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Asynchronous Line Multiplexor Interfaces
for
Sun SPARCstation, SPARCserver, Compatible Workstations
and
Sun SPARCEngine 1E Board Level Computers

INSTALLATION & USER'S MANUAL

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1. INTRODUCTION

This user manual is supplied with **CoALM-S**, a family of high-performance controllers for asynchronous serial devices and a Centronics compatible printer port for workstations based on Sun Microsystems standard 32-bit SBus. CoALM-S controllers are fully compatible with all models of Sun workstations that use SBus. Specifically, they are supported in SPARCstation 1, 1+, 2, 10, IPC and IPX models. In addition, CoALM-S is fully compatible with SPARCsystem 600MP models and Sun SPARCengine 1E board level computers. A mix of up to 3 CoALM-S boards are supported in any one system, for a full configuration of 24 serial ports and 3 parallel printer ports.

This manual is intended primarily for Systems Administrators or others in charge of installing equipment on Sun Microsystems and compatible SBus based workstations. As such, it is assumed that the reader has basic systems administration skills. Familiarity with Sun Microsystems' **Systems Administrators** manual for adding hardware is essential, because a number of functions described in this manual provide equivalent functions as recommended by Sun. Information contained in this manual should be used to *install, configure, use and maintain* a complete serial communications subsystem that incorporates CoALM-S. The name **CoALM-S** applies to any member of the family: **CoALM-S4, CoALM-S4E, CoALM-S8, CoALM-S8P**, CoALM-S8P(Mil) or CoALM-S16P.

The manual is very specific to SunOS and OS/MP and may not be used for configuring these peripherals in other systems. These peripherals may be available for other SBus based workstations. Please contact CoSystems for support of such systems.

CoALM-S boards support up to eight serial devices with any combination of asynchronous formats and data rates up to 38.4 kbps (bits/second). The standard configuration for all channels is EIA-232E (RS-232) with 25-pin female connectors and a female DB25 connector for the the IBM PC (Centronics) standard printer interface. An optional EIA-422 converter (PN 10304420x) is available that converts the Tx and Rx signals to differential for long line applications.

CoALM-S boards are supplied with a software driver that supports all asynchronous functions of Sun's ALM-2 controller for VMEbus based systems. In particular, CoALM-S supports dial-in and dial-out on all ports. The driver for CoALM-S is called "css" and this name is used interchangeably with CoALM-S. SunOS releases 4.1, through the latest, 4.1.3 are supported. SunoS 4.0.X is not supported. Solaris 2.0 is not supported by the drivers in this release.
If you are using Solaris 2.0, this driver is of no use to you. CoSystems is committed to supporting Solaris 2.0 but because the driver must be substantially modified you must obtain a driver specifically for the Solaris 2.0 release. If your purchase is under warranty you may be eligible for a free upgrade.

Expert Systems Administrators may wish to first read the section "QUICK INSTALLATION" and proceed with the installation. Novice users are urged to read the entire manual before proceeding.

This manual is organized in the following main sections:

1. **Unpacking and inspecting CoALM-S**
2. **Configuring and installing CoALM-S**
3. **Connecting serial devices to CoALM-S**

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4. Setting configuration flags
5. Connecting Modems to CoALM-S
6. Connecting Printers to CoALM-S
7. Manually Configuring a Kernel
8. A Serial Communications Primer
9. Appendices:
   1. Connector and Interface Information
   2. Using coalmdiag, a local diagnostics utility
10. Defect Report Form
11. Reader Comment Form

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2. UNPACKING AND INSPECTING CoALM-S

Each model of the **CoALM-S** family is a single, Sun compatible, SBus board that is shipped in an electrostatic-proof envelope that is sealed and safely packaged between two pieces of sponge for protection. The CoALM-S and accessories are packaged in a sturdy carton suitable for shipment. Also included may be a conversion panel, cables that connect this panel to CoALM-S and a Sun compatible floppy disk that contains the driver software. If you requested your driver on cartridge tape it is usually a QIC-150 style.

Please inspect the shipping carton for possible damage in transit. Do not further unpack the unit(s) if you suspect there is some damage. Notify the shipping carrier and CoSystems immediately.

If there is no evidence of damage, carefully unpack CoALM-S. CoALM-S has electrostatic sensitive components and should be handled with care. While configuring and inspecting CoALM-S, it can be laid on top of the electrostatic envelope placed on top of the foam pad.

Please check that all of the following items are in the shipping carton:

- CoALM-S4, CoALM-S4E, CoALM-S8, CoALM-S8P or CoALM-S16P Board
- User's Manual
- 3.5" Floppy disk
- With the CoALM-S4 and -S4E, 4 modular telephone cables and 4 adapters to convert the RJ45 connector to DB25.
- With CoALM-S8, CoALM-S8P, CoALM-S16P and CoALM-S8PMil, a long cable for connection to a converter panel
- With CoALM-S8, CoALM-S8P and CoALM-S16P, a panel that converts signals from flat ribbon cable to standard DB25 connectors for connecting serial devices. The panel for CoALM-S8P has an IBM-PC compatible printer port on the panel cable.
- With CoALM-S4E a copy of this manual is shipped with a short installation addendum. The User's Manual and floppy disk are not shipped with CoALM-S4E. A CoALM-S4E also includes a short (1 inch) ribbon cable for connecting it to an adjacent CoALM-S4.

If any of these items is missing, please contact CoSystems immediately.

Please save the shipping cartons and the packing material for future use.

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3. QUICK INSTALLATION

If you are familiar with SBus and serial communications subsystems on Sun machines, this section may help you expedite installation on your system. The next section gives further details if any problems are encountered.

Steps for auto-installation of the driver and a terminal login on port 0 of CoALM-S:

1. **PREPARE THE WORKSTATION** - Shut down the operating system. Switch off the power and unplug the power cord. Remove the top cover by removing screws at the back of the CPU box. IPC and IPX systems have 2 latches on either side. Depress these and slide the top up top remove.
2. **INSTALL CoALM-S IN A SPARE SBus SLOT**. Remove the dummy front plate on the spare slot. Unpack CoALM-S. Carefully align its front panel and the SBus connector from inside the CPU box. Press firmly on the connector area on CoALM-S to properly seat it in the slot.
3. **REBOOT THE WORKSTATION**. Replace the top cover on the workstation. Apply power and let the system boot with the standard SunOS kernel.
4. **RETRIEVE CoALM-S SOFTWARE FROM FLOPPY**. Login as "root", and change to "/dev" directory. Insert the software distribution floppy in the drive on the side of CPU box. Extract the drivers and utilities by typing:

   tar xvf /dev/rfd0a

   If you do not have a floppy drive on the machine on which you are trying to install, you will need to copy the files from a machine on your network that does have a floppy. Remove the floppy by typing the command "eject". Save it in a safe place.
5. **INSTALL THE CoALM-S SOFTWARE**. Type the following command when in the "/dev" directory (as root):

   css.INSTALL

   Follow these steps:

   - When the install script asks how many boards to make devices for, you may type one or return. If you are planning to add CoALM-S boards you may enter a number up to six.
   - When asked whether the driver should be automatically loaded each time you re-boot, answer "y". Answer "n" only if you wish to evaluate the CoALM-S. After the next reboot, the CoALM-S must be loaded manually with css.LOAD.
   - The script then executes a "modload" command to dynamically load the css driver in to your current kernel.
   - It then makes the special device files which are named */dev/ttyZ0* through */dev/ttyZ7*, lpz and others if requested. If these files already exist, they are *not* removed.
6. **CONNECT A TERMINAL TO CoALM-S** (9600 bps, 8 bits no parity) with a cable prepared according to the installation manual to port 0 of CoALM-S. On the -S4 port 0 is the left-most RJ45 jack looking into the -S4.

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7. Check the basic operation of the CoALM-S by:

   cat /etc/motd >/dev/ttyZ0

   A message should appear on the terminal and the console prompt should appear at your window. If this does not happen, there is a problem and you should begin debugging.

8. Finally, Enable a login on the terminal. Change the following line to the */etc/ttytabs* file or add it if it does not exist:

   ttyZ0 "/usr/etc/getty std.9600" unknown on local secure

   The "unknown" field should be changed to reflect the type of terminal you are using. The "off" field is changed to "on" Then type *kill -1 1* at the console so that the login is enabled. The login prompt should appear at the terminal.

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4. CONFIGURING AND INSTALLING CoALM-S

CoALM-S requires simple but carefully executed changes to your system for proper configuration and installation.

Because the physical installation and hardware/software configuration procedures are intertwined, we use the word *configuration* to describe both procedures.

CoALM-S boards may be used in any slot on the SBus. Multiple CoALM-S boards may be located in a machine without any special configuration. The software supplied on the floppy disk allows run time configuration of the driver into the kernel also known as "loadable" drivers. Alternatively, the supplied driver may be statically linked into the SunOS kernel for controlling CoALM-S. See section 11 for linking the driver into the SunOS kernel. There is no performance impact to consider when selecting which method to use. That is, the system performance is the same whether the driver is statically built into the kernel or loaded. The static build method exists for those users who need to fix the special device major number. This method also results in a slightly shorter boot time because the driver is copied into memory with the kernel.

PLEASE READ THE "README" FILE OR "ADDENDUM" IF INCLUDED WITH CoALM-S FOR THE LATEST INFORMATION ON CHANGES THAT HAVE NOT YET APPEARED IN THIS MANUAL.

The following lists all steps that must be executed in order to successfully complete the configuration process:

- Install CoALM-S in Sun workstation chassis.
- Retrieve CoALM-S driver and installation script from tape.
- Load or Build a new SunOS kernel to include CoALM-S driver.
- Connect terminals (or other devices) to CoALM-S.
- Reboot the system (for static build only).

For this process, the Sun workstation must be properly shut down by following procedures recommended by Sun Microsystems and power must be switched off. For added protection, disconnect the power cord that supplies AC power to the workstation.

4.1 Installing CoALM-S in SPARCstation chassis

Physical installation of CoALM in the Sun SPARCstation or other system chassis is straightforward. The board may be located in any empty SBus slot. Remember that the component side of CoALM-S faces up, in tune with other boards. On the 600MP systems and the SPARCengine 1E boards, you will need to remove the top piece of the face plate on CoALM-S so that it fits in the faceplate of the system. Further, on the SPARCengine, you should remove the black plastic retainer and screw the CoALM-S card into the studs on the motherboard. Save the top piece of the faceplate and the screws in a plastic bag in case you ever want to install the card in a desk-top SPARCstation.

A CoALM-S4E must be located adjacent to a CoALM-S4 on the side where there is a small jumper block. The small jumper blocks on the CoALM-S4 and CoALM-S4E must be

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interconnected with the small ribbon cable shipped with the CoALM-S4E.

Take time at this point to check your cabling to terminals and printers.

4.2 Retrieving driver and utilities from distribution disk

All necessary utilities and a binary copy of the driver are distributed on floppy disk in *tar* format. The standard medium is a 3 1/2" floppy disk.

