SyncLink USB Serial Adapter

Hardware User Manual

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http://www.microgate.com

Contents

Overview

The SyncLink USB Serial Adapter is an external device that connects a host computer USB port to a synchronous serial port. The adapter provides a single serial port for use by the system. Multiple SyncLink USB adapters may be attached to the same computer or powered USB hub. A variety of serial protocols and interface standards are supported. Refer to the software documentation included with the adapter for details on using the card for a specific application.

Before connecting the SyncLink USB to your system, preinstall drivers as described in the README provided on the software disc or the software package downloaded from the MicroGate website.

The SyncLink USB serial adapter should be plugged into a USB 2.0 or later Hi-speed (480Mbps) USB port. Operating on a slower USB port will not allow you to take full advantage of the adapter's capabilities. Install directly into a host USB port for best results.

SyncLink USB requires 500mA of power from the USB port, which is standard and supported by most USB ports. Some unpowered/passive hubs or small mobile devices may not provide a full 500mA. Check the documentation provided with your external hub or mobile device if you are unsure of the specifications or experiencing any difficulties.

Features

- Maximum Speeds: 10Mbps
- SDLC, HDLC, BISYNC, ISOCHRONOUS, MONOSYNC, ASYNC, raw bit-synchronous protocols
- Selectable hardware CRC: CRC-16, CRC-32, None
- Clock Recovery (x8 and x16 sampling)
- Clock Generation
- Configurable transmit preamble and idle patterns
- Encoding: NRZ,NRZB,NRZ-L,NRZI,NRZ-M,NRZ-S,FM0,FM1,Manchester,differential biphase level
- Selectable interface for RS-232, V.35, RS-422/485, RS-530, RS-530A, RS-449, X.21
- Full set of control and status signals (DTR,DSR,RTS,CTS,DCD,RI,LL,RL)

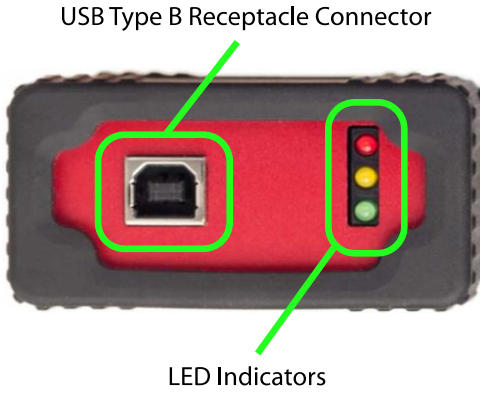
Specifications

- MicroGate FPGA serial controller (one port)
- USB 2.0 hi-speed (480Mbps), compatible with USB 2.0 and USB 3.0 ports
- Operating Temperature: 0C to 70C standard, -40C to +85C optional
- Storage Temperature: -55C to +125C
- Environmental: humidity 0 to 95% non-condensing; alt. - 200 to +20,000 ft
- Mechanical: 3.6" length, 2.6" width, 1.9" height
- Power usage: Bus Powered, 5V, 500mA max (300mA typ)
- Regulatory: FCC, CE, RoHS
- Connector: DB-25 (male)
- Cable Options: DB-25 (female) to DB-25 (male); DB-25 (female) to 34-pin V.35 (male); DB-25 (female) to 37-pin RS-449 (male); DB-25 (female) to 15-pin X.21 (male)

LED Indicators

LEDs near the USB port provide information about SyncLink USB operation:

Red Only	Device plugged in and powered.
Yellow Only	Device software loaded, DB-25 interface is disabled.
Green On	Device is ready for use. Red = Transmit Data, Yellow = Receive Data



Troubleshooting

Try these steps if the SyncLink USB is plugged into a USB port and not functioning as expected:

All LEDs Off

Verify host system or USB hub is turned on and powered.

Try a different USB cable, or reseat cable.
Plug SyncLink USB in a different USB port.

