><td></td><td></td></tr><tr><td><div>B</div></td><td><div>Frame G</div></td><td><div>Frame H-I</div></td></tr></table>		Ground Terminal Wire	Frame A-C	Frame D-F	<div></div> <div>A</div>			<div>B</div>	<div>Frame G</div> 	<div>Frame H-I</div> 
Ground Terminal Wire	Frame A-C	Frame D-F								
<div></div> <div>A</div>										
	<div>B</div>	<div>Frame G</div> 	<div>Frame H-I</div> 							

GS30 Communication Card Installation Steps (Position 1)(continued)	
Step	Description
4	<p>Plug each end of the control board connector cable included with the option card into the appropriate slot on the card and the drive. Apply enough pressure to ensure the connector is properly locked in place.</p>  
5	<p>Aim the two clips at the two slots on the drive, and then press downward to have the two clips engage the slots.</p> 
6	<p>With the terminal block and connector of the option card facing downward, aim the two holes of the option card to the position column and press downward so that the three clips engage the option card.</p> 

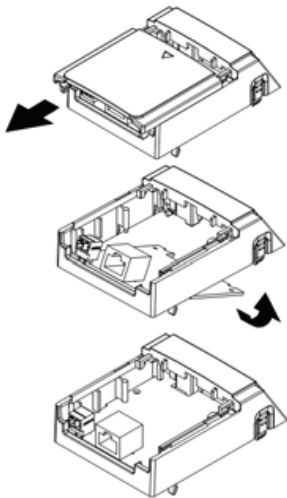
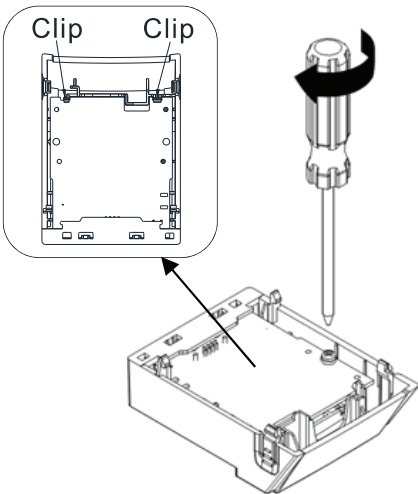
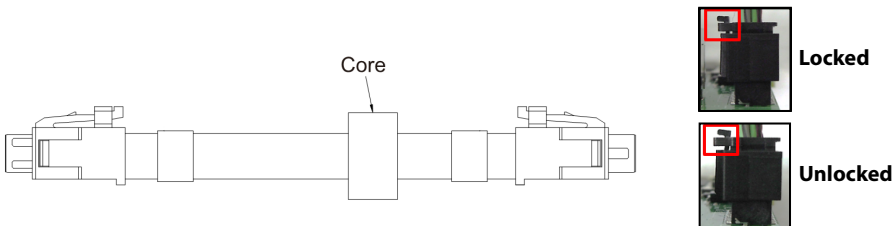
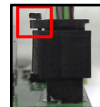
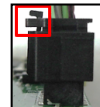
GS30 Communication Card Installation Steps (Position 1)(continued)	
Step	Description
7	<p>Fasten the screw to fix the option card firmly in place and torque approximately 4-6 kg-cm (3.5-5.2 in-lb)(0.39-0.59 N·m).</p> 
8	<p>Replace the GS30 drive front cover. Installation is complete.</p> 

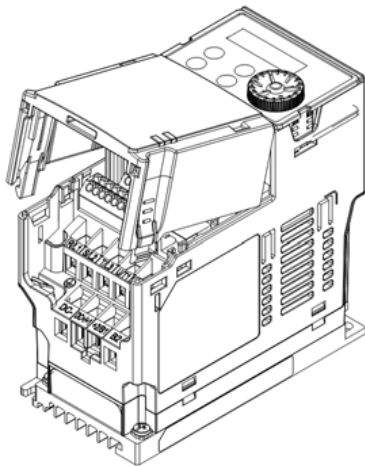
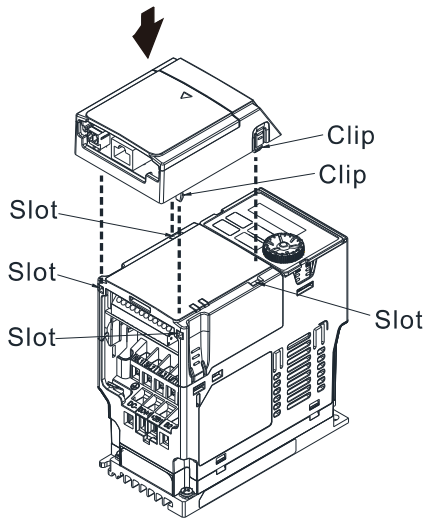
**INSTALL THE COMMUNICATION CARD IN POSITION 2**

Installation method: Back-mount the option card by connecting flat cables to the control board.

GS30 Communication or BPS Card Installation Steps (Position 2)			
Step	Description		
1	Turn off the power of the drive, and then remove the front cover. 		
2	Remove the plug terminal cover from the drive control board. A small screwdriver can be used to pry the cover from the plug. 		
3	The communication card must be grounded before wiring. A ground terminal wire is included with the card. The A side of the ground terminal connects to the PE on the drive as indicated by the red circles below. The B side of the ground terminal connects to the green terminal block labeled PE on the option card. Connect the wire then plug the terminal block back into the option card. Note, for E-I frames, snip the "A" ring of the ground terminal wire to fit the connector around the ground screw.		
Ground Terminal Wire		Frame A-C	Frame D-F
			
		Frame G	Frame H-I
			

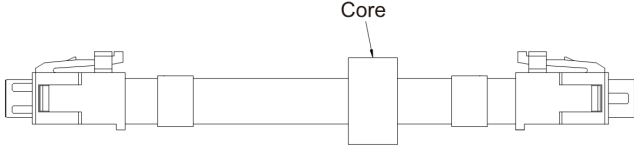
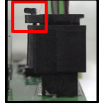
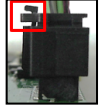
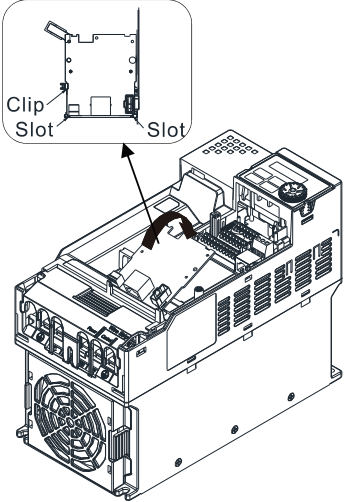
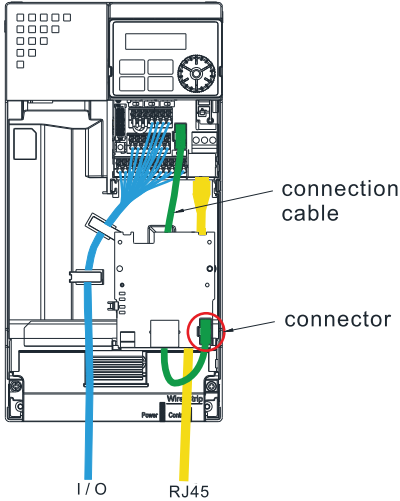
**FINAL INSTALLATION STEPS FOR FRAME A-D:**

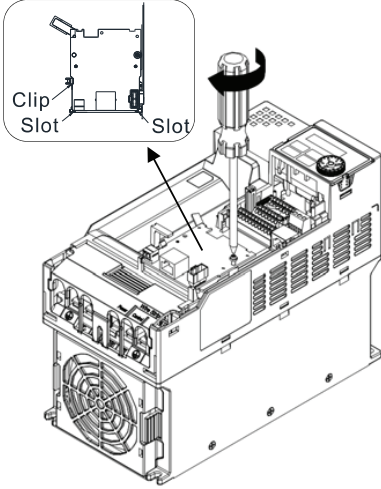
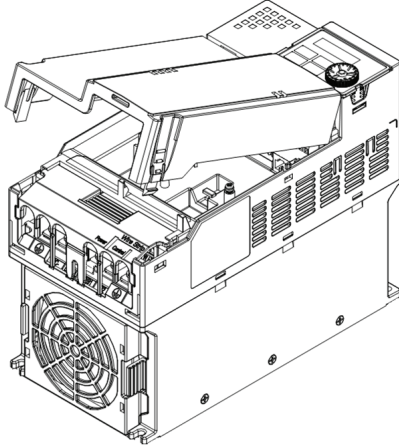
GS30 Communication or BPS Card Installation Steps (Position 2)	
Step	Description
4	<p>Detach the upper cover of the external mounting cover and place the communication card in the box with the terminal block and connector facing up and snap into place.</p> 
5	<p>Flip the external mounting cover over and ensure the two clips are fully engaged. Then fasten the screws as shown below (torque screws to 4-6 kg•cm/3.5-5.2 lb-in/ 0.39-0.59 N•m).</p> 
6	<p>Plug each end of the control board connector cable included with the option card into the appropriate slot on the card and the drive. Apply enough pressure to ensure the connector is properly locked in place.</p>  <div style="display: flex; align-items: center;">  <div style="margin-left: 10px;"><b>Locked</b></div> </div> <div style="display: flex; align-items: center;">  <div style="margin-left: 10px;"><b>Unlocked</b></div> </div>

GS30 Communication or BPS Card Installation Steps (Position 2)(Continued)	
Step	Description
7	<p>Replace the GS30 drive front cover.</p> 
8	<p>Line up the four clips on the back of the installation box with the four slots on the front of the GS30 drive. Press downward to engage the clips. Installation is complete</p> 



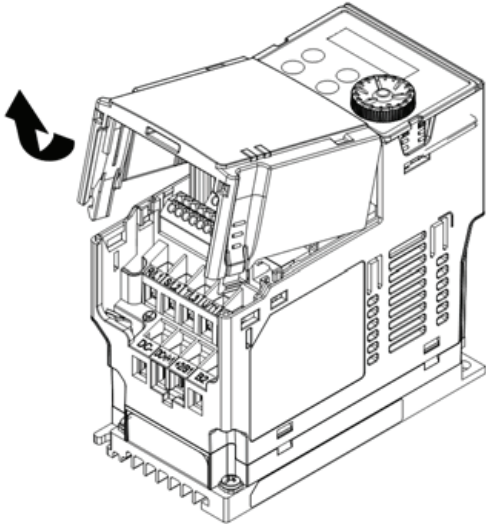
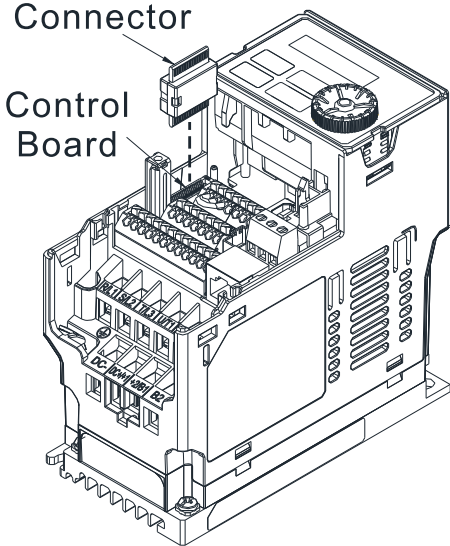
**FINAL INSTALLATION STEPS FOR FRAME E-I:**

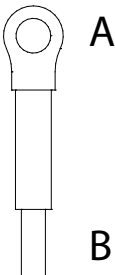
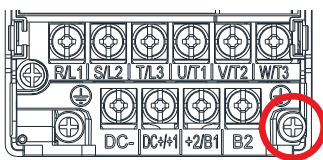
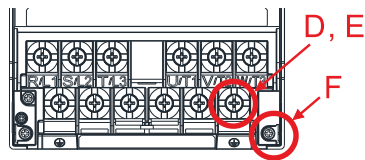
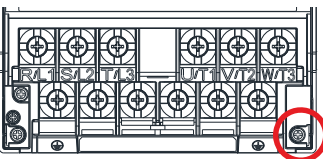
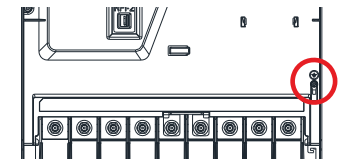
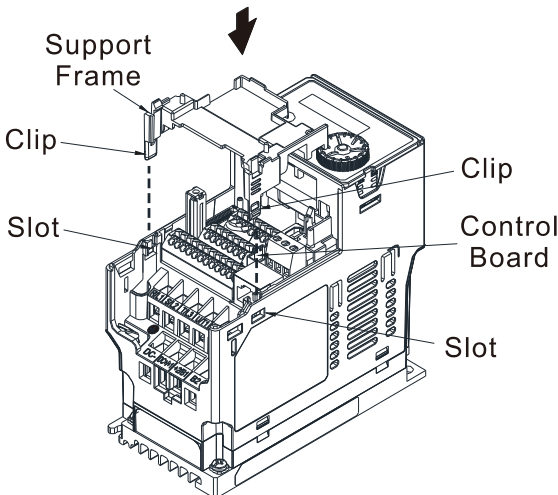
GS30 Communication or BPS Card Installation Steps (Position 2)	
Step	Description
4	<p>Plug each end of the control board connector cable included with the option card into the appropriate slot on the card and the drive. Apply enough pressure to ensure the connector is properly locked in place.</p>   <b>Locked</b>  <b>Unlocked</b>
5	<p>Place the communication card with terminal block and connector facing up in the position 2 slot of the drive. Make sure to run the connector cable under the card, not over it.</p> 
6	<p>Before securing the card in place, make sure all cables are running around or under the communication card (see below).</p> 

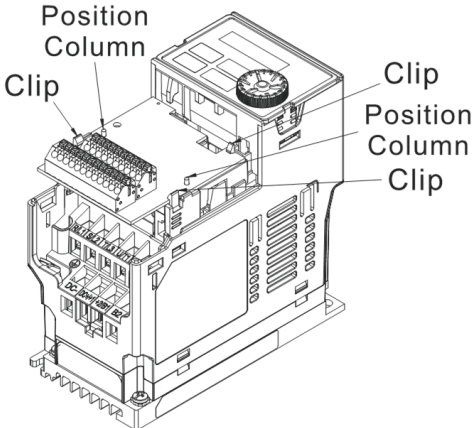
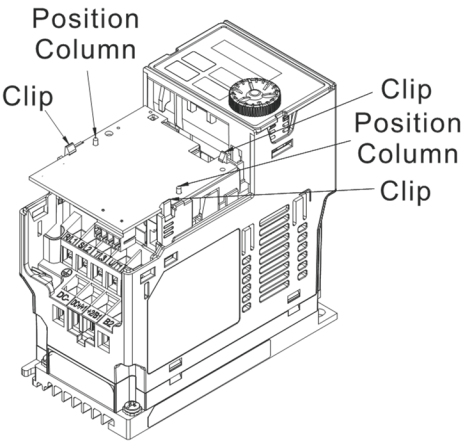
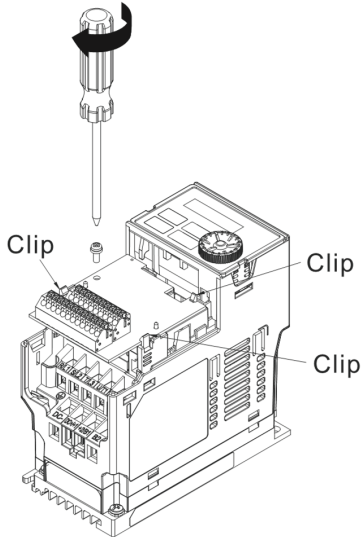
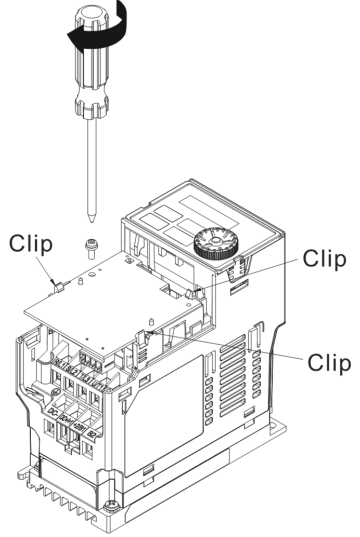
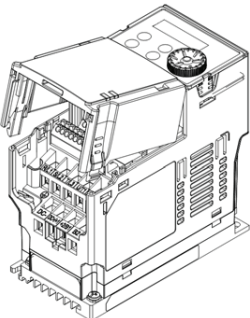
GS30 Communication or BPS Card Installation Steps (Position 2)(Continued)	
Step	Description
7	<p>Press downward to engage the clips, then fasten the screws as shown (torque screws to 4-6 kg•cm/3.5-5.2 lb-in/ 0.39-0.59 N•m).</p> 
8	<p>Replace the GS30 drive front cover. Installation is complete.</p> 

**INSTALL THE I/O, ENCODER, OR BPS CARD IN POSITION 1**

Installation method: Back-mount the option card by connecting a card connector to the control board.

GS30 I/O Card Installation Steps (Position 1)	
Step	Description
1	<div>Turn off the drive power and remove the front cover.</div> <div></div>
2	<div>Mount the card connector to the drive control board.</div> <div></div>

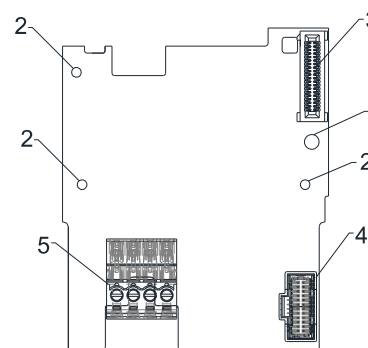
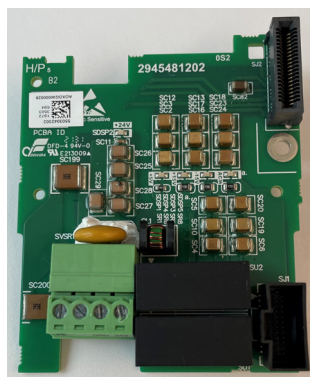
GS30 I/O Card Installation Steps (Position 1)(continued)		
Step	Description	
3	<p>The encoder and BPS cards must be grounded before wiring. A ground terminal wire is included with the card. The A side of the ground terminal connects to the PE on the drive as indicated by the red circles below. The B side of the ground terminal connects to the green terminal block labeled PE on the option card. Connect the wire then plug the terminal block back into the option card. Note, for E-I frames, snip the "A" ring of the ground terminal wire to fit the connector around the ground screw.</p>	
	<p><b>Ground Terminal Wire</b></p> 	<div> <p><b>Frame A-C</b></p>  </div> <div> <p><b>Frame D-F</b></p>  </div> <div> <p><b>Frame G</b></p>  </div> <div> <p><b>Frame H-I</b></p>  </div>
4	<p>Aim the two clips at the two slots on the drive, and then press downward to have the two clips engage the slots.</p> 	

GS30 I/O Card Installation Steps (Position 1)(continued)	
Step	Description
5	With the terminal block and connector of the option card facing downward, aim the two holes of the option card to the position column and press downward so that the three clips engage the option card.
	
	Encoder and I/O cards, terminals up
6	Fasten the screw to fix the option card firmly in place and torque approximately 4-6 kg-cm (3.5-5.2 in-lb)(0.39-0.59 N-m).
	
	BPS card, terminals down
7	Replace the GS30 drive front cover. Installation is complete.
	
	Encoder and I/O cards
7	
	BPS card
7	

## GS30A-BPS

The GS30A-BPS is a backup power supply for GS30 series AC drives that can be installed in Position 1 or Position 2 as needed.

A backup power supply card allows external 24VDC to be connected to the drive, which keeps communications and some I/O of the drive active during main power downs. This is especially useful if frequent operator lockouts turn line power off to the drive. Network communications will remain active during power downs.



**GS30A-BPS**

GS30A-BPS Overview			
Drawing Item	Description	Wiring Info	Screw Torque
1	Screw fixing hole	Wire gauge: 0.25–0.5 mm <sup>2</sup> [24–20 AWG] Stripping length: 7–8 mm	Screw torque: 2 kg-cm / [1.7 lb-in.] / [0.2 N•m]
2	Positioning hole		
3	AC drive connection port		
4	AC drive connection port		
5	+24 V terminal block		

### FEATURES

- Provides external power supply for the controls circuitry.
- Supports 24 VDC input.
- Supports parameter reading and writing and status monitoring of the drive.

