

OPTIONAL I/O AND COMMUNICATION CARDS



APPENDIX

B

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Appendix B: Optional I/O and Communication Cards

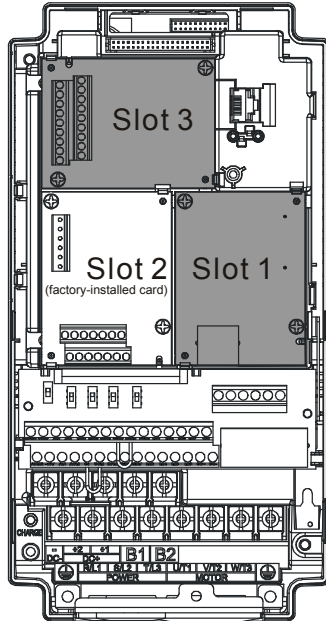
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INTRODUCTION

GS4 drives have several option cards that can be used to expand the functionality of the drive. Input/Output cards are available to provide additional DC I/O, 120VAC outputs, and relay outputs. Communication interface cards are also available to provide ModbusTCP or EtherNet/IP™ communication. Only one additional I/O card can be installed in a GS4 drive at a time, and only one comm card can be installed in a drive at a time.

OPTION CARD LOCATIONS

- Any optional comm card must be installed in Slot #1.
- Slot #2 is reserved for firmware upgrade module. See the GSoft2 helpfile for information on how to upgrade drive, keypad, and comm card firmware.
- Any optional I/O card must be installed in Slot 3.

GS4 Optional I/O and Communication Cards			
Part Number	Description	Placement	
GS4-06CDD	4-point DC input, 2-point DC output card	Slot 3	
GS4-06NA	6-point AC input card	Slot 3	
GS4-06TR	6-point relay output card	Slot 3	
GS4-CM-MODTCP	Modbus TCP comm card	Slot 1	
GS4-CM-ENETIP	EtherNet/IP comm card	Slot 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.



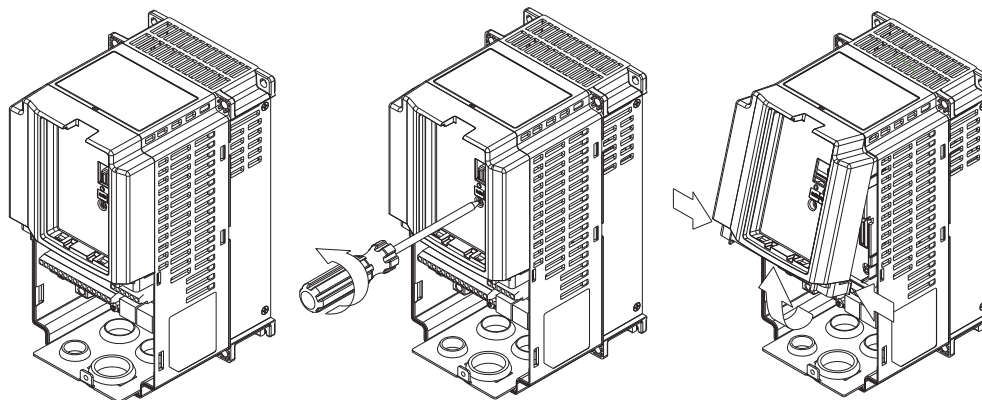
WARNING: A CHARGE MAY STILL REMAIN IN THE DC-LINK CAPACITOR WITH HAZARDOUS VOLTAGES, EVEN IF THE POWER HAS BEEN TURNED OFF. TO AVOID PERSONAL INJURY, DO NOT REMOVE THE COVER OF THE AC DRIVE UNTIL ALL "DISPLAY LED" LIGHTS ON THE DIGITAL KEYPAD ARE OFF. PLEASE NOTE THAT THERE ARE LIVE COMPONENTS EXPOSED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

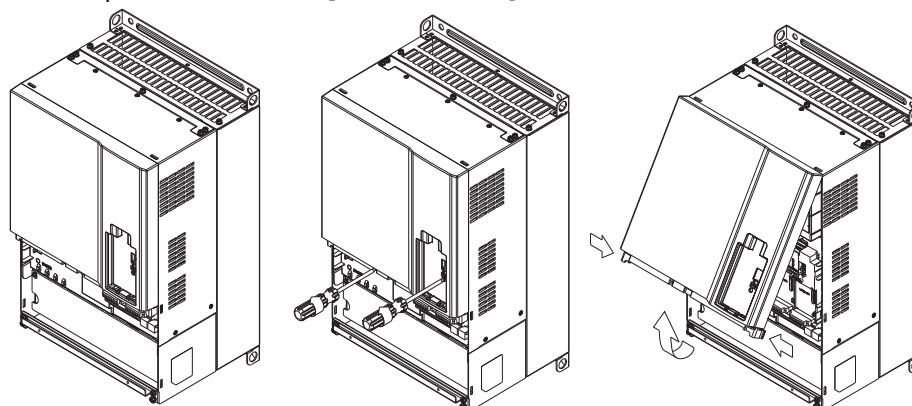
DRIVE FRAMES A, B, AND C

Remove the cover screw and press the tabs on both sides to remove the cover.
Cover screw torque is 6.9~8.7 in·lb [0.78~0.98 N·m].



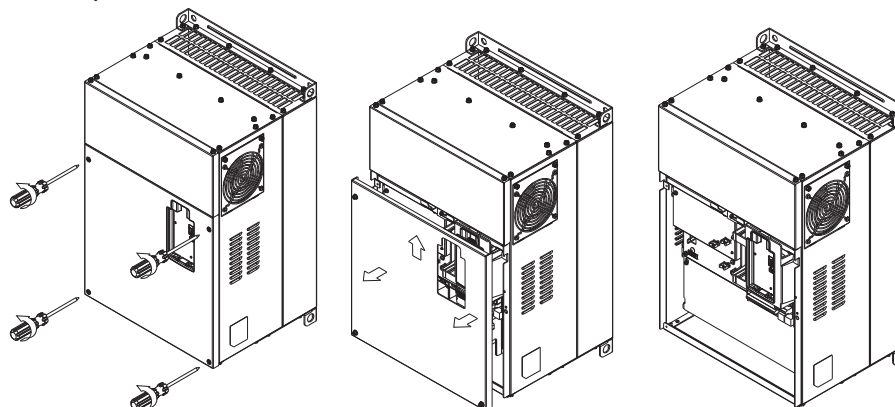
DRIVE FRAME D

Loosen the captive screws and press the tabs on both sides to remove the cover.
Cover screw torque is 6.9~8.7 in·lb [0.78~0.98 N·m].