Currently, the following files are on the distribution tape:

1. *"README"* is a file containing the latest information on the version of drivers and/or firmware with your shipment. It will list any special instructions which could not be included in this manual. Please read this file before installing CoALM-S.
2. *"VER.x.y"* is an ascii text file that confirms the current version of the release.
3. *"MANUAL.ps"* is this document in PostScript printable format.
4. There are three directories at this level, "sunos4.1", "sunos4.03" and "solbourne". If you are installing on a Solbourne workstation, follow the installation procedures described in section 12. Use the appropriate directory for your version of the operating system; the directory "sunos4.1" should be used for installing on a SunOS 4.1 and above operating system. In the sunos4.1 directory, the following files may be found:
    1. *"css.o.4c"* is a CoALM-S driver for SPARCstations; it handles all CoALM-S models and includes support for the printer port on CoALM-S8P and CoALM-S16P.
    2. *"css.o.4e"* is a driver for Sun SPARCengine 1E VMEbus board level computers.
    3. *"css.o.4m"* is a driver for Sun SPARCsystem 4/600MP (all models),
    4. *"css.INSTALL""* is an installation script. The script initializes the driver on a system while running and makes the device files entries. in the "/dev" directory.
    5. *"css_kernel.BUILD"* is an installation script used to install the CoALM-S and build a kernel with css. It also makes the device files.
    6. *"edits"* is a file that lists all changes required in various files when configuring in CoALM-S for SunOS. If you are manually configuring your kernel to include the driver. Use portions of this file for assistance when editing the configuration files.
    7. *"css.4s and ttycsflags.8"* are man page files for on-line documentation.
    8. *"MAKEDEV.cs"* is a script that makes special device files for CoALM-S for
    9. *"MAKEDEV.cs9"* is a script that makes special device files for the first CoALM
    10. *"confawk"* and *"createcsflags"* are scripts used during automatic kernel installation
    11. *"UTILS/coalmdiag"* is a utility for testing and CoALM-S.
    12. *"UTILS/ttycsflags"* is a user command that allows run time reconfiguration of the serial channel configuration flags. Flags permit configuration of such parameters as hardware or software flow control and receiver optimization.
    13. *"UTILS/coalm_printer_status"* is a utility that prints the status of the printer port (S8P, S16P and S8P(Mil) only)

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14. *"UTILS/coalm_printer_status.c"* is the source code for coalm_printer_status.
15. *"EXAMPLES/vcrin.c"* and *"EXAMPLES/vcrout.c"* are examples of how to program serial ports.

In the solbourne directory, the driver object file is different. It is called *css.o.idt*. Because OS/MP does not support dynamic loading, there is no css.INSTALL script. You must use css_kernel.BUILD.

The following steps retrieve the files:

1. Apply AC main power to the Sun workstation and bring it up to normal operation with your standard kernel.
2. Login as "root" or acquire superuser status and change to a temporary working directory.
3. Load the floppy disk in the unit. If you do not have a local floppy disk on your target machine, these files may be retrieved on another workstation on the network and copied over using *rcp*.
4. Change the current working directory to */dev* if using automatic loading of driver is desired or in "/tmp" if you are planning to build a new kernel. Make a directory called "CoALM-S" and cd into it. This last step is not absolutely required, but avoids conflicts if additional CoSystems products are installed at a later time.
5. Execute the tar command *tar xvf /dev/rfd0a*. Note that the retrieved software is placed relative to "." directory. If you do not have a floppy drive on your machine you will need to copy the files from another machine on your network that does.

4.3 Automatic Configuration Of Driver - Dynamic Loading

A SunOS kernel that contains a communications driver for accessing CoALM-S is required in order to access the serial and parallel ports.

The software can be completely installed even on a running, multiuser system by executing the "css.INSTALL" script. This must be executed with super user permissions. Note that the kernel allocates the next available major device number to the CoALM-S driver for special device files. If you wish to allocate specific major device numbers, consider using the second, more conventional method of statically linking the driver into your kernel.

AUTOINSTALLATION MUST ONLY BE ATTEMPTED ON KERNELS THAT DO NOT HAVE THE CSS DRIVER CONFIGURED IN. This is the case for the first time installation.

Type the following command when in the */dev* directory (as root):

css.INSTALL

This script performs the following tasks:

1. Asks whether you want to load the driver automatically each time you re-boot. If your answer is yes, it modifies the */etc/rc.local* script to call the script */etc/loadable*. If this script does not exist, it is created.

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2. The */etc/loadable* script is then modified to include a *modload* command to load the css driver automatically as part of the boot sequence.

3. It also creates a script */etc/setcssflags* which sets the operational parameters such as hardware or software control and whether the port is intended to be a modem port. At the end of your installation process, edit this script to set up your local modes for each port. The default configuration for all ports is for a hardwired device, with neither flow control nor receiver optimization.

   NOTE THAT THE PORTS ARE CONFIGURED ACCORDING TO THIS SCRIPT ONCE, AT SYSTEM BOOT-TIME. THE MODES SET IN THIS SCRIPT APPLY ON ANY OPEN OF THE PORT.

4. It makes several other files which are really links to itself to perform specialized tasks such as making devices, loading and unloading the driver etc. A file named css.DEINSTALL is created and is used to completely deinstall the CoALM-S if you ever wish to do so.

5. At this time, it executes a *modload* command to dynamically load the css driver into the kernel.

6. It then makes a number of special device files for each of the eight serial ports, the companion dial-out ports, and the parallel port. You may choose to make more special files if needed.

7. It writes a file called *css.ID* which identifies the module identifier returned as a part of the *modload* command. This is useful if you want to later unload the css driver using the "modunload" command.

8. It copies the files *css.4s* and *ttycssflags.8* to */usr/man* directory to support the on-line man page commands.

9. Entries are added to */etc/ttytab* for the first board.

After css.INSTALL is successful, do not run it again until css.DEINSTALL is run. If you ever need to load the css driver use css.LOAD. This also creates the device files. Use css.UNLOAD to remove the driver and remove the device files.

The script makes the special device files in */dev* for the number of boards specified.

You also need to edit the */etc/ttytabs* file to enable logins at terminals and may need to edit various other files such as */etc/remote* for supporting "tip", "uucp" and dial-in/dial-out capabilities over modems.

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5. CONNECTING SERIAL DEVICES TO CoALM-S

5.1 CoALM-S4 and CoALM-S4E

Because most users are accustomed to connecting to serial ports via EIA-232 standard twenty-five pin D type (DB25) connectors, CoALM-S4 and CoALM-S4E are supplied with an eight conductor telephone style cable with an RJ45 connector at each end and an RJ45 to DB25 converter for each serial port. The user simply plugs one end of the cable into the desired port on the CoALM-S and the other end into the RJ45 connector on the back of a converter. The jack for port 0 is on the left as you look into the four jacks.

The RJ45 to DB25 converters are shipped unassembled and may be configured with any pinout on the DB25 side which the user desires. It is recommended, however, that one of the two configurations given in Tables 2 and 3 below be used. The configuration of Table 2 is recommended because it matches the pinout of the serial ports built into Sun systems. The advantage to this is that devices which operate correctly when connected to a Sun native port can be connected to the CoALM-S without a change in the connecting cable (i.e. addition or removal of a null modem).

The first step in assembly of the RJ45 to DB25 converter is to identify the two respective connector pieces. The RJ45 connector may be recognized by the eight colored wires which are attached to it. The DB25 connector shell is black plastic partially covered with a plastic hood. Each of the colored wires attached to the RJ45 connector should have a gold contact mounted on it's free end. Assembly of the DB25 connector is done by inserting each of the gold contacts into one of the numbered holes on the rear of the DB25 shell and pushing it in until it snaps into place.

Important: Be very sure that each contact is in the correct hole before snapping it into place. Once installed the contacts may not be removed without destroying the shell.

Once the DB25 is configured as desired, final assembly is accomplished by fitting the RJ45 connector and the DB25 connector into the appropriate positions in the converter enclosure and securing the enclosure halves together with the accompanying hardware.

TABLE 1. RJ45 To DB25 Converter Wiring (SUN Port Equivalent - DTE)

Signal Name	Abbreviation	Color	Pin Number
Request To Send	RTS	White	4
Data Terminal Ready	DTR	Brown	20
Transmit Data	TXD	Yellow	2
Data Carrier Detect	DCD	Green	8
Receive Data	RXD	Red	3
Signal Ground	GND	Black	7
Data Set Ready	DSR*	Orange	6
Clear To Send	CTS	Blue	5

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TABLE 2. RJ45 To DB25 Converter Wiring (SUN Port Opposite - DCE)

Signal Name	Abbreviation	Color	Pin Number
Request To Send	RTS	White	5
Data Terminal Ready	DTR	Brown	6
Transmit Data	TXD	Yellow	3
Data Carrier Detect	DCD	Green	8
Receive Data	RXD	Red	2
Signal Ground	GND	Black	7
Data Set Ready	DSR*	Orange	20
Clear To Send	CTS	Blue	4

* not used

When the configuration described by Table 2 is used, the port is wired as Data Terminal Equipment (DTE) according to EIA-232 specification. The user will need a null modem cable to connect to other DTE type equipment (i.e. ascii terminals). Inversely, a straight cable correctly connects the port to Data Communication Equipment (DCE) such as a modem.

Using the configuration described in Table 3 results in a port wired as DCE and is the natural opposite of DTE. This configuration may be useful to those who wish to interface to terminals but, may lead to confusion because it is opposite that of the Sun native ports.

The CoALM-S4 and CoALM-S4E each have 4 telephone style RJ45 connectors which extend through the metal face plate and are accessible from outside of the host system enclosure. Each connector carries all of the signals for one serial port. The signal pinout for each RJ45 is listed in Table 4.1 below. Correct orientation is found by looking into the connector opening while holding the printed circuit board horizontally with the component side towards the ceiling and the SBus connector side towards the floor. Contact 1 of each RJ45 is the contact on the left and the other contacts are numbered sequentially to the right.

TABLE 3. RJ45 PINOUT

Contact	Signal Name	Abbreviation	Direction
1	Request To Send	RTS	Output
2	Data Terminal Ready	DTR	Output
3	Transmit Data	TXD	Output
4	Data Carrier Detect	DCD	Input
5	Receive Data	RXD	Input
6	Signal Ground	GND	-----
7	Data Set Ready	DSR*	Input
8	Clear To Send	CTS	Input

* not used

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5.2 CoALM-S8, CoALM-S8P and CoALM-S16P

The CoALM-S8, CoALM-S8P and CoALM-S16P are both normally shipped with a ribbon cable assembly and an EIA-232 distribution panel. The distribution panel is a metal enclosure which has connectors extending through it's top.

The CoALM-S8 panel connectors consist of 8 female EIA-232 standard DB25 connectors and a sixty conductor ribbon cable connector while the CoALM-S8P panel has 9 female DB25 connectors and an eighty conductor ribbon cable connector. In both cases, the connectors labeled P0 through P7 correspond to the eight serial ports.

