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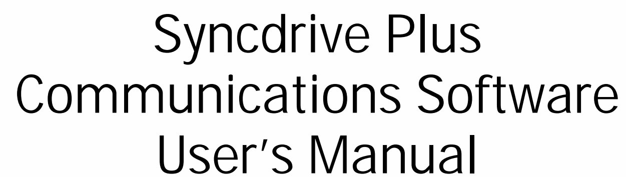

Syncdrive Plus
Communications Software
User's Manual

QUATECH, INC.
662 Wolf Ledges Parkway
Akron, Ohio 44311
Toll free: 1-800-553-1170
TEL: (330) 434-3154
FAX: (330) 434-1409
http://www.quatech.com

Syncdrive Plus
User's Manual P/N: 940-0184-100

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Introduction

Note: For on-line technical support, see Quatech's Web site: http://www.quatech.com/technical.htm

Syncdrive Plus is a synchronous communications software driver package that helps users of Quatech synchronous communication hardware to develop their application software.

The Syncdrive Plus driver package includes these features:

- Multiple communication channels using multiple MPA-series adapters
- Support for bit-synchronous (SDLC, HDLC) communications
- User-control of most communication parameters
- Relieves programmers of the burden of directly programming the synchronous communications hardware
- User can change or upgrade synchronous communication hardware with minimal modifications to the application software
- Support for all Quatech MPA-series PCI bus and PCMCIA adapters:
  - MPAP-100: Multi-protocol RS-232 synchronous serial card
  - MPAP-200/300: Multi-protocol RS-422/485 synchronous serial card
  - MPAC-100: Single port RS-232 synchronous board.
- Versions for Windows 2000 and Windows XP

Written specifically for use with C, Syncdrive Plus is also compatible with other languages that support C-type subroutine interfaces.

System Requirements

Note: See Quatech's Internet site for the latest drivers and updates: http://www.quatech.com/.

The system requirements are as follows:

- PC running either Windows 2000 or Windows XP
- Available PCI slot or PC Card slot

We recommend that you install the latest service packs.

All other requirements are the same as for the respective operating systems.

Installing Syncdrive plus

Follow this procedure to install your Quatech Syncdrive Plus synchronous communication software.

Step	Procedure	Description
☐ Step 1	Insert the Quatech installation CD-ROM into your CD-ROM drive.	*This is the CD that shipped with the MPAX-XXX adapter.*
☐ Step 2	Insert the MPAX-XXX adapter into any available PC Card socket.	*The Found New Hardware prompt displays briefly, followed by the Found New Hardware Wizard's Welcome screen.*

Figure 1 - Found new hardware prompt

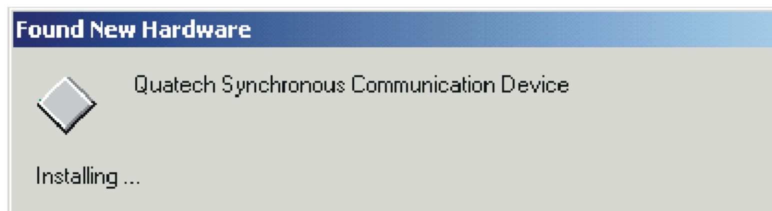


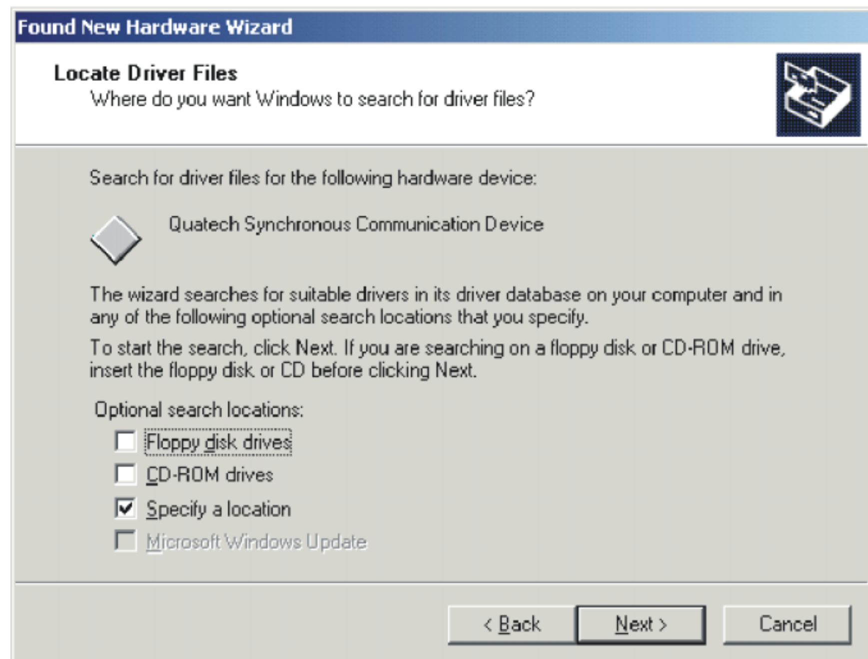
Figure 2 - Welcome screen

Step	Procedure	Description
☐ Step 3	Press Next to continue.	*The Install Hardware Device Drivers screen displays.*

Figure 3 - Install Hardware Device Drivers screen

Step	Procedure	Description
☐ Step 4	Select the Search for a suitable driver for my device (recommended) option. Press Next to continue.	*The Locate Driver Files screen displays.*

Figure 4 - Locate Driver Files screen

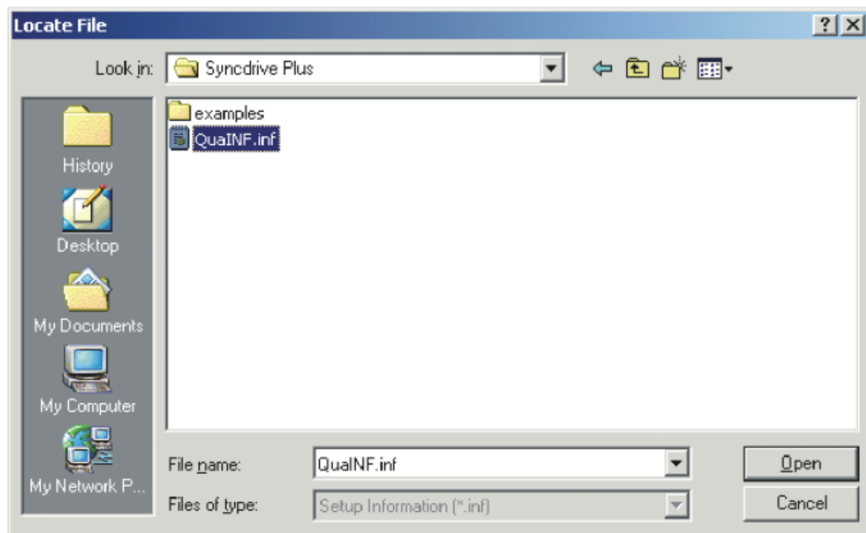


Step	Procedure	Description
☐ Step 5	Select the Specify a location option. Press Next to continue.	*The Insert installation disk prompt displays.*

Figure 5 - Insert installation disk prompt

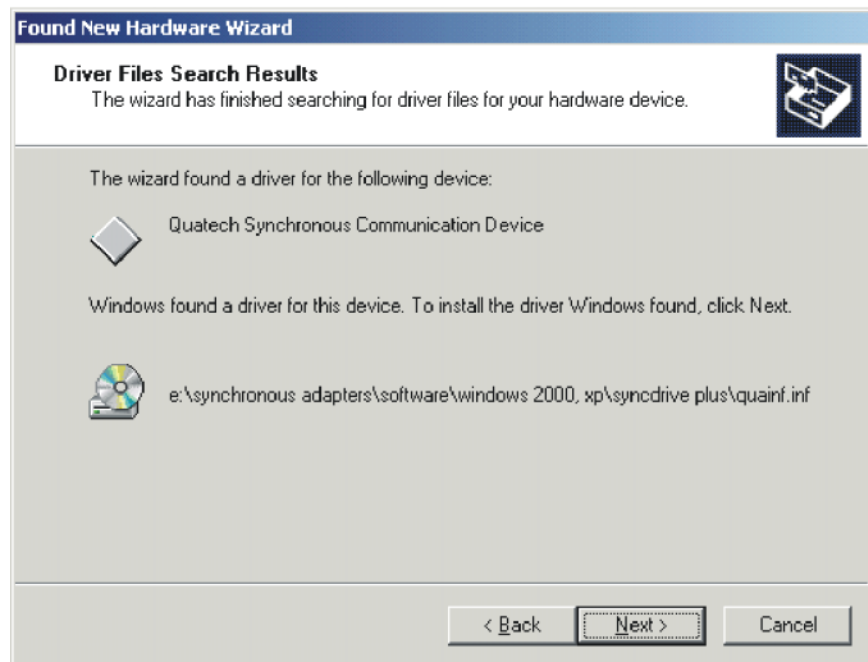
Step	Procedure	Description
☐ Step 6	Browse to the correct drive location on your CD-ROM drive.	*The complete path is E:\Synchronous Adapters\Software\Windows 2000, XP\Syncdrive Plus. Replace E: with your CD-ROM drive designation.*
	Click OK to continue.	*The Locate File screen displays.*

