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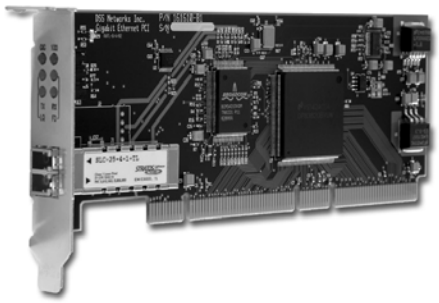
GigMAC PMC/PCI Controllers

Board and Driver Users Manual

(Includes models 5161, 5162, 5164, 5261, 5262, 6161, 6167, 6162 and 7160)

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1. INTRODUCTION

The GigMAC family of network controllers are a high-performance, cost-effective solution for adding Gigabit Ethernet connectivity to any embedded or real-time Network Appliance, Switch, Router, Server or other access device equipped with a PCI or PMC Mezzanine slot and is ideal for PCI, CompactPCI, PMC Mezzanine and other embedded systems.

The GigMac family includes optimized, high-performance driver support for VxWorks, Linux, and Windows XP/2000. Instructions for Linux and Windows driver installation are included in this manual. In addition, a companion document titled "VxWorks Users Manual And Integration Guide" is provided for technical assistance in integrating and testing the driver in an embedded real-time VxWorks environment.

1.1 SEE ALSO

Please also see the following documents on our website at www.dssnetworks.com and also included in the OEM developers kit CD:

Datasheets – please see product datasheets and other updated product information on OEM developer CD and on website.

Release Notes -- where updated information is provided on new features, compatibility, performance benchmarks, platform information and corrected problems.

VxWorks Users Manual and Integration Guide, DSS Document part no 131901. Provides technical information on integrating and testing our controllers and drivers into a VxWorks BSP and system board.

GIGFAQ.HTML – Also on website and included on OEM developer CD contains many answers to commonly asked questions regarding Gigabit Ethernet and our products including performance and system recommendations.

README.LINUX – Included on OEM developer CD contains latest driver installation and usage instructions for Linux Operating System.

netPerformance.txt -- Included on OEM developer CD contains useful information on tuning the VxWorks network protocol stack.

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1.2 COMPATIBILITY

The GigMac family is fully compliant with the following standards:

- IEEE 802.3 (all sections applicable to 1000 Base T, 1000 Base SX, 1000 Base LX)
- IEEE 802.1D and IEEE 802.1Q as applicable for VLAN and priority queuing support
- PCI 2.2 bus compliant
- PCI low-profile specification (as applicable for model)
- IEEE 1386.1 Draft 2.2
- **Linux driver compatibility:** Standard Linux 2.2 or 2.4 kernel level Network driver module compiled and tested on Intel and PowerPC architectures up to Linux kernel 2.4.18 and 2.4.20.
- **VxWorks driver compatibility:** Standard Tornado 2.0.2 and Tornado 2.2, VxWorks 5.4/5.5 Enhanced Network Driver loadable module integrated and tested on PowerPC, Intel and MIPS architectures

2. MODEL NUMBERS

This user manual covers all Models of our GigMAC PMC and PCI cards including:

PMC models

- Model 5161 PMC copper
- Model 5162 dual-port PMC copper
- Model 5164 quad-port PMC copper
- Model 7160 fiber
- Model 5261-LC (fiber), 5261-RJ (copper)
- Model 5262-LC (fiber), 5262-RJ (copper)

PCI models

- Model 6161 PCI copper
- Model 6162 PCI-X copper
- Model 6167 PCI fiber

End-of-life

- Model 5160 PMC and model 6160 PCI have been replaced by newer models (5161, 6161).

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3. FEATURES

The GigMac adapter offers the following key features:

- Sustained throughput of 245 Mbytes/sec (1.96 Gb) over PCI bus using 64-bit, 66 MHZ PCI
- Sustained throughput of 118 Mbytes/sec (944 Gb) over PCI bus using 32-bit, 33 MHZ PCI
- Frame processing rate of up to 1,000,000 frames per second (as measured on 2 GHZ P4/Zeon running Linux 2.4 kernel)
- Support for copper and fiber interfaces
- Driver support for vxWorks, Linux, Embedded Linux and Windows
- Built in management and diagnostics capabilities in drivers
- Both 64-bit PMC and 64-bit PCI low-profile card adapter form factors
- Supports 33 and 66 MHz, 32 and 64 bit PCI interfaces including PMC form factor
- Installs in any PCI or CompactPCI system with a PMC or universal PCI slot
- Ideal solution for CompactPCI and embedded 1U and 2U PC-based systems
- Utilizes either 5 or 3.3 volt pci bus power supply and contains onboard power regulators
- Full duplex Gigabit Ethernet Interface over standard CAT5 cabling
- Complies with all PCI revision 2.2 mechanical and electrical requirements
- Fully IEEE 802.3z, IEEE 802.3ab, 802.3u and IEEE 1386 compliant
- Compatible with all 10/100/1000BaseT hubs, switches and routers
- Burst rate of up to 256 dwords (1024 bytes) over PCI bus
- Jumbo frame support for up to 9K, 802.3x full duplex flow control with automatic pause and priority with multiple priority queues

4. OEM DEVELOPER KIT CONTENTS

An OEM developer kit is provided with the purchase of the Gigabit Ethernet controllers which contains drivers, documentation and sample code including the following:

- Driver source code for vxWorks, Linux 2.4, PowerPC, Intel platforms
- Users Manual(s)
- VxWorks Users Manual and Integration Guide
- Datasheets for chipset controllers (Intel, National, etc.)
- Windows device driver executables

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- TCP/UDP/IP performance test programs (vxWorks, Linux, Windows versions included)
- TCP, UDP and raw driver performance tests
- Driver Utilities (Linux)
- High-performance frame generator (wire and bus-speed capable)
- Transmit and receive callbacks (hooks) for driver-level application code
- Internal and external loopback capabilities
- Built-in performance instrumentation statistics
- Gigabit Ethernet FAQ sheet
- NetPerformance.txt protocol stack tuning guide for vxWorks

5. SYSTEM REQUIREMENTS

Intel Platform (minimum): Pentium III 800 MHZ or faster with PC100 or PC133 SDRAM, **32-bit 33 MHZ PCI**.

