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# **IpGeneric**

## **Driver Documentation**

### **Win32 Driver Model**

Revision B

## **IpGeneric** WDM Device Driver for an Unknown IP Module

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This product has been designed to operate with IP Module carriers and compatible user-provided equipment. Connection of incompatible hardware is likely to cause serious damage.



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## Introduction

The IpGeneric driver is a Win32 driver model(WDM) device driver for an unknown IP module. This driver can control any IP module by mapping the IO, MEM, and INT memory spaces so that they can be accessed by driver calls. A separate Device Object controls each IP module, and a separate handle references each Device Object. IO Control calls (IOCTLs) are used to configure the hardware and ReadFile() and WriteFile() calls are used to transfer data to and from the MEM space over the IP bus.

## Note

This documentation will provide information about all calls made to the driver, and how the driver interacts with the device for each of these calls. For more detailed information on the hardware implementation, refer to the hardware manual for the particular device being used.

## Driver Installation

**Warning:** The appropriate IP carrier driver must be installed before any IP modules can be detected by the system.

There are several files provided in each driver package. These files include IpGeneric.sys, IpDevice.inf, DDIpGeneric.h, IpGenericGUID.h, IpGenericDef.h, IGTTest.exe, and IGTTest source files.

## Windows 2000 Installation

Copy IpDevice.inf and IpGeneric.sys to a floppy disk, or CD if preferred.

With the hardware installed, power-on the PCI host computer and wait for the **Found New Hardware Wizard** dialogue window to appear.

- Select **Next**.
- Select **Search for a suitable driver for my device**.
- Select **Next**.
- Insert the disk prepared above in the desired drive.
- Select the appropriate drive e.g. **Floppy disk drives**.
- Select **Next**.
- The wizard should find the IpDevice.inf file.
- Select **Next**.
- Select **Finish** to close the **Found New Hardware Wizard**.



## Windows XP Installation

Copy IpDevice.inf to the WINDOWS\INF folder and copy IpGeneric.sys to a floppy disk, or CD if preferred. Right click on the IpDevice.inf file icon in the WINDOWS\INF folder and select **Install** from the pop-up menu. This will create a precompiled information file (.pnf) in the same directory.

With the hardware installed, power-on the PCI host computer and wait for the **Found New Hardware Wizard** dialogue window to appear. **Unknown-IP Device** should be named in the dialogue box. Follow the steps below:

- Insert the disk prepared above in the appropriate drive.
- Select **Install from a list or specific location**
- Select **Next**
- Select **Don't search. I will choose the driver to install**
- Select **Next**
- Select **Show all devices** from the list
- Select **Next**
- Select **Dynamic Engineering** from the Manufacturer list
- Select **Unknown-IP Device** from the Model list
- Select **Next**
- Select **Yes** on the Update Driver Warning dialogue box.
- Enter the drive e.g. **A:\** in the **Files Needed** dialogue box.
- Select **OK**.
- Select **Finish** to close the **Found New Hardware Wizard**.

This process must be completed for each new device that is installed.

The DDIpGeneric.h file is the C header file that defines the Application Program Interface (API) to the driver. The IpGenericGUID.h file is a C header file that defines the device interface identifier for the IpGeneric. These files are required at compile time by any application that wishes to interface with the IpGeneric driver. The IpGenericDef.h file contains the relevant bit defines for the IP module slot control register. These files are not needed for driver installation.

The IGTTest.exe file is a sample Win32 console application that makes calls into the IpGeneric driver to test the driver calls without actually writing an application. It is not required during the driver installation. Open a command prompt console window and type **IGTest /nd0 -?** to display a list of commands (the IGTTest.exe file must be in the directory that the window is referencing). The commands are all of the form **IGTest /ndn /nim** where **n** and **m** are the device number and driver ioctl number respectively. This application is intended to test the proper functioning of the driver calls, not for normal hardware operation.



## Driver Startup

Once the driver has been installed it will start automatically when the system recognizes the hardware.