Plug SyncLink USB in a different host or hub.
If the above steps fail, the SyncLink USB may have a hardware failure.

Red LED Only

Verify device software (driver) is installed and loaded.
Verify device software is latest version.
Verify device is not disabled in software (such as in Windows Device Manager).
If the above steps fail, the SyncLink USB may have a hardware failure.

Yellow LED Only

Follow the steps appropriate for your operating system to enable the DB-25 serial interface. In Windows, this is done from the Advanced tab of the Properties page of the device in the Device Manager. You must select the serial interface standard required for your application (RS232, V.35, RS530, etc).

Green LED On

Monitor the red LED (transmit) and yellow LED (receive) for indications of data transfer. These are only valid when the green LED is on. If you see no data, verify cabling, serial interface selection (RS232, V.35, RS530, etc), serial protocol settings and remote device status.

Signal Specifications

Each serial signal (control, status, data, or clock) is compatible with an electrical specification that is selected through software settings.

Single Ended Signals (RS-232/V.28)

SyncLink single ended signals are compatible with RS-232 and ITU V.28 standards. Each signal has one connector pin. Single ended signals share a common ground conductor.

The following voltages are measured with respect to ground.

- Maximum Voltage Range: +15 to -15V (between signal and ground)
- +3V to +15V (+5V typical) = non-data signal on or data value of 0
- -3V to -15V (-5V typical) = non-data signal off or data value of 1
- Voltage between -3V to +3V = invalid (indeterminate) state
- Max cable length 50 feet
- Max data rate 20kbps

The maximum data rate of 20kbps is part of the RS-232/V.28 standards. The SyncLink card can operate at speeds up to 120kbps depending on the cable length and loading. Longer cables and increased loading reduces the maximum supported data rate.

Differential Signals (RS-422/RS-485/V.11)

SyncLink differential signals are compatible with RS-422, RS-485 and ITU V.11 standards. Each signal has two connector pins, named A and B. These pins are also named -/+, but this convention can be inverted depending on context and manufacturer. Use A and B to avoid confusion.

A common ground conductor is recommended, but not required, to reduce common mode voltages between cable ends which may result in incorrect or impaired operation.

The following voltages are measured pin A with respect to pin B of each signal. Probing pin A with respect to ground (single probe) gives a positive voltage or ground, corresponding to the positive and negative differential values. Probing pin B with respect to ground gives a positive voltage or ground, with inverted polarity from pin A.

- Maximum Voltage Range: +6 to -6V (between conductors in a pair)
- +200mV to +6V (+2V typical) = non-data signal on or data value of 0
- -200mV to -6V (-2V typical) = non-data signal off or data value of 1
- Voltage between -200mV to +200mV invalid (indeterminate) state
- Max cable length 4000 feet
- Max data rate 10Mbps

Longer cables and increased loading reduces the maximum supported data rate.

Clock Polarity

Synchronous serial communications (HDLC/Bisync/Monosync) may use separate clock signals to control the timing of data signals. One clock cycle equals one bit. There are two clock edges (rising and falling) for each clock cycle. On one edge, the transmit data output changes. On the other edge, the receive data input is sampled. The assignment of clock edges to transmit data transition and receive data sampling is referred to as clock polarity.

SyncLink USB clock polarity is compatible with RS-232/RS-422/V.24/V.28/V.11:

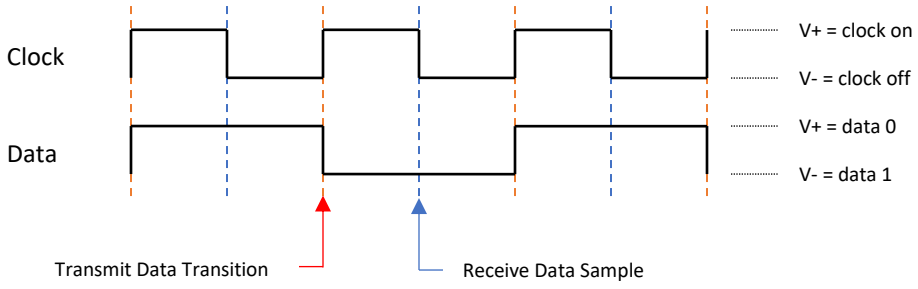
RS-232/V.28 Single Ended Signals

- +3V to +15V (+5V typical) = clock on
- -3V to -15V (-5V typical) = clock off
- On to Off edge (falling edge) = receive data sample (bit center)
- Off to On edge (rising edge) = transmit data transition (bit edge)

