Using GS20(X) AC Drives with AutomationDirect PLCs

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Appendix D Overview

The material presented here will help you connect your GS20(X) 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 GS20(X) 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).

GS20(X) 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)*

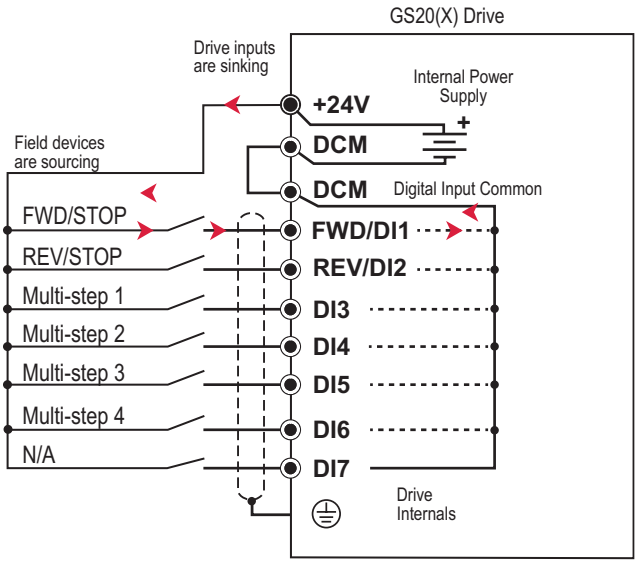
Sinking/Sourcing Basics

GS20(X) 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.

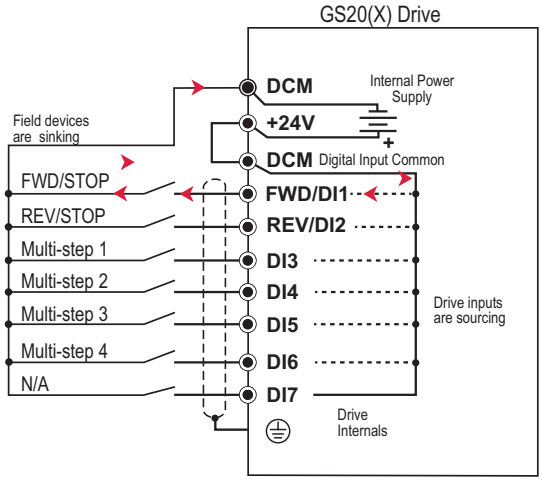
- *For a detailed technical explanation of sink and source, please follow this link: www.automationdirect.com/static/specs/sinksource.pdf*

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.

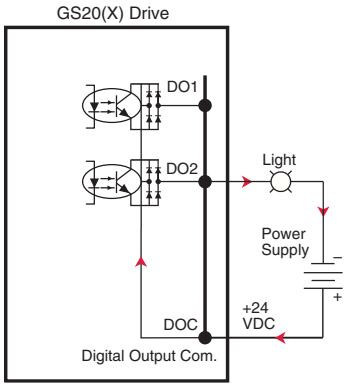
So, if the GS20(X) inputs are wired for sinking, they require the external device (FWD/STOP switch in this example) to supply current (when closed, the external device will "source" current). Notice the current flow represented by the red arrows. The GS20(X) input "sinks" the current flow.



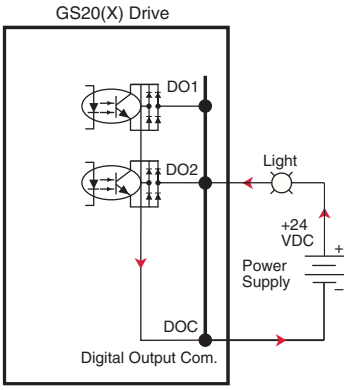
GS20(X) DC inputs can also be wired for sourcing. In this configuration, notice that the 24VDC supply is feeding into the DIC (Digital Input Common) terminal and the current is coming out of the drive input (GS20(X) is sourcing) and the field device is sinking the current.



GS20(X) 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).



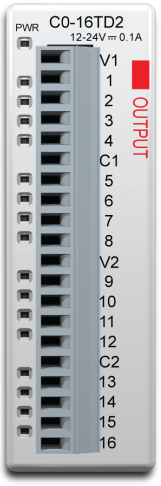
NOTE: GS20(X) output can be wired as sinking or sourcing, but not both at the same time.

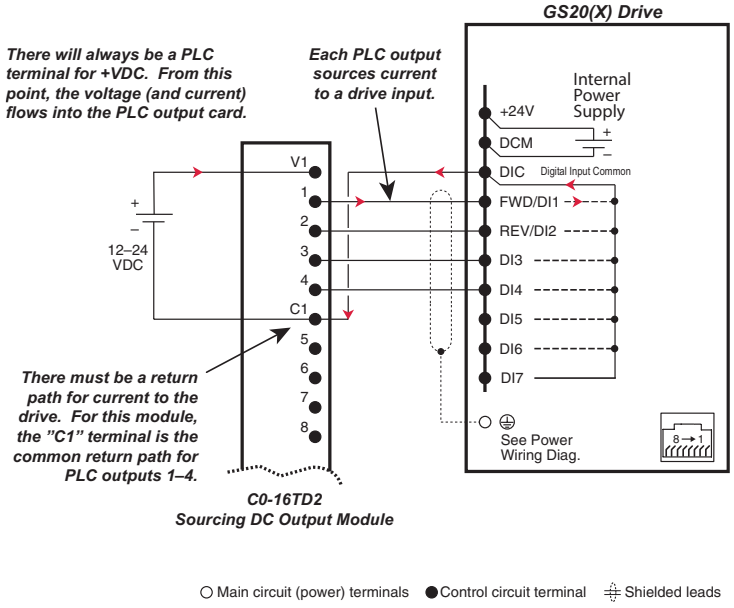
GS20(X)-to-PLC I/O Wiring Examples

This section shows typical wiring examples of PLC inputs and outputs connected to a GS20(X) 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)

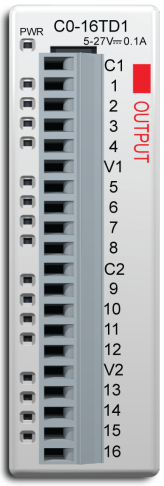
CLICK Expansion Module
C0-16TD2

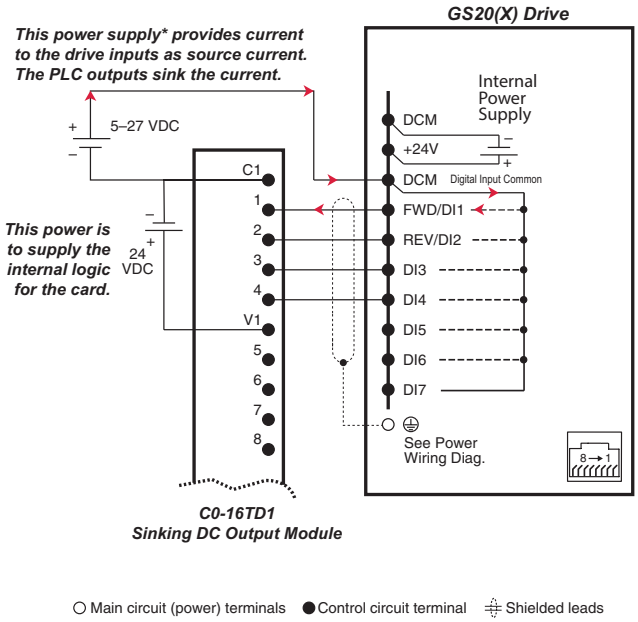




Drive Wired with DC Sourcing Inputs (PLC output card is sinking)

CLICK Expansion Module
C0-16TD1

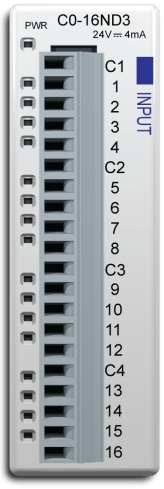


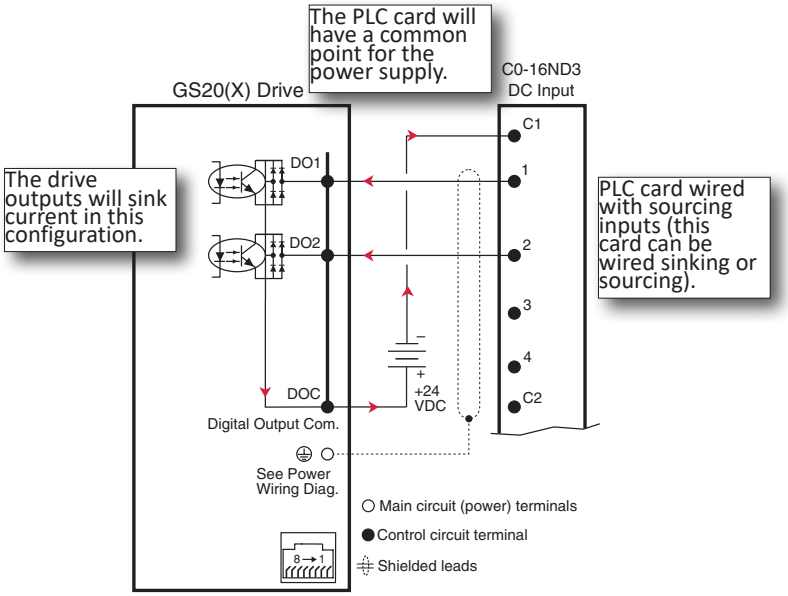


**Alternately, the drive internal power supply (+24V) could be used. However, the DCM common would have to be connected to the PLC power supply common.*

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

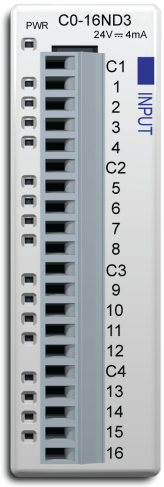
CLICK Expansion Module
C0-16ND3

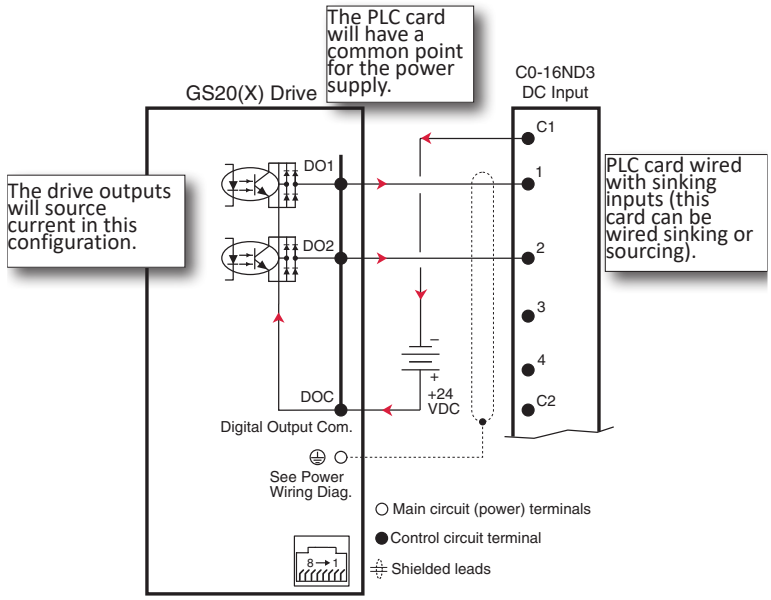




Drive Wired with DC Sourcing Outputs (PLC input card is sinking)