A handle can be opened to a specific board by using the CreateFile() function call and passing in the device name obtained from the system.

The interface to the device is identified using a globally unique identifier (GUID), which is defined in IpGenericGUID.h.

Below is example code for opening a handle for device 0. The device number is underlined and italicized in the SetupDiEnumDeviceInterfaces call.

```
// The maximum length of the device name for
// a given instance of an interface
#define MAX_DEVICE_NAME 256
// Handle to the device object
HANDLE hIpGeneric = INVALID_HANDLE_VALUE;
// Return status from command
LONG status;
// Handle to device interface information structure
HDEVINFO hDeviceInfo;
// The actual symbolic link name to use in the createfile
CHAR deviceName[MAX_DEVICE_NAME];
// Size of buffer required to get the symbolic link name
DWORD requiredSize;
// Interface data structures for this device
SP_DEVICE_INTERFACE_DATA interfaceData;
PSP_DEVICE_INTERFACE_DETAIL_DATA pDeviceDetail;

hDeviceInfo = SetupDiGetClassDevs((LPGUID)&GUID_DEVINTERFACE_IPGENERIC,
                                  NULL,
                                  NULL,
                                  DIGCF_PRESENT | DIGCF_DEVICEINTERFACE);

if(hDeviceInfo == INVALID_HANDLE_VALUE)
{
    printf("***Error: couldn't get class info, (%d)\n",
           GetLastError());
    exit(-1);
}

interfaceData.cbSize = sizeof(interfaceData);

// Find the interface for device 0
if(!SetupDiEnumDeviceInterfaces(hDeviceInfo,
                                NULL,
                                (LPGUID)&GUID_DEVINTERFACE_IPGENERIC,
                                0,
                                &interfaceData))
{
    status = GetLastError();
}
```



```

if(status == ERROR_NO_MORE_ITEMS)
{
    printf("***Error: couldn't find device(no more items), (%d)\n", 0);
    SetupDiDestroyDeviceInfoList(hDeviceInfo);
    exit(-1);
}
else
{
    printf("***Error: couldn't enum device, (%d)\n",
           status);
    SetupDiDestroyDeviceInfoList(hDeviceInfo);
    exit(-1);
}
}

// Get the details data to obtain the symbolic link name
if(!SetupDiGetDeviceInterfaceDetail(hDeviceInfo,
                                     &interfaceData,
                                     NULL,
                                     0,
                                     &requiredSize,
                                     NULL))
{
    if(GetLastError() != ERROR_INSUFFICIENT_BUFFER)
    {
        printf("***Error: couldn't get interface detail, (%d)\n",
               GetLastError());
        SetupDiDestroyDeviceInfoList(hDeviceInfo);
        exit(-1);
    }
}

// Allocate a buffer to get detail
pDeviceDetail = (PSP_DEVICE_INTERFACE_DETAIL_DATA)malloc(requiredSize);
if(pDeviceDetail == NULL)
{
    printf("***Error: couldn't allocate interface detail\n");
    SetupDiDestroyDeviceInfoList(hDeviceInfo);
    exit(-1);
}

pDeviceDetail->cbSize = sizeof(SP_DEVICE_INTERFACE_DETAIL_DATA);

// Get the detail info
if(!SetupDiGetDeviceInterfaceDetail(hDeviceInfo,
                                     &interfaceData,
                                     pDeviceDetail,
                                     requiredSize,
                                     NULL,
                                     NULL))
{
    printf("***Error: couldn't get interface detail(2), (%d)\n",
           GetLastError());
    SetupDiDestroyDeviceInfoList(hDeviceInfo);
    free(pDeviceDetail);
    exit(-1);
}
}

