ASUS
RAID Subsystem Application Note

Contents

Chapter 1 Introduction of ASUS-DA2100 PCI-SCSI Controller

1.1 Product Description

The ASUS PCI-DA2100 is a PCI-to-SCSI RAID controller. Specifically designed to provide RAID 0,1,3,5 capability to any host system equipped with PCI Local Bus interface. All the RAID functions of ASUS PCI-DA2100 are performed by 486 CPU coupled with high speed DRAM and firmware in Flash Memory. In effect, it endows the host system with the high performance and fault tolerant disk storage operation of RAID technology. It is also an idea solution for weaving several hard disks into one contiguous volume.

1.2 Features

£ »Support RAID levels:

RAID Levels	Method Descriptions
Non-RAID	Disk Spanning
RAID 0	Striping
RAID 1	Mirroring
RAID 3	Block Striping with Dedicated Parity
RAID 5	Multi Block Striping with Distributed Parity

£ »Failure management capability:

Automatic bad sector reassignment

Hot-swapping

Spare drive operation (Global Spare and Local Spare)

Background rebuilding

£ »PCI Rev. 2.1 compliance

£ »Up to 15 SCSI IDs per channel

£ »Up to 8 logical drives, each with independent RAID modes.

£ »Dynamic mapping of LUMs to logical drives. Two or more LUNs can be mapped to the same logical drive for redundant host operation.

£ »Allow adjustment of delay prior to first disk access during controller initial to enhance compatibility with slow-initial drives.

£ »All channels are Ultra Wide SCSI-2 and can be configured as either or drive interface

£ »Compatibility and automatic matching of any SCSI HDDs complying with SCSI-1, SCSI-2 or Wide SCSI, Ultra Wide SCSI specification.

£ »Fully Ultra Wide SCSI-2 implementation including Tagged Command Queuing and Multi-Threaded I/O.

£ »Uses 486 CPU with all executable firmware downloaded into high-speed DRAM.

£ »EDO DRAM support for enhanced performance.

£ »Up to 64MB of intelligent Read-Ahead/Write-Back cache with backup battery option.

£ »Flash Memory for easy firmware and BIOS updates.

£ »Easy-to-use Text or GUI RAID Manager for RAID management.

1.3 Layout of DA2100
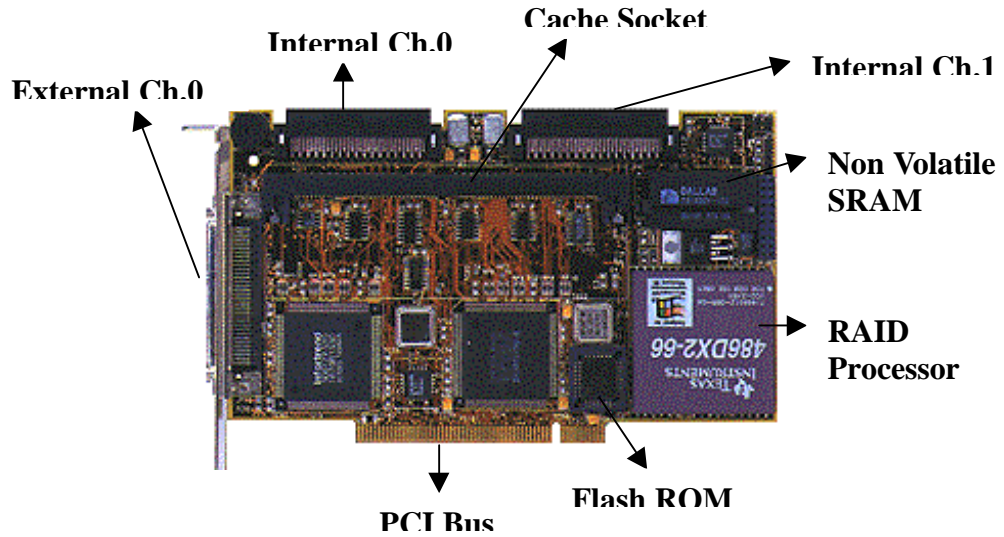
1.4 Jumper Setting

Jumpers	Descriptions
JP1,JP2,JP5,JP7	Factory use. Open for normal operation.
JP6	LED Connector for hard disk drive activity light.
JP13	Connector for manufacturing diagnostic.

2.1 How to install DA2100 on the P/I-P65UP8 M/B.

The PCI-DA2100 requires a minimum of 4MB of 72-pin 60ns FPM SIMM module or EDO SIMM module, **8MB** is recommended.

The PCI-DA2100 plug into **PCI Slot1** is recommended because the IRQ resources are limited. The following table shows the IRQ routing usage in P/I-P65UP8 M/B, if using other PCI card on shared slots, make sure that the drivers support "Share IRQ" or that the cards do not need IRQ assignments.

