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# **SpWrBase & SpWrChan**

## **Driver Documentation**

### **Win32 Driver Model**

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Corresponding Firmware:

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External FIFO: Revision D

**SpWrBase & SpWrChan**  
WDM Device Drivers for the  
PMC/PCI-SpaceWire  
4-Channel SpaceWire Interface

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## Introduction

The SpWrBase and SpWrChan drivers are Win32 driver model (WDM) device drivers for the PMC-SpaceWire and PCI-SpaceWire from Dynamic Engineering.

The SpWrChan driver has been extended to recognize and control an I/O channel using external FIFOs (128 K by 32 bits) as well as the standard internal FIFO (1 K by 32 bits) channel. In order to accommodate this, the data structure fields representing the FIFO counts and programmable almost full/empty levels have been changed to 32-bit values. Also, Tx and Rx FIFO size fields have been added to the channel info structure. When the channel driver initializes, it checks the channel control register. If bits 22 or 23 can be cleared, it has detected an external FIFO channel and proceeds to write and read to the programmable almost empty/full registers of the FIFO. Depending on what value is returned, the size of the external FIFO is calculated and default values for the Tx almost empty and/or Rx almost full values are written to the FIFO ( $\frac{1}{8}$  and  $\frac{7}{8}$  of the FIFO size respectively).

The SpaceWire board has a Spartan3-1000 Xilinx FPGA to implement the PCI interface, FIFOs and protocol control and status for four SpaceWire channels. There is also a programmable PLL with four clock outputs to create separate programmable I/O clocks for each SpaceWire channel.

When the SpaceWire board is recognized by the PCI bus configuration utility it will start the SpWrBase driver which will create a device object for each board, initialize the hardware, create child devices for the four I/O channels and request loading of the SpWrChan driver. The SpWrChan driver will create a device object for each of the I/O channels and perform initialization on each channel. IO Control calls (IOCTLs) are used to configure the board and read status. Read and Write calls are used to move blocks of data in and out of the device.

Beginning with the rev.D firmware, the width of the packet length FIFOs has been increased to 17 bits for internal data FIFO channels and 31 bits for external data FIFO channels. In order to be compatible with these changes, the packet length parameter in the WRITE\_PACKET\_LENGTH and READ\_PACKET\_LENGTH IO control calls has been changed from an unsigned short to an unsigned long. Please note that the received packet length FIFO is one bit wider to accommodate the packet error bit (18 and 32 bits).

## Note

This documentation will provide information about all calls made to the drivers, and how the drivers interact with the device for each of these calls. For more detailed information on the hardware implementation, refer to the SpaceWire user manual (also referred to as the hardware manual).



## Driver Installation

There are several files provided in each driver package. These files include SpWrBase.sys, SpWrBase.inf, DDSpWrBase.h, SpWrBaseGUID.h, SpWrChan.sys, SpWrChan.inf, DDSpWrChan.h, SpWrChanGUID.h, SpWrTest.exe, and SpWrTest source files.

SpWrBaseGUID.h and SpWrChanGUID.h are C header files that define the device interface identifiers for the drivers. DDSpWrBase.h and DDSpWrChan.h files are C header files that define the Application Program Interface (API) to the drivers. These files are required at compile time by any application that wishes to interface with the drivers, but they are not needed for driver installation.

SpWrTest.exe is a sample Win32 console applications that makes calls into the SpWrBase/SpWrChan drivers to test each driver call without actually writing any application code. They are not required during driver installation either.

To run SpWrTest, open a command prompt console window and type **SpWrTest -d0 -?** to display a list of commands (the SpWrTest.exe file must be in the directory that the window is referencing). The commands are all of the form **SpWrTest -dn -im** where n and m are the device number and SpWrBase driver ioctl number respectively or **SpWrTest -cn -im** where n and m are the channel number (0-3) and SpWrChan driver ioctl number respectively.

This test application is intended to test the proper functioning of each driver call, **not** for normal operation.