The CoALM-S16P panel connectors consist of 17 female EIA-232 standard DB25 connectors which are labelled P0 through P15.

Note: The board should be physically installed in the host system before attaching the cable.

One end of the cable assembly is attached to the mating connector on the distribution panel and one end to the CoALM-S. There are white orientation arrows on the bodies of all connectors to guide the user to the correct mating alignment. Additionally, the connectors are physically keyed to prevent incorrect mating and in the case of the CoALM-S8P, there are ejection levers on the bodies of the connectors mounted on the cables which must be depressed prior to mating. The ribbon cable connectors, aligned properly, mate smoothly and easily and snap into place.

Warning: Do not use excessive force to mate the ribbon cable connectors or damage will likely result. If resistance to mating is encountered inspect both connectors to make sure they are not damaged and if not then recheck the mating alignment.

Once the distribution panel is connected to the CoALM-S, the user may connect to the individual serial ports in the same manner in which connections are made to the serial ports built into the Sun host system. The signal pinout for the serial ports of both CoALM-S8 and CoALM-S8P, described in Table 4 below, is equivalent to the pinout of the Sun native ports. Devices that are usable on Sun Native ports may be connected to CoALM-S ports without any change in cabling.

TABLE 4. CoALM-S8 and CoALM-S8P Serial DB25 Pinout

Signal Name	Abbreviation	Pin Number	Direction
Request To Send	RTS	5	Output
Data Terminal Ready	DTR	6	Output
Transmit Data	TXD	3	
Data Carrier Detect	DCD	8	Input
Receive Data	RXD	2	
Signal Ground	GND	7	---
Data Set Ready	DSR	20	Input*
Clear To Send	CTS	4	Input

*used only if CoALM-S has 96-pin connector such as with CoALM-S8P(Mil).

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TABLE 5. CoALM-S16P Serial DB25 Pinout for Serial Ports 0 - 3

Signal Name	Abbreviation	Pin Number	Direction
Request To Send	RTS	5	Output
Data Terminal Ready	DTR	6	Output
Transmit Data	TXD	3	
Data Carrier Detect	DCD	8	Input
Receive Data	RXD	2	
Signal Ground	GND	7	---
Data Set Ready	DSR	20	Input*
Clear To Send	CTS	4	Input

Note that the full modem signals are only available on the first 4 ports on CoALM-S16P. The remaining 12 ports are 3 wire interfaces as defined in the following table:

TABLE 6. CoALM-S16P Serial DB25 Pinout for Serial Ports 4 - 15

Signal Name	Abbreviation	Pin Number	Direction
Transmit Data	TXD	3	
Receive Data	RXD	2	
Signal Ground	GND	7	---

The DB25 connector, labeled PAR, on the CoALM-S8P and the CoALM-S16P distribution panels is a parallel port which has a completely different pinout than serial ports. Serial devices may not be connected to port PAR. This port is for use with devices which have a Centronics style parallel interface such as printers.

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6. SETTING CONFIGURATION FLAGS FOR SERIAL CHANNELS

There are several flags that govern the behavior of each active serial channel. The flags configure the following:

1. Select the channel either as a hardwired device (which always asserts the carrier detected condition) or as a remote device which waits for a hardware carrier detect signal from a modem. This feature can also be accessed from the *ttysoftcar* command which is a standard SunOS 4.1.x feature.
2. Select and set the various modes and values related to flow control options. For more details, see the subsection FLOW CONTROL FOR SERIAL DEVICES.
3. Select the receiver optimization algorithm for a channel. For more details see the subsection OPTIMIZING RECEIVER DATA BUFFERING.

IF AN OPTION IS NOT SPECIFIED, ITS DEFAULT VALUE PERSISTS UNTIL CHANGED BY A PROCESS.

These flags and parameters are set by executing the *ttycsflags* command which has the following syntax:

ttycsflags [-h | -s | -o | -d] special-file

where the optional flags are:

-h selects hardware flow control - default is no flow control.

-s selects software flow control - default is no flow control.

-o selects the receiver buffer optimization feature - default is no optimization.

-d causes all flags to be reset, which is the default condition.

For the given special file (e.g. */dev/ttyZ2*) if no options are provided, the command prints the current values for the channel.

The default configuration of the device is as a hardwired device (software carrier detect) with no other options selected.

Commands for setting these options are usually placed in the script */etc/setcssflags* which is created by the *css.INSTALL* installation script. These commands are normally executed once, per channel, at system boot time. The result of executing this command is a change in the initialization of the port. The new setting is applied at each subsequent open of the device.

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6.1 Flow control for serial devices

There are two types of flow control that may be chosen:

1. **Out-of-band (hardware) flow control**. The channel uses CTS and RTS signals on the EIA-232 connector for transmit and receive sides. CTS is an input to the CoALM-S serial channel. Transmissions from CoALM-S only occur when the CTS pin is asserted. RTS is an output from CoALM-S to the connected serial device. CoALM-S receives data only if it has asserted the RTS pin. The response time at this level is immediate (on a character by character basis) and "cost" in terms of host processor overhead in this this mode is minimal. Your serial device should be wired to react to the CTS and RTS signals accordingly. Note that if your device requires a constantly asserted DTR as input to operate at all, you should plan to tie its DTR input to "high" independently of CoALM-S. Such devices usually supply a "high" signal when ready to accept data; this signal can be looped back to the device's DTR. The usual trick that works is to loopback the DTR output of your equipment to the DSR (and or DCD) input of your equipment.

2. **In-band flow control**. This style uses XON/XOFF characters to regulate the flow, is implemented on-board the CoALM-S and has a much faster response than the native ports. The data in the receive stream is simply scanned for the XON/XOFF characters and the transmission from CoALM-S started or stopped accordingly. These characters are not filtered but passed on to SunOS. When receiving data from serial devices, the CoALM-S inserts XON/XOFF characters in the transmissions depending on the internal receive buffer capacity.

6.1.1 Setting Flow Control Options

The flow control options are fully accessible through the *termio*(4) ioctls, no further configuration is required if you are using the standard SunOS mechanisms for flow control.

The following section is intended for those applications which require greater control over the flow control parameters.

Beyond the standard SunOS mechanism to set the flow control parameters, these options can be set on CoALM-S from the script "/etc/setcssflags" at system boot time.

THE FLOW CONTROL OPTIONS SET BY THE SETCSSFLAGS SCRIPT SURVIVE ALL OPEN AND CLOSE ACTIONS ON THE SERIAL PORTS AND CAN BE CONSIDERED INITIALIZATION VALUES FOR THE PORT.

Note that each channel has individually programmable flow control.

The option "-h" sets the channel for hardware flow control.

The option "-s" sets the channel for firmware (XON/XOFF) flow control.

Both transmit and receiver side in-band flow control are processed by the CoALM-S without assistance from the host.

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6.1.2 *Guidelines For Using Flow Control*

The following guidelines should be used in configuring flow control:

- Extended flow control options should not be used unless there is a definite need for it. Most modern terminals accepts data at the full rate. CoALM-S is fast enough to maintain full input speeds at 9600 bps without overrunning its buffers. The need for flow control is also likely if you have a large number of channels which continuously receive data from other equipment. In such cases without flow control, receive data buffers may overflow.
- The two flow control mechanisms are independent of each other, but the hardware flow control negates the effect of any firmware flow control because firmware flow control simply wastes the processor cycles.
- If a device requires extended flow control, attempt to get it working with the hardware flow control.
- Use firmware flow control only as a last resort after you have made a serious attempt to get the device working with hardware flow control as described above.
- Note that firmware flow control does not filter XON/XOFF characters from the receive data stream. This is performed so as to allow full "raw" mode of operation for applications programs that use raw devices. For normal applications, this has no side effects. On the transmit side, extra XON/XOFF characters are inserted in the transmissions to regulate the receive data. If you are using "raw" access to serial ports, carefully consider the effects of this on your data streams.
- For the reason noted above, applications performing binary data transfer may not find this option acceptable.
- The flow control settings applied to the printer port has no effect on the hardware. Its transmissions are regulated by the BUSY and ACK* bits on the Centronics interface.
- Hardware flow control between CoALM-S ports on different machines is a reliable method for transmitting data between the machines, if the serial method is your only option. Full flow control conditions are transmitted on both sides all the way up to the applications programs.

6.2 Optimizing receiver data buffering

Using the CoALM-S driver receiver optimization feature results in a significant reduction in the number of interrupts generated by the board. If this option is not used, each received character causes one interrupt to the system. If used, then the number of interrupts is reduced by a factor of up to 8.

6.2.1 *Setting Optimizing Option*

To enable this feature of a particular channel, use the "-O" option of the *ttycsflags* command as described above. The default is to *not* perform receiver optimization.

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6.2.2 *Guidelines For Using Receiver Optimization*

1. This feature should be used for normal terminal login sessions for humans. Fast keyboard input particularly benefits the overall system by buffering characters but without significant loss of the interactive feedback. Very fast typists may feel disconcerted since the characters will be echoed in a "bunch" as opposed to singly.
2. This feature should be enabled for applications which receive constant streams of data from other machines such as CPUs, mice, trackballs, document scanners etc.
3. Do NOT use this feature for applications that require receipt of packetized data, especially if the packet sizes vary a great deal.
4. Receiver optimization may cause performance anomalies with UUCP. You should try both settings to see which works best with your modem.

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7. CONNECTING TELEBIT MODEMS TO CoALM-S

The Telebit(tm) family of modems, including the TrailBlazer(tm), are extremely popular with workstation users. These modems offer very high throughput at effective rates between 9600 and 19200 bps. They also offer a substantial throughput increase for UUCP transfers which reduces connect time and thus phone bills. Although they are quite flexible, they may seem complicated to the novice. The following may be used as guidelines when connecting Telebit modems.

When installing a modem first thoroughly read the instruction manual for the modem and gain familiarity with its operation. Secondly, read the section entitled 'Adding Hardware to Your System' in the Sun Systems and Network Administration Manual.

As an example, to connect a modem to port 4 a special device entry must be created. Note that cuZ4 should exist in /dev with minor number set to 132 (not 4). This allows both a dial-in and dial-out to occur on the same port. The special device /dev/cuZ4 can be created if necessary with the following command sequence:

```
mknod /dev/cuZ4 c 104 132
chown uucp /dev/cuZ4
chmod 600 /dev/cuZ4
```

To begin modem checkout use tip to make sure that the modem is responsive and properly programmed. Edit the /etc/remote file. There should be two lines for a remote host called 'hardwire' in this file. Insert the following two lines at the end after the 'dialers' line or with the other host names. Edit these new lines to reflect the port on which the modem is attached. For example for a 19200 Baud modem on IttyZ4 with 'cu' device as cuZ4, the line should read:

```
hardZ4:
:dv=/dev/cuZ4:br#19200:el=^C^S^Q^U^D:ie=%$:oe=^D:
```

At this point if the modem is powered on and properly connected, type:

```
tip -19200 /dev/cuZ4
```

Tip should respond with 'connected' if everything works properly. Now type AT<ret>. The modem should respond with 'OK' or '0'. If you get no response try AT several more times just to be sure. If this fails you must double check the cables, CoALM-S driver configuration and modem installation instructions until the modem responds with OK or 0. Continue only after you are sure the modem is alive and you can communicate with it. If you get the '0' response set the verbose mode by ATV1.

