

# SERIAL COMMUNICATIONS

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## CHAPTER 5

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## COMMUNICATIONS PARAMETERS SUMMARY

A summary of the GS4 AC drives Communications Parameters is listed below. Refer to “Parameters” Chapter 4 for a complete listing of all GS4 AC drives parameters, including details and Modbus addresses.



*For EtherNet/IP and Modbus TCP card parameters and information, please see Appendix B.*



*For detailed BACnet parameter information, please see the BACnet section of this chapter, [page 5-18](#).*

### SUMMARY – SERIAL COMMUNICATION PARAMETERS

GS4 Serial Communication Parameters Summary (P9.xx)							
Parameter		Range		Modbus Address			Default Setting
				Hex	Dec	Octal	
P9.00	VFD Comm Address	1 to 254		0900	42305	4400	1
P9.01	Modbus Baud Rate	0: 4.8k 1: 9.6k 2: 19.2k	3: 38.4k 4: 57.6k 5: 115.2k	0901	42306	4401	1
P9.02	Modbus Protocol	1: 7N2 (ASCII) 2: 7E1 (ASCII) 3: 7O1 (ASCII) 4: 7E2 (ASCII) 5: 7O2 (ASCII) 6: 8N1 (ASCII) 7: 8N2 (ASCII) 8: 8E1 (ASCII) 9: 8O1 (ASCII)	10: 8E2 (ASCII) 11: 8O2 (ASCII) 12: 8N1 (RTU) 13: 8N2 (RTU) 14: 8E1 (RTU) 15: 8O1 (RTU) 16: 8E2 (RTU) 17: 8O2 (RTU)	0902	42307	4402	12
P9.03	Modbus Fault Select	0: Warn & Continue Operation 1: Warn & Ramp to Stop 2: Warn & Coast to Stop 3: No Warning & Continue Operation		0903	42308	4403	3
P9.04	Time Out Detection	0: Disable 1: Enable		0904	42309	4404	0
P9.05	Time Out Duration	0.1 to 100.0 seconds		0905	42310	4405	0.5
P9.06	Parameter Copy	0: Disable Copy Keypad Function 1: Enable Copy Keypad Function		0906	42311	4406	0
P9.07	Parameter Lock	0: Normal Operation (allow changes) 1: Prevent any Changes to Parameters		0907	42312	4407	0
P9.08	<u>Restore to Default</u>	0: no function 1: Parameter Lock 2: no function 3: no function 4: no function 5: Reset kWh Display to Zero 6: Reset PLC (clear PLC) 7: no function 8: no function 9: Reset 50Hz Default 10: Reset 60Hz Default		0908	42313	4410	0
P9.09~P9.24	Block Transfer Parameters; refer to separate "Block Transfer Parameters" summary table, <a href="#">page 5-5</a>						
P9.25	reserved	n/a		0919	42330	4431	n/a
P9.26	RS-485 Last Known Speed Reference	0.00~599.00 Hz		091A	42331	4432	60.00
P9.27	RS-485 RUN Command	0: Stop 1: Run		091B	42332	4433	0
P9.28	RS-485 Direction Command	0: Forward 1: Reverse		091C	42333	4434	0
P9.29	RS-485 External Fault	0: No Fault 1: External Fault		091D	42334	4435	0
(table continued next page)							

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<b>GS4 Parameters Summary – Serial Communication Parameters (P9.xx) – (continued)</b>						
<b>Parameter</b>		<b>Range</b>	<b>Modbus Address</b>			<b>Settings</b>
			<b>Hex</b>	<b>Dec</b>	<b>Octal</b>	<b>Default</b>
<b>P9.30</b>	RS-485 Fault Reset	0: No Action 1: Fault Reset	091E	42335	4436	0
<b>P9.31</b>	RS-485 JOG Command	0: Stop 1: Jog	091F	42336	4437	0
<b>P9.32</b>	reserved	n/a	0920	42337	4440	n/a
<b>P9.33</b>	GS4 Drive Rated Amps	0.00~655.34A	0921	42338	4441	#.##
<b>P9.34</b>	PLC Command Mask (status only)	0~65535	0922	42339	4442	0
<b>P9.35</b>	Response Delay Time	0.0~200.0 ms	0923	42340	4443	2.0
<b>P9.36</b>	reserved	n/a	0924	42341	4444	n/a
<b>P9.37</b>	PLC Address	1~254	0925	42342	4445	2
<b>P9.38</b>	Firmware Date Code	Format: yywwd • yy = year (2017 = 17) • ww = week (01~52) • d = day of week (1~7; Mon=1, Sun=7)	0926	42343	4446	#####
<b>P9.39</b>	Firmware version	x.xx	0927	42344	4447	#.##
<b>P9.40</b>	reserved	n/a	0928	42345	4450	n/a
<b>P9.41</b>	GS Series Number	0~9	0929	42346	4451	4
<b>P9.42</b>	GS Model ID	00: GS4-21P0 (230V 1ph/3ph 1.0hp) 01: GS4-22P0 (230V 1ph/3ph 2.0hp) 02: GS4-23P0 (230V 1ph/3ph 3.0hp) 03: GS4-25P0 (230V 3ph 5.0hp) 04: GS4-27P5 (230V 3ph 7.5hp) 05: GS4-2010 (230V 3ph 10hp) 06: GS4-2015 (230V 3ph 15hp) 07: GS4-2020 (230V 3ph 20hp) 08: GS4-2025 (230V 3ph 25hp) 09: GS4-2030 (230V 3ph 30hp) 10: GS4-2040 (230V 3ph 40hp) 11: GS4-2050 (230V 3ph 50hp) 12: GS4-2060 (230V 3ph 60hp) 13: GS4-2075 (230V 3ph 75hp) 14: GS4-2100 (230V 3ph 100hp) 15: GS4-41P0 (460V 3ph 1.0hp) 16: GS4-42P0 (460V 3ph 2.0hp) 17: GS4-43P0 (460V 3ph 3.0hp) 18: GS4-45P0 (460V 3ph 5.0hp) 19: GS4-47P5 (460V 3ph 7.5hp) 20: GS4-4010 (460V 3ph 10hp) 21: GS4-4015 (460V 3ph 15hp) 22: GS4-4020 (460V 3ph 20hp) 23: GS4-4025 (460V 3ph 25hp) 24: GS4-4030 (460V 3ph 30hp) 25: GS4-4040 (460V 3ph 40hp) 26: GS4-4050 (460V 3ph 50hp) 27: GS4-4060 (460V 3ph 60hp) 28: GS4-4075 (460V 3ph 75hp) 29: GS4-4100 (460V 3ph 100hp) 30: GS4-4125 (460V 3ph 125hp) 31: GS4-4150 (460V 3ph 150hp) 32: GS4-4175 (460V 3ph 175hp) 33: GS4-4200 (460V 3ph 200hp) 34: GS4-4250 (460V 3ph 250hp) 35: GS4-4300 (460V 3ph 300hp)	092A	42347	4452	##
<b>P9.43</b>	Ignore Comm Card Warning	0: Disable function (do NOT ignore) 1: Enable function (ignore warning)	092B	42348	4453	1

(table continued next page)

