



Technical Reference

Capstone Protocol Converter

This document presents technical information for the Capstone Protocol Converter (Model CPC-100), manufactured by the Capstone Turbine Corporation®.



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Table of Contents

Table of Contents	3
Introduction	4
Safety Precautions	4
General Precautions.....	4
Electrical Precautions	4
System Component Details	5
Installation Details.....	6
System Operational Details.....	7
CPCMux.....	7
CPCTerm	7
JavaTerm	7
Electrical Details	7
Power	8
Ports	8
RS-232 Connectors	8
RJ-45 Connectors.....	9
RS-485 and Power Connector	9
Status Indicators	9
Setup Procedure.....	10
Requirements.....	10
Setup Instructions	11
Maintenance	14
Wiring Interconnections.....	15
Capstone Technical Support.....	18

Introduction

The Capstone Protocol Converter (CPC-100) is a stand-alone protocol converter that provides the ability to use the standard Capstone MicroTurbine RS-232 commands over a TCP/IP network connection, local or wide area. With the CPC-100, multiple users may connect to the same MicroTurbine simultaneously at different password levels. All maintenance functions, including software upload may be accomplished over the network.

The CPC-100 also includes an embedded Web Server capable of serving HTML JAVA documents to an external Browser running on a PC. These files, when accessed by the Browser, will establish communication with the CPC through another TCP/IP channel. This will in turn allow the browser to display generator status and issue control commands.

The CPC-100 may include an optional modem, which allows the MicroTurbine to be accessed by an ordinary telephone modem. This may be used either as a redundant connection for the LAN, or as the primary means of connection.

The CPC-100 is fully supported by Capstone Remote Monitoring Software (CRMS) version 4.20 or later. This version allows connections to one or more MicroTurbines directly from a LAN or a dial-up modem connection.

Safety Precautions

Safety precautions are essential when installing and operating the Capstone equipment. The following paragraphs present both general and detailed Safety Precautions.

General Precautions

Always obey to the following general safety precautions:

- Keep ABC rated fire extinguishers handy.
- Obey all warning labels.
- Follow all applicable local, state, and federal codes and regulations.
- Keep equipment clean.

Electrical Precautions

All output connections must be made in accordance with applicable codes and regulations. Use extreme caution when working on electrical equipment. Always obey the following:

- Remove jewelry, and make sure clothing and shoes are dry.
- Stand on an insulated platform on the ground or floor (if possible).
- Always disconnect all power sources.
- Verify that all circuits are de-energized with a voltmeter.

System Component Details

Two models are available and are identified as Assembly 513047-1XX without an optional Modem, and Assembly 513047-2XX with an optional Modem. System component details are presented in the following table.

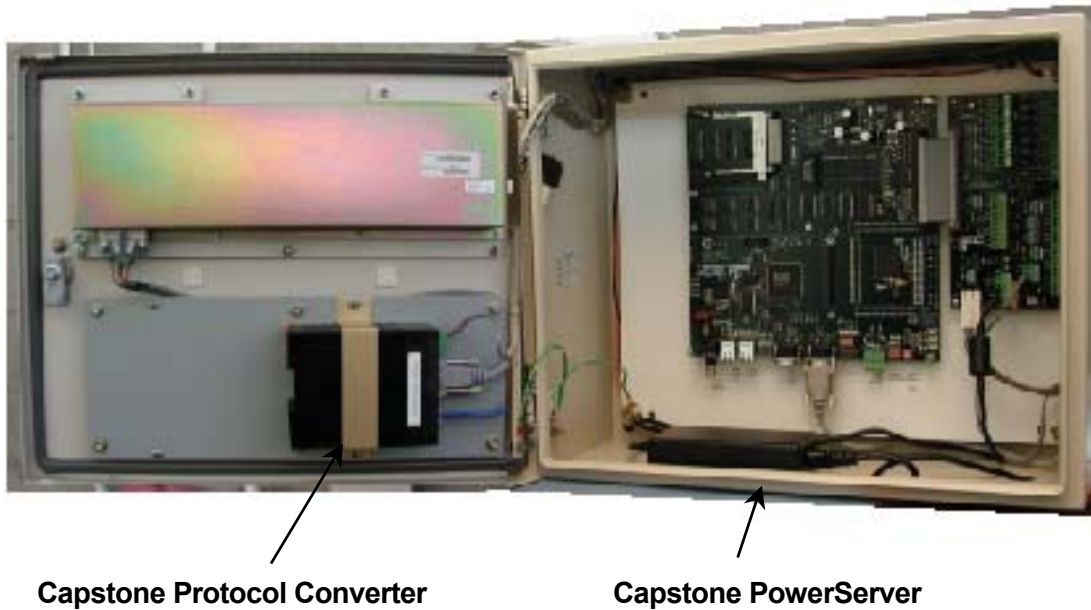
Part No.	Description
507762-XXX	Label, Barcode
510369-XXX	Conn, plug, 5-Ckt, FRONT screws, 3.81 mm
512612-XXX	PCBA, CPC-100 Motherboard
512640-XXX	IC, Modem, V. 34BIS, 33600 BPS (Only required with Assembly 513047-2XX)
513048-XXX	Enclosure, Mod, CPC-100 Protocol Converter
513287-XXX	CD Assy, CPC DNLD/Sys Code (Not provided with the Assembly. For test and training only)
513644-XXX	PubDoc, CPC Application Guide (This Document)

