SWITCHERGEAR
GEAR TO CONTROL YOUR POWER SWITCHES

Module N23201

2/2-channel RS-232 transceiver interface Isolated

REFERENCE MANUAL

Features

Standard module for SwitcherGear

RS-232 transceiver interface

- *2 transmitter channels*
- *2 receiver channels*
- *Data rate up to 1 Mbit/s*

Galvanic isolation

Signal lines are protected against short-circuit and ESD

12-way pluggable screw terminal

Applications

Serial communications to industrial systems

Serial communications with PC

- *Serial diagnostic data stream*
- *Serial link with development tools*

Serial interface for field programming of SwitcherGear

General Description

The N23201 module is a RS-232 interface with 2 transmit channels and 2 receive channels. These lines can be used to implement two RS-232 serial links (1 transmit and 1 receive channel each).

Ordering Information

Order Code	***Description***
N23201	*SwitcherGear module, 2/2-channel RS-232 transceiver interface, isolated*

Module Quick Start

1. **Set the configurable features.**

   Determine the feature settings that are required for the system under control. If necessary, change the default solder jumper settings. Refer to the Configuration section.

2. **Review the allocation of the MCU interface signals.**

   Confirm that the MCU interface signals connect to appropriate pins on the host MCU. Refer to your SwitcherGear configuration document and Table 3.

3. **Insert into the base slot.**

   Refer to your SwitcherGear configuration document for the location of modules.

4. **Connect the external wiring to the system connector.**

   Refer to Table 1 for the pin-out of the system connector.

Standard Interfaces

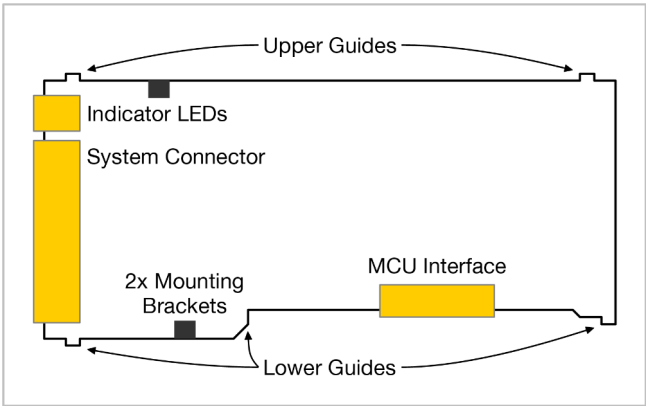

Figure 1: Parts of a SwitcherGear module.

System Connector

A 12-way pluggable screw terminal connector is used to connect system wiring to the N23201 module. Table 1 shows the pin-out of this connector.

The connector can be keyed by inserting the supplied red coding keys into the slots on the header. The corresponding moulded key on the plug must be removed to allow insertion into the header.

Table 1: System connector

Pin	Signal	Description
1 (Top)	TX1	Serial link 1 RS-232 transmit output signal.
2	-	-
3	RX1	Serial link 1 RS-232 receive input signal.
4	-	-
5	COM	0V for transceiver circuitry.
6	FIELDGND	External field ground.
7	TX2	Serial link 2 RS-232 transmit output signal.
8	-	-
9	RX2	Serial link 2 RS-232 receive input signal.
10	-	-
11	COM	0V for transceiver circuitry.
12 (Bottom)	FIELDGND	External field ground.

Table 2: Indicator LEDs

Appearance	Left Column		Right Column	
	Colour	Description	Colour	Description
	Green	Serial link 1 TX active	Green	Serial link 1 RX active
	Green	Serial link 2 TX active	Green	Serial link 2 RX active
	-	-	-	-
	-	-	-	-

Table 3: MCU interface

Pin	Signal	Description
D0	TXD1	Serial link 1 transmit data input signal.
D1	RXD1	Serial link 1 receive data output signal.
D2	TXD2	Serial link 2 transmit data input signal.
D3	RXD2	Serial link 2 receive data output signal.
D4	-	-
D5	-	-
D6	-	-
D7	-	-
D8	-	-
D9	-	-
D10	-	-
D11	-	-
A0	-	-
A1	-	-
A2	-	-
A3	-	-