Most AT command set compatible modems have software registers called the 'S' registers which may be set by the user and affect operating modes of the modem. The command to set an 'S' register is

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ATSnn=xx<ret>

where nn is the register number and xx is the value. The register value is printed by :

ATSnn?<ret>

The following register values should be set for the Telebit models shown. These values have been tested and found to be satisfactory with use with CoALM-S. For models not shown consult the manual for your modem and use the corresponding S register settings. Note that these settings demand the CoALM-S port to be configured with hardware flow control as described in section 6. Do not use XON-XOFF flow control, this only confuses matters and the Telebit modems support hardware flow control very well. Not all register values are covered here. For these values select your preference, or leave to the default. Most of the other register values are not relevant for simple operation.

These register values must be done once manually via the above hardwire method and saved in the user profile or by some other programmatic method. Note that the SunOS 4.1 Honey-Danberr uucp implementation has a tb1200, tb2400 and tbfast entry in the Dialers file for easy installation. For SunOS 4.0X only the ACUHAYES type is accepted and you should additionally set ATX0 to coerce Hayes style result codes for uucp.

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TABLE 7. TrailBlazer Plus & T2000

S Register Description	Setting	S Register	Notes
Modulation Speed	Automatic	S50=0	See also S90, S91, S92 for V.22 modes
Interface Speed	Automatic	S51=255, S66=1	Works for call-out at any rate. For dial-in set to the desired rate.
DTR interpretation	Modem disconnect	S52=1 or	Use value 2 with S52=2 user profile first!
DCD interpretation	DCD follows carrier	S53=3	
BREAK signal interpretation		S54=3	Allow BREAK signaling
Flow control (DTE)	Full duplex hardware control	S58=2	You must use HW flow control or data will be lost !
Flow control (DCE)	Same as DTE	S68=255	
Data Format	8, none, 1	S60=0	Binary data needs 8 bits
UUCP support	UUCP 'g'	S111=30	This must be set to realize full UUCP transfer rates
Auto Answer	for dial-in no dial-in	S0=1 S0=0	Allow auto answer No auto answer

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TABLE 8. TrailBlazer T1600 & T3000

S Register Description	Setting	S Register	Notes
Modulation Speed	Automatic	S50=0	See also S94
Interface Speed Automatic	S51=254, S66=1	Works for call-out	
DTR interpretation	Modem disconnect	&D3	Reset and Reload user profile on DTR on to off transition
DCD interpretation	DCD follows carrier	&C1	
BREAK signal interpretation		S61=0,S63=1	Immediate BREAK signaling
Flow control (DTE)	Full duplex hardware control	S58=2	You must use HW flow control or data will be lost !
Flow control (DCE)	Same as DTE	S68=255	
UUCP support	UUCP proto 'g'	S111=30	This must be set to realize full UUCP transfer rates

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8. CONNECTING A PRINTER TO CoALM-S8P and CoALM-S16P

The distribution panel supplied with the CoALM-S8P and CoALM-S16P has 9 female DB-25 connectors. The connector marked **PAR** is for connecting a printer to these boards.

The printer interface is identical to the parallel printer port on an IBM-PC or compatible. The boards are not shipped with a printer cable, but any standard IBM-PC printer cable can be used. CoALM-S8P and CoALM-S16P support most IBM-PC compatible printers.

The printer port is always configured in the kernel at auto-load time regardless of whether the printer was actually connected to board or not. The boards detect the following printer conditions:

1. *Printer Offline*. No printing can occur until the printer is put on-line usually with a button on the printer front panel.
2. *Out of paper*. Printer needs more paper to continue printing.
3. *Printer Error*. An error detected at the interface; is usually specific to the printer.

These error conditions are reported at the systems console on the Sun workstation when the printer port is open by the spooler. The messages will *not* be printed if there are no print jobs in the queue, thus avoiding needless, irritating messages. They are also *not* printed if the port is closed, even if data remains to be printed.

The file */etc/printcap* contains entries for many popular printers. Consult Sun documentation for your system and printer. The following entry has been tested at CoSystems for Epson FX and Epson compatible dot matrix printers (such as Panasonic etc):

```
lp|local line printer:\
        :lp=/dev/lpz:\
        :sd=/usr/spool/lpd:pl#66:pw#80:sh
```

STREAMS automatically translates certain characters into multibyte sequences. Namely carriage return and tabs are expanded. When sending data to printers or devices that require no conversion of special characters (that is binary or graphics data) you must suppress the conversion with the *-opost* option as shown below.

```
lp|local line printer:\
    :lp=/dev/lpz:\
    :ms=-opost:\
    :sd=/usr/spool/lpd:pl#66:pw#80:sh
```

Further, you cannot use the *cat* utility to copy data to the port because there is no way to suppress the conversions. The *cat* utility may be used to copy PostScript data because it is ASCII with carriage returns and/or line feeds.

With serial printers the printcap differs somewhat. Namely the ms field may include various settings from the *stty(1) man page* such as ixon, ioxff, parity, and cstopb. The bit rate may be changed with the "br" field. For example:

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```
hp2ps1|hp2p serial interface 1:\
        :lp=/dev/ttyZ0:br#19200:\
        :ms=pass8,ixon,ixoff,-parity,-opost:\
        :sd=/usr/spool/hp2ps:pl#66:pw#80:sh
```

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9. Using NeWSprint(1.0) with the CoALM-S

When using the add_np_printer script to install a NeWSprint printer attached to the CoALM-S, the script asks which device to use and suggests */dev/bpp0*. Respond with */dev/lpz* (or other name as chosen). NeWSprint assumes a "serial" device type. Although the CoALM-S is a parallel device it is a **STREAMS** driver. NeWSprint constructs a proper printcap entry for a STREAMS driver only for serial ports. Parameters which apply only to serial devices such as bit rate and character format are ignored by the CoALM-S. A printcap entry so constructed looks like:

```
# entry for a CoALM-S8P/16P/HP LaserJet II NeWSprint printer on a "serial !" port
hp|HP II:\
        :mx#0:br#19200:sf:sb:\
        :xc#0177777:\
        :ms=-parity,ixon,-opost:\
        :lp=/dev/lpz:\
        :sd=/var/spool/hp:\
        :lf=/var/spool/hp/log:\
        :af=/var/spool/hp/acct:\
        :if=/usr/np/lpd/if:\
        :gf=/usr/np/lpd/gf:\
        :nf=/usr/np/lpd/nf:\
        :tf=/usr/np/lpd/tf:\
        :rf=/usr/np/lpd/rf:\
        :vf=/usr/np/lpd/vf:\
        :cf=/usr/np/lpd/cf:\
        :df=/usr/np/lpd/df:\
        :of=/usr/np/lpd/ofe
```

Your particular field names may vary as you specify to add_np_printer but the "mx", "sf", "sb", "xc" and "ms" fields must appear as shown. To use this entry with lpr issue: lpr -P hp2p <filename>. Note that at this timeNeWSprint does not support PostScript printers with a parallel port. This is because NeWSprint requires a full-duplex connection. The CoALM-S parallel port is half-duplex (it can receive or transmit but not both simultaneously).

In case of persistent difficulties in accessing the printer, try

cat /etc/motd > /dev/lpz

which sends just the sign-on messages directly to the printer without using the printer spooler or the NeWSprint software. **Note that this file will not print on a PostScript printer.** A small PostScript file should be used instead of */etc/motd*. There are several demonstration files in the directory *openwin/demo/PostScript*.

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10. PROGRAMMING CONSIDERATIONS

The css driver is a STREAMS driver that substantially conforms to the SunOS manual page for termio(4). Programming is accomplished in a manner identical to the native ports. All programming by the user including bit rate and character format must be done through supervisor services such as open(2V), close(2V), read(2V), write(2V), and ioctl(2). The sole structure used to control port behavior is *termios* defined in */usr/include/termios.h*. No direct user access to the board is permitted by SunOS for security reasons. No additional programmer's manual is needed.

Because the CoALM-S driver is a STREAMS driver, there are implications for users who wish to write programs for the CoALM-S. Two standard modules, *ttcompat* and *ldterm* are automatically loaded each time a CoALM-S port is opened. These modules perform both output and input processing on data prior to delivering it to the application. To prevent the processing you must "pop" the modules. This is accomplished by the following code segment:

```
#include <stropts.h>

fd = open("/dev/ttyZn", <flags>);

ioctl(fd, I_POP, 0);
ioctl(fd, I_POP, 0);
```

The ioctl returns -1 when no module is present. The termio(4) man page gives general details on programming STREAMS I/O devices.

After these modules are popped, STREAMS may allow a received character to become "trapped" within the STREAMS buffers. This only occurs when activity on the incoming data stream is spurious and the application program either does not expect or cannot wait for more data to satisfy the read request. This behavior can be avoided by reading only 1 byte at a time, but doing so is detrimental to performance. There is no way to flush the STREAMS buffer programmatically.

10.1 ioctls

The *css* driver responds to this device specific ioctl.

```
TIOCGETPRNSTAT          /* get printer port status */
  #define PR_BUSY       0x01   /* error on */
  #define PR_SLCT       0x04   /* printer selected */
  #define PR_NOERROR    0x08   /* paper end */
```

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The following is an example of the TIOCGETPRNSTAT usage:

```
#include <czioctl.h>

char channel[]= "/dev/lpz";

    if ((cfd = open(channel, (O_RDONLY | O_NDELAY))) < 0) {
       perror(channel);
       exit(2);
    }

    if (ioctl(cfd, TIOCGETPRNSTAT, &pr_status) == -1) {
       perror(channel);
       exit(3);
    }

    printf("coalm_status: %s", channel);

