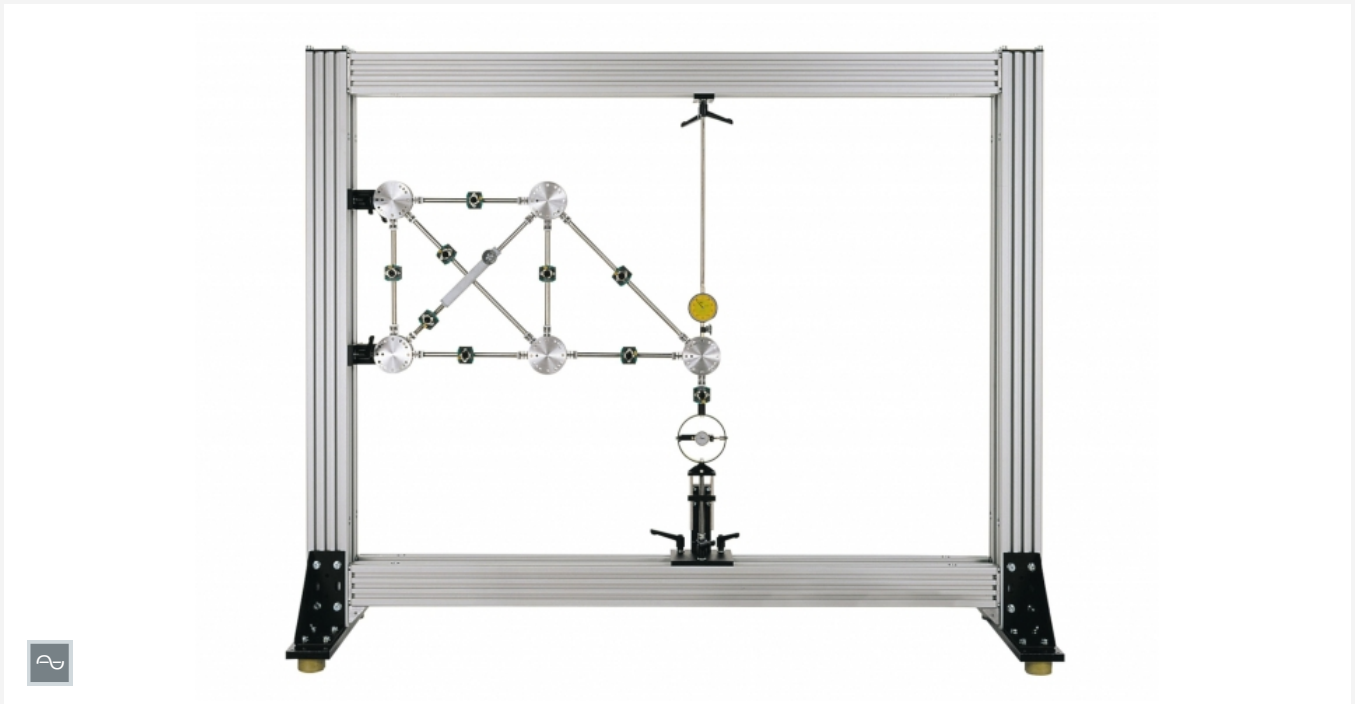


## SE 110.22

### Forces in an overdeterminate truss



The picture shows SE 110.22 in a frame similar to SE 112.

#### Description

- **comparison of forces in statically determinate and overdeterminate trusses**
- **bars with strain gauge measurement to measure bar force**

With surplus bars a statically determinate truss becomes internally statically indeterminate. In this case the truss is termed statically overdeterminate. In an overdeterminate truss, the bar forces depend on the elastic properties of the truss and cannot be calculated easily.

The SE 110.22 experimental setup permits investigation and comparison of statically determinate and statically indeterminate trusses.

Using the bars and node disks, a statically determinate, single plane truss is first constructed. On installation of a surplus bar the truss becomes overdeterminate. By way of a load application device, straight or inclined forces are applied to the truss, thereby simulating various load cases. The occurring tensile and compressive forces in the bars are recorded by means of strain gauge measurement.

Computerised evaluation of measured values is provided by measuring amplifier FL 152. The software in FL 152 is used to manage the measuring data and provide graphical representation of the bar forces. The software features a comprehensive help function.

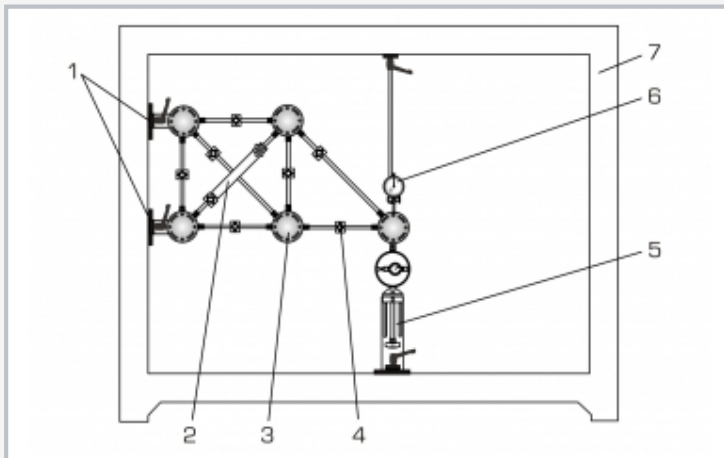
All the component elements of the experiment are clearly laid-out and housed securely in a storage system. The complete experimental setup is arranged in the frame SE 112.

