

**ICP PANEL-TEC
MICROGATE II**

**MODBUS TO MODBUS
APPLICATION**

**INSTALLATION
AND
OPERATION
GUIDE**

REVISION HISTORY

Revision	Date	Author	Comments
000	27 Oct 2008	David Walker	Initial release.
001	30 Apr 2009	David Walker	Added documentation for security feature

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INTRODUCTION

The Modbus to Modbus version of the MicroGate II converts and retransmits Modbus requests received on the Local port to the Network port, and Modbus responses received on the Network port back to the Local port. Each port is independently configured, allowing the MicroGate II to translate between Modbus/RTU and Modbus/ASCII, connect devices using different baud rates, or even connect RS-232 devices to RS-485 devices.

Port Configuration

The MicroGate II has 2 DB9 ports. Both ports can be configured for either RS232 or 2-Wire RS485 communication. The Local port is a DB9 female RS232 DCE port for connection of a Local Modbus Master. The Network port is a DB9 Male RS232 DTE for connection to a network with one or more Modbus Slave(s). The RS485 signals are located on the same pins on both ports.

The utility to configure the ports is built into the MicroGate II. It is activated by connecting the RS-232 pins of any of the ports to the serial port of a PC running a terminal communication program such as HyperTerminal, and entering the correct key sequence within 5 seconds of powering up the MicroGate II.

Ordering Information

The part numbers for the MicroGate II Modbus unit, power supply, and optional cables are shown in the following table.

Table 1 - Part Numbers

Part Number	Description
6001-202-100	MicroGate II, Modbus to Modbus
4000-0205	MicroGate II Power Supply
6000-RS232	MicroGate II Configuration Cable Modbus Device Cable for any Port (Straight-Through DB9F to DB9M RS232 Cable)
6000-RS232N	Modbus Device Cable for any Port (Null-Modem DB9F to DB9F RS232 Cable)
6000-0003	Modbus Device Cable for Local and Remote Master Ports (DB9M to Stripped Wires, 2-Wire RS485 Cable)
6000-0006	Modbus Device Cable for Slave Port (DB9F to Stripped Wires, 2-Wire RS485 Cable)
6000-0008	Modbus Device Cable for Local and Remote Master Ports (DB9M to Stripped Wires, RS232 Cable)
6000-0009	Modbus Device Cable for Slave Port (DB9F to Stripped Wires, RS232 Cable)

HARDWARE

Power Supply

The MicroGate II requires a 6-28 Volts DC power source, capable of supplying a minimum of 250mA. Power may be supplied to the MicroGate II by either connecting the MicroGate II Power Supply to the Input Power jack on the side of the unit, or by providing 6-28 Volts DC power to pin 9 of the Local serial port.

Programming Switch

The Programming Switch on the MicroGate II should always be in the RUN position for normal operations and configuration. The PRG position is used strictly for loading firmware at the factory.

Serial Port Pinouts

The MicroGate II 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 Modbus Master, and supports both RS232 and RS485 (2-wire) communications. The Local port is also used for programming the MicroGate II at the factory.

The Network port is for connection to a network of Modbus Slaves, and also supports both RS232 and RS485 (2-wire) communications.

Either port may be used for configuring the MicroGate II.

Table 2 - Serial Port Pinouts

Local: DB9-Female			Network: DB9-Male		
Pin	Label	Description	Pin	Label	Description
1	D+	RS485 D+	1	D+	RS485 D+
2	TXD	RS232 TxD	2	RXD	RS232 RxD
3	RXD	RS232 RxD	3	TXD	RS232 TxD
4	DTR	RS232 DTR	4		No Connect
5	GND	Signal Ground	5	GND	Signal Ground
6	D-	RS485 D-	6	D-	RS485 D-
7	CTS	RS232 CTS	7	RTS	RS232 RTS
8	RTS	RS232 RTS	8	CTS	RS232 CTS
9	VIN	24Vdc input	9	-	No Connect

Serial Cables

RS-232 Communications

When a port is configured for RS232 communications, an off-the-shelf straight-through or null-modem is generally used to connect to other Modbus devices. The type of cable required and optional cable that can be purchased from ICP -Panel-Tec are shown in the following table.

