GS2 MODBUS COMMUNICATIONS

CHAPTER 5

In This Chapter...

Communication Parameters Summary

A summary of the GS2 Communications Parameters is listed below. For a complete listing of the GS2 Parameter, refer to CHAPTER 4.

Communications Parameters			
GS2 Parameter	**Description**	**Range**	**Default**
P 9.00	Communication Address	01 to 254	01
P 9.01	Transmission Speed	00: 4800 baud 01: 9600 baud 02: 19200 baud 03: 38400 baud	01
P 9.02	Communication Protocol	00: Modbus ASCII mode 7 data bits,no parity,2 stop bits 01: Modbus ASCII mode 7 data bits,even parity,1 stop bit 02: Modbus ASCII mode 7 data bits,odd parity,1 stop bit 03: Modbus RTU mode 8 data bits,no parity,2 stop bits 04: Modbus RTU mode 8 data bits,even parity,1 stop bit 05: Modbus RTU mode 8 data bits,odd parity,1 stop bit	00
P 9.03	Transmission Fault Treatment	00: Display fault and continue operating 01: Display fault and RAMP to stop 02: Display fault and COAST to stop 03: No fault displayed and continue operating	00
P 9.04	Time Out Detection	00: Disable 01: Enable	00
P 9.05	Time Out Duration	0.1 to 60.0 seconds	0.5
◆ **P 9.07**	Parameter Lock	00: All parameters can be set and read 01: All parameters are read-only	00
P 9.08	Restore to Default	99: Restores all parameters to factory defaults	00
◆ **P 9.11**	Block Transfer Parameter 1	P0.00 to P8.01, P9.99	P 9.99
◆ **P 9.12**	Block Transfer Parameter 2	P0.00 to P8.01, P9.99	P 9.99
◆ **P 9.13**	Block Transfer Parameter 3	P0.00 to P8.01, P9.99	P 9.99
◆ **P 9.14**	Block Transfer Parameter 4	P0.00 to P8.01, P9.99	P 9.99
◆ **P 9.15**	Block Transfer Parameter 5	P0.00 to P8.01, P9.99	P 9.99
◆ **P 9.16**	Block Transfer Parameter 6	P0.00 to P8.01, P9.99	P 9.99
◆ **P 9.17**	Block Transfer Parameter 7	P0.00 to P8.01, P9.99	P 9.99

◆ **Parameter can be set during RUN Mode.**

Communications Parameters (continued)			
GS2 Parameter	**Description**	**Range**	**Default**
◆ **P 9.18**	Block Transfer Parameter 8	P0.00 to P8.01, P9.99	P 9.99
◆ **P 9.19**	Block Transfer Parameter 9	P0.00 to P8.01, P9.99	P 9.99
◆ **P 9.20**	Block Transfer Parameter 10	P0.00 to P8.01, P9.99	P 9.99
◆ **P 9.21**	Block Transfer Parameter 11	P0.00 to P8.01, P9.99	P 9.99
◆ **P 9.22**	Block Transfer Parameter 12	P0.00 to P8.01, P9.99	P 9.99
◆ **P 9.23**	Block Transfer Parameter 13	P0.00 to P8.01, P9.99	P 9.99
◆ **P 9.24**	Block Transfer Parameter 14	P0.00 to P8.01, P9.99	P 9.99
◆ **P 9.25**	Block Transfer Parameter 15	P0.00 to P8.01, P9.99	P 9.99
◆ **P 9.26**	Serial Comm Speed Reference	0.0 to 400.0 Hz	60.0
◆ **P 9.27**	Serial Comm RUN Command	00: Stop 01: Run	00
◆ **P 9.28**	Serial Comm Direction Command	00: Forward 01: Reverse	00
◆ **P 9.29**	Serial Comm External Fault	00: No fault 01: External fault	00
◆ **P 9.30**	Serial Comm Fault Reset	00: No action 01: Fault Reset	00
◆ **P 9.31**	Serial Comm JOG Command	00: Stop 01: Jog	00
P 9.39	Firmware Version	#.##	#.##
P 9.41	GS Series Number	01: GS1 02: GS2 03: GS3	##
P 9.42	Manufacturer Model Information	00: GS2-20P5 (230V 1ph/3ph 0.5hp) 01: GS2-21P0 (230V 1ph/3ph 1hp) 02: GS2-22P0 (230V 1ph/3ph 2hp) 03: GS2-23P0 (230V 1ph/3ph 3hp) 04: GS2-25P0 (230V 3ph 5hp) 05: GS2-27P5 (230V 3ph 7.5hp) 06: Reserved 07: GS2-41P0 (460V 3ph 1hp) 08: GS2-42P0 (460V 3ph 2hp) 09: GS2-43P0 (460V 3ph 3hp) 10: GS2-45P0 (460V 3ph 5hp) 11: GS2-47P5 (460V 3ph 7.5hp) 12: GS2-4010 (460V 3ph 10hp) 13: GS2-10P2 (115V 1ph 0.25hp) 14: GS2-10P5 (115V 1ph 0.5hp) 15: GS2-11P0 (115V 1ph 1hp) 16~20: Reserved 21: GS2-51P0 (575V 3ph 1hp) 22: GS2-52P0 (575V 3ph 2hp) 23: GS2-53P0 (575V 3ph 3hp) 24: GS2-55P0 (575V 3ph 5hp) 25: GS2-57P5 (575V 3ph 7.5hp) 26: GS2-5010 (575V 3ph 10hp)	##
◆ **Parameter can be set during RUN Mode.**			

GS2 Parameter Memory Addresses

Parameter Memory Addresses				
GS2 Parameter	**Description**	**Hexadecimal**	**Modbus Decimal**	**Octal**
Motor Parameter Addresses				
P 0.00	Motor Nameplate Voltage	0000	40001	0
P 0.01	Motor Nameplate Amps	0001	40002	1
P 0.02	Motor Base Frequency	0002	40003	2
P 0.03	Motor Base RPM	0003	40004	3
P 0.04	Motor Maximum RPM	0004	40005	4
Ramp Parameter Addresses				
P 1.00	Stop Methods	0100	40257	400
◆ **P 1.01**	Acceleration Time 1	0101	40258	401
◆ **P 1.02**	Deceleration Time 1	0102	40259	402
P 1.03	Accel S-curve	0103	40260	403
P 1.04	Decel S-curve	0104	40261	404
◆ **P 1.05**	Acceleration Time 2	0105	40262	405
◆ **P 1.06**	Deceleration Time 2	0106	40263	406
P 1.07	Select method to use 2nd Accel/Decel	0107	40264	407
P 1.08	Accel 1 to Accel 2 frequency transition	0108	40265	410
P 1.09	Decel 2 to Decel 1frequency transition	0109	40266	411
P 1.10	Skip Frequency 1	010A	40267	412
P 1.11	Skip Frequency 2	010B	40268	413
P 1.12	Skip Frequency 3	010C	40269	414
P 1.17	Skip Frequency Band	0111	40274	421
P 1.18	DC Injection Current Level	0112	40275	422
P 1.20	DC Injection during Start-up	0114	40277	424
P 1.21	DC Injection during Stopping	0115	40278	425
P 1.22	Start-point for DC Injection	0116	40279	426
Volts/Hertz Parameter Addresses				
P 2.00	Volts/Hertz Settings	0200	40513	1000
◆ **P 2.01**	Slip Compensation	0201	40514	1001
◆ **P 2.02**	Auto-torque Boost	0202	40515	1002
P 2.04	Mid-point Frequency	0204	40517	1004
P 2.05	Mid-point Voltage	0205	40518	1005
P 2.06	Min. Output Frequency	0206	40519	1006
P 2.07	Min. Output Voltage	0207	40520	1007
P 2.08	PWM Carrier Frequency	0208	40521	1010

◆ **Parameter can be set during RUN Mode.**

Parameter Memory Addresses (continued)				
GS2 Parameter	Description	Hexadecimal	Modbus Decimal	Octal
Digital Parameter Addresses				
P 3.00	Source of Operation Command	0300	40769	1400
P 3.01	Multi-function Input Terminals (DI1 - DI2)	0301	40770	1401
P 3.02	Multi-function Input (DI3)	0302	40771	1402
P 3.03	Multi-function Input (DI4)	0303	40772	1403
P 3.04	Multi-function Input (DI5)	0304	40773	1404
P 3.05	Multi-function Input (DI6)	0305	40774	1405
P 3.11	Multi-Function Output Terminal 1	030B	40780	1413
P 3.12	Multi-Function Output Terminal 2	030C	40781	1414
◆ **P 3.16**	Desired Frequency	0310	40785	1420
◆ **P 3.17**	Desired Current	0311	40786	1421
◆ **P 3.18**	PID Deviation Level	0312	40787	1422
◆ **P 3.19**	PID Deviation Time	0313	40788	1423
Analog Parameter Addresses				
P 4.00	Source of Frequency Command	0400	41025	2000
P 4.01	Analog Input Offset Polarity	0401	41026	2001
◆ **P 4.02**	Analog Input Offset	0402	41027	2002
◆ **P 4.03**	Analog Input Gain	0403	41028	2003
P 4.04	Analog Input Reverse Motion Enable	0404	41029	2004
P 4.05	Loss of ACI Signal (4-20mA)	0405	41030	2005
◆ **P 4.11**	Analog Output Signal	040B	41036	2013
◆ **P 4.12**	Analog Output Gain	040C	41037	2014
Presets Parameter Addresses				
◆ **P 5.00**	Jog	0500	41281	2400
◆ **P 5.01**	Multi-Speed 1	0501	41282	2401
◆ **P 5.02**	Multi-Speed 2	0502	41283	2402
◆ **P 5.03**	Multi-Speed 3	0503	41284	2403
◆ **P 5.04**	Multi-Speed 4	0504	41285	2404
◆ **P 5.05**	Multi-Speed 5	0505	41286	2405
◆ **P 5.06**	Multi-Speed 6	0506	41287	2406
◆ **P 5.07**	Multi-Speed 7	0507	41288	2407

◆ **Parameter can be set during RUN Mode.**

Parameter Memory Addresses (continued)				
GS2 Parameter	**Description**	**Hexadecimal**	**Modbus Decimal**	**Octal**
Protection Parameter Addresses				
P 6.00	Electronic Thermal Overload Relay	0600	41537	3000
P 6.01	Auto Restart after Fault	0601	41538	3001
P 6.02	Momentary Power Loss	0602	41539	3002
P 6.03	Reverse Operation Inhibit	0603	41540	3003
P 6.04	Auto Voltage Regulation	0604	41541	3004
P 6.05	Over-VoltageTrip Protection	0605	41542	3005
P 6.06	Auto Adjustable Accel/Decel	0606	41543	3006
P 6.07	Over-Torque Detection Mode	0607	41544	3007
P 6.08	Over-Torque Detection Level	0608	41545	3010
P 6.09	Over-Torque Detection Time	0609	41546	3011
P 6.10	Over-Current Stall Prevention during Acceleration	060A	41547	3012
P 6.11	Over-Current Stall Prevention during Operation	060B	41548	3013
P 6.12	Maximum Allowable Power Loss Time	060C	41549	3014
P 6.13	Base-Block Time for Speed Search	060D	41550	3015
P 6.14	Maximum Speed Search Current Level	060E	41551	3016
P 6.15	Upper Bound of Output Frequency	060F	41552	3017
P 6.16	Lower Bound of Output Frequency	0610	41553	3020
P 6.31	Present Fault Record	061F	41568	3037
P 6.32	Second Most Recent Fault Record	0620	41569	3040
P 6.33	Third Most Recent Fault Record	0621	41570	3041
P 6.34	Fourth Most Recent Fault Record	0622	41571	3042
P 6.35	Fifth Most Recent Fault Record	0623	41572	3043
P 6.36	Sixth Most Recent Fault Record	0624	41573	3044
◆ Parameter can be set during RUN Mode.				

