USING GS4 AC DRIVES WITH AUTOMATIONDIRECT PLCS

APPENDIX

D

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Appendix D Overview

The material presented here will help you connect your GS4 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 GS4 supports either of the following communications: serial Modbus or serial BACnet (only one is available at a time via the built-in RS-485 port). Ethernet communication is available by installing a ModTCP option card or an EtherNet/IP option card (Only one can be installed at a time).

GS4 supports a variety of I/O on the main control board.

- *10 Sinking/sourcing DC inputs*
- *2 Sinking/sourcing DC outputs*
- *2 Form C relay outputs (inductive load [cosØ 0.4] 1.2A [NO or NC] @ 250VAC)*
- *3 Analog inputs (0~10V, -10~10V, 0~20 mA, 4~20 mA)*
- *2 Analog outputs (0~10V, -10~10V, 4~20 mA)*
- *1 Hi-speed pulse output (30V/30mA/100kHz max)*

I/O can be extended by installing optional I/O cards (only one can be installed):

- *6-pt 120VAC input card (100~130 VAC)*
- *4-pt DC input / 2-pt DC output card (min. 19VDC – max. 30VDC input, max. 48VDC output; inputs and outputs are sink/source; jumper selectable)*
- *6-pt Relay output card, SPST (max. 250VAC/30VDC; max. 5A resistive/2A inductive)*

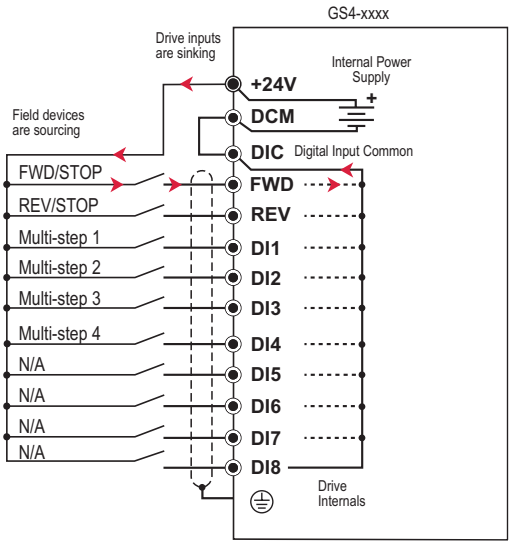
Sinking/Sourcing Basics

GS4 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.

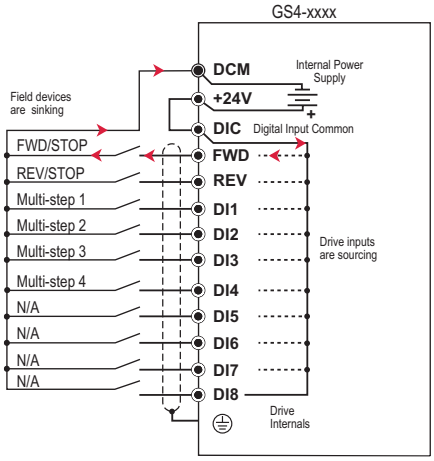
- *For a detailed technical explanation of sink and source, please follow this link:* www.automationdirect.com/static/specs/sinksource.pdf

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.

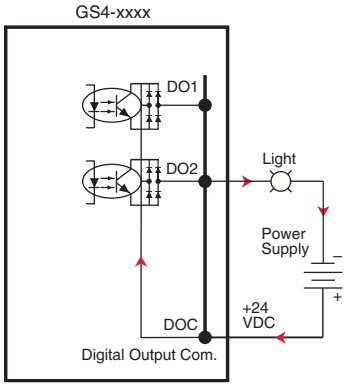
So, if the GS4 inputs are wired for sinking, they require the external device (FWD/STOP switch in this example) to supply current (when closed, the external device will “source” current). Notice the current flow represented by the red arrows. The GS4 input “sinks” the current flow.



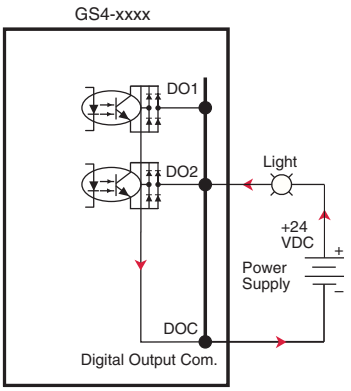
GS4 DC inputs can also be wired for sourcing. In this configuration, notice that the 24VDC supply is feeding into the DIC (Digital Input Common) terminal and the current is coming out of the drive input (GS4 is sourcing) and the field device is sinking the current.



GS4 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).



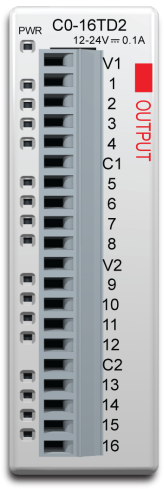
NOTE: GS4 output can be wired as sinking or sourcing, but not both at the same time.

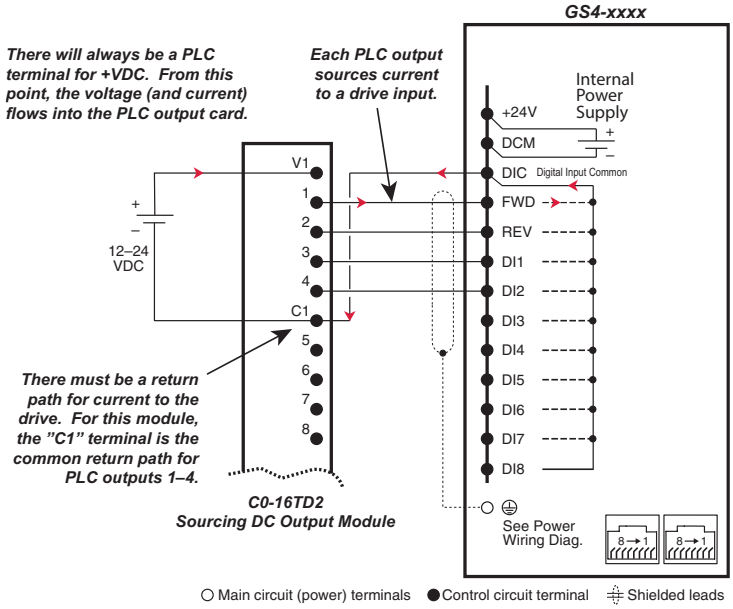
GS4-to-PLC I/O Wiring Examples

This section shows typical wiring examples of PLC inputs and outputs connected to a GS4 drive. While we are using CLICK PLCs in the examples, the samples should be relevant to most any PLC. 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)

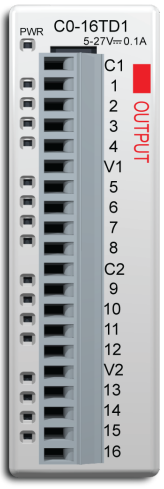
CLICK Expansion Module
C0-16TD2

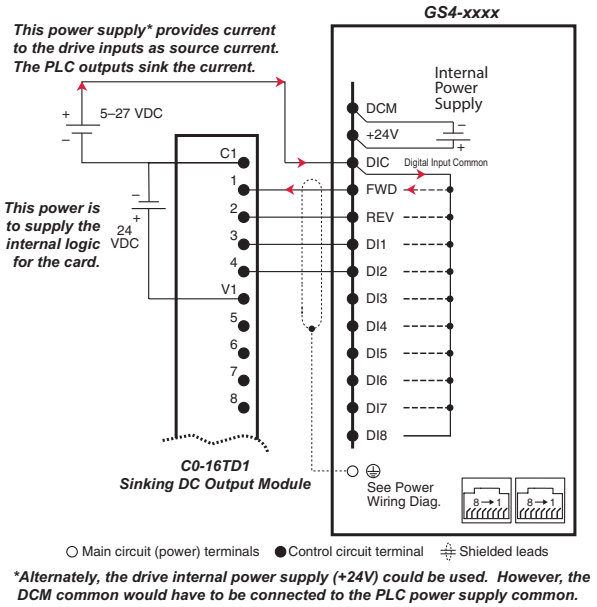




Drive Wired with DC Sourcing Inputs (PLC output card is sinking)

