



Buffer tank (Level/Flow control)

Study system (buffer tank) for level, flow and instrumentation control

Régulflex 1

Buffer Tank (Flow Level Control) at a glance

Sections

- ✓ Electrical engineering, Industrial maintenance, Automation, Control, Water professions....

Educational activities

- ✓ Study of the different measurement principles (physical laws, sensors, transmitters, etc.)
- ✓ Study of a control valve (measurement of the ΔP , calculation of the C_v , drawing of the installed characteristic, etc.).
- ✓ Identification of an Open Loop and/or Closed Loop system (Description of the different methods).
- ✓ Simple level control. (Study of P,PI,PD,PID algorithms), response to a change in setpoint, response to a disturbance
- ✓ Predictive level control, cascade control (implementation of complex strategies, dead time compensation, etc.)
- ✓ Single or split range flow control

Specific components

- ✓ Level measurement □ Ultrasonic sensor, pressure sensor, capacitive probe, bubbler rod, ...
- ✓ Flow measurements □ Rotameter, Vane flow meter, ...
- ✓ Free sockets □ Reserve for instrumentation
- ✓ Valve □ Control valve with current/pressure converter)
- ✓ Pumps □ Volumetric vane pumps with variable speed drives)
- ✓ Converters □ Current/Pressure, Current/Voltage
- ✓ Storage □ Atmospheric stainless steel tanks
- ✓ Communication & Fieldbus (Option) □ Profibus PA, HART Protocol
- ✓ Process control □ Controller, PLC, DCS

Highlights

- ✓ Three types of commands can be used
- ✓ Product dedicated to the study of industrial instrumentation, level and flow control
- ✓ System based on a real application (Buffer tank of a soda production line)

Related products

- ✓ RC10: Communicating Industrial Controller Module
- ✓ RC21: PLC module with PID and Touch Panel (Schneider M340 version with 16E/16S TOR - 8E ANA - 4S ANA + Ethernet TCP/IP + Web Server + CANopen Bus)
- ✓ RC31: PLC Module with PID and Touch Panel (Siemens S7-1500 version with 8E/8S digital - 24E ANA, of which 4 HART - 20S ANA + Ethernet TCP/IP)
- ✓ RC12: Digital Control System Module
- ✓ RC40: Pressure calibrator with pneumatic pump
- ✓ RC41: Calibrator for RTD temperature sensors (Pt100, PT1000, ...)
- ✓ RC42: Calibrator for Thermocouple (Tc) Temperature Sensors
- ✓ RM13: Option - 0/4-20 mA Current Loop Calibrator

References

- ✓ RN10: Buffer Tank (Flow Level Control)
- ✓ RL10: Power and Safety Box (For one or more Regulflex systems)
- ✓ RN11: Second process circulating pump option (for closed loop operation or split range control)
- ✓ RN12: Option Capacitive level transmitter
- ✓ RM10: Option: Diaphragm for pressure and flow measurement
- ✓ RM11: Option: 4-20mA/Hart pressure sensor

Features

- ✓ L/ W/ H (with RL10 power supply unit): 920 x 1000 x 2230mm
- ✓ Electrical power: 240Vac - 50 Hz single phase (RL10 - System Power and Safety Box)
- ✓ Weight (with RL10 power supply): 210kg

BTS CIRA - BTS ME - Bac Pro Me

Grandes thématiques

Control - Servo control Instrumentation
Measurement - Maintenance





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Description technique

Functional description

- ✓ This module corresponds to a water storage tank. The purpose of this module is to regulate the liquid level in the tank by acting on the water supply valve.

Product used:

- ✓ Water

Adjusted variable:

- ✓ Water level in the tank

Control variable :

- ✓ Water flow rate at the inlet and/or outlet of the

Disturbance variable:

- ✓ Variation of the water flow in and out of the tank

How it works

This module is dedicated to the study of level control. The objective is to maintain a constant water level in the storage tank during the use of the system, taking into account the various disturbances that the system undergoes. The optimum value of the controlled variable therefore corresponds to the set value defined by the user (water level in the tank).

- ✓ The level in the tank is regulated by adjusting the water inlet flow rate through an electro-pneumatic control valve. One or more sensors measure the water level in the tank, and transmit the information to a controller (or PLC, SNCC,...) which controls the control valve in opening or closing.
- ✓ Disturbances on the water inlet or outlet flow are possible.
- ✓ A delay system (Normally Open Solenoid Valve) can be implemented in the water supply to the control valve.
- ✓ Both circulation pumps (for closed loop operation or split range control)

Second process circulation pump (option RN11)

A second circulation pump placed at the outlet of the storage tank can be used. This option then allows two separate operations of the module.