Installation Details

The CPC-100 module is housed in a standard DIN rail mount package. Typical installation details are presented in the following table.

Parameter	Data
Length	130 mm (5.12 inches)
Width	102 mm (4.0 inches)
Height	50 mm (1.97 inches)
Approximate Weight	318 gm (0.7 pound)
Operating Temperature	-20 °C to 50 °C (-4 °F to 122 °F)

The following figure presents a typical installation of the CPC-100 inside the Capstone PowerServer enclosure.



System Operational Details

The CPC-100 uses an embedded processor running the Linux Operating System. The use of Linux allows for maximum flexibility in interconnection and security. The CPC-100 contains the following applications:

CPCMux

This application runs at the start-up and is used to connect multiple clients to a single MicroTurbine. CPCMux handles MicroTurbine connection and password access to one or more users. Each user may use a different password level. A Superuser password that prevents other connections is also provided and is typically used during software uploads or other critical operations.

CPCTerm

This application allows a user to access and control a MicroTurbine connected to the CPC-100 via a terminal program connected locally, or remotely using a Telnet connection to the Linux shell.

JavaTerm

This application resides in the CPC embedded Web Server and may be run from any connected Java-enabled browser. This application allows the user to issue text-based commands and receive responses.

Electrical Details

The CPC-100 electrical details are presented in the following paragraphs. Refer to the following figure as required.



Power

The CPC-100 requires 9 to 30 VDC. The power may be derived from the MicroTurbine or an external DC supply.

Ports

Communication port details are presented in the following table. Connector details are presented in the following paragraphs.

Port	Connector Type	Description
TERMINAL	RS-232 (DB9 Male)	Local Serial Communication
MICROTURBINE	RS-232 (DB9 Female)	MicroTurbine Serial Communication
PHONE	RJ-45	Telephone Connection (Used with Modem Option)
ETHERNET	RJ-45	TCP/IP, 10Base-T
Terminal Strip	5-pin Connector	RS-485 and Power Connections

RS-232 Connectors

The serial port connectors are DB-9 and are identified as TERMINAL and MICROTURBINE. Details are presented in the following table.

Pin #	Terminal (DB9 Male)	MicroTurbine (DB9 Female)	Connector Designation
1	DCD (Data Carrier Detect)	DCD (Data Carrier Detect)	<p>TERMINAL</p> <p>Pin 1 Pin 5</p> <p>Pin 6 Pin 9</p> <p>MICROTURBINE</p> <p>Pin 5 Pin 1</p> <p>Pin 9 Pin 6</p>
2	RXD (Receive Data)	TXD (Transmit Data)	
3	TXD (Transmit Data)	RXD (Receive Data)	
4	DTR (Data Terminal Ready) Not Used	DSR (Data Set Ready) Not Used	
5	Signal Ground	Signal Ground	
6	DSR (Data Set Ready) Not Used	DTR (Data Terminal Ready) Not Used	
7	RTS (Request To Send)	CTS (Clear To Send)	
8	CTS (Clear To Send)	RTS (Request To Send)	
9	RI (Ring Indicator)	RI (Ring Indicator)	

RJ-45 Connectors

These connectors are identified as PHONE and ETHERNET. Details are presented in the following table.

