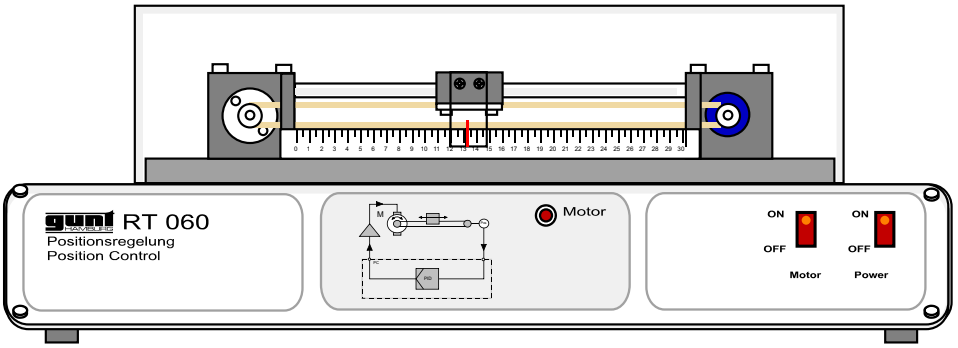
Equipment for Engineering Education

Instruction Manual

RT 060 Linear Position Control Unit

G.U.N.T. Gerätebau GmbH
Fahrenberg 14
D-22885 Barsbüttel
Germany
Phone: ++49 (40) 670854.0
Fax: ++49 (40) 670854.42
E-mail: sales@gunt.de
Web: http://www.gunt.de

RT 060 **LINEAR POSITION CONTROL UNIT**



Instruction Manual

Please read and follow the safety regulations before the first installation!

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1 Introduction

The **RT 060 position control model** represents a typical loop control system, as is standard and widespread in engineering.

The actual loop is a positioning carriage. An externally actuated electric motor performs the actuator function and positions the carriage on a linear guide. The absolute carriage position is determined by a rotary encoder and provided as a voltage signal.

The model must be supplemented by a separate external controller to create a complete control loop. It communicates with the peripheral equipment (e.g. a PC) via a USB interface.

The most suitable control and regulation program is the associated software **RT 010 - RT 060 Principles of control engineering**.

In conjunction with the software, an extensive individual experimental program is available for the model, which includes the following application areas:

- Influence of controller design on control action
- Stability of control loop
- Controller optimisation

The clear real loop model is closely related to reality and thus aids understanding to a greater extent than pure computer simulation. The processes taking place on the model can easily be observed through the transparent protective hood.

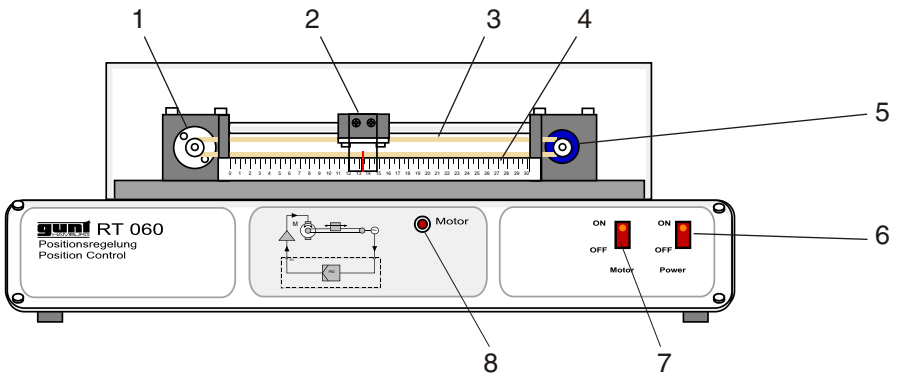
As a compact table-top model that does not require much space, it is particularly suitable for simultaneous experiments at multiple desks in the same room.

The software's networking capability also allows extensive systems to be set up.

The **RT 060 position control model** is not designed for industrial use, but is intended exclusively for teaching and training purposes.

