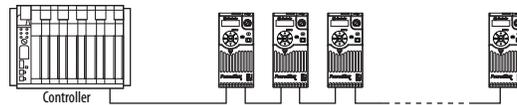


## RS-485 (DSI) Protocol

PowerFlex 520-series drives support the RS-485 (DSI) protocol to allow efficient operation with Rockwell Automation peripherals. In addition, some Modbus functions are supported to allow simple networking. PowerFlex 520-series drives can be multi-dropped on an RS-485 network using Modbus protocol in RTU mode.

### PowerFlex 520-Series Drive Network



For information regarding EtherNet/IP or other communication protocols, refer to the appropriate user manual.

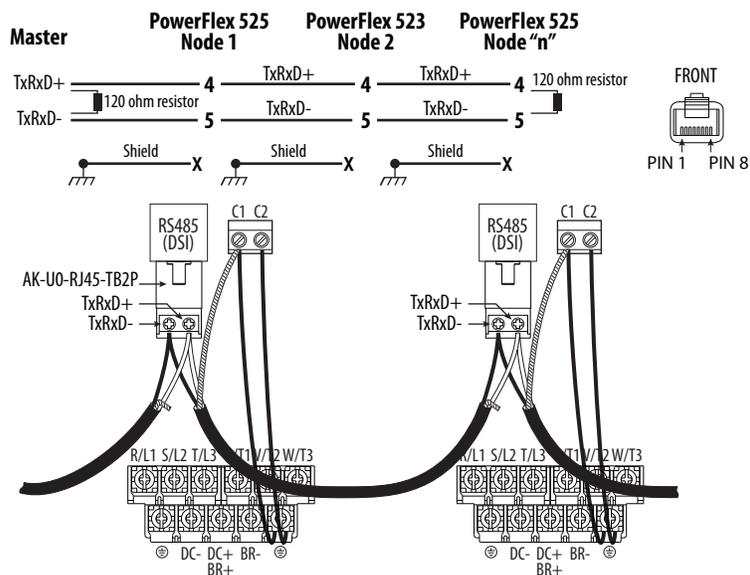
## Network Wiring

Network wiring consists of a shielded 2-conductor cable that is daisy-chained from node to node.



**ATTENTION:** Never attempt to connect a Power over Ethernet (PoE) cable to the RS-485 port. Doing so may damage the circuitry.

### Network Wiring Diagram Example



**IMPORTANT** The shield is connected at ONLY ONE end of each cable segment.

Only pins 4 and 5 on the RJ45 plug should be wired. The other pins on the PowerFlex 520-series drive's RJ45 socket must not be connected because they contain power, etc. for other Rockwell Automation peripheral devices.

Wiring terminations on the master controller will vary depending on the master controller used and "TxRxD+" and "TxRxD-" are shown for illustration purposes only. Refer to the master controller's user manual for network terminations. Note that there is no standard for the "+" and "-" wires, and consequently Modbus device manufacturers interpret them differently. If you have problems with initially establishing communications, try swapping the two network wires at the master controller.

Standard RS-485 wiring practices apply.

- Termination resistors need to be applied at each end of the network cable.
- RS-485 repeaters may need to be used for long cable runs, or if greater than 32 nodes are needed on the network.
- Network wiring should be separated from power wires by at least 0.3 meters (1 foot).
- Network wiring should only cross power wires at a right angle.

I/O Terminal C1 (RJ45 Shield) for the Ethernet and DSI network cables on the PowerFlex 520-series drive must also be connected to PE ground (there are two PE terminals on the drive). The shield for the network cables should be connected to PE ground at one end only.

I/O Terminal C2 (Comm Common) is internally tied to Network Common for the network signals, and NOT to RJ45 Shield. Tying I/O Terminal C2 to PE ground may improve noise immunity in some applications.

See I/O Control Terminal Designations on [page 39](#) and [page 42](#) for more information.

## Parameter Configuration

The following PowerFlex 520-series drive parameters are used to configure the drive to operate on a DSI network.

### Configuring Parameters for DSI Network

Parameter	Details	Reference
<a href="#">P046</a> [Start Source 1]	Set to 3 "Serial/DSI" if Start is controlled from the network.	<a href="#">page 86</a>
<a href="#">P047</a> [Speed Reference1]	Set to 3 "Serial/DSI" if the Speed Reference is controlled from the network.	<a href="#">page 86</a>
<a href="#">C123</a> [RS485 Data Rate]	Sets the data rate for the RS-485 (DSI) Port. All nodes on the network must be set to the same data rate.	<a href="#">page 100</a>
<a href="#">C124</a> [RS485 Node Addr]	Sets the node address for the drive on the network. Each device on the network requires a unique node address.	<a href="#">page 100</a>
<a href="#">C125</a> [Comm Loss Action]	Selects the drive's response to communication problems.	<a href="#">page 100</a>
<a href="#">C126</a> [Comm Loss Time]	Sets the time that the drive will remain in communication loss before the drive implements <a href="#">C125</a> [Comm Loss Action].	<a href="#">page 100</a>
<a href="#">C127</a> [Comm Format]	Sets the transmission mode, data bits, parity, and stop bits for the RS-485 (DSI) Port. All nodes on the network must be set to the same setting.	<a href="#">page 101</a>
<a href="#">C121</a> [Comm Write Mode]	Set to 0 "Save" when programming drive. Set to 1 "RAM only" to only write to volatile memory.	<a href="#">page 100</a>

## Supported Modbus Function Codes

The Drive Serial Interface (DSI) used on PowerFlex 520-series drives supports some of the Modbus function codes.