### SPECIFICATIONS

If the GS30 drive is running solely on power provided by the GS30A-BPS, GS30 communication works normally along with the following functions:

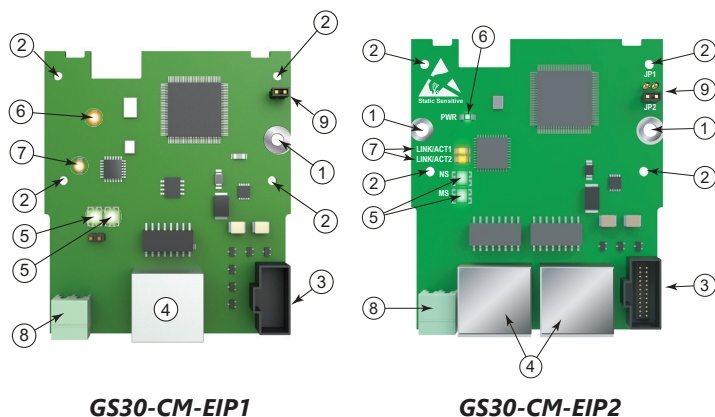
- Parameter reading and writing
- Keypad display
- Keys on the keyboard panel (except the RUN key)
- Analog input with +10 V terminal supply power
- Multi-function inputs (FWD/DI1, REV/DI2, DI3–DI7) with +24V terminal or external power supply
- Relay output
- Pulse sequence frequency command

The following functions are not supported when running on backup power only:

- DO digital frequency signal output
- AO1 multi-function analog voltage output
- PLC functions

## GS30A-CM-EIP1 AND GS30A-CM-EIP2

The GS30A-CM-EIP1 and GS30A-CM-EIP2 are communication cards for GS30 series AC drives that enable Modbus TCP and EtherNet/IP communications. The GS30A-CM-EIP1 is a single port card while GS30A-CM-EIP2 is a dual-port card. Either card can be installed in Position 1 or Position 2.



GS30A-CM-EIP1 Overview			
Drawing Item	Description	Wiring Info	Screw Torque
1	Screw fixing hole	Wire gauge: 0.25–0.5 mm <sup>2</sup> [24–20 AWG] Stripping length: 7–8 mm	Screw torque: 2 kg-cm / [1.7 lb-in.] / [0.2 N•m]
2	Positioning hole		
3	AC drive connection port		
4	Communication port		
5	Indicator lights; NET1 (NS), NET2 (MS)		
6	Power indicator		
7	Link indicator		
8	Ground terminal block		
9	Jumper		

GS30A-CM-EIP2 Overview			
Drawing Item	Description	Wiring Info	Screw Torque
1	Screw fixing hole	Wire gauge: 0.25–0.5 mm <sup>2</sup> [24–20 AWG] Stripping length: 7–8 mm	Screw torque: 2 kg-cm / [1.7 lb-in.] / [0.2 N•m]
2	Positioning hole		
3	AC drive connection port		
4	Communication ports: Port 1, Port 2		
5	Indicator lights; NS, MS		
6	Power indicator		
7	Link indicator: ACT1 (Port 1), ACT2 (Port 2)		
8	Ground terminal block		
9	Jumper		

### FEATURES

- Supports Modbus TCP and EtherNet/IP protocol
- 32/32 words read/write parameters correspondence
- User-defined corresponding parameters
- MDI / MDI-X auto-detect



## SPECIFICATIONS

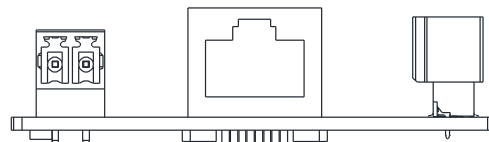
GS30A-CM-EIPx Specifications	
Network Interface	
<b>Interface</b>	RJ45 with Auto MDI/MDIX
<b>Number of ports</b>	GS30A-CM-EIP1: 1 port GS30A-CM-EIP2: 2 ports
<b>Transmission method</b>	IEEE 802.3, IEEE 802.3u
<b>Transmission cable</b>	Category 5e shielding 100MHz
<b>Transmission speed</b>	10/100 Mbps Auto-Detect
<b>Network protocol</b>	ICMP, IP, TCP, UDP, DHCP, Modbus over TCP/IP, EtherNet/IP, BOOTP
Electrical	
<b>Power supply voltage</b>	15VDC (supplied by the AC drive)
<b>Insulation voltage</b>	500VDC
<b>Power consumption</b>	0.8W
Physical	
<b>Weight</b>	GS30-CM-EIP1: 25g GS30-CM-EIP2: 30g
Environment	
<b>Noise immunity</b>	ESD (IEC 61800-5-1, IEC 61000-4-2) EFT (IEC 61800-5-1, IEC 61000-4-4) Surge Test (IEC 61800-5-1, IEC 61000-4-5) Conducted Susceptibility Test (IEC 61800-5-1, IEC 61000-4-6)
<b>Operation / storage</b>	Operation: -10°C~50°C [14°F~122°F] (temperature), 90% (humidity) Storage: -25°C~70°C [-13°F~158°F] (temperature), 95% (humidity)
<b>Vibration / shock immunity</b>	International standard: IEC 61800-5-1, IEC 60068-2-6/IEC 61800-5-1, IEC 60068-2-27

## CONNECTING COMM CARD TO PC

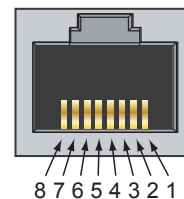
To connect the GS30A-CM-EIPx to the network:

- 1) Turn off the power of the drive.
- 2) Open the front cover of the drive.
- 3) Connect the CAT-5e network cable to the RJ45 port of the GS30A-CM-EIPx (as shown in the right figure).

Note: the GS30A-CM-EIP2 has 2 ports but steps are the same.



PIN Description for GS30A-CM-EIPx					
PIN	Signal	Description	PIN	Signal	Description
1	TX+	Transmit Data +	5	–	N/C
2	TX–	Transmit Data –	6	RX –	Receive Data –
3	RX+	Receive Data +	7	–	N/C
4	–	N/C	8	–	N/C



**GS30A-CM-EIPx LED INDICATORS AND TROUBLESHOOTING**

There are four LED indicators on the GS30A-CM-EIP1 and GS30A-CM-EIP2 cards. The POWER LED displays the status of the power supply, and the LINK LED displays the communication status with the network. If any of these conditions exist and the cause cannot be determined, power down the drive, remove the comm card and reinstall it. Re-seating the card may eliminate certain problems.

GS30A-CM-EIPx LED Indicators				
LED	Status		Indication	How to correct it?
<b>POWER</b>	Amber/ Green*	On	Power supply in normal status	None
		Off	No power supply	Re-seat comm card connection and verify drive power
<b>LINK</b>	Amber	On	Network is connected	None
		Off	No network connection	Verify network cable is connected
<b>NET1 (NS) (network status)</b>	Off	Off	The device is powered off, or is powered on but with no IP address configured	Re-seat comm card connection cable and verify drive power. Enter IP address in device
	Green	Flashes	Network in operation, sending/receiving network packet.	None
		On	IP address is configured, at least one CIP connection is established, and an Exclusive Owner connection has not timed out.	None
	Red	Flashes	Connection timeout- An IP address is configured, and an Exclusive Owner connection for which this device is the target has timed out.	Verify that the Originator is attempting communication with the target. Verify operation of network cabling and switches.
		On	Major Fault- Duplicate IP detected	Ensure no other device on the network has the same IP address
	Red/ Green	Flashes	Self-Test, device is performing power up testing.	Device is performing power up testing.
<b>NET2 (MS) (module status)</b>	Off	Off	The device is powered off, or is powered on but with no IP address configured	Re-seat comm card connection cable and verify drive power
	Green	Flashes	Device in Standby, has not been configured	None
		On	Device Operational	None
	Red	Flashes	Major Recoverable Fault	An incorrect or inconsistent configuration. Update configuration settings.
		On	Major Unrecoverable Fault	Cycle power on the drive, reseat cables. If error doesn't clear, contact ADC Technical support
	Red/ Green	Flashes	Self-Test, device is performing power up testing.	None

\* Applies to dual port model only (GS30A-CM-EIP2)



**NOTE:** If the communication card is not recognized by the drive (P09.60=0), try the following:

- 1) Ensure cable connector is in locked position on the card.
- 2) Ensure the J2 Jumper is removed from the card and then cycle power to the drive.

GS30A-CM-EIPx LED Troubleshooting		
<b>Abnormality</b>	<b>Cause</b>	<b>How to correct it?</b>
<b>POWER LED off</b>	AC drive not powered	Check if AC drive is powered, and if the power supply is normal.
	GS30A-CM-EIPx not connected to the AC drive	Make sure GS30A-CM-EIPx is connected to the AC drive.
<b>MS or NS LED off</b>	GS30A-CM-EIPx not connected to the network	Make sure the network cable is correctly connected to the network.
	Poor contact to RJ-45 connector	Make sure the RJ-45 connector is connected to the Ethernet port.
<b>Cannot ping communication card IP address on the network</b>	The GS30A-CM-EIPx is not connected to the network.	Ensure that the GS30A-CM-EIPx is correctly connected to the network. Ensure Jumper J2 is not left in place on the EIP card after a FW update.
	The PC and the GS30A-CM-EIPx are in different networks and blocked by network firewall.	Search by IP or set up relevant settings using the AC drive keypad.
<b>Cannot open GS30A-CM-EIPx setup page</b>	The GS30A-CM-EIPx is not connected to the network.	Ensure that the GS30A-CM-EIPx is correctly connected to the network.
	Incorrect communication setting in GSoft2.	Ensure that the communication setting in GSoft2 is set to Ethernet.
	The PC and the GS30A-CM-EIPx are in different networks and blocked by network firewall.	Use the drive keypad to set the ethernet card address.

GS30A-CM-EIPx Error Codes		
<b>ID</b>	<b>Code</b>	<b>Definition</b>
<b>71</b>	ECLv	5V power that drive provides to the Comm card is too low
<b>72</b>	ECtt	Communication card is in test mode
<b>75</b>	ECFF	Incorrect default setting
<b>76</b>	ECiF	Serious internal error
<b>80</b>	ECEF	Ethernet connection error. Ensure ethernet cable is plugged in and ethernet switch is powered (if used).
<b>81</b>	ECto	Communication timeout between GS30A-CM-EIPx and GS30
<b>82</b>	ECCS	Checksum error in the communication between GS30A-CM-EIPx and GS30
<b>83</b>	ECrF	Reset GS30A-CM-EIPx to default setting
<b>84</b>	ECo0	Exceeds max. number of communications in Modbus TCP
<b>85</b>	ECo1	Exceeds max. number of communications in EtherNet/IP
<b>86</b>	ECiP	IP error: Default Gateway address must match subnet of IP address or be set to 0.0.0.0
<b>87</b>	EC3F	reserved
<b>88</b>	ECbY	GS30 is busy.
<b>89</b>	ECCb	ExCom card break

### GS30A-CM-EIPx IP ADDRESS AND NETWORK CONFIGURATION

Ethernet communication cards must have their own unique IP address. While the card addresses can be set for DHCP (IP address is set and can be changed by the network), we recommend using static IP addresses. That way, the IP address of the drive will stay fixed. Either method requires the IP addresses (and subnet masks) of the communication cards to be compatible with any other devices that want to connect to the drive. For an easy subnet mask calculator, please visit [www.subnet-calculator.com](http://www.subnet-calculator.com).



**NOTE:** If at any point the communication card configuration becomes problematic, the communication card can always be reset to factory defaults by entering a “1” into P09.90 Com Card Factory Reset.

The following **example** will set the IP addresses of the PC and drive. **Your actual addresses may need to be different, depending on your local network.**

#### SET THE IP ADDRESS OF THE GS30 DRIVE

Set the IP address of the drive through GSoft2 software or by the drive keypad.



**NOTE:** Changing an Ethernet communication parameter in the drive does not immediately affect the communication card; there is a second set of registers in the comm card. Entering a value of 2 in parameter P09.91 causes the drive to push the P09 communication parameters to the card. Bits in P09.91 reset themselves automatically.

#### GSoft2 method

Connect to the drive thru the Type B serial port. Once connected, the “IP Config button” will become active. Click on it. The Overview tab that pops up shows the current drive configuration. Click on the Basic tab to edit the IP address. Enter the following:

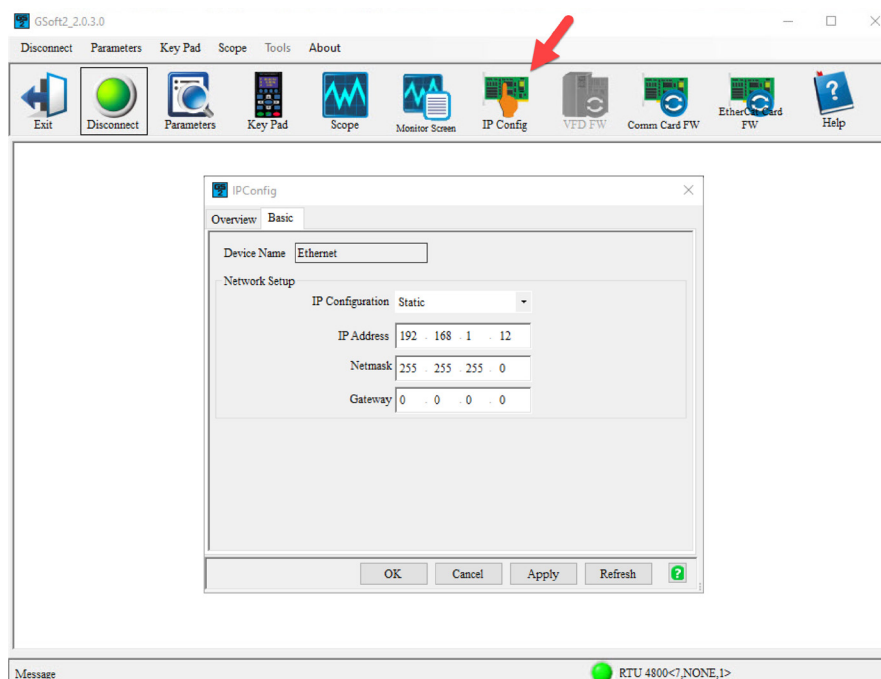
IP Configuration = Static

IP Address = 192.168.1.10

Subnet Mask = 255.255.255.0

Gateway = 0.0.0.0 (or same as IP address 1st three octets; ex: 192.168.1.1)

Press Apply for the changes to take effect. (This effectively sets bit 1 in P09.91)



Keypad method

Enter the following parameter data in the drive keypad:

GS30 IP Configuration		
Parameter	Set Value	Explanation
P09.75	0	Set the IP to "Static"
P09.76	192	IP address 1
P09.77	168	IP address 2
P09.78	1	IP address 3
P09.79	10	IP address 4
P09.80	255	Subnet Mask 1
P09.81	255	Subnet Mask 2
P09.82	255	Subnet Mask 3
P09.83	0	Subnet Mask 4
P09.84	192	Gateway Address 1
P09.85	168	Gateway Address 2
P09.86	1	Gateway Address 3
P09.87	1	Gateway Address 4

Enter a "2" into P09.91 (sets bit 1 = 1) and press "Enter" to transfer the network parameters to the comm card. P09.91 will save the parameters to the card and will then reset P09.91 to zero.

**GS30A-CM-EIPx COMMON PARAMETERS**

When the GS30 drive is connected via Ethernet, please use the communication parameters in the table below to configure the drive. The master will be able to read/write the frequency word and control word for the GS30 drive after the communication parameters are set up.

GS30 Communication Parameters			
Parameter	Function	Set Value (Dec)	Explanation
P00.20	Source of frequency command setting	8	The frequency command is controlled by communication card.
P00.21	Source of operation command setting	5	The operation command is controlled by communication card.
P09.30	Communication decoding method	0	Set decoding method
P09.74	Set Comm Master Protocol	1	Set master
P09.75	IP setting	0	Static IP(0) / Dynamic distribution IP(1)
P09.76	IP address -1	192	IP address 192.168.1.5
P09.77	IP address -2	168	IP address 192.168.1.5
P09.78	IP address -3	1	IP address 192.168.1.5
P09.79	IP address -4	5	IP address 192.168.1.5
P09.80	Netmask -1	255	Netmask 255.255.255.0
P09.81	Netmask -2	255	Netmask 255.255.255.0
P09.82	Netmask -3	255	Netmask 255.255.255.0
P09.83	Netmask -4	0	Netmask 255.255.255.0
P09.84	Default gateway -1	192	Default gateway 192.168.1.1
P09.85	Default gateway -2	168	Default gateway 192.168.1.1
P09.86	Default gateway -3	1	Default gateway 192.168.1.1
P09.87	Default gateway -4	1	Default gateway 192.168.1.1
P09.93	EIP Comm Card Fault Select	3	Set communication timeout settings
P09.94	EIP Comm Card Time Out Detection	1	Set communication timeout settings
P09.95	EIP Comm Card Time Out Duration	3.0	Set communication timeout settings

Communication Card Special Function Parameters	
Parameter	Explanation
<b>P09.90</b>	Communication Card Factory Reset, 1 = Reset to factory defaults
<b>P09.91</b>	Communication Card Set, 2 = Write parameters to card

After changing any of the P09.xx communication card parameters, enter a “2” into P09.91 (Bit1 = 1). This will write any parameter changes from the drive into the communication card.



**NOTE:** The external controller's RPI must be set greater than 10ms.

### MODBUS TCP OR ETHERNET/IP PROTOCOL SELECTION

The GS30A-CM-EIPx card can communicate via Modbus TCP or EtherNet/IP protocols.

P09.74 defines the master protocol of the communication card and allows the user to define proper actions in the event of communication timeouts.

If P09.74 = 1: EtherNet/IP, in a timeout situation (defined by P09.93 – P09.95), only the EtherNet/IP connection (Implicit OR Explicit) will trigger the timeout, not Modbus TCP. A ‘timeout situation’ is defined by 5 different possibilities:

- 1) A TCP RST or FIN message from the Master in EtherNet/IP Explicit (no EtherNet/IP Implicit).
- 2) A Forward Close message in EtherNet/IP Implicit.
- 3) No data message received in the time duration specified in Pr09-95 on EtherNet/IP Explicit.
- 4) No data message received in the time duration specified in RPI timeout EtherNet/IP Implicit.
- 5) Physical connection loss (no link available on Ethernet interface).

If P09.74 = 2: Modbus TCP, in a timeout situation (defined by P09.93 – P09.95), only the Modbus TCP connection will trigger the timeout, not EtherNet/IP Explicit (Implicit won't be allowed in this case). A ‘timeout situation’ is defined by 3 different possibilities:

- 1) 1) A TCP RST or FIN message from the Master in Modbus TCP
- 2) 2) No data message received in the time duration specified in Pr09-95 on Modbus TCP
- 3) 3) Physical connection loss (no Link Good on Ethernet interface).

If P09.74 = 0: Ethernet/IP and Modbus TCP both on, a loss in either will cause a timeout.

## MODBUS TCP PROTOCOL CONFIGURATION

### GS30A-CM-EIPx CONTROL WORDS – MODBUS ADDRESSING

Modbus TCP Protocol Parameter Address Definitions			
Modbus Address		Definition	
Decimal	Hex		
48193	2000	bit 0~1	00: No function
			01: Stop
			10: Run
			11: Enable JOG
		bit 2~3	reserved
		bit 4~5	00B: No function
			01B: Forward command
			10B: Reverse command
			11B: no function
		bit 6~7	00B: 1st accel. / decel.
			01B: 2nd accel. / decel.
			10B: 3rd accel. / decel.
			11B: 4th accel. / decel.
		bit 8~11	000B: Master speed
			0001B: 1st step speed frequency
			0010B: 2nd step speed frequency
			0011B: 3rd step speed frequency
			0100B: 4th step speed frequency
			0101B: 5th step speed frequency
			0110B: 6th step speed frequency
			0111B: 7th step speed frequency
			1000B: 8th step speed frequency
			1001B: 9th step speed frequency
			1010B: 10th step speed frequency
			1011B: 11th step speed frequency
			1100B: 12th step speed frequency
			1101B: 13th step speed frequency
			1110B: 14th step speed frequency
			1111B: 15th step speed frequency
		bit 12	1: Enable bit 06-11 function. Must = 1 to use above bits
		bit 13~14	00B: No function
			01B: No function
			10B: No function
			11B: No function
		bit 15	Reserved
48194	2001*	Frequency Command / PID Setpoint	6000 = 60.00Hz
48195	2002	bit 0	1: E.F. = ON (Trigger an External Fault)
		bit 1	1: Reset command
		bit 2	1: External interruption (B.B) = ON
		bit 3~5	reserved
**Note concerning 2001h: If the Frequency Command (via RS485, Ethernet, Keypad, analog, etc.) is set higher than P01.00 Max Frequency Output, the drive will limit the actual output to P01.00.			