Intel Platform (recommended): Pentium4 at 1.8GHZ or faster, DDR SDRAM or RDRAM based, **64-bit, 66 MHZ PCI**.

PowerPC Platform(minimum): PowerPC 7400 or 750 series at 500 MHZ or faster, PC100 or PC133 SDRAM, 32-bit, 33 MHZ PCI

PowerPC Platform(recommended): PowerPC 7400 or 750 series at 700 MHZ or faster, PC133 SDRAM or DDR SDRAM, 64-bit, 33 or 66 MHZ PCI

Linux Operating system: Linux 2.4 (2.4.18, 2.4.20, all)

Tornado II requirements: Tornado 2.2/vxWorks 5.5 (or Tornado 2.0.2/vxWorks 5.4 with patch updates. PCI Configuration Library support (pciConfigLib).

Windows: Windows 2000 or Windows XP Embedded

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6. BOARD AND CONNECTOR INFORMATION

6.1 BOARD PHOTOS



Model 5161 PMC



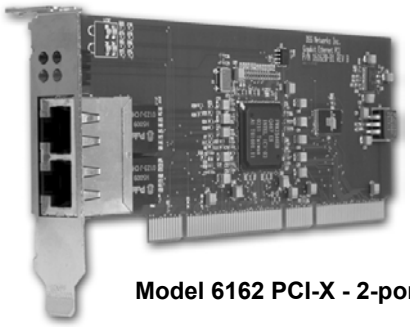
Model 5162 - 2-port PMC



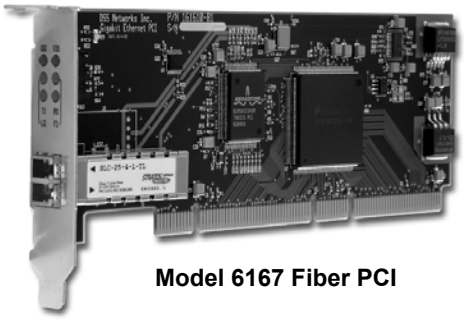
Model 5164 - 4-port PMC



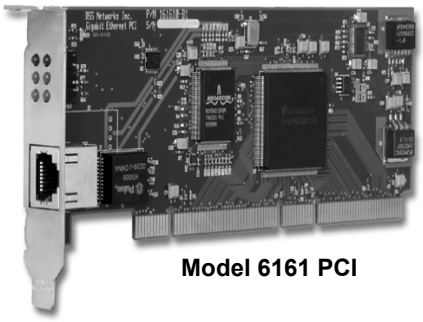
Model 7160 Fiber PMC



Model 6162 PCI-X - 2-port



Model 6167 Fiber PCI



Model 6161 PCI

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6.2 BOARD LED INDICATORS

PCI / PMC Boards LED Function Table

Gigabit NIC Model	LED # 1 Green	LED # 2 Green	LED #3 Yellow	LED #4 Yellow	LED #5 Yellow	LED #6 Yellow
PCI 6161	TX	RX	Quality	Duplex	1000	100
PCI 6167	TX	RX	Quality	Duplex	1000	100
PCI-X 6162	TX	RX	1000	100	N/A	N/A
PMC 5164	ACT	ACT	ACT	ACT	N/A	N/A
PMC 5161	TX	RX	10	100	1000	FD
PMC 7160	TX	RX	Link	SD	N/A	N/A
PMC 5162	TX	RX	1000	100	N/A	N/A

Models 5161, 6161 and 6167 with RJ-45 connector

The front panel has onboard RJ-45 connectors that supports the connection of Category 5 cabling with 6 LED indicators that provide the following as marked with silkscreen nomenclature on front panels:

Three of the Yellow LEDs are used to indicate the link status and port speed option: 10 Mb, 100 Mb (Fast Ethernet), and 1000 Mb (Gigabit Ethernet) modes. The illuminated LED indicated that the link is up and established at the speed indicated.

One yellow LED indicates Full-Duplex status if illuminated, else half-duplex.

The remaining two Green LEDs are used to indicate both transmit and receive activity.

LED SUMMARY

Speed Link Activity Indicators
10 Mbps LED glows solid yellow
when link is detected

100 Mbps LED glows solid yellow
when link is detected

1000 Mbps LED glows solid yellow
when link is detected

Full-Duplex Link Activity Indicator

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Full-Duplex LED illuminates solid yellow
to indicate full duplex status

Transmit and Receive Activity Indicators
Transmit and Receive LEDs are on solid or blinking green
to indicate activity on the link (solid shows constant activity, blinking shows intermittent activity)

Model 7160 with SC or LC connector

The front panel has onboard fiber optic connectors that supports the connection of fiber optic cabling using 50 or 62.5 micron multimode fiber, SC or LC type connectors with 4 LED indicators that provide the following as marked with silkscreen nomenclature on front panels:

Two of the Yellow LEDs are used to indicate Signal Detect (SD) and Link Status (LNK). The Signal Detect indicates the physical layer connection is established while the LNK indicates that the auto negotiation has completed and the link is established at the MAC and driver level.

The remaining two Green LEDs are used to indicate both transmit and receive activity. All ports function in the same manner as shown in the Table below:

LED SUMMARY

Signal "SD" detect Indicator
On solid yellow when hardware detects valid signal from Fiber. Flashing or intermittent yellow indicates poor signal quality and line errors.

Link "LNK" Indicator
On solid yellow to indicate auto-negotiation complete and MAC and driver level link is up.

Transmit and Receive Activity Indicators
Transmit and Receive LEDs are solid or blinking green
to indicate activity on the link (solid shows constant activity, blinking shows intermittent activity).