DRIVE FRAMES E, F, AND G

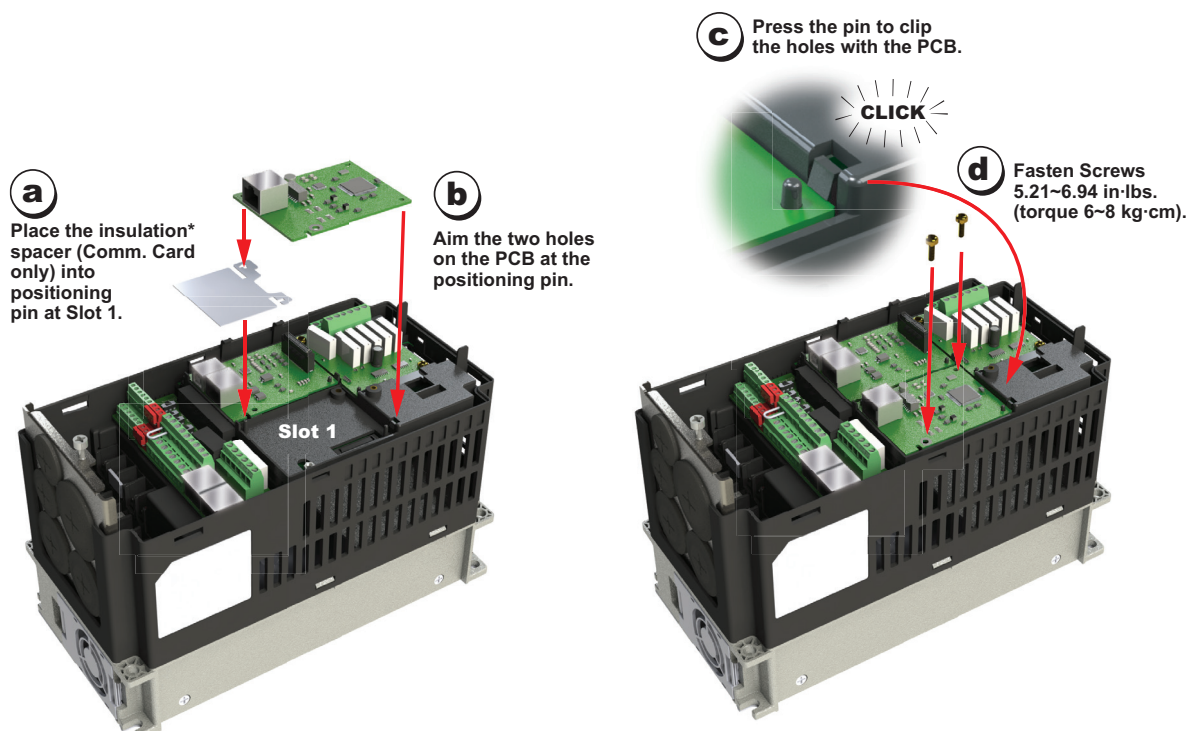
Loosen the captive screws, lift the cover slightly and pull it outward to remove (Frame E shown).
Cover screw torque is 10.4~13.0 in·lb [1.18~1.47 N·m]



OPTION CARD INSTALLATION AND REMOVAL

INSTALLATION

- 1) Disconnect power to the GS4 AC drive.
- 2) Remove the digital keypad and cover to the GS4 AC drive. (See “Chapter 2: Installation and Wiring” for detailed instructions.)
- 3) Install the circuit board.
 - a) Place the insulation spacer on the positioning pin at Slot 1 (communication cards only).
 - b) Align the two holes on the circuit board with the positioning pin of the GS4 drive slot that is appropriate for the option card being installed (see [page B-2](#)).
 - c) Push down on the circuit board until the board clicks into place under the retaining clip.
 - d) Fasten the circuit board with the M3 x 0.5 x 5mm long mounting screws. Tighten to a torque of 5.21~6.94 in·lb (0.59~0.78 N·m).



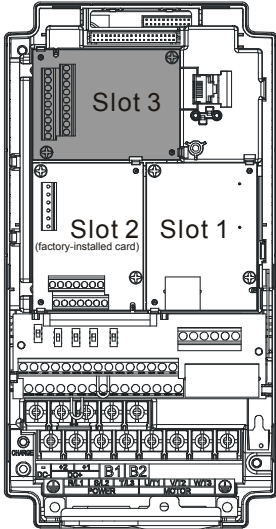
* Insulation spacer assists in preventing accidental contact of cable, board, screw, and relay terminals.

REMOVAL

- 1) Disconnect power to the GS4 AC drive.
- 2) Remove the digital keypad and cover to the GS4 AC drive. See Chapter 2 - Installation and Wiring detailed instructions.
- 3) Remove the circuit board.
 - a) Remove the M3 x 0.5 x 5mm long mounting screws.
 - b) Push back on the retaining clip and lift the circuit board off of the positioning pin

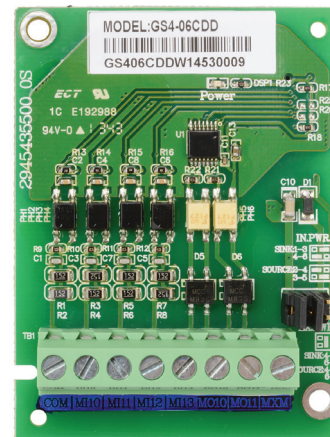
OPTIONAL I/O CARDS

The following chart lists the optional input/output cards available for GS4 series drives.

GS4 Optional I/O Cards *		
Part Number	Description	Placement
GS4-06CDD *	DURAPULSE combination discrete I/O module, selectable sinking or sourcing 24VDC input, 24VDC output, 4-point input, 2-point output, 1 input common(s), 1 output common(s), 50mA resistive output current. For use with GS4 series AC drives.	
GS4-06NA *	DURAPULSE discrete input module, sinking 120VAC input, 6-point input, 1 input common(s). For use with GS4 series AC drives.	
GS4-06TR *	DURAPULSE relay output module, Form A (SPST) relays, 6-point output, 6 output common(s). For use with GS4 series AC drives.	
* I/O cards can be installed only in Slot #3 of the GS4 drive, and only one I/O card at a time can be installed.		

GS4-06CDD COMBO I/O CARD

GS4-06CDD - 4 DC Inputs / 2 DC Outputs		
Part Number	Terminals	Description
GS4-06CDD	COM	Common for Multi-Function Input terminals Select SINK(NPN)/SOURCE(PNP) and internal/external power supply with J1 jumper. Jumper is only applicable to the inputs
	DI10~DI13	Refer to parameters P3.11~P3.14 to program the multi-function inputs DI10~DI13. Internal power is applied from terminal E24: +24VDC $\pm 5\%$ 200mA, 5W External power +24VDC: max. voltage 30VDC, min. voltage 19VDC ON: the activation current is 3.3mA @ ≥ 11 VDC OFF: leakage current tolerance is 1.4mA ≤ 5 VDC
	DO10~DO11	Refer to P3.21 and P3.22 to program the multi-function outputs DO10~DO11 Multi-function output terminals (photocoupler) Duty-cycle: 50% $\pm 5\%$ Max. output frequency: 100Hz Max. current: 50mA Max. voltage: 48VDC
	DOC	Common for multi-function output terminals DO11~DO11 (photocoupler) Max 48VDC 50mA Outputs are bi-directional (can be wired sink or source)