**GS4 Parameters Summary – Serial Communication Parameters (P9.xx) – (continued)**

Parameter		Range	Modbus Address			Settings
			Hex	Dec	Octal	Default
<b>P9.44</b>	Comm Card Type	0: No Communication Card 1: reserved 2: reserved 3: reserved 4: MODBUS-TCP Slave 5: EtherNet/IP Slave 6: reserved 7: reserved 8: reserved	092C	42349	4454	0
<b>P9.45</b>	Comm Card Version	0~65535	092D	42350	4455	0
<b>P9.46</b>	Comm Card Production Code	0~65535	092E	42351	4456	0
<b>P9.47</b>	Comm Card Fault Code	0~65535	092F	42352	4457	0
<b>P9.48</b>	Comm Card IP Configuration	0: Static IP 1: Dynamic IP (DHCP)	0930	42353	4460	0
<b>P9.49</b>	Comm Card IP Address Octet 1	0~255	0931	42354	4461	0
<b>P9.50</b>	Comm Card IP Address Octet 2	0~255	0932	42355	4462	0
<b>P9.51</b>	Comm Card IP Address Octet 3	0~255	0933	42356	4463	0
<b>P9.52</b>	Comm Card IP Address Octet 4	0~255	0934	42357	4464	0
<b>P9.53</b>	Comm Card Mask Octet 1	0~255	0935	42358	4465	0
<b>P9.54</b>	Comm Card Mask Octet 2	0~255	0936	42359	4466	0
<b>P9.55</b>	Comm Card Mask Octet 3	0~255	0937	42360	4467	0
<b>P9.56</b>	Comm Card Mask Octet 4	0~255	0938	42361	4470	0
<b>P9.57</b>	Comm Card Gateway Octet 1	0~255	0939	42362	4471	0
<b>P9.58</b>	Comm Card Gateway Octet 2	0~255	093A	42363	4472	0
<b>P9.59</b>	Comm Card Gateway Octet 3	0~255	093B	42364	4473	0
<b>P9.60</b>	Comm Card Gateway Octet 4	0~255	093C	42365	4474	0
<b>P9.61</b>	reserved	~	093D	42366	4475	0
<b>P9.62</b>	reserved	~	093E	42367	4476	0
<b>P9.63</b>	Comm Card Factory Reset	0: No Action 1: Reset to the Factory Setting	093F	42368	4477	0
<b>P9.64</b>	Comm Card External Set	0, 2 Bit 0 = reserved Bit 1 = Write Ethernet Parameters to Comm Card Bit 2 = reserved	0940	42369	4500	0
<b>P9.65</b>	reserved	~	0941	42370	4501	0
<b>P9.66</b>	reserved	~	0942	42371	4502	~
<b>P9.67</b>	reserved	~	0943	42372	4503	~
<b>P9.68</b>	reserved	~	0944	42373	4504	~
<b>P9.69~P9.84</b>	Block Transfer Parameters; refer to separate "Block Transfer Parameters" summary table, <a href="#">page 5-5</a>					
<b>P9.85</b>	PLC Frequency Command Force to 0	0~1h Bit 0 = 1: Before PLC scan, set up PLC Target Frequency = 0	0955	42390	4525	0
<b>P9.86</b>	COMM1 Protocol (via RS-485)	0: Modbus 1: BACnet	0956	42391	4526	0
<b>P9.87</b>	BACnet Address	0~127	0957	42392	4527	10
<b>P9.88</b>	BACnet Baud Rate	9.6~76.8 Kbps	0958	42393	4530	38.4
<b>P9.89</b>	BACnet Device Instance Low Word	0~65535	0959	42394	4531	10
<b>P9.90</b>	BACnet Device Instance High Byte	0~63	095A	42395	4532	0
<b>P9.91</b>	BACnet Max Polling Address	0~127	095B	42396	4533	127
<b>P9.92</b>	BACnet Password	0~65535	095C	42397	4534	0

### SUMMARY – BLOCK TRANSFER PARAMETERS

GS4 Communications Parameters Summary – Block Transfer Parameters										
Parameter / Address Description	Block Transfer Data Locations					Block Transfer Address Pointers				
	Parameter	Description (Range)	Modbus Address			Parameter	Description (Range)	Modbus Address		
			Hex	Dec	Octal			Hex	Dec	Octal
Block Transfer _ 1	P9.09	Dependent upon the target address.  Example: If Block Transfer points to a digital parameter, range = 0,1. If it points to analog parameter, the range could be 0–65535.	0909	42314	4411	P9.69	0–65535  Format as xxyy, where: xx = target parameter group # yy = target parameter #	0945	42374	4505
Block Transfer _ 2	P9.10		090A	42315	4412	P9.70		0946	42375	4506
Block Transfer _ 3	P9.11		090B	42316	4413	P9.71		0947	42376	4507
Block Transfer _ 4	P9.12		090C	42317	4414	P9.72		0948	42377	4510
Block Transfer _ 5	P9.13		090D	42318	4415	P9.73		0949	42378	4511
Block Transfer _ 6	P9.14		090E	42319	4416	P9.74		094A	42379	4512
Block Transfer _ 7	P9.15		090F	42320	4417	P9.75		094B	42380	4513
Block Transfer _ 8	P9.16		0910	42321	4420	P9.76		094C	42381	4514
Block Transfer _ 9	P9.17		0911	42322	4421	P9.77		094D	42382	4515
Block Transfer _ 10	P9.18		0912	42323	4422	P9.78		094E	42383	4516
Block Transfer _ 11	P9.19		0913	42324	4423	P9.79		094F	42384	4517
Block Transfer _ 12	P9.20		0914	42325	4424	P9.80		0950	42385	4520
Block Transfer _ 13	P9.21		0915	42326	4425	P9.81		0951	42386	4521
Block Transfer _ 14	P9.22		0916	42327	4426	P9.82		0952	42387	4522
Block Transfer _ 15	P9.23		0917	42328	4427	P9.83		0953	42388	4523
Block Transfer _ 16	P9.24		0918	42329	4430	P9.84		0954	42389	4524

#### BLOCK TRANSFER EXPLANATION

Block Transfer allows Parameters from many different Parameter Groups to be consolidated into one Modbus communication message. This can greatly simplify PLC programming and reduce network traffic.

Unlike previous GS drives\*, the GS4 has two sets of Block Transfer Parameters:

- Pointer Parameters (where you enter the address that you want to consolidate)
- Data Locations (where you push data into, or pull data out of)

Example: To consolidate the parameters Multi-Speed 15 (P5.15), Skip Frequency 3 Lower Limit (P1.24), and Circulation Time (P10.02), enter the following values into P9.69, P9.70, and P9.71:

#### Pointer Address

Block Transfer \_ 1 P9.69 = 515 (points to P5.15)  
Block Transfer \_ 2 P9.70 = 124 (points to P1.24)  
Block Transfer \_ 3 P9.71 = 1002 (points to P10.02)

#### Push Data to (or Pull data from)

P9.09  
P9.10  
P9.11

(Note that the Pointer Addresses use xxyy format where xx=Parameter Group and yy=Parameter# in that group.)

Now you can write 1 Modbus message to P9.09 with a length of three registers that will change P5.15, P1.24, and P10.02, or use 1 Modbus Read message to collect all 3 parameters at once.

\* Previous GS Drives only had one set of parameters for Block Transfer. The Pointer address had to be manually entered into the keypad. Only then would any read or write into that Block Transfer address actually be linked to the desired data. Unfortunately, this meant that you would have to manually enter Block Transfer addresses via the keypad for any new drive. With the GS4 method, the Pointer Addresses are in separate parameters. Thus, the complete configuration can be downloaded via software (no keypad entry necessary).

## SERIAL MODBUS STATUS ADDRESSES

The *DURAPULSE* GS4 AC drive has status memory addresses that are used to monitor the AC drive.

