Using GS30 AC Drives with AutomationDirect PLCs

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Appendix D Overview

The material presented here will help you connect your GS30 drive to an ADC PLC. The concepts and techniques used can also be applied to any 3rd party PLC.

There are two ways a PLC can control the drive; via communications or via physical inputs. The GS30 supports serial Modbus via the built-in RS-485 connections. Ethernet communication is available by installing an EtherNet/IP option card (that can be configured as Ethernet/IP or Modbus TCP).

GS30 supports a variety of I/O on the main control board.

- *7 Sinking/sourcing DC inputs (includes 1 Hi-speed pulse input, 30V/30mA/33kHz max)*
- *2 Sinking/sourcing DC outputs*
- *1 Form C relay output (inductive load [cosØ 0.4] 1.2A [NO or NC] @ 250VAC)*
- *2 Analog inputs (0~10V, -10~10V, 0~20 mA, 4~20 mA)*
- *1 Analog output (0~10V, -10~10V, 4~20 mA)*
- *1 Hi-speed pulse output (30V/30mA/33kHz max)*

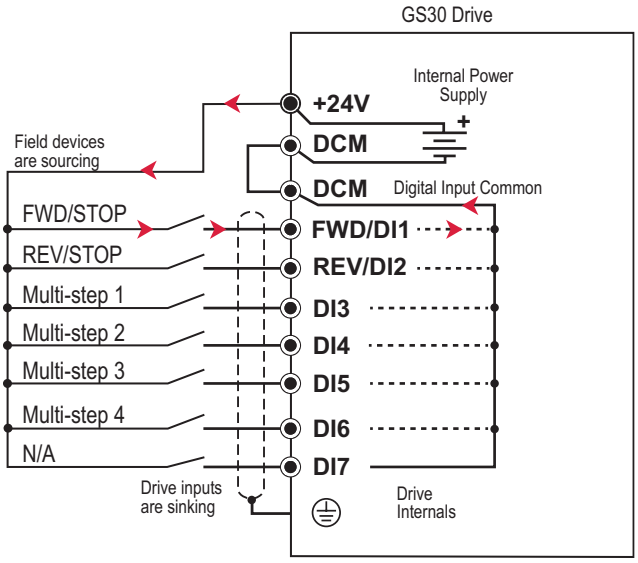
Sinking/Sourcing Basics

GS30 DC inputs and outputs can be sinking or sourcing, depending on how they are wired. If you understand the basics of how sinking and sourcing work, the two options can be easily applied.

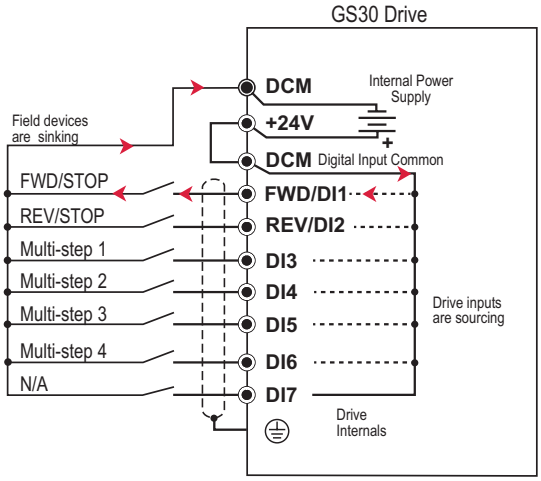
- *For a detailed technical explanation of sink and source, please follow this link: www.automationdirect.com/static/specs/sinksource.pdf*

The term "sinking" means that the device "sinks" current into itself. It does not supply current. Sinking inputs are ON when you apply voltage (and thus, current) to them. A "sinking" device needs to have a "sourcing" device attached to it to supply current.

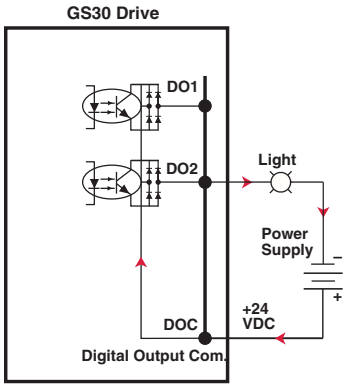
So, if the GS30 inputs are wired for sinking, they require the external device (FWD/STOP switch in this example) to supply current (when closed, the external device will "source" current). Notice the current flow represented by the red arrows. The GS30 input "sinks" the current flow.



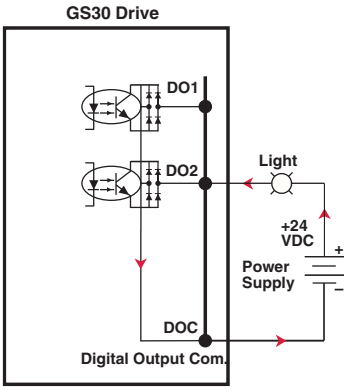
GS30 DC inputs can also be wired for sourcing. In this configuration, notice that the 24VDC supply is feeding into the DIC (Digital Input Common) terminal and the current is coming out of the drive input (GS30 is sourcing) and the field device is sinking the current.



GS30 DC outputs can also be wired as sinking or sourcing. A sourcing output supplies current. This requires a device (pilot light, buzzer, PLC input card) that will sink the current. Notice how the electronics of the output allow current to flow out the DO1 or DO2 terminal. The DOC (Digital Output Common) terminal is connected to +24VDC.



The same drive output circuit can be used to sink current. Notice below that the DOC terminal is now connected to the power supply common. The pilot light sources the current into the drive. The drive output sinks the current. (Even though the light has 24V on it at all times, it will not light up unless current is flowing through it and into the drive output).



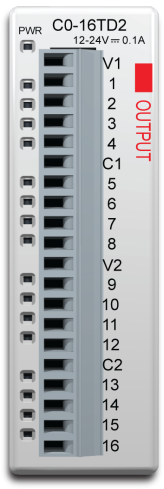
NOTE: GS30 output can be wired as sinking or sourcing, but not both at the same time.

