

ProtoNode Reference Manual

Table of Contents

1.0	INTRODUCTION	1
2.0	PACKAGE COMPONENTS (CHECK-LIST)	1
3.0	PRODUCT DESCRIPTION	1
3.1	SPECIFICATIONS	1
3.2	FEATURES	1
3.3	CONNECTION INFORMATION	2
3.3.1	DB-9 Pinouts	2
3.3.2	RS-232 Connection	2
3.3.3	RS-485 Connection	3
4.0	PROTONODE COMPATIBILITY AND BAUD RATES.....	4
5.0	FIELDSEVER UTILITIES SOFTWARE OVERVIEW	4
6.0	PROTONODE MODBUS MAPPING DESCRIPTIONS.....	6
6.1	READ-ONLY MONITORING REGISTERS SUPPORTED BY EACH UPS.	6
6.2	READ STATUS/FAULT MAPPING DESCRIPTION SUPPORTED BY EACH UPS.....	10
7.0	UPGRADING FIRMWARE	11
8.0	MULTI-MODULE CONFIGURATION	12
9.0	DOWNLOADING CONFIGURATION FILE TO PROTONODE.....	13
10.0	TROUBLESHOOTING TIPS	14
10.1	PROTONODE NOT IDENTIFIABLE ON THE NETWORK	14
10.2	CHANGING IP ADDRESS AND SUBNET MASK	14

1.0 Introduction

ProtoNode is a reliable multi-protocol client/server device that allows you to remotely monitor your Uninterruptible Power System (UPS) using your own building management system. It communicates over Ethernet and RS-232/422/485 while using the mostly used protocols in the industrial sector. This ProtoNode is intended to be used with Toshiba UPS models and it is intended to do the following:

- Monitors multiple parameters such as, battery voltage percentage, amperage, status, faults etc.
- Enables your Toshiba UPS to communicate to the outside world through the following protocols: BACnet MSTP, BACnet IP, Modbus RTU, Modbus TCP, Metasys NS, and SNMP.
- Works with the following Toshiba's Uninterruptible Power Systems Models:
 - o 1600EP
 - o 1800
 - o 4200
 - o G8000
 - o G8000MM
 - o G9000

2.0 Package Components (Check-List)

- 1) Quick Install Guide
- 2) ProtoNode (Multi-Protocol Device Client/Server)
- 3) One Cat5e (Direct Ethernet Cable)
- 4) One Serial Cable (Connection link between UPS and ProtoNode)
- 5) One Power Supply

3.0 Product Description

3.1 Specifications

Power Requirements: Multi-Mode power adapter, 5V-30V DC, 500 mA Power over Ethernet (PoE) option: 30mA@48V DC

Operating Temperature: -40°C to 85°C (-40°F to 185 °F)

Surge Suppression: EN61000-4-2 ESD, EN61000-4-3 EMC, EN61000-4-4 EFT

Approvals: UL60950, EN60950, UL916, CE (EN55022 and 55024) FCC Class Part 15

Note: Specifications subject to change without notice.

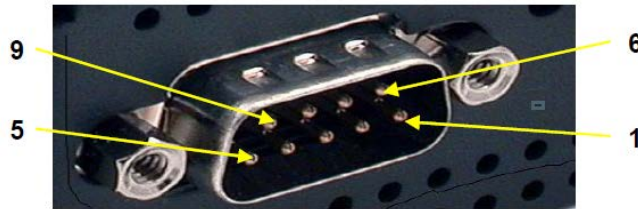
3.2 Features

- Two serial ports (defaulted to RS-485 unless specified differently at the time of purchase).
- Data communications speeds of 300 to 115200 baud supported.
- 10/100BaseT Ethernet LAN interface (auto-sensing)
- DB-9 connectors for the RS-232/422/485 ports.
- Easy configuration via text editor or spreadsheet and the available utilities.

