C3414 CPU Manual

C3414-AAA-00001 V1.2
C3414 CPU Manual

For Reference Only

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Manual No. C3414-AAA-00001

Document Approval

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

1.1 CPU/Memory

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

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
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.

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
<th>PRODUCT NUMBER</th>
<th>SERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>B000-079-1150</td>
<td>CBL ETHERNET 10B-T CO 15FT 0</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>C3413-CB1-00007</td>
<td>CBL ASSY FLAT FF 50/10 00F0</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>C3414-000-00001</td>
<td>PCA CPU LX800 W/CF/IMG/LIC 1</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>J0203-185-00000</td>
<td>WASHER LOCK INT NO 3 SS</td>
<td>4.000</td>
<td></td>
</tr>
<tr>
<td>J4001-242-00000</td>
<td>SCREW-MACH 4-40 BH SS 03</td>
<td>4.000</td>
<td></td>
</tr>
</tbody>
</table>
Chapter 3 - RTU Upgrades

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](image)

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
BOARDS 2

Figure 3-6 Communication Expansion Card C3437 – 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

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.
Chapter 4 - Console Commands

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
cert                  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
ecochannel          TCP/UDP echo client
echoserver          TCP/UDP echo server
enc                  Encoding with Ciphers
event                Hardware Crypto Support
enginetest          engine test utility.
evp_test             evp_test test utility.
event                Exit the shell session.
expr                Evaluate expressions
expect               Big number test utility.
file ...            file...
func ...            func ...
gendh               Generation of Diffie-Hellman Parameters. Obsoleted by
dhparam

gendsa              Generation of DSA Parameters
genrsa              Generation of RSA keys
genenv              Get an environment variable
help                Display the list of the shell commands
history ...         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 ...           Browse and page through a text file.
more                
netstat              IPNET socket and route stats
nseq                Create or examine a netscape certificate sequence
nslookup            Query Internet name servers interactively
object ...          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.
routemc              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
shaltest             shaltest 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
Chapter 4 - Console Commands

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.

-> setup "172.18.1%0.51:fffff800"
OK.
value = 4 = 0x4
-> reboot 2

Accidentally entered IP address with an illegal character. Once you hit Enter, you are stuck. Go ahead and reboot, as shown.
(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
Chapter 4 - Console Commands

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=0,0
unit number          : 0
processor number     : 0
host name            : host
file name            : /ata0a/vxworks
inet on ethernet (e) : 172.18.1%0.51: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)    : 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

[VxWorks Boot]: 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

Note: Bootline not saved to NVRAM
Chapter 4 - Console Commands

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

[VxWorks Boot]: @

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

-> 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 boot up 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.

One-time boot with this set of parameters

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

After bootup, whoru to verify correct IP address.
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]

<table>
<thead>
<tr>
<th>NAME</th>
<th>ENTRY</th>
<th>TID</th>
<th>PRI</th>
<th>STATUS</th>
<th>PC</th>
<th>SF</th>
<th>UENO</th>
<th>DELAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>tHTTPd</td>
<td>50820</td>
<td>155I</td>
<td>0</td>
<td>FEND</td>
<td>313100</td>
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<tr>
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<tr>
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<tr>
<td>tIOIO</td>
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<td>155I</td>
<td>0</td>
<td>FEND</td>
<td>313100</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>tcp0_telnet</td>
<td>50820</td>
<td>155I</td>
<td>0</td>
<td>FEND</td>
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<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>tcp0_dip</td>
<td>50820</td>
<td>155I</td>
<td>0</td>
<td>FEND</td>
<td>313100</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>tcp0_dip</td>
<td>50820</td>
<td>155I</td>
<td>0</td>
<td>FEND</td>
<td>313100</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>tcp0_dip</td>
<td>50820</td>
<td>155I</td>
<td>0</td>
<td>FEND</td>
<td>313100</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>tcp0_dip</td>
<td>50820</td>
<td>155I</td>
<td>0</td>
<td>FEND</td>
<td>313100</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>tcp0_dip</td>
<td>50820</td>
<td>155I</td>
<td>0</td>
<td>FEND</td>
<td>313100</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Chapter 4 - Console Commands

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 target address must be in double quote marks

The number of pings must be at least 1

This number must always be 0

The following figure shows the result of a ping

Figure 4-3 Pinging From Within The RTU

->
-> whomu
IP Address = 172.18.150.51
Subnet Mask = 255.255.248.0
value = -2048 = 0x0000800
-> ping "172.18.150.54",3,0
value = 0 = 0x0
->
Pinging 172.18.150.54 (172.18.150.54) with 54 bytes of data:
Reply from 172.18.150.54 bytes=64 ttl=64 seq=0 time=0ms
Reply from 172.18.150.54 bytes=64 ttl=64 seq=1 time=16ms
Reply from 172.18.150.54 bytes=64 ttl=64 seq=2 time=33ms

--- 172.18.150.54 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2034 ms
rtt min/avg/max = 0/16/33 ms
->
->
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

```
$ ifconfig #
```

Type this command

The RTU’s MAC Address

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.