Pin #	PHONE (Modem Option)	ETHERNET (10Base-T)	Connector Designation
1	Not Used	TXD (+)	
2	Not Used	TXD (-)	
3	Not Used	RXD (+)	
4	Ring	Not Used	
5	Tip	Not Used	
6	Not Used	RXD (-)	
7	Not Used	Not Used	
8	Not Used	Not Used	

RS-485 and Power Connector

Pin details are presented in the following table.

Pin #	Description	Connector Designation
1	RS-485 Termination (See Note Below)	
2	RS-485 (B+) Lead	
3	RS-485 (A-) Lead	
4	Power (+) (9 to 36 VDC)	
5	Power (-) or Ground	
Note: Add a jumper wire between pins 1 and 2 for RS-485 bus termination.		

Status Indicators

Eight LED indicators are provided to indicate connection and operation status.

Setup Procedure

This section describes the setup procedure for the Capstone Protocol Converter (CPC-100) at the customer's site. The procedure should be carried out by a Capstone authorized service provider.

The CPC-100 provides the ability to connect to the Capstone PowerServer or the MicroTurbine over a network connection. For this, it needs to be assigned a static IP and some other parameters to make it valid within the local network. The procedure is explained in the following paragraphs.

Requirements

1. A Personal Computer (PC) with the following features:
 - ❑ A COM port for communicating with and controlling the CPC-100
 - ❑ Loaded with the CRMS Version 4.20 or higher.
 - ❑ Should have the utility HyperTerminal installed.
 - ❑ Must have Windows 2000 Operating System or higher.

NOTE

The HyperTerminal in other operating systems do not have TCP/IP features. In those cases, another telnet application may be used.

2. A null modem cable.
3. Information on the required network parameters for each CPC-100 that needs to be set up. This includes:
 - ❑ IP address (IPADDR0 192.168.1.200)
 - ❑ Subnet mask (IPMASK0 255.255.255.0)
 - ❑ Network address (IPNET0 192.168.1.0)
 - ❑ Gateway IP (IPGW0 192.168.1.100)

NOTE

The Network address is the result of the binary AND between the Subnet mask address and Gateway IP address.
(Network address = Subnet mask & Gateway IP.)