CLICK Expansion Module
C0-16TD1

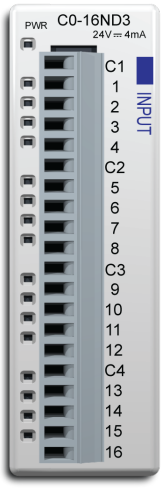


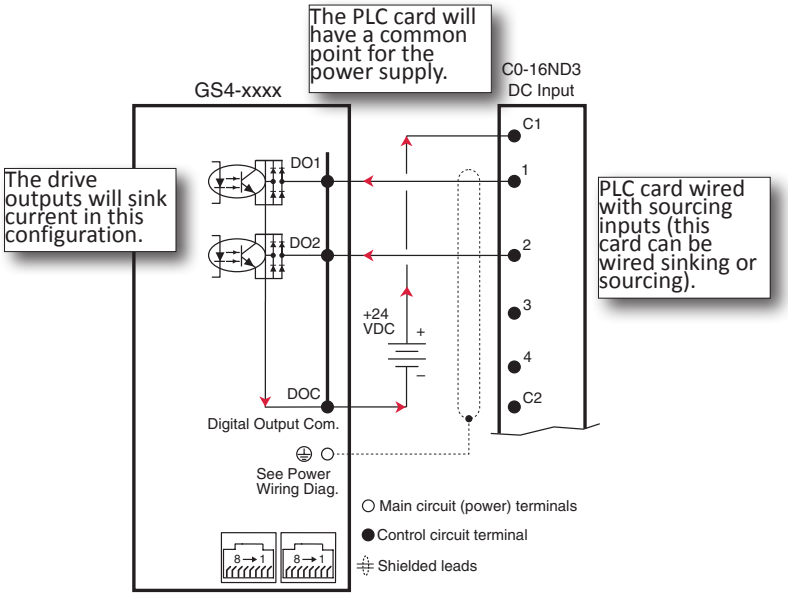


**Alternately, the drive internal power supply (+24V) could be used. However, the DCM common would have to be connected to the PLC power supply common.*

DRIVE WIRED WITH DC SINKING OUTPUTS (PLC INPUT CARD IS SOURCING)

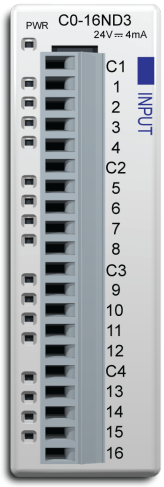
CLICK Expansion Module
C0-16ND3

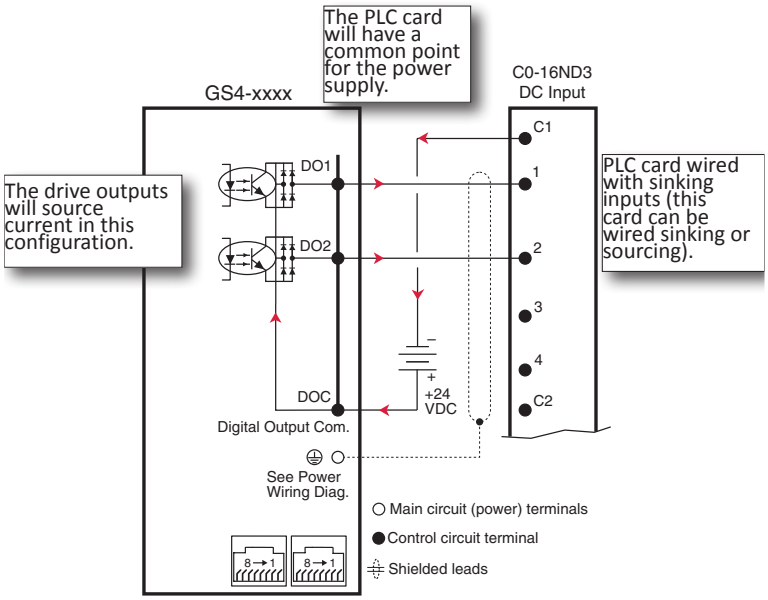




DRIVE WIRED WITH DC SOURCING OUTPUTS (PLC INPUT CARD IS SINKING)

CLICK Expansion Module
C0-16ND3

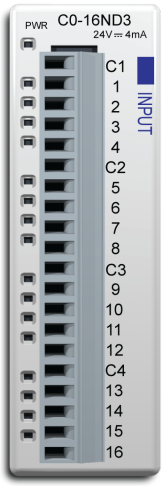


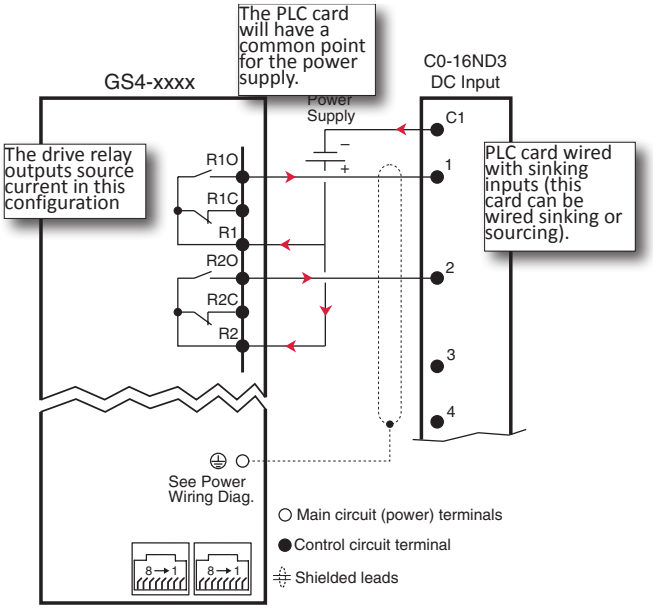


Drive Relay Outputs Wired with Sinking PLC Modules

In this example, the inputs are wired to the Normally-Open contacts (R1O, R2O). You could also wire to the Normally-Closed contacts (R1C, R2C), 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

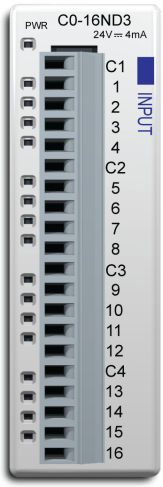


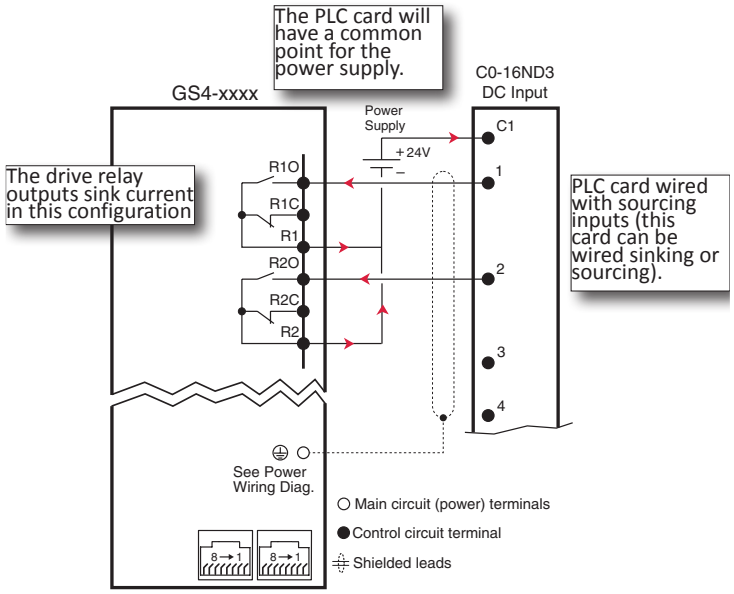


Drive Relay Outputs Wired with Sourcing PLC Modules

In this example, the inputs are wired to the Normally-Open contacts (R1O, R2O). You could also wire to the Normally-Closed contacts (R1C, R2C), 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 GS4 has 3 analog inputs (AI1, AI2 and AI3) that can be configured for a variety of input functions. AI1 and AI2 must be configured via a Parameter (P4.05 or P4.06). They also have a DIP switch located above the I/O terminal strip that allows them to be configured as voltage or current inputs. AI3 is voltage input only. All three inputs have a variety of settings in Parameter Group 4 (P4.xx) that allows you to customize their scaling, offset, etc.

- *AI1: 0~10V, 4~20 mA, 0~20 mA (See P4.05 and the DIP switch AI1 above the I/O terminals)*
- *AI2: 0~10V, 4~20 mA, 0~20 mA (See P4.06 and the DIP switch AI2 above the I/O terminals)*
- *AI3: 0~10V, -10V to +10V*

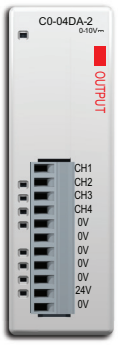
Connecting the analog inputs to PLC outputs is very straightforward. All three analog inputs share the same common.

NOTE: The GS4 analog inputs do not supply the current when configured for 0~20 mA or 4~20 mA. The analog output device needs to supply the loop power.