**GS30A-CM-EIPx STATUS WORDS – MODBUS ADDRESSING**

Modbus TCP Protocol Parameter Address Definitions			
Address		Definition	
Modbus Decimal	Modbus Hex		
Status Monitor 1 – Warning Codes			
48449	2100	bit 0–7	Fault Code*
		bit 8–15	Warning Code*
		* Refer to Chapter 6: Maintenance and Troubleshooting for code definitions.	
Status Monitor 2 – Status of GS30 AC Drive			
48450	2101	bit 0~1	00: Stop
			01: Decel during stop
			10: Standby
			11: Run
		bit 2	1: JOG active
			bit 3~4
		01: Transition from Reverse to Forward	
		10: Transition from Forward to Reverse	
		11: Reverse	
		bit 5~7	reserved
		bit 8	1: Main Frequency comes from Communication Interface
		bit 9	1: Main Frequency comes from Analog/External Terminal signal input
		bit 10	1: The Command is operated by Communication Interface (keypad)
		bit 11	1: Parameters have been Locked
		bit 12	Running Status [0 = Drive Stopped; 1 = Drive Running (including Standby)]
bit 13~15	reserved		
48451	2102	Frequency Command (F) / PID Setpoint	
48452	2103	Output Frequency (H)	
48453	2104	Output Current (A)	
48454	2105	DC Bus Voltage (U)	
48455	2106	Output Voltage (E)	
48456	2107	Multi Speed or PID Inputs current Step Number	
48457	2108	Max Output Torque (N·m)	
48458	2109	Digital Input Counter Value	
48459	210A	Power Factor Angle (cos Θ)	
48460	210B	Output torque (XXX.X%)	
48461	210C	Actual Motor Speed in rpm (Sensorless Estimate or Encoder Feedback actual)	
48462	210D	Encoder (PG1) feedback counts (option card), 16-bit, 0–65,535	
48463	210E	Pulse Command (PG2) pulses per rev (option card)	
48464	210F	Power Output in kW	
48471	2116	Multi-function display P00.04	
48476	211B	Maximum Operation Frequency P01.00 or Maximum User- defined Value P00.26 When P00.26 is 0, this value is equal to P01.00 setting. When P00.26 is not 0, and the command source is keypad, this value = P00.24 * P00.26 / P01.00. When P00.26 is not 0, and the command source is 485, this value = P09.10 * P00.26 / P01.00.	
48480	211F	High byte: the decimal place of current value display	
48705	2200	Display the drive's output current XX.XX. When the current is higher than 655.35, it automatically shifts one decimal place as XXX.X. Refer to the high byte of 211F for information on the decimal places.	
48706	2201	Counter value	
48707	2202	Actual output frequency XXXXX Hz	
48708	2203	DC bus voltage XXX.X V	
48709	2204	Output voltage XXX.X V	
Continued on next page			

Communication Protocol Parameter Address Definitions (continued)		
Address		Definition
Modbus Decimal	Modbus Hex	
48710	2205	Power factor angle XXX.X
48711	2206	Display the output power of U, V, W XXXX.X kW
48712	2207	Actual Motor Speed in rpm (Sensorless Estimate or Encoder Feedback actual)
48713	2208	Display the positive / negative output torque estimated by the drive +0.0: positive torque; -0.0: negative torque XXX.X%
48714	2209	Encoder (PG1) Feedback Pulses per Rev (option card)*
48715	220A	Display the P ID feedback value after enabling ID function XXX.XX%
48716	220B	Display the AI1 analog input terminal signal, 0-10 V corresponds to 0.00-100.00% see Explanation 1 in P00.04
48717	220C	Display the AI2 analog input terminal signal, 4-20 m / 0-10 V corresponds to 0.00-100.00% 2. See Explanation 2 in P00.04,
48718	220D	Reserved
48719	220E	IGBT temperature of the power module XXX.X °C
48720	220F	Reserved
48721	2210	The digital input status ON / OFF , refer to P02.12. See Explanation 2 in P00.04.
48722	2211	The digital output status ON / OFF , refer to P02.18. See Explanation 3 in P00.04.
48723	2212	Current step for the multi-step speed operation
48724	2213	The corresponding PLC digital input pin status. See Explanation 3 in P00.04
48725	2214	The corresponding PLC digital output pin status. See Explanation 4 in P00.04
48726	2215	Encoder (PG1) Position Counts (option card),16-bit, 0–65,535
48727	2216	Pulse Command (PG2) Frequency (option card) XXX.XX Hz
48728	2217	Pulse Command (PG2) Position Counts (option card) 16-bit, 0–65,535
48729	2218	Reserved
48730	2219	Counter value of overload XXX.XX %
48731	221A	GFF XXX.XX %
48732	221B	DC bus voltage ripples XXX.X V
48733	221C	PLC register D1043 data
48734	221D	Magnetic field area of the synchronous motor
48735	221E	User page displays the value in physical measure
48736	221F	Output value of P00.05 XXX.XX Hz
48737	2220	Reserved
48738	2221	Reserved
48739	2222	Reserved
48740	2223	Control mode of the drive, 0: speed mode 1: torque mode
48741	2224	Carrier frequency of the drive XX kHz
48742	2225	Reserved
*When P10.01 is set to 1000 and P10.02 is set to 1, 2, the displayed range for PG feedback is between 0–4000. When P10.01 is set to 1000 and P10.02 is set to 3, 4, 5, the displayed range for PG feedback is between 0–1000.		
Continued on next page		

Communication Protocol Parameter Address Definitions (continued)			
Address		Definition	
Modbus Decimal	Modbus Hex		
48743	2226	bit 1~0	Drive status
			00b: No direction
			01b: Forward
			10b: Reverse
		bit 3~2	01b: Drive ready
			10b: Error
		bit 4	0b: Drive does not output
			1b: Drive outputs
		bit 5	0b: No warning
			1b: Warning
48744	2227	Drive's estimated output torque positive or negative direction XXXX N•m	
48745	2228	Reserved	
48746	2229	KWH display XXXX.X	
48747	222A	Encoder (PG1) Position Counts 32-bit register, Low Word (option card), 16-bit, 0–65,535	
48748	222B	Encoder (PG1) Position Counts 32-bit register, High Word (option card), 16-bit, 0–65,535	
48749	222C	Reserved	
48750	222D	Reserved	
48751	222E	PID target value XXX.XX %	
48752	222F	PID offset XXX.XX %	
48753	2230	PID output frequency XXX.XX Hz	
48754	2231	Reserved	
48755	2232	Display the auxiliary frequency	
48756	2233	Display the master frequency	
48757	2234	Display the frequency after adding and subtracting of the master and auxiliary frequencies.	

**MODBUS TCP COMMUNICATION**

GS30A-CM-EIPx Modbus Function Codes	
Code	Definition
0x03	Read register(s) from GS30
0x06	Write single register to GS30
0x10	Write multiple data registers to GS30

## ETHERNET/IP PROTOCOL

### GS30A-CM-EIPx ETHERNET/IP I/O MESSAGING (IMPLICIT MESSAGING)

- Trigger type: Cyclic
- Transport class: 1
- Application connection type: Exclusive owner

Parameter	O→T		T→O	
Data size		Fixed		Fixed
Connection type	Point-to-Point		Multicast, Point to Point	

### GS30A-CM-EIPx ETHERNET/IP COMMUNICATION PARAMETER

- Input buffer register: In Assembly Instance = 101, Data Type = 16 bits, Size = 16
- Output buffer register: Out Assembly Instance = 100, Data Type = 16 bits, Size = 3
- Configuration: Instance = 102, Data Type = 8 bits, Size = 0

### GS30A-CM-EIPx ETHERNET/IP CIP COMMAND STATUS CODE

Status Code	Status	Definition
0x00	Success	Requested service is successfully executed.
0x01	Connection failure	Connected service fails.
0x04	Path segment error	Node in the program cannot identify the definition or syntax of a path segment. When this error takes place, the execution of program will be terminated.
0x05	Path destination unknown	The path is related to object type, but the node in the program does not cover or cannot identify the type or structure of the object. When this error takes place, the execution of program will be terminated.
0x08	Service not supported	The object does not support required service or has not yet defined the service.
0x0E	Attribute not settable	Receives request to modify unchangeable attribute
0x13	Not enough data	Receives insufficient data and therefore cannot execute command
0x14	Attribute not supported	Does not support requested attribute
0x 5	Too much data	The received data exceeds what the command execution requires.
0x20	Invalid parameter	The requested parameter is invalid, indicating that the parameter does not fit the definition of the requirement, or the requirement has been defined in "Application Object Specification".
0x26	Path size invalid	The size of the path transmitting requested service cannot afford the request to the object or cover too much route data.

**GS30A-CM-EIPx ETHERNET/IP ERROR CODE FOR MONITOR REQUEST**

<b>Status Code</b>	<b>Extended Status Code</b>	<b>Definition</b>
<b>0x00</b>	–	The execution of service is successful.
<b>0x01</b>	0x0100	The connection is in progress or the connection is re-opened. The code will be sent back when the source is trying to establish a connection to the target but the target has already been connected.
<b>0x01</b>	0x0103	Does not support the combination of this transmission type and trigger. The target does not support the defined combination of transmission type and trigger. The router will not terminate the connection, only the target end has to send back this extended status code.
<b>0x01</b>	0x0106	Clash of control right A connection takes the control, blocking the establishment of other connections. When this device occupies the connection in this way, only one connection will be allowed to control this device.
<b>0x01</b>	0x0107	Cannot find the corresponding target to connect
<b>0x01</b>	0x0108	Invalid network connection parameter When the application program in the target does not support the defined connection type, connection level, or there are too many users, the extended status code will be sent back. Only the node on target has to send back the extended status code.
<b>0x01</b>	0x0109	Invalid setting of the size of the on-line data exchange zone This device does not support the setting of the current data exchange zone. The setting can be too big or too small.
<b>0x01</b>	0x0111	RPI setting not supported
<b>0x01</b>	0x0112	RPI Value(s) Not Acceptable. Module requires an RPI of 10ms or greater.
<b>0x01</b>	0x0113	The number of connections exceeds the maximum. No further connections are able to connect to this device.
<b>0x01</b>	0x0114	The company ID does not match product code. The product code or company ID marked in the electronic key logic section does not match the record in the target device.
<b>0x01</b>	0x0115	Inconsistent product type The product type marked in the electronic key logic section does not match the record in the target device.
<b>0x01</b>	0x0116	Inconsistent version The primary and secondary revised versions marked in the electronic key logic section do not match the record in the target device.
<b>0x01</b>	0x0315	Invalid section exists in the path. The type or value of a section in the path is invalid. When the device cannot interpret the path, it will respond with this extended status code. Cause of this error: Unidentifiable path type, unexpected section type or other problems existing in the path.

**GS30A-CM-EIPx ETHERNET/IP COMMUNICATION PROTOCOL PARAMETER ADDRESS DEFINITIONS**

EtherNet/IP Communication Protocol Parameter Address Definitions				
Class Code (Parameter Content)	Instance	Address	Definition	
Class 4 (Commands to GS30)	Instance 100 (0x64)	0	bit 0~1	00: no function
				01: Stop
				10: Run
				11: Enable JOG
			bit 2~3	reserved
			bit 4~5	00: no function
				01: Forward command
				10: Reverse command
				11: no function
			bit 6~7	00B: 1st accel. / decel.
				01B: 2nd accel. / decel.
				10B: 3rd accel. / decel.
				11B: 4th accel. / decel.
			bit 8~11	0000B: Master speed
				0001B: 1st step speed frequency
				0010B: 2nd step speed frequency
				0011B: 3rd step speed frequency
				0100B: 4th step speed frequency
				0101B: 5th step speed frequency
				0110B: 6th step speed frequency
				0111B: 7th step speed frequency
				1000B: 8th step speed frequency
				1001B: 9th step speed frequency
		1010B: 10th step speed frequency		
		1011B: 11th step speed frequency		
		1100B: 12th step speed frequency		
		1101B: 13th step speed frequency		
1110B: 14th step speed frequency				
1111B: 15th step speed frequency				
bit 12	1: Enable bit 06-11 function. Must =1 to use above bits			
bit 13~14	00B: No function			
	01B: No function			
	10B: No function			
	11B: No function			
bit 15	Reserved			
1	Frequency command (6000 = 60.00Hz)			
2	bit 0	1: E.F. = ON (trigger an External Fault)		
	bit 1	1: Reset command		
	bit 2	1: External interruption (B.B) = ON		
	bit 3~15	reserved		
Continued on next page				

Communication Protocol Parameter Address Definitions (continued)				
Class Code (Parameter Content)	Instance	Address	Definition	
Class 4 (Monitor GS30 status)	Instance 101 (0x65)	0	bit 0~7	Fault Code*
			bit 8~15	Warning Code*
			*Refer to Chapter 6: Maintenance and Troubleshooting for code definitions.	
		1	bit 0~1	00: Stop
				01: Decel during Stop
				10: Standby
				11: Run
			bit 2	1: JOG active
			bit 3~4	00: Forward
				01: Transition from Reverse to Forward
				10: Transition from Forward to Reverse
				11: Reverse
			bit 5~7	reserved
			bit 8	1: Main frequency comes from communication interface
			bit 9	1: Main frequency comes from analog/external terminal signal input
			bit 10	1: The command is operated by communication interface (keypad)
			bit 11	1: Parameters have been locked
			bit 12	Running status
				0: Drive stopped
				1: Drive running (including standby)
			bit 13~15	reserved
		2	Frequency command (F) / PID Setpoint (6000 = 60.00Hz)	
		3	Output frequency (H) (6000 = 60.00Hz)	
		4	Output current (A)	
		5	DC bus voltage (U)	
		6	Output voltage (E)	
		7	Multi-speed or PID Inputs current Step Number	
		8	Max Output Torque (N·m)	
		9	Digital Input counter value	
		10	Power Factor angle (cosθ)	
		11	Output torque (XXX.X%)	
		12	Actual Motor Speed in rpm (Sensorless Estimate or Encoder Feedback actual)	
		13	Encoder (PG1) Feedback Counts (option card), 16-bit, 0~65,535	
		14	Pulse Command (PG2) Position Counts (option card), 16-bit, 0~65,535	
		15	Power Output (kW)	



EtherNet/IP Communication Protocol Parameter Address Definitions – Class 300			
Class Code (Parameter Content)	Instance	Attribute	Definition
Explicit Class 0x300 (Montior GS30 Status)	Instance 33 (0x21)	0x16	Multi-function display P00.04
		0x1B	Maximum Operation Frequency P01.00 or Maximum User-defined Value P00.26 When P00.26 is 0, this value is equal to P01.00 setting. When P00.26 is not 0, and the command source is keypad, this value = P00.24 * P00.26 / P01.00. When P00.26 is not 0, and the command source is 485, this value = P09.10 * P00.26 / P01.00.
		0x1F	High byte: the decimal place of current value display
	Instance 34 (0x22)	0x00	Display the drive's output current XX.XX. When the current is higher than 655.35, it automatically shifts one decimal place as XXX.X. Refer to the high byte of 211F for information on the decimal places.
		0x01	Counter value
		0x02	Actual output frequency XXXXX Hz
		0x03	DC bus voltage XXX.X V
		0x04	Output voltage XXX.X V
		0x05	Power factor angle XXX.X
		0x06	Display the output power of U, V, W XXXX.X kW
		0x07	Display the motor speed estimated by the drive or encoder feedback XXXXX rpm
		0x08	Display the positive / negative output torque estimated by the drive +0.0: positive torque; -0.0: negative torque XXX.X%
		0x09	Reserved
		0x0A	Display the P ID feedback value after enabling ID function XXX.XX%
		0x0B	Display the AI1 analog input terminal signal, 0-10 V corresponds to 0.00-100.00% see Explanation 1 in P00.04
		0x0C	Display the AI2 analog input terminal signal, 4-20 m / 0-10 V corresponds to 0.00-100.00%. See Explanation 2 in P00.04.
		0x0D	Reserved
		0x0E	IGBT temperature of the power module XXX.X °C
		0x0F	Reserved
		0x10	The digital input status ON / OFF , refer to P02.12. See Explanation 2 in P00.04
		0x11	The digital output status ON / OFF , refer to P02.18. See Explanation 3 in P00.04.
		0x12	Current step for the multi-step speed operation
		0x13	The corresponding PLC digital input pin status. See Explanation 3 in P00.04.
		0x14	The corresponding PLC digital output pin status. See Explanation 4 in P00.04.
		0x15	Reserved
		0x16	Pulse input frequency XXX.XX Hz
		0x17	Reserved
		0x18	Reserved
		0x19	Counter value of overload XXX.XX %
		0x1A	GFF XXX.XX %
		0x1B	DC bus voltage ripples XXX.X V
		0x1C	PLC register D1043 data
		0x1D	Magnetic field area of the synchronous motor
		0x1E	User page displays the value in physical measure
		0x1F	Output value of P00.05 XXX.XX Hz
		0x20	Reserved
	0x21	Reserved	
	0x22	Reserved	
	0x23	Control mode of the drive, 0: speed mode 1: torque mode	
	0x24	Carrier frequency of the drive XX kHz	
	0x25	Reserved	
Continued on next page			

EtherNet/IP Communication Protocol Parameter Address Definitions – Class 300 (continued)			
Class Code (Parameter Content)	Instance	Attribute	Definition
Explicit Class 0x300 (Monitor GS30 Status)	Instance 34 (0x22)	0x26	Drive status
			00b: No direction
			01b: Forward
			10b: Reverse
			01b: Drive ready
			10b: Error
		bit 4	0b: Drive does not output 1b: Drive outputs
		bit 5	0b: No warning
			1b: Warning
		0x27	Drive's estimated output torque positive or negative direction XXXX N•m
		0x28	Reserved
		0x29	KWH display XXXX.X
		0x2A	Reserved
		0x2B	Reserved
		0x2C	Reserved
		0x2D	Reserved
		0x2E	PID target value XXX.XX %
		0x2F	PID offset XXX.XX %
		0x30	PID output frequency XXX.XX Hz
		0x31	Reserved
		0x32	Display the auxiliary frequency
		0x33	Display the master frequency
		0x34	Display the frequency after adding and subtracting of the master and auxiliary frequencies.

**GS30A-CM-EIPx EXPLICIT MESSAGING**
**ETHERNET/IP SERVICES AND OBJECTS**

EtherNet/IP Objects Supported		
Object	Class Code	Definition
<b>Identity Object</b>	0x01	For device identity
<b>Message Router Object</b>	0x02	For message route
<b>Assembly Object</b>	0x04	For assembly
<b>Connection Manager Object</b>	0x06	For connection management
<b>TCP/IP Interface Object</b>	0xF5	For TCP/IP interface
<b>Ethernet Link Object</b>	0xF6	For Ethernet connection
<b>BR Object</b>	0x64	For basic control registers
<b>AL Object</b>	0x65	For alarm registers
<b>AC Drive (VFD) Data Object</b>	0x300	For any VFD parameter

EtherNet/IP Data Formats Supported	
Data Format	Explanation
<b>BYTE</b>	8-bit string
<b>WORD</b>	16-bit string
<b>DWORD</b>	32-bit string
<b>STRING[n]</b>	String composed of n bytes
<b>SHORT_STRING</b>	String combined from bytes (1 byte length indicator, 1 byte characters)
<b>USINT</b>	8-bit unsigned integer
<b>UINT</b>	16-bit unsigned integer
<b>UDINT</b>	32-bit unsigned integer

**IDENTITY OBJECT (CLASS CODE: 0x01)**

Instance Code: 0x01

Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Description of Attribute
0x01	Get	Vendor ID	UINT	660
0x02	Get	Device Type	UINT	Communications Adapter 12
0x03	Get	Product Code	UINT	Model code: 0x0104
0x04	Get	Revision	STRUCT of: USINT, USINT	Firmware version Major revision Minor revision
0x05	Get	Status	WORD	Summary status of devices.
0x06	Get	Serial Number	UDINT	32-bit serial number of device
0x07	Get	Product Name	SHORT_STRING	GS30A-CM-EIP1/EIP2

**Common Services**

Service Code	Implemented for		Service Name	Description of Service
	Class	Instance		
0x05		✓	Reset	Resets device settings
0x0E		✓	Get Single Attribute	Sends back attribute of designated object

**MESSAGE ROUTER OBJECT (CLASS CODE: 0x02)***Instance Code: 0x01**Instance Attributes: None*Common Services

Service Code	Implemented for		Service Name	Description of service
	Class	Instance		
0x0E		✓	Get Single Attribute	Sends back attribute of designated object

**ASSEMBLY OBJECT (CLASS CODE: 0x04)***Instance Code*

Instance	Description
0x64	Corresponds to output buffer register
0x65	Corresponds to input buffer register
0x66	Corresponds to setup object

Instance Attributes

Attribute ID	Access Rule	Name	Data type	Description of attribute
0x03	Get / Set	Data	ARRAY of BYTE	Instance Code = 0x64 (Get/Set) Others Get only

Common Services

Service Code	Implemented for		Service Name	Description of service
	Class	Instance		
0x0E		✓	Get Single Attribute	Sends back attribute of designated object
0x10		✓	Set Single Attribute	Modifies attribute

**CONNECTION MANAGER OBJECT (CLASS CODE: 0x06)***Instance Code: 0x01**Instance Attributes: None*Services

Service Code	Implemented for		Service Name	Description of service
	Class	Instance		
0x4E		✓	Forward Close	Shuts down the connection
0x54		✓	Forward Open	Establishes the connection, max. 511 bytes per transmission.