Table 3 – RS232 Cables

MicroGate II Port	Modbus Device Type	Recommended Cable
Local	RS232 DTE with DB9 connector	6000-RS232 (Straight-Through DB9/DB9)
Local	RS232 DTE/DCE with terminal block	6000-0008 (DB9M to Stripped Wires)
Network	RS232 DTE with DB9 connector	6000-RS232N (Null-Modem DB9/DB9)
Network	RS232 DTE/DCE with terminal block	6000-0009 (DB9F to Stripped Wires)

RS-485 Communications

When a port is configured for RS485 communications, the connector on the Modbus device(s) being connected to the MicroGate II can vary significantly. Because of this, all optional RS485 cables offered by ICP Panel-Tec end in stripped wires to provide maximum flexibility. The cables available for both master ports and the slave port are shown in the following table.

Table 4 – RS485 Cables

MicroGate II Port	Modbus Device Type	Recommended Cable
Local	2-Wire RS485 with any connector	6000-0003 (DB9 Male to Stripped Wires)
Network	2-Wire RS485 with any connector	6000-0006 (DB9 Female to Stripped Wires)

MicroGate II Power Supply

The MicroGate II requires a 250 mA DC power supply with any voltage from 6 – 28 Volts DC. A center-positive input jack is used for connection of the power supply, as shown in the following figure.

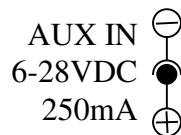


Figure 1 – Power Supply Connector

LED Indicators

There are a total of 3 Bi-color LED indicators on the MicroGate II. The APP LED displays the overall status of the MicroGate II. The LCL LED displays communications activity on the Local Master port. The NET LED displays communications activity on the Network (Slave) port.

Table 5 –APP LED Indications

For this state:	LED is:	To indicate:
No Power	Off	There is no power applied to the device.
Startup	Solid Green	The MicroGate II is checking the ports for a valid configuration startup sequence prior to entering RUN Mode.
Run Mode	Flashing Green (250ms On, 250ms Off)	The MicroGate II is operating normally in RUN Mode.
Configuration Mode	Flashing Green (1.5 sec On, 1.5 sec Off)	The MicroGate II is in Configuration Mode.
Fatal Error	Flashing Yellow (any rate)	The MicroGate II has experienced a fatal error and has halted communications.

Table 6 – LCL LED Indications

For this state:	LED is:	To indicate:
Receive Data	Red	The MicroGate II is receiving data from the Local Modbus Master.
Transmit Data	Green	The MicroGate II is transmitting data to the Local Modbus Master.

Table 7 – NET LED Indications

For this state:	LED is:	To indicate:
Receive Data	Red	The MicroGate II is receiving data from a Modbus Slave.
Transmit Data	Green	The MicroGate II is transmitting data to a Modbus Slave

MICROGATE II CONFIGURATION

Configuration Cable

Either of the ports on the MicroGate II may be used for configuration via the RS-232 signals on the port. A straight-through DB9 cable (Order Number 6000-RS232) can be used to connect the LCL port on the MicroGate II to a serial port on a PC for configuration. A null modem cable (Order Number 6000-RS232N) is necessary to configure the MicroGate II via the NET port. The minimum pin connections for the standard configuration cable are shown in the following figure.