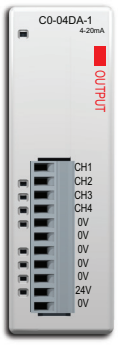
ANALOG INPUT WIRED FOR VOLTAGE AND CURRENT

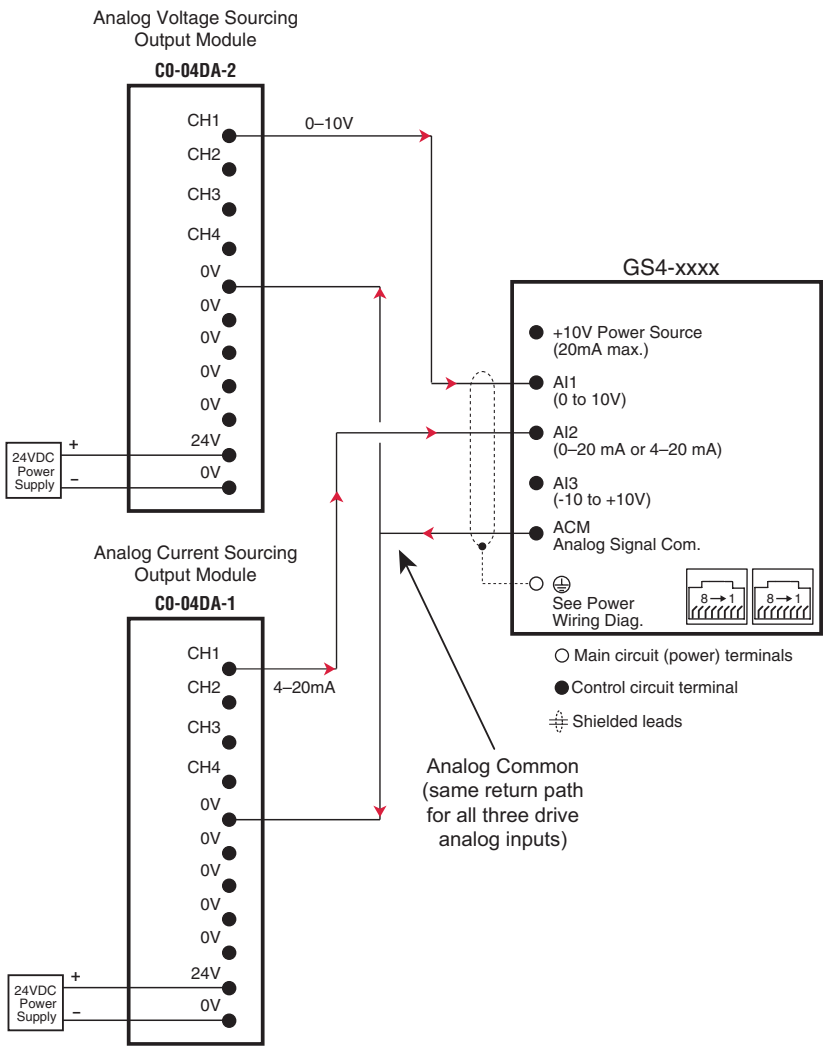
In this example, AI1 is configured for 0~10V (DIP switch and P4.05). AI2 is configured for 4~20 mA (DIP switch and P4.06).

CLICK Expansion Module C0-04DA-2



CLICK Expansion Module C0-04DA-1





Drive Analog Outputs

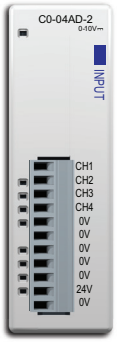
The GS4 has 2 analog outputs (AO1 and AO2) which can be configured for a variety of uses. The outputs are configured via parameters and DIP switch settings (located above the I/O terminal strip). There are several parameters associated with each analog output that defines the signal and adjusts gain, offset, etc. Both outputs share the same Analog Common (ACM).

- *AO1: 0~10V or -10V to +10V (see P4.50 and the DIP switch AO1 above the I/O terminals)*
- *AO2: 0~10V or 4–20mA (see P4.54 and the DIP switch AO2 above the I/O terminals)*

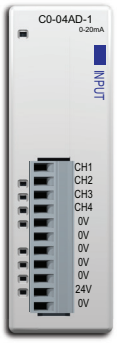
Analog Output Wired for Voltage and Current

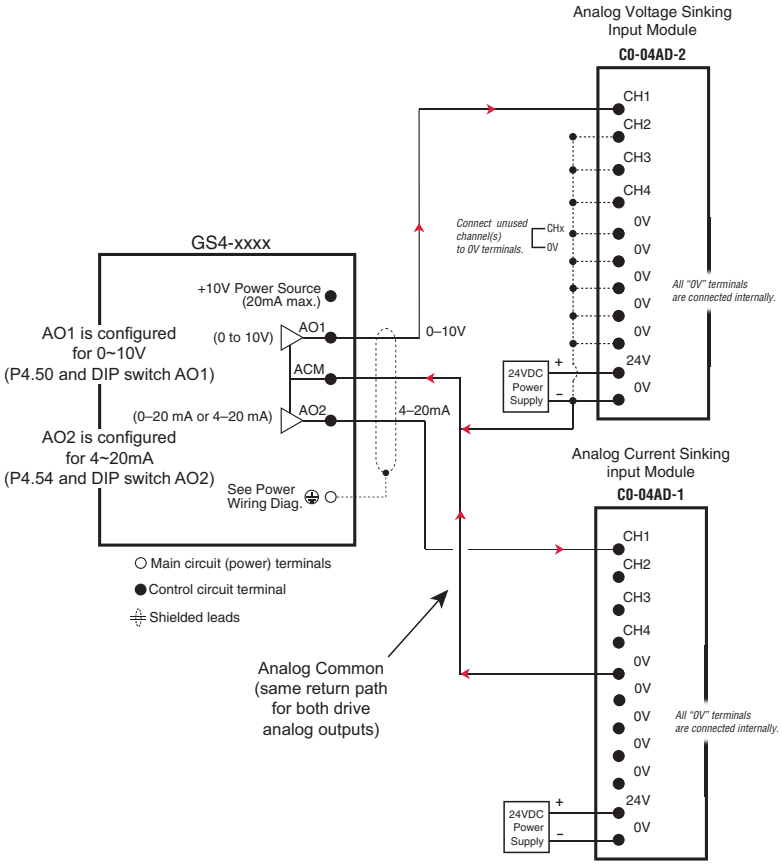
In this example AO1 is configured for 0~10V (P4.50 and DIP switch AO1).

CLICK Expansion module
C0-04AD-2



CLICK Expansion module
C0-04AD-1





Drive Frequency Output (High-speed pulse output)

The GS4 has one high-speed pulse train output: FO. This pulse train output is based on the actual main frequency output of the drive. A scaling factor is available to adjust the frequency.

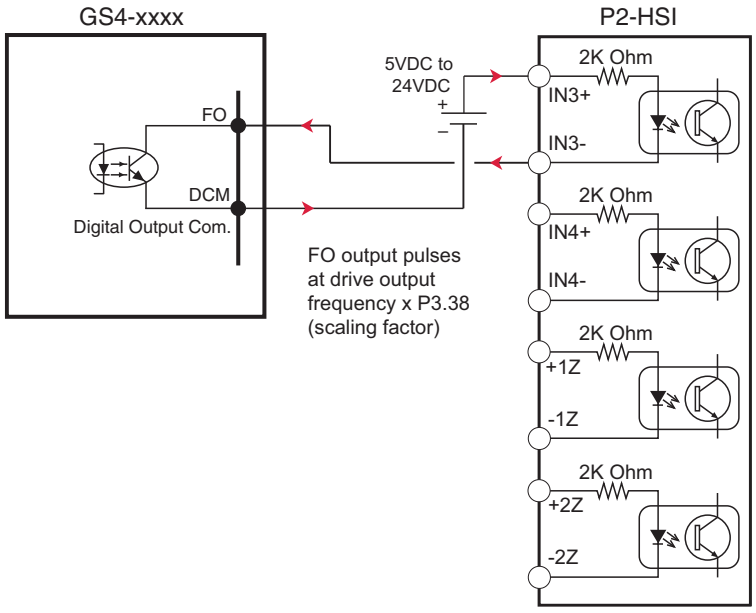
P3.38 Frequency Output Scaling Factor:

- *Actual FO pulses per second output = GS4 output frequency (Hz) x P3.38*

Drive FO output is limited to 30V@ 30mA max. Max frequency is 100kHz (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 FO needs to see a minimum of 1kΩ resistance.

P2 Expansion Module
P2-HSI



Communication with GS4 Drives

The GS4 drive supports several types of communication:

- *Serial Modbus (built-in RS-485 port)*
- *Serial BACnet (built-in RS-485 port)*
- *Modbus TCP (optional GS4-CM-MODTCP card)*
- *EtherNet/IP (optional GS4-CM-ENETIP 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 GS4 drive. Detailed serial BACnet information can be found in Chapter 5: Communications.

The first thing to do with the GS4 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. The minimal set of parameters that need to be adjusted can be found in the QuickStart Menu. After powering up the drive and ensuring that your E-stop and/or STO input work, press MENU on the keypad. Scroll down to 7: QuickStart and press ENTER. The options inside the QuickStart menu provide the bare essentials to properly set up the drive so that it will run and protect the motor. With the cursor located at 1: Keypad, press Enter. Enter information into the eight parameters listed under the 1: Keypad setting. For more information, see Chapter 3: Keypad Operation and QuickStart.

NOTE: If you have changed many parameters and cannot get your drive to function the way you want, go to Parameter P9.08 Parameter Reset and enter a value of 9 or 10. This will reset your drive to its factory default settings. Then go to the QuickStart Menu and enter the eight parameters listed under "Keypad."

