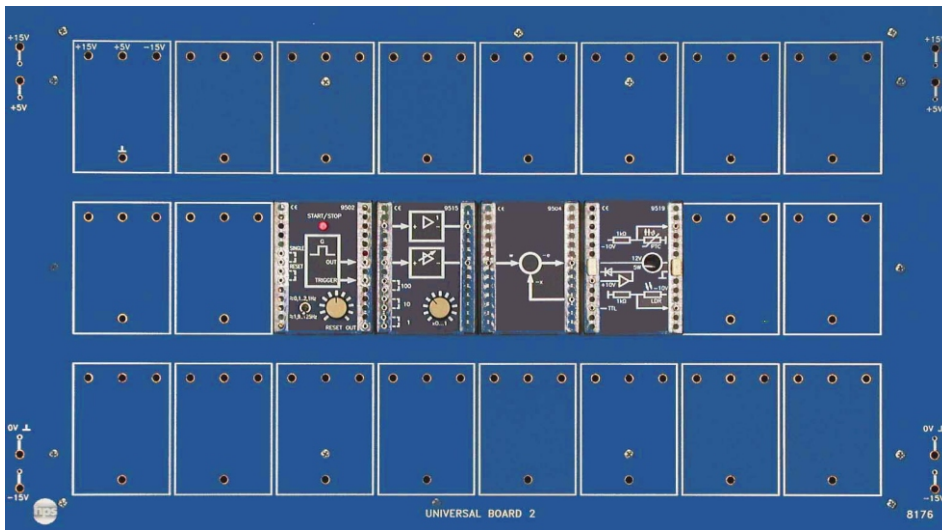


# Control Engineering



**Modulsystem  
Control  
Engineering**

**Series 9500**



UNIVERSAL BOARD 2 (Type 8176)

- **Modular training system for fundamental control engineering**
- **Clear experiment set-up because only the modules required for the experiment are plugged in**
- **Short experiment set-up times due to central operating voltage supply**
- **Individual combination possibilities**
- **Extendible with MOTOR BOARD, SERVO BOARD and Temperature and Brightness Controlled System**
- **Detailed experiment descriptions**

hps SystemTechnik has designed the Module System for Control Engineering specially for basic and further experiments in control engineering.

It consists of plug-in modules which are plugged into the

- UNIVERSAL BOARD 1 (Type 8175) or the
- UNIVERSAL BOARD 2 (Type 8176)

for conducting experiments.

- UNIVERSAL ASSEMBLY BOARD (Type 1012.1) or
  - UNIVERSAL ASSEMBLY BOARD (Type 1012.2)
- can be used to set up the experiments instead of the UNIVERSAL BOARDs.

The Module System for Control Engineering can also be used in connection with other hps systems such as:

- POWER BOARD (Type 5125)
- MOTOR BOARD (Type 5130)
- Temperature and Brightness Controlled System (Type 5125.5)
- SERVO BOARD (Type 5131)

To conduct the experiments, the Boards or Assembly Boards can be placed at an ergonomically favourable angle on the table or suspended in a demonstration rack.

The modules are wired with 2 mm connecting leads and plugs.



## Modulsystem Control Engineering

Series 9500

### General Technical Data

Apart from a few exceptions, all the modules are designed with time-dependent behaviour so that their jump reply can be measured with a standard oscilloscope, a storage oscilloscope and with a y-t recorder.

Repetition frequencies up to about 125 Hz are possible. Measurements with a recorder can be made as a single process at times in the seconds range.

The process control developed by hps SystemTechnik specially for the Module System for Control Engineering is decisive for the reproducibility and comfort of the measurements.

When using an oscilloscope, this control system allows the measuring process to be repeated cyclically, whereby all the capacitors involved are discharged before every cycle.

A pre-trigger circuit provides an optimum signal representation on the oscilloscope.

Every measuring cycle can be triggered singly for measurements with a recorder. The trigger output is available in connection with the Relay (Type 9131.2) for controlling the nib. The process control can also be controlled by a PC or PLC through an additional RESET input.