Model 6162 dual-port PCI with RJ-45 connector(s)

The front panel has two onboard RJ-45 connectors that supports the connection of Category 5 cabling with 4 LED indicators per port that provide the following as marked with silkscreen nomenclature on front panels:

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- LED_ACT (activity)
- LED_LINK (link)
- LED_1000 (1000 Mb mode)
- LED_100 (100 Mb mode)

Model 5162 dual-port PMC with RJ-45 connector(s)

The front panel has two onboard RJ-45 connectors that supports the connection of Category 5 cabling with 4 LED indicators per port that provide the following as marked with silkscreen nomenclature on front panels:

- LED_1000 (1000 Mb mod)
- LED_FD (full-duplex mode)
- LED_TX (transmit activity)
- LED_RX (receive activity)

Model 5262 dual-port or 5261 single port PMC with RJ-45 connector(s)

The front panel has two onboard RJ-45 connectors that supports the connection of Category 5 cabling with 4 LED indicators per port that provide the following as marked with silkscreen nomenclature on front panels:

- LED_1000 (1000 Mb mod)
- LED_FD (full-duplex mode)
- LED_TX (transmit activity)
- LED_RX (receive activity)

Model 5164 quad-port PMC with RJ-45 connector(s)

The front panel has four onboard RJ-45 connectors that supports the connection of Category 5 cabling with one bi-color LED indicators per port that provides an “activity” indicator.

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6.3 PMC CONNECTOR PIN/SIGNAL DEFINITIONS

PMC Connectors Pin Assignments

Pn1/Jn1 32 Bit PCI

1		TCK	-12V	NC	2
3		GND	INITA#		4
5		INTB#	INTC#	NC	6
7		BUSMODE1#	+5V		8
9	NC	INTD#	PCI-RSVD	NC	10
11		GND	PCI-RSVD	NC	12
13		CLK	GND		14
15		GND	GNT#		16
17		REQ#	+5V		18
19		VIO	AD[31]		20
21		AD[28]	AD[27]		22
23		AD[25]	GND		24
25		GND	C/BE[3]#		26
27		AD[22]	AD[21]		28
29		AD[19]	+5V		30
31	NC	VIO	AD[17]		32
33		FRAME#	GND		34
35		GND	IRDY#		36
37		DEVSEL#	+5V		38
39		GND	LOCK#		40
41	NC	SDONE#	SBO#		42
43		PAR	GND		44
45	NC	VIO	AD[15]		46
47		AD[12]	AD[11]		48
49		AD[09]	+5V		50
51		GND	C/BE[0]#		52
53		AD[06]	AD[05]		54
55		AD[04]	GND		56
57	NC	VIO	AD[03]		58
59		AD[02]	AD[01]		60
61		AD[00]	+5V		62
63		GND	REQ64#		64

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Pn2/Jn2 32 Bit PCI

1	NC	+12V	TRST#		2
3		TMS	TDO		4
5		TDI	GND		6
7		GND	PCI-RSVD	NC	8
9	NC	PCI-RSVD	PCI-RSVD	NC	10
11	NC	BUSMODE2#	+3.3V		12
13		RST#	BUSMODE3#	PMC_1	14
15		3.3V	BUSMODE4#	NC	16
17	NC	PCI-RSVD	GND		18
19		AD[30]	AD[29]		20
21		GND	AD[26]		22
23		AD[24]	3.3V		24
25		IDSEL	AD[23]		26
27		+3.3V	AD[20]		28
29		AD[18]	GND		30
31		AD[16]	C/BE[2]#		32
33		GND	PMC-RSVD	NC	34
35		TRDY#	+3.3V		36
37		GND	STOP#		38
39		PERR#	GND		40
41		+3.3V	SERR#		42
43		C/BE[1]#	GND		44
45		AD[14]	AD[13]		46
47		M66EN	AD[10]		48
49		AD[08]	3.3V		50
51		AD[07]	PMC-RSVD	NC	52
53		+3.3V	PMC-RSVD	NC	54
55	NC	PMC-RSVD	GND		56
57	NC	PMC-RSVD	PMC-RSVD	NC	58
59		GND	PMC-RSVD	NC	60
61		ACK64#	+3.3V		62
63		GND	PMC-RSVD	NC	64

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Pn3/Jn3 32 Bit PCI

1	NC	PCI-RSVD	GND		2
3		GND	C/BE[7]#		4
5		C/BE[6]#	C/BE[5]#		6
7		C/BE[4]#	GND		8
9	NC	VIO	PAR64		10
11		AD[63]	AD[62]		12
13		AD[61]	GND		14
15		GND	AD[60]		16
17		AD[59]	AD[58]		18
19		AD[57]	GND		20
21	NC	VIO	AD[56]		22
23		AD[55]	AD[54]		24
25		AD[53]	GND		26
27		GND	AD[52]		28
29		AD[51]	AD[50]		30
31		AD[49]	GND		32
33		GND	AD[48]		34
35		AD[47]	AD[46]		36
37		AD[45]	GND		38
39	NC	VIO	AD[44]		40
41		AD[43]	AD[42]		42
43		AD[41]	GND		44
45		GND	AD[40]		46
47		AD[39]	AD[38]		48
49		AD[37]	GND		50
51		GND	AD[36]		52
53		AD[35]	AD[34]		54
55		AD[33]	GND		56
57	NC	VIO	AD[32]		58
59	NC	PCI-RSVD	PCI-RSVD		60
61	NC	PCI-RSVD	GND		62
63		GND	PCI-RSVD	NC	64

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7. POWER CONSUMPTION SPECS

PCI / PMC Boards Power Consumption Table

Gigabit NIC Model	3.3V Source Current I (mA, A)	5V Source Current I (mA, A)	Power (P) P = I . V (W)	
PCI 6161	775	785	2.55	3.92
PCI 6167	775	785	2.55	3.92
PCI-X 6162	1.17	1.70	3.86	8.5
PMC 5160	445	485	1.47	2.42
PMC 5161	435	465	1.44	2.33
PMC 7160	525	567	1.74	2.83
PMC 5162	1.45	1.60	4.80	8.0
PMC 5164	2.34	1.80	7.90	9.0

8. HARDWARE INSTALLATION

Before attempting to install the GigMac Gigabit adapter into your system, please make sure of the following:

Shut off the power to the computer and any peripherals. It is important to **remove the power cable** to the computer to reduce the possibility of residual power remaining in the power supply.

