University of Stuttgart
Institut für Ingenieurgeodäsie (IIGS)
Institute of Engineering Geodesy

Kinematic Measurement Systems

Summer 2019

Lab 1 + 2

Laboratories 1+2: Dates+Structure

Preparation

Lab 1

Lab 2

Date	Group	Room	Time
Tuesday 16.04.2019	All Students	24.01	11:30-13:00
Tuesday 23.04.2019	Group 1+2	CIP-Pool IIGS (6th Floor)	11:30-13:00
Tuesday 23.04.2019	Group 3+4	CIP-Pool IIGS (6th Floor)	14:00-15:30
Tuesday 30.04.2019	Group 1+2	CIP-Pool IIGS (6th Floor)	11:30-13:00
Tuesday 30.04.2019	Group 3+4	CIP-Pool IIGS (6th Floor)	15:45-17:15

Laboratories 1+2: Dates+Structure

Please choose your group!

- List is going around right now
- List will also put up on the IIGS Blackboard (6th floor, right hand side of the elevator)
- Once you‘ve chosen a group, you have to stay in until lab 2 ends
- Dates and times can be found in ILIAS

Laboratories 1+2: Dates+Structure

The Labs are mandatory!

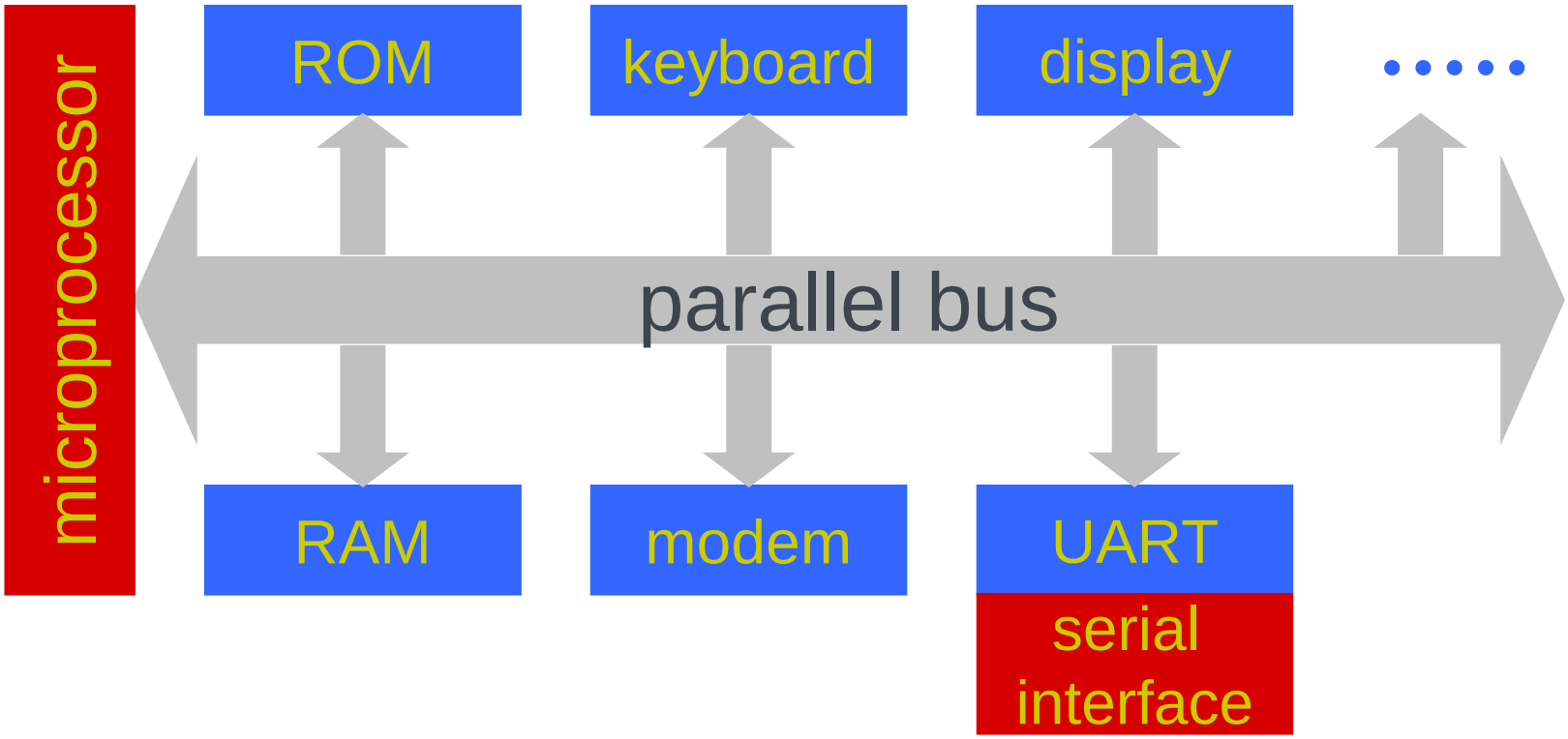
- You have to participate in all Labs
- They are precondition to take part in the final exam
- There is a guideline with rules for the labs and elaborations at IIGS, which you could find also in ILIAS