P/I-P65UP8 MainBoard

Primary PCI Slot1
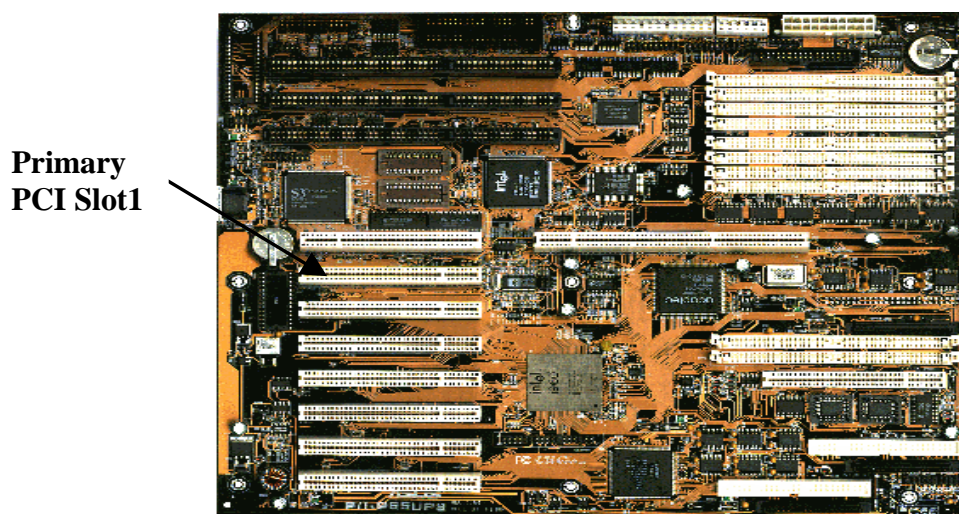
Table of INT Router

Host	System INTA#	System INTB#	System INTC#	System INTD#
PCI Slot 1	Card INTA#	Card INTB#	Card INTC#	Card INTD#
PCI Slot 2	Card INTD#	Card INTA#	Card INTB#	Card INTC#
PCI Slot 3	Card INTC#	Card INTD#	Card INTA#	Card INTB#
Onboard VGA	X	X	INTA#	X
AIC7880 SCSI	X	INTA#	X	X
i960 Processor	X	X	X	INTA#
2nd-PCI Slot 1	Card INTB#	Card INTC#	Card INTD#	Card INTA#
2nd-PCI Slot 2	Card INTA#	Card INTB#	Card INTC#	Card INTD#
2nd-PCI Slot 3	Card INTD#	Card INTA#	Card INTB#	Card INTC#
2nd-PCI Slot 4	Card INTC#	Card INTD#	Card INTA#	Card INTB#
Symbios SCSI	Ch. 2 INTB#	X	X	Ch. 1 INTA#

P.S. Using INTA#, if your PCI cards has only one INT# signal.

2.2 Main Board BIOS Setting

Put DA2100 in PCI Slot 1, then IRQ number is automatically assigned. If you want to assign IRQ number by manual, please use System BIOS / PCI and PnP Configuration.

2.3 Connection of Hard Disk Drives with ASUS SCSI Back Panel Board
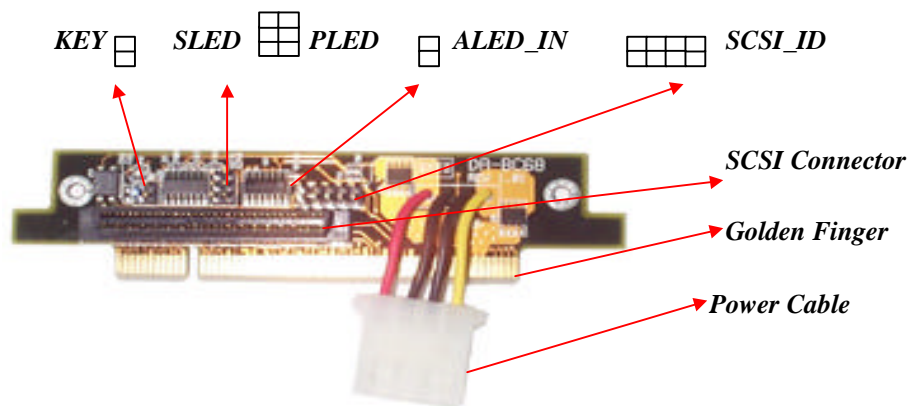
2.3.1 Prepare Hard Disk Drives and connect to mobile rack

a) If you want to adjust the ID# on Back Panel Board, please connect HDD ID jumper to SCSI_ID connector.

b) Hard Drive terminator must be **disabled**.

c) After connect the ID line, R/W LED, put the HDD into the Mobile Rack.

