

BENTEK SYSTEMS LTD

SCADA and Telemetry Solutions

SCADALink IP Gateway



Modbus Ethernet Gateway/Terminal Server

User Manual

IP Gateway Ver 1.00
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1 INTRODUCTION

The SCADALink IP Gateway is a Multi Serial Port Server / Ethernet Gateway designed for industrial applications. Equipped with 3 Serial Ports and a single 10BaseT Ethernet Port, it can be configured to perform one or more of the following functions:

1. Modbus Ethernet Gateway (Modbus TCP, TCP or UDP):

- Serial Connection to Modbus RTU Slave
- Serial Connection to Modbus Master (IP Lookup, Modbus Address to IP Lookup)

2. Virtual Serial Port :

- Serial Port Server
- Serial Port Client

3. Modbus Port Multiplexer

2 OPERATION

Equipped with 3 Serial Ports and 1 10BaseT Ethernet Port, the IP Gateway allows TCP and Legacy Serial Devices to interoperate with each other. It can be configured to perform one or more of the following functions:

4. Modbus Ethernet Gateway (Modbus TCP, TCP or UDP):

- Serial Connection to Modbus RTU Slave
- Serial Connection to Modbus Master (IP Lookup, Modbus Address to IP Lookup)

5. Virtual Serial Port :

- Serial Port Server
- Serial Port Client

6. Modbus Port Multiplexer

The difference between Virtual Serial Port and a Modbus Port is that a Virtual serial port is a dedicated point to point, protocol independent serial link whereas the Modbus serial mode incorporates a Modbus Gateway functionality that allow multiple simultaneous host connections:

1. Modbus Ethernet Gateway:

- Ethernet to Serial Connection to Modbus RTU Slave
- Ethernet to Serial Connection to Modbus Master (Modbus Address to IP Lookup)
- Serial to Ethernet Connection to IP Enabled Modbus Slave

2. "Virtual" Serial Port End-to-End Serial emulation over Ethernet connection:

Table 1: Available Serial Port Options

CONFIGURABLE OPTIONS FOR COM1, 2 and 3
VIRTUAL PORT OPTION
MODBUS PORT OPTION:Modbus TCP
MODBUS PORT OPTION:Modbus over TCP
MODBUS PORT OPTION:Modbus over UDP

In *Modbus Ethernet Gateway* mode, the IP Gateway translates Modbus-RTU protocol to Modbus TCP, TCP or UDP protocol to enable a Modbus Slave/Master device connected to the IP Gateway's COM port to communicate over the network to a remote Ethernet device.

In *Virtual Serial* mode, a pair of IP Gateways enables 2 Serial devices to establish End-to-End Serial communication over the network.

2.1. MODBUS ETHERNET GATEWAY

2.1.1. MODBUS ETHERNET GATEWAY FOR PLC/RTU CONNECTION TO SLAVES.

This mode enables a Modbus-RTU Serial Slave device connected to an IP Gateway COM port to communicate to up to 3 local or remote Modbus Master devices (PC, PLC, RTU).

To configure the IP Gateway for *Modbus Slave* mode, the main points are:

- Assign IP and Modbus Slave address to IP Gateway
- Configure the Modbus Slave device's IP Gateway Serial port as *Modbus Slave*
- Configure all other port parameters associated with that associated COM port including: *Protocol, Port Address*, etc...

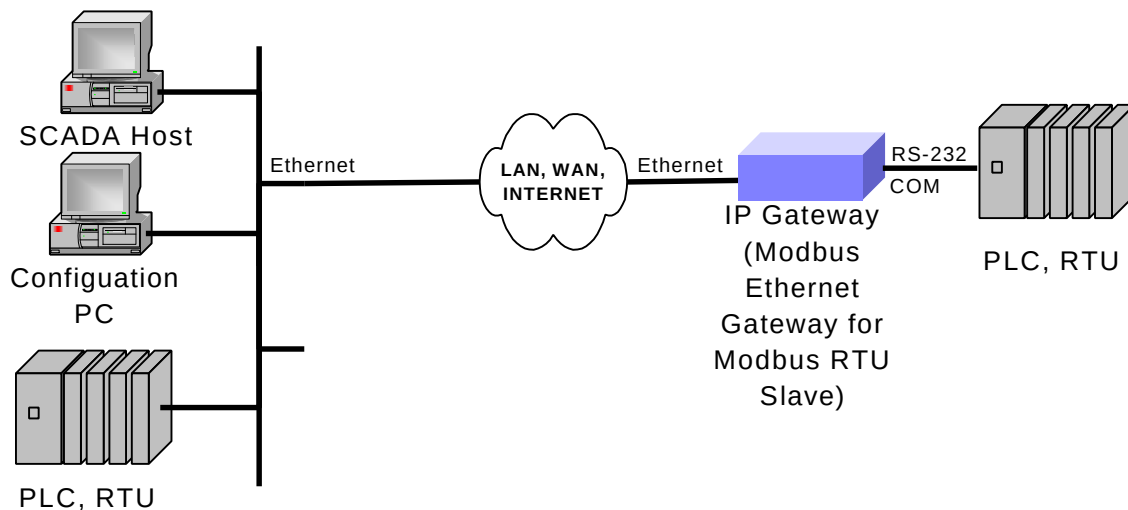


Figure 1: Ethernet Gateway – Modbus Slave

2.1.2. MODBUS ETHERNET GATEWAY FOR SCADA HOST OR PLC/RTU AS A SERIAL MASTER

This configuration enables a Serial Master (Modbus-RTU) connected to an IP Gateway COM port to communicate to remote Serial (Modbus-RTU) and Ethernet (Modbus TCP or Modbus over TCP) Slaves. The Modbus-RTU Master can address up to 50 devices.

To configure the IP Gateway for *Modbus Master* mode, the main points are:

- Configure the Modbus Master IP Gateway COM port to be *Modbus Gateway Master*
- Configure all other *Modbus Master Gateway* parameters associated with that COM port including: *Destination IP address, Port Address, Protocols*, etc...
- If a Slave site has a Serial Slave, configure the IP Gateway COM port for *Modbus Slave* mode; Ethernet Slave devices connect via internet or local LAN.

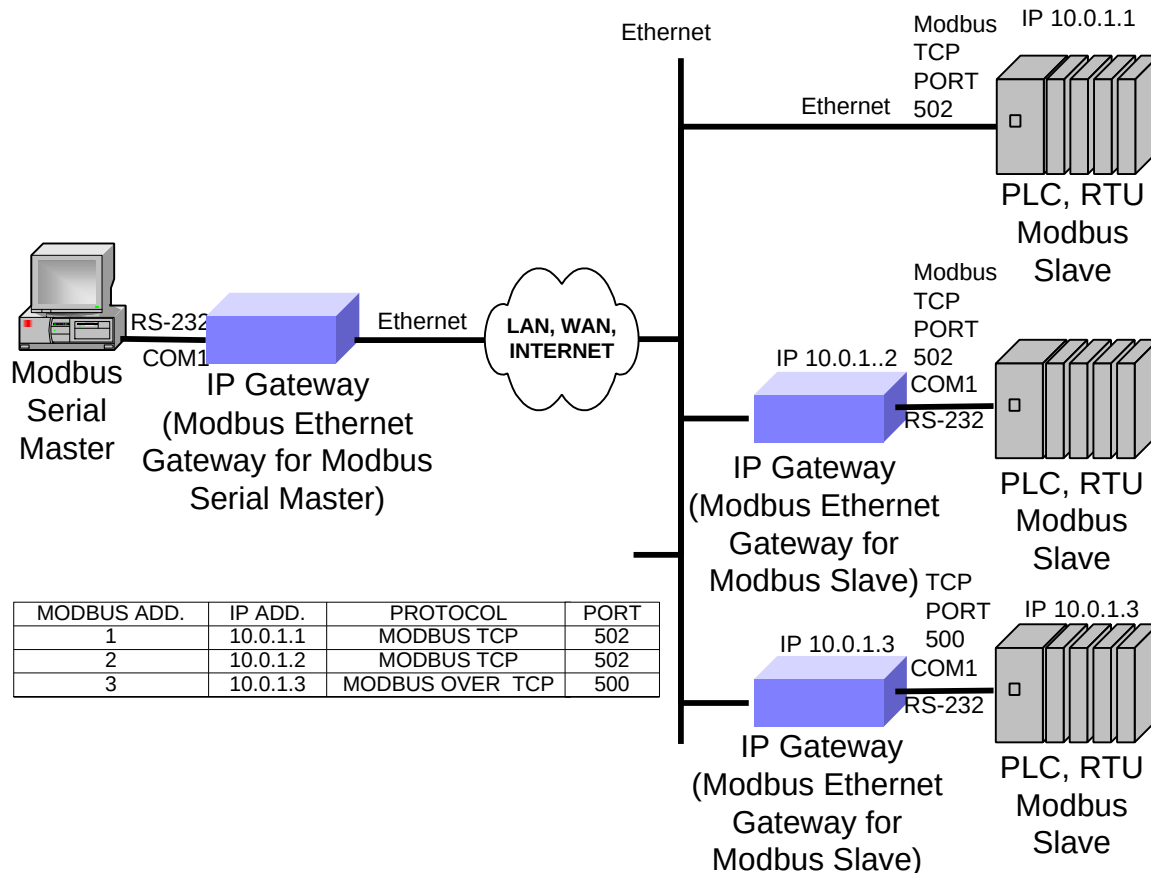


Figure 2: Ethernet Gateway – Modbus Master

2.2. MODBUS MULTIPLEXER

This configuration allows all 3 COM ports of the IP Gateway to be used as a local Modbus Serial Multiplexer. 2 locally connected Modbus-RTU Master devices and multiple remote Ethernet Masters can simultaneously communicate to 1 locally connected Modbus-RTU Slave device.