CLICK Expansion Module
C0-16ND3

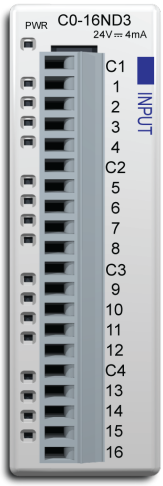


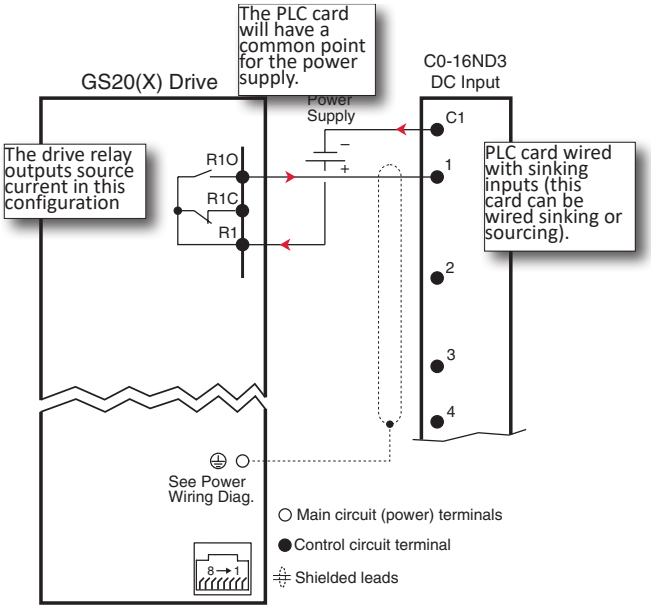


Drive Relay Outputs Wired with Sinking PLC Modules

In this example, the inputs are wired to the Normally-Open contacts (R1O). 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

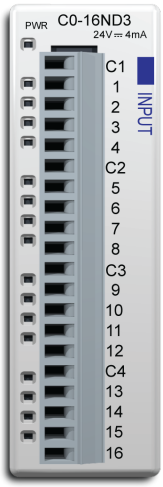


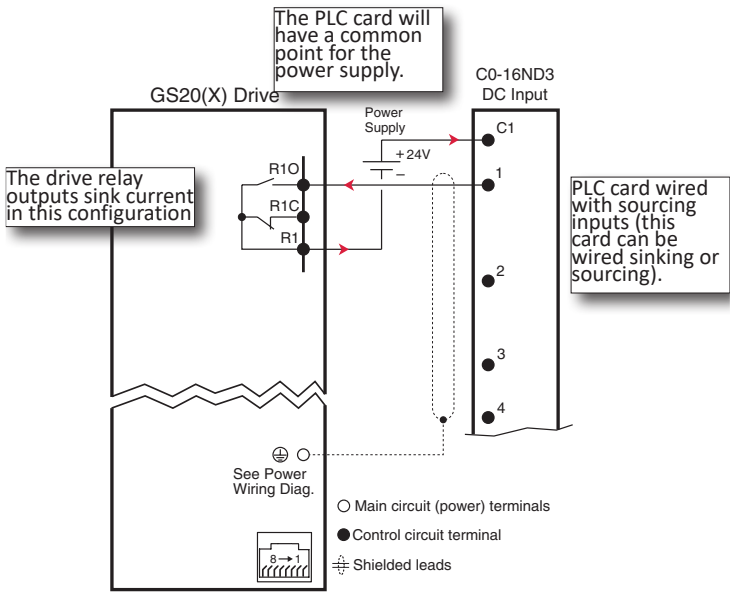


Drive Relay Outputs Wired with Sourcing PLC Modules

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 GS20(X) 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.

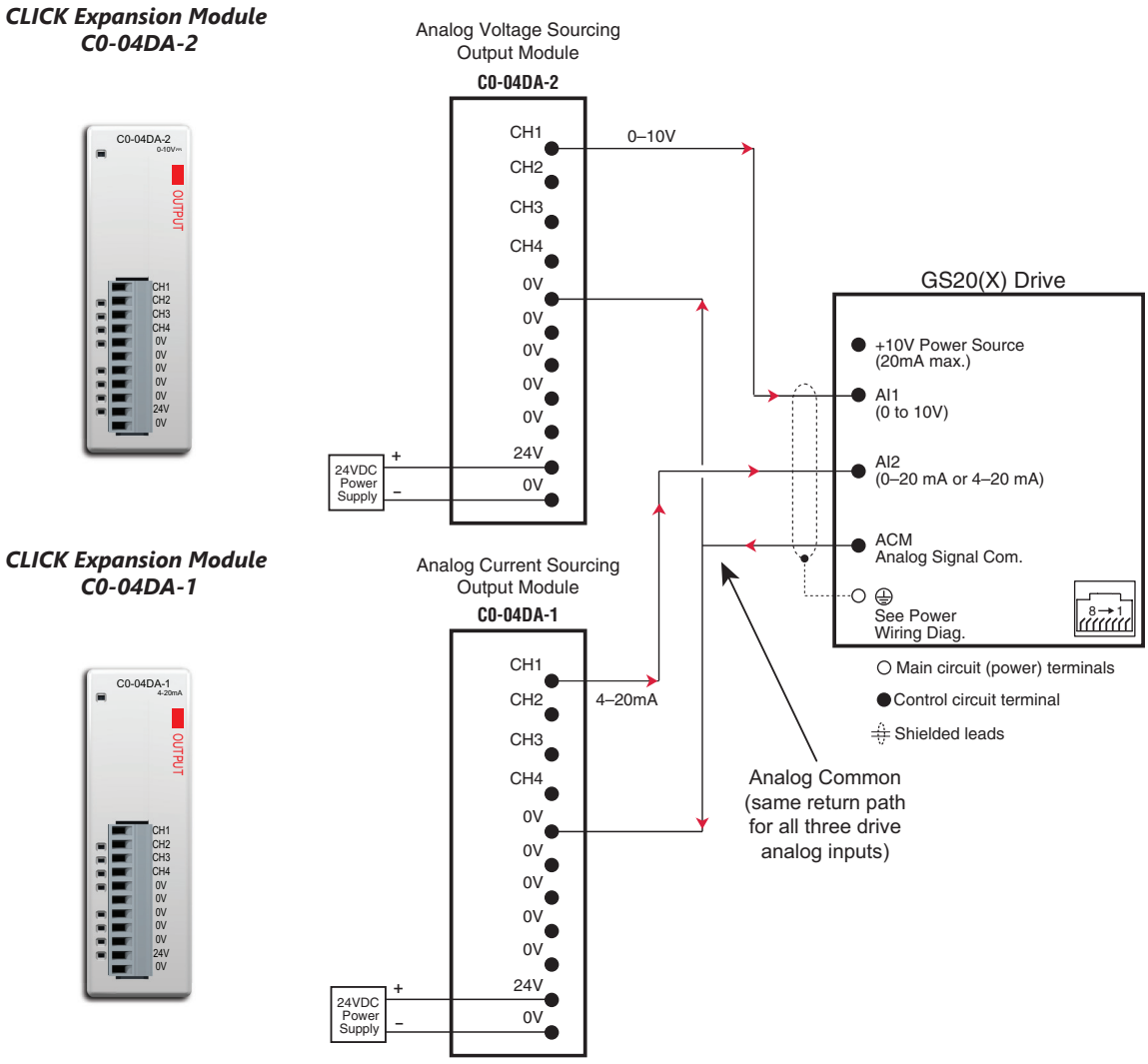
- *AI1: 0~10V, -10V to +10V*
- *AI2: 0~10V, 4~20 mA, 0~20 mA (See P03.29 and the DIP switch AI2 above the I/O terminals)*

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

NOTE: The GS20(X) 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).



Drive Analog Outputs

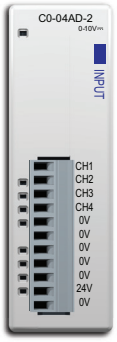
The GS20(X) has one analog output (AO1) which can be configured for a variety of uses. The output is configured via parameters and DIP switch settings (located above the I/O terminal strip). There are several parameters associated with the analog output that defines the signal and adjusts gain, offset, etc.

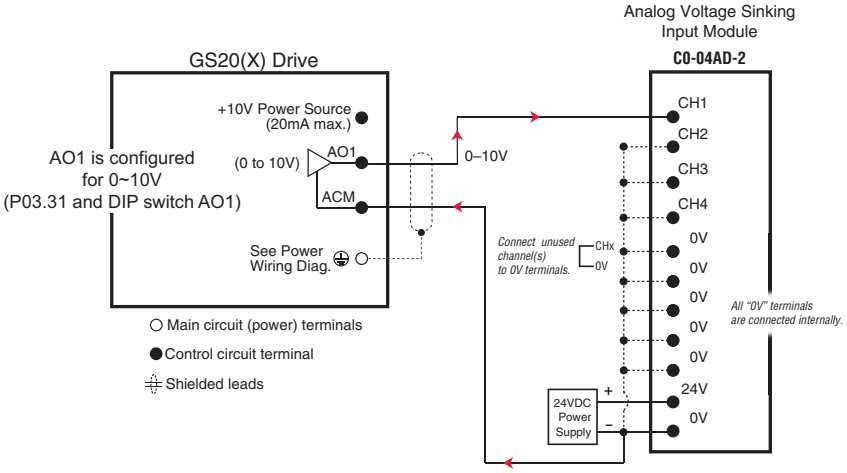
- *AO1: 0~10V or 0~2mA or 4~20mA (see P03.31 and the DIP switch AO1 above the I/O terminals)*

Analog Output Wired for Voltage and Current

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

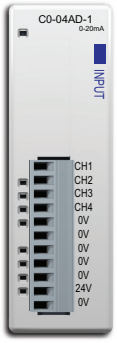
CLICK Expansion module
C0-04AD-2

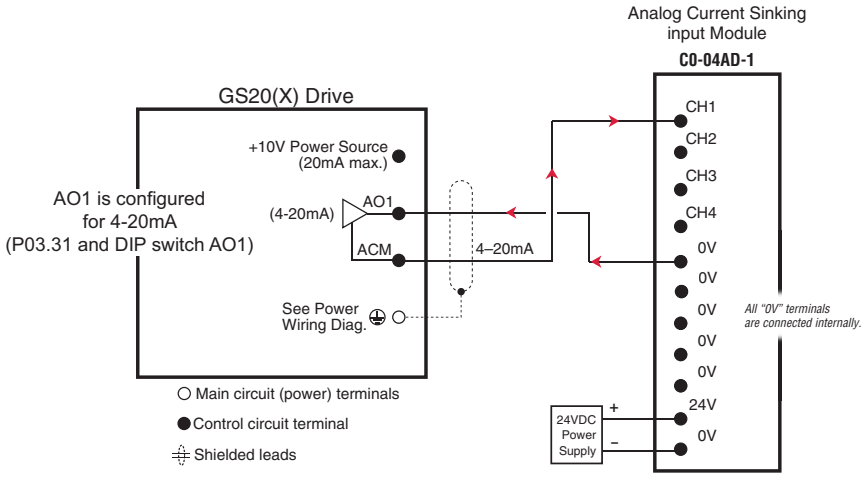




In this example AO1 is configured for current signal, 4-20mA (P03.31 and DIP switch AO1).

