



## FRAME DEFLECTIONS AND REACTIONS

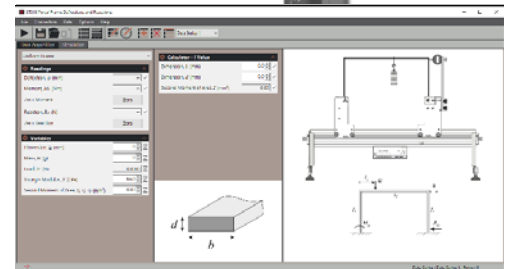


Experiment for the study of rectangular portals subjected to vertical loads. Mounts on the Structures platform and connects to the Structures automatic data acquisition unit and software (VDAS® Onboard).



SHOWN FITTED TO THE STRUCTURES PLATFORM (STS1, AVAILABLE SEPARATELY)

LAPTOP NOT INCLUDED



SCREENSHOT OF THE VDAS® SOFTWARE

### KEY FEATURES

- One of a range of experiment modules that teach structures principles
- Fits to the Structures platform for ergonomic use and space-saving storage
- Includes two different portal frames for experiments with uniform and non-uniform cross-section frames
- Includes Vernier caliper for measurement of cross-section
- Supplied with a storage tray to keep smaller items safe
- Direct reading of horizontal reaction and fixing moment for quick and simple experiments
- Works with user-friendly software (VDAS®)



# FRAME DEFLECTIONS AND REACTIONS



## DESCRIPTION

One of a range of experiment modules that fit to the Structures platform (STS1, available separately), this product helps students understand the deflections and reactions of a portal frame under various loading conditions.

Students fit one of a choice of two frames between two supports and apply vertical loads to the beam member. Load cells in the supports measure the bending moment and horizontal reaction at the base of the uprights due to the load. A precision indicator measures any horizontal deflection (sway) at the junction of the beam and the upright. Each support includes pointers that work with the scale on the platform for accurate positioning.

One of the frames has a uniform second moment of area for both the uprights and the beam, the other has one upright with a second moment of area of approximately half that of the other upright and the beam. Both frame beams can be loaded anywhere along their length. This allows the students to understand the two causes of frame sway other than direct loads.

Students apply loads to the portal frame. They use textbook equations and analysis to predict the reaction forces and fixing moments due to the load and whether or not the frame will sway and its magnitude. They compare predictions to measured and observed results. This helps confirm the reliability of the textbook equations and the accuracy of the experiment results.

This product includes a Vernier caliper for accurate measurement of the frame cross-section.

The deflection indicator has its own display but it can connect (with the load cells) to the USB interface hub of the Structures platform for computer display and data acquisition (VDAS® Onboard).

## STANDARD FEATURES

- Supplied with comprehensive user guide
- Five-year warranty
- Made in accordance with the latest European Union directives
- ISO9001 certified manufacturer

## LEARNING OUTCOMES

- Horizontal reaction and fixing moment due to a varying single point load on a portal frame
- Uniform and non-uniform cross-section portal frames
- Predicting sway direction by consideration of shear forces
- Use of the moment distribution (Hardy Cross) method to calculate bending moments, sway magnitude and horizontal support reactions
- Deflection (sway) of a portal frame due to loading asymmetry
- Deflection (sway) of a portal frame due to asymmetry of the uprights
- Plotting bending moment diagrams

## ESSENTIAL ANCILLARY

- Structures Platform (STS1)

## SOFTWARE

TecEquipment has created data acquisition applications (VDAS® Onboard) for each experiment module, with additional simulated experiments.

The simulated experiments allow students to simulate the hands-on laboratory experiments, verifying their results. They also allow simulation of alternative set-ups, such as other loading conditions and portal properties, extending the learning experience beyond the practical laboratory session.

## OPERATING CONDITIONS

### OPERATING ENVIRONMENT:

Laboratory

### STORAGE TEMPERATURE RANGE:

-25°C to +55°C (when packed for transport)

### OPERATING TEMPERATURE RANGE:

+5°C to +40°C

### OPERATING RELATIVE HUMIDITY RANGE:

80% at temperatures < 31°C decreasing linearly to 50% at 40°C

# FRAME DEFLECTIONS AND REACTIONS



## SPECIFICATIONS

TecQuipment is committed to a programme of continuous improvement; hence we reserve the right to alter the design and product specification without prior notice.

### DIMENSIONS AND WEIGHT:

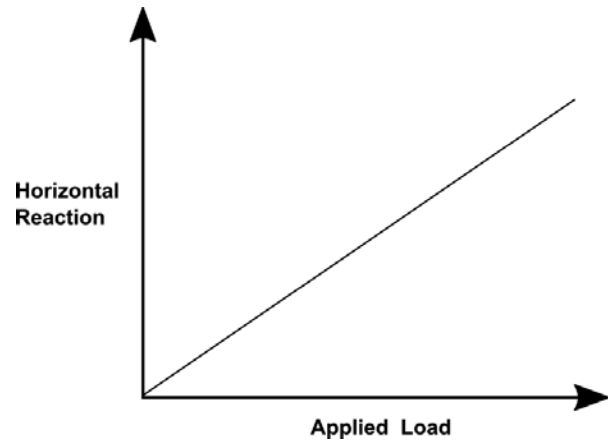
- Nett (assembled): 660 mm long x 100 mm front to back and 320 mm high and 6 kg
- Approximate primary packed (with storage tray): 0.07 m<sup>3</sup> and 8 kg

### SPACE NEEDED:

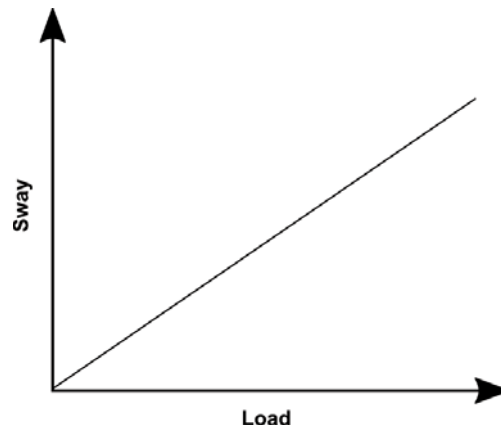
- 1500 mm x 600 mm, level bench or desk

### ITEMS INCLUDED:

- Two supports, one with horizontal reaction load cell, the other with a fixing moment load cell
- Uniform frame of 250 mm height x 500 mm length and nominal cross-section: 15 mm x 2 mm
- Non-uniform frame of 250 mm height x 500 mm length. Nominal cross-sections 15 mm x 2 mm and one vertical of 15 x 1.5 mm
- Three cables
- Three mass hangers
- 25 x 20 g masses
- Vernier caliper
- Storage tray
- Comprehensive user guide



TYPICAL EXPERIMENT RESULTS SHOWING THE LINEAR RELATIONSHIP BETWEEN LOAD AND HORIZONTAL REACTION



TYPICAL EXPERIMENT RESULTS SHOWING HOW AN INCREASING ASYMMETRICAL LOAD AFFECTS THE DEFLECTION (SWAY)