Your drive should now be ready to function from the keypad and be able to properly protect the motor from an overload. From the main screen, press LOCAL. The drive should start and stop by pressing the RUN and STOP keys. The output speed can be changed by pressing ENTER when the cursor is beside the "F" setting (frequency). 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 GS4 drive using two different methods. The GS4 drive is equipped with two RJ45 ports on the main control board. Using these ports, the GS4 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 main control 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		
GS4	***Description***	***Default***
P9.00	VFD Comm Address	1
P9.01	MODBUS Baud Rate	9.6 kbps
P9.02	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 P1.07, Acceleration Time 4. As you can see in the Parameter Summary Table (partial from Ch 4 shown below), the Modbus address for P1.07 is 0107H or 40264 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***
P1.06	Deceleration Time 3	P1.15=0: 0.00~600.00 sec P1.15=1: 0.0~6000.00 sec	R/W	0106H	40263	10.00
P1.07	Acceleration Time 4	P1.15=0: 0.00~600.00 sec P1.15=1: 0.0~6000.00 sec	R/W	0107H	40264	10.00
P1.08	Deceleration Time 4	P1.15=0: 0.00~600.00 sec P1.15=1: 0.0~6000.00 sec	R/W	0108H	40265	10.00
**Decimal value is the Modbus address + hexidecimal value; 40001 + 263(0107H) = 40264).*						

In the GS4 keypad, change the default value of P1.07 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 P1.06 to 9.96 and P1.08 to 9.98. Then try to read again. Remember, some controllers 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 very simple. Enter the following values to set up PLC Control RS485 for the drive:

Parameter Settings Table					
Parameter	***MODBUS Address***		***Description***	***Setting Value***	***Note***
	HEX	***Decimal***			
P3.00	0300	40769	Remote source of operation	3: RS-485, Keypad Stop enabled	This allows the RS-485 commands to start and stop the drive when the REMOTE button is pressed (drive is in REMOTE mode).
P4.00	0400	41025	Remote source of frequency	1: RS485 Communication	This allows the RS-485 commands to set the drive speed when the REMOTE button is pressed (drive is in REMOTE mode).

Now when the REMOTE button is pressed, 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 full keypad control, press the LOCAL button. The drive will Start and Stop with the keypad. Pressing ENTER when the cursor is beside the “F” on the display, will allow the arrow keys to adjust the drive output frequency).

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 Bits 3~15: reserved
** For 2001h: When the GS4 drive is configured with Frequency Reference as RS-485, Modbus TCP, or EtherNet/IP (P4.00=1 or 4 and drive in Remote/Auto) – OR – (P4.01=1 or 4 and drive in Local/hand) – AND – Reference > P0.04 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 edge triggered, 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 P11.04~P11.09 (0B04h~0B09h, 42821~42826 decimal). See Chapter 5 for more detailed explanations of these registers.

GS4 Status Addresses (Read Only)						
Description		***Range***		***Modbus Address***		
				Hex	***Dec***	***Octal***
Status Monitor 1	Fault Codes	0: No Error 1: Overcurrent during Accel (ocA) 2: Overcurrent during Decel (ocd) 3: Overcurrent during normal speed (ocn) 4: Ground Fault (GFF) 5: IGBT short circuit (occ) 6: Overcurrent during Stop (ocS) 7: Overvoltage during Accel (ovA) 8: Overvoltage during Decel (ovd) 9: Overvoltage during normal speed (ovn) 10: Overvoltage during Stop (ovS) 11: Low voltage during Accel (LvA) 12: Low voltage during Decel (Lvd) 13: Low voltage during normal speed (Lvn) 14: Low voltage during Stop (LvS) 15: Input phase loss (OrP) 16: IGBT Overheat 1 (oH1) 17: Cap Overheat 2 (oH2) 18: Thermister 1 open (tH1o) 19: Thermister 2 open (tH2o) 20: Power Reset Off (PWR) 21: Overload (oL) (150% 1Min, Inverter) 22: Motor1 Thermal Overload (EoL1) 23: Motor2 Thermal Overload (EoL2) 24: Motor Overheat-PTC (oH3) 25: reserved 26: Over Torque 1 (ot1) 27: Over Torque 2 (ot2) 28: Under current (uc) 29: reserved 30: EEPROM write error (cF1) 31: EEPROM read error (cF2) 32: reserved 33: U phase current sensor detection error (cd1) 34: V phase current sensor detection error (cd2) 35: W phase current sensor detection error (cd3) 36: CC Hardware Logic error 0 (Hd0) 37: OC Hardware Logic error 1 (Hd1) 38: OV Hardware Logic error 2 (Hd2) 39: OCC Hardware Logic error 3 (Hd3)	40: Motor auto tune error (AuE) 41: PID Feedback loss (AFE) 42~47: reserved 48: Analog input signal loss (ACE) 49: External Fault (EF) 50: Emergency Stop (EF1) 51: Base Block (bb) 52: Password Error (Pcod) 53: Software Code lock (ccod) 54: PC Command error (CE1) 55: PC Address error (CE2) 56: PC Data error (CE3) 57: PC Slave error (CE4) 58: PC Communication Time Out (CE10) 59: PC Keypad Time out (CP10) 60: Braking Transistor Fault (bf) 61: Y-Delta connection Error (ydc) 62: Decel Energy Backup Error (dEb) 63: Over Slip Error (oSL) 64: Electromagnet switch error (ryF) 65~71: reserved 72: STO Loss1 (STL1) STO1~SCM1 internal hardware detect error 73: ES1 Emergency Stop (S1) 74: In Fire Mode (Fire) 75: reserved 76: Safety Torque Off function active (STO) 77: STO Loss2 (STL2) STO2~SCM2 internal hardware detect error 78: STO Loss3 (STL3) – STO1~SCM1 and STO2~SCM2 internal hardware detect errors 79: U Phase Short (Uoc) 80: V Phase Short (Voc) 81: W Phase Short (Woc) 82: U Phase Loss (UPHL) 83: V Phase Loss (VPHL) 84: W Phase Loss (WPHL) 85~89: reserved 90: PLC Force Stop (FStp) 91~98: reserved 99: CPU Command error (TRAP) 100~110: reserved 111: reserved	2100	48449	20400

(table continued next page)

GS4 Status Addresses (Read Only) (continued)					
Description		**Range**	**Modbus Address**		
			Hex	**Dec**	**Octal**
Status Monitor 2	Bit 0,1	0: Stop 1: Decelerate during the drive stopping 10: The drive standby 11: Run	2101	48450	20401
	Bit 2	1: JOG active			
	Bit 3,4	0: FWD 1: REV to FWD 10: FWD to REV 11: REV			
	Bit 5	reserved			
	Bit 6	reserved			
	Bit 7	reserved			
	Bit 8	1: Source of frequency by communication			
	Bit 9	1: Source of frequency by AI			
	Bit 10	1: Source of operation by communication (If Keypad Stop is enabled (P3.00, P3.01 = 1,3,5), this bit will remain "1" even if the source of operation is not communication.)			
	Bit 11	1: Parameters have been locked			
	Bit 12	Running Status (0: Drive Stopped; 1: Drive Running (including Standby))			
	Bit 13 to Bit 15	reserved			
Frequency command F (xxx.x) *			2102	48451	20402
Output Frequency H (xxx.x)			2103	48452	20403
Output Current A (xxx.x)			2104	48453	20404
DC-BUS Voltage U (xxx.x)			2105	48454	20405
Output Voltage E (xxx.x)			2106	48455	20406
Multi-Speed or PID Inputs current Step Number			2107	48456	20407
Active Warning			2108	48457	20410
DI6 Counter Value (must set P3.44)			2109	48458	20411
Power Factor angle (cos θ)			210A	48459	20412
% Load			210B	48460	20413
Motor Actual Speed (rpm)			210C	48461	20414
PID Feedback Signal (pv)			210D	48462	20415
reserved			210E	48463	20416
reserved			210F	48464	20417
reserved			2110	48465	20420
Error/ Warning	Low Byte	Active Error [2100h = Active Error/Fault]	2118	48473	20430
	High Byte	Active Warning [2108h = Active Warning]			

** If frequency command is greater than the Drive Maximum Output Frequency (P0.04), the GS4 drive will accelerate to the Drive Maximum Output Frequency, as defined in (P0.04).*

ModTCP (Ethernet) Monitor and Control

Ethernet control over ModTCP is very similar to serial Modbus control. After installing the ModTCP option card (see Appendix B for more information on card installation), set the following parameters:

GS4 Parameter Settings for ModTCP (Ethernet) Monitor and Control						
Parameter		***Setting***	***Run[1] Read/ Write***	***Modbus Address***		***Note***
				Hex	***Dec***	
P3.00	1st Source of Operation Command [Remote]	5: Comm Card; Keypad STOP is enabled	R/W	0300	40769	This allows Ethernet commands to start and stop the drive after the REMOTE button is pressed (drive is in REMOTE mode).
P3.01	2nd Source of Operation Command [Local]		R/W	0301	40770	
P4.00	1st Source of Frequency Command [Remote]	4: Comm Card	♦R/W	0400	41025	This allows Ethernet commands to set the drive speed after the REMOTE button is pressed (drive is in REMOTE mode).
P4.01	2nd Source of Frequency Command [Local]		♦R/W	0401	41026	