Ground yourself. Many electronic components inside computer and on the GigMac card can be severely damaged by receiving a shock of static electricity. Before touching any electronic components or boards, discharge any static electricity on your body by touching the bare metal case around the power supply inside your computer. Avoid excessive movement during the installation, such as walking across carpets, as this can generate static. If you must leave the installation area before the installation is complete, be sure to ground yourself again before continuing the installation.

Assess system power requirements. If you already have other PCI cards in your Mac, make sure that your system is able to provide the necessary power to support the addition of the GigMac adapter card. Check your computer's user manual for power limitations.

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8.1 INSTALLATION IN PC COMPUTER

There are many different styles and types of PC platforms that utilize PCI slots. This section contains a generic installation procedure. Please refer to your User's manual for more detailed instructions on installing the adapter in a PC.

The GigMAC PMC card requires a PMC-to-PCI Carrier adapter module in order to be used in a standard PCI system. Please refer to section 2.2 below for instructions on installing the GigMAC PMC adapter onto a mainboard carrier adapter.

Step 1 - Shut down the power to the computer system and remove the power cord and any peripheral cables.

Step 2 - Open the computer case. This will expose the interior of the case and allow the adapter card to be installed. Consult your User's Manual for assistance in opening your computer. The PCI card edge connector contains “key” notches that correspond to dividers in the motherboard slot. It is very important to align the key notches with the matching dividers in the slot. Failure to align the notches correctly could cause the card or slot to be damaged.
Step 3 - Align the GigMac PCI edge connector and the system motherboard socket as indicated in the diagram above. Once aligned, push down firmly on the PCI card until it is completely seated in the slot. Once the GigMac adapter has been successfully installed, close the PC case, re-attach the power cable and any other cables that were removed for the hardware installation procedure. Consult Section 2.3 for information on connecting the adapter to the network.

8.2 EMBEDDED OR COMPACT PCI INSTALLATION

There are many different styles and types of Embedded System platforms that utilize PMC Mezzanine slots. This section contains a generic installation procedure. Please refer to your User's manual for more detailed instructions on installing the adapter in an Embedded or CompactPCI system.

Step 1 - Shut down the power to the computer system and remove the power cord and any peripheral cables.

Step 2 – Remove the CompactPCI or Embedded Mainboard controller from the system, if necessary to access the PMC slot. This will allow the PMC adapter card to be more easily installed. Consult your User's Manual for assistance in opening and removing the mainboard. The PMC card has 3 connectors labeled JN1, JN2 and JN3. JN1 and JN2 are required for all modes of operation while JN3 is required only for 64-bit mode. Your CompactPCI mainboard or other PMC carrier will also contain PMC card connectors labeled JN1 and JN2, and

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optionally JN3 and JN4. JN4 is for optional user-defined I/O and is not used by the GigMAC PMC adapter. Additionally, the mainboard may also contain either a 5 volt or 3.3 volt key to prevent voltage mismatches. Since the GigMAC PMC card may operate from a 5 or 3.3 volt supply, it can be used in either a 5 or 3.3 volt keyed system. It is very important to align the connectors before pressing the PMC card onto the mainboard to prevent damage to the card or slot.

Step 3 - Align the GigMac PMC connectors and the system motherboard Connectors and push down firmly on the PMC card until it is completely seated in the connectors on the mainboard. Once the GigMac adapter has been successfully installed, re-install the mainboard. Re-attach the power cable and any other cables that were removed for the hardware installation procedure.

9. COPPER CABLING AND CONNECTOR INFO

9.1. FIBER CABLE SPECIFICATIONS

Distance (Model 7160, 6167, 5261-LC, 5262-LC multimode/singlemode fiber)

(1000-base-SX 850nm multimode)
(1000-base-LX 1310nm singlemode)

1000BASE-SX/LX (850 nm Laser for multimode-SX, 1310nm laser for single-mode-LX)

Fiber Core Diameter	Type	Fiber Bandwidth Mhz* km	Distance
62.5/125 um	multi-mode	160 Mhz * km	2 to 220 m
62.5/125 um	multi-mode	200 Mhz * km	2 to 275 m
50.0/125 um	multi-mode	400 Mhz * km	2 to 500 m
50.0/125 um	multi-mode	500 Mhz * km	2 to 550 m
8.0/125 um	single-mode	500 Mhz * km	5 km

Connecting Fiber optic Model 7160, 6167, 5261-LC, 5262-LC

This section explains how to connect the GigMac fiber controller to the external network using standard fiber optic cables. Typically 50 or 62.5 micron multimode fiber optic cables with LC or SC type connectors are used depending on the connector option. For extended distance, single-mode fiber can be used in models equipped with extended range single-mode connectors.

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Insert the fiber optic cable into the SC or LC type connector until the self-locking tab clicks into position. Connect the opposite end in to a 1000 Base SX switch. Two types of cables are used when connecting the GigMac fiber controller to the network. A workstation or "straight through" cable is typically used to connect Ethernet adapters to switches. A fiber “crossover” cable may also be used to connect controllers back-to-back. This configuration is useful for loopback and/or diagnostic purposes or when a switch is not available.

9.2 COPPER RJ-45 CONNECTOR AND CABLE

Connecting Copper RJ-45 Models 5161, 5162, 5261-RJ, 5262-RJ, 5164, 6161, 6162

This section explains how to connect the GigMac controller to the external network using the standard Category 5, 5e or 6 cables. The maximum cable length is typically 100 meters or 328 feet.