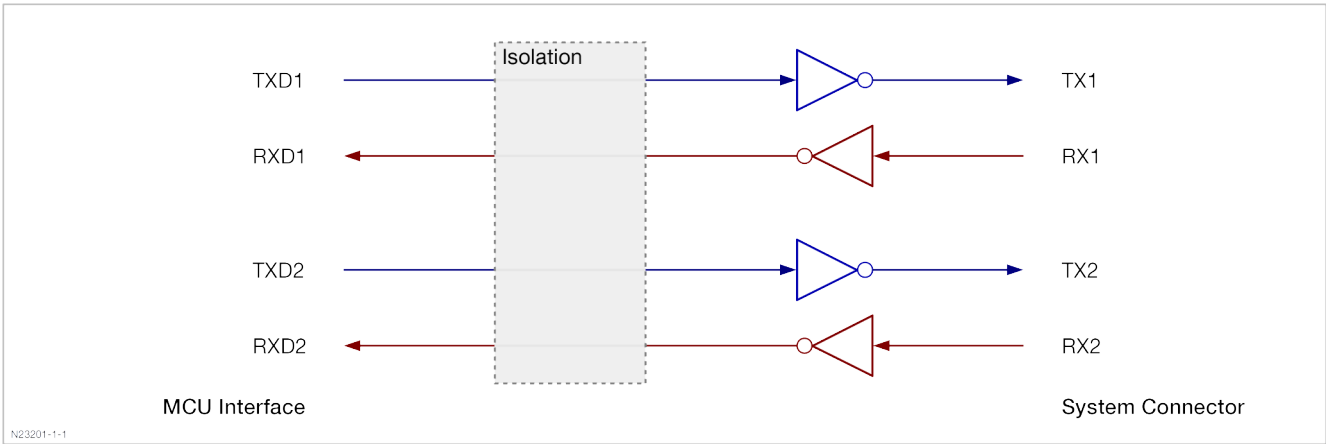

Figure 2: Functional block diagram of the N23201 module.

Indicator LEDs

Miniature indicator LEDs on the front panel show the status of the data lines. Refer to Table 2 for details.

MCU interface

The MCU interface contains analogue and digital signals that allow interaction between the module and the host MCU. The MCU interface supports up to 12 digital inputs/outputs and up to 4 analogue outputs.

Refer to Table 3 for details of the signals provided by the N23201 module.

The signals in the MCU interface must be routed to appropriate pins of the host MCU. Refer to the SwitcherGear Configuration Document for your specific SwitcherGear unit for information on the routing of signals between the installed modules and the host MCU.

Configuration

The N23201 module has no user configurable hardware features.

Functional Description

The N23201 module is a hardware interface for RS-232 communication with 2 transmitter channels and 2 receiver channels. As shown in Figure 2, the signal chain consists of an isolation barrier and transceiver circuits. The signals on the system connector meet the voltage specification for RS-232 signals and can be used for data rates up to 1 Mbit/s.

The data signals on the MCU interface are standard logic signals that should be routed to appropriate pins on the host MCU.

The N23201 module only performs the conversion of the communications signals between logic signal levels and RS-232 levels. The host MCU is responsible for generating and receiving data frames at the required Baud rate. Data frames for RS-232 communications typically comprise one start bit, up to 8 data bits, an optional parity bit and 1 or 2 stop bits.

Isolation

The TX1, TX2, RX1, RX2 and COM terminals are galvanically isolated from the SwitcherGear controller. These terminals are group-isolated, i.e. they all share the same COM supply voltage.

The module includes an on-board isolated power supply to power the isolated transmitter and receiver circuitry.

The purpose of the isolation in the N23201 module between the RS-232 signal lines and the SwitcherGear controller is to prevent ground loops that may introduce electrical interference. In this scenario, the working voltage across the isolation barrier is typically no more than 10 V. The isolation barrier must not be used to isolate mains supplies.