## Windows 2000 Installation

Copy SpWrBase.inf, SpWrChan.inf, SpWrBase.sys and SpWrChan.sys to a floppy disk, CD, or some other accessible location.

With the SpaceWire 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 SpWrBase.inf file.
- Select **Next**.
- Select **Finish** to close the **Found New Hardware Wizard**.

The system should now see the SpaceWire channels and reopen the **New Hardware Wizard**. Proceed as above substituting SpWrChan.inf for SpWrBase.inf.

Repeat this for each channel as necessary.

## Windows XP Installation

Copy SpWrBase.inf, SpWrChan.inf, SpWrBase.sys and SpWrChan.sys to a floppy disk, CD, or some other accessible location.

With the SpaceWire 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**.

The system should now see the SpaceWire channels and reopen the **New Hardware Wizard**. Proceed as above for each channel as necessary.

## Driver Startup

Once the drivers have been installed they will start automatically when the system recognizes the hardware.

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

The interfaces to the devices are identified using globally unique identifiers (GUIDs), which are defined in SpWrBaseGUID.h and SpWrChanGUID.h.

Below is example code for opening handles for SpWrBase device *devNum*.

```
// The maximum length of the device name for a given interface
#define MAX_DEVICE_NAME 256
// Handles to the device objects
HANDLE hSpWrBase = INVALID_HANDLE_VALUE;

HANDLE hSpWrChan[SPWR_BASE_NUM_CHANNELS] = {INVALID_HANDLE_VALUE,
                                             INVALID_HANDLE_VALUE,
                                             INVALID_HANDLE_VALUE,
                                             INVALID_HANDLE_VALUE};

// SpaceWire device number
ULONG devNum
// SpaceWire channel handle array index and interface number
ULONG chan, i;
// 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;
// The base device information structure
SPWR_BASE_DRIVER_DEVICE_INFO info;
// The channel device information structure
SPWR_CHAN_DRIVER_DEVICE_INFO cinfo;
// Flag indicating success finding correct device
BOOLEAN found = FALSE;

hDeviceInfo = SetupDiGetClassDevs(
    (LPGUID)&GUID_DEVINTERFACE_SPWR_BASE,
    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);

i = 0;
while(!found)
{
    // Find the interface for device devNum
    if(!SetupDiEnumDeviceInterfaces(hDeviceInfo,
                                    NULL,
                                    (LPGUID)&GUID_DEVINTERFACE_SPWR_BASE,
                                    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);
        }
    }

    // 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);

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

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

    exit(-1);
}

```

```

// Read info
if(!DeviceIoControl(hSpWrBase,
                    IOCTL_SPWR_BASE_GET_INFO,
                    NULL,
                    0,
                    &info,
                    sizeof(info),
                    &length,
                    NULL))
{
    printf("IOCTL_SPWR_BASE_GET_INFO failed: %d\n", GetLastError());
    exit(-1);
}

if(info.InstanceNumber == devNum)
    found = TRUE;
else
    i++;
}

SetupDiDestroyDeviceInfoList(hDeviceInfo);

hDeviceInfo = SetupDiGetClassDevs(
                (LPGUID)&GUID_DEVINTERFACE_SPWR_CHAN,
                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);

i = 0;
chan = 0;

while(chan < SPWR_BASE_NUM_CHANNELS)
{
    // Find the interface for device
    if(!SetupDiEnumDeviceInterfaces(hDeviceInfo,
                                    NULL,
                                    (LPGUID)&GUID_DEVINTERFACE_SPWR_CHAN,
                                    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);
}
}

// 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);

// Open driver - Create the handle to the device
hSpWrChan[chan] = CreateFile(deviceName,
                            GENERIC_READ    | GENERIC_WRITE,
                            FILE_SHARE_READ | FILE_SHARE_WRITE,
                            NULL,
                            OPEN_EXISTING,
                            NULL,
                            NULL);

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

if(!DeviceIoControl(hSpWrChan[chan],
                    IOCTL_SPWR_CHAN_GET_INFO,
                    NULL,
                    0,
                    &cinfo,
                    sizeof(cinfo),
                    &length,
                    NULL) )
{
    printf("IOCTL_SPWR_CHAN_GET_INFO failed: %d\n", GetLastError());
    exit(-1);
}

if(cinfo.InstanceNumber / 4 == devNum &&
    cinfo.InstanceNumber % 4 == chan)
{
    chan++;
}

i++;
}