## Control Engineering

### Technical Data of the Modules for Control Engineering (Types 9501 ... 9519)

#### Mechanical construction

The module housings consist of a top section made of unbreakable transparent plastic and a sturdy bottom section made of black, glass-fibre reinforced plastic. The top and bottom sections are held together by two snap-action catches; these enable the housing to be opened quickly and easily.

There are three gold-plated laminated plugs in the base of the housing to plug the modules into the Boards or Assembly Boards. The power supply is fed to the modules through these plugs also. The circuit symbol of the function group contained in the module is printed in white on the front.

#### Other technical data

- Plug diameter: 4 mm (arrangement in 19 mm grid)
- Operating voltage:  $\pm 15$  V DC
- All modules with reverse polarity protection
- All IC components inserted in sockets
- Housing dimensions: 75 x 56 x 35 mm (w x d x h)
- Weight: approx. 0.1 kg

hps SystemTechnik offers 16 modules for conducting experiments in control engineering.

These are illustrated below with designation, technical data and type number.

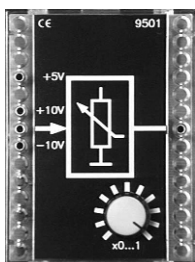
# Control Engineering

## Modules for Control Engineering

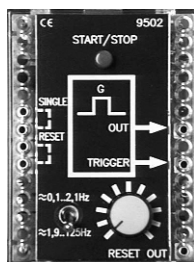


**Modulsystem  
Control  
Engineering**

**Series 9500**



Type 9501



Type 9502

### Setpoint Potentiometer

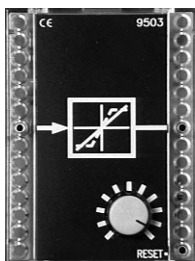
**Type 9501**

Setpoint voltage (convertible): 0 ... +5 V; 0 ... +10 V; 0 ... -10 V;  
current consumption: max. approx. 25 mA

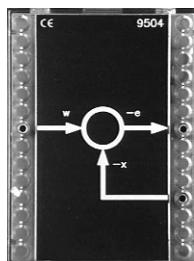
### Sequence Control

**Type 9502**

Output voltage: +12 V (squarewave); frequency: 0.1 ... 2.1 Hz/1.9 ... 125 Hz;  
with single trigger and repetitive trigger;  
current consumption: max. approx. 80 mA



Type 9503



Type 9504

### Setpoint Integrator

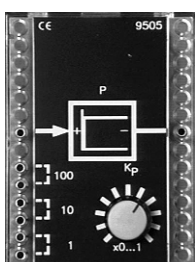
**Type 9503**

The setpoint integrator enables an adjustable integral action factor  $K_I$  of  
approx. 10 mV/ms ... approx. 1 V/ms  
current consumption: max. approx. 16 mA

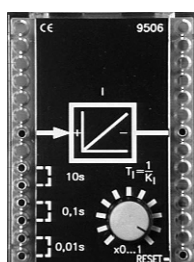
### Comparator

**Type 9504**

The comparator is structured as an inverting adder. It forms the difference of  
both input signals, the result is inverted.  
current consumption: max. 20 mA



Type 9505



Type 9506

### P-Controller

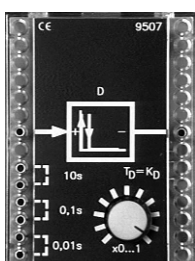
**Type 9505**

Proportional action factors  $K_P$ : 0 ... 1; 0 ... 10; 0 ... 100;  
current consumption: max. approx. 20 mA

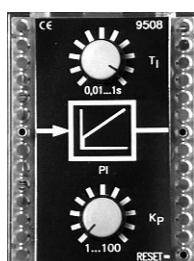
### I-Controller

**Type 9506**

Integration times  $T_I$ : 0 ... 0.01 s; 0 ... 0.1 s; 0 ... 10 s;  
current consumption: max. approx. 15 mA



