Functions

CRISP/32 systems may be setup with dual processors in a redundant configuration. The processor controlling the plant process is called the Active host and the processor that is not in control is called the Standby host. If there is a software or hardware failure in the Active processor, the system will automatically switch to the Standby machine. More information about the monitoring of software processes may be found under CRMON in the CRISP Utilities Manual.

Each of the two hosts in a redundant configuration communicate their health to an independent intelligent device. The intelligent device assigned to each host system also communicates to the device assigned to the other host. This communication is called arbitration. When a host fails to communicate with its arbitration device, the watchdog timer expires and causes a switchover.

Overview

The CRISP Serial Arbitration unit is a standalone box containing two small intelligent devices which perform the arbitration functions. It is connected to the host processors by standard null modem cables as shown in **Figure 1**. The host serial ports may be either RS-232 or RS-423 (MMJ) ports on the processor itself or, if necessary, the serial ports may be in one or a pair of network terminal servers.

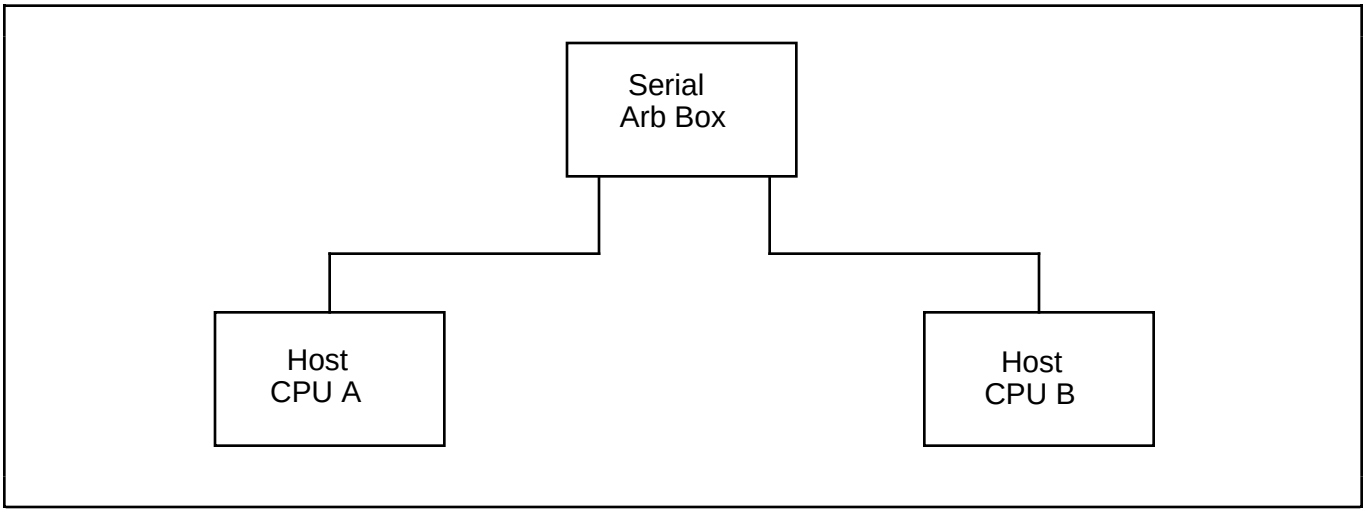

Figure 1. Serial Arbitration Block Diagram

CPU A and CPU B are determined by which host is connected to which port of the Serial Arbitration unit, however, this is completely arbitrary unless the switchcard option is being used.

CRISP/32 V3.0-4 or later is required to support the Serial Arbitration unit.

Front Panel Controls

Figure 2 shows the Serial Arbitration unit's front panel controls and indicators. There are Active and Ready lights for each CPU plus a Switchover Disable switch. The indicators for CPU A are on the left side when viewed from the front.