RS-422/RS-485/V.11 Differential Signals

- +200mV to +6V (+2V typical) = clock on
- -200mV to -6V (-2V typical) = clock off
- On to Off edge (falling edge) = receive data sample (bit center)
- Off to On edge (rising edge) = transmit data transition (bit edge)

Most serial communications equipment uses the above clock polarity, but some non-standard equipment may use the opposite polarity. For differential signals, inverting the conductors of each clock signal pair will alter the polarity. These polarities are defined at the serial connector. Documentation for serial controller ICs define logic signal polarity at the IC which is inverted from the serial connector.



Measured with respect to ground for single ended signals.
Measured pin A with respect to pin B for differential signals.

Data and Clock Polarity

Serial Interface Selection

The serial adapter supports different interface types, which are selected by software configuration. By default on power up, the interface is disabled and does not drive any outputs. The method of changing the interface type depends on the operating system and application. For example, Windows implements this setting in the device properties of the device manager and Linux implements the setting with an ioctl() call. Refer to the software documentation for details.

Some interface types require a conversion cable in addition to a software setting to provide the necessary connector type. Refer to the Serial Pin Assignments section for more details.

Differential Input Termination

The port on the card has 120-ohm termination of RS-422 differential inputs. Termination is used to increase signal reliability at high speeds (generally 1Mbps or more). At high speeds, receivers at each end of a cable should be terminated.

Serial Connector Pin Assignments

The assignment of signals to the connector pins is controlled by the software interface selection. For interface types that use a connector different than DB-25 an adapter cable purchased from MicroGate is required. The following sections describe the software settings and cables for each supported standard.

RS-232

RS-232 uses single ended signals on a DB-25 connector. The adapter DB-25 connector follows this standard when the software selects RS-232. Use any straight through 25 conductor DB-25M to DB-25F cable (such as MicroGate Part # CMF000) to connect the adapter connector to the communications equipment.

The maximum data rate supported by the adapter when using RS-232 is 128Kbps. Cable length and signal loading may reduce the maximum usable data rate from this value.

RS-232 DB-25 Male DTE			
Signal Name	**Electrical Desc**	**Pin #**	**Direction**
Earth/Shield Ground		1	
TxD, Transmit Data	RS-232/V.28	2	Output
RxD, Receive Data	RS-232/V.28	3	Input
RTS, Request to Send	RS-232/V.28	4	Output
CTS, Clear to Send	RS-232/V.28	5	Input
DSR, Data Set Ready	RS-232/V.28	6	Input
Signal Ground		7	
DCD, Data Carrier Detect	RS-232/V.28	8	Input
TxC, Transmit Clock	RS-232/V.28	15	Input
RxC, Receive Clock	RS-232/V.28	17	Input
LL, Local Loopback Control	RS-232/V.28	18	Output
DTR, Data Terminal Ready	RS-232/V.28	20	Output
RL, Remote Loopback Control	RS-232/V.28	21	Output
RI, Ring Indicator	RS-232/V.28	22	Input
AuxClk, DTE Clock Output	RS-232/V.28	24	Output

RS-232 Cable (Part# CMF000)

V.35

V.35 uses both single ended and differential signals on a 34-pin block connector. To use this standard, select V.35 in software and use the MicroGate V.35 cable (Part # 2534GT, picture shown below).

