TPRO/TSAT-PCI

SYNCHRONIZABLE TIMECODE GENERATOR with UNIVERSAL PCI BUS INTERFACE

Windows Driver Application Programmer's Guide

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1 Overview

1.1 General

The TPRO/TSAT PCI Windows Driver provides an interface between the PCI board and applications developed for 32-bit or 64-bit Windows™ operating systems. In addition to the interface library, a Control Utility program, Time Daemon Utility and example programs with source code are provided. The TPRO/TSAT PCI Windows Driver has been tested for compatibility with the following versions of Windows:

- Windows 2000
- Windows XP
- Windows Server 2003
- Windows Vista
- Windows Server 2008 & R2
- Windows 7

The 32-bit library file and DLL (`tpro.lib` & `tpro.dll`) can be found in the "`KSI\Dev`" directory under "`Program Files`". Similarly, the 64-bit versions of the same files are located in the "`KSI\Dev64`" directory under "`Program Files (x86)`" on 64-bit operating systems.

1.2 Features

The TPRO/TSAT PCI Windows Driver includes the following:

- Interface API library that accesses all of the PCI board features
- Example programs with source code, utilizing the API library
- A Control Utility that can be used to retrieve data from the card and/or modify card settings
- A Time Daemon tray Utility and Time Daemon service that query the TPRO/TSAT-PCI card and sets the computer's system clock at a user-defined interval

2 Installing the Driver

NOTE: If your system is equipped with the TPRO-TSAT PCI software driver, it must be uninstalled before installing the new, updated driver. To uninstall the driver:

1. Go to “Control Panel”, “Add/Remove Programs”
2. Remove “TPRO-TSAT PCI”

To install the driver, perform the following steps:

1. Install the TPRO/TSAT-PCI card in a vacant slot on the computer to be used.
2. Switch on the PC power. Once the PC is running, Windows may prompt you to install the newly found hardware. Disregard and cancel this dialog box.
3. Insert the CD with the TPRO/TSAT-PCI driver into the CD-ROM drive and follow the automated installation procedure. If Auto-Run is disabled, manually install the driver by running “setup.exe” from the Windows driver folder located on the CD.
4. Once the driver installation has completed, the computer must be rebooted for the changes to take effect.

The following folders are created in the Program Files folder under “KSI” when the driver is installed:

- control – contains the Clock Daemon utilities, daemon.ini, and Control utility
- dev – contains “`tpro.h`” and “`tpro.dll`” files needed for application software development
- documentation – contains PCI user manual and application programmer’s guide
- drivers – contains all Windows driver files
- examples – contains example executables and source code for each TPRO API

2.1 Running the TPRO/TSAT Control Utility

1. From the Windows Start menu, select the "`Programs`" folder.
2. Select the "`Spectracom\PCI`" folder.
3. Select the "`TPRO-TSAT Control Utility`" program.

2.2 Clock Daemon Utilities

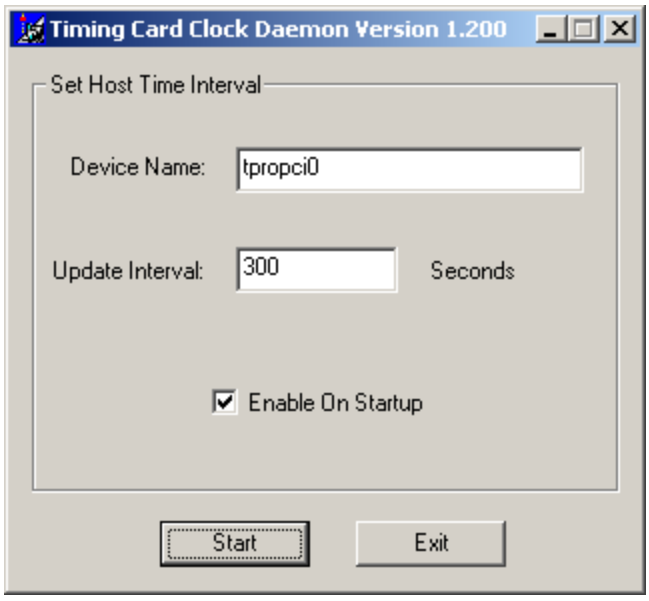
Two clock daemon utilities are provided that can be used to set the computer's system clock: "Clock Daemon.exe" and "ClockDaemonService.exe". Both will query the TPRO/TSAT PCI and set the system clock on a periodic basis.

