ICP PANEL-TEC

MICROBRIDGE INSTALLATION AND OPERATION GUIDE

MODBUS PLUS TO SIEMENS G110/G120/MM440 APPLICATION

Revision History

Revision	Date	Author	Comments
000	3 May 2010	David Walker	Initial release.

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INTRODUCTION

The Modbus Plus to G110/G120/MM440 version of the MicroBridge connects G110, G120, or MM440 drive to a Modbus Plus Network. A pre-defined set of Modbus registers in the Modbus Plus client are provided to allow access to the most common drive parameters, monitor values, setpoint values, and control points for the drive.

The MicroBridge device is a light-weight DIN Rail Mountable unit with 2 serial ports, a Modbus Plus port, and 5 LED indicators. It is powered with a DC supply providing any voltage between 7 and 28 volts.

The MicroBridge has a built-in configuration utility. The configuration screens are accessed through any terminal communication program such as HyperTerminal.

Ordering Information

The MicroBridge product is sold with several different software applications. To ensure that the correct version of the MicroBridge is procured, please include the correct part number when ordering. Part numbers for the MicroBridge, power supply and cables for the Modbus Plus to G110/G120/MM440 application are as follows:

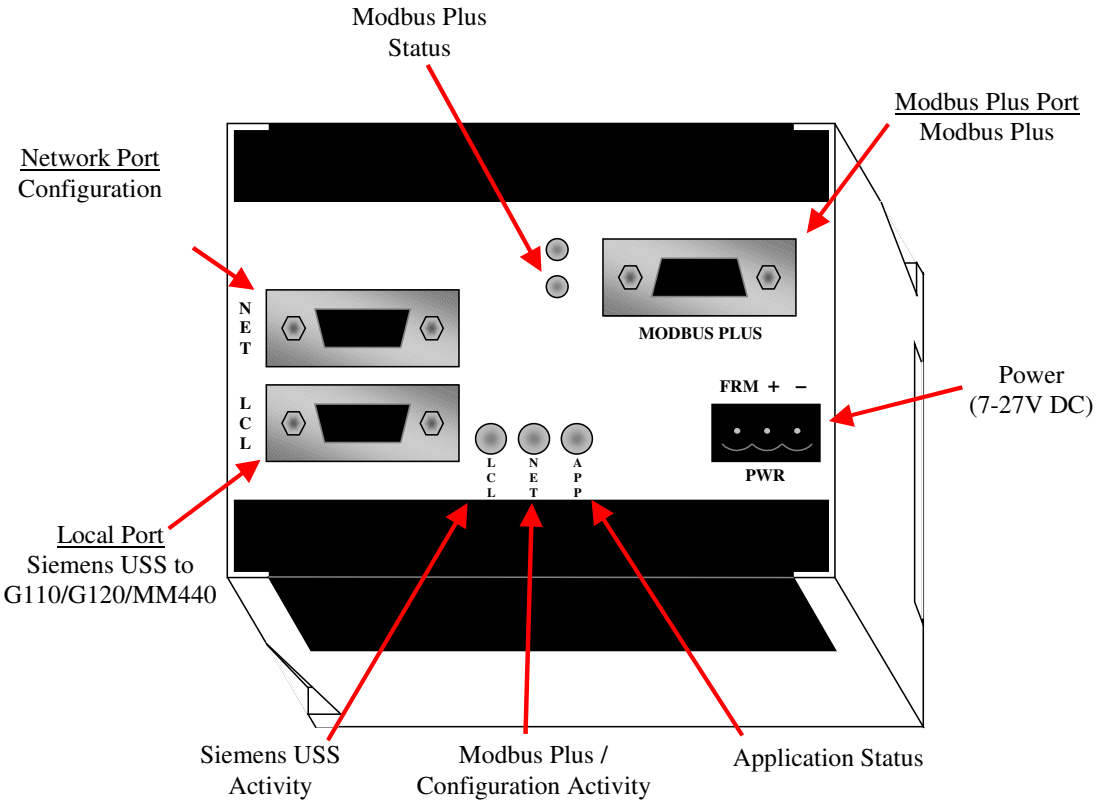
Table 1 - Part Numbers

Part Number	Description
5008-402-102	MicroBridge with Modbus Plus to G110/G120/MM440 Application
4000-0205	MicroBridge Power Supply
6000-0003	MicroBridge Local Port Drive Cable (RS485 cable with stripped wires for connection to terminal block)
6000-0007	MicroBridge Local Port G120 Drive Cable (RS485 cable for connection to DB9 on CU240S)
6000-0010	MicroBridge Configuration Cable (Null Modem)