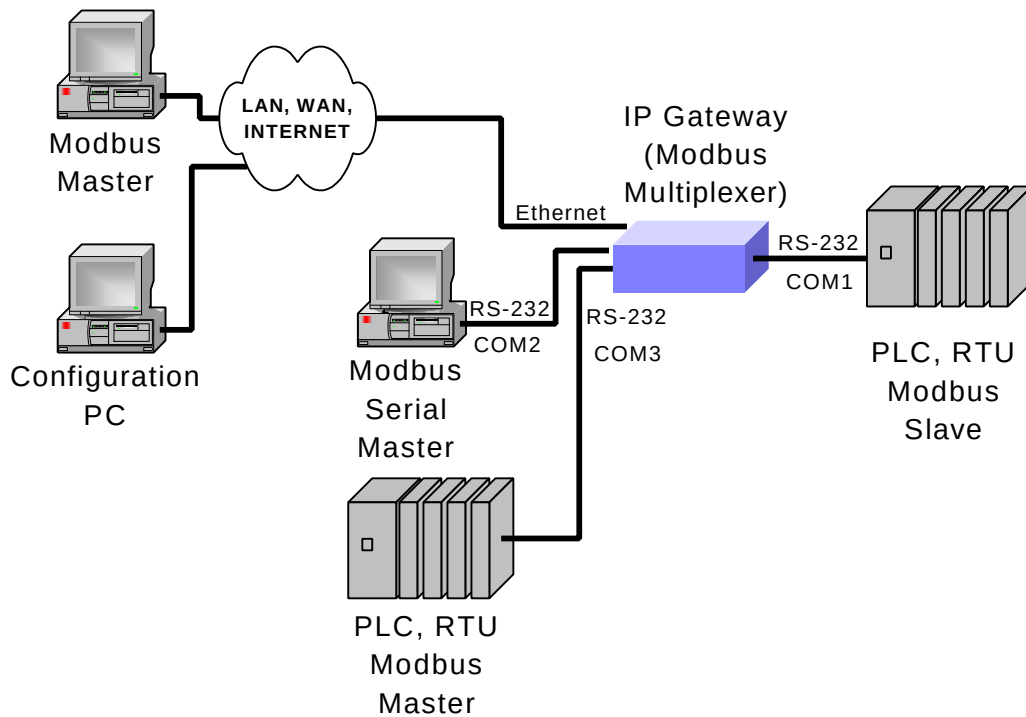


Figure 3: MULTIPLEXER

2.3. VIRTUAL SERIAL PORT

This mode emulates Serial communication over an Ethernet or Internet network. It enables communications between Serial devices over a TCP/IP, LAN, WAN or Internet as if they were connected by a point to point Serial link.

In *Virtual Serial* mode, there must be at least one IP Gateway Server and one IP Gateway Client. A Server passively listens for requests for establishment of a connection, whereas the Client initiates requests for and establishes a connection to the Server.

Each Client can only connect to one Server; a Client's *Destination IP address* and *Destination Port* parameters completely specify this one Server. When RS232 data is detected on the Client IP Gateway's COM port, the Client IP Gateway attempts to establish a data link to the remote Server. If the Server is free, it receives the Client's request and establishes a bi-directional link with the Client. After a link has been established, the Server will only communicate with that Client until the session is finished or dropped due to timeout.

The Serial Port Client can be:

- Another IP Gateway
- Host application software
- COM Port Redirector software
- Serial Port Server.

To configure the IP Gateway for *Virtual Serial* mode, the main points are:

- At least one IP Gateway must be configured as a Client and one as a Server
- Each Client can only be programmed to communicate with only one Server
- The Client's Destination IP address and Port number parameters specify the Server
- Set the *Virtual-Serial No Message Timeout* parameter in both the Server and Client to guarantee the session will close down and not hang due to an unexpected interruption.
- There can be multiple Servers and each can establish links with multiple Clients but only one at a time. The session must end before another Client has access to that Server.

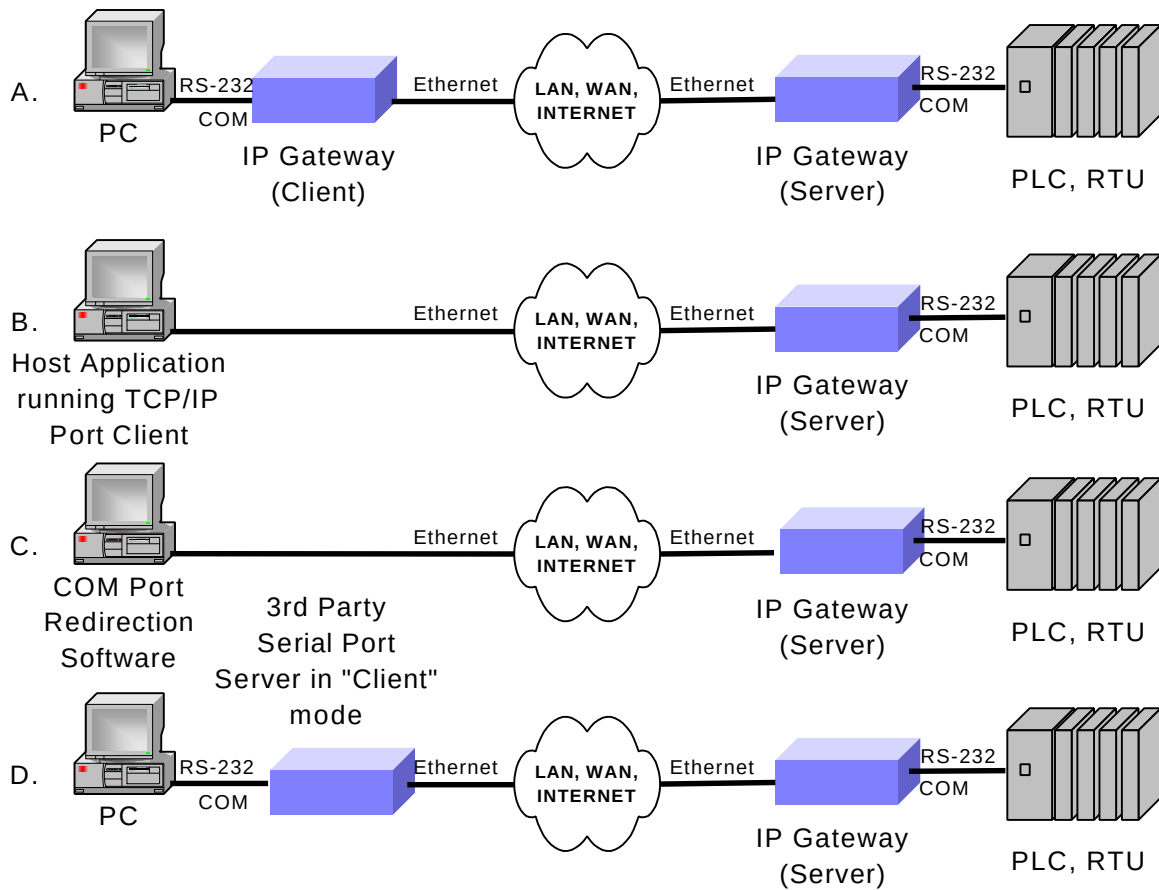


Figure 4: Virtual Serial Port Configurations

3 HARDWARE DESCRIPTION

The IP Gateway is housed in a 7.5" x 5.75" x 2.875" panel mount aluminum enclosure. The top face of the enclosure houses status LEDs and the back face of the enclosure houses Power, Serial, and Ethernet Connectors.