Items	Functions	Cables Uses	Connect To
Golden Finger	Bus of Slot Card	None	DA-BP4-1S
Power Cable	Power of SCSI drive	None	SCSI drive
SCSI connector	Connector of wide SCSI	68-pin wide SCSI cable	DA-BP4-1S
SCSI_ID(8-pin)	SCSI ID could be managed from DA-BP4-1(S), refer to Fig: 3-28	SCSI_ID cable, 8-wire,	ID jumper of SCSI drive. *Be sure the target SCSI ID is in the right order.
ALED_IN(2-pin)	Jumper of device accessing	ALED_IN cable, 2-wire, (Red/Black)	Access jumper of SCSI drive
PLED (3-pin)	Power LED	PLED cable, 3-wire, (Orange/Black/Green)	Light-1 of Drive Bay
SLED (3-pin)	Status LED	SLED cable, 3-wire, (Green/Black/Red)	Light-2 of Drive Bay
KEY (2-pin)	Insure the SCSI drive power has been off while Key Lock of Drive Bay being opened. To protect device during hot-swap.	KEY cable, 2-wire, (Black/Red)	Key Lock of Drive Bay

d) The ID switch of each Back Panel Board must be adjusted to ID0, 1, 2, 3.

e) If have the sensor chip on back panel board, the ID switch can't assign to ID4.

ID Switch

Setting ID3
Setting ID2

Setting ID0
Setting ID1

Back Panel Board
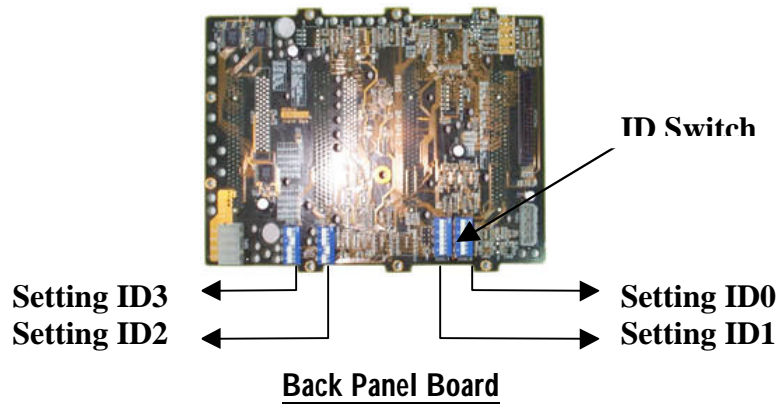
2.3.2 Connection of SCSI Cable

a) Suggest SCSI cable length don't over **1.5 meters** from DA2100 to Back Plane Board.

Internal Cable Length < 1.5m

Back Panel Board

PCI-DA2100
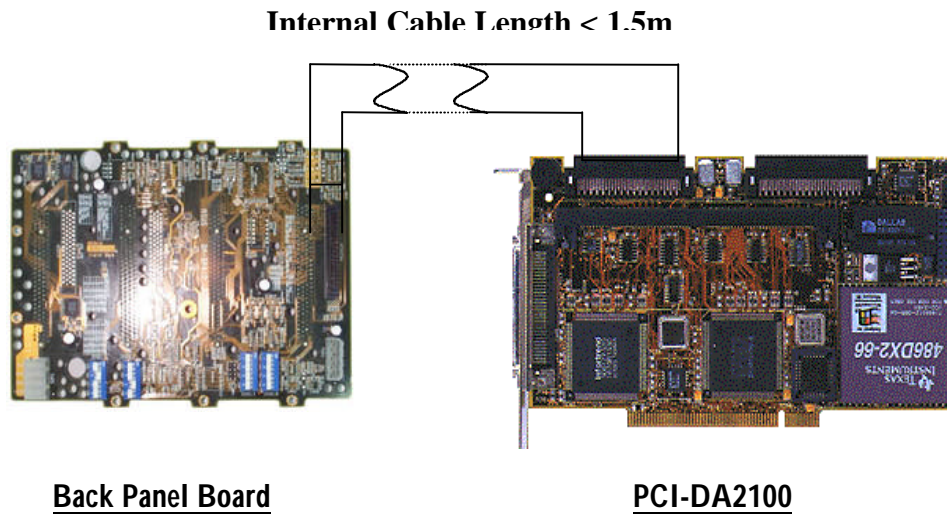
2.3.3 Lock the mobile rack before power on the system

Power Switch Key-Lock

Mobile Rack
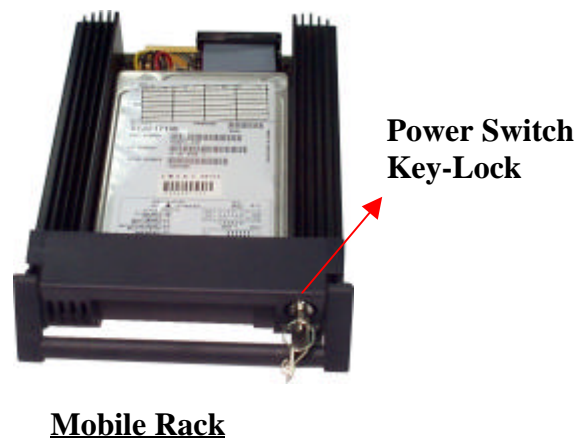
Chapter 3 Initial of RAID Subsystem by Utility Driver

3.1 Suggest initial from DOS Utility of Text RIAD Manager, if you have only RAID Subsystem's hard drives. You can follow step to finished initial.