### STATUS ADDRESSES (READ ONLY)

GS4 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: 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	2100	48449	20400
		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: InrCom Time Out (ictE)			

(table continued next page)

<b>GS4 Status Addresses (continued from previous page)</b>					
<b>Description</b>		<b>Range</b>	<b>Modbus Address</b>		
			<b>Hex</b>	<b>Dec</b>	<b>Octal</b>
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	Operation Command controlled by external terminal (If P3.00 = 1 or 2; then Bit 7 = 1)			
	Bit 8	Master Frequency controlled by communication interface (If P4.00 = 0, 1, or 4; then Bit 8 = 1)			
	Bit 9	Master Frequency controlled by analog signal (If P4.00 = 2; then Bit 9 = 1)			
	Bit 10	Operation Command controlled by communication interface (If P3.00=0, 1, 3, or 5; then Bit 10 = 1)			
	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
Reserved			210B	48460	20413
Motor Actual RPM			210C	48461	20414
reserved			210D	48462	20415
reserved			210E	48463	20416
Output Power (kW)			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]			
Display signal of AI1 analog input terminal, 0–10V corresponds to 0.00–100.00%			220Bh	48716	21013
Display signal of AI2 analog input terminal, 4–20mA / 0–10V corresponds to 0.00–100.00%			220Ch	48717	21014
Display signal of AI3 analog input terminal, -10V–10V corresponds to -100.00–100%			220Dh	48718	21015
IGBT temperature of drive power module (XXX.X °C)			220Eh	48719	21016
The temperature of capacitance (XXX.X °C)			220Fh	48720	21017
* 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).					



## SERIAL COMMUNICATIONS OVERVIEW

The *DURAPULSE* GS4 RJ-45 Serial Comm Port will accommodate an RS-485 connection, through which the drive can be controlled by a remote master device on an RS-485 network spanning up to 1000 meters (4000 feet) of cable. RS-232 signals can be converted to RS-485 by using a separate converter.

The *DURAPULSE* GS4 AC drive communication address is specified in P9.00, and the remote master device can control each AC drive according to its individual communication address.

The *DURAPULSE* GS4 AC drive can be configured to communicate using either Modbus or BACnet. The desired protocol is selected in parameter P9.86, COM1 Protocol. (The GS4 drive cannot utilize both protocols simultaneously.)

- Standard Modbus protocol using ASCII or RTU transmission modes.  
Parameter P9.02, Communication Protocol, is used to select the desired mode, number of data bits, parity, and number of stop bits. The mode and serial parameters must be the same for all devices on a Modbus network.
- BACnet protocol.



*DURApulse GS4 drives have a provision for shutting down control or power to the inverter in the event of a communications time out. This feature can be set up through parameters P9.03 (Communication Fault Operation), P9.04 (Time Out Detection), and P9.05 (Time Out Duration).*



*Ethernet connectivity for EtherNet/IP communication is possible with an optional communication card # GS4-CM-ENETIP.*

*Ethernet connectivity for Modbus TCP communication is possible with an optional communication card # GS4-CM-MODTCP.*

*Refer to “Appendix B: Optional I/O and Communication Cards” for details.*

## SERIAL COMMUNICATIONS CONNECTIVITY



*This section contains information regarding wiring connections to the GS4 RS-485 serial communication ports. For information regarding serial connections to AutomationDirect PLCs, please refer to Appendix D of this user manual, or to the applicable PLC user manual.*

### MINIMUM AC DRIVE PARAMETER SETTINGS FOR SERIAL COMMUNICATION

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

Minimum Parameter Settings (for Communication to ADC PLC)			
Parameter Setting	Description	Setting Value Explanation	
<b>P3.00 = 03 or 04</b>	1st Source of Operation Command [Remote]	3: RS-485 (Modbus/BACnet), Keypad STOP is Enabled 4: RS-485 (Modbus/BACnet), Keypad STOP is Disabled	
<b>P3.01 = 03 or 04</b>	2nd Source of Operation Command [Local]	3: RS-485 (Modbus/BACnet), Keypad STOP is Enabled 4: RS-485 (Modbus/BACnet), Keypad STOP is Disabled	
<b>P3.03~P3.16 = 33</b>	Digital Input Definition	33: Local/Remote Control Select (can also be switched via Local and Remote buttons on the keypad)	
<b>P4.00 = 01</b>	1st Source of Frequency Command [Remote]	1: RS-485 Communication (Modbus/BACnet)	
<b>P4.01 = 01</b>	2nd Source of Frequency Command [Local]	1: RS-485 Communication (Modbus/BACnet)	
<b>P9.00 = 1~254</b>	Communication Address	01~254 Drive Comm Address	
<b>P9.01 = 4.8~115.2</b>	Transmission Speed	0: 4.8Kbps 1: 9.6Kbps	2: 19.2Kbps 3: 38.4Kbps 4: 57.6Kbps 5: 115.2Kbps
<b>P9.02 = 12</b>	Communication Protocol	12: <8 data bits, no parity, 1 stop bit, RTU>	
<b>P9.86 = 00 or 01</b>	COM1 Protocol	0: Modbus 485 1: BACnet	



*This list of parameter settings is the minimum required to communicate with an AutomationDirect PLC. There may be other parameters that need to be set to meet the needs of your particular application.*



### COMMON THIRD-PARTY MODBUS RTU MASTERS

- KEPSERVER EX 5.0 from [www.kepware.com](http://www.kepware.com)
- Modbus Poll from [www.modbustools.com](http://www.modbustools.com)

### AUTOMATIONDIRECT PLCs AS MODBUS MASTER

Serial Modbus-capable AutomationDirect PLCs can communicate with the GS4 drive (for GS4 Ethernet connectivity and control, refer to the Ethernet option card information in Appendix B). Serial Modbus control is easier to accomplish from a PLC that has a built-in RS-485 port and supports dedicated Modbus messaging. [RS-232-only PLCs will require an RS-232–RS-485 converter (FA-ISOCN); and older PLCs may require programming to construct the Modbus strings.] We recommend PLCs with built-in RS-485 ports and dedicated Modbus serial commands: CLICK (with RS-485 ports), Productivity, BRX/Do-more, DirectLogic (DL06 or D2-260). Other PLC-Drive connectivity is possible: Please refer to the “Typical ADC PLC to GS4 Serial Connectivity Matrix” below.

#### Typical ADC PLC to GS4 Serial Communications Connectivity

Typical ADC PLC to GS4 Serial Communications Connectivity Matrix*						
Recommended PLC Connectivity			Communication	Direct Cable	GS4	
PLC	Port #	Port Type			Port Type	Port #
CLICK	3	3 screw terminals	RS-485	L19954 cable	RJ45 or SG+ SG- SGND	RJ45-1 RJ45-2 or 3 screw terminals
D2-260	2	HD15	RS-485	D2-DSCBL-2		
DL06	2	HD15	RS-485	D2-DSCBL-2		
BRX/Do-more	RS-485	3 screw terminals	RS-485	L19954 cable		
Do-more H2-DM1	RS-232	RJ12	RS-232 to RS-485	FA-ISOCON with L19954 cable		
P1 CPUs	RS-485	screw terminals	RS-485	L19954 cable		
P2 CPUs	RS-485	screw terminals	RS-485	L19954 cable		
P3 CPUs	RS-485	screw terminals	RS-485	L19954 cable		
Other PLC Connectivity			—	—		
D2-250-1	2	HD15	RS-485	D2-DSCBL-2		
D4-450/D4-454	1	DB25	RS-232 to RS-485	FA-ISOCON with L19954 cable		
DL05	2	RJ12	RS-232 to RS-485	FA-ISOCON with L19954 cable		
DL06 + DCM	2	HD15	RS-485	D2-DSCBL-2		
Do-more H2-DM1 + H2-SERIO-4	3	5 screw terminals	RS-485	L19954 cable		
Do-more T1H-DM1	RS-232	RJ12	RS-232 to RS-485	FA-ISOCON with L19954 cable		
P2-SCM	4	4 screw terminals	RS-485	L19954 cable		
P3-SCM	4	4 screw terminals	RS-485	L19954 cable		
* Ethernet connectivity for EtherNet/IP communication is possible with an optional communication card # GS4-CM-ENETIP. Refer to “Appendix B: Optional I/O and Communication Cards” for details.						
* Ethernet connectivity for Modbus TCP communication is possible with an optional communication card # GS4-CM-MODTCP. Refer to “Appendix B: Optional I/O and Communication Cards” for details.						