```

## IO Controls

The drivers use IO Control calls (IOCTLs) to configure the device. IOCTLs refer to a single Device Object, which controls a single board or I/O channel. 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  
);
```

The IOCTLs defined for the SpWrBase driver are described below:

### IOCTL\_SPWR\_BASE\_GET\_INFO

**Function:** Returns the Driver version, Xilinx revision, Switch value, Instance number, and PLL ID.

**Input:** None

**Output:** SPWR\_BASE\_DRIVER\_DEVICE\_INFO structure

**Notes:** Switch value is the configuration of the on-board dip-switch that has been set by the User (see the board silk screen for bit position and polarity). The PLL ID is the device address of the PLL device. This value, which is set at the factory, is usually 0x69 but may also be 0x6A. See DDSpWrBase.h for the definition of SPWR\_BASE\_DRIVER\_DEVICE\_INFO.

### IOCTL\_SPWR\_BASE\_LOAD\_PLL\_DATA

**Function:** Loads the internal registers of the PLL.

**Input:** SPWR\_BASE\_PLL\_DATA structure

**Output:** None

**Notes:** After the PLL has been configured, the register array data is analyzed to determine the programmed frequencies and the IO clock A-D initial divisor fields in the base control register are automatically updated.

### **IOCTL\_SPWR\_BASE\_READ\_PLL\_DATA**

**Function:** Returns the contents of the PLL's internal registers

**Input:** None

**Output:** SPWR\_BASE\_PLL\_DATA structure

**Notes:** The register data is output in the SPWR\_BASE\_PLL\_DATA structure in an array of 40 bytes.

### **IOCTL\_SPWR\_BASE\_SET\_TIME\_CONFIG**

**Function:** Sets the time-code timing and routing on the SpaceWire board.

**Input:** SPWR\_BASE\_TIME\_CONFIG structure

**Output:** None

**Notes:** The master counter that controls the TICK\_IN rate is clocked by the 80 MHz link clock. The Count field of the input data structure determines the count at which this counter will roll-over, increment the six-bit time-code count and issue a TICK\_IN pulse. The Flags field specifies the two control flag bits sent in bit 6 and 7 of the time-code data byte. The TimeSource values determine the source of time-codes sent by each of the four channels. These can be the master timer, any of the four channel time-code outputs, or disabled.

### **IOCTL\_SPWR\_BASE\_GET\_TIME\_CONFIG**

**Function:** Returns the time-code timing and routing on the SpaceWire board.

**Input:** None

**Output:** SPWR\_BASE\_TIME\_CONFIG structure

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

The IOCTLs defined for the SpWrChan driver are described below:

### IOCTL\_SPWR\_CHAN\_GET\_INFO

**Function:** Returns the driver version, instance number and transmit and receive FIFO sizes of the referenced channel.

**Input:** None

**Output:** SPWR\_CHAN\_DRIVER\_DEVICE\_INFO structure

**Notes:** See the definition of SPWR\_CHAN\_DRIVER\_DEVICE\_INFO in the DDSpWrChan.h header file.

### IOCTL\_SPWR\_CHAN\_SET\_CONFIG

**Function:** Writes a configuration value to the channel control register.

**Input:** Value of channel control register (unsigned long integer)

**Output:** None

**Notes:** See DDSpWrChan.h for the relevant channel control bit definitions. Only the bits in CHAN\_CNTRL\_MASK can be controlled by this call.

### IOCTL\_SPWR\_CHAN\_GET\_CONFIG

**Function:** Returns the channel's control configuration.

**Input:** None

**Output:** Value of the channel control register (unsigned long integer)

**Notes:** Returns the values of the bits in CHAN\_CNTRL\_READ\_MASK.

### IOCTL\_SPWR\_CHAN\_GET\_STATUS

**Function:** Returns the channel's status value and clears the latched bits.

**Input:** None

**Output:** Value of channel status register (unsigned long integer)

**Notes:** The latched bits in CHAN\_STAT\_LATCH\_MASK will be cleared if they are set when the status is read. Even though CHAN\_STAT\_TICK\_RCVD is latched, it is not cleared by this call. It will be in the ISR if the CHAN\_CNTRL\_TICK\_INTEN bit is set and by the IOCTL\_SPWR\_CHAN\_READ\_TIME\_CODE call.