- Physical Dimensions:
 - Length: 4.55 in/11.56cm
 - Width: 4.50 in/11.68 cm (with flange mounts)
 - Height: 1.35 in /3.43 cm

3.3 Connection Information

3.3.1 DB-9 Pinouts

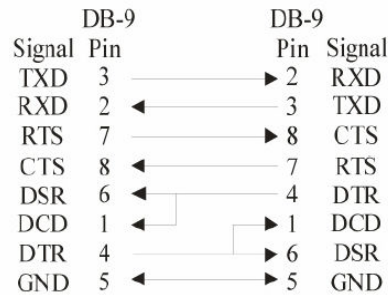


3.3.2 RS-232 Connection

- Used to connect to DTE type devices.
- The serial cable used (serial cross-over cable) is available at any electronics retailer/distributor.

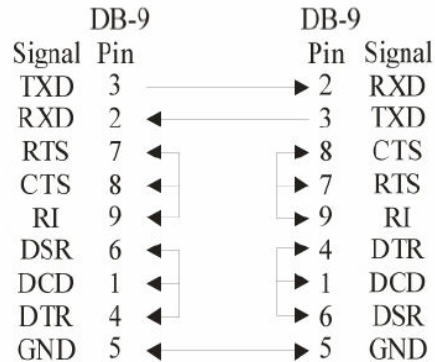
Typical RS-232 null modem connection:

- This is used to connect to DTE type devices.
- Used when Hardware RTS->CTS flow control is required.
- This cable is also called a cross over cable and is commonly available at any Electronics retailer/distributor.



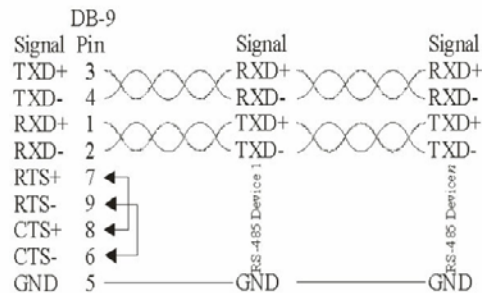
Basic “3 wire” RS-232 null modem connection:

This is used to connect to DTE type devices.
Used when Hardware RTS->CTS flow control is **not** required.
This cable is also called a cross over cable.



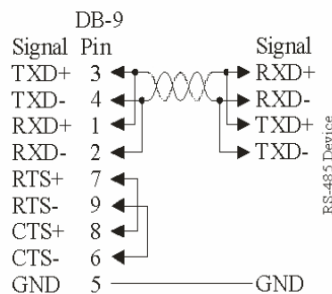
3.3.3 RS-485 Connection

Four-wire (full duplex multi-drop, “RS-485 mode”)



Note: The flow control signals, RTS and CTS should be connected as per diagram when unused to prevent loss of performance on your ProtoNode.

Two-wire (1/2 duplex, “RS-485 mode”) Wiring



Note: The flow control signals, RTS and CTS should be connected as per diagram when unused to prevent loss of performance on your ProtoNode.

Note: The flow signals, RTS and CTS, should be connected as per diagram when unused to prevent loss of performance on the ProtoNode.
For those who do not wish to construct their own connector, we recommend using a DB-9 to screw block connector.

4.0 ProtoNode Compatibility and Baud Rates

ProtoNode is compatible only with the following Uninterruptible Power Systems:

Compatible Models	Baud Rate
1600EP	9600
1800	9600
4200	1200
G8000	1200
G8000MM	9600
G9000	9600

Table 1 – UPS models Compatible with ProtoNode

NOTE: The baud rate is between UPS and ProtoNode.

5.0 FieldServer Utilities Software Overview

The FieldServer Utilities Software is a group of software programs that help you configure, debug, monitor and setup your ProtoNode. It consists of Ping Utility (RuiPing), Remote User Interface (RuiNet), Serial and Snapshot Capture Utility (RuiDebug), FST_Diag Utility, and Internet Address Configurator (RuiBoot). Look at Table 2, for a brief description of each utility tool.

Utility Name	Description
Ping Utility (RuiPing)	RuiPing is a Utility that “pings” a specific ProtoNode or all ProtoNodes on the network.

Remote User Interface (RuiNet)	RuiNet is a utility interface that allows the user to configure the IP settings, upgrade the firmware, and upload configuration file to the ProtoNode.
Serial and Snapshot Capture Utility (RuiDebug)	RuiDebug utility creates logs to help diagnose a problem that occurs when a specific event occurs.
FieldServer Technologies Diagnostics Utility (FST_Diag)	The FST_Diag Utility communicates with the ProtoNode and collects information about the ProtoNode setup, current communications activities and then reports back to Field Server support.
Internet Address Configurator (RuiBoot)	RuiBoot gets the old IP address whenever ProtoNode starts up. RuiBoot will then allocate an IP address for you to use.