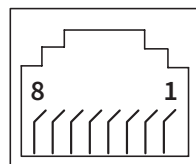
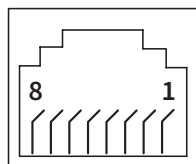
**CONNECTING COMMUNICATION CABLES**

The GS4 AC drive includes an “RS-485” switch on the control board that will switch in a 120Ω terminating resistor for the RS-485 network. an external terminating resistor is not required for the drive end. An external termination resistor may be required on the other end of RS-485 network; especially on long runs. Select resistors that match the impedance of the cable (between 100Ω and 500Ω).

The DURAPULSE GS4 serial communication port is an RS-485 input. Please note that terminals SG+ and SG- are shared with the RJ45 connectors. That means the user can use standard RJ45 patch cables or industrial RS-485 cabling to access the comm port. GS4 to GS4 serial connections can be accomplished with standard Ethernet patch cables (do not use cross-over cables). RS-232 signals can be converted to RS-485 by using a separate converter (see the FA-ISOCAN drawings on [page 5-11](#)).

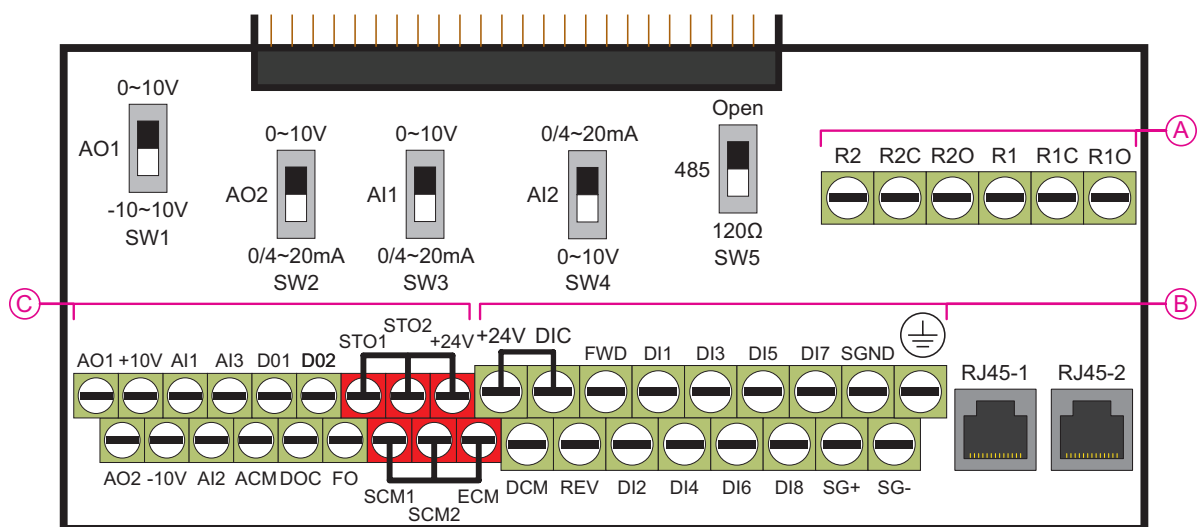
**DURAPULSE GS4 RS-485 SERIAL COMM PORTS**

GS4 Serial Comm Ports (2)  
RS-485 Interface



- 1: reserved\*
- 2: reserved\*
- 3: GND
- 4: SG-
- 5: SG+
- 6: GND
- 7: reserved\*
- 8: reserved\*

\* Reserved pins 1, 2, 7, & 8 are open and unused.



Control circuit board is removable from the GS4 (for ease of wiring)



**Recommended RS-485 cable: Belden 9842, AutomationDirect L19954 series, or equivalent.**

### RS-232C TO RS-485 CONVERSION

An RS-485 network cable can span up to 1000 meters (4000 feet). However, many AutomationDirect PLCs have only RS-232C communication ports, and require an FA-ISOCON (RS-232C to RS-422/485 network adapter) in order to make an RS-485 connection.



*If an FA-ISOCON module is used, set the module dipswitches as required.  
Refer to the FA-ISOCON manual for more detailed information.*

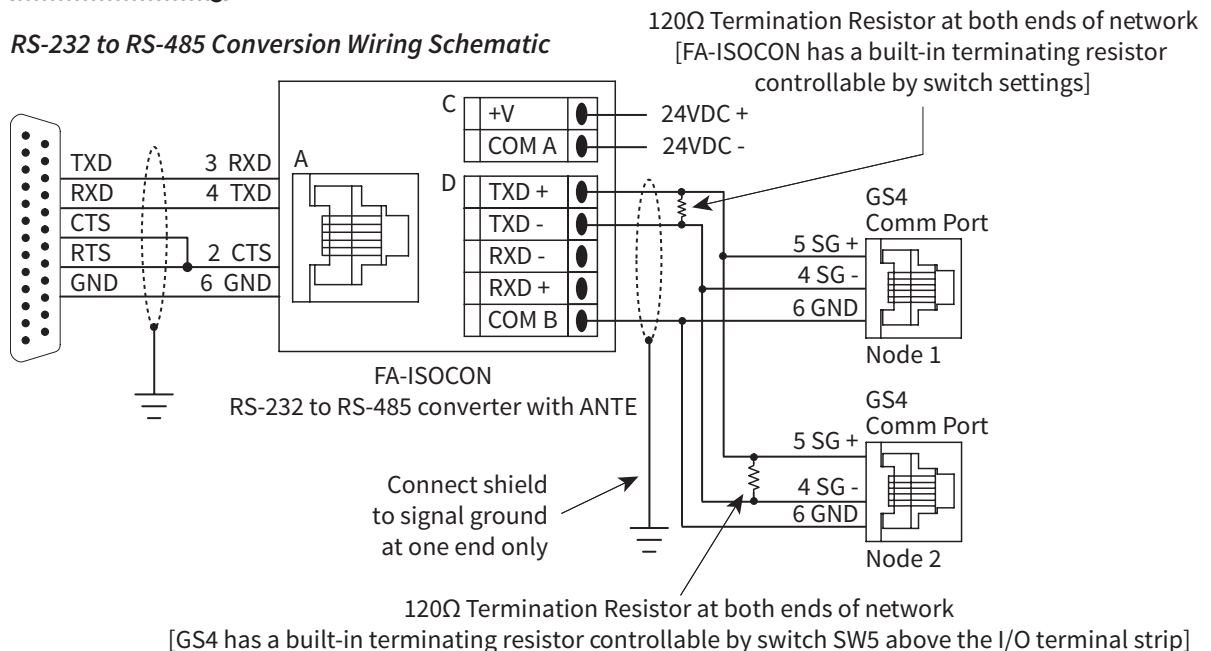
#### FA-ISOCON Switch Settings:

- S21–S23: OFF, ON, ON (19200 baud)
- S24–S27: OFF (Automatic Network Transmit Enable)
- Terminate: ON (end of run term resistors)
- Bias (2): ON (end of run bias resistors)
- 1/2 DPX (2): ON (RS-485 TXD/RXD jumpers)