  a) System boot from DOS

  b) Execute A:\RAIDMAN\DOS\RAIDMAN.EXE

  c) Execute "View And Edit Logical Drives"

  d) Execute "View And Edit SCSI ID Map"

  e) If you have spare drive, execute "View And SCSI/Spare Drives" then exit utility.

  f) Create partitions from DOS's FDISK, please attention when execute the FDISK command, the DA2100's cache data is not written to HDD immediately. You must wait several seconds before the command of "system will now restart" appeared, because of **Cache Write-Back**.
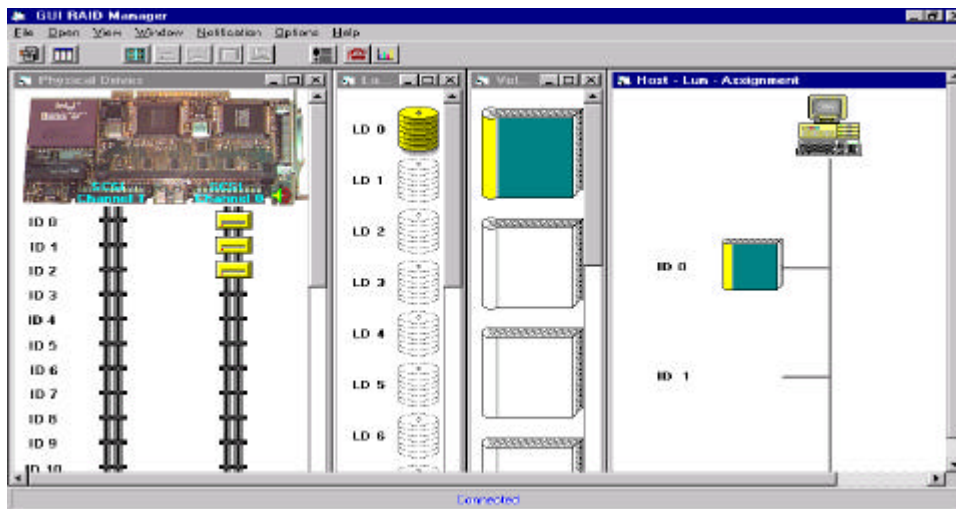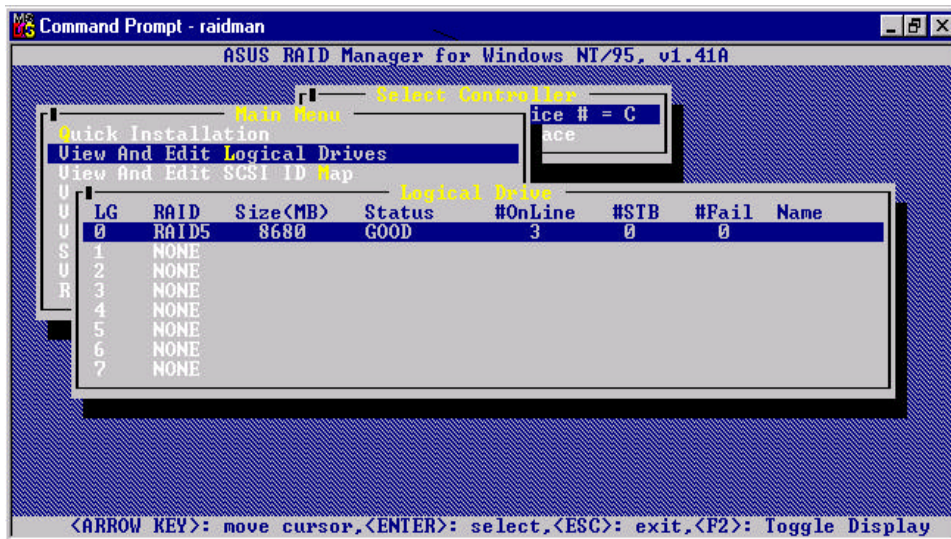
3.2 Select a correct driver on Windows 95

When you install the DA2100 driver in Windows 95 for ASUSPRO 7000, you may find several SCSI Bus Controllers on the My Computer/Control/System/Device Manager, You must choose a SCSI Bus Controller of DA2100 correctly, **the DA2100 default I/O address and IRQ should be D800 and 11**.

3.3 Plans for the PCI-DA2100 RAID Subsystem

a) 2 Physical Channels (CH.0 & CH.1)

Max. 15 Drives per Channel. (ID0 to ID15 except ID7)

b) Logical Drive (LD0 ~ LD7)

Max. 8 Logical Drives per Channel. (LG0 ~ LG7)

c) RAID Modes

Independent RAID Modes per Logical Drive

Max 8 Partitions per each Logical Drive

d) MAP ID

Map to ID0 ~ ID15 for each Partition

e) Map LUN (Logical Unit Number)

Map to LUN0 ~ LUN7 for each ID number

Attention: The DA2100 BIOS has assigned a SCSI ID for Logical Drive. So, the DA2100 architecture is one SCSI channel for host, two SCSI channels for hard drives.