---

**Note:** Secondary Ethernet (fei1) is displayed only if the device has been configured via the GUI / Application firmware.
Chapter 4 - Console Commands

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

```
C:\WINDOWS\system32\cmd.exe
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.
C:\Documents and Settings\tubgr>arp
Displays and modifies the IP-to-Physical address translation tables used by address resolution protocol (ARP).

ARP -s inet_addr eth_addr [if_addr]
ARP -d inet_addr [if_addr]
ARP -a [inet_addr] [-N if_addr]

-a Displays current ARP entries by interrogating the current protocol data. If inet_addr is specified, the IP and Physical addresses for only the specified computer are displayed. If more than one network interface uses ARP, entries for each ARP table are displayed.

-g Same as -a.

-inet_addr Specifies an internet address.

-N if_addr Displays the ARP entries for the network interface specified by if_addr.

-d Deletes the host specified by inet_addr. inet_addr may be wildcarded with * to delete all hosts.

c Adds the host and associates the Internet address inet_addr with the Physical address eth_addr. The Physical address is given as 6 hexadecimal bytes separated by hyphens. The entry is permanent.

-eth_addr Specifies a physical address.

-if_addr If present, this specifies the Internet address of the interface whose address translation table should be modified. If not present, the first applicable interface will be used.

Example:
  > arp -s 157.55.85.212 00-aa-00-62-c6-09 .... Adds a static entry.
  > arp -a .... Displays the arp table.
```
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 through the console to help troubleshoot 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_SBOxCEEXEC_READ_LO 00
IOPLD_SBOxCEEXEC_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 (CEEXEC0 and CEEXEC7 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.

```c
-> 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

<table>
<thead>
<tr>
<th>Location</th>
<th>SBO Database Relay #</th>
<th>Sequential Relay #</th>
<th>Execute/Select</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank 1 J7</td>
<td>1 trip to 4 close</td>
<td>1 to 8</td>
<td>0/0 to 0/7</td>
<td>do not exist</td>
</tr>
<tr>
<td></td>
<td>5 trip to 12 close</td>
<td>9 to 24</td>
<td>1/0 to 1/15</td>
<td>1st 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>13 trip to 20 close</td>
<td>25 to 40</td>
<td>2/0 to 2/15</td>
<td>2nd 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>21 trip to 28 close</td>
<td>41 to 56</td>
<td>3/0 to 3/15</td>
<td>3rd 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>29 trip to 36 close</td>
<td>57 to 72</td>
<td>4/0 to 4/15</td>
<td>4th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>37 trip to 44 close</td>
<td>73 to 88</td>
<td>5/0 to 5/15</td>
<td>5th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>45 trip to 52 close</td>
<td>89 to 104</td>
<td>6/0 to 6/15</td>
<td>6th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>53 trip to 60 close</td>
<td>105 to 120</td>
<td>7/0 to 7/15</td>
<td>7th 16-relay SBO XT</td>
</tr>
<tr>
<td>Bank 2 J8</td>
<td>61 trip to 68 close</td>
<td>121 to 136</td>
<td>8/0 to 0/15</td>
<td>8th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>69 trip to 76 close</td>
<td>137 to 152</td>
<td>9/0 to 1/15</td>
<td>9th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>77 trip to 84 close</td>
<td>153 to 168</td>
<td>10/0 to 2/15</td>
<td>10th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>85 trip to 92 close</td>
<td>169 to 184</td>
<td>11/0 to 3/15</td>
<td>11th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>93 trip to 100 close</td>
<td>185 to 200</td>
<td>12/0 to 4/15</td>
<td>12th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>101 trip to 108 close</td>
<td>201 to 216</td>
<td>13/0 to 5/15</td>
<td>13th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>109 trip to 116 close</td>
<td>217 to 232</td>
<td>14/0 to 6/15</td>
<td>14th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>117 trip to 124 close</td>
<td>233 to 248</td>
<td>15/0 to 7/15</td>
<td>15th 16-relay SBO XT</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Location</th>
<th>SBO Database Relay #</th>
