MODULAR AUTOMATIC PROCESS CONTROLS
Mod. APC-900/EV

The system enables the training of instrument technicians and users in the field of industrial process controls. In particular, it is suitable to study courses where the familiarization with the concepts of process, regulation and stability are required. The different command and control blocks are electronic kind but appear as modules which input/output relation is important to be known.

MODULAR AUTOMATIC PROCESS CONTROLS mod. PT/EV, mod. PLP/EV, mod. PP/EV, mod. PV/EV, mod. PPL/EV, mod. CPL/EV, mod. TF/EV, mod. TSL/EV, mod. SP/EV
Using a frame for vertical mounting of the modules and the power supply unit, the different cards are assembled for conditioning, setting, regulation and display of signals that are connected to the studied process. This kind of mounting enables to use the system also for collective explanations and demonstrations. The main characteristics are:

- Wide range of transducers and actuators
- Many controlled processes
- Use of electronic regulators
- A/D and D/A interface for connection to Personal Computer

TRAINING PROGRAM:

- Analysis and calibration of the signal conditioners
- Detection of the characteristic curve of the transducers
- Determination of the linearity of the transducers
- Determination of the response delay of transducers and signal conditioners
- Analysis of the On/Off, three-state, proportional, integrative and derivative actions of the controller
- Detection of the transfer functions of the power amplifiers
- Determination of the time constants of the single processes
- Controller set-up according to:
  - response at stability limit
  - process index response
  - process frequency response
- Detection of the closed-loop processes response with On/Off or Three-state controller
- Detection of the closed-loop processes response with P, P+I, P+D, P+I+D controller
- Open loop processes: comparison of the responses with closed-loop processes
- Comparison of the sensitivity to the open-loop and closedloop load variations
- Detection of the permanent state error and the processes, according to the used controller
- Detection of the transient state behavior of the processes, according to the controller time constants

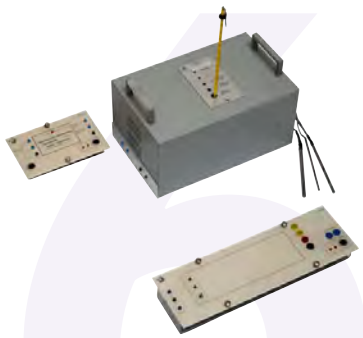
TECHNICAL SPECIFICATIONS:

The system is considered in the different subdivisions of group of modules and components, so to enable the users to configure the equipment according to their needs.

Basic system
It provides the essential units to carry out the process control and is common to all the analyzed processes. Besides the power supplies and the module-holder frame, it includes the module to provide the SET-POINT signal to the process, the P.I.D. controller module for the proportional, derivative and integrative actions, the module for ON/OFF control with 2- or 3-position module and display module for the analog signals via LED diode bars.
It consists of:

- Module-holder frame **mod. VF2/EV**
- Power supply: 115/230 Vac ±10%, 50/60 Hz; outputs: ±12 Vdc/0.5A, 24 Vac/5A, +5 Vdc/2A, 30 Vdc/5A **mod. MU5A/EV**
- Analog set-point module **SP-1**
- P.I.D. controller module **PC-1**
- 2 and 3-position controller module **PC-2**
- Voltage indicator module **VI-1**

Temperature process mod. PT/EV



The process unit includes the thermal actuators consisting in a double resistor and a fan and three different kinds of usable industrial temperature transducers (PTC, RTD and thermocouple).
Beside the basic modules of the system, there is the power amplifier module for heating and cooling actuators and the conditioning modules of the signals provided by the three kinds of usable sensors.
The system includes:

- Process unit PU-1
- Amplifier module PA-1A
- Signal conditioner module for P.T.C. SC-1A
- Signal conditioner module for RTD SC-1B
- Signal conditioner module for thermocouple SC-1C

Level and flow process mod. PLP/EV

The process unit consists of a tank with pump to provide the liquid necessary to reach and keep the level. The actuator consists of a proportional valve while the level transducer consists in a pressure sensor set at the bottom of the process tank. A windmill flowmeter with a manual throttle valve set in series on the delivery pipe enables to carry out flow measurements.
Beside the basic modules of the system, there is the power amplifier module for the level and flow actuators and the conditioning modules of the signals provided by the two level and flow transducers.
The system includes:

- Process unit PU-2
- Amplifier module PA-2
- Signal conditioner module for level transducer SC-2A
- Signal conditioner module for flow transducer SC-3A