**Helpful Hint:** Some applications require that the FA-ISOCON baud rate is set faster than the drive/network baud rate.

#### FA-ISOCON Wiring

#### RS-232 to RS-485 Conversion Wiring Schematic



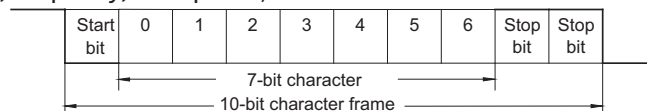
*For information regarding configuration of AutomationDirect PLCs or other PLCs, please refer to Appendix D of this user manual, or to the applicable PLC user manual for your application.*

## DETAILED SERIAL MODBUS COMMUNICATION INFORMATION

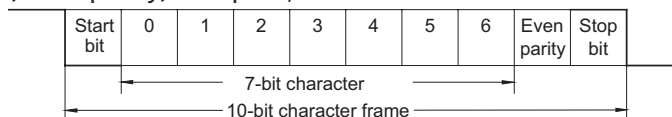
### DATA FORMAT

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

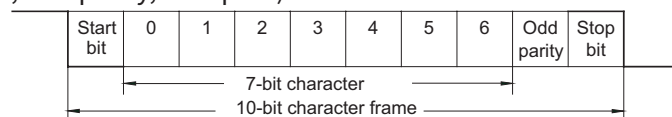
P9.02 = 00 (7 data bits, no parity, 2 stop bits)



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

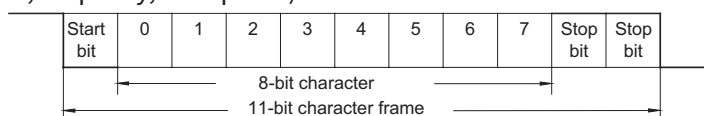


P9.02 = 02 (7 data bits, odd parity, 1 stop bit)

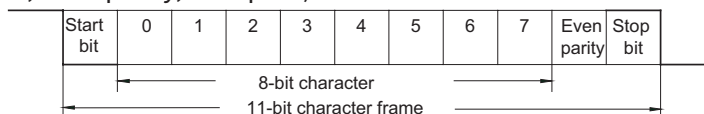


#### RTU Mode: 11-bit character frame (For 8-bit character):

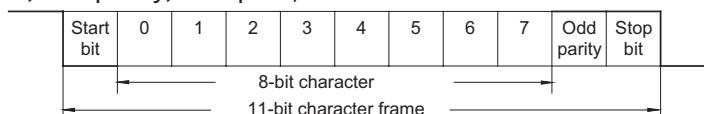
P9.02 = 03 (8 data bits, no parity, 2 stop bits)



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. A communication address equal to 0 means broadcast to all AC drives, in which case the drives will not acknowledge any message from 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:**

<b>Command Message</b>		<b>Response Message</b>	
STX	'.'	STX	'.'
ADR 1	'0'	ADR 1	'0'
ADR 0	'1'	ADR 0	'1'
CMD 1	'0'	CMD 1	'0'
CMD 0	'3'	CMD 0	'3'
Starting data address	'2'	Number of data	'0'
	'1'	(Count by byte)	'4'
	'0'	Content of starting data address	'1'
	'2'	2102H	'7'
Number of data (Count by word)	'0'		'7'
	'0'		'0'
	'0'	Content data address 2103H	'0'
	'2'		'0'
LRC CHK 1	'D'		'0'
LRC CHK 0	'7'		'0'
END 1	CR	LRC CHK 1	'7'
END 0	LF	LRC CHK 0	'1'
		END 1	CR
		END 0	LF

**RTU mode:**

<b>Command Message</b>		<b>Response Message</b>	
ADR	01H	ADR	01H
CMD	03H	CMD	03H
Starting data address	21H	Number of data	04H
	02H	(Count by byte)	'0'
Number of data (Count by word)	00H	Content of data address	17H
	02H	2102H	70H
CRC CHK Low	6FH	Content of data address	00H
	F7H	2103H	02H
		CRC CHK Low	FEH
		CRC CHK High	5CH

**COMMAND CODE: 06H, WRITE 1 WORD**

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

**ASCII mode:**

<b>Command Message</b>		<b>Response Message</b>	
STX	'.'	STX	'.'
ADR 1	'0'	ADR 1	'0'
ADR 0	'1'	ADR 0	'1'
CMD 1	'0'	CMD 1	'0'
CMD 0	'6'	CMD 0	'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	'7'	LRC CHK 1	'7'
LRC CHK 0	'1'	LRC CHK 0	'1'
END 1	CR	END 1	CR
END 0	LF	END 0	LF

**RTU mode:**

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

<b>Command Message</b>		<b>Response Message</b>	
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	4AH
Content of data address 2000H	00H	CRC CHK High	08H
	02H		
Content of data address 2001H	02H		
	58H		
CRC CHK Low	CBH		
CRC CHK High	34H		



**NOTE Concerning 2100h:** When GS4 drive is setup with reference RS-485, ModbusTCP, or EtherNet/IP (P4.00 = 1 or 4, & drive in Remote/Auto) -OR- (P4.00 = 1 or 4, & drive in Local/Hand) -AND- Reference > P0.04 Drive Max Out Freq, the GS4 drive goes up to Max Out Freq and remains there until Max Out Freq is modified or a lower Freq Ref or a Stop Command is sent to the drive.



**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.

<b>Command Message</b>	
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:**

<b>Response Message</b>	
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:**

- 1) Load a 16-bit register (called CRC register) with FFFFh.
- 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.
- 3) Shift the CRC register one bit to the right with MSB zero filling. Extract and examine the LSB.
- 4) If the LSB of CRC register is 0, repeat step 3; else Exclusive or the CRC register with the polynomial value A001h.
- 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.
- 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.