    /* Check for printer errors */

    if (pr_status == 0x0f)
       printf(": NO PRINTER ");

    else if ((pr_status >= 0x08) && (pr_status <= 0x0e))
       printf(": printer says NO PAPER");

    else if (pr_status <= 3)
       printf(": printer says NOT SELECTED - OFFLINE ?");

    else if ((pr_status == 4) || (pr_status == 5))
       printf(": printer says ERROR or OFFLINE");

    else
       printf(": printer ONLINE");
```

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11. CSS DRIVER INSTALLATION IN SUN SPARCstations

Version 2.3.1 now features an automatic kernel build script. The script css_kernel.BUILD builds a kernel derived from the configuration of the current kernel. If you wish to use another configuration as the basis of the build a single parameter consisting of the name of a configuration file may be used. You must be root to run this script. The script checks for several prerequisites prior to executing. Namely, css.o must exist in the same directory and various system commands must exist in their normal directories. The string "-COALM" is appended to the kernel name to create the new name.

When css_kernel.BUILD is executed, the file */sys/sun/conf.c* is saved in *conf.c.PRE-COALM* to protect against its loss. It is then scanned and the next available major number identified. The major number is required for correct operation of the driver. An entry is installed for the COALM-S at this slot and the number is saved for later use. Lastly, the special files for one board are created using the major number. Entries are placed in */etc/ttytab*. If you are installing more than one board, use the MAKEDEV.cs script to create additional device files.

Because there are many conditions to consider, you should not rely on the install script to execute perfectly. For example, it is possible to misidentify the major number. After the install script is run, you should carefully inspect the build and correct any errors which may prevent proper operation. A step by step guide for manual kernel builds is given in section 11.

To deinstall the driver from the system use css_kernel.DEBUILD. This removes CoALM-S specific entries from various system files and removes css.o. It requests verification to delete the directory where the kernel and the kernel configuration file. This script accepts the name of a configuration as a parameter. If no parameter is specified the current configuration is used.

If you ever need to build a kernel without the css_kernel.BUILD script here is how to do it:

1. Retrieve driver software as described in section 4.2.
2. Copy the appropriate *css.o* file for your system to */usr/share/sys/sun4c/OBJ/css.o*. Use the command: *arch -k* to determine which architecture you have.
3. Copy the file *ttycsflags* to */usr/local/bin* directory.
4. In the front part of the *conf.c* file, add the following line:

```
#include "css.h"
#if NCSS > 0
#define cztab &czinfo
extern struct streamtab czinfo;
#else
#define cztab 0
#endif
```

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The entire driver is accessed from the kernel via the *d_str* field of the cdevsw entry which points to the structure *czinfo* inside the STREAMS driver. The C-MAJOR number given by *modstat* or in the entry number in /sys/sun/conf.c is the major number and is and index into an array of which *czinfo* is an entry.

The *cdevsw* entry for STREAMS based driver in SunOS 4.1.X is extremely simple as follows:

```
{ nodev,  nodev,  nodev,  nodev,          /* major device # */
  nodev, nulldev, nodev,  0,
  cztab, 0,
},
```

Note that the major device number for SunOS 4.1.x is 104 In SunOS 4.1.x various Sun architectures impose restrictions on the major numbers resulting in a wide variety of possible numbers. Choose a number to suit your installation.

5. Modify */usr/share/sys/[sun4c,sun4m]/conf/files* file. This contains a list of acceptable devices to the autoconfiguration process of the SunOS kernel. Add the following line after the the corresponding lines for the "mti" communications controller:

```
sundev/css.c      optional css      device-driver
```

6. Generate a new kernel config file in */sys/sun[4c,4m,4e]/conf* directory. This is usually a modified form of your current configuration file. Add the following lines to the new config file for the first CoALM-S controller (this line handles any number of boards):

```
#
# Support for CoSystems CoALM-S Boards
#
device-driver   css      # Handles -S4, -S4E, -S8, -S8P and -S16P Models
```

Note that each CoALM-S board occupies 32 entries in the minor device number array. This supports the 17 minor devices that are physically available (16 serial and 1 parallel) on the CoALM-S16P product. The remaining 15 minor device numbers are unavailable. CoALM-S4 uses the first four devices only, CoALM-S4E uses the next four and CoALM-S8 uses the first eight channels. Unused channels are not accessible from other boards. For example, if the first board is a CoALM-S4, it occupies the minor devices 0 through 31, but only devices 0, 1, 2 and 3 are accessible. Then if the second board is a CoALM-S8, it occupies up devices 32 through 63, but must use only minor devices 32 through 39. A CoALM-S4 and CoALM-S4E pair take up 32 consecutive slots and may be thought of an CoALM-S8.

7. Make a new kernel that incorporates the CoALM-S driver. Execute the following commands, assuming that your new config file is called PICKLE:

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```
config PICKLE

cd ../PICKLE

make
```

This process generates a new kernel *vmunix* in the */usr/sys/PICKLE* directory". Save your current kernel in the "/" directory with a new name, copy the new kernel to "/" and verify that the new kernel is functional by rebooting the system (see the following section) before destroying your existing kernel. If errors are reported, the process must be repeated with corrective actions.

NOTE: IF YOU ARE PLANNING TO SUPPORT A LARGE NUMBER OF USERS SIMULTANEOUSLY, SOME OF THE KERNEL PARAMETERS MAY NEED MODIFICATION. IN PARTICULAR, THE NUMBER DECLARED FOR MAXUSERS IN THE KERNEL SHOULD BE CHANGED.

8. Make special device files in the */dev* directory. CoALM-S serial channels are usually named *ttyZ0* through *ttyZ7* and the printer device file *lpz*. These can be conveniently accomplished by changing to */dev* and executing the script:

   MAKEDEV.cs9

   to make serial devices and a printer port for the first board.

   The printer special device is also of type "character", and has the minor device number "8" with same major number as the other serial channels.

   The device names may be changed to any name of your choice, however note that the *ps(1)* command accepts only two letters for identifying ports on the screen. CoSystems recommends naming CoALM-S ports from *ttyZ0-ttyZ7* for the first CoALM-S, *ttyY0-ttyY7* for the second, and *ttyX0-ttyX7* for the third CoALM-S and so forth.

   Make changes to the */etc/ttytab* file. Changes should also be made to the *uucp* and *tip* related files. CoALM-S is completely compatible with Sun in these respects and procedures listed in the appropriate Sun manuals are also applicable to CoALM-S.

11.1 Rebooting the system

The Sun workstation must be rebooted with the new kernel that includes the driver for accessing CoALM-S. On a running system, this can be done by using the reboot(8) command.

In the event that CoALM-S is not recognized or all channels are not properly configured, please check that the kernel is correctly generated.

In case of persistent difficulties, call CoSystems for further assistance.

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NOTE THAT IF YOUR NEW KERNEL DOES NOT BOOT FOR ANY REASON, YOU CAN ALWAYS BOOT WITH YOUR OLD KERNEL SINCE IT WAS SAVED IN THE "/" DIRECTORY.

This can be done by typing the command:

b*dd*(,,)*vmunixname* - where *dd* is the name of your boot device and *vmunixname* is the name of your original kernel.

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12. UNIX DRIVER INSTALLATION IN SOLBOURNE WORKSTATIONS

Solbourne S4000 machines with OS/MP through 4.1a1 do not support the dynamic loading feature of Sun SPARCstations. For Solbourne machines, execute the css_kernel.BUILD script or manually enter the following in sequence to complete the configuration of the kernel. If performing a manual build, use the *edits* file as a reference when making the changes (or you can patch various portions of it directly into your files):

1. Retrieve driver software as described in section 4.2.
2. Copy the file *css.o* to */sys/idt/OBJ/css.o*.
3. Copy the file *ttycsflags* to */usr/bin* directory.
4. In the front part of the */sys/kap/conf.c* file, add the following line:

```
#include "css.h"
#if NCSS > 0
#define cztab &czinfo
        extern struct streamtab czinfo;
#else
#define cztab 0
#endif
```

The entire driver is accessed from the kernel via the *d_str* field of the cdevsw entry which points to the structure *czinfo* inside the STREAMS driver.

The *cdevsw* entry for STREAMS based driver in the operating system is extremely simple as follows:

```
{ nodev,  nodev,  nodev,  nodev,          /* major device # */
  nodev,  noodev, nodev,  0,
  cztab, 0,      parflag(D_SERIAL, 0)
},
```

Note that the major device number is usually 74, but may be different if you have other devices in your system.

5. Modify */sys/idt/conf/files* file. This file contains a list of acceptable devices to the autoconfiguration process of the SunOS kernel. Add the following lines after the the corresponding lines for the "mti" communications controller:

```
kapdev/css.c      optional css      device-driver
```

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6. Generate a new kernel config file in */sys/idt/conf* directory. This would usually be a modified form of your current configuration file. Add the following lines to the new config file for the first CoALM-S controller:

```
#
# Support for CoSystems CoALM-S Boards
#
device          css0 at obio ? csr 0x00000000 priority 6
```

Note that each CoALM-S board occupies 32 entries in the minor device number array. This supports the 17 minor devices that are physically available (16 serial and 1 parallel) on the CoALM-S16P product. The remaining 15 minor device numbers are unavailable. CoALM-S4 uses the first four devices only, CoALM-S4E uses the next four and CoALM-S8 uses the first eight channels. Unused channels are not accessible from other boards. For example, if the first board is a CoALM-S4, it occupies the minor devices 0 through 31, but only devices 0, 1, 2 and 3 are accessible. Then if the second board is a CoALM-S8, it occupies up devices 32 through 63, but must use only minor devices 32 through 39. A CoALM-S4 and CoALM-S4E pair take up 32 consecutive slots and may be thought of an CoALM-S8.

7. Make a new kernel that incorporates the CoALM-S driver. Execute the following commands, assuming that your new config file is called PICKLE:

```
config PICKLE

cd ../PICKLE

make
```

This process generates a new kernel *vmunix* in the */usr/sys/PICKLE* directory. Save your current kernel in the "/" directory with a new name, copy the new kernel to "/" and verify that the new kernel is functional by rebooting the system (see the following section) before destroying your existing kernel. If errors are reported, the process must be repeated with corrective actions.

NOTE: IF YOU ARE PLANNING TO SUPPORT A LARGE NUMBER OF USERS SIMULTANEOUSLY, SOME OF THE KERNEL PARAMETERS MAY NEED MODIFICATION. IN PARTICULAR, THE NUMBER DECLARED FOR MAXUSERS SHOULD BE CHANGED.

8. Make special device files in the */dev* directory. CoALM-S serial channels are usually named *ttyZ0* through *ttyZ7* and the printer device file "lpz". The script MAKEDEV.cs9 may be modified and executed to make device files for the first board. The MAKEDEV.cs script makes special device files for up to an additional 5 boards.

The device names may be changed to any name of your choice, however note that the *ps(1)* command accepts only two letters for identifying ports on the screen. CoSystems

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recommends naming CoALM-S ports from *ttyZ0-ttyZ7* for the first CoALM-S, *ttyY0-ttyY7* for the second, and *ttyX0-ttyX7* for the third CoALM-S.

Make changes to the */etc/ttytab* file. Changes should also be made to the *uucp* and *tip* related files. CoALM-S is completely compatible with Sun in these respects and procedures listed in the appropriate Sun manuals are also applicable to CoALM-S.

12.1 Rebooting the system

The Solbourne workstation must be rebooted with the new kernel that includes the driver for accessing CoALM-S. On a running system, this can be done by using the reboot(8) command.

In the event that CoALM-S is not recognized or all channels are not properly configured, please check that the kernel is correctly generated.

In case of persistent difficulties, call CoSystems for further assistance.

NOTE THAT IF YOUR NEW KERNEL DOES NOT BOOT FOR ANY REASON, YOU CAN ALWAYS BOOT WITH YOUR OLD KERNEL SINCE IT WAS SAVED IN THE "/" DIRECTORY.