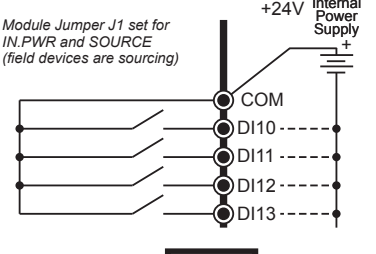
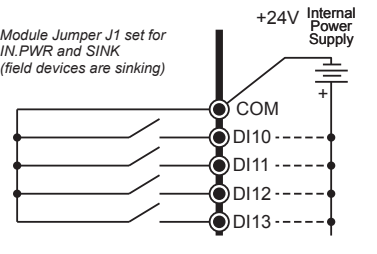
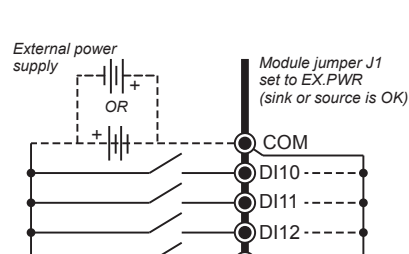
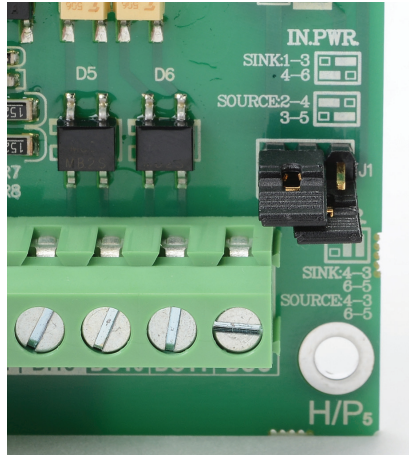
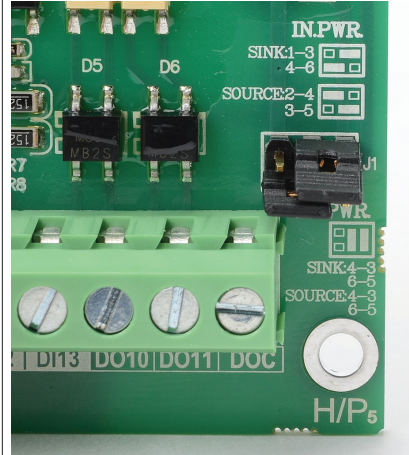



GS4-06CDD Terminal Torque Specs

Wire Gauge	20~24 AWG
Torque	3.47 in-lb (0.39 N·m)

GS4-06CDD DIGITAL INPUTS WIRING

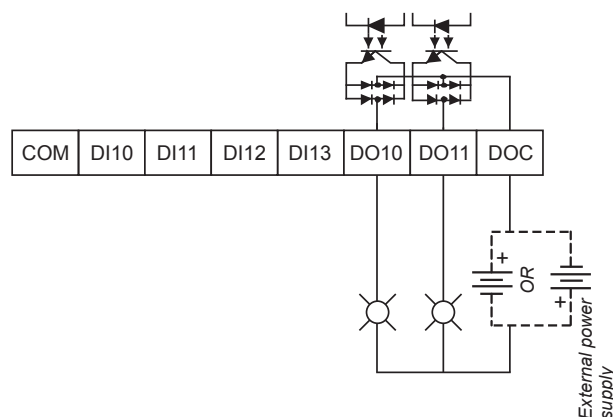
NOTE: When using the Internal 24VDC Power Supply, 3-wire devices (such as proximity switches, photoeyes, etc.) cannot be used because both the positive and negative sides of the power supply are not available. Either use a 2-wire device or use an external power supply.

Internal Power Supply (Sourcing field devices)	Internal Power Supply (Sinking field devices)	External Power Supply (Sinking or Sourcing field devices)
<p>Module Jumper J1 set for IN.PWR and SOURCE (field devices are sourcing)</p>  <p>Source</p> <p>When jumpered for Source: Dixx terminals will sink current (field devices are sourcing). COM terminal provides +24VDC (200mA max).</p>	<p>Module Jumper J1 set for IN.PWR and SINK (field devices are sinking)</p>  <p>Sink</p> <p>When jumpered for Sink: Dixx terminals will provide +24VDC (field devices are sinking). Connect COM to GND.</p>	<p>External power supply</p>  <p>Sink or Source</p> <p>Module jumper J1 set to EX.PWR (sink or source is OK)</p>
J1 Jumper Settings (only for Digital Inputs)		
		

GS4-06CDD DIGITAL OUTPUTS WIRING

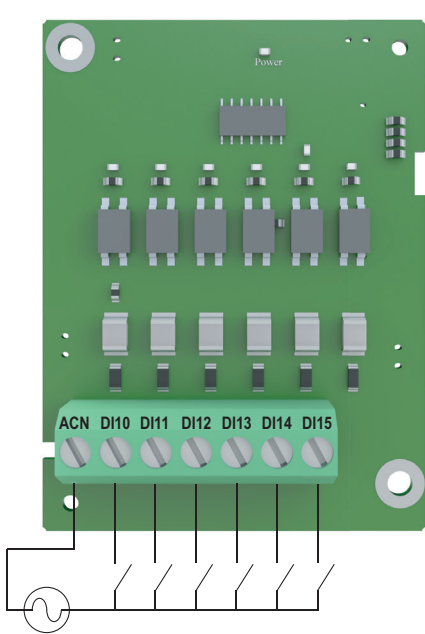
Outputs are bidirectional: can be used in sinking or sourcing applications.

J1 jumper has no effect on digital outputs' operation.)



GS4-06NA INPUT CARD

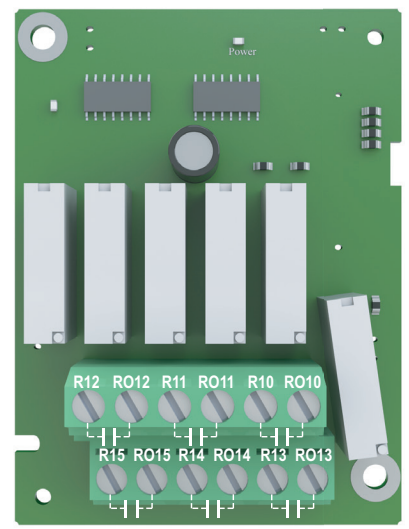
GS4-06NA (Six AC Inputs)		
Part #	Terminals	Description
GS4-06NA	ACN	AC power Common for multi-function input terminal (Neutral)
	DI10~DI15	<p>Refer to P3.11~P3.16 for multi-function input selection</p> <p>Input voltage: 100~130 VAC Input frequency: 47~63 Hz Input impedance: 27kΩ</p> <p>Terminal response time: ON: 10ms OFF: 20ms</p>