Figure 6 - Locate File screen



Step	Procedure	Description
☐ Step 7	Select the Quainf.inf file and click Open.	*The Driver Files Search Results screen displays, showing the path to the* Quainf.inf *driver.*

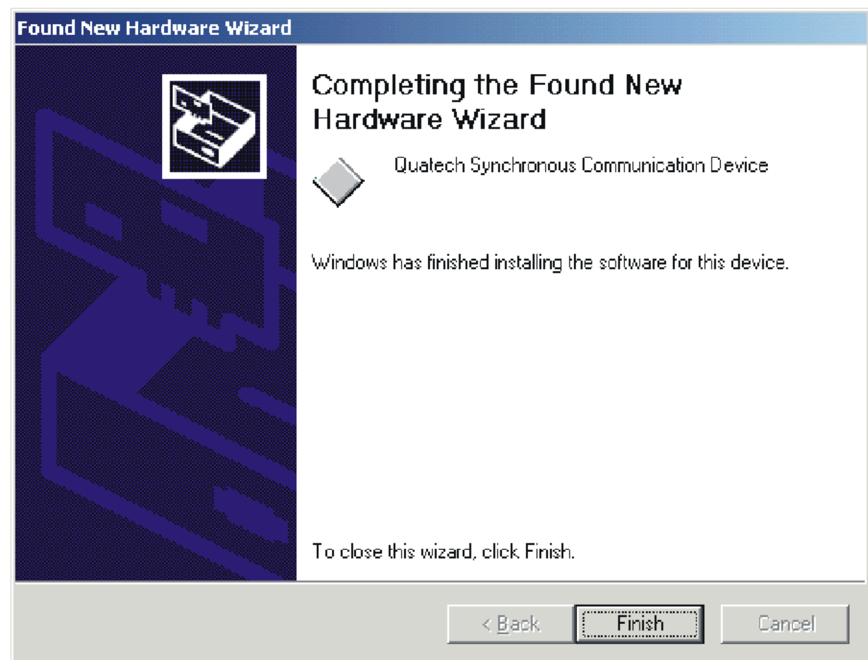
Figure 7 - Driver Files Search Results screen



Step	Procedure	Description
☐ Step 8	Make sure the directory path ends at the Quainf.inf file. Click Next to continue.	*The Completing the Found New Hardware Wizard screen displays.*

Figure 8 - Completing the Found New Hardware Wizard screen

Note: You can find your Syncdrive Plus adapter listed in the Windows Device Manager under Synchronous Communication



Step	Procedure	Description
☐ Step 9	Click Finish to continue.	*The Installation Wizard completes the installation of the Syncdrive Plus driver.*

Synchronous communication with Syncdrive Plus

Note: Syncdrive Plus uses synchronous communication for faster data transfer rates with less overhead.

Most data communications in personal computers is handled asynchronously using standard communication ports. Asynchronous communication transfers data one character at a time with significant overhead due to the addition of the start and stop bits required for each character. These additions can decrease the rate of data transfer by 20% or more.

In contrast, synchronous communication transfers data in a format referred to as a frame. Each frame consists of a block of data plus a fixed amount of overhead from the insertion of control, synchronization, and error detection characters. Since the amount of overhead is independent of the data block size, the percentage of the total transfer time devoted to the frame overhead diminishes as the size of the data block increases.

Synchronous communication is further divided into bit-synchronous and byte-synchronous transfers. Bit-synchronous transfers treat the data block as a series of data bits with no specific character boundaries. Byte-synchronous transfers treat the data block as a series of fixed-length characters.

The first release of Syncdrive Plus transfers data in bit-synchronous mode only. The bit-synchronous mode can be used to implement such protocols as SDLC or HDLC. Syncdrive Plus does not implement any specific protocol itself, but supports most protocols implemented by the application software. Future releases of Syncdrive Plus will add support for byte-synchronous modes such as BISYNC.

Understanding BIT-synchronous formatting

Syncdrive's bit-synchronous mode generates a frame formatted according to the scheme shown below.

Figure 9 - Syncdrive Plus bit-synchronous frame format

flag	data	CRC	flag

The hardware uses the frame's start flag and end flag characters for synchronization purposes. When the application transmits a block of data, Syncdrive Plus automatically appends these flag characters to the frame. When receiving a frame, the driver automatically removes these flag characters from the frame before returning it to the application.

Syncdrive Plus uses the frame's CRC bytes for error detection purposes. When transmitting a block of data, it automatically generates and transmits the CRC after it sends all of the data. When receiving a frame, Syncdrive Plus automatically checks the CRC to determine if the frame was corrupted. If a CRC error occurs, Syncdrive Plus returns an error code (see MPA_GetData() return values).

Operational overview

Data handling

The Syncdrive Plus driver simplifies application development. Applications simply read and write frames as they would files without any worry about buffer management, interrupts, or register handling.

Once a handle is opened to the driver, the application can write as many frames as desired if the handle was opened with overlapped I/O. Syncdrive Plus queues the frames in the order in which they were received and sends them out one at a time. The number of frames that can be queued is limited only by system resources. However, if the handle is opened without overlapped I/O, only a single frame can be transmitted at one time. Control returns to the application when the transfer is completed.

Note: The application can loop on MPA_GetFrameCount() *until a frame is received. Once the application receives a frame, it calls* MPA_GetFrameSize() *to determine the frame's size so that it can allocate an appropriately sized buffer.*

The driver can also queue frame buffers for receive if non-overlapped I/O is specified. The buffers are filled as frames arrive. Alternately, if the application did not queue read buffers, buffers in the driver can store received frames until the application requests them. The size and quantity of these driver receive buffers are dynamically configurable.

If non-overlapped I/O is specified, only one frame can be read at a time. If a frame has already been received, it is copied into the application buffer immediately; otherwise, the driver waits until it receives a complete frame before returning control to the application.

Transmitting frames

Queued transmit frames use Windows' built-in I/O request queuing, which stores data in a system buffer until it can be transmitted. The application can obtain transfer status by using MPA_GetTransferStatus(). However, transmit frames are not queued for non-overlapped I/O. In this case, the application waits until the frame has been transferred before regaining control.

The Quatech board has a 1-KB transmit FIFO to supplement the 4-byte transmit FIFO in the Zilog ESCC chip. If it receives an end-of-frame (EOF) or the transmitter is not busy, the driver immediately transfers as much data as possible into the transmit FIFOs. If the frame is smaller than the FIFO size, then the transmit code waits until the frame is transmitted completely before starting the next frame. If the frame is larger than the FIFO depth, the driver waits for an interrupt that indicates that the transmit FIFO has drained to half capacity. At this point, the transmit code fills the transmit FIFO up to its capacity. This process repeats until the entire frame buffer has been transferred into the FIFOs. When the driver receives an EOF interrupt indicating that the frame has been transmitted completely, it starts the next frame (if there is one queued).

Receiving frames

The receive code has driver-allocated buffers that receive frames without needing a user-supplied buffer. This allows the application to allocate buffers as frames arrive.

Note: Typically, you would use this approach for known frame sizes and arrival times.

A typical approach is to call MPA_GetFrameCount() until frame(s) arrive. The application then uses MPA_GetFrameSize() to allocate the buffer size and retrieves the frame using MPA_GetData(). Alternatively, the application can keep read buffers queued in anticipation of incoming frames.

The receive logic works in a similar fashion to the transmit logic. The Quatech board has a 1-KB receive FIFO to supplement the 8-byte receive FIFO in the Zilog ESCC chip. If it receives a frame is that is smaller than half of the receive FIFO depth, the receive code simply acknowledges the EOF interrupt and transfers the frame either into an internal buffer if there is no queued read buffer, or directly into the user's read buffer if there is one. For frames larger than half-FIFO size, the receive code generates interrupts when the half-FIFO depth is reached. The driver then drains the receive FIFO by filling either the internal buffer or the user's buffer. This process repeats until the EOF is reached.