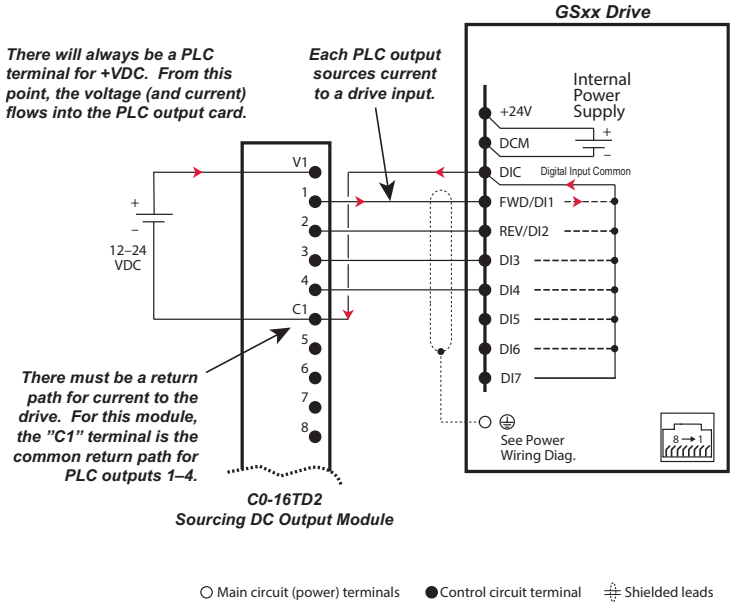
GS30-to-PLC I/O Wiring Examples

This section shows typical wiring examples of PLC inputs and outputs connected to a GS30 drive. While we are using CLICK PLCs in the examples, the samples should be relevant to most PLCs. The terminal designation of other PLCs may be different, but the general connections should be the same (i.e. in the 1st example below, all PLC sourcing output modules will have a +VDC connection, a DC common terminal, and individual outputs). In the examples below, we make note of the typical connections involved. We also indicate current flow (with red arrows) to emphasize which modules are sourcing and which modules are sinking.

Drive Wired with DC Sinking Inputs (PLC output card is sourcing)

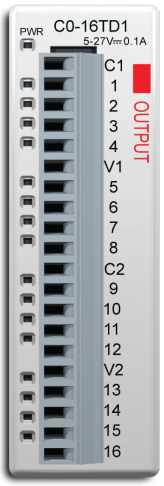
CLICK Expansion Module
C0-16TD2

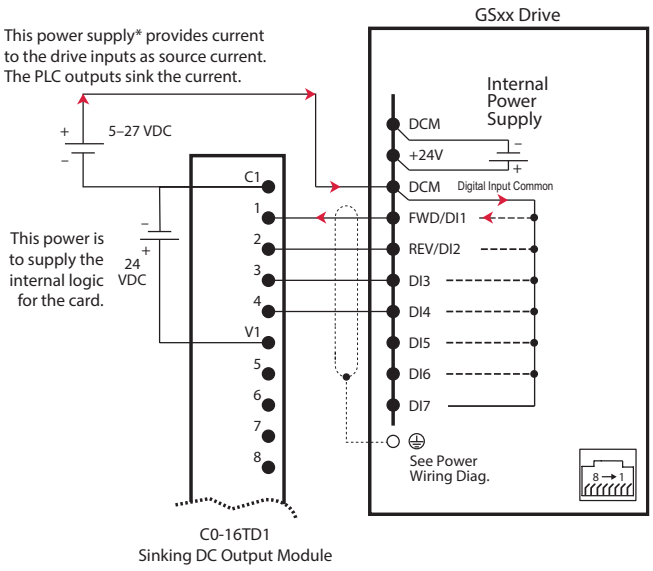




Drive Wired with DC Sourcing Inputs (PLC output card is sinking)

CLICK Expansion Module
C0-16TD1

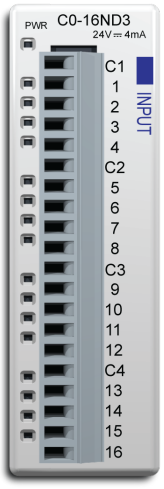


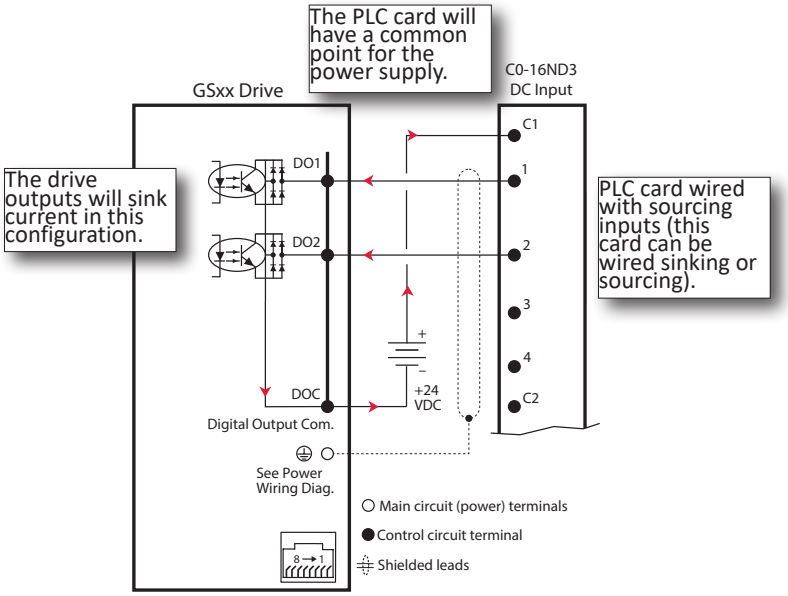


*Alternately, the drive internal power supply (+24V) could be used. However, the

Drive Wired with DC Sinking Outputs (PLC input card is sourcing)

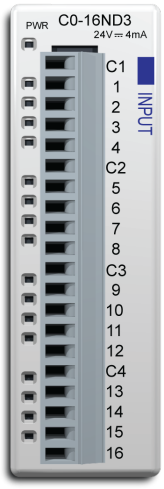
CLICK Expansion Module
C0-16ND3

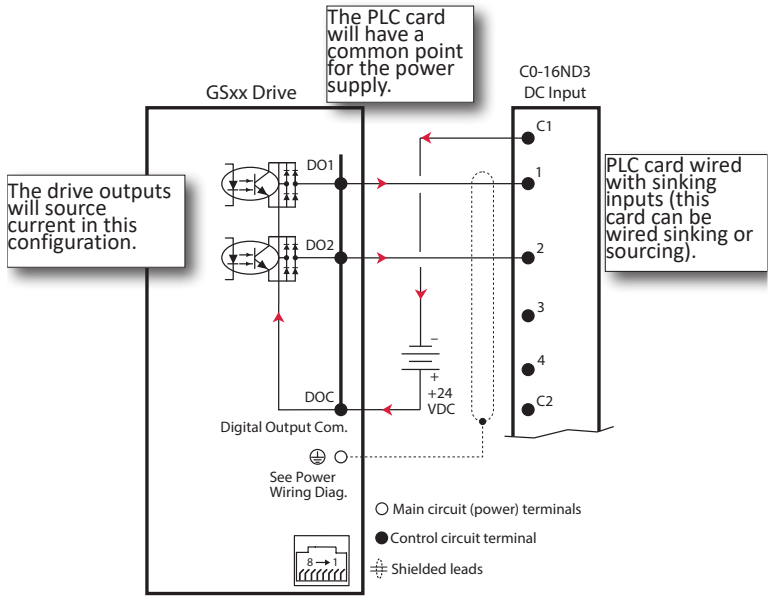




Drive Wired with DC Sourcing Outputs (PLC input card is sinking)

