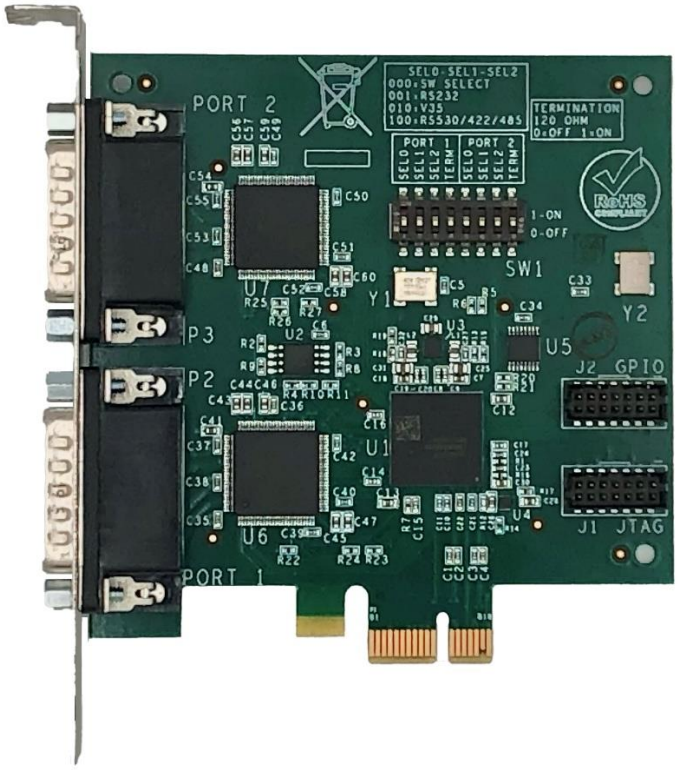
SyncLink PCIe Serial Adapter

Hardware User's Manual



MicroGate Systems, Ltd

http://www.microgate.com

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Overview

The SyncLink PCIe Serial Adapter is an add-in card for systems with PCI Express expansion slots. The card provides two serial ports for use by the system. A variety of serial protocols and interface standards are supported. Refer to the software documentation included with the card for details on using the card for specific applications.

For compatibility the SyncLink PCIe identifies as a SyncLink GT2 when used with older drivers. The latest drivers identify the card as SyncLink PCIe and enable new features.

Features

- Maximum Speed 10Mbps
- SDLC, HDLC, BISYNC, MONOSYNC, ASYNC, raw bit-synchronous, TDM/McASP protocols
- Selectable hardware CRC: CRC-16, CRC-32, None
- DPLL 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, RS-422/485, RS-530, RS-449, X.21
- Optional termination for differential inputs
- Full set of control and status signals (DTR,DSR,RTS,CTS,DCD,RI,LL,RL)

Specifications

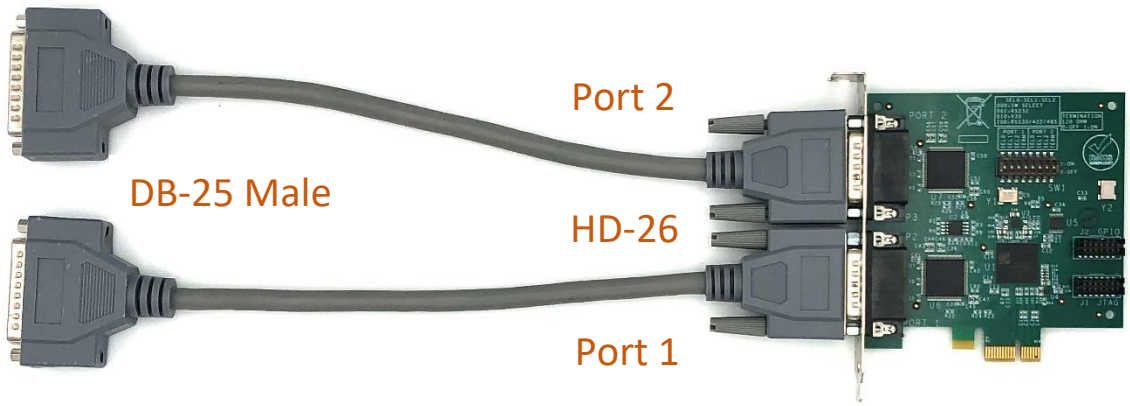
- MicroGate FPGA serial controller (2 ports)
- PCI Express (x1)
- Bus Master DMA data transfer
- Operating Temperature Range: -40C to +85C
- Storage Temperature Range: -55C to +125C
- Environmental: humidity 0 to 95% non-condensing; alt. - 200 to +20,000 ft
- Mechanical: Standard PCI Express short card; length 3.8", height 4.0"
- Power usage: 2.5W (max)
- Regulatory: FCC, CE, RoHS
- Connectors: HD-26 male (x2) with adapter cable included to convert to 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)