Note: There are no internal buffers for transmit because queued transmit buffers use the system buffers.

The receive buffers are configurable using MPA_SetConfig() as detailed in the API (see Syncdrive Plus application programming interface) and Structure (see Syncdrive Plus data structures) sections. The driver allocates these buffers when the device is opened. Be sure to take care to minimize requirements because the driver uses non-paged system memory, which is scarce after boot-up.

The maximum number of internal receive buffers matches the maximum number of frames that can be queued in the ESCC, which is 10 frames. The ESCC has a status FIFO that queues the frame lengths, so the frames do not have to be serviced immediately. The maximum internal buffer length matches the depth of the internal ESCC counters, 16 K. Once again, transmit buffers are only limited by system resources.

Clocking parameters

The API supports many different clocking configurations. It is up to the application to configure valid combinations. The application can control the following:

- Transmit clock source
- Receive clock source
- Output of TRxC pin
- DPLL clock source and mode if DPLL used
- Baud rate of the baud rate generator (BRG), if BRG is used

Clocking can originate from two sources within the Quatech board:

1. Baud rate generator (BRG)
2. Digital phase locked loop (DPLL)

The BRG is a variable-rate clocking mechanism used with external clock pins. The DPLL is used to encode the clocking signal within the data stream, eliminating the need for an external clock pin. The DPLL requires a clock and can either acquire it from the BRG or externally through the RTxC pin.

Include file structure

QuaDLL.h – Provides function prototypes for Syncdrive Plus API functions.

QuaDef.h – Defines structures that are used with Syncdrive Plus API calls.

Operating under Windows 2000/XP

Building Syncdrive Plus applications

Link the application's object modules with the Syncdrive Plus API import library file QuaDLL.LIB. The file can be found in the \Synchronous Adapters\Software\Windows 2000, XP\Syncdrive Plus \Examples directory of the Quatech CD-ROM.

Ensure that the Windows XP/2K device driver has been installed properly on the system.

You can find all the required Syncdrive Plus include files in the \Synchronous Adapters\Software\Windows 2000, XP\Syncdrive Plus\Examples directory of the Quatech CD-ROM.

Syncdrive Plus applications must include the QuaDLL.h file. Applications must use the MPADLL_API calling convention, defined in the QuaDLL.h include file, in order to access the Windows DLL.

Terminating applications

Applications should ensure that any allocated memory is freed before terminating.

Because applications can terminate unexpectedly due to bugs or operator intervention, termination procedures should be called in exit handler functions.

Tips and Techniques

Note: Syncdrive Plus data structures must be 8-byte-aligned.

The following is an outline of the basic steps that an application must take to transmit or receive data frames using Syncdrive Plus.

1. Allocate data structures.
2. Configure the channel.
3. Register buffer queues (optional).
4. Transmit or receive data.
5. Free buffer queues (if used).
6. Release the channel.
7. Deallocate data structures.

Syncdrive Plus data structures

Note: This design ensures that the application uses the same header file as the driver files and helps to minimize difficult memory overwrite debugging.

This section describes the structures that Syncdrive Plus uses with API calls. Every structure passed to the API needs its structLen member filled out with the structure's length in bytes. This is true even if the structure is used to retrieve information from the driver.

MPA_CONFIG	*Handles device configuration*

Syntax:

```
typedef struct tagMPA_CONFIG
{
    ULONG         structLen;
    union
    {
        struct
        {
            // Set the following bits to indicate which parameter(s) are to be set.
            // Parameter value(s) with corresponding bits set to zero are not
            // changed.
            // Tx does not require buffers since pending I/O requests provide buffers.
            UCHAR            FrameBufferSizeRx         : 1;
            UCHAR            NumFrameBuffersRx         : 1;
            UCHAR            BaudRate                  : 1;
            UCHAR            ClockRate                 : 1;
            UCHAR            ClockMode                 : 1;
            UCHAR            InternalLoopback          : 1;
            UCHAR            RxClockSource             : 1;
            UCHAR            TxClockSource             : 1;
            UCHAR            TRXCOutput                : 1;
            UCHAR            Encoding                  : 1;
            UCHAR            DPLLClockSource           : 1;
            UCHAR            DPLLMode                  : 1;
            UCHAR            AutoRTSDeact              : 1;
            UCHAR            CRCPreset                 : 1;
            UCHAR            IdleLineControl           : 1;
            ULONG            pad                       : (8*sizeof(ULONG) - 13);
        } bits;
        ULONG all;  // Used to clear/set all bits at once.
    } set;
    ULONG                         FrameBufferSizeRx;     // In bytes.
    ULONG                         NumFrameBuffersRx;
    ULONG                         BaudRate;
    ULONG                         ClockRate;
    ULONG                         ClockMode;
    BOOLEAN                       InternalLoopback;
    CLOCK_SOURCE                  RxClockSource;
    CLOCK_SOURCE                  TxClockSource;
    TRXC_OUTPUT                   TRXCOutput;
    ENCODING                      Encoding;
    DPLL_CLOCK_SOURCE DPLL        ClockSource;
    DPLL_MODE                     DPLLMode;
    BOOLEAN                       AutoRTSDeact;
    BOOLEAN                       CRCPreset;
    IDLE_LINE_CONTROL             IdleLineControl;
} MPA_CONFIG, *PMPA_CONFIG;
```

MPA_CONFIG	*Continued*
Description:	Used to set or get device configuration(s). *Note: When configuring baud rate, be sure to remember to set both the clock rate and the clock mode. The driver needs to know the oscillator frequency in order to run at the baud rate specified. Because FM DPLL requires a clock rate 16 times the data rate, the clock mode will be 16 in this case. Similarly, NRZI DPLL requires a clock rate 32 times the data rate. Notice that clock mode acts as a divisor and results in a lower maximum data rate.*
API Functions Used:	MPA_SetConfig() and MPA_GetConfig() only.
Parameters:	
structLen	Length of the MPA_CONFIG structure in bytes. Should be filled in before calling MPA_GetConfig() or MPA_SetConfig() functions.
set	Union composed of set structure and a ULONG all. Bits in set structure are set to tell the driver the corresponding value is valid and should be set in hardware. Use all to clear or set all bits simultaneously. Pad is reserved and is only used to align the structure.
FrameBufferSizeRx	The size of each of the receive buffer(s) in bytes. This should be set to the largest frame expected. The value should be as small as possible since it requires non-paged system memory. This value only changes when the device is opened. For the new values to take effect, you must close and re-open the device.
NumFrameBuffers	The number of receive frame buffers for use by the driver. This setting should be based on how quickly frames will be read from the driver. If frame sizes are large, infrequent, or frame servicing will be handled as frames arrive, then this value can be small. Back-to-back small frames that cannot be serviced as they arrive would require a larger value. The value should be as small as possible since it requires non-paged system memory. This value only changes when the device is opened. For the new values to take effect, you must close and re-open the device.
BaudRate	The baud rate in baud. Valid ranges are 1 to 1/6 of clock rate.
ClockRate	The clock rate in Hz. The clock rate is determined by the Quatech hardware. Factory standard configuration is 9.8304 MHz. This value may be different if you are using custom-configured Quatech hardware.
ClockMode	The clock mode rate. Can be X1, X16, X32, or X64.
InternalLoopback	TRUE to enable internal loopback. Internal loopback allows transmit and receive testing from a single card without any external connections.

RxClockSource	The source of the receive clock. Use the following enumeration to set clock source. Any other value is invalid.
	typedef enum tagCLOCK_SOURCE
	{
	    RTXC,
	    TRXC,
	    BAUD_RATE_GEN,
	    DPLL
	} CLOCK_SOURCE;

MPA_CONFIG	*Continued*

Parameters, cont.:

TxClockSource

The source of the transmit clock. Use the following enumeration to set clock source. Any other value is invalid.

```
typedef enum tagCLOCK_SOURCE
{
    RTXC,
    TRXC,
    BAUD_RATE_GEN,
    DPLL
} CLOCK_SOURCE;
```

TRXCOutput

Selection for what should be output the TRxC pin. Use the following enumeration to set TRxC source. Any other value is invalid.

```
typedef enum tagTRXC_OUTPUT
{
    CRYSTAL_OUT,
    TX_CLOCK,
    BAUD_RATE_GEN_OUT,
    DPLL_OUT
} TRXC_OUTPUT;
```

Encoding

Encoding method for both transmit and receive. Use the following enumeration to set encoding method. Any other value is invalid.

```
typedef enum tagENCODING
{
    NRZ,
    NRZI,
    FM1,
    FM0
} ENCODING;
```

DPLLClockSource

The source for the DPLL clock. This is required if DPLL is used. Use the following enumeration to set DPLL clock source. Any other value is invalid.

```
typedef enum tagDPLL_CLOCK_SOURCE
{
    DPLL_SRC_BAUD_RATE_GEN,
    DPLL_SRC_RTXC
} DPLL_CLOCK_SOURCE;
```

DPLLMode

The DPLL mode. This is required if DPLL is used. Use the following enumeration to set DPLL mode. Any other value is invalid.

```
typedef enum tagDPLL_MODE
{
    DPLL_MODE_NRZI,
    DPLL_MODE_FM
} DPLL_MODE;
```

AutoRTSDeact

TRUE to select automatic RTS deactivation.

