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# **IpPir**

## **Driver Documentation**

### **Win32 Driver Model**

Revision B

Corresponding Hardware: Revision B

10-2002-1702

Corresponding Firmware: Revision B

**IpPir**  
WDM Device Driver for the  
IP-QuadUART-485-PLRA 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 IpPIr driver is a Win32 driver model (WDM) device driver for the IP-QuadUART-485-PLRA board from Dynamic Engineering. A separate Device Object controls each IP-QuadUART-485-PLRA board, and a separate handle references each Device Object. IO Control calls (IOCTLs) are used to configure the board.

## Note

This documentation will provide information about all calls made to the driver, and how the driver interacts with the hardware for each of these calls. For more detailed information on the hardware implementation, refer to the IP-QuadUART-485-PLRA device user manual (also referred to as the hardware manual).

## Driver Installation

**Warning:** All Dynamic Engineering IndustryPack drivers are only compatible with any of the Dynamic Engineering IP carriers (PCI, CompactPCI or PC104p) and carrier drivers. 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 IpPIr.sys, IpDevice.inf, DDIpPIr.h, IpPIrGUID.h, IpPIrTest.exe, and IpPIrTest source files.



## Windows 2000 Installation

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

With the IP-QuadUART-485-PLRA 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 and IpPIr.sys to a floppy disk, or CD if preferred.

With the IP-QuadUART-485-PLRA hardware installed, power-on the PCI host computer and wait for the **Found New Hardware Wizard** dialogue window to appear.

- Insert the disk prepared above in the desired drive.
- Select **No** when asked to connect to Windows Update.
- Select **Next**.
- Select **Install the software automatically**.
- Select **Next**.
- Select **Finish** to close the **Found New Hardware Wizard**.

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

DDIpPIr.h is the C header file that defines the Application Program Interface (API) to the driver. IpPIrGUID.h is a C header file that defines the device interface identifier for the IP-Quart-485-PLRA. These files are required at compile time by any application that wishes to interface with the IpPIr driver. These files are not needed for driver installation.

IpPIrTest.exe is a sample Win32 console application that makes calls into the IpPIr 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 **IpPIrTest -d0 -?** to display a list of commands (IpPIrTest.exe must be in the directory that the window is referencing). The commands are all of the form **IpPIrTest -dn -im** where **n** and **m** are the zero-based device number and driver ioctl number respectively. This application is intended to test the proper functioning of the driver calls, not for normal 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 IpPlrGUID.h.

Below is example code for opening a handle for device n, where n is the zero-based instance number of the device.

```
#define MAX_DEVICE_NAME 256 // The maximum length of the device name for a
                             // given instance of an interface

// Device handle
HANDLE hIpPlr = INVALID_HANDLE_VALUE;
// IpPlr device number
ULONG devNum;
// Return status from command
LONG status;
// Index for interface search loop
UCHAR i;
// Handle to device information structure for the interface to devices
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 for this device
SP_DEVICE_INTERFACE_DATA interfaceData;
PSP_DEVICE_INTERFACE_DETAIL_DATA pDeviceDetail;

printf("Enter board number(starting from zero): \n");
scanf_s("%lx", &devNum);

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

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

interfaceData.cbSize = sizeof(interfaceData);
```



```

for(i = 0; i <= devNum; i++)
{
    // Find the interface for device devNum
    if(!SetupDiEnumDeviceInterfaces(hDeviceInfo,
                                    NULL,
                                    (LPGUID)&GUID_DEVINTERFACE_IPPLR,
                                    i,
                                    &interfaceData))
    {
        status = GetLastError();
        if(status == ERROR_NO_MORE_ITEMS)
        {
            printf("***Error: couldn't find device(no more items), (%d)\n", i);
            SetupDiDestroyDeviceInfoList(hDeviceInfo);
            exit(-1);
        }
        else
        {
            printf("***Error: couldn't enum device, (%d)\n", status);
            SetupDiDestroyDeviceInfoList(hDeviceInfo);
            exit(-1);
        }
    }
}

// Found our device, 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
lstrcpyn(deviceName, pDeviceDetail->DevicePath, MAX_DEVICE_NAME);

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

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

if(hIpPlr == 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, which controls a single board. IOCTLs are called using the Win32 function DeviceIoControl() (see below), and passing in the handle to the device opened with CreateFile() (see above). IOCTLs generally have input parameters, output parameters, or both. Often a custom structure is used.