GS4-06NA Terminal Torque Specs

Wire Gauge	20~24 AWG
Torque	3.47 in·lb (0.39 N·m)

GS4-06TR OUTPUT CARD

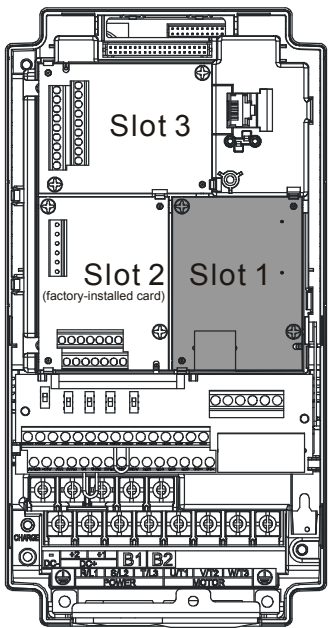
GS4-06TR (Six Relay Outputs)		
Part #	Terminals	Description
GS4-06TR	R10~R15 RO10~RO15	<p>Refer to P3.21~P3.26 for multi-function output selection</p> <p>Resistive load: 5A(N.O.) / 250VAC 5A(N.O.) / 30VDC</p> <p>Inductive load (COSØ 0.4) 2A(N.O.) / 250VAC</p> <p>Six Form A (SPST-NO) relay outputs Rxx = separate common for each relay R0xx = normally open output</p>


GS4-06TR Terminal Torque Specs

Wire Gauge	20~26 AWG
Torque	5.21 in·lb (0.59 N·m)

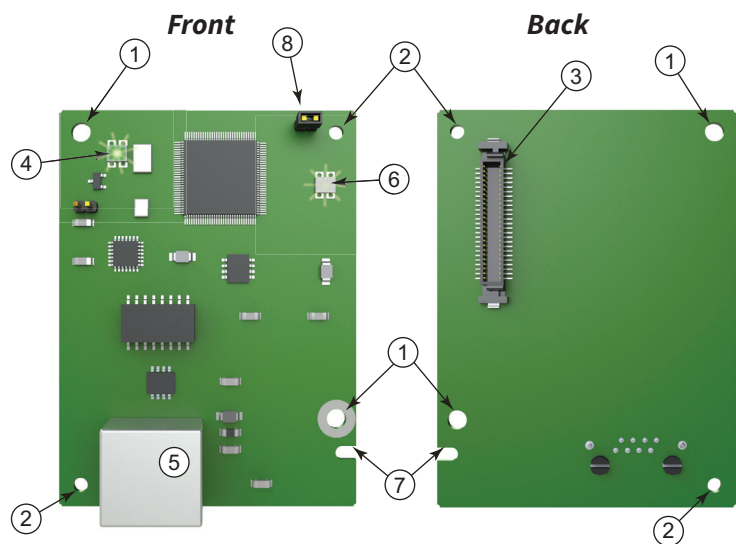
OPTIONAL COMMUNICATIONS CARDS

The following chart lists the optional communication cards available for GS4 series drives.

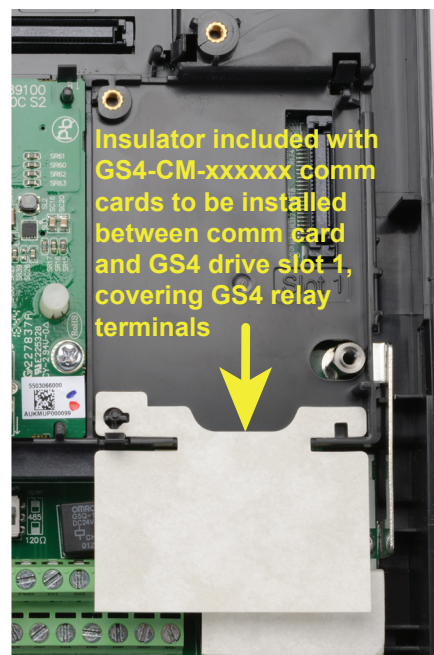
GS4 Optional Communication Cards *		
Part Number	Description	Placement
GS4-CM-MODTCP *	DURApulse communication card, Modbus TCP, 10/100 Mbps auto-detect, Ethernet (RJ45) port. For use with GS4 series AC drives.	
GS4-CM-ENETIP *	DURApulse communication card, EtherNet/IP 10/100 Mbps auto-detect, Ethernet (RJ45) port. For use with GS4 series AC drives.	

** Communication cards can be installed only in Slot #1 of the GS4 drive, and only one comm card at a time can be installed.*

GS4-CM-xxxxxx CIRCUIT BOARD LAYOUT

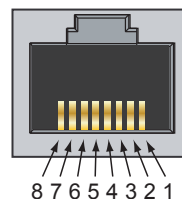


- | | |
|---------------------------------|------------------------|
| 1) Mounting screw hole (qty: 2) | 5) RJ45 port |
| 2) Positioning hole (qty: 2) | 6) POWER LED indicator |
| 3) GS4 AC drive connection port | 7) Alignment groove |
| 4) LINK LED indicator | 8) FW upgrade jumper |



CONNECTING COMM CARD TO PC**GS4-CM-xxxxxx RJ45 PIN DESCRIPTION**

PIN Description for GS4-CM-ENETIP & GS4-CM-MODTCP					
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

**GS4-CM-xxxxxx OPTIONAL CABLE**

Cat5E patch (straight-through) shielded-twisted-pair cable with RJ45 male connectors:

- Part # C5E-STPxx-Snn, where:
 - xx = color; BK-black, BL-blue, GN-green, GY-gray, OR-orange, PL-purple, RD-red, YL-yellow
 - yy = length; 3, 7, 10, 14, 25, or 50 feet

COMMUNICATION CARD FIRMWARE UPDATE INSTRUCTIONS

These instructions explain how to update firmware via the internet for the following GS4 optional communication cards:

- GS4-CM-ENETIP – EtherNet/IP™ communication card
- GS4-CM-MODTCP – Modbus TCP communication card

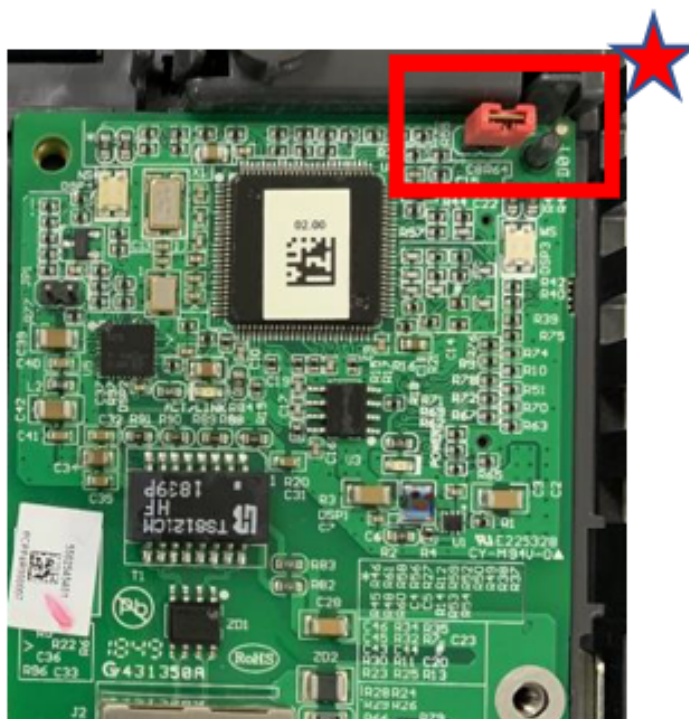
The comm card firmware can be updated via GSOFT2 configuration software for GS4 AC drives, or via an internet browser. The browsers we support are Internet Explorer, Microsoft Edge, Chrome, Firefox and Safari.