CRCPreset

The preset value (either 0 or 1) to which the receive CRC checker and transmit CRC generator should be set.

IdleLineControl

Specifies what should be transmitted on an idle line. The choices are either to send all ones or the flag character (usually 7Eh for SDLC). Sending all zeros is not supported on the ESCC chip. Use the following enumeration to set idle line control. Any other value is invalid.

```
typedef enum tagIDLE_LINE_CONTROL
{
    IDLE_LINE_FLAGS,
    IDLE_LINE_ONES     // ESCC doesn't support sending continuous 0s.
} IDLE_LINE_CONTROL;
```

MPA_DRIVER_VERSION	*Used to get driver version*

Syntax:	typedef struct tagMPA_DRIVER_VERSION
	{
	ULONG structLen;
	// Driver version is in format major.minor.
	UCHAR major;
	UCHAR minor;
	} MPA_DRIVER_VERSION, *PMPA_DRIVER_VERSION;

Description:	Structure for retrieving driver version. Driver version is in format major.minor.
API Functions Used:	MPA_GetDriverVersion() only.
Parameters:	
structLen	Length of the MPA_DRIVER_VERSION structure in bytes. Should be filled in before calling MPA_GetDriverVersion().
major	The major driver version.
minor	The minor driver version.

MPA_HANDLE	*Used to store handle information for open device*
Syntax:	typedef struct tagMPA_HANDLE { ULONG structLen; HANDLE hndDevice; BOOLEAN overlapped; } MPA_HANDLE, *PMPA_HANDLE;
Description:	Used to store handle information for an open device. Other than filling out structLen before calling MPA_Open(), no modifications should be made to this structure. Structure should remain available until device is successfully closed with MPA_Close().
API Functions Used:	All MPA_Xxx() functions.
Parameters:	
structLen	Length of the MPA_HANDLE structure in bytes. Should be filled in before calling MPA_Open().
hndDevice	System-supplied handle to the device. Should not be modified by the application.
overlapped	TRUE or FALSE indicating whether device was opened with overlapped capability. Should not be modified by the application.

MPA_NODE_ADDRESS	*Handles node addressing*
Syntax:	(see code below)

```
typedef struct tagMPA_NODE_ADDRESS
{
   ULONG                    structLen;
   union
   {
      struct
      {
         // Set the following bits to indicate which parameter(s) are to be set.
         // Parameter value(s) with corresponding bits set to zero are not
         // changed.
         UCHAR addr         : 1;
         UCHAR enable       : 1;
         UCHAR pad          : (8*sizeof(UCHAR) - 2);
      } bits;
      ULONG all;  // Used to clear/set all bits at once.
   } set;
   UCHAR                    addr;
   BOOLEAN                  enable;
} MPA_NODE_ADDRESS, *PMPA_NODE_ADDRESS;
```

Description:	Used to set the device's node address and/or enable node addressing.
API Functions Used:	MPA_SetNodeAddress() only.
Parameters:	
structLen	Length of the MPA_NODE_ADDRESS structure in bytes. Should be filled in before calling MPA_SetNodeAddress().
set	This is a union composed of set structure and a ULONG all. Bits in the set structure are set to tell the driver the corresponding value is valid and should be set in hardware. Use all to clear or set all bits simultaneously. Pad is reserved and is only used to align the structure.
addr	The node address to set for this device. This will only be set in hardware if the corresponding addr bit is set in the `set` structure. If the corresponding addr bit in the `set` structure is cleared, addr will be ignored by the driver.
enable	TRUE or FALSE value used to enable or disable node addressing. This will only be set in hardware if the corresponding enable bit is set in the set structure. If the corresponding enable bit in the set structure is cleared, the driver will ignore enable.

MPA_RESET_FRAMES	*Used to reset transmit and/or receive frames*
Syntax:	typedef struct tagMPA_RESET_FRAMES { ULONG structLen; BOOLEAN tx; BOOLEAN rx; } MPA_RESET_FRAMES, *PMPA_RESET_FRAMES;
Description:	Used to reset frames. Transmit and receive frames can be reset individually or simultaneously.
API Functions Used:	MPA_ResetFrames() only.
Parameters:	
structLen	Length of the MPA_RESET_FRAMES structure in bytes. Should be filled in before calling MPA_ResetFrames().
tx	TRUE to reset transmit frames. FALSE to leave transmit frames unchanged.
rx	TRUE to reset receive frames. FALSE to leave receive frames unchanged.

Syncdrive Plus application programming interface

Note: All Syncdrive Plus API functions are prototyped in the QuaDLL.h *Syncdrive Plus include file.*

There are a number of functions that make up the application programs entry points into Syncdrive Plus. These API functions are listed below.

Function	Description
MPA_Close()	*Closes previously opened handle to the MPA device*
MPA_GetConfig()	*Gets the current configuration in an* MPA_CONFIG *structure*
MPA_GetData()	*Used to receive a frame of data*
MPA_GetDriverVersion()	*Gets the driver version of the kernel-mode driver*
MPA_GetFrameCount()	*Gets the number of frames received but not yet transferred to caller buffers via* MPA_GetData()
MPA_GetFrameSize()	*Gets the frame size in bytes of the oldest received frame that hasn't yet been given to the caller*
MPA_GetModemControlSignals()	*Gets the current configuration of the modem control signal(s)*
MPA_GetTransferStatus()	*Used to get status of an overlapped transfer*
MPA_Open()	*Opens a handle to the MPA device driver*
MPA_PutData()	*Used to transmit a frame of data*
MPA_ResetFrames()	*Resets transmit and/or receive frames by clearing out values*
MPA_SetConfig()	*Sets the configuration for the device*
MPA_SetModemControlSignals()	*Sets the modem control signals for the device*
MPA_SetNodeAddress()	*Sets the node address for the device and/or enables addressing*

Calling convention

All Syncdrive Plus functions use a C-language interface with the MPADLL_API call linkage macro. This macro is defined in the QuaDLL.h include file.

Return values

All Syncdrive Plus functions return an enumerated integer value of type MPA_ERROR_CODE. A return code of ERR_NO_ERROR. indicates a successful completion.

If Syncdrive Plus cannot successfully complete a function, it returns an error code other than ERR_NO_ERROR. We define the error codes in the QuaDef.h include file and describe them in the Error codes section on page 32.

Examples

Use of the Syncdrive Plus API functions is demonstrated in the numerous example programs supplied on the Syncdrive Plus CD-ROM. These example programs are described in the Using example programs section beginning on page 29.

Command reference

MPA_Close ()	*Close the MPA device*
Syntax:	MPADLL_API MPA_ERROR_CODE MPA_Close (IN const PMPA_HANDLE pHandle);
Description:	Closes previously opened handle to the MPA device. Must be called when finished calling MPA_Xxx() functions.
Return:	
ERR_NO_ERROR	Successful close.
ERR_COULDNT_ CLOSE_DEVICE	Unsuccessful close.
ERR_DEVICE_NOT_ OPENED	Device was not opened with MPA_Open().
ERR_INVALID_ STRUCT_SIZE	The structure size in structLen did not match size in driver.
Parameters:	
pHandle	Handle to the open device obtained from MPA_Open().

Example:	MPA_ERROR_CODE err;
	MPA_HANDLE handle;
	MPA_Open(&handle, 0, FALSE);
	err = MPA_Close(&handle);
	if (err != ERR_NO_ERROR)
	printf("ERROR: Unable to close device. Error code %d.\n", err);

MPA_GetConfig ()	*Gets configuration*
Syntax:	MPADLL_API MPA_ERROR_CODE MPA_GetConfig (IN const PMPA_HANDLE pHandle, OUT PMPA_CONFIG pConfigOut);
Description:	Gets the current configuration in a MPA_CONFIG structure. The bits in the set union are undefined (used for setting configuration only).
Return:	
ERR_NO_ERROR	Configuration retrieved successfully.
ERR_BAD_ RETURN_SIZE	The configuration length returned did not match expected value.