CLICK Expansion module
C0-04AD-1





Drive Frequency Output (High-speed pulse output)

The GS20(X) has one high-speed pulse train output: DO. This pulse train output is based on the actual main frequency output of the drive. A scaling factor is available to adjust the frequency.

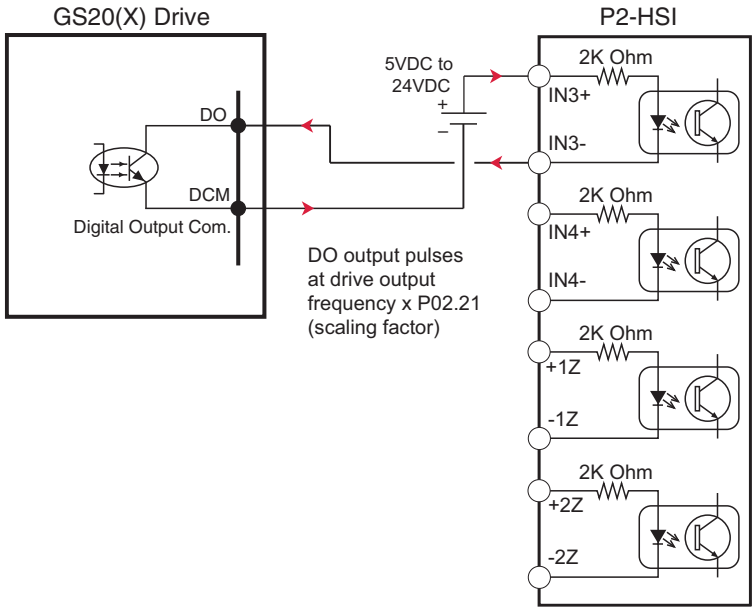
P02.21 Frequency Output Scaling Factor:

- *Actual DO pulses per second output = GS20(X) 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 GS20(X) Drives

The GS20(X) drive supports two types of communication:

- *Serial Modbus (built-in RS-485 port)*
- *EtherNet/IP (optional GS20A-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 GS20(X) drive.

The first thing to do with the GS20(X) 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 GS20 Parameter Settings – Quick Configuration				
Parameter	***Description***	***Range***	***Default***	***User***
P00.00	GS20 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 2=Reset to GS2 mode (1 of 2) 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) 20=Reset to GS2 mode (2 of 2)	0	
P00.06	Firmware Version	Read Only	n/a	
P00.10	Control Mode	0=Speed mode 2=Torque mode	0	
P00.11	Speed Control Mode	0=VF (IM V/F control) 1=VFPG (IM V/F control + Encoder) 2=SVC (Parameter 05.33 set as IM or PM) 5=FOC 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=External UP/DOWN terminal 4=Pulse input without direction command (refer to parm 10.16 without direction) 7=Digital keypad dial	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	
P00.23	Motor Direction	0=Enable forward/reverse 1=Disable reverse 2=Disable forward	0	

DURApulse GS20 Parameter Settings – Quick Configuration (continued)				
Parameter	***Description***	***Range***	***Default***	***User***
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=External UP/Down terminal 4=Pulse input without direction command (refer to parm 10.16 without direction) 7=Digital keypad dial 8=Communication card	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 (M1: FWD/STOP, M2: REV/STOP) 2=2-wire mode 2, power on for operation control (M1: RUN/STOP, M2 REV/FWD) 3=3-wire, power on for operation control (M1: RUN, M2: REV/FWD, M3: STOP) 4=2-wire mode 1, fast start up (M1: FWD/STOP, M2: REV/STOP) 5=2-wire mode 2, fast start up (M1: RUN/STOP, M2: REV/FWD) 6=3-wire, fast start up (M1: RUN, M2: REV/FWD, M3: 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	
P05.01	Motor 1 Full Load Amps (FLA)	10-120% of drive rated current	#.##	
P05.03	Motor 1 Rated RPM	0-65535	1710	

DURAPULSE GS20 Parameter Settings – Quick Configuration (continued)				
Parameter	***Description***	***Range***	***Default***	***User***
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 close 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	0	
P09.08	Restore to GS20 default	When in GS2 mode: 20: Reset to GS20 mode from GS2 mode	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 pressing the UP/DOWN arrows on the "F" setting (frequency). Set P00.20 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 GS20(X) drive using two methods.

The GS20(X) drive is equipped with one RJ45 port. Using this port, the GS20(X) 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		
GS20(X)	***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 the Modbus address + hexidecimal value; 40001 + 273(0111H) = 40274).*						

From the GS20(X) 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 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***			
P00.20	0014	40021	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).
P00.21	0015	40022	Remote source of operation	2: RS-485 Communication	This allows the RS-485 commands to start and stop the drive 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 Bit 5: Enable Fire Mode Bits 6~15: reserved
** For 2001h: When the GS20(X) 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 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 P06.17–P06.22 (0611h-0616h , 41555 - 41559 decimal). See Chapter 5 for more detailed explanations of these registers.

GS20(X) Status Addresses (Read Only)						
Description		***Range***		***Modbus Address***		
				Hex	***Dec***	***Octal***
Status Monitor 1	Error 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: Thermistor 1 open (tH1o) 19: Thermistor 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 (SrL1) 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 (SrL2) STO2~SCM2 internal hardware detect error 78: STO Loss3 (SrL3) – 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) 91~96: reserved 97: Ethernet Card Timeout (CD10) 98: reserved 99: CPU Command error (TRAP) 100: reserved	0611	41554	3021

(table continued next page)

GS20(X) 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 GS20A-CM-ENETIP option card (see Appendix B for more information on card installation), set the following parameters:

GS20(X) 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 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 GS20(X). 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.

GS20A-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

GS20A-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*

See “GS20A-CM-ENETIP EtherNet/IP Communication Protocol Parameter Address Definitions” on page B–22 for more information.

Program Examples Using AutomationDirect PLCs

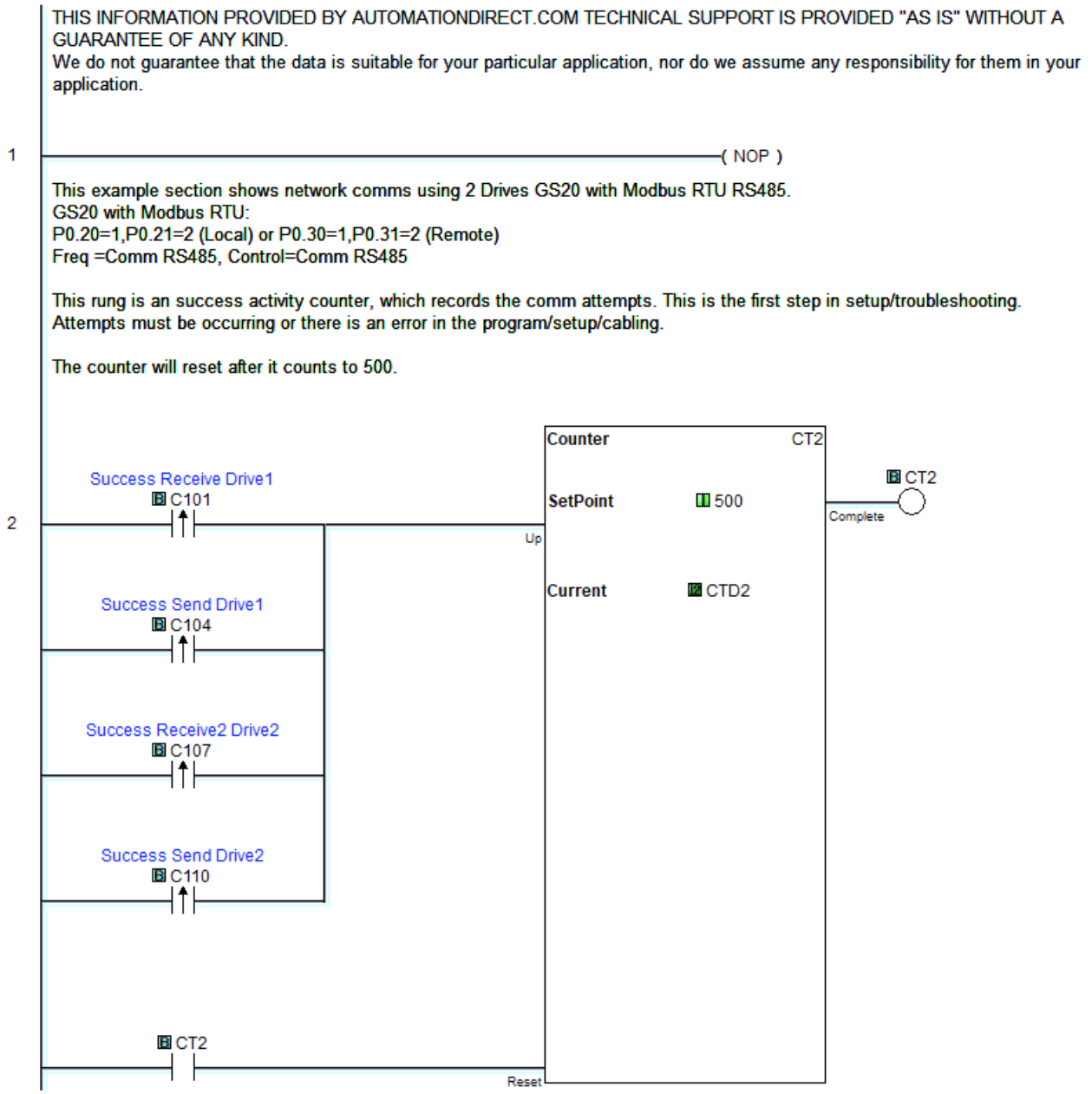
Modbus RTU CLICK Program Example

This example section shows CLICK ladder logic designed to show a method of establishing and monitoring network communications when using two GS20(X) drives with Modbus RTU.

NOTE: The PLC program can be downloaded from the support resources section of the GS20 drive item page on the AutomationDirect website.