3.4 The procedure for creating a RAID.
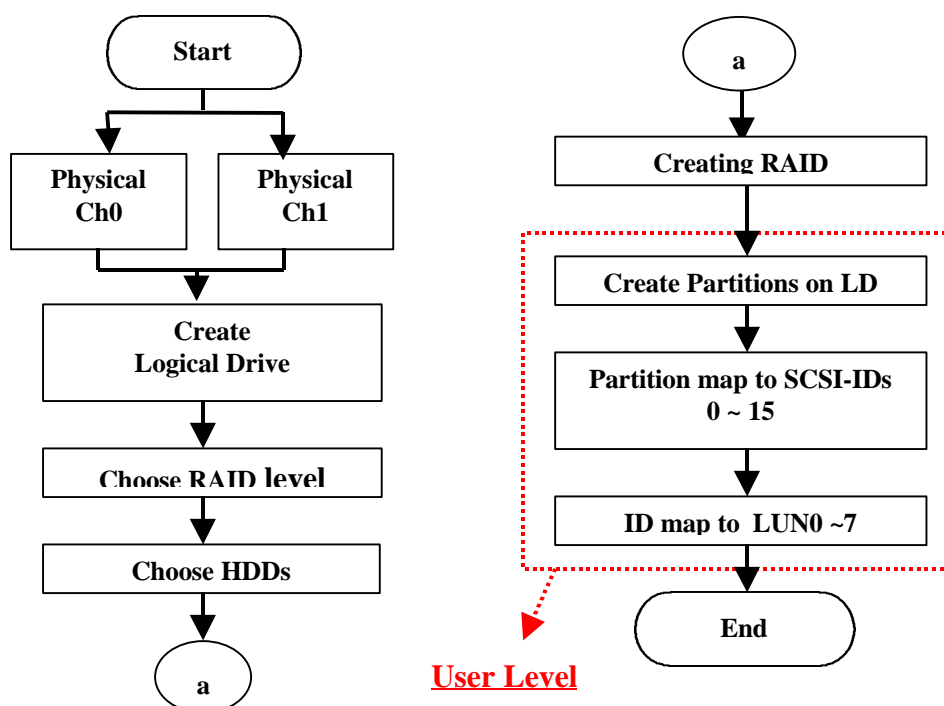
3.5 Look at the hard drives of PCI-DA2100 from different viewpoint.

PCI-DA2100

Channel 0   **Channel 1**

Ch0 ID0	Ch1 ID0
Ch0 ID1	Ch1 ID1
Ch0 ID2	Ch1 ID2
Ch0 ID3	Ch1 ID3
Ch0 ID4	Ch1 ID4
Ch0 ID15	Ch1 ID15

From System viewpoint

1.Create Logical Drive (0 ~ 7)
2.Choose HDDs Ch0 ID0,1,2 Ch1 ID0,1,2
3.Create RAID Level (0,1,3,5)

LG: 0 RAID: 5

1. Create LG's Partitions (0 ~ 7)

LG0 / Partition0

LG0 / Partition1

1. SCSI ID Map (ID0 ~ 15)
2. LUN Map (LUN0 ~ 7)

ID0 / LUN0

ID0 / LUN1

From user's viewpoint

---Show System Booting---

ASUS PCI-DA2100 (PCI-to SCSI RAID) BIOS v1.14D
PCI Bus # = 00 Device # = 0C Port = D400 IRQ=11 EDO RAM= 8MB FW = 1.22O

SCSI ID0 LUN0 : ASUS PCI-DA2100 0122 => Disk #80
SCSI ID0 LUN1 : ASUS PCI-DA2100 0122 => Disk #81
BIOS Function Installed Successfully!

Chapter 4 RAID fail rebuild on the PCI-DA2100.

4.1 Logical Spare Drive

A Local Spare Drive is a standby drive assigned to serve one specified logical drive. When one member drive of this specific logical drive fails, the Local Spare Drive becomes a member drive and starts to rebuild automatically.

4.2 Global Spare Drive

A Global Spare Drive does not serve one specific logical drive. If any member drive of every logical drive fails, the Global Spare Drive will join that logical drive and starts to rebuild automatically.