MPA_GetConfig ()	*Continued*
Return, cont.:	
ERR_DEVICE_NOT_OPENED	Device was not opened with MPA_Open().
ERR_INVALID_STRUCT_SIZE	The structure size in structLen did not match size in driver.
ERR_IOCTL_ERROR	Communication error occurred between DLL and SYS.
Parameters:	
pHandle	Handle to the open device obtained from MPA_Open().
pConfigOut	The current configuration in a caller-supplied MPA_CONFIG structure. StructLen should be filled out before calling MPA_GetConfig().
Example:	MPA_CONFIG config; config.structLen = sizeof(MPA_CONFIG); MPA_GetConfig(&handle, &config);

MPA_GetData()	*Receive a frame of data*
Syntax:	MPADLL_API MPA_ERROR_CODE MPA_GetData (IN const PMPA_HANDLE pHandle, OUT UCHAR *pBuffer, IN ULONG bufferLen, OUT ULONG *pBytesRead, IN LPOVERLAPPED lpOverlapped);
Description:	Used to receive a frame of data. Read requests can be queued up in anticipation of received frames. For non-overlapped I/O, a single request can be sent and it will return when a frame is received. For overlapped I/O, only system resources limit the number of requests that can be queued.
Return:	
ERR_NO_ERROR	Frame received completely and successfully.
ERR_DATA_CRC	A CRC error occurred during transfer. In overlapped mode, you would typically call MPA_GetTransferStatus to determine availability of the frame before making this call. If MPA_GetData returns a bad frame, no part of the frame is returned.
ERR_DATA_OVERRUN	A data overrun occurred. This happens when the caller buffer is too small for the frame received. In overlapped mode, you would typically call MPA_GetTransferStatus to determine availability of the frame before making this call. If MPA_GetData returns a bad frame, no part of the frame is returned.
ERR_DEVICE_NOT_OPENED	Device was not opened with MPA_Open().
ERR_ERROR_READING_DATA	Error receiving frame occurred. In overlapped mode, you would typically call MPA_GetTransferStatus to determine availability of the frame before making this call. If MPA_GetData returns a bad frame, no part of the frame is returned.

MPA_GetData()	*Continued*
Return, cont.:	
ERR_INCORRECT_NUM_BYTES_READ	For non-overlapped I/O only. Bytes received differ from requested. Not necessarily an error if a larger buffer was allocated than required.
ERR_INVALID_PARAMETERS_PASSED	Device opened as overlapped but storage for an overlapped structure not passed in lpOverlapped.
ERR_INVALID_STRUCT_SIZE	The structure size in structLen did not match size in driver.
ERR_READ_PENDING	Receiving frame in the background since device opened as overlapped.
Parameters:	
pHandle	Handle to the open device obtained from MPA_Open().
pBuffer	Pointer to a caller-supplied buffer to receive data. Each call to MPA_GetData() provides a buffer to receive a complete frame of data.
bufferLen	The length of the buffer in bytes.
pBytesWritten	The number of bytes received. For overlapped I/O, this can be less than bufferLen since the transfer is occurring in the background.
lpOverlapped	Caller-supplied storage for an overlapped structure if device was opened for overlapped I/O. Should be NULL if device was opened for non-overlapped I/O.
Example:	See code below

```
MPA_ERROR_CODE err;
MPA_HANDLE handle;
UCHAR data[4];
ULONG read;
MPA_Open(&handle, 0, FALSE);                     // Open for non-overlapped I/O.
err = MPAGetData(&handle, data, 4, &read, NULL); // 4-bytes or less
if (err != ERR_NO_ERROR)
        printf("ERROR: Unable to read data.\n");
else
        printf("Read %d bytes.\n", read);
```

MPA_GetDriverVersion ()	*Gets the version of the driver*
Syntax:	See code below
Description:	Gets the driver version of the kernel-mode driver, QuaSYS.SYS, in the format major.minor.
Return:	
ERR_NO_ERROR	Configuration retrieved successfully.
ERR_BAD_RETURN_SIZE	The driver version length returned did not match expected length.
ERR_DEVICE_NOT_OPENED	Device was not opened with MPA_Open().

```
MPADLL_API MPA_ERROR_CODE          MPA_GetDriverVersion
(
   IN  const PMPA_HANDLE           pHandle,
   OUT PMPA_DRIVER_VERSION         pVersion
);
```

MPA_GetDriverVersion ()	*Continued*
Return, cont.:	
ERR_INVALID_ STRUCT_SIZE	The structure size in structLen did not match size in driver.
ERR_IOCTL_ERROR	Communication error occurred between DLL and SYS.
Parameters:	
pHandle	Handle to the open device obtained from MPA_Open().
pVersion	The driver version in a caller-supplied MPA_DRIVER_VERSION structure. StructLen should be filled out before calling MPA_GetDriverVersion().

Example:	MPA_DRIVER_VERSION ver;
	ver.structLen = sizeof(MPA_DRIVER_VERSION);
	MPA_GetDriverVersion(&handle, &ver);
	printf("Driver version is %d.%d\n", ver.major, ver.minor);

MPA_GetFrameCount ()	*Gets the number of frames received*
Syntax:	MPADLL_API MPA_ERROR_CODE MPA_GetFrameCount (IN const PMPA_HANDLE pHandle, OUT PULONG pFrameCount);
Description:	Gets the number of frames received but not yet transferred to caller buffers via MPA_GetData(). These are the frames that currently reside in the internal buffers set up in the MPA_CONFIG structure.
Return:	
ERR_NO_ERROR	Successfully obtained frame count.
ERR_BAD_RETURN_ SIZE	The frame count length returned did not match expected value.
ERR_DEVICE_NOT_ OPENED	Device was not opened with MPA_Open().
ERR_INVALID_ STRUCT_SIZE	The structure size in structLen did not match size in driver.
ERR_IOCTL_ERROR	Communication error occurred between DLL and SYS.
Parameters:	
pHandle	Handle to the open device obtained from MPA_Open().
pFrameCount	The number of frames received, but not yet given to the caller.
Example:	ULONG frameCnt; MPA_GetFrameCount(&handle, &frameCnt); printf("%d frames waiting to be retrieved.\n", frameCnt);

MPA_GetFrameSize ()	*Gets the size of the oldest received frame*
Syntax:	MPADLL_API MPA_ERROR_CODE MPA_GetFrameSize (IN const PMPA_HANDLE pHandle, OUT PMPA_FRAME_SIZE pFrameSize);
Description:	Gets the frame size in bytes of the oldest received frame that hasn't been given to the caller via MPA_GetData(). This permits the caller to allocate the exact size buffer necessary prior to receiving the frame.
Return:	
ERR_NO_ERROR	Successfully obtained frame size.
ERR_BAD_ RETURN_SIZE	The frame size length returned did not match expected value.
ERR_DEVICE_ NOT_OPENED	Device was not opened with MPA_Open().
ERR_INVALID_ STRUCT_SIZE	The structure size in structLen did not match size in driver.
ERR_IOCTL_ ERROR	Communication error occurred between DLL and SYS.
Parameters:	
pHandle	Handle to the open device obtained from MPA_Open().
pFrameSize	The frame size in bytes of the oldest received frame that hasn't been given to the caller. StructLen should be filled out before calling MPA_SetNodeAddress().

Example:	ULONG frameCnt, frameSize;
	MPA_GetFrameCount(&handle, &frameCnt);
	if (frameCnt)
	{
	MPA_GetFrameSize(&handle, &frameSize);
	printf("%d byte frame waiting to be retrieved.\n", frameSize);
	}

MPA_GetModemControl Signals ()	*Gets the state of the modem control signals*
Syntax:	MPADLL_API MPA_ERROR_CODE MPA_GetModemControlSignals (IN const PMPA_HANDLE pHandle, OUT PMPA_MODEM_CNTL_SIG pModemCntlSig);
Description:	Gets the current configuration of the modem control signals in a MPA_MODEM_CNTL_SIG structure. The bits in the set union are undefined (used for setting modem control signals only).
Return:	
ERR_NO_ERROR	Configuration retrieved successfully.
ERR_BAD_RETURN_ SIZE	The configuration length returned did not match expected length.