CLICK Expansion Module
C0-16ND3

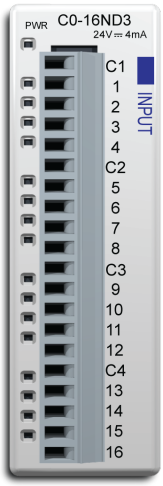


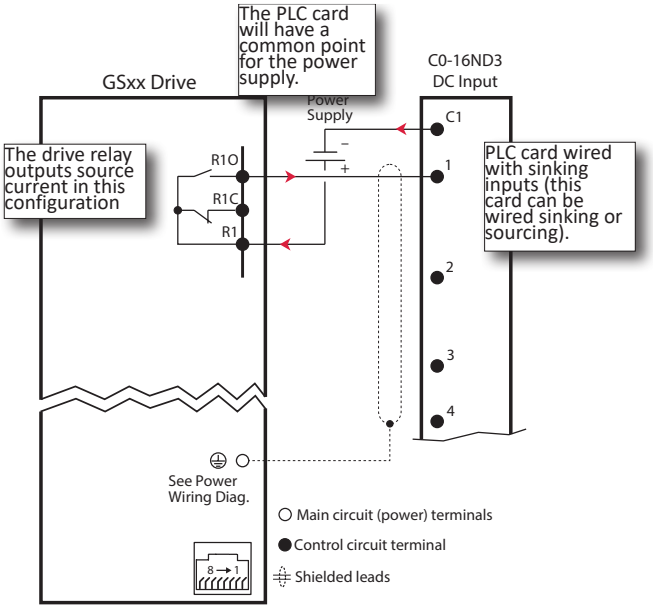


Drive Relay Outputs Wired with Sinking PLC Modules

In this example, the inputs are wired to the Normally-Open contacts (R1O). You could also wire to the Normally-Closed contacts (R1C), but you would not be able to tell if the drive lost power or if the drive outputs are simply OFF.

CLICK Expansion Module
C0-16ND3

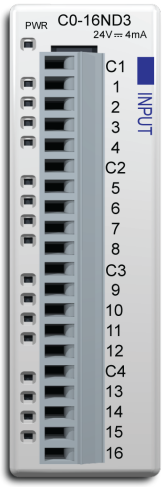


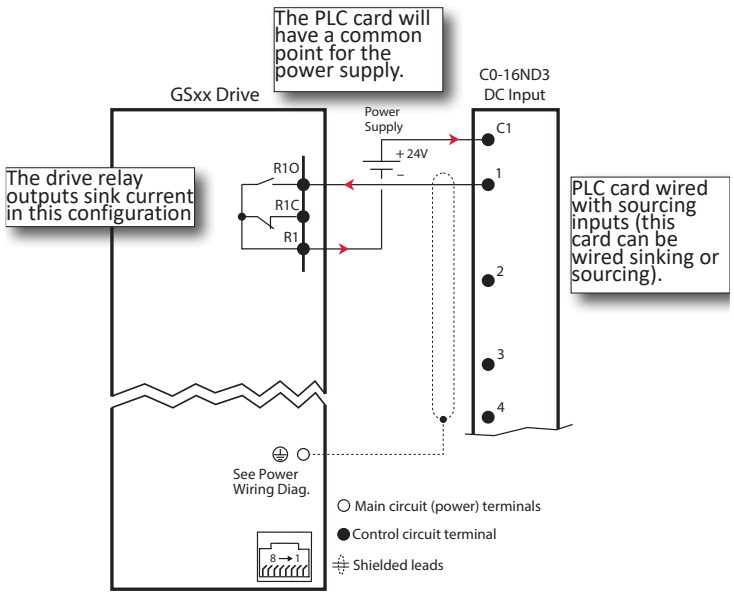


Drive Relay Outputs Wired with Sourcing PLC Modules

In this example, the inputs are wired to the Normally-Open contacts (R1O). You could also wire to the Normally-Closed contacts (R1C), but you would not be able to tell if the drive lost power or if the drive outputs are simply OFF.

CLICK Expansion Module
C0-16ND3





Drive Analog Inputs

The GS30 has 2 analog inputs (AI1 and AI2) that can be configured for a variety of input functions. AI1 and AI2 must be configured via drive parameters group 3. AI2 has a DIP switch located above the I/O terminal strip that allows configuration as voltage or current input. AI1 is voltage input only. Both inputs have a variety of settings in Parameter Group 3 (P03.xx) that allows you to customize their scaling, offset, etc.

- *AI1: 0~10V, -10V to +10V*
- *AI2: 0~10V, 4~20 mA, 0~20 mA (See P03.29 and the DIP switch AI2 above the I/O terminals)*

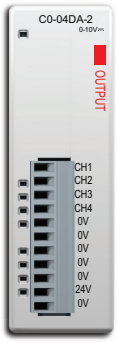
Connecting the analog inputs to PLC outputs is very straightforward. Both analog inputs share the same common.

NOTE: The GS30 AI2 analog input does not supply the current when configured for 0~20 mA or 4~20 mA. The analog output device needs to supply the loop power.