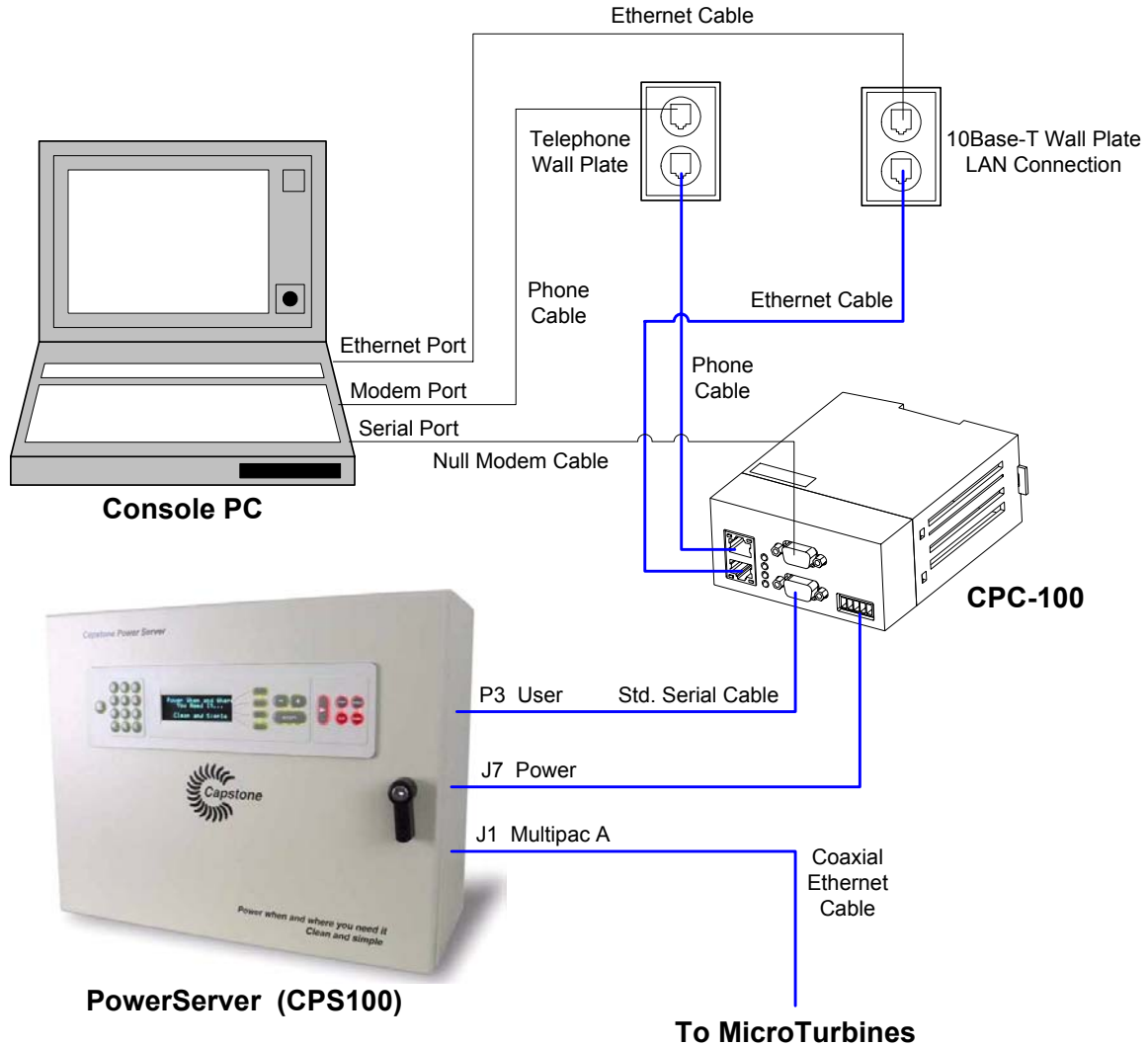
Values displayed in () may be the default values that were used when the unit was initially configured. These values must be changed. The Network Administrator responsible for the network at the installation site should be requested to provide these values.

NOTE

In the following example, some default values are shown. Replace the default values with values valid for the network at the installation site. The information required may be obtained from the network administrator at the local site.

Setup Instructions

The following figure presents a typical interconnection diagram when using the CPC-100. Refer to this figure as required during the setup procedure.



1. Use the null modem cable to connect the PC's COM port to the CPC-100 port marked TERMINAL. The PC will be used as the Console and will be referred to as the Console PC.
2. Using a regular serial communication cable, connect the port marked MICROTURBINE to either a PowerServer or a MicroTurbine, as required.
3. Connect one end of a telephone line to the port marked PHONE and connect the other end to a telephone jack. Connect one end of a network cable to the port marked ETHERNET and connect the other end to a local LAN connector.

4. Open a HyperTerminal window on the Console PC and set its communication settings as follows (ensure the correct COM port is configured):
Baud: 19200
Data Bits: 8
Parity: None
Stop Bits: 1
Flow Control: None
Connect with the CPC-100
5. Turn ON the CPC-100. The red LED's will light up and then turn OFF in a certain sequence, which determines if the hardware is OK. The sequence should be 1, 2, 3, 4, followed by the two green ETHERNET LED's and then the two green PHONE LED's. Almost immediately after the sequence is completed, the LED's should turn OFF in the same exact order.
6. In the following steps, you need to enter the bootloader and modify some parameters. Cycle power to the CPC-100. Almost immediately after it is powered, you will be prompted to enter the bootloader. Hit <Esc> at the Console PC when you see the following prompt:

```
uCbootstrap v1.5.9 (c) Copyright 1999-2000 Rt-Control Inc.  
      (c) Copyright 2000-2001 Lineo, Inc.  
All Rights Reserved.  
Autoboot in 2 seconds. <esc> to abort...
```