Other key parameters that must be modified (or at least must be known) to set up Ethernet communications					
P9.48	Comm Card IP Configuration	0: Static IP 1: Dynamic IP (DHCP)	R/W	0930	42353
P9.49	Comm Card IP Address Octet 1	0~255	R/W	0931	42354
P9.50	Comm Card IP Address Octet 2	0~255	R/W	0932	42355
P9.51	Comm Card IP Address Octet 3	0~255	R/W	0933	42356
P9.52	Comm Card IP Address Octet 4	0~255	R/W	0934	42357
P9.53	Comm Card Mask Octet 1	0~255	R/W	0935	42358
P9.54	Comm Card Mask Octet 2	0~255	R/W	0936	42359
P9.55	Comm Card Mask Octet 3	0~255	R/W	0937	42360
P9.56	Comm Card Mask Octet 4	0~255	R/W	0938	42361
P9.57	Comm Card Gateway Octet 1	0~255	R/W	0939	42362
P9.58	Comm Card Gateway Octet 2	0~255	R/W	093A	42363
P9.59	Comm Card Gateway Octet 3	0~255	R/W	093B	42364
P9.60	Comm Card Gateway Octet 4	0~255	R/W	093C	42365
P9.64	Comm Card External Set	0, 2 Bit 0 = reserved Bit 1 = Write Ethernet Parameters to Comm Card Bit 2 = reserved	R/W	0940	42369

Refer to Appendix B for detailed information and an example on how to set up these parameters. We recommend using Static IP (P9.48=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 P9.64 = 2 (bit 1) after changing any of these parameters to save the changes to the card firmware.

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

EtherNet/IP Monitor and Control

After installing the EtherNet/IP option card, set the following parameters:
(See Appendix B for more information on card installation.)

GS4 Parameter Settings for EtherNet/IP Monitor and Control						
Parameter		**Setting**	**Run[1] Read/ Write**	**Modbus Address**		**Note**
				Hex	**Dec**	
P3.00	1st Source of Operation Command [Remote]	5: Comm Card; Keypad STOP is enabled	R/W	0300	40769	This allows Ethernet commands to start and stop the drive after the REMOTE button is pressed (drive is in REMOTE mode).
P3.01	2nd Source of Operation Command [Local]		R/W	0301	40770	
P4.00	1st Source of Frequency Command [Remote]	4: Comm Card	♦R/W	0400	41025	This allows Ethernet commands to set the drive speed after the REMOTE button is pressed (drive is in REMOTE mode).
P4.01	2nd Source of Frequency Command [Local]		♦R/W	0401	41026	

Other key parameters that must be modified (or at least must be known) to set up Ethernet communications					
P9.48	Comm Card IP Configuration	0: Static IP 1: Dynamic IP (DHCP)	R/W	0930	42353
P9.49	Comm Card IP Address Octet 1	0~255	R/W	0931	42354
P9.50	Comm Card IP Address Octet 2	0~255	R/W	0932	42355
P9.51	Comm Card IP Address Octet 3	0~255	R/W	0933	42356
P9.52	Comm Card IP Address Octet 4	0~255	R/W	0934	42357
P9.53	Comm Card Mask Octet 1	0~255	R/W	0935	42358
P9.54	Comm Card Mask Octet 2	0~255	R/W	0936	42359
P9.55	Comm Card Mask Octet 3	0~255	R/W	0937	42360
P9.56	Comm Card Mask Octet 4	0~255	R/W	0938	42361
P9.57	Comm Card Gateway Octet 1	0~255	R/W	0939	42362
P9.58	Comm Card Gateway Octet 2	0~255	R/W	093A	42363
P9.59	Comm Card Gateway Octet 3	0~255	R/W	093B	42364
P9.60	Comm Card Gateway Octet 4	0~255	R/W	093C	42365
P9.64	Comm Card External Set	0, 2 Bit 0 = reserved Bit 1 = Write Ethernet Parameters to Comm Card Bit 2 = reserved	R/W	0940	42369

Refer to Appendix B for detailed information and an example on how to set up these parameters. We recommend using Static IP (P9.48=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 P9.64 = 2 (bit 1) after changing any of these parameters to save the changes to the card firmware.

Appendix B details all the Implicit and Explicit data that can be transferred to and from the GS4. 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.

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	Multicast, Point to Point	Mulitcast, Point to Point

GS4-CM-ENETIP 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*

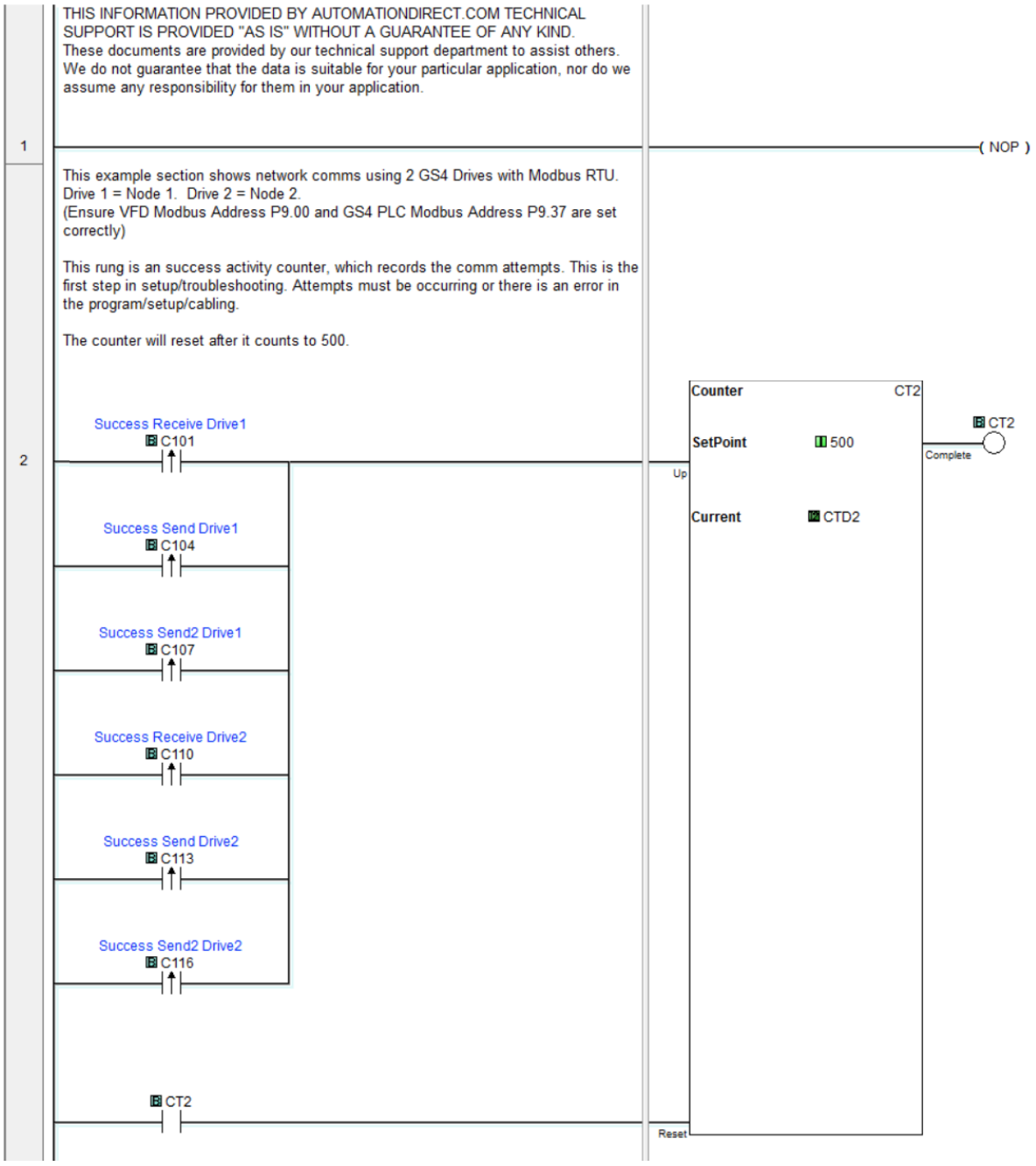
GS4-CM-ENETIP Communication Protocol Parameter Address Definitions

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 6~15	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
Monitor GS4 status	0	Warning/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)	