Table 2 – FieldServer Utilities Software Description

5.1 PC Requirements

The Utilities work with TCP/IP enabled PC with an Ethernet network card supporting 10/100Mbit/s. The PC and ProtoNode can be connected via an established network or directly using a cross-over Cat5e cable. The Utilities run under any of the following operating systems: DOS, Windows 95 (SP2 upwards), Windows 98, 2000, NT, XP, 7.

5.2 Downloading and Installing FieldServer Utilities Software

1. The FieldServer utilities software can be downloaded from the following link:

http://www.toshiba.com/ind/product_display.jsp?id1=14&id2=30&id3=581.

2. Click on the “Software” tab and select the “Install” file and save the file into your computer.

3. Open the compressed file (Install.zip) and double click on the “setup.exe” to execute.

4. Follow the instructions on the screen to complete installation.

Note: These instructions assume a Windows Operating System.

6.0 ProtoNode Modbus Mapping Descriptions

6.1 Read-only monitoring registers supported by each UPS.

These are read-only registers, so you will need to adjust your Building Management System (BMS) settings to read the following registers below. (Note: The registers available to read depends on the UPS model)

1600EP/Register Address	Description	Units	Multiplier
30001	Battery Voltage Percentage	%	X 10
30002	Battery Current	%	X 10
30003	Battery Temperature	Fahrenheit	X 10
30004	Battery Estimated Charge Remaining	%	X 10
30005	Battery Estimated Minutes Remaining	Mins	X 10
30006	Battery Life Remaining	Months	X 0.01
30007	Battery Rated Holding Time	Sec	X 10
30008	Input Voltage Phase 1	Volts AC	X 10
30009	Input Current Phase 1	Amps	X 10
30010	Output Voltage Phase 1	Volts AC	X 10
30011	Output Current Phase 1	Amps	X 10
30012	Output Frequency	Hz	X 10
30013	Output Load Percentage Phase 1	%	X 10
30014	Bypass Voltage Phase 1	Volts AC	X 10
30015	Bypass Current	Amps	X 10
30016	Bypass Frequency	Hz	X 10
30017	Shutdown After Delay	Sec	X 10
30018	Input Frequency	Hz	X 10

1800/Register Address	Description	Units	Multiplier
30001	Battery Current	%	X 10
30002	Battery Estimated Charge Remaining	%	X 10
30003	Battery Estimated Minutes Remaining	Mins	X 10
30004	Battery Life Remaining	Months	X 10
30005	Bypass Voltage Phase 1	Volts AC	X 0.01
30006	Bypass Current	Amps	X 10
30007	Bypass Frequency	Hz	X 10
30008	Battery Remaining Holding Time	Sec	X 10
30009	Battery Temperature	Fahrenheit	X 10

30010	Battery Voltage Percentage	%	X 10
30011	DC Bus Voltage	Volts DC	X 10
30012	Input Current Phase 1	Amps	X 10
30013	Input Frequency	Hz	X 10
30014	Input Voltage Phase 1	Volts AC	X 10
30015	Output Current Phase 1	Amps	X 10
30016	Output Frequency	Hz	X 10
30017	Output Load Percentage Phase 1	%	X 10
30018	Output Voltage Phase 1	Volts AC	X 10
30019	Seconds on Battery	Sec	X 10
30020	Shutdown After Delay	Sec	X 10

