



**New Model**



ERD 552  
Water level and water flow  
Control, 1 tanks



**ERD 551**



Experiments

## SIMPLE OR CASCADE WATER FLOW/LEVEL PROCESS CONTROL

### COMPOSITION

The ERD 551 000 consists of a 15-litre PVC tank, supporting the operating part which comprises 1 column (height 50 cm, diameter 9.4 cm), a differential pressure sensors to measure the height of water in the column, a flow sensor, three disturbance leaks controlled by solenoid valves, one flow leak also controlled by a solenoid valve, a coil generating a pure delay of about 9 seconds. A high-power electronic board ensures the control of the power interfaces and the adaptation of the sensors in a 4/20 mA current loop.

### Characteristic values:

- 5% response time for the flow: about 0,48 s
- Time constant for level : approx 70 s with 3 leaks, 140 s with 2 leaks, 280 s with 1 leak

### TOPICS

- Study of Flow/Level transducers characteristics
- Identification in open loop of Flow/Level control process
- Digital PID control, ON/OFF control, fuzzy logic, Z transform
- Flow
- 1st or 2nd order level control, with or without pure delay

### TRAINING AND SYLLABUS

- Technical highschoools
- Vocational training centers (post secondary)
- Polytechnics,
- Enginners schools
- Universities
- Military higher education

## WATER FLOW AND LEVEL PROCESS:

Filling of the water column directly or via pure time delay (selection by solenoid valves)

Pulse flow sensor (from 0,1 to 6,5 l/min)

Flow leak controlled by solenoid valve

Control panel

Filler cap

Coil generating a 9 second delay

Water level sensor (pressure differential 1psi or 70.3 cm H<sub>2</sub>O) for water level measurement

Column of 50 cm Ø 10 cm graduated in centimetres

3 leaks controlled by solenoid valves

15-litre tank, with PWM-controlled submersible pump

## CONTROL PANEL:

It consists of a didactic front panel, including the necessary connections for sensor and actuator wiring, internal power supply. As in industrial processes, the control unit is remote from the operating part. This operating part can be controlled either by the D\_CCA software (see next page), or by a stand-alone control unit or by an industrial controller or PLC.

UBS-A connection

On/Off switch

24 V<sub>DC</sub> /6,7 A power supply With 4 pins DIN connector

4/20-mA flow measurement (24 V<sub>DC</sub> power supply)

4/20-mA external control of the pump

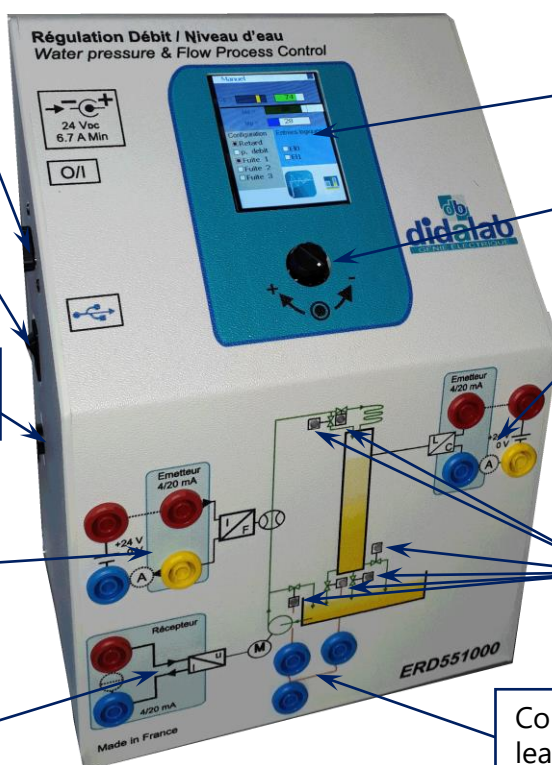
Display for autonomous control, leaks n°2 and 3 activation

Digital potentiometer

4/20-mA level measurement (24 V<sub>DC</sub> power supply)

6 leds for visualization of the controlled solenoid valves

Control of the flow disturbance and leak n°1



# ERD550100 : D\_REG, PROCESS CONTROL SOFTWARE

It allows the user, via an ergonomic graphical interface, to configure the system :

- selection of the system structure: Open loop, Closed loop, in flow or level control
- selection of control type and specific values: constant step, ramp, sine, trapezoid signals,
- selection of the corrector and its adjustments (can be modified during operation),
- selection of acquisition and recording parameters,
- selection of measurements units,

It also allows the structured running of experimental work:

- request of time response display of one (or several) characteristic parameter(s) : flow, level, error, corrector output, etc...