NOTE: If the PCI board is not synchronized to an external reference, the system clock will not be set.

Clock Daemon.exe:

When the driver is installed, a shortcut to "Clock Daemon.exe" is automatically added to the user's Startup folder and will run automatically from the system tray when the computer boots up.

A small icon — — will show up in the system tray. Double click on that icon to display a window. A shortcut can also be found in the "`Start/Spectracom Corp/PCI`" Windows Start menu.



Device Name: Will select which board you want to use as a time source. The default is“tpropci0”.

Update Interval: Controls how often the PCI board time will be queried. The default is “300” seconds.

To enable the clock daemon on startup, make sure the “Enable On Startup” checkbox has been selected before starting the program.

ClockDaemonService.exe:

“Clock DaemonService.exe” will set the computer’s system clock as does the “Clock Daemon.exe”, but it will run as a Windows service. It will run automatically at boot-up and does not need to be added to the user’s Startup folder. The program can be found in the folder C:\Program Files\KSI\control and a shortcut can be found in the “`Start/Spectracom Corp/PCI`” Windows Start menu.

NOTE: Do not attempt to run “Clock DaemonService.exe” and “Clock Daemon.exe” at the same time. When running the Clock Daemon Service, stop “Clock Daemon.exe” and remove it from the Startup folder.

Executing ClockDaemonService.exe from the command prompt stops, removes, installs, and starts the "Clock Daemon" service. The service startup type defaults to automatic. To remove the "Clock Daemon" service, run ClockDaemonService.exe from a command prompt with the -r option (ClockDaemonService.exe -r).

The controls for device name and update interval are setup by the “`daemon.ini`” located in the folder `C:\Program Files\KSI\control`.

2.3 Example Executables and Source Code

The driver package includes folders with example programs to interface to the board. The source code and make files for the example programs are included. All of the example programs were compiled using **Visual Studio 2005**. All example programs are 32-bit applications.

To see usage help for any example program, execute the program with no parameters:

```
> HW_GetTime.exe
```