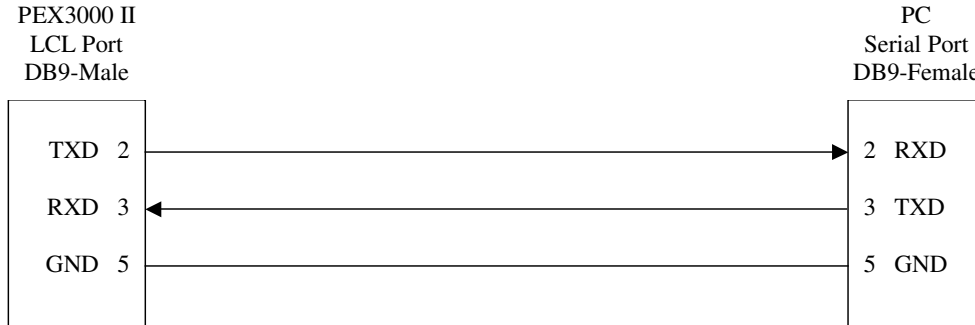
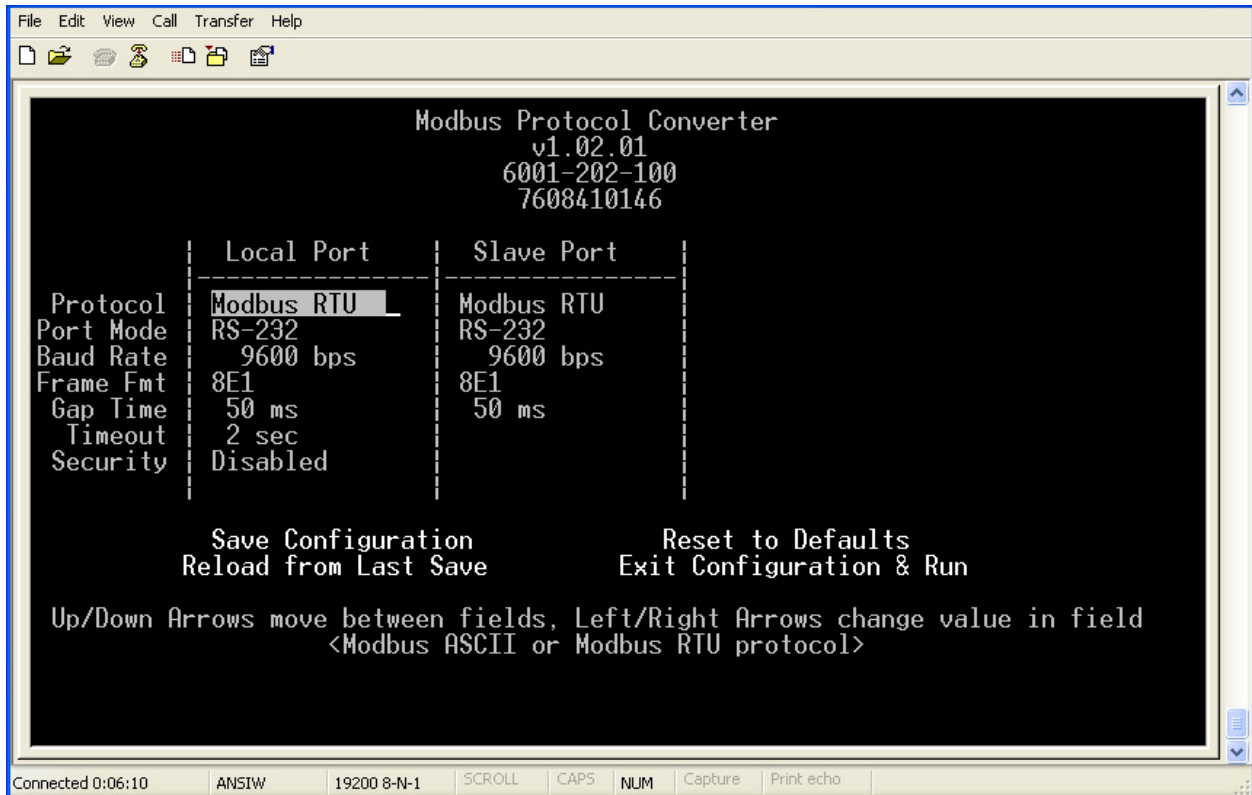


Figure 4 – Minimum Configuration Cable Pinout for LCL port

Default Configuration

The default configuration is shown on the following configuration screen.