Programming of Robot Tachymeters

Principles

Content

1. Hardware of robot tachymeter



UART: Universal Asynchronous Receiver/Transmitter

2. Serial interface RS 232 C / V24

- Standardized communications channel
- Transmission protocol fixes the communication parameters:
  - Transfer rate in Baud = Bits/sec.
  - Number of data bits und stop bits
  - Parity check yes/no
- Interface uses handshakes to secure the communication
- At a transfer rate of 19200 Baud it‘s possible to transfer about 1700 ASCII characters/per second.

3. Communication

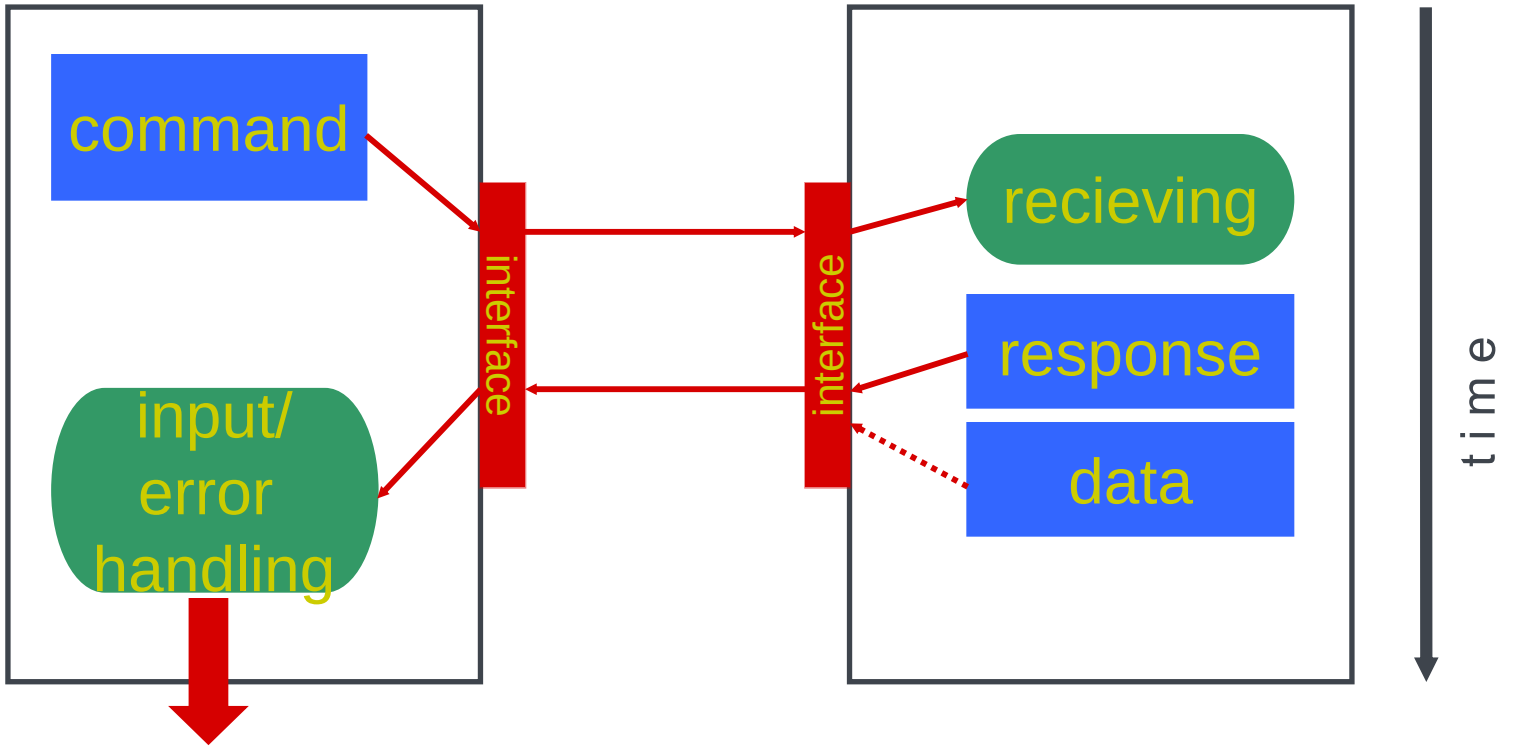
3.1 The demands for communication

- **Control commands of the tachymeter have to be known (manufacturers' instructions)**
- **The interface has to be requested permanent („auto-modus", no need for action)**