3 Interface to the Windows API

3.1 Header File

The following is the “TPRO.H” API Interface Header File.

```
/*****************************************************************
**
** Module:      tpro.h
** Date:        08/08/2007
** Purpose:     Contains structures and definions used to interface
**              with the TPRO-PCI or TSAT-PCI API.  Applications
**              that access the API should include this header.
**
** Copyright(C) 2007 Spectracom Corporation. All Rights Reserved
**
*****************************************************************
** Modifications:
**
**              08/08/2007 Multi-user enablement
**
*****************************************************************/

#ifndef _defined_TPRO_
#define _defined_TPRO_

#pragma pack(8)

#ifdef __cplusplus
extern "C" {
#endif


#define DLL_EXPORT __declspec(dllexport)


/*****************************************************************************
                        SUPPORT CONSTANTS
*****************************************************************************/


/**
***  Heartbeat constants
**/

#define SIG_PULSE      (0xE5)         // signal type for PCI card
#define SIG_SQUARE     (0xE7)         // signal type for PCI card

#define SIG_NO_JAM     (0)            // output type for PCI card
#define SIG_JAM        (1)            // output type for PCI card

#define HEART_NORMAL   (0)            // signal type for CPCI card
#define HEART_INVERT   (8)            // signal type for CPCI card

#define HEART_DISABLE  (0)            // output type for CPCI card
#define HEART_ENABLE   (4)            // output type for CPCI card

#define CLK_10MHZ      (0)            // clock frequency for CPCI board
#define CLK_3MHZ       (1)            // clock frequency for CPCI board
#define CLK_1MHZ       (2)            // clock frequency for CPCI board
#define CLK_1KHZ       (3)            // clock frequency for CPCI board

    /*
```

```
** Length of firmware rev string
*/
#define TPRO_FIRMWARE_LENGTH        ( 4 )

/*
** Length of driver version string "XX.YY"
** (not including termination)
*/
#define TPRO_DRV_VERSION_LENGTH     ( 5 )

/**
***  Match constants
**/

#define MATCH_TIME_START      (0)            // start time
#define MATCH_TIME_STOP       (1)            // stop time

/*
**  board sync options
*/
#define TPRO_DISABLE_SYNC           ( 0x0 )     /* freewheel */
#define TPRO_ENABLE_SYNC            ( 0x1 )     /* sync to input */
#define TPRO_SYNC_STAT_FREE         ( 0x0 )     /* sync is freewheel */

/**
***  Oscillator frequencies - for Compact PCI Card Only
**/

#define OSC_OUT_OFF           (0)
#define OSC_OUT_1KHZ          (1)
#define OSC_OUT_1MHZ          (2)
#define OSC_OUT_5MHZ          (3)
#define OSC_OUT_10MHZ         (4)


/*****************************************************************************
                              OBJECTS
*****************************************************************************/

/*===========================================================================
                        TPRO BOARD OBJECT
===========================================================================*/

typedef struct TPRO_BoardObj
{ /*-------------------------------------------------------------------------*/
  void *hDevice;

  unsigned short options;
  unsigned char slotPosition;
} /*-------------------------------------------------------------------------*/
TPRO_BoardObj;


/*===========================================================================
                        TPRO ALTITUDE OBJECT
===========================================================================*/

typedef struct TPRO_AltObj
{ /*-------------------------------------------------------------------------*/
  float         meters;                     /*-- meters --------------*/
} /*-------------------------------------------------------------------------*/
TPRO_AltObj;


/*===========================================================================
                         TPRO DATE OBJECT
===========================================================================*/

typedef struct TPRO_DateObj
{ /*-------------------------------------------------------------------------*/
  unsigned short year;                      /*-- year ----------------*/
```

```
  unsigned char  month;                     /*-- month ---------------*/
  unsigned char  day;                       /*-- day -----------------*/