4.3 Automatic Rebuild

```
                    ┌─────────────────────┐
                    │       Start         │
                    │  Automatic Rebuild  │
                    └─────────────────────┘
                               │
                               ▼
                    ┌─────────────────────┐
                    │ One member drive fails
                    │ in logical drive    │
                    └─────────────────────┘
                               │
                               ▼
              ◇ Any Local Spare              ┌──────────────────────┐
                Drive assigned to    Yes     │ Rebuild using the Local
                this logical drive? ───────▶ │ Spare Drive automatically
                drive?                        └──────────────────────┘
                               │
                              No
                               │
                               ▼
              ◇ Any Global Spare             ┌──────────────────────┐
                Drive assigned to    Yes     │ Rebuild using the Global
                this logical drive? ───────▶ │ Spare Drive automatically
                drive?                        └──────────────────────┘
                               │
                              No
                               │
                               ▼
                    ┌─────────────────────┐
                    │ Wait for manual rebuild
                    └─────────────────────┘
```
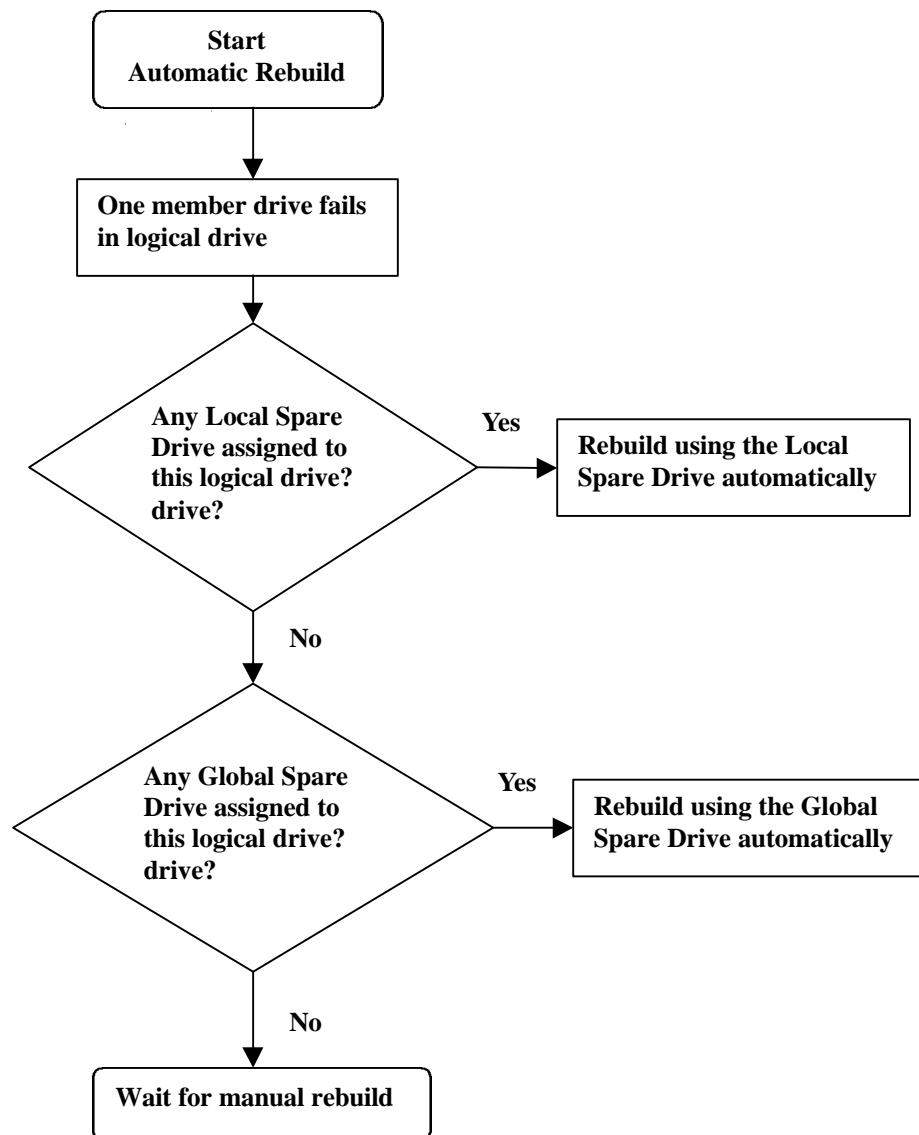
4.4 Manual Rebuild

```
        ┌─────────────────────┐
        │       Start         │
        │   Manual Rebuild    │
        └─────────────────────┘
                   │
                   ▼
        ┌─────────────────────┐
        │ User forces a manual│
        │ rebuild             │
        └─────────────────────┘
                   │
                   ▼
            ◇ Any Local Spare ◇        Yes    ┌─────────────────────┐
            ◇ Drive assigned to ◇ ─────────►  │ Rebuild using the Local
            ◇ this logical drive? ◇           │ Spare Drive         │
            ◇ drive?           ◇              └─────────────────────┘
                   │ No
                   ▼
            ◇ Any Global Spare ◇       Yes    ┌─────────────────────┐
            ◇ Drive assigned to ◇ ─────────►  │ Rebuild using the   │
            ◇ this logical drive? ◇           │ Global Spare Drive  │
            ◇ drive?           ◇              └─────────────────────┘
                   │ No
                   ▼
            ◇ Has the failed  ◇        Yes    ┌─────────────────────┐
            ◇ drive been      ◇ ─────────►    │ Rebuild using the   │
            ◇ replaced?       ◇               │ replaced drive      │
                   │ No                       └─────────────────────┘
                   ▼
        ┌─────────────────────┐
        │ Wait for manual rebuild
        └─────────────────────┘
```
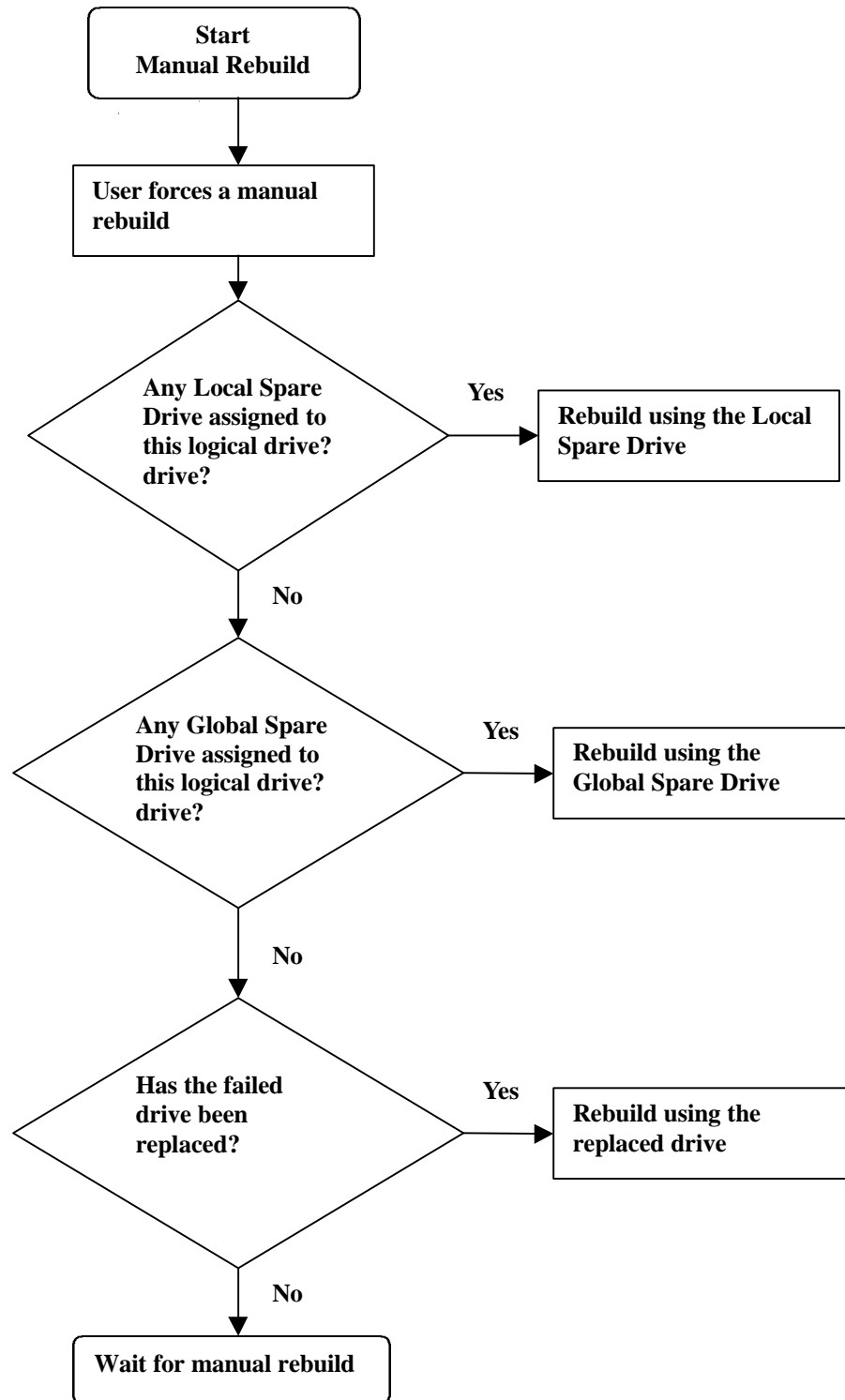
5.1 Simple Network Management Protocol (SNMP)