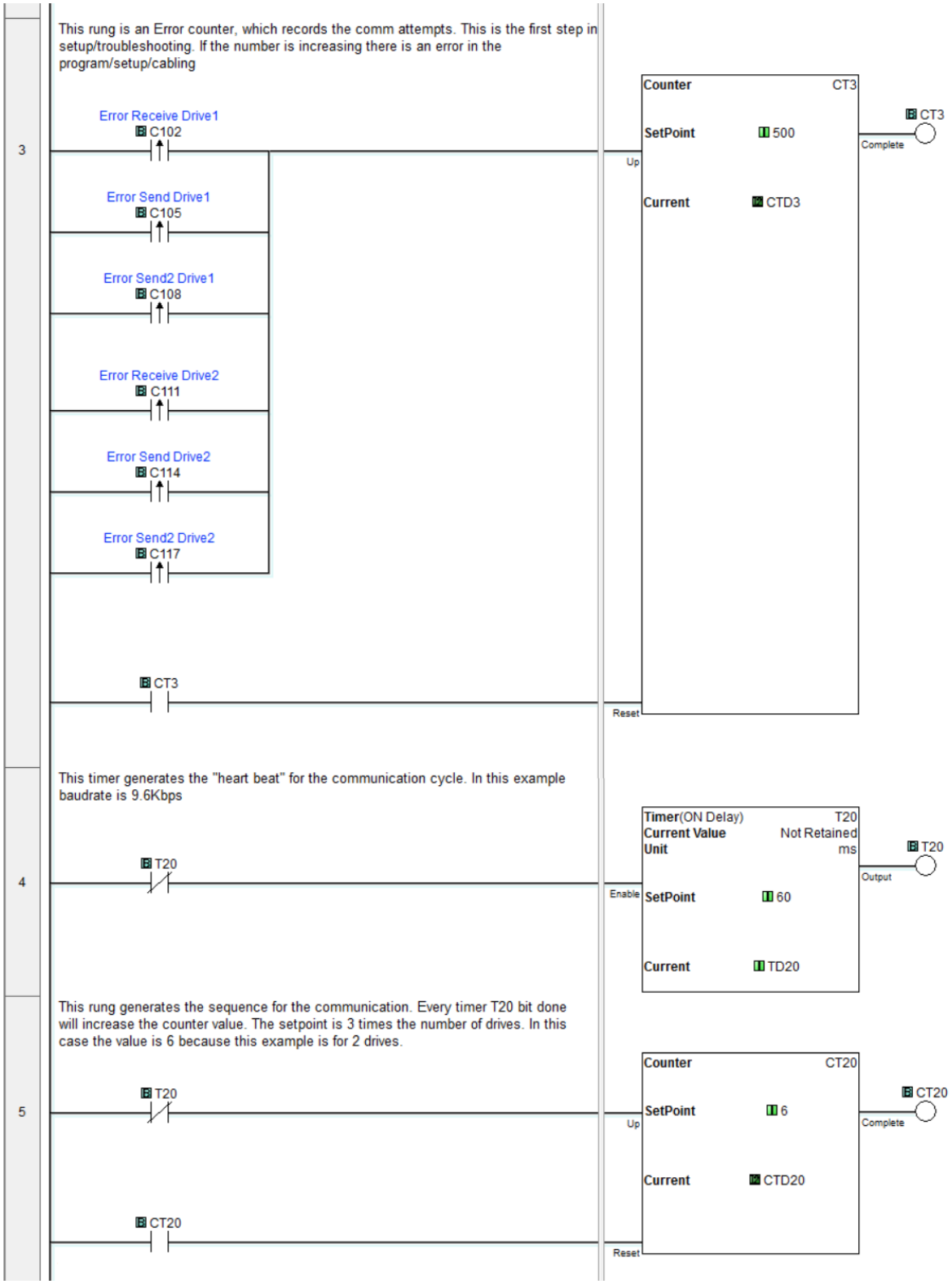
Program Examples Using AutomationDirect CLICK PLC

Modbus RTU CLICK Program Example

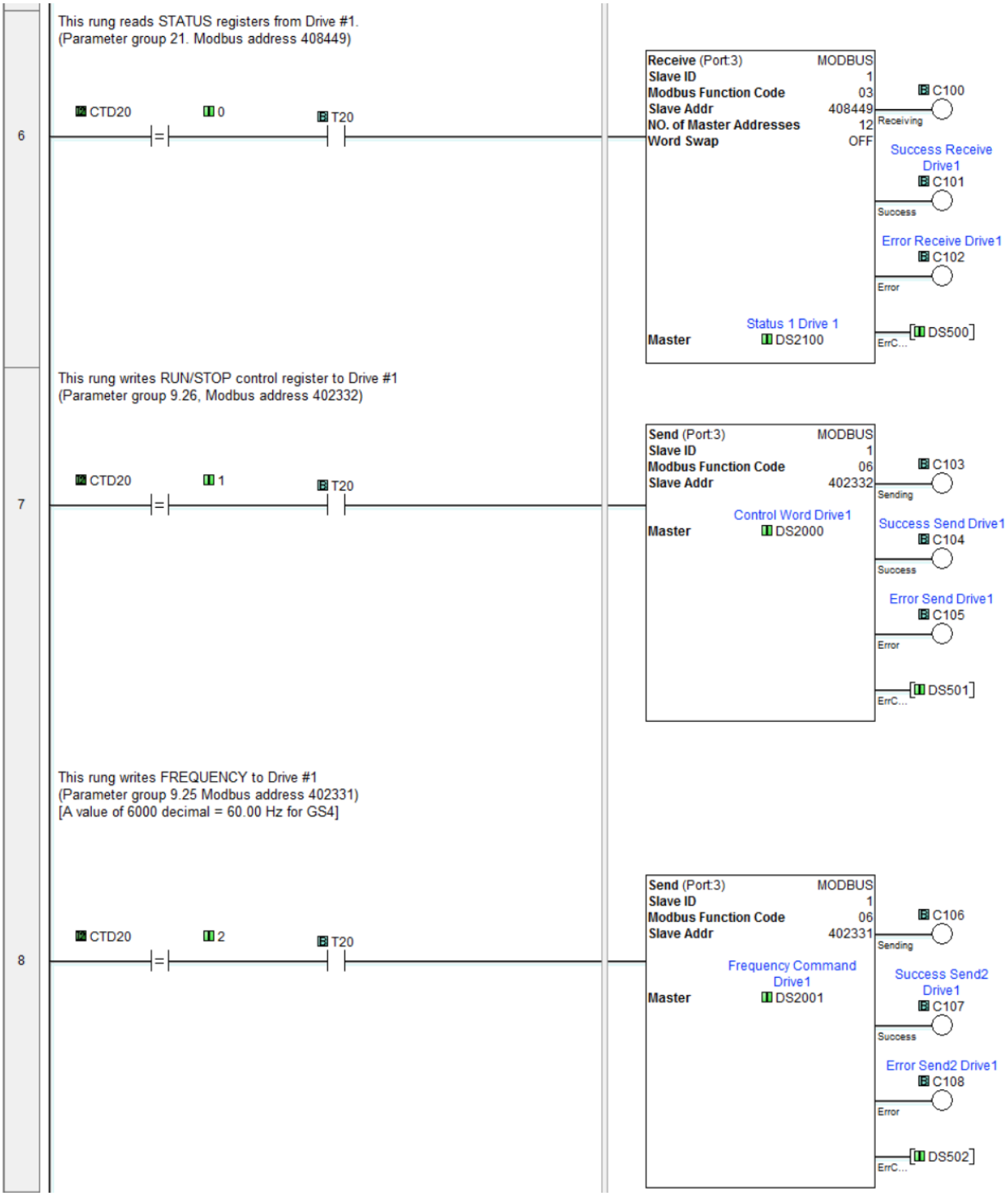
This example section shows CLICK ladder logic designed to show a method of establishing and monitoring network communications when using two GS4 drives with Modbus RTU.