**TCP/IP INTERFACE OBJECT (CLASS CODE: 0xF5)**
**Instance Code: 0x01**
**Instance Attributes**

Attribute ID	Access Rule	Name	Data type	Description of attribute
0x01	Get	Status	DWORD	Interface status
0x02	Get	Configuration Capability	DWORD	Interface capability flags
0x03	Get / Set	Configuration Control	DWORD	Interface control flags
0x04	Get	Path Size, Path	STRUCT of: UINT, Padded EPATH	Path size Path
0x05	Get / Set	Interface Configuration	STRUCT of: UDINT, UDINT, UDINT, UDINT, UDINT, STRING	IP Address Network Mask Gateway Address Name Server Name Server 2 Domain Name
0x06	Get / Set	Host Name	STRING	Host name

**Status Instance Attribute**

Bits	Name	Description
0~3	Interface Configuration Status	0 = The Interface Configuration attribute has not been configured. 1 = The Interface Configuration attribute contains valid configuration obtained from BOOTP, DHCP or non-volatile storage. 2 = The IP address member of the Interface Configuration attribute contains valid configuration, obtained from hardware settings (e.g.: pushwheel, thumbwheel, etc.) 3-15 = reserved for future use.

**Configuration Capability Attribute**

Bits	Name	Description
2	DHCP Client	1 (TRUE) shall indicate the device is capable of obtaining its network configuration via DHCP.
4	Configuration Settable	1 (TRUE) shall indicate the Interface Configuration attribute is settable.

**Configuration Control Attribute**

Bits	Name	Description
0~3	Startup Configuration	0 = The device shall use the interface configuration values previously stored in non-volatile memory. 1 = The device shall obtain its interface configuration values via BOOTP. 2 = The device shall obtain its interface configuration values via DHCP upon start-up. 3-15 = reserved for future use.

**Common Services**

Service Code	Implemented for		Service Name	Description of service
	Class	Instance		
0x0E		✓	Get Single Attribute	Sends back attribute of designated object
0x10		✓	Set Single Attribute	Modifies attribute

**ETHERNET LINK OBJECT (CLASS CODE: 0xF6)****Instance Code: 0x01****Instance Attributes**

<b>Attribute ID</b>	<b>Access Rule</b>	<b>Name</b>	<b>Data type</b>	<b>Description of attribute</b>
0x01	Get	Interface Speed	UDINT	Interface speed currently in use Speed in Mbps (e.g., 0, 10, 100, 1000, etc.)
0x02	Get	Interface Flags	DWORD	Interface status flags
0x03	Get	Physical Address	USINT[6]	MAC address

**Interface Flags**

<b>Bits</b>	<b>Name</b>	<b>Description</b>
0	Link Status	0 indicates an inactive link; 1 indicates an active link.
1	Half/Full Duplex	0 indicates the interface is running half duplex; 1 indicates full duplex.
2-4	Negotiation Status	Indicates the status of link auto-negotiation 0 = Auto-negotiation in progress. 1 = Auto-negotiation and speed detection failed. Using default values for speed and duplex. defaults are 10Mbps and half duplex. 2 = Auto negotiation failed but detected speed. default is half duplex. 3 = Successfully negotiated speed and duplex. 4 = Auto-negotiation not attempted. Forced speed and duplex.

**Services**

<b>Service Code</b>	<b>Implemented for</b>		<b>Service Name</b>	<b>Description of service</b>
	<b>Class</b>	<b>Instance</b>		
0x0E		✓	Get Single Attribute	Sends back attribute of designated object

### GS30A-CM-EIPx ETHERNET/IP BASIC REGISTERS

GS30A-CM-EIPx Basic Registers			
BR#	Read / Write	Content	Explanation
#0	R	Model name	Set up by the system; read only. The model code of GS30A-CM-EIPx=0204H
#1	R	Firmware version	Displaying the current firmware version in hex, e.g. 0100H indicates the firmware version V1.00.
#2	R	Release date of the version	Displaying the data in decimal form. 10,000s digit and 1,000s digit are for "month"; 100s digit and 10s digit are for "day". For 1 digit: 0 = morning; 1 = afternoon.
#6	R	GS30 Drive station number	1 – 254
#11	R/W	Modbus Timeout	Pre-defined setting: 50 (ms)
#13	R/W	Keep Alive Time	Pre-defined setting: 30 (s)

**BR#0 - Model Name:** Model code for GS30A-CM-EIPx is 0x0104. Read the model code to confirm connection with GS30A-CM-EIPx.

**BR#1 - Firmware Version:** The firmware version of GS30A-CM-EIPx displayed in hexadecimal.  
Example: 0100h indicates version V1.00.

**BR#2 - Release Date of the Version:** The date is displayed in decimal form. 10,000s digit and 1,000s digit are for "month;" 100s digit and 10 digit are for "day." For 1s digit: 0 = morning; 1 = afternoon.10  
Example: 12191 indicates that the version was released the afternoon of December 19.

**BR#6 - GS30 Drive Station Number:** Station number of the GS30 series drive. Range 1~254.

**BR#11 - Modbus Communication Timeout:** Sets the communication timeout (ms) for Modbus TCP.

**BR#13 - Modbus TCP Keep Alive Time:** Range 5~65,535 seconds. If the connection idle time exceeds the keep alive time, GS30A-CM-EIPx will cut the idling connection.

### BR OBJECT (CLASS CODE: 0x64)

#### Instance Code

Instance	Description
0x01	Corresponds to BR0: Model name
0x02	Corresponds to BR1: Firmware version
0x03	Corresponds to BR2: Release date of the version
0x07	Corresponds to BR6: GS30 station No.
0x0C	Corresponds to BR11: MODBUS communication timeout
0x0E	Corresponds to BR13: Network keep alive time (TCP/IP)

#### Instance Attributes

Attribute ID	Access Rule	Name	Data type	Description of attribute
0x03	Get / Set	Data	UINT	Refer to 4.2 for corresponding value Instance Code = 0x0E Get/Set Others Get Only

#### Common Services

Service Code	Implemented for		Service Name	Description of service
	Class	Instance		
0x0E		✓	Get Single Attribute	Sends back attribute of designated object
0x10		✓	Set Single Attribute	Modifies attribute

**GS30A-CM-EIPx EtherNet/IP Alarm Register**

GS30A-CM-EIPx EtherNet/IP Alarm Register (Alarm Modbus Address Base – 0x0200, 40513)						
AL#	Bit in each AL	Read / Write	Function	Explanation		
#0~#15	bit 15	R	Function enabling flag	bit 15 = 1 → Function enabled bit 15 = 0 → Function disabled		
	bit 4~bit 14	R	reserved			
	bit 2~bit 3	R	Type of triggered event		bit 3	bit 2
				reserved	0	0
				reserved	0	1
				reserved	1	0
				reserved	1	1
	bit 1	R	Status of trigger	bit 1 = 1 → Not yet triggered bit 1 = 0 → Already triggered		
	bit 0	R	Type of trigger	bit 0 = 1 → Triggered by software bit 0 = 0 → Triggered by hardware		

**AL OBJECT (CLASS CODE: 0x65)**Instance Code

Instance	Description
0x01~0x10	Corresponds to AL0~AL15: Alarm register

Instance Attributes

Attribute ID	Access Rule	Name	Data type	Description of attribute
0x03	Get	Data	UINT	Refer to 4.3 for corresponding value

Common Services

Service Code	Implemented for		Service Name	Description of service
	Class	Instance		
0x0E		✓	Get Single Attribute	Sends back attribute of designated object

**AC DRIVE (VFD) DATA OBJECT (CLASS CODE: 0x300)**Class Attributes & Instance Attributes

- Object Class = 0x300
- Instance = Parameter Group
- Attribute = Parameter Member

Instance & Attributes					
Instance	Attributes	Access Rule	Name	Data Type	Description of Attribute
0x20	0x00~0x02	Get / Set	VFD Command	UINT	VFD Command Data
0x21	0x00~0x1F	Get	VFD Status	UINT	VFD Status Data
0x22	0x00~0x34	Get	VFD Status	UINT	VFD Status Data

Services

Instance & Attributes				
Service Code	Implemented for		Service Name	Description of Service
	Class	Instance		
0x0E	✓	✓	Get_Attribute_Single	Returns the attributes of a designated element
0x10	✓	✓	Set_Attribute_Single	Gets the attributes of a designated element



### ETHERNET/IP COMMUNICATION CARD REGISTER SETTINGS

The EtherNet/IP interface of the GS30 AC Drive supports the drive's various modes of control. The communication protocol provides support for two packet types for data exchange:

- Explicit Message
- Implicit Message

#### EXPLICIT MESSAGE-BASED DATA EXCHANGE:

The host controller directly assigns values to the GS30 Drive. Therefore it is necessary for the EIP communication card to allocate a corresponding address for the Object Class.

Currently, the address of the Object Class occupied by the GS30 Drive is 0x300.

The regular correspondence between parameter addresses and explicit messages is as follows:

#### EIP Communication Data Format

Object Class	+	Instance	+	Attribute
0x300	+	Parameter Group #	+	Parameter Member #

#### For example:

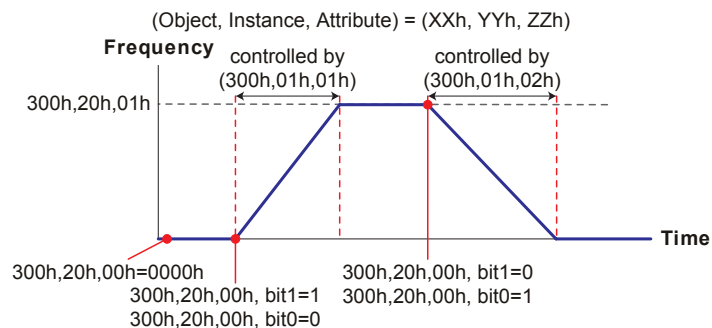
If we wish to write a command for parameter P01.01 (to set Acceleration Time 1), proceed as follows:

#### Explicit Message Format to Write to P1.01

	Object Class	+	Instance	+	Attribute
=	0x300	+	Parameter Group #	+	Parameter Member #
=	0x300	+	1 [0x01]	+	1 [0x01]
=	0x300	+	0x01	+	0x01

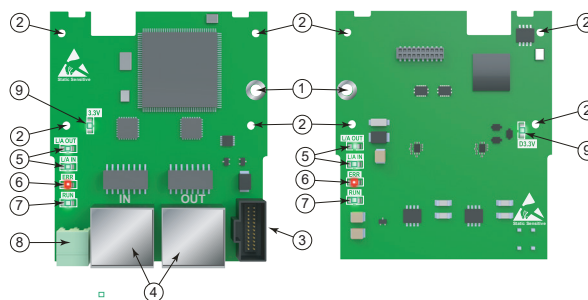
### USING SPEED MODE AS A CONTROL METHOD

- 1) Setting the Target Frequency:  
Set (Object, Instance, Attribute) = (300h, 20h, 01h);  
Unit = Hz, with a decimal precision at the hundredths position;  
Example: 1000 represents 10.00.
- 2) Operation:  
Setting (Object, Instance, Attribute) = (300h, 20h, 00h) = 0002h indicates Run;  
Setting (Object, Instance, Attribute) = (300h, 20h, 00h) = 0001h indicates Stop.
- 3) Acceleration/Deceleration time Operations:  
If the first accel/decel section is used as the basis,  
the accel time is set to (Object, Instance, Attribute) = (300h, 01h, 01h),  
and the decel time is set to (Object, Instance, Attribute) = (300h, 01h, 02h),  
with unit = seconds and a decimal precision at the tenths position.  
Example: 100 represent 10.0 seconds.



## GS30A-CM-ECAT

The GS30A-CM-ECAT option module uses an EtherCAT based industrial ethernet network with the CoE (CANOpen over EtherCAT) protocol. The GS30A-CM-ECAT comes equipped with two RJ45 Ethernet ports. It should be installed in Position 2 using the included mounting kit.



**GS30A-CM-ECAT**

GS30A-CM-ECAT Overview			
Drawing Item	Description	Wiring Info	Screw Torque
1	Screw fixing hole	Wire gauge: 0.25–0.5 mm <sup>2</sup> [24–20 AWG] Stripping length: 7–8 mm	Screw torque: 2 kg-cm / [1.7 lb-in.] / [0.2 N•m]
2	Positioning hole		
3	AC drive connection port		
4	Communication ports		
5	Indicator lights: L/A OUT, L/A IN		
6	Error indicator		
7	Run indicator		
8	Ground terminal block		
9	Power indicator		

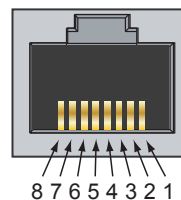
### FEATURES

- Supports speed mode
- Supports standard CANopen CiA 402 decoding (CoE)
- Supports reading and writing parameters
- Supports stop during disconnection

### SPECIFICATIONS

GS30A-CM-ECAT Specifications	
Network Interface	
Interface	RJ45
Number of ports	2 ports
Transmission method	IEEE 802.3, IEEE 802.3u
Transmission cable	Category 5e shielding 100MHz
Transmission speed	100 Mbps
Electrical	
Power supply voltage	15VDC (supplied by the AC drive)
Insulation voltage	500VDC
Power consumption	0.8W
Physical	
Weight	27g
Environment	
Noise immunity	ESD (IEC 61800-5-1, IEC 61000-4-2) EFT (IEC 61800-5-1, IEC 61000-4-4) Surge Test (IEC 61800-5-1, IEC 61000-4-5) Conducted Susceptibility Test (IEC 61800-5-1, IEC 61000-4-6)
Operation / storage	Operation: -10°C~50°C [14°F~122°F] (temperature), 90% (humidity) Storage: -25°C~70°C [-13°F~158°F] (temperature), 95% (humidity)
Vibration / shock immunity	International standard: IEC 61800-5-1, IEC 60068-2-6/IEC 61800-5-1, IEC 60068-2-27

PIN Description for GS30A-CM-ECAT					
PIN	Signal	Description	PIN	Signal	Description
1	TX+	Transmit Data +	5	–	N/C
2	TX–	Transmit Data –	6	RX –	Receive Data –
3	RX+	Receive Data +	7	–	N/C
4	–	N/C	8	–	N/C



### COMMON PARAMETERS

When the GS30 drive is connected via EtherCAT, please use the communication parameters in the table below to configure the drive. The master will be able to read/write the frequency word and control word for the GS30 drive after the communication parameters are set up.

GS30 Communication Parameters			
Parameter	Function	Set Value (Dec)	Explanation
<b>P09.00</b>	COM1 communication address	-	Use to set the EtherCAT node address.
<b>P00.20</b>	Source of frequency command setting	8	The frequency command is controlled by communication card.
<b>P00.21</b>	Source of operation command setting	5	The operation command is controlled by communication card.
<b>P09.30</b>	Communication decoding method	1	Set decoding method. EtherCAT only supports decoding method 2 (60xx).
<b>P09.60</b>	Comm card identification	6	When the drive connects with GS30-CM-ECAT the value displayed is 6 (EtherCAT Slave).

### LED INDICATORS AND TROUBLESHOOTING

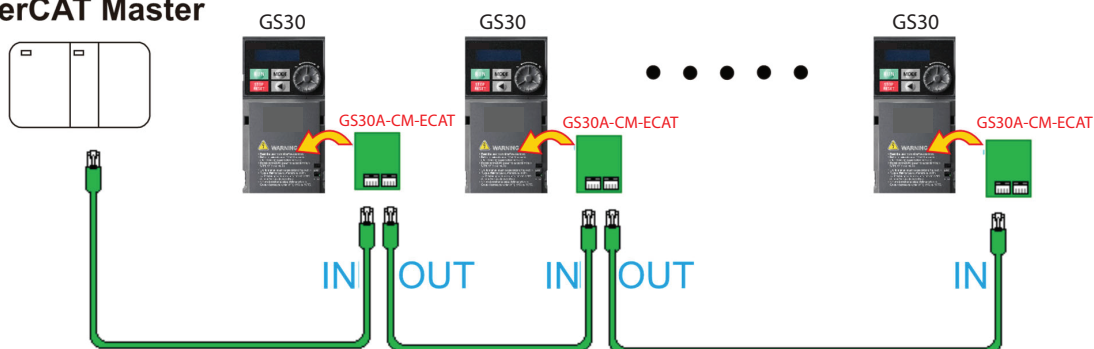
There are four LED indicators on the GS30A-CM-ECAT card. The POWER LED displays the status of the power supply, and the LINK LED displays the communication status with the network. If any of these conditions exist and the cause cannot be determined, power down the drive, remove the comm card and reinstall it. Re-seating the card may eliminate certain problems.

GS30A-CM-ECAT LED Indicators			
LED	Status		Indication
<b>RUN</b>	Green	ON	Normal operation
		Flashes	Pre-operation (the light stays ON for 200ms and then goes OFF for 200s, alternating)
		OFF	No power supply
<b>ERROR</b>	Red	Flashes	Basic configuration error (the light stays ON for 200ms and then goes OFF for 200ms, alternating)
			Status switching error (the light stays ON for 200ms then goes OFF for 1000ms, alternating)
			Time out (the light stays ON for 200ms twice, then goes OFF for 200ms, alternating)
		OFF	No errors
<b>LINK-IN</b>	Green	ON	Network connection normal
		Flashes	Network in operation
		OFF	No network connection
<b>LINK-OUT</b>	Green	ON	Network connection normal
		Flashes	Network in operation
		OFF	No network connection

### ETHERCAT CONNECTION SETUP

Packet delivery when using EtherCAT communications is directional, so careful setup of cable connections is important. When front-mounting the communication card, the delivery direction for GS30A-CM-ECAT is from left (IN) to right (OUT). Each port is labeled on the circuit board as “IN” or “OUT”. The diagram below shows the correct wiring for front-mounting GS30A-CM-ECAT.

#### EtherCAT Master



After assembling the hardware, supply power to the drive. P09.60 should now display “EtherCAT” with a value of 6. If not, make sure your GS30 drive has firmware version 1.02 or later and that the communication card is correctly connected.

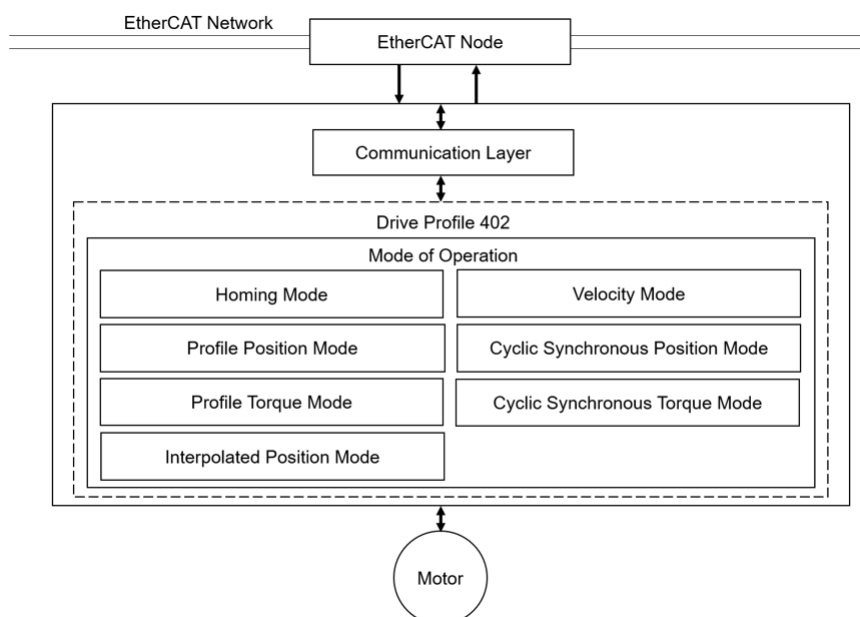
### INTRODUCTION TO ETHERCAT

#### PROTOCOL

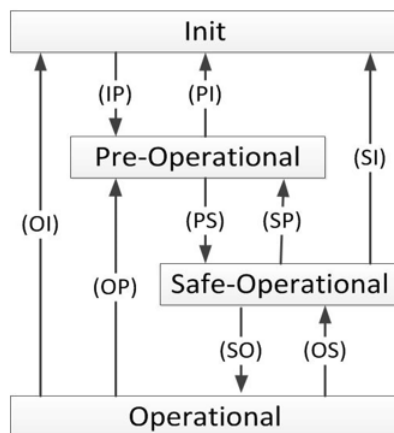
EtherCAT (Ethernet for Control Automation Technology) was created by the German company Beckhoff based on the Ethernet communication protocol which is applicable on the industrial automation and industrial open, real-time, on-site fieldbus technology. The EtherCAT Technology Group (ETG) currently supports and promotes future development of this technology.