Applications Information

The N23201 module has 2 transmitter channels and 2 receiver channels. They are typically used to implement bi-directional serial links consisting of one transmit signal line and one receive signal line. Two such serial links can be implemented using the N23201 module. The pin-out of the system connector facilitates this usage, with connections for serial link 1 and serial link 2 grouped separately.

The 2/2-channels are general purpose in nature and any other usage is allowed to suit particular requirements. For example, older implementations of serial links include two additional signals to control data flow (hardware handshaking), RTS and CTS. The N23201 module can be use to implement one serial link with hardware handshaking.

Wiring

The naming and connector pin-out conventions for RS-232 serial links are not well defined and commonly cause problems for wiring between equipment. Rather than relying on traditional naming conventions you should consult equipment data sheets to identify whether signals are transmitter outputs or receiver inputs.

The naming convention for RS-232 signals on the N23201 module is:

- TX1 and TX2 are transmitter outputs – output channels with signals that are transmitted away from the module.
- RX1 and RX2 are receiver inputs – input channels with signals that are received into the module.

A TX1 or TX2 transmitter output on the module must be connected to a receiver input on the other equipment, and vice versa. Consult the documentation for the other equipment to ensure the RS-232 receive and transmit line are correctly identified.

FTDI USB to RS-232 Serial Converter Cables

A USB to RS-232 serial converter cable can be used to provide a serial interface on a PC or laptop. Suitable cables are manufactured by FTDI, e.g. part number USB-RS232-WE-1800-BT-0.0 with 1.8 m cable and USB-RS232-WE-5000-BT-0.0 with 5.0 m cable.

Figure 3 shows the typical connections for a simple bi-directional serial link. This shows that the RXD receiver input of the serial converter cable is connected to the TX1 transmitter output on the N23201 module and, conversely, the TXD transmitter output is connected to RX1 receiver input.

The corresponding TXD1 and RXD1 signals on the MCU interface of the module must also be routed to appropriate pins on the MCU. You should consult the SwitcherGear Configuration Document for your controller to confirm the routing. For example, for a C2000 microcontroller, the module's TXD1 signal must be routed to a pin of the MCU that includes in its mux (multiplexer) grouping the TXD signal for a SCI peripheral. And the module's RXD1 signal must be routed to a pin of the MCU that includes the RXD signal for the same SCI peripheral.

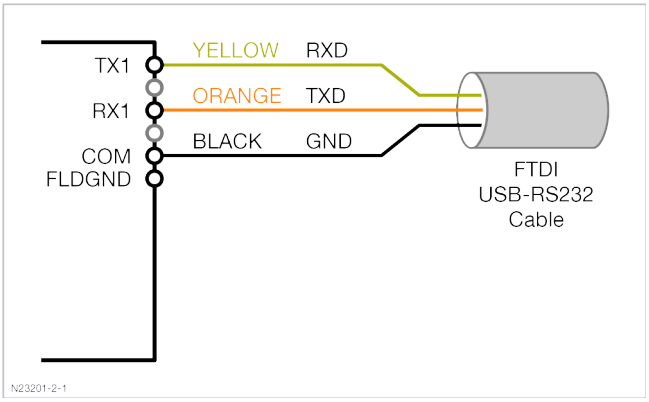

Figure 3: Connection of USB-RS232 cable to serial link 1 of the module.

Figure 4 shows how to connect two USB-RS232 serial converter cables to the N23201 module for two independent, bi-directional serial links. Again, the TXD1/RXD1 and TXD2/RXD2 signals on the MCU interface of the module must be routed to appropriate serial communications resources on the MCU.

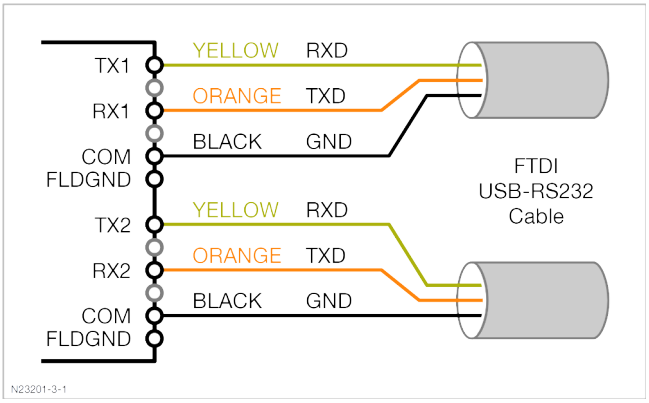

Figure 4: Connection of USB-RS232 cables to both serial links of the module.

