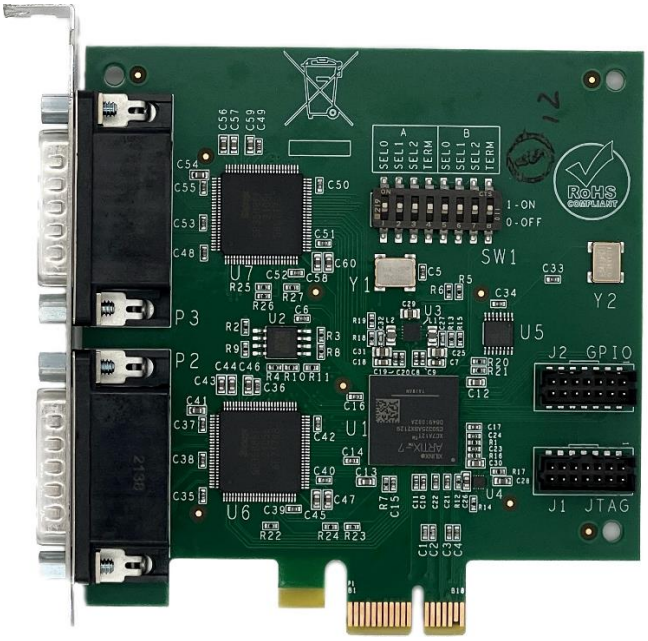
SyncLink PCIe 4-Port Serial Adapter

Hardware User Manual



MicroGate Systems, Ltd

http://www.microgate.com

Contents

Overview

The SyncLink PCIe 4-Port Serial Adapter is an add-in card for systems with PCI Express expansion slots. A variety of serial protocols and interface standards are supported. **Only data and clock signals are implemented to achieve higher port density.** Use the SyncLink PCIe 2-Port Serial Adapter if legacy control and status signals are required (RTS, DTR, DSR, CTS, DCD, LL, RL, RI). Refer to MicroGate software documentation for details on using the card for specific applications.

The SyncLink PCIe 4-Port Serial Adapter identifies as a SyncLink GT4 when used with older drivers (compatibility mode). The latest drivers identify the card as SyncLink PCIe 4-Port and enable new features.

Features

- Maximum Speed 10Mbps
- SDLC, HDLC, BISYNC, MONOSYNC, ASYNC, ISOCHRONOUS, raw bit-synchronous
- 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
- Software and switch selectable interface for RS-232, V.35 or RS-422
- Optional termination for differential inputs
- Port Signals: data input, data output, 2 clock inputs, clock output

Specifications

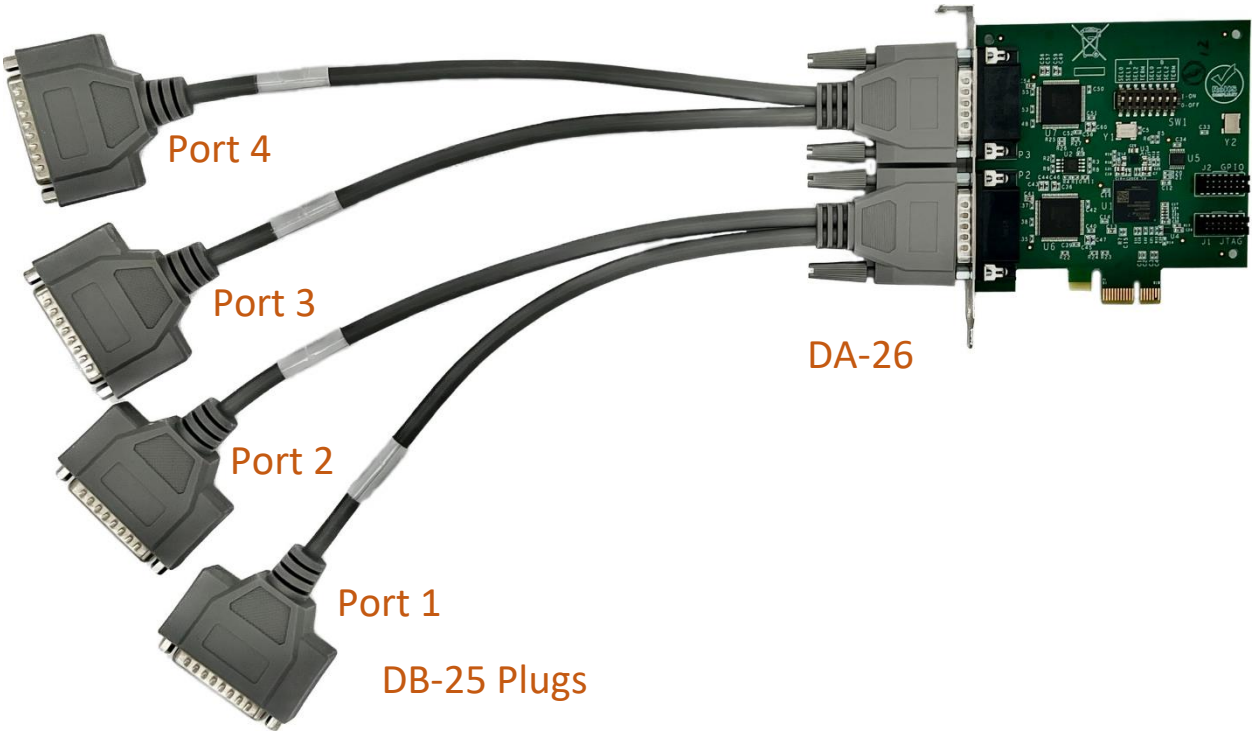
- MicroGate FPGA serial controller (4 ports)
- PCI Express (x1)
- DMA data transfer
- Operating Temperature Range: -40C to +85C
- Storage Temperature Range: -55C to +125C
- Environmental: humidity 0 to 95% non-condensing; alt. - 200 to +20,000 ft
- Mechanical: Standard PCI Express short card; length 3.8", height 4.0"
- Power usage: 2.5W (max)
- Regulatory: FCC, CE, RoHS
- Connectors: DA-26 plug (x2) with adapter cables included to convert to 4 DB-25 plug.