Changing the Configuration

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

1. Power off the MicroGate II.
2. Attach a configuration cable between any port on the MicroGate II and a serial port on a PC.
3. Start a terminal program, such as HyperTerminal on the PC, and connect using the following settings:
 - Baud = 19200 bps
 - Data bits = 8
 - Parity = None
 - Stop Bits = 1
 - Flow Control = None
4. Apply power to the MicroGate II, and send the configuration start sequence (“+++”) by pressing the **plus** key three times within 5 seconds of startup.

Once the MicroGate II is in Configuration Mode, it will send its current configuration information to the terminal program, as follows:

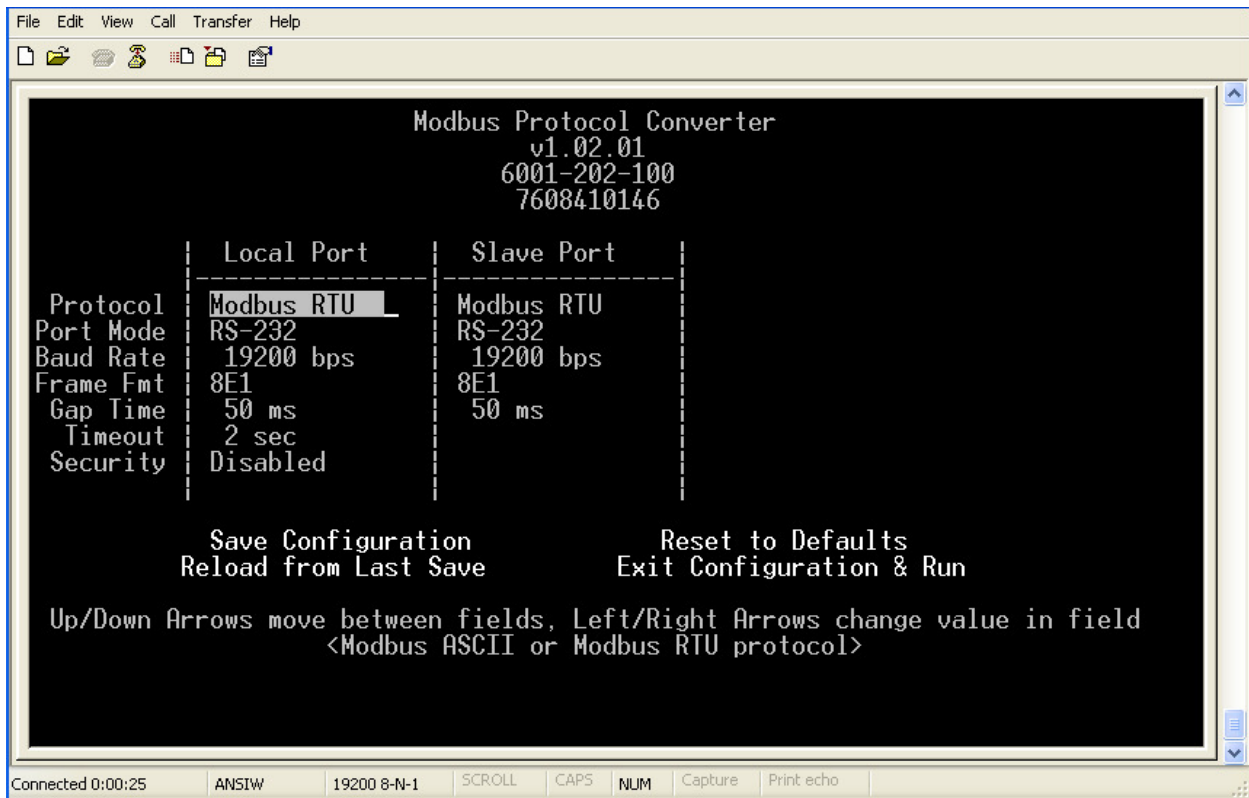


Figure 2 – MicroGate II Configuration Display

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 MicroGate II. If the configuration is invalid, a message will be displayed indicating the reason. If the configuration was successfully saved, a “Configuration Saved” message will be displayed.

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

Local (Master) Port Configuration Settings

The Local port, labeled “LCL” on the MicroGate II, may be connected to a local Modbus master device. Any device that will initiate Modbus requests is considered to be a Modbus master device.

