SL-253 RS232<->20mA converter

The SL-253 is a compact converter, which transforms RS-232 voltage signals into current, known as 20mA current loop.

1. When should one use 20mA loops?

Apart from the obvious reason, when you're connecting an RS-232 device (PC) to a device that has an inbuilt 20mA interface (i.e. PLCs) here are some situations when you should use current loops to connect two RS-232 devices, using an SL-253 converter on both sides:

- When the devices that need to be connected far from each other (more than 15m).
- When the signal cables are exposed to electromagnetic interference: they pass beside other signal or power cables. Cables that power electric motors and fluorescent tubes are especially good sources of interference.
- When there's a voltage difference between the referent points (grounds) of the two devices that need to be connected. This induces ground loops that not only corrupt data but can destroy equipment. The reason for this effect is usually bad electric installation in the building in question and/or a higher than permitted earthing resistance.

2. When can one use 20mA loops?

Current loops are usually made to convert and transmit only the Rx/Tx signals of the serial interface. (To do this, you need 4 wires altogether, with a minimum surface of 0,14mm2). This means that current loop is not well adapted to serial channels that require hardware handshake lines.

This problem can usually be solved by setting the communication channels to use software handshaking like the XON/XOFF protocol. If there is no way around using extra signalling lines, it is possible to use two (or more) converters at each side of the communication line. Each converter will provide one incoming and one outgoing channel. One has to make an adapter for both sides of the communication channel, that will route the signals from one D25 connector of the RS-232 device in question to the multiple D25F connectors of the SL-253 converters.

The speed of the SL-253 is limited to 19200 Bd. It can even be less when the cable length is more that 500m. The maximum speed is limited by the cable length and the properties of the cable: resistance, capacitance and inductance.

3. Passive side / active side ??

If we look at one channel only, TX for example (T+ and T- lines at the sending end are connected to the R+ and R- lines at the receiving end respectively) we can see that one side, and one side only has to provide the voltage for the current source so the communication can function at all..The side that is set up to provide the current source is called the "active" side, the other being the "passive". Various combinations are possible, both the Tx and the Rx side of both converters can be either passive or active.

If at least one of the channels (Rx or Tx) of a converter is configured as active, then you will need to connect a power supply to the converter. It is therefore logical to set the converters so that one has both Rx and Tx channels as active, the other side being both passive. This way you don't need a power supply on the side of the passive converter. Furthermore, if you are using multiport serial cards, you can probably use a single AC/DC adapter to power all the converters connected to the ports (4, 8 or 16). A single converter needs about 50mA at the peak so you can calculate the current requirements of the AC/DC adapter for multiple converter supply.