PCI Express

PCI Express is an expansion slot standard for adding components to a system. PCI Express is not compatible with PCI or PCI-X slots. SyncLink cards are keyed to prevent insertion into incompatible slots. The SyncLink PCIe 4-Port is a x1 (single lane) card and is compatible with any of the different PCI Express slots sizes (x1, x4, x8, or x16). PCI Express x1 slots are the shortest and x16 slots are the longest.

Adapter Cables

The card has two DA-26 plug connectors. Each connector carries two ports (1-2 or 3-4). Cables included with the card convert each DA-26 to two DB-25 plug connectors. Ports 1-2 are closest to the PCIe edge connector.



Adapter Cables and Port Numbering

Signal Specifications

Each serial signal is compatible with an electrical specification selected by software or switch settings on the card. This section briefly describes the specifications supported by the card.

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 128kbps

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

Differential Signals (RS-422/RS-485/V.35/V.11)

SyncLink differential signals are compatible with RS-422, RS-485, V.35 and 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 clock polarity is compatible with RS-232/RS-422/V.24/V.28/V.11:

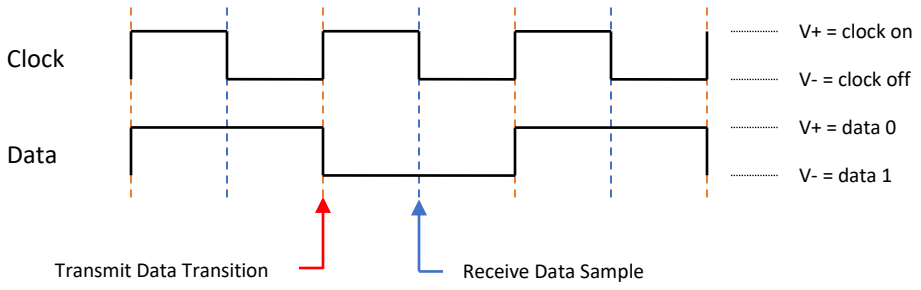
RS-232/V.28 Single Ended Signals

- +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.35/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. 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 and Termination Selection

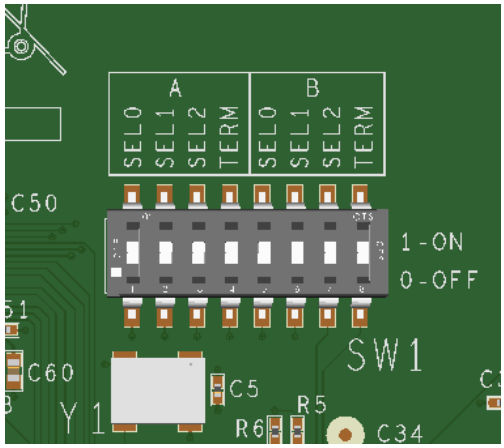
Serial interface type and input termination (120 Ohms) are selected by software or manually with switches on the card. Manual configuration prevents software configuration. Port interfaces are configured in pairs (1-2 or 3-4). Interfaces are turned off until configured.

The Application Programming Interface (API) manual for the target OS (Linux or Windows) documents software configuration. Port pairs are configured with API calls to the primary port (1 or 3). Interface configuration calls to secondary ports (2 or 4) are ignored. Interfaces may be configured in the Windows device manager when software select is enabled.

Enable input termination (120 Ohms) for RS422 unless card is not an endpoint on a cable with more than two serial devices. RS232 never uses input termination.

Port Pair	Primary	Secondary
A	1	2
B	3	4

SEL0 SEL1 SEL2 TERM	Primary	Secondary
0000	Software Select	Software Select
0010	RS232	RS232
0100	V.35	RS232
0101	V.35 Terminated	RS232
1000	RS422	RS422
1001	RS422 Terminated	RS422 Terminated



Interface Configuration Switches

Serial Connector Pin Assignments

The card has two DA-26 plug connectors. Each DA-26 carries a pair of ports (1-2 or 3-4). Adapter cables included with the card split each DA-26 into two DB-25 plug connectors. Port pairs are configured for a serial interface standard as described in the Serial Interface and Termination Selection section.