HARDWARE

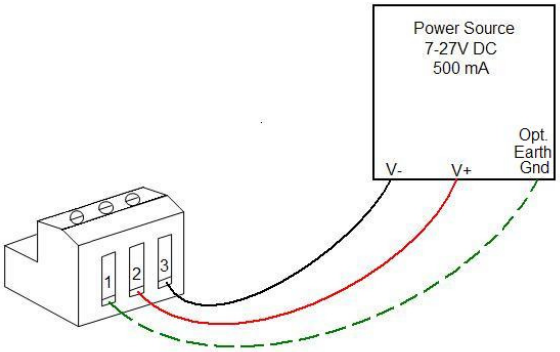
Dimensions

The MicroBridge is packaged in a 10cm x 7.5cm x 11cm plastic box, with a din-rail mounting on the bottom. The serial and Modbus Plus ports, leds, and power connector are on the top of the unit.



Power Supply

The MicroBridge requires a power supply of 7-24V DC at 500 mA. A 3-position pluggable terminal block is used to connect the power supply. The following diagram shows the wiring of the power supply.



Serial Ports

The MicroBridge has two DB9 serial ports. Both ports can be used in either RS232 mode or 2-Wire RS485 mode, depending on the application. The RS485 signals are located on the same pins on both ports. They are placed on pins that are not generally used for RS232 communications so off-the-shelf RS232 cables can be used when operating in RS232 mode.

The female DB9 port is referred to as the Local port (LCL), and is used to communicate with Siemens drive via the Siemens USS protocol. The RS485 signals on the port are used for connection to the drive. The port will operate at baud rates of 2.4K, 4.8K, 9.6K, 19.2K, 38.4K, 57.6K, 76.8K, 93.75K, or 115.2K. An LED indicator is used to reflect transmit/receive activity on this port.

The male DB9 port is referred to as the Network port (NET), and is used to configure the MicroBridge using the built-in configuration utility. The RS232 signals on the Network port use a DTE configuration, requiring a null-modem cable to be used during configuration mode. An LED indicator is used to reflect transmit/receive activity on this port.

Table 2 - Serial Port Pinouts

Local: DB9-Female		
Pin	**Label**	**Description**
1	485+	RS485 D+
2	TXD	RS232 TxD
3	RXD	RS232 RxD
4	DTR	RS232 DTR
5	GND	Reference Ground
6	485-	RS485 D-
7	RTS	RS232 RTS
8	CTS	RS232 CTS
9	-	No Connect

Network: DB9-Male		
Pin	**Label**	**Description**
1	485+	RS485 D+
2	RXD	RS232 RxD
3	TXD	RS232 TxD
4	-	No Connect
5	GND	Reference Ground
6	485-	RS485 D-
7	CTS	RS232 CTS
8	RTS	RS232 RTS
9	-	No Connect

Modbus Plus Port

The MicroBridge also has a single female DB9 Modbus Plus port. The Modbus Plus port supports standard Modbus Plus communications at 1 Mbps, and is used to connect the MicroBridge to a Modbus Plus network. An LED indicator is used to reflect the status of the Modbus Plus connection.

Table 3 - Modbus Plus Port Pinout

Modbus Plus Port: DB9-Female		
Pin	**Label**	**Description**
1	GND	Chassis Ground
2	A	Receive/Transmit A
3	B	Receive/Transmit B
4	-	No Connect
5	-	No Connect
6	-	No Connect
7	-	No Connect
8	-	No Connect
9	-	No Connect

Siemens Drive Cable (G110 / G120 with CU240E / MM440)

One end of the RS485 Siemens Drive cable (Part # 6000-0003) connects to the DB9 Female Local port on the MicroBridge. The other end of the cable has stripped wires for connection to the corresponding terminals on the drive.