#### Learning objectives/experiments

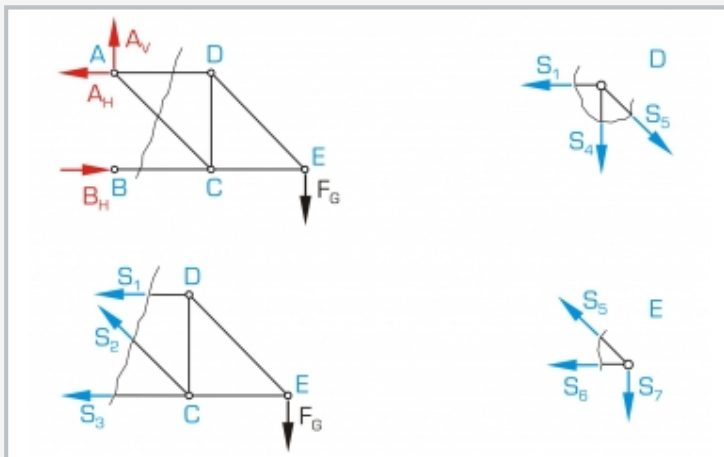
- measurement of the bar forces in a statically determinate and a statically overdeterminate, single plane truss
- distribution of forces in the single plane truss dependent on the use of a surplus bar
- dependency of the bar forces on the external force
  - ▶ magnitude, direction, point of application
- comparison of measuring results with mathematical methods
  - ▶ method of joints
  - ▶ Ritter's method of sections
- basic principle: measurement of forces using strain gauge measurement

# SE 110.22

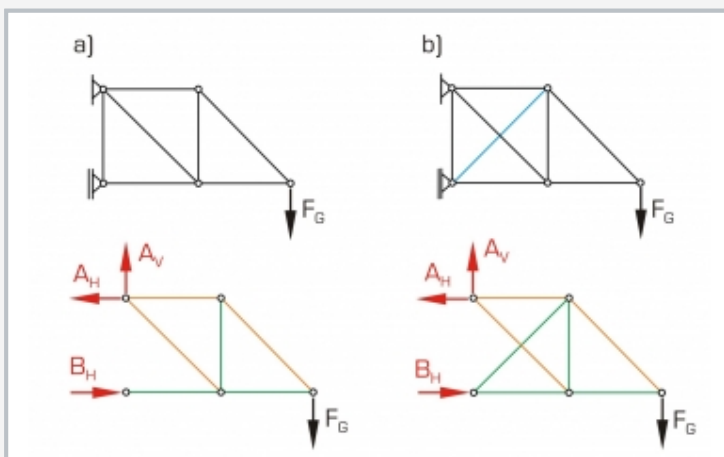
## Forces in an overdeterminate truss



1 support, 2 surplus bar (adjustable), 3 node disk, 4 bar with measuring point, 5 load application device, 6 dial gauge with fixture, 7 frame SE 112



Free-body diagram of truss, Ritter's method of sections:  
A, B, C, D, E: nodes, black: applied force, red: support reactions, blue:  $S_1$ - $S_7$  bar forces



a) statically determinate truss, b) statically overdeterminate truss;  
red: support reactions, black: applied force, blue: surplus bar, green: compression bars (struts), orange: tension bars (ties)

### Specification

- [1] investigation of bar forces in statically overdeterminate trusses
- [2] surplus bar, longitudinally adjustable
- [3] straight and inclined loading possible
- [4] load application device with force gauge mountable on different node disks
- [5] measuring point to measure force on each bar
- [6] measuring amplifier FL 152 required
- [7] GUNT-software in FL 152 to evaluate measured values graphically
- [8] storage system to house the components
- [9] experimental setup in frame SE 112

### Technical data

Bars: 8

- 5 bars, fixed 300mm
- 2 bars, fixed 424mm
- 1 bar, adjustable 400...450mm
- angle between bars: 30°, 45°, 60°, 90°
- maximum bar force: 500N
- measuring point on each bar
- height of truss max. 270mm
- length of truss max. 500mm

Load application device

- ±500N
- graduation: 10N

Dial gauge: measuring range: 0...20mm

LxWxH: 1170x480x178mm (storage system)

Weight: approx. 22kg (total)

### Scope of delivery

- 1 set of bars
- 5 node disks
- 1 load application device
- 1 dial gauge
- 1 set of cables
- 1 storage system with foam inlay
- 1 set of instructional material

# SE 110.22

## Forces in an overdeterminate truss

Required accessories

021.15200	FL 152	Multi-channel measuring amplifier
022.11200	SE 112	Mounting frame