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 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 high density 26-pin connectors, one for each port. Adapter cables are included with the card to convert each 26-pin connector into a standard DB-25 male connector. Port 1 is closest to the PCIe edge connector. Port numbers are labeled on the board and bracket.



Adapter Cables and Port Numbering

Signal Specifications

Each serial signal (control, status, data, or clock) is compatible with an electrical specification that is selected by placement of jumpers 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) = control/status signal on or data value of 0
- -3V to -15V (-5V typical) = control/status 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.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) = control/status signal on or data value of 0
- -200mV to -6V (-2V typical) = control/status 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:

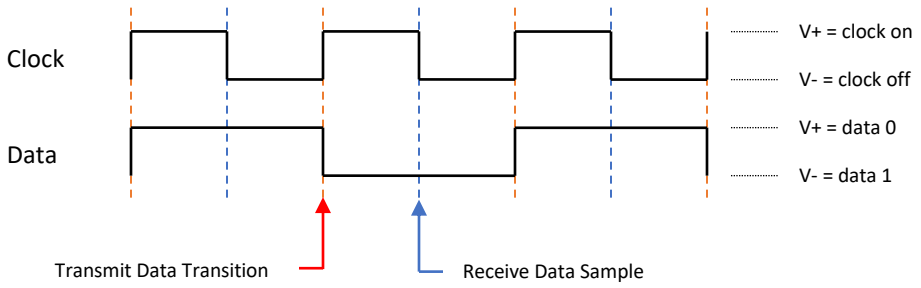
RS-232/V.28 Single Ended Signals

- +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.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.



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

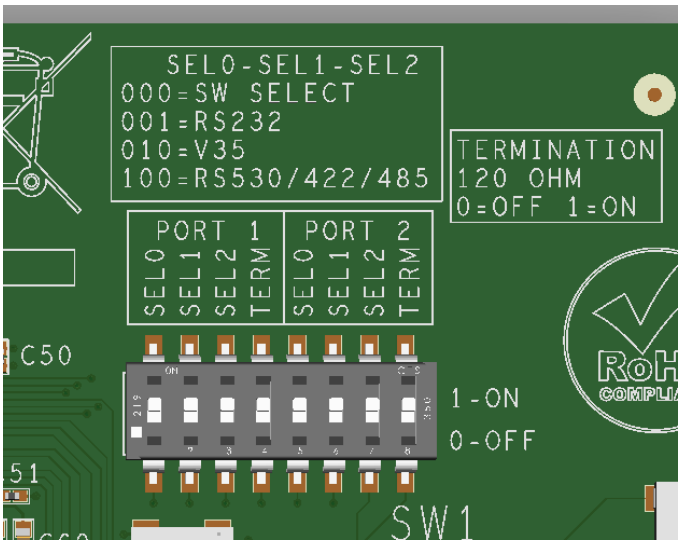
The serial interface type and input termination are selected with switch settings or through software. Two ports use 4 positions each of an 8 position DIP switch.

The SEL0-SEL1-SEL2 switches select the interface type as shown in the image below. Valid choices are software select, RS-232, V.35 and RS-530/422/485. Software select disables the serial interface until configured by API call. Other selections fix the interface, preventing software modification.

The TERM switch controls the 120 ohm termination option for differential inputs (RS-530/422/485/V.11) on a port. Single ended inputs (RS-232/V.28) never use termination regardless of the TERM switch setting. If the serial interface is software selected then the TERM switch is ignored and termination is enabled through software.

Interface selection is preset at the factory as specified by the ordering code.