If you do not press <Esc> when prompted, the CPC-100 will boot completely and load the Linux operating system. If this happens you will be at the login screen, which looks as follows:

```
Welcome to uClinux!
```

```
uClinux /ju:si:`linuks/ 1.n. Microcontroller Linux;  
Embedded microcontroller operating system. 2.n. An  
embedded soft real time kernel (see also POSIX.4)  
3.n. Embedded Linux internet/intranet development  
platform. 4. synonym for the successful rapid  
development of embedded system applications.
```

```
For more information on the uClinux operating system  
please visit the http://www.uclinux.com and  
http://www.uclinux.org web sites.
```

```
uCdim login:
```

In this case, you will have to reboot the CPC-100 by recycling power.

Once you successfully enter the bootloader, the screen may look as follows:

```
uCbootstrap v1.5.9 (c) Copyright 1999-2000 Rt-Control Inc.
(c) Copyright 2000-2001 Lineo, Inc.
All Rights Reserved.
Autoboot in 2 seconds. <esc> to abort...
FLASH type 00c0 [AT49BV1614]
DP|002000 DP|004000 DP|006000 DP|008000 DP|00a000 DP|00c000
DP|00e000 D-|010000 D-|018000 D-|020000 D-|030000 D-|040000
D-|050000 D-|060000 D-|070000 D-|080000 D-|090000 D-|0a0000
D-|0b0000 D-|0c0000 D-|0d0000 D-|0e0000 D-|0f0000 D-|100000
D-|110000 D-|120000 D-|130000 D-|140000 D-|150000 D-|160000
D-|170000 D-|180000 D-|190000 D-|1a0000 D-|1b0000 D-|1c0000
D-|1d0000 D-|1e0000 D-|1f0000 D-|200000
B$
```

NOTE B\$ is the boot prompt, indicating that you have successfully entered the bootloader.

7. Use the command “printenv” to review the environmental variables already set on the CPC-100.

```
B$ printenv
```

NOTE The Linux Operating System is case sensitive. Type commands exactly as shown.

On a typically set up system, the response to the “printenv” command may look as follows:

```
FACTORY=uCdim-VZ (c) 2001 Lineo Canada Corp
REVISION=uCdim-VZ Rev 2.0
HWADDR0=00:50:C2:03:6e:33
SERIAL=990645929-01e33
CONSOLE=ttyS0
IPADDR0=192.168.1.200
IPMASK0=255.255.255.0
IPNET0=192.168.1.0
IPGW0=192.168.1.100
AUTOBOOT=2
B$
```

8. Use the command “setenv” to set the following 5 parameters (set one parameter at a time, hitting <Enter> after typing each of the following lines):

```
B$ setenv IPADDR0 192.168.1.200
B$ setenv IPMASK0 255.255.255.0
B$ setenv IPNET0 192.168.1.0
B$ setenv IPGW0 192.168.1.100
B$ setenv AUTOBOOT 2
```

Replace the default IP and other values with the correct values you may have obtained for the installation site.

9. Use “printenv” to verify that the parameters have been set correctly.
10. At the boot prompt type “go” and hit <Enter>. This will cause the operating system to load. After successfully loading the operating system, you will be presented with the login screen.
11. On the Console PC, open another instance of HyperTerminal. This time set it up to connect using TCP/IP. For the Host Address, enter the IP address recently assigned to the CPC-100. Leave the default Port number (23) unchanged, and hit <Enter> to establish connection.
12. The PC should successfully connect to the CPC-100, and you should be presented with the login prompt as follows:

UCdimm login:

This confirms that the CPC-100 is recognized on the network by its new IP. You may now disconnect HyperTerminal TCP/IP connection and close the window.

13. After this, you can reboot the CPC-100 and wait for the operating system to load completely. On the HyperTerminal window that had established a serial connection with the CPC-100, you should be presented with the login screen. You need not log on, being presented the login screen confirms that the CPC-100 has successfully rebooted. Now, disconnect this HyperTerminal connection and close the window.
14. From the Console PC, connect to the CPC-100 using CRMS Version 4.20 or higher. Use the TCP/IP method of connection and enter the IP assigned to the CPC-100 in the communication settings window of the CRMS.
15. Make sure the CRMS can connect and operate correctly using the TCP/IP protocol and the IP address used above.
16. Disconnect the PC from the CPC-100.