Parameter Memory Addresses (continued)				
GS2 Parameter	**Description**	**Hexadecimal**	**Modbus Decimal**	**Octal**
PID Parameter Addresses				
P 7.00	Input Terminal for PID Feedback	0700	41793	3400
P 7.01	PV 100% Value	0701	41794	3401
P 7.02	PID Setpoint Source	0702	41795	3402
◆ **P 7.10**	Keypad PID Setpoint	070A	41803	3412
◆ **P 7.11**	PID Multi-setpoint 1	070B	41804	3413
◆ **P 7.12**	PID Multi-setpoint 2	070C	41805	3414
◆ **P 7.13**	PID Multi-setpoint 3	070D	41806	3415
◆ **P 7.14**	PID Multi-setpoint 4	070E	41807	3416
◆ **P 7.15**	PID Multi-setpoint 5	070F	41808	3417
◆ **P 7.16**	PID Multi-setpoint 6	0710	41809	3420
◆ **P 7.17**	PID Multi-setpoint 7	0711	41810	3421
◆ **P 7.20**	Proportional Control	0714	41813	3424
◆ **P 7.21**	Integral Control	0715	41814	3425
◆ **P 7.22**	Derivative Control	0716	41815	3426
P 7.23	Upper Bound for Integral Control	0717	41816	3427
P 7.24	Derivative Filter Time Constant	0718	41817	3430
P 7.25	PID Output Frequency Limit	0719	41818	3431
P 7.26	Feedback Signal Detection Time	071A	41819	3432
P 7.27	PID Feedback Loss	071B	41820	3433
Display Parameter Addresses				
◆ **P 8.00**	User Defined Display Function	0800	42049	4000
◆ **P 8.01**	Frequency Scale Factor	0801	42050	4001
◆ **Parameter can be set during RUN Mode.**				

Parameter Memory Addresses (continued)				
GS2 Parameter	**Description**	**Hexadecimal**	**Modbus Decimal**	**Octal**
Communications Parameter Addresses				
P 9.00	Communication Address	0900	42305	4400
P 9.01	Transmission Speed	0901	42306	4401
P 9.02	Communication Protocol	0902	42307	4402
P 9.03	Transmission Fault Treatment	0903	42308	4403
P 9.04	Time Out Detection	0904	42309	4404
P 9.05	Time Out Duration	0905	42310	4405
◆ **P 9.07**	Parameter Lock	0907	42312	4407
P 9.08	Restore to Default	0908	42313	4410
◆ **P 9.11**	Block Transfer Parameter 1	090B	42316	4413
◆ **P 9.12**	Block Transfer Parameter 2	090C	42317	4414
◆ **P 9.13**	Block Transfer Parameter 3	090D	42318	4415
◆ **P 9.14**	Block Transfer Parameter 4	090E	42319	4416
◆ **P 9.15**	Block Transfer Parameter 5	090F	42320	4417
◆ **P 9.16**	Block Transfer Parameter 6	0910	42321	4420
◆ **P 9.17**	Block Transfer Parameter 7	0911	42322	4421
◆ **P 9.18**	Block Transfer Parameter 8	0912	42323	4422
◆ **P 9.19**	Block Transfer Parameter 9	0913	42324	4423
◆ **P 9.20**	Block Transfer Parameter 10	0914	42325	4424
◆ **P 9.21**	Block Transfer Parameter 11	0915	42326	4425
◆ **P 9.22**	Block Transfer Parameter 12	0916	42327	4426
◆ **P 9.23**	Block Transfer Parameter 13	0917	42328	4427
◆ **P 9.24**	Block Transfer Parameter 14	0918	42329	4430
◆ **P 9.25**	Block Transfer Parameter 15	0919	42330	4431
◆ **P 9.26**	Serial Comm Speed Reference	091A	42331	4432
◆ **P 9.27**	Serial Comm RUN Command	091B	42332	4433
◆ **P 9.28**	Serial Comm Direction Command	091C	42333	4434
◆ **P 9.29**	Serial Comm External Fault	091D	42334	4435
◆ **P 9.30**	Serial Comm Fault Reset	091E	42335	4436
◆ **P 9.31**	Serial Comm JOG Command	091F	42336	4437
P 9.41	GS Series Number	0929	42346	4451
P 9.42	Manufacturer Model Information	092A	42347	4452

◆ **Parameter can be set during RUN Mode.**

GS2 Status Addresses

The GS2 Series AC drive has status memory addresses that are used to monitor the AC drive. The status addresses and value definitions are listed below.

Status Addresses (Read Only)

GS2 Status Addresses			
Description	**Hexadecimal**	**Modbus Decimal**	**Octal**
Status Monitor 1	2100	48449	20400
Status Monitor 2	2101	48450	20401
Frequency Command F	2102	48451	20402
Output Frequency H	2103	48452	20403
Output Current A	2104	48453	20404
DC Bus Voltage d	2105	48454	20405
Output Voltage U	2106	48455	20406
Motor RPM	2107	48456	20407
Scale Frequency (Low Word)	2108	48457	20410
Scale Frequency (High Word)	2109	48458	20411
Power Factor Angle	210A	48459	20412
% Load	210B	48460	20413
Firmware Version	2110	48465	20420

Status Monitor 1 h2100

Error Codes:

00: No fault occurred
01: Over-current(oc)
02: Over-voltage(ov)
03: Overheat (oH)
04: Overload (oL)
05: Overload 1 (oL1)
06: Overload 2 (oL2)
07: External Fault (EF)
08: CPU failure 1 (cF1)
09: CPU failure 2 (cF2)
10: CPU failure 3 (cF3)
11: Hardware Protection Failure (HPF)
12: Over-current during accel (ocA)
13: Over-current during decel (ocd)
14: Over-current during steady state (ocn)
15: Ground fault or fuse failure (GFF)
16: Low voltage (Lv)
17: Input power 3-phase loss (PHL)
18: External Base-Block (bb)
19: Auto adjust accel/decel failure (cFA)
20: Software protection code (codE)

Status Monitor 2 h2101

GS2 Memory Address (hexadecimal) / GS2 Memory Data (binary)

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Bits
2101	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	
	32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1	Bit Values (decimal)

Status Monitor 2 - Memory Address h2101		
Address Bit(s)	**Bit(s) Value Binary (Decimal)**	**AC Drive Status**
0 and 1	00 (0)	Drive operation stopped (STOP)
	01 (1)	Run to Stop transition
	10 (2)	Standby
	11 (3)	Drive operation running (RUN)
2	1 (4)	JOG active
3 and 4	00 (0)	Rotational direction forward (FWD)
	01 (8)	REV to FWD transition
	10 (16)	FWD to REV transition
	11 (24)	Rotational direction reverse (REV)
5	1 (32)	Source of frequency determined by serial comm interface (P4.00 = 5)
6	1 (64)	Source of frequency determined by AI terminal (P4.00 = 2, 3, or 4)
7	1 (128)	Source of operation determined by serial comm interface (P3.00 = 3 or 4)
8	1 (256)	Parameters have been locked (9-07 = 1)
9 to 15	N/A	Reserved

Frequency Command F (XXX.X) h2102

Status location for the frequency setting of the AC drive.

Output Frequency H (XXX.X) h2103

Status location for the actual operating frequency present at the T1, T2, and T3 terminal.

Output Current A h2104

Status location for the output current present at the T1, T2, and T3 terminals.

DC-BUS Voltage d (XXX.X) h2105

Status location for the DC Bus Voltage.

Output Voltage U (XXX.X) h2106

Status location for the output voltage present at the T1, T2, and T3 terminals.

Motor RPM h2107

Status location for the present estimated speed of the motor.

Scale Frequency (Low word) h2108

Status location for result of output frequency x P 8.01 (low word).

Scale Frequency (High word) h2109

Status location for result of output frequency x P 8.01 (high word).

Power Factor Angle h210A

Status location for the power factor angle.

% Load h210B

Status location for the amount of load on the AC drive. (Output Current ÷ Drive Rated Current) x 100.

Firmware Version h2110

Status location for the firmware version of the AC drive.

Communicating with *Direct*LOGIC PLCs

The following steps explain how to connect to and communicate with the GS2 Series AC drives using ***Direct***LOGIC PLCs.

Step 1: Choose the Appropriate CPU.

The GS2 Series AC drives will communicate with the following ***Direct***LOGIC CPUs using Modbus communications:

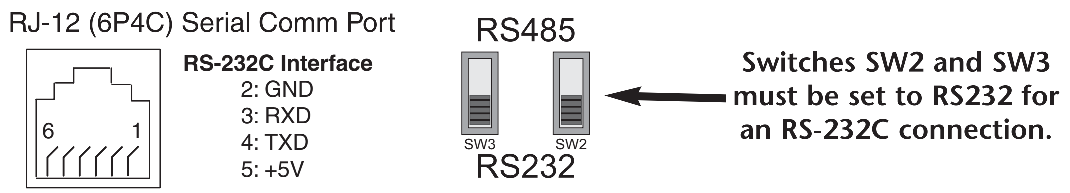
- DL05
- DL06
- DL250(-1)
- DL260
- DL350
- DL450

Step 2: Make the Connections

First you must decide what type of interface will work best for your application. The GS2 Comm Port can accomodate an RS-232C or an RS-485 connection.

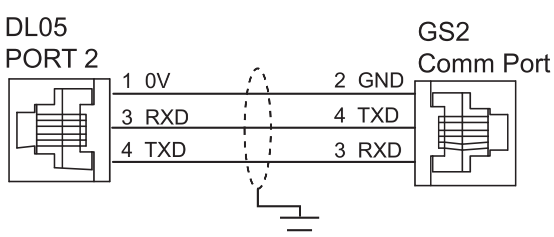
RS-232C

An RS-232C connection is somewhat limited. The maximum RS-232C network cable length is 15 meters (50 feet). In addition, using the RS-232C interface will allow you to connect an AC drive to only one PLC. For an RS-232C connection, set the GS2 DIP switches SW2 and SW3 to RS232.