This can be done by typing the command:

b *vmunixname* - where *vmunixname* is the name of your original kernel.

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13. USER TIPS & TROUBLESHOOTING

This is a collection of hints that may be used as a checklist if you are having difficulties installing or using your CoALM-S.

1. CANNOT OPEN CoALM PORT -- NO SUCH DEVICE MESSAGE

This indicates that the access to the CoALM-S driver through the "cdevsw" table has not been properly configured. If the driver was dynamically loaded use *modstat(8)* to discover the "C-major" number. Compare this number to the number shown by *ls -l /dev/ttyZ0*. If there is a mismatch, delete the *ttyZ* devices and remake with the correct major number. If the kernel was statically built, check the index number in the cdevsw array in the file */sys/sun/conf.c* , near the end. Remake the *ttyZ* devices if necessary. If the css.INSTALL or css_kernel.BUILD script was used, this should not happen, but check nevertheless.

Note that unused major device numbers in conf.c must have NULL entries in the table.

Check that the driver has been properly configured into the kernel used for booting.

2. PORT HANGS WHEN USING tip(1) COMMAND

This may happen in case of a conflict between another process, usually getty(8) and tip(1). If the *ttysoftcar* setting for the port was initially "y" and a process or getty opened the port it will inhibit tip from opening because tip requires exclusive use. You can check this by typing *ps -ax*. Check the second column for the name of the controlling terminal. If there is a process with Zn where n is your port number, that process has the port open. You must kill this process and keep the port free or use ttycsflags -n on the port to make the process wait for carrier.

Another reason tip may hang is if you have issued *ttysoftcar -n* on a port then issue a tip for the *tty* port instead of the *cu* port. Tip will then be stuck waiting for carrier. Reconfigure the kernel for software carrier detect with *ttysoftcar -y* command if you want to use the *ttyZ* device.

3. TERMINAL DOES NOT DISPLAY DATA

Check that the terminal parameters are correctly set. The terminal must be connected to the correct connector on the signal distribution box or the internal wiring of the RJ45 to EIA-232 connector must match the diagram in this manual.

Check pins 2 and 3 on the cable for correct configuration. Also, some terminals require one or more modem or flow control signals to be present.

4. TERMINAL CANNOT SEND DATA

If your terminal has a detachable keyboard, ensure that it is properly plugged in.

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Check pins 2 and 3 on the cable for correct configuration. Also, some terminals require one or more modem signals to be present.

If you have configured the port for hardware flow control, the port will not send data until it's DCD input has been pulled high. This is easily accomplished by tying its DTR output to its DCD input. See the section "FLOW CONTROL FOR SERIAL DEVICES" for further details.

If hardware flow control is being used, the signals must be present.

5. **TERMINAL DISPLAYS DATA OUT OF SEQUENCE OR LOSES IT**

Some terminals cannot accept data continuously at higher specified bps rates. DEC vt100 terminals are typical of these. Try operating the terminal at a lower date rate. Data rates can be specified in SunOS 4.1 by changing entries in the */etc/ttytab* file.

CoALM-S supports XON/XOFF flow control protocol.

See the section "FLOW CONTROL FOR SERIAL DEVICES" for further details.

6. **MODEM DOES NOT ECHO "AT" COMMAND"**

Check that echo and verbose modes of the modem are on. This is usually set via ATE and ATV commands. Also try ATQ0. Also if you are using a windowing system, avoid *commandtool* in favor of *shelltool*.

7. **RECEIVER CHANNEL LOSES DATA**

Try setting the receiver optimization flag using the "-O" option of the *ttycsflags* utility provided with CoALM-S.

The incoming traffic on the system may be too high to be managed without flow control. Configure both the receiving port and the transmitting equipment for flow control.

If problems persists, switch off firmware flow control and activate the hardware flow control. Your device must of course support hardware flow control.

8. **MODEM LOGIN SEQUENCE DOES NOT WORK**

Check that the appropriate */dev/ttyZ** (where * is the port number) nodes have been correctly made, and that they relate to the major and minor device numbers for CoALM-S. Check that your modem is correctly configured. SunOS utilities only support the Hayes Ventel and Telebit modems as specified in SunOS Hardware Installation manuals. Check that the modem lines have enabled in the */etc/ttytab*. file as specified in this manual. Ensure that there aren't multiple "gettys" competing for remote login on the same port. Check that your remote terminal and modem match the specified data rate. Use a "hardwired" tip to establish communication with the modem. This may be performed by entering the command (as super user) *tip /dev/cuZ4* where *cuZ4* is a valid special file in */dev* for dialing out on the correct CoALM-S port number.

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9. **PRINTER DOES NOT START WHEN JOBS ARE QUEUED**

   Use the *lpc* (line printer control) utility to manage the print queue. *lpc* offers several commands including clean, up, down, restart and status. See the SunOS manual page for more details.

10. **ERROR MESSAGES APPEAR ON Sun CONSOLE FOR SunOS 4.1**

    SunOS 4.1 uses a STREAMS based character device driver. STREAMS configures a number of data structures and data buffers for use by all character drivers including the driver for CoALM-S. These data structures are fixed for a given kernel, but are user configurable. If you are planning to support many users, these parameters must be expanded and tuned. The SunOS 4.1 command *netstat -m* displays among other things, the number of STREAMS buffers in use and spare. In general, keep on doubling the various sizes until no more messages appear on the console. Then back off the last addition to a number that leaves approximately 20% of buffers free. It is unfortunate that this limitation exists in the current version of SunOS since experimenting in the above suggested manner is very time consuming and may require several attempts to complete.

    A detailed guide on this procedure appears in the April 1989 issue of the *Software Technical Bulletin* published by Sun.

11. If you decide to call for support, please have the exact details of your problem ready for analysis by customer support engineers. If possible, have hard copies of the various files modified during the install procedure. Also have available the output of the command *ps -ex* and the file */etc/ttytab* in hardcopy form. Also have available a hard copy of the output of the command *dmesg | tail -100* on the system with CoALM-S. A request may be made for copies to be FAXed to us for closer examination.

For Customer Support, call: (408) 748-2190

To send documents via Fax: (408) 988-0785

12. For other less pressing problems please send us e-mail at the following address:

amdcad!cosys!support

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14. SERIAL COMMUNICATIONS - A PRIMER

Thank you for choosing the CoALM-S family of serial expansion boards. Many people, particularly novices find that installing and using serial equipment is confusing and frustrating. This primer provides background information and tips to assist you in understanding and interfacing your CoALM-S. If you are at all unfamiliar with SunOS or EIA-232 please review before proceeding. Hopefully this will familiarize you with serial interfacing techniques and SunOS so that you will be able to proceed with less aggravation.

14.1 EIA-232 Signals & CoALM

A CoALM-S board, like Sun serial ports, provides a subset of the EIA-232 (formerly known as RS-232) electrical interface to data communications equipment. EIA-232 is an industry standard that is widely used to connect computers to terminals, modems and other computers. So widely used, in fact, that it has often been abused, misstated or plainly ignored. This fact contributes to difficult installation and troubleshooting when adding serial peripherals. The EIA-232 specification describes some 25 signals which should be implemented. Most manufacturers commonly offer a subset ranging from 3 to 7 of these signals. The CoALM-S offers the 7 signals: DATA TERMINAL READY, DATA CARRIER DETECT, TRANSMITTER DATA, RECEIVER DATA, REQUEST TO SEND, CLEAR TO SEND and SIGNAL GROUND. These signals are sufficient to meet the needs of all the normal asynchronous communications functions such as terminal login, uucp and tip.

TABLE 9. EIA-232 Signals Supported by CoALM

Signal	Abbreviation	CoALM Function
Data Terminal Ready	DTR	The computer is ready to send/receive data'
Data Carrier Detect	DCD	A carrier is present on the (phone) line and the modem is ready to send/receive data.
Transmitter Data	TXD	Data transmitted from the computer to the modem.
Receiver Data	RXD	Data received by the computer from the modem.
Request To Send	RTS	The computer is ready to receive data from the modem. Note that this is not EIA-232(A-D) compatible, but rather conforms to EIA-232E
Clear To Send	CTS	The modem is ready to receive data from the computer.
Signal Ground	GND	Signal ground is MANDATORY for proper operation of your interface. Never omit it.

EIA-232 is used to connect DATA COMMUNICATIONS EQUIPMENT to DATA TERMINAL EQUIPMENT. You can almost always read DATA COMMUNICATIONS EQUIPMENT to mean modem and DATA TERMINAL EQUIPMENT to mean terminal or computer. When interfacing a modem to your computer, the computer assumes the role of the DTE. When interfacing a terminal to your computer BOTH ends assume the role of a terminal. How to deal with this dilemma is discussed below.

A difference between DTE and DCE is necessary because if you connect two terminals together using a cable with one-to-one correspondence between its ends data will not be sent or received properly. This is because the two transmitters of each are tied together and the

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receivers of each are tied together. What is needed to solve this problem is a swap of pins 2 and 3 between the two devices. This style of wiring is called a NULL-MODEM because two modems connected via a phone wire do this for you automatically. If you are using two DCEs or two DTEs you will need a null-modem.

Null modems are usually implemented by wiring your cable with pins 2 and 3 swapped. Alternatively, most electronics emporiums offer a variety of low cost null modem adapters. These are often a good choice because you can then buy all straight cables and insert null-modems as needed. The ports on your Sun system are all wired as DTEs (terminals) and connect directly to modems with straight cables. To connect to terminals you will need a null modem.

```
   Pin 3      Pin3
RXD ---------- RXD
   Pin 2      Pin2
TXD ---------- TXD
```

TXD, RXD connection in need of null-modem!

```
   Pin 3      Pin2
RXD ---------- TXD
   Pin 2      Pin3
TXD ---------- RXD
```

TXD, RXD connection with null-modem

For EIA-422 null-modems, you also need to swap pins 14 and 16 because each signal is transmitted on a pair.

```
RXD(-) ---------- TXD(-)
   Pin 16     Pin 14
TXD(-) ---------- RXD(-)
   Pin 14     Pin 16
```

The factory setting of panel wiring for CoALM-S is shown below.

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TABLE 10. CoALM Default Settings

Board Type	EIA-232 Type
CoALM and CoALM-V (VMEbus cards) with:	
- Passive distribution panel and NO jumpers (newer)	DTE
- Passive distribution panels and internal jumpers (older)	DCE
- Active distribution panels	DTE (some ports are EIA-422 level)
CoALM-S8, S8P and S16P (SBus cards) with:	
- Passive distribution panel and NO jumpers (newer)	DTE
- Older passive distribution panel and internal jumpers(older)	DCE
- Active distribution panels	DTE (some ports are EIA-422 level)
CoALM-S4 (SBus) with:	
- Unassembled RJ45 modular phone jack to DB25	Assemble as needed
- Assembled RJ45 to DB25	DTE

Very old versions of CoALM-S were shipped as DCE's. You will find the new factory setting of all CoALM-S products is DTE. This conforms to the standard Sun setting and reduces confusion. Any cable arrangement which works on the Sun port also works on the CoALM-S.