LL, RL, and RI signals are available on the DB25 connector but are not available (NC = no connect) on the 34-pin block connector when using the V.35 cable.

Maximum data rate supported by the adapter when using V.35 is 10Mbps. Cable length and signal loading may reduce the maximum usable data rate from this value.

V.35 Male DTE				
Signal Name	**Electrical Desc**	**DB25 Pin**	**V.35 Pin**	**Direction**
Earth/Shield Ground		1	A	
TxD (-/A), Transmit Data	RS-422/V.11	2	P	Output
RxD (-/A), Receive Data	RS-422/V.11	3	R	Input
RTS, Request to Send	RS-232/V.28	4	C	Output
CTS, Clear to Send	RS-232/V.28	5	D	Input
DSR, Data Set Ready	RS-232/V.28	6	E	Input
Signal Ground		7	B	
DCD, Data Carrier Detect	RS-232/V.28	8	F	Input
RxC (+/B), Receive Clock	RS-422/V.11	9	X	Input
AuxClk (+/B), DTE Clock Output	RS-422/V.11	11	W	Output
TxC (+/B), Transmit Clock	RS-422/V.11	12	AA	Input
TxD (+/B), Transmit Data	RS-422/V.11	14	S	Output
TxC (-/A), Transmit Clock	RS-422/V.11	15	Y	Input
RxD (+/B), Receive Data	RS-422/V.11	16	T	Input
RxC (-/A), Receive Clock	RS-422/V.11	17	V	Input
LL, Local Loopback Control	RS-232/V.28	18	NC	Output
DTR, Data Terminal Ready	RS-232/V.28	20	H	Output
RL, Remote Loopback Control	RS-232/V.28	21	NC	Output
RI, Ring Indicator	RS-232/V.28	22	NC	Input
AuxClk (-/A), DTE Clock Output	RS-422/V.11	24	U	Output

V.35 Cable (Part# 2534GT)

RS-422/RS-449/RS-485/RS-530

RS-422 and RS-485 define differential electrical signals but not connector or pin assignments. RS-530 and RS-449 define connectors and pin assignments using differential signals. The differential signals on the card meet both RS-422 and RS-485 electrical specifications.

RS-530 uses differential signals on a DB-25 connector. The adapter DB-25 connector follows this standard when software selects RS-422/485. Use any straight through 25 conductor DB-25M to DB-25F cable (such as MicroGate Part # CMF000) to connect the adapter to RS-530 communications equipment.

RS-449 uses differential signals on a DB-37 connector. To use this standard, select RS-422/485 in software and use the MicroGate RS-449 cable (Part # 2537FM).

The maximum data rate supported by the adapter when using RS-530 or RS-449 is 10Mbps. Cable length and signal loading may reduce the maximum usable data rate from this value.

RS-422/RS-530/RS-449 Male DTE				
Signal Name	**Electrical Desc**	**DB25 (RS530) Pin**	**DB37 (RS449) Pin**	**Direction**
Earth/Shield Ground		1	1	
TxD (-/A), Transmit Data	RS-422/V.11	2	4	Output
RxD (-/A), Receive Data	RS-422/V.11	3	6	Input
RTS (-/A), Request to Send	RS-422/V.11	4	7	Output
CTS (-/A), Clear to Send	RS-422/V.11	5	9	Input
DSR (-/A), Data Set Ready	RS-422/V.11	6	11	Input
Signal Ground		7	19	
DCD (-/A), Data Carrier Detect	RS-422/V.11	8	13	Input
RxC (+/B), Receive Clock	RS-422/V.11	9	26	Input
DCD (+/B), Data Carrier Detect	RS-422/V.11	10	31	Input
AuxClk (+/B), DTE Clock Output	RS-422/V.11	11	35	Output
TxC (+/B), Transmit Clock	RS-422/V.11	12	23	Input
CTS (+/B), Clear to Send	RS-422/V.11	13	27	Input
TxD (+/B), Transmit Data	RS-422/V.11	14	22	Output
TxC (-/A), Transmit Clock	RS-422/V.11	15	5	Input
RxD (+/B), Receive Data	RS-422/V.11	16	24	Input
RxC (-/A), Receive Clock	RS-422/V.11	17	8	Input
LL, Local Loopback Control	RS-232/V.28	18	10	Output
RTS (+/B), Request to Send	RS-422/V.11	19	25	Output
DTR (-/A), Data Terminal Ready	RS-422/V.11	20	12	Output
RL, Remote Loopback Control	RS-232/V.28	21	14	Output
DSR (+/B), Data Set Ready	RS-422/V.11	22	29	Input
DTR (+/B), Data Terminal Ready	RS-422/V.11	23	30	Output
AuxClk (-/A), DTE Clock Output	RS-422/V.11	24	17	Output