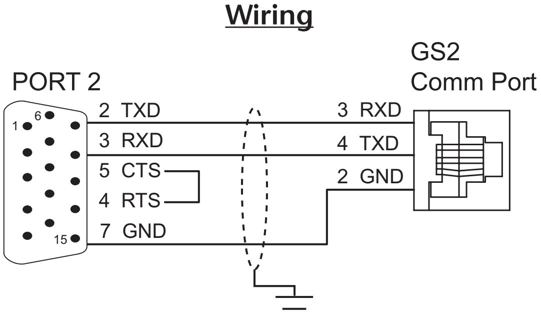


Use the following wiring diagrams to connect your ***Direct***LOGIC PLC to a GS2 Series AC drive with an RS-232C interface:

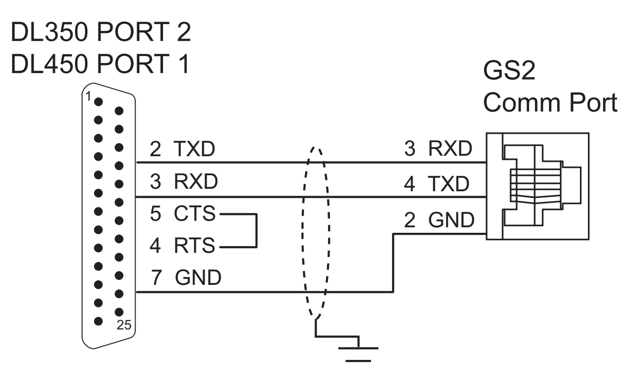
DL05: RS-232C Connection Wiring



DL06/DL250/DL260: RS-232C Connection Wiring

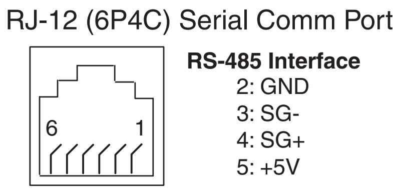


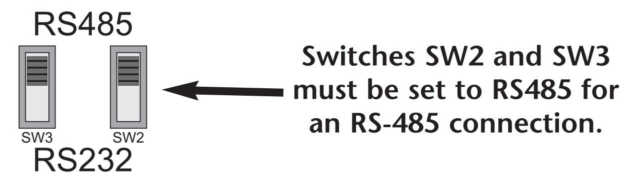
DL350/DL450: RS-232C Connection Wiring



RS-232C to RS-485 Conversion

An RS-485 network cable can span up to 1000 meters (4000 feet). However, most ***Direct***LOGIC PLCs require an FA-ISOCON (RS-232C to RS-422/485 network adapter) in order to make this type of connection. For an RS-485 connection, set the GS2 DIP switches SW2 and SW3 to RS485.

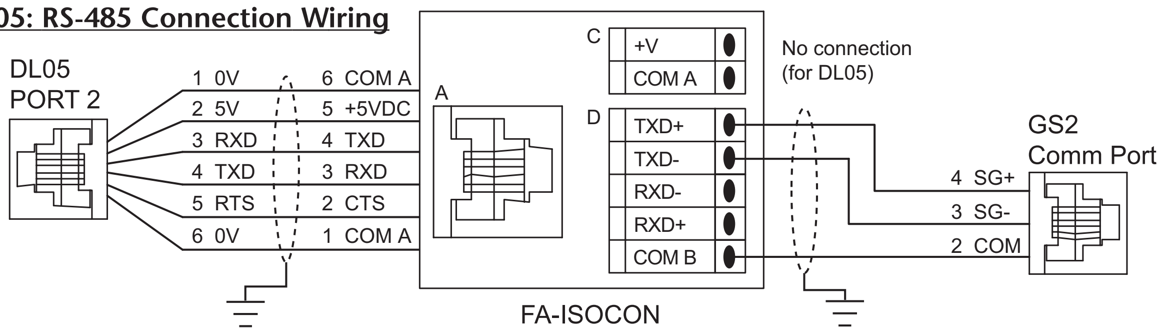




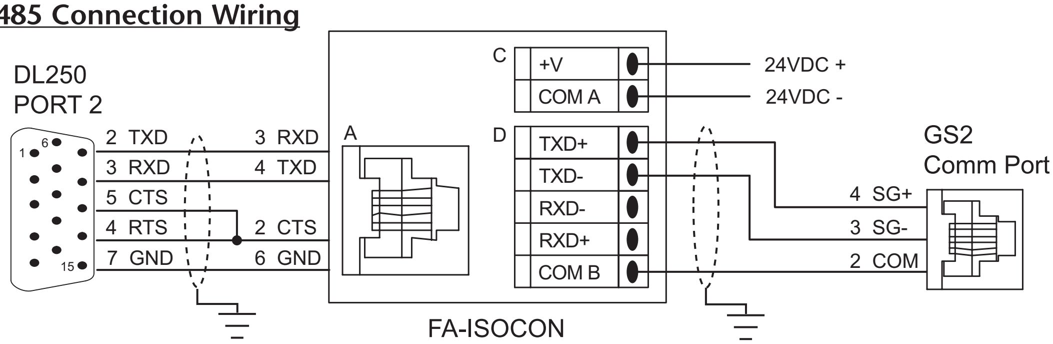
Use the following wiring diagrams to connect your ***Direct***LOGIC PLC to a GS2 Series AC drive with an RS-485 interface:

Note: If an FA-ISOCON module is used in your connection, set the module dipswitches S21 = ON; S22 - S27 = OFF; TERMINATE, BIAS, and DPX = ON. Refer to FA-ISOCON manual for more detailed information.

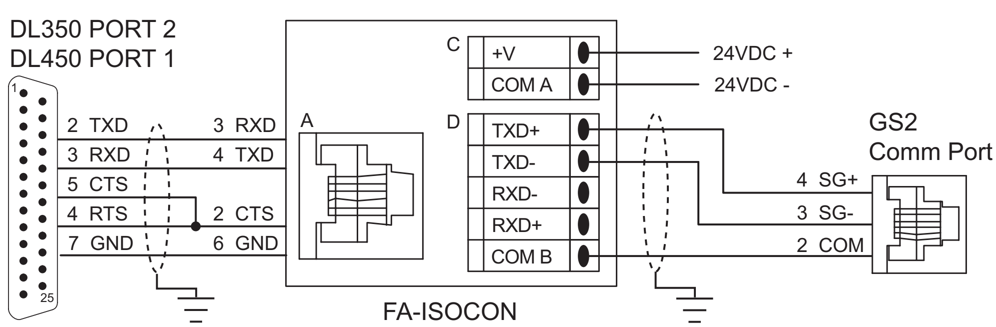
DL05: RS-485 Connection Wiring



DL250: RS-485 Connection Wiring

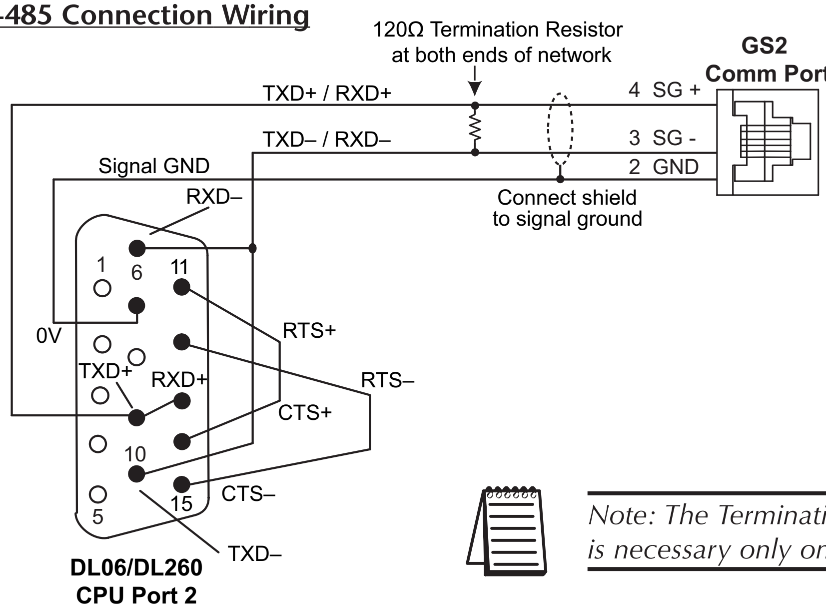


DL350/DL450: RS-485 Connection Wiring



RS-485

DL06/DL260: RS-485 Connection Wiring



Note: The Termination Resistor is necessary only on large runs.

Step 3: Set AC Drive Parameters

The following parameters need to be set as shown in order to communicate properly.

P 3.00: 03 or 04 – Operation Determined by RS-232C/RS-485 interface. Keypad STOP is enabled (03) or disabled (04).

P 4.00: 05 – Frequency determined by RS-232/RS-485 communication interface

P 9.00: xx – Communication address 1-254 (unique for each device, see P 9.00)

P 9.01: 01 – 9600 baud data transmission speed

P 9.02: 05 – Modbus RTU mode <8 data bits, odd parity, 1 stop bit>

*Note: The previous list of parameter settings is the minimum required to communicate with a **Direct**LOGIC PLC. There may be other parameters that need to be set to meet the needs of your application.*

Step 4: Configure the *Direct*LOGIC CPUs

The ***Direct***LOGIC CPUs must be configured to communicate with the GS2 Series AC drives. This set up includes setting up the communication port and adding instructions to your logic program.

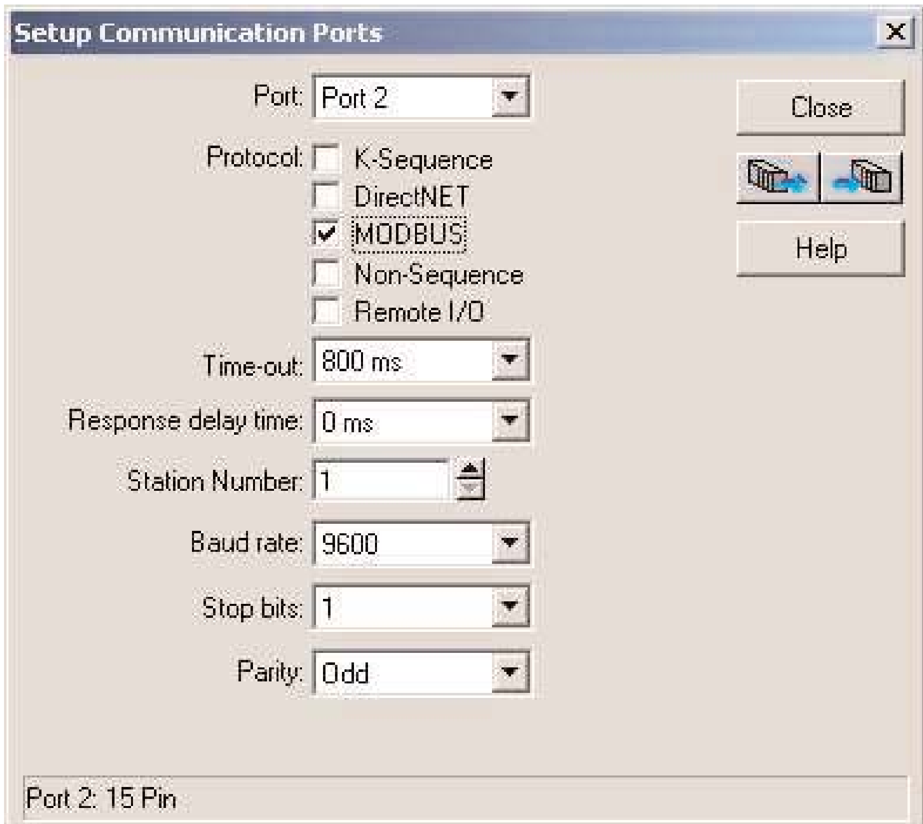
The set up for all of the ***Direct***LOGIC CPUs is very similar. However, there may be some subtle differences between CPUs. Refer to the appropriate CPU User Manual for the specifics on your ***Direct***LOGIC CPU.

Note: For instructions on Modbus Configuration for your specific CPU, refer to the appropriate CPU User Manual.

*Direct*LOGIC Modbus Port Configuration

The following configuration example is specific to the DL250(-1) CPU. Refer to the appropriate CPU User Manual for the specifics on your ***Direct***LOGIC CPU.

- In ***Direct***SOFT, choose the PLC menu, then Setup, then "Secondary Comm Port".
- From the **Port** list box, choose "Port 2".
- For the protocol, select "Modbus".



- In the **Timeout** list box, select "800 ms".
- **Response Delay Time** should be "0 ms".
- The **Station Number** should be set to "1" to make the DL250(-1) CPU a Modbus master.

Note: The DL250(-1) network instructions used in Master mode will access only slaves 1 to 90. Each slave must have a unique number.

