C3414 CPU Manual

C3414-AAA-00001 V1.2

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C3414 CPU Manual

For Reference Only

Manual No. **C3414-AAA-00001**

Document Approval

Rev	Date	Description	ECO #	Technical Review	Admin. Approval
0.0	04-27-10	Initial Release	N/A		
1.0	10-23-12	Update	N/A		
1.1	12-10-2013	Updates for Schneider	N/A		
1.2	12-08-2014	Minor Updates for Drawings			
				Garry Macejewski, Manager, RTU Engineering	Dan Stark, Manager, RTU S/W Engineering

1 Introduction

1.1 CPU/Memory

BOARD SIZE	4.250” x 3.775”
DRAM	256 MB
OPERATING TEMPERATURE	-40º C to 85º C
SYSTEM RESET	Voltage sensing, resets when the 3.3V power rail varies by more than +/- 10% of its optimal value.
	Watchdog timeout
ETHERNET INTERFACE	Two Intel 82551ER based Fast Ethernet 10/100 Controllers and half/full duplex autonegotiated
COM1-2 INTERFACE	RS-232, 16C550 compatible, 115k baud max
BIOS	General Software Embedded BIOS with OEM enhancements. Field upgradable with Flash BIOS Upgrade Utility
BUS SPEED	CPU Bus: 800 MHz (Celeron equiv), 500 MHz actual.
COMPATIBILITY	PC/104 – full compliance
WEIGHT	0.102 kg (3.616 oz)
GENERATED FREQUENCIES	32 KHz, 8.25MHz, 14.318MHz, 33MHz, 48MHz, 66MHz, 166.5MHz

1.2 Visual Indicators

PC/104 CPU LEDs	D1 - Green Secondary Ethernet Link/Activity (ON=Active Link, BLINK=RX/TX data activity)
	Yellow Secondary Ethernet 1 Link Speed (ON=100baseT, OFF=10baseT) D2 Green Primary Ethernet 0 Link/Activity (ON=Active Link, BLINK=RX/TX data activity)
	Yellow Primary Ethernet 0 Link Speed (ON=100baseT, OFF=10baseT)

Figure 1-1 C3414 CPU Module

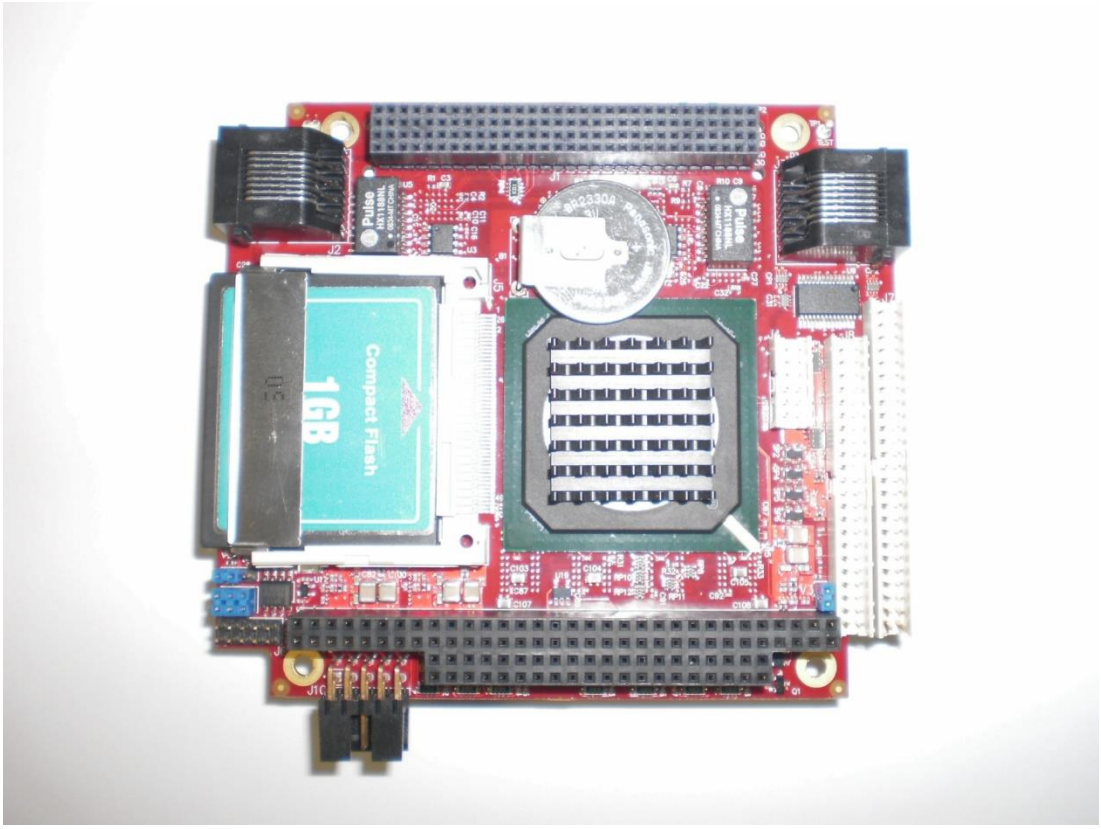
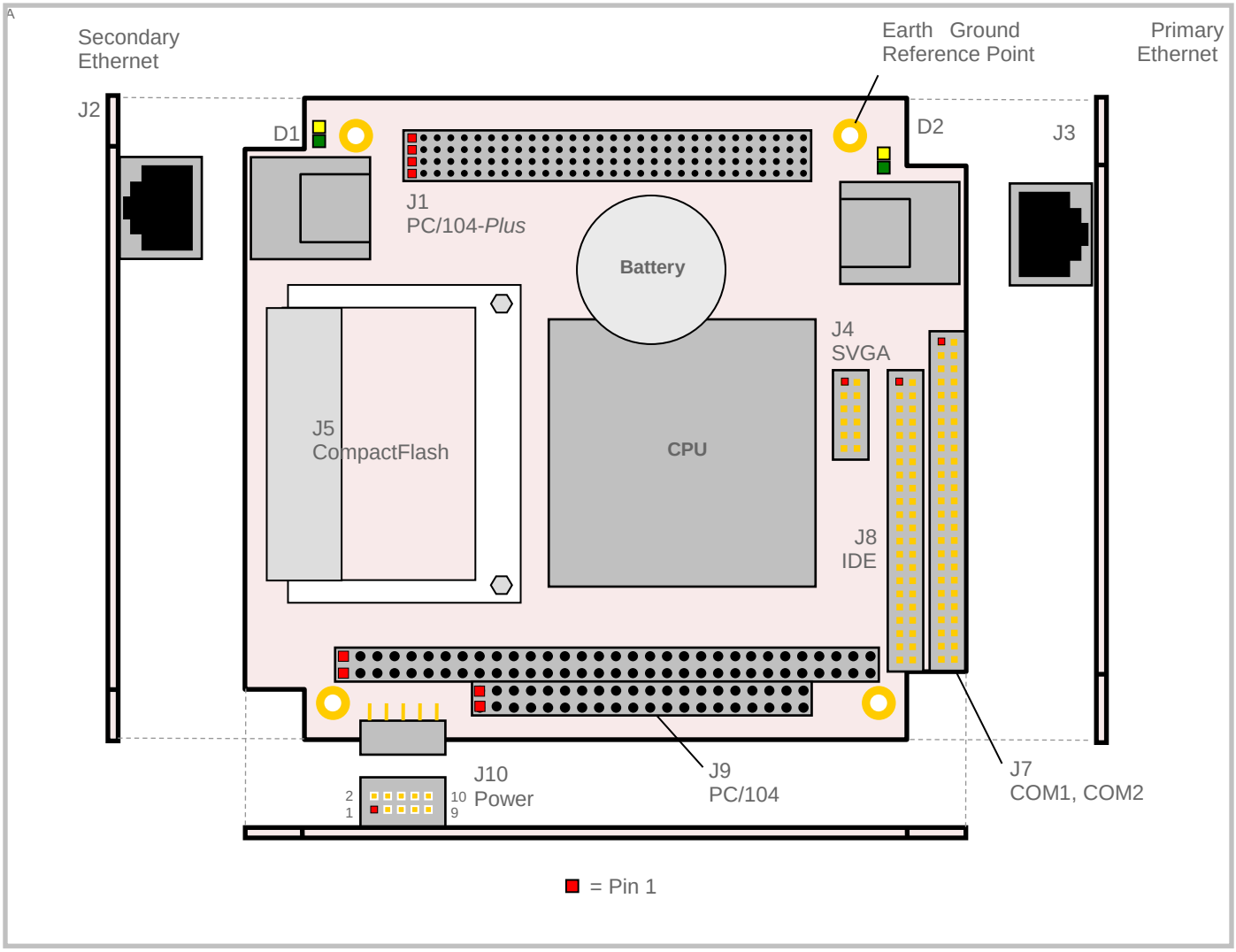


Figure 1-2 C3414 Connectors



Only connectors J2, J3, J5, J7 and J9 are used in RTU application.

2 Processor Overview

2.1 PC/104 Architecture

The open architecture of the PC/104 bus interface provides for expanded functions. You may add a PC/104-based C3461GPS receiver, C3437/C3438 Communication cards that allow up to eight additional Comm ports, a C3830 analog to digital card or a C3831 IRIG B interface card.

The PC/104 architecture is a compact version of the IEEE P996 (PC and PC/AT) bus, optimized for the unique requirements of embedded systems applications. The PC/104 bus derives its name from the 104 signal contacts on the two bus connectors (64 pins on P1, plus 40 pins on P2). The main differences from the IEEE P996 are:

1. Reduced form-factor (4.250 x 3.775 inches)
2. Self-stacking, eliminating need for backplanes or card cages
3. Minimized component count and power consumption (typically 1-2 watts per module) and reduced bus drive requirement (typically 4 mA)

2.2 SAGE RTU Microprocessor Overview

The RTU uses a PC/104-based CPU card as the engine for the system. The LX 800 microcontroller has a 32-bit, low-voltage AMD x86 CPU microprocessor at its core. It provides the RTU with the benefits of high performance, low cost, and low power consumption, while maintaining compatibility with the large base of industry-standard 32-bit software. The high performance of the processor is because of its 500 MHz operating clock frequency and architectural features which include pipelining, reduced clock cycle instruction fetches, reduced instruction set, and an integrated memory management unit.

2.3 Hardware Design

2.3.1 VersaLogic Model EPM-14 CPU Card

The EPM-14 (Cougar) is an AMD LX 800 based processor board in a compact PC/104-Plus format. It is specifically designed for OEM control projects requiring compact size, high reliability, and long product lifespan / availability.

Further documentation for this board may be obtained from the vendor.

VersaLogic Corporation
www.versalogic.com
3888 Stewart Road
Eugene, OR 97402
(541) 485-8575
Fax (541) 485-5712

2.3.1.1 Geode LX 800 CPU

The Geode LX 800 microcontroller combines a 32-bit, low-voltage AMD x86 CPU with a complete set of integrated peripherals suitable for both real-time and PC/AT-compatible embedded applications. The device also features a 32-bit PCI bus, a high-performance, 32-bit SDRAM interface and a full-featured, high-performance in-circuit emulation capability, known as the AMDebug™ technology.

You may learn more about the microprocessor directly from the OEM:

2.3.1.1.1 Technical Support

Answers to technical questions are available online, through e-mail, and by telephone.

Go to AMD's home page at www.amd.com and follow the Support link for the latest AMD technical support phone numbers, software, and Frequently Asked Questions.

For technical support questions on all E86 products, send e-mail to epd.support@amd.com (in the US and Canada) or euro.tech@amd.com (in Europe and the UK).

You can also call the AMD Corporate Applications Hotline at:

(800) 222-9323 Toll-free for U.S. and Canada

44-(0) 1276-803-299 U.K. and Europe hotline

2.3.1.1.2 WWW Support

For specific information on E86 products, access the AMD home page at www.amd.com and follow the Embedded Processors link. These pages provide information on upcoming product releases, overviews of existing products, information on product support and tools, and a list of technical documentation. Support tools include online benchmarking tools and CodeKit software—tested source code example applications. Many of the technical documents are available online in PDF form.

Questions, requests, and input concerning AMD's WWW pages can be sent via e-mail to webfeedback@amd.com.

2.3.1.2 Socketed Battery

The battery on the EPM-14 PC/104 CPU card is a rechargeable 3.5V Lithium cell.

2.3.1.3 LEDs

LEDs D1 and D2 are dual LEDs, one segment yellow and the other green. LED D1 is used to indicate activity on Ethernet 1 (Secondary) while LED D2 is used to indicate activity on Ethernet 0 (Primary).

2.3.1.3.1 Link/Activity LED (GREEN)

ON	Active Ethernet cable plugged into connector. No Tx/Rx data activity.
OFF	Cable not plugged into connector. Cable not plugged into active hub.
BLINKING	Active Ethernet cable plugged into connector. Tx or Rx data activity detected on the cable.

2.3.1.3.2 Speed LED (YELLOW)

ON	100Base-T (Fast) detected on Ethernet cable.
OFF	10Base-T (Slow) detected on Ethernet cable.

2.3.1.4 PC/104 Bus Interface/Connector

The bus interface connector is compatible with the PC/104 Consortium specification.