DA2100 support remote management over the network of host/agent running Windows NT via the Simple Network Management Protocol (SNMP).
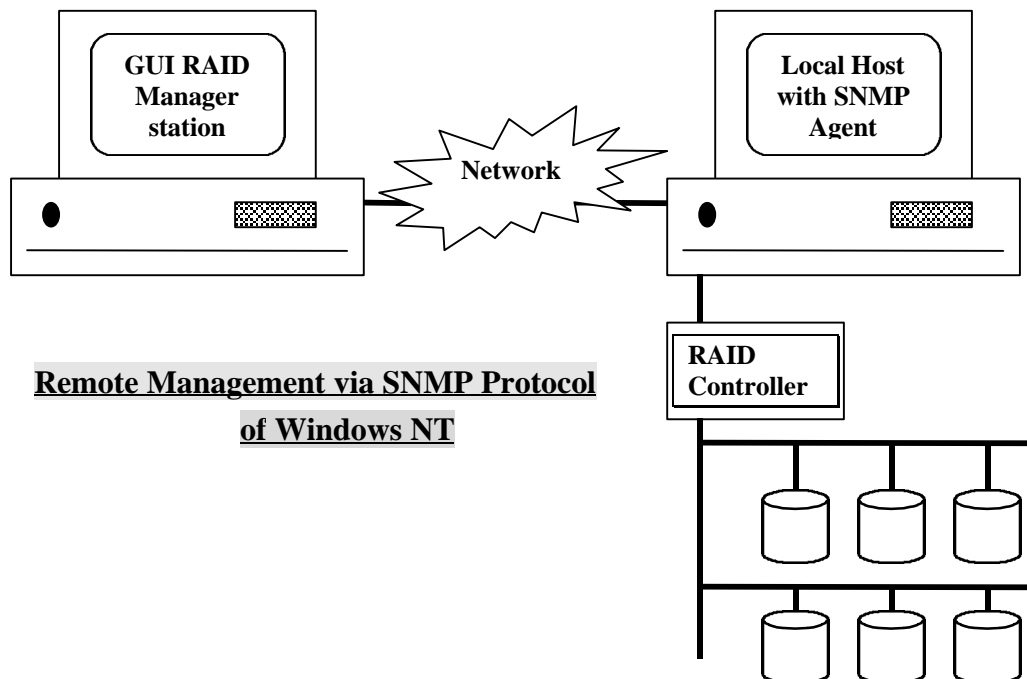
5.2 Software Setup