- **The PC must have a serial interface**
- **The use of any programming language is possible**
- **The interface has to be adressed within the program**
  - **Control commands have to be transferred to the tachymeter**
  - **The response of the tachymeter has to be processed.**

3. Communication

3.2 Operation of communication



4. Control commands (Leica GeoCom for TCRP1201,TS30)

Command	Response	Meaning
%R1Q,9028:0<cr>	%R1P,0,0:0	Change face (I in II)
%R1Q,2008:1,1<cr>	%R1P,0,0:0	New measurement.
%R1Q,2108:0,0<cr>	%R1P,0,0:1284,5.7175979871, 1.561920067, 1.81901	Get the data Hz-angle [rad] V-angle [rad] slope distance [m]
%R1Q,2006:1<cr>		Compensator on

Communication parameters:
transfer rate 19200 Baut, no parity, 8 bit, 1 stop bit

5. Contents of Lab 1

Task: Steering of the robot tachymeter

In this Lab functions should be created to establish the communication between the PC and the tachymeter to initiate the measurements using the graphical programming language “LabView”.

Following functions are needed:

- Initialising
- Steering *(e.g. change face, new measurement, readout the data)*
- Storage into file

For steering commands *‘write_and_wait_for_Ack.vi’* is needed. This function will be provided → check at ILIAS!

5. Contents of Lab 1

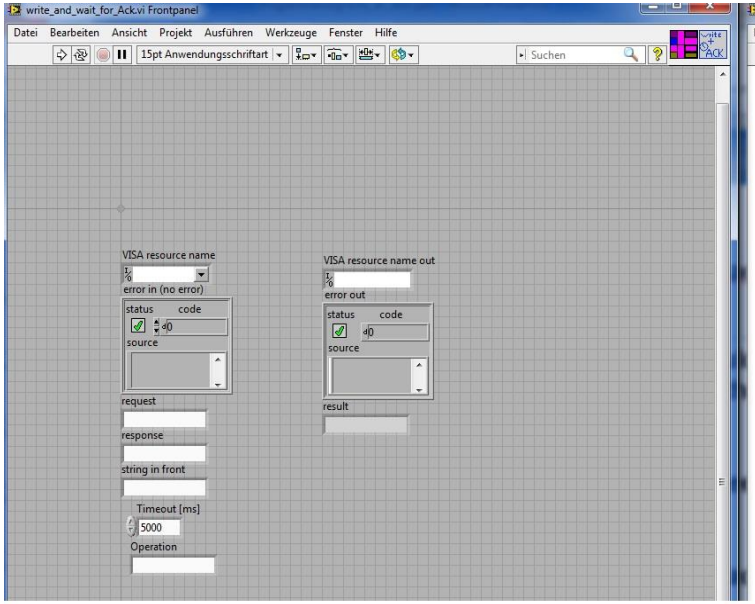
Task: Steering of the robot tachymeter

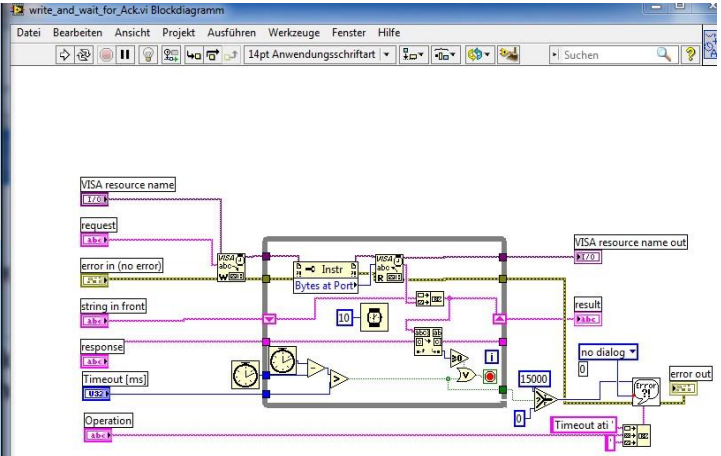
In preparation of Lab 1 I would recommend you to watch some introductory YouTube Tutorials about programming in LabVIEW. For example the first few Videos of the Playlist “Getting Started with LabVIEW” by YouTube Channel “LabVIEW”

https://www.youtube.com/watch?v=ZHNlKyYzrPE&list=PLB968815D7BB78F9C

5. Contents of Lab 1

write_and_wait_for_Ack.vi'