RS-530 Cable (Part# CMF000)

RS-449 Cable (Part# 2537FM)

RS-530A

RS-530A is similar to RS-530, except DTR and DSR outputs are single ended instead of differential.

RS-530A Male DTE			
Signal Name	**Electrical Desc**	**DB25 Pin**	**Direction**
Earth/Shield Ground		1	
TxD (-/A), Transmit Data	RS-422/V.11	2	Output
RxD (-/A), Receive Data	RS-422/V.11	3	Input
RTS (-/A), Request to Send	RS-422/V.11	4	Output
CTS (-/A), Clear to Send	RS-422/V.11	5	Input
DSR (-/A), Data Set Ready	RS-232/V.28	6	Input
Signal Ground		7	
DCD (-/A), Data Carrier Detect	RS-422/V.11	8	Input
RxC (+/B), Receive Clock	RS-422/V.11	9	Input
DCD (+/B), Data Carrier Detect	RS-422/V.11	10	Input
AuxClk (+/B), DTE Clock Output	RS-422/V.11	11	Output
TxC (+/B), Transmit Clock	RS-422/V.11	12	Input
CTS (+/B), Clear to Send	RS-422/V.11	13	Input
TxD (+/B), Transmit Data	RS-422/V.11	14	Output
TxC (-/A), Transmit Clock	RS-422/V.11	15	Input
RxD (+/B), Receive Data	RS-422/V.11	16	Input
RxC (-/A), Receive Clock	RS-422/V.11	17	Input
LL, Local Loopback Control	RS-232/V.28	18	Output
RTS (+/B), Request to Send	RS-422/V.11	19	Output
DTR, Data Terminal Ready	RS-232/V.28	20	Output
RL, Remote Loopback Control	RS-232/V.28	21	Output
AuxClk (-/A), DTE Clock Output	RS-422/V.11	24	Output

RS-530A Cable (Part# CMF000)

X.21

X.21 is an interface standard using differential signals on a DB-15 connector. To use this standard, select RS-422/485 in software and use the MicroGate X.21 cable (Part # 2515FM).

The X.21 signal names are different than those used by the adapter and other interface standards. The mapping of the X.21 signals to the adapter signals are shown in the table below.

The maximum data rate supported by the adapter when using X.21 is 10Mbps. Cable length and signal loading may reduce the maximum usable data rate from this value.

X.21 Male DTE				
Signal Name	**Electrical Desc**	**DB25 Pin**	**DB15 Pin**	**Direction**
Earth/Shield Ground		1	1	
T(-/A), Transmit Data	RS-422/V.11	2	2	Output
R(-/A), Receive Data	RS-422/V.11	3	4	Input
I(-/A), Indicator (DSR/DCD)	RS-422/V.11	6,8	5	Input
Signal Ground		7	8	
S(+/B), Clock Input (TxC, RxC)	RS-422/V.11	9,12	13	Input
I(+/B), Indicator (DSR/DCD)	RS-422/V.11	10,22	12	Input
X(+/B), Clock Output (AuxClk)	RS-422/V.11	11	14	Output
T(+/B), Transmit Data	RS-422/V.11	14	9	Output
S(-/A), Clock Input (TxC, RxC)	RS-422/V.11	15,17	6	Input
R(+/B), Receive Data	RS-422/V.11	16	11	Input
C(-/A), Control (DTR)	RS-422/V.11	20	3	Output
C(+/B), Control (DTR)	RS-422/V.11	23	10	Output
X(-/A), Clock Output (AuxClk)	RS-422/V.11	24	7	Output