- ✓ Operation N°1: Use of the level control module (RN10) in closed circuit. Pump N°1 manages the water inlet flow into the tank and pump N°2 sets the water outlet flow from this same tank.
- ✓ Operation N°2: Use of two circulation pumps to allow the management of a "Small flow" and/or "Large flow" at the outlet of the storage tank. The two pumps and their associated frequency inverters can be used simultaneously. A universal transmitter is also associated with each inverter/pump assembly in order to carry out "complex" control modes (Example: Regulation of the tank outlet flow rate with control of the two pumps in "Split Range")

Sockets and loose fittings

There are "free" tappings on the pipework to add various sensors. Students can calibrate, set up and test different sensors on the existing process.

Electricity, water and air supply :

- ✓ The air and water supply must be provided from the establishment's water and air supply (max. P. 6 bar).
- ✓ The power supply is provided by the RL10 power supply box (one RL10 box can supply up to 5 systems in the Regulflex line).

Connection to other Regulflex systems :

- ✓ This module can be connected to one of the following systems to implement all or part of the manufacturing process:
 - Module N°2 (RD10) - Dosing (Flow/Ratio) : Flow control study system, ratio and instrumentation.
 - Module N°3 (RT10) - Refrigeration (Flow/Temperature) : Study system for temperature control (Cooling), flow and instrumentation.
 - Module N°4 (RG10) Carbonation (Flow/Pressure): Carbonation of a liquid with measurement of flow, pressure and temperature.
 - Module N°5 (RP10) Pressure vessel (Level/Pressure): Study system (pressure storage) of pressure regulation, level and instrumentation
- ✓ It can be operated by three types of controls:
 - Industrial Controller Module (RC10) : Study of industrial PID single-loop and/or dual-loop controllers
 - Industrial Controller Module (RC21/RC31): Study of Industrial Controllers in PID regulation
 - DCS Module (RC12) : Study of Digital Control Systems
- ✓ Process supervision is possible:
 - Using the WinnCC Flexible environment (RC31)
 - Using the Touch Panel (RC21)

Communication

- ✓ The option "4-20mA/Hart pressure sensor" (RM11) allows to realize control loops via a transmitter communicating through a fieldbus HART protocol.