### Supported Modbus Function Codes

Modbus Function Code (Decimal)	Command
03	Read Holding Registers
06	Preset (Write) Single Register
16 (10 Hexadecimal)	Preset (Write) Multiple Registers

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**IMPORTANT** Modbus devices can be 0-based (registers are numbered starting at 0) or 1-based (registers are numbered starting at 1). Depending on the Modbus Master used, the register addresses listed on the following pages may need to be offset by +1. For example, Logic Command may be register address 8192 for some master devices (for example, ProSoft 3150-MCM SLC™ Modbus scanner) and 8193 for others (for example, PanelView™).

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## Writing (06) Logic Command Data

The PowerFlex 520-series drive can be controlled through the network by sending Function Code 06 writes to register address 2000H (Logic Command). [Po46](#) [Start Source 1] must be set to 3 “Serial/DSI” in order to accept the commands. PowerFlex 523 drives support only Velocity bit definitions.

PowerFlex 525 drives can use Parameter [C122](#) [Cmd Stat Select] to select either Velocity or Position bit definitions.



Powerup/Reset the drive after selecting an option for C122 [Cmd Stat Select] for the change to take effect.

### Velocity Bit Definitions

Comm Logic Command - C122 = 0 "Velocity"			
Address (Decimal)	Bit(s)	Description	
2000H (8192)	0	1 = Stop, 0 = Not Stop	
	1	1 = Start, 0 = Not Start	
	2	1 = Jog, 0 = No Jog	
	3	1 = Clear Faults, 0 = Not Clear Faults	
	5, 4	00	No Command
		01	Forward Command
		10	Reverse Command
		11	No Command
	6	1 = Force Keypad Control, 0 = Not Force Keypad Control	
	7	1 = MOP Increment, 0 = Not Increment	
	9, 8	00	No Command
		01	Accel Rate 1 Enable
		10	Accel Rate 2 Enable
		11	Hold Accel Rate Selected
	11, 10	00	No Command
01		Decel Rate 1 Enable	
10		Decel Rate 2 Enable	
11		Hold Decel Rate Selected	
14, 13, 12	000	No Command	
	001	Freq. Source = P047 [Speed Reference1]	
	010	Freq. Source = P049 [Speed Reference2]	
	011	Freq. Source = P051 [Speed Reference3]	
	100	A410 [Preset Freq 0]	
	101	A411 [Preset Freq 1]	
	110	A412 [Preset Freq 2]	
111	A413 [Preset Freq 3]		
15	1 = MOP Decrement, 0 = Not Decrement		

## Position Bit Definitions

Comm Logic Command - C122 = 1 "Position"			
Address (Decimal)	Bit(s)	Description	
2000H (8192)	0	1 = Stop, 0 = Not Stop	
	1	1 = Start, 0 = Not Start	
	2	1 = Jog, 0 = No Jog	
	3	1 = Clear Faults, 0 = Not Clear Faults	
	5, 4	00	No Command
		01	Forward Command
		10	Reverse Command
		11	No Command
	6	1 = Logic In 1	
	7	1 = Logic In 2	
	10, 9, 8	000	Freq. and Position Step 0
		001	Freq. and Position Step 1
		010	Freq. and Position Step 2
		011	Freq. and Position Step 3
		100	Freq. and Position Step 4
101		Freq. and Position Step 5	
110		Freq. and Position Step 6	
111	Freq. and Position Step 7		
11	1 = Find Home		
12	1 = Hold Step		
13	1 = Pos Redefine		
14	1 = Sync Enable		
15	1 = Traverse Disable		

## Writing (06) Comm Frequency Command

The PowerFlex 520-series drive Comm Frequency Command can be controlled through the network by sending Function Code 06 writes to register address 2001H (Comm Frequency Command).

### Comm Frequency Command

Reference	
Address (Decimal)	Description
2001H (8193)	Used by internal comm modules to control the reference of the drive. In units of 0.01 Hz.

## Reading (03) Logic Status Data

The PowerFlex 520-series drive Logic Status data can be read through the network by sending Function Code 03 reads to register address 2100H (Logic Status). PowerFlex 523 drives support only Velocity bit definitions. PowerFlex 525 drives can use Parameter [C122](#) [Cmd Stat Select] to select either Velocity or Position bit definitions.