} /*-------------------------------------------------------------------*/
TPRO_DateObj;


/*===================================================================
                TPRO LONGITUDE/LATTITUDE OBJECT
===================================================================*/

typedef struct TPRO_LongLat
{ /*-------------------------------------------------------------------*/
  unsigned short degrees;                   /*-- degrees -------------*/
  float          minutes;                   /*-- minutes -------------*/
} /*-------------------------------------------------------------------*/
TPRO_LongObj, TPRO_LatObj;


/*===================================================================
                        TPRO MATCH OBJECT
===================================================================*/

typedef struct TPRO_MatchObj
{ /*-------------------------------------------------------------------*/
  unsigned char   matchType;                /*-- start/stop time -----*/
  double          seconds;                  /*-- seconds -------------*/
  unsigned char   minutes;                  /*-- minutes -------------*/
  unsigned char   hours;                    /*-- hours ---------------*/
  unsigned short  days;                     /*-- days ----------------*/
} /*-------------------------------------------------------------------*/
TPRO_MatchObj;


/*===================================================================
                        TPRO SATINFO OBJECT
===================================================================*/

typedef struct TPRO_SatObj
{ /*-------------------------------------------------------------------*/
  unsigned char satsTracked;                /*-- num sats tracked ----*/
  unsigned char satsView;                   /*-- num sats in view ----*/
} /*-------------------------------------------------------------------*/
TPRO_SatObj;


/*===================================================================
                       TPRO HEARTBEAT OBJECT
===================================================================*/

typedef struct TPRO_HeartObj
{ /*-------------------------------------------------------------------*/
  unsigned char signalType;                 /*-- heart signal type ---*/
  unsigned char outputType;                 /*-- jamming option ------*/
  unsigned char clockFreq;                  /*-- clock freq for CPCI -*/
  double  frequency;                        /*-- heartbeat freq ------*/
} /*-------------------------------------------------------------------*/
TPRO_HeartObj;


/*===================================================================
                         TPRO TIME OBJECT
===================================================================*/

typedef struct TPRO_TimeObj
{ /*-------------------------------------------------------------------*/
  double         secsDouble;                /*-- seconds -------------*/
  unsigned char  seconds;                   /*-- seconds -------------*/
  unsigned char  minutes;                   /*-- minutes -------------*/
  unsigned char  hours;                     /*-- hours ---------------*/
  unsigned short days;                      /*-- days ----------------*/
```

```
  unsigned short year;              /*-- year for CPCI board -*/
  unsigned short sync;              /*--sync flags (0x91xx boards -*/
} /*-------------------------------------------------------------------------*/
TPRO_TimeObj;


/*=========================================================================
                        TPRO WAIT OBJECT
=========================================================================*/

typedef struct TPRO_WaitObj
{ /*-------------------------------------------------------------------------*/
  unsigned int ticks;                       /*-- # ticks to wait -----*/

  double        seconds;                    /*-- seconds -------------*/
  unsigned char  minutes;                   /*-- minutes -------------*/
  unsigned char  hours;                     /*-- hours ---------------*/
  unsigned short days;                      /*-- days ----------------*/
  unsigned short year;                      /*-- year for cPCI card --*/
  unsigned char  month;                     /*-- month for cPCI card -*/
  unsigned char  day;                       /*-- day for cPCI card ---*/
} /*-------------------------------------------------------------------------*/
TPRO_WaitObj;

/*=========================================================================