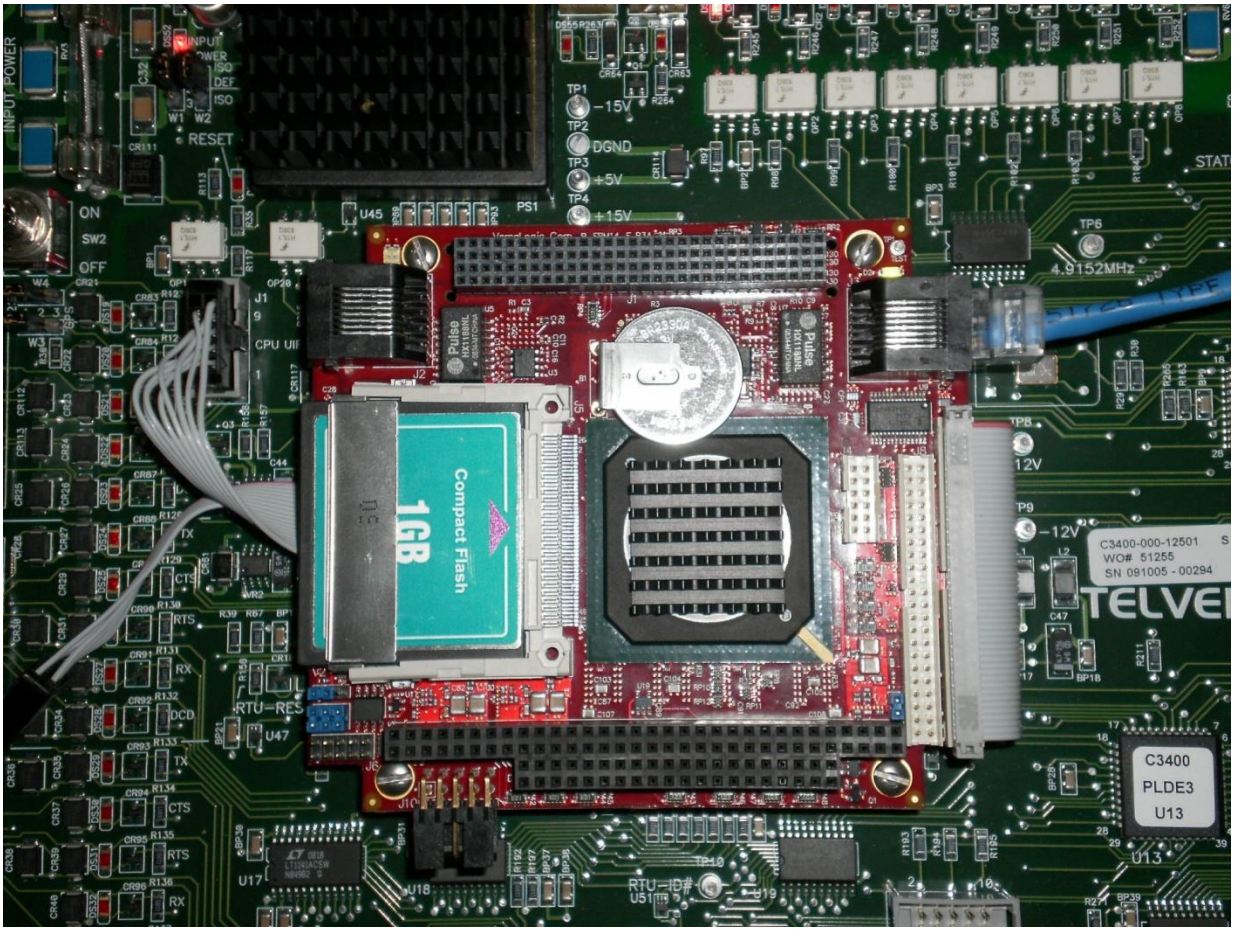
Contact the Consortium at:

PC/104 Consortium
849 Independence Ave., Suite B
Mountain View, CA 94043
Phone: 650.903.8304
Fax: 650.967.0995
Email: info@pc104.org

The PC/104 standard is available on the web in downloadable PDF format at:

URL: http://www.pc104.org

Figure 2-1 C3414 on SAGE 2400



3 RTU Upgrades

3.1 CPU Upgrade Kit (C3414-KIT-800UG)

The upgrade to the C3414 CPU card may be delivered through Schneider-Electric Houston Customer Service. The kit consists of the C3414 CPU card with a Compact Flash memory loaded with Schneider-Electric firmware, a ribbon cable that connects to the baseboard, an Ethernet cable, and 4 sets of mounting screws/washers.

This kit comes installed as part of any SAGE RTU that is ordered with this CPU.

Important Note: If you are upgrading or replacing the CPU, download and store in a safe place your configuration file from the old card in order to have it available for configuration conversion.

The parts list for the kit is shown below.

```
=========================================================================
PRODUCT: C3414-KIT-800UG                          PRINTED ON:     SALES
ORDERS
DESC:      UPGRADE  KIT  3/4/586  TO  800-CPU                    SHIPPING
DOCUMENTS
UM:       EA                                                     PACKING
LISTS
                                                                 INVOICE/CREDIT
MEMOS
=========================================================================
                                                    QUANTITY
MANUFACTURING                                        PER
PART  NUMBER          DESCRIPTION                          PRODUCT   SERIAL
NUMBER
------------------ ---------------------------- ---------- ----------
B0000-079-11500        CBL  ETHERNET  10B-T  CO  15FT  0          1.000
UNRESTRICTED
C3413-CB1-00007        CBL  ASSY  FLAT  FF  50/10    00F0         1.000
UNRESTRICTED
C3414-000-00001        PCA  CPU  LX800  W/CF/IMG/LIC  1          1.000
UNRESTRICTED
J0203-185-00000       WASHER  LOCK  INT  NO  3  SS                4.000
UNRESTRICTED
J4001-242-00000       SCREW-MACH       4-40  BH    SS  03         4.000
UNRESTRICTED
```

SAGE 1110, 1210, 1310 may be upgraded to a SAGE 1410.

Important Note: SAGE 1110, 1210, 1310 must be returned to Schneider-Electric for upgrade if the User Interface DB3 is not a right angle connector.

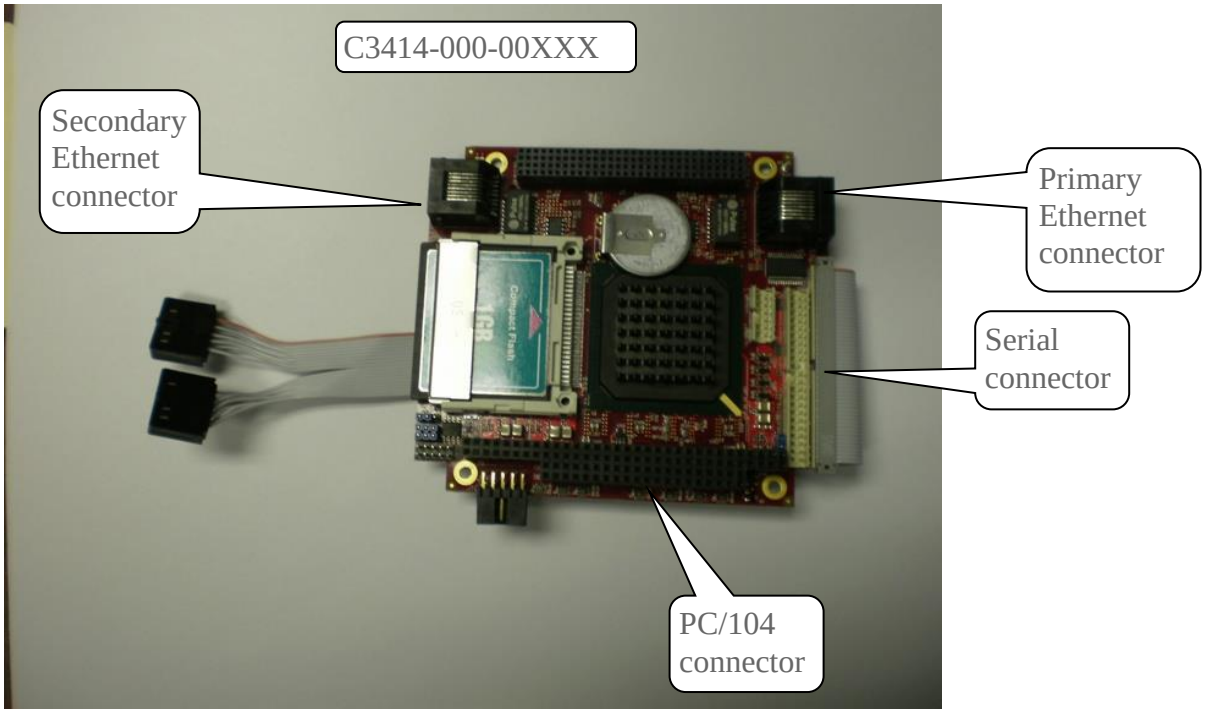
SAGE 1130, 1230, 1330 may be upgraded to a SAGE 1430.

SAGE 1150, 1250, 1350 may be upgraded to a SAGE 1450.

SAGE 2100, 2200, 2300 may be upgraded to a SAGE 2400.

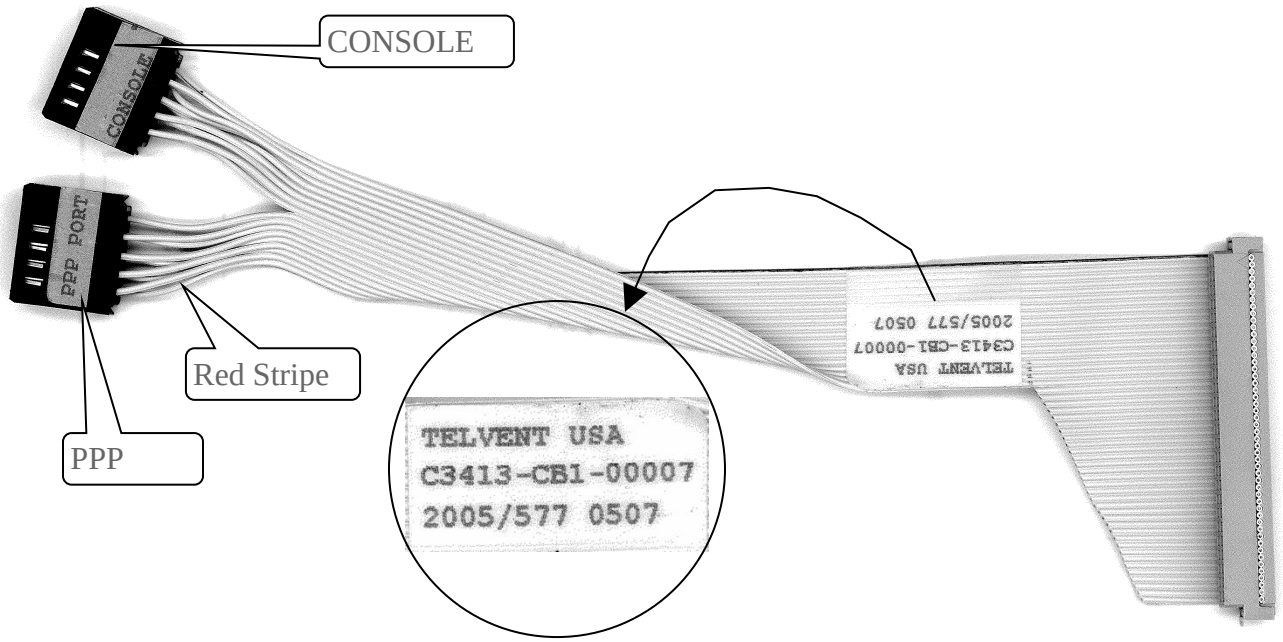
SAGE 3030 may be upgraded to a SAGE 3030M; the unit must be returned to Schneider-Electric in order to upgrade it.

The C3414 card with the ribbon cable is shown below. Note how the ribbon cable must go beneath the CPU card. This does not apply to the SAGE 3030. The SAGE 3030 ribbon cable is different from the one pictured.



The ribbon cable itself is depicted below. Note that the small connectors are keyed to plug into J1 on the baseboard. They are also labeled CONSOLE and PPP PORT. Whichever connector is not being used may float free (unconnected).

Important Note Do not remove the ribbon cable once it is connected.



3.2 Configuration Update

If the CPU card you are replacing meets the following requirements, it may be updated with your previous CPU configuration by following directions on the Configuration Update document on the Customer website.

You should download and store in a safe place your configuration from the old card in order to have it available for configuration conversion.

Hint: You should also run the Configuration Conversion program on your existing configuration to make sure that it converts properly with no errors before installing the C3414 CPU.

Firmware configurations from the SAGE 1210 and SAGE 1310 may be converted and used in the SAGE 1410.

Firmware configurations from the SAGE 1230 and SAGE 1330 may be converted and used in the SAGE 1430.

Firmware configurations from the SAGE 1250 and SAGE 1350 may be converted and used in the SAGE 1450.

Firmware configurations from the SAGE 2200 and SAGE 2300 may be converted and used in the SAGE 2400.

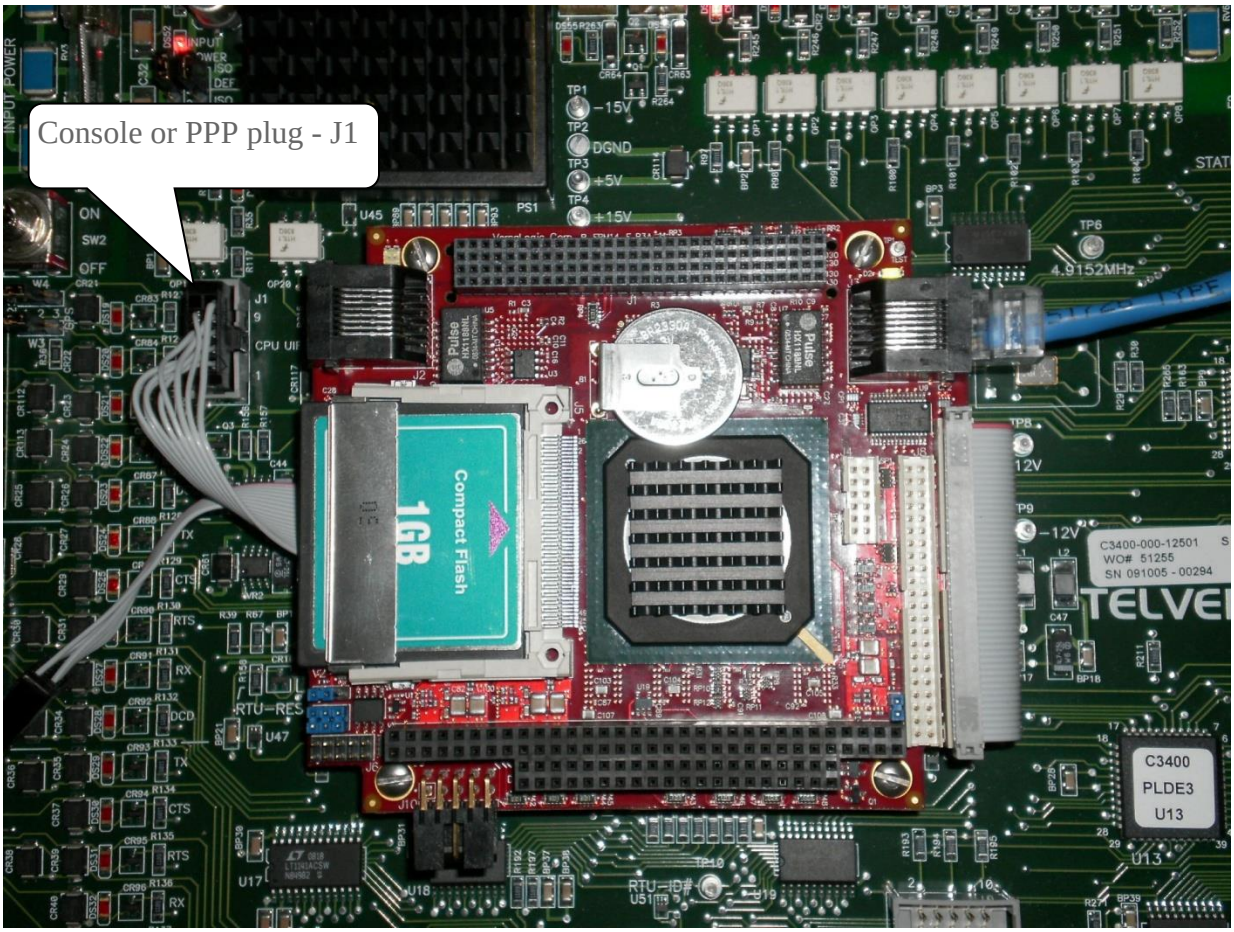
Firmware configurations from the SAGE 3030 may be converted and used in the SAGE 3030M.