Insert the Category 5 or 5e cable into the RJ-45 connector until the self-locking tab clicks into position. Connect the opposite end in to a 10/100 or 10/100/1000 Base T switch. Two types of cables are used when connecting the GigMac controller to the network. A workstation or "straight through" cable is typically used to connect Ethernet adapters to switches. A “crossover” cable may also be used to connect controllers back-to-back. This configuration is useful for diagnostic purposes or when a hub or switch is not available. However, it is not recommended for extended use, as it violates the IEEE specification for 10 Mbit, 100 Mbit and 1000 Mbit Ethernet networks.

Note(1): GigMAC Models 5161, 5162, 5164, 6161 and 6162 support “auto-MDIX” mode where a crossover cable is not required when directly attaching two controllers.

***Note(2)*:** Cables used for Gigabit networks must use all 8 wires. In 10 and 100 modes, wires are dedicated for transmit or receive while in Gigabit mode, data is transmitted and received over all 4-pairs.

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RJ-45 pinouts for CAT5 connectors and cables are shown in the following table:

Pin	10/100 Signal	Gigabit Signal
1	Transmit+	Channel A+
2	Transmit-	Channel A-
3	Receive+	Channel B+
4	Unused	Channel C+
5	Unused	Channel C-
6	Receive-	Channel B-
7	Unused	Channel D+
8	Unused	Channel D+

10. SOFTWARE DRIVER INSTALLATION

The following sections explain how to install the driver software in VxWorks, Linux and Windows based systems.

10.1 VXWORKS DRIVER INSTALLATION AND USAGE

This section is covered in a separate manual. Please see the vxWorks OEM Developers Guide p/n 131901 for vxWorks software installation and integration instructions.

10.2 LINUX DRIVER INSTALLATION AND USAGE

These instructions assume that you are running Red Hat Linux 7.x, 8.x, 9.x or a similar Linux OS. You should be using at least a kernel version 2.4.18 installation for any other Red Hat-based system will be similar. For other Linux based systems, the location of some files may be slightly different.

Building the driver

To build the driver, copy the driver files to an appropriate directory. You will need to make sure your CD is mounted.

```
$ mkdir dpm
$ cd dpm
$ cp /mnt/cdrom/linux-dpm-driver/dpm/dpm*.tar.gz .
$ gunzip dpm*.tar.gz
$ tar vxf dpm*.tar
```


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To create a new driver object module:

```
$ make clean
$ make
```

Repeat same procedure with driver utility directory as follows:

```
$ mkdir util
$ cd util
$ cp /mnt/cdrom/linux-dpm-driver/util/util*.tar.gz .
$ gunzip util*.tar.gz
$ tar vxf util*.tar
```

To create a new utility programs:

```
$ make clean
$ make
```

Note(1): If you are installing the GigMac in an SMP machine, you should comment out the standard CFLAGS line in the “Makefile” and uncomment the SMP version of CFLAGS before compiling the driver (safe to leave SMP enabled on most newer versions of Linux).

Note(2): Before compiling, please also edit the Makefile and set “INCLUDEDIR” to the path of your Linux kernel source tree. For example:

INCLUDEDIR = /usr/src/linux-2.4.25/include

Installing the driver

To install the driver object module in the file system, become root and run:

```
# make install
# depmod -a
# insmod dpm.o [ChipSelector=0] [ChipSelector=1]
```

Note(1): For loading driver with Intel 82546 based cards, use ‘ChipSelector=1’

Note(2): For loading driver with National DP83820 based cards, use ‘ChipSelector=0’ or leave blank (default)

Note(3): ‘modprobe’ may be used in place of ‘insmod’ to resolve module dependencies.

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Configure the card using your preferred configuration tool, or edit the initialization script for the interface directly. On Red Hat, the file /etc/sysconfig/network-scripts/ifcfg-eth0 might look something like this (substituting ethernet device number, example: eth0, eth1, etc):

```
DEVICE='eth1'
BOOTPROTO='none'
ONBOOT='yes'
IPADDR=192.168.0.3
GATEWAY=192.168.0.1
TYPE=Ethernet
USERCTL=no
NETMASK=255.255.255.0
NETWORK=192.168.0.0
BROADCAST=192.168.0.255
```

Note: You should also add a line to /etc/modules.conf for each interface as shown in the following example:

SAMPLE MODULES.CONF FILE

```
alias eth1 dpm
alias eth2 dpm
alias eth3 dpm
alias eth4 dpm
options dpm ChipSelector=1 IntrHoldOff=0
```

Note: In order to load the Intel driver, the "ChipSelector=1" option is required in the 'options' field of modules.conf. Please see man page for modules.conf for additional information on module configuration.

MANUAL DRIVER INSTALLATION

```
insmod ./dpm.o # to insert driver module
ifconfig eth1 192.168.0.3 # if not already configured by system
```

Once driver is inserted you may need to run "ifconfig" command or it may be run automatically by the system.

MANUAL DRIVER REMOVAL

```
ifdown eth[n]  # repeat for all 'dpm' network interfaces
rmmod dpm      # to remove driver module
```


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LOADING THE DRIVER FOR INTEL BASED MODELS (5261, 5262, 5164, etc.)

Note: In order to load the Intel driver, the "ChipSelector=1" option is required during the 'insmod' as follows:

```
insmod ./dpm.o ChipSelector=1
```

TUNING THE INSTALLATION

Interrupt holdoff (programmed latency)

To increase (or decrease) the value of the programmed interrupt latency, insert the module and set the "IntrHoldOff" parameter as follows:

```
insmod ./dpm.o IntrHoldOff=1 # value can be 0, 1, 2 or 3
```

Note: A value greater than 3 is not recommended.

Other driver parameters that can be set during driver load or in modules.conf:

```
MediaSpeed=10,100,1000  # Media Speed (default 1000)

SetAutoNeg=0,1          # Setting for auto negotiation (default 1=auto)

DuplexMode=0,1          # Setting for duplex (default 1=FULL)

IntrHoldOff=0,1,2       # interrupt holdoff value in 100 microsecond
units

ChipSelector=0,1        # default=0 (National), 1=Intel

NumBufDescs=<cnt>       # default=256, 128, 256, 512, 1024

MaxBufferSize=<size>    # default=2048, 2048, 4096, 8192

FrameGenSize=<size>     # frame generator test size (64-9000 bytes)
```

See “Command Line Parameters” table below for additional information on driver module insertion parameters.