```



```

// Save the name
lstrcpy(deviceName,
        pDeviceDetail->DevicePath,
        MAX_DEVICE_NAME);

// Cleanup search
free(pDeviceDetail);
SetupDiDestroyDeviceInfoList(hDeviceInfo);

// Open driver
// Create the handle to the device
hIpGeneric = CreateFile(deviceName,
                        GENERIC_READ | GENERIC_WRITE,
                        FILE_SHARE_READ | FILE_SHARE_WRITE,
                        NULL,
                        OPEN_EXISTING,
                        NULL,
                        NULL);

if(hIpGeneric == INVALID_HANDLE_VALUE)
{
    printf("***Error: couldn't open %s, (%d)\n", deviceName,
          GetLastError());
    exit(-1);
}

```

## IO Controls

The driver uses IO Control calls (IOCTLs) to configure the device. IOCTLs refer to a single Device Object in the driver, which controls a single board. IOCTLs are called using the Win32 function DeviceIoControl(), and passing in the handle to the device opened with CreateFile(). IOCTLs generally have input parameters, output parameters, or both. Often a custom structure is used.

### IOCTL\_IPGENERIC\_GET\_INFO

**Function:** Returns the current driver version.

**Input:** none

**Output:** DRIVER\_IP\_DEVICE\_INFO structure

**Notes:** This call does not access the hardware, only driver parameters. See DDIpGeneric.h for the definition of DEVICE\_IP\_DEVICE\_INFO.

### IOCTL\_IPGENERIC\_SET\_MEM\_OFFSET

**Function:** Sets the address offset into the MEM space.

**Input:** ULONG

**Output:** none

**Notes:** Sets the address offset into the IP MEM space for ReadFile and WriteFile operations.



## **IOCTL\_IPGENERIC\_GET\_MEM\_OFFSET**

**Function:** Returns the address offset into the MEM space.

**Input:** none

**Output:** ULONG

**Notes:** Returns the address offset into the IP MEM space for ReadFile and WriteFile operations.

## **IOCTL\_IPGENERIC\_PUT\_IO\_DATA**

**Function:** Writes one word to the Rx FIFO.

**Input:** IO\_ACCESS structure

**Output:** none

**Notes:** This call is used to write data to the IO space. The IO\_ACCESS structure contains an address-offset field; a length field, which can be 1, 2, or 4; and a data field. For this call the address-offset, length, and data fields are initialized and the structure is passed to the driver which performs the write operation. See DDlpGeneric.h for the definition of the IO\_ACCESS structure.

## **IOCTL\_IPGENERIC\_GET\_IO\_DATA**

**Function:** Reads one word from the Tx FIFO.

**Input:** IO\_ACCESS structure

**Output:** IO\_ACCESS structure

**Notes:** This call is used to read data from the IO space. The IO\_ACCESS structure contains an address-offset field; a length field, which can be 1, 2, or 4; and a data field. For this call the address-offset and length fields are initialized and the returned data field is written by the driver. See DDlpGeneric.h for the definition of the IO\_ACCESS structure.

## **IOCTL\_IPGENERIC\_SET\_IP\_CONTROL**

**Function:** Sets the configuration of the board slot.

**Input:** ULONG

**Output:** none

**Notes:** Controls the IP clock speed, access controls, interrupt enables, and the Force Interrupt bit for the IP slot that the board occupies. See the bit definitions in the IpGenericDef.h header file for more information.

## **IOCTL\_IPGENERIC\_GET\_IP\_CONTROL**

**Function:** Returns the configuration of the board slot.

**Input:** none

**Output:** ULONG

**Notes:** Returns the slot configuration register value. See the bit definitions in the IpGenericDef.h header file for more information.

## **IOCTL\_IPGENERIC\_REGISTER\_EVENT**

**Function:** Registers an event to be signaled when an interrupt occurs.

**Input:** Handle to Event object

**Output:** none

**Notes:** The caller creates an event with CreateEvent() and supplies the handle returned from that call as the input to this IOCTL. The driver then obtains a system pointer to the event and signals the event when an interrupt is serviced. The user interrupt service routine waits on this event, allowing it to respond to the interrupt.