The Ethernet structure of a drive is shown in the image below.

- 1) Communication layer: This protocol covers communication objects such as PDO, SDO, Sync and Emergency Objects. It also covers related communication object dictionary.
- 2) DS402 is the motion control layer (Drives and motion control device profile) It defines the action of different motions and the parameter setting of the objects when



## ETHERCAT STATE MACHINE



### State Description

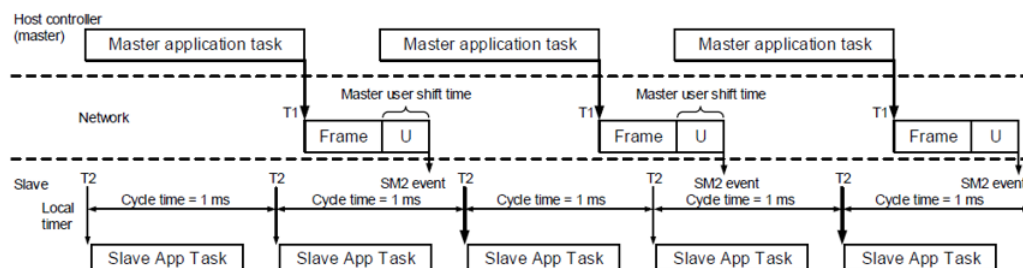
State Descriptions	
State	Description
Init	The drive successfully finishes initializing after power-on, and no error occurs. There are no communications for the application layer.
Pre-Operational	Can use mailbox communication for the current status.
Safe-Operational	Can read PDO input data (TxPDO). Cannot receive PDO output data (RxPDO)
Operational	Executes cyclic I/O communications. Can process PDO output data (RxPDO).
State Switch Command	Description
IP	Starts mailbox communication.
PI	Interrupts mailbox communication.
PS	Starts updating input data (TxPDO).
SP	Stops updating input data (TxPDO).
SO	Starts updating output data (RxPDO)
OS	Stops updating output data (RxPDO)
OP	Stops updating input/output data.
SI	Stops updating input data and mailbox communication.
OI	Stops all input/output data update and mailbox communication.

## SYSTEM SETUP

### FREE RUN MODE (ASYNCHRONOUS)

The GS30 drive currently only supports Free Run mode (Asynchronous) operation.

In Free Run mode the master and slave stations run asynchronously. Each station has an individual clock that calculates the time. In other words, the clocks of the master and slave are not synchronized. The command and feedback transmissions between the master and slave are based on a sequential order instead of a precise time synchronization. For example, the master sends a PDO at time T1, and the slave receives the PDO at T2 after the SM2 event.



### PDO MAPPING CONFIGURATION

The following tables show the default PDO mapping configuration of the EtherCAT drive for data exchange. This is also defined in the XML file of the EtherCAT slave. You can modify the PDO mapping configuration according to the requirements.

#### RxPDO Mapping

First group of RxPDO mapping in VL Mode.

RxPDO (0x1600)	Controlword (0x6040)	vl target velocity (0x6042)	Mode of Operation (0x6060)
	Max Torque (0x6072)	Max Motor Speed (0x6080)	

#### TxPDO Mapping

First group of TxPDO mapping.

TxPDO (0x1A00)	Statusword (0x6041)	Mode of Operation Display (0x6061)	Position Actual Value (0x6064)
	Velocity Actual Value (0x606C)	Torque Actual Value (0x6077)	Error Code (0x603F)

### SET PDO MAPPING

The settings are as follows:

- 1) Disable the PDO configuration: set OD 1C12 sub 0 to 0 (RxPDO) and OD 1C13 sub 0 to 0 (TxPDO).
- 2) Disable the PDO mapping setting: set OD 1600 sub 0 to 0 (RxPDO) and OD 1A01 sub 0 to 0 (TxPDO).
- 3) Set the contents and number of RxPDO mappings: set OD 1600 to 1603 sub 1 to sub 8 (RxPDO) for the content and set OD 1600 to 1603 sub 0 (RxPDO) for the number of RxPDO mappings.

Take the OD 1601 as an example:

<b>Mapping parameter setting for RxPDO</b>	<b>Data</b>	<b>Description</b>
OD 1601 sub1	6040h	Controlword, 16-bit
OD 1601 sub2	6060h	Modes of operation, 8-bit
OD 1601 sub3	6072h	Max torque, 32-bit
OD 1601 sub4	607Ah	Target torque, 32-bit
OD 1601 sub5	6080h	Max motor speed, 32-bit
OD 1601 sub0	5	Set 5 for the number of RxPDO mappings

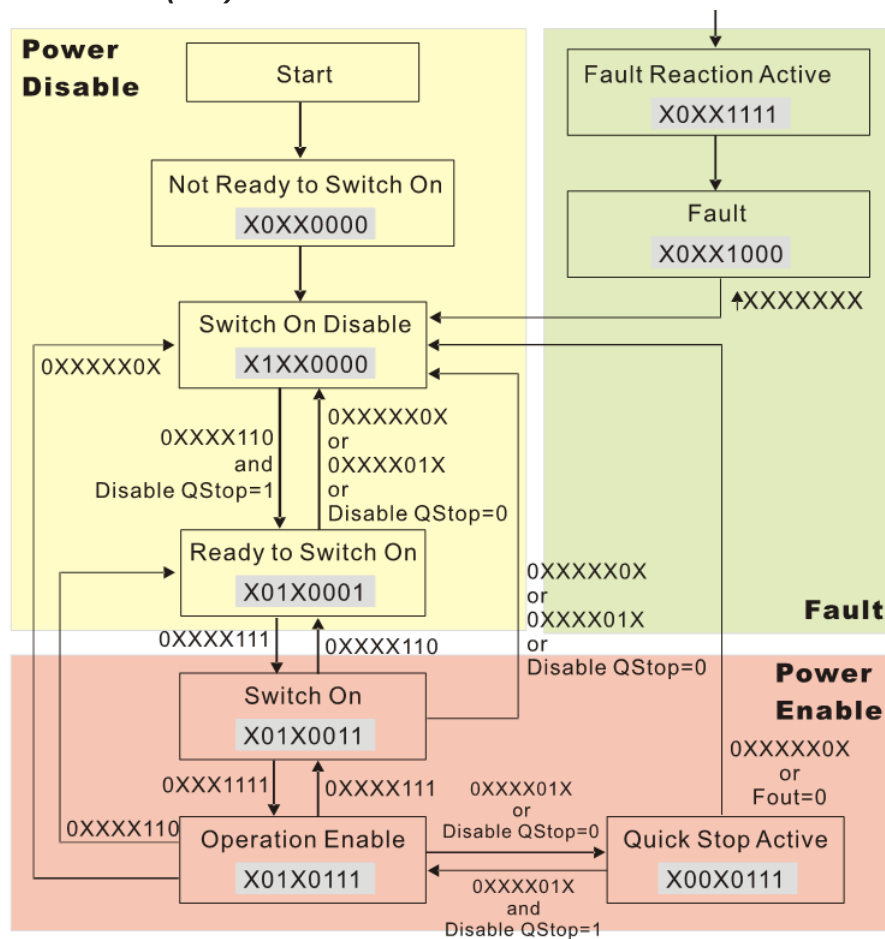
- 4) Set the contents and number of TxPDO mappings: set OD 1A00 to 1A03 sub 1 to sub 8 (TxPDO) for the content and set OD 1A00 to 1A03 sub 0 (TxPDO) for the number of TxPDO mappings. Take the OD 1A00 below as an example:

<b>Mapping parameter setting for TxPDO</b>	<b>Data</b>	<b>Description</b>
OD 1A00 sub1	6041h	Statusword, 16-bit
OD 1A00 sub2	6061h	Modes of operation display, 8-bit
OD 1A00 sub3	6064h	Position actual value, 32-bit
OD 1A00 sub4	606Ch	Velocity actual value, 32-bit
OD 1A00 sub5	6077h	Max motor speed, 32-bit
OD 1A00 sub6	603Fh	Error code, 16-bit
OD 1A00 sub0	6	Set 6 for the number of RxPDO mappings.

- 5) Set the PDO mapping configuration: set OD 1C12 sub 1 to 0x1601 (RxPDO) and OD 1C13 sub 1 to 0x1A01 (TxPDO).
- 6) Enable the PDO configuration: set OD 1C12 sub 0 to 1 (RxPDO) and OD 1C13 sub 0 to 1 (TxPDO).

**CiA402 EQUIPMENT REGULATION**

This section describes the modes of operation specified by CiA402 when the drive is in the EtherCAT mode. The contents include basic operation and setting of related objects. The host controller controls the drive through the control word (OD 6040h) and read the current status of the drive through the status word (OD 6041h). The drive follows the commands from the host controller to run the motors.

**CANOPEN OVER ETHERNET (CoE) STATE MACHINE**

**NOTE:** As shown in the diagram above, the strings beside the arrows are the control words and the strings in the squares are the status words.

The state machine can be divided into three blocks.

<b>Block</b>	<b>Description</b>
Power Disable	Drive doesn't have PWM output.
Power Enable	Drive has PWM output.
Fault	Faults occur

The three big blocks are composed of 9 statuses:

<b>Status</b>	<b>Description</b>
Start	Power-on
Not Ready to Switch On	The drive is initializing.
Switch On Disable	The drive finishes initializing.
Ready to Switch On	The drive is waiting to be switched on (energized). The motor isn't excited.
Switch On	The drive now has PWM output. The reference command is invalid.



Status	Description
Operation Enable	Motor is enabled, it runs by following control commands.
Quick Stop Active	Motor stops by following parameter setting.
Fault Reaction Active	The drive detects warning / fault and stops by following parameter settings. The motor is still excited.
Fault	The motor is not excited.

Control Word (controlword, OD 6040h): Description of Bit:

15-9	8	7	6-4	3	2	1	0
Reserved	Halt	Fault reset	Operation mode specific	Enable operation	Quick stop	Enable voltage	Switch on

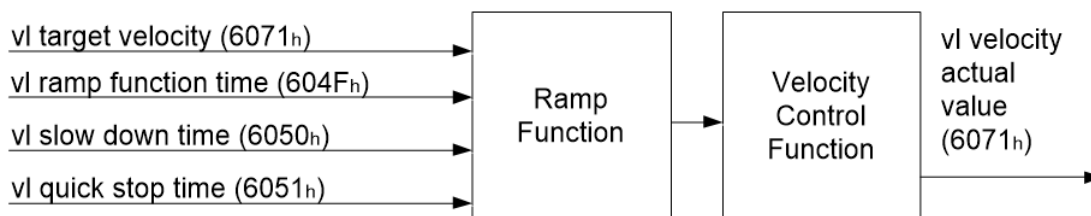
Status Word (statusword, OD 6041h): Description of Bit:

15-14	13-12	11	10	9	8	7
Reserved	Operation mode specific	Reserved	Target reached	Remote	Reserved	Warning
6	5	4	3	2	1	0
Switch on disabled	Quick stop	Voltage enabled	Fault	Operation enable	Switch on	Ready to switch on

## ETHERCAT OPERATION MODE

### Velocity Mode

The host controller sends velocity command and acceleration / deceleration data to a drive. Then the drive controls the velocity.



Operation Steps are as follows:

- 1) Set mode: OD 6060h = 02h as velocity mode
- 2) Set velocity command. OD 6042h (unit: RPM)
- 3) Set acceleration time OD 604Fh (unit: ms)
- 4) Set deceleration time OD 6050h (unit: ms)
  - a) Set control commands OD 6040h. By following the control word commands listed below to do the setup, the motor drive operates as mentioned above. Refer to the description of OP 6041h to see the contents of the state machine.
  - b) OD 6040h = 06h, the motor drive goes into < Ready to Switch On > state.
  - c) OD 6040h = 0Eh, the motor drive goes into < Switch On > Servo On state.
  - d) OD 6040h = 0Fh, the motor drive goes into < Operation Enable > state.
  - e) OD 6040h = 7Fh, the motor drive starts running.

Control commands are defined as follows:

Step	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Description
(1)	0	0	0	0	1	1	0	Shutdown
(2)	0	0	0	0	1	1	1	Switch On (Enable Servo On ready)
(3)	0	0	0	1	1	1	1	Enable Operation (Enable Servo On)
(4)	1	1	1	1	1	1	1	Runs to the target speed.

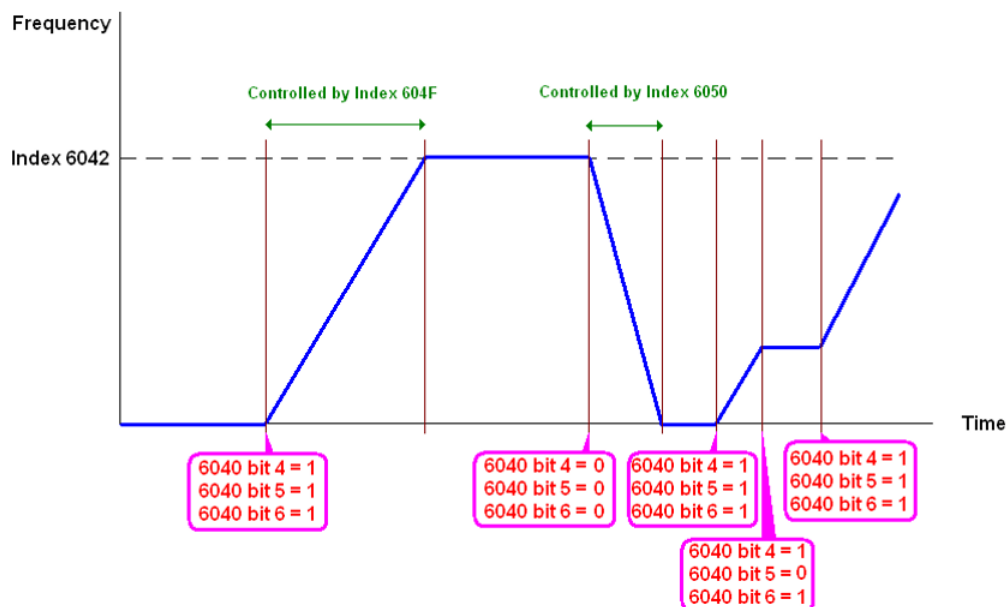
When using the velocity mode (OD 6060h = 02h), the controlword bit (bit 4 ~ bit 6) is defined as follows:

OD 6040h			Description
bit 6	bit 5	bit 4	
1	0	1	Maintain current speed
1	1	1	Run to the target speed
X	X	X	Decelerate to 0 RPM

### Read Drive Data

OD 606Ch: to observe motor rotation speed.

OD 6041h: Drive's state word, bit 10 target reached (0: Not running to target speed; 1: Run to the target speed)



### Index Related to the Drive

Index	Definition	Form	Attribute
6040h	Controlword	UNSIGNED16	RW
6041h	Statusword	UNSIGNED16	RO
6060h	Mode of operation	INTEGER8	RW
6061h	Mode of operation display	INTEGER8	RO
6042h	vl target velocity	INTEGER16	RW
6043h	vl velocity demand	INTEGER16	RO
6044h	vl velocity actual value	INTEGER16	RO
604Fh	vl ramp function time	INTEGER16	RW
6050h	vl slow down time	INTEGER16	RW

## COMMUNICATION WARNING / FAULT TABLE

### DRIVE WARNING/FAULT TABLE

ID No.	Warning/ Fault Code	Warning/Fault Name	Description	Corrective Action
81	ECto_WARN	EtherCAT communication time out	Timer out warning on the Communication between communication card and the host controller.	-Verify if communication system is wiring correctly. -Verify if the upperhost is connecting correctly.
89	ECCb_WARN	Communication card disconnected	Warning on the disconnected communication card	-Reinstall the communication card. -Change a new communication card or change a new motor drive.
111	SYCE_WARN	Synchronization warning	The source of communication is not the communication card. Loss of synchronization signal (data packet) after setting up the synchronization mode. A warning message pops up.	-Reinstall a motor drive to the upperhost.
161	SYCE_ERR	Synchronization fault	The source of command is the communication card. Loss of synchronization signal (data packet) after setting up the synchronization mode. A fault message pops up.	Reinstall a motor drive to the upperhost.

### SDO ABORT CODE

SDO Abort Code	Description
0x05030000	Deflection fault while doing segment transmission
0x05040000	SDO time out.
0x05040001	Client / servo command are invalid or don't exist.
0x05040005	Register overflow when running SDO.
0x06010000	Not supported access
0x06010001	Try to read a write-only object
0x06010002	Try to write a read-only object
0x06010003	Unable to write into sub-index. The sub-index has to be 0.
0x06020000	The object doesn't exist in the object dictionary.
0x06040041	Unable to map the object to PDO
0x06040042	The number and the length of the objects mapped to PDO is longer than PDO.
0x06040043	Format of the parameter is not compatible.
0x06040047	Compatibility issue of motor drive.
0x06060000	Fail to save due to hardware error. (Saving or returning to origin fault)
0x06070010	Incorrect data type; wrong parameter length.
0x06070012	Incorrect data type; parameter length is too long
0x06070013	Incorrect data type; parameter length is too short.
0x06090011	Sub-index doesn't exist.
0x06090030	The parameter value is out of bounds.
0x06090031	Setting value is too big.
0x06090032	Setting value is too small.
0x06090033	Detected Module Ident List (0xF030) and Configured Module Ident list (0xF050) don't match.
0x06090036	Setting value is smaller than the lower limit.
0x08000000	General error
0x08000020	Data cannot be read or written.
0x08000021	Data access denied due to local control.
0x08000022	Data access denied due to current status.
0x08000023	Object dictionary doesn't exist.

**DESCRIPTION OF OBJECT SPECIFICATION****OBJECT TYPE**

<b>Object Type</b>	<b>Description</b>
Variable	A single value such as a UNSIGNED8, a Boolean, a float and an INTEGER16
Array	An object with multiple data fields composed of multiple variables of the same data type such as UNSIGNED16. The Sub-index 0 data belongs to UNSIGNED8, so it's not classified as array data
Record	An object with multiple data fields composed of multiple variables of the same data type. The Sub-index 0 data belongs to UNSIGNED8, so it's not classified as record data.

**DATA TYPE**

<b>Data Type</b>	<b>Data Size</b>	<b>Range</b>
BOOLEAN	1 bit	0~1
UNSIGNED8	1 byte	0~255
UNSIGNED16	2 bytes	0~65535
UNSIGNED32	4 bytes	0~4294967295
INTEGER8	1 byte	-128~127
INTEGER16	2 bytes	-32768~32767
INTEGER32	4 bytes	-2147483648~2147483647
VISIBLE STRING	-	-

**OBJECT DICTIONARY****OD 1000H COMMUNICATION GROUP**

<b>Index</b>	<b>Object Type</b>	<b>Name</b>	<b>Data Type</b>	<b>Attribute</b>
1000h	Variable	Device type	UNSIGNED32	RO
1001h	Variable	Error register	UNSIGNED8	RO
1008h	Variable	Device name	STRING	RO
100Ah	Variable	Software version	STRING	RO
1018h	Record	Identity	IDENTITY	RO
1600h	Record	Receive PDO mapping	PDOMAPPING	RW
1A00h	Record	Transmit PDO mapping	PDOMAPPING	RW
1C12h	Array	RxPDO assign	UNSIGNED16	RW
1C13h	Array	TxPDO assign	UNSIGNED16	RW

**OD 3000H DRIVE'S PARAMETER GROUP**

The objects defined here are related to the settings of the motor drive's parameters. The setting methods are as follows:

Index 300Xh are related to motor drive's parameter Group X. The sub-index 1h~64h (hexadecimal) correspond to the parameter Group X-00 to Group X-99.