MPA_GetModemControl Signals ()	*Continued*
Return:	
ERR_DEVICE_NOT_ OPENED	Device was not opened with MPA_Open().
ERR_INVALID_ STRUCT_SIZE	The structure size in structLen did not match size in driver.
ERR_IOCTL_ERROR	Communication error occurred between DLL and SYS.
Parameters:	
pHandle	Handle to the open device obtained from MPA_Open().
pModemCntlSig	The current configuration of the modem control signals in a caller-supplied MPA_MODEM_CNTL_SIG structure. StructLen should be filled out before calling MPA_SetNodeAddress(). StructLen should be filled out before calling MPA_GetModemControlSignals().
Example:	MPA_MODEM_CNTL_SIG sig; sig.structLen = sizeof(MPA_MODEM_CNTL_SIG); MPA_GetModemControlSignals(&handle, &sig);

MPA_GetTransferStatus()	*Get the status of a queued overlapped transfer*
Syntax:	MPADLL_API MPA_ERROR_CODE MPA_GetTransferStatus (IN const PMPA_HANDLE pHandle, IN LPOVERLAPPED lpOverlapped, OUT ULONG *pBytesTransferred, IN BOOL wait);
Description:	Used to get status of an overlapped transfer; specifically, the number of bytes that have been transferred (transmitted or received, depending on whether the overlapped structure was sent in MPA_PutData() or MPA_GetData()). This call is not applicable for non-overlapped I/O.
Return:	
ERR_NO_ERROR	Successfully returned status.
ERR_DATA_ OVERRUN	A data overrun occurred. This happens when the caller buffer is too small for the frame received.
ERR_DEVICE_NOT_ OPENED	Device was not opened with MPA_Open().
ERR_INVALID_FOR_ NON_OVERLAPPED	This call is not valid for non-overlapped I/O.
ERR_INVALID_ PARAMETERS_ PASSED	WAIT cannot be TRUE when overlapped is NULL.
ERR_INVALID_ STRUCT_SIZE	The structure size in structLen did not match size in driver.
ERR_IO_STILL_ PROGRESSING	I/O is still occurring in background. The transferred bytes are placed in pBytesTransferred.

MPA_GetTransferStatus()	*Continued*
Return:	
ERR_TRANSFER_ STATUS	Driver failed to return correct status to DLL. Could indicate hardware failure.
Parameters:	
pHandle	Handle to the open device obtained from MPA_Open().
lpOverlapped	Pointer to the overlapped structure corresponding to the transfer that status is requested.
pBytesTransferred	The amount of data that has been transferred.
wait	TRUE or FALSE to determine whether or not to wait until transfer has completed before returning.
Example:	(see code below)

```
MPA_ERROR_CODE err;
MPA_HANDLE handle;
UCHAR data[] = {10, 20, 30, 40};
ULONG written;
OVERLAPPED overlapped;
MPA_Open(&handle, 0, TRUE);      // Open for overlapped I/O.
memset(&overlapped[0], 0, sizeof(overlapped[0]));
MPAPutData(&handle, data, sizeof(data)/sizeof(data[0]), &written, &overlapped);
MPA_GetTransferStatus(&handle, &overlapped, &written, FALSE);
if (err != ERR_NO_ERROR)
        printf("ERROR: Unable get transfer status. \n");
else
        printf("Transferred %d bytes so far.\n", written);
```

MPA_Open ()	*Open the MPA device*
Syntax:	(see code below)
Description:	Opens a handle to the MPA device driver. MPA_Open() must be called before using other MPA_Xxx() functions.
Return:	
ERR_NO_ERROR	Successful open. Subsequent calls to other API functions can be performed.
ERR_INVALID_ STRUCT_SIZE	The structure size in structLen did not match size in driver.
ERR_COULDNT_ OPEN_DEVICE	Unsuccessful open.
Parameters:	
pHandle	Caller-supplied storage for a MPA_HANDLE structure (defined in QuaDef.h) with structure length field filled out in structLen. Member variables hndDevice and overlapped should not be modified by the caller. This structure is required for subsequent calls to other API functions.

```
MPADLL_API MPA_ERROR_CODE          MPA_Open
(
   OUT PMPA_HANDLE                 pHandle,
   IN  UCHAR                       deviceNumber,
   IN  BOOLEAN                     overlapped
);
```

MPA_Open ()	*Continued*
Parameters, cont.:	
deviceNumber	The number specifying which device to open. For systems with a single card installed, this will always be 0. For 2-card systems, select 0 or 1 to specify which card. A single system supports up to 16 cards (0 through 15).
overlapped	TRUE or FALSE to specify whether or not to use overlapped I/O. Calls to MPA_PutData() and MPA_GetData() return immediately and perform I/O in background when device is opened with overlapped I/O. If device is opened with non-overlapped I/O, MPA_PutData() and MPA_GetData() return when transfer has been completed.

Example:	`MPA_ERROR_CODE err;`
	`MPA_HANDLE handle;`
	`handle.structLen = sizeof(MPA_HANDLE);`
	`err = MPA_Open(&handle, 0, FALSE);     // Open for non-overlapped I/O.`
	`if (err != ERR_NO_ERROR)`
	`    printf("ERROR: Unable to open device. Error code %d.\n", err);`

MPA_PutData ()	*Transmits a frame of data*

Syntax:	`MPADLL_API MPA_ERROR_CODE    MPA_PutData`
	`(`
	`  IN  const PMPA_HANDLE    pHandle,`
	`  IN  const PUCHAR    pBuffer,`
	`  IN  ULONG    bufferLen,`
	`  OUT ULONG    *pBytesWritten,`
	`  IN  LPOVERLAPPED    lpOverlapped`
	`);`

Description:	Used to transmit a frame of data. For non-overlapped I/O, a single transmit request can be sent and it will return when the frame has been transmitted. For overlapped I/O, the number of transmit requests that can be queued is limited only by system resources.
Return:	
ERR_NO_ERROR	Successful close.
ERR_COULDNT_ CLOSE_DEVICE	Unsuccessful close.
ERR_DEVICE_NOT_ OPENED	Device was not opened with MPA_Open().
ERR_ERROR_ WRITING_DATA	Returned if the driver fails for some reason, possibly due to a hardware failure.
ERR_INCORRECT_ NUM_BYTES_WRITTEN	The number of bytes returned differs from the number of bytes in the request to write.
ERR_INVALID_ STRUCT_SIZE	The structure size in structLen did not match size in driver.
ERR_WRITE_PENDING	Returned when the driver is set up for overlapped I/O. Indicates that the driver is still working on the last write and is not really an error.
Parameters:	
pHandle	Handle to the open device obtained from MPA_Open().

MPA_PutData ()	*Continued*
Parameters, cont.:	
pBuffer	Pointer to a caller-supplied buffer of data to be transferred. Each call to MPA_PutData() sends the data in the buffer as a complete frame of data.
bufferLen	The length of the buffer in bytes.
pBytesWritten	The number of bytes transmitted. For overlapped I/O, this can be less than bufferLen since the transfer is occurring in the background.
lpOverlapped	Caller-supplied storage for an overlapped structure if device was opened for overlapped I/O. Should be NULL if device was opened for non-overlapped I/O.

Example:	MPA_ERROR_CODE err;
	MPA_HANDLE handle;
	UCHAR data[] = {10, 20, 30, 40};
	ULONG written;
	MPA_Open(&handle, 0, FALSE); // Open for non-overlapped I/O.
	err = MPAPutData(&handle, data, sizeof(data)/sizeof(data[0]), &written, NULL);
	if (err != ERR_NO_ERROR)
	        printf("ERROR: Unable to write data.\n");
	else
	        printf("Wrote %d bytes.\n", written);

MPA_ResetFrames ()	*Resets transmit and/or receive frames by clearing out values*

Syntax:	MPADLL_API MPA_ERROR_CODE MPA_ResetFrames
	(
	   IN const PMPA_HANDLE pHandle,
	   IN const PMPA_RESET_FRAMES pReset
	);

Description:	Resets the hardware FIFOs on the board for the transmit and/or receive frames by clearing out values. It does not leave any already buffered received packets or pending transmit packets.
Return:	
ERR_NO_ERROR	Successfully reset frame(s).
ERR_DEVICE_NOT_ OPENED	Device was not opened with MPA_Open().
ERR_INVALID_ STRUCT_SIZE	The structure size in structLen did not match size in driver.
ERR_IOCTL_ERROR	Communication error occurred between DLL and SYS.
ERR_NOTHING_TO_DO	Neither transmit nor receive frames were marked to be reset.
Parameters:	
pHandle	Handle to the open device obtained from MPA_Open().
pReset	Pointer to a filled-out MPA_RESET_FRAMES structure indicating which frames to reset (transmit or receive or both).