- The **Baud Rate** should be set at "9600".
- In the **Stop Bits** list box, choose "1".
- In the **Parity** list box, choose "Odd".

*Direct*LOGIC Modbus Ladder Programming

The set up for all of the ***Direct***LOGIC CPUs is very similar. However, there may be some subtle differences between CPUs. Refer to the appropriate CPU User Manual for the specifics on your ***Direct***LOGIC CPU.

The following ladder program shows some examples of how to control the GS2 AC drive through Modbus RTU. The drive should be setup and tested for communications before it is connected to a load.

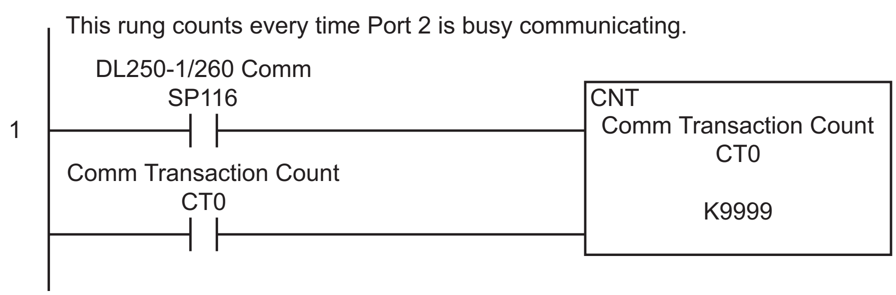
WARNING: A drive should never be connected to a load until any applicable communication programs have been proven.

Note: This program is for illustration purposes only, and is not intended for a true application.

In many drive applications, electromagnetic interference can sometimes cause frequent, short duration communication errors. Unless the application environment is perfect, an occasional communication error will occur. In order to distinguish between these non-fatal transients and a genuine communication failure, you may want to use the instructions as shown in Rungs 1 through 4.

Rung 1 monitors the number of times that the PLC attempts to communicate with the AC drive. When the PLC's communication attempts are successful, SP116 will count up, and SP117 will not count. Once the count reaches 9999, the counter will reset and resume counting.

Note: SP116 and SP117 are special relays in the ***Direct***LOGIC *CPUs that monitor the PLC's communications. SP116 is on when Port 2 is communicating with another device. SP117 is on when Port 2 has encountered a communication error.*



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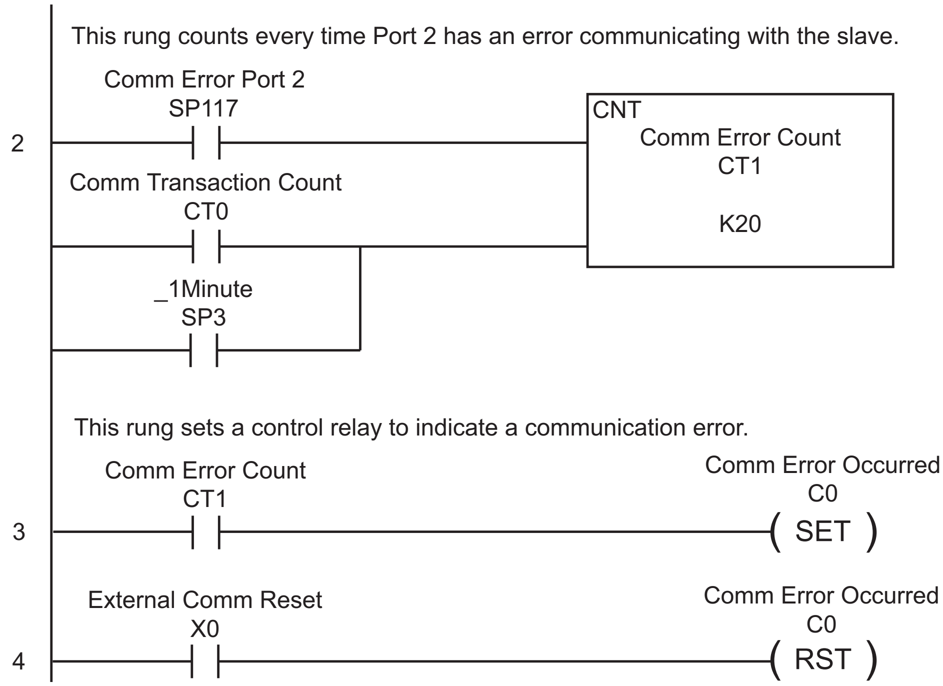
*Direct*LOGIC Modbus Ladder Programming (cont.)

Rungs 2 through 4 monitor the number of times the PLC fails in communicating with the AC drive. These instructions set the C0 control relay bit (to be used for alarm or shut-down) based on the number of times the SP117 bit is active in one minute. In this example, C0 will be set if the number of errors exceed 20 in one minute.



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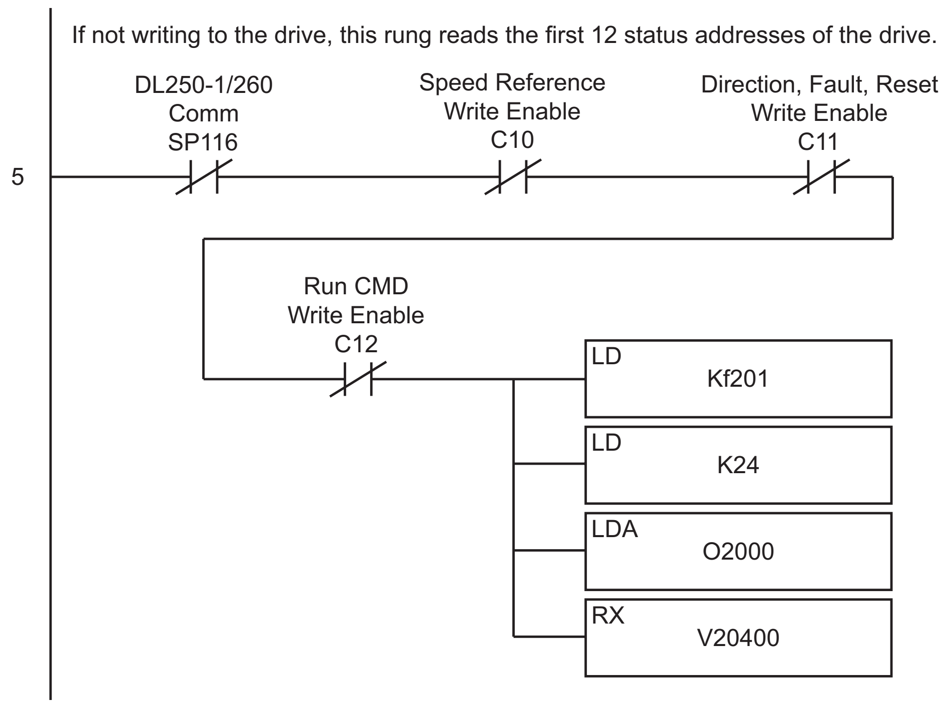
*Direct*LOGIC Modbus Ladder Programming (cont.)

Rung 5 reads 12 of the status addresses of the GS2 AC drive. These instructions read the values from the GS2 status addresses, 2100 to 210B, and places the values into the PLC memory addresses, V2000 to V2013.

Notice the number in the RX box; V20400. 20400 is an **octal** number, as are all address references in the ***Direct***LOGIC PLCs. 20400 octal converted to hex is 2100, which is the first status address for the GS2 AC drive.

Note: Refer to your PLC User Manual for more specifics on Modbus addressing and address conversions.



(Continued following "Alternate Modbus Read Instruction")

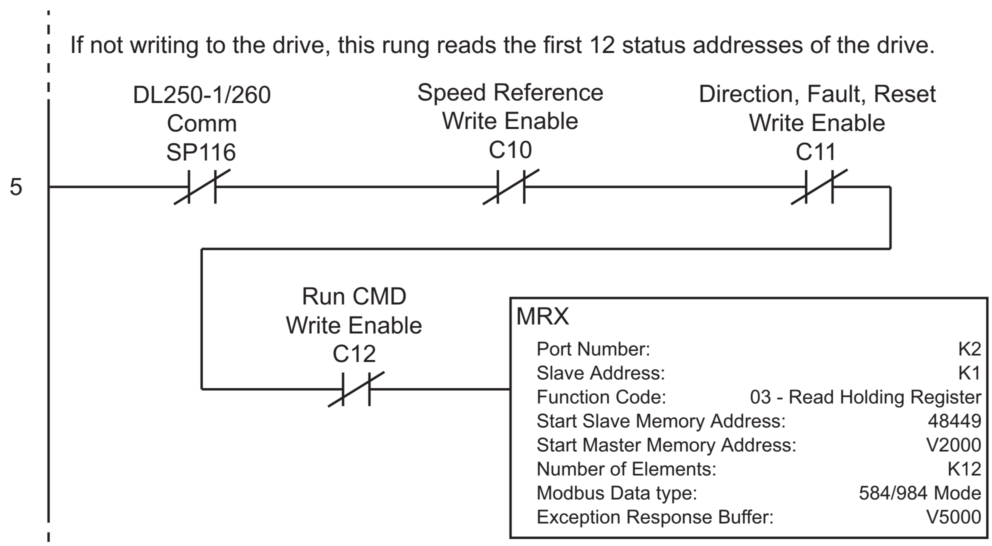
Alternate Modbus Read Instruction for DL06 and DL260 CPUs

The DL06 and DL260 CPUs offer "Modbus Read from Network" and "Modbus Write to Network" instructions that are easier to use than are the "Read from Network" and "Write to Network" instructions of the other ***Direct***LOGIC CPUs.

Rung 5, as shown below, reads the first 12 of the status addresses of the GS2 AC drive. This instruction reads the values from the GS2 status addresses, 2100 to 210B, and place the values into the PLC memory addresses V2000 to V2013.

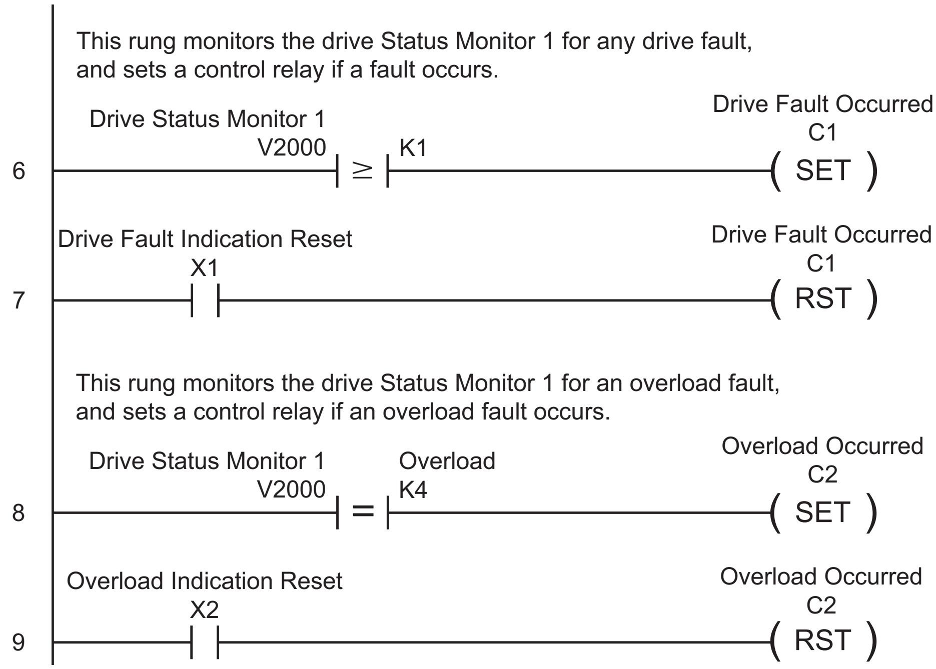
The Start Slave Memory Address in the MRX box is 48449, which is a **Modbus decimal number (584/984 type)**. To convert 48449 decimal to hex, you first subtract 40001, and then convert the remainder to (hex) 2100. H2100 is the address for the GS2 Status Monitor.