                  TPRO MEM OBJECT FOR PEEK/POKE
=========================================================================*/

typedef struct TPRO_MemObj
{ /*-------------------------------------------------------------------------*/
  unsigned short offset;
  unsigned long  value;
} /*-------------------------------------------------------------------------*/
TPRO_MemObj;


/***************************************************************************
                           ERROR CODES
***************************************************************************/

#define TPRO_SUCCESS                  (0)     // success
#define TPRO_HANDLE_ERR               (1)     // error creating handle to device
#define TPRO_OBJECT_ERR               (2)     // error creating device object
#define TPRO_CLOSE_HANDLE_ERR         (3)     // error closing device handle
#define TPRO_DEVICE_NOT_OPEN_ERR      (4)     // tpro device was not opened
#define TPRO_INVALID_BOARD_TYPE_ERR   (5)     // function is not available for board type
#define TPRO_FREQ_ERR                 (6)     // invalid frequency
#define TPRO_YEAR_PARM_ERR            (7)    // invalid year parameter
#define TPRO_DAY_PARM_ERR             (8)    // invalid day parameter
#define TPRO_HOUR_PARM_ERR            (9)    // invalid hour parameter
#define TPRO_MIN_PARM_ERR            (10)    // invalid minutes parameter
#define TPRO_SEC_PARM_ERR            (11)    // invalid seconds parameter
#define TPRO_DELAY_PARM_ERR          (12)    // invalid delay factor
#define TPRO_TIMEOUT_ERR             (13)    // device timed out
#define TPRO_COMM_ERR                (14)    // error communicating with driver
#define TPRO_DEV_BUSY                 (15) // The driver is currently busy executing a request
from a different user



/***************************************************************************
                     PUBLIC ROUTINE PROTOTYPES
***************************************************************************/

DLL_EXPORT
unsigned char TPRO_open             (TPRO_BoardObj **hnd, char *deviceName);

DLL_EXPORT
unsigned char TPRO_close          (TPRO_BoardObj *hnd);

DLL_EXPORT
```

```
unsigned char TPRO_flushFIFO      (TPRO_BoardObj *hnd);

DLL_EXPORT
unsigned char TPRO_getAltitude      (TPRO_BoardObj *hnd, TPRO_AltObj *Altp);

DLL_EXPORT
unsigned char TPRO_getDate          (TPRO_BoardObj *hnd, TPRO_DateObj *Datep);

DLL_EXPORT
unsigned char TPRO_getDriver      (TPRO_BoardObj *hnd, char *driver);

DLL_EXPORT
unsigned char TPRO_getFirmware            (TPRO_BoardObj *hnd, char *firmware);

DLL_EXPORT
unsigned char TPRO_getFPGA        (TPRO_BoardObj *hnd, char *fpga);

DLL_EXPORT
unsigned char TPRO_getLatitude      (TPRO_BoardObj *hnd, TPRO_LatObj *Latp);

DLL_EXPORT
unsigned char TPRO_getLongitude     (TPRO_BoardObj *hnd, TPRO_LongObj *Longp);

DLL_EXPORT
unsigned char TPRO_getSatInfo       (TPRO_BoardObj *hnd, TPRO_SatObj *Satp);

DLL_EXPORT
unsigned char TPRO_getTime        (TPRO_BoardObj *hnd, TPRO_TimeObj *Timep);

DLL_EXPORT
unsigned char TPRO_resetFirmware    (TPRO_BoardObj *hnd);

DLL_EXPORT
unsigned char TPRO_setHeartbeat     (TPRO_BoardObj *hnd, TPRO_HeartObj *Heartp);

DLL_EXPORT
unsigned char TPRO_setMatchTime     (TPRO_BoardObj *hnd, TPRO_MatchObj *Matchp);

DLL_EXPORT
unsigned char TPRO_setOscillator    (TPRO_BoardObj *hnd, unsigned char *freq);

DLL_EXPORT
unsigned char TPRO_setPropDelayCorr (TPRO_BoardObj *hnd, int *us);

DLL_EXPORT
unsigned char TPRO_setTime          (TPRO_BoardObj *hnd, TPRO_TimeObj *Timep);

DLL_EXPORT
unsigned char TPRO_setYear          (TPRO_BoardObj *hnd, unsigned short *yr);

DLL_EXPORT
unsigned char TPRO_simEvent       (TPRO_BoardObj *hnd);

DLL_EXPORT
unsigned char TPRO_synchControl     (TPRO_BoardObj *hnd, unsigned char *enbp);

DLL_EXPORT
unsigned char TPRO_synchStatus      (TPRO_BoardObj *hnd, unsigned char *status);

DLL_EXPORT
unsigned char TPRO_waitEvent        (TPRO_BoardObj *hnd, TPRO_WaitObj *waitp);

DLL_EXPORT
unsigned char TPRO_waitHeartbeat    (TPRO_BoardObj *hnd, unsigned int *ticks);

DLL_EXPORT
unsigned char TPRO_waitMatch        (TPRO_BoardObj *hnd, unsigned int *ticks);

DLL_EXPORT
unsigned char TPRO_peek                   (TPRO_BoardObj *hnd, TPRO_MemObj *Mem);
```

```
DLL_EXPORT
unsigned char TPRO_poke                  (TPRO_BoardObj *hnd, TPRO_MemObj *Mem);

#ifdef __cplusplus
}
#endif

#pragma pack()

#endif  // _defined_TPRO_
```