Example:	MPA_RESET_FRAMES reset;
	reset.structLen = sizeof(MPA_RESET_FRAMES);
	reset.tx = TRUE; // Reset tx frames.
	reset.rx = FALSE;// Do not reset rx frames.
	MPAResetFrames(&handle, &reset);

MPA_SetConfig ()	*Sets the configuration and gets the resulting configuration*
Syntax:	MPADLL_API MPA_ERROR_CODE MPA_SetConfig (IN const PMPA_HANDLE pHandle, IN const PMPA_CONFIG pConfigIn, OUT PMPA_CONFIG pConfigOut);
Description:	Sets the configuration for the device. The bits in the MPA_CONFIG union are used to indicate which parameter(s) are to be set. The driver ignores parameters associated with bits that are not set. For an example of how this works, see MPA_SetNodeAddress(). The resultant configuration is returned in pConfigOut. The bits in the set union of pConfigOut are undefined (used for setting configuration only). All parameters can be updated dynamically except number of receive buffers and quantity of receive buffers. If the buffer size or quantity is changed, the device must be closed and reopened to see the results. Otherwise the previous values are used and returned in pConfigOut until the device is re-opened.
Return:	
ERR_NO_ERROR	Configuration set successfully.
ERR_BAD_RETURN_ SIZE	The configuration length returned did not match expected length.
ERR_DEVICE_NOT_ OPENED	Device was not opened with MPA_Open().
ERR_INVALID_ STRUCT_SIZE	The structure size in structLen did not match size in driver.
ERR_IOCTL_ERROR	Communication error occurred between DLL and the driver.
Parameters:	
pHandle	Handle to the open device obtained from MPA_Open().
pConfigIn	An MPA_CONFIG structure filled out and bit(s) selected to determine which parameter(s) are valid.
pConfigOut	The resulting configuration in a caller-supplied MPA_CONFIG structure. StructLen should be filled out before calling MPA_SetConfig().

Example:	MPA_CONFIG configIn, configOut;
	configIn.structLen = sizeof(MPA_CONFIG);
	configIn.set.all = 0; // Clear all set bits.
	configIn.BaudRate = 9600;
	configIn.set.bits.BaudRate = TRUE; // Set baud rate only.
	configOut.structLen = sizeof(MPA_CONFIG);
	MPA_SetConfig(&handle, &configIn, &configOut);
	if (configIn.BaudRate != configOut.BaudRate)
	printf("ERROR: Could not set baud rate.\n");

MPA_SetModemControlSignals()	***Sets the modem control signal(s) and gets resulting configuration***
Syntax:	MPADLL_API MPA_ERROR_CODE MPA_SetModemControlSignals (IN const PMPA_HANDLE pHandle, IN const PMPA_MODEM_CNTL_SIG pModemCntlSig, OUT PMPA_MODEM_CNTL_SIG pModemCntlSigOut);
Description:	Sets the modem control signal(s) for the device. The bits in the MPA_MODEM_CNTL_SIG union are used to indicate which parameter(s) are to be set. The driver ignores parameters associated with bits that are not set. For an example of how this works, see MPA_SetNodeAddress(). The resulting configuration is returned in pModemCntlSigOut. The bits returned in pModemCntlSigOut are undefined (used for setting configuration only). All parameters can be updated dynamically and can be verified by the values in pModemCntlSigOut.
Return:	
ERR_NO_ERROR	Configuration set successfully.
ERR_BAD_RETURN_SIZE	The configuration length returned did not match expected value.
ERR_DEVICE_NOT_OPENED	Device was not opened with MPA_Open().
ERR_INVALID_STRUCT_SIZE	The structure size in structLen did not match size in driver.
ERR_IOCTL_ERROR	Communication error occurred between DLL and SYS.
Parameters:	
pHandle	Handle to the open device obtained from MPA_Open().
pModemCntlSig	An MPA_MODEM_CNTL_SIG structure filled out and bit(s) selected to determine which parameter(s) are valid.
pModemCntlSigOut	The resulting modem control signal configuration in a caller-supplied MPA_MODEM_CNTL_SIG structure. StructLen should be filled out before calling MPA_SetModemControlSignals().
Example:	see code below

```
MPA_MODEM_CNTL_SIG sigIn, sigOut;
sigIn.structLen = sizeof(MPA_MODEM_CNTL_SIG);
sigIn.set.all = 0;                  // Clear all set bits.
sigIn.rts = TRUE;
sigIn.set.bits.rts = TRUE;          // Set RTS only.
sigOut.structLen = sizeof(MPA_MODEM_CNTL_SIG);
MPA_SetModemControlSignals(&handle, &sigIn, &sigOut);
if (sigIn.rts != sigOut.rts)
        printf("ERROR: Could not set RTS.\n");
```

MPA_SetNodeAddress ()	*Sets the SDLC node address and/or enables addressing*
Syntax:	MPADLL_API MPA_ERROR_CODE MPA_SetNodeAddr (IN const PMPA_HANDLE pHandle, IN PMPA_NODE_ADDRESS pAddrIn, OUT PMPA_NODE_ADDRESS pAddrOut);
Description:	Sets the SDLC node address for the device and/or enables addressing. The SDLC address is eight bits long and is used to designate which receiving station accepts a transmitted message. The bits in the MPA_NODE_ADDRESS union are used to indicate which parameter(s) are to be set. The driver ignores parameters associated with bits that are not set. For example, setting the addr bit and clearing the enable bit causes the node address to be set in hardware but the enable status to remain unchanged. The current node address and enable status are returned in pAddrOut.
Return:	
ERR_NO_ERROR	Successfully set SDLC node address.
ERR_BAD_RETURN_ SIZE	The address length returned did not match expected value.
ERR_DEVICE_NOT_ OPENED	Device was not opened with MPA_Open().
ERR_INVALID_ STRUCT_SIZE	The structure size in structLen did not match size in driver.
ERR_IOCTL_ERROR	Communication error occurred between DLL and SYS.
Parameters:	
pHandle	Handle to the open device obtained from MPA_Open().
pAddrIn	An MPA_NODE_ADDRESS structure filled out and bit(s) selected to determine which parameter(s) are valid.
pAddrOut	The address the device was set to. StructLen should be filled out before calling MPA_SetNodeAddress().

Example:	MPA_NODE_ADDRESS node;
	node.structLen = sizeof(MPA_NODE_ADDRESS);
	node.set.all = 0; // Reset set bits
	node.addr = 0xCA;
	node.set.bits.addr = TRUE; // Set address for this device.
	node.enable = FALSE;
	node.set.bits.enable = TRUE; // Disable node addressing.
	MPA_SetNodeAddress(&handle, &node);

Using example programs

Quatech supplies numerous small console application example programs with Syncdrive Plus. These examples cover the various operating modes of the product. We also supply source code and executable files for each example program.

We have tested the Syncdrive Plus example programs with Visual C++ 6.0© and included the project files on the Syncdrive Plus CD-ROM.

Source code

For the source code for all examples, see the Synchronous Adapters\Software\Windows 2000, XP\Syncdrive Plus\Examples directory on the Syncdrive Plus CD-ROM.

Executable files

The executable programs can be found in the Synchronous Adapters\Software\Windows 2000, XP\Syncdrive Plus\Examples \Exe directory of the Quatech CD-ROM.

All examples can be run from the command line prompt. Type the program name along with a space and the "/?" argument for a listing of option arguments.

Descriptions of example programs

LPBCKBI2K

This is a loopback program, running in bit-synchronous mode. You need only one MPA-series adapter. No connector or cable is necessary. You can select configuration options on the command line.

FDBCKBI2K

This is a feedback program and runs in bit-synchronous mode. You must install two MPA-series adapters in the same system to run this program. Connect a crossover cable between the two adapters. See Crossover cable on page 30 for pinouts.

SENDBI2K

This program transmits single frames. It runs in bit-synchronous mode. You can use it in tandem with RECBI2K running on another computer by connecting two MPA-series adapters with a crossover cable. You can select configuration options on the command line. See Crossover cable on page 30 for pinouts.

RECBI2K

This program receives single frames and runs in bit-synchronous mode. You can use it in tandem with SENDBI2K running on another computer by connecting two MPA-series adapters with a crossover cable. You can select configuration options on the command line. See Crossover cable below for pinouts.

THREADRX2K

This WIN2K/XP program demonstrates Syncdrive Plus' support for multithreaded programs and overlapped receive buffer querries. It spawns a number of threads that take turns setting up bit-synchronous single-frame receive operations. By default, timeouts are enabled. You can use THREADRX2K in tandem with THREADTX2K or SENDBI2K running on another computer by connecting two MPA-series adapters with a crossover cable. You can select configuration options on the command line. See Crossover cable below for pinouts.