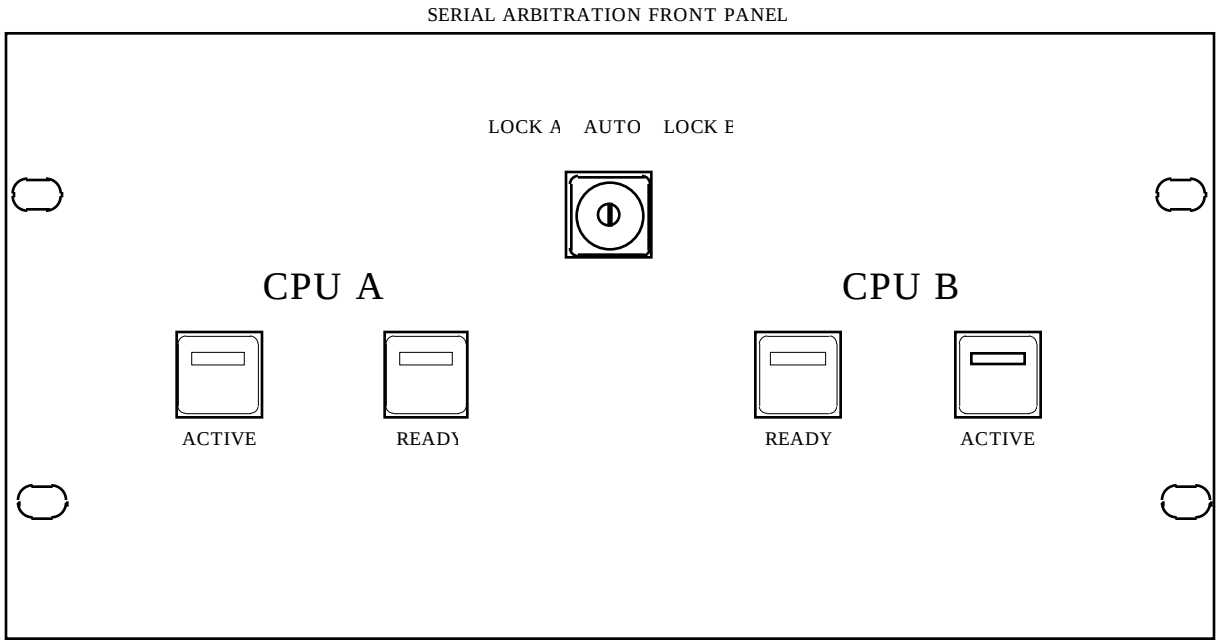

Figure 2. Serial Arbitration Unit Front Panel

Active Indicator

The Active indicator is a red LED that is on when the corresponding host CPU is Active. No more than one of the two indicators will be on at any time. If the Switchover Disable switch (see below) is turned to either side, that side's Active indicator will blink until the switch is returned to the center (AUTO) position.

The Active indicator is mounted in a momentary pushbutton switch which may be used to force a switchover.If the Active indicator is not on, pushing this button causes the Active CPU to go to Standby, and the Standby CPU to become Active.

Ready Indicator

The Ready indicator is a green LED that is lighted when the corresponding host CPU is healthy and, thus, either is Active or is ready to become Active should the need arise. If CRISP is running on both hosts and everything is normal, both Ready indicators will be lit.

Switchover Disable Switch

The Switchover Disable switch is a three-position key switch. The normal position is in the middle (labelled AUTO) which allows normal arbitration and redundancy. If switched to either side, it will force that host CPU to become active regardless of its health as long as CRISP is running and communications between that CPU and the Serial Arbitration unit are normal. While this switch is turned to either side, that side's Active indicator will blink until the switch is returned to the center (AUTO) position.

The intended use for this switch is to prevent a switchover while someone is testing a CRISP logic program on the Standby side. In this case, everything would seem normal to the system but the programmer may not want the experimental program to gain control of the process until it has been debugged.

Rear Panel Connectors

Figure 3 shows the Serial Arbitration unit's rear panel connectors. There are individual connectors for each host for AC power, serial communications, and the customer use contacts. Additionally, there is a connector for the CRISP switchcard option. As on the front panel, the connectors for CPU A are on the left side when viewed from the rear.