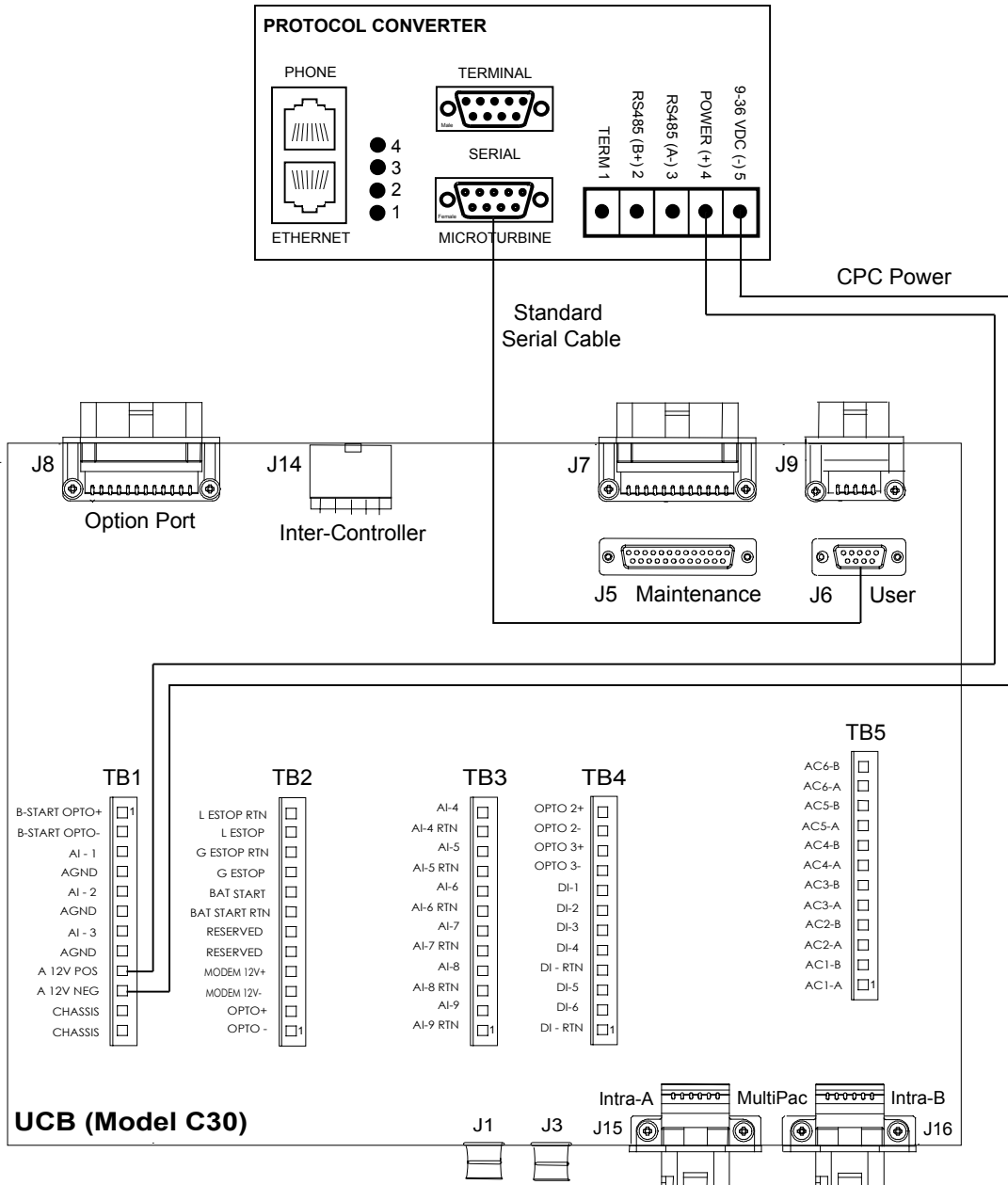
Maintenance

The CPC-100 is a solid-state product, which requires only limited maintenance. Capstone recommends that only authorized service technicians service the Capstone Protocol Converter. Failure to provide proper maintenance may void the warranty.