### Velocity Bit Definitions

Comm Logic Status - C122 = 0 "Velocity"		
Address (Decimal)	Bit(s)	Description
2100H (8448)	0	1 = Ready, 0 = Not Ready
	1	1 = Active (Running), 0 = Not Active
	2	1 = Cmd Forward, 0 = Cmd Reverse
	3	1 = Rotating Forward, 0 = Rotating Reverse
	4	1 = Accelerating, 0 = Not Accelerating
	5	1 = Decelerating, 0 = Not Decelerating
	6	Not Used
	7	1 = Faulted, 0 = Not Faulted
	8	1 = At Reference, 0 = Not At Reference
	9	1 = Main Freq Controlled by Active Comm
	10	1 = Operation Cmd Controlled by Active Comm
	11	1 = Parameters have been locked
	12	Digital Input 1 Status (DigIn TermBlk 05)
	13	Digital Input 2 Status (DigIn TermBlk 06)
	14	Digital Input 3 Status (DigIn TermBlk 07)
15	Digital Input 4 Status (DigIn TermBlk 08)	

### Position Bit Definitions

Comm Logic Status - C122 = 1 "Position"		
Address (Decimal)	Bit(s)	Description
2100H (8448)	0	1 = Ready, 0 = Not Ready
	1	1 = Active (Running), 0 = Not Active
	2	1 = Cmd Forward, 0 = Cmd Reverse
	3	1 = Rotating Forward, 0 = Rotating Reverse
	4	1 = Accelerating, 0 = Not Accelerating
	5	1 = Decelerating, 0 = Not Decelerating
	6	1 = Forward Travel Position, 0 = Reverse Travel Position
	7	1 = Faulted, 0 = Not Faulted
	8	1 = At Reference, 0 = Not At Reference
	9	1 = At Position, 0 = Not At Position
	10	1 = At Home, 0 = Not At Home
	11	1 = Drive Homed, 0 = Not Drive Homed
	12	1 = Sync Hold, 0 = Not Sync Hold
	13	1 = Sync Ramp, 0 = Not Sync Ramp
	14	1 = Traverse On, 0 = Traverse Off
15	1 = Traverse Decel, 0 = Not Traverse Decel	

## Reading (03) Drive Error Codes

The PowerFlex 520-series Error Code data can be read through the network by sending Function Code 03 reads to register address 2101H (Drive Error Codes).

### Drive Error Codes

Logic Status			
Address (Decimal)	Value (Decimal)	Description	
2101H (8449)	0	No Fault	
	2	Auxiliary Input	
	3	Power Loss	
	4	Undervoltage	
	5	Overvoltage	
	6	Motor Stalled	
	7	Motor Overload	
	8	Heatsink Overtemperature	
	9	Control Module Overtemperature	
	12	HW Overcurrent (300%)	
	13	Ground Fault	
	15	Load Loss	
	21	Output Phase Loss	
	29	Analog Input Loss	
	33	Auto Restart Tries	
	38	Phase U to Ground Short	
	39	Phase V to Ground Short	
	40	Phase W to Ground Short	
	41	Phase UV Short	
	42	Phase UW Short	
	43	Phase VW Short	
	48	Parameters Defaulted	
	59	Safety Open	
	63	Software Overcurrent	
	64	Drive Overload	
	70	Power Unit Fail	
	71	DSI Network Loss	
	72	Option Card Network Loss	
	73	Embedded EtherNet/IP Adapter Network Loss	
	80	AutoTune Fail	
	81	DSI Communication Loss	
	82	Option Card Communication Loss	
	83	Embedded EtherNet/IP Adapter Communication Loss	
	91	Encoder Loss	
	94	Function Loss	
	100	Parameter Checksum Error	
	101	External Storage	
	105	Control Module Connect Error	
	106	Incompatible Control-Power Module	
	107	Unrecognized Control-Power Module	
	109	Mismatched Control-Power Module	
	110	Keypad Membrane	
	111	Safety Hardware	
	114	Microprocessor Failure	
	122	I/O Board Fail	
	2101H (8449)	125	Flash Update Required
		126	Non Recoverable Error
127		DSI Flash Update Required	

## Reading (03) Drive Operational Values

The PowerFlex 520-series Drive Operational Values can be read through the network by sending Function Code 03 reads to register addresses 2102H...210AH.

### Drive Operational Values

Reference	
Address (Decimal)	Description
2102H (8450)	Frequency Command (xxx.xx Hz)
2103H (8451)	Output Frequency (xxx.xx Hz)
2104H (8452)	Output Current (xxx.xx A)
2105H (8453)	DC-BUS Voltage (xxxV)
2106H (8454)	Output Voltage (xxx.xV)

## Reading (03) and Writing (06) Drive Parameters

To access drive parameters, the Modbus register address equals the parameter number. For example, a decimal “1” is used to address Parameter 0001 [Output Freq] and decimal “41” is used to address Parameter P041 [Accel Time 1].

## Additional Information

See <https://www.ab.com/drives> for additional information.