Pressure process mod. PP/EV

The process unit consists of a tank and a compressor activated by an electrical motor providing the air necessary to reach and keep the pressure.
The actuator consists of a proportional valve and the pressure transducer is piezoresistive.
Besides the basic modules of the system, there is also a power amplifier for the pressure unit and the conditioning modules of the signals for the pressure transducer.
The system includes:

- Process unit PU-4
- Amplifier module PA-2
- Signal conditioner module for pressure transducer SC-4A

Angular speed process mod. PV/EV

The process unit consists of a bidirectional permanent magnets d.c. motor. A tachogenerator and an incremental encoder of optical kind – which are the transducers - are splined on the axis. The actuator consists of a DC motor.
Beside the basic modules of the system, there is the power amplifier module for the angular speed and the conditioning modules of the signals for the speed and angular position sensors.
The system includes:

- Process unit PU-6
- Amplifier module PA-6
- Signal conditioner module for tacho-generator SC-6A
- Signal conditioner module for feedback reaction SC-6B
- Signal conditioner module for photoelectric speed transducer SC-6C

Linear position process mod. PPL/EV

The microprocessor position control drives the motion of a single-axis translator by reading from bidirectional incremental encoder.
The microprocessor controller is the processing unit of the position control and is complete with display and keyboard for data insertion and display. A D/A converter module is used to control the analog section of the position control while a second module enables the display of the logic state of the output lines of the microprocessor controller. There are also the conditioning modules for the speed and position sensors.
Beside the base modules, the system includes:

- Process unit PU-7
- Amplifier module PA-6
- Microprocessor digital control module CU-1
- Display and keyboard for module CU-1 DK-1
- 12-bit D/A converter module DA-1
- 8-bit I/O module IO-1
- Signal conditioner module for tachogenerator SC-6A
- Signal conditioner module for incremental encoder SC-7A

Luminosity process mod. CPL/EV

The process unit consists of a dark chamber where the actuator of the light processing is inserted which consists of an incandescent lamp and three semiconductor luminosity transducer devices.
Beside the basic modules of the system, there is the power amplifier module for the luminosity unit and the conditioning modules of the signals for the sensors.

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The system includes:

- Process unit PU-9
- Amplifier module PA-9
- Signal conditioner module for photoresistor SC-9A
- Signal conditioner module for photodiode SC-9B
- Signal conditioner module for phototransistor SC-9C

Force transducer mod. TF/EV

The system consists of a strain gauge load cell and a conditioning module for the generated signal. Beside the module-holder frame and the power supply, the system includes:

- Force transduction unit TU-5
- Signal conditioner module for load cell SC-5A

Linear shift transducer mod. TSL/EV

The system consists of an L.V.D.T. (Linear Variable Differential Transformer) and potentiometric position tranducer and the conditioning modules of the generated signals.
Beside the module-holder frame and the power supply, the system includes:

- Position transduction unit TU-7C
- Signal conditioner module for L.V.D.T. SC-7C
- Signal conditioner module for linear potentiometer SC-7D

Proximity sensors mod. SP/EV

The system consists of a linear inductive proximity sensor, an ON/OFF inductive sensor and an ON/OFF capacitive sensor and the conditioning modules for the generated signals. Beside the module-holder frame and the power supply, the system includes:

- Proximity transduction unit TU-8
- Signal conditioner module for linear inductive sensor SC-8A
- Signal conditioner module for On-Off inductive sensor SC-8B
- Signal conditioner mod. for On-Off capacitive sensor SC-8C

PERSONAL COMPUTER INTERFACING

To detect the data from the transducers and the actuators of the processes, an acquisition interface is used which provides a set of analog, digital interfaces, counters and timers.
The DMA input/output functions (direct access to the CPU) and simultaneous input/output control for command/response applications (signal acquisition from transducers, signal transmission of control signals to the actuator…) are also supported.

- Industrial interface card mod. MFI-U/EV

REQUIRED (NOT INCLUDED)

- **SOFTWARE**
  - Data acquisition from transducers, process. of intermediate variables in the conditioning and display circuits via virtual instruments **mod. SW-TW/EV**
  - Transmission of the control and acquisition variable, processing and supervision of the process variables **mod. SW-PW/EV**
- **PERSONAL COMPUTER**
- **INSTRUMENTS:** multimeter, oscilloscope

SUPPLIED WITH

THEORETICAL-APPLICATION HANDBOOK WITH GUIDE TO THE PROCESS CONTROL APPLICATIONS

INSTALLATION, USE AND MAINTENANCE HANDBOOK