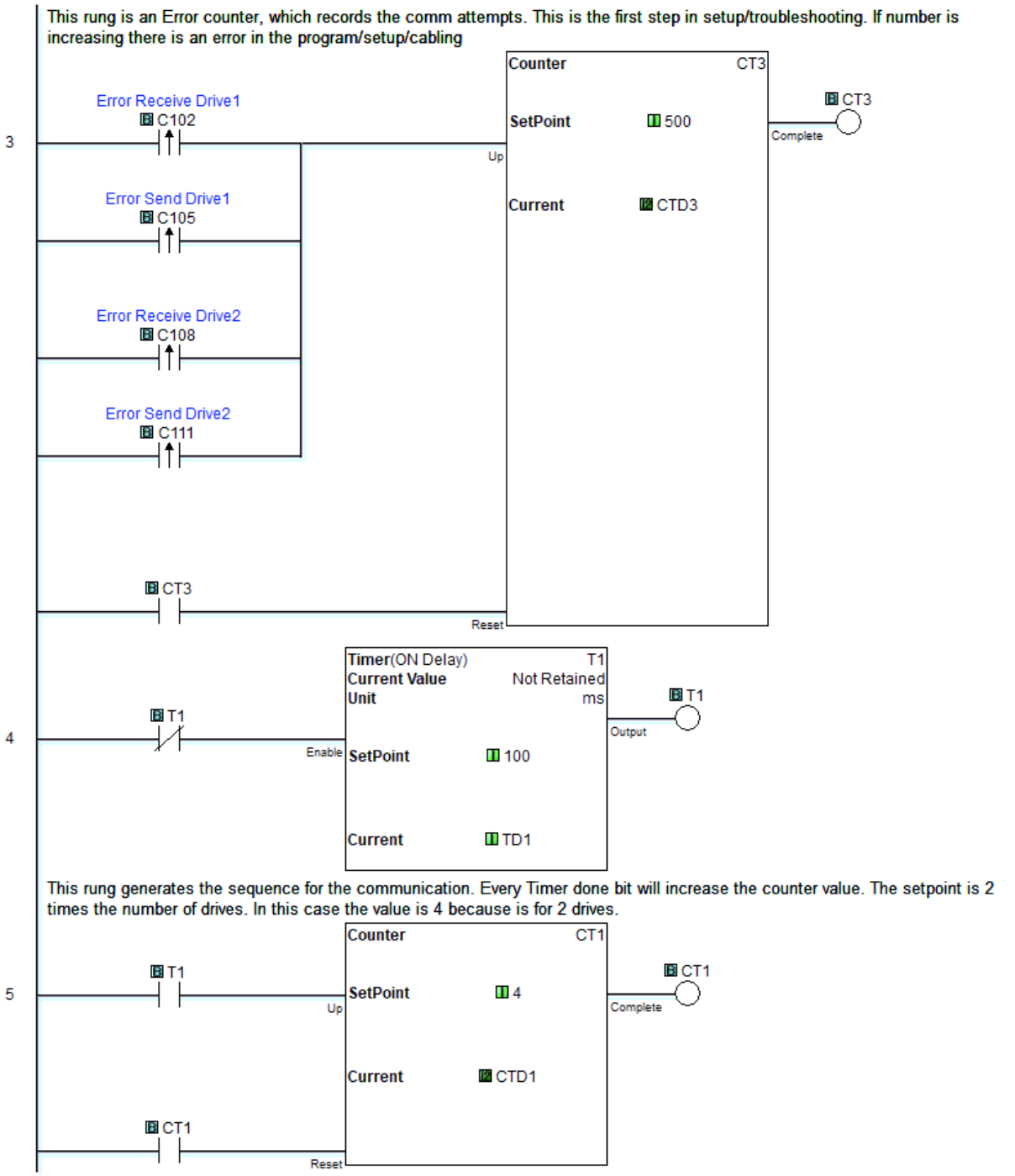
CLICK GS20 MODBUSRTU

Main Program(Page 1 of 7)



CLICK GS20 MODBUSRTU

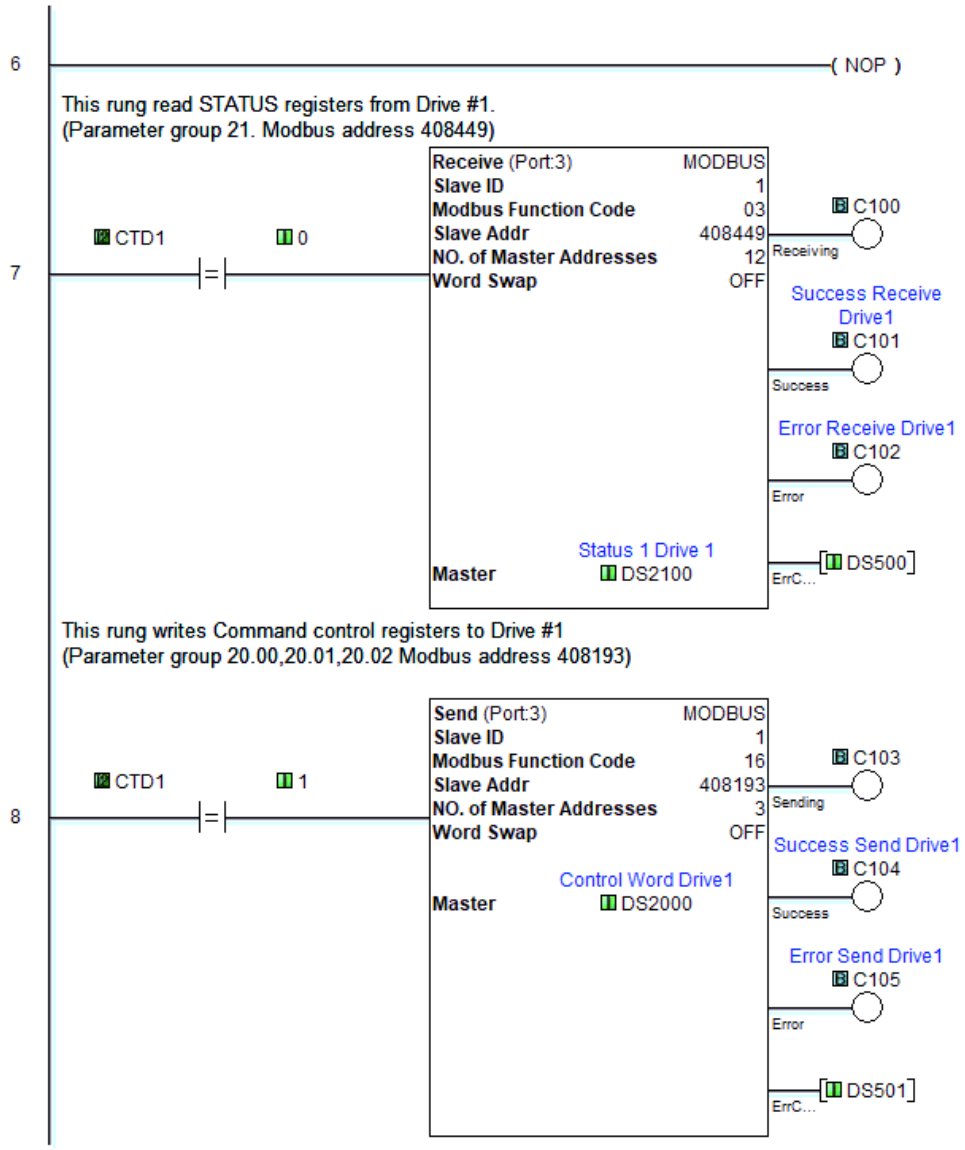
Main Program(Page 2 of 7)



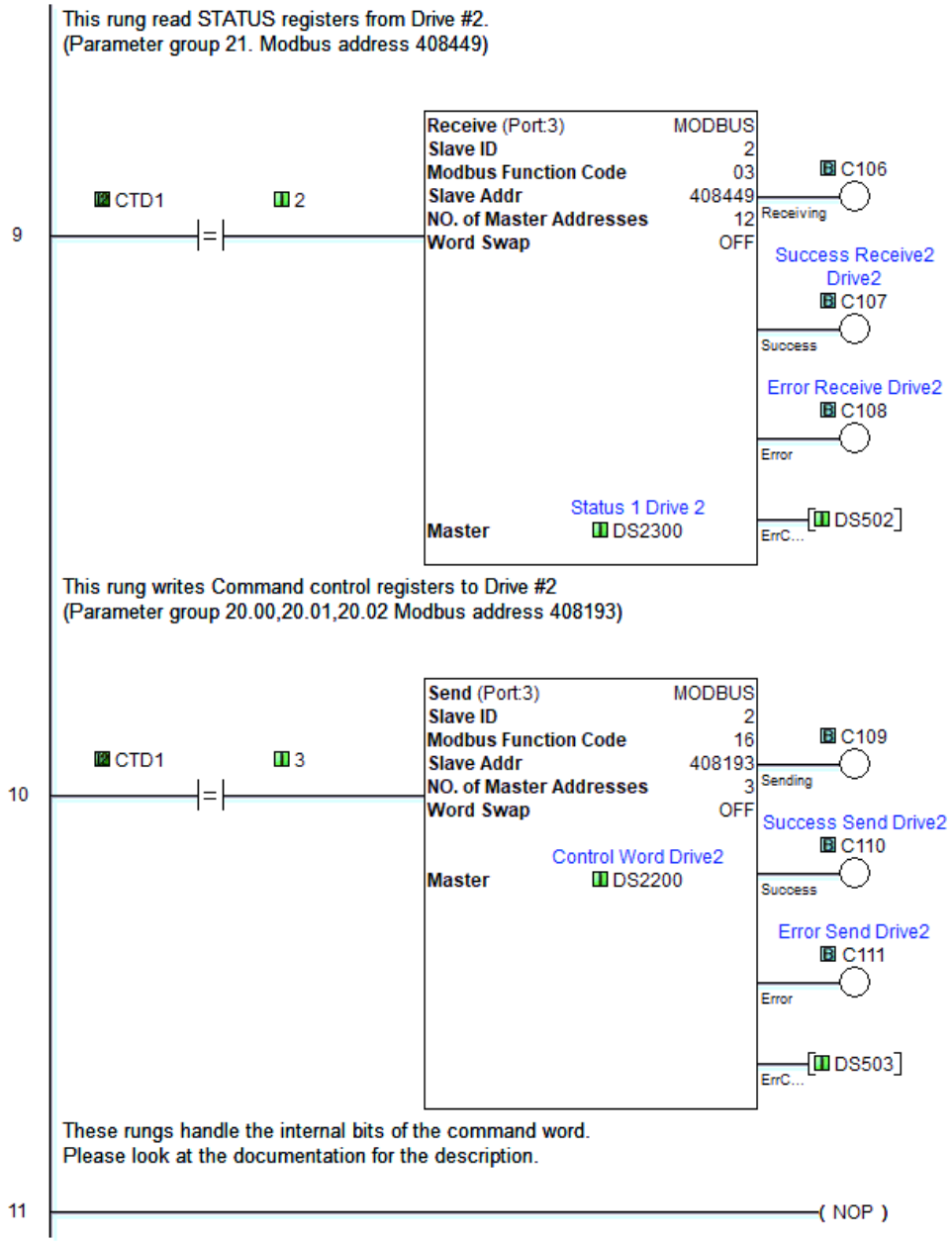
Page 2 of 7 (Total Pages)