4200/Register Address	Description	Units	Multiplier
30001	Battery Current	%	X 10
30002	Bypass Voltage Phase 1	Volts AC	X 10
30003	Bypass Voltage Phase 2	Volts AC	X 10
30004	Bypass Voltage Phase 3	Volts AC	X 10
30005	Bypass Current	Amps	X 10
30006	Bypass Frequency	Hz	X 10
30007	Battery Rated Holding Time	Sec	X 10
30008	Battery Voltage Percentage	%	X 10
30009	DC Bus Voltage	Volts DC	X 10
30010	Input Current Phase 1	Amps	X 10
30011	Input Current Phase 2	Amps	X 10
30012	Input Current Phase 3	Amps	X 10
30013	Input Frequency	Hz	X 10
30014	Input Voltage Phase 1	Volts AC	X 10
30015	Input Voltage Phase 2	Volts AC	X 10
30016	Input Voltage Phase 3	Volts AC	X 10
30017	Output Current Phase 1	Amps	X 10
30018	Output Current Phase 2	Amps	X 10
30019	Output Current Phase 3	Amps	X 10
30020	Output Frequency	Hz	X 10
30021	Output Load Percentage Phase 1	%	X 10
30022	Output Load Percentage Phase 2	%	X 10
30023	Output Load Percentage Phase 3	%	X 10
30024	Output Voltage Phase 1	Volts AC	X 10
30025	Output Voltage Phase 2	Volts AC	X 10
30026	Output Voltage Phase 3	Volts AC	X 10
30027	Shutdown After Delay	Sec	X 10

G8000/Register Address	Description	Units	Multiplier
30001	Battery Current	%	None
30002	Battery Estimated charge	%	None
30003	Bypass Voltage Phase 1	Volts AC	None
30004	Bypass Voltage Phase 2	Volts AC	None
30005	Bypass Voltage Phase 3	Volts AC	None
30006	Bypass Current Phase 1	Amps	X 100
30007	Bypass Current Phase 2	Amps	X 100
30008	Bypass Current Phase 3	Amps	X 100
30009	Bypass Frequency	Hz	None
30010	Battery Voltage Percentage	%	None
30011	DC Bus Voltage	Volts DC	None
30012	Input Frequency	Hz	None
30013	Input Voltage 1	Volts AC	None
30014	Input Voltage 2	Volts AC	None
30015	Input Voltage 3	Volts AC	None
30016	Output Current 1	Amps	X100
30017	Output Current 2	Amps	X100
30018	Output Current 3	Amps	X100
30019	Output Frequency	Hz	None
30020	Output Load Percentage Phase 1	%	None
30021	Output Load Percentage Phase 2	%	None
30022	Output Load Percentage Phase 3	%	None
30023	Output Voltage Phase 1	Volts AC	None
30024	Output Voltage Phase 2	Volts AC	None
30025	Output Voltage Phase 3	Volts AC	None
30026	Output Voltage AB	Volts AC	None
30027	Output Voltage BC	Volts AC	None
30028	Output Voltage CA	Volts AC	None

G8000MM/Register Address	Description	Units	Multiplier
30001	Battery Current	%	None
30002	Battery Estimated Charge Remaining	%	None
30003	Bypass Voltage Phase 1	Volts AC	None
30004	Bypass Voltage Phase 2	Volts AC	None

30005	Bypass Voltage Phase 3	Volts AC	None
30006	Bypass Current Phase 1	Amps	X 100
30007	Bypass Current Phase 2	Amps	X 100
30008	Bypass Current Phase 3	Amps	X 100
30009	Bypass Frequency	Hz	None
30010	Battery Voltage Percentage	%	None
30011	DC Bus Voltage	Volts DC	None
30012	Input Frequency	Hz	None
30013	Input Voltage Phase 1	Volts AC	None
30014	Input Voltage Phase 2	Volts AC	None
30015	Input Voltage Phase 3	Volts AC	None
30016	Output Current Phase 1	Amps	X 100
30017	Output Current Phase 2	Amps	X 100
30018	Output Current Phase 3	Amps	X 100
30019	Output Frequency	Hz	None
30020	Output Load Percentage Phase 1	%	None
30021	Output Load Percentage Phase 2	%	None
30022	Output Load Percentage Phase 3	%	None
30023	Output Voltage Phase 1	Volts AC	None
30024	Output Voltage Phase 2	Volts AC	None
30025	Output Voltage Phase 3	Volts AC	None
30026	Output Voltage AB	Volts AC	None
30027	Output Voltage BC	Volts AC	None
30028	Output Voltage CA	Volts AC	None