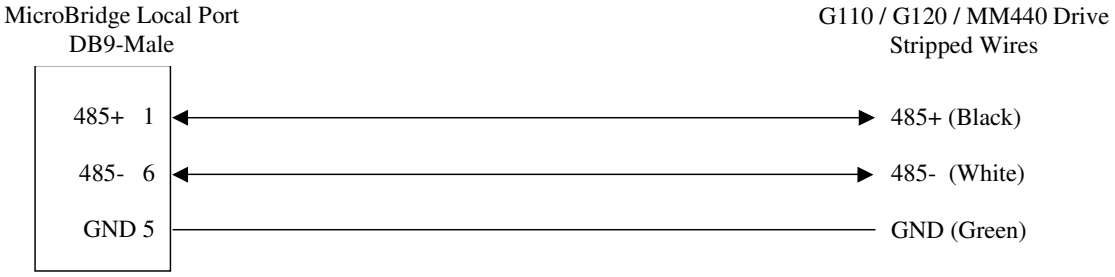


Figure 1 - G110 / G120 / MM440 Drive Cable

Siemens Drive Cable (G120 with CU240S)

One end of the RS485 Siemens Drive cable (Part # 6000-0007) connects to the DB9 Female Local port on the MicroBridge. The other end of the cable connects to the DB9 Female connector on the CU240S module.

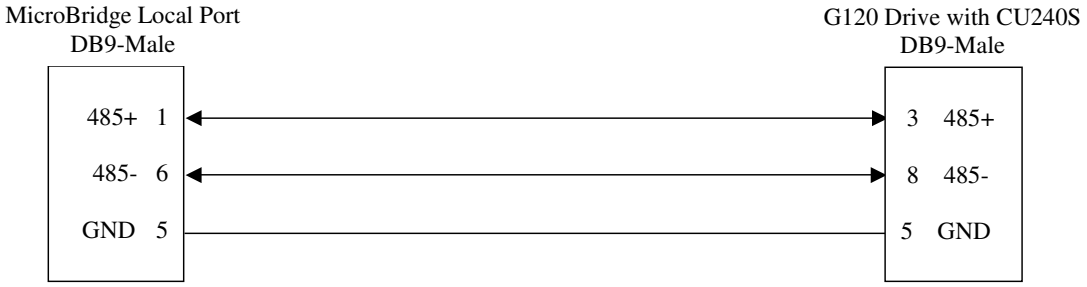


Figure 2 - G120 with CU240S Cable

Configuration Cable

One end of the MicroBridge Configuration cable (Part # 6000-0010) connects to the DB9 Male Network port on the MicroBridge during configuration mode. The other end connects to a serial port on a PC. A standard off-the-shelf null-modem DB9-F to DB9-F cable (pins 2 and 3 crossed) can be used as well.

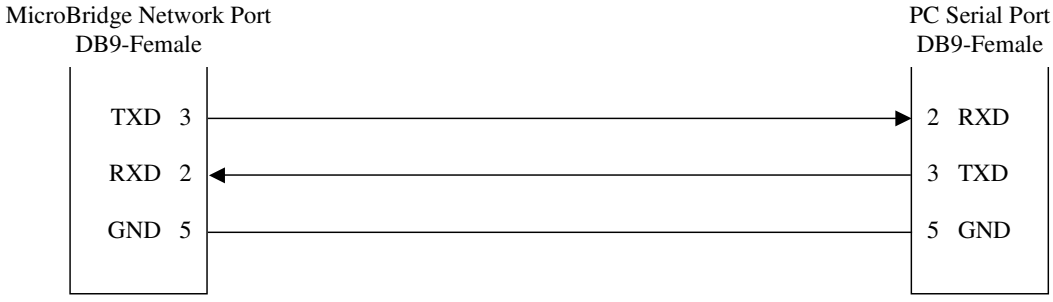


Figure 3 - Configuration Cable (null-modem)

LED Indicators

There are a total of 3 Bi-color and 2 single-color LED indicators on the MicroBridge. The LCL, NET, and APP LEDs are located next to the Local Port on the MicroBridge. The LCL LED displays the communications activity on the Local (Siemens drive) port. The NET LED displays communications activity on the Network (Configuration) port during configuration mode, or the transmit/receive of Modbus messages on the Modbus Plus port during run mode. The APP LED displays the overall status of the MicroBridge application. During normal operations, the LCL and NET LEDs will quickly alternate red and green flashes, making them look almost amber. This is normal.

The two single-color LEDs are located next to the Modbus Plus port on the MicroBridge. The MBP LED (closest to the APP LED) displays the status of the Modbus Plus connection. The other LED displays internal activity on the Modbus Plus command interface, and is used for diagnostics only.

Table 4 - MicroBridge General Application Status LED (APP)

For this state:	LED is:	To indicate:
No Power	Off	There is no power applied to the device.
Run Mode	Flashing Green (250ms On, 250ms Off)	The MicroBridge is operating normally in RUN Mode.
Configuration Mode	Flashing Green (1.5 sec On, 1.5 sec Off)	The MicroBridge is in Configuration Mode.
Initialization Mode	Flashing Yellow (Amber) (250ms On, 250 ms Off)	The MicroBridge is initializing the Modbus Plus command interface (usually takes several seconds).
Fatal Error	Flashing Red (250ms On, 250ms Off)	The Modbus Plus command interface has crashed, and the MicroBridge is attempting to restart it.

Table 5 - Network Port Communications Activity LED (NET)

For this state:	LED is:	To indicate:
Receive Data	Red	The MicroBridge is receiving data from Modbus Plus.
Transmit Data	Green	The MicroBridge is transmitting data to Modbus Plus.

Table 6 - Local Port Communications Activity LED (LCL)

For this state:	LED is:	To indicate:
Receive Data	Red	The MicroBridge is receiving data from the Siemens Drive.
Transmit Data	Green	The MicroBridge is transmitting data to the Siemens Drive.

Table 7 - Modbus Plus LED (MBP)

For this state:	LED is:	To indicate:
Inactive	Off	The Modbus Plus command inteface is not active.
Online	Flash every 160 ms	The Modbus Plus node is working normally, in that it is successfully exchanging the token with at least one other Modbus Plus node.
Monitor Offline	Flash every 1 sec	The Modbus Plus node is monitoring the link and building an active station table, prior to participating in token passing. This activity takes approximately 5-7 seconds.
MAC Idle	2 flashes, then off 2 secs	The MicroBridge can hear the token being passed between other Modbus Plus nodes, but it is never passed to this node. It may have a bad transmitter.
Active Offline	3 flashes, then off 1.7 secs	The MicroBridge is not hearing any other nodes, so it is periodically claiming and releasing the token. Either there are no other nodes on the link, or the unit has a bad receiver. In the latter case, this node will periodically disrupt communications on the link.
Duplicate Offline	4 flashes, then off 1.4 secs	The MicroBridge has heard a valid packet that was sent from another node on the link using the same Modbus Plus node address.

MICROBRIDGE CONFIGURATION

Default Configuration

The Modbus Plus port on the MicroBridge is configured to act as a slave on a Modbus Plus network. It must be assigned a unique Modbus Plus node address, as follows:

Table 8 - Modbus Plus Configuration Options

Parameter	Options	Default
Node Address	1-64	2

The Local Port on the MicroBridge is configured for communications with a Siemens drive using USS. The configuration parameters that may be changed are shown in the following table:

Table 9 – G120 / MM440 Port Configuration Options

Parameter	Options	Default
Port Type	RS232 RS485	RS485
USS Baud Rate	2400 bps 4800 bps 9600 bps 19200 bps 38400 bps 57600 bps 76800 bps 93750 bps 115200 bps 187500 bps	38400 bps

Changing the Configuration

The configuration stored in the MicroBridge may be changed from the default configuration by entering Configuration Mode. The following steps are required to enter Configuration Mode.

1. Attach a configuration cable between the Network port on the MicroBridge and a serial port on a PC.
2. Start a terminal program, such as HyperTerminal, on the PC, and connect using the following settings:
    - Baud = 9600 bps
    - Data bits = 8
    - Parity = None
    - Stop Bits = 1
    - Flow Control = None
    - Terminal Emulation = ANSI
    - Local Echo = Off
3. Apply power to the MicroBridge, and send a carriage return (press the **Enter** key) within 5 seconds of startup.

Once the MicroBridge is in Configuration Mode, it will send its current configuration information to the terminal program.

Use the **up** and **down** arrows on your keyboard to navigate to the field you want to change, then use the **left** and **right** arrows to change the value in that field. When you are finished, navigate to "Save Configuration" and press the **Enter** key to save the configuration information to the MicroBridge.

Once the configuration has been saved, remove power from the MicroBridge and remove the configuration cable.

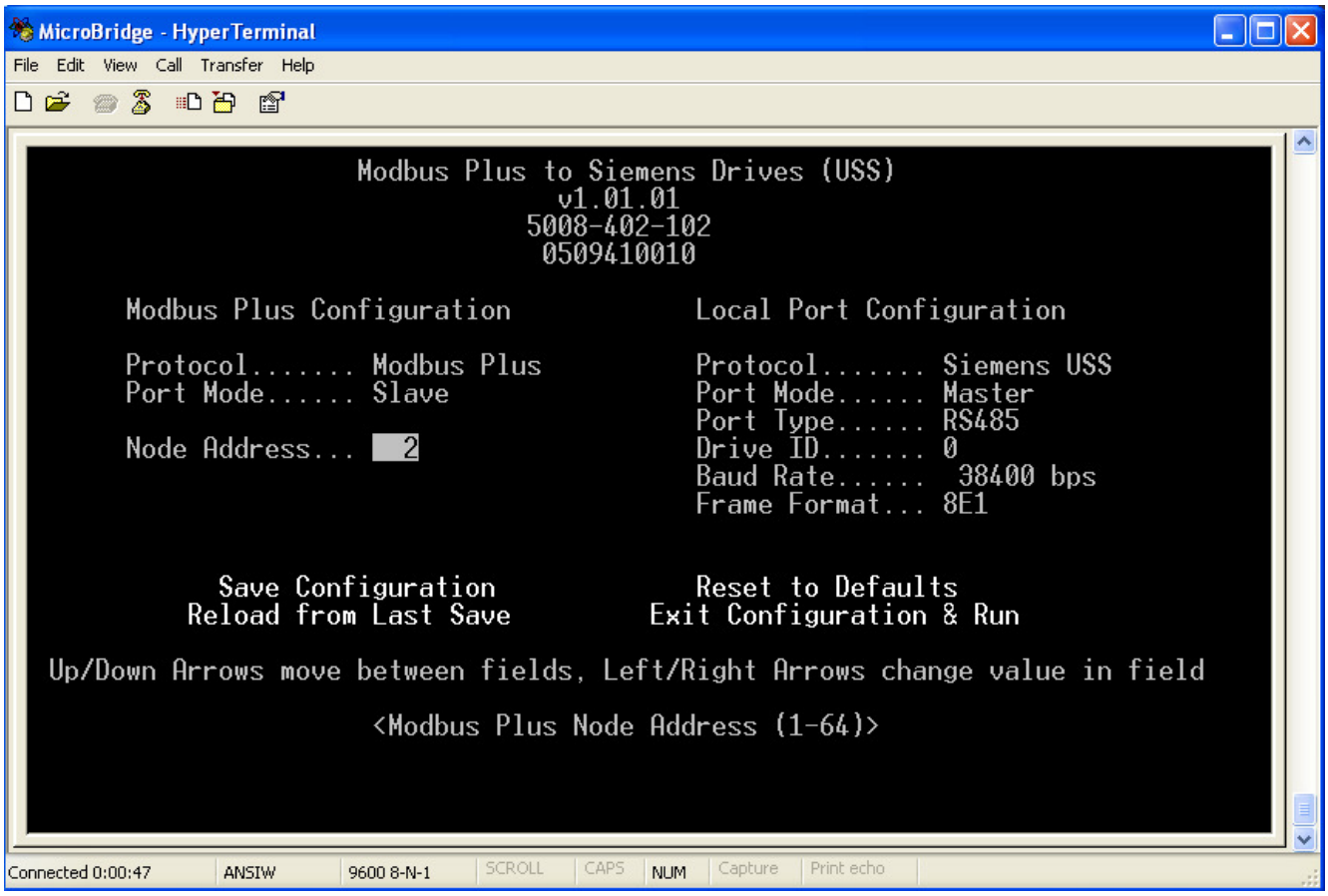


Figure 4 - Configuration Screen

The top 4 lines on the configuration screen include the following information, which should be recorded and made available when requesting technical support:

- Application Name
- Firmware Version
- Part Number
- Serial Number

SIEMENS DRIVE SETUP

Siemens Drive Parameter Configuration

The Siemens drive must be configured before the MicroBridge will communicate properly with the drive. The MicroBridge communicates with the drive through the USS interface. The baud-rate for the USS network is configurable but defaults to 38.4K baud.

To setup the drive for communications with a MicroBridge, the drive parameters in the following table must be configured with the values shown via the drive keypad or Starter software.

Table 10 - Siemens Drive Parameter Configuration

G120 Parameter	Function	Set Value
P0003	User Access Level	3 (Expert Setting)
P0700[0]	Command Source	5 if Starting/Stopping Drive from Modbus Otherwise: **Do Not Change**
P1000[0]	Frequency Setpoint Source	5 if Setting the Frequency from Modbus Otherwise: **Do Not Change**
P2009[0]	USS Normalization	0 (Disabled) **Only for MM440**
P2010[0]	USS Baud Rate	8 (38.4K baud)
P2011[0]	USS Address	0
P2012[0]	USS PZD Length	2
P2013[0]	USS PKW Length	127 (Variable)
P2014[0]	USS telegram off time	0 to Disable the USS "watchdog" timer, or > 0 to enable the USS "watchdog" timer (NOTE: values less than 100ms are not recommended)
P2041[0]	Protocol Selection for RS485 port	0 (USS Protocol) **Only for MM440**

USS Watchdog Timer Setup

The drive has a timeout function for the USS port, which is controlled by Parameter 2014, "USS telegram off time". Once the MicroBridge has established communications with a drive with the watchdog function enabled, the watchdog timer is activated. If communications are subsequently lost for the specified length of time, the drive will automatically generate a F0072 fault. Setting Parameter 2014 to a value of 0 disables the watchdog timer function. Setting Parameter 2014 to a non-zero value enables the watchdog timer function with the specified time. Avoid setting this value too low, as that could result in false fault indications.

Verifying the Installation

After all necessary connections have been made, power up the drive and the MicroBridge, and wait approximately 5 seconds. If the MicroBridge has been installed correctly, the APP led will be flashing green, and the LCL led will be alternating so fast between red and green that it will appear to be glowing amber.

To verify that the MicroBridge and drive are set up correctly, set P0700[0] to a value of 5 and P1000[0] to a value of 5 so that the drive can be controlled from the Modbus Plus network. From the Modbus Plus host, issue a Modbus write with a value of 1 to the Control from PLC register (40013) to enable drive remote control. Then, write a value of 5000 (50% of the maximum frequency) to the Main Setpoint register (40019), followed by a value of 1 to the appropriate Enable register(s). Write a value of 1 to the ON/OFF1 register (40003), and the drive should start running. Write a value of 0 to the ON/OFF1 register to stop the drive. The drive frequency can be changed at any time during this process by writing to the Main Setpoint register (40019).

MODBUS REGISTERS

The following table contains the list of all Modbus holding registers available on the MicroBridge. The Modbus Plus master may write to Registers 40001 through 40039. All other registers are read-only.

There is a scaling factor included for some of the registers. Because Modbus does not represent floating point numbers, all floating point values in the drive are converted to integer register values by applying a scaling (multiplication) factor. The scaling factors are in the range of 10 to 1000. For example: "Ramp Up Time" has a scaling factor of 100. If the drive contains a value of 20.50, then the "Ramp Up Time" register will contain a value of 2050.

STW and HSW refer to the 1st and 2nd words, respectively, of PZD data included in every poll sent from the MicroBridge to the drive via Profibus. ZSW and HIW refer to the 1st and 2nd words, respectively, of PZD data included in every poll response sent from the drive to the MicroBridge via Profibus. Registers mapped to PZD data are updated frequently.

All other parameters (except "Watchdog Action" and "Watchdog Time", which are handled internally in the MicroBridge) are mapped to parameters in the drive, and are updated cyclically. Registers mapped to *monitor* parameters – parameters such as "Actual Current", or "Output Power", whose values change automatically during normal operation of the drive, without the intervention of an operator – are updated at a rate of approximately once per second. Registers mapped to *setup* parameters – parameters such as "Ramp Up Time" or "Frequency MAX Limit", whose values typically change only via intervention by an operator – are updated at a rate of approximately once every 5 seconds.

Registers Mapped to Unsupported Parameters

If a particular parameter is not supported in the drive, then the corresponding Modbus register from the register map will not be supported unless it is noted as reserved. Attempts to read or write that register will result in an exception response. Attempts to read or write a block of register including one or more unsupported registers (not reserved registers which are ok) will result in an exception response. For example, if PID functionality is disabled in the drive, such that parameter r2260 is not supported, then attempts to read Modbus register 40090 will result in a Modbus exception response.

Modbus Plus Watchdog Timer Setup

The MicroBridge includes a watchdog timer function for Modbus Plus communications. When this function is enabled, the MicroBridge will stop the drive if it is running under Modbus Plus control and Modbus Plus communications are lost for the specified period of time. This Modbus Plus master controls the watchdog timer function via Modbus holding registers 40001 (Watchdog Time) and 40002 (Watchdog Action) on the MicroBridge. To activate the Modbus Plus watchdog timeout function, the Modbus Plus master should set the "Watchdog Time" register to the desired timeout period (in milliseconds), then set the "Watchdog Action" register to a value of 1. To disable the Modbus watchdog timeout function, the Modbus Plus master should set the "Watchdog Action" register to a value of 0.

Modbus Register Table

Register	Description	Units	Scaling Factor	1	0	Parameter Reference
				Range		
Watchdog Registers						
40001	Watchdog Time	ms	1	0…65535	--	
40002	Watchdog Action	--	--	Stop Drive	No Action	--
PZD Output Word 1 (Control Word 1/STW1)						
40003	ON/OFF1	--	--	ON	OFF1	STW1:0
40004	No OFF2	--	--	No OFF2	OFF2	STW1:1
40005	No OFF3	--	--	No OFF3	OFF3	STW1:2
40006	Pulse Enable	--	--	Enable	Off	STW1:3
40007	RFG Enable	--	--	Enable	Off	STW1:4
40008	RFG Start	--	--	Start	Off	STW1:5
40009	Setpoint Enable	--	--	Enable	Off	STW1:6
40010	Fault Acknowledge	--	--	Ack On	Off	STW1:7
40011	Jog Right	--	--	Yes	No	STW1:8
40012	Jog Left	--	--	Yes	No	STW1:9
40013	Control From PLC	--	--	Yes	No	STW1:10
40014	Reverse Command	--	--	Reverse	Forward	STW1:11
40015	Reserved	--	--	---	---	STW1:12
40016	MOP Up	--	--	Yes	No	STW1:13
40017	MOP Down	--	--	Yes	No	STW1:14
40018	CDS Bit 0,Local/Remote	--	--	Local	Remote	STW1:15
PZD Output Word 2 (HSW)						
40019	Main Setpoint	%	100	-200.00…200.00		HSW
Read/Write Parameters						
40020	Ramp Up Time	sec	100	0.00…650.00		P1120[0]
40021	Ramp Down Time	sec	100	0.00…650.00		P1121[0]
40022	Current Limit	%	10	10.0…400.0		P0640[0]
40023	Frequency MAX Limit	Hz	100	0.00…649.99		P1082[0]
40024	Frequency MIN Limit	Hz	100	0.00…649.99		P1080[0]
40025	OFF3 Ramp Down Time	sec	100	0.00…650.00		P1135[0]
40026	PID Enable	--	--	Enable	No	P2200[0]
40027	PID Filter Time Constant	sec	100	0.00…60.00		P2265