CLICK GS20 MODBUSRTU

Main Program(Page 3 of 7)

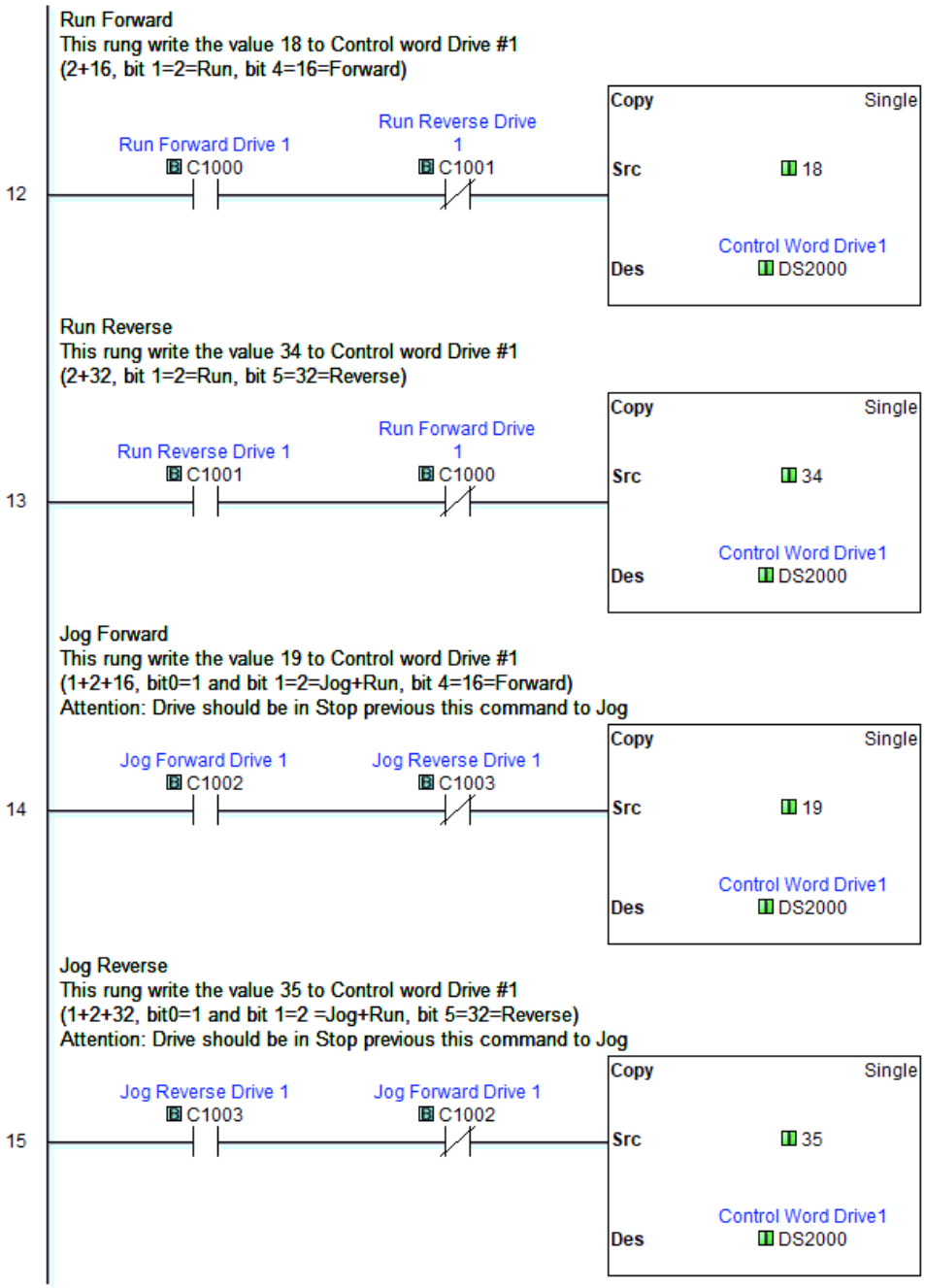


CLICK GS20 MODBUSRTU



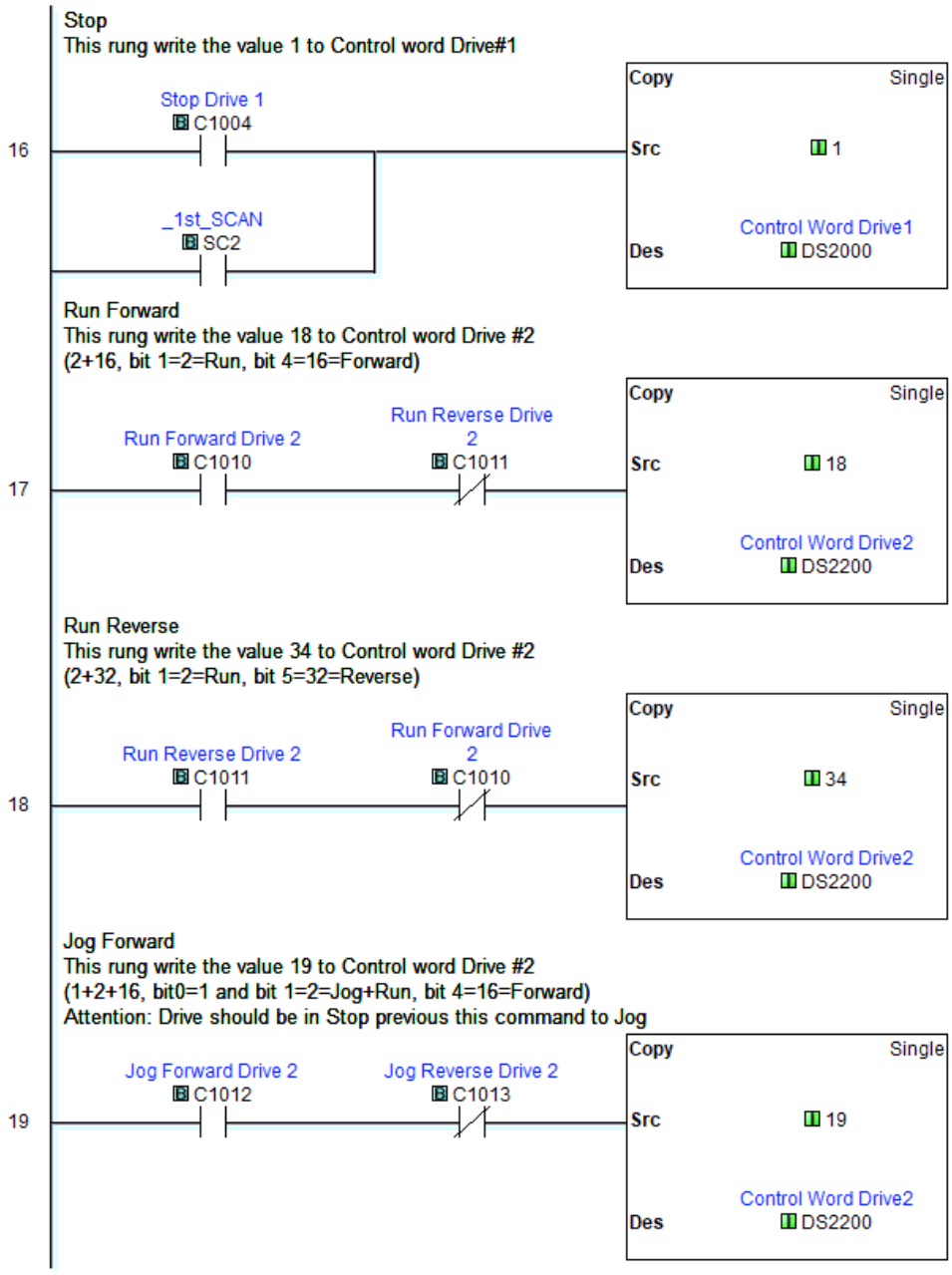
CLICK GS20 MODBUSRTU

Main Program(Page 5 of 7)



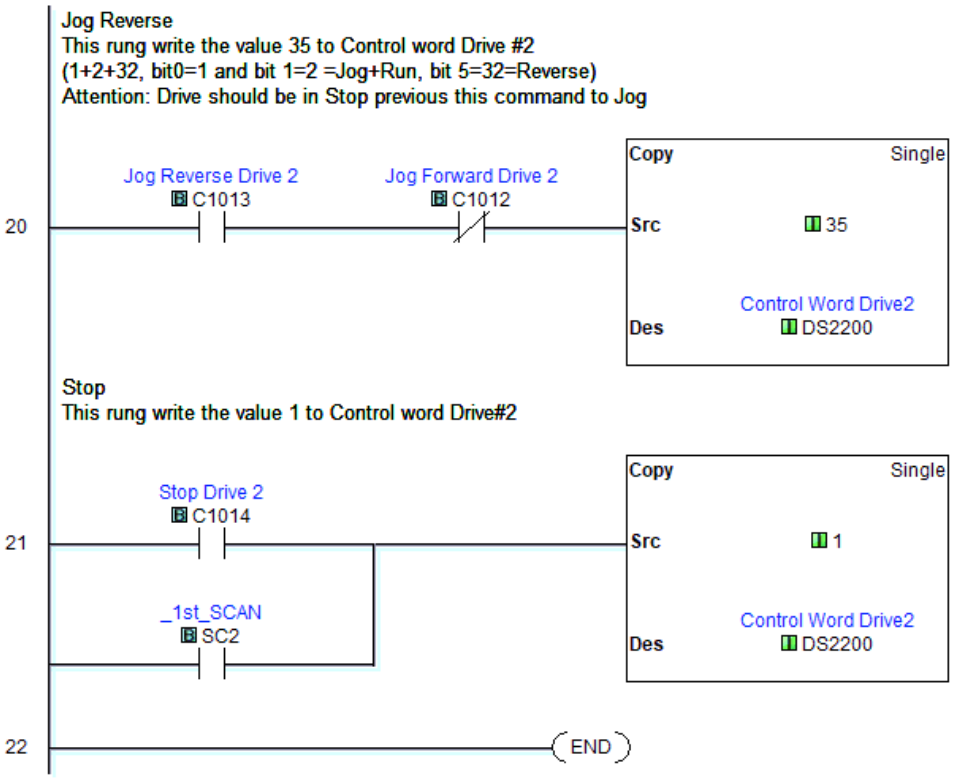
Page 5 of 7 (Total Pages)

CLICK GS20 MODBUSRTU



CLICK GS20 MODBUSRTU

Main Program(Page 7 of 7)



Page 7 of 7 (Total Pages)