3.2 TPRO API — Routine Descriptions

The TPRO-PCI driver permits overlapping use of the TPRO-waitXXX routines and other device access routines.

NOTE: Simultaneous access to the device requires multiple open device handles. (If an application requires access to the device driver from two different threads, each thread must have its own device handle.)

3.2.1.1.1 TPRO_open

```
unsigned char TPRO_open  (TPRO_BoardObj **hnd, char *deviceName);
```

This routine allocates a TPRO_BoardObj obect, sets a handle to the TPRO/TSAT, and sets the driver firmware, fpga revision (if applicable), and the driver revision strings.

```
Arguments:  Pointer to TPRO_BoardObj handle
            Device name - "TPROpci0"

Returns:    TPRO_OBJECT_ERR – error allocating board object
            TPRO_HANDLE_ERR – error retrieving handle to device
            TPRO_COMM_ERR   - error communicating with driver
            TPRO_SUCCESS    - success
```

3.2.1.1.2 TPRO_close

```
unsigned char TPRO_close (TPRO_BoardObj *hnd);
```

This routine frees the allocated board object and closes the handle to the TPRO/TSAT device.

```
Arguments:  Pointer to TPRO_BoardObj

Returns:    TPRO_CLOSE_HANDLE_ERR – error closing handle to device
            TPRO_DEVICE_NOT_OPEN  - device is not open
            TPRO_SUCCESS          - success
```

3.2.1.1.3 TPRO_getAltitude

```
unsigned char TPRO_getAltitude (TPRO_BoardObj *hnd, TPRO_AltObj *Altp);
```

This routine retrieves the altitude information from the TSAT board. Altitude distance is in meters.

```
Arguments:  Pointer to TPRO_BoardObj
            Pointer to TPRO_AltObj

Returns:    TPRO_INVALID_BOARD_TYPE_ERR – invalid board type for function
            TPRO_COMM_ERR               - error communicating with driver
            TPRO_SUCCESS                - success
```

3.2.1.1.4 TPRO_getDate

unsigned char TPRO_getDate (TPRO_BoardObj *hnd, TPRO_DateObj *Datep);

This routine retrieves the current date from the TPRO/TSAT board. The date is in Gregorian Format.

```
Arguments:  Pointer to TPRO_BoardObj
            Pointer to TPRO_DateObj

Returns:    TPRO_INVALID_BOARD_TYPE_ERR – invalid board type for function
            TPRO_COMM_ERR               - error communicating with driver
            TPRO_SUCCESS                - success
```

3.2.1.1.5 TPRO_getLatitude

unsigned char TPRO_getLattitude(TPRO_BoardObj *hnd, TPRO_LatObj *Latp);

This routine retrieves the latitude information from the TSAT device.

```
Arguments:  Pointer to TPRO_BoardObj
            Pointer to TPRO_LatObj

Returns:    TPRO_INVALID_BOARD_TYPE_ERR – invalid board type for function
            TPRO_COMM_ERR               - error communicating with driver
            TPRO_SUCCESS                - success
```

3.2.1.1.6 TPRO_getLongitude

unsigned char TPRO_getLongitude(TPRO_BoardObj *hnd, TPRO_LongObj *Longp);

This routine retrieves the longitude information from the TSAT device.

```
Arguments:  Pointer to the TPRO_BoardObj
            Pointer to the TPRO_LongObj

Returns:    TPRO_INVALID_BOARD_TYPE_ERR – invalid board type for function
            TPRO_COMM_ERR               - error communicating with driver
            TPRO_SUCCESS                - success
```

3.2.1.1.7 TPRO_getSatInfo

`unsigned char TPRO_getSatInfo(TPRO_BoardObj *hnd, TPRO_SatObj *Satp);`

This routine retrieves the number of satellites tracked from the TSAT device.

```
Arguments:  Pointer to the TPRO_BoardObj
            Pointer to the TPRO_SatObj

Returns:    TPRO_INVALID_BOARD_TYPE_ERR – invalid board type for function
            TPRO_COMM_ERR               - error communicating with driver
            TPRO_SUCCESS                - success
```