3.1. LEDs

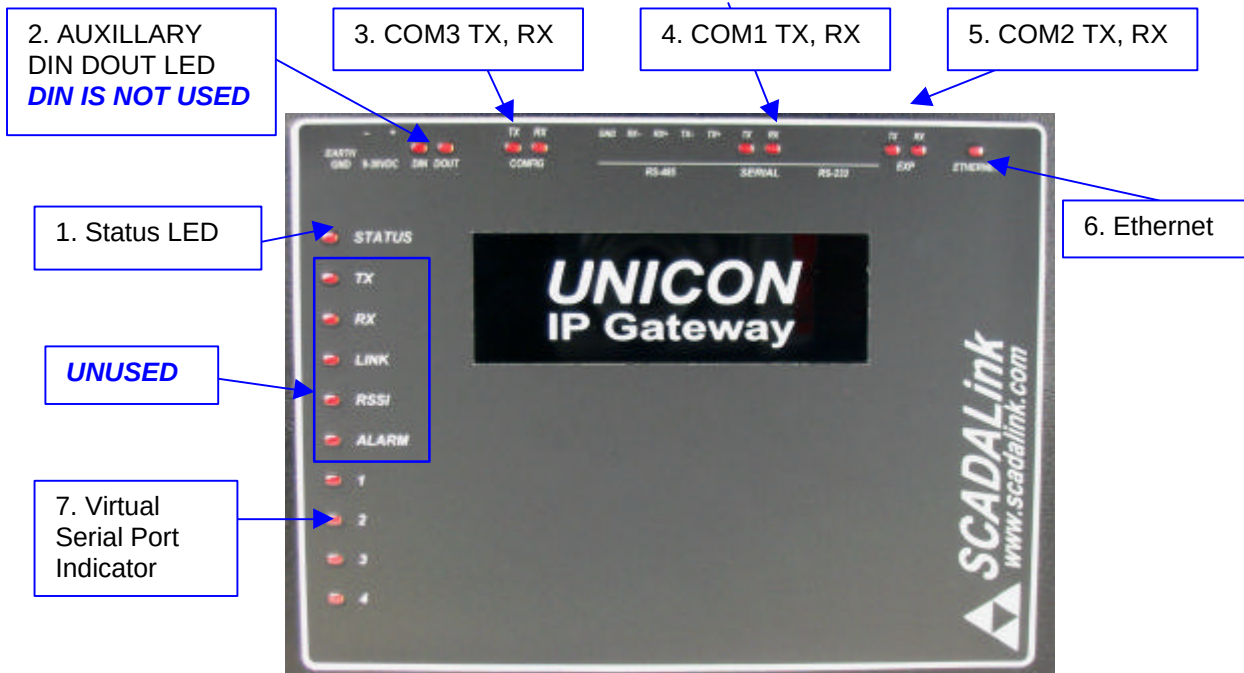


Figure 5: Front Panel LED Display

Table 2: LED Function Chart

ITEM No.	LED NAME	DESCRIPTION
		MEMBRANE LED's
1	STATUS	STATUS=ON indicates power
2	DIN, DOUT	DOUT = ON when DOUT is logic Hi DIN IS NOT USED
3	COM3 TX, RX	TX = ON: data From IP Gateway To COM3 device RX = ON: data To IP Gateway From COM3 device
4	COM1 TX, RX	TX = ON: data From IP Gateway To COM1 device RX = ON: data To IP Gateway From COM1 device
5	COM2 TX, RX	TX = ON: data From IP Gateway To COM2 device RX = ON: data To IP Gateway From COM2 device
6	ETHERNET	ETHERNET= ON indicates that the IP Gateway is configured to listen on a TCP socket and is mapped to a serial port
7	SPARE1,2,3,4	1,2,3 are on when COM1, 2 or 3 is respectively configured as a Virtual Serial port. NOTE: ONLY ONE OF 1,2 OR 3 CAN BE ON AT

HARDWARE DESCRIPTION

		ANY ONE TIME. LED 4 IS NOT USED.
		CONNECTOR LED's
7	ETHERNET – RJ45	GREEN = ON indicates Ethernet data (See Fig.1)
8	ETHERNET – RJ45	YELLOW = ON indicates link (See Fig.1)

3.2. CONNECTORS

The Figure below shows the connectors of the IP Gateway.

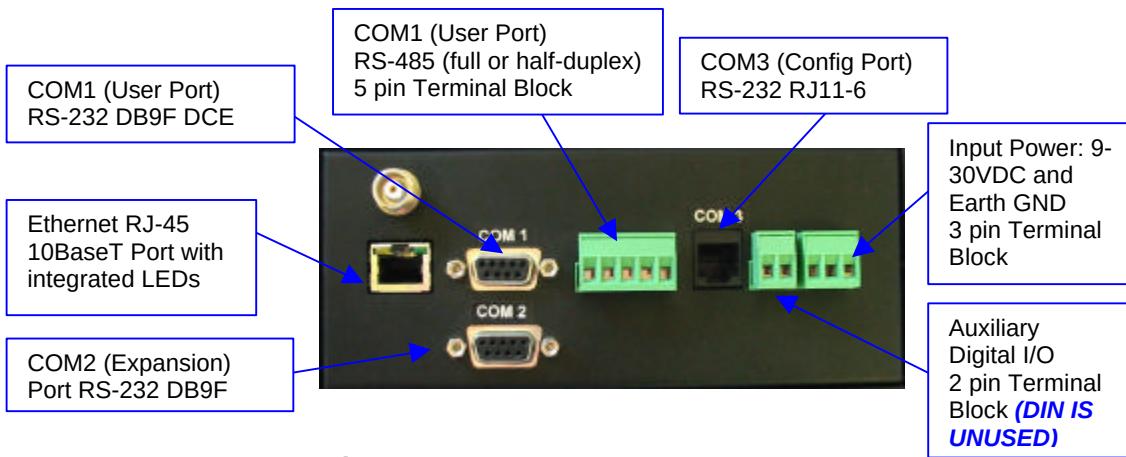


Figure 6: IP Gateway Connectors

3.2.1. POWER

The IP Gateway requires a DC power supply of 9-30VDC. At 24 V, the IP Gateway draws a nominal 50mA. Power is connected to the IP Gateway via the removable 3 pin Power Terminal Block. Maximum wire size is 16AWG.

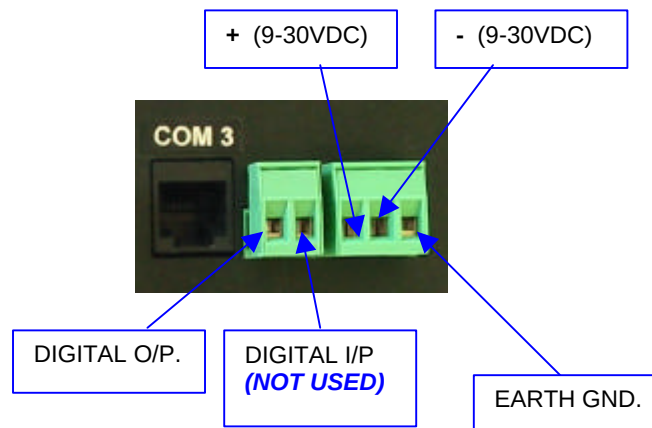


Figure 7: Power and Auxiliary I/O Connector

HARDWARE DESCRIPTION

3.2.2. EARTH GROUND

NOTE: IF TRANSIENT PROTECTION IS REQUIRED, IT IS IMPORTANT TO CONNECT A PROPERLY GROUNDED 16AWG EARTH GROUND WIRE TO THE "EARTH GND" TERMINAL ON THE REMOVABLE 3 PIN TERMINAL BLOCK. SEE ABOVE FIGURE. DO NOT CONNECT EARTH GROUND AND POWER SUPPLY GROUND TOGETHER.

3.2.3. SERIAL PORT

There are 3 Serial ports available on the IP Gateway. All 3 are configurable using the IP Gateway Configuration software.

COM1 and COM2 are wired as 5 pin DCE devices and require:

- Straight-through cable to connect to a PC (or other DTE device)
- Null modem cable to connect to a modem (or other DCE device)

COM1 and COM2 pin assignments are:

- Pin.2 RXD
- Pin.3 TXD
- Pin.5 GND
- Pin.7 RTS (future)
- Pin.8 CTS (future)

COM3 is an RJ-11 connector, which is normally a factory port only. However, by ordering a custom cable, this port is also available to the user for the functions shown below:

Table 3: COM3 FUNCTION vs. CABLE

COM3 FUNCTION	CUSTOM CABLE PART NO.	CABLE FUNCTION
3 Wire DCE Serial Port	SCADALink P/N CBL-USR-01	Convert RJ11 to DB9F
Field FLASH Upgrade Port	SCADALink P/N CBL-PRG-01	See Appendix A

NOTE: COM1 – RS232 IS INTERNALLY WIRE-ORED WITH THE COM1: RS-485 PORT. BOTH PORTS CAN BE USED SIMULTANEOUSLY IF THE DEVICES CONNECTED TO THE PORTS ARE BOTH MODBUS SLAVES. DO NOT CONNECT AND USE 2 MASTER DEVICES OR DATA CONTENTION MAY OCCUR.

3.2.4. RS-485 COM1

The RS-485 can be either 2-wire half duplex or 4-wire full duplex. Up to 128 IP Gateway's can be multi-dropped onto one RS-485 bus. See Appendix B for RS-485 wiring details. The RS-485 port is internally Wire-Ored with the RS-232 port. See the above note.