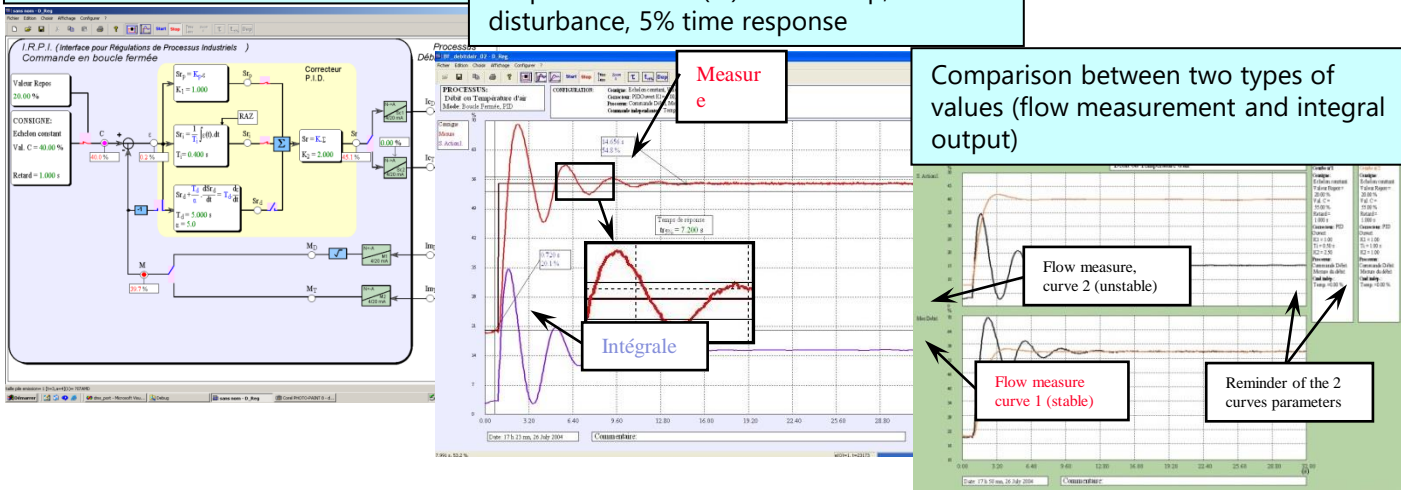
- modification of time diagram scales (X or Y zoom)
- recording of the running test, comparison with the previous tests,
- recording of the test response curves,
- exportation of the response curves for exploitation in txt, csv or XML formats
- determination of process control characteristics values:

- response to constant step: time constant 5 % response time, overshoot,
- sine excitation: mean value, amplitude, frequency, time period,
- harmonics : mean values ratio, amplitudes ratio, phase shift

## D REG curves examples:

Main screen, Close loop in flow with PI corrector

Response in flow (PI) closed loop, without disturbance, 5% time response



## ERD 550 800 : OPTIONAL EXTRA: Scilab Module for creation of real time correctors with sous Scilab/XCOS

**D Scil**: A complete development process, it is part of a modern method of development in Automatic Systems. This method is described below in 5 successive global steps, it is very representative of a development in the industry, it allows to optimize the development costs and the costs of material prototypes..

### STRONG POINTS

- Automatic generation of real time correctors
- Creation of real time correctors
- Does not require real-time computing skills
- Can be used for research



# Experiments

## Water level process control

### SYSTEM WITHOUT COIL

Exp1 Identification in Open Loop

Exp2 P/ PI/ PID control

### SYSTEM WITH COIL

Exp3 Identification in Open Loop

Exp4 P/ PI/ PID control

## Water flow process control

Exp1 Identification in Open Loop

Exp2 P/ PI/ PID control

Exp3 Digital Z control

Exp4 Control with « On/ Off » corrector

# STANDARD CONFIGURATIONS

## ERD551C : Complete package « STUDY OF A WATER LEVEL AND FLOW PROCESS CONTROL » 1 column

Reference	Description	Qty
ERD551000	Operating unit for the water level and flow process control with 1 column with pure delay	1
ERD550100	Logiciel D_REG, régulation et acquisition sous Windows	1
ERD551010	Technical and user manual	1
ERD550040	Teacher's Experiments manual, «Water level and flow control, in continuous range », sources on USB drive	1
ERD550050	Student's Experiments manual, «Water level and flow control, in continuous range », sources on USB drive	1
EGD000023	24-Vdc 6,6-A power supply, -pin DIN connector	1
EGD000006	USB- AA patching cord	1

## ERD551S : Complete package « STUDY OF A WATER LEVEL AND FLOW PROCESS CONTROL with PROTOTYPING AND SIMULATION » 1 column

Reference	Description	Qty
ERD 551 C	Complete package « STUDY OF A WATER LEVEL AND FLOW PROCESS CONTROL » 1 column	1
ERD550800	D_Scil: Scilab/XCOS real time corrector creation module	1

### POWER SUPPLY:

1-ph mains: 240V 50Hz 1A

### PACKING LIST:

Dimensions (L, l, h) 550 × 350 × 1000 mm, net weight: 12 kg