3.3 CPU Card Connections

3.3.1 Console

For normal operation (non-PPP), place the ribbon cable that does NOT have the red stripe into J1 on the baseboard as shown below. This is console position.

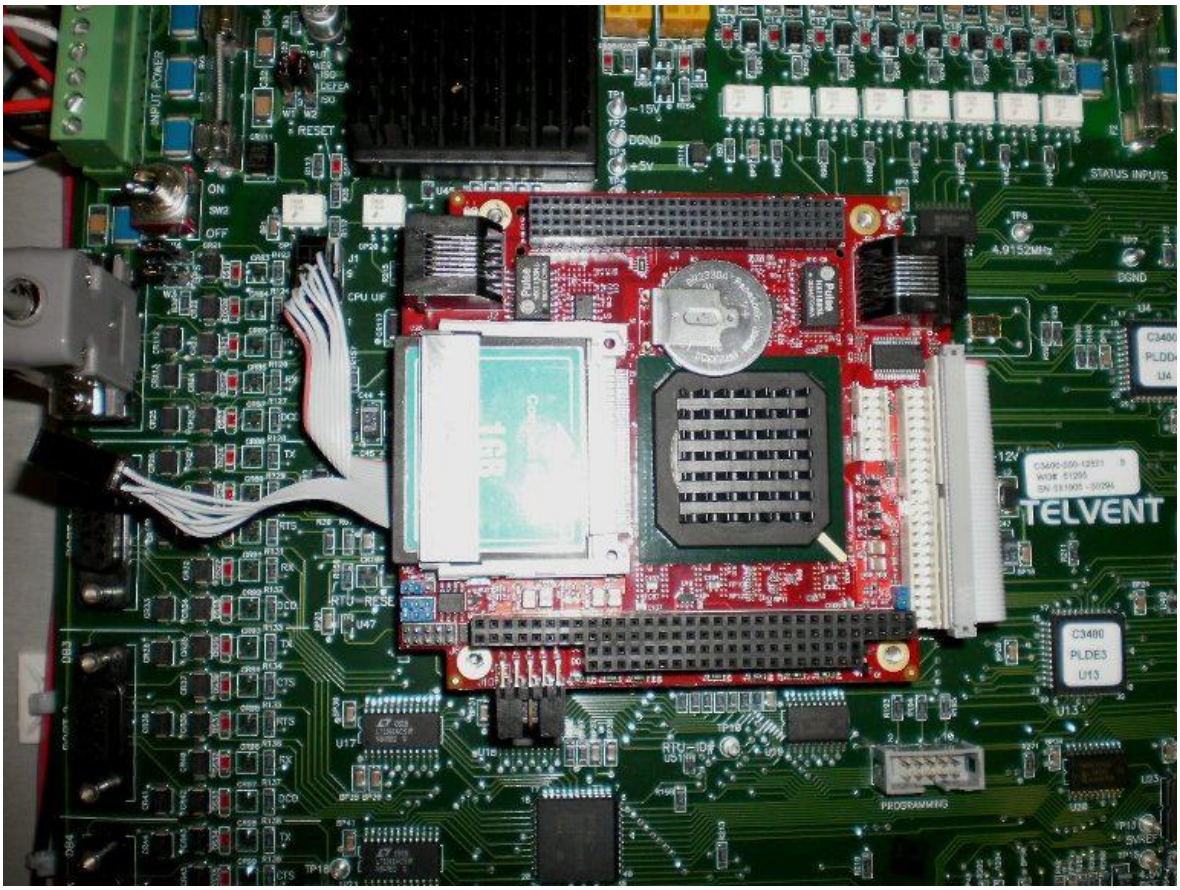
Figure 3-1 Console Operation



3.3.2 Point-to-Point Protocol (PPP)

For PPP operation, place the ribbon cable that has the red stripe into J1 as shown below.

Figure 3-2 PPP Operation



3.3.3 Ethernet

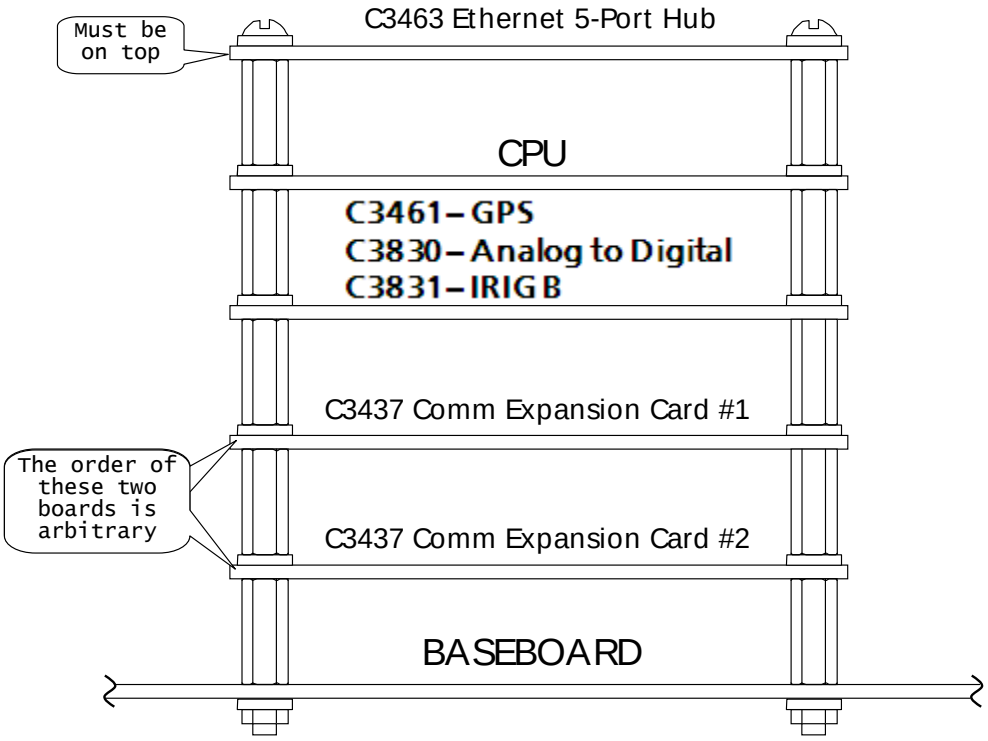
Ethernet 0 is the primary Ethernet connector and is active when the RTU is powered.

Ethernet 1 is the secondary Ethernet connector and is active only after it has been configured via the GUI and Application firmware.

3.4 PC/104 Card Stacking

The PC/104 cards should be stacked with the CPU card on top, as shown in Figure 3-3, except in the case of the installation of the C3463 Ethernet Switching Hub, which, because of clearance restrictions, must be installed on top.

Figure 3-3 PC/104 Card Stacking

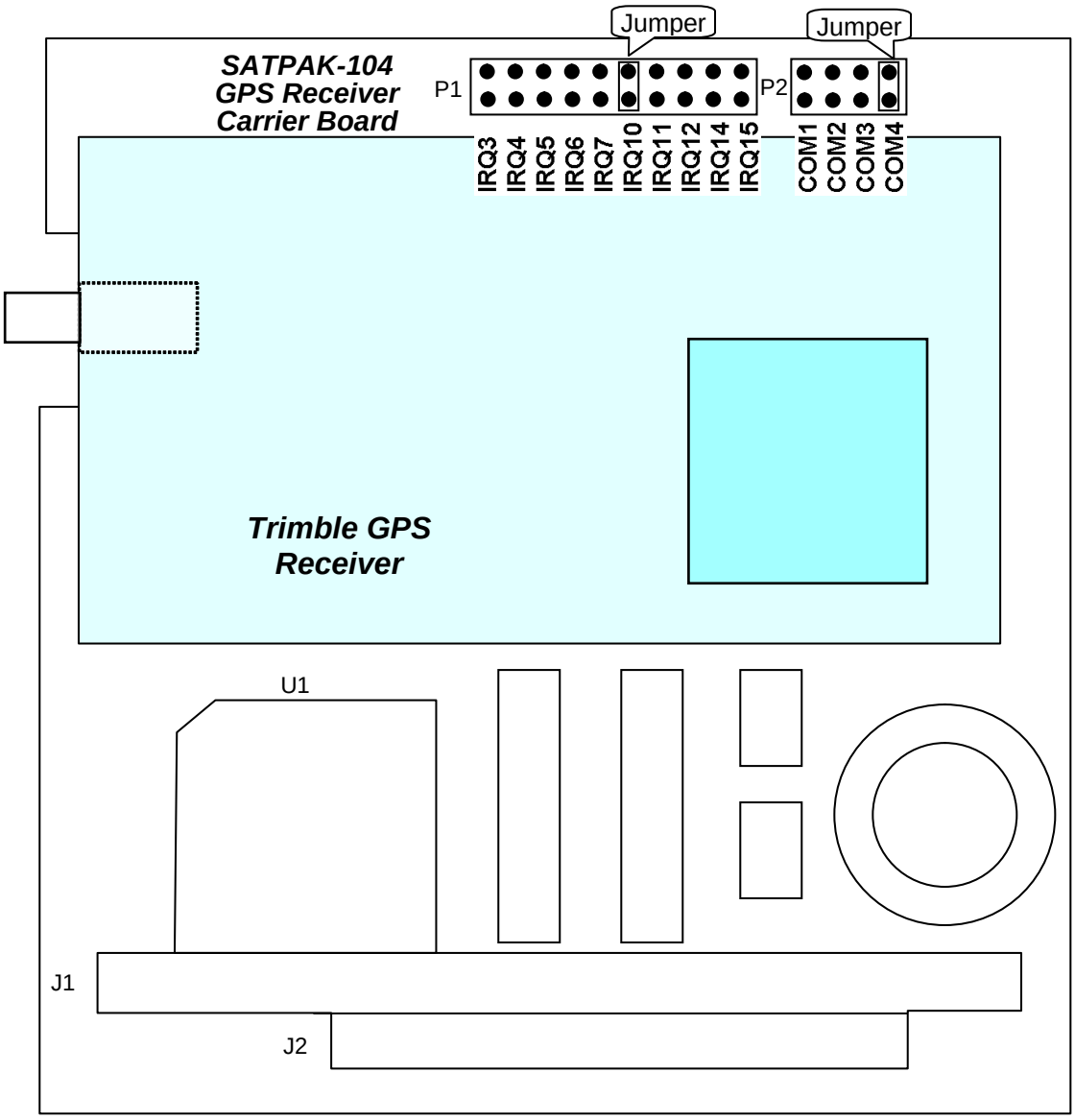


3.5 PC/104 Card Jumpers

3.5.1 GPS Card C3461

The GPS card jumpers should be verified to be as shown in Figure 3-4.