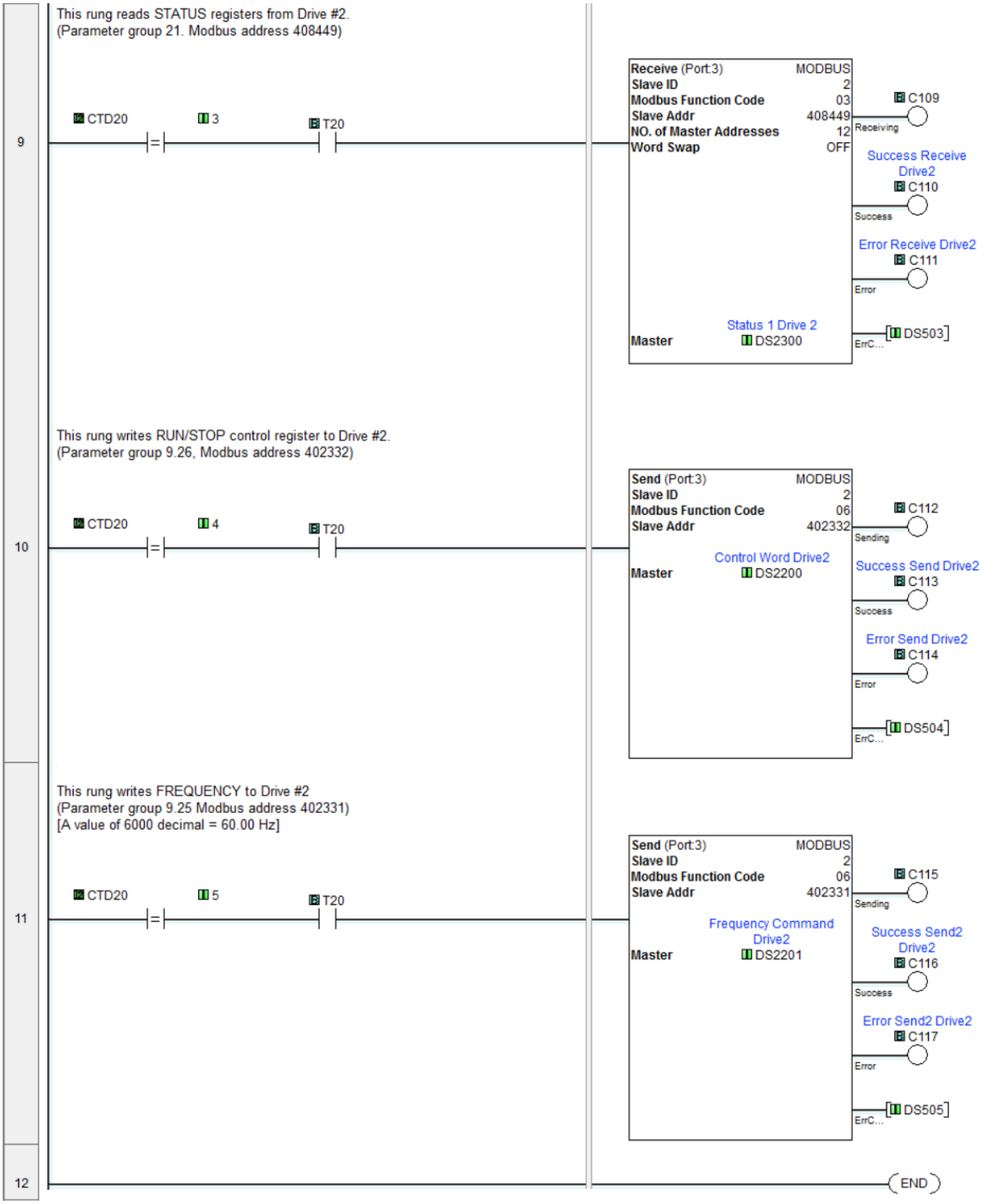
MODBUS RTU CLICK PROGRAM EXAMPLE (CONTINUED)



MODBUS RTU CLICK PROGRAM EXAMPLE (CONTINUED)

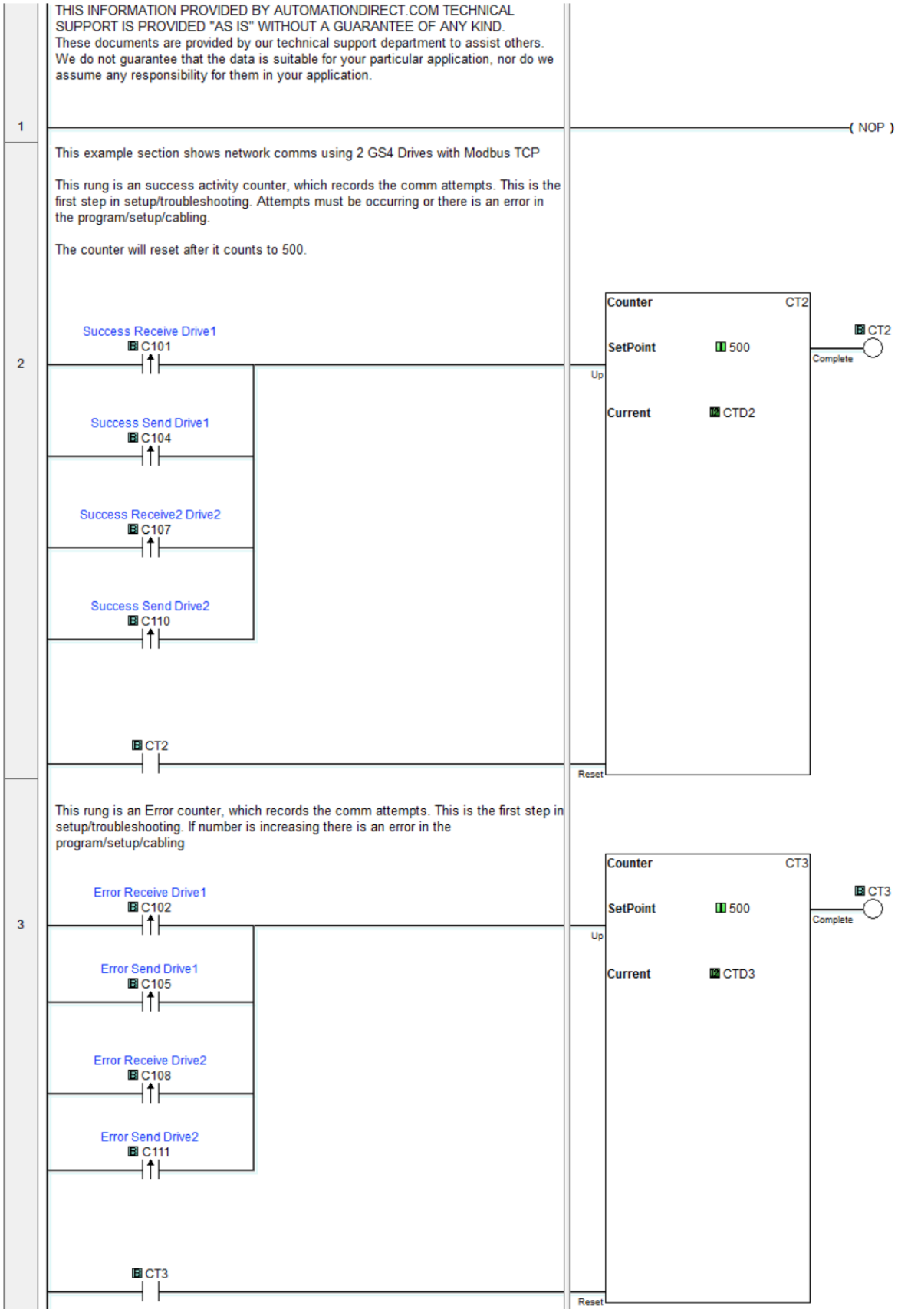


MODBUS RTU CLICK PROGRAM EXAMPLE (CONTINUED)