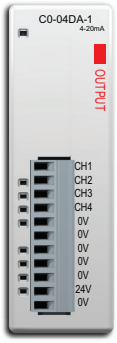
Analog Input Wired for Voltage and Current

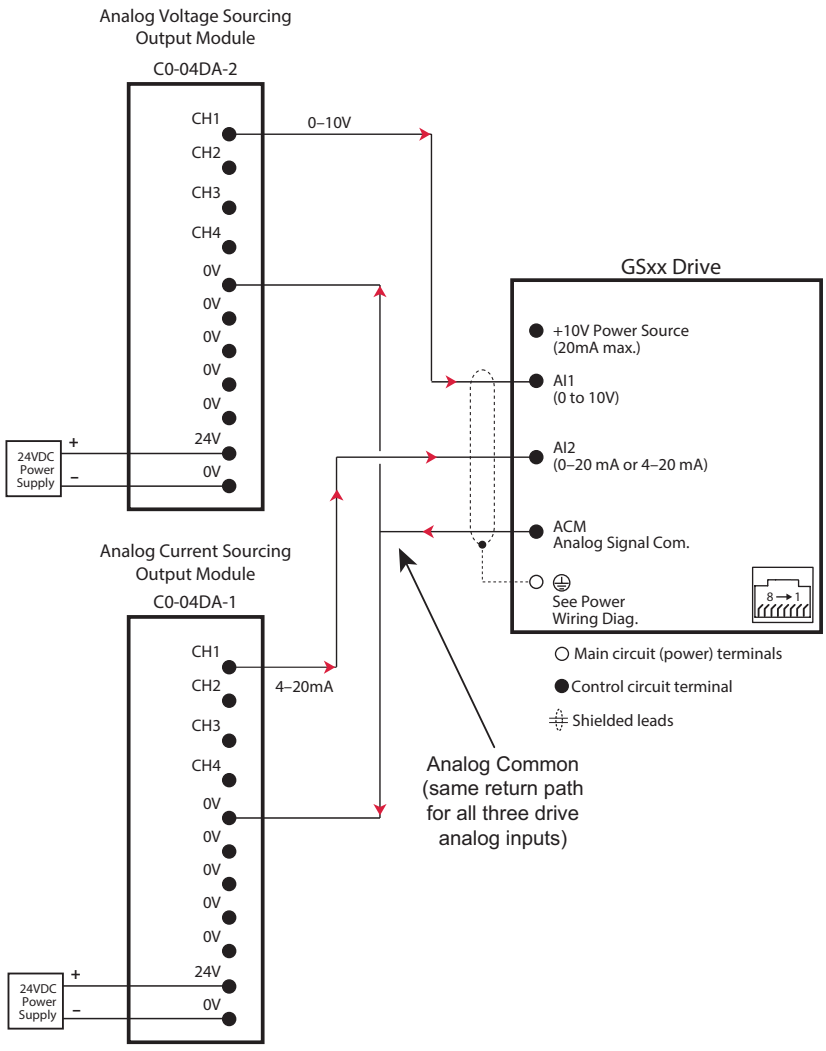
In this example, AI1 is configured for 0~10V (P03.28). AI2 is configured for 4~20 mA (DIP switch and P03.29).

CLICK Expansion Module C0-04DA-2



CLICK Expansion Module C0-04DA-1





Drive Analog Outputs

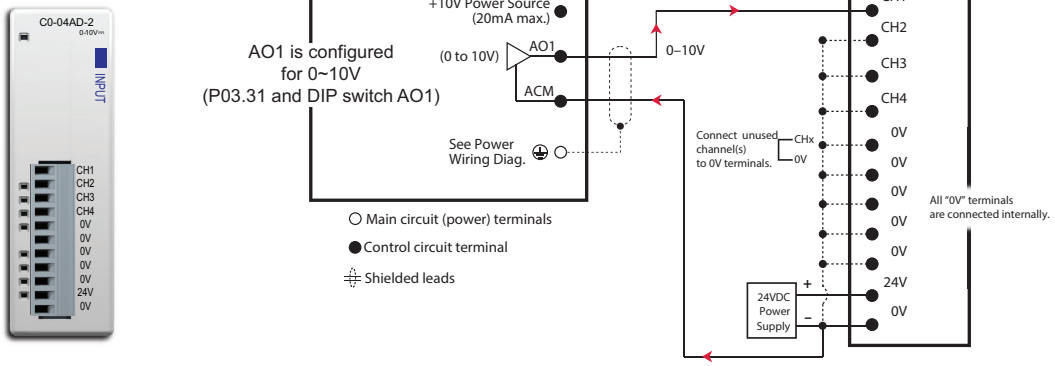
The GS30 has one analog output (AO1) which can be configured for a variety of uses. The output is configured via parameters and DIP switch settings (located above the I/O terminal strip). There are several parameters associated with the analog output that defines the signal and adjusts gain, offset, etc.

- *AO1: 0~10V or 0~2mA or 4~20mA (see P03.31 and the DIP switch AO1 above the I/O terminals)*

Analog Output Wired for Voltage and Current

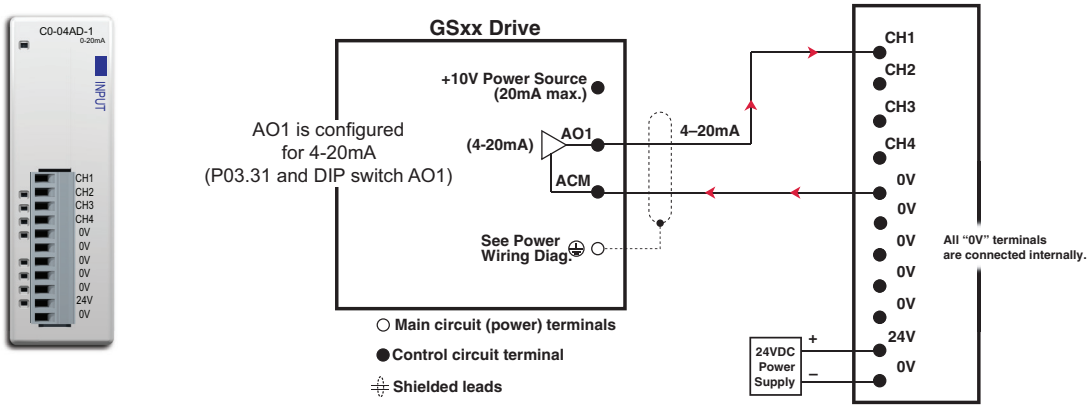
In this example AO1 is configured for voltage signal, 0-10V (P03.31 and DIP switch AO1).

CLICK Expansion module
C0-04AD-2



In this example AO1 is configured for current signal, 4-20mA (P03.31 and DIP switch AO1).