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'Insmod' Command Line Parameters

The following parameters are used by entering them on the command line with the modprobe or insmod command. For example, with Intel based card model (ex. 5262, 5164, etc.) entering:

```
insmod dpm ChipSelector=1 IntrHoldOff=0
```

loads the dpm driver setting it for Intel chipset and setting the Interrupt Holdoff latency to zero (disabled).

Parameter Name	Valid Range/Settings	Default	Description
SetAutoNeg	0,1	1	This parameter specifies the enabling of auto negotiation.
DuplexMode	0,1,2 (0=half, 1=full, 2=both)	1	Defines the direction in which data is allowed to flow. Can be either one or two-directional. If both. If auto negotiation is enabled, defines modes advertised. If auto negotiation is disabled sets duplex to this value.
PauseFlowEn	0, 1	1	This parameter enables or disables pause frame flow control (typically enabled).
IntrHoldOff	0, 1 or 2 (0=off)	1	This value delays the generation of receive interrupts in units of 100 microseconds. Receive interrupt reduction can improve CPU efficiency if properly tuned for specific network traffic. Increasing this value adds extra latency to frame reception and if set too high could decrease the throughput of TCP traffic.
MediaSpeed	10, 100, 1000	1000	If auto negotiation id disabled, speed forces the line speed to the specified value in megabits per second (Mbps). If auto negotiation is enabled, sets the highest speed advertised. (adapters using copper connections only)
NumBufDescs	80 - 4096	256	This value is the number of transmit and receive descriptors allocated by the driver. Increasing this value allows the driver to queue more transmit and receive buffers. Each descriptor is 16 bytes.
MaxMtuSize	1500-9600	1500	This value is the maximum mtu size supported in the driver.
MaxBufferSize	2048, 4096, 8192, 16384	2048	Sets the maximum buffer size supported in the driver.

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AccAllUni	0, 1	0	Setting this parameter to one instructs the driver to receive all unicast frames (sometimes useful in frame generator testing). Do not enable for normal traffic.
ChipSelector	0, 1	0	Sets the chipset selector (0=National, 1=Intel). Default is National chipset.
FrameGenSize	60-MaxMtuSize	1500	Sets the frame generator frame size for testing end-to-end or loopback.

FUNCTIONALITY TESTING

When the driver is loaded into the system via `insmod' it probes the PCI bus to locate all DP83820 devices, and creates control structures for each. The driver logs a couple of messages available in `/var/log/messages' for each device with information about its PCI geographic location, IRQ, IO address, and some basic debug information (addresses of some important structures).

All the devices on the PCI bus can be listed by,

```
# cat /proc/pci
# cat /proc/interrupts
```

IRQ and IO address information from this can be correlated with the information displayed by the driver in `/var/log/messages'

When the TCP/IP stack is initialized, it opens all configured ethernet devices, and initializes them for use. At this time, the driver will perform auto negotiation and log information about the link status. The driver can then be tested by running ping, telnet, ftp, NFS etc.

Suggested basic verifications to be run

```
lsmod               # lists loaded drivers
ifconfig            # lists configured network interfaces
dmUtil -s eth[n]    # prints low-level driver statistics for device
ping <ip addr>      # ping to remote station to verify
```

ADDITIONAL VERIFICATION AND PERFORMANCE TESTING

Verification and performance testing can be done using the Linux "uxBlaster" and "uxBlastee" test programs found on OEM developer kit CD. The 'dmUtil' utility program also found on the CD can be used to obtain valuable information used for debug and integration verification.

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```
dmUtil -s eth0    # displays low-level driver statistics
dmUtil -m eth0    # displays DP83820 MAC controller registers
dmUtil -p eth0    # displays gigabit (phy) transceiver registers
dmUtil -e eth0    # displays eeprom
dmUtil -a eth0    # displays mac address
dmUtil -ms eth0   # displays mac stats (Intel only)
```

LOOPBACK PERFORMANCE TESTING

1. Edit 'Makefile'
2. Un-comment the following define:

```
CFLAGS += -DNS_FRAME_TEST -DIN_FRAME_TEST
```

3. Save file, unload and reload driver using procedures described above.
4. Use "ifconfig" command to bring up Ethernet interface.
5. Run the following command from the 'util' directory:

./dmUtil -l eth1 # loopback eth0, eth1, etc.

6. View statistics using dmUtil command as follows:

./dmUtil -s eth1 1 # second arg=1 zeroes statistics after gathering

Note: The driver must be compiled without "-DNS_FRAME_TEST" for normal operation.

Jumbo frames: The mtu size can be increased using the ifconfig utility, as follows:

ifconfig <interface-name> mtu <mtu-size>

Example: ifconfig eth0 mtu 3000

Note: Use of jumbo frames is not recommended as it is not IEEE standard and many switches do not support the forwarding of jumbo frames. It also has to be enabled and negotiated on both ends of the connection and in today's faster systems, using jumbo frames offers little performance improvement and may only be useful in closed application-specific networks.

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Using dmUtil dpm driver utility:

The “dpm driver utility” is used to capture detailed board levels statistics, controller registers and to set loopback mode. Example usage of the “dmUtil” are as follows:

```
dmUtil -s eth1              # get driver statistics for interface 1

dmUtil –p eth1              # get phy (transceiver) registers for interface 1

dmUtil –m eth1              # get MAC (PCI controller) registers for interface 10

dmUtil –t eth1              # get execution debug trace for interface1
                             (DEBUG_FLAGS trace option must be compiled in)

dmUtil –e eth1              # get eeprom configuration settings

dmUtil –ms eth1             # get mac MIB statistics

dmUtil –a eth1              # get mac address

dmUtil –w eth1 <0,1,2>      # write default eeprom configuration to controller


dmUtil –l eth1 <arg>        # set controller in internal loopback mode
                            (driver must be compiled with –DNS_FRAME_TEST
                            in Makefile). Arg=1 for enable, 0 for disable.
```


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10.3 DPM DRIVER MANAGEMENT API

The dpm network driver management API is an api extension primarily used by the 'dmUtil' command line utility to enable various management functions or to acquire driver status and statistics. The typical api usage sequence is as follows:

1. User enters 'dmUtil' command and parameters as shown in the following example:
   ./dmUtil –s eth1

2. dmUtil parses command line and prepares an "ioctl" request block to send to driver. A pointer to a application buffer to hold the text message results (for example formatted statistics) is provided by dmUtil in the request block.

3. Driver receives ioctl request block performs action and copies result data to applications message buffer.

The following is an API description of the management ioctl commands issued to the driver from the 'dmUtil' application's viewpoint:

A. Opening a socket for management API

```
int s;
s = socket (PF_INET, SOCK_STREAM, 0);
```

B. Create request block for driver ioctl

```
struct ifreq ifr;
int subCmd;
NpkUserCtl myIoc;
char myDataBuf[MAX_LINES * MAX_LINE_LEN];

/* set interface name */
strcpy (ifr.ifr_name, "eth1");

/* set ioctl sub-type */
subCmd = DM_IOCTL_GET_STATS;

/* set command argument */
myIoc.arg1 = 0;

myIoc.dataItm = (u_int) myDataBuf;
ifr.ifr_data = (char *) &myIoc;
```


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C. Issue ioctl command

```
/* issue ioctl to network driver */
err = ioctl (s, SIOCDEVPRIVATE + subCmd, &ifr);
```

D. Check and print results

```
if (err < 0)
{
    /* perror (errno); */
    usage ();
    exit (1);
}
if (subCmd == DM_IOCTL_GET_TRC)
{
    print_trace();
}
else
{
    if ((subCmd != DM_IOCTL_SET_LOOP_MODE) &&
        (subCmd != DM_IOCTL_PROG_EEPROM))
        printf ("\n%s\n", myDataBuf);
}
```

IOCTL COMMAND SUB-TYPES

/* get driver trace buffer */

```
#define DM_IOCTL_GET_TRC            1

/* get driver statistics */
#define DM_IOCTL_GET_STATS          2

/* get phy registers */
#define DM_IOCTL_GET_PHY_REGS       3

/* get mac registers */
#define DM_IOCTL_GET_MAC_REGS       4

/* set loopback mode */
#define DM_IOCTL_SET_LOOP_MODE      5
```

Additional arguments:

```
      arg1=0      Disable loopback
      arg1=1      Enable  loopback
```

```
/* read eeprom */
#define DM_IOCTL_READ_EEPROM        6

/* program eeprom */
#define DM_IOCTL_PROG_EEPROM        7

/* get mac address */
#define DM_IOCTL_GET_MAC_ADDR       8
```


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```
/* dump buffer descriptors */
#define DM_IOCTL_DUMP_BDS           9

/* get mac MIB statistics */
#define DM_IOCTL_GET_MAC_STATS      10
```

Please also see example code in dmUtil.c for additional information.

10.4 WINDOWS DRIVER INSTALLATION

This chapter describes the installation of the GigMac in Windows 2000/98/ME environment. Before attempting to install the software, make sure your system settings match the system requirements listed in Chapter 1.

The Hardware Wizard in Windows 98, and the Found New Hardware Wizards of Windows 2000 and Windows Me makes the installation processes of these programs very similar. Before installing the GigMac driver, make sure the hardware has been installed properly, and the adapter is connected to the network with the appropriate network cables. For information on connecting network cables to the GigMac Ethernet adapter, please see the "Connecting to the GigMac" section presented earlier in this manual.

Step 1 - Once the hardware is installed, reconnect the power and network cables and turn on the power to the computer.

The Hardware Wizard will detect the card. Click the **Next>** button to continue Installation and proceed to Step 2 below. If the Wizard does not detect the card, please goto to Control Panel->Add/Remove Hardware. Click **Next>** and select Add/Troubleshoot Device. At this point the system may find your device or you may have to select it manually from the list. Then select **Update Driver**.

Step 2 - The Hardware Wizard will search for new software for the hardware it has detected. Click Next> to continue installation.

Step 3 - The Hardware Wizard will ask you what you wish to do. Click Next> to accept the Recommended option and continue installation.

Step 4 - The Hardware Wizard will ask where you wish to search for drivers. Click the "Specify a location" option. Insert the DSS Networks GigMac Gigabit Ethernet Adapter CD. Click Browse and select the CD. Select the appropriate Windows directory and Click Next to continue.

Step 5 - The Hardware Wizard will find the driver and list the path to the INF file. Click Next to continue installation. If the Wizard indicates more than 1 possible driver, please make sure you have selected the one from the installation CD.

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Step 6 - The Hardware Wizard will ask you to configure Advanced Features for your adapter. For most users, the default settings are sufficient. Click OK to accept the default settings.

Step 7 - The Hardware Wizard may ask you to insert your Windows 98, Windows 2000 or Windows Me CD and then click OK. One Windows 2000, this step may not be necessary as all of the necessary files may be on your hard disk. If needed, insert the Windows CD and Click OK. The Hardware Wizard may copy files from the Windows CD.

Step 8 - The Hardware Wizard will finish installing the adapter software. Click Finish to continue the installation.

Step 9 - The Hardware Wizard ***may*** ask you to restart your computer. Click Yes to reboot your computer and complete your installation. The installation of your DSS Networks GigMac Gigabit Ethernet Adapter is now complete.

11. TESTING AND VERIFICATION

There are several ways to test your adapter on vxWorks, Linux and Windows platforms. This section provides *suggestions* on how you may test and verify your installation. Before you can proceed with any of the suggested tests, you must have previously configured your TCP/IP protocols and interfaces on your computer. Please refer to your online help and User Manuals for your particular system on instructions on setting up your TCP/IP environment.

- **ICMP Ping**. Ping is a simple verification method and it very useful for verification of cabling, adapter configuration and system configuration of the TCP/IP protocol software. You can also specify a “fast ping” and larger message sizes in order to more effectively test the protocols and adapter interface.