Figure 5 shows the typical connections for a serial link with hardware handshaking. In this case, the TXD1/RXD1 signals on the MCU interface of the module are routed to an appropriate serial communications resource on the MCU. The TXD2/RXD2 signals on the MCU interface should be routed to general-purpose digital i/o pins on the MCU that are software controlled to provide the RTS and CTS behaviour.

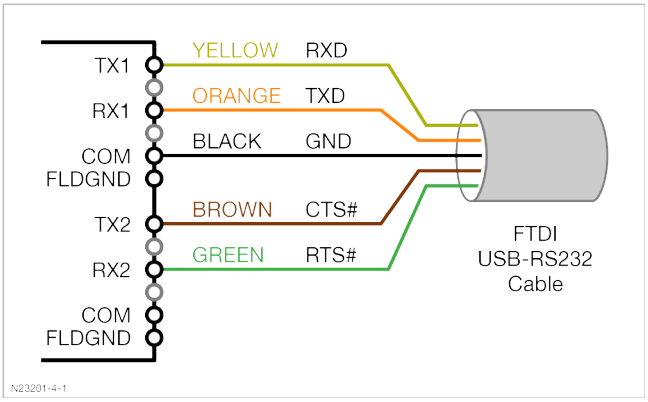

Figure 5: Connection of USB-RS232 cable for serial link with hardware handshaking.

The USB-RS232 serial converter cable can be configured using the Device Manager (Windows). The device will appear as a COM device under the heading **Ports (COM & LPT)**. If there are multiple COM devices, you can identify a specific device by monitoring the list as you plug and unplug the device. You should make a note of the COM number of the device – it will be required by the application that uses the serial port.

Right-click on the device entry and select **Properties** to edit the port settings. The port settings of the USB to RS-232 serial converter must be the same as the settings used by the serial communications resources on the SwitcherGear host MCU.

Host MCU

Texas Instruments C2000

When using a C2000 microcontroller, the serial data signals of the module should be connected to a SCI peripheral or GPIO data pins.

SwitcherWare Library

The SwitcherWare Library from Denkinetic includes code resources to handle the low-level hardware configuration and provide a simple-to-use interface for the N23201 module. See the SwitcherWare documentation for the class `SerialPort` for more information. The SwitcherWare library also includes examples for using the N23201 module for serial communications and many others.

Warnings

The terminals of the system connector (TXx, RXx, COM) must not be connected to a mains supply or circuits connected to a mains supply.

The length of cables connected to the system connector must not be longer than 30 m.

The user is responsible to ensure that the cables and connectors used for external wiring have insulation and/or separation distances that provide isolation from live parts and from earth.

Electrical Characteristics

The following specifications apply for T_A = 25 °C, unless otherwise noted.

Parameter	Conditions	Min	Typ	Max	Unit
RECEIVER					
Input Voltage		-25		25	V
Positive-Going Input Threshold			1.8	2.4	V
Negative-Going Input Threshold		0.8	1.5		V
Input Hysteresis			0.3		V
Input Resistance		3	5	7	kΩ
TRANSMITTER					
High-Level Output Voltage		5	5.5		V
Low-Level Output Voltage		-5	5.4		V
Short-Circuit Output Current			±35		mA

Timing Characteristics

The following specifications apply for T_A = 25 °C, unless otherwise noted.

Parameter	Conditions	Min	Typ	Max	Unit
Transmitter data rate				1	Mbit/s
Transmitter pulse skew			300		ns
Receiver propagation delay time			300		ns
Receiver pulse skew			300		ns

Revision History

Revision	Date	Changes From Previous Release
1	4 Mar 2020	▪ Original release.
2	23 Feb 2021	▪ Added wiring information for FTDI USB to RS-232 serial converter cables.