3.2.1.1.8 TPRO_getTime

`unsigned char TPRO_getTime(TPRO_BoardObj *hnd, TPRO_TimeObj *Timep);`

This routine retrieves the current time from the TPRO/TSAT device. The seconds value is received as type double.

```
Arguments:  Pointer to the TPRO_BoardObj
            Pointer to the TPRO_TimeObj

Returns:    TPRO_COMM_ERR               - error communicating with driver
            TPRO_SUCCESS                - success
```

3.2.1.1.9

3.2.1.1.10 TPRO_resetFirmware

`unsigned char TPRO_resetFirmware(TPRO_BoardObj *hnd);`

This routine resets the firmware programmed on the TPRO/TSAT device. This function is for troubleshooting purposes only and should not be used in the main application.

```
Arguments:  Pointer to the TPRO_BoardObj

Returns:    TPRO_COMM_ERR               - error communicating with driver
            TPRO_SUCCESS                - success
```

3.2.1.1.11 TPRO_setHeartbeat

```
unsigned char TPRO_setHeartbeat(TPRO_BoardObj *hnd, TPRO_HeartObj *Heartp);
```

This routine controls the hearbeat output. The heartbeat output may be a square wave or pulse at various frequencies.

```
Arguments:  Pointer to the TPRO_BoardObj
            Pointer to the TPRO_HeartObj

Returns:    TPRO_FREQ_ERR – invalid frequency value
            TPRO_COMM_ERR - error communicating with driver
            TPRO_SUCCESS  - success
```

3.2.1.1.12 TPRO_setMatchTime

```
unsigned char TPRO_setMatchTime(TPRO_BoardObj *hnd, TPRO_MatchObj *Matchp);
```

This routine drives the match output line high (start time) or low (stop time) when the desired time is met.

```
Arguments:  Pointer to the TPRO_BoardObj
            Pointer to the TPRO_MatchObj

Returns:    TPRO_DAY_PARM_ERR  - invalid days parameter (must be 0-366)
            TPRO_HOUR_PARM_ERR – invalid hours parameter (must be 0 – 23)
            TPRO_MIN_PARM_ERR  - invalid minutes parameter (must be 0 – 59)
            TPRO_SEC_PARM_ERR  - invalid seconds paramter (must be 0 – 69)
            TPRO_COMM_ERR      - error communicating with driver
            TPRO_SUCCESS       - success
```

3.2.1.1.13 TPRO_setPropDelayCorr

```
unsigned char TPRO_setPropDelayCorr (TPRO_BoardObj *hnd, int *us);
```

This routine sets the propagation delay correction factor.

```
Arguments:  Pointer to the TPRO_BoardObj
            Pointer to correction factor in microseconds

Returns:    TPRO_DELAY_PARM_ERR – invalid propagation delay factor
            TPRO_COMM_ERR       - error communicating with driver
            TPRO_SUCCESS        - success
```

3.2.1.1.14 TPRO_setTime

`unsigned char TPRO_setTime(TPRO_BoardObj *hnd, TPRO_TimeObj *Timep);`

This routine sets the time on the on-board clock of the TPRO/TSAT device. If the board is synchronized to a GPS antenna this value will not be accepted.

```
Arguments:  Pointer to the TPRO_BoardObj
            Pointer to the TPRO_TimeObj

Returns:    TPRO_DAY_PARM_ERR  - invalid days parameter (must be 0-366)
            TPRO_HOUR_PARM_ERR - invalid hours parameter (must be 0 - 23)
            TPRO_MIN_PARM_ERR  - invalid minutes parameter (must be 0 - 59)
            TPRO_SEC_PARM_ERR  - invalid seconds paramter (must be 0 - 69)
            TPRO_COMM_ERR      - error communicating with driver
            TPRO_SUCCESS       - success
```