## **IOCTL\_IPGENERIC\_ENABLE\_INTERRUPT**

**Function:** Sets the master interrupt enable to true.

**Input:** INT\_SEL enumeration type

**Output:** none

**Notes:** Sets one or both of the IP slot interrupt enables, leaving all other bit values in the IP slot control register the same. This IOCTL is used in the user interrupt processing function to re-enable the interrupts after they were disabled in the driver interrupt service routine. This allows that function to enable the interrupts without knowing the particulars of the other configuration bits.

## **IOCTL\_IPGENERIC\_DISABLE\_INTERRUPT**

**Function:** Sets the master interrupt enable to true.

**Input:** INT\_SEL enumeration type

**Output:** none

**Notes:** Clears one or both of the IP slot interrupt enables, leaving all other bit values in the IP slot control register the same. This IOCTL is used when interrupt processing is no longer desired.



## IOCTL\_IPGENERIC\_FORCE\_INTERRUPT

**Function:** Causes a system interrupt to occur.

**Input:** none

**Output:** none

**Notes:** Causes an interrupt to be asserted for the IP slot. This IOCTL is used for development, to test interrupt processing.

## IOCTL\_IPGENERIC\_GET\_INT\_STATUS

**Function:** Returns the interrupt status and interrupt vector.

**Input:** none

**Output:** INT\_STAT structure

**Notes:** Returns the interrupt vector and the contents of the interrupt status register that were read in the last ISR call. These values are returned in the INT\_STAT structure. See the bit definitions in the IpGenericDef.h header file and the structure definition in the DDIpGeneric.h header file for more information.

## Write

Data to be written to the IP MEM space uses a WriteFile() call. The user supplies the device handle, a pointer to the buffer containing the data, the number of bytes to write, a pointer to a variable to store the amount of data actually transferred, and a pointer to an optional Overlapped structure for performing asynchronous IO. The number of bytes is checked to see if the transfer length plus the address offset will overrun the end of memory. The driver takes advantage of the carrier's 32-bit double-write capability to load two IP words with a single PCI write until less than four bytes remain in the buffer. If necessary, the MEM address offset can be initialized using the IOCTL\_IPGENERIC\_SET\_MEM\_OFFSET call. See Win32 help files for details of the WriteFile() call.

## Read

Data to be read from the IP MEM space uses a ReadFile() call. The user supplies the device handle, a pointer to the buffer to store the data in, the number of bytes to read, a pointer to a variable to store the amount of data actually transferred, and a pointer to an optional Overlapped structure for performing asynchronous IO. The number of bytes is checked to see if the transfer length plus the address offset will overrun the end of memory. The driver takes advantage of the carrier's 32-bit double-read capability to read two IP words with a single PCI read until less than four bytes remain to be read. See Win32 help files for the details of the ReadFile() call.



## Warranty and Repair

Dynamic Engineering warrants this product to be free from defects under normal use and service and in its original, unmodified condition, for a period of one year from the time of purchase. If the product is found to be defective within the terms of this warranty, Dynamic Engineering's sole responsibility shall be to repair, or at Dynamic Engineering's sole option to replace, the defective product.

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Dynamic Engineering's products are not authorized for use as critical components in life support devices or systems without the express written approval of the president of Dynamic Engineering.

## Service Policy

Before returning a product for repair, verify as well as possible that the driver is at fault. The driver has gone through extensive testing and in most cases it will be 'cockpit error' rather than an error with the driver. When you are sure or at least willing to pay to have someone help then call the Customer Service Department and arrange to speak with an engineer. We will work with you to determine the cause of the issue. If the issue is one of a defective driver we will correct the problem and provide an updated module(s) to you [no cost]. If the issue is of the customer's making [anything that is not the driver] the engineering time will be invoiced to the customer. Pre-approval may be required in some cases depending on the customer's invoicing policy.

## Out of Warranty Repairs

Out of warranty support will be billed. The current minimum repair charge is \$125. An open PO will be required.



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