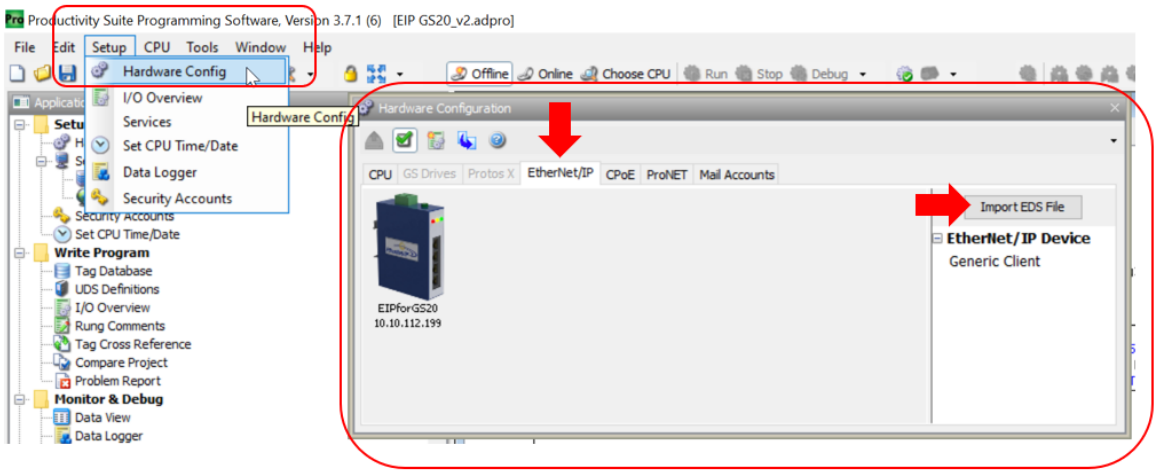
EtherNet/IP Productivity PLC Example

Use the following example to set up a GS20 drive EtherNet/IP configuration.

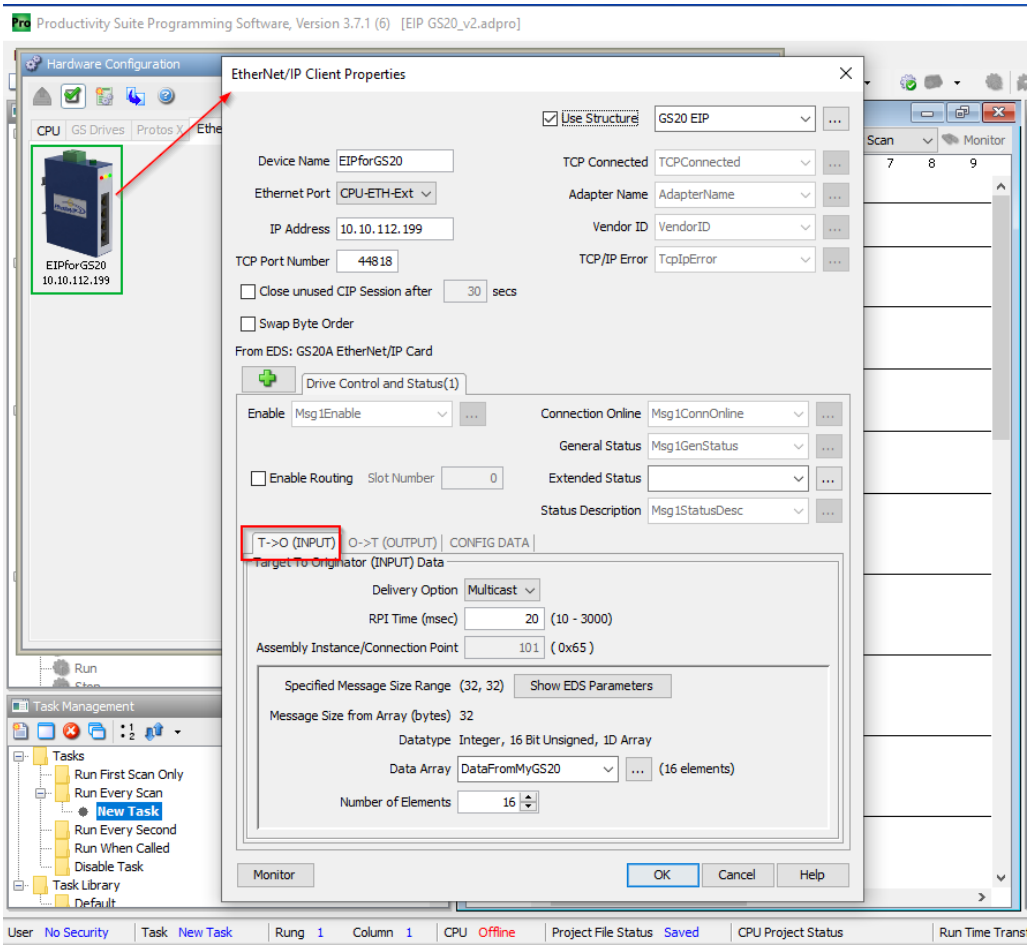
The first steps cover the hardware configuration setup, followed by the ladder logic code. This PLC example uses the GS20 EDS file for easy and quick configuration. The PLC program and EDS file can be downloaded from the GS20 support page.

https://support.automationdirect.com/products/gs20.html

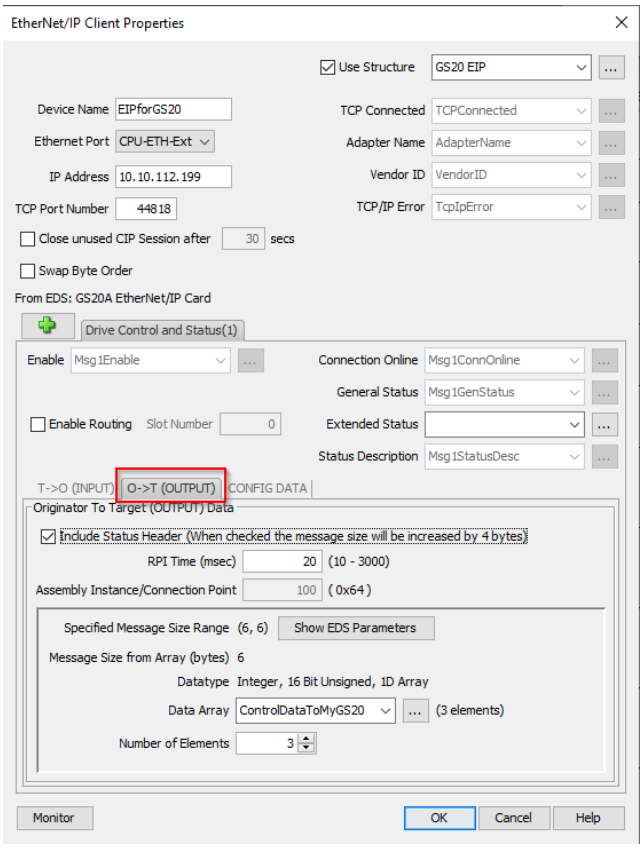
Step 1



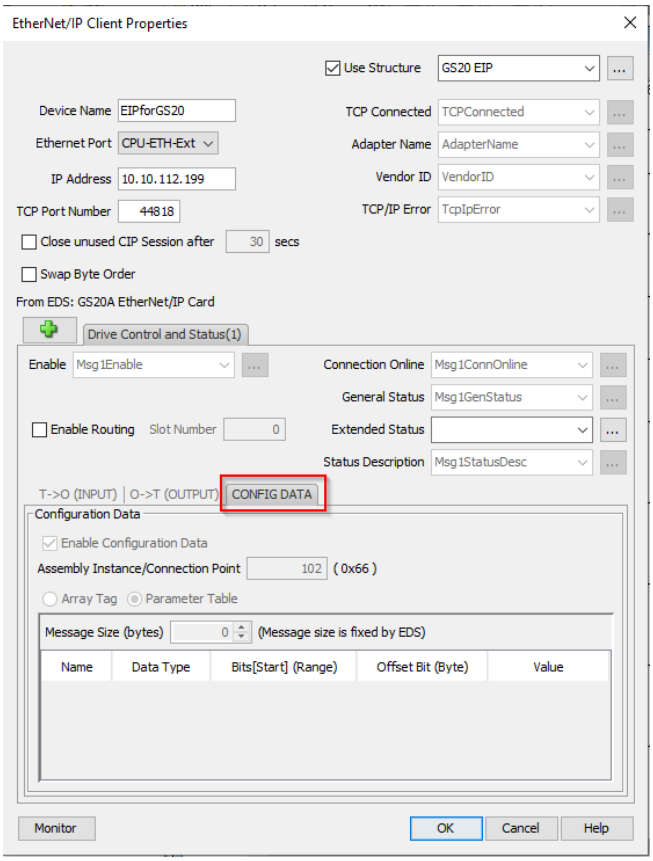
Step 2



Step 3


EtherNet/IP Client Properties
Use Structure
GS20 EIP
Device Name
EIPforGS20
Ethernet Port
CPU-ETH-Ext
IP Address
10.10.112.199
TCP Port Number
44818
Close unused CIP Session after
30
secs
Swap Byte Order
From EDS: GS20A EtherNet/IP Card
Drive Control and Status(1)
Enable
Msg1Enable
Enable Routing
Slot Number
0
TCP Connected
TCPConnected
Adapter Name
AdapterName
Vendor ID
VendorID
TCP/IP Error
TcpIpError
Connection Online
Msg1ConnOnline
General Status
Msg1GenStatus
Extended Status
Status Description
Msg1StatusDesc
T->O (INPUT)
O->T (OUTPUT)
CONFIG DATA
Originator To Target (OUTPUT) Data
Include Status Header (When checked the message size will be increased by 4 bytes)
RPI Time (msec)
20
(10 - 3000)
Assembly Instance/Connection Point
100
(0x64)
Specified Message Size Range (6, 6)
Show EDS Parameters
Message Size from Array (bytes) 6
Datatype Integer, 16 Bit Unsigned, 1D Array
Data Array
ControlDataToMyGS20
(3 elements)
Number of Elements
3
Monitor
OK
Cancel
Help

Step 4


EtherNet/IP Client Properties
Use Structure
GS20 EIP
Device Name
EIPforGS20
Ethernet Port
CPU-ETH-Ext
IP Address
10.10.112.199
TCP Port Number
44818
Close unused CIP Session after
30
secs
Swap Byte Order
From EDS: GS20A EtherNet/IP Card
Drive Control and Status(1)
Enable
Msg1Enable
Enable Routing
Slot Number
0
TCP Connected
TCPConnected
Adapter Name
AdapterName
Vendor ID
VendorID
TCP/IP Error
TcpIpError
Connection Online
Msg1ConnOnline
General Status
Msg1GenStatus
Extended Status
Status Description
Msg1StatusDesc
T->O (INPUT)
O->T (OUTPUT)
CONFIG DATA
Configuration Data
Enable Configuration Data
Assembly Instance/Connection Point
102
(0x66)
Array Tag
Parameter Table
Message Size (bytes)
0
(Message size is fixed by EDS)
Name
Data Type
Bits[Start] (Range)
Offset Bit (Byte)
Value
Monitor
OK
Cancel
Help

Use the following ladder logic code for GS20 ethernet communications.