G9000/Data Address	Description	Units	Multiplier
30001	Battery Voltage Percentage	%	None
30002	Battery Current	%	None
30003	Battery Estimate Charge	%	None
30004	DC Bus Voltage	Volts DC	None
30005	Input Voltage Phase 1	Volts AC	None
30006	Input Voltage Phase 2	Volts AC	None
30007	Input Voltage Phase 3	Volts AC	None
30008	Input Current Phase 1	Amps	X 100
30009	Input Current Phase 2	Amps	X 100
30010	Input Current Phase 3	Amps	X 100
30011	Input Frequency	Hz	None
30012	Output Current Phase 1	Amps	X 10
30013	Output Current Phase 2	Amps	X 10
30014	Output Current Phase 3	Amps	X 10

30015	Output Frequency	Hz	None
30016	Output Load Percentage Phase 1	%	None
30017	Output Load Percentage Phase 2	%	None
30018	Output Load Percentage Phase 3	%	None
30019	Bypass Voltage Phase 1	Volts AC	None
30020	Bypass Voltage Phase 2	Volts AC	None
30021	Bypass Voltage Phase 3	Volts AC	None
30022	Bypass Frequency	Hz	None
30023	Output Voltage Phase 1	Volts AC	None
30024	Output Voltage Phase 2	Volts AC	None
30025	Output Voltage Phase 3	Volts AC	None
30026	Input Power Total	kW	X 0.1
30027	Input Power Phase 1	kW	X 0.1
30028	Input Power Phase 2	kW	X 0.1
30029	Input Power Phase 3	kW	X 0.1
30030	Output Power	kW	None
30031	Output Power Percentage	%	None
30032	Power Factor	pF	X 100

6.2 Read Status/Fault Mapping Description Supported by Each UPS

In this section you will see the Status/Faults register addresses, and descriptions. These are read-only registers, so you will need to adjust your Building Management System (BMS) settings to read these registers.

Notice: The unit for these registers are Boolean, so that means that you will only see a 1 (true) or 0 (false).

Register Address	Description	Units	4200	G8000	G8000MM	G9000
10001	UPS Input & Output Voltage Sync	Boolean	Yes	Yes	Yes	Yes
10002	UPS Output From Inverter	Boolean	Yes	Yes	Yes	Yes
10003	UPS Output From Bypass	Boolean	Yes	Yes	Yes	Yes
10004	Low Battery Voltage Detected	Boolean	Yes	Yes	Yes	Yes
10005	Input Voltage Out of Spec	Boolean	Yes	Yes	Yes	Yes
10006	UPS Fault Detected	Boolean	Yes	Yes	Yes	Yes
10007	1 (Constant)	Boolean	-	-	-	-
10008	Not Used	Boolean	-	-	-	-
10009	DC Bus Imbalance	Boolean	No	No	Yes	Yes
10010	Phase Rotation Error	Boolean	Yes	No	No	No

10011	DC Bus Undervoltage	Boolean	Yes	No	Yes	Yes
10012	DC Bus Overvoltage	Boolean	Yes	Yes	Yes	Yes
10013	DC Over Current	Boolean	Yes	Yes	Yes	Yes
10014	Input Overcurrent	Boolean	No	No	No	No
10015	1 (Constant)	Boolean	-	-	-	-
10016	Not Used	Boolean	-	-	-	-
10017	Fuse has Opened	Boolean	Yes	No	No	No
10018	0 (Constant)	Boolean	-	-	-	-
10019	UPS Overheat	Boolean	Yes	Yes	Yes	Yes
10020	Battery Overheat	Boolean	Yes	No	Yes	Yes
10021	Battery or Charger Circuit Fault	Boolean	No	No	Yes	Yes
10022	EEPROM Error	Boolean	No	No	No	No
10023	1 (Constant)	Boolean	-	-	-	-
10024	Not Used	Boolean	-	-	-	-
10025	Inverter Overvoltage	Boolean	Yes	Yes	Yes	Yes
10026	Overload	Boolean	Yes	No	Yes	Yes
10027	Inverter Undervoltage	Boolean	Yes	Yes	Yes	Yes
10028	Inverter Overload	Boolean	Yes	No	Yes	Yes
10029	UPS Overload	Boolean	Yes	Yes	No	No
10030	Inverter Overcurrent	Boolean	Yes	No	Yes	Yes
10031	1	Boolean	-	-	-	-
10032	Not Used	Boolean	-	-	-	-

7.0 Upgrading Firmware

To update ProtoNode's firmware please go to the following link: http://www.toshiba.com/ind/product_display.jsp?id1=14&id2=30&id3=581 and find the correct firmware, see table 3 to choose the correct firmware. Keep checking the link regularly for new firmware updates.