REMOVING THE CARD SLOT COVER

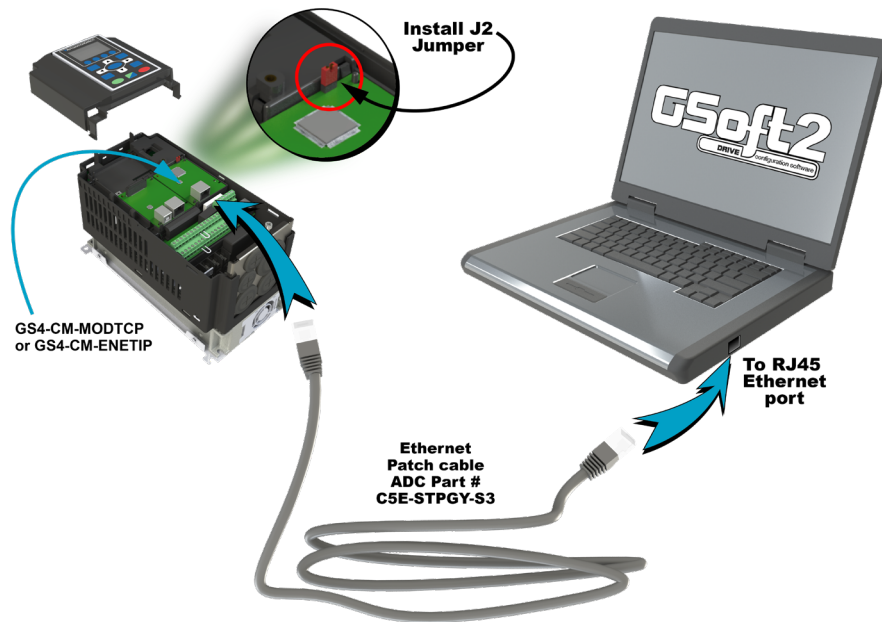
Refer to “Removing the Card Slot Cover” ([page B-2](#)) for instructions for gaining physical access to the communications card.

FIRMWARE UPDATE INSTRUCTIONS

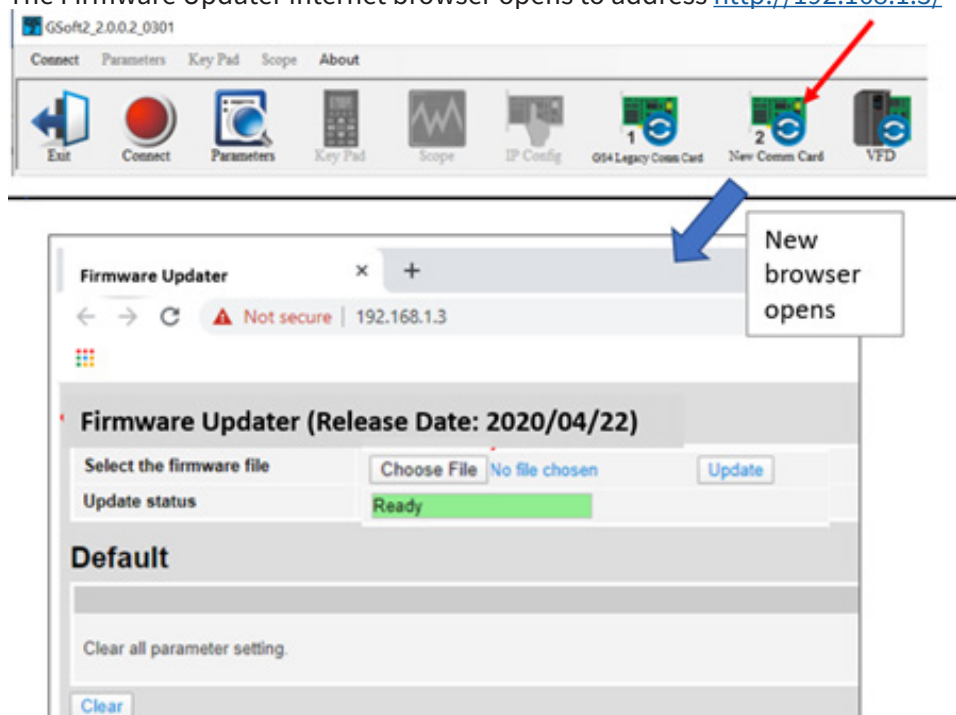
- 1) Remove power from the drive. Remove necessary drive components to access the Comm card circuitry. Install the jumper on JP2 on the Comm card. Ensure the Comm card remains plugged into the drive.



- 2) Connect the PC and the Comm card with an Ethernet cable (straight-through cable) as shown below:

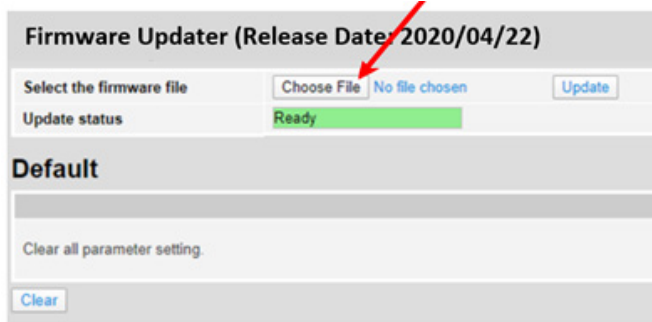


- 3) Energize the Drive input power to enter the Comm Card FW BOOT mode (jumper must be installed).
- 4) In GSoft2, click the **New Comm Card** icon in the menu bar.
The Firmware Updater internet browser opens to address <http://192.168.1.3/>