Type 9507



Type 9508

### D-Controller

**Type 9507**

Differentiation times  $T_D$ : 0 ... 0.01 s; 0 ... 0.1 s; 0 ... 10 s;  
current consumption: max. approx. 10 mA

### PI-Controller

**Type 9508**

Proportional action factor  $K_P$ : approx. 1 ... 100;  
integration time  $T_I$ : approx. 0.01 s ... 1 s;  
current consumption: max. approx. 30 mA

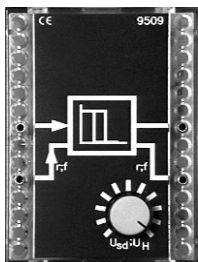


## Modulsystem Control Engineering

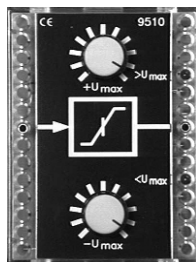
Series 9500

## Control Engineering

### Modules for Control Engineering



Type 9509



Type 9510

#### Two-Level Controller

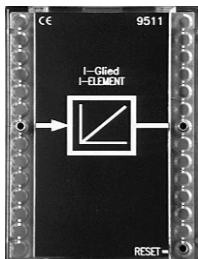
Type 9509

Threshold value switch with adjustable switching difference and additionally wirable control feedback;  
current consumption: max. approx. 20 mA

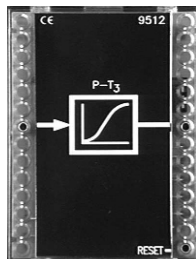
#### Limiter

Type 9510

Upper and lower limit separately adjustable;  
upper limit: approx. 0 V ... +10 V; lower limit: approx. 0 V ... -10 V;  
respectively with overload indicator; current consumption: max. approx. 65 mA



Type 9511



Type 9512

#### I-Element

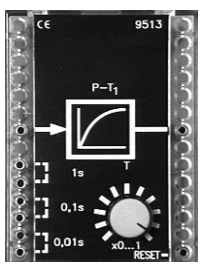
Type 9511

Integral action factor  $K_I$ : approx. 400 mV/ms;  
current consumption: max. approx. 15 mA

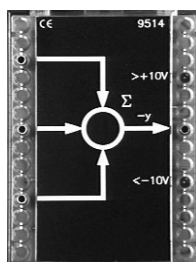
#### P-T3-Element

Type 9512

3rd order delay element; compensation time  $T_g$ : approx. 2 ms;  
current consumption: max. approx. 15 mA



Type 9513



Type 9514

#### P-T1-Element

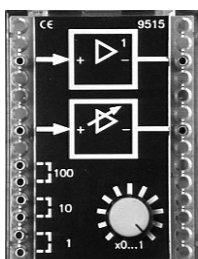
Type 9513

1st order delay element;  
time constant  $T$  (adjustable in 3 ranges): 0 ... 1 s; 0 ... 0.1 s; 0 ... 0.01 s;  
current consumption: max. approx. 15 mA

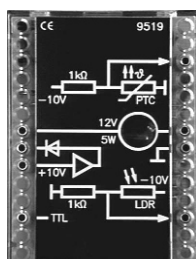
#### Summer

Type 9514

The adder forms the sum of the input voltages and inverts them;  
max. output voltage: -10 V ... +10 V; with 2 overload indicators;  
current consumption: max. approx. 25 mA



Type 9515



Type 9519

#### Amplifier/Inverter

Type 9515

Inverter: for inverting an analog input signal;  
amplifier (adjustable):  $V = 0 \dots 1$ ;  $0 \dots 10$ ;  $0 \dots 100$ ; inverting;  
current consumption: max. approx. 30 mA

#### Temperature and Brightness Controlled Module

Type 9519

Double control circuit; with PC resistor for actual value acquisition of the temperature and LDR resistance for actual value acquisition of the light; with built-in amplifier; current consumption: max. approx. 350 mA