4. The SL-253 converter

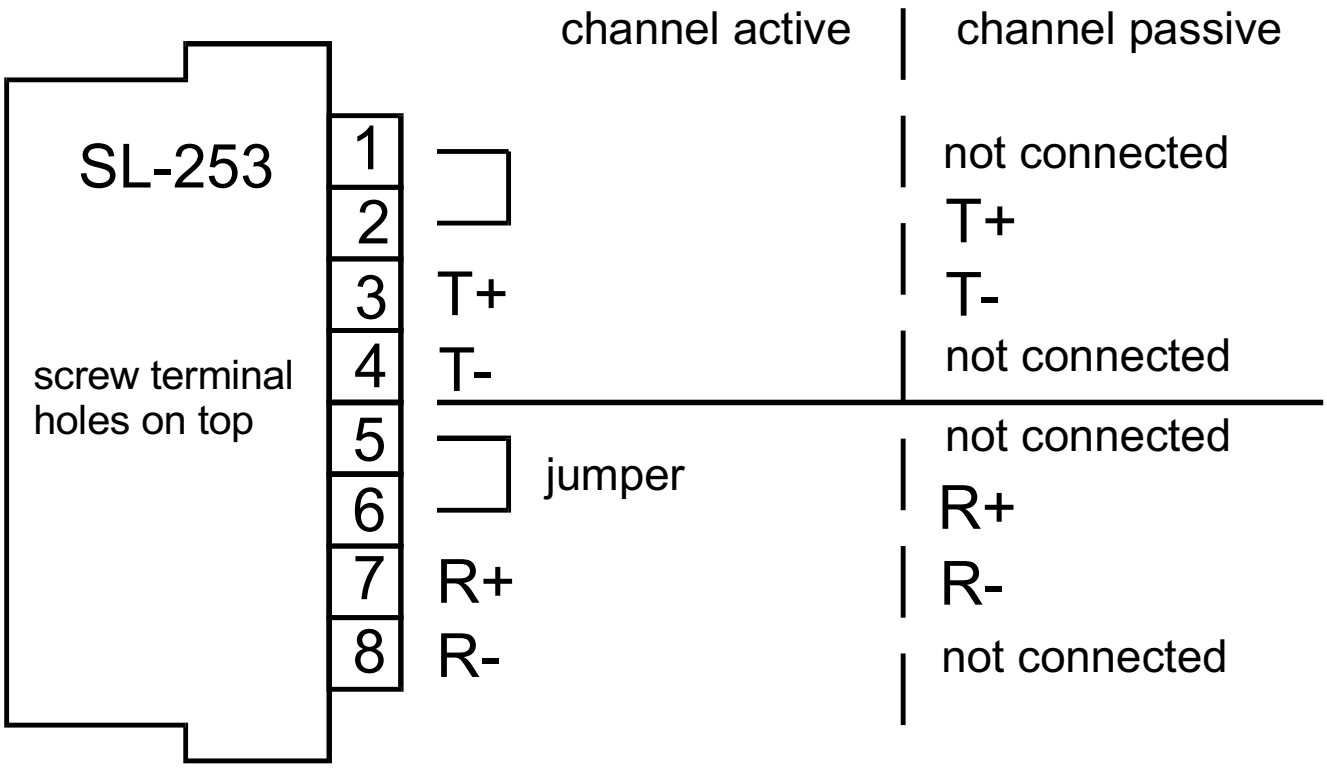
The converter has a D25F (female) connector on the RS-232 side. It is meant for connection to a standard IBM PC COM port. It can also be connected directly to most multiport cards and terminals. Some multiport card manufacturers, for unknown reasons, put female connectors onto their adapter boxes or cables. If this is the case, you need a male-to-male adapter to connect the converter to this equipment. If the converter is used in the "active" mode, you will need to attach an external DC voltage source (8-18V).

This voltage is brought to the converter via the short cable or "tail" that has a 9V block battery connector at the end.

It's possible to check if the applied voltage is OK by shorting the R+ and R- terminals with a piece of wire. (This can only be done if the Rx channel is set up for active mode.). The Rx LED lights up when we short the diode of the RX channel.

If the LED doesn't light up, you probably connected the voltage with the wrong polarity. This will not harm the converter.

The screw terminal contacts are visible on the sticker:.



We can test the functionality of the converter with any terminal program. Connect it so that R+ is shorted to T+ and R- to T-. Setting the Tx channel as active and the Rx as passive. You will need a power supply.

Now, with the terminal program, check to see if the transmitted characters are the same as the received ones (switch on "local echo"). Also, the LED indicators on the converter will blink when you send a character. (The blinking will be more noticable at lower Baud rates).

5. Technical details

The converter uses the following signals on the RS - 232 side:

2. TxD OUTPUT (from the PC - a)
3 RxD INPUT
4. RTS OUTPUT
5. CTS
6. DSR
7. GND SIGNAL GROUND
8. DCD
20. DTR OUTPUT

The communication itself uses only the TxD and RxD signals and the reference pin GND. The whole RS-232 side is galvanically isolated from the loop and has a 'phantom' supply from the RS-232 output signals: TxD, RTS and DTR. This is why you must use the RTS and DTR, though you can also connect these pins to fixed voltages if they are available. It isn't important which voltage (+12V or –12V) is connected to which pin. The positive voltage is the more important of the two (actually, any voltage between 6V and 16V will do), the -12V is necessary only if the threshold of the RS-232 receiver (RxD pin) is set to –3V and not 0V. (According to the RS-232 standard, the thresholds are –3V and +3V, with an undetermined area between these two voltages. Most equipment manufacturers, however set the threshold at 0V so that a 0V level is accepted as a LOW.