Firmware Version	Protocol
Firmware pcc6029	BACnet MSTP, BACnet IP
Firmware pcc6030	Modbus RTU, Modbus TCP, Metasys NS, SNMP
Firmware pcc6032	EtherNet/IP

Table 3 – Correct Firmware for Net Protocol

1. Open and extract the ProtoNode firmware file (NLPN.BIN) and place it in the "Configuration File Folder", by going to Start|Programs|FieldServerUtilities|Configuration File Folder.
NOTE: Do not rename the "NLPN.BIN" file.

2. In the main menu of the Remote User Interface screen, type “d” to go to “Download configuration to FieldServer” menu (See Figure 2).
3. Type “f”, for firmware, and the program will automatically fetch the firmware from the “Configuration File Folder”.
4. Type “y”, for yes, to precede the installation of the new firmware.
5. Wait until the download completes (Note: Resetting or turning off the ProtoNode while it is installing the firmware can corrupt the ProtoNode.)
6. Once download is complete hit “<esc>” key to go to the main menu. Type “!” or cycle power to ProtoNode to put the new firmware into operation.

8.0 Multi-Module Configuration

- When using multiple ProtoNodes in the same network, the “System_Node_ID” number in the configuration file has to be different in order to avoid any collision of data between the ProtoNodes.
- It is recommended that the configuration file be backed up before editing. To change the “System Node ID” number, open the protocol configuration file (e.g. config-mod.csv) and look for the section “Common Information” (See Figure 1). Change the “System Node ID” to another number other than 11. Eleven is the number by default. In order to avoid any data collision, make sure each “config file” has its own “System Node ID” number.

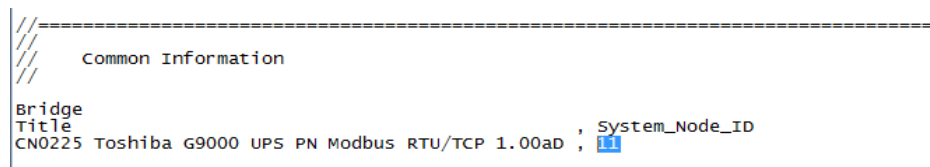


Figure 1 – Change System Node ID

- Example: If there are 3 ProtoNodes, then 3 configuration files have to be individually edited. Each configuration file has to have a different “System_Node_ID” number. One configuration file can have the ID number 11, and download the file to the first ProtoNode. The second configuration file can have a node ID number 12, and download the file to the second ProtoNode. The third configuration file can have a node ID number 13, and download the file to the third ProtoNode etc.
- Note: The “System_Node_ID” number can be any number of your choosing; making sure not to replicate the numbers. It is not recommended to change any other parameter, since the output data can be corrupted.
- **Note: The information on Figure 1 might be different depending on which UPS Model and protocol you have selected.**

9.0 Downloading Configuration file to ProtoNode

By default, the ProtoNode is setup with G9000 UPS Modbus configuration file. If using a different UPS and communication protocol, Please go to the following link http://www.toshiba.com/ind/product_display.jsp?id1=14&id2=30&id3=581 and download the correct UPS protocol configuration file.

1. Before attempting to download the “protocol configuration file” to the ProtoNode, put the protocol configuration file (e.g. config-mod.csv) in “Configuration File Folder”, by going to Start | Programs | FieldServerUtilities | Configuration File Folder.
2. Open RUI Utility Software and go to the main menu.
3. From the main menu, type “d”, for the download configuration option.
4. Type “L” to specify the name and extension of the file that is being downloaded to the ProtoNode (e.g. config-mod.csv). Hit the <Enter> key when done.
5. The utility will search for the configuration file specified on step 3 (e.g. config-mod.csv) to download. On rare occasions where other files need to be downloaded to the ProtoNode, type “o” for other files, then type “r” to specify the remote filename needed on the ProtoNode.
6. When satisfied, type “d” to download the file to the ProtoNode. The utility software will display a menu showing the download progress.
7. **Wait until the utility indicates that the download is complete, before resetting the ProtoNode which can corrupt the ProtoNode.**
8. Once download is complete hit the <esc> key to go to the main menu. Type “!” or cycle power to ProtoNode to put the new configuration file into operation.
9. To verify that the protocol configuration file was downloaded successfully, go to the main menu and look at the top of the main menu to see the UPS model and the protocol (see Figure 2).