6. Contents of Lab 2

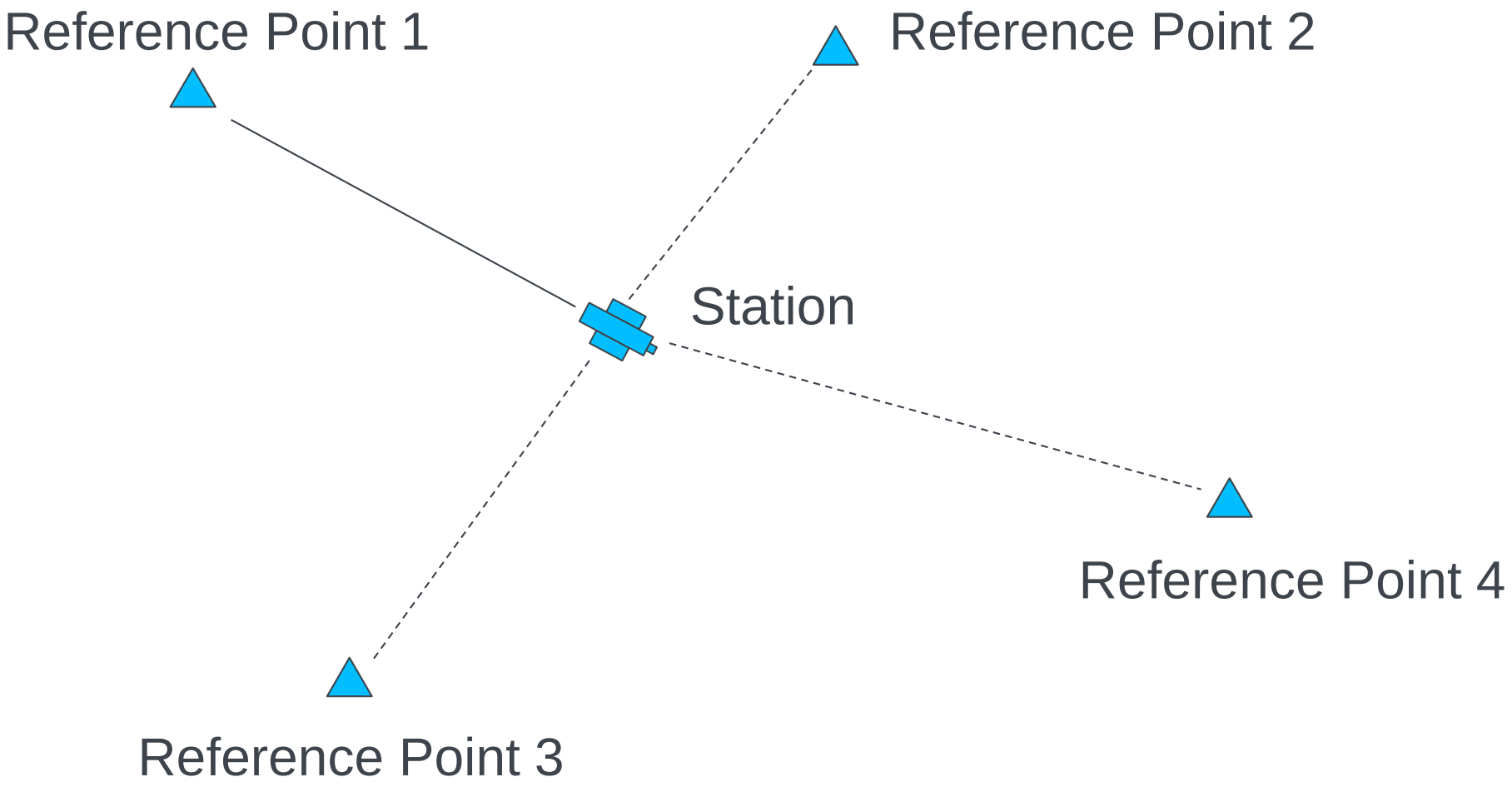
Task: Programming the robot tachymeter

Here, the measured data should be processed. The main focus is to program a free stationing for the tachymeter using the Helmert Transformation and determine the coordinates of new object points, using the measured polar elements.