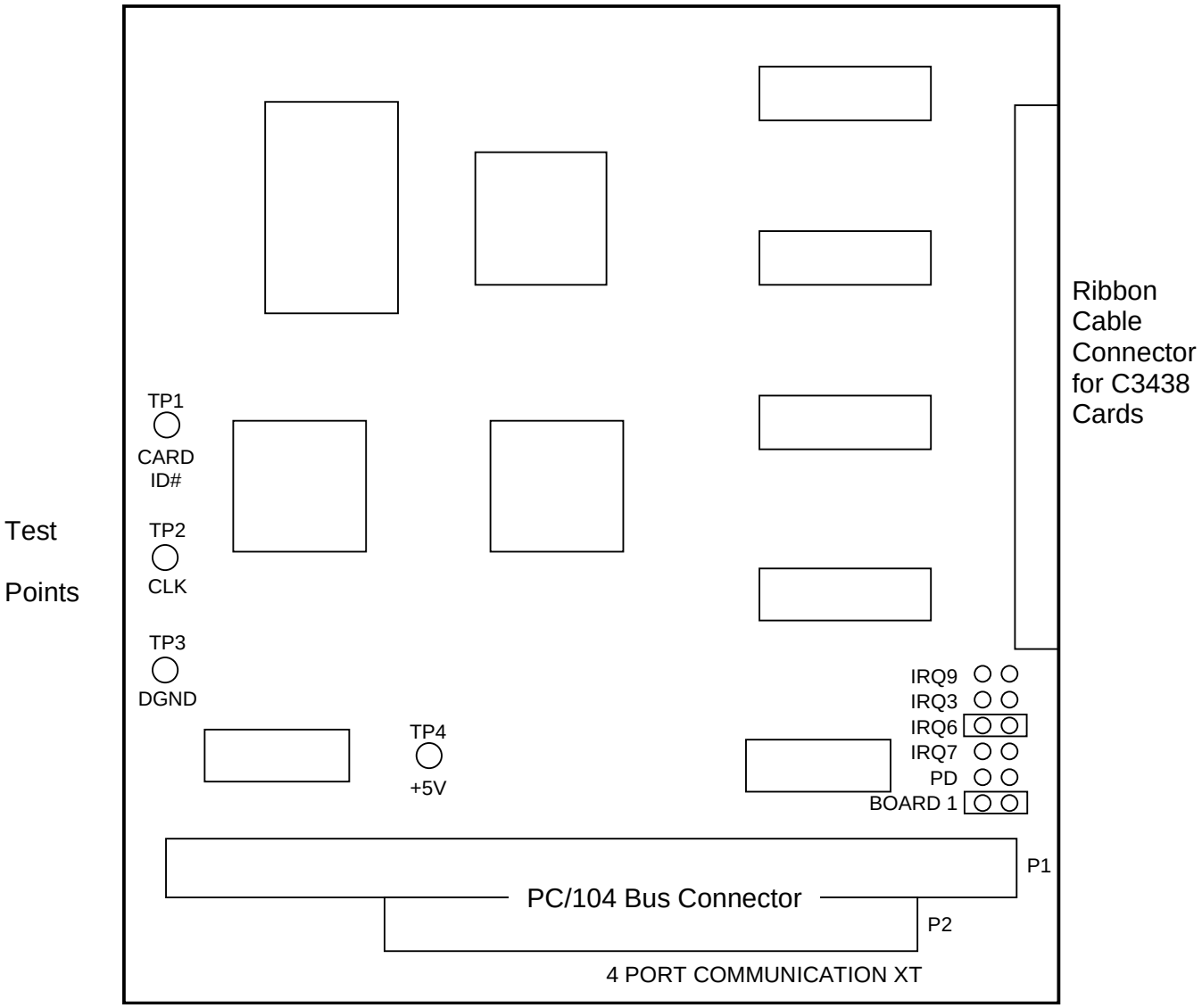
Figure 3-4 GPS Card C3461 Jumpers for a C3414 CPU



3.5.2 Communications Expansion Card C3437

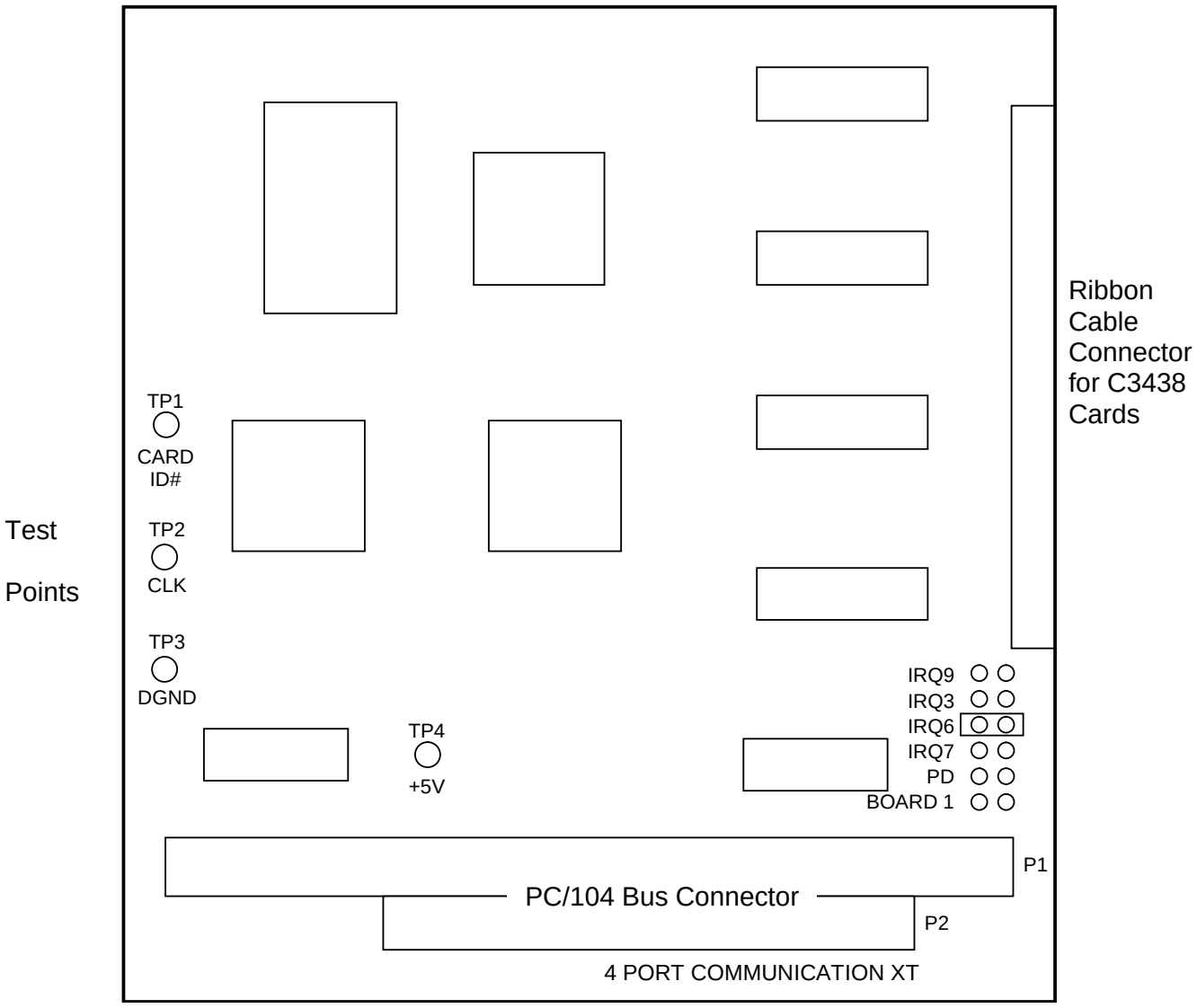
The jumpers for the Communications Card(s) should be placed as shown in Figure 3-5 and Figure 3-6.

Figure 3-5 Communication Expansion Card C3437 – Board #1



BOARD 1

Figure 3-6 Communication Expansion Card C3437 – Board #2

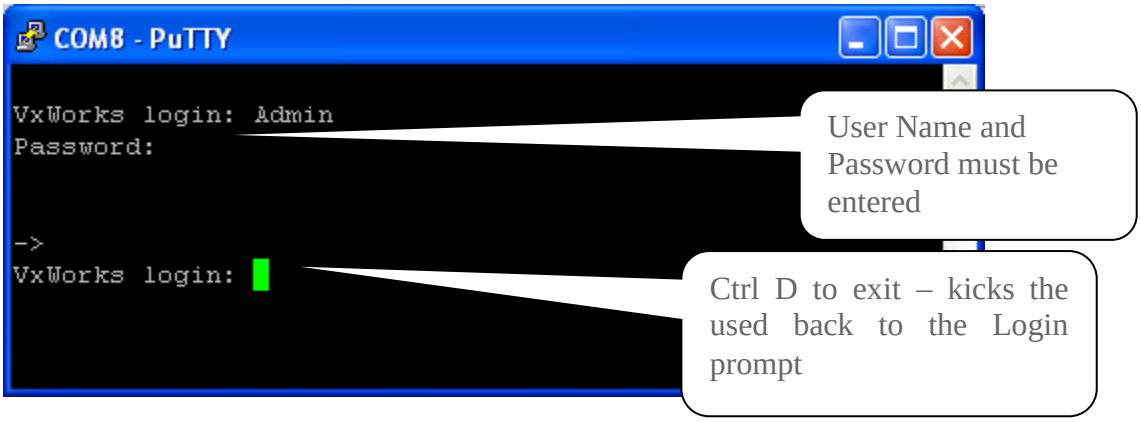


BOARD 2

4 Console Commands

4.1 Logging In/Out

With the introduction of the Secure firmware, the user must Login to use Console. When finished using Console the user must exit by typing Ctrl D. See below.



4.2 List of Console Commands

The console now has two command modes, “C” and “cmd”.

Typing “cmd” at the console will bring you to the [VxWorks]# command prompt:

```
-> cmd
[vxWorks]#
[vxWorks]# help
```

At [VxWorks Boot] prompt, type help to get list of options

```
List of the registered topics:
VM                  List of the shell commands related to virtual memory.
basic               List of basic shell commands.
breakpoint          List of the shell commands related to breakpoints.
filesystem          List of the shell commands related to file system.
history             List of commands relative to history management.
interpreter         Interpreter shell commands.
memory              List of the shell commands related to memory.
modules             List of the shell commands related to kernel modules.
network             Network commands
object              List of the shell commands related to objects.
symbols             List of the shell commands related to symbols.
tasks               List of the shell commands related to tasks.
vxmux               VXMUX routines

List of the registered commands:
C                   Switch to C interpreter
aes_ccm_test        aes_ccm_test
aesgcmtest          aesgcmtest
aeskeywraptest      AES-Keywrap test utility.
```

```
alias               Add an alias or display alias
arp                 IPNET arp control
asn1parse           Parse an ASN.1 sequence
bftest              bftest test utility.
bntest              Big number test utility.
bp                  Display, set or unset a breakpoint
ca                  Certificate Authority (CA) Management
casttest            casttest test utility.
cd                  Change current directory.
ciphers             SSL Cipher Suites
cmactest            AES-CMAC test utility.
cmp                 cmp
cpu                 Set/Get CPU affinity
crl                 Certificate Revocation List (CRL) Management
date                Show/Set current date
demangle            Display demangled string
destest             destest test utility.
dgst                Message Digest Calculation
dh                        Diffie-Hellman Parameter Management. Obsoleted by
dhparam
dhparam             Generation and Management of Diffie-Hellman Parameters
dhtest              dhtest test utility.
dprintf             Insert a dynamic printf eventpoint
dsa                 DSA key processing
dsaparam            DSA parameter manipulation and generation
dsatest             dsatest test utility.
echo                Display a line of text
echoclient          TCP/UDP echo client
echoserver          TCP/UDP echo server
enc                 Encoding with Ciphers
engine              Hardware Crypto Support
enginetest          engine test utility.
evp_test            evp_test test utility.
exit                Exit the shell session.
expr                Evaluate expressions
exptest             Big number test utility.
file ...
func ...
gendh               Generation of Diffie-Hellman Parameters. Obsoleted by
                    dhparam
gendsa              Generation of DSA Parameters
genrsa              Generation of RSA keys
getenv              Get an environment variable
help                Display the list of the shell commands
history ...
hmactest            hmactest test utility.
ifconfig            IPNET interface configuration
ipcrypto_ver        Show IPCRYPTO version
ipd                 ipd - Interpeak daemon control
ipf                 Firewall
ipsecctrl           config ipsec
ipssh_list          List connected ssh clients
ipssh_stop          Stop SSH spawns
ipversion           Show interpeak product versions
```

```
keyadm              admin IPsec keys
keydb               Key DB admin command
keyfp               Generate key finger print
logout              Logout the shell session.
lookup              Lookup a symbol
macsec              MACsec commands
md2test             md2test test utility.
md4test             md4test test utility.
md5test             md5test test utility.
mem ...
module ...
more                Browse and page through a text file.
netstat             IPNET socket and route stats
nseq                Create or examine a netscape certificate sequence
nslookup            Query Internet name servers interactively
object ...
ocsp                ocsp - Online Certificate Status Protocol utility
passwd              Generation of hashed passwords
pcap                Packet capture utility
ping                IPNET ping utility
pkcs7               PKCS#7 Data Management
pkcs8               PKCS#8 format private key conversion tool
print ...
printf              Write formatted output
pwd                 Display current working directory.
qc                  IPNET output queue configuration
qos                 IPNET Quality of Service configuration
radiusc             Radius client
rand                Generate pseudo-random bytes
randtest            randtest test utility.
rc2test             RC2 test utility.
rc4test             RC4 test utility.
reboot              Reboot the system
repeat              Repeat a command
req                 X.509 Certificate Signing Request (CSR) Management
rmdtest             rmdtest test utility.
route               IPNET route table control
rsa                 RSA Data Management
rsa_test            rsa_test test utility.
rsautl              RSA utility for signing, verification, encryption, and
                    decryption
s_client            SSL client
s_server            SSL server
s_time              Time SSL connection
set ...
setenv              Set an environment variable
sftp                sftp file transfer
sha1test            sha1test test utility.
sha512test          sha512 test utility.
shatest             shatest test utility.
show ...
slab                Print slab cache information
sleep               Suspend execution for an interval.
smime               S/MIME mail processing
```

```
speed                Test encryption performance
spkac                SPKAC printing and generating utility
spy ...
ssl_clt              SSL client for performance measurements
ssl_srv              SSL server for performance measurements
sslmem               sslmem
ssltest              ssltest
string ...
sysctl               IPNET sysctl configuration
syslog               syslog
sysvar               System variable tool
tabtest              X509 test utility.
task ...
time                 Show/Set current time
tip                     Connect to one or several remote systems over serial
lines.
traceroute           Trace route command for IPv4
ttcp                 ttcp - standard performance test
ttcp1                ttcp - min priority
ttcp7                ttcp - max priority
unalias              Remove an alias
unset ...
user                 User admin command
verify               X.509 Certificate Verification
version              Display VxWorks version information.
vm ...
vxslab               Print VXMUX slab cache information
x509                 Certificate display and signing utility
```