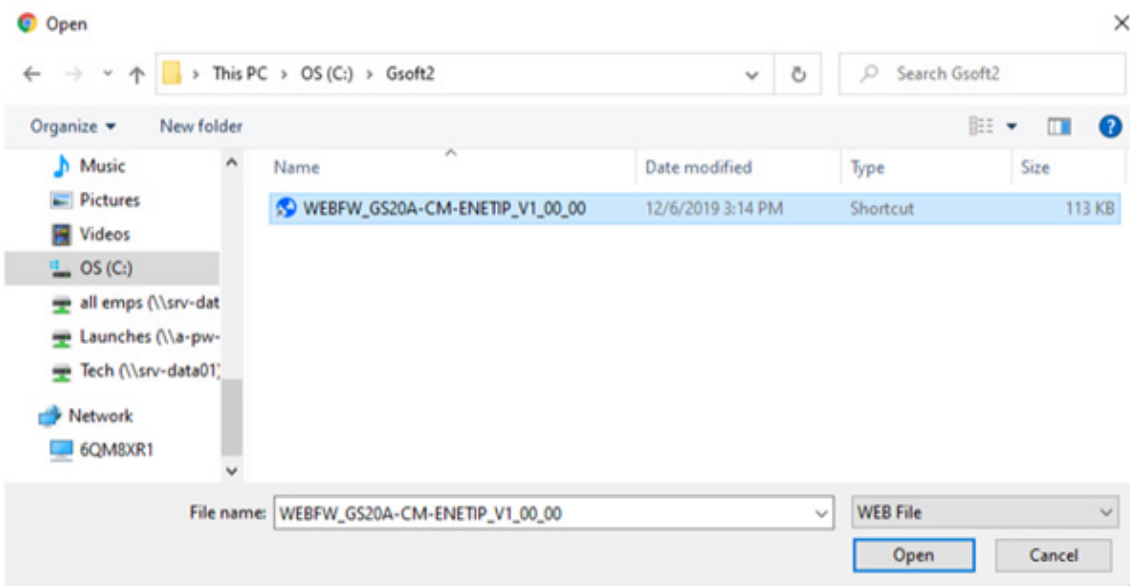


If the internet browser will not connect, validate the network card settings for the PC Ethernet port.

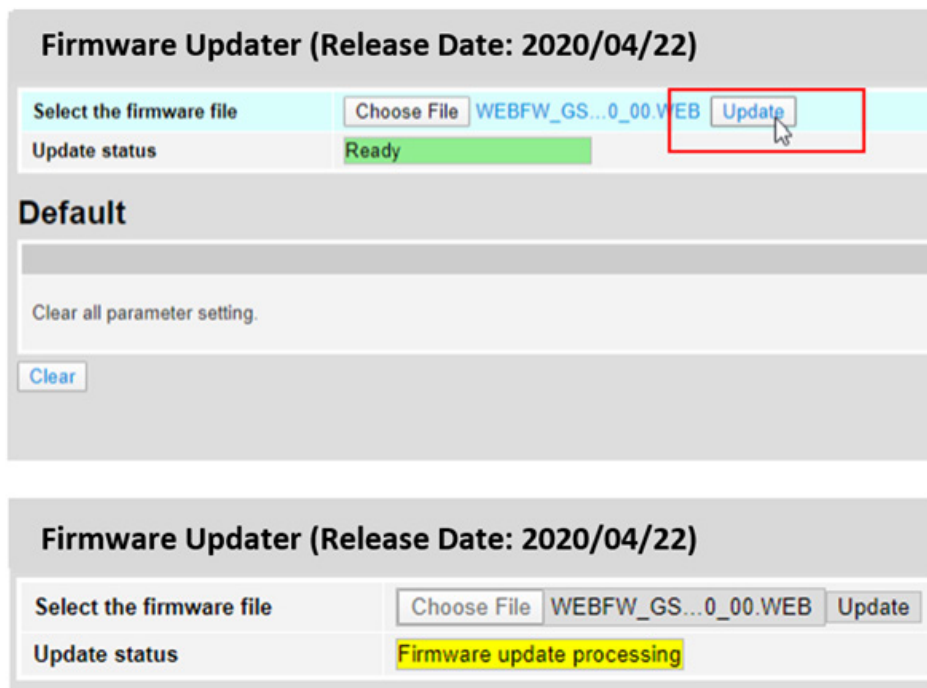
- 5) After successful connection, the Firmware update screen will appear in the browser. Click **Choose File**.



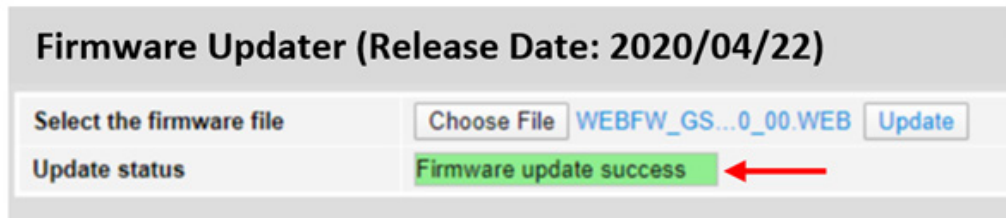
- 6) Navigate to the Comm Card FW” file. Click **Open**.



- 7) Click **Update**.
The firmware update will begin. Typical update time is a few seconds.



- 8) The message “Firmware Update Success” will indicate the process is completed.



- 9) **IMPORTANT!** Remove power from the drive, then remove the jumper from J2.
- 10) Reinstall the Comm card and apply power to the drive.
Verify the new firmware version in the P09.45 parameter value.
If the firmware version is 0, the jumper was not removed and the Comm card will not function.

GS4-CM-MODTCP AND GS4-CM-ENETIP 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.



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 P9.63 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 GS4 DRIVE

Now the IP address of the drive must be set. This can be done in GSoft2 or by the drive’s 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 P9.64 causes the drive to push the P9 communication parameters to the card. Bits in P9.64 reset themselves automatically.

GSoft2 method

Connect to the drive thru the RS485 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 P9.64)

Keypad method

Enter the following parameter data in the drive keypad:

GS4 IP Configuration		
Parameter	Set Value	Explanation
P9.48	0	Set the IP to “Static”
P9.49	192	IP address 1
P9.50	168	IP address 2
P9.51	1	IP address 3
P9.52	10	IP address 4
P9.53	255	Subnet Mask 1
P9.54	255	Subnet Mask 2
P9.55	255	Subnet Mask 3
P9.56	0	Subnet Mask 4
P9.57	192	Gateway Address 1
P9.58	168	Gateway Address 2
P9.59	1	Gateway Address 3
P9.60	1	Gateway Address 4

Enter a “2” into P9.64 (sets bit 1 = 1) and press “Enter” to transfer the network parameters to the comm card. P9.64 will save the parameters to the card and will then reset P9.64 to zero.

GS4-CM-MODTCP SPECIFICATIONS**FEATURES**

- Modbus TCP protocol
- MDI/MDI-X auto-detect
- Baud rate: 10/100Mbps auto-detect

GS4-CM-MODTCP Specifications	
Network Interface	
Interface	RJ45 with Auto MDI/MDIX
Number of ports	1 Port
Transmission method	IEEE 802.3, IEEE 802.3u
Transmission cable	Category 5e shielding 100MHz
Transmission speed	10/100 Mbps Auto-Detect
Network protocol	ICMP, IP, TCP, UDP, DHCP, Modbus TCP, BOOTP
Electrical	
Power supply voltage	5VDC (supplied by the AC motor drive)
Insulation voltage	500VDC
Power consumption	0.8W
Weight	25g
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

GS4-CM-MODTCP LED INDICATORS AND TROUBLESHOOTING

There are 2 LED indicators on GS4-CM-MODTCP. The POWER LED displays the status of the power supply, and the LINK LED displays the communication status with the network.