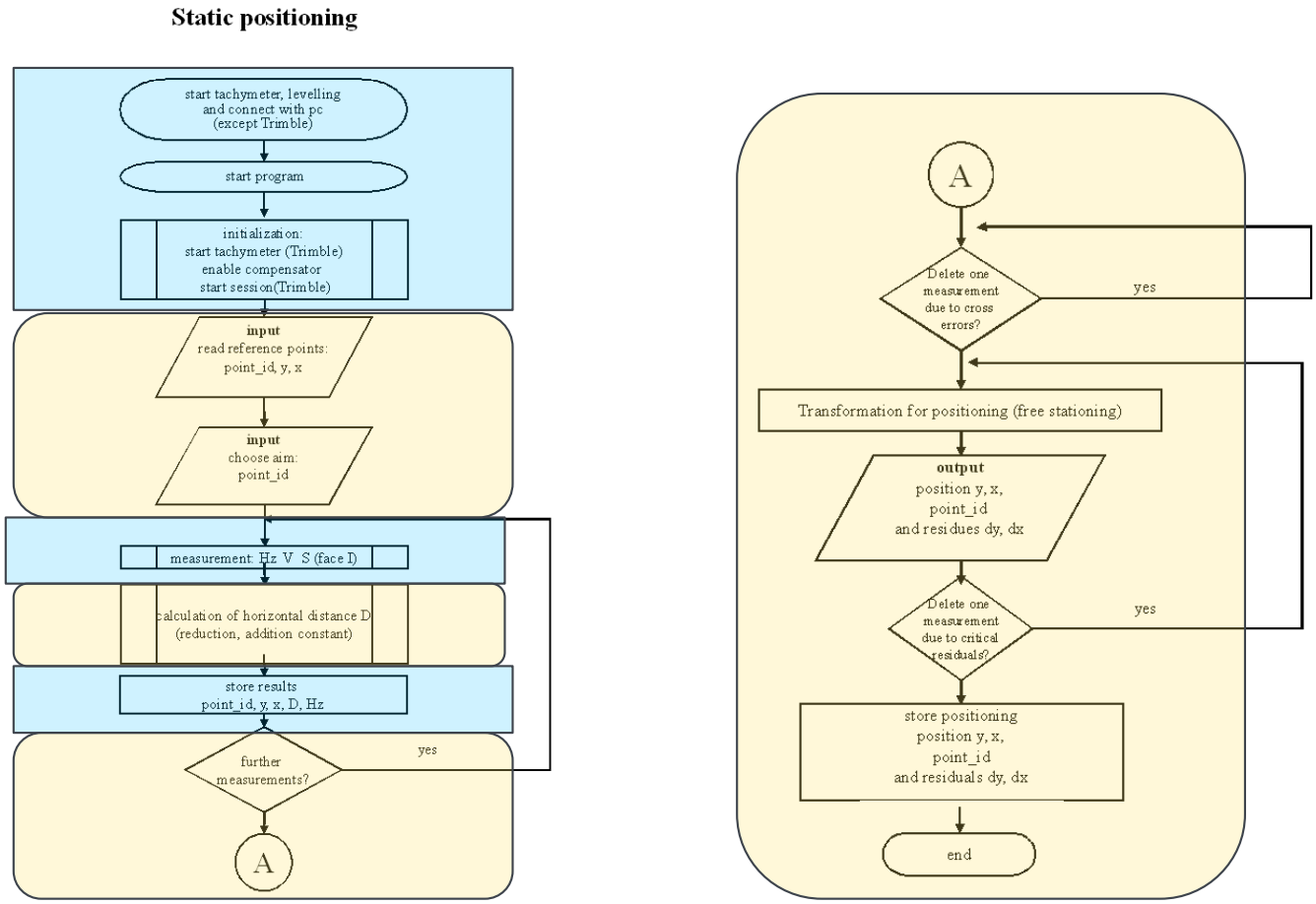
Following functions are needed:

- Readout of the measured data
- Reduction of slope distances
- Computation of local coordinates
- CoordinateTransformation from local to global reference system
- Coordinates determination of new object points in global system
- Data storage to file

Free Stationing - Principle



Workflow


Static positioning
start tachymeter, levelling and connect with pc (except Trimble)
start program
initialization: start tachymeter (Trimble) enable compensator start session(Trimble)
input read reference points: point_id, y, x
input choose aim: point_id
measurement: Hz V S (face I)
calculation of horizontal distance D (reduction, addition constant)
store results point_id, y, x, D, Hz
further measurements?
yes
A
A
Delete one measurement due to cross errors?
yes
Transformation for positioning (free stationing)
output position y, x, point_id and residues dy, dx
Delete one measurement due to critical residuals?
yes
store positioning position y, x, point_id and residuals dy, dx
end
- Contents of lab 1
- Contents of lab 2

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Thank you!

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