The following configuration settings may be changed for the Local (Master) port:

Setting	Values	Default
Protocol	Modbus RTU Modbus ASCII	Modbus RTU
Port Mode	RS-232 RS-485	RS-232
Baud Rate	9600 bps 19200 bps 38400 bps 57600 bps 115200 bps	9600 bps
Frame Format	7E1* 7O1* 7N2* 8N1 8E1 8O1 8N2	8E1
Gap Time	5 ms – 500 ms	50 ms
Timeout	250 ms – 10 sec	2 sec
Security	Disabled Read-only	Disabled

*7 data bits not supported for Modbus RTU

Frame Format

Frame Format is listed by data bits (7 or 8), parity (Even, Odd or None), and stop bits (1 or 2) - i.e. 8E1 indicates 8 data bits, even parity, and 1 stop bit.

Note: Because Modbus RTU is encoded as 8-bit binary data, frame formats utilizing 7 data bits are not supported for Modbus RTU.

Gap Time

Gap Time is the maximum time allowed between received characters in a Modbus RTU message before “giving up” on that message. It is there to handle sudden loss of communications (power loss, cable unplugged or severed, etc.) smoothly. The default value of 50ms should be sufficient for most networks.

Timeout

Timeout is the maximum time that the Local port will wait for a response to be received on the Network (Slave) port before timing out on the current request and listening for a new request. The timer starts when the original request message is received on the Local port. For proper timeout handling, it **MUST** be set to a value lower than the timeout programmed into the Modbus master device.

Security

If read-only security is enabled, Modbus write requests (function codes 5, 6, 15, and 16) received on the Local (Master) port will be rejected by the MicroGate II with an exception response back to the originating master.

Network (Slave) Port Configuration Settings

The Network (Slave) port, labeled “NET” on the MicroGate II, may be connected to a Modbus slave device. Any device that will only respond to Modbus requests addressed to itself is considered to be a Modbus slave device.

The following configuration settings may be changed for the Network (Slave) port:

Setting	Values	Default
Protocol	Modbus RTU Modbus ASCII	Modbus RTU
Port Mode	RS-232 RS-485	RS-232
Baud Rate	9600 bps 19200 bps 38400 bps 57600 bps 115200 bps	9600 bps
Frame Format	7E1* 7O1* 7N2* 8N1 8E1 8O1 8N2	8E1
Gap Time	5 ms – 500 ms	50 ms

*7 data bits not supported for Modbus RTU

Frame Format

Frame Format is listed by data bits (7 or 8), parity (Even, Odd or None), and stop bits (1 or 2) - i.e. 8E1 indicates 8 data bits, even parity, and 1 stop bit.

Note: Because Modbus RTU is encoded as 8-bit binary data, frame formats utilizing 7 data bits are not supported for Modbus RTU.

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Gap Time is the maximum time allowed between received characters in a Modbus RTU message before “giving up” on that message. It is there to handle sudden loss of communications (power loss, cable unplugged or severed, etc.) smoothly. The default value of 50ms should be sufficient for most networks.

MICROGATE II OPERATION

Protocol Convertor Operation

The MicroGate II waits until a complete Modbus message has been received on the Local (Master) port.. If the message is valid, it will forward the message out the Network (Slave) port, converting between Modbus ASCII and RTU if necessary. It then waits for a response to be received from the addressed slave on the Network (Slave) port. If a response is received before the configured timeout value, the Network (Slave) port will forward the response to the Local (Master) port, once again converting between Modbus ASCII and RTU if necessary, and the Local (Master) port will transmit the response back to the originating Modbus master device.

Because the MicroGate II actively buffers and converts messages on the fly, the ports can be configured for different protocols, port modes, baud rates and frame formats without affecting throughput.

If read-only security is enabled on the Local (Master) port of the MicroGate II, write requests (function codes 5, 6, 15, and 16) will not be passed through to the slave device. Instead, the MicroGate II will generate an exception response (exception code 01 - ILLEGAL FUNCTION) back to the originating master.