CLICK Expansion module
C0-04AD-1



Drive Frequency Output (High-speed Pulse Output)

The GS30 has one high-speed pulse train output: DO. This pulse train output is based on the actual frequency output of the drive. A scaling factor is available to adjust the frequency.

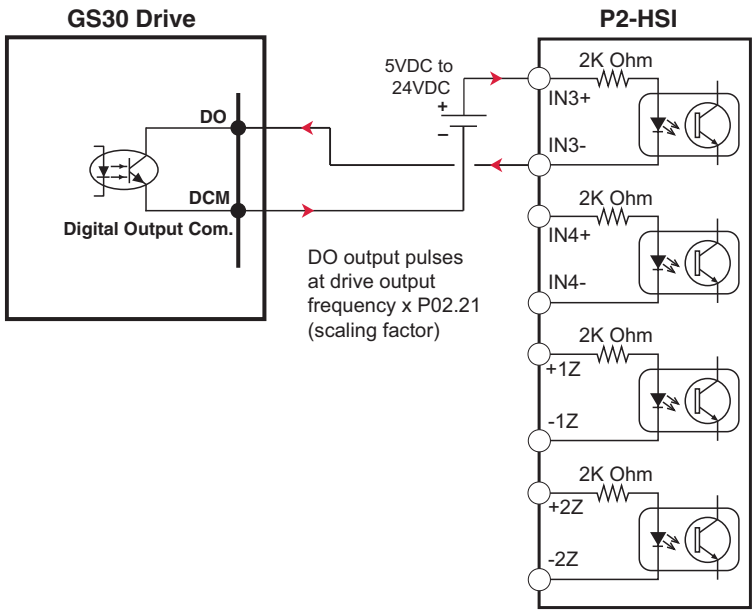
P02.21 Frequency Output Scaling Factor:

- *Actual DO pulses per second output = GS30 output frequency (Hz) x P02.21*

Drive DO output is limited to 30V@ 30mA max. Max frequency is 33kHz (50% duty cycle).

The PLC high-speed input will have a certain amount of resistance built-in (P2-HSI module has 2kΩ resistance). The drive terminal DO needs to see a minimum of 1kΩ resistance.

P2 Expansion Module
P2-HSI



Communication with GS30 Drives

The GS30 drive supports two types of communication:

- *Serial Modbus (built-in RS-485 port)*
- *EtherNet/IP (optional GS30A-CM-EIPx card)*
- *EtherCAT® (optional GS30A-CM-ECAT card)*

Note: Only one serial protocol can be used at a time. Only one Ethernet option card can be installed at a time (You can have serial Modbus and one Ethernet card running at the same time).

Getting Started

This section will point out the "need to know" details of how to connect to your PLC to a GS30 drive.

The first thing to do with the GS30 drive after the basic wiring, is to set up the motor information and protection features. Detailed information on drive setup can be found in Chapter 4: Parameters. After powering up the drive and ensuring that your E-stop and/or STO input work, press MENU on the keypad.

Configure the following minimal set of parameters:

DURApulse GS30 Parameter Settings – Quick Configuration				
Parameter	***Description***	***Range***	***Default***	***User***
P00.00	GS30 Model ID	Read Only	n/a	
P00.01	Displays AC drive rated current	Displays value based on model	n/a	
P00.02	Restore to default	0=No function 1=Parameter write protect 5=Reset kWH display to 0 6=Reset PLC 7=Reserved 8=Keypad doesn't respond 9=Reset 50Hz defaults 10=Reset 60Hz defaults 11=Reset 50Hz defaults (keep user config) 12=Reset 60Hz defaults (keep user config)	0	
P00.06	Firmware Version	Read Only	n/a	
P00.10	Control Mode	0=Velocity mode 1=P2P APR mode 2=Torque mode	0	
P00.11	Speed Control Mode	0=VF Open Control 1=VF Closed Control 2=SVC 3=IM FOC Encoder Control 4=PM FOC Encoder Control 5=FOC Sensorless 7=IPM Sensorless	0	
P00.16	Load Selection	0=VT 1=CT	1	
P00.20	Frequency Command Source (Auto)	0=Digital keypad 1=Communication RS-485 input 2=External analog input (refer to parm 03.00) 3=Digital keypad dial 4=Encoder reference without direction 5=Encoder reference with direction 8=Comm card 9=PID	0	
P00.21	Operation Command Source (Auto)	0=Digital keypad 1=External terminals 2=Communication RS-485 input 5=Communication card	0	
P00.22	Stop Method	0=Ramp to stop 1=Coast to stop	0	

DURAPULSE GS30 Parameter Settings – Quick Configuration (continued)				
Parameter	***Description***	***Range***	***Default***	***User***
P00.23	Motor Direction	0=Enable forward/reverse 1=Disable reverse 2=Disable forward	0	
P00.29	Local/Remote Selection	0=Standard HOA function 1=Switching Local/Remote, the drive stops 2=Switching Local/Remote, the drive runs as the REMOTE setting for frequency and operation status 3=Switching Local/Remote, the drive runs as the LOCAL setting for frequency and operation status 4=Switching Local/Remote, the drive runs as LOCAL setting when switched to Local and runs as REMOTE setting when switched to Remote for frequency and operation status	0	
P00.30	Master Frequency Command Source (Hand)	0=Digital keypad 1=Communication RS-485 input 2=External analog input (refer to parm 03.00) 3=Digital keypad dial 4=Encoder reference without direction 5=Encoder reference with direction 8=Comm card 9=PID	0	
P00.31	Operation Command Source (Hand)	0=Digital keypad 1=External terminals 2=Communication RS-485 input 5=Communication card	0	
P01.00	Motor 1 Max Frequency	0.00-599.00 Hz	60	
P01.01	Motor 1 Base Frequency	0.00-599.00 Hz	60	
P01.02	Motor 1 Rated Voltage	110V/230V: 0.0~255.0 460V: 0.0~510.0V	220.0 440.0	
P01.09	Startup Frequency	0.00-599.0 Hz	0.5	
P01.12	Acceleration Time 1	P01.45=0: 0.00-600.00 sec P01.45=1: 0.00-6000.00 sec	10.00 10.00	
P01.13	Deceleration Time 1	P01.45=0: 0.00-600.00 sec P01.45=1: 0.00-6000.00 sec	10.00 10.00	
P01.20	Jog Acceleration Time	P01.45=0: 0.00-600.00 sec P01.45=1: 0.00-6000.00 sec	10.00 10.00	
P01.21	Jog Deceleration Time	P01.45=0: 0.00-600.00 sec P01.45=1: 0.00-6000.00 sec	10.00 10.00	
P01.22	Jog Frequency	0.00-599.0 Hz	0.5	
P02.00	2-wire / 3-wire Control	0=No function 1=2-wire mode 1, power on for operation control (D1: FWD/STOP, D2: REV/STOP) 2=2-wire mode 2, power on for operation control (D1: RUN/STOP, D2 REV/FWD) 3=3-wire, power on for operation control (D1: RUN, D2: REV/FWD, D3: STOP) 4=2-wire mode 1, fast start up (D1: FWD/STOP, D2: REV/STOP) 5=2-wire mode 2, fast start up (D1: RUN/STOP, D2: REV/FWD) 6=3-wire, fast start up (D1: RUN, D2: REV/FWD, D3: STOP) Note: In fast start up mode, the drive skips detecting IGBT signal and will run immediately. When using fast start up mode: Terminal output stays in ready status and drive responds to commands immediately. The output terminal will have higher voltage If the drive is short circuited an OC error will display when running up	1	