Note: Refer to your PLC User Manual for more specifics on Modbus addressing and address conversions.



*Direct*LOGIC Modbus Ladder Programming (cont.)

Rungs 6 through 9 show examples of how data read from the drive Status Addresses to set Control Relay bits that can be used for alarm or shut-down.



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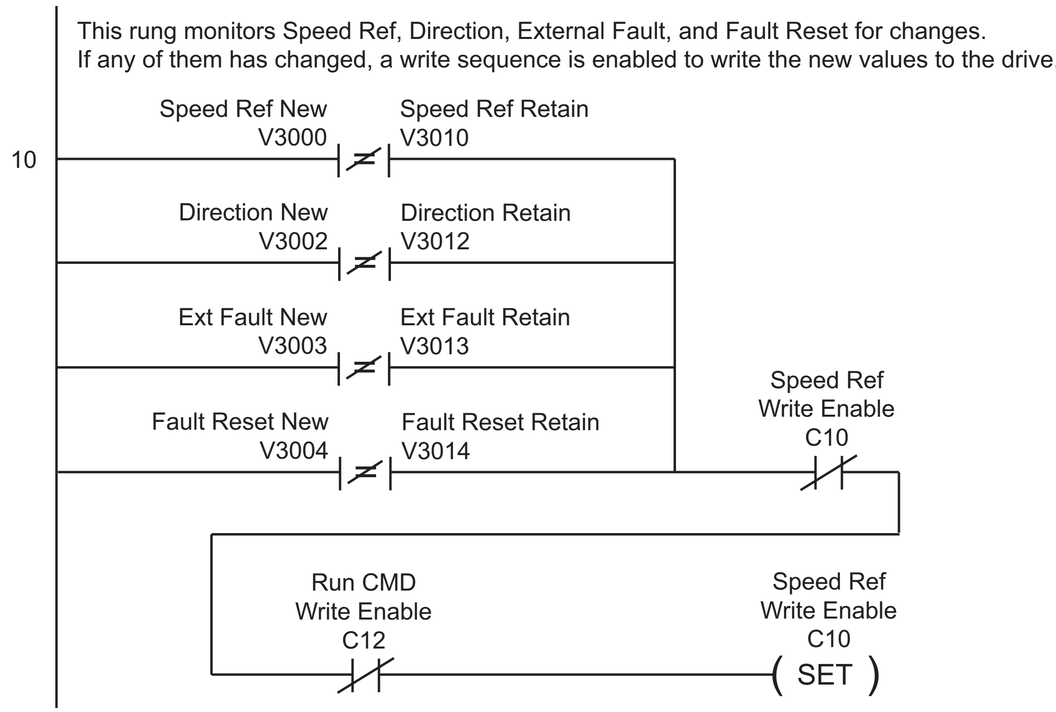
*Direct*LOGIC Modbus Ladder Programming (cont.)

Rung 10 monitors the Speed Reference, Direction, External Fault, and Fault Reset Commands for changes. If there are any changes, then a control relay is set to allow the Speed Reference to be written to the drive in the next rung. (This control relay is also used in later rungs to enable writes for the other three listed commands.)

The program monitors the commands for changes, and then writes to the drive only when there is a change. This procedure promotes safe machine operation by isolating the Run Command from the write block.



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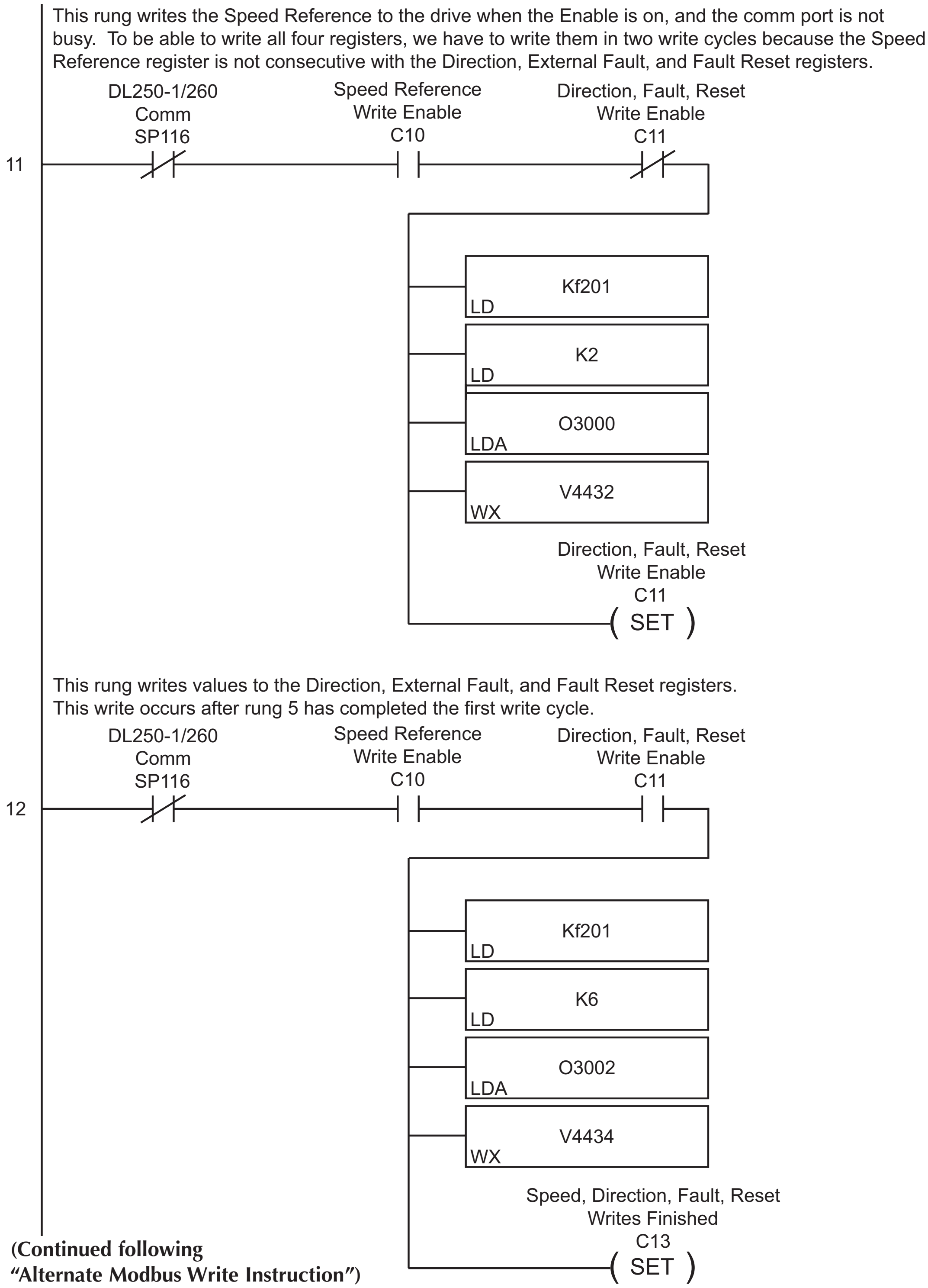
*Direct*LOGIC Modbus Ladder Programming (cont.)

Rungs 11 and 12 write the new Speed Reference, Direction, External Fault, and Fault Reset commands to the drive. We use two separate write commands in two separate rungs because the drive's Speed Reference command address (O4432) is not sequential with the Direction, External Fault, and Fault Reset command addresses (O4434 ~ O4436).



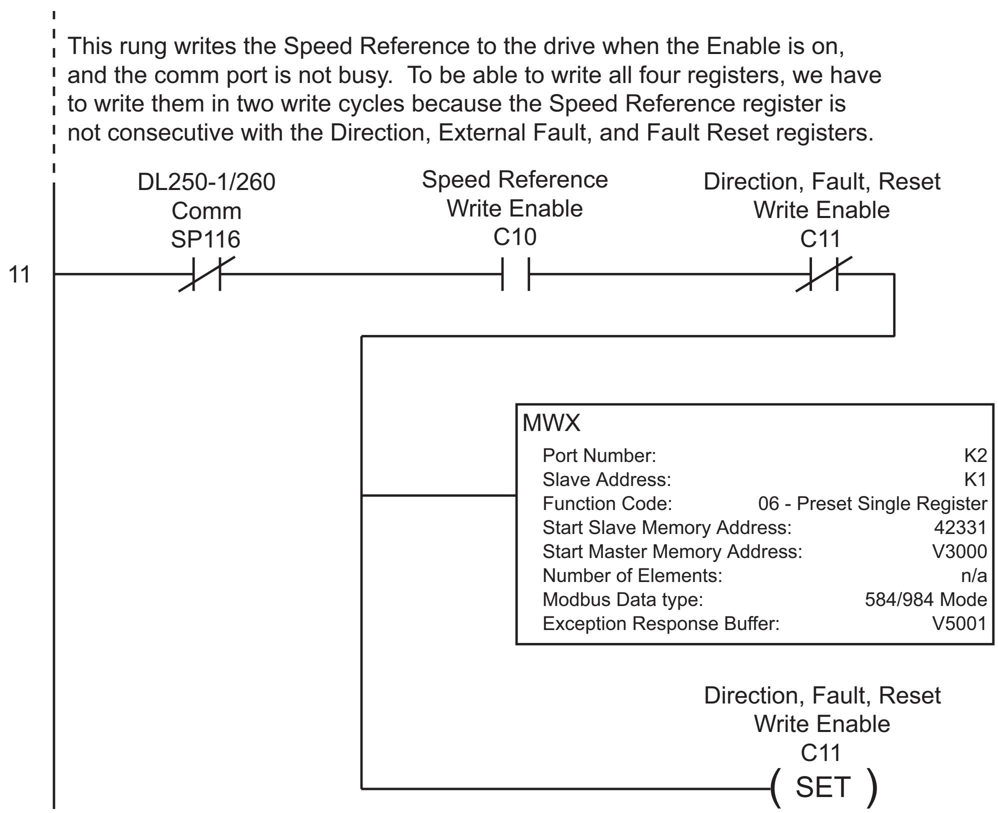
(Continued following "Alternate Modbus Write Instruction")

Alternate Modbus Write Instruction for DL06 and DL260 CPUs

The DL06 and DL260 CPUs offer "Modbus Read from Network" and "Modbus Write to Network" instructions that are easier to use than are the "Read from Network" and "Write to Network" instructions of the other ***Direct***LOGIC CPUs.

Rungs 11, 12, and 15 write the V3000 Speed Reference, V3002 Direction, V3003 External Fault, V3004 Fault Reset, and V3001 Run values to the corresponding drive Modbus decimal addresses 42331, 42333, 42334, 42335, and 42332. In the first MWX box, the slave start memory address is 42331, which is a **Modbus decimal number (584/984 type)**. To convert 42311 decimal to hex, you first subtract 40001, and then convert the remainder to hex (91A). 91A is the address for the Serial Comm Speed Reference.

Note: Refer to your PLC User Manual for more specifics on Modbus addressing and address conversions.



