

Mechanics

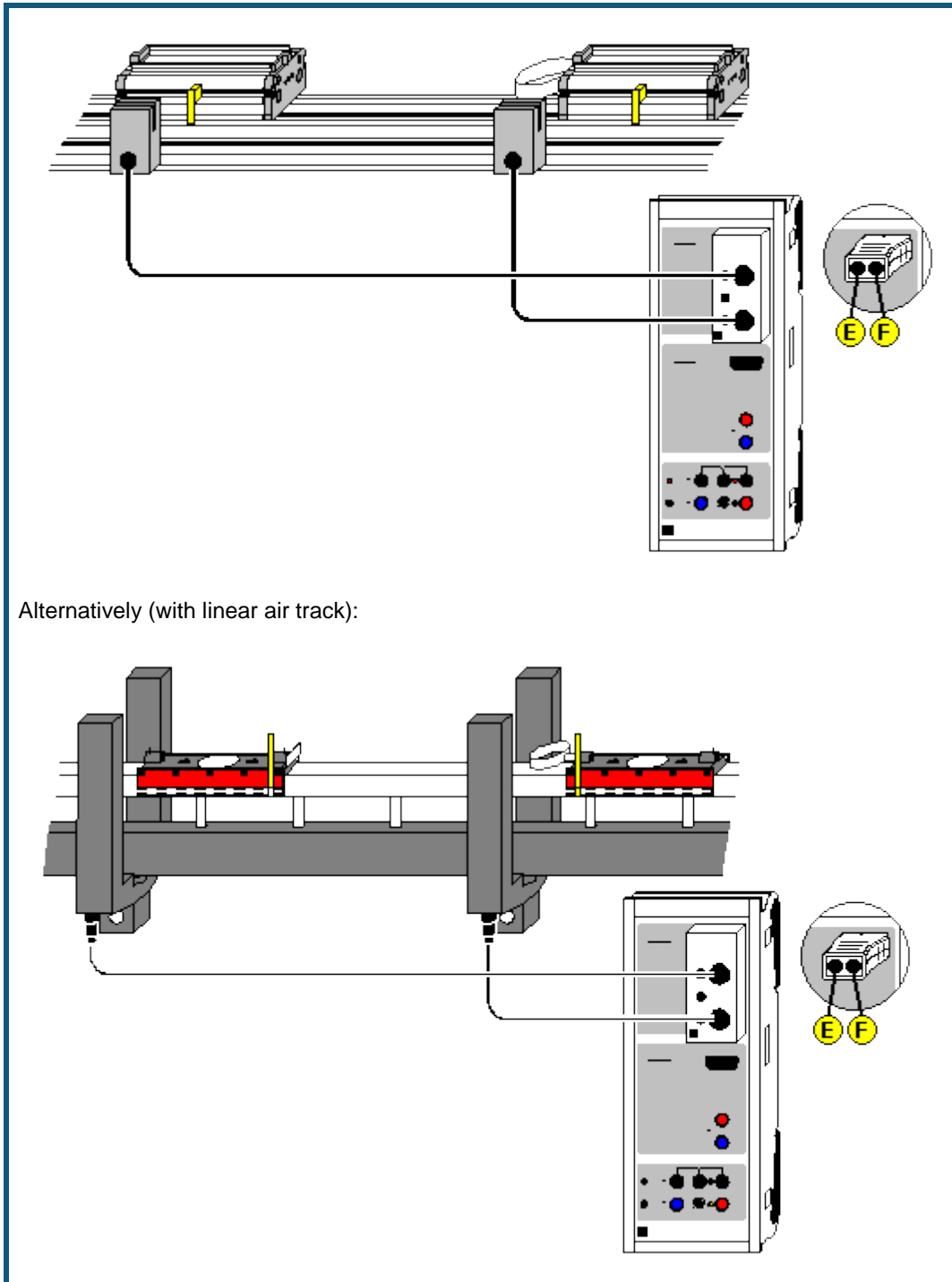
Translational motions of a mass point
Conservation of linear momentum

Energy and momentum in
elastic collision - Measuring
with two forked light barriers


Description from CASSY Lab 2

For loading examples and settings,
please use the CASSY Lab 2 help.

Conservation of momentum and energy (collision)



Alternatively (with linear air track):

 can also be carried out with [Pocket-CASSY](#)

Experiment description

On a track, the velocities v of two trolleys before and after their collisions can be measured from the obscuration times of two light barriers. By this means, it is possible to verify the law of conservation of momentum for elastic and inelastic collision, as well as that of conservation of energy for elastic collision.

Equipment list

1	Sensor-CASSY	524 010 or 524 013
1	CASSY Lab 2	524 220
1	Timer box or Timer S	524 034 or 524 074
1	Track	337 130
2	Trolleys	337 110
1	Pair of additional weights	337 114
1	Impact spring for trolley	337 112
2	Combination light barriers	337 462
2	Multi-core cables, 6-pole, 1.5 m	501 16
1	PC with Windows XP/Vista/7/8	

Alternatively (with linear air track)


1	Sensor-CASSY	524 010 or 524 013
1	CASSY Lab 2	524 220
1	Timer box or Timer S	524 034 or 524 074
1	Linear air track	337 501
1	Track support	337 45
1	Air supply	337 53
1	Power controller	667 823
2	Forked light barriers	337 46
2	Multi-core cables, 6-pole, 1.5 m	501 16
1	PC with Windows XP/Vista/7/8	

Experiment setup (see drawing)


First put the track into operation and position the two light barriers (at inputs E and F of the timer box) so that the trolleys collide **between** the light barriers. The flags of the two trolleys must interrupt the light barriers when they pass through.

Carrying out the experiment

■ Load settings

- Enter masses m_1 and m_2 in the table (activate keyboard input in the cells beneath m_1 and m_2 with the mouse).
- Enter the trolley arrangement before collision in relation to light barriers E and F ([Settings v1, v2, v1' or v2'](#)). There are four different arrangements:
Both trolleys outside of light barriers.
Left trolley between light barriers, right trolley outside.
Right trolley between light barriers, left trolley outside.
Both trolleys inside (explosion).
- Enter the flag width (also in [Settings v1, v2, v1' or v2'](#)).
- Initiate the collision (if velocities are displayed before the collision, you can clear these with $\rightarrow 0 \leftarrow$) and watch to make sure that the light barriers do not register any extra pulses (e.g. due to reflection of a trolley at the end of the track).
- Terminate the measurement with [End of Collision](#) (the measurement is terminated automatically after four measured velocities).
- Transfer the measured values to the table for evaluation with  or initialize the next measurement with $\rightarrow 0 \leftarrow$.

Evaluation

Tables have been pre-defined for momentum before and after collision, total momentum, energy, total energy and energy loss; you can transfer measured values to these tables with . Click on the table tabs to display these. If you want these quantities to be visible immediately after collision, open the corresponding display instruments.

You can also define additional [formulas](#) to compare your results with theory. For elastic collision, we say that

$$v_1' = (2 \cdot m_2 \cdot v_2 + (m_1 - m_2) \cdot v_1) / (m_1 + m_2)$$

$$v_2' = (2 \cdot m_1 \cdot v_1 + (m_2 - m_1) \cdot v_2) / (m_1 + m_2)$$

For inelastic collision, the following applies:

$$v_1' = v_2' = (m_1 \cdot v_1 + m_2 \cdot v_2) / (m_1 + m_2).$$