If any of the following 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.

GS4-CM-MODTCP LED Indicators				
LED	Status		Indication	How to correct it?
POWER	Amber	On	Power supply in normal status	–
		Off	No power supply	Check the power supply
LINK	Amber	On	Network connection in normal status	–
		Flashes	Network in operation	–
		Off	Network not connected	Check if the network cable is connected

GS4-CM-MODTCP LED Troubleshooting		
Abnormality	Cause	How to correct it?
POWER LED off	GS4 drive not powered	Check if GS4 drive is powered, and if the power supply is normal.
	GS4-CM-MODTCP not connected to AC drive	Make sure GS4-CM-MODTCP is connected to AC drive.
LINK LED off	GS4-CM-MODTCP not connected to network	Make sure the network cable is correctly connected to network.
	Poor contact to RJ-45 connector	Make sure RJ-45 connector is connected to Ethernet port.
No COMM Card	GS4-CM-MODTCP not connected to AC drive	Make sure GS4-CM-MODTCP is connected to AC drive.

GS4-CM-MODTCP Error Codes		
ID	Code	Definition
75	ECFF	Incorrect default setting
76	ECiF	Serious internal error
80	ECEF	Ethernet connection error
81	ECto	Communication timeout between GS4-CM-MODTCP and GS4
82	ECCS	Checksum error in the communication between GS4-CM-MODTCP and GS4
83	ECrF	Reset GS4-CM-MODTCP to default setting
84	EC00	Exceeds max. number of communications in Modbus TCP
85	EC01	Exceeds max. number of communications in EtherNet/IP
86	ECiP	IP error: Default Gateway address must match subnet of IP address or be set to 0.0.0.0
87	EC3F	reserved
88	ECbY	GS4 is busy.
89	ECCb	Comm Card Break (disconnected) for > 5 seconds.

GS4-CM-MODTCP COMMON COMMUNICATION PARAMETERS

When the GS4 drive, is connected via Ethernet, please use the communication parameters in the table below to configure the drive. The Ethernet master will be able to read/write the frequency word and control word for the GS4 drive after the communication parameters are set up.

GS4 Communication Parameters			
Parameter	Function	Set Value (Dec)	Explanation
P4.00	1st Source of Frequency Command [Remote]	4	The frequency command is controlled by communication card.
P3.00	Source of operation command setting	5	The operation command is controlled by communication card.
P9.48	IP setting	0	Static IP(0) / Dynamic distribution IP(1)
P9.49	IP address -1	192	IP address 192.168.1.5
P9.50	IP address -2	168	IP address 192.168.1.5
P9.51	IP address -3	1	IP address 192.168.1.5
P9.52	IP address -4	5	IP address 192.168.1.5
P9.53	Netmask -1	255	Netmask 255.255.255.0
P9.54	Netmask -2	255	Netmask 255.255.255.0
P9.55	Netmask -3	255	Netmask 255.255.255.0
P9.56	Netmask -4	0	Netmask 255.255.255.0
P9.57	Default gateway -1	192	Default gateway 192.168.1.1
P9.58	Default gateway -2	168	Default gateway 192.168.1.1
P9.59	Default gateway -3	1	Default gateway 192.168.1.1
P9.60	Default gateway -4	1	Default gateway 192.168.1.1

Communication Card Special Function Parameters	
Parameter	Explanation
P9.63	Communication Card Factory Reset, 1 = Reset to Factory Defaults
P9.64	Communication Card Set, 2 = Write Parameters to Card

After changing any of the P9.xx communication card parameters, enter a “2” into P9.64 (Bit1 = 1). This will write any parameter changes from the drive into the communication card.

GS4-CM-MODTCP CONTROL WORDS

Communication 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	Reserved
		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 2000h: Writing to and Reading from the 2000h control word works as expected with Ethernet communication. If you are also simultaneously writing to P9.27 and P9.28 via RS-485 (the Control words for RS-485 communication), the Ethernet control word may not read back correctly with the current status. (Please use RS-485 OR Ethernet for exact feedback, but do NOT use both.)

**Note concerning 2001h: If the Frequency Command (via RS485, Ethernet, Keypad, analog, etc.) is set higher than P0.04 Max Frequency Output, the drive will limit the actual output to P0.04.

GS4-CM-MODTCP STATUS WORDS

Communication Protocol Parameter Address Definitions			
Address		Definition	
Modbus Decimal	Modbus Hex		
Status Monitor 1 – Warning Codes			
48449	2100	Fault Code: Refer to Troubleshooting – Warning/Fault Codes in Chapter 6: Maintenance and Troubleshooting	
Status Monitor 2 – Status of GS4 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	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		
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	Warning Codes	
48458	2109	Digital Input Counter Value	
48459	210A	Power Factor Angle (cos Θ)	
48460	210B	reserved	
48461	210C	Actual Motor Speed (rpm)	
48462	210D	reserved	
48463	210E	reserved	
48464	210F	Power Output in kW	

MODBUS COMMUNICATION

GS4-CM-MODTCP Modbus Function Codes	
Code	Definition
0x03	Read register(s) in GS4
0x06	Write single register in GS4
0x10	Write multiple data registers in GS4

GS4-CM-ENETIP SPECIFICATIONS
FEATURES

- Auto-detects transmission speed 10/100 Mbps
- MDI/MDI-X auto-detect
- Supports MODBUS TCP slave communication protocol (1 connection)
- On-line monitoring
- Supports Ethernet/IP explicit message Class 3
- EtherNet/IP implicit Class 1

GS4-CM-ENETIP Specifications	
Network Interface	
Interface	RJ45 with Auto MDI/MDIX
Number of ports	1 Port
Transmission method	IEEE 802.3, IEEE 802.3u
Transmission cable	Category 5e shielding 100M
Transmission speed	10/100 Mbps Auto-Detect
Network protocol	ICMP, IP, TCP, UDP, DHCP, Modbus TCP, EtherNet/IP
Electrical	
Power supply voltage	5VDC (supplied by the AC motor drive)
Insulation voltage	500VDC
Power consumption	0.8W
Weight	25g
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
NOTE: The external controller's RPI must be set greater than 10ms.	

GS4-CM-ENETIP LED INDICATORS AND TROUBLESHOOTING

There are 2 LED indicators on GS4-CM-ENETIP. 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.