3.2.1.1.15 TPRO_setYear

`unsigned char TPRO_setYear(TPRO_BoardObj *hnd, unsigned short *yr);`

This routine programs the TPRO/TSAT device with the desired year. If the board is synchronized to a GPS antenna this value will not be accepted.

```
Arguments:  Pointer to the TPRO_BoardObj
            Pointer to the desired year

Returns:    TPRO_INVALID_BOARD_TYPE_ERR - invalid board type for function
            TPRO_COMM_ERR               - error communicating with driver
            TPRO_SUCCESS                - success
```

3.2.1.1.16 TPRO_simEvent

`unsigned char TPRO_simEvent(TPRO_BoardObj *hnd);`

This routine simulates an external time tag event.

```
Arguments:  Pointer to the TPRO_BoardObj

Returns:    TPRO_COMM_ERR - error communicating with driver
            TPRO_SUCCESS  - success
```

3.2.1.1.17 TPRO_synchControl

unsigned char TPRO_synchControl(TPRO_BoardObj *hnd, unsigned char *enbp);

This routine commands the TPRO/TSAT device to synchronize to input or freewheel. This distinction is made using the enable argument. If the enable argument is (0) the clock will freewheel, otherwise it will synchronize to input. When disabling synchronization (freewheeling), the device will continue to synchronize until the time is set.

```
Arguments:  Pointer to the TPRO_BoardObj
            Pointer to the synch enable

Returns:    TPRO_COMM_ERR - error communicating with driver
            TPRO_SUCCESS  - success
```

3.2.1.1.18 TPRO_synchStatus

unsigned char TPRO_synchStatus(TPRO_BoardObj *hnd, unsigned char *status);

This routine reports the synchronization status of the TPRO/TSAT device. When status is equal to zero, the device is freewheeling. Otherwise the device is synchronized to its input.

```
Arguments:  Pointer to the TPRO_BoardObj
            Pointer to the synch status variable

Returns:    TPRO_COMM_ERR - error communicating with driver
            TPRO_SUCCESS  - success
```

3.2.1.1.19 TPRO_waitEvent

unsigned char TPRO_waitEvent(TPRO_BoardObj *hnd, TPRO_WaitObj*waitp);

This routine will report the time an external event was detected on the Time Tag Input pin. The routine will block for a given number of ticks (in milliseconds) until an event occurs or the timeout period has been reached.

```
Arguments:  Pointer to the TPRO_BoardObj
            Pointer to wait time

Returns:    TPRO_TIMEOUT_ERR – routine has timed-out
            TPRO_COMM_ERR    - error communicating with driver
            TPRO_SUCCESS     - success
```

3.2.1.1.20 TPRO_waitHeartbeat

`unsigned char TPRO_waitHeartbeat(TPRO_BoardObj *hnd, unsigned int *ticks);`

This routine will reports the condition of the heartbeat output. The routine will block for a given number of ticks (in milliseconds) until a heartbeat occurs or the timeout period has been reached.

```
Arguments:  Pointer to the TPRO_BoardObj
            Pointer to timeout variable in milliseconds

Returns:    TPRO_TIMEOUT_ERR – routine has timed-out
            TPRO_COMM_ERR    - error communicating with driver
            TPRO_SUCCESS     - success
```

3.2.1.1.21 TPRO_waitMatch

`unsigned char TPRO_waitMatch(TPRO_BoardObj *hnd, unsigned int *ticks);`

This routine will reports the condition of the match start time. The routine will block for a given number of ticks (in milliseconds) until a match start time occurs or the timeout period has been reached.

```
Arguments:  Pointer to the TPRO_BoardObj
            Pointer to wait time

Returns:    TPRO_TIMEOUT_ERR – routine has timed-out
            TPRO_COMM_ERR    - error communicating with driver
            TPRO_SUCCESS     - success
```

Document Revision History			
Rev	***ECN***	***Description***	***Date***
A	2325	*First draft of Spectracom documentation for this product.*	
B	2332	*Minor corrections.*	
C	2552	*Added 32/64-bit Lib/DLL comments. Added Windows 7 support comment. Other minor corrections.*	December 2010

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