X.21 Cable (Part# 2515FM)

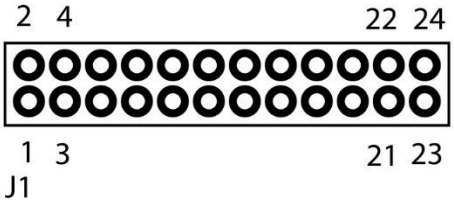
General Purpose I/O Signals

The SyncLink USB has a 24-pin header (2 x 12 pins, 0.050” spacing) inside the case and on the circuit board that provides general-purpose input/output (GPIO) signals for application specific uses. These signals are controlled by an application using the serial API (Windows and Linux). Each signal can be configured to be either an input or an output. Inputs can be monitored and outputs can be controlled.

DC GPIO Specifications

Vil (input low) = -0.5V min, 0.8V max
Vih (input high) = 2.0V min, 5.5V max
Vol (output low) = 0.4V max
Voh (output high) = 2.4V min
Iol (output low) = 24mA max
Iil (output high) = -24mA max
Input Current = +/- 10uA max
GPIO signals are 3.3V TTL compatible and inputs are 5V tolerant.

GPIO Pin Assignments	
Pin #	**Description**
1	Ground
2	Ground
3	GPIO[0]
4	GPIO[1]
5	GPIO[2]
6	GPIO[3]
7	GPIO[4]
8	GPIO[5]
9	GPIO[6]
10	GPIO[7]
11	GPIO[8]
12	GPIO[9]
13	GPIO[10]
14	GPIO[11]
15	GPIO[12]
16	GPIO[13]
17	GPIO[14]
18	GPIO[15]
19	GPIO[16]
20	GPIO[17]
21	GPIO[18]
22	GPIO[19]
23	Ground
24	Ground



GPIO Header (J1) Pin Numbering
Pin 1 is next to "J1" Marking

The SyncLink USB adapter has a total of 20 general purpose I/O signals (GPIO[0] to GPIO[19]). By default on power up all GPIO signals are configured as inputs (direction control = 0). Refer to the serial API documentation for details on configuring and using GPIO signals.

The GPIO header is not accessible from outside the standard case. For prototyping, the header can be accessed by removing the case end plate from the USB connector end of the case. This allows space for a ribbon cable to run to the outside of the case. For production, contact MicroGate for a quote on custom end plates and connectors.

WARNING: Take care when connecting to GPIO signals to prevent damage to the serial adapter. Outputs should only be connected to inputs and not other outputs. Voltage limits as shown above should not be exceeded.

Base Clock and Frequency Synthesizer

All ports share a common **base clock** for generating individual **data clocks**. Data clocks are generated by dividing the base clock by a 16-bit integer. A data clock may be output on the AUXCLK signal or used internally as a synchronous data clock, an asynchronous sampling clock, or for clock recovery.

The base clock defaults to a fixed frequency oscillator (14.7456MHz). Applications may select a variable frequency synthesizer as the base clock for data clocks that cannot be generated exactly when dividing the fixed frequency oscillator by a 16-bit integer.

Sample code to select the synthesizer and base clock frequency is included with the Microgate software development kit (SDK). The maximum synthesizer frequency is 80MHz. The synthesizer frequency is configured from a list of programming data for commonly used frequencies. Contact Microgate for new list entries if the desired base clock frequency is not present.

The fixed frequency oscillator may be special ordered with different values for legacy applications written for hardware without a frequency synthesizer. Contact Microgate for details.