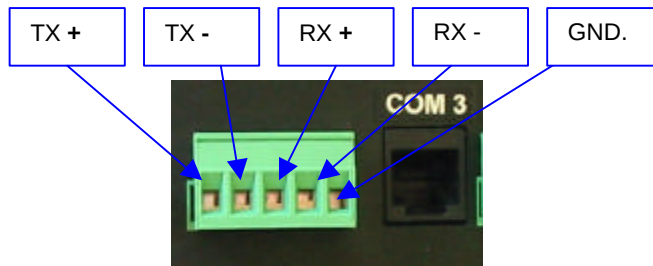


Figure 8: RS-485 Connector

3.2.5. ETHERNET

This Ethernet connector is a 10Base-T RJ-45 connector wired as a DTE:

- Use Straight-thru CAT5 cable to connect to a Hub
- Use Crossover CAT5 to connect to computer or PLC.

This connector has integral status LEDs: Green LED indicates data while Yellow indicates Link.

3.2.6. AUXILLARY DIGITAL INPUT AND OUTPUT

See Fig.7 above for a picture of the Auxillary digital input/output connector. Digital input is not available on the IP Gateway. The user can force this open collector digital output high or low from within the UNICON configuration software 4) *Miscellaneous* menu for diagnostic purposes. The Figure below shows typical wiring of a relay coil from a 24V power source. The power can between 9 and 30V.

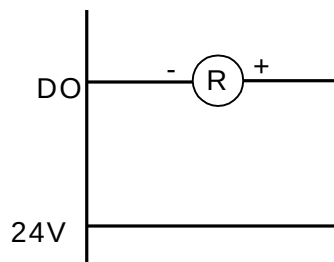


Figure 9: Auxillary DO Wiring Example

4 SETUP AND CONFIGURATION

Configuration is done via software, which operates as an ASCII terminal: there are *Selection Prompts* to select options and *Parameter Prompts* for entering values.

NAVIGATION KEYS

Pressing **<ESC>** from either Prompt jumps the user out of the existing menu and displays the previous menu.

During a *Parameter Prompt*, pressing **<ENTER>** will accept the default value indicated in brackets and move the Prompt to the next parameter. If an invalid entry is made, an error message will be displayed. If a valid entry is made, pressing **<ENTER>** will accept the entered value and move the Prompt to the next parameter.

GETTING STARTED

Before entering detailed setup and configuration information, the user should review the *Operation* section of this manual to see which modes and functions are best suited for their application. Once that is done, follow the instructions in this section to configure the appropriate settings.

After the units are configured, it is strongly advised to bench test the system before installing it out in the field; an incorrectly configured unit is a lot easier to test and troubleshoot on the bench than in the field.

ACCESSING THE CONFIGURATION MENU

The configuration menu can be accessed in one of two ways:

1. Terminal Program such as HyperTerminal (configured for 9600 N 8 1) running on PC connected to COM1 via straight-through Serial Cable
2. TELNET Connection to the IP Gateway's internal IP address.

TERMINAL CONFIGURATION

1. Connect a Straight-Through 9-pin Serial cable to COM1 RS232 Port on the IP Gateway.
2. Close any existing applications that may be using your PC's COM port that is connected to the IP Gateway.
3. Open a Terminal program such as Windows HyperTerminal, ProComm or any another Terminal emulation program on the PC.
4. Make sure the program is setup to communicate at a baud rate of 9600 8-N-1.

SETUP AND CONFIGURATION

5. Make sure a 9-30VDC Power Supply is connected to the IP Gateway and turn the Power on. The LED's will flash and the following Welcome message will display on the Terminal:

SCADALINK IP Gateway, BENTEK SYSTEMS Ltd.
Unit Number BA02I00001 Software version 1.01

6. Hit the ESC key within 5 seconds of this message to enter Configuration mode. Otherwise, the system will default to normal runtime mode.

TELNET

To Telnet to an IP Gateway, the IP Gateway must first be configured with an IP address and Port number. This is done in *1) Network/IP Setting* menu. To Telnet to a target IP Gateway connected to a network, while in Windows, open a DOS window. At the DOS prompt, type the following:

Telnet xxx.xxx.xxx.xxx (where xxx.xxx.xxx.xxx represents the target IP Gateway IP address)

You will then see a message stating the Site name and a prompt requesting a password: type in the correct password. (your own configured password, or, if the unit is new, the factory default password: "scadalink". The password is case sensitive).

NOTE1: THE TELNET DEFAULT PASSWORD IS "scadalink" AND IS CASE-SENSITIVE

NOTE2: USER PASSWORD IS ASSIGNED IN 4) MISCELLANOUS. IN THIS SECTION.

NOTE3: IF YOU FORGET YOUR PASSWORD, USE TERMINAL MODE TO GO TO 4) MISCELLANOUS. TERMINAL MODE HAS NO PASSWORD PROTECTION.

4.4 MAIN SCREEN

```
Hit <ESC> key within 5 seconds to enter configuration mode

SCADALINK IP GATEWAY, BENTEK SYSTEMS Ltd.
Serial Number CZ02F00037   Software version 1.04

1) Network/IP setting:
   Ethernet Interface
   IP address..... [10.0.1.71]
   Default Gateway..... [10.0.1.1]
   Netmask..... [255.255.255.0]
   Number of Connections..... [ONE]
   Protocols(1=On, 0=Off).... UDP[0] TCP[0] MTCP[1]

2) Serial Port Parameters:
      BAUD   FORMAT  MODE  TIMEOUT
COM 1 ..... [ 9600] [N-8-1] [RTU] [500]
COM 2 ..... [ 9600] [N-8-1] [RTU] [500]
COM 3 ..... [ 9600] [N-8-1] [RTU] [500]

3) Serial Port Mode Setting:
      TYPE      UDP      TCP      MTCP
COM 1 ..... [Not-Used]
COM 2 ..... [Not-Used]
COM 3 ..... [Not-Used]

4) Misc:
Select parameter (1..4) to change.(ESC to exit 5 to set default):
```

Figure 10: Main Configuration Screen

The above screenshot shows the main configuration menu. This main screen shows the existing IP Gateway configuration. To change any of these values, the user must enter the appropriate Configuration screen by typing the corresponding number (1 to 4) at the Selection prompt (on the bottom line of the above screenshot). Doing this will bring up the selected configuration menu.

The following sections show a screen shot of each menu and a table listing and describing each of the parameters.

SETUP AND CONFIGURATION

4.1.1. 1) NETWORK / IP SETTING

```
Select parameter (1..4) to change, (ESC to exit, 5 to set default): 1
1) Network/IP setting:
  Enter IP Address (10.0.1.71):
  Enter Gateway Address (10.0.1.1):
  Enter Netmask (255.255.255.0):
  Number of connections allowed (1=ONE, 2=MULTI)[1]:
  Enable UDP (1=Yes, 0=No) [0]:
  Enable TCP (1=Yes, 0=No) [0]:
  Enable MTCP (1=Yes, 0=No) [1]:
  Change Advanced Network Settings(1=Yes, 2=No)[2]: 1
  WARNING ALTERING THESE SETTINGS MAY CAUSE COMMUNICATIONS FAILURE.
  Enter Network Latency (scale 0->Fast - 10->Slow)[0]:
  TCP No Message Timeout (2-1800s)[10]:
  Enter Minimum Retransmission Time in ms (minimum 250 ms)[250]:
  Enter Maximum Retransmission Time in ms (maximum 50000 ms)[50000]:
```

Figure 11: 1) Network / IP setting Screen

Table 4: 1) Network / IP setting Parameters

PARAMETER NAME	VALUE	DESCRIPTION
IP Address	xxx.xxx.xxx.xxx	IP Gateway IP address
Gateway Address	xxx.xxx.xxx.xxx	IP Gateway Gateway address
Netmask	xxx.xxx.xxx.xxx	IP Gateway Netmask
Number of Connections Allowed	1 = one connection 2 = multiple	Number of Masters that can connect to the IP Gateway.
Enable UDP	0 = No 1 = Yes	UDP Protocol
Enable TCP	0 = No 1 = Yes	TCP Protocol
Enable MTCP	0 = No 1 = Yes	Modbus TCP Protocol
Change Advanced Network Settings	0 = No 1 = Yes	1 = yes allows user to edit the parameters on the lines below
ADVANCED NETWORK SETTINGS		
Network Latency	0 – 10 0 = fastest 10 = slowest	
TCP No Message Timeout	2 – 1800 sec.	Time in seconds that the connection will be closed if no message is detected within this programmed timeout
Minimum Retransmission Time	250 ms. min.	Minimum timeout in ms before re-transmitting an UNACKED message. We recommend a minimum value for this setting.
Maximum Retransmission Time	50,000 ms. max.	Maximum timeout in ms to re-transmitting an UNACKED message. Adjust this value to 1.5 the maximum response-time if LOST MESSAGES is a KNOWN problem on your network.