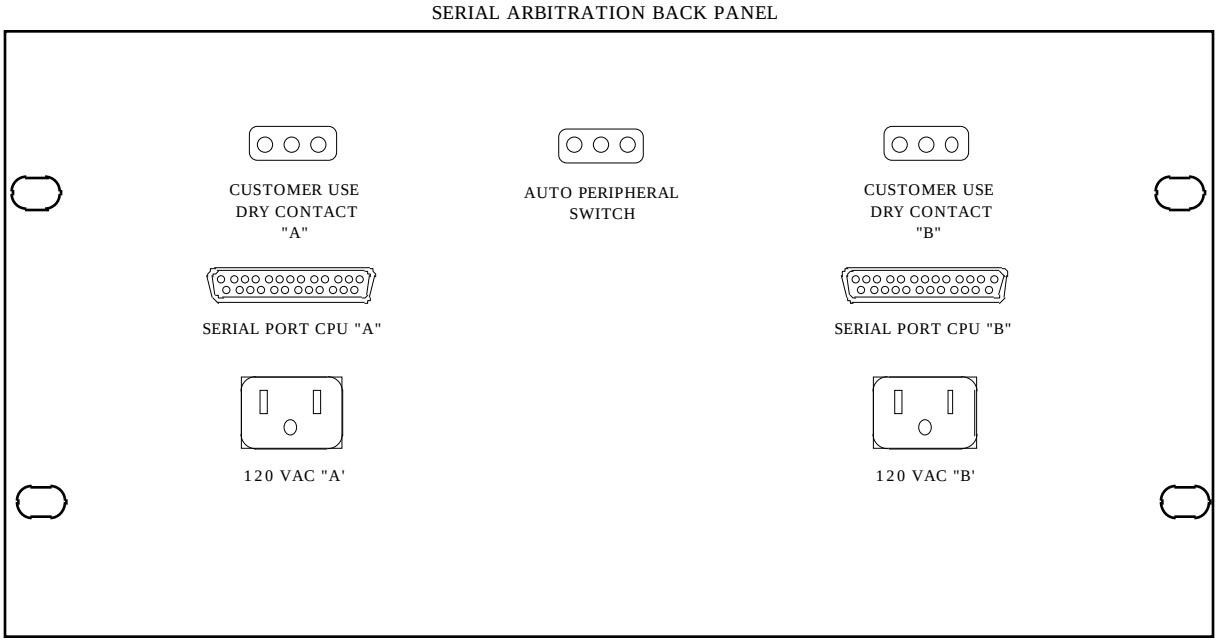

Figure 3. Serial Arbitration Unit Rear Panel

AC Power Connectors

These are standard 120 VAC connectors. Each side has a separate connector so that they may be plugged into different circuits if so desired.

Serial Port Connectors

These are standard male DB25 connectors for an RS232 cable. Since these are wired as DTE devices, a standard null modem cable must be used between the Serial Arbitration unit and the host CPU's serial port. If the host end is an RS-423 (MMJ) port, a 25-pin female to 6-pin MMJ adapter (such as Digital H8575-A) may be used to connect to the Serial Arbitration unit. If the host end is an RS-232 (25-pin) port, a null modem cable (such as Digital BC22D-x) may be used, or a custom cable on adapter may be constructed using two female DB25 connectors and wiring as shown below in Figure 4.