<th>Sequential Relay #</th>
<th>Execute/Select</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank 1 J4</td>
<td>1 trip to 8 close</td>
<td>1 to 16</td>
<td>1/0 to 1/15</td>
<td>1st 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>9 trip to 16 close</td>
<td>17 to 32</td>
<td>2/0 to 2/15</td>
<td>2nd 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>17 trip to 24 close</td>
<td>33 to 48</td>
<td>3/0 to 3/15</td>
<td>3rd 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>25 trip to 32 close</td>
<td>49 to 64</td>
<td>4/0 to 4/15</td>
<td>4th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>33 trip to 40 close</td>
<td>65 to 80</td>
<td>5/0 to 5/15</td>
<td>5th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>41 trip to 48 close</td>
<td>81 to 96</td>
<td>6/0 to 6/15</td>
<td>6th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>49 trip to 56 close</td>
<td>97 to 112</td>
<td>7/0 to 7/15</td>
<td>7th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>57 trip to 64 close</td>
<td>113 to 128</td>
<td>0/0 to 0/15</td>
<td>8th 16-relay SBO XT</td>
</tr>
<tr>
<td>Bank 2 J3</td>
<td>65 trip to 72 close</td>
<td>129 to 144</td>
<td>8/0 to 8/15</td>
<td>9th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>73 trip to 80 close</td>
<td>145 to 160</td>
<td>9/0 to 9/15</td>
<td>10th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>81 trip to 88 close</td>
<td>161 to 176</td>
<td>10/0 to 10/15</td>
<td>11th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>89 trip to 96 close</td>
<td>177 to 192</td>
<td>11/0 to 11/15</td>
<td>12th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>97 trip to 104 close</td>
<td>193 to 208</td>
<td>12/0 to 12/15</td>
<td>13th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>105 trip to 112 close</td>
<td>209 to 224</td>
<td>13/0 to 13/15</td>
<td>14th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>113 trip to 120 close</td>
<td>225 to 240</td>
<td>14/0 to 14/15</td>
<td>15th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>121 trip to 128 close</td>
<td>241 to 256</td>
<td>15/0 to 15/15</td>
<td>16th 16-relay SBO XT</td>
</tr>
</tbody>
</table>

Table 4-3  C3800 SBO Relay Assignments

<table>
<thead>
<tr>
<th>Location</th>
<th>SBO Database Relay #</th>
<th>Sequential Relay #</th>
<th>Execute/Select</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank 1 J3</td>
<td>1 trip to 8 close</td>
<td>1 to 16</td>
<td>0/0 to 0/15</td>
<td>do not exist</td>
</tr>
<tr>
<td></td>
<td>9 trip to 16 close</td>
<td>17 to 32</td>
<td>1/0 to 1/15</td>
<td>1st 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>17 trip to 24 close</td>
<td>33 to 48</td>
<td>2/0 to 2/15</td>
<td>2nd 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>25 trip to 32 close</td>
<td>49 to 64</td>
<td>3/0 to 3/15</td>
<td>3rd 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>33 trip to 40 close</td>
<td>65 to 80</td>
<td>4/0 to 4/15</td>
<td>4th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>41 trip to 48 close</td>
<td>81 to 96</td>
<td>5/0 to 5/15</td>
<td>5th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>49 trip to 56 close</td>
<td>97 to 112</td>
<td>6/0 to 6/15</td>
<td>6th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>57 trip to 64 close</td>
<td>113 to 128</td>
<td>7/0 to 7/15</td>
<td>7th 16-relay SBO XT</td>
</tr>
</tbody>
</table>
## Table 4-4 C3800 / C3810 LANDAC II SBO Relay Assignments

<table>
<thead>
<tr>
<th>Location</th>
<th>SBO Database Relay #</th>
<th>Sequential Relay #</th>
<th>Execute/Select</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bank 1 J7 (C3810)</strong></td>
<td>1 trip to 8 close</td>
<td>1 to 16</td>
<td>1/0 to 1/15</td>
<td>1st 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>9 trip to 16 close</td>
<td>17 to 32</td>
<td>2/0 to 2/15</td>
<td>2nd 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>17 trip to 24 close</td>
<td>33 to 48</td>
<td>3/0 to 3/15</td>
<td>3rd 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>25 trip to 32 close</td>
<td>49 to 64</td>
<td>4/0 to 4/15</td>
<td>4th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>33 trip to 40 close</td>
<td>65 to 80</td>
<td>5/0 to 5/15</td>
<td>5th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>41 trip to 48 close</td>