SETUP AND CONFIGURATION

4.1.2. 2) SERIAL PORT PARAMETERS

```

2) Serial Port Parameters:
      BAUD  FORMAT  MODE  TIMEOUT
COM 1 ..... [ 9600] [N-8-1] [RTU] [500]
COM 2 ..... [ 9600] [N-8-1] [RTU] [500]
COM 3 ..... [ 9600] [N-8-1] [RTU] [500]
Choose COM Port to config: 1
BAUD: 1=1200 2=2400 3=4800 4=9600
      5=19200 6=38400 7=57600 8=115200
Enter a BAUD RATE for COM 1 [9600]: 8
Enter data mode for COM 1 (1=RTU, 2=ASCII) [RTU]:
Enter Message Timeout for COM 1(100-30000 ms,10ms resolution) [500]:
Change Data Format for COM 1 [N-8-1] (1=Yes, 2=No)[N-8-1]: 1
Enter parity (0=None, 1=Odd, 2=Even) [N]:
Enter data bit (7,8) [8]:
Enter stop bit (1,2) [1]:
2) Serial Port Parameters:
  
```

Figure 12: 2) Serial Port Parameters Screen

Table 5: 2) Serial Port Parameters Parameters

PARAMETER NAME	VALUE	DESCRIPTION
Baud Rate	1 = 1200 baud 2 = 2400 baud 3 = 4800 baud 4 = 9600 baud 5 = 19200 baud 6 = 38400 baud 7 = 57600 baud 8 = 115200 baud	Asynchronous Serial port baud rate
Data mode	1 = RTU 2 = ASCII	Modbus RTU or ASCII
Message Timeout	100 to 30,000 ms 10ms resolution	Maximum allowable time for serially connected device to response

Table 6: 2) Serial Port Parameters Data Format Parameters: Allowed Combinations

DATA BITS	PARITY	STOP BITS
7	0 = none	1
		2
	1 = odd	1
	2 = even	1
8	0 = none	1
		2
	1 = odd	1
	2 = even	1

SETUP AND CONFIGURATION

4.1.3. 3) SERIAL PORT MODE

Each Serial Port can be configured to operate in 1 of the following 4 modes:

1. **Master Mode:** Each Master can poll 1 or more slaves. There are 2 configuration menus: Master for a Single Remote Slave and Master for Multiple Remote Slaves.
2. **Slave Mode:** One or more masters can poll the serially connected (SLAVE) device through the configured protocol(s)
3. **Modbus MUX Mode:** Multiple Masters (local or remote) can poll the serially connected (SLAVE) device through the configured protocol.
4. **Virtual Serial Mode:** Simulate a serial connection between two serial devices using a TCP virtual connection. There are 2 configuration menus: Virtual Serial Client or Virtual Serial Server.

When 3) *Serial Port Mode Setting* menu item is chosen, the COM port to configure must be chosen first. The Table below shows the parameters for selecting the COM port.

Table 7: Mode Parameters

PARAMETER NAME	VALUE	DESCRIPTION
Choose COM port to configure	1-3	1-3 for COM1 to COM3 respectively
COM X Mode	0-3	0 = Not used, 1=Master, 2=Slave, 3=Mux, 4=Virtual Serial

An example screenshot and parameter description table is given for each of these in the following sections.

SETUP AND CONFIGURATION

4.3.3.1. MASTER MODE

```

Select 1 to Add, 2 to Delete:
3) Serial Port Mode Setting:
                                TYPE      UDP      TCP      MTCP
COM 1 ..... [MASTER]
COM 2 ..... [Not-Used]
COM 3 ..... [Not-Used]

Choose COM Port to Config: 1

COM 1 Mode(0=Not-Used,1=Master,2=Slave,3=Mux,4=Virt-Serial)[MASTER]:
How many remotes allowed (1=ONE, 2=MULTI)[1]:

Dest-IP      Port  Protocol
[10.0.1.55] [ 502] [MTCP]
Enter IP in dotted format, ex: 10.0.1.10
Enter Destination IP: _

```

Figure 13: Master Mode Screen: 1 Remote

```

COM 1 Mode(0=Not-Used,1=Master,2=Slave,3=Mux,4=Virt-Serial)[Not-Used]: 1
How many remotes allowed (1=ONE, 2=MULTI)[1]: 2
IP Lookup Table

Table is empty, select Add
Select 1-to Add, 2-to Delete: 1

Enter Destination RTU ID: 1
Enter IP in dotted format, ex: 10.0.1.10
Enter Destination IP: 10.0.1.77
Enter Destination Port: 500
Select protocol(1=UDP,2=TCP,3=Modbus TCP): 1
Select 1-to Add another, Esc to return: 1

Enter Destination RTU ID: 2
Enter IP in dotted format, ex: 10.0.1.10
Enter Destination IP: 10.0.1.76
Enter Destination Port: 502
Select protocol(1=UDP,2=TCP,3=Modbus TCP): 3
Select 1-to Add another, Esc to return:

IP Lookup Table
Entry  ID    Dest-IP      Port  Type
1)    [ 1]   [10.0.1.77] [ 500] [UDP]
2)    [ 2]   [10.0.1.76] [ 502] [MTCP]

Select 1-to Add, 2-to Delete: _

```

Figure 14: Master Mode Screen: Multiple Remote Sites

Table 8: Master Mode Parameters

PARAMETER NAME	VALUE	DESCRIPTION
1 REMOTE		
Destination IP	xxx.xxx.xxx.xxx	IP address in dotted decimal notation
Destination Port	2 to 65535	Port Number
Select Protocol	1 = UDP, 2= TCP 3 = Modbus TCP	Protocol
2 MULTIPLE REMOTES		
Destination RTU ID	1-255	Modbus Address
Destination IP	xxx.xxx.xxx.xxx	IP address in dotted decimal notation
Destination Port	2 to 65535	Port Number
Select Protocol	1 = UDP,2 = TCP 3 = Modbus TCP	Protocol

SETUP AND CONFIGURATION

4.3.3.2. SLAVE MODE

Each IP Gateway can support a **maximum of 3 Slave connections**. These connections can exist on just one physical COM port up to all 3 physical COM ports. Each connection can also be configured for Modbus TCP, TCP or UDP.

NOTE: MODBUS TCP, TCP AND UDP PROTOCOLS ARE ENABLED/DISABLED IN THE 1) NETWORK /IP CONFIGURATION MENU AND NOT THIS ONE.

The example below shows COM1 configured as a Master, COM3 unconfigured and COM2 being configured as a Slave. In this example, only Modbus TCP has been enabled. TCP and UDP have been disabled in the Network/IP Configuration menu. The user is prompted to enter a port number only for the Modbus TCP port.

```
3) Serial Port Mode Setting:
                                TYPE      UDP      TCP      HTCP
COM 1 ..... [MASTER]
COM 2 ..... [Not-Used]
COM 3 ..... [Not-Used]

Choose COM Port to Config: 2

COM 2 Mode(0=Not-Used,1=Master,2=Slave,3=Mux,4=Uirt-Serial)[Not-Used]: 2

Enter Destination Port(s) for Enabled Protocols
xDUPLICATE PORTS ARE NOT ALLOWEDx Put 0 for UN-USED
UDP disabled. Can not input a UDP Port number!!!
TCP disabled. Can not input a TCP Port number!!!
Enter MTCP Port [0]: 502

3) Serial Port Mode Setting:
                                TYPE      UDP      TCP      HTCP
COM 1 ..... [MASTER]
COM 2 ..... [SLAVE] [ 0 ] [ 0 ] [ 502 ]
COM 3 ..... [Not-Used]
```

Figure 15: Slave Mode Screen

Table 9: Slave Mode PARAMETERS

PARAMETER NAME	VALUE	DESCRIPTION
MTCP Port	2 to 65535	Modbus TCP Protocol
TCP Port	2 to 65535	TCP Protocol
UDP Port	2 to 65535	UDP Protocol

NOTE: IN THE ABOVE TABLE, ONLY THOSE PROTOCOLS WHICH ARE ENABLED IN 1) NETWORK /IP CONFIGURATION MENU CAN BE EDITED.

SETUP AND CONFIGURATION

4.3.3.3. MODBUS MUX MODE

Modbus Multiplexer mode can be used to allow up to 2 Modbus MASTERS connected to 2 IP Gateway COM ports to simultaneously poll the same Modbus SLAVE connected to the 3rd IP Gateway COM port.

By using a combination of SLAVE and MUX configuration, both locally connected Serial Modbus MASTER AND remotely-connected TCP/IP Modbus MASTERS can simultaneously poll the same Modbus SLAVE.

Do the following in the MUX menu to multiplex a COM port to another COM port:

1. Select the COM port which the Modbus RTU will SLAVE connect to.
2. Select the COM port which the Modbus RTU MASTER will connect to.

NOTE: MODBUS TCP, TCP AND UDP PROTOCOLS MUST BE ENABLED/DISABLED IN THE 1) NETWORK /IP CONFIGURATION MENU FIRST BEFORE ANY OF THE SETTINGS HERE WILL BE READ.

In the example below, COM3 is first chosen as the COM port which the Modbus RTU MASTER will connect to. The user is then prompted for the COM port which the Modbus RTU SLAVE will connect to. COM2 is specified.