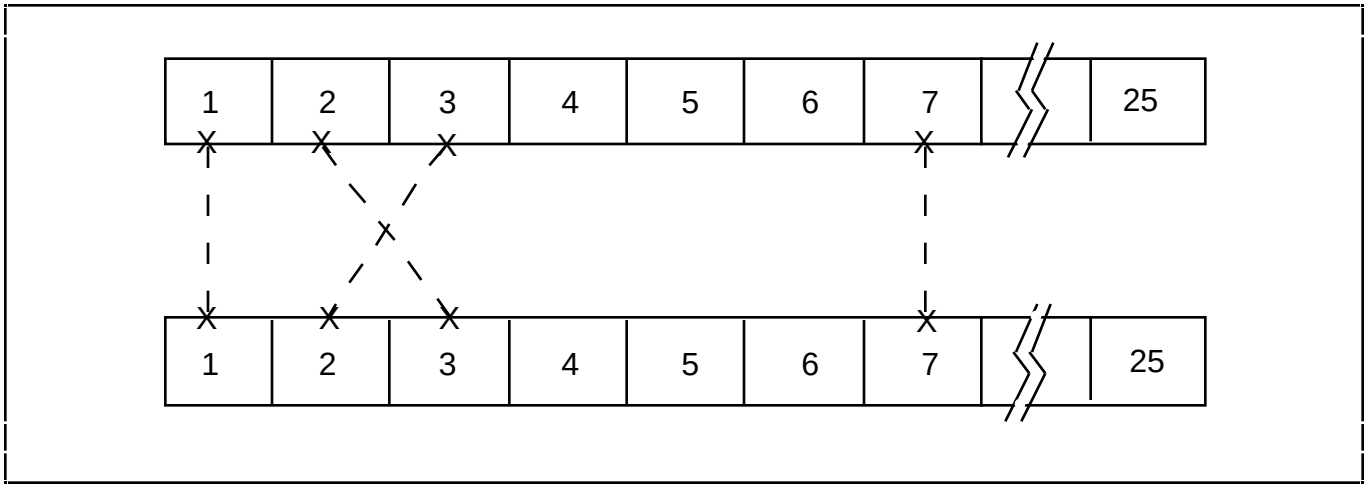

Figure 4. RS-232 Null Modem Connectors

Customer Use Connectors

These are 3-pin MATE-N-LOK connectors with the two outer pins connected to normally open dry contacts which may be controlled by a CRISP logic program. These contacts may be used to control another device such as a horn or warning light. Software control of these contacts is described later in this document.

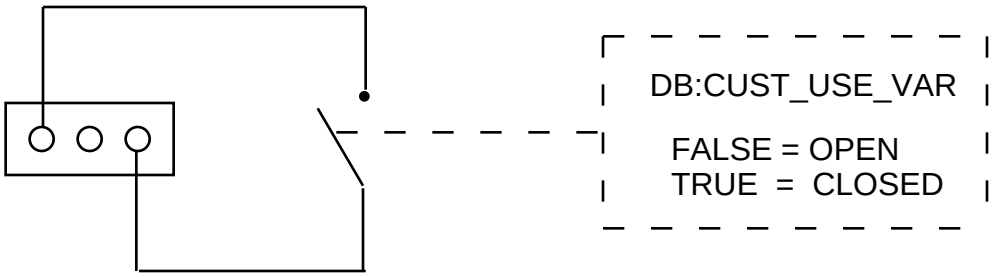

Figure 5. Customer Use Control Diagram

NOTE

If either side of the Serial Arbitration unit loses communications with its host CPU, the corresponding contacts will be opened automatically.

Peripheral Switch Connection

This 3-pin MATE-N-LOK connector is reserved for connection to the optional CRISP switchcard unit.

Serial Port Requirements

The Serial Arbitration unit may be connected to an available RS-232 or RS-423 (MMJ) serial port which is internal to the host CPU. No special setup is required -- the user must merely specify the VMS device name (e.g., TTA2:) during CRISP configuration. All necessary port settings will be performed by the CRISP system software.

If there are no serial ports available on the host CPUs or if the two CPUs are located in separate rooms that are too far apart for direct connection, a terminal server may be used to provide one or both serial ports. However, there are several things which must be noted about such a configuration.

- Use of network-based terminal servers adds additional points of failure in the arbitration system. The system is designed so that a host CPU will go to the Standby mode if it loses communications with the Serial Arbitration unit. This could result in both hosts being Standby, but will never result in two Active hosts. If available, one serial port on each of two terminal servers should be used to protect against failure of the terminal server itself.

- Due to the packetized nature of network communications, the timeout values used by the host software are automatically increased when a terminal server port is being used. This slows CRISPmon's response to critical process problems in the event of communication failures.

- Spurious switchovers may be incurred due to network integrity, traffic levels, terminal server capacity, etc. These will show as SERIOTMO (Serial Arbitration I/O timed out) messages on the CRISP$TT device. Generally speaking, the newer models of terminal servers (such as the DECserver 700) will be more reliable due to their much greater character handling capacity.

- The user must manually setup the terminal server(s) and ports being used. To minimize the timing delays in the server-to-host communications, the terminal server's CIRCUIT TIMER must be set down to 30 milliseconds. The display from the SHOW SERVER command should then resemble the example on the following page.

Serial Port Requirements (cont)

```
Local> SHOW SERVER

DECserver 700-08 V1.1 BL44-11  LAT V5.1  ROM V3.4-9  Uptime:  51 20:49:16

Address:   08-00-2B-36-C7-58   Name:   TEST               Number:     0

Identification:

Circuit Timer:            30          Password Limit:            3
Console Port:              1          Prompt:              Local>
Inactivity Timer:         30          Queue Limit:             100
Keepalive Timer:          20          Retransmit Limit:          8
Multicast Timer:          60          Session Limit:            64
Node Limit:              200          Software:              WWENG1

Service Groups:   0

Enabled Characteristics:
Announcements, Broadcast, Dump, Lock
```