- **FTP File Transfer**. FTP is also an available method for testing your installation. FTP allows you to test by transferring files of different sizes. Using large file transfers is a good way to test medium transfer rates through the protocol stack.

- **HTTP Web Browsing.** Is a good means of testing the protocols and interface to the adapter.
- **Telnet**. Using Telnet you can log into another system and invoke commands to send a receive data. You can also test multiple connections within a single Window by repetitively Telnet’ing back and forth between multiple systems.

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- **Windows Explorer**. In a Windows environment, you can also use the Windows explorer to access files on other systems within your Workgroup or Domain.

- **Blaster / blastee** can be used to perform TCP throughput tests between VxWorks, Linux and Windows platforms. These test programs are included on the OEM developer CD.

- **Internal loopback**: The vxWorks and Linux drivers can be placed into internal loopback for a full-speed raw driver and controller throughput test. This is very useful for getting a baseline throughput measurement and also for verifying the robustness of the controller and driver in your system.

12. SPECIFICATIONS

Connector (Models 5161, 5162, 5261-RJ, 5262-RJ, 5164, 6161, 6162): Gigabit Ethernet (1000BaseT, 100BaseTX, 10BaseT): **RJ-45 CAT5**

Connector (Model 7160, 6167 Fiber): SC or LC connector type for 50 and 62.5 micron multimode fiber.

Connector (Model 5261-LC, 5262-LC Fiber): LC connector type for 50 and 62.5 micron multimode fiber.

Drivers:
- Microsoft Windows 2000 Professional
- Microsoft XP Embedded
- Linux 2.4 (all versions)
- Tornado 2.0.2 and Tornado 2.2 (VxWorks 5.4/5.5)

Status Indicators (models 5161 and 6161, 6167): 1000 Mbps Link, 100 Mbps Link, 10 Mbps link, Full-Duplex, Transmit and Receive Activity

Status Indicators (model 7160 fiber): Signal Detect, Link, Transmit and Receive

Status Indicators (model 6162 PCI): Link, Activity, 1000 Mbps, 100 Mbps

Status Indicators (model 5162 PMC): 1000 Mbps, 100 Mbps. Transmit and Receive

Status Indicators (model 5164 PMC): Link/Activity (all four ports)

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Status Indicators (model 5261/5262 PMC): Link/1000, Full-Duplex, Transmit, Receive

Bus Interface: PCI v2.2 bus master, 32/64-bit, 33/66 MHz
PCI-X (Model 6162)

Dimensions: (PMC Models 5161, 5162, 5164, 7160, 5261, 5262):
5.866" X 2.913

Dimensions: (PCI models 6161, 6162, 6167):
6.6" X 2.535"

PCI Power supply voltage: 5V or 3.3V (factory optioned), 5V is default

PCI signaling voltage: 5V and 3.3V

Performance Throughput (PCI 64/66): 245 Mbytes/sec (1.96 Gb) (full-duplex) sustained

Performance Throughput (PCI 32/33): 118 Mbytes/sec (944 Mb) full or half duplex sustained

Maximum frame rate: Over 850,000 frames per second sustained per port

Burst Rate: Up to 256 dwords (1024 bytes) over PCI bus

Host Offloading: IPv.4 checksum (UDP, TCP and IP) and optional statistics gathering for RFC 1213 (MIB II), RFC 1398 (Ether-like MIB), IEEE 802.3 LME

Optional: Jumbo packets, 802.3x full duplex flow control with automatic pause and priority with multiple priority queues

Link Quality Monitor: Continuously adapts to actual line conditions by managing echo and crosstalk cancellation, equalization, timing and skew compensation.
Automatic Gain Control maximizes signal strength

Environmental Range:
Operating Temperature: **0º to 60ºC**
Relative Humidity: 10% to 90%, non-condensing
Power: Model 5161 – 3.3W @3.3V
Model 7160 – 2.6W @3.3V
Model 6160 – 4W @ 3.3V

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Voltage: 5 or 3.3 volts

MTBF:

Model 5161 – 350,000 hours
Model 7160 – 250,000 hours
Model 6160 – 300,000 hours
Model 5261 – 300,000 hours
Model 5262 – 300,000 hours

Environmental Standards Compliance (pending):

- FCC Part 15, Class B
- EN 55022; 1998 Class B
- EN 50082-1
- CE Mark

Standards Compliance:

- Network: IEEE 802.3u Auto Negotiation and parallel detection
- IEEE 802.3ab Gigabit Ethernet over 4 pairs of UTP Category 5 (1000BaseT) Gigabit
- IEEE 802.3z Gigabit Ethernet over 1000 Base SX multimode fiber
- IEEE 802.1D and 802.1Q as applicable for VLAN priority queuing
- Ethernet Cable or EIA/TIA-568A Category 5E recommended.
- IEEE 802.3u Fast Ethernet over 2 pairs of UTP Category 5 (100BaseTX).
- IEEE 802.3 Ethernet over 2 pairs of UTP Category 3 (10BaseT).
- IEEE 1386 Draft 2.2 PMC Mezzanine Standard

Full Duplex: Support for 10/100/1000 Mbps data rates on all copper models (fiber models Gigabit mode only)

Virtual Network: Virtual LAN (VLAN) tag support

Distance (Models 5161, 5162, 5261, 5262, 5164, 6161 and 6162 copper): Recommended maximum distance is 328 feet (100 meters).

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13. WARRANTEE AND SUPPORT INFO

Technical Support and Warranty:

Telephone technical support (8AM to 6PM, MST), 24-hour support via web email
1 year product warranty on controller hardware

Contacting Us

You may contact DSS Networks in one of several ways: via the Web, e-mail, fax or telephone.

Technical Support

Send all technical support queries to support@dssnetworks.com or visit the DSS Networks website at www.dssnetworks.com. The DSS Networks website contains technical as well as sales literature for all of our products.

Technical Support-Worldwide
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Technical Support-Fax
+1.949.727.2498

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