COMPUTERGESTÜTZTES EXPERIMENTIEREN I
(Computer-Assisted Experimentation I)
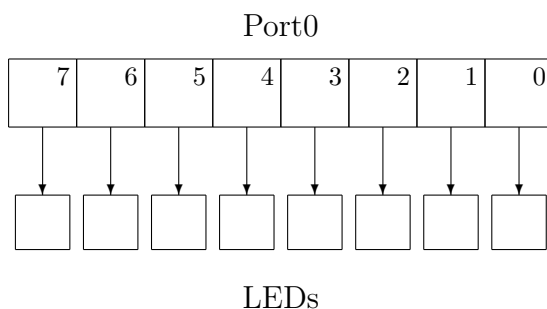
P R A C T I C A L
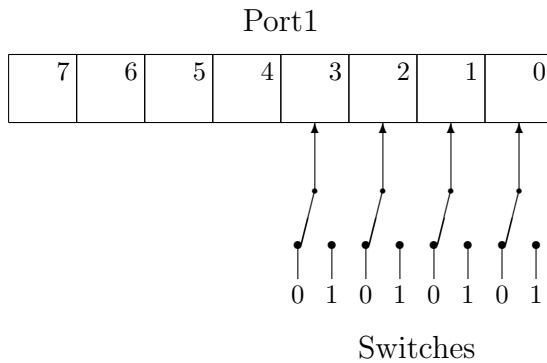## Programming in LabVIEW

Input and output of digital signals

Due to the digital nature of the modern computers, the communication between computer and experiment via digital signals is the simplest to implement. Digital interfaces are generally used when electrical lines connected to the outside world are turned on or off or to sense the state of incomming lines. Such lines may be used to control relais, stepping motors etc. or to sense switches, contacts etc.. In this practical exercise you will learn to employ the interface NI USB-6009 to do digital outputs and inputs. In contrast to the previous exercises the programming will not be done on high level VIs used for intelligent lab devices but on the lowest level of the interface.

The interface provides two ports that may be configured both for output and input. Port0 is controlled by an 8 bit register; port1 by the lowest 4 bits (nibble) of an 8 bit register.

In the exercises port0 is connected to eight LEDs while port1 is connected to four switches. Therefore, port0 has to be configured for output and port1 for input. This is done indirectly by using the appropriate functions of the NI-DAQmx Software (see Appendix NIDAQmx)

Port0

7	6	5	4	3	2	1	0

LEDs

Port1

7	6	5	4	3	2	1	0

0 1 0 1 0 1 0 1

Switches

For preparation find out which device is active on your PC using National Instruments Measurement & Automation Explorer. (Measurement & Automation Explorer → Konfiguration → Geräte und Schnittstellen (expand) → NI-DAQmx-Geräte (expand) active devices are green). Select Testpanels and then Digital I/O and test the two ports.

In LabVIEW you will find the functions for operating the interface under Functions → Measurement I/O → NI DAQmx. For an input or output you have to select and connect the VIs: Create Channel, Start Task, and Read or Write, respectively.

1. Create a program, in which you enter a character in the Userprompt window, convert it into internal represenation (ASCII character code) and write the bit pattern to port0. Compare the pattern on the LEDs to the bit pattern of the ASCII character code that you find on the internet.

2. Create a program, that reads the switches connected to port1 and moves the bit pattern across the LEDs connected to port0 .

3. Optional, in case you have time, a little challenge: create a program that reads a bit pattern from the switches as in the previous program, but you do a circular shift on port0. Using a toggle switch define the direction of the shift (left/right circular shift). Modify the program such that you can change the direction while it is shifting. How do you need to modify your program to allow a change of the bit pattern while shifting?

Objectives: Control of an experiment using "low level" interfaces in LabVIEW; accessing input and output interfaces via VIs, that encapsulate the device drivers; input and output of digital signals; bit manipulation operations; ASCII character codes.