GS4-CM-ENETIP LED Indicators				
LED	Status		Indication	How to correct it?
POWER	Amber	On	Power supply in normal status	–
		Off	No power supply	Check the power supply
LINK	Amber	On	Network connection in normal status	–
		Flashes	Network in operation	–
		Off	Network not connected	Check if the network cable is connected

GS4-CM-ENETIP LED Troubleshooting		
Abnormality	Cause	How to correct it?
POWER LED off	AC motor drive not powered	Check if AC motor drive is powered, and if the power supply is normal.
	GS4-CM-ENETIP not connected to AC drive	Make sure GS4-CM-ENETIP is connected to AC motor drive.
LINK LED off	GS4-CM-ENETIP not connected to network	Make sure the network cable is correctly connected to network.
	Poor contact to RJ-45 connector	Make sure RJ-45 connector is connected to Ethernet port.

GS4-CM-ENETIP Error Codes		
ID	Code	Definition
75	ECFF	Incorrect default setting
76	ECiF	Serious internal error
80	ECEF	Ethernet connection error
81	ECto	Communication timeout between GS4-CM-ENETIP and GS4
82	ECCS	Checksum error in the communication between GS4-CM-ENETIP and GS4
83	ECrF	Reset GS4-CM-ENETIP to default setting
84	ECo0	Exceeds max. number of communications in Modbus TCP
85	ECo1	Exceeds max. number of communications in EtherNet/IP
86	ECiP	IP error: Default Gateway address must match subnet of IP address or be set to 0.0.0.0
87	EC3F	reserved
88	ECbY	GS4 is busy.

GS4-CM-ENETIP COMMON PARAMETERS

When the GS4 drive, is connected via Ethernet, please use the communication parameters in the table below to configure the drive. The Ethernet master will be able to read/write the frequency word and control word for the GS4 drive after the communication parameters are set up.

GS4 Communication Parameters			
Parameter	Function	Set Value (Dec)	Explanation
P4.00	Source of frequency command setting	4	The frequency command is controlled by communication card.
P3.00	Source of operation command setting	5	The operation command is controlled by communication card.
P9.48	IP setting	0	Static IP(0) / Dynamic distribution IP(1)
P9.49	IP address -1	192	IP address 192.168.1.5
P9.50	IP address -2	168	IP address 192.168.1.5
P9.51	IP address -3	1	IP address 192.168.1.5
P9.52	IP address -4	5	IP address 192.168.1.5
P9.53	Netmask -1	255	Netmask 255.255.255.0
P9.54	Netmask -2	255	Netmask 255.255.255.0
P9.55	Netmask -3	255	Netmask 255.255.255.0
P9.56	Netmask -4	0	Netmask 255.255.255.0
P9.57	Default gateway -1	192	Default gateway 192.168.1.1
P9.58	Default gateway -2	168	Default gateway 192.168.1.1
P9.59	Default gateway -3	1	Default gateway 192.168.1.1
P9.60	Default gateway -4	1	Default gateway 192.168.1.1

Communication Card Special Function Parameters	
Parameter	Explanation
P9.63	Communication Card Factory Reset, 1 = Reset to factory defaults
P9.64	Communication Card Set, 2 = Write parameters to card

After changing any of the P9.xx communication card parameters, enter a “2” into P9.64 (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.

GS4-CM-ENETIP ETHERNET/IP I/O MESSAGING (IMPLICIT MESSAGING)

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

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

GS4-CM-ENETIP 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

GS4-CM-ENETIP 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.

GS4-CM-ENETIP ERROR CODE FOR MONITOR REQUEST

Status Code	Extended Status Code	Definition
0x00	–	The execution of service is successful.
0x01	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.
0x01	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.
0x01	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.
0x01	0x0107	Cannot find the corresponding target to connect
0x01	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.
0x01	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.
0x01	0x0111	RPI setting not supported
0x01	0x0112	RPI Value(s) Not Acceptable. Module requires an RPI of 10ms or greater.
0x01	0x0113	The number of connections exceeds the maximum. No further connections are able to connect to this device.
0x01	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.
0x01	0x0115	Inconsistent product type The product type marked in the electronic key logic section does not match the record in the target device.
0x01	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.
0x01	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.

GS4-CM-ENETIP COMMUNICATION PROTOCOL PARAMETER ADDRESS DEFINITIONS

Communication Protocol Parameter Address Definitions			
Parameter Content Parameters Set in GS4	Address	Definition	
Commands to GS4	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	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	Reserved
		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

(Table continued next page.)

Communication Protocol Parameter Address Definitions (continued)			
Parameter Content Parameters Set in GS4	Address	Definition	
Monitor GS4 status	0	Fault Code: Refer to Troubleshooting – Warning/Fault Codes in Chapter 6: Maintenance and Troubleshooting	
	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	Warning codes	
	9	Digital Input counter value	
	10	Power Factor angle (cosθ)	
	11	reserved	
	12	Actual Motor Speed (rpm)	
	13	reserved	
	14	reserved	
	15	Power Output (kW)	

GS4-CM-ENETIP EXPLICIT MESSAGING**ETHERNET IP SERVICES AND OBJECTS**

EtherNet/IP Objects Supported		
Object	Class Code	Definition
Identity Object	0x01	For device identity
Message Router Object	0x02	For message route
Assembly Object	0x04	For assembly
Connection Manager Object	0x06	For connection management
TCP/IP Interface Object	0xF5	For TCP/IP interface
Ethernet Link Object	0xF6	For Ethernet connection
BR Object	0x64	For basic control registers
AL Object	0x65	For alarm registers

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

IDENTITY OBJECT (CLASS CODE: 0x01)Instance Code: 0x01Instance 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: 0x0204
0x04	Get	Revision	STRUCT of: USINT, USINT	Firmware version Major revision Minor revision
0x05	Get	Status	WORD	Summary status of devices; The value is always 0.
0x06	Get	Serial Number	UDINT	32-bit serial number of device
0x07	Get	Product Name	SHORT_STRING	GS4-CM-EN

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, 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

Attribute ID	Access Rule	Name	Data type	Description of attribute
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

Bits	Name	Description
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

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

GS4-CM-ENETIP BASIC REGISTERS

GS4-CM-ENETIP Basic Registers			
BR#	Read / Write	Content	Explanation
#0	R	Model name	Set up by the system; read only. The model code of GS4-CM-ENETIP=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	GS4 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 GS4-CM-ENETIP is 0204h. Read the model code to confirm connection with GS4-CM-ENETIP.

BR#1 - Firmware Version: The firmware version of GS4-CM-ENETIP 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 - GS4 Drive Station Number: Station number of the GS4 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, GS4-CM-ENETIP 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: GS4 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

GS4-CM-ENETIP ALARM REGISTER

GS4-CM-ENETIP 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
	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 Class	Instance	Service Name	Description of service
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	UDINT, STRING	VFD Command Data
0x21	0x00~0x1F	Get	VFD Status	UDINT, STRING	VFD Status Data

Services

Instance & Attributes				
Service Code	Implemented for Class	Instance	Service Name	Description of Service
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 GS4 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 GS4 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 GS4Drive 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 P1.01 (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 METHOD1) 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.