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



Interface and Termination Selection

Serial Connector Pin Assignments

The SyncLink PCIe card has two high density 26 pin D-SUB male connectors (HD-26), one for each port. The HD-26 connectors allow two ports to fit on a PCIe bracket. Adapter cables included with the card convert the HD-26 to the larger standard DB-25 male connector. Each port is configured for a specific serial interface standard as described in the Serial Interface and Termination Selection section. Interface types that use a connector different than DB-25 (V.35, RS-449, X.21) require an additional adapter cable to convert the DB-25 to the required connector type. The following sections describe the cable pin assignments for supported standards.

RS-232

RS-232 defines single ended signals on a DB-25 connector. Use a straight through 25 conductor DB-25M to DB-25F cable, such as MicroGate Part # CMF000.

Maximum data rate is 128Kbps. Cable length and signal loading may reduce the maximum data rate.

RS-232 DB-25 Male DTE				
Signal	**Electrical**	**HD-26 Pin**	**DB-25 Pin**	**Direction**
TxD, Transmit Data	RS-232/V.28	8	2	Output
RxD, Receive Data	RS-232/V.28	17	3	Input
RTS, Request to Send	RS-232/V.28	1	4	Output
CTS, Clear to Send	RS-232/V.28	24	5	Input
DSR, Data Set Ready	RS-232/V.28	19	6	Input
Signal Ground		14	7	
DCD, Data Carrier Detect	RS-232/V.28	22	8	Input
TxC, Transmit Clock	RS-232/V.28	25	15	Input
RxC, Receive Clock	RS-232/V.28	10	17	Input
LL, Local Loopback Control	RS-232/V.28	13	18	Output
DTR, Data Terminal Ready	RS-232/V.28	3	20	Output
RL, Remote Loopback Control	RS-232/V.28	12	21	Output
RI, Ring Indicator	RS-232/V.28	20	22	Input
AuxClk, DTE Clock Output	RS-232/V.28	6	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 the V.35 interface type and use the MicroGate V.35 cable (Part # 2534GT, picture shown below).

LL, RL, and RI signals are available on the HD-26 and DB-25 connectors but are not available (NC = no connect) on the 34-pin block connector when using the V.35 cable.

Maximum data rate is 10Mbps. Cable length and signal loading may reduce the maximum data rate.

V.35 Male DTE					
Signal	**Electrical**	**HD-26 Pin**	**DB-25 Pin**	**V.35 Pin**	**Direction**
TxD (-/A), Transmit Data	RS-422/V.11	8	2	P	Output
RxD (-/A), Receive Data	RS-422/V.11	17	3	R	Input
RTS, Request to Send	RS-232/V.28	1	4	C	Output
CTS, Clear to Send	RS-232/V.28	24	5	D	Input
DSR, Data Set Ready	RS-232/V.28	19	6	E	Input
Signal Ground		14	7	B	
DCD, Data Carrier Detect	RS-232/V.28	22	8	F	Input
RxC (+/B), Receive Clock	RS-422/V.11	11	9	X	Input
AuxClk (+/B), DTE Clock Output	RS-422/V.11	7	11	W	Output
TxC (+/B), Transmit Clock	RS-422/V.11	26	12	AA	Input
TxD (+/B), Transmit Data	RS-422/V.11	9	14	S	Output
TxC (-/A), Transmit Clock	RS-422/V.11	25	15	Y	Input
RxD (+/B), Receive Data	RS-422/V.11	18	16	T	Input
RxC (-/A), Receive Clock	RS-422/V.11	10	17	V	Input
LL, Local Loopback Control	RS-232/V.28	13	18	NC	Output
DTR, Data Terminal Ready	RS-232/V.28	3	20	H	Output
RL, Remote Loopback Control	RS-232/V.28	12	21	NC	Output
RI, Ring Indicator	RS-232/V.28	20	22	NC	Input
AuxClk (-/A), DTE Clock Output	RS-422/V.11	6	24	24	Output

V.35 Cable (Part# 2534GT)

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

RS-422, RS-485 and ITU V.11 define electrical properties of differential signals but not connector type or pin assignments. Configure a port to RS-422/485/530 to use all differential signals.

RS-530 defines differential signals on a DB-25 connector. Use a straight through 25 conductor DB-25M to DB-25F cable, such as MicroGate Part # CMF000.

RS-449 defines differential signals on a DB-37 connector. Use MicroGate RS-449 cable (Part # 2537FM).

