

Carbonation (Pressure Flow Control)

Study system (Carbonation) of flow control, pressure and instrumentation

Module N°4 (RG10)

Carbonation (Flow/Pressure) at a glance

Sections

- ✓ Electrical engineering, Industrial maintenance, Automation, Regulation....

Educational activities

- ✓ Study of the different sensors (pressure, flow, temperature) and the CO analyser₂.
- ✓ Calibration of various measuring devices (pressure, flow, temperature)
- ✓ Study of a simple PID control
- ✓ CO mass flow control₂

Specific components

- ✓ Flow measurements □ Thermal mass
- ✓ Pressure measurements □ Relative
- