ICP PANEL-TEC MICROBRIDGE

MODBUS TO SIEMENS SED2 DRIVE APPLICATION

INSTALLATION AND OPERATION GUIDE

REVISION HISTORY

Revision	Date	Author	Comments
000	34 Mar 2008	David Walker	Initial release.

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INTRODUCTION

The Modbus to SED2 version of the MicroBridge connects one SED2 drive to a Modbus RTU/ASCII Network. A pre-defined set of Modbus Holding registers (4xxxx registers) are provided that allow access to the most common drive parameters, monitor values, setpoint values, and control points for the SED2 drive.

Part Numbers

The MicroBridge product is sold with several different 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 to SED2 application are as follows:

Table 1 - Part Numbers

Part Number	Description
1200-UBW-S6R03-S6C13-0	MicroBridge Modbus-SED2 (cables included)
4000-0204	MicroBridge Power Supply
6000-????	MicroBridge SED2 Drive Cable (replacement)
6000-????	MicroBridge Modbus Network Cable (replacement)

HARDWARE

Power Supply

The MicroBridge requires a 7-24V DC power source, capable of supplying a minimum of 250mA @ 5V. Power is supplied to the MicroBridge by connecting the MicroBridge Power Supply to the Input Power connector on the front of the unit.

Serial Port Pinouts

The MicroBridge comes with two serial ports. The pinouts for the serial ports are shown in the table below.

The Local port is for connection to a local device (in this case, an SED2 Drive), and supports both RS232 and RS485 (2-wire) communications. The Local port is also used for configuration and programming of the MicroBridge.

The Network port is for connection to a network (in this case, a Modbus network), and supports both RS232 and RS485 (2-wire) communications.

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	VCC	+5VDC Input

Network: DB9-Male		
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

Modbus Network Cable

The MicroBridge is provided with a cable to connect the NETWORK port on the MicroBridge to a Modbus network. Because the network connection type may vary among different installations, the cable ends in stripped wires to provide maximum flexibility.

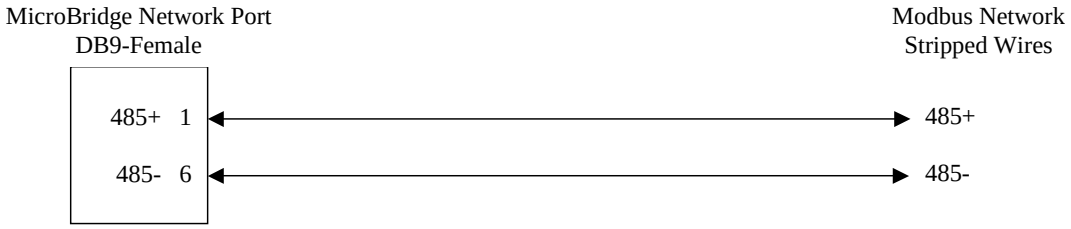

Figure 1 - Modbus Network Cable

SED2 Drive Cable

The MicroBridge is provided with a cable to connect the LOCAL port on the MicroBridge to an SED2 drive. The cable ends in stripped wires to facilitate connection to the SED2 drive terminals shown in the table below. SED2 drive power should be off while connecting the wires to the drive terminals.

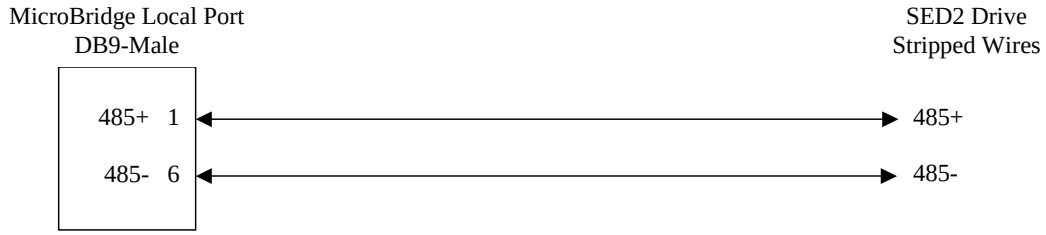

Figure 2 - SED2 Drive Cable

Table 3 - SED2 Cable Connections

Signal	Connection
485+	SED2 Terminal #29
458-	SED2 Terminal #30

LED Indicators

There are a total of 3 Bi-color LED indicators on the MicroBridge. The NET LED displays communications activity on the Network (Modbus) port. The STATUS LED displays the overall status of the MicroBridge. The LCL LED displays communications activity on the Local (SED2) port. During normal operations, the NET and LCL LEDs will quickly alternate red and green flashes, making it look almost amber. This is normal.

Table 4 – MicroBridge General Status LED (STATUS)

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.
Fatal Error	Flashing Yellow (250ms On, 250ms Off)	The MicroBridge has experienced a fatal error, and has halted communications.

Table 5 - Network Communications Activity LED (NET)

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

Table 6 - SED2 Communications Activity LED (LCL)

For this state:	LED is:	To indicate:
Receive Data	Red	The MicroBridge is receiving data from the SED2 drive.
Transmit Data	Green	The MicroBridge is transmitting data to the SED2 drive.

MICROBRIDGE CONFIGURATION

Configuration Cable

The local port on the MicroBridge includes RS232 signals for use in configuration, as shown in the pinout and cable diagram below. A standard straight-through DB9-F to DB9-M cable connects the MicroBridge to a serial port on a PC during configuration.

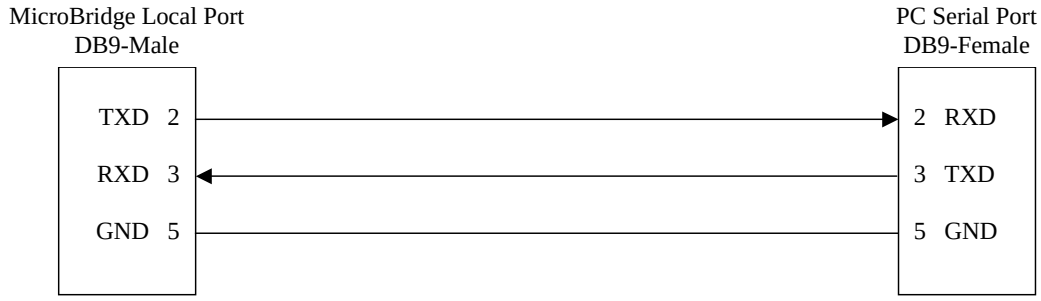

Figure 3 - Configuration Cable

Default Configuration

The Modbus protocol on the Network Port of the MicroBridge is configurable to make it easy to add it to an existing Modbus network. The configuration parameters that may be changed are shown in the following table:

Table 7 - Configuration Options

Parameter	Options	Default
Protocol	Modbus ASCII Modbus RTU	Modbus RTU
Modbus ID	1… 254	2
Baud Rate	1200 bps 4800 bps 9600 bps 19200 bps 38400 bps 57600 bps 115200 bps	9600 bps
Data Bits	7 8	8
Parity	None Even Odd	Even
Stop Bits	1 2	1

Changing the Configuration

The configuration stored in the MicroBridge may be changed from the default configuration by entering Configuration Mode.

1. Attach a configuration cable between the Local port on the MicroBridge and a serial port on a PC.
2. Start a terminal program, such as Hyper Terminal, on the PC, and connect using the following settings:
   - Baud = 9600 bps
   - Data bits = 8
   - Parity = None
   - Stop Bits = 1
   - Flow Control = None
3. With the Programming Switch set to "RUN", 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, as follows:

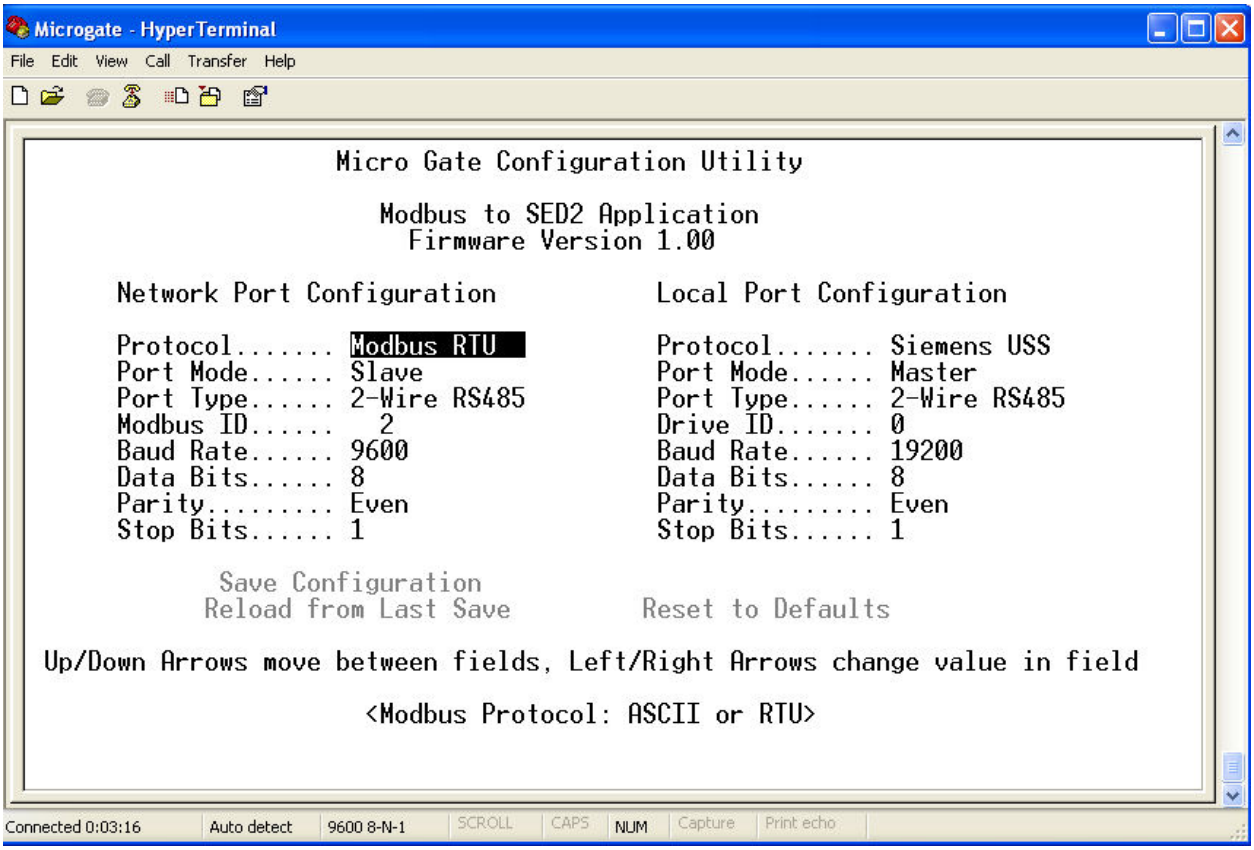

Figure 4 - MicroBridge Configuration Display

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.

SED2 DRIVE SETUP

SED2 Drive Parameter Configuration

The Siemens SED2 drive must be configured before the MicroBridge will communicate with the drive. The MicroBridge communicates with the SED2 drive using the USS protocol, with the following configuration:

- 19200 baud
- 8 data bits
- even parity
- 1 stop bit
- drive id 0

To setup the SED2 drive for communications with a MicroBridge, the drive parameters in the following table must be configured with the values shown via the SED2 keypad.

Table 8 - SED2 Parameter Configuration

SED2 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)
P2010[0]	USS Baud Rate	7 (19.2K baud)
P2011[0]	USS Address	0
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)

USS Watchdog Timer Setup

The SED2 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 an SED2 drive with the watchdog function enabled, the watchdog timer is activated. If communications are subsequently lost for the specified length of time, the SED2 will automatically generate a F0070 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 SED2 drive and the MicroBridge, and wait approximately 5 seconds. If the MicroBridge has been installed correctly, the STAT 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 network. Then, from the Modbus host, issue a Modbus write with of a value of 8192 (2000h, or 50% of the maximum frequency) to the FREQ REF register (40003) followed by a Modbus write with the value of 1 to the ENABLE register (40004). Then write a value of 1 to the CMD START register (40006), and the drive should start running. Write a value of 0 to the CMD START register to stop the drive again. The drive frequency can be changed at any time during this process by writing to the FREQ REF register (40003).

MODBUS REGISTERS

The following table contains the list of all Modbus holding registers available on the MicroBridge. The Modbus host may write to Registers 40001 through 40023. 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: ACCEL TIME has a scaling factor of 100. If the SED2 contains a value of 20.50, then the ACCEL TIME register will contain a value of 2050.

FREQ REF (40003) and FREQ ACTUAL (40063) are special case registers. FREQ REF contains the raw integer value passed in the HSW portion of a USS protocol request to the SED2 drive, and FREQ ACTUAL contains the raw integer value passed in the HIW portion of a USS protocol response from the SED2 drive. Both registers are scaled such that a value of 4000h represents 100% of the maximum frequency.

FREQ SCALED (40044) contains a scaled version of the HIW data, such that a value of 2000 in the register represents the value 4000h in the USS protocol response (and 100% of the maximum frequency). It is included in the Modbus register map as a legacy parameter for existing customers of our discontinued UFC Modbus to SED2 product.

STW and HSW refer to the 1st and 2nd words, respectively, of PZD data included in every poll sent from the MicroBridge to the SED2 drive via the USS protocol. ZSW and HIW refer to the 1st and 2nd words, respectively, of PZD data included in every poll response sent from the SED2 drive to the MicroBridge via the USS protocol. Registers mapped to PZD data are updated frequently.

All other parameters (except WDOG ACTION and WDOG TIME, which are handled internally in the MicroBridge) are mapped to parameters in the SED2 drive, and are updated cyclically. Registers mapped to *monitor* parameters – parameters such as CURRENT, or SPEED, 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 ACCEL TIME or FREQ MAX, 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 an SED2 drive, then the corresponding Modbus register from the register map will not be supported, either. 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 will result in an exception response. For example, if PID functionality is disabled in a particular SED2 drive, such that parameter P2240 is not supported, then attempts to read or write Modbus register 40008 will result in a Modbus exception response.

Modbus Watchdog Timer Setup

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

Table 9 - Modbus Registers

Register	Description	Units	Scaling Factor	1	0	SED2 Ref.
				Range		
40001	WDOG TIME	MS	1	0…65535		--
40002	WDOG ACTION	--	1	STOP DRIVE	NO ACTION	--
40003	FREQ REF	--	1	0…4000h (4000h = 100%)		HSW
40004	RUN ENABLE	--	1	ENABLE	OFF	STW:3
40005	CMD FWD REV	--	1	REV	FWD	STW:11
40006	CMD START	--	1	START	OFF	STW:0
40007	FAULT ACK	--	1	ACK	NO ACK	STW:7
40008	PID SETP REF	PCT	10	-200.0…200.0		P2240
40009	ENABLE PID	--	1	ENABLE	DISABLE	P2200
40010	CURRENT LMT	PCT	10	10.0…400.0		P0640
40011	ACCEL TIME	SEC	100	0.00…650.00		P1120
40012	DECEL TIME	SEC	100	0.00…650.00		P1121
40013	HAND AUTO	--	1	HAND	AUTO	P0718
40014	DIGITAL OUT 1	--	1	ON	OFF	P0731
40015	DIGITAL OUT 2	--	1	ON	OFF	P0732
40016	FREQ MAX	HZ	100	1.00…650.00		P2000
40017	PID UP LMT	PCT	10	-200.0…200.0		P2291
40018	PID LO LMT	PCT	10	-200.0…200.0		P2292
40019	P GAIN	--	1000	0.000…65.000		P2280
40020	I GAIN	SEC	1	0…60		P2285
40021	D GAIN	--	1	0…60		P2274
40022	FEEDBK GAIN	PCT	100	0.00…500.00		P2269
40023	LOW PASS	--	100	0.00…60.00		P2265
40024	FREQ OUTPUT	HZ	10	-650.0…650.0		r0024
40025	SPEED	RPM	1	-16250…16250		r0022
40026	CURRENT	A	10	0.0…6553.5		r0027
40027	TORQUE	NM	10	-3250.0…3250.0		r0031
40028	ACTUAL PWR	KW	100	0.00…655.35		r0032
40029	TOTAL KWH	KWH	1	0…65535		r0039
40030	DC BUS VOLTS	V	1	0…65535		r0026
40031	REFERENCE	HZ	10	-650.0…650.0		r0020
40032	RATED PWR	KW	100	0.00…655.35		r0206

Register	Description	Units	Scaling Factor	1	0	SED2 Ref.
				Range		
40033	OUTPUT VOLTS	V	1	0…65535		r0025
40034	FWD REV	--	1	FWD	REV	ZSW:14
40035	STOP RUN	--	1	STOP	RUN	ZSW:2
40036	AT MAX FREQ	--	1	MAX	NO	ZSW:10
40037	CONTROL MODE	--	1	SERIAL	LOCAL	ZSW:9
40038	ENABLED	--	1	ON	OFF	ZSW:0
40039	READY TO RUN	--	1	READY	OFF	ZSW:1
40040	ANALOG IN 1	PCT	10	-300.0…300.0		r0754/0
40041	ANALOG IN 2	PCT	10	-300.0…300.0		r0754/1
40042	ANALOG OUT 1	PCT	10	-100.0…100.0		r0774/0
40043	ANALOG OUT 2	PCT	10	-100.0…100.0		r0774/1
40044	FREQ SCALED	PCT	20	0.0…100.0		HIW
40045	PID SETP OUT	PCT	10	-100.0…100.0		r2250
40046	PID OUTPUT	PCT	10	-100.0…100.0		r2294
40047	PI FEEDBACK	PCT	10	-100.0…100.0		r2266
40048	DIGITAL IN 1	--	1	ON	OFF	r0722:0
40049	DIGITAL IN 2	--	1	ON	OFF	r0722:1
40050	DIGITAL IN 3	--	1	ON	OFF	r0722:2
40051	DIGITAL IN 4	--	1	ON	OFF	r0722:3
40052	DIGITAL IN 5	--	1	ON	OFF	r0722:4
40053	DIGITAL IN 6	--	1	ON	OFF	r0722:5
40054	FAULT	--	1	FAULT	OK	ZSW:3
40055	LAST FAULT	--	1	0…65535		r0947
40056	1^{ST} FAULT	--	1	0…65535		r0947
40057	2^{ND} FAULT	--	1	0…65535		r0947
40058	3^{RD} FAULT	--	1	0…65535		r0947
40059	WARNING	--	1	WARN	OK	ZSW:7
40060	LAST WARNING	--	1	0…65535		r2110
40061	INVERTER VER	--	100	0.00…655.35		r0018
40062	DRIVE MODEL	--	1	0…65535		r0200
40063	FREQ ACTUAL	--	1	0…4000h (4000h = 100%)		HIW