**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;
}

```



**RTU mode is preferred. Limited support is available to ASCII users.**

## BACNET SERIAL COMMUNICATION

### ABOUT BACNET

BACnet is an ASHRAE communication protocol for building automation and control networks. (ASHRAE: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.).

GS4's BACnet is based on BACnet-2004 (ver.1, rev.4).

BACnet's regulations are related to several kinds of physical layers' interfaces. The physical layer built inside GS4 is achieved via MS/TP interface.

The BACnet of GS4 supports a device type called B-ASC. B-ASC supports six types of services such as DS-RP-B, DS-RPM-B, DS-WP-B, DM-DDB-B, DM-DOB, and DM-DCC-B.

### PARAMETER SUMMARY FOR BACNET

GS4 Communications Parameters Summary – BACnet Communication Parameters						
Parameter		Range	Modbus Address			Default Setting
			Hex	Dec	Octal	
<b>P9.86</b>	COM1 Protocol	0: Modbus 485 1: BACnet	0956	42391	4526	0
<b>P9.87</b>	BACnet Address	0~127	0957	42392	4527	10
<b>P9.88</b>	BACnet Baud Rate	9.6~76.8Kbps	0958	42393	4530	38.4
<b>P9.89</b>	BACnet Device ID L	0~65535	0959	42394	4531	10
<b>P9.90</b>	BACnet Device ID H	0~63	095A	42395	4532	0
<b>P9.91</b>	BACnet Max Address	0~127	095B	42396	4533	127
<b>P9.92</b>	BACnet Password	0~65535	095C	42397	4534	0

**GS4 BACNET OBJECT AND PROPERTY**

In GS4, BACnet supports three object types: Device, AnalogValue (AV), and BinaryValue (BV), as shown in the following list.

GS4 Supported BACnet Objects and Properties List				
Property ID		Object Type		
		Device	Analog Value	Binary Value
#4	ACTIVE TEXT			V
#11	APDU_TIMEOUT	V		
#12	APPLICATION_SOFTWARE_VERSION	V		
#28	DESCRIPTION	V	V	V
#30	DEVICE_ADDRESS_BINDING	V	V	
#36	EVENT STATE		V	V
#44	FIRMWARE_REVISION	V		
#46	INACTIVE TEXT			V
#62	MAX_APDU_LENGTH_ACCEPTED	V		
#63	MAX_INFO_FRAMES	V		
#64	MAX_MASTER	V		
#70	MODEL_NAME	V		
#73	NUMBER_OF_APDU_RETRIES	V		
#75	OBJECT_IDENTIFIER	V*	V	V
#76	OBJECT_LIST	V		
#77	OBJECT_NAME	V*	V	V
#79	OBJECT_TYPE	V	V	V
#81	OUT OF SERVICE		V	V
#85	PRESENT VALUE		V**	V**
#87	PRIORITY ARRAY		V***	V***
#96	PROTOCOL_OBJECT_TYPES_SUPPORTED	V		
#97	PROTOCOL_SERVICES_SUPPORTED	V		
#98	PROTOCOL_VERSION	V		
#104	RELINQUISH DEFAULT		V***	V***
#107	SEGMENTATION_SUPPORTED	V		
#111	STATUS FLAGS		V	V
#112	SYSTEM_STATUS	V		
#117	UNITS		V	
#120	VENDOR_IDENTIFIER	V		
#121	VENDOR_NAME	V		
#139	PROTOCOL_REVISION	V		
#155	DATABASE_REVISION	V		
* The Object_ID and Object_Name Properties of Device are writeable.				
** The Present_Value Property of some AV and BV objects is writeable.				
*** Only Writeable objects support Priority_Array and Relinquish_Default.				

**AV objects have writeable and read-only cases.**

- Writeable case: We can use Write\_Service to access the Present\_Value property of writeable AV objects. Thus, the writeable AV objects are linking to the Control\_Word and Pr\_Word in GS4.
- Read only case: We can use Read\_Service to access the Present\_Value property of read-only AV objects. Thus, these read-only AV objects are linking to the Status\_Word in GS4.

**BV objects also have writeable and read-only cases.**

- Writeable case: We can use Write\_Service to access the Present\_Value property of writeable BV objects. Thus, the writeable BV objects are linking to the Control\_Bit in GS4.
- Read-only case: We can use Read\_Service to access the Present\_Value property of read-only BV objects. Thus, these read-only BV objects are linking to the Status\_Bit in GS4.

**WRITEABLE ANALOG VALUE OBJECT**

In GS4, we have AV\_000–AV\_026 supporting writeable Present\_Value property. For these AV Objects, we also can use (Multi)Read\_Service to access Priority\_Array and Relinquish\_Default properties.

Analog Value Objects				
Object Number	R/W	Object Name	Object Description	Unit
<b>AV 000</b>	RW	Reserved	Reserved	UNITS_NO_UNITS
<b>AV 001</b>	RW	FreqRefValue	Frequency Reference Value	UNITS_HERTZ
<b>AV 002</b>	RW	Reserved	Reserved	UNITS_NO_UNITS
<b>AV 003</b>	RW	Reserved	Reserved	UNITS_NO_UNITS
<b>AV 004</b>	RW	Reserved	Reserved	UNITS_NO_UNITS
<b>AV 005</b>	RW	Reserved	Reserved	UNITS_NO_UNITS
<b>AV 006</b>	RW	Reserved	Reserved	UNITS_NO_UNITS
<b>AV 007</b>	RW	Reserved	Reserved	UNITS_NO_UNITS
<b>AV 008</b>	RW	Reserved	Reserved	UNITS_NO_UNITS
<b>AV 009</b>	RW	Reserved	Reserved	UNITS_NO_UNITS
<b>AV 010</b>	RW	Reserved	Reserved	UNITS_NO_UNITS
<b>AV 011</b>	RW	(P9.09 map set)	AV011 will modify the data that is mapped to P9.09	Depends
<b>AV 012</b>	RW	(P9.10 map set)	AV012 will modify the data that is mapped to P9.10	Depends
<b>AV 013</b>	RW	(P9.11 map set)	AV013 will modify the data that is mapped to P9.11	Depends
<b>AV 014</b>	RW	(P9.12 map set)	AV014 will modify the data that is mapped to P9.12	Depends
<b>AV 015</b>	RW	(P9.13 map set)	AV015 will modify the data that is mapped to P9.13	Depends
<b>AV 016</b>	RW	(P9.14 map set)	AV016 will modify the data that is mapped to P9.14	Depends
<b>AV 017</b>	RW	(P9.15 map set)	AV017 will modify the data that is mapped to P9.15	Depends
<b>AV 018</b>	RW	(P9.16 map set)	AV018 will modify the data that is mapped to P9.16	Depends
<b>AV 019</b>	RW	(P9.17 map set)	AV019 will modify the data that is mapped to P9.17	Depends
<b>AV 020</b>	RW	(P9.18 map set)	AV020 will modify the data that is mapped to P9.18	Depends
<b>AV 021</b>	RW	(P9.19 map set)	AV021 will modify the data that is mapped to P9.19	Depends
<b>AV 022</b>	RW	(P9.20 map set)	AV022 will modify the data that is mapped to P9.20	Depends
<b>AV 023</b>	RW	(P9.21 map set)	AV023 will modify the data that is mapped to P9.21	Depends
<b>AV 024</b>	RW	(P9.22 map set)	AV024 will modify the data that is mapped to P9.22	Depends
<b>AV 025</b>	RW	(P9.23 map set)	AV025 will modify the data that is mapped to P9.23	Depends
<b>AV 026</b>	RW	(P9.24 map set)	AV026 will modify the data that is mapped to P9.24	Depends

**STATUS (READ-ONLY) ANALOG VALUE OBJECT**

In GS4, we have AV\_027–AV\_068 with read-only Present\_Value property. For these AV\_Objects, we do NOT have Priority\_Array and Relinquish\_Default properties.

Status Analog Value Objects				