Task: New Task Project: EIP GS20_v2.adpro Page 1 of 7

1 2 3 4 5 6 7 8 9 10

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the data is suitable for your particular application, nor
do we assume any responsibility for them in your
application.

1 ———————————————————————————

11

1> ————————(NOP)

1 2 3 4 5 6 7 8 9 10

This example section shows comms in GS20 with
EtherNet/IP implicit
The configuration for the GS20 Drive is done in
"Hardware Config" under the tab "Ethernet/IP"
When enabled the PLC and Drive will continuously
exchange data.
When using Ethernet/IP the names of registers
(Input/Output) are related to the PLC.
Data input means input from the PLC (output from
Drive). Data output means output from the PLC (input
from Drive)
Please read the documentation for Ethernet/IP card
GS20: P0.20=8/P0.21=5 or P0.30=8/P0.31=5
P9.74=1 (EIP)

2 ———————————————————————————

11

2> ————————(NOP)

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1 2 3 4 5 6 7 8 9 10

For Ethernet Configuration, go to Tool bar-
SETUP->HARDWARE CONFIGURATION. Click on the
EtherNet/IP tab. This example utilizes the GS20 EDS file
for setup of the configuration.

3 EIPEnable

11

3 > GS20 EIP.Msg1Enable (OUT)

1 2 3 4 5 6 7 8 9 10

4 EIPEnable

11

4 > Enable

COPY DATA
Source: Frequency Command
Destination: ControlDataToMyGS20(2)
Type: Copy Value

1 2 3 4 5 6 7 8 9 10

Basic Commands to GS20.
Attention: The contacts are considered to be
Momentary.
Attention: It is possible to execute "Run Forward" or
"Run Reverse" if the previous state is "Stop" or "Run
Forward" or "Run Reverse". If GS20 is in "Jog Forward"
it will not be executed
It is possible to execute "Jog Forward" or "Jog Reverse"
if the previous state is "Stop". If GS20 is in "Run
Forward" or "Run Reverse" it will not be executed

5

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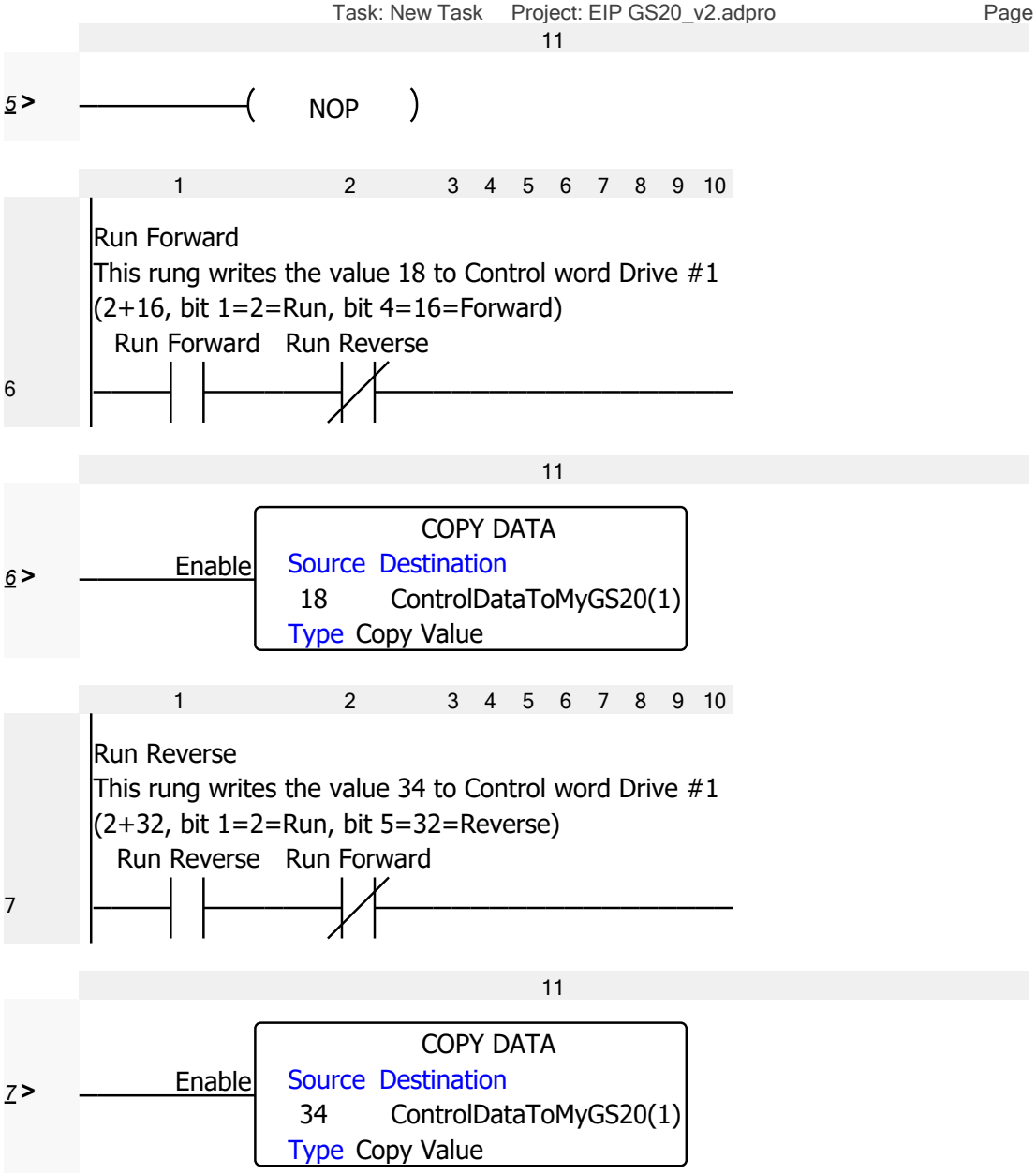
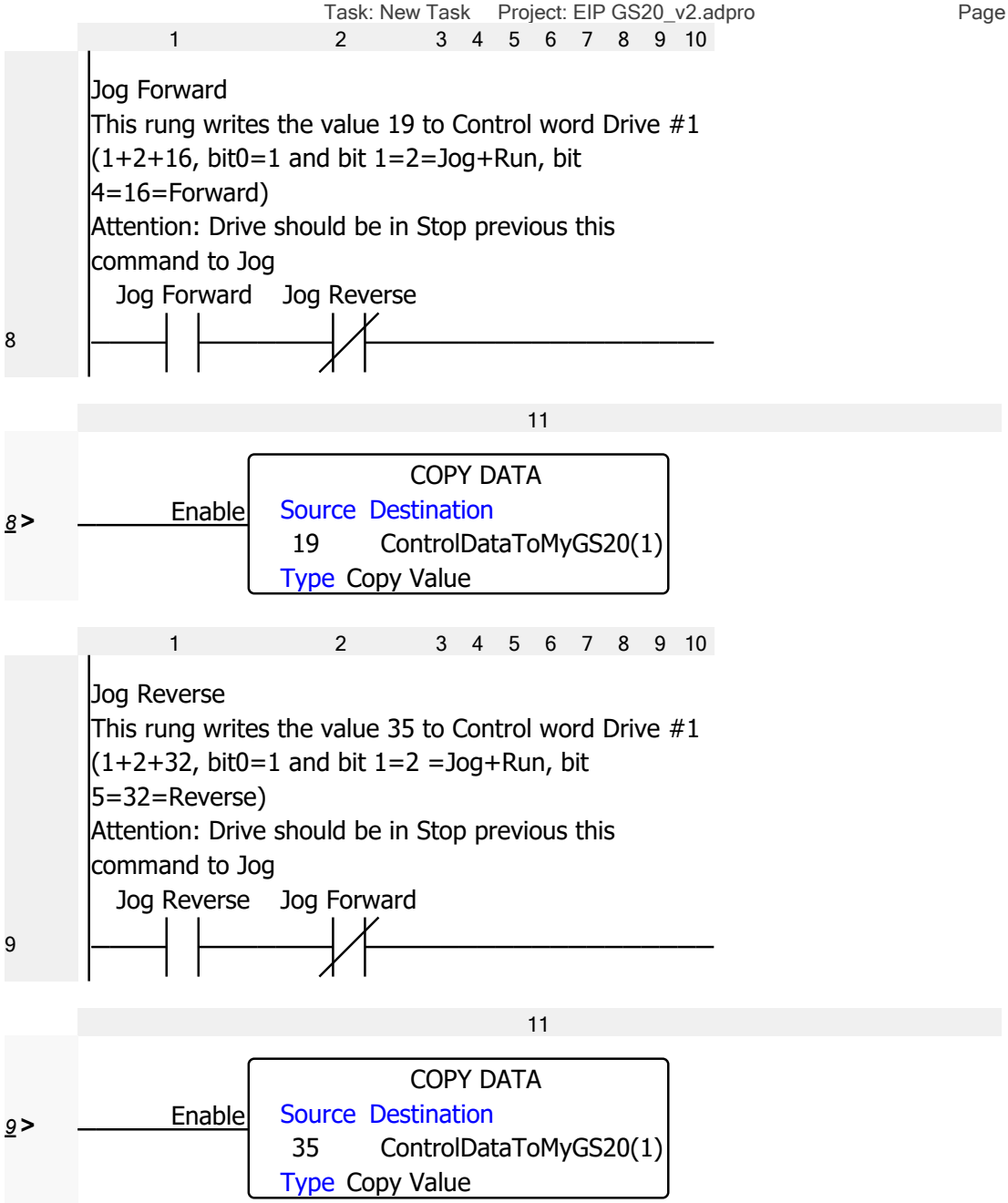

11
5>
NOP
1 2 3 4 5 6 7 8 9 10
Run Forward
This rung writes the value 18 to Control word Drive #1
(2+16, bit 1=2=Run, bit 4=16=Forward)
Run Forward
Run Reverse
6
11
6>
Enable
COPY DATA
Source Destination
18 ControlDataToMyGS20(1)
Type Copy Value
1 2 3 4 5 6 7 8 9 10
Run Reverse
This rung writes the value 34 to Control word Drive #1
(2+32, bit 1=2=Run, bit 5=32=Reverse)
Run Reverse
Run Forward
7
11
7>
Enable
COPY DATA
Source Destination
34 ControlDataToMyGS20(1)
Type Copy Value