Also notice in the example that COM2 is already configured as a Modbus SLAVE able to receive Modbus TCP messages on port 502. This combination of SLAVE and MUX configuration allows a remote Modbus TCP MASTER **and** a local Modbus RTU MASTER connected to COM3 to simultaneously poll the Modbus SLAVE connected to COM2.

```
3) Serial Port Mode Setting:
      TYPE      UDP      TCP      MTCP
COM 1 ..... [MASTER]
COM 2 ..... [SLAVE] [ 0 ] [ 0 ] [ 502 ]
COM 3 ..... [Not-Used]

Choose COM Port to Config: 3

COM 3 Mode(0=Not-Used,1=Master,2=Slave,3=Mux,4=Virt-Serial)[Not-Used]: 3

Select SLAVE COM Port to Mux to[N]: 2
3) Serial Port Mode Setting:
      TYPE      UDP      TCP      MTCP
COM 1 ..... [MASTER]
COM 2 ..... [SLAVE] [ 0 ] [ 0 ] [ 502 ]
COM 3 ..... [MUX]  [Mux to COM 2]

Choose COM Port to Config: _
```

Figure 16: Mux Mode Screen

Table 10: Mux Mode Parameters

PARAMETER NAME	VALUE	DESCRIPTION
SLAVE COM Port to MUX to	1, 2 or 3	Serial Port that is assigned to be a Multiplexed Modbus Slave.

SETUP AND CONFIGURATION

4.3.3.4. VIRTUAL SERIAL MODE

```
Select parameter (1..4) to change.(ESC to exit,5 to set default): 3
3) Serial Port Mode Setting:

      TYPE      UDP      TCP      MTCP
COM 1 ..... [MASTER]
COM 2 ..... [SLAVE] [ 0 ] [ 0 ] [ 502 ]
COM 3 ..... [MUX] [Mux to COM 2]

Choose COM Port to Config: 1

COM 1 Mode(0=Not-Used,1=Master,2=Slave,3=Mux,4=Virt-Serial)[MASTER]: 4
Virtual-Serial Client or Server(1-Client, 0-Server)[0]:
Enter TCP port to listen on[2300]:
Virtual-Serial No Message Timeout(2-1800s)[30]:
3) Serial Port Mode Setting:

      TYPE      UDP      TCP      MTCP
COM 1 ..... [US]
COM 2 ..... [SLAVE] [ 0 ] [ 0 ] [ 502 ]
COM 3 ..... [MUX] [Mux to COM 2]
```

Figure 17: Virtual Serial Mode Screen: Server

```
      TYPE      UDP      TCP      MTCP
COM 1 ..... [US]
COM 2 ..... [SLAVE] [ 0 ] [ 0 ] [ 502 ]
COM 3 ..... [MUX] [Mux to COM 2]

Choose COM Port to Config: 1

COM 1 Mode(0=Not-Used,1=Master,2=Slave,3=Mux,4=Virt-Serial)[US]:
Virtual-Serial Client or Server(1-Client, 0-Server)[0]: 1

Dest-IP      Port      Protocol
[0.0.0.0]    [ 2300 ] [TCP]
Enabled Client "Connected" Message(1-Yes, 0-No)[0]: 1
Enter IP in dotted format, ex: 10.0.1.10
Enter Destination IP: 10.0.1.78
Enter Destination Port: 501
Virtual-Serial No Message Timeout(2-1800s)[30]:
3) Serial Port Mode Setting:

      TYPE      UDP      TCP      MTCP
COM 1 ..... [US]
COM 2 ..... [SLAVE] [ 0 ] [ 0 ] [ 502 ]
COM 3 ..... [MUX] [Mux to COM 2]
```

Figure 18: Virtual Serial Mode Screen: Client

Table 11: Virtual Serial Mode Parameters

PARAMETER NAME	VALUE	DESCRIPTION
Virtual Serial Port Client or Server	0 = Server 1 = Client	Client: devices requesting service Server: devices responding to requests
SERVER		
TCP Port to Listen on	2 to 65535	
No-message Timeout	2 to 1800 sec.	Time to wait before closing connection if no activity (only applies to Virtual Serial)
CLIENT		
Enabled Client "Connected" Message	0 = No 1 = Yes	Connected to "Virtual Serial Server IP" Port "number"
Destination IP	xxx.xxx.xxx.xxx	IP address in dotted decimal notation
Destination Port	2 to 65535	
No-message Timeout	2 to 1800 sec.	Time to wait before closing connection if no activity (only applies to Virtual Serial)

SETUP AND CONFIGURATION

4.1.4. 4) MISCELLANEOUS

```
1) Digital Output Control [0]
2) Site Info [Site Description Goes Here]
3) Change Telnet Configuration Password:

Select Parameter (1..3) to change: 1

Enter Output Level (0,1)[0]:
4) Misc:

1) Digital Output Control [0]
2) Site Info [Site Description Goes Here]
3) Change Telnet Configuration Password:

Select Parameter (1..3) to change: 2

Enter Site Info(40 characters max):
4) Misc:

1) Digital Output Control [0]
2) Site Info [Site Description Goes Here]
3) Change Telnet Configuration Password:

Select Parameter (1..3) to change: _
```

Figure 19 4) Miscellaneous Mode Screen

Table 12: 4) Miscellaneous Mode Parameters

PARAMETER NAME	VALUE	DESCRIPTION
1 DIGITAL OUTPUT CONTROL		
Enter Output Level	0 = low logic 1 = high logic	Set logic level for Auxillary digital output.
2 SITE INFO		
Site Info	40 characters maximum	Description of Site IP Gateway is installed at.
3 CHANGE TELNET CONFIGURATION PASSWORD		
Change Telnet Configuration Password	4 to 10 characters alphanumeric	Default is "scadalink" This password is case-sensitive.

5 TROUBLESHOOTING TIPS

5.1. Problem: Unable to ping unit

Solution:

- Check network/ip setting for correct IP address, gateway, netmasks
- Check ethernet cable connection: RJ45 straight through cable is required

5.2. Problem: Unit does not respond to poll

Solution:

- Configure serial port mode settings
- Ensure the SLAVE device is connected to the configured serial port
- Ensure correct serial setting such as: BAUD, FORMAT, and TIMEOUT
- Ensure matching RTU address
- Check for Master timeout. If the master is polling too quickly the slave may not have enough time to respond.
- Check for Slave timeout, the slave must be able to response within the time specified on the serial port (Serial setting: baud, format, and timeout)
- Make sure the serially connected SLAVE is set up correctly

5.3. Problem: I am able to poll but connection keeps dropping

Solution:

- Check for Master timeout, the master could be timing out too quick
- Check Advanced Network Setting for "TCP No Message Timeout". IP gateway will close the connection if no message is detected within this timeout. For example: the "TCP No Message Timeout" is set to 2 seconds, the master is polling at every 4 seconds. The IP gateway is closing the connection after 2 seconds causing the connection to drop.

5.4. Problem: I could not get more than 3 connections to IP gateway

Solution:

- IP Gateway can only handle 3 masters simultaneously.

5.5. Problem: Connection takes long time to established

Solution:

- Disable not-used protocol
- Reset COM port setting to "Not-Used" for not-used ports
- Set Number of Connections to 1 if only one is required
- If more than 1 protocol is enabled, increase network latency in advanced setting,

this determines how long the IP gateway will spin on each protocol while waiting for a connection.

- Over a WAN, increasing network latency will help the connection to establish quicker

5.6. Problem: I am not getting 100% Communications

Solution:

- Increase number of retry on master
- Over a WAN, or over RADIO where lost messages occurs, set the Maximum Retransmission Timeout to 1.5times the maximum response time
- If multiplexing to one slave device, ensure the masters have reasonable poll delay

5.7. Problem: I could not get in telnet configuration

Solution:

- Make sure you enter the correct password. The password could be change in terminal menu and telnet menu
- Reboot IP gateway if you could not get to the unit at all
- Only 1 telnet menu is available

5.8. Problem: Telnet menu crashes

Solution:

- IP gateway is too busy handling other connections, turn the polling off while telnet
- Telnet menu automatically timeouts if menu is not active in approximately 1 minute

5.9. Problem: I have a Multiple IP Gateways and I don't know which is which

Solution:

- Give each unit a description, this description is part of the telnet password prompt

5.10. Problem: IP Gateway crashes if I enabled everything

Solution:

- Only enabled setting that is required, overloading cause crashes
- Settings that are enabled but not in use takes up resources too

6 INSTALLATION

Installation consists of 3 aspects:

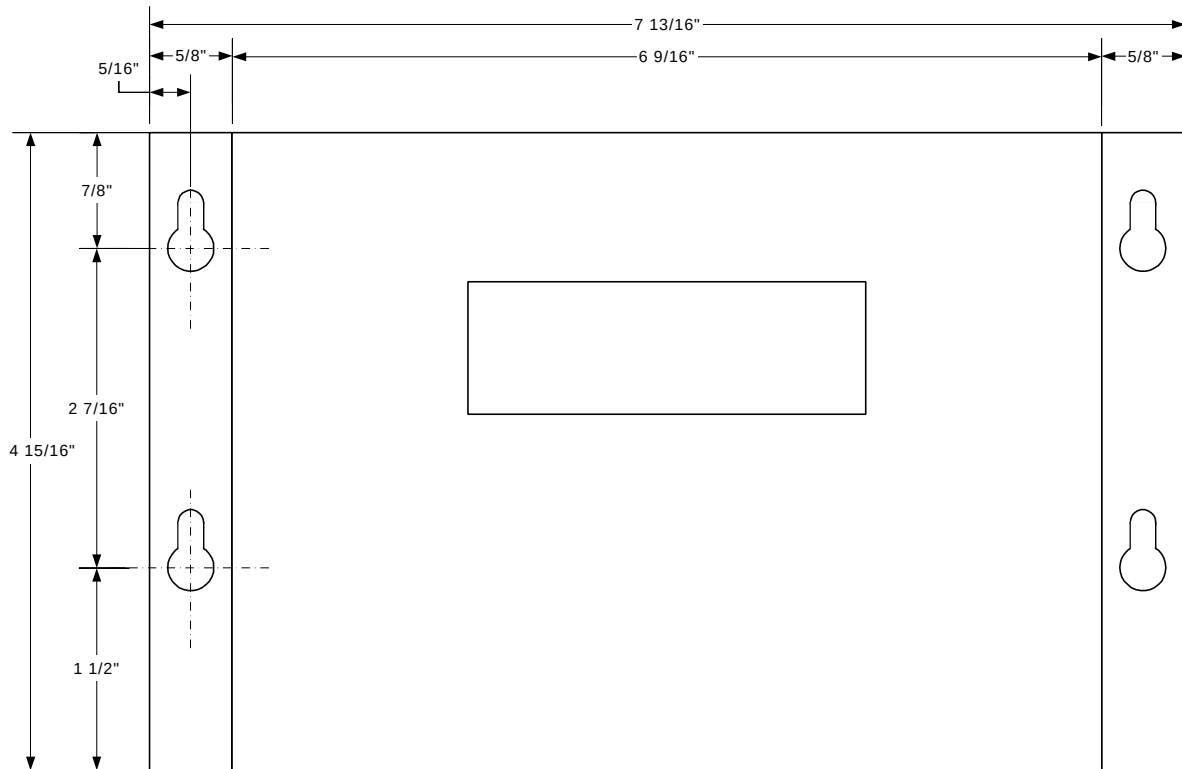
1. Physical mounting
2. Basic bench setup and testing

6.1. PHYSICAL MOUNTING

The IP Gateway is a panel mount device usually mounted on a backpanel by using 4 # screws through the 4 keyslot holes on the IP Gateway mounting bracket.

The Figure below shows the IP Gateway's physical dimensions.

INSTALLATION



FRONT VIEW



SIDE VIEW

Figure 20: Physical Dimensions

6.2. BENCH SETUP AND TEST

It is recommended to bench test communications before attempting field installation. This is especially advised for new User's of the equipment. Any problems due either to misconfiguration or equipment fault will be much easier to identify and fix when all the equipment is accessible from the bench.

6.2.1. EQUIPMENT

For the following bench setup and preliminary testing, have the following equipment available:

1. IP Gateway units to be installed
2. Devices which will be connected to IP Gateway in the field or devices that can emulate the field device's interface
3. Configuration PC
4. 9-26VDC regulated power supply
5. All necessary cables
6. IP Gateway Programming cable
7. User manual
8. List of configuration parameters and their values prepared as per following section.

6.2.2. USER CONFIGURATION

Before bench testing and preliminary setup, read the User manual and look at the various functions to determine which one is most applicable to your application. Make a copy of the Configuration Parameter Template found in Appendix C and write down all your configuration parameters.

7 TECHNICAL SPECIFICATIONS

GENERAL

Power	Input Voltage	9-30 VDC
	Current (Average)	50mA @24 V (assumes Continuous operation in MASTER mode)
Temperature Range Size: Max dimensions	Operating Length	-40 to 85 Deg. C 7.5"
	Width	5.75" (including Top Faceplate connectors)
	Height	2.875"
	Mounting	4 x 5/32" Dia. mounting holes (Fits #8 Screws), 2.400" vertical 6.218" horizontal
Weight		850 grams

SERIAL COMMUNICATIONS

Interface	COM1	RS-232 (9 pin DB-9 Female DCE standard) RS-485 (2 Wire or 4 Wire Half Duplex) See Note1
	COM2	RS-232 (9 pin DB-9 Female DCE standard)
	COM3	RS-232 (3-wire only) See Note2
Data Rates		1200, 2400, 4800, 9600, 19200, 38400, 56000, 115000
Data Format		Asynchronous – N,E or O parity, 7 or 8 data bits, 1 or 2 stop bits
Flow Control		None (RTS/CTS future)
Protocols		Modbus TCP, Modbus over TCP, Modbus over UDP

Note1: Both COM1 RS-232 and COM1 RS-485 ports are internally wire-Ored. They can be used simultaneously if Modbus Slaves devices are connected to both ports.

Note2: COM3 requires a custom cable to convert the RJ11 to a standard DB9F. Cable No. CBL-USR01 from BenteK Systems.

ETHERNET COMMUNICATIONS

Interface	10BaseT	CAT 5 Straight-Thru for PC or PLC CAT 5 Crossover for Hub
-----------	---------	--

I/O

Auxillary I/O	DI	NOT USED
	DO	Open collector. 9-30VDC/1A max. Transient protected. Set via Configuration Software.

APPENDIX A UPGRADING FIRMWARE

The SCADALink IP Gateway operates from firmware stored in FLASH EPROM that can be field upgraded by the end user.

Field upgrade of IP Gateway firmware may be necessary for the following reasons:

- change firmware version to new version with added features
- upgrade firmware for bug fixes
- change firmware to version with required features
- load custom firmware for specialized applications.

FIRMWARE UPGRADE TOOL

To be able to perform field firmware upgrade the user must obtain the following from BenteK Systems Ltd:

1. SCADALink Firmware Utility Software – (operates in WIN98, WIN2000, WIN-NT OS's).
2. SCADALink Firmware Programming Cable SCADALink P/N CBL-PRG-01.

FIRMWARE UPGRADE PROCEDURE

1. Make sure to record settings of the device since upgrade may delete configuration.
 2. Install SCADALink Firmware Utility on PC.
 3. Copy New Firmware Files into the same directory.
 4. Connect CBL-PRG-01 cable between PC and IP Gateway COM3 port.
 5. Run the SCADALink Utility Software and select the firmware version to download.
- Reconfigure Settings of IP Gateway for the application.

APPENDIX B RS-485 WIRING

The IP Gateway RS-485 Interface supports both 2-wire half duplex and 4-wire full duplex wiring. 2-wire half duplex allows using only one pair of wire but this limitation means data can flow only in one direction at any one time. 4-wire full duplex allows simultaneous bi-directional data flow. A minimum of 32 and a maximum of 128 nodes can be supported depending on the Unit Load of the RS485 equipment. Add a 120-Ohm terminating resistor between TX+ and TX- and one between RX+ and RX- at the 2 end nodes of the RS-485 bus if the bus is long and noise becomes an issue.

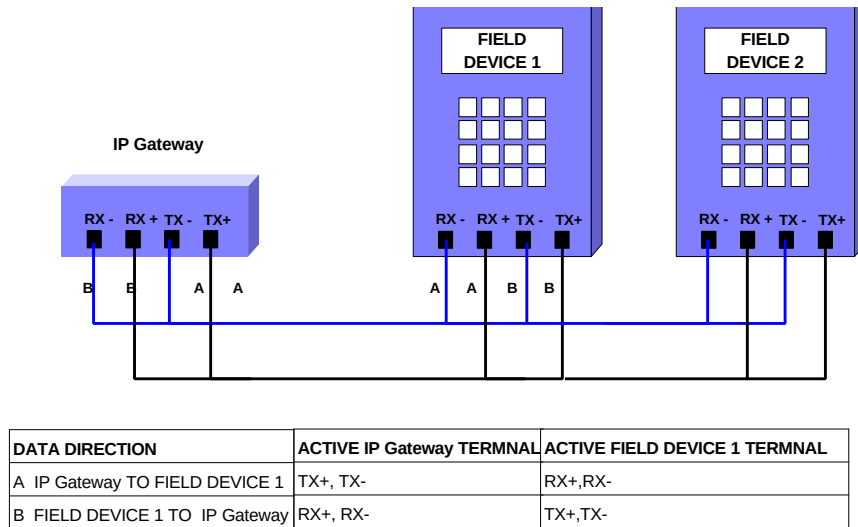


Figure 21: 2 Wire (Half-Duplex) RS-485 Wiring Example: IP Gateway can only be Transmitting or Receiving at any one time