Object Number	R/W	Object Name	Object Description	Unit
AV 027	R	Reserved	Reserved	UNITS_NO_UNITS
AV 028	R	Reserved	Reserved	UNITS_NO_UNITS
AV 029	R	Reserved	Reserved	UNITS_NO_UNITS
AV 030	R	Reserved	Reserved	UNITS_NO_UNITS
AV 031	R	Output frequency	Display output frequency (Hz)	UNITS_HERTZ
AV 032	R	Reserved	Reserved	UNITS_NO_UNITS
AV 033	R	Reserved	Reserved	UNITS_NO_UNITS
AV 034	R	Reserved	Reserved	UNITS_NO_UNITS
AV 035	R	Output torque (%)	Display output torque (%)	UNITS_PERCENT
AV 036	R	Reserved	Reserved	UNITS_NO_UNITS
AV 037	R	Reserved	Reserved	UNITS_NO_UNITS
AV 038	R	Reserved	Reserved	UNITS_NO_UNITS
AV 039	R	Status word	Display status word,made from BV16–BV31	UNITS_NO_UNITS
AV 040	R	Reserved	Reserved	UNITS_NO_UNITS
AV 041	R	Driver type code	Driver type code	UNITS_NO_UNITS
AV 042	R	Warn code	Warn code	UNITS_NO_UNITS
AV 043	R	Error code	Error code	UNITS_NO_UNITS
AV 044	R	Output current	Display output current (Amp)	UNITS_AMPERES
AV 045	R	DC-bus voltage	Display DC-BUS voltage (Volt)	UNITS_VOLTS
AV 046	R	Output Voltage	Display output voltage of U, V, W (Volt)	UNITS_VOLTS
AV 047	R	Count Value	Display counter value of TRG terminal	UNITS_NO_UNITS
AV 048	R	Power Angle	Display output power angle of U, V, W	UNITS_POWER_FACTOR
AV 049	R	Output Power	Display actual output power of U, V, W (kW)	UNITS_KILOWATTS
AV 050	R	IGBT temperature	Display the IGBT temperature	UNITS_DEGREES_CELSIUS
AV 051	R	Temperature of driver	Display the temperature of capacitance	UNITS_DEGREES_CELSIUS
AV 052	R	Real carry frequency	Display real carrier frequency of the drive( KHz)	UNITS_HERTZ
AV 053	R	PID feedback value	Display PID feedback value (%)	UNITS_PERCENT
AV 054	R	Overload rate	Display overload condition (%)	UNITS_PERCENT
AV 055	R	Ground fail detect level	Display GND fail detect level (%)	UNITS_PERCENT
AV 056	R	DC bus ripple	Display DCbus voltage ripples (Volt)	UNITS_VOLTS
AV 057	R	Fan Speed	Fan speed of the drive (%)	UNITS_PERCENT
AV 058	R	Output speed (rpm)	Output speed (rpm)	UNITS_REVOLUTIONS_PER_MINUTE
AV 059	R	KW per Hour	KW per Hour	UNITS_KILOWATTS
AV 060	R	Multi-speed switch	Real multi-speed switch	UNITS_NO_UNITS
AV 061	R	AVI input value	0–10V corresponds to 0–100%	UNITS_PERCENT
AV 062	R	ACI input value	4–20mA/0–10V corresponds to 0–100%	UNITS_PERCENT
AV 063	R	AUI input value	-10V–10V corresponds to -100–100%	UNITS_PERCENT
AV 064	R	Digital input status	Refer to P2-12	UNITS_NO_UNITS
AV 065	R	Digital output status	Refer to P2-18	UNITS_NO_UNITS
AV 066	R	CPU pin status of DI	Corresponding CPU pin status of digital input	UNITS_NO_UNITS
AV 067	R	CPU pin status of DO	Corresponding CPU pin status of digital output	UNITS_NO_UNITS
AV 068	R	PLC D1043 value	PLC D1043 value	UNITS_NO_UNITS

**WRITEABLE BINARY VALUE OBJECT**

In GS4, we have BV\_000–BV\_015 supporting writeable Present\_Value property. For these BV\_Objects, we also can use (Multi)Read\_Service to access Priority\_Array and Relinquish\_Default properties.

Writeable Binary Value Objects			
Object Number	R/W	Object Name	Object Description
<b>BV 000</b>	RW	ACTIVE CMD	(0)FreqCmd=0; (1)FreqCmd=FreqRefValue
<b>BV 001</b>	RW	FWD/REV CMD	(0)Forward; (1)Reverse
<b>BV 002</b>	RW	Reserved	Reserved
<b>BV 003</b>	RW	HALT CMD	(0)None; (1)RampDown to 0Hz
<b>BV 004</b>	RW	LOCK CMD	(0)None; (1)OutputFreq stays at current frequency
<b>BV 005</b>	RW	Reserved	Reserved
<b>BV 006</b>	RW	QSTOP CMD	(0)None; (1)Force driver quick stop
<b>BV 007</b>	RW	ServoPower CMD	(0)PowerOff(free run to stop); (1)PowerOn
<b>BV 008</b>	RW	Reserved	Reserved
<b>BV 009</b>	RW	Reserved	Reserved
<b>BV 010</b>	RW	Reserved	Reserved
<b>BV 011</b>	RW	Reserved	Reserved
<b>BV 012</b>	RW	Reserved	Reserved
<b>BV 013</b>	RW	Reserved	Reserved
<b>BV 014</b>	RW	Reserved	Reserved
<b>BV 015</b>	RW	RESET	RESET:(0)Do nothing;(1)Reset fault

**STATUS (READ-ONLY) BINARY VALUE OBJECT**

In GS4, we have BV\_016–BV\_031 with read-only Present\_Value property. For these BV\_Objects, we do NOT have Priority\_Array and Relinquish\_Default properties.

Status Binary Value Objects			
Object Number	R/W	Object Name	Object Description
<b>BV 016</b>	R	ARRIVE STATE	(0)Not yet; (1)Arrive (OutputFreq=FreqCmd)
<b>BV 017</b>	R	FWD/REV STATE	(0)Forward; (1)Reverse
<b>BV 018</b>	R	WARN STATE	(0)No Warn; (1)Occur Warn
<b>BV 019</b>	R	ERROR STATE	(0)No Error; (1)Occur Error
<b>BV 020</b>	R	Reserved	Reserved
<b>BV 021</b>	R	Reserved	Reserved
<b>BV 022</b>	R	QSTOP STATE	(0)No QSTOP; (1)Occur QSTOP
<b>BV 023</b>	R	SerovPower STATE	(0)PowerOff(free run to stop); (1)PowerOn
<b>BV 024</b>	R	Reserved	Reserved
<b>BV 025</b>	R	Reserved	Reserved
<b>BV 026</b>	R	Reserved	Reserved
<b>BV 027</b>	R	Reserved	Reserved
<b>BV 028</b>	R	Reserved	Reserved
<b>BV 029</b>	R	Reserved	Reserved
<b>BV 030</b>	R	Reserved	Reserved
<b>BV 031</b>	R	Reserved	Reserved



**STEPS TO SETUP THE GS4 PARAMETERS FOR BACNET**

Related to BACnet function in GS4, we have to configure two parts of the parameters.

- Part1. Setup parameter group 9 related to Communication.
- Part2. Setup parameter groups 3 and 4 related to Digital and Analog I/O.

**Part1. Parameter Group9, Communication**

- 1) Set P9.86 =1, BACnet is enabled, then the COM1\_Port will be accessed by BACnet. When this is set, the COM1\_Port communication format will be changed to RTU 8N1.  
(Note: The HW Pins of COM1\_Port are shared by RJ45 and RS-485. When BACnet is enabled, BACnet will access the COM1\_Port, that also means we can NOT have Modbus, PLC connections, Gsoft2, or GSLogic connected by COM1\_Port.)
- 2) Set P9.87, Default =10, BACnet's MS/TP station number 0-127.
- 3) Set P9.88, Default =38400, BACnet communication baud rate, 9600, 19200, 38400, or 76800bps.
- 4) Set P9.89 and P9.90, The default setting of Device Object\_Identifier is 0x0010.  
(P9.89 =10, P9.90 =00). Device Object\_Identifier is the combination of P9.89 and P9.90, thus the setting range can be 0-4194303.)  
For example, P9.90 =12(0Ch) and P9.89 =3456(0D80h), then the device Identifier's value =12\*65536+3456 =789888(0C0D80h).
- 5) Set P9.91, Default =127, the highest allowable address for master nodes on the same MS/TP network. GS4 uses this setting to establish the Max search range.