**For example:**

Set P05.33 (Induction motor or permanent magnet synchronous motors selection). The Index is 3005h and the sub-index is 22h (34).

**OD 6000H COMMUNICATION OBJECT GROUP**

<i>Index</i>	<i>Object Type</i>	<i>Name</i>	<i>Data Type</i>	<i>Attribute</i>	<i>PDO Mapping</i>
6007h	Variable	Abort connection option code	INTEGER16	RW	N
603Fh	Variable	Error code	UNSIGNED16	RO	Y
6040h	Variable	Controlword	UNSIGNED16	RW	Y
6041h	Variable	Statusword	UNSIGNED16	RO	Y
6042h	Variable	vl target velocity	INTEGER16	RW	Y
6043h	Variable	vl velocity demand	INTEGER16	RO	N
6044h	Variable	vl velocity actual value	INTEGER16	RO	Y
604Fh	Variable	vl ramp function time	INTEGER16	RW	N
6050h	Variable	vl slow down time	INTEGER16	RW	N
6051h	Variable	vl quick stop time	INTEGER16	RW	N
605Ah	Variable	Quick stop option code	INTEGER16	RW	N
605Ch	Variable	Disable operation option code	INTEGER16	RW	N
6060h	Variable	Modes of operation	INTEGER8	RW	Y
6061h	Variable	Modes of operation display	INTEGER8	RO	Y
6502h	Variable	Supported drive modes	INTEGER32	RO	N

**DETAILED INFORMATION ABOUT OBJECTS****OD 1000H COMMUNICATION GROUP**Object 1000h: Device Type

<b>Index</b>	1000h
<b>Name</b>	Device type
<b>Object Type</b>	Variable
<b>Data Type</b>	UNSIGNED32
<b>Read-Write Permission</b>	RO
<b>PDO Mapping Setting</b>	No
<b>Setting Range</b>	UNSIGNED32

Object 1000h: Error Register

<b>Index</b>	1001h
<b>Name</b>	Error register
<b>Object Type</b>	Variable
<b>Data Type</b>	UNSIGNED8
<b>Read-Write Permission</b>	RO
<b>PDO Mapping Setting</b>	No
<b>Setting Range</b>	UNSIGNED8

Object 1008h: Device Name

<b>Index</b>	1008h
<b>Name</b>	Device name
<b>Object Type</b>	Variable
<b>Data Type</b>	STRING
<b>Read-Write Permission</b>	RO
<b>PDO Mapping Setting</b>	No

Object 100Ah: Software Version

<b>Index</b>	100Ah
<b>Name</b>	Software version
<b>Object Type</b>	Variable
<b>Data Type</b>	STRING
<b>Read-Write Permission</b>	RO
<b>PDO Mapping Setting</b>	No

Object 1018h: Identity

<b>Index</b>	1018h
<b>Name</b>	Identity
<b>Object Type</b>	RECORD
<b>Read-Write Permission</b>	RO
<b>PDO Mapping Setting</b>	No

<b>Sub-index</b>	0
<b>Name</b>	SubIndex 000
<b>Data Type</b>	UNSIGNED8
<b>Read-Write Permission</b>	RO
<b>PDO Mapping Setting</b>	No
<b>Setting Range</b>	UNSIGNED8

<b>Sub-index</b>	1
<b>Name</b>	Vendor ID
<b>Data Type</b>	UNSIGNED32
<b>Read-Write Permission</b>	RO
<b>PDO Mapping Setting</b>	No
<b>Setting Range</b>	UNSIGNED32

<b>Sub-index</b>	2
<b>Name</b>	Product code
<b>Data Type</b>	UNSIGNED32
<b>Read-Write Permission</b>	RO
<b>PDO Mapping Setting</b>	No
<b>Setting Range</b>	UNSIGNED32

<b>Sub-index</b>	3
<b>Name</b>	Revision
<b>Data Type</b>	UNSIGNED32
<b>Read-Write Permission</b>	RO
<b>PDO Mapping Setting</b>	No
<b>Setting Range</b>	UNSIGNED32

<b>Sub-index</b>	4
<b>Name</b>	Serial number
<b>Data Type</b>	UNSIGNED32
<b>Read-Write Permission</b>	RO
<b>PDO Mapping Setting</b>	No
<b>Setting Range</b>	UNSIGNED32

#### **Object 1600h–1603h: Receive PDO Mapping Parameter**

<b>Index</b>	1600h / 1601h / 1602h / 1603h
<b>Name</b>	Receive PDO mapping
<b>Object Type</b>	RECORD
<b>Data Type</b>	PDO mapping
<b>Read-Write Permission</b>	RW
<b>PDO Mapping Setting</b>	No
<b>Note</b>	The total length of a PDO set cannot be longer than 64-bit.

<b>Sub-index</b>	0
<b>Name</b>	Number of Objects
<b>Data Type</b>	UNSIGNED8
<b>Read-Write Permission</b>	RW
<b>PDO Mapping Setting</b>	No
<b>Setting Range</b>	0: Disable 1–8: Set number of PDO mapping and enable this function.
<b>Factory Setting</b>	0

<b>Sub-index</b>	1–8
<b>Name</b>	Mapping entry (n)
<b>Data Type</b>	UNSIGNED32
<b>Read-Write Permission</b>	RW
<b>PDO Mapping Setting</b>	No
<b>Setting Range</b>	UNSIGNED32
<b>Factory Setting</b>	0

**Object 1A00h–1A03h: Transmit PDO Mapping Parameter**

<b>Index</b>	1A00h / 1A01h / 1A02h / 1A03h
<b>Name</b>	Transmit PDO Mapping Parameter
<b>Object Type</b>	RECORD
<b>Data Type</b>	PDO mapping
<b>Read-Write Permission</b>	RW
<b>Note</b>	The total length of a PDO set cannot be longer than 64-bit.

<b>Sub-index</b>	0
<b>Name</b>	Number of Objects
<b>Data Type</b>	UNSIGNED8
<b>Read-Write Permission</b>	RW
<b>PDO Mapping Setting</b>	No
<b>Setting Range</b>	0: Disable 1–8: Set number of PDO mapping and enable this function.
<b>Factory Setting</b>	0

<b>Sub-index</b>	1–8
<b>Name</b>	Mapping entry (n)
<b>Data Type</b>	UNSIGNED32
<b>Read-Write Permission</b>	RW
<b>PDO Mapping Setting</b>	No
<b>Setting Range</b>	UNSIGNED32
<b>Factory Setting</b>	0

**Object 1C12h: RxPDO Assign**

<b>Index</b>	1C12h
<b>Name</b>	RxPDO assign
<b>Object Type</b>	ARRAY
<b>Data Type</b>	UNSIGNED16
<b>Read-Write Permission</b>	RW
<b>PDO Mapping Setting</b>	No

<b>Sub-index</b>	0
<b>Name</b>	Number of assigned RxPDOs
<b>Data Type</b>	UNSIGNED8
<b>Read-Write Permission</b>	RW
<b>PDO Mapping Setting</b>	No
<b>Setting Range</b>	0–1
<b>Factory Setting</b>	1



<b>Sub-index</b>	1
<b>Name</b>	Index of assigned RxPDO
<b>Data Type</b>	UNSIGNED16
<b>Read-Write Permission</b>	RW
<b>PDO Mapping Setting</b>	No
<b>Setting Range</b>	0x1600 / 0x1601 / 0x1602 / 0x1603
<b>Factory Setting</b>	0x1600

**Object 1C13h: TxPDO Assign**

<b>Index</b>	1C13h
<b>Name</b>	TxPDO assign
<b>Object Type</b>	ARRAY
<b>Data Type</b>	UNSIGNED16
<b>Read-Write Permission</b>	RW
<b>PDO Mapping Setting</b>	No

<b>Sub-index</b>	0
<b>Name</b>	Number of assigned TxPDOs
<b>Data Type</b>	UNSIGNED8
<b>Read-Write Permission</b>	RW
<b>PDO Mapping Setting</b>	No
<b>Setting Range</b>	0–1
<b>Factory Setting</b>	1

<b>Sub-index</b>	1
<b>Name</b>	Index of assigned TxPDO
<b>Data Type</b>	UNSIGNED16
<b>Read-Write Permission</b>	RW
<b>PDO Mapping Setting</b>	No
<b>Setting Range</b>	0x1A00 / 0x1A01 / 0x1A02 / 0x1A03
<b>Factory Setting</b>	0x1A00

**OD 3000H DRIVE'S PARAMETER GROUP**

<b>Index</b>	3XXXh
<b>Name</b>	Driver parameter
<b>Object Type</b>	Variable
<b>Data Type</b>	UNSIGNED16
<b>Read-Write Permission</b>	RW
<b>PDO Mapping Setting</b>	No
<b>Setting Range</b>	UNSIGNED16
<b>Factory Setting</b>	N/A

You can read/write drive's parameters via this object group. The drive's parameter can only be changed by SDO.

The setting methods are as follows:

Index 300Xh are related to drive's parameter Group X. The sub-index 1h–64h (hexadecimal) corresponds to the parameter Group X-00 to Group X-99.

**For example:**

Set P05.33 (Induction motor or permanent magnet synchronous motors selection). The Index is 3005h and the sub-index is 22h (34).

**OD 6000H COMMUNICATION OBJECT GROUP*****Object 6007h: Abort Connection Option Code***

<b>Index</b>	6007h
<b>Name</b>	Abort connection option code
<b>Object Type</b>	Variable
<b>Data Type</b>	INTEGER16
<b>Read-Write Permission</b>	RW
<b>PDO Mapping Setting</b>	No
<b>Setting Range</b>	0: No function 2: Switch on Disable 3: Quick Stop
<b>Factory Setting</b>	2

- When object 6007h = 0, CANopen ignores a disconnection fault, no warning and do nothing.
- When object 6007h = 2, CANopen turns to Switch on Disable and displays ECto. CANopen then follows the setting at object 605Ah to trigger parking. When reconnection is successful, the warning code disappears.
- When object 6007h = 3, CANopen turns to Quick Stop and displays ECto. CANopen then follows the setting at object 605Ch to trigger parking. When reconnection is successful, the warning code clears.

***Object 603Fh: Error code***

<b>Index</b>	603Fh
<b>Name</b>	Error code
<b>Object Type</b>	Variable
<b>Data Type</b>	UNSIGNED16
<b>Read-Write Permission</b>	RO
<b>PDO Mapping Setting</b>	Yes
<b>Setting Range</b>	UNSIGNED32
<b>Factory Setting</b>	0

***Object 6040h: Controlword***

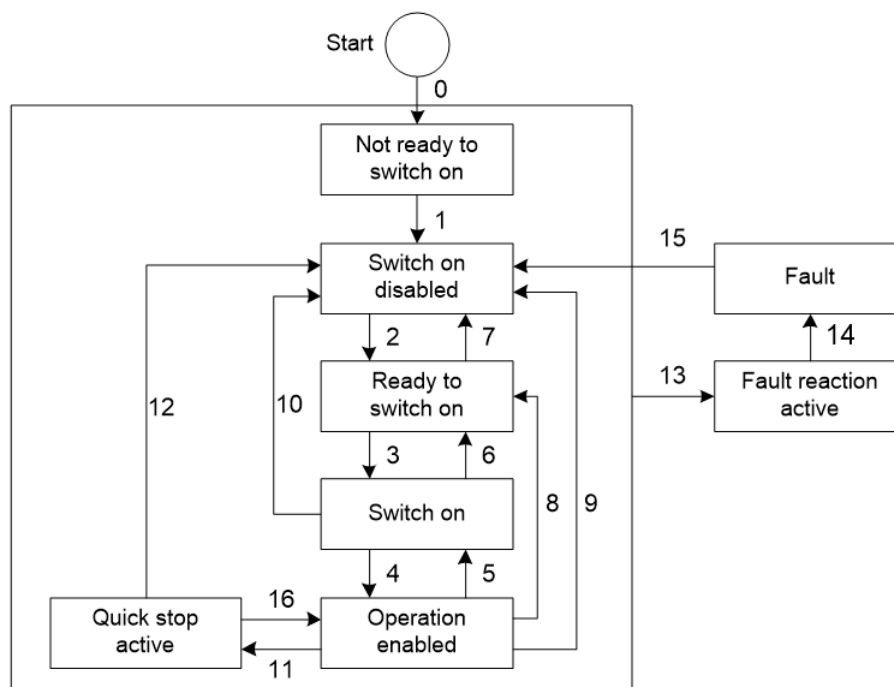
<b>Index</b>	6040h
<b>Name</b>	Controlword
<b>Object Type</b>	Variable
<b>Data Type</b>	UNSIGNED16
<b>Read-Write Permission</b>	RW
<b>PDO Mapping Setting</b>	Yes
<b>Setting Range</b>	UNSIGNED16
<b>Factory Setting</b>	0

**a) Description of Different Bits**

<b>Bit</b>	<b>Function</b>	<b>Description</b>
Bit 0	Switch on	-
Bit 1	Enable voltage	-
Bit 2	Quick stop	-
Bit 3	Enable operation	-
Bit 4–Bit 6	Operation mode specific	Refer to the Specific Model Definition table below
Bit 7	Fault reset	-
Bit 8	Halt	-
Bit 9–Bit 15	Reserved	-

b) Specific Model Definition Table


Bit	Specific Model Definition						
	VL	PP	Homing	IP	PT	CSP	CST
Bit 4	Enable ramp	New set-point	Homing operation start	Enable interpolation	-	-	-
Bit 5	Unlock ramp	Change set immediately	-	-	-	-	-
Bit 6	Reference ramp	0: Absolute target position 1: Relative target position	-	-	-	-	-
Bit 8	Halt	Halt	Halt	Halt	-	-	-




c) Status Switching Definition Table

Status Switching	Event	Action
0–1	Auto run after powering on	Activate the device and initialize.
2	Shutdown command	N/A
3	Switch on command	Motor drive prepares for servo on
4	Enable operation command	Motor drive has servo on and is in operation.
5	Disable operation command	Servo has servo off.
6	Shutdown command	N/A
7	Disable voltage or Quick stop command	N/A
8	Shutdown command	Motor drive has servo off.
9	Disable voltage command	Motor drive has servo off.
10	Disable voltage or Quick stop command	N/A
11	Quick stop command	Enable Quick Stop function.
12	Disable voltage command	Motor drive has servo off
13–14	Warning / Fault codes pop up	Motor drive has servo off.
15	Warning / Fault codes clear	N/A
16	Enable operation; no alarm command	Restart operation command.

d) Via Controlword (6040h), status can be changed, the commands are as follows:

Command	Bit of Controlword (6040h)					Status Change
	Bit 7	Bit 3	Bit 2	Bit 1	Bit 0	
Shutdown	0	X	1	1	0	2,6,8
Switch on	0	0	1	1	1	3
Switch on + Enable operation	0	1	1	1	1	3 + 4
Disable voltage	0	X	X	0	X	7,9,10,12
Quick stop	0	X	0	1	X	7,10,11
Disable operation	0	0	1	1	1	5
Enable operation	0	1	1	1	1	4-16
Fault reset		X	X	X	X	15



NOTE: 0=Bit is off; 1=Bit is on; X=Bit is not affected;  = positive edge triggering

#### Object 6041h: Statusword

<b>Index</b>	6041h
<b>Name</b>	Statusword
<b>Object Type</b>	Variable
<b>Data Type</b>	UNSIGNED16
<b>Read-Write Permission</b>	RO
<b>PDO Mapping Setting</b>	Yes
<b>Setting Range</b>	UNSIGNED16
<b>Factory Setting</b>	0

a) Description of Different Bits

Bit	Function	Description
Bit 0	Ready to switch on	Bit 0 to Bit6 display current status of the motor drive. See table below for details.
Bit 1	Switched on	
Bit 2	Operation enabled	
Bit 3	Fault	
Bit 4	Voltage enabled	
Bit 5	Quick stop	
Bit 6	Switch on disabled	
Bit 7	Warning	Warning status: motor drive still has servo on.
Bit 8	Reserved	-
Bit 9	Remote	-
Bit 10	Target reached	Target reached
Bit 11	Reserved	-
Bit 12–Bit 13	Operation mode specific	See Specific Model Definition table below.
Bit 14	Reserved	-
Bit 15	Reserved	-

Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Description
0	-	-	0	0	0	0	Not ready to switch on
1	-	-	0	0	0	0	Switch on disabled
0	1	-	0	0	0	1	Ready to switch on
0	1	-	0	0	1	1	Switch on
0	1	-	0	1	1	1	Operation enabled
0	0	-	0	1	1	1	Quick stop active
0	-	-	1	1	1	1	Fault reaction active
0	-	-	1	0	0	0	Fault



NOTE: 0=Bit is off; 1=Bit is on; - means bit is not functional.

## b) Specific Model Definition Table

<b>Bit</b>	<b>Specific Model Definition</b>						
	<b>VL</b>	<b>PP</b>	<b>Homing</b>	<b>IP</b>	<b>PT</b>	<b>CSP</b>	<b>CST</b>
Bit 10	-	Target reached	Target reached	Target reached	Target reached	-	-
Bit 12	-	-	Homing attained	-	-	-	-
Bit 13	-	Following error	Homing error	Following error	-	Following error	-

**Object 6042h: vl Target Velocity**

This object is a velocity command value under the velocity mode.

<b>Index</b>	6042h
<b>Name</b>	vl target velocity
<b>Object Type</b>	Variable
<b>Data Type</b>	INTEGER16
<b>Read-Write Permission</b>	RW
<b>PDO Mapping Setting</b>	Yes
<b>Setting Range</b>	INTEGER16
<b>Factory Setting</b>	0
<b>Unit</b>	RPM

**Object 6043h: vl Velocity Demand**

This object is a velocity command calculated by the motor drive under the velocity mode.

<b>Index</b>	6043h
<b>Name</b>	vl velocity demand
<b>Object Type</b>	Variable
<b>Data Type</b>	INTEGER16
<b>Read-Write Permission</b>	RO
<b>PDO Mapping Setting</b>	No
<b>Setting Range</b>	INTEGER16
<b>Unit</b>	RPM

**Object 6044h: vl Velocity Actual Value**

This object is the actual running speed under the velocity mode.

<b>Index</b>	6044h
<b>Name</b>	vl velocity actual value
<b>Object Type</b>	Variable
<b>Data Type</b>	INTEGER16
<b>Read-Write Permission</b>	RO
<b>PDO Mapping Setting</b>	Yes
<b>Setting Range</b>	INTEGER16
<b>Unit</b>	RPM

**Object 604Fh: vl Ramp Function Time**

This object is the time spent when the motor drive accelerates from 0 RPM to 6042h under the Velocity Mode.

<b>Index</b>	604Fh
<b>Name</b>	vl ramp function time
<b>Object Type</b>	Variable
<b>Data Type</b>	UNSIGNED32
<b>Read-Write Permission</b>	RW
<b>PDO Mapping Setting</b>	No
<b>Setting Range</b>	UNSIGNED32
<b>Factory Setting</b>	10000
<b>Unit</b>	ms

**Object 6050h: vl Slow Down Time**

This object is the time spent when the motor drive decelerates from 6042h to 0 RPM under the Velocity Mode.

<b>Index</b>	6050h
<b>Name</b>	vl slow down time
<b>Object Type</b>	Variable
<b>Data Type</b>	UNSIGNED32
<b>Read-Write Permission</b>	RW
<b>PDO Mapping Setting</b>	No
<b>Setting Range</b>	UNSIGNED32
<b>Factory Setting</b>	10000
<b>Unit</b>	ms

**Object 6051h: vl Quick Stop Time**

This object is at velocity mode. It's the time required for decelerating from 6402h to 0 RPM.

<b>Index</b>	6051h
<b>Name</b>	vl quick stop time
<b>Object Type</b>	Variable
<b>Data Type</b>	UNSIGNED32
<b>Read-Write Permission</b>	RW
<b>PDO Mapping Setting</b>	No
<b>Setting Range</b>	Motor drive parameter P01.45 P01.45=0, Setting Range: 10–600000 P01.45=1, Setting Range: 100–6000000
<b>Factory Setting</b>	1000
<b>Unit</b>	ms

**Object 605Ah: Quick Stop Option Code**

This object is a choice behavior when 6040h (Controlword) triggers Quick Stop bit.

<b>Index</b>	605Ah
<b>Name</b>	Quick stop option code
<b>Object Type</b>	Variable
<b>Data Type</b>	INTEGER16
<b>Read-Write Permission</b>	RW
<b>PDO Mapping Setting</b>	No
<b>Setting Range</b>	0: Disable motor drive function 1: Decelerate to stop by slow down ramp then Switch on Disabled (cannot be back to OP) 2: Decelerate to stop by quick stop ramp then Switch on Disabled (cannot be back to OP) 5: Decelerate to stop by slow down ramp and keep on Quick Stop status (can be back to OP) 6: Decelerate to stop by quick stop ramp and keep on Quick Stop status (can be back to OP)
<b>Factory Setting</b>	2

**Object 605Ch: Disable Operation Option Code**

This object is a choice behavior of the motor drive when the status switches from Operation Enable to Switched On.