THREADTX2K

This WIN2K/XP program demonstrates Syncdrive Plus's support for multithreaded programs and overlapped transmit buffer querries. It spawns a number of threads that take turns setting up bit-synchronous single-frame transmit operations. By default, timeouts will be generated. You can use THREADTX2K in tandem with THREADRX2K running on another computer by connecting two MPA-series adapters with a crossover cable. You can select configuration options on the command line. See Crossover cable below for pinouts.

Crossover cable

All sample programs use the transmitting adapter's BRG clock source as the master for both transmitter and receiver. The crossover cable for these tests should cross the TxD to RxD lines and the TxClk(DTE) to RxClk(DCE) lines. For RS-422/485, like polarities should match.

Figure 10 - RS-232 Crossover cable pinouts

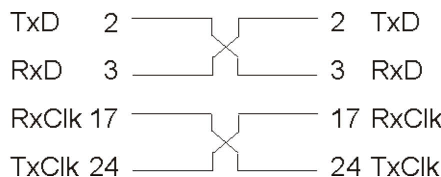
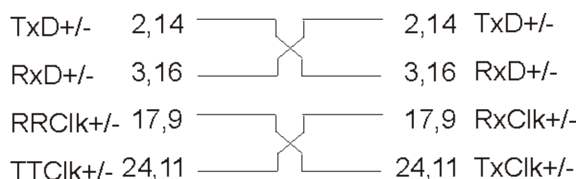


Figure 11 - RS-422/485 Crossover cable pinouts



Troubleshooting

Verify that the hardware is configured properly

Note: The compiled Syncdrive Plus example programs are good tools to use for this purpose because we test them all in a known-good system before shipping.

Hint: Run the program with a /? parameter on the command line for a short help screen.

A good first step in solving problems is to make sure that there are no hardware conflicts. One way to do this is to try a known-good Syncdrive Plus application on the hardware.

The LPBCKBI2K.EXE program is the best place to start because it does not require you to connect any cables. It can accept as command line input whatever resource settings are being used on the installed MPA-series adapter.

LPBCKBI2K runs continuous frames in loopback mode. As it runs, it prints each frame to the screen. If LPBCKBI2K is able to run successfully, then you know that the hardware configuration is good. If LPBCKBI2K crashes or locks up, it indicates that the hardware is not configured properly. You may need to change some of the hardware settings to avoid conflicts with other devices in the system.

Check the Syncdrive Plus configuration

If the hardware is verified to be good, then the problem must be somewhere in the software. The first place to check is the MPA_CONFIG configuration structure. Double check that all variables in this structure are set properly.

Check the clock sourcing

If transmit or receive operations just don't seem to work right, double check the RxClockSource and TxClockSource variables in the MPA_CONFIG configuration structure. In conjunction with the hardware manual for the MPAX-series adapter, make sure that any clock signals on the cable are routed to the proper SCC inputs and outputs, and that the modes in the RxClockSource and TxClockSource variables are set properly.

Know the speed limits

There are limits on how fast the MPAX-series adapters can operate under Syncdrive Plus. Most of the limitations are the result of external cabling, the upper limits of the SCC, and clock jitter as that upper limit is approached. Syncdrive Plus limits the maximum rate to 1/6 of the input clock frequency.

If you need a baud rate that cannot be achieved with the standard clock frequency, contact Quatech Technical Support. It may be possible to use a custom clock oscillator to change the available baud rate selections.

Error codes

Note: The error code meaning may vary, depending on the Syncdrive Plus command.

The definitive source for error codes is the QuaDef.h include file. The error codes for Release 1.00 are duplicated here for convenience. The significance of the error code depends on the function returning it. See the return code explanation for the API of interest in the document.

Error message	Description
ERR_NO_ERROR	*Successful operation; operation varies, depending on command*
ERR_BAD_RETURN_SIZE	*The (address/frame count/frame size/configuration/ driver version) length returned did not match expected*
ERR_COULDN'T_CLOSE_DEVICE	*Unsuccessful close*
ERR_COULDN'T_OPEN_DEVICE	*Unsuccessful open*
ERR_DATA_CRC	*A CRC error occurred during transfer*
ERR_DATA_OVERRUN	*A data overrun occurred because the caller buffer was too small for the frame received*
ERR_DEVICE_NOT_OPENED	*Device was not opened with* MPA-Open()
ERR_ERROR_READING_DATA	*Error receiving frame occurred*
ERR_ERROR_WRITING_DATA	*Error transmitting frame occurred*
ERR_INCORRECT_NUM_BYTES_READ	*For non-overlapped I/O only; bytes received differ from requested; not necessarily an error if a larger buffer was allocated than required*
ERR_INCORRECT_NUM_BYTES_WRITTEN	*Number of bytes written differs from number expected*
ERR_INVALID_FOR_NON_OVERLAPPED	*This call is not valid for non-overlapped I/O*
ERR_INVALID_PARAMETERS_PASSED	*Device opened as overlapped but storage for an overlapped structure not passed in* lpOverlapped; WAIT *cannot be* TRUE *when overlapped is* NULL;
ERR_INVALID_STRUCT_SIZE	*The structure size in* structLen *did not match size in driver*
ERR_IOCTL_ERROR	*Communication error occurred between DLL and SYS*
ERR_IO_STILL_PROGRESSING	*I/O is still occurring in the background; Bytes-transferred is placed in pBytesTransferred*
ERR_NOTHING_TO_DO	*Neither transmit nor receive frames were marked to be reset*
ERR_READ_PENDING	*Receiving frame in the background since device opened as overlapped*
ERR_TRANSFER_STATUS	*Driver failed to return the correct status to the DLL; probable hardware failure*
ERR_WRITE_PENDING	*Returned when driver is set up for overlapped I/O; indicates that driver is still working on the last write*

Appendix A

Definitions

Term	Definition
API (Application Programming Interface)	*An application program interface is the specific method prescribed by a computer operating system or by an application program by which a programmer writing an application program can make requests of the operating system or another application.*
Asynchronous communication	*In general, asynchronous is an adjective describing objects or events that are not coordinated in time. Asynchronous communications do not employ a clocking signal. Instead, they rely on start and stop bits, which is a simple but inefficient scheme.* *Contrast with synchronous communication.*
Bit-sync	*Sub-division of synchronous communication. Bit-synchronous transfers treat a data block as a series of data bits with no specific character boundaries. Used to implement SDLC or HDLC.*
BRG (Baud Rate Generator)	*An SCC feature that is used for internally generating a data clocking signal.*
Byte-sync	*Sub-division of synchronous communication. Byte-synchronous transfers treat a data block as a series of fixed-length characters. Used to implement BISYNC. Not currently supported by Syncdrive Plus.*
CRC	*Cyclic redundancy checking is a method of checking for errors in data that has been transmitted on a communications link. A sending device applies a 16- or 32-bit polynomial to a block of data that is to be transmitted and appends the resulting cyclic redundancy code (CRC) to the block. The receiving end applies the same polynomial to the data and compares its result with the result appended by the sender. If they agree, the data has been received successfully. If not, the sender can be notified to resend the block of data.*
DPLL (Digital Phase Locked Loop)	*Used to encode or decode a clocking signal within a data stream.* *A Digital PLL (DPLL) circuit may consist of a serial shift register which receives digital input samples (extracted from the received signal), a stable local clock signal which supplies clock pulses to the shift register to drive it and a phase corrector circuit which takes the local clock and regenerates a stable clock in phase with the received signal by slowly adjusting the phase of the phase of the regenerated clock to match the received signal.* *The DLL is typically used in situations where separate signals for transmit and receive data clocks are not available in the cables. The clocking information is embedded in the data itself.*

Term	Definition
Frame	*In telecommunications, a frame is data that is transmitted between network points as a unit complete with addressing and necessary protocol control information. A frame is usually transmitted serial bit by bit and contains a header field and a trailer field that "frame" the data. (Some control frames contain no data.)*
PCI bus	*PCI (Peripheral Component Interconnect) is an interconnection system between a microprocessor and attached devices in which expansion slots are spaced closely for high-speed operation. PCI is designed to be synchronized with the clock speed of the microprocessor.*
Protocol	*In information technology, a protocol is the special set of rules that end points in a telecommunication connection use when they communicate.*
SCC (Serial Communications Controller)	*The integrated circuit that handles the bulk of the hardware functions for the serial channel. Typically, the SCC will either be an AM85C30-10 or Z85230-10 on Quatech MPA-series adapters.*
Synchronous communication	*In general, synchronous is an adjective describing objects or events that are coordinated in time. Synchronous communications use clocking information sent with the data. This eliminates the need for start and stop bits and also allows for a more continuous data stream than is possible with asynchronous communication. Reduced overhead and higher possible speeds are the main advantages of synchronous communications.* *Contrast with asynchronous communication.*