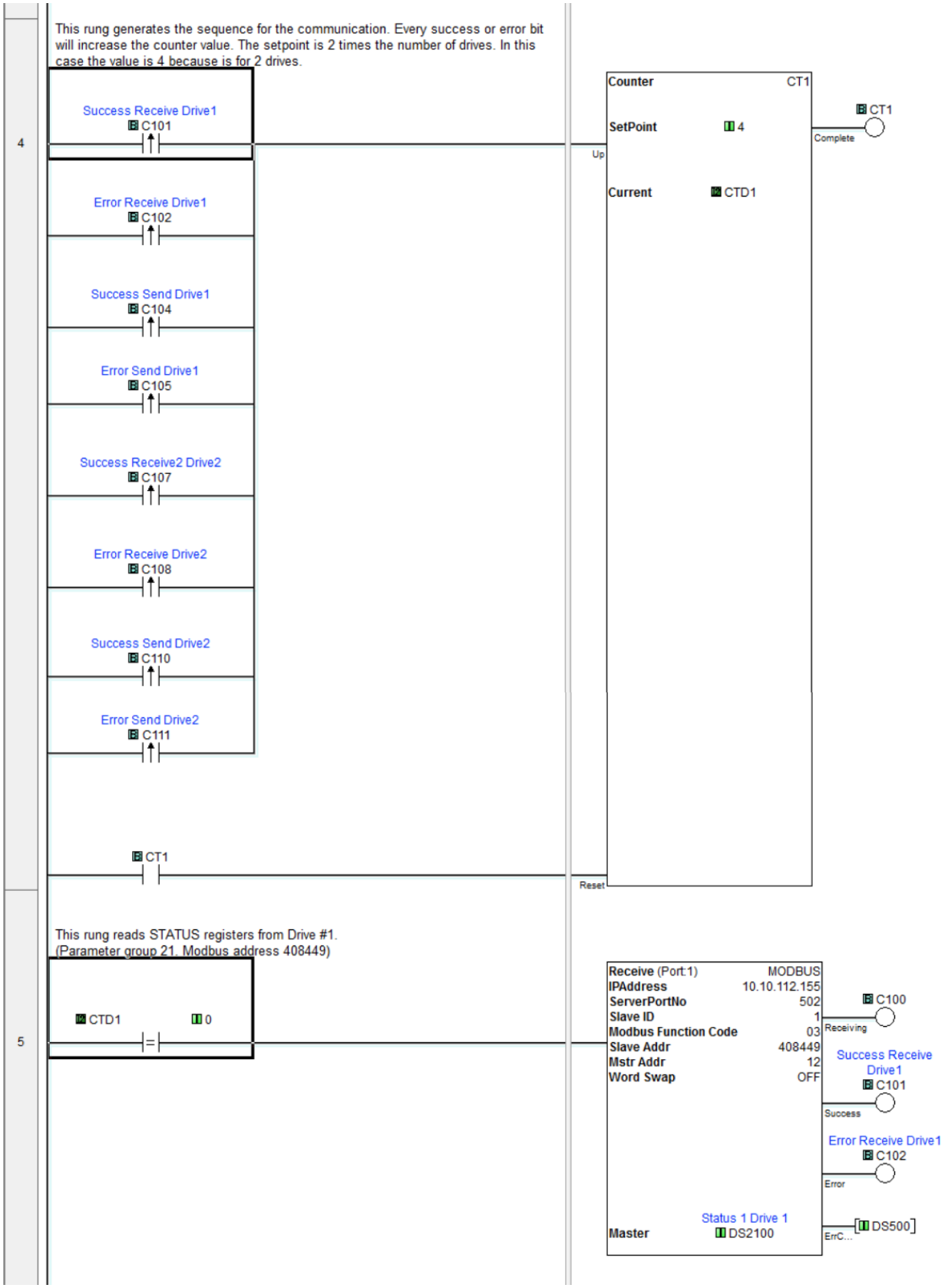


Modbus TCP CLICK Program Example

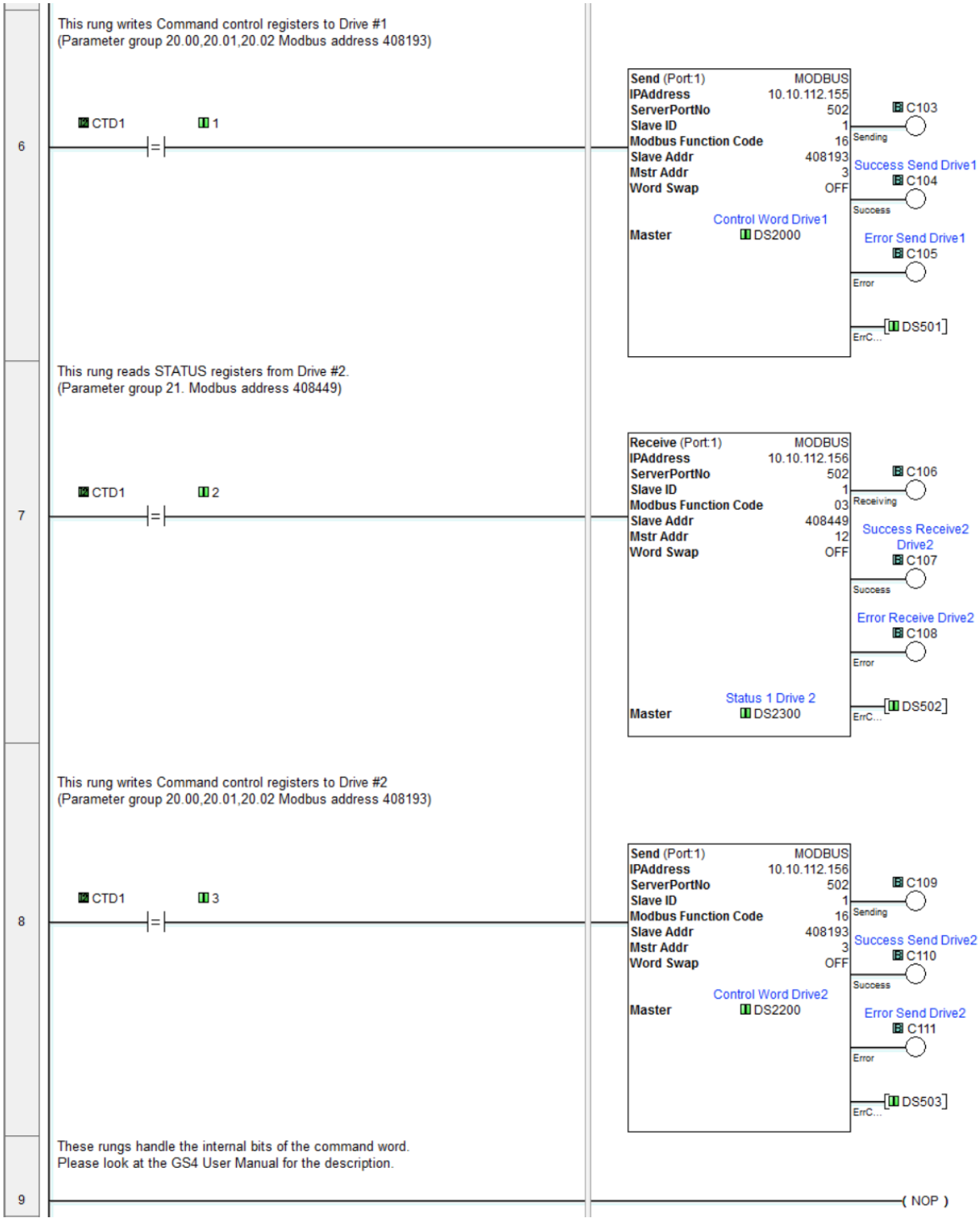
This example section shows CLICK ladder logic designed to show a method of establishing and monitoring network communications when using two GS4 drives with Modbus TCP.



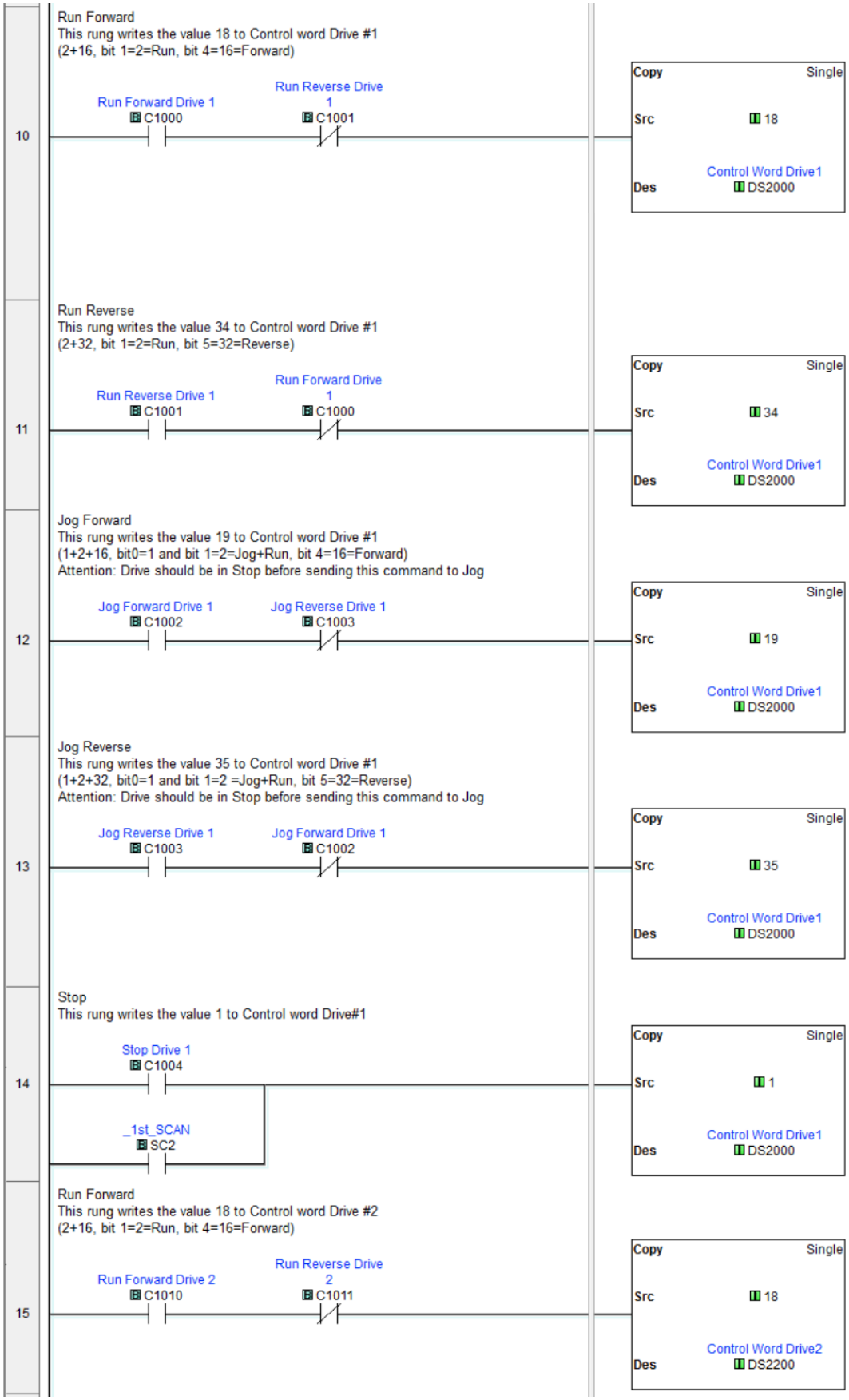
MODBUS TCP CLICK PROGRAM EXAMPLE (CONTINUED)



MODBUS TCP CLICK PROGRAM EXAMPLE (CONTINUED)



MODBUS TCP CLICK PROGRAM EXAMPLE (CONTINUED)



MODBUS TCP CLICK PROGRAM EXAMPLE (CONTINUED)