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Description technique



Connectiques de consignes et mesures

Boutons de commande de la pompe et des perturbations

Potentiomètre de commande vitesse pompe



Canne capacitive

Piquage pour canne de bullage

Capteur de niveau à ultrasons

Cuve tampon d'eau, sans pression

Débitmètre à flotteur

Indicateur de niveau d'eau



Servo-moteur de la vanne

Vanne de régulation pneumatique

Vanne d'alimentation en eau froide du système

Electrovanne de perturbation

Robinet pointeau de réglage sortie libre cuve tampon

Robinet pointeau de réglage débit de fuite tampon

Vanne manuelle de sectionnement

Transmetteur de débit

Arrivée d'eau de la cuve tampon

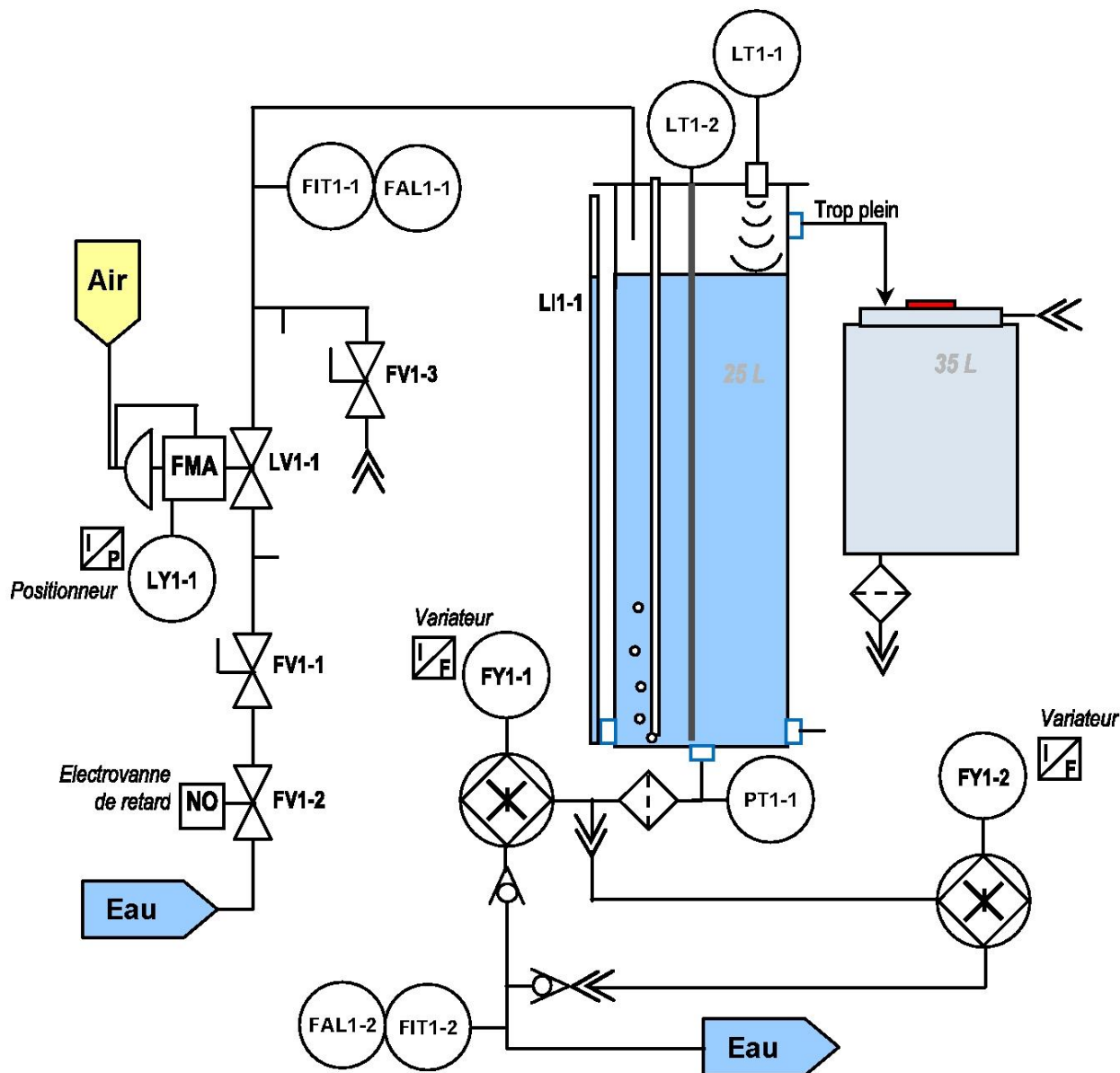
Pompe de circulation Process

Raccord rapide auto-obturant, évacuation des eaux usées ou alimentation de la suite de la ligne Regulflex



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Technical Description



FIT1-1 /FAL1-1: Flow transmitter with display (Rotor flow meter 0,08-20l/min - 4-20 mA signal) + Alarm contact for "low" flow detection (24Vdc digital signal)

FIT1-2 /FAL1-2: Flow transmitter with display (Rotor flow meter 1-16l/min - 4-20 mA signal) + Alarm contact for "low" flow detection (24Vdc digital signal)

FV1-1: 1/4 turn manual ball valve with full bore

FV1-2: Normally Open Solenoid Valve for "Delay" on water supply

FV1-3: 1/4 turn manual ball valve with full bore

FY1-1: Frequency converter for circulation pump control N°1 (4-20mA signal)

FY1-2 (OPTION) : Frequency converter for circulation pump control N°2 (4-20mA signal)

LI1-1: Level indicator in the tank (Transparent tube)

LT1-1: Ultrasonic level transmitter (4-20 mA signal)

LT1-2 (OPTION): Capacitive Level Transmitter (Capacitive Channel - 4-20 mA signal)

LV1-1: Pneumatic level control valve ("Closed by Lack of Air" valve)

LY1-1: "Current/Pressure" I/P positioner for level control valve (4-20 mA signal)

PT1-1 (OPTION): Relative pressure transmitter (0-200mbar - 4-20 mA signal)

PVI1-1: Air supply pressure gauge for pneumatic valve (0 - 10 Bar)



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Pedagogical approach

Educational activities

- ✓ Study of the different measurement principles (physical laws, sensors, transmitters, etc.)
- ✓ Study of a control valve (measurement of ΔP , calculation of C_v , drawing of the installed characteristic, etc.)
- ✓ Identification of an Open Loop and/or Closed Loop system (Description of the different methods)
- ✓ Simple level control. (Study of P,PI,PD,PID algorithms), response to a change in setpoint, response to a disturbance
- ✓ Level control with delay. (Implementation of complex strategies, dead time compensation, ...)
- ✓ Flow control at the storage tank outlet (simple or complex "Split Range" control strategy)
- ✓ Predictive control of the storage tank level (depending on the tank outlet flow rate)
- ✓ Complex level control (cascade) (depending on the water inflow)

Examples of practical work proposed by ERM

- ✓ TP1 Generic Regulflex: Methods for identifying and controlling "Stable" and "Integrating" systems
 - BROIDA's method
 - ZIEGLER NICHOLS method
 - Empirical method or "tuner" method (successive approaches)
- ✓ TP2 Generic Regulflex: Principle of "Volumetric" and "Massive" flow measurement and regulation
 - Type of measure
 - Method, Calculations...
- ✓ TP3 Generic Regulflex: Sizing and implementation of depressors
- ✓ TP4 Generic Regulflex: Complex regulations that can be implemented on the system (Cascades, Predictive, Split Range, ...)