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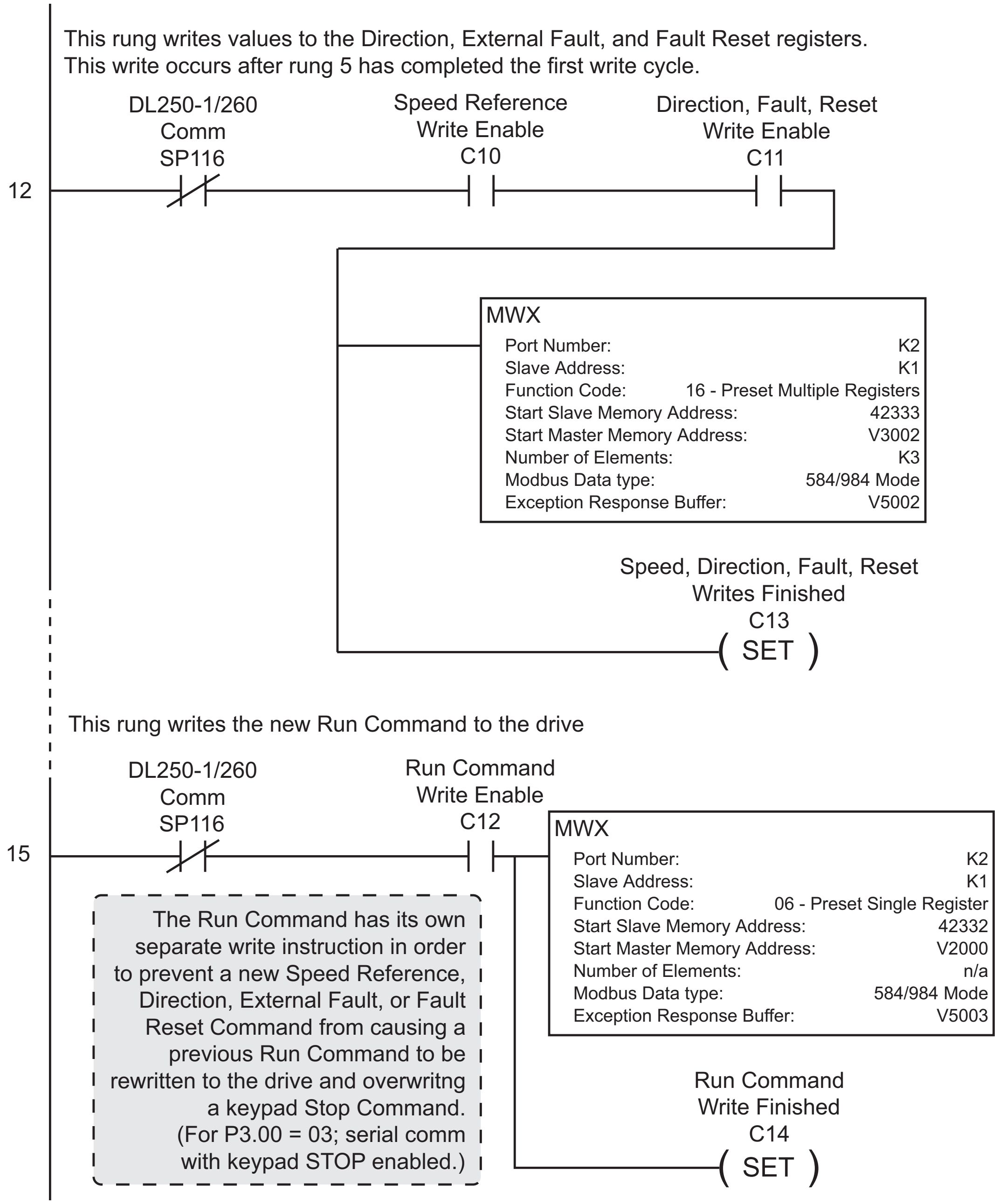
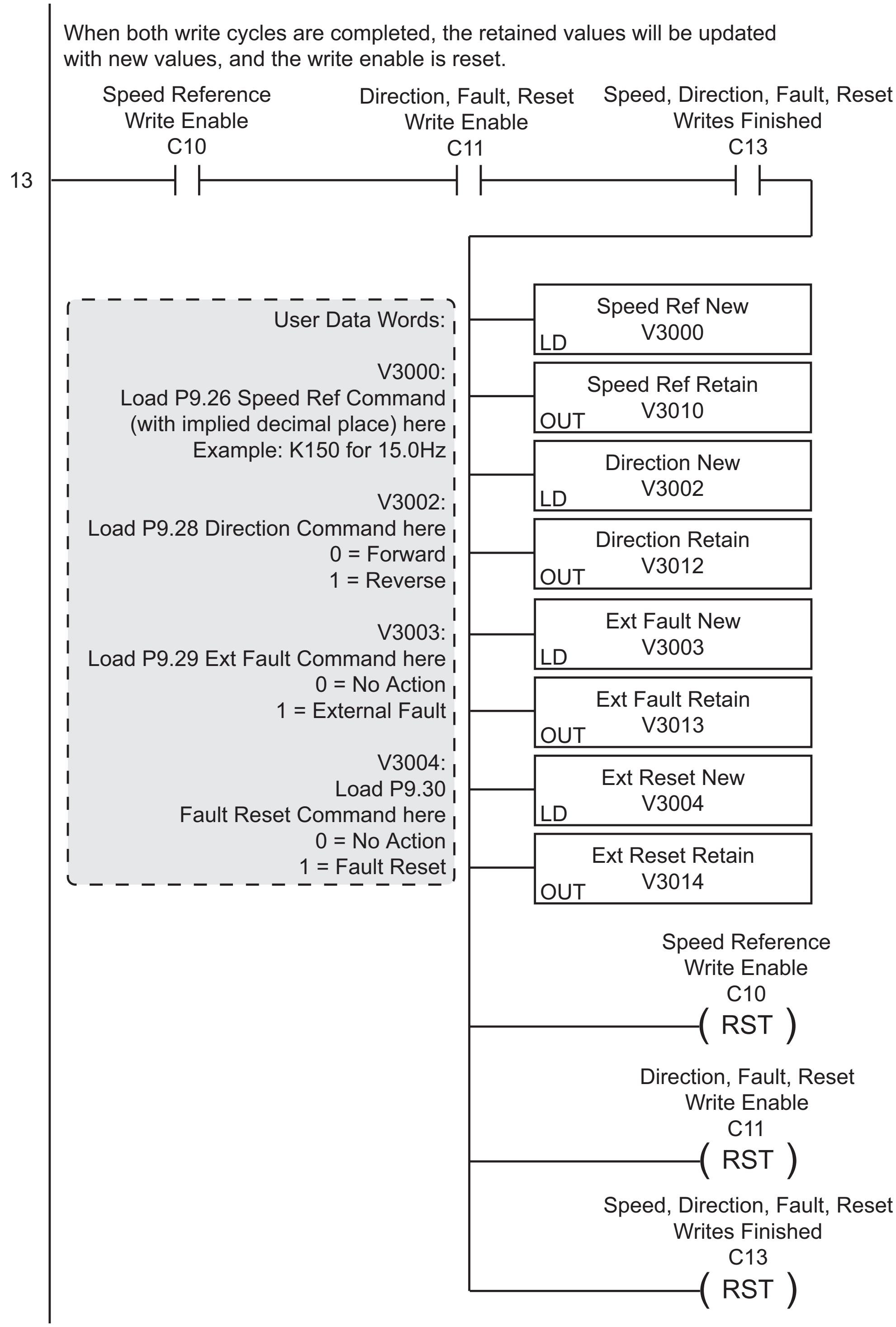
Alternate Modbus Write Instruction for DL06 and DL260 CPUs (cont.)



*Direct*LOGIC Modbus Ladder Programming (cont.)

Rung 13 loads the new Speed Reference, Direction, External Fault, and Fault Reset Command values into the retained value registers, and resets the applicable Write Enable control relays. Now the program is ready for the next command change detection and write to the drive.



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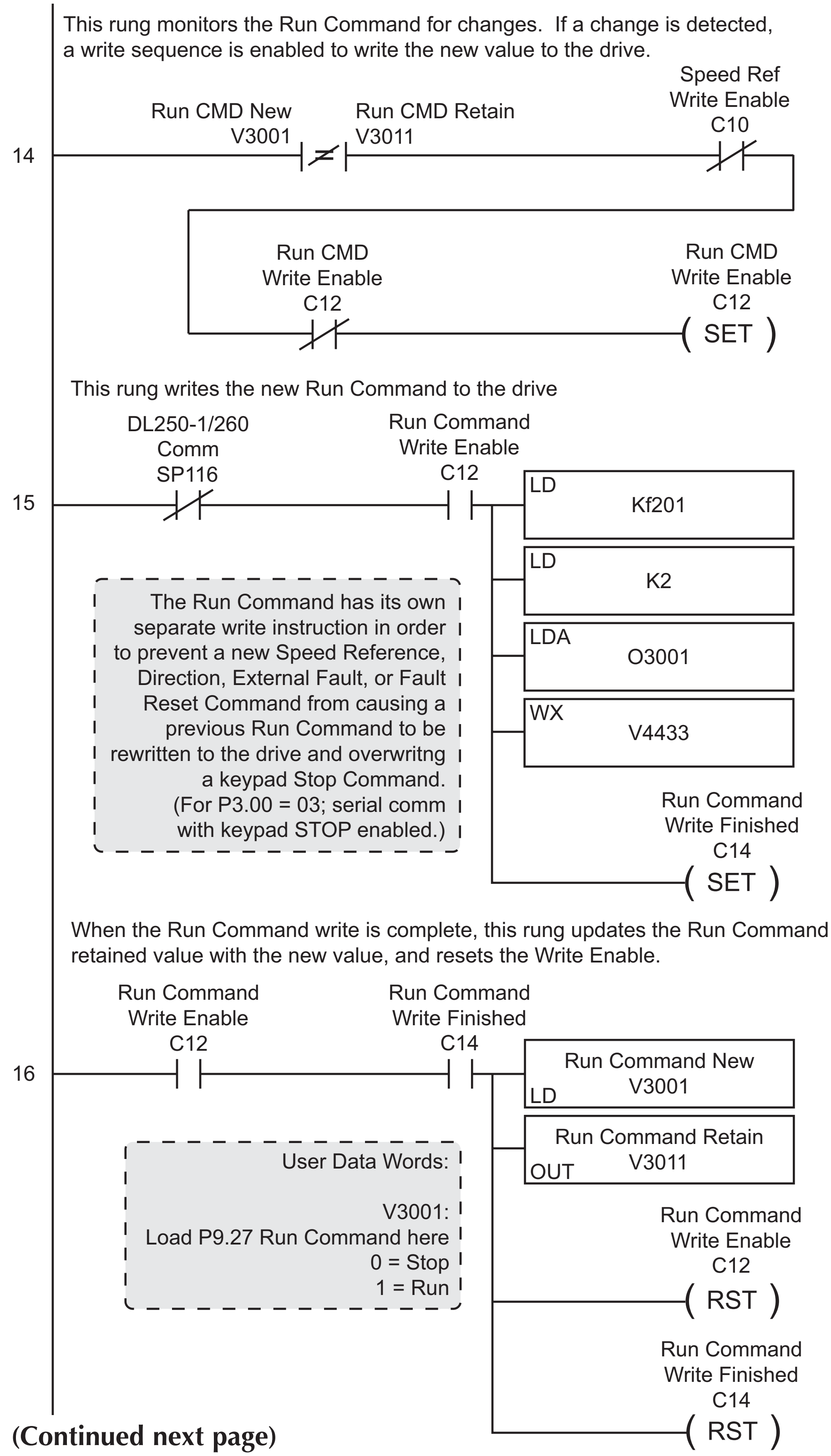
*Direct*LOGIC Modbus Ladder Programming (cont.)