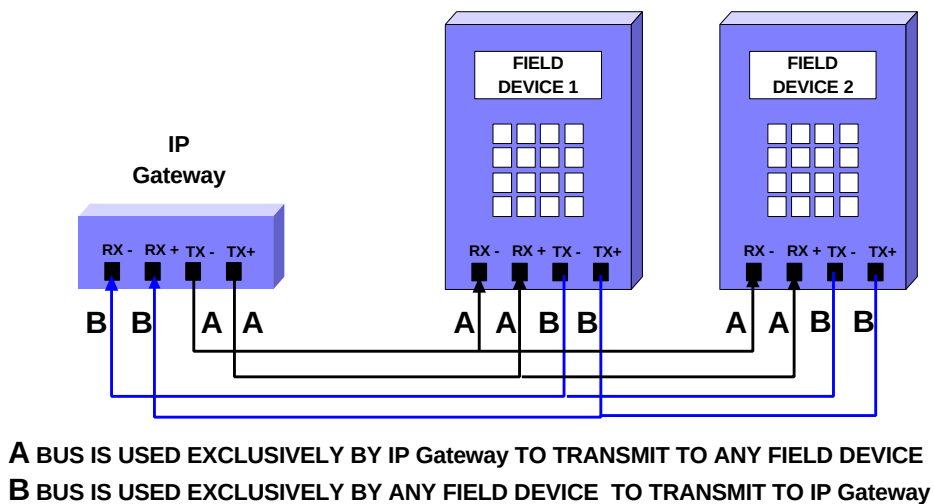


Figure 22: 4 Wire (Full Duplex) RS-485 Wiring Example: IP Gateway can be transmitting and receiving simultaneously

APPENDIX C CONFIGURATION TEMPLATE

APPENDIX C CONFIGURATION TEMPLATE

Table 13: IP Gateway General Configuration Template

VARIABLE NAME	DEFAULT VALUE	ASSIGNED VALUE	UNIT
1) NETWORK / IP SETTING			
IP Address			
Gateway Address			
Netmask			
Number of Connections Allowed 1 = one connection 2 = multiple	1		
Enable TCP	0 =Disabled		
Enable UDP	0 =Disabled		
Enable MTCP	1 = Enabled		
Network Latency 0-10	10 = slowest		
Number of Connections	1 = 1 Master		
TCP No-Message Timeout (2-1800)	60		Sec.
Minimum Retransmission Time (250msec min.)	1000		Msec
Maximum Retransmission Time (50,000msec max.)	50000		Msec
2) SERIAL PORT PARAMETERS: COM 1			
Baud Rate	9600		BPS
Parity 0 = None, 1 = Odd, 2 = Even	None		
Data Bits (7 or 8)	8		
Stop Bits (1 or 2)	1		
Mode 1 = RTU, 2 = ASCII	1 = RTU		
Message Timeout (100-30000)	500		Msec.
2) SERIAL PORT PARAMETERS: COM 2			
Baud Rate	9600		BPS
Parity 0 = None, 1 = Odd, 2 = Even	None		
Data Bits (7 or 8)	8		
Stop Bits (1 or 2)	1		
Mode 1 = RTU, 2 = ASCII	1 = RTU		
Message Timeout (100-30000)	500		Msec.

APPENDIX C CONFIGURATION TEMPLATE

VARIABLE NAME	DEFAULT VALUE	ASSIGNED VALUE	UNIT
2) SERIAL PORT PARAMETERS: COM 3			
Baud Rate	9600		BPS
Parity 0 = None, 1 = Odd, 2 = Even	None		
Data Bits (7 or 8)	8		
Stop Bits (1 or 2)	1		
Data Mode 1 = RTU, 2 = ASCII	1 = RTU		
Message Timeout (100-30000)	500		Msec.
3) SERIAL PORT MODE SETTING: SLAVE MODE COM 1			
COM 1 Mode 0 = Not used, 1=Master, 2=Slave , 3=Mux, 4=Virtual Serial			
Option. Slave Mode UDP Address			
Option. Slave mode TDP address			
Option. Slave Mode MTCP Address			
3) SERIAL PORT MODE SETTING: SLAVE MODE COM 2			
COM 2 Mode 0 = Not used, 1=Master, 2=Slave , 3=Mux, 4=Virtual Serial			
Option. Slave Mode UDP Address			
Option. Slave mode TDP address			
Option. Slave Mode MTCP Address			
3) SERIAL PORT MODE SETTING: SLAVE MODE COM 3			
COM 3 Mode 0 = Not used, 1=Master, 2=Slave , 3=Mux, 4=Virtual Serial			
Option. Slave Mode UDP Address			
Option. Slave mode TDP address			
Option. Slave Mode MTCP Address			

APPENDIX C CONFIGURATION TEMPLATE

VARIABLE NAME	DEFAULT VALUE	ASSIGNED VALUE	UNIT
3) SERIAL PORT MODE SETTING: MUX MODE			
COM 1 Mode 0 = Not used, 1=Master, 2=Slave, 3=Mux, 4=Virtual Serial			
COM 2 Mode 0 = Not used, 1=Master, 2=Slave, 3=Mux, 4=Virtual Serial			
COM 3 Mode 0 = Not used, 1=Master, 2=Slave, 3=Mux, 4=Virtual Serial			
3) SERIAL PORT MODE SETTING: VIRTUAL SERIAL COM 1			
COM 1 Mode 0 = Not used, 1=Master, 2=Slave, 3=Mux, 4=Virtual Serial			
Option. V.S. Mode 1=Client or 0=Server			
Option.V.S.Server TCP Listen Port (2 to 65535)			
Option.V.S.Server No message Timeout (2 -1800)			Sec.
Option V.S. Client Enable "Client connected" Message 0=No, 1=Yes			
Option V.S. Client Dest. IP Port (2 to 65535)			
Option V.S. Client Dest. IP Address			
Option V.S. Client No Message Timeout (2 -1800)			
3) SERIAL PORT MODE SETTING: VIRTUAL SERIAL COM 2			
COM 2 Mode 0 = Not used, 1=Master, 2=Slave, 3=Mux, 4=Virtual Serial			
Option. V.S. Mode 1=Client or 0=Server			
Option.V.S.Server TCP Listen Port (2 to 65535)			
Option.V.S.Server No message Timeout (2 -1800)			Sec.
Option V.S. Client Enable "Client connected" Message 0=No, 1=Yes			

APPENDIX C CONFIGURATION TEMPLATE

VARIABLE NAME	DEFAULT VALUE	ASSIGNED VALUE	UNIT
Option V.S. Client Dest. IP Port (2 to 65535)			
Option V.S. Client Dest. IP Address			
Option V.S. Client No Message Timeout (2 -1800)			
3) SERIAL PORT MODE SETTING: VIRTUAL SERIAL COM 3			
COM 3 Mode 0 = Not used, 1=Master, 2=Slave, 3=Mux, 4=Virtual Serial			
Option. V.S. Mode 1=Client or 0=Server			
Option.V.S.Server TCP Listen Port (2 to 65535)			
Option.V.S.Server No message Timeout (2 -1800)			Sec.
Option V.S. Client Enable "Client connected" Message 0=No, 1=Yes			
Option V.S. Client Dest. IP Port (2 to 65535)			
Option V.S. Client Dest. IP Address			
Option V.S. Client No Message Timeout (2 -1800)			

APPENDIX C CONFIGURATION TEMPLATE

**Table 14: IP Gateway Configuration Template
for 3) Serial Mode Setting: Master**

VARIABLE NAME	DEFAULT VALUE	ASSIGNED VALUE	UNIT
COM Port to Configure (1-3)			
COM XMode 0 = Not used, 1=Master , 2=Slave, 3=Virtual Serial			
Master 1 Dest. RTU ID			
Master 1 Dest. IP			
Master 1 Dest. Port (2 to 65535)			
Master 1 Protocol UDP, TCP, MTCP			
Master 2 Dest. RTU ID			
Master 2 Dest. IP			
Master 2 Dest. Port			
Master 2 Protocol			
Master 3 Dest. RTU ID			
Master 3 Dest. IP			
Master 3 Dest. Port			
Master 3 Protocol			
Master 4 Dest. RTU ID			
Master 4 Dest. IP			
Master 4 Dest. Port			
Master 4 Protocol			
Master 5 Dest. RTU ID			
Master 5 Dest. IP			
Master 5 Dest. Port			
Master 5 Protocol			
Master 6 Dest. RTU ID			
Master 6 Dest. IP			
Master 6 Dest. Port			
Master 6 Protocol			
Master 7 Dest. RTU ID			
Master 7 Dest. IP			
Master 7 Dest. Port			
Master 7 Protocol			
Master 8 Dest. RTU ID			
Master 8 Dest. IP			
Master 8 Dest. Port			
Master 8 Protocol			
Master 9 Dest. RTU ID			
Master 9 Dest. IP			
Master 9 Dest. Port			
Master 9 Protocol			

WARRANTY

The IP Gateway is has a 1 year factory warranty. Any changes or modifications to this equipment not expressly approved by BENTEK SYSTEMS LTD could void the user's equipment warranty.