DURAPULSE GS30 Parameter Settings – Quick Configuration (continued)				
Parameter	***Description***	***Range***	***Default***	***User***
P05.01	Motor 1 Full Load Amps (FLA)	10-120% of drive rated current	#.##	
P05.03	Motor 1 Rated RPM	0-65535	1710	
P05.04	Motor 1 Number of poles	2-20	4	
P06.13	Motor 1 Electronic Thermal Overload Relay	0=Inverter motor (with external forced cooling) 1=Standard motor (motor with fan on the shaft) 2=Disabled	2	
P06.14	Motor 1 Electronic Thermal Relay Time	30.0-600.0	60	
P06.55	Drive Derating Method	0=Constant rated current and limit carrier wave by load current and temperature 1=Constant carrier frequency and limit load current by setting carrier wave 2=Constant rated current (same as setting 0) but no current limit	0	
P13.00	Application Selection	00=Disabled 01=User parameter 02=Compressor 03=Fan 04=Pump 05=Conveyor 06=Machine tool 07=Packing 08=Textiles 10=Logistics 11=PID 12=PID + Auxiliary	0	

NOTE: If you have changed many parameters and cannot get your drive to function the way you want, go to Parameter P00.02 Parameter Reset and enter a value of 9 or 10. This will reset your drive to its factory default settings. Then review the quick start parameters to ensure they are configured as needed.

Your drive should now be ready to function from the keypad and be able to properly protect the motor from an overload. The drive should start and stop by pressing the RUN and STOP keys. The output speed can be changed by turning the dial while the display is showing the "F" setting (frequency). Make sure P00.20 is set to 7 to use the VR/Potentiometer dial on the drive. If the drive doesn't run, check all power and control wiring, especially wiring associated with STO (E-Stop).

Serial Modbus Monitoring and Control

Serial Modbus connections over RS485 can be made to the GS30 drive using two methods.

The GS30 drive is equipped with one RJ45 port. Using this port, the GS30 drive can be connected to an RS485 network using standard Ethernet cables. For longer cable runs, use the SG+, SG- and SGND terminals, also located on the control terminal board, with shielded cable. See Chapter 2 for detailed wiring specifications and Chapter 5 for detailed Modbus information.

The most common serial port parameters are shown below:

Serial Port Parameters		
GS30	***Description***	***Default***
P09.00	VFD Comm Address	1
P09.01	MODBUS Baud Rate	9.6 kbps
P09.04	MODBUS Protocol (Range Setting)	12: 8N1 (RTU)

Before starting to control the drive or to write to critical parameters, you should ensure that you are addressing the correct values. To check that your PLC is pointing to the correct location, read and write from a non-critical parameter. A good example is P01.17, Deceleration Time 3. As you can see in the Parameter Summary Table (partial from Ch 4 shown below), the Modbus address for P01.17 is 0111H or 40274 decimal (The hex address = the parameter number).

Parameter Summary Table (Excerpt from Table in Ch4)						
Parameter	***Description***	***Range***	***Run Read/ Write***	***MODBUS Address***		***Settings***
				HEX	***Decimal****	***Default***
P01.17	Deceleration Time 3	P01.45=0: 0.00~600.00 sec P01.45=1: 0.0~6000.00 sec	R/W	0111H	40274	10.00
P01.18	Acceleration Time 4	P01.45=0: 0.00~600.00 sec P01.45=1: 0.0~6000.00 sec	R/W	0112H	40275	10.00
P01.19	Deceleration Time 4	P01.45=0: 0.00~600.00 sec P01.45=1: 0.0~6000.00 sec	R/W	0113H	40276	10.00
**Decimal value is a calculation of the Modbus hex address and a decimal constant. For example: 273(decimal value of 0111h) + 40001(decimal constant) = 40274.*						

From the GS30 keypad, change the default value of P01.18 from 10 to 9.97. Now read this value with your PLC to verify your PLC addressing is correct. If your PLC reads back a value of 10, use the keypad to change P01.17 to 9.96 and P1.19 to 9.98. Then try to read again. Remember, some PLCs use Base 0 and some use Base 1 addressing. So, you may need to offset your addressing by 1. If you still have issues, please refer to the detailed Modbus information in Chapter 5.

Once you have verified that your PLC addressing is correct, serial control for the drive is straightforward. Enter the following values to set up PLC Control via RS485 for the drive:

Parameter Settings Table					
Parameter	***MODBUS Address***		***Description***	***Setting Value***	***Note***
	HEX	***Decimal***			
P00.20	0014	40021	Remote source of frequency	1: RS485 Communication 8: Comm card	This allows the RS-485 commands to set the drive speed.
P00.21	0015	40022	Remote source of operation	2: RS-485 Communication 5: Comm card	This allows the RS-485 commands to start and stop the drive.

Now when the P00.20 and P00.21 are set to RS485 or Comm Card, the drive will start via serial commands. The drive will stop by either serial command or by pressing the STOP button on the keypad. To return to local control, set both P00.20 and P00.21 to option 0. The drive will Start and Stop with the keypad. When “F” is displayed on the drive, the dial will set the speed.

There are three command words to control the drive over serial Modbus. Toggling these bits and setting the Frequency Command will control the drive.