The serial ports to be used for Serial Arbitration must be set to 9600 bps, 8-bit, even parity, and 1 stop bit with flow control disabled, access set to remote, and all options under "Enabled Characteristics" disabled. The resulting display from the SHOW PORT command should be similar to the following.

```
Local> SHOW PORT 5

Port  5: (Remote)                    Server: TEST

Character Size:            8          Input Speed:        9600
Flow Control:           None          Output Speed:       9600
Parity:                 Even          Modem Control:  Disabled
Stop Bits:                 1

Access:                Remote         Local Switch:       None
Backwards Switch:        None         Name:             SARB_A
Break:                  Local         Session Limit:         4
Forwards Switch:         None         Type:                Hard
Default Protocol:         LAT

Preferred Service: None

Authorized Groups:   0
(Current)  Groups:   0

Enabled Characteristics:
```

Serial Port Requirements (cont)

- The user must manually create the VMS LAT port to be used for arbitration. Noting in the above examples that the server name has been set to TEST and the port name has been set to SARB_A, the following LATCP commands should be added to SYS$MANAGER:LAT$SYSTARTUP.COM to create that port. See the VMS LAT Control Program (LATCP) Manual for more information.

  CREATE PORT LTAnn: /APPLICATION
  SET PORT LTAnn: /NODE=TEST /PORT=SARB_A /NOQUEUED

  The "nn" in LTAnn: should be an unused LTA device unit number. This same device specification should then be used in CRISP_CONFIG for the serial arbitration device.

Customer Use Contact Usage

The two "Customer Use" connectors on the back of the Serial Arbitration unit may be controlled by a CRISP logic program to control another device such as a horn or warning light. During CRISP configuration, the user will be asked to enter the DB:NAME of the user output control variable. This may be answered with the specification of any LOGICAL variable in any CRISP database (e.g., ARRAYS:BITS(100)). When this variable is TRUE, the contacts will be closed, otherwise they will be opened.

If a blank or null response is given to this configuration question, the contacts will be controlled according to the Ready state of the host CPU. If CRISPmon is unable to resolve the specified variable at the time CRISP startup completes, the contacts will remain open. In any case, a message will be written to the CRISP$TT device to show the status of this control.

Arbitration Unit Replacement

Should a failure occur in the Serial Arbitration unit, it may be replaced while one of the host CPUs is still actively controlling the process. The CRMON utility has a SWAP SARB command that may be used to force the Active CPU to remain Active even though communications to the Arbitration unit will be lost during replacement. An example of this procedure is shown on the following page.

NOTE

This procedure should only be used during replacement of a failed Serial Arbitration unit. Otherwise, the Switchover Disable switch on the front panel should be used to prevent switchovers if desired.

Arbitration Unit Replacement (cont)

```
$ CRMON SWAP SARB

 This command will force the current CPU to remain active even if there
 are critical processes stopped or it is unable to communicate to the
 Serial Arbitration unit.  Its purpose is to allow the Arbitration box
 to be replaced while CRISP is still running on one host.  Any other use
 of this command is strictly *not* recommended -- use the front panel
 Switchover Disable switch instead!

* Are you sure? [N]: y

 This CPU is now being held active.  This terminal will beep periodically
 until the operation is complete.  You may now disconnect or replace the
 Serial Arbitration unit.  To do so, you must follow the steps below.

 * Ensure that CRISP is not running on the REMOTE CPU.  This is necessary
   to ensure that it does not try to become active unexpectedly.
 * Disconnect serial cable from REMOTE CPU first.
 * Disconnect serial cable from this CPU next.
 * Unplug and remove the old Serial Arbitration unit.
 * Make sure that the Switchover Disable switch on the new Serial Arbitration
   unit is in the middle (AUTO) position.
 * Put the new Serial Arbitration unit into place and connect the power.
 * Connect the serial cable to this CPU first making sure that you
   are using the proper connectors as labelled on the back of the unit.
 * Connect the serial cable to the REMOTE CPU last.
 * Verify that the Serial Arbitration program has successfully downloaded
   on the active side by reading the messages on its CRISP$TT device.  If
   not, check that all cables are properly attached.
 * Press <Return> to restore normal arbitration.
 * Start CRISP on the REMOTE CPU as desired.

* Press <Return> when the operation is finished:

 Arbitration should now return to normal.  You may examine the messages
 on your CRISP$TT device to verify this fact.

$
```