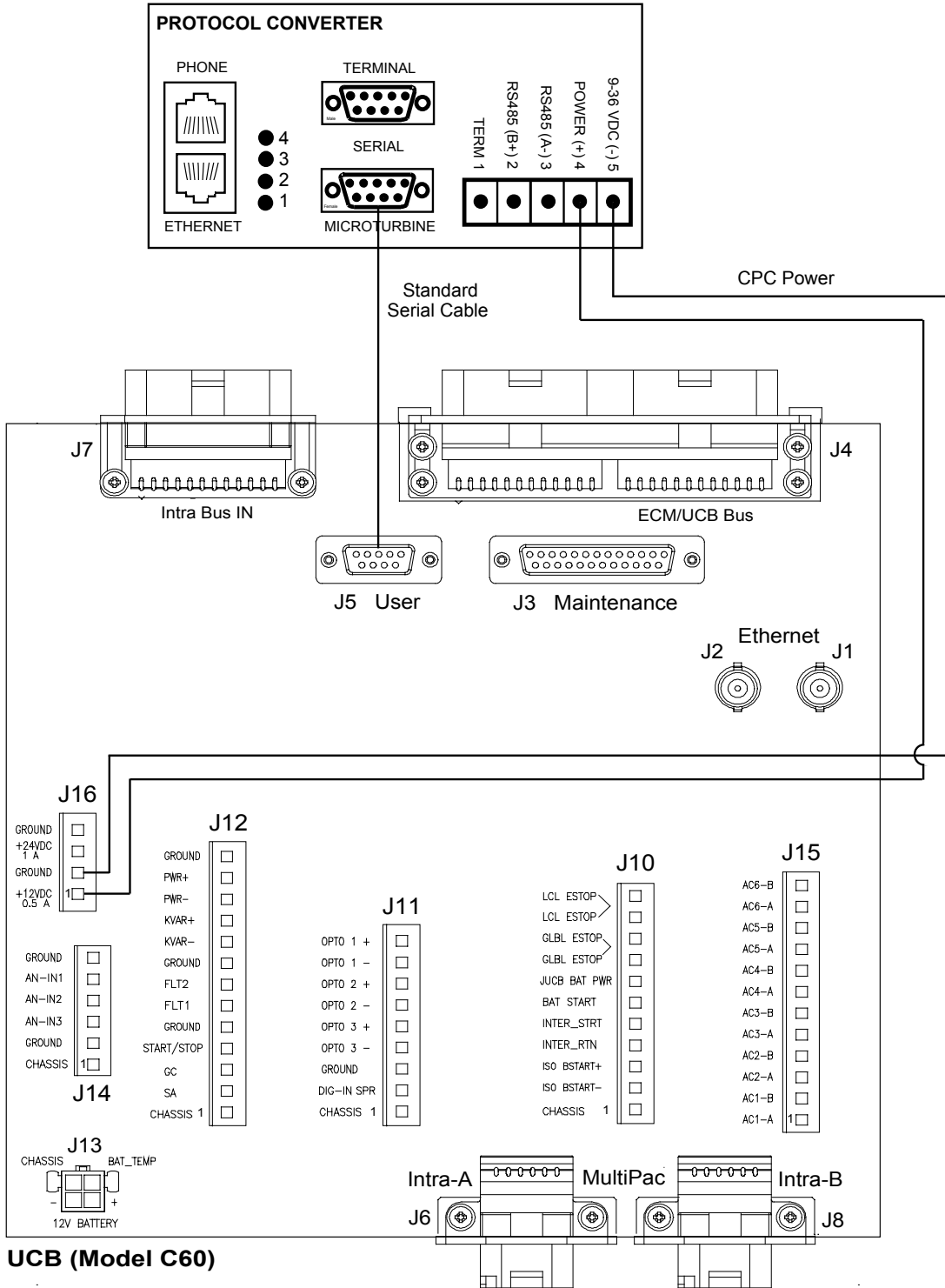
Wiring Interconnections

The following figures present the wiring interconnections between the Capstone Protocol Converter and Model C30, Model C60, and Capstone PowerServer.