```
BOOL DeviceIoControl(  
    HANDLE         hDevice,           // Handle opened with CreateFile()  
    DWORD          dwIoControlCode,  // Control code defined in API header file  
    LPVOID         lpInBuffer,       // Pointer to input parameter  
    DWORD          nInBufferSize,    // Size of input parameter  
    LPVOID         lpOutBuffer,      // Pointer to output parameter  
    DWORD          nOutBufferSize,   // Size of output parameter  
    LPDWORD        lpBytesReturned,  // Pointer to return length parameter  
    LPOVERLAPPED  lpOverlapped,     // Optional pointer to overlapped structure  
); // used for asynchronous I/O
```

The IOCTLs defined for the IpP1r driver are described below:

### IOCTL\_IPPLR\_GET\_INFO

**Function:** Returns the current driver version, instance number and other module information.

**Input:** None

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

**Notes:** This call does not access the hardware, only driver parameters. See DDIP1r.h for the definition of DRIVER\_IPPLR\_DEVICE\_INFO.

### IOCTL\_IPPLR\_SET\_IP\_CONTROL

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

**Input:** Register configuration (unsigned long integer)

**Output:** None

**Notes:** Controls the IP clock speed, IP data controls and interrupt enables for the IP slot that the board occupies. See the bit definitions in the DDIP1r.h header file for more information.

### IOCTL\_IPPLR\_GET\_IP\_CONTROL

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

**Input:** None

**Output:** Register configuration (unsigned long integer)

**Notes:** Returns the values set in the previous call.

### **IOCTL\_IPPLR\_SET\_CONFIG**

**Function:** Sets configuration parameters in the IP-QuadUART-485-PLRA base control register.

**Input:** IPPLR\_CONFIG structure

**Output:** None

**Notes:** Controls monitor enable, strobe enable, external interrupt controls, start (of transfer), start\_test (target enable), and interrupt enables. See DDIPPlr.h for the definition of IPPLR\_CONFIG and user manual for bit definitions.

### **IOCTL\_IPPLR\_GET\_CONFIG**

**Function:** Returns the configuration of the base control register.

**Input:** None

**Output:** IPPLR\_CONFIG structure

**Notes:** Returns the values set in the previous call.

### **IOCTL\_IPPLR\_GET\_STATUS**

**Function:** Returns the status bits from the STATUS and INT\_STAT registers.

**Input:** None

**Output:** IPPLR\_STATUS

**Notes:** Reads and returns the value of the STATUS and INT\_STAT registers which indicate the interrupt source. See DDIPPlr.h for structure definition.

### **IOCTL\_IPPLR\_SET\_TTL\_CONFIG**

**Function:** Set function for TTL bits 7-0.

**Input:** IPPLR\_TTL\_CONFIG structure

**Output:** None

**Notes:** Set any of the 8 TTL bits as in input to detect a hi level change of state (COS), low level change of state (COS), rising edge change of state (COS), falling edge change of state, rising edge and falling edge change of state or ignore all state change or as an output.

### **IOCTL\_IPPLR\_GET\_TTL\_CONFIG**

**Function:** Returns function of TTL bits 7-0.

**Input:** None

**Output:** IPPLR\_TTL\_CONFIG structure

**Notes:** Returns the values set in the previous call.



### **IOCTL\_IPPLR\_SET\_TTL\_DATA**

**Function:** Write TTL data register.

**Input:** unsigned character

**Output:** None

**Notes:** Writes data to TTL bits, valid for TTL bits configured as outputs.

### **IOCTL\_IPPLR\_GET\_TTL\_DATA**

**Function:** Returns contents of TTL data register.

**Input:** None

**Output:** unsigned character

**Notes:** Returns the values set in the previous call.

### **IOCTL\_IPPLR\_READ\_TTL\_DIRECT**

**Function:** Returns unfiltered TTL bus data.