<b>Index</b>	605Ch
<b>Name</b>	Disable operation option code
<b>Object Type</b>	Variable
<b>Data Type</b>	INTEGER16
<b>Read-Write Permission</b>	RW
<b>PDO Mapping Setting</b>	No
<b>Setting Range</b>	0: Disable motor drive 1: Decelerate to stop; disable motor drive
<b>Factory Setting</b>	1

**Object 6060h: Modes of Operation**

This object is to set up the operation mode.

<b>Index</b>	6060h
<b>Name</b>	Modes of operation
<b>Object Type</b>	Variable
<b>Data Type</b>	INTEGER8
<b>Read-Write Permission</b>	RW
<b>PDO Mapping Setting</b>	Yes
<b>Setting Range</b>	UNSIGNED32
<b>Factory Setting</b>	8

The operation modes are as follows:

<b>Setting Value</b>	<b>Operation Mode</b>
0	Reserved
1	Profile Position Mode
2	Velocity Mode
3	Reserved
4	Profile Torque Mode
5	Reserved
6	Homing Mode
7	Interpolated Position Mode
8	Cyclic Synchronous Position Mode
9	Reserved
10	Cyclic Synchronous Torque Mode

#### **Object 6061h: Modes of Operation Display**

This object shows the current operation mode.

<b>Index</b>	6061h
<b>Name</b>	Modes of operation display
<b>Object Type</b>	Variable
<b>Data Type</b>	INTEGER8
<b>Read-Write Permission</b>	RO
<b>PDO Mapping Setting</b>	Yes
<b>Setting Range</b>	INTEGER8
<b>Factory Setting</b>	0

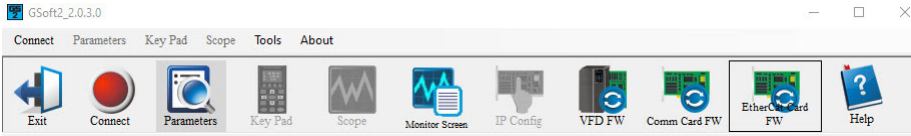
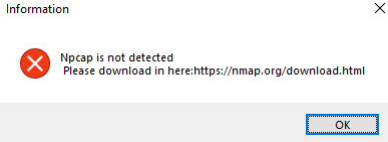
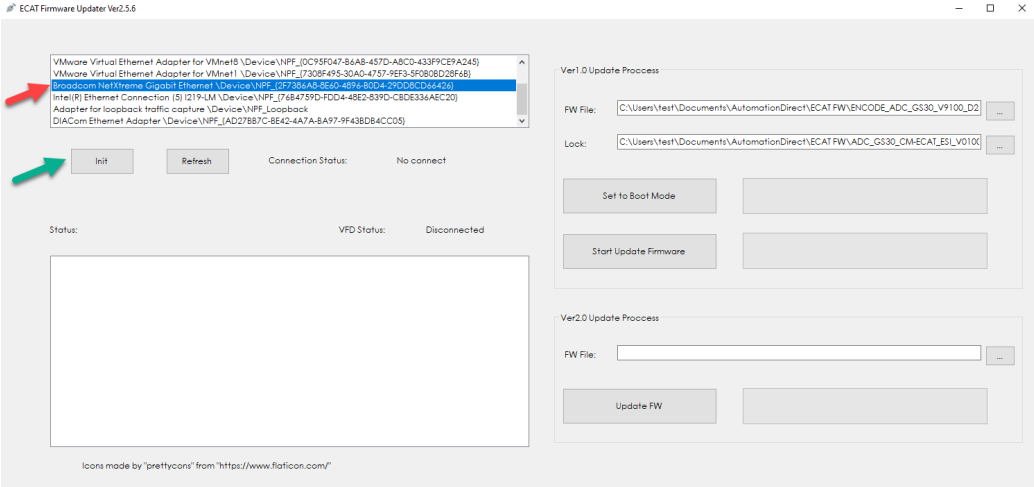
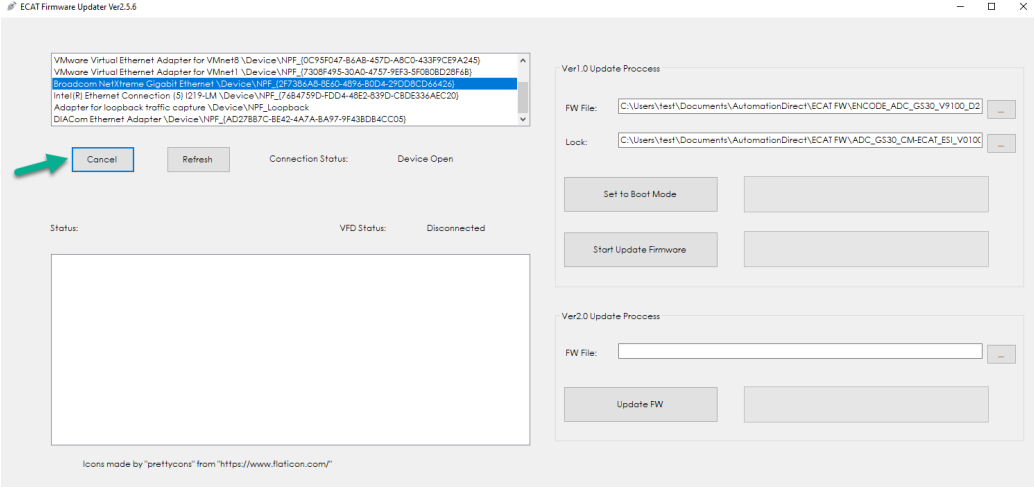
#### **Object 6502h: Support Drive Modes**

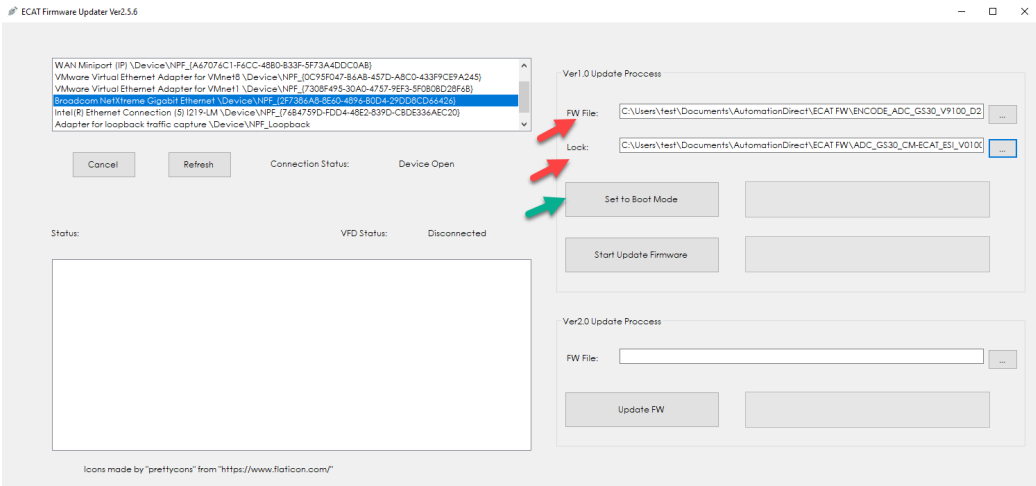
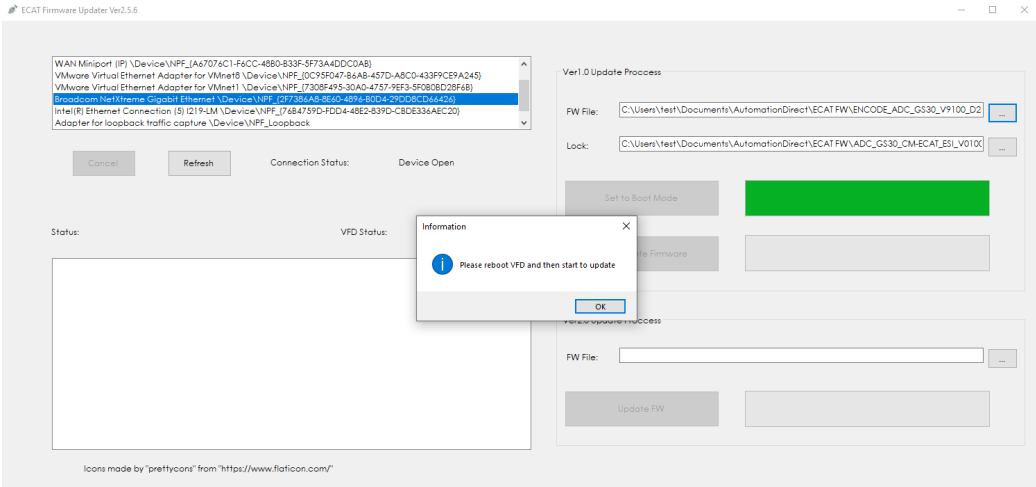
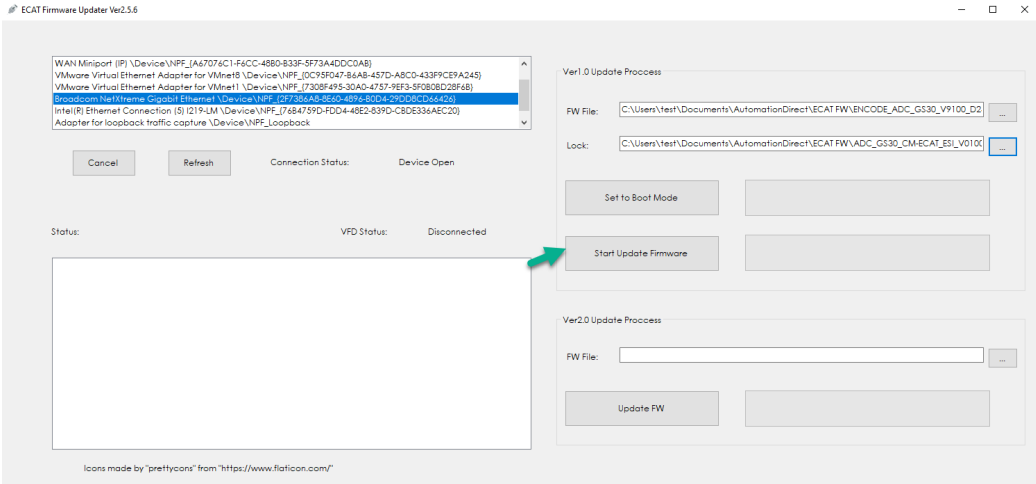
<b>Index</b>	6502h
<b>Name</b>	Supported drive modes
<b>Object Type</b>	Variable
<b>Data Type</b>	UNSIGNED32
<b>Read-Write Permission</b>	RO
<b>PDO Mapping Setting</b>	No
<b>Setting Range</b>	UNSIGNED32

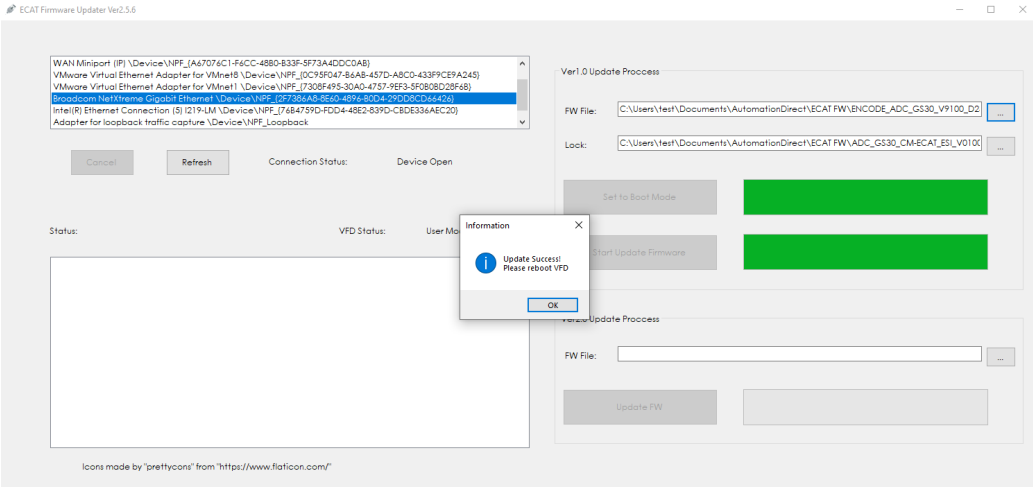


**ETHERCAT FIRMWARE UPDATE**

Follow the steps below to update the firmware of the GS30A-CM-ECAT card.

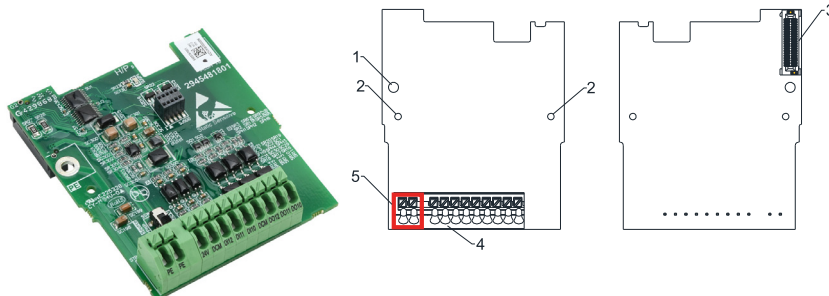
Step	Description
1	<p>Open EtherCAT firmware update by clicking <b>EtherCAT Card FW</b> on the GSoft2 menu bar.</p> 
2	<p>You may get a pop-up prompting installation of Npcap.</p>  <p>You can download it for free here: <a href="https://nmap.org/download">https://nmap.org/download</a></p> <p>If you already have Npcap installed, you can skip this step.</p>
3	<p>Select the Ethernet card the drive is connected to and click <b>Init</b>.</p> 
4	<p>Verify that the <b>Init</b> button has changed to <b>Cancel</b>.</p> 

Step	Description
5	<p>a) In <b>Ver 1.0 Update Process</b>, for <b>FW File</b> select the <b>ENCODE_ADC_GS30_V9100_D23295.BIN</b> file.</p> <p>b) In <b>Ver 1.0 Update Process</b>, for <b>Lock</b> select the <b>ADC_GS30_CM-ECAT_ESI_V0100.bin</b> file.</p> <p>c) Click <b>Set to Boot Mode</b>.</p> 
6	<p>The <b>Set to Boot Mode</b> progress bar will change to green. Click <b>OK</b> at the prompt and cycle drive power.</p> 
7	<p>After power cycle, click <b>Start Update Firmware</b>.</p> 

GS30A-CM-ECAT Firmware Update	
Step	Description
8	<p>The <b>Start Updated Firmware</b> progress bar will change to green. After the firmware is updated, click <b>OK</b> at the prompt and cycle drive power again.</p> 

## GS30A-06CDD

The GS30A-06CDD is a digital combo module with 3-point input and 3-point output. This card is for use with GS30 series AC drives in installation Position 1 only.



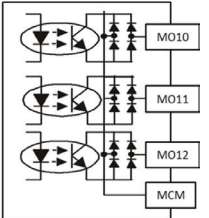
**GS30-06CDD**

GS30A-06CDD Overview			
Drawing Item	Description	Wiring Info	Screw Torque
1	Screw fixing hole	Wire gauge: 0.25–0.75 mm <sup>2</sup> [24–18 AWG] Stripping length: 9mm	Screw torque: 2 kg-cm / [1.7 lb-in.] / [0.2 N•m]
2	Positioning hole		
3	AC drive connection port		
4	Terminal block		
5	Ground terminal block		

### FEATURES

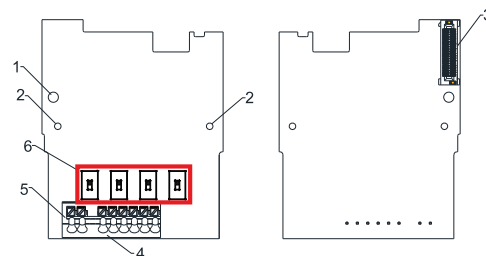
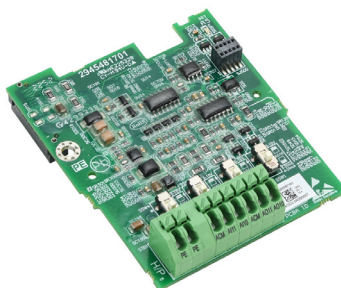
- Input: 3-point, 24VDC, sinking/sourcing selectable
- Output: 3-point, 48VDC, sinking/sourcing selectable, 50mA resistive output current

### SPECIFICATIONS

GS30A-06CDD Specifications	
Terminals	
<b>24V, DCM</b>	Output power: +24VDC $\pm 5\%$ < 30mA
<b>DI10–DI12</b>	<ul style="list-style-type: none"> <li>• Choose SINK (NPN) / SOURCE (PNP) by SWW1</li> <li>• Internal power is supplied by terminal 24V: +24VDC <math>\pm 5\%</math></li> <li>• If external power is +24VDC, the maximum voltage is 30VDC and the minimum voltage is 19VDC</li> <li>• ON: activation current is 6.5 mA</li> <li>• OFF: leakage current tolerance is 10<math>\mu</math>A</li> </ul>
<b>DO10–DO12</b>	<ul style="list-style-type: none"> <li>• The drive outputs various monitor signals, such as drive in operation, frequency reached and overload indication through the transistor (open collector)</li> <li>• DO output signal: each DO terminal needs a pull-up resistor, the maximum external power voltage is 48VDC / 50mA</li> </ul> 
<b>DCM</b>	Common for digital output terminals DO10–DO12 (photocoupler)
<b>PE</b>	Grounding terminals. To decrease noise, properly ground this terminal.
Environment	
<b>Noise immunity</b>	ESD (IEC 61800-5-1, IEC 61000-4-2) EFT (IEC 61800-5-1, IEC 61000-4-4) Surge Test (IEC 61800-5-1, IEC 61000-4-5) Conducted Susceptibility Test (IEC 61800-5-1, IEC 61000-4-6)
<b>Operation / storage</b>	Operation: -10°C~50°C [14°F~122°F] (temperature), 90% (humidity) Storage: -25°C~70°C [-13°F~158°F] (temperature), 95% (humidity)
<b>Vibration / shock immunity</b>	International standard: IEC 61800-5-1, IEC 60068-2-6/IEC 61800-5-1, IEC 60068-2-27

## GS30A-2AD2DA

The GS30A-2AD2DA is an analog combo module with 2-channel input and 2-channel output. This card is for use with GS30 series AC drives in installation Position 1 only.



GS30-2AD2DA

GS30A-2AD2DA Overview			
Drawing Item	Description	Wiring Info	Screw Torque
1	Screw fixing hole	Wire gauge: 0.25–0.75 mm <sup>2</sup> [24–18 AWG] Stripping length: 9mm	Screw torque: 2 kg-cm / [1.7 lb-in.] / [0.2 N•m]
2	Positioning hole		
3	AC drive connection port		
4	Terminal block		
5	Switch (SSW1–SSW4)		

### FEATURES

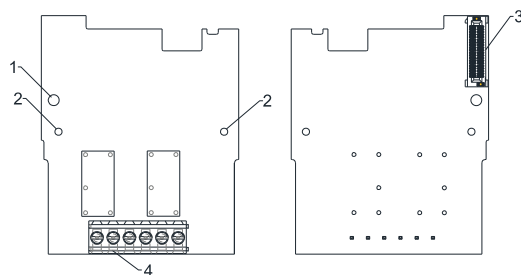
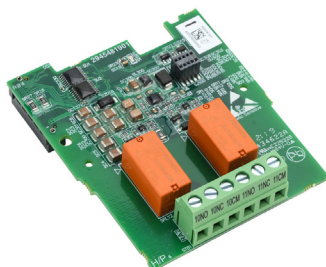
- Input: 2-channel, current/voltage, 0–20 mA and 4–20 mA, 0–10 VDC
- Output: 2-channel, current/voltage, 0–20 mA and 4–20 mA, 0–10 VDC

### SPECIFICATIONS

GS30A-2AD2DA Specifications	
Terminals	
<b>ACM</b>	Common output signal and input signal terminals.
<b>AI10, AI11</b>	Two sets of AI ports: SSW3, SSW4 switch for AI1, AI2 (default is AI1) <ul style="list-style-type: none"> <li>• AI1: input 0–10 V</li> <li>• AI2: input 0–20 mA</li> </ul>
<b>AO10–AO11</b>	Two sets of AO ports: SSW1, SSW2 switch for AVO or ACO (default is ACO). <ul style="list-style-type: none"> <li>• AVO: output 0–10 V</li> <li>• ACO: output 0–20 mA</li> </ul>
<b>PE</b>	Grounding terminal. to decrease noise, properly ground this terminal.
Environment	
<b>Noise immunity</b>	ESD (IEC 61800-5-1, IEC 61000-4-2) EFT (IEC 61800-5-1, IEC 61000-4-4) Surge Test (IEC 61800-5-1, IEC 61000-4-5) Conducted Susceptibility Test (IEC 61800-5-1, IEC 61000-4-6)
<b>Operation / storage</b>	Operation: -10°C~50°C [14°F~122°F] (temperature), 90% (humidity) Storage: -25°C~70°C [-13°F~158°F] (temperature), 95% (humidity)
<b>Vibration / shock immunity</b>	International standard: IEC 61800-5-1, IEC 60068-2-6/IEC 61800-5-1, IEC 60068-2-27

## GS30A-02TRC

The GS30A-02TRC is a relay output module with (2) SPDT relays. This card is for use with GS30 series AC drives in installation Position 1 only.