14.2 Hard or Soft Carrier

The next bit of information you need to know is whether your equipment uses a carrier detect signal. This signal, DCD, is often used by modems to indicate that a connection is established on the phone line and further data transmission is valid. Terminals do not output DCD, although they may require it before receiving any data you send to them. SunOS needs to know if a particular port is using DCD. This is communicated through the *ttysoftcar* (tty-soft-carrier-set) command in SunOS 4.1 and above. In SunOS 4.0 through 4.0.3 it is set only via a flag in the kernel configuration file. With SunOS 4.1 a new field is defined in the /etc/ttytab file which is used by *ttysoftcar* at system boot time to set each port for hard or soft carrier.

ttytab entries for SunOS 4.1.X (note the new remote/local entry):

```
ttyZ0 "/etc/getty std.9600"    dialup    on remote secure
ttyZ2 "/etc/getty std.9600"    vt100     on local secure
```

A ttytab entry for SunOS 4.0.3:

```
ttyZ0 "/etc/getty std.9600"    vt100     on secure
```

In the above 4.1.X examples the word "remote" declares the use of hard carrier while local declares soft carrier. Hard carrier means DCD is used. Soft carrier means DCD is not used. Dialup and vt100 are used to set the characteristics of terminal and do not affect the carrier setting.

The *ttysoftcar* command can be called manually in SunOS 4.1.X as:

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ttysoftcar /dev/ttyZ0 <--- reports value of ttyZ0 as y (soft) or n (hard)

ttysoftcar -y /dev/ttyZ2 <--- do NOT use DCD for Z2

ttysoftcar -n /dev/ttyZ3 <--- use DCD for Z3

The *ttysoftcar* setting is often the source of misdiagnosed troubles because if you specify hard carrier (-n), no activity results on the port until DCD is asserted. Your line appears to hang for no reason.

Now the tricky part! It is possible and often desirable to bypass the use of DCD even if hard carrier has been declared. The way to do this is to define an alternate device entry -- called the cu device in /dev. This alternate entry differs from the main entry by the name and the minor number. The minor number is used by SunOS to identify the port. By convention, the minor number of a dialup port is equal to the physical port number OR, for cu ports, the port number + 128. For example:

```
crw-rw-rw- 1 root    59, 0   Jan 1 12:00 ttyZ0  <-- defines dialup port
crw-rw-rw- 1 uucp    59, 128 Jan 1 12:00 cuZ0   <-- defines cu type port
```

Note that the names tty* and cu* are arbitrary but this is the style used by SunOS.

You can now use the cu port to ignore the value of DCD. This is particularly important when you want to use a connected modem to dial out. When you initiate the call there is not yet any carrier (the modem at the remote site supplies that) so you don't want to wait for it. Any incoming calls still wait for the carrier to be supplied by your end before sending or receiving any data.

The cu devices must be owned by user uucp for tip or the uucp utilities to work properly. Error messages similar to 'permission denied' often stem from the /dev/ entry being owned by root instead of uucp. You must specify cu devices in the /etc/remotes file or in the uucp Systems file if the port is used for both dial-in and dial-out. If you need to change ownership of a file become superuser then:

*chown uucp /dev/ttycu** where * is your cu port number

14.3 Flow Control

Flow control is used to throttle the receiver or transmitter. There are two types of commonly used flow control in Sun systems: hardware and software. (This should not be confused with hard or soft carrier above.)

Software flow control, sometimes called in-band flow control, uses 2 of the 128 ascii characters to control the transmitter of the opposing side. While this works very nicely for quite a few situations, it lacks the robustness and precision of hardware flow control. Always use hardware flow control when possible because it is less prone to error and does not steal characters from the data stream. This is particularly important for utilities like uucp which expect all ascii characters to pass through to the uucp process in the other computer.

The method of specifying flow control to CoALM-S has changed as the drivers matured. Prior to revision 2.2, flow control could only be specified in the flags field of the kernel

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configuration file. With 2.2 and above, the driver follows the values in the termio(4) entry. The *stty* options crtscts, ixon and ixoff now dynamically change flow control and may be set by *stty* or *ioctl* at any time.

When using hardware flow control however, keep in mind that the Request to Send (RTS) signal does not conform to the EIA-232(A-D) specification, but rather to the function that some high-speed modem manufacturers have given it. This is because the EIA-232(A-D) definition of RTS is only useful for what are called half-duplex connections. Equipment which supports only half-duplex is rare. Most modern equipment, including modems, are full-duplex. Full-duplex is the desirable choice. Only EIA-232E encompasses the need for full-duplex flow control. Popular modem manufacturers introduced this alternate definition of RTS to extend the usefulness of EIA-232 and for this reason we conform to the full-duplex usage.

When connecting to a DTE to a DTE (or a DCE to DCE) the flow control signals need to be swapped like the transmit and receive if hardware flow control is used.

You will almost always need to use hardware flow control when connecting to popular modems like those made by Hayes and Telebit and US Robotics. Failure to do so results in lost data. Note that uucp may actually work without flow control because it is packet oriented and most modems now have buffers which are larger than a uucp packet. Depending on this for reliable transmission is not encouraged. UUCP can be setup with hardware flow control. Refer to the "System and Network Administration" manual of SunOS 4.1 for more details.

14.4 Starting a login

The */etc/ttytab* entry has a field which controls whether a login process (often called a getty) is started or not. If you plan to use ports to add users in a standard way, you must start a login on each port with an entry like:

```
ttyZ2 "/etc/getty std.9600"     vt100        on local secure
```

If you plan to connect equipment that can not respond to a login prompt then do NOT add an entry, or if you do, specify 'off' instead of on.

You may start and stop logins at any time if you are super user. To do so, simply modify the *etc/ttytab* file and type

kill -HUP 1

or

kill -1 1

14.5 Basic Debugging of Serial Ports

The The first thing you should try when adding a new peripheral is to make it work on a Sun native port and then move it to the CoALM-S. Connect a "dumb" terminal to the port with a null-modem cable. Dumb terminals are hard to find today because most terminals have a multitude of user-selectable options. It is usually possible to select a line interface mode which uses on 3-wires (TX data, RX data and GROUND). A DEC VT100 , Wyse 50 or compatible are often found nearby. These are good choices to use for debugging. Review the user manual for your terminal and get it selected for 9600 bps, 7 data bits, even parity and 1

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stop bit. This is the default setting of SunOS serial ports.

When connected, become super user and type

*cat /etc/motd >/dev/ttyZ** where * is the number of your port.

You should see a legible message which may run off the end of your terminal. This is normal. If the message looks fairly normal then proceed. If it is garbled then debug and repeat until it is normal.

If you get nothing at all then you may have a nasty interface problem and will need to examine the electrical interface more closely. For this type of sleuthing you may find a gadget called a 'breakout box' very helpful. A breakout box is a small box with two DB25 connectors and LEDs on each line. The LEDS glow when the line is high or low. Most computer shops offer a low-cost EIA-232 tester with the usual subset of signals. These are indispensable and you will find them a worthwhile investment.

If you get this far then start a login or 'getty' process on your port with the terminal.

The familiar

<hostname> login:

prompt should display within a few seconds. You should now be able to login and use SunOS. The display may appear garbled because we have not yet started flow control. Once flow control options are set on your terminal and the corresponding stty options set by command, the display should never lose characters , lock up or exhibit other weird behaviors.

14.6 Using ps to diagnose port problems

The ps command is very useful in determining how a serial port is behaving. When the CoALM-S is installed and getty processes are started, you may observe something similar to the following by typing *ps -ax*:

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```
.....
.....
.....
 465  p1 IW    0:00 -csh (csh)
1051   ? IW    0:00 - std.19200 ttyZ0 (getty)
 924  p2 IW    0:00 -csh (csh)
 222  re S     0:07 -sh (csh)
1117  re R     0:00 ps -ax
 223  rf IW    0:00 -sh (csh)
1103  Z3 IW    0:00 - std.9600 ttyZ3 (getty)
1054  Z4 IW    0:00 -csh (csh)
 162  Z5 IW    0:00 -csh (csh)
 202  Z5 IW    0:00 /bin/sh startxgo.local
 211  Z5 IW    0:00 xgoinit -- Xgo -co /usr/graphon/lib/sun3/X11/rgb -fp /usr/g
 212  Z5 S    20:59 Xgo :1 -co /usr/graphon/lib/sun3/X11/rgb -fp /usr/graphon/l
 163  Z6 IW    0:00 - std.9600 ttyZ6 (getty)
.....
.....
.....
```

Process number 1051 is a getty running on *ttyZ0* set for 19200 bps and is waiting for a carrier. This is shown by the question mark in the second column of the display. We can deduce from this that the carrier setting is hard. The getty is in IDLE state as shown by the I field in the third column. Gettys which have a Zn in the second column are either set for soft carrier or set for hard carrier *and* the carrier is present. If you have a port that is set for hard carrier and you believe that the carrier is truly not present, then check the modem (or other equipment) settings and the wiring on that port. If DCD is removed from a port it may take up to a minute for the system to become aware of this before putting the getty back to sleep.

14.7 Interfacing long lines to the CoALM

The range of EIA-232 is limited to about 50 feet at 19,200 bps. By using slower data rates and high quality cable, you should be able to extend this distance to well over 100 feet. Chose a cable which has a metal shield or foil around 28 gauge wires. The wires should not be twisted with each other because this will only cause interference between the two signals. Connect the cable shield to a good chassis or earth ground. A chassis ground may be obtained from some exposed part of your computer, particularly if it is mounted in a data center (19-inch) cabinet. Earth grounds are less commonly available. Check with your facilities engineer or electrician if you are searching for a suitable earth ground. If you are in an environment which is prone to static discharges, for example a carpeted office or one which is subject to lightning storms, we suggest installing surge protectors on each port. This simple investment can save thousands of dollars in damaged computers.

14.8 Programmatic interfacing to CoALM-S through SunOS

CoALM-S boards and drivers are substantially compatible with the software interface provided by Sun Microsystems as described in termio(4), ttycompat(4) and the zs driver(4) For complete details on the system calls available to the 'C' programmer refer to the section entitled 'Devices and Networking' in the SunOS reference manual volume II for SunOS 4.1 and also the System Calls overview in SunOS reference manual volume I. A simple 'C'

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program which opens two ports and reads and writes data to it is given here for examination. A loopback cable can be connected to two physical ports. Data is transmitted on from one port, received and echoed on the second port. It is then read back on the first port and compared for errors.

Note the *ioctl* used to set the bit rate in this example. This is a older Berkeley *tty* style. The STREAMS modules *ttcompat* and l*dterm* intercept these ioctls and translate them into newer STREAMS calls. Examples of STREAMS *ioctls* are given in the *EXAMPLES* directory on the distribution.