①Remote System:
- Windows NT Environment
- Add SNMP Protocol and Enable SNMP Service
- Install the GUI RAID Manager's SNMP Manager Site

②Local Hosts:
- Windows NT or Windows 95 Environment
- Add SNMP Protocol and Enable SNMP Service
- Install the GUI RAID Manager's SNMP Agent Site

Remote Management via SNMP Protocol of Windows NT

6.1   Attention of SCSI (ASUS PCI-DA2100)

a) Why is Termination Necessary?

The SCSI bus must be properly terminated at both ends so that commands and data can be transmitted to and from all devices on the bus. This is roughly similar to sending vibrations back and forth over the length of a string that is firmly secured at both ends.
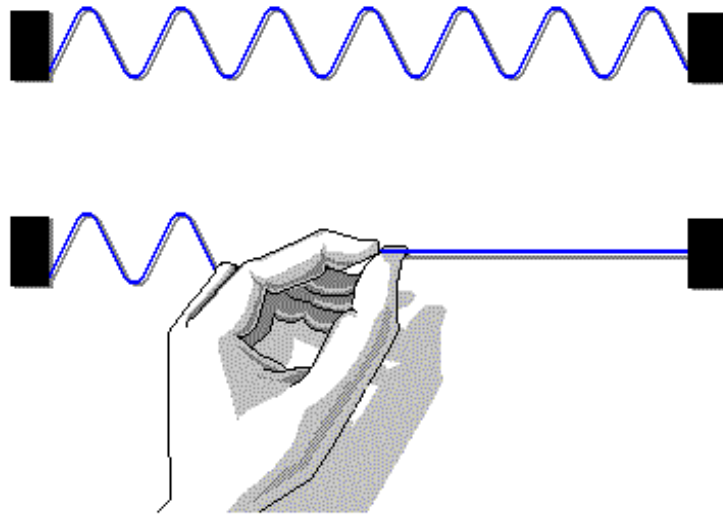
If you hold the middle of the string, the vibrations cannot be transmitted This is similar to what happens to data and commands on the SCSI bus if you terminate a device in the middle of the bus.

b) External channel of ASUS PCI-DA2100

The external channel 0 and internal channel 0 are the same channel, the total devices on external channel 0 and internal channel 0 should not exceed 15. Disable the termination of internal channel 0 if external devices are connected.
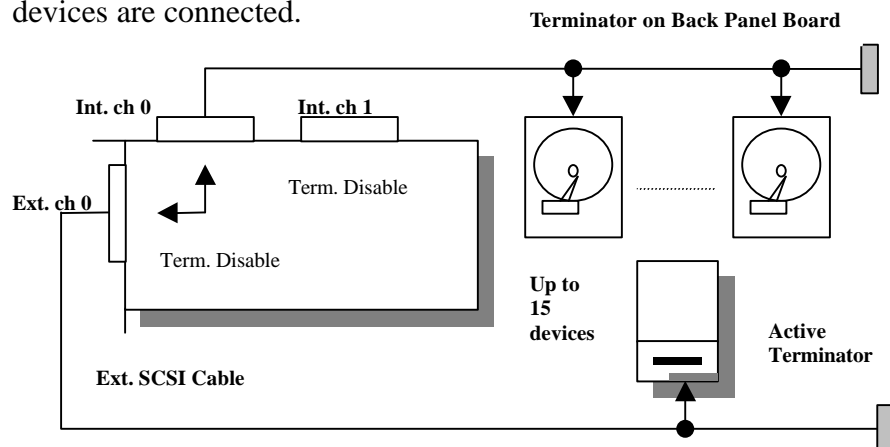
c) ASUS SCSI Back Panel Board

The Back Panel Board has Active Terminator, you don't need connect the other one.