Maximum data rate is 10Mbps. Cable length and signal loading may reduce the maximum data rate.

RS-422/RS-530/RS-449 Male DTE					
Signal	**Electrical**	**HD-26 Pin**	**DB-25/RS-530 Pin**	**DB-37/RS-449 Pin**	**Direction**
TxD (-/A), Transmit Data	RS-422/V.11	8	2	4	Output
RxD (-/A), Receive Data	RS-422/V.11	17	3	6	Input
RTS (-/A), Request to Send	RS-422/V.11	1	4	7	Output
CTS (-/A), Clear to Send	RS-422/V.11	24	5	9	Input
DSR (-/A), Data Set Ready	RS-422/V.11	19	6	11	Input
Signal Ground		14	7	19	
DCD (-/A), Data Carrier Detect	RS-422/V.11	22	8	13	Input
RxC (+/B), Receive Clock	RS-422/V.11	11	9	26	Input
DCD (+/B), Data Carrier Detect	RS-422/V.11	21	10	31	Input
AuxClk (+/B), DTE Clock Output	RS-422/V.11	7	11	35	Output
TxC (+/B), Transmit Clock	RS-422/V.11	26	12	23	Input
CTS (+/B), Clear to Send	RS-422/V.11	23	13	27	Input
TxD (+/B), Transmit Data	RS-422/V.11	9	14	22	Output
TxC (-/A), Transmit Clock	RS-422/V.11	25	15	5	Input
RxD (+/B), Receive Data	RS-422/V.11	18	16	24	Input
RxC (-/A), Receive Clock	RS-422/V.11	10	17	8	Input
LL, Local Loopback Control	RS-232/V.28	13	18	10	Output
RTS (+/B), Request to Send	RS-422/V.11	2	19	25	Output
DTR (-/A), Data Terminal Ready	RS-422/V.11	3	20	12	Output
RL, Remote Loopback Control	RS-232/V.28	12	21	14	Output
DSR (+/B), Data Set Ready	RS-422/V.11	20	22	29	Input
DTR (+/B), Data Terminal Ready	RS-422/V.11	4	23	30	Output
AuxClk (-/A), DTE Clock Output	RS-422/V.11	6	24	17	Output

RS-530 Cable (Part# CMF000)

RS-449 Cable (Part# 2537FM)

X.21

X.21 defines differential signals on a DB-15 connector. Configure a port for RS-422/485/530 and use the MicroGate X.21 cable (Part # 2515FM).

The mapping of the X.21 signals to the card signals are shown below.

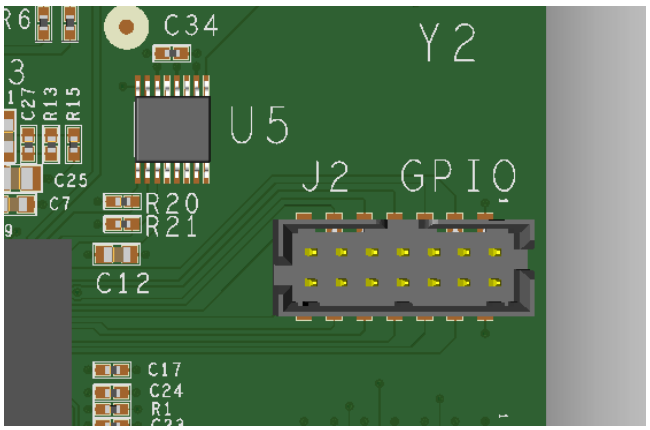
Maximum data rate is 10Mbps. Cable length and signal loading may reduce the maximum data rate.