2 Description

2.1 Equipment layout

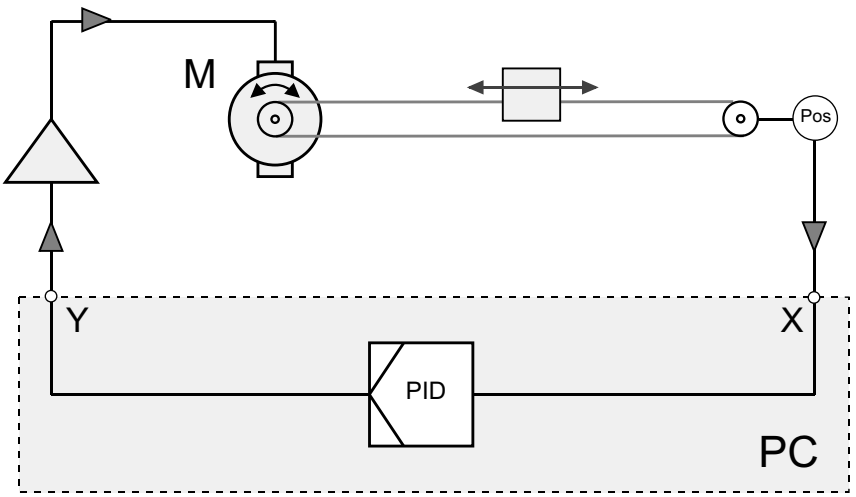


1 Actuator motor
2 Positioning carriage
3 Toothed belt
4 Linear scale
5 Rotary encoder
6 Master switch
7 Motor switch
8 Motor signal lamp

> USB plug-in connection (rear of unit)
> Mains connection (rear of unit)

Fig. 2.1 RT 060 Overall View

2.2 Process diagram



2.3 Function

The **RT 060 position control model** is used as a simple loop for a controller. It does not include a controller itself; all control processes must be run externally. The **"RT 010 = RT 060 Principles of control engineering"** learning and exercise program is ideally suited for this purpose.

The model communicates with external devices via a USB interface, for which it has a plug-in connection on the rear.

An electric DC motor (1) with secondary spur wheel transmission acts as the actuator and drives the positioning carriage (2) along a guide by way of a toothed belt (3). The motor can turn in both directions at the same speed. The motor can be separated from its actuation signal as required using the associated motor switch (7). The motor signal lamp (8) indicates whether the motor is actuated.

A multi-start potentiometer is coupled to the deflection roller on the toothed belt. This acts as a rotary encoder (5) and represents the measuring instrument in the system. The position of the potentiometer corresponds to a precisely defined position of the carriage. A signal for the absolute carriage position is thus available in the form of an electric voltage.

The carriage position is read off on the linear scale (4) with the aid of a pointer fixed to the positioning carriage. The two end positions of the carriage (0 m and 0.3 m) are monitored by separate switches on the carriage guide. The motor is automatically shut down if the carriage reaches one of the two end positions.

NOTE: The actuator motor has a **response threshold**. This means that it only starts to move when the control signal **y** is at least 15% of its full final value (~ 0.75 V).

2.4 Commissioning

– Connect the model to the mains using the connecting socket on the rear.
– Using the USB port on the rear of the model, connect it to an external controller (e.g. PC).
– Switch on the model at the master switch (6)
– Switch on the motor switch (7)

The model is now ready for use.

Shutting down

To shut down, the model only needs to be switched off at the master switch.

The model should be disconnected from the mains if it will not be used for a long period of time.

The unit is maintenance free and does not require any additional servicing.

3 Safety

3.1 Health hazards

DANGER! Caution when making changes to the electrical components in the system! There is a risk of electric shock.

Do not open the housing of the unit. Disconnect the mains connector prior to any necessary work.

Only have work performed by suitably qualified personnel.

Protect the unit from moisture and dampness.

DANGER! Never operate the unit without a correctly installed earth wire. Non-compliance with this requirement means that the operator and the unit are no longer adequately protected.

CAUTION! Moving parts

There is a risk of serious injuries.

Do not touch the carriage or the toothed belt during operation. Do not operate the unit without the protective hood.

3.2 Hazards for Equipment and Function

CAUTION! Do not obstruct or block the carriage during operation. This can cause damage to the unit.

CAUTION! Risk of corrosion

Protect the unit from moisture and dampness.

4 Appendix

4.1 Technical data

L x W x H:	600 x 410 x 280 mm
Weight:	approx. 12 kg
Mains supply:	230 V , ~50 Hz
Optional alternatives, see rating plate	

Actuator motor:

Type:	DC motor with gears
Transmission	1 : 10
Carriage travel	0 ... 300 mm
Travel speed	max. 45 mm/s
Response threshold	(y) = min. 15 %
	(~ 0,75 V)
Toothed belt (DIN 7721)	
Graduations	2,5 mm
Length	915 mm
Width	6 mm

Position sensor:

Type:	Potentiometer
Output signal	0 ... 5 V
corresponds to	0 ... 300 mm

PC communication	USB

4.2 Items supplied

1	Complete model
1	USB cable
1	Mains cable
1	Operating instructions