Rungs 14 through 16 check for a Run Command change, write it to the drive, store the new value in the program register, and reset the enable control relays.



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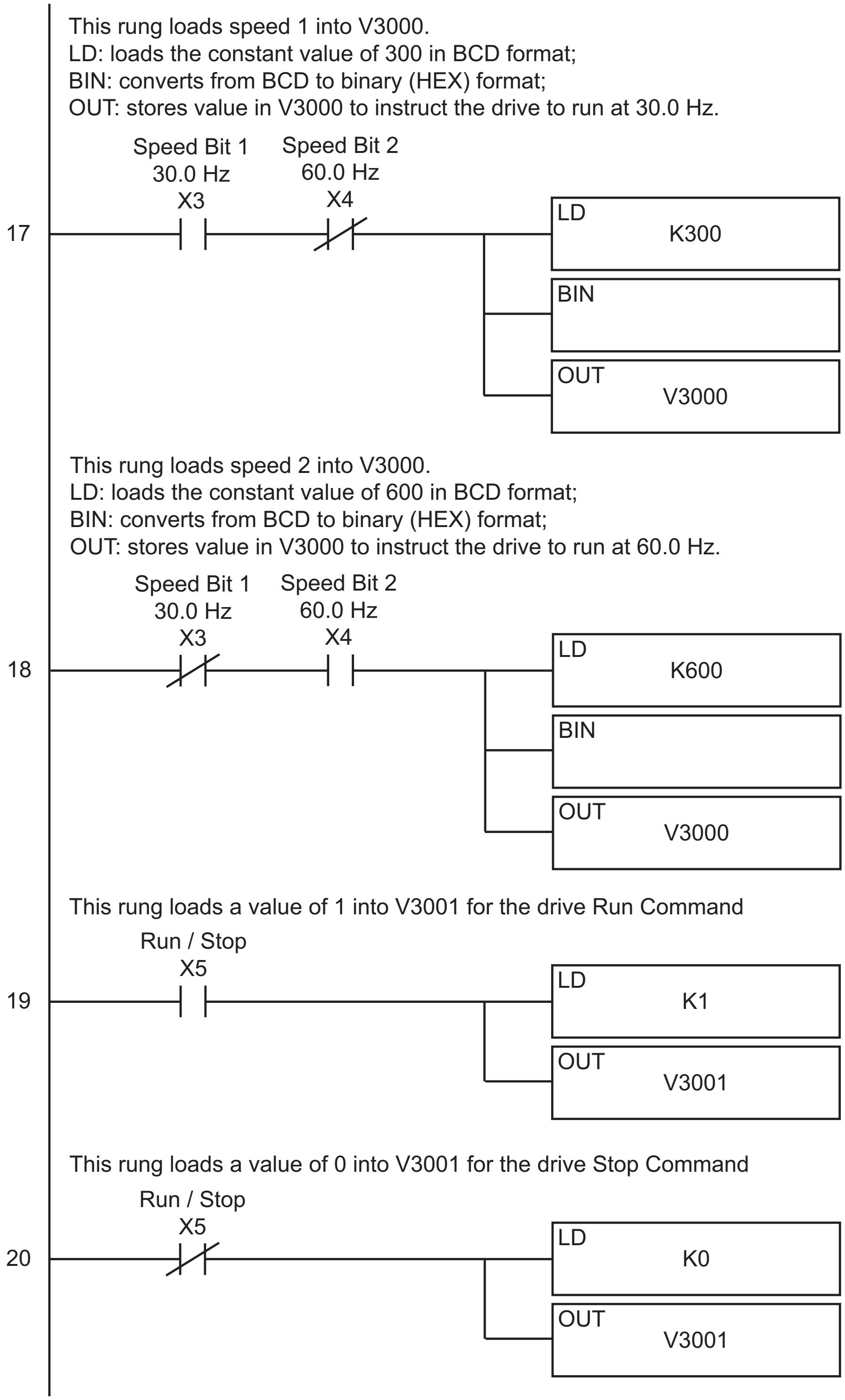
*Direct*LOGIC Modbus Ladder Programming (cont.)

Rungs 17 through 26 show an example of a method of inputting command values into the PLC.



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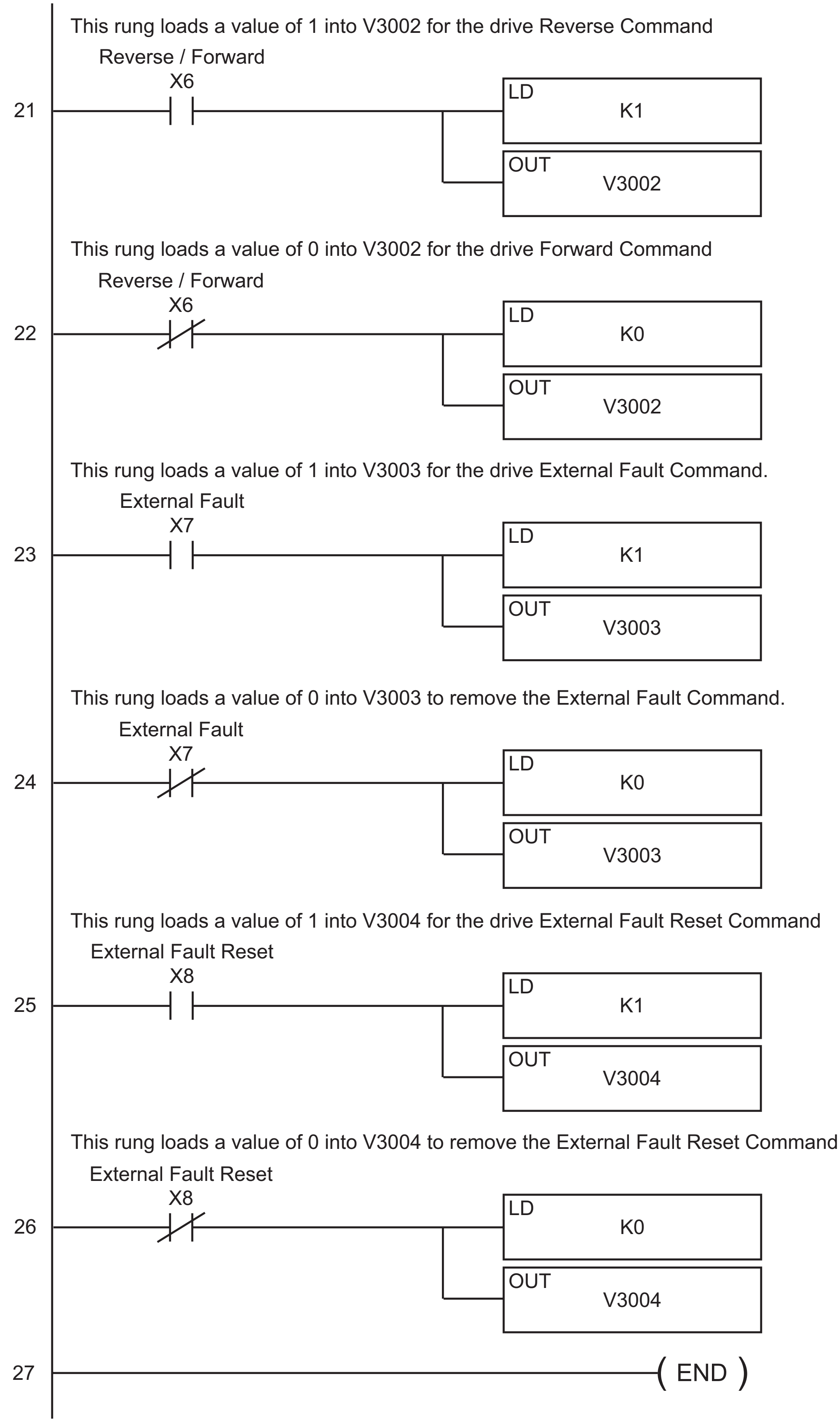
*Direct*LOGIC Modbus Ladder Programming (cont.)



*Direct*LOGIC Modbus Ladder Programming (cont.)

Separate Run Command Write Instruction

Why do we write the Run Command with a separate write instruction? If we write the Run Command to the drive along with the Speed Reference, Direction, External Fault, and Fault Reset Commands, we can keep the parameter addresses in sequence, and we can update all five of the commands with one write instruction. This method is valid **only** if we disable the drive's keypad STOP button (P3.00 = 04).

Typically, the keypad STOP button will be enabled (P3.00 = 03), and we need to prevent a change in one of the other commands from overriding a keypad Stop Command by causing a previous Run Command to be rewritten to the drive. By using a separate Run Command write instruction, only a deliberate Run Command change by the program will run the drive again after a stop.

Block Transfer Parameters

For writing to any of the parameters from P0.00 to P8.01, a group of 15 block transfer parameters (P9.11 to P9.25) is available in the GS2 AC drive. This sequential block of parameters can be used to "group" various miscellaneous non-sequential parameters, so that you can update the parameters in one programming write block instead of having to use multiple WX commands.

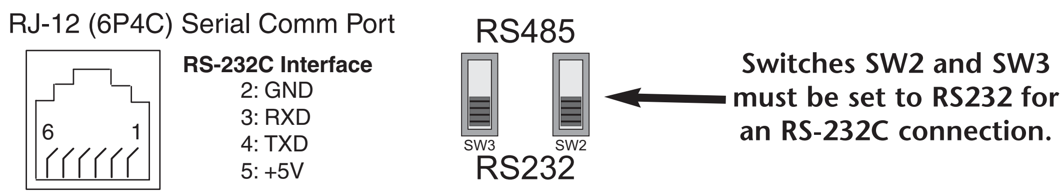
For example: If you need to change the PID setpoint (P7.11), accel time (P1.01), and multi-speed 1 (P5.01), this would typically take three different WX commands because the parameters are non-sequential. However, by setting P9.11 to P7.11, P9.12 to P1.01, and P9.13 to P5.01, the parameters become sequential, and can be controlled using one WX command (LD Kf201, LD K6, LDA Oxxxx, WX V4413).

Communicating with Third-party Devices

First you must decide what type of interface will work best for your application. The GS2 RJ-12 Serial Comm Port can accommodate an RS232C or an RS-485 connection.

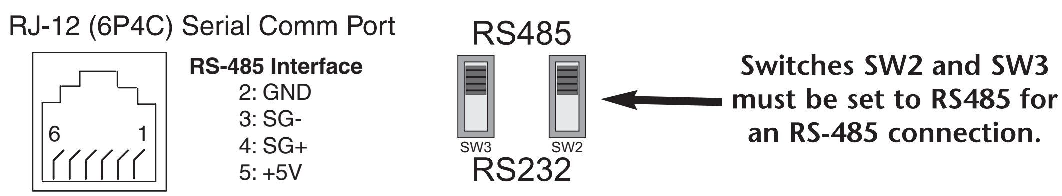
RS-232C

An RS-232C connection is somewhat limited. The maximum network cable length for an RS-232C connection is 15 meters (50 feet). In addition, using the RS-232C interface will allow you to connect only one AC drive to one Modbus device. For an RS-232C connection, set the GS2 DIP switches SW2 and SW3 to RS232.



RS-485

An RS-485 network cable can span up to 1000 meters (4000 feet). For an RS-485 connection, set the GS2 DIP switches SW2 and SW3 to RS485.