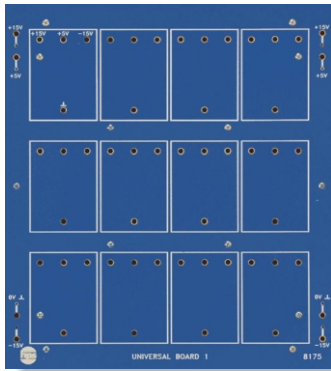
## Control Engineering

### UNIVERSAL BOARD 1 / UNIVERSAL BOARD 2

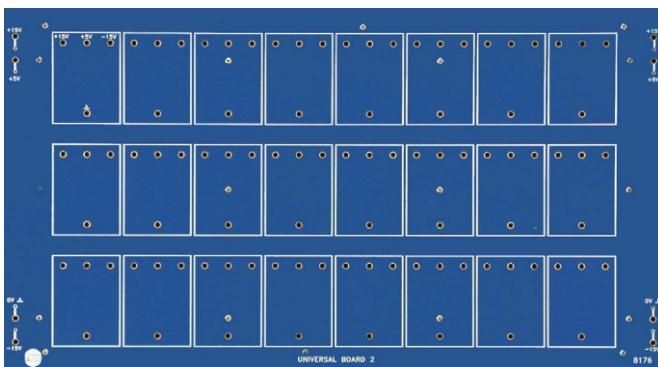


Modulsystem  
Control  
Engineering

Series 9500



Front view of the  
**UNIVERSAL BOARD 1**  
(Type 8175)



Front view of the  
**UNIVERSAL BOARD 2**  
(Type 8176)

With these two Boards, which differ in size only, hps SystemTechnik offers a low-cost introduction for conducting experiments in connection with the Modules for Control Engineering.

The front panel of the Board is divided into 12 or 24 slots. The slots are used for plug-in in the modules and are equipped with four 4 mm jacks each.

The operating voltage is also fed to the modules through three of these jacks (+15 V DC/-15 V DC/ground).

The fourth jack is provided for +5 V, e. g. for use of digital modules.

On the right and left hand side of the Boards, 2 and 4 mm jacks are installed for the external operating voltage supply.

To conduct the experiments, the Boards can be placed at an ergonomically favourable angle on the table or suspended in a demonstration rack.

## Technical Data

### Operating voltage supply for the Modules

+15 V DC/-15 V DC, by external power supply units. It is fed centrally through 2 mm or 4 mm jacks which are electrically connected to the jacks of the individual locations.

### Front panel

5 mm thick laminate, matt blue in colour, white printing

### Plug-in locations

- UNIVERSAL BOARD 1 (Type 8175): 12, with 4 jacks each
- UNIVERSAL BOARD 2 (Type 8176): 24, with 4 jacks each

### Dimension/weight

- UNIVERSAL BOARD 1 (Type 8175):  
266 x 297 x 90 mm (w x h x d)/1.33 kg
- UNIVERSAL BOARD 2 (Type 8176):  
532 x 297 x 90 mm (w x h x d)/2.65 kg



## Modulsystem Control Engineering

**Series 9500**

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## Control Engineering

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### Recommended Accessories

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- Set of Accessories (Type 5125.1), consisting of 2 mm connecting leads and plugs
- Manual:  
„Introduction to Control Engineering“ (Type V 0120)
- Power supply:  
DC SUPPLY BOARD (Type 1002.1)

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### Extension Possibilities

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The Module System for Control Engineering can be extended with the control systems listed below.

- MOTOR BOARD (Type 5130)
- Temperature and Brightness Controlled System (Type 5125.5),  
in connection with the MOTOR BOARD (Type 5130)
- SERVO BOARD (Type 5131)
- Manual:  
„Controlled Systems/Control Circuits“ (Type V 0122)
- Relay (with driver), Type 9131.2
- Assembly kit (for making your own plug-in modules), consisting of:  
Empty Housing (Type 9152.7)  
Universal PCB with dot grid (Type 9167)  
Universal PCB with line grid (Type 9167.1)  
Set of Jacks (Type 9168)  
Sticker (Type 9162.5-6)