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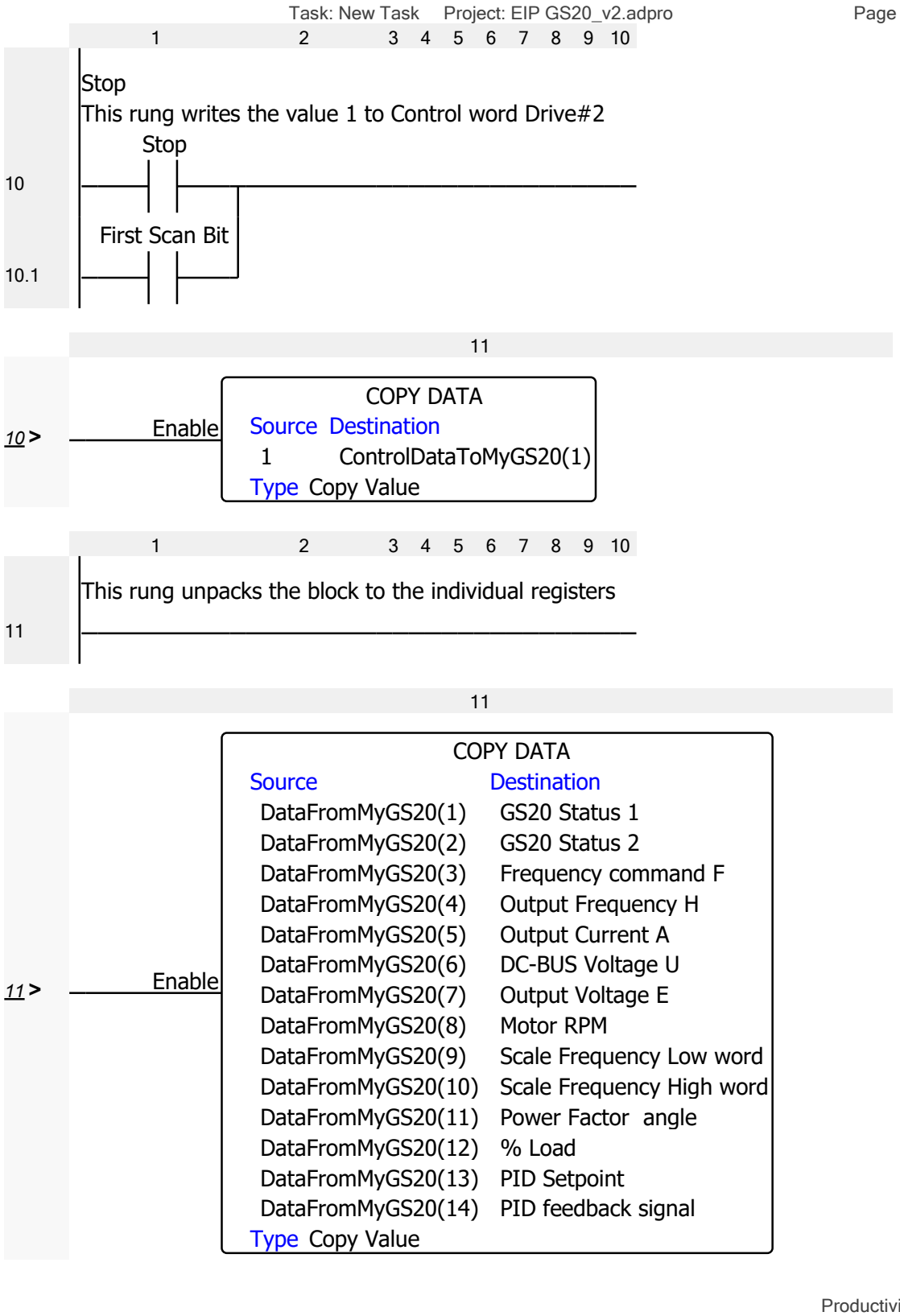
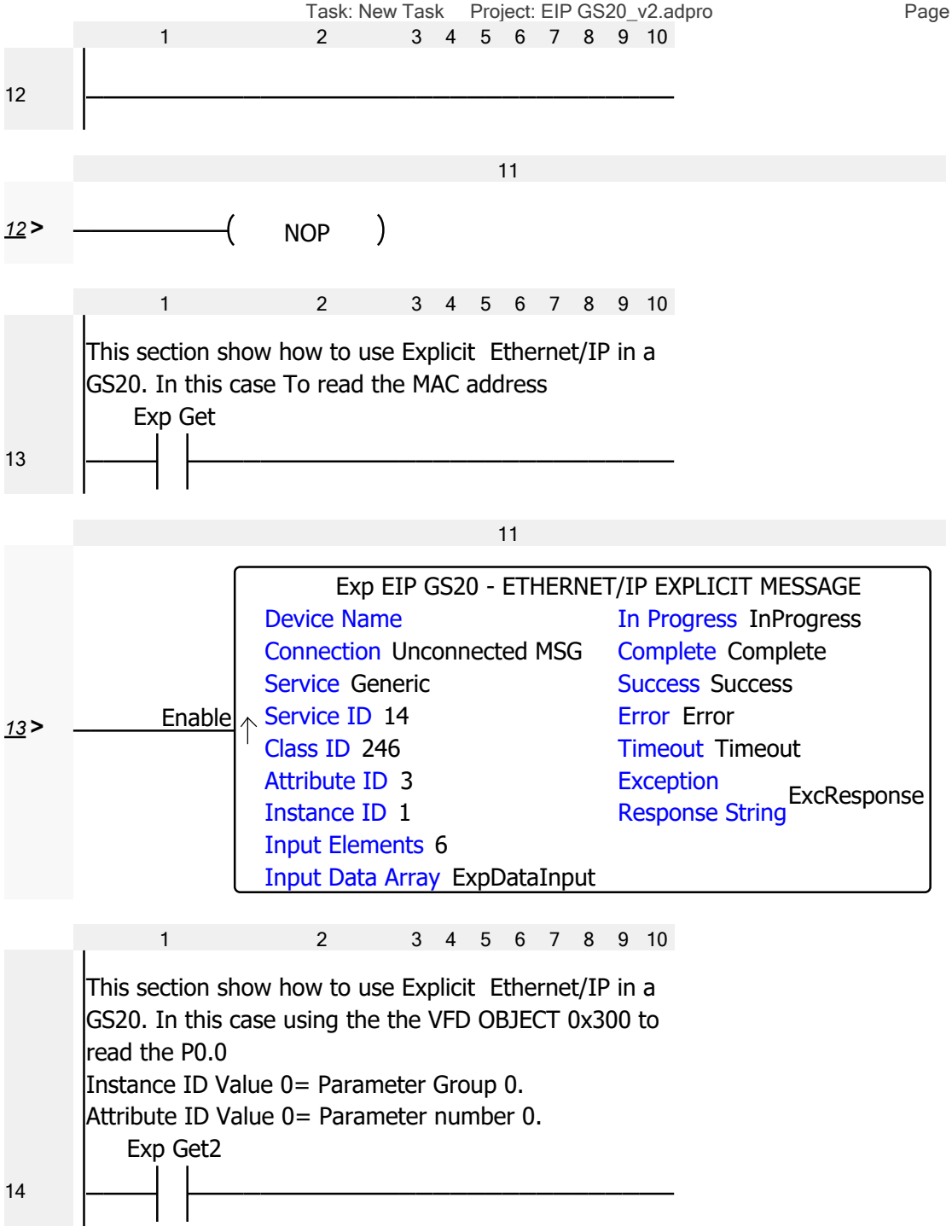
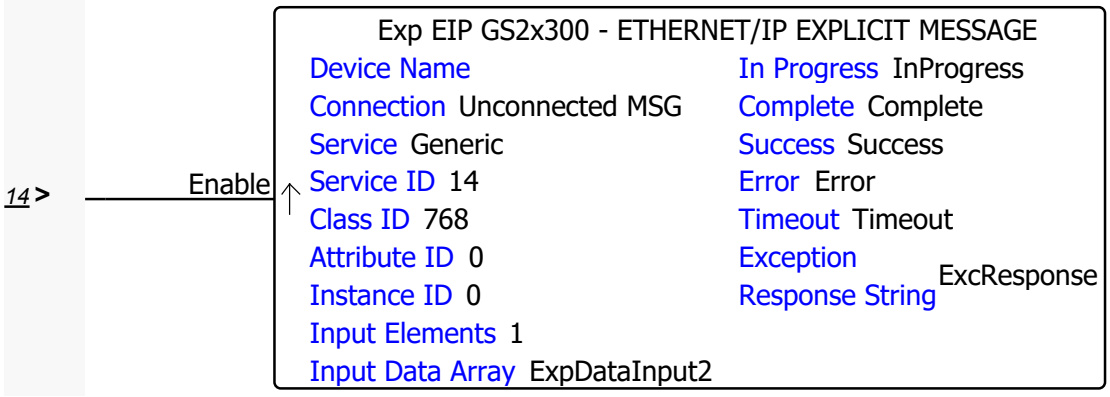

Task: New Task Project: EIP GS20_v2.adpro Page 5 of 7
1 2 3 4 5 6 7 8 9 10
Stop
This rung writes the value 1 to Control word Drive#2
Stop
10
First Scan Bit
10.1
11
10 >
Enable
COPY DATA
Source Destination
1 ControlDataToMyGS20(1)
Type Copy Value
1 2 3 4 5 6 7 8 9 10
This rung unpacks the block to the individual registers
11
11
11 >
Enable
COPY DATA
Source Destination
DataFromMyGS20(1) GS20 Status 1
DataFromMyGS20(2) GS20 Status 2
DataFromMyGS20(3) Frequency command F
DataFromMyGS20(4) Output Frequency H
DataFromMyGS20(5) Output Current A
DataFromMyGS20(6) DC-BUS Voltage U
DataFromMyGS20(7) Output Voltage E
DataFromMyGS20(8) Motor RPM
DataFromMyGS20(9) Scale Frequency Low word
DataFromMyGS20(10) Scale Frequency High word
DataFromMyGS20(11) Power Factor angle
DataFromMyGS20(12) % Load
DataFromMyGS20(13) PID Setpoint
DataFromMyGS20(14) PID feedback signal
Type Copy Value
Productivity1000


1 2 3 4 5 6 7 8 9 10
12
11
12 > NOP
1 2 3 4 5 6 7 8 9 10
This section show how to use Explicit Ethernet/IP in a GS20. In this case To read the MAC address
Exp Get
13
11
13 > Enable
Exp EIP GS20 - ETHERNET/IP EXPLICIT MESSAGE
Device Name
Connection Unconnected MSG
Service Generic
Service ID 14
Class ID 246
Attribute ID 3
Instance ID 1
Input Elements 6
Input Data Array ExpDataInput
In Progress InProgress
Complete Complete
Success Success
Error Error
Timeout Timeout
Exception
Response String ExcResponse
1 2 3 4 5 6 7 8 9 10
This section show how to use Explicit Ethernet/IP in a GS20. In this case using the the VFD OBJECT 0x300 to read the P0.0
Instance ID Value 0= Parameter Group 0.
Attribute ID Value 0= Parameter number 0.
Exp Get2
14

11



Productivity1000

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PAGE