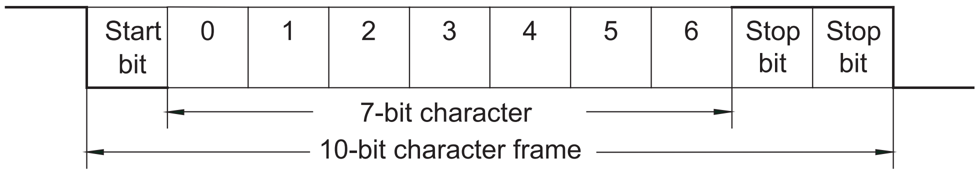
The GS2 Series AC drive communication address is specified by P9.00. The third party device then controls each AC drive according to its communication address.

The GS2 Series AC drive can be setup to communicate on standard Modbus networks using the following transmission modes: ASCII or RTU. Using the Communication Protocol parameter (P9.02), you can select the desired mode, data bits, parity, and stop bits. The mode and serial parameters must be the same for all devices on a Modbus network.

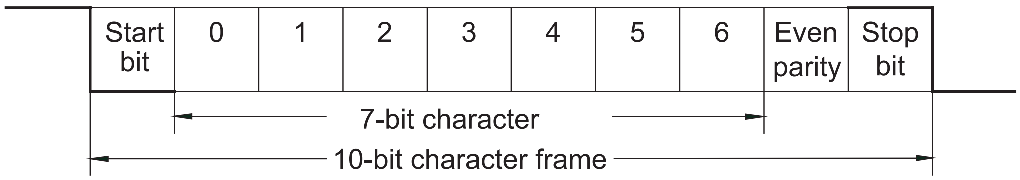
Data Format

ASCII Mode: 10-bit character frame (For 7-bit character):

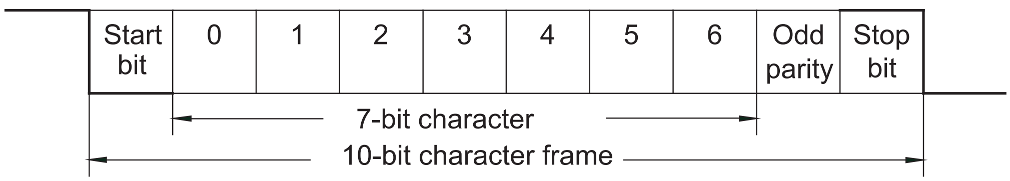
P9.02 = 00 (7 data bits, no parity, 2 stop bits)



P9.02 = 01 (7 data bits, even parity, 1 stop bit)

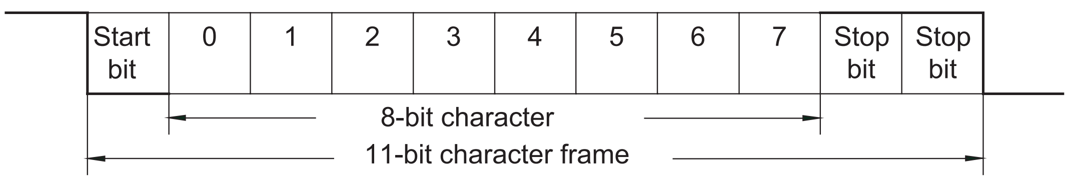


P9.02 = 02 (7 data bits, odd parity, 1 stop bit)

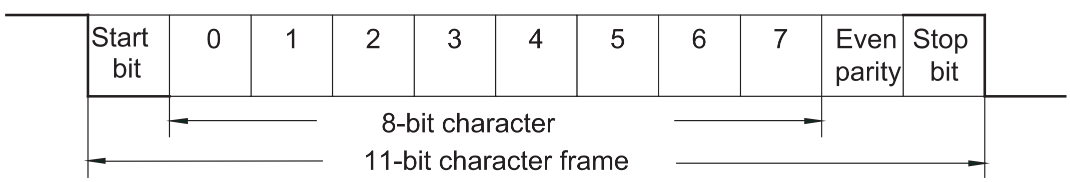


RTU Mode: 11-bit character frame (For 8-bit character):

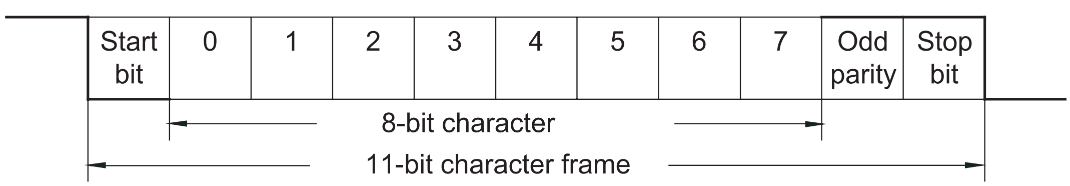
P9.02 = 03 (8 data bits, no parity, 2 stop bit)



P9.02 = 04 (8 data bits, even parity, 1 stop bit)



P9.02 = 05 (8 data bits, odd parity, 1 stop bit)



Communication Protocol

ASCII Mode:

STX	Start Character: (3AH)
ADR 1	Communication Address: 8-bit address consists of 2 ASCII codes
ADR 0	
CMD 1	
CMD 0	
DATA (n-1)	Contents of data: n x 8-bit data consists of 2n ASCII codes. n ≤ 25 maximum of 50 ASCII codes
....	
DATA 0	
LRC CHK 1	LRC check sum: 8-bit check sum consists of 2 ASCII codes
LRC CHK 0	
END 1	END characters: END 1 = CR (0DH), END 0 = LF (0AH)
END-0	

RTU Mode:

START	A silent interval of more than 10 ms
ADR	Communication Address: 8-bit address
CMD	Command Code: 8-bit command
DATA (n-1)	Contents of data: n x 8-bit data, n ≤ 25
....	
DATA 0	
CRC CHK Low	CRC check sum: 16-bit check sum consists of 2 8-bit characters
CRC CHK High	
END	A silent interval of more than 10 ms

ADR (Communication Address)

Valid communication addresses are in the range of 0 to 254. Communication address equals to 0 means broadcast to all AC drives, in which case the drives will not reply any message to the master device.

For example, communication to AC drive with address 16 decimal:

ASCII mode: (ADR 1, ADR 0)='1','0' => '1'=31H, '0'=30H
RTU mode: (ADR)=10H

CMD (Command code) and DATA (data characters)

The format of data characters depends on the command code. The available command codes are described as followed: Command code: 03H, read N words. The maximum value of N is 12. For example, reading continuous 2 words from starting address 2102H of the AC drive with address 01H.

ASCII mode:

Command Message	
STX	':'
ADR 1 ADR 0	'0'
	'1'
CMD 1 CMD 0	'0'
	'3'
Starting data address	'2'
	'1'
	'0'
	'2'
Number of data (Count by word)	'0'
	'0'
	'0'
	'2'
LRC CHK 1 LRC CHK 0	'D'
	'7'
END 1 END 0	CR
	LF

Response Message	
STX ':'	':'
ADR 1 ADR 0	'0'
	'1'
CMD 1 CMD 0	'0'
	'3'
Number of data (Count by byte)	'0'
	'4'
Content of starting data address 2102H	'1'
	'7'
	'7'
	'0'
Content data address 2103H	'0'
	'0'
	'0'
	'0'
LRC CHK 1 LRC CHK 0	'7'
	'1'
END 1 END 0	CR
	LF

RTU mode:

Command Message	
ADR	01H
CMD	03H
Starting data address	21H
	02H
Number of data (Count by word)	00H
	02H
CRC CHK Low CRC CHK High	6FH
	F7H

Response Message	
ADR	01H
CMD	03H
Number of data (Count by byte)	04H
	'0'
Content of data address 2102H	17H
	70H
Content of data address 2103H	00H
	02H
CRC CHK Low CRC CHK High	FEH
	5CH

Command code: 06H, write 1 word

For example, writing 6000(1770H) to address 0100H of the AC drive with address 01H.

ASCII mode:

Command Message			Response Message	
STX	':'		STX ':'	':'
ADR 1 ADR 0	'0'		ADR 1 ADR 0	'0'
	'1'			'1'
CMD 1 CMD 0	'0'		CMD 1 CMD 0	'0'
	'6'			'6'
Data Address	'0'		Data Address	'0'
	'1'			'1'
	'0'			'0'
	'0'			'0'
	'1'		Data Content	'1'
	'7'			'7'
	'7'			'7'
	'0'			'0'
LRC CHK 1 LRC CHK 0	'7'		LRC CHK 1 LRC CHK 0	'7'
	'1'			'1'
END 1 END 0	CR		END 1 END 0	CR
	LF			LF

RTU mode:

This is an example of using function code 16 for writing to multiple registers.

Command Message			Response Message	
ADR	01H		ADR	01H
CMD	10H		CMD	10H
Starting data address	20H		Starting data address	20H
	00H			00H
Number of registers	00H		Number of data (Count by word)	00H
	02H			02H
Byte count	04H		CRC CHK Low CRC CHK High	4AH
Content of data address 2000H	00H			08H
	02H			
Content of data address 2001H	02H			
	58H			
CRC CHK Low CRC CHK High	CBH			
	34H			

CHK (check sum)

ASCII Mode:

LRC (Longitudinal Redundancy Check) is calculated by summing up module 256, the values of the bytes from ADR1 to last data character then calculating the hexadecimal representation of the 2's-complement negation of the sum.

For example, reading 1 word from address 0401H of the AC drive with address 01H.

Command Message	
STX	':'
ADR 1	'0'
ADR 0	'1'
CMD 1	'0'
CMD 0	'3'
Starting data address	'0'
	'4'
	'0'
	'1'
Number of data (Count by word)	'0'
	'0'
	'0'
	'1'
LRC CHK 1	'F'
LRC CHK 0	'6'
END 1	CR
END 0	LF

01H+03H+04H+01H+00H+01H=0AH;
the 2's complement negation of 0AH is F6H.

RTU Mode:

Response Message	
ADR	01H
CMD	03H
Starting data address	21H
	02H
Number of data (Count by word)	00H
	02H
CRC CHK Low	6FH
CRC CHK High	F7H

CRC (Cyclical Redundancy Check) is calculated by the following steps:

Step 1: Load a 16-bit register (called CRC register) with FFFFH.

Step 2: Exclusive OR the first 8-bit byte of the command message with the low order byte of the 16-bit CRC register, putting the result in the CRC register.

Step 3: Shift the CRC register one bit to the right with MSB zero filling. Extract and examine the LSB.

Step 4: If the LSB of CRC register is 0, repeat step 3; else Exclusive OR the CRC register with the polynomial value A001H.

Step 5: Repeat step 3 and 4 until eight shifts have been performed. When this is done, a complete 8-bit byte will have been processed.

Step 6: Repeat steps 2 to 5 for the next 8-bit byte of the command message.

Continue doing this until all bytes have been processed. The final contents of the CRC register are the CRC value.

Note: When transmitting the CRC value in the message, the upper and lower bytes of the CRC value must be swapped, i.e. the lower order byte will be transmitted first.

The following is an example of CRC generation using C language. The function takes two arguments:

Unsigned char* data ← a pointer to the message buffer
Unsigned char length ← the quantity of bytes in the message buffer

The function returns the CRC value as a type of unsigned integer.

```
Unsigned int crc_chk(unsigned char* data, unsigned char length){
  int j;
  unsigned int reg_crc=0xFFFF;
  while(length--){
     reg_crc ^= *data++;
     for(j=0;j<8;j++){
        if(reg_crc & 0x01){  /* LSB(b0)=1 */
           reg_crc=(reg_crc>>1) ^ 0xA001;
        }else{
           reg_crc=reg_crc >>1;
        }
     }
  }
 return reg_crc;
}
```