### IOCTL\_SPWR\_CHAN\_WRITE\_PACKET\_LENGTH

**Function:** Writes a transmitter packet length value to the packet length FIFO.

**Input:** Packet length value (unsigned long integer)

**Output:** None

**Notes:** When operating in packet mode, no data will be sent until a value is written to the transmit packet length FIFO.

### **IOCTL\_SPWR\_CHAN\_READ\_PACKET\_LENGTH**

**Function:** Reads a received packet length value from the packet length FIFO.

**Input:** None

**Output:** Packet length value (unsigned long integer)

**Notes:** Only bits 16-0 (31-0 for external data FIFO channels) are used for the packet length (maximum of 128 KBytes (2 GBytes)). Bit 17 (bit 32 for external data FIFO channels) is an error flag that indicates that an error condition occurred during the reception of the referenced packet or that it was terminated by an EEP.

### **IOCTL\_SPWR\_CHAN\_SET\_FIFO\_LEVELS**

**Function:** Sets the transmitter almost empty and receiver almost full levels for the channel.

**Input:** SPWR\_CHAN\_FIFO\_LEVELS structure

**Output:** None

**Notes:** These values are initialized to the default values  $\frac{1}{8}$  FIFO and  $\frac{7}{8}$  FIFO respectively when the driver initializes. The FIFO counts are compared to these levels to determine the value of the CHAN\_STAT\_TX\_FF\_AMT and CHAN\_STAT\_RX\_FF\_AFL status bits. Also, if the control bits CHAN\_CNTRL\_URGNT\_IN\_EN and/or CHAN\_CNTRL\_URGNT\_OUT\_EN are set, these levels are used to determine when to give priority to an input or output DMA channel.

### **IOCTL\_SPWR\_CHAN\_GET\_FIFO\_LEVELS**

**Function:** Returns the transmitter almost empty and receiver almost full levels for the channel.

**Input:** None

**Output:** SPWR\_CHAN\_FIFO\_LEVELS structure

**Notes:**

### **IOCTL\_SPWR\_CHAN\_GET\_FIFO\_COUNTS**

**Function:** Returns the number of data words in the transmit and receive FIFOs.

**Input:** None

**Output:** SPWR\_CHAN\_FIFO\_COUNTS structure

**Notes:** There is one pipe-line latch for the transmit FIFO data and four for the receive FIFO data. These are counted in the FIFO counts. That means, for the internal FIFO channels, the transmit count can be a maximum of 1025 32-bit words and the receive count can be a maximum of 1028 32-bit words. For external FIFO channels, the transmit count can be a maximum of 131,073 32-bit words and the receive count can be a maximum of 131,076 32-bit words.

### **IOCTL\_SPWR\_CHAN\_RESET\_FIFOS**

**Function:** Resets one or both FIFOs for the referenced channel.

**Input:** SPWR\_FIFO\_SEL enumeration type

**Output:** None

**Notes:** Resets the transmit or receive FIFO or both depending on the input parameter selection. Also sets the programmable almost full/empty levels back to the default values for the FIFO(s) that were reset.

### **IOCTL\_SPWR\_CHAN\_WRITE\_FIFO**

**Function:** Writes a 32-bit data-word to the transmit FIFO.

**Input:** FIFO word (unsigned long integer)

**Output:** None

**Notes:** Used to make single-word accesses to the transmit FIFO instead of using DMA.

### **IOCTL\_SPWR\_CHAN\_READ\_FIFO**

**Function:** Returns a 32-bit data word from the receive FIFO.

**Input:** None

**Output:** FIFO word (unsigned long integer)

**Notes:** Used to make single-word accesses to the receive FIFO instead of using DMA.

### **IOCTL\_SPWR\_CHAN\_REGISTER\_EVENT**

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