- 6) Set P9.92, setup the BACnet password. If setup is successful, the keypad will display 8888.

**Part2. Parameter Group 3 and 4, Digital and Analog I/O Parameters.**

- 1) Set P4.00 =1 (RS-485). That means the source of the Frequency command is from RS-485 Interface (accessed by BACnet).
- 2) Set P3.00 = 3 or 4. That means the source of the Operation command is from RS-485 Interface (accessed by BACnet).
  - Selecting 3 keeps the Stop button on the keypad active (preferred setting).
  - Selecting 4 disables the keypad's Stop button.

**Example:**

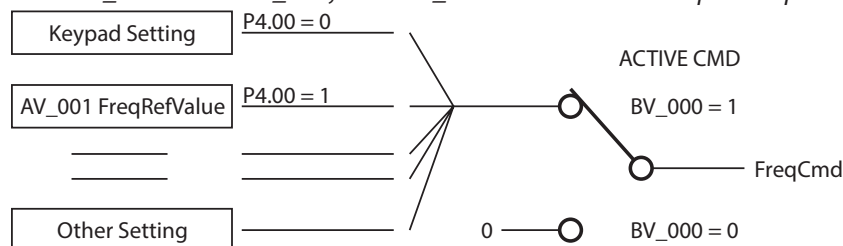
After setting up the two parts of the parameters, we can enable the BACnet function in GS4. Then, we can access some BACnet objects to make the GS4 Run or Stop.

Step1: Write\_Service on AV\_001, Present\_Value =60 → Setup Frequency Reference Value.

Step2: Write\_Service on BV\_007, Present\_Value =Active → Setup Drive PowerOn.

Step3: Write\_Service on BV\_000, Present\_Value =Active → Setup Active CMD.

Step4: Read\_Service on AV\_031, Present\_Value → Read the Output frequency.



As shown in the diagram above, the GS4 can get its Frequency Command from a variety of sources. A typical configuration is to set P4.00 REMOTE Frequency Source = 1 (RS-485/BACnet), and to set P4.01 LOCAL Frequency Source = 0 (Keypad). This way, when the REMOTE button is pressed on the drive's keypad, the drive will be commanded by BACnet. If you experience network problems (or need to spin the motor during commissioning), you can press the LOCAL button on the keypad and control the drive from the keypad.

(See parameters P3.00, P3.01, P4.00, and P4.01 for more details.)

**BACNET PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT****Date:** July 24, 2014**Vendor Name:** AutomationDirect**Product Name:** GS4**Product Model Number:** GS4**Applications Software Version:** Ver 01.04- 201406    **Firmware Revision:** Ver 01.04    **BACnet Protocol Revision:** 7**Product Description:**

ADC GS4 is a Variable Frequency AC motor Drive with BACnet embedded.

In GS4, the BACnet connection is by MS/TP, RS-485-based. GS4 provides a BACnet communication function that permits it as a server and supports BIBBs defined by the BACnet B-ASC.

GS4 BACnet provides the capability to control and monitor the GS4 machine.

**BACnet Standardized Device Profile (Annex L):**

- ☐ BACnet Operator Workstation (B-OWS)
- ☐ BACnet Building Controller (B-BC)
- ☐ BACnet Advanced Application Controller (B-AAC)
- ☒ BACnet Application Specific Controller (B-ASC)
- ☐ BACnet Smart Sensor (B-SS)
- ☐ BACnet Smart Actuator (B-SA)

**List all BACnet Interoperability Building Blocks Supported (Annex K):****Data Sharing BIBBs**

Data Sharing-ReadProperty-B (DS-RP-B)

Data Sharing-WriteProperty-B (DS-WP-B)

Data Sharing-ReadPropertyMultiple-B (DS-RPM-B)

**Device and Network Management BIBBs**

Device Management-Dynamic Device Binding-B (DM-DDB-B)

Device Management-Dynamic Object Binding-B (DM-DOB-B)

Device Management-DeviceCommunicationControl-B (DM-DCC-B)

**Segmentation Capability:**

- ☐ Segmented requests supported      Window Size \_\_\_\_\_
- ☐ Segmented responses supported      Window Size \_\_\_\_\_

**Standard Object Types Supported:**

Analog Value  
Binary Value  
Device

Object instantiation is static. Refer to table at end of this document for object details.

**Data Link Layer Options:**

- ☐ BACnet IP, (Annex J)
- ☐ BACnet IP, (Annex J), Foreign Device
- ☐ ISO 8802-3, Ethernet (Clause 7)
- ☐ ANSI/ATA 878.1, 2.5 Mb. ARCNET (Clause 8)
- ☐ ANSI/ATA 878.1, RS-485 ARCNET (Clause 8), baud rate(s) \_\_\_\_\_
- ☒ MS/TP master (Clause 9), baud rate(s): 9600, 19200, 38400, 76800
- ☐ MS/TP slave (Clause 9), baud rate(s): \_\_\_\_\_
- ☐ Point-To-Point, EIA 232 (Clause 10), baud rate(s): \_\_\_\_\_
- ☐ Point-To-Point, modem, (Clause 10), baud rate(s): \_\_\_\_\_
- ☐ LonTalk, (Clause 11), medium: \_\_\_\_\_
- ☐ Other: \_\_\_\_\_

**Device Address Binding:**

Is static device binding supported? (This is currently necessary for two-way communication with MS/TP slaves and certain other devices.) ☐ Yes ☒ No

**Networking Options:**

- ☐ Router, Clause 6 - List all routing configurations, e.g., ARCNET-Ethernet, Ethernet-MS/TP, etc.
- ☐ Annex H, BACnet Tunneling Router over IP
- ☐ BACnet/IP Broadcast Management Device (BBMD)

Does the BBMD support registrations by Foreign Devices? ☐ Yes ☐ No

**Character Sets Supported:**

Indicating support for multiple character sets does not imply that they can all be supported simultaneously.

- ☒ ANSI X3.4 ☐ IBM™/Microsoft™ DBCS ☐ ISO 8859-1
- ☐ ISO 10646 (UCS-2) ☐ ISO 10646 (UCS-4) ☐ JIS C 6226

**If this product is a communication gateway, describe the types of non-BACnet equipment/networks(s) that the gateway supports:**

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**The Properties of Objects**

Property ID		Object Type		
		Device	Analog Value	Binary Value
#4	ACTIVE TEXT			V
#11	APDU_TIMEOUT	V		
#12	APPLICATION_SOFTWARE_VERSION	V		
#28	DESCRIPTION	V	V	V
#30	DEVICE ADDRESS BINDING	V	V	
#36	EVENT STATE		V	V
#44	FIRMWARE_REVISION	V		
#46	INACTIVE TEXT			V
#62	MAX_APDU_LENGTH_ACCEPTED	V		
#63	MAX_INFO_FRAMES	V		
#64	MAX_MASTER	V		
#70	MODEL_NAME	V		
#73	NUMBER_OF_APDU_RETRIES	V		
#75	OBJECT_IDENTIFIER	V *1	V	V
#76	OBJECT_LIST	V		
#77	OBJECT_NAME	V *1	V	V
#79	OBJECT_TYPE	V	V	V
#81	OUT OF SERVICE		V	V
#85	PRESENT VALUE		V *2	V *2
#87	PRIORITY ARRAY		V *3	V *3
#96	PROTOCOL_OBJECT_TYPES_SUPPORTED	V		
#97	PROTOCOL_SERVICES_SUPPORTED	V		
#98	PROTOCOL_VERSION	V		
#104	RELINQUISH DEFAULT		V *3	V *3
#107	SEGMENTATION_SUPPORTED	V		
#111	STATUS FLAGS		V	V
#112	SYSTEM_STATUS	V		
#117	UNITS		V	
#120	VENDOR_IDENTIFIER	V		
#121	VENDOR_NAME	V		
#139	PROTOCOL_REVISION	V		
#155	DATABASE_REVISION	V		

\*1. The Object\_ID and Object\_Name Properties of Device are writeable.

\*2. The Present\_Value Property of some AV and BV objects are commandable.

\*3. Only Commandable objects support Priority\_Array and Relinquish\_Default.