**Input:** None

**Output:** unsigned character

**Notes:** Reads logic states of the 8 TTL data bits, COS not monitored.

### **IOCTL\_IPPLR\_READ\_TTL\_FILTERED**

**Function:** Read TTL bus data latched COS bits.

**Input:** None

**Output:** unsigned character

**Notes:** Read the TTL data bits using the available filters to check for a change-of-state (COS) condition in one or more of the TTL bits. Filters available are edge changes (rising, falling, or both) and levels (high and low state).

### **IOCTL\_IPPLR\_SET\_SERIAL\_DATA**

**Function:** Set serial data to be written from the Master, to the Target when enabled.

**Input:** 24-bit data word (unsigned long)

**Output:** None

**Notes:** Sets a serial data word to be sent to a Target when enabled.

### **IOCTL\_IPPLR\_GET\_SERIAL\_DATA**

**Function:** Returns stored serial data written to the Master (to be sent to the Target when enabled).

**Input:** None

**Output:** 24-bit data word (unsigned long)

**Notes:** Returns the values set in the previous call.



### **IOCTL\_IPPLR\_READ\_SERIAL\_DATA**

**Function:** Serial data received by the Target from the Master.

**Input:** None

**Output:** 24-bit data word (unsigned long)

**Notes:** Captures data stream sent to Target.

### **IOCTL\_IPPLR\_SET\_MON\_DATA**

**Function:** Write Monitor data to Target to be sent to the Master.

**Input:** 16-bit data word (unsigned short)

**Output:** None

**Notes:** When Monitor signal is asserted, this data is sent to the Master.

### **IOCTL\_IPPLR\_GET\_MON\_DATA**

**Function:** Returns stored Monitor data.

**Input:** None

**Output:** 16-bit data word (unsigned short)

**Notes:** Returns the values set in the previous call.

### **IOCTL\_IPPLR\_READ\_MON\_DATA**

**Function:** Reads the Monitor data sent from the Target to the Master.

**Input:** None

**Output:** 16-bit data word (unsigned short)

**Notes:** Read the 16-bit data transmitted from the Target to the Master when Monitor signal is active.

### **IOCTL\_IPPLR\_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. In order to un-register the event, set the event handle to NULL while making this call.

### **IOCTL\_IPPLR\_ENABLE\_INTERRUPT**

**Function:** Set master interrupt enable.

**Input:** None

**Output:** None

**Notes:** Enabling the master interrupt, allows the COS, external and I/O interrupt conditions to cause an interrupt, provided they are enabled.

### **IOCTL\_IPPLR\_DISABLE\_INTERRUPT**

**Function:** Disable PLR interrupts.

**Input:** None

**Output:** None

**Notes:** I/O interrupt (Data transfer complete), external interrupt and COS interrupt (TTL bit changes) are disabled.

### **IOCTL\_IPPLR\_FORCE\_INTERRUPT**

**Function:** Force interrupt to occur if master interrupt is enabled.

**Input:** None

**Output:** None

**Notes:** Used for hardware or software development

### **IOCTL\_IPPLR\_SET\_VECTOR**

**Function:** Set the interrupt vector value.

**Input:** unsigned character

**Output:** None

**Notes:** Write 8-bit vector value.

### **IOCTL\_IPPLR\_GET\_VECTOR**

**Function:** Returns the interrupt vector value.

**Input:** None

**Output:** unsigned character

**Notes:** Returns the values set in the previous call.

### **IOCTL\_IPPLR\_GET\_ISR\_STATUS**

**Function:** Returns the interrupt status, vector values, and state of COS bits.

**Input:** None

**Output:** IPPLR\_INT\_STAT structure

**Notes:** The status contains the contents of the STATUS and IPPLR\_INT\_STAT registers read in the last driver interrupt service routine execution. See DDIPPlr.h for the definition of IPPLR\_INT\_STAT and interrupt status bits.



## 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.

## For Service Contact:

Customer Service Department  
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