Parameter Settings Table			
MODBUS Address		***Description***	***Range***
HEX	***Decimal***		
2000	48193	Bit 0~1	00: no function
			01: Stop
			10: Run
			11: Jog+Run (at P5.00 Jog speed)
		Bit 2~3	reserved
		Bit 4~5	00: no function
			01: FWD
			10: REV
			11: no function
		Bit 6~15	reserved
2001*	48194*	Frequency Command / PID Setpoint *	In 1/100 of Hz (1500 = 15.00 Hz output)
2002	48195	External Fault Input	Bit 0: Trigger External Fault (EF) Bit 1: Reset EF Bit 2: External Interruption (B.B) = ON Bit 5: Enable Fire Mode Bits 6~15: reserved
** For 2001h: When the GS30 drive is configured with Frequency Reference as RS-485, Modbus TCP, or EtherNet/IP (P00.20=1 or 8 and drive in Remote/Auto) – OR – (P00.30=1 or 8 and drive in Local/hand) – AND – Reference > P01.00 Max Output Freq, then the drive will go up to Max Freq where it will remain until Max Freq is modified lower or a lower Freq Ref or a Stop signal is sent to the drive.*			

NOTE: The bits are retentive, meaning that you set them once and they will remain in effect until another command changes operation. Example: if you send the Run command, the drive will run. Clearing the Run bit will have no effect. You must send the Stop bit to make the drive Stop.

The status of the drive is reported back in registers 2100h~2110h (48449~48465 decimal). The six most recent faults are found in P06.17–P06.22 (0611h-0616h , 41555 - 41559 decimal). See Chapter 5 for more detailed explanations of these registers.

GS30 Status Addresses (Read Only)						
Description		***Range***		***Modbus Address***		
				Hex	***Dec***	***Octal***
Status Monitor 1	Fault Codes	0: No fault record 1: Over-current during acceleration (ocA) 2: Over-current during deceleration (ocd) 3: Over-current during steady operation (ocn) 4: Ground fault (GFF) 6: Over-current at stop (ocS) 7: Over-voltage during acceleration (ovA) 8: Over-voltage during deceleration (ovd) 9: Over-voltage during constant speed (ovn) 10: Over-voltage at stop (ovS) 11: Low-voltage during acceleration (LvA) 12: Low-voltage during deceleration (Lvd) 13: Low-voltage during constant speed (Lvn) 14: Low-voltage at stop (LvS) 15: Phase loss protection (orP) 16: IGBT overheating (oH1) 18: IGBT temperature detection failure (tH1o) 21: Over load (oL) 22: Electronic thermal relay 1 protection (EoL1) 23: Electronic thermal relay 2 protection (EoL2) 24: Motor PTC overheating (oH3) 26: Over torque 1 (ot1) 27: Over torque 2 (ot2) 28: Under current (uC) 31: EEPROM read error (cF2) 33: U-phase error (cd1) 34: V-phase error (cd2) 35: W-phase error (cd3) 36: cc (current clamp) hardware error (Hd0) 37: oc (over-current) hardware error (Hd1) 40: Auto-tuning error (AUE) 41: PID loss AI2 (AFE) 43: PG feedback loss (PGF2) 44: PG feedback stall (PGF3) 45: PG slip error (PGF4) 48: AI2 loss (ACE) 49: External fault (EF) 50: Emergency stop (EF1) 51: External base block (bb) 52: Password is locked (Pcod) 54: Illegal command (CE1) 55: Illegal data address (CE2)	56: Illegal data value (CE3) 57: Data is written to read-only address (CE4) 58: Modbus transmission time-out (CE10) 61: Y-connection / Δ-connection switch error (ydc) 62: Deceleration energy backup error (dEb) 63: Over slip error (oSL) 72: STO Loss (STL1) 76: STO (STo) 77: STO Loss 2 (STL2) 78: STO Loss 3 (STL3) 79: U-phase over-current before run (Aoc) 80: V-phase over-current before run (boc) 81: W-phase over-current before run (coc) 82: Output phase loss U phase (oPL1) 83: Output phase loss V phase (oPL2) 84: Output phase loss W phase (oPL3) 87: Low frequency overload protection (oL3) 89: Rotor position detection error (roPd) 97: Ethernet Card Timeout (CD10) 111: InrCOM time-out error (ictE) 121: Internal communication error (CP20) 123: Internal communication error (CP22) 124: Internal communication error (CP30) 126: Internal communication error (CP32) 127: Internal communication error (CP33) 128: Over-torque 3 (ot3) 129: Over-torque 4 (ot4) 134: Internal communication error (EoL3) 135: Internal communication error (EoL4) 140: Oc hardware error (Hd6) 141: GFF occurs before run (b4GFF) 142: Auto-tune error 1 (DC test stage) (AuE1) 143: Auto-tune error 2 (High frequency test stage) (AuE2) 144: Auto-tune error 3 (Rotary test stage) (AuE3) 149: Auto-tune error 5 (Rotor resistance measure test stage) (AuE5)	0611	41554	3021

(table continued next page)

GS30 Status Addresses (Read Only) (continued)					
Description	**Range**		**Modbus Address**		
			Hex	**Dec**	**Octal**
Status monitor read only	High byte: Warning code / Low Byte: Error code		2100	48449	20400
	bit 1–0	AC motor drive operation status 00B: The drive stops 01B: The drive is decelerating 10B: The drive is in standby status 11B: The drive is operating	2101	48450	20401
	bit 2	1: JOG command			
	bit 4–3	Operation direction 00B: FWD running 01B: From REV running to FWD running 10B: From FWD running to REV running 11B: REV running			
	bit 8	1: Master frequency controlled by the communication interface			
	bit 9	1: Master frequency controlled by the analog / external terminal signal			
	bit 10	1: Operation command controlled by the communication interface			
	bit 11	1: Parameter locked			
	bit 12	1: Enable to copy parameters from keypad			
	bit 15–13	Reserved			
	Frequency command (XXX.XX Hz)		2102	48451	20402
	Output frequency (XXX.XX Hz)		2103	48452	20403
	Display the drive's output current (XX.XX A). When the current is higher than 655.35, it automatically shifts one decimal place as (XXX.X A). Refer to the high byte of 211F for information on the decimal places.		2104	48453	20404
	DC bus voltage (XXX.X V)		2105	48454	20405
	Output voltage (XXX.X V)		2106	48455	20406
	Current step for the multi-step speed operation		2107	48456	20407
	Reserved		2108	48457	20410
	Counter value		2109	48458	20411
	Output power factor angle (XXX.X)		210A	48459	20412
	Output torque (XXX.X %)		210B	48460	20413
	Actual motor speed (XXXXX rpm)		210C	48461	20414