**GS30-02TRC**

GS30A-02TRC Overview			
Drawing Item	Description	Wiring Info	Screw Torque
1	Screw fixing hole	Wire gauge: 0.25–1.5 mm <sup>2</sup> [24–16 AWG] Stripping length: 6mm	Screw torque: 5 kg-cm / [4.3 lb-in.] / [0.49 N•m]
2	Positioning hole		
3	AC drive connection port		
4	Terminal block		

### FEATURES

- 240VAC/30VDC
- (2) Form B (SPDT) relays
- 1 isolated common
- 1 point per common
- Screw terminal blocks included

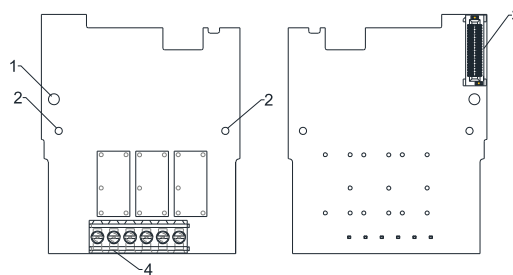
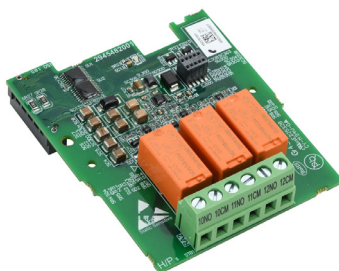
### SPECIFICATIONS

See parameters P02.36 and P02.37 for configuration.

GS30A-02TRC Specifications	
Terminals	
<b>10NO-10NC-10CM (DO10)</b>	Resistive load: 5A (N.O.) / 250VAC
<b>11NO-11NC-11CM (DO11)</b>	Function: outputs the monitor signals, such as drive in operation, frequency reached, or overload indication.
Environment	
<b>Noise immunity</b>	ESD (IEC 61800-5-1, IEC 61000-4-2) EFT (IEC 61800-5-1, IEC 61000-4-4) Surge Test (IEC 61800-5-1, IEC 61000-4-5) Conducted Susceptibility Test (IEC 61800-5-1, IEC 61000-4-6)
<b>Operation / storage</b>	Operation: -10°C~50°C [14°F~122°F] (temperature), 90% (humidity) Storage: -25°C~70°C [-13°F~158°F] (temperature), 95% (humidity)
<b>Vibration / shock immunity</b>	International standard: IEC 61800-5-1, IEC 60068-2-6/IEC 61800-5-1, IEC 60068-2-27

## GS30A-03TRA

The GS30A-03TRA is a relay output module with (3) SPST relays. This card is for use with GS30 series AC drives in installation Position 1 only.



**GS30-03TRA**

GS30A-03TRA Overview			
Drawing Item	Description	Wiring Info	Screw Torque
1	Screw fixing hole	Wire gauge: 0.25–1.5 mm <sup>2</sup> [24–16 AWG] Stripping length: 6mm	Screw torque: 5 kg-cm / [4.3 lb-in.] / [0.49 N•m]
2	Positioning hole		
3	AC drive connection port		
4	Terminal block		

### FEATURES

- 250VAC/30VDC
- (3) Form C (SPST) relays
- 1 isolated common
- 1 point per common
- Screw terminal blocks included

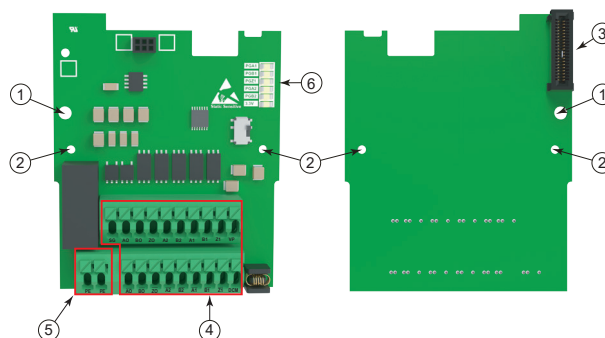
### SPECIFICATIONS

See parameters P02.36–P02.38 for configuration.

GS30A-03TRA Specifications	
Terminals	
10NO-10CM (DO10)	Resistive load: 6A (N.O.) / 250VAC Function: outputs the monitor signals, such as drive in operation, frequency reached, or overload indication.
11NO-11CM (DO11)	
12NO-12CM (DO12)	
Environment	
Noise immunity	ESD (IEC 61800-5-1, IEC 61000-4-2) EFT (IEC 61800-5-1, IEC 61000-4-4) Surge Test (IEC 61800-5-1, IEC 61000-4-5) Conducted Susceptibility Test (IEC 61800-5-1, IEC 61000-4-6)
Operation / storage	Operation: -10°C~50°C [14°F~122°F] (temperature), 90% (humidity) Storage: -25°C~70°C [-13°F~158°F] (temperature), 95% (humidity)
Vibration / shock immunity	International standard: IEC 61800-5-1, IEC 60068-2-6/IEC 61800-5-1, IEC 60068-2-27

## GS30A-FB-LD

The GS30A-FB-LD is a line driver (differential) encoder module. This card is for use with GS30 series AC drives in installation Position 1 only. For encoder parameter setup, see Group P10.xx Details – Speed Feedback Control Parameters” on page 4–234.



**GS30-FB-LD**

GS30A-FB-LD Overview			
Drawing Item	Description	Wiring Info	Screw Torque
1	Screw fixing hole	Wire gauge: 0.25–0.75 mm <sup>2</sup> [24–18 AWG] Stripping length: 9mm	Screw torque: 5 kg-cm / [4.3 lb-in.] / [0.49 N•m]
2	Positioning hole		
3	AC drive connection port		
4	Terminal block		
5	Ground terminal block		
6	Channel indicator LEDs		

### FEATURES

- Line driver (differential) encoder input
- 1-phase or 2-phase input

### SPECIFICATIONS

GS30A-FB-LD Specifications		
Terminals		
Encoder PG1	VP	<ul style="list-style-type: none"> <li>• Power output voltage: +5V ±5% or +12V ±5%</li> <li>• Maximum output current: 200mA (+5V)</li> </ul>
	DCM	Common for power and signal
	A1, A1̄, B1, B1̄, Z1, Z1̄	<ul style="list-style-type: none"> <li>• Encoder input signal (applicable for line driver or open collector)</li> <li>• Open collector input voltage +5–24 VDC</li> <li>• Supports 1-phase and 2-phase input</li> <li>• Maximum input signal: 300kHz</li> </ul>
Pulse Command PG2	A2, A2̄, B2, B2̄	<ul style="list-style-type: none"> <li>• Pulse input signal (applicable for line driver or open collector)</li> <li>• Open collector input voltage +5–24 VDC</li> <li>• Supports 1-phase and 2-phase input</li> <li>• Maximum input signal: 300kHz</li> </ul>
PG OUT	AO, AŌ, BO, BŌ, ZO, ZŌ, SG	<ul style="list-style-type: none"> <li>• Encoder (PG1) feedback signal output, supports frequency elimination: 1–255 times</li> <li>• Maximum output voltage of the line driver: 5VDC</li> <li>• Maximum output current: 15mA</li> <li>• Maximum output frequency: 300kHz</li> <li>• SG, the referenced electric potential for encoder output signal, serves as the ground for host controller or PLC to make the output signal become the common point. Do not use common grounding with SG and DCM as it may influence the signal quality</li> </ul>
Ground	PE	Grounding terminal. To decrease noise, properly ground this terminal.
Environment		
Noise immunity		ESD (IEC 61800-5-1, IEC 61000-4-2) EFT (IEC 61800-5-1, IEC 61000-4-4) Surge Test (IEC 61800-5-1, IEC 61000-4-5) Conducted Susceptibility Test (IEC 61800-5-1, IEC 61000-4-6)



GS30A-FB-LD Specifications (continued)	
<b>Operation / storage</b>	Operation: -10°C~50°C [14°F~122°F] (temperature), 90% (humidity) Storage: -25°C~70°C [-13°F~158°F] (temperature), 95% (humidity)
<b>Vibration / shock immunity</b>	International standard: IEC 61800-5-1, IEC 60068-2-6/IEC 61800-5-1, IEC 60068-2-27

**NOTE:** Open collector applicatoin: input current 5-15 mA to each set and each set needs one pull-up resistor. If the input voltage of the open collector is 24V, power for the encoder must be connected externally.

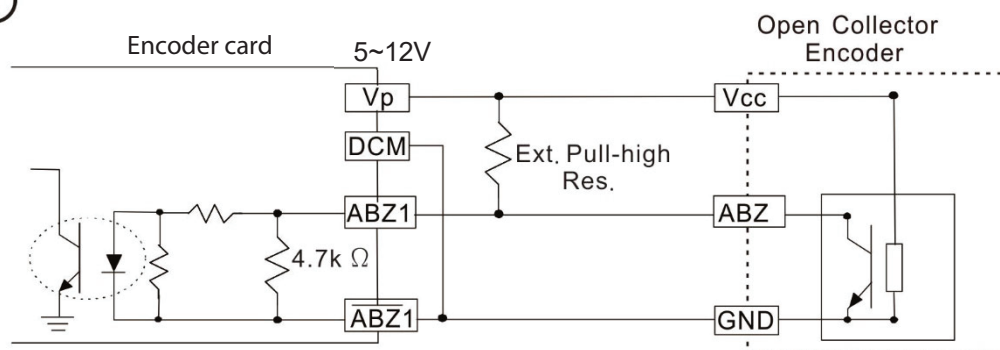


Input Voltage	Recommendation
5V	Recommended pull-up resistor: above 100~220Ω, 1/2 W
12V	Recommended pull-up resistor: above 510Ω~1.35 kΩ, 1/2 W
24V	Recommended pull-up resistor: above 1.8~3.3 kΩ, 1/2 W

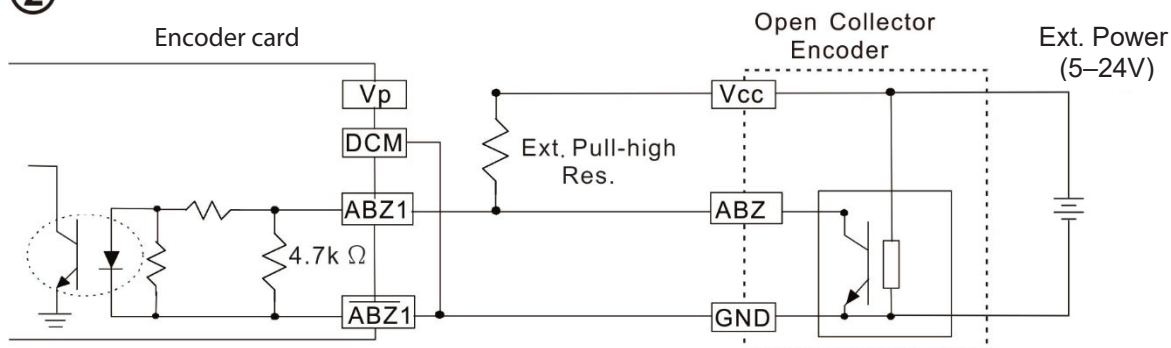
## WIRING DIAGRAMS

### Encoder Wiring Diagram

①



②

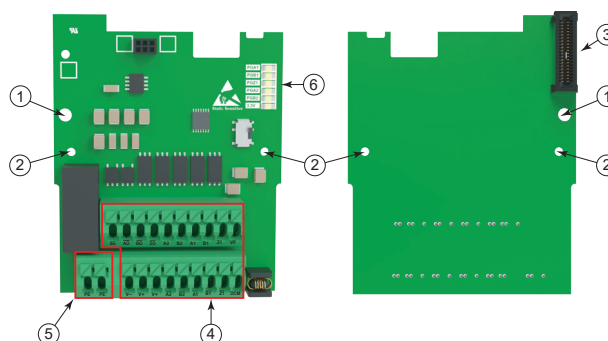


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## GS30A-FB-OC

The GS30A-FB-OC is an open collector encoder module. This card is for use with GS30 series AC drives in installation Position 1 only.

For encoder parameter setup, see Group P10.xx Details – Speed Feedback Control Parameters” on page 4–234.



**GS30-FB-OC**

GS30A-FB-OC Overview			
Drawing Item	Description	Wiring Info	Screw Torque
1	Screw fixing hole	Wire gauge: 0.25–0.75 mm <sup>2</sup> [24–18 AWG] Stripping length: 9mm	Screw torque: 5 kg-cm / [4.3 lb-in.] / [0.49 N•m]
2	Positioning hole		
3	AC drive connection port		
4	Terminal block		
5	Ground terminal block		
6	Channel indicator LEDs		

### FEATURES

- NPN/PNP open collector encoder input
- 1-phase or 2-phase input

### SPECIFICATIONS

GS30A-FB-OC Specifications		
Terminals		
Encoder PG1	VP	<ul style="list-style-type: none"> <li>• Power output voltage: +5V <math>\pm</math>5% or +12V <math>\pm</math>5%</li> <li>• Maximum output current: 200mA (+5V)</li> </ul>
	DCM	Common for power and signal
	A1, A1̄, B1, B1̄, Z1, Z1̄	<ul style="list-style-type: none"> <li>• Encoder input signal (applicable for line driver or open collector)</li> <li>• Open collector input voltage +5–24 VDC</li> <li>• Supports 1-phase and 2-phase input</li> <li>• Maximum input signal: 300kHz</li> </ul>
Pulse Command PG2	A2, A2̄, B2, B2̄	<ul style="list-style-type: none"> <li>• Pulse input signal (applicable for line driver or open collector)</li> <li>• Open collector input voltage +5–24 VDC</li> <li>• Supports 1-phase and 2-phase input</li> <li>• Maximum input signal: 300kHz</li> </ul>
PG OUT	V+, V+	<ul style="list-style-type: none"> <li>• Needs an external power source for the PG OUT circuit</li> <li>• Input voltage: +7–24 V</li> </ul>
	V-	The negative side for external power supply
	A0, B0, Z0	<ul style="list-style-type: none"> <li>• Encoder (PG1) feedback signal output: supports frequency elimination: 1–255 times</li> <li>• Open collector's output signal: add a pull-up resistor on each PG out external power</li> <li>• Maximum input frequency: 300kHz</li> </ul>
Environment		
Noise immunity	ESD (IEC 61800-5-1, IEC 61000-4-2) EFT (IEC 61800-5-1, IEC 61000-4-4) Surge Test (IEC 61800-5-1, IEC 61000-4-5) Conducted Susceptibility Test (IEC 61800-5-1, IEC 61000-4-6)	

<b>Operation / storage</b>	Operation: -10°C~50°C [14°F~122°F] (temperature), 90% (humidity) Storage: -25°C~70°C [-13°F~158°F] (temperature), 95% (humidity)
<b>Vibration / shock immunity</b>	International standard: IEC 61800-5-1, IEC 60068-2-6/IEC 61800-5-1, IEC 60068-2-27

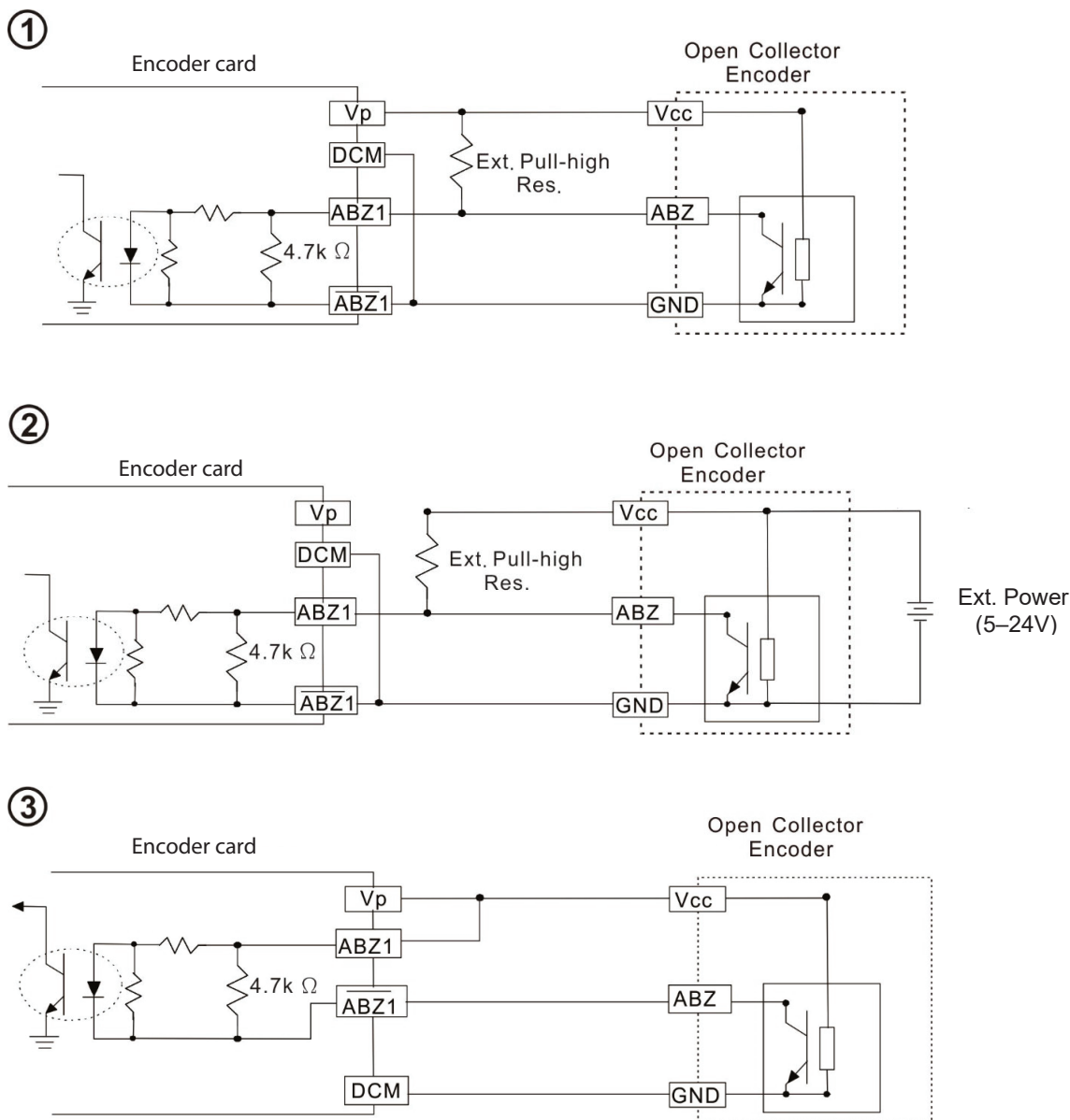
**NOTE:** Open collector applicatoin: input current 5-15 mA to each set and each set needs one pull-up resistor. If the input voltage of the open collector is 24V, power for the encoder must be connected externally.



Input Voltage	Recommendation
5V	Recommended pull-up resistor: above 100–220Ω, 1/2 W
12V	Recommended pull-up resistor: above 510Ω–1.35 kΩ, 1/2 W
24V	Recommended pull-up resistor: above 1.8–3.3 kΩ, 1/2 W

## WIRING DIAGRAMS

### Encoder Wiring Diagram



- Use a shielded cable to prevent interference. Do not run control wires parallel to any high voltage AC power line (200VAC and above)
- Recommended wire size: 0.0509–1.31mm<sup>2</sup> (30-16 AWG)
- Cable length: less than 30m



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