**Input:** Handle to the 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 a user interrupt is serviced. The user interrupt service routine waits on this event, allowing it to respond to the interrupt. The DMA interrupts do not cause the event to be signaled.

### **IOCTL\_SPWR\_CHAN\_ENABLE\_INTERRUPT**

**Function:** Enables the channel master interrupt.

**Input:** None

**Output:** None

**Notes:** This command must be run to allow the board to respond to user interrupts. The master interrupt enable is disabled in the driver interrupt service routine when a user interrupt is serviced. Therefore this command must be run after each interrupt occurs to re-enable it.

### **IOCTL\_SPWR\_CHAN\_DISABLE\_INTERRUPT**

**Function:** Disables the channel master interrupt.

**Input:** None

**Output:** None

**Notes:** This call is used when user interrupt processing is no longer desired.

### **IOCTL\_SPWR\_CHAN\_FORCE\_INTERRUPT**

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

**Input:** None

**Output:** None

**Notes:** Causes an interrupt to be asserted on the PCI bus as long as the channel master interrupt is enabled. This IOCTL is used for development, to test interrupt processing.

### **IOCTL\_SPWR\_CHAN\_GET\_ISR\_STATUS**

**Function:** Returns the interrupt status read in the ISR from the last user interrupt.

**Input:** None

**Output:** Interrupt status value (unsigned long integer)

**Notes:** Returns the interrupt status that was read in the interrupt service routine of the last interrupt caused by one of the enabled channel interrupts. The interrupts that deal with the DMA transfers do not affect this value.

### **IOCTL\_SPWR\_CHAN\_READ\_TIME\_CODE**

**Function:** Returns the last time-code received and clears the tick received latched bit.

**Input:** None

**Output:** SPWR\_CHAN\_TIME\_CODE structure

**Notes:** Returns the value of the time-code data byte last received in the Time field. The New field will be set to TRUE if the time-code has not been previously read. Either by a previous instance of this call or by an ISR responding to an enabled TICK\_OUT interrupt.

## Write

SpaceWire DMA data is written to the referenced I/O channel device using the write command. Writes are executed using the Win32 function WriteFile() and passing in the handle to the I/O channel device opened with CreateFile(), a pointer to a pre-allocated buffer containing the data to be written, an unsigned long integer that represents the size of that buffer in bytes, a pointer to an unsigned long integer to contain the number of bytes actually written, and a pointer to an optional Overlapped structure for performing asynchronous IO.

## Read

SpaceWire DMA data is read from the referenced I/O channel device using the read command. Reads are executed using the Win32 function ReadFile() and passing in the handle to the I/O channel device opened with CreateFile(), a pointer to a pre-allocated buffer that will contain the data read, an unsigned long integer that represents the size of that buffer in bytes, a pointer to an unsigned long integer to contain the number of bytes actually read, and a pointer to an optional Overlapped structure for performing asynchronous IO.

## 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.

Dynamic Engineering's warranty of and liability for defective products is limited to that set forth herein. Dynamic Engineering disclaims and excludes all other product warranties and product liability, expressed or implied, including but not limited to any implied warranties of merchantability or fitness for a particular purpose or use, liability for negligence in manufacture or shipment of product, liability for injury to persons or property, or for any incidental or consequential damages.

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  
Dynamic Engineering  
150 DuBois Street, Suite C  
Santa Cruz, CA 95060  
831-457-8891  
831-457-4793 Fax

[support@dyneng.com](mailto:support@dyneng.com)

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