

## 03.2 Universal asynchronous receivers–transmitters

Universal asynchronous receivers-transmitters (UARTs) are hardware devices that allow microcontroller CPUs to asynchronously, serially communicate with other devices of the microcontroller or peripheral devices.

Often, the data input to a TX UART arrives in parallel but must be transmitted in serial. This is achieved via a shift register operating in parallel-in, serial-out (PISO) mode. Consider the byte 1101 0001 into a four-bit shift register.

Table 03.1 shows the register contents at each step of transmission.

**Table 03.1:** a four-bit shift register operating in PISO mode transmitting the byte 1101 0001 in serial.

registers	output
0 0 0 1 →	
1 0 0 0 →	1
0 1 0 0 →	0
1 0 1 0 →	0
1 1 0 1 →	0
0 1 1 0 →	1
0 0 1 1 →	0
0 0 0 1 →	1
0 0 0 0 →	1

In the corresponding RX UART, the opposite process called serial-in, parallel-out (SIPO) is also performed with a shift register in SIPO mode.

A UART can transmit and receive data with different rates, parity bits, stop bits, etc., and therefore must be properly configured. If a peripheral device requires a certain serial communication configuration, the UART transmitter controlled by a microcontroller's CPU must match this configuration.

The myRIO microcontroller has a configurable UART interface that will be used in [Lab Exercise 03](#) to transmit data to the LCD display.