Register	Description	Units	Scaling Factor	1	0	Parameter Reference
				Range		
40028	PID D Gain	sec	1000	0.000…60.000		P2274
40029	PID P Gain	--	1000	0.000…65.000		P2280
40030	PID I Gain	sec	1000	0.000…60.000		P2285
40031	PID Up Limit	%	100	-200.00…200.00		P2291
40032	PID Down Limit	%	100	-200.00…200.00		P2292
(Reserved for future use)						
40033	Reserved	--		--		--
…..	…..	…..	…..	…..		…..
40039	Reserved	--		--		--
PZD Input Word 1 (Status Word 1/ZSW1)						
40040	Drive Ready	--		Drive ready	No	ZSW1:0
40041	Drive Ready to Run	--		Ready to run	No	ZSW1:1
40042	Drive Running	--		Running	No	ZSW1:2
40043	Drive Fault Active	--		Fault	Ok	ZSW1:3
40044	No OFF2 Active	--		No OFF2	OFF2	ZSW1:4
40045	No OFF3 Active	--		No OFF3	OFF3	ZSW1:5
40046	On Inhibit Active	--		Inhibited	Ok	ZSW1:6
40047	Drive Alarm Active	--		Alarm	Ok	ZSW1:7
40048	Speed Setpoint Deviation	--		No	Yes	ZSW1:8
40049	PZD Control	--		Yes	No	ZSW1:9
40050	At Max Frequency	--		At Max	No	ZSW1:10
40051	Motor Current Alarm	--		No	Alarm	ZSW1:11
40052	Holding Brake Active	--		Active	No	ZSW1:12
40053	Motor Overload	--		No	Overload	ZSW1:13
40054	Motor Runs Forward	--		Forward	Reverse	ZSW1:14
40055	Inverter Overload	--		No	Overload	ZSW1:15
PZD Input Word 2 (HIW)						
40056	Actual Frequency	%	100	-200.00…200.00		HIW
Read-only Parameters						
40057	Speed Setpoint	Hz	10	-3250.0…3250.0		r0020
40058	Output Frequency	Hz	10	-3250.0…3250.0		r0024
40059	Output Voltage	Vac	10	-3250.0…3250.0		r0025
40060	DC Link Voltage	Vdc	10	-3250.0…3250.0		r0026[0]

Register	Description	Units	Scaling Factor	1	0	Parameter Reference
				Range		
40061	Actual Current	A	100	0.00…655.35		r0027
40062	Actual Torque	Nm	10	-3250.0…3250.0		r0031
40063	Output Power	kW/Hp	100	-325.00…325.00		r0032
40064	Motor Temperature	°C	100	0.00…200.00		r0035
40065	Power Unit Temperature	°C	100	0.00…200.00		r0037[0]
40066	Energy kWh	kWh	1	0…65535		r0039
40067	CDS Eff (Local Mode)	--	1	0…2		r0050
40068	Status Word 2	--	Bit Mask	0000…FFFF		r0053
40069	Control Word 1	--	Bit Mask	0000…FFFF		r0054
40070	Motor Speed (Encoder)	Hz	10	-650.0…650.0		r0061
40071	Digital Inputs	--	Bit Mask	0000-FFFF		r0722
40072	Digital Outputs	--	Bit Mask	0000-FFFF		r0747
40073	Analog Input 1	V/ma	1000	-20.000…20.000		r0752[0]
40074	Analog Input 2	V/ma	1000	-20.000…20.000		r0752[1]
40075	Analog Output 1	V/ma	1000	-20.000…20.000		r0774[0]
40076	Analog Output 2	V/ma	1000	-20.000…20.000		r0774[1]
40077	Fault Code 1	--	1	0…65535		r0947[0]
40078	Fault Code 2	--	1	0…65535		r0947[1]
40079	Fault Code 3	--	1	0…65535		r0947[2]
40080	Fault Code 4	--	1	0…65535		r0947[3]
40081	Fault Code 5	--	1	0…65535		r0947[4]
40082	Fault Code 6	--	1	0…65535		r0947[5]
40083	Fault Code 7	--	1	0…65535		r0947[6]
40084	Fault Code 8	--	1	0…65535		r0947[7]
40085	Pulse Frequency	kHz	100	0.00…16.00		r1801
40086	Alarm Code 1	--	1	0…65535		r2110[0]
40087	Alarm Code 2	--	1	0…65535		r2110[1]
40088	Alarm Code 3	--	1	0…65535		r2110[2]
40089	Alarm Code 4	--	1	0…65535		r2110[3]
40090	PID Setpoint Output	%	100	-100.00…100.00		r2260
40091	PID Feedback	%	100	-100.00…100.00		r2266
40092	PID Output	%	100	-100.00…100.00		r2294

Register	Description	Units	Scaling Factor	1	0	Parameter Reference
				Range		
(Reserved for future use)						
40093	Reserved	--		--		--
…..	…..	…..	…..	…..		…..
40100	Reserved	--		--		--