Typing “C” (uppercase only) at the will switch back to the C interpreter:

```
[vxWorks]# C
->
->
->
-> help
help                          Print this list
dbgHelp                       Print debugger help info
edrHelp                       Print ED&R help info
ioHelp                        Print I/O utilities help info
nfsHelp                       Print nfs help info
netHelp                       Print network help info
rtpHelp                       Print process help info
spyHelp                       Print task histogrammer help info
timexHelp                     Print execution timer help info
h         [n]                 Print (or set) shell history
i         [task]              Summary of tasks' TCBs
ti        task                Complete info on TCB for task
sp        adr,args...         Spawn a task, pri=100, opt=0x19, stk=20000
taskSpawn name,pri,opt,stk,adr,args... Spawn a task
tip       "dev=device1#tag=tagStr1", "dev=device2#tag=tagStr2", ...
                                        Connect to one or multiple serial lines
td        task                Delete a task
ts        task                Suspend a task
tr        task                Resume a task
```

```
Type <CR> to continue, Q<CR> or q<CR> to stop:

tw        task                 Print pending task detailed info
w         [task]               Print pending task info
d         [adr[,nunits[,width]]] Display memory
m         adr[,width]          Modify memory
mRegs     [reg[,task]]         Modify a task's registers interactively
pc        [task]               Return task's program counter
iam       "user"[,"passwd"]    Set user name and passwd
whoami                         Print user name
devs                           List devices
ld        [syms[,noAbort][,"name"]] Load stdin, or file, into memory
                                        (syms = add symbols to table:
                                        -1 = none, 0 = globals, 1 = all)
lkup      ["substr"]           List symbols in system symbol table
lkAddr    address              List symbol table entries near address
checkStack  [task]             List task stack sizes and usage
printErrno  value              Print the name of a status value
period    secs,adr,args...     Spawn task to call function periodically
repeat    n,adr,args...        Spawn task to call function n times (0=forever)
version                        Print VxWorks version info, and boot line
shConfig  ["config"]           Display or set shell configuration variables

Type <CR> to continue, Q<CR> or q<CR> to stop:

strFree   [address]            Free strings allocated within the shell (-1=all)

NOTE:  Arguments specifying 'task' can be either task ID or name.

value = 1 = 0x1
->
```

Some of the more common “C” commands not listed in help:

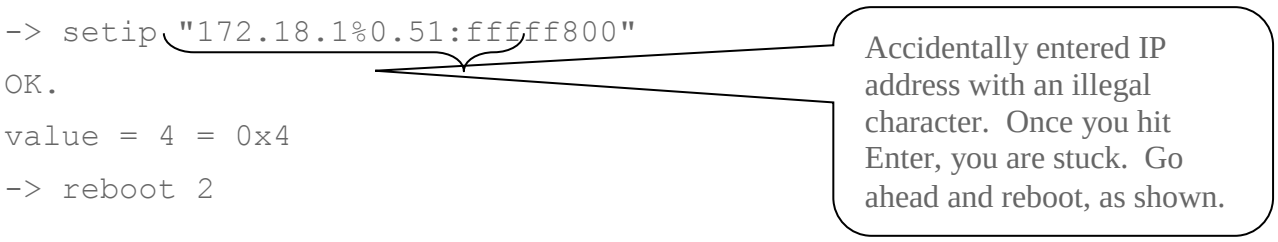
```
setip                          Set the IP address of the RTU
whoru                          Get the RTU IP address
```

Commonly used “cmd” command not listed in help

```
reboot                         Reboot the RTU
```

4.3 Recovering From a Corrupt IP Address

If an illegal character has been entered as an IP address, the bootup process will stop at the [VxWorks Boot] prompt. The condition can be corrected by following the example below.



```
(With a "bad" IP address, the RTU continuously reboots.  Carefully
watch the display until the following message appears:


Press any key to stop auto-boot...
 1

[VxWorks Boot]: ?

Commands:
 ?                     - print this list
 @                     - boot (load and go)
 p                     - print boot params
 c                     - change boot params
 l                     - load boot file
 g adrs                - go to adrs
 e                     - print fatal exception
 v                     - print boot logo with version
 d adrs[,n]            - display memory
 m adrs                - modify memory
 f adrs, nbytes, value - fill memory
 t adrs, adrs, nbytes  - copy memory
 devs                  - print system devices

Bootline Format:
  $dev(0,procnum)host:/file h=# e=# b=# g=# u=usr [pw=passwd] f=#
                          tn=targetname s=script o=other

File System Boot Device Formats:
 boot device: fs
 file name: /FileSystemDeviceName/vxWorks
 other: network device name

 boot device: ata[=ctrl,drive]         file name: /ata0a/vxWorks

Boot Flags:
  0x0002 -   load local system symbols
  0x0004 -   don't autoboot
  0x0008 -   quick autoboot (no countdown)
  0x0080 -   use tftp to get boot image

Available Boot Devices:
  Filesystem Devices: /ata0a /ata00:2
  Enhanced Network Devices:  fei0 fei1
[VxWorks Boot]: p
```

At [VxWorks Boot] prompt, type ? to get list of options

Type "p" to verify the incorrect IP address

```
boot device          : ata=0,0
unit number          : 0
processor number     : 0
host name            : host
file name            : /ata0a/vxworks
inet on ethernet (e) : 172.18.1%0.51:ffff0000
host inet (h)        : 172.18.150.49
gateway inet (g)     : 172.18.1.1
user (u)             : target
ftp password (pw)    : password
flags (f)            : 0x8
target name (tn)     : Telvent
other (o)            : fei

[VxWorks Boot]: c

'.' = clear field;  '-' = go to previous field;  ^D = quit

boot device          : ata=0,00
processor number     : 0
host name            : host
file name            : /ata0a/vxworks
inet on ethernet (e) : 172.18.1%0.1:ffff0000 172.18.150.1:ffff0000
inet on backplane (b):
host inet (h)        : 172.18.150.49
gateway inet (g)     : 172.18.1.1
user (u)             : target
ftp password (pw) (blank = use rsh): password
flags (f)            : 0x8
target name (tn)     : Telvent
startup script (s)   :
other (o)            : fei


NOTE: Bootline not saved to NVRAM
[VxWorks Boot]: p

boot device          : ata=0,0
unit number          : 0
processor number     : 0
host name            : host
file name            : /ata0a/vxworks
inet on ethernet (e) : 172.18.150.1:ffff0000
host inet (h)        : 172.18.150.49
gateway inet (g)     : 172.18.1.1
user (u)             : target
ftp password (pw)    : password
flags (f)            : 0x8
```

The Problem

Change boot parameters one step at a time by entering lowercase “c”

When the offending IP address comes up

Type in correct IP address & mask here. Continue to hit Enter until [VxWorks Boot] prompt appears

Print boot parameters to verify correct IP

```
target name (tn)      : Telvent
other (o)             : fei

[VxWorks Boot]: @
```

One-time boot with this set of parameters

```
-> setip "172.18.150.51:fffff800"
OK.
value = 4 = 0x4
-> reboot 2
```

After normal bootup, you must now do setip again using the correct IP, then reboot again

After bootup, whoru to verify correct IP address.

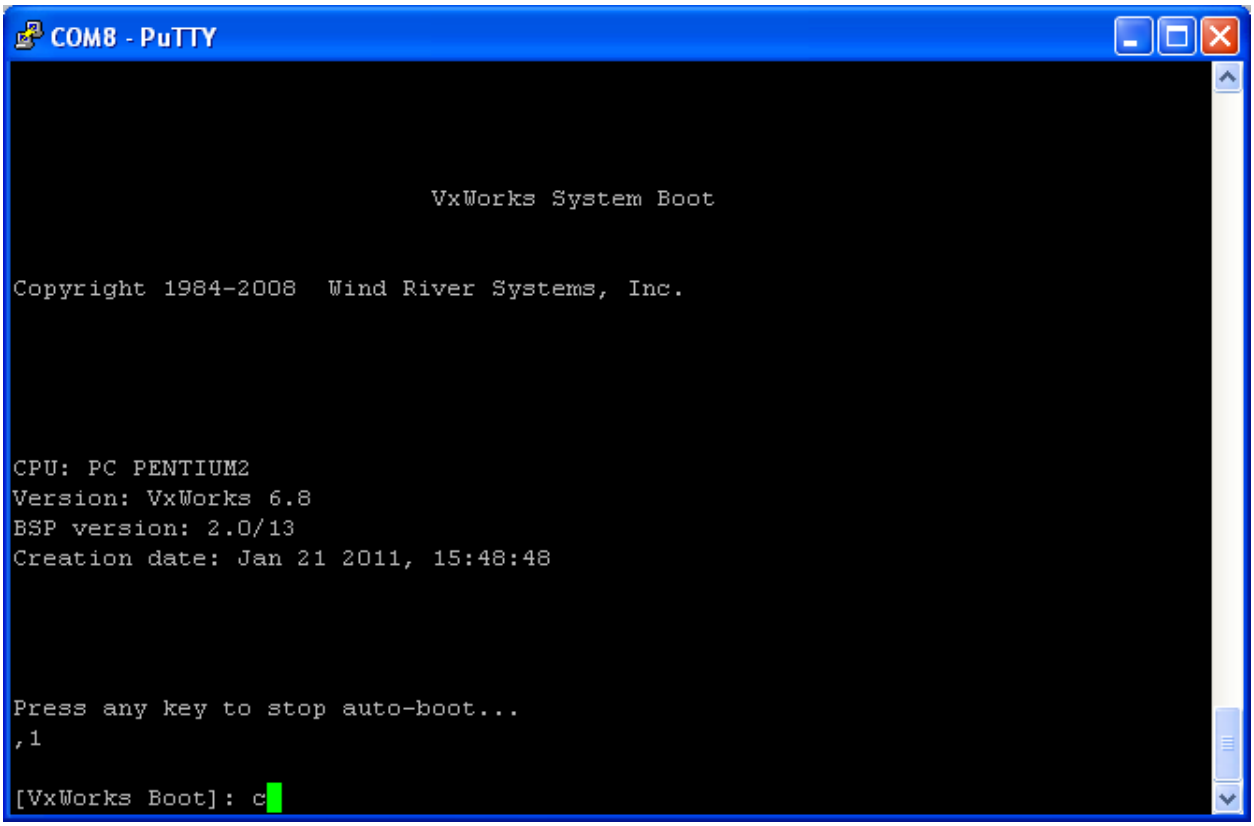
```
-> whoru
IP Address = 172.18.150.51
Subnet Mask = 255.255.248.0
value = 28 = 0x1c
->
```

4.4 Booting the RTU in Safe Mode

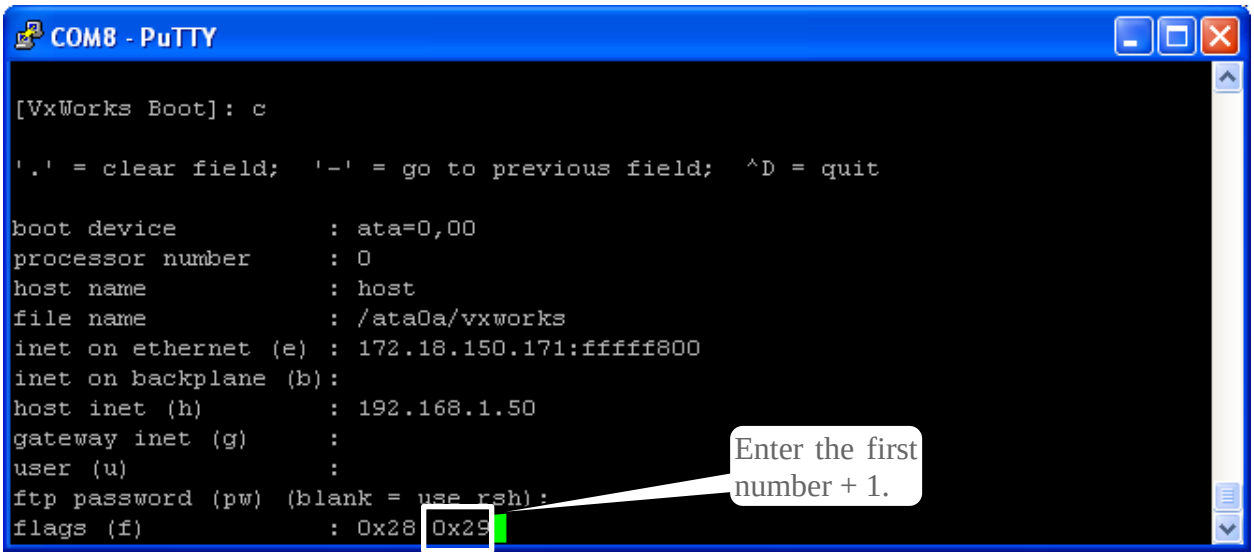
To bootup in Safe Mode from the console, you must first reboot in console by logging in (if not already logged in), then type reboot 2 as shown below, and hit return.

Press any key repeatedly as login begins. The login will stop at [VxWorks Boot]: as shown below.

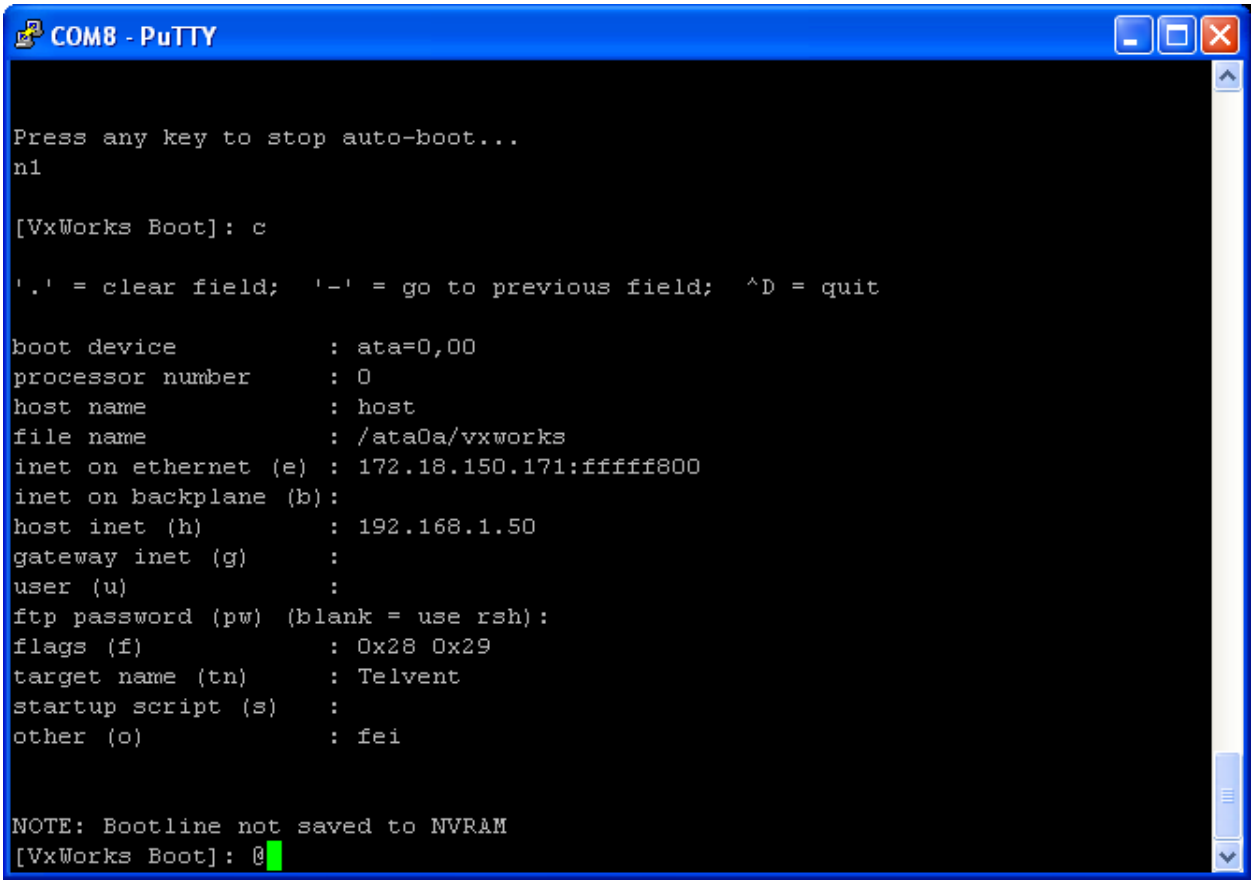
Enter a lower case c as shown below, and hit return.



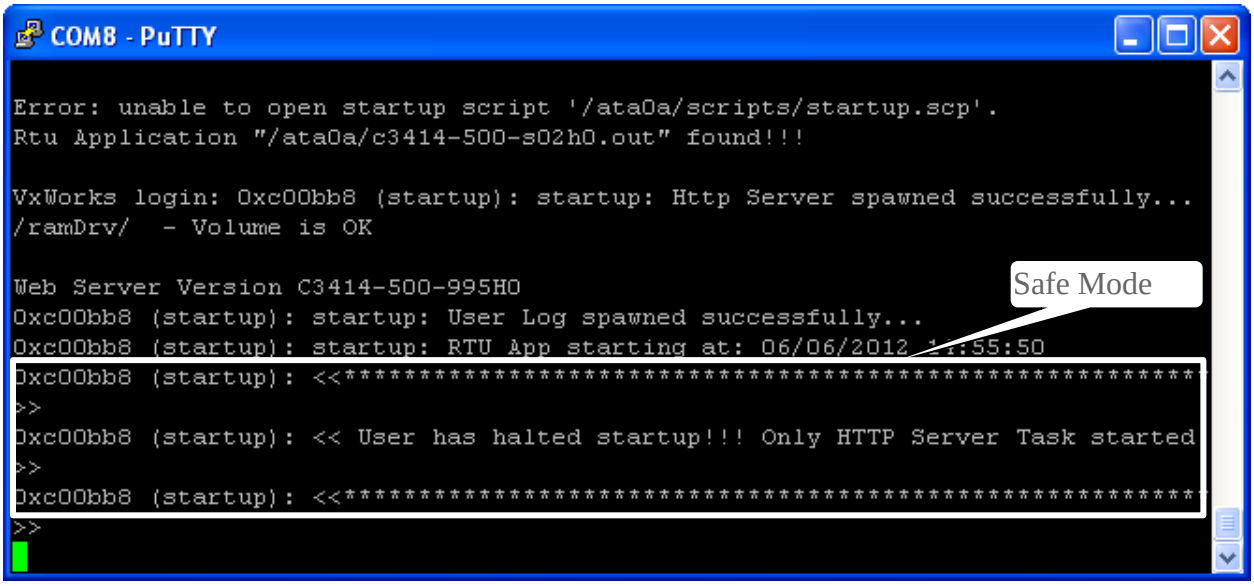
Keep hitting return to advance the cursor to flags (f) as shown below. Whatever number is displayed after the colon (in this case 0x28), add 1 to that number and enter the new number. The entered number entered must be odd.



Hit return until the cursor returns to [VxWorks Boot]: as shown below. Enter an "at" symbol, that is @ as shown, then hit return to continue bootup.



The RTU will bootup in Safe Mode as shown below.



4.5 Checking Task Status

Typing the lowercase I into the console prompt shows the status of all tasks running. The critical clue to watch for, if you suspect a problem, is the STATUS of each task. PEND, READY, and DELAY are okay, but a SUSP means trouble. See below.

For instance, the tHTTPd task serves up web pages to Internet Explorer. If this task is SUSP, then there will be no response in I.E. from the RTU.

Figure 4-1 Checking Task Status

COM1 - PuTTY

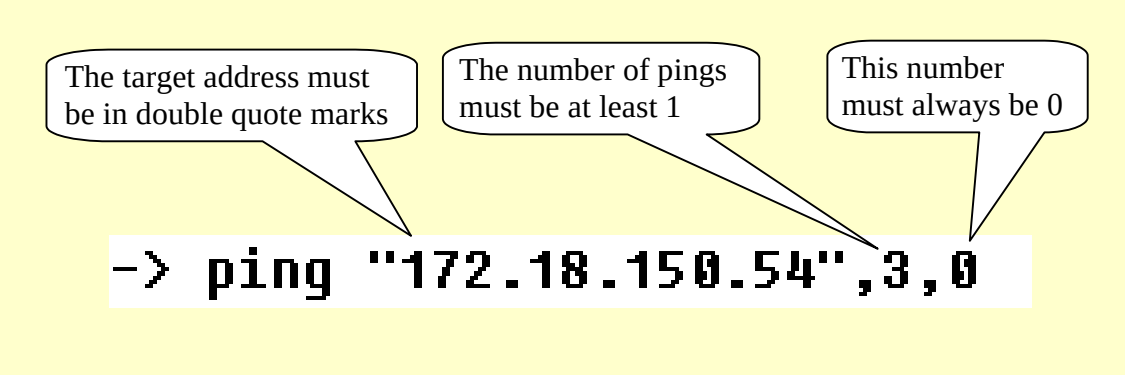
```
->
-> i

  NAME         ENTRY       TID    PRI   STATUS      PC       SP     ERRNO  DELAY
---------- ------------ -------- --- ---------- -------- -------- ------- -----
tIsr0       43eb60       166a7ec   0 PEND       63d1b0   16d5f80       0     0
tJobTask    5c96f0       166e250   0 PEND       63d1b0   16dbf30       0     0
tExcTask    5c8a70        7c1d20   0 PEND       63d1b0    7bf220       0     0
tLogTask    logTask      16d8978   0 PEND       63b06a   16e1ed0       0     0
tNbioLog    5ca6b0       166e6c0   0 PEND       63d1b0   16e8ef0       0     0
tShell0     shellTask    18839bc   1 READY      6452e0   18c8120       0     0
tWdbTask    wdbTask      1891010   3 PEND       63d1b0   18b6f00       0     0
tErfTask    4460e0       16e5cf4  10 PEND       63d610   16edf20       0     0
ipcom_tick> 656080       187e348  20 DELAY      64320a   188af80       0     4
tAtaSvc0    432718       16de790  50 PEND       63d610   16c8f30       0     0
tNet0       ipcomNetTask 167cb10  50 PEND       63d1b0   170df20       6     0
ipcom_sysl> 462800       1841278  50 PEND       63d610   184ae50       0     0
ipcom_teln> ipcom_telnet 166c1e4  50 PEND       63d1b0   1881e00       0     0
ipppp_work  40c16d       168c100  50 PEND       63d610   188ff30       0     0
ipftps      ipftps_main  185a828  50 PEND       63d1b0   189ee10       0     0
ipiked      ipike_proc   1896b38  50 PEND+T     63d1b0   18b09b0  3d0004     3
tXbdServic> 5c2650       18b86e4  50 PEND+T     63d610   18cdf40  3d0004    58
t5Msec      clk_task_5ms ef26d4c  98 PEND       63d1b0   1b0df00       0     0
t50Msec     clk_task_50m 1b0a530  99 PEND       63d1b0   1b13f30       0     0
dcmgMain    dcmgMain     1c626e0 100 DELAY      64320a   1c69f80 1f5003d    22
ETCP        etcpMain     18849b0 100 DELAY      64320a   1c74f20 1f5003d     2
IsaIXD      dixdMain     1c7f6e8 100 DELAY      64320a   1c85f60 1f5003d     3
dnTcpSrv17  dnpTcpServ   1be2558 203 PEND       63d1b0   1c54c90       0     0
dnTcpWrk17  tcpProcess   1842000 203 PEND       63b06a   1c59eb0       0     0
dnUdpSrv17  dnpUdp       1843290 203 PEND       63d1b0   1c5ecf0       0     0
DBC         m1_dbc       1b8ab50 204 PEND+T     63d1b0   1b92f10  3d0004   122
SCHED       1a5d340      1b85eb0 205 PEND       63b06a   1b8ceb0       0     0
COS         m1_cos       1b90970 205 PEND+T     63b06a   1b98e70  3d0004   172
CTLR        m1_ctlr      1b90c60 205 PEND+T     63b06a   1b9fe00  3d0004    30
ANA         m1_ana       1b9d980 205 PEND       63d1b0   1ba6f10       0     0
DAC         m1_dac       1b9dd50 205 PEND+T     63b06a   1baddf0  3d0004   105
ISaGRAF_IF  1931950      1babc70 205 PEND       63d1b0   1bc49a0   30065     0
DNPMCOM 1   dnp_dl_task  1bc1c70 205 PEND+T     63d1b0   1be9ea0  3d0004    17
DNP COM 17  dnp_dl_task  1bd0c00 205 PEND+T     63d1b0   1c01ea0  3d0004    15
USERLOG     usrlog_task  ef279b0 206 PEND       63b06a   1af2e70  3d0002     0
MBM COM 2   mbm_task     1bd0980 206 DELAY      64320a   1bf9e20  3d0004    46
DNP_APPR17  dnp_appr_tas 1bd7980 206 PEND+T     63d1b0   1c09ea0       0   171
DNP_APPM1   dnp_appm_tas 1bc99f0 207 PEND+T     63d1b0   1bf1e50  3d0004     2
SOELOG      soelog_task  1bb2980 208 PEND+T     63d1b0   1bcbed0  3d0004   130
ALARMS      alarms_task  1bb2d68 208 PEND       63b06a   1bd2e90       0     0
SELF        m1_self      1ba4ad0 215 DELAY      64320a   1bb5a20  3d0001    57
GPST        gpst_task    1bab980 215 PEND+T     63d1b0   1bbcf30  3d0004   147
```

4.6 Pinging From The RTU

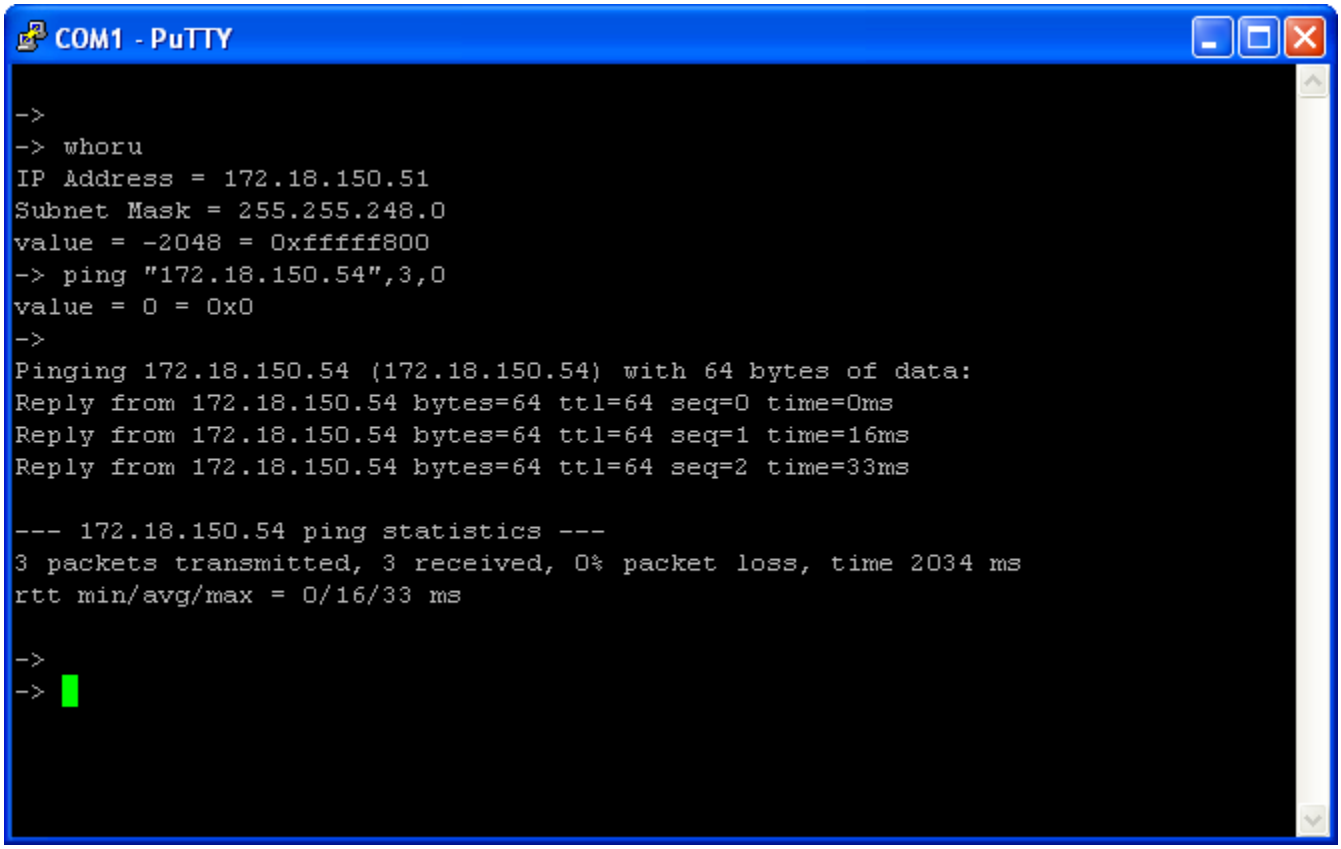
It has always been possible to ping the RTU from a device if you know the RTUs I.P. address. The RTU itself is now capable of sending a ping over TCP/IP with a console command. This function is useful if you want to check TCP/IP communication integrity directly from the RTU to any TCP/IP address compatible with the IP address range. See the syntax rules below.

Figure 4-2 Ping Syntax Rules



The following figure shows the result of a ping

Figure 4-3 Pinging From Within The RTU

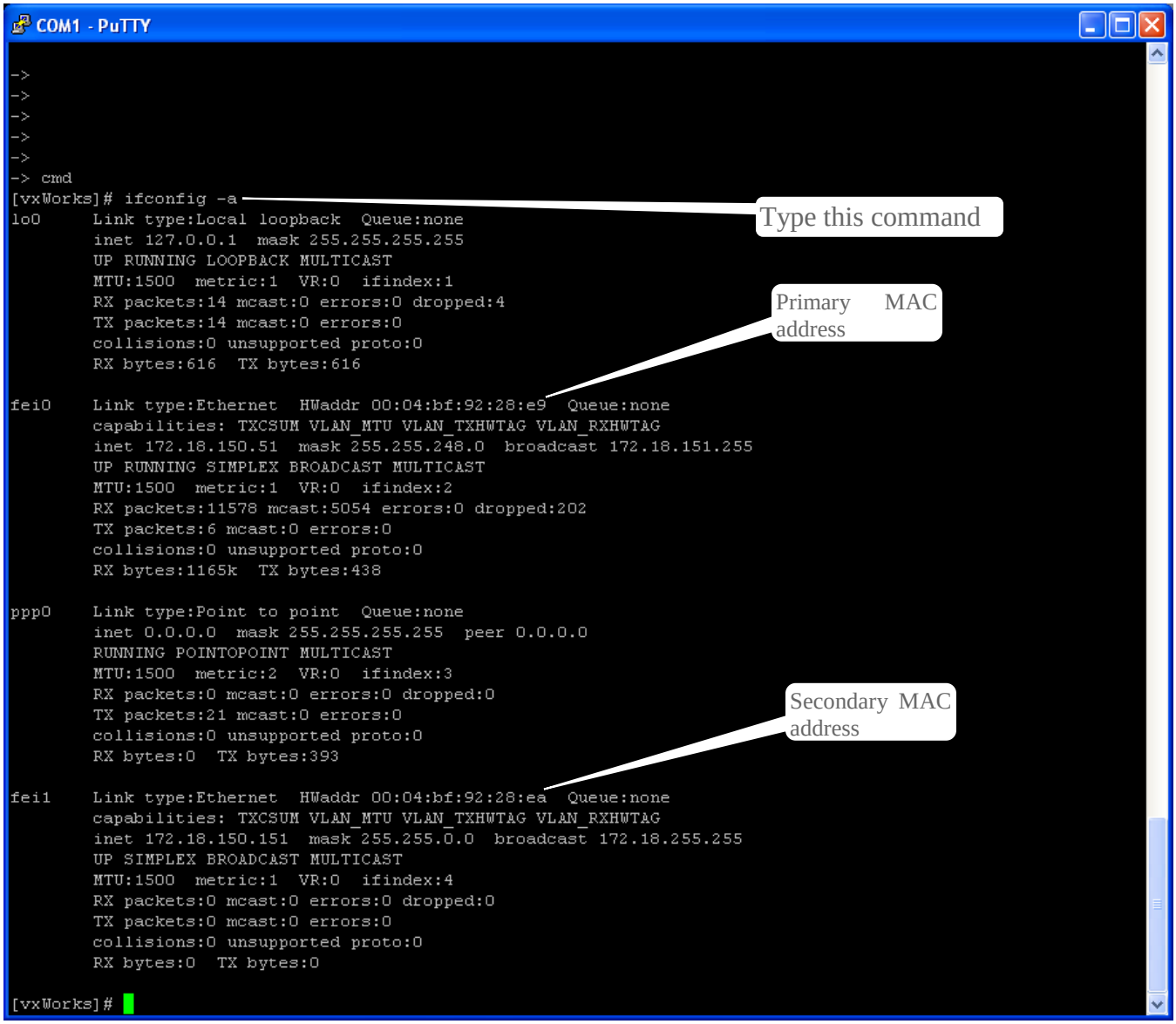


4.7 The RTU's MAC Address

4.7.1 Finding RTU's MAC Address Using Console

Enter the command shown below to retrieve the MAC address of the Ethernet circuits on the CPU card.

Figure 4-4 Finding the CPU Card's MAC Address Using Console

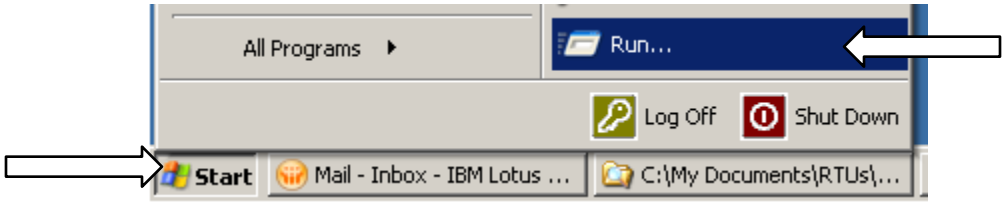


Note: Secondary Ethernet (fei1) is displayed only if the device has been configured via the GUI / Application firmware.

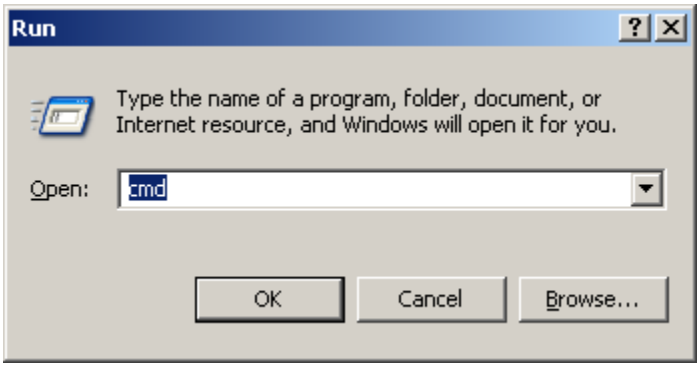
4.7.2 Finding RTU's MAC Address Remotely

If the console cannot be used remotely, you can find the MAC address though a Windows command line using the ARP command as follows if your PC is directly connected to the RTU. Otherwise, you will have to connect to the device serving as the gateway to the network for the RTU and use the ARP command appropriate for the device.

Go to Start and Run.

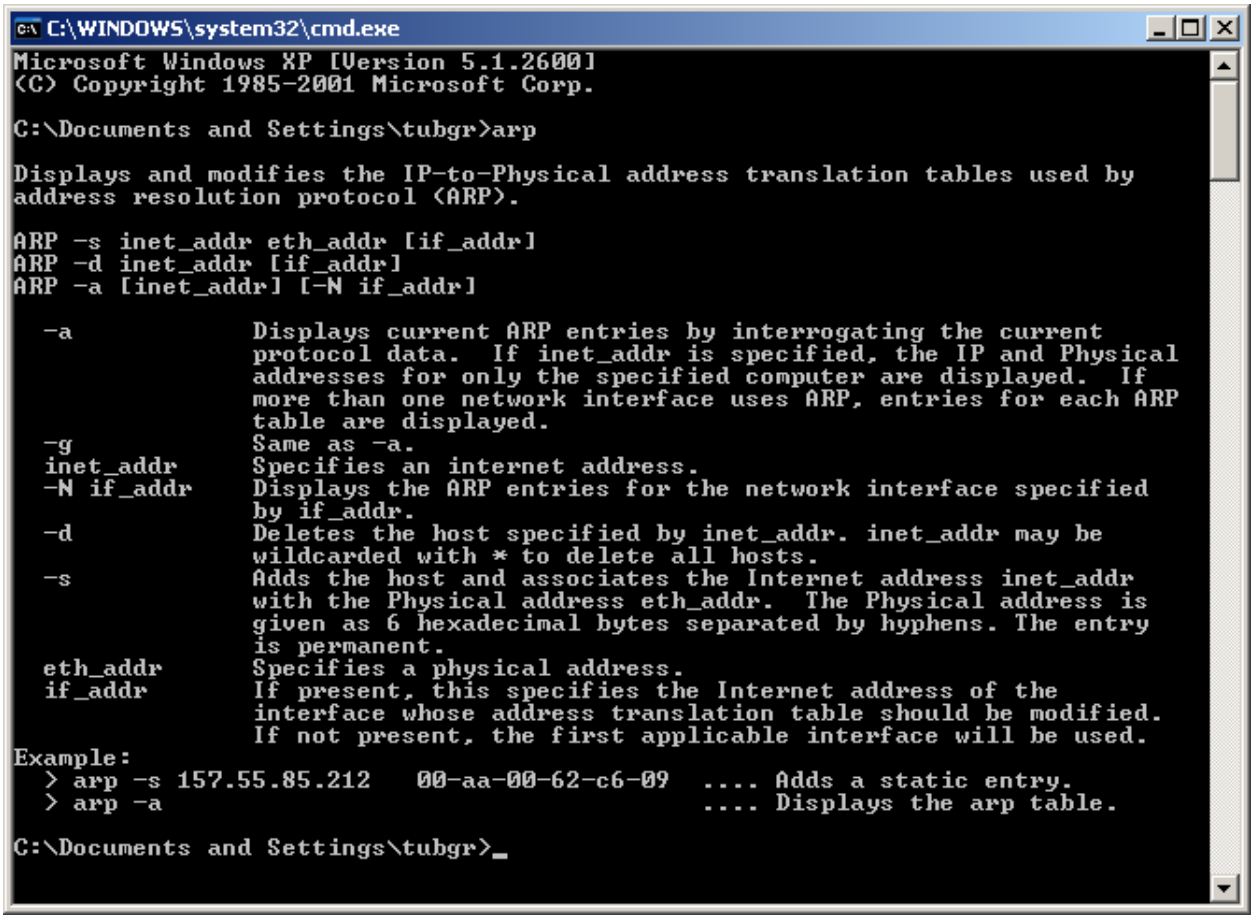


Click OK for cmd.



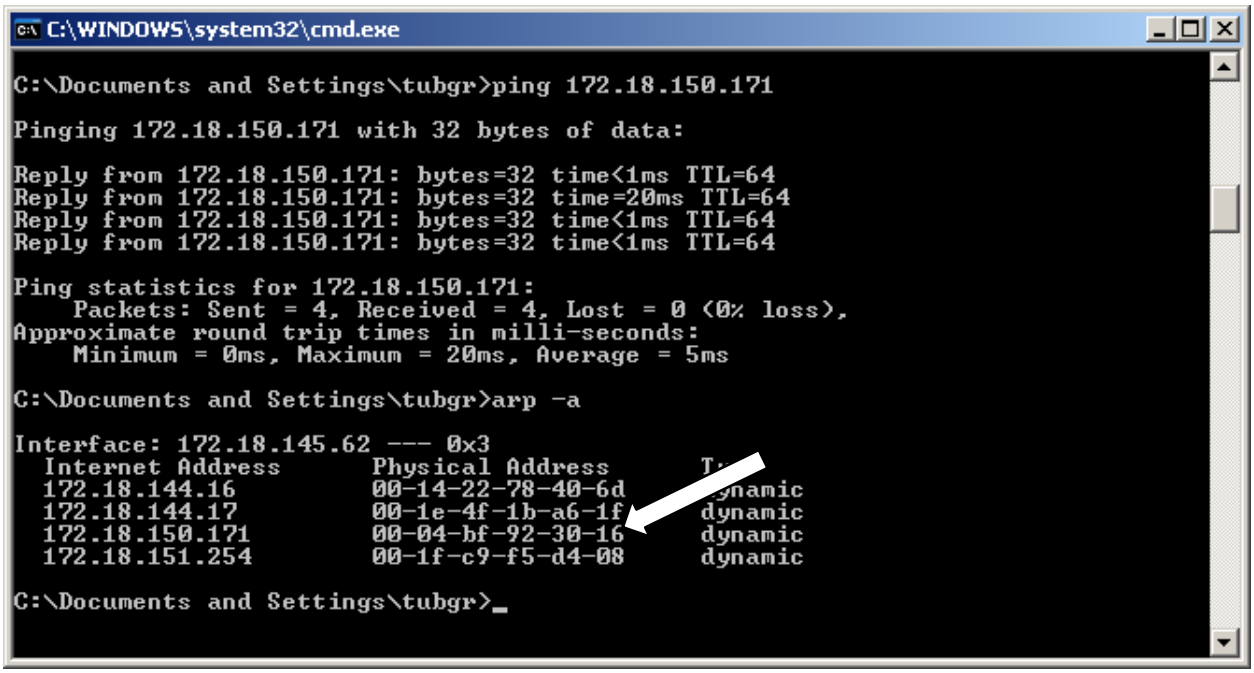
When you type arp alone, the Command window returns the definition of the command and all its modifiers.

Figure 4-5 The ARP Command



To find the Primary Port MAC address (Ethernet Port 0), Ping the IP address of the Primary Port in the RTU to establish a network connection. Then enter "ARP –a" as shown. The Physical Address displayed is the MAC Address.

Figure 4-6 Finding the CPU Card's MAC Address Remotely



Note: To find the MAC address of the Secondary Port (Ethernet Port 1), set the computer's IP address in the same group as the RTU so that the Ping command and the ARP command will see the Secondary Port of the RTU. Then repeat the Ping and ARP commands above using the IP Address of the Secondary Port.

4.8 SBO Troubleshooting

Beginning with C3413-500-001C6 and newer firmware, the following function is available though the console to help trouble shoot the SBO bus. This function is valid only for the C3400 (SAGE 2300/SAGE 2400) and C3800 (SAGE 3030/SAGE 3030M) baseboards.

To use this function, connect your PC to the console port on the RTU and start the terminal emulation program. Type the <Enter> key and make sure that you get the "->" prompt.

Start the GUI and log on. Make sure to disconnect the field wiring from the point you are going to operate and perform the Trip or Close that does not work.

Type "c34_print_sbo_table" on the console (don't type the double quotes). After you have typed this in one time, you can type an "<ESC>k" to recall the history and type a "<Enter>" to execute the function again.

The following display is a successful trip of point 4 on the baseboard. If you have multiple executes (execute read - more than one bit set) or multiple selects (select read - more than one bit clear), the SBO control will fail. All of the IOPLD values will be 00 on a successful operation. The rt section of the display is valid only when the RTU detects a control error in real time. In this case, the RTU has started to perform the control but detects an error while the control is active. The selects expected and read, executes expected and read, and the time the relay was expected to close and time left to close to completion is displayed.

```
-> c34_print_sbo_table
progress counter   60
select expected  bfff
select read      bfff
execute expected 0001
execute read     0001
sel shift loops     0
driver chk loops    0
IOPLD_EXECUTE           00
IOPLD_DID               00
IOPLD_SBO_CSEL_HI       00
IOPLD_SBO_CSEL_LO       00
IOPLD_SBO_CEXEC_READ_LO 00
IOPLD_SBO_CEXEC_READ_HI 00
rt select expected  0000
rt select read      0000
rt execute expected 0000
rt execute read     0000
rt time expected       0
rt time left err       0
value = 25 = 0x19
```

```
->
```

The following display is a execute fail trip of point 4 on the baseboard. Note that execute 0 and execute 7 (CEXEC0 and CEXEC7 on the schematics) are both 1. Execute 0 is used for the baseboard relays or the last XT position on the SBO bus if the baseboard points are disabled.

```
-> c34_print_sbo_table
progress counter   50
select expected  bfff
select read      bfff
execute expected 0001
execute read     0081
sel shift loops     0
driver chk loops    0
IOPLD_EXECUTE           00
IOPLD_DID               00
IOPLD_SBO_CSEL_HI       00
IOPLD_SBO_CSEL_LO       00
IOPLD_SBO_CEXEC_READ_LO 00
IOPLD_SBO_CEXEC_READ_HI 00
rt select expected  0000
rt select read      0000
rt execute expected 0000
rt execute read     0000
rt time expected       0
rt time left err       0
value = 25 = 0x19
->
```

The following display is of a select fail, trip of point 4 on the baseboard. Note that select 14 and select 15 (CSEL14 and CSEL15 on the schematics) are both 0. The high byte of the selects is used for the baseboard relays.

```
-> c34_print_sbo_table
progress counter   30
select expected  bfff
select read      3fff
execute expected 0000
execute read     0000
sel shift loops     0
driver chk loops    0
IOPLD_EXECUTE           00
IOPLD_DID               00
IOPLD_SBO_CSEL_HI       00
IOPLD_SBO_CSEL_LO       00
IOPLD_SBO_CEXEC_READ_LO 00
IOPLD_SBO_CEXEC_READ_HI 00
rt select expected  0000
rt select read      0000
rt execute expected 0000
rt execute read     0000
rt time expected       0
rt time left err       0
value = 25 = 0x19
->
```

The progress counter code indicates the error/success code.

At reset or if there was an error detected on a previous SBO operation, a reset function is called to determine if the problem has cleared. These are the codes that this function produces.

- 100 initial check of registers on the baseboard failed, should have nonzero values in the IOPLD values
- 110 shifting of the select bits failed (shift in progress bit not set)
- 115 shifting of the select bits failed (shift in progress bit not clear)
- 120 execute bit stuck on
- 130 select bit stuck on
- 140 completion check of registers on the baseboard failed, should have nonzero values in the IOPLD values

These are the codes produced by the normal operation of the SBO control system.

10 check of registers on the baseboard failed, should have nonzero values in the IOPLD values
20 relay number out of range
30 select fail
40 check of registers on the baseboard failed, should have nonzero values in the IOPLD values
50 execute fail
60 successful operation

The following tables show the relationship between the control lines and the relays being controlled.

The Execute/Select column is based on the schematic. The digit before the "/" is the Execute number. The digit after the "/" is the Select number. For example, 0/8 CEXEC0/CSEL8. This combination is point 1 Trip.

Table 4-1 C3400 SBO Relay Assignments with Baseboard Enabled

Location	SBO Database Relay #	Sequential Relay #	Execute/Select	Comments
			0/0 to 0/7	do not exist
	1 trip to 4 close	1 to 8	0/8 to 0/15	baseboard relays
Bank 1 J7	5 trip to 12 close	9 to 24	1/0 to 1/15	1st 16-relay SBO XT
	13 trip to 20 close	25 to 40	2/0 to 2/15	2nd 16-relay SBO XT
	21 trip to 28 close	41 to 56	3/0 to 3/15	3rd 16-relay SBO XT
	29 trip to 36 close	57 to 72	4/0 to 4/15	4th 16-relay SBO XT
	37 trip to 44 close	73 to 88	5/0 to 5/15	5th 16-relay SBO XT
	45 trip to 52 close	89 to 104	6/0 to 6/15	6th 16-relay SBO XT
	53 trip to 60 close	105 to 120	7/0 to 7/15	7th 16-relay SBO XT
Bank 2 J8	61 trip to 68 close	121 to 136	8/0 to 0/15	8th 16-relay SBO XT
	69 trip to 76 close	137 to 152	9/0 to 1/15	9th 16-relay SBO XT
	77 trip to 84 close	153 to 168	10/0 to 2/15	10th 16-relay SBO XT
	85 trip to 92 close	169 to 184	11/0 to 3/15	11th 16-relay SBO XT
	93 trip to 100 close	185 to 200	12/0 to 4/15	12th 16-relay SBO XT
	101 trip to108 close	201 to 216	13/0 to 5/15	13th 16-relay SBO XT
	109 trip to116 close	217 to 232	14/0 to 6/15	14th 16-relay SBO XT
	117 trip to 124 close	233 to 248	15/0 to 7/15	15th 16-relay SBO XT

The Execute/Select column is based on the schematic. The digit before the "/" is the Execute number. The digit after the "/" is the Select number. For example, 0/8 CEXEC0/CSEL8. This combination is point 61 Trip.

Table 4-2 C3400 SBO Relay Assignments with Baseboard Disabled

Location	SBO Database Relay #	Sequential Relay #	Execute/Select	Comments
Bank 1 J4	1 trip to 8 close	1 to 16	1/0 to 1/15	1st 16-relay SBO XT
	9 trip to 16 close	17 to 32	2/0 to 2/15	2nd 16-relay SBO XT
	17 trip to 24 close	33 to 48	3/0 to 3/15	3rd 16-relay SBO XT
	25 trip to 32 close	49 to 64	4/0 to 4/15	4th 16-relay SBO XT
	33 trip to 40 close	65 to 80	5/0 to 5/15	5th 16-relay SBO XT
	41 trip to 48 close	81 to 96	6/0 to 6/15	6th 16-relay SBO XT
	49 trip to 56 close	97 to 112	7/0 to 7/15	7th 16-relay SBO XT
	57 trip to 64 close	113 to 128	0/0 to 0/15	8th 16-relay SBO XT
Bank 2 J3	65 trip to 72 close	129 to 144	8/0 to 8/15	9th 16-relay SBO XT
	73 trip to 80 close	145 to 160	9/0 to 9/15	10th 16-relay SBO XT
	81 trip to 88 close	161 to 176	10/0 to 10/15	11th 16-relay SBO XT
	89 trip to 96 close	177 to 192	11/0 to11/15	12th 16-relay SBO XT
	97 trip to 104 close	193 to 208	12/0 to 12/15	13th 16-relay SBO XT
	105 trip to112 close	209 to 224	13/0 to 13/15	14th 16-relay SBO XT
	113 trip to120 close	225 to 240	14/0 to 14/15	15th 16-relay SBO XT
	121 trip to 128 close	241 to 256	15/0 to 15/15	16th 16-relay SBO XT

Table 4-3 C3800 SBO Relay Assignments

Location	SBO Database Relay #	Sequential Relay #	Execute/Select	Comments
			0/0 to 0/15	do not exist
Bank 1 J3	1 trip to 8 close	1 to 16	1/0 to 1/15	1st 16-relay SBO XT
	9 trip to 16 close	17 to 32	2/0 to 2/15	2nd 16-relay SBO XT
	17 trip to 24 close	33 to 48	3/0 to 3/15	3rd 16-relay SBO XT
	25 trip to 32 close	49 to 64	4/0 to 4/15	4th 16-relay SBO XT
	33 trip to 40 close	65 to 80	5/0 to 5/15	5th 16-relay SBO XT
	41 trip to 48 close	81 to 96	6/0 to 6/15	6th 16-relay SBO XT
	49 trip to 56 close	97 to 112	7/0 to 7/15	7th 16-relay SBO XT

Table 4-4 C3800 / C3810 LANDAC II SBO Relay Assignments

Location	SBO Database Relay #	Sequential Relay #	Execute/Select	Comments
Bank 1 J7 (C3810)	1 trip to 8 close	1 to 16	1/0 to 1/15	1st 16-relay SBO XT
	9 trip to 16 close	17 to 32	2/0 to 2/15	2nd 16-relay SBO XT
	17 trip to 24 close	33 to 48	3/0 to 3/15	3rd 16-relay SBO XT
	25 trip to 32 close	49 to 64	4/0 to 4/15	4th 16-relay SBO XT
	33 trip to 40 close	65 to 80	5/0 to 5/15	5th 16-relay SBO XT
	41 trip to 48 close	81 to 96	6/0 to 6/15	6th 16-relay SBO XT
	49 trip to 56 close	97 to 112	7/0 to 7/15	7th 16-relay SBO XT
	57 trip to 64 close	113 to 128	0/0 to 0/15	8th 16-relay SBO XT
Bank 2 J8 (C3810)	65 trip to 72 close	129 to 144	8/0 to 8/15	9th 16-relay SBO XT
	73 trip to 80 close	145 to 160	9/0 to 9/15	10th 16-relay SBO XT
	81 trip to 88 close	161 to 176	10/0 to 10/15	11th 16-relay SBO XT
	89 trip to 96 close	177 to 192	11/0 to 11/15	12th 16-relay SBO XT
	97 trip to 104 close	193 to 208	12/0 to 12/15	13th 16-relay SBO XT
	105 trip to112 close	209 to 224	13/0 to 13/15	14th 16-relay SBO XT
	113 trip to120 close	225 to 240	14/0 to 14/15	15th 16-relay SBO XT
	121 trip to 128 close	241 to 256	15/0 to 15/15	16th 16-relay SBO XT
Bank 3 J9 (C3800)	129 trip to 136 close	257 to 272	1/0 to 1/15	17th 16-relay SBO XT
	137 trip to 144 close	273 to 288	2/0 to 2/15	18th 16-relay SBO XT
	145 trip to 152 close	289 to 304	3/0 to 3/15	19th 16-relay SBO XT
	153 trip to 160 close	305 to 320	4/0 to 4/15	20th 16-relay SBO XT
	161 trip to 168 close	321 to 336	5/0 to 5/15	21th 16-relay SBO XT
	169 trip to 176 close	337 to 352	6/0 to 6/15	22th 16-relay SBO XT
	177 trip to 184 close	353 to 368	7/0 to 7/15	23th 16-relay SBO XT
	185 trip to 192 close	369 to 384	0/0 to 0/15	24th 16-relay SBO XT

The tables above have a Execute/Select column. The format of the information displayed is Execute/Select order (execute is before the slash, the select follows the slash). The following tables convert the Execute and Select to the bit patterns displayed in c34_print_sbo_table.

The Select will be displayed in the c34_print_sbo_table as the following bit patterns:

Table 4-5 Select Bit Patterns

Select	**Bit Pattern**
0	FFFE
1	FFFD
2	FFFB
3	FFF7
4	FFEF
5	FFDF
6	FFBF
7	FF7F
8	FEFF
9	FDFF
10	FBFF
11	F7FF
12	EFFF
13	DFFF
14	BFFF
15	7FFF

The Execute will be displayed in the c34_print_sbo_table as the following bit patterns:

Table 4-6 Execute Bit Patterns

Execute	Bit Pattern
0	0001
1	0002
2	0004
3	0008
4	0010
5	0020
6	0040
7	0080
8	0100
9	0200
10	0400
11	0800
12	1000
13	2000
14	4000
15	8000

4.9 Restoring the RTU to a Known State

If the firmware in the compact flash is in an unstable state but still bootable, you may be able to restore it to a known configuration. Once it has been restored to this known configuration, a stable system will be in place so that you can use SFTP to restore the compact flash.

The UIF cable must be connected to your PC with a terminal emulator program running to determine if this is possible, and if so, perform the steps to install the system. The UIF serial configuration is 1 start, 8 data, no parity, and 1 stop bit @ 9600 baud, no flow control.

This capability exists on VxWorks versions greater than the 6.7 version. At bootup, the following (or similar) information is displayed as part of the startup sequence.

```
CPU: PC PENTIUM2
Version: VxWorks 6.7
BSP version: 2.0/10
Creation date: Aug 27 2009, 09:46:21
```

If the string "Version: VxWorks 6.7" is displayed, this capability is not available and it will be difficult to restore a system.

If the string "Version: VxWorks 6.8" or higher is displayed, this function is available. Older versions do not have the features in the boot ROM code required to restore to a known configuration.

To restore to the known configuration:

1) Reboot the RTU

2) Enter any key to stop the boot up process when you see the following prompt:

Press any key to stop auto-boot…

Type the following at the *[VxWorks Boot]:* prompt:

```
[VxWorks Boot]:  cd /ata0a/recovery
[VxWorks Boot]:  cp VxWorks /ata0a
[VxWorks Boot]:  cp recovery.scp /ata0a/scripts/vxworks_start.scp
[VxWorks Boot]:  @
```

The RTU should automatically restore itself to the initial state.

The IP address of the recovered RTU will be 192.168.1.1:255.255.0.0

The Username is Admin. The password is Telvent1!

You can now login to the RTU using a SFTP client after you make the private key file "Admin.ppk" distributed with the S02 Update File known to the client.

After you login to the RTU, you may transfer a new Firmware, Configuration, and User Access packages to the /ata0a/install directory.