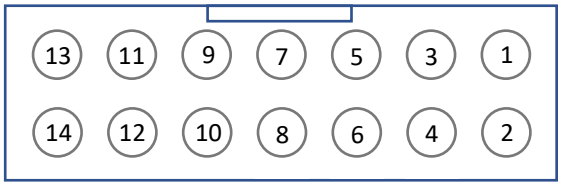
X.21 Male DTE					
Signal	**Electrical**	**HD-26 Pin**	**DB-25 Pin**	**DB-15 Pin**	**Direction**
T(-/A), Transmit Data	RS-422/V.11	8	2	2	Output
R(-/A), Receive Data	RS-422/V.11	17	3	4	Input
I(-/A), Indicator (DSR/DCD)	RS-422/V.11	19,22	6,8	5	Input
Signal Ground		14	7	8	
S(+/B), Clock Input (TxC, RxC)	RS-422/V.11	11,26	9,12	13	Input
I(+/B), Indicator (DSR/DCD)	RS-422/V.11	21,20	10,22	12	Input
X(+/B), Clock Output (AuxClk)	RS-422/V.11	7	11	14	Output
T(+/B), Transmit Data	RS-422/V.11	9	14	9	Output
S(-/A), Clock Input (TxC, RxC)	RS-422/V.11	25,10	15,17	6	Input
R(+/B), Receive Data	RS-422/V.11	18	16	11	Input
C(-/A), Control (DTR)	RS-422/V.11	3	20	3	Output
C(+/B), Control (DTR)	RS-422/V.11	4	23	10	Output
X(-/A), Clock Output (AuxClk)	RS-422/V.11	6	24	7	Output

X.21 Cable (Part# 2515FM)

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.



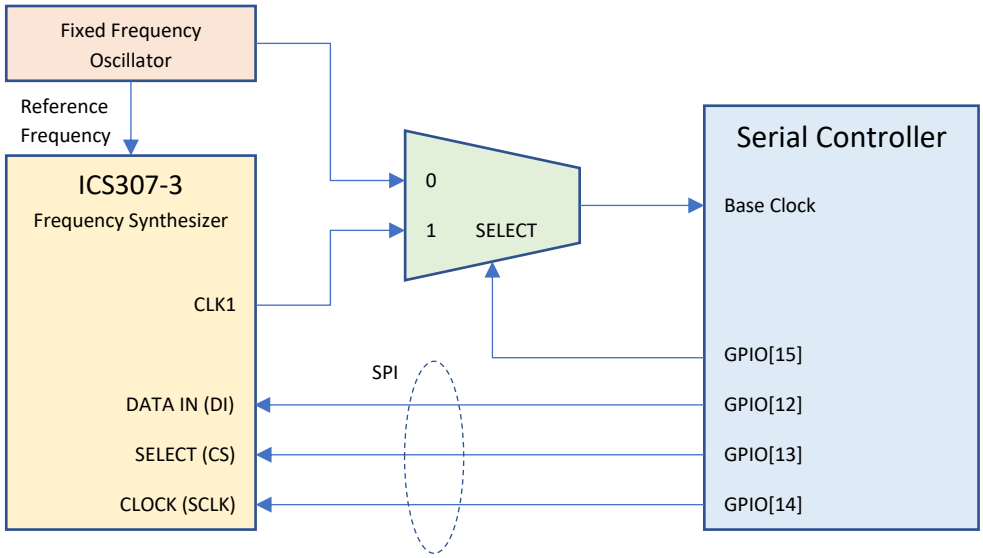


GPIO DC Specifications		
Name	Min	Max
V_{IL} (input low)	-0.5V	0.8V
V_{IH} (input high)	2.0V	5.5V
I_{IN} (input current)		+/-10uA
V_{OL} (output low)		0.4V
V_{OH} (output high)	2.4V	
I_{OL} (output low)		24mA
I_{OH} (output high)		-24mA

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]

Frequency Synthesizer

The serial controller requires a base clock which is used by the baud rate generator (BRG) to create data clocks. A data clock may be output on the AUXCLK signal or used internally for a synchronous data clock, an asynchronous sampling clock, or for DPLL clock recovery.



The card has a fixed frequency oscillator and a variable frequency synthesizer. Either source can supply the base clock. The oscillator is used as the synthesizer reference clock input. Serial controller GPIO signals program the synthesizer through an SPI interface and select between the oscillator and synthesizer outputs. The base clock is common to all ports in the controller.

The synthesizer is made by Integrated Device Technologies (IDT). Refer to the documentation available from IDT (www.idt.com) for details on programming the synthesizer. An IDT supplied program (Versaclock) generates programming data (132 bit value) for a specific frequency output. The CLK1 output of the synthesizer is used, CLK2 and CLK3 are unconnected. Sample code for programming the synthesizer through the GPIO portion of the serial API is available from Microgate. The maximum synthesizer frequency supported by the serial controller is 80MHz.

The default oscillator frequency is 14.7456MHz. Other frequencies are available by special order. By default the serial controller uses the oscillator as the base clock.