Ethernet/IP and Modbus TCP Monitor and Control

EtherNet/IP and ModTCP are very similar to serial Modbus control. After installing the GS30A-CM-EIPx option card (see Appendix B for more information on card installation), set the following parameters:

GS30 Parameter Settings for Ethernet/IP, Modbus TCP Monitor and Control						
Parameter		***Setting***	***Run[1] Read/ Write***	***Modbus Address***		***Note***
				Hex	***Dec***	
P00.21	1st Source of Operation Command [Remote]	5: Comm Card	R/W	0015	40022	This allows Ethernet commands to start and stop the drive while the drive is in Local or Remote mode
P00.31	2nd Source of Operation Command [Local]		R/W	001F	40032	
P00.20	1st Source of Frequency Command [Remote]	8: Comm Card	♦R/W	0014	40021	This allows Ethernet commands to set the drive speed while the drive is in Local or Remote mode
P00.30	2nd Source of Frequency Command [Local]		♦R/W	001E	40031	
P09.74	Set Comm Master Protocol setting	0: Both Ethernet and Modbus 1: Ethernet/IP 2: Modbus TCP	♦R/W	094A	42379	Select Ethernet and/or Modbus depending on desired control

Other key parameters that must be modified (or at least must be known) to set up Ethernet communications					
P09.75	Comm Card IP Configuration	0: Static IP 1: Dynamic IP (DHCP)	R/W	0930	42353
P09.76	Comm Card IP Address Octet 1	0~255	R/W	0931	42354
P09.77	Comm Card IP Address Octet 2	0~255	R/W	0932	42355
P09.78	Comm Card IP Address Octet 3	0~255	R/W	0933	42356
P09.79	Comm Card IP Address Octet 4	0~255	R/W	0934	42357
P09.80	Comm Card Mask Octet 1	0~255	R/W	0935	42358
P09.81	Comm Card Mask Octet 2	0~255	R/W	0936	42359
P09.82	Comm Card Mask Octet 3	0~255	R/W	0937	42360
P09.83	Comm Card Mask Octet 4	0~255	R/W	0938	42361
P09.84	Comm Card Gateway Octet 1	0~255	R/W	0939	42362
P09.85	Comm Card Gateway Octet 2	0~255	R/W	093A	42363
P09.86	Comm Card Gateway Octet 3	0~255	R/W	093B	42364
P09.87	Comm Card Gateway Octet 4	0~255	R/W	093C	42365

Refer to Appendix B for detailed information and an example on how to set up these parameters. We recommend using Static IP (P09.75=0) and testing the communications between drive and PC/PLC with either an Ethernet crossover cable or a simple Ethernet hub/switch *Do not try to commission Ethernet communications for the first time on a larger, managed network*.

Set P09.74 = 2: Modbus TCP for Modbus master control.

Once communications have been established, please refer to the serial Modbus section above for all the relevant Command and Status Words.

Appendix B details all the Implicit and Explicit data that can be transferred to and from the GS30. Below is a list of the Implicit (I/O messaging) data that will be automatically transferred back and forth between the PLC and drive once the connection is configured.

GS30A-CM-EIPx 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	Multicast, Point to Point	Mulitcast, Point to Point

GS30A-CM-EIPx EtherNet/IP Communication Parameter

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

See “GS30A-CM-EIPx EtherNet/IP Communication Protocol Parameter Address Definitions” on page B–31 for more information.

Modbus Remote I/O Control Applications (use MODRW)

The GS30's internal PLC supports RS485 read/write functions, which can be realized using the MODRW command. However, the RS485 serial port must be defined as available for the PLC's RS485 use before writing a program, and P09.31 must be set as -12. After completing settings, the standard functions defined by RS485 can be used to implement read/write commands at other stations. Communications speed is defined by P09.01, the communications format is defined by P09.04, and the PLC's current station number is defined by P09.35. The GS30 currently supports the functions read coil (0x01), read input (0x02), read register (0x03), write to single register (0x06), write to several coils (0x0F), and write to several registers (0x10). Explanations and the usage of these functions are provided as follows:

MODRW Command					***General Meaning***	***Slave Device is GS30 PLC Meaning***	***Slave Device is GS30 Converter Meaning***
S1	***S2***	***S3***	***S4***	***S5***			
Node ID	***Command***	***Address***	***Return D Area***	***Length***			
K3	H01	H500	D0	K18	Read coil (bit)	Read 18 bits of data corresponding to slave station 3 PLC Y0 to Y21. This data is stored by bit 0 to 15 of the station's D0 and bit 0 to bit 3 of D1.	Does not support this function
K3	H02	H400	D10	K10	Read input (bit)	Read 10 bits of data corresponding to slave station 3 PLC X0 to X11. This data is stored by bit 0 to 9 of this station's D10.	Does not support this function
K3	H03	H600	D20	K3	Read register (word)	Read 3 words of data corresponding to slave station 3 PLC T0 to T2. This data is stored by D20 to D22.	Read 3 words of data corresponding to slave station 3 converter parameters P06.00 to P06.02. This data is stored by D20 to D22
K3	H06	H610	D30	n/a	Write to single register (word)	Write slave station 3 PLC's T16 to this station's D30 value	Write slave station 3 converter 06 to 16 parameter to this station's D30 value
K3	H0F	H509	D40	K10	Write to multiple coils (bit)	Write slave station 3 PLC's Y11 to Y22 to bit 0 to 9 of D40.	Does not support this function
K3	H10	H602	D50	K4	Write to multiple registers (word)	Write slave station 3 PLC's T2 to T5 to D50 to D53	Write slave station 3 converter P06.02 to P06.05 parameters to this station's D50 to D53

After implementing MODRW, the status will be displayed in M1077 (485 read/write complete), M1078 (485 read/write error), and M1079 (485 read/write time out). M1077 is defined so as to immediately revert to 0 after the MODRW command has been implemented. However, any of three situations—a report of no error, a data error report, or time out with no report—will cause the status of M1077 to change to On.

Program Examples Using AutomationDirect PLCs

Please see the AutomationDirect support website for sample program downloads. A range of examples for various applications are available.

NOTE: The PLC program can be downloaded from the support resources section of the GS30 drive item page on the AutomationDirect website.