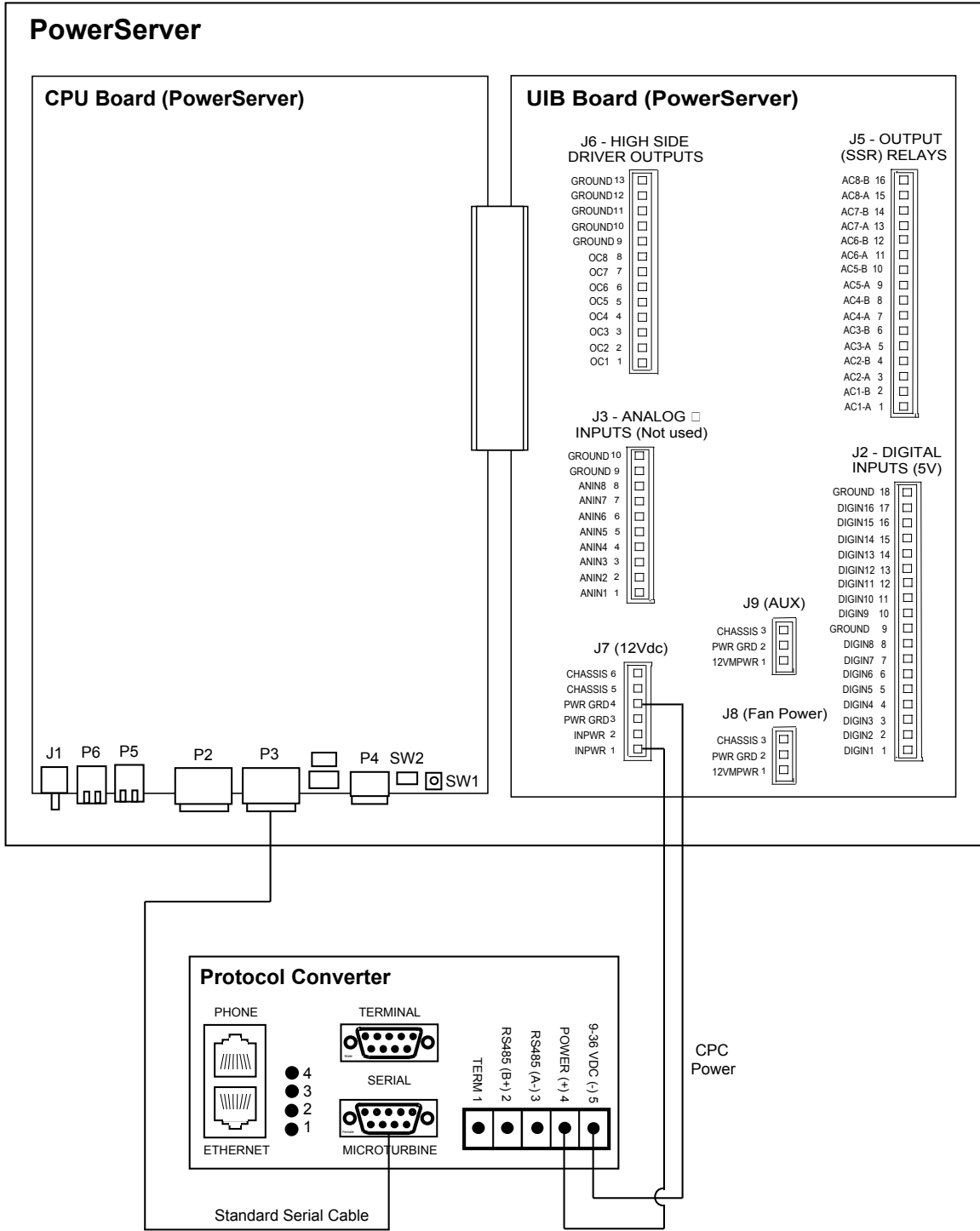
NOTE For MultiPac applications, connect the Protocol Converter to the Master MicroTurbine only (no connections between the Protocol Converter and subordinate MicroTurbines).



Protocol Converter and Model C30 Interconnections



Protocol Converter and Model C60 Interconnections



Protocol Converter and PowerServer Interconnections

Capstone Technical Support

If you have additional questions, please contact:

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