Differential signals are compatible with RS-422, V.35 electrical standards.
Single ended signals are compatible with RS-232 electrical standards.
DB-25 pin assignments are compatible with RS-232 and RS-530 pin assignments.

For RS-422/V.35, all listed signals are used. For RS-232, only signals labeled (-/A) are used.

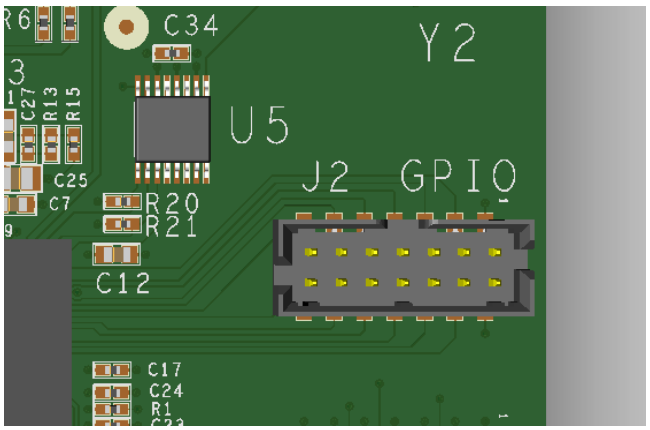
Use a straight through 25 conductor DB-25 plug to DB-25 receptacle cable, such as MicroGate CMF000, to connect to RS-530 and RS-232 devices.
Use MicroGate RS-530 to RS-449 cable (2537FM, not included with card) with RS-449 devices.
Use MicroGate RS-530 to X.21 cable (2515FM, not included with card) with X.21 devices.

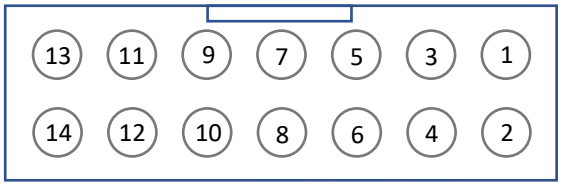
The following table describes pin assignments for a pair of ports. DB-25 (1) and DB-25 (2) are the two connectors of a Y-cable. DB-25 (1) is either Port 1 or Port 3, depending on which DA-26 connector the Y-cable is plugged into. DB-25 (2) is either Port 2 or Port 4. The DA-26 connector closest to the gold fingers (PCIe connector) is ports 1 and 2.

Pin Assignments				
Signal	**DA-26**	**DB-25 (1)**	**DB-25 (2)**	**Direction**
TxD (-/A), Transmit Data	8	2		Output
TxD (+/B)	9	14		Output
RxD (-/A), Receive Data	17	3		Input
RxD (+/B)	18	16		Input
AuxClk (-/A), DTE Clock	6	24		Output
AuxClk (+/B)	7	11		Output
RxC (-/A), Receive Clock	10	17		Input
RxC (+/B)	11	9		Input
TxC (-/A), Transmit Clock	25	15		Input
TxC (+/B)	26	12		Input
TxD (-/A), Transmit Data	3		2	Output
TxD (+/B)	4		14	Output
RxD (-/A), Receive Data	24		3	Input
RxD (+/B)	23		16	Input
AuxClk (-/A), DTE Clock	1		24	Output
AuxClk (+/B)	2		11	Output
RxC (-/A), Receive Clock	22		17	Input
RxC (+/B)	21		9	Input
TxC (-/A), Transmit Clock	19		15	Input
TxC (+/B)	20		12	Input
Signal Ground	14	7	7	

General Purpose I/O Signals

A 14 pin header (J2, Molex PN 87832-1420) provides 12 general purpose input/output signals (GPIO[0] to GPIO[11]) for application specific use. Applications configure, control and monitor these signals with the serial API. Each signal may be configured as an input (power on default) or output. GPIO signals are 3.3V TTL compatible and inputs are 5V tolerant. Exceeding specifications can damage the card.





GPIO DC Specifications		
Name	Min	Max
V_{IL} (input low)	-0.5V	0.8V
V_{IH} (input high)	2.0V	5.5V
I_{IN} (input current)		+/-10uA
V_{OL} (output low)		0.4V
V_{OH} (output high)	2.4V	
I_{OL} (output low)		24mA
I_{OH} (output high)		-24mA

GPIO Pin Assignments	
Pin	**Description**
1	Ground
2	GCK0 Dedicated special purpose LVTTL input – Leave unconnected
3	GPIO[6]
4	GPIO[0]
5	GPIO[7]
6	GPIO[1]
7	GPIO[8]
8	GPIO[2]
9	GPIO[9]
10	GPIO[3]
11	GPIO[10]
12	GPIO[4]
13	GPIO[11]
14	GPIO[5]

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.