```
/*************************************************************************
** program to implement a loopback test on a mux port
**
** Usage: test_pair  -i inputmux -e echomux -c count -m message_level
**
** inputmux: name of port on which to send and receive data
** echomux:  name of port on which to receive and echo data back to sender
** count:    number of times to perform operation
**
** message_level:  0 --> no messages, exits silently if all OK
**                 1 --> prints header, total pass, fail counts
**                 2 --> as in 1 + prints pass/fail message every pass
**                 9 --> prints all available information
*************************************************************************/

#include <stdio.h>
#include <fcntl.h>
#include <sgtty.h>          /* terminal control */
#include <signal.h>

/* Globals */

char *testfile, *tempfile, *iomux, *echomux;
int rfd, iofd, efd, wfd, info;

struct sgttyb sg;           /* structure used for tty control */

unsigned char sndbuf[256];
unsigned char rcvbuf[256];
unsigned char echobuf[256];


/* main procedure */

main(argc, argv)
int  argc;
char **argv;
{
        int i, cpid, count, len, rlen, errors, passes, fails;
        char sc, rc;

        if (argc < 5) {
```


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```
        printf("Usage: test_pair -i iomux -e echomux -m message level\n");
        exit(1);
}

for (i=0; i<argc; i++) {
        if (argv[i][0] == '-') {
                switch (argv[i][1]) {

                case 'e':
                        echomux = &argv[i+1][0];
                        break;

                case 'i':
                        iomux = &argv[i+1][0];
                        break;

                case 'm':
                        info = atoi(&argv[i+1][0]);
                        break;

                }
        }
}
if (info >= 1)
        printf("---------- Title: test pair %s %s ----------\n", iomux, echomux);
if (info == 9) {
        printf("test pair: echomux = %s\n", echomux);
        printf("test pair: iomux = %s\n", iomux);
        printf("test pair: count = %d\n", count);
}

/*
 * Open iomux for write and read
 */

if ((iofd = open(iomux, O_RDWR)) < 0) {
        printf("test pair: cannot open %s\n", iomux);
        exit(2);
}

ioctl(iofd,TIOCGETP,&sg);
sg.sg_ospeed = sg.sg_ispeed = B9600;
sg.sg_flags &= ~ECHO;
sg.sg_flags |= RAW;
ioctl(iofd,TIOCSETP,&sg);

/*
 * Open echomux for well, echo
 */

if ((efd = open(echomux, O_RDWR)) < 0) {
        printf("test pair: cannot open %s\n", echomux);
```


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```
        exit(2);
}

ioctl(efd,TIOCGETP,&sg);
sg.sg_ospeed = sg.sg_ispeed = B9600;
sg.sg_flags &= ~ECHO;
sg.sg_flags |= RAW;
ioctl(efd,TIOCSETP,&sg);

passes = fails = 0;

if (info >= 2)
        printf("test pair: start loop\n");

for (i=0; i<sizeof(rcvbuf); i++)
        sndbuf[i] = i;

if ((cpid = fork()) == 0) {

        /* child */

        echodata();
}
else while (count--) {

        /* parent */

        /*--- Write data to iomux ---*/

        if ((len = write(iofd, &sndbuf[0], sizeof(sndbuf))) != sizeof(sndbuf)) {
                printf("test pair: output mux write error\n");
                exit(4);
        }
        if (info == 9)
                printf("test pair: sent %d bytes\n", len);

        /*--- read from iomux ---*/
        for (i=0; i<sizeof(rcvbuf); i++)
                rcvbuf[i] = 0;

        while (len) {
                if (((rlen = read(iofd, &rcvbuf[sizeof(rcvbuf) - len], len))) < 0) {
                        printf("test pair: input mux read error\n");
                                exit(4);
                }

                len -= rlen;

                if (info == 9)
                        printf("test pair: received %d bytes <%d>\n", rlen, len);
        }
        if (info >= 2)
```


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```
                printf("test pair: loop complete, passes = %d fails = %d\n", passes, fails);

        passes++;       /* total number of loop executed */
        errors = 0;     /* number of mismatches this loop */

        for (i=0; i<sizeof(rcvbuf); i++) {
                if (info == 9)
                        printf("sent = %x, received = %x\n", sndbuf[i], rcvbuf[i]);
                if (sndbuf[i] != rcvbuf[i])
                        errors++;
        }
        if (!errors) {
                if (info >= 2)
                        printf("test pair: data compared ---------- OK\n");
        }else {
                fails++;
                if (info >= 2)
                        printf("test pair: ERRORS = %d ERROR-ERROR-ERROR\n", errors);
                if (info >= 1) {
                        printf("Passes = %d fails = %d\n", passes, fails);
                        printf("--------------------------------------------------------------------------------\n");
                }
        }
    }
    kill(cpid, SIGTERM);
    if (info >= 1) {
        printf("Passes = %d fails = %d\n", passes, fails);
        printf("--------------------------------------------------------------------------------\n");
    }
    exit(0);
}

/*** child process echoes all data ***/

echodata()
{
    int relen, welen, total;

    total = 0;
    while(1) {

        if (total == sizeof(echobuf))
            total = 0;

        /*--- read from echo mux ---*/

        if ((relen = read(efd, &echobuf[0], sizeof(echobuf))) < 0) {
            printf("echo: read error\n");
            exit(4);
        }

        /*--- write to echo mux ---*/
```


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```
                while(relen) {
                        if ((welen = write(efd, &echobuf[0], relen)) < 0) {
                                printf("echo: write error\n");
                                exit(4);
                        }
                        relen -= welen;
                        total += welen;
                }
                if (info == 9)
                        printf("echo: total %d bytes\n", total);
        }
}
```

As usual, if all else fails and you are unable to get your CoALM-S working to your satisfaction, CoSystems is always delighted to assist. When calling us for help, please have hardcopies of as much information about your system as possible. In particular, the pertinent parts of any files you have modified, the output of *ps -ax*, the version number of the EPROM on the CoALM-S and also of the driver. The version number of the driver is written on the distribution tape and also occurs in the files extracted from the tape.

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15. Appendix 1 -- Connector and Interface Data

The CoALM-S 9U (large) and 6U (small) VME boards use either Robinson-Nugent or Honda high-density connectors. Honda offers a wide variety of mating connectors. One is recommended, but others may serve as well.

Robinson-Nugent connectors are arranged as two rows of fingers, one above the other. Pin 1 of the connector is marked on the body with an embossed arrow. Under this is pin 30 (60 pin) or pin 40 (80 pin).

Pin 1 of Honda connectors is indicated by a recessed dot on the body.

All CoALM-S serial products are included in the table as a convenience.

TABLE 11. CoALM-S Connector Part Numbers

Model	Manufac.	Board PN	Cable Mate PN
S8	RN	P50-060-P1-SR1-TG	P50-060S-TG
S8P	RN	P50E-080P1-SR1-TG	P50E-080S-TG
S16P	RN	P50E-080P1-SR1-TG	P50E-080S-TG
S8PMil	Honda	PCS-E96LMD	PCSE96Fx*

* The connector number varies according to wire size. Consult the Honda catalog for more details. This series also offers a variety of hoods.

TABLE 12. CoALM Connector Pin Assignments

PIN#	DESCRIPTION		
	S8 and VME,	S8P	S8PM
1	NONE	GND	RATE SEL 1
2	NONE	GND	RATE SEL 2
3	DTR0	DTR0	RATE SEL 3
4	DCD0	DCD0	SELECT
5	RTS0	RTS0	FAULT*
6	CTS0	CTS0	BUSY
7	TXD0	TXD0	GND
8	RXD0	RXD0	GND
9	GND	GND	GND
10	GND	GND	SLCT_IN*
11	RXD1	RXD1	INIT*
12	TXD1	TXD1	ERROR
13	CTS1	CTS1	AUTO_FD*
14	RTS1	RTS1	DTR3
15	DCD1	DCD1	DCD3
16	DTR1	DTR1	RTS3
17	DTR2	DTR2	CTS3
18	DCD2	DCD2	TXD3

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19	RTS2	RTS2	RXD3
20	CTS2	CTS2	RING IN 3
21	TXD2	TXD2	RING IN 2
22	RXD2	RXD2	RXD2
23	GND	GND	TXD2
24	GND	GND	CTS2
25	RXD3	RXD3	RTS2
26	TXD3	TXD3	DCD2
27	CTS3	CTS3	DTR2
28	RTS3	RTS3	DTR1
29	DCD3	DCD3	DCD1
30	DTR3	DTR3	RTS1
31	DTR4	AUTO_FD*	CTS1
32	DCD4	ERROR	TXD1
33	RTS4	INIT*	RXD1
34	CTS4	SLCT_IN*	RING IN 1
35	TXD4	GND	RING IN 0
36	RXD4	GND	RXD0
37	GND	GND	TXD0
38	GND	BUSY	CTS0
39	RXD5	FAULT*	RTS0
40	TXD5	SELECT	DCD0
41	CTS5	DTR4	DTR0
42	RTS5	DCD4	GND
43	DCD5	RTS4	GND
44	DTR5	CTS4	DSR3
45	DTR6	TXD4	DSR2
46	DCD6	RXD4	DSR1
47	RTS6	GND	DSR0
48	CTS6	GND	RATE SEL 0
49	TXD6	RXD5	RATE SEL 5
50	RXD6	TXD5	RATE SEL 6
51	GND	CTS5	RATE SEL 7
52	GND	RTS5	ACK*
53	RXD7	DCD5	DATA7
54	TXD7	DTR5	DATA6
55	CTS7	DTR6	DATA5
56	RTS7	DCD6	DATA4
57	DCD7	RTS6	DATA3
58	DTR7	CTS6	DATA2
59	NONE	TXD6	DATA1
60	NONE	RXD6	DATA0
61		GND	STROBE*
62		GND	GND
63		RXD7	GND
64		TXD7	DTR7
65		CTS7	DCD7
66		RTS7	RTS7
67		DCD7	CTS7
68		DTR7	TXD7
69		GND	RXD7
70		GND	RING IN 7

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71		STROBE*	RING IN 6
72		DATA0	RXD6
73		DATA1	TXD6
74		DATA2	CTS6
75		DATA3	RTS6
76		DATA4	DCD6
77		DATA5	DTR6
78		DATA6	DTR5
79		DATA7	DCD5
80		ACK*	RTS5
81			CTS5
82			TXD5
83			RXD5
84			RING IN 5
85			RING IN 4
86			RXD4
87			TXD4
88			CTS4
89			RTS4
90			DCD4
91			DTR4
92			DSR7
93			DSR6
94			DSR5
95			DSR4
96			RATE SEL 4

Notes:

1) VME means CoALM (9U and 6U) for VMEbus systems.

2) Rate Select and Ring In are received but not used and are not monitored by the driver software.

3) FAULT is the printer general error condition.

4) ERROR is the PAPER LOW condition.

5) Select is input from the printer.

6) Slct_In* is output to the printer.

7) Auto-Fd* functions as the direction line for bi-directional transfers.

8) Signals marked NONE on the 9U and 6U are not connected. These are GROUND in the S8.

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CoALM-S USER MANUAL

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Is this manual technically accurate ?_____YES____NO___

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