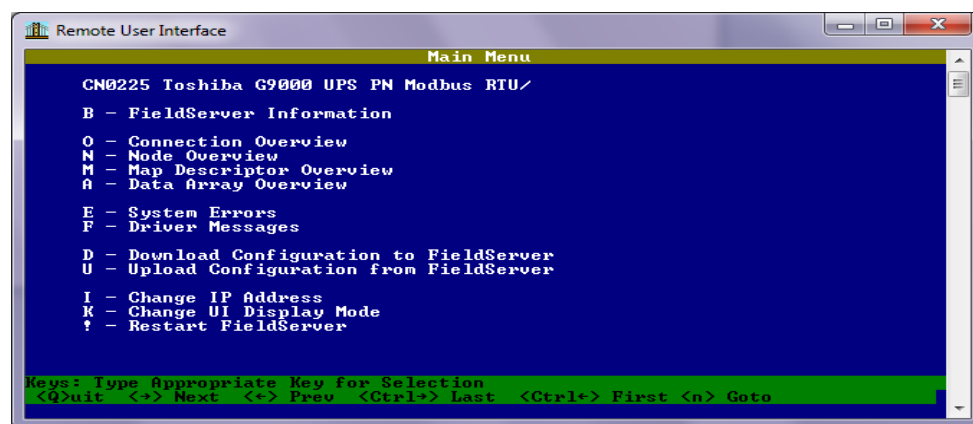


Figure 2 – Main Menu

Note: If configuring multiple modules, see Section 8.

Note: Make sure that you have the latest display, control board, and ProtoNode firmware installed. Failure to do so will cause communication problems.

10.0 Troubleshooting Tips

10.1 ProtoNode not Identifiable on the Network

- Check the Ethernet RJ45 port of the ProtoNode that the Activity LED is blinking (Amber or Green LED). It should flash at least once every 2 seconds if RUI is still running and perhaps more often, depending on network traffic.
- Check that the IP settings of the PC matches the ProtoNode (except the ProtoNode's IP address). The Default IP Address of the ProtoNode is 192.168.1.168, Subnet Mask is 255.255.255.0.
- Ensure that the PC and ProtoNode are on the same IP Network, or assign this Static IP settings that works with the ProtoNode default IP settings: IP address 192.168.1.150, Subnet Mask 255.255.255.0, and the Default Gateway Address: 192.168.1.1 (See section 10.2 on how to change the IP settings of your PC).
- Confirm that there is an Ethernet adapter driver installed in the PC's Device Manager List, and that it is configured to run the TCP/IP protocol.
- If using Windows XP, ensure that the firewall is disabled.
- Disable any other Ethernet LAN cards active on the PC, especially wireless Ethernet cards.

10.2 Changing IP address and Subnet mask

1. Open the network connections by clicking **Control Panel | Network and Internet | Network and Sharing Center | Manage network connections**.
2. Right-click the connection that you want to edit the IP settings (click on the Local Area Connection) and click on **Properties**.
3. Under "This connection uses the following items" table list, click on **Internet Protocol Version 4(TCP/IPv4)**, and then click on **properties**.
4. Click on "Use the following IP address" radio button and type in the IP address settings.

Note: you can use this example 192.168.1.168 for IP address, 255.255.255.0 for subnet mask, and 192.168.1.1 for Default Gateway address. This only works if the ProtoNode had the default IP settings. (This assumes Windows Operating System.)

TOSHIBA

TOSHIBA INTERNATIONAL CORPORATION

INDUSTRIAL DIVISION

13131 West Little York Rd., Houston, TX 77041

Tel: 713/466-0277 Fax 713/466-8773

US 877/867-8773 Canada 800/872-2192 Mexico 01/800/527-1204

www.toshiba.com/ind

Printed in U.S.A.