<td>81 to 96</td>
<td>6/0 to 6/15</td>
<td>6th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>49 trip to 56 close</td>
<td>97 to 112</td>
<td>7/0 to 7/15</td>
<td>7th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>57 trip to 64 close</td>
<td>113 to 128</td>
<td>0/0 to 0/15</td>
<td>8th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>65 trip to 72 close</td>
<td>129 to 144</td>
<td>8/0 to 8/15</td>
<td>9th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>73 trip to 80 close</td>
<td>145 to 160</td>
<td>9/0 to 9/15</td>
<td>10th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>81 trip to 88 close</td>
<td>161 to 176</td>
<td>10/0 to 10/15</td>
<td>11th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>89 trip to 96 close</td>
<td>177 to 192</td>
<td>11/0 to 11/15</td>
<td>12th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>97 trip to 104 close</td>
<td>193 to 208</td>
<td>12/0 to 12/15</td>
<td>13th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>105 trip to 112 close</td>
<td>209 to 224</td>
<td>13/0 to 13/15</td>
<td>14th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>113 trip to 120 close</td>
<td>225 to 240</td>
<td>14/0 to 14/15</td>
<td>15th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>121 trip to 128 close</td>
<td>241 to 256</td>
<td>15/0 to 15/15</td>
<td>16th 16-relay SBO XT</td>
</tr>
<tr>
<td><strong>Bank 2 J8 (C3810)</strong></td>
<td>129 trip to 136 close</td>
<td>257 to 272</td>
<td>1/0 to 1/15</td>
<td>17th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>137 trip to 144 close</td>
<td>273 to 288</td>
<td>2/0 to 2/15</td>
<td>18th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>145 trip to 152 close</td>
<td>289 to 304</td>
<td>3/0 to 3/15</td>
<td>19th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>153 trip to 160 close</td>
<td>305 to 320</td>
<td>4/0 to 4/15</td>
<td>20th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>161 trip to 168 close</td>
<td>321 to 336</td>
<td>5/0 to 5/15</td>
<td>21th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>169 trip to 176 close</td>
<td>337 to 352</td>
<td>6/0 to 6/15</td>
<td>22th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>177 trip to 184 close</td>
<td>353 to 368</td>
<td>7/0 to 7/15</td>
<td>23th 16-relay SBO XT</td>
</tr>
<tr>
<td></td>
<td>185 trip to 192 close</td>
<td>369 to 384</td>
<td>0/0 to 0/15</td>
<td>24th 16-relay SBO XT</td>
</tr>
<tr>
<td><strong>Bank 3 J9 (C3800)</strong></td>
<td>129 trip to 136 close</td>
<td>257 to 272</td>
<td>1/0 to 1/15</td>
<td>17th 16-relay SBO XT</td>
</tr>
</tbody>
</table>

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>
<thead>
<tr>
<th>Select</th>
<th>Bit Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>FFFE</td>
</tr>
<tr>
<td>1</td>
<td>FFFD</td>
</tr>
<tr>
<td>2</td>
<td>FFFB</td>
</tr>
<tr>
<td>3</td>
<td>FFF7</td>
</tr>
<tr>
<td>4</td>
<td>FFEF</td>
</tr>
<tr>
<td>5</td>
<td>FFDF</td>
</tr>
<tr>
<td>6</td>
<td>FFBF</td>
</tr>
<tr>
<td>7</td>
<td>FF7F</td>
</tr>
<tr>
<td>8</td>
<td>FEFF</td>
</tr>
<tr>
<td>9</td>
<td>FDFF</td>
</tr>
<tr>
<td>10</td>
<td>FBFF</td>
</tr>
<tr>
<td>11</td>
<td>F7FF</td>
</tr>
<tr>
<td>12</td>
<td>EFFF</td>
</tr>
<tr>
<td>13</td>
<td>DFFF</td>
</tr>
<tr>
<td>14</td>
<td>BFFF</td>
</tr>
<tr>
<td>15</td>
<td>7FFF</td>
</tr>
</tbody>
</table>
The Execute will be displayed in the c34_print_sbo_table as the following bit patterns:

<table>
<thead>
<tr>
<th>Execute</th>
<th>Bit Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0001</td>
</tr>
<tr>
<td>1</td>
<td>0002</td>
</tr>
<tr>
<td>2</td>
<td>0004</td>
</tr>
<tr>
<td>3</td>
<td>0008</td>
</tr>
<tr>
<td>4</td>
<td>0010</td>
</tr>
<tr>
<td>5</td>
<td>0020</td>
</tr>
<tr>
<td>6</td>
<td>0040</td>
</tr>
<tr>
<td>7</td>
<td>0080</td>
</tr>
<tr>
<td>8</td>
<td>0100</td>
</tr>
<tr>
<td>9</td>
<td>0200</td>
</tr>
<tr>
<td>10</td>
<td>0400</td>
</tr>
<tr>
<td>11</td>
<td>0800</td>
</tr>
<tr>
<td>12</td>
<td>1000</td>
</tr>
<tr>
<td>13</td>
<td>2000</td>
</tr>
<tr>
<td>14</td>
<td>4000</td>
</tr>
<tr>
<td>15</td>
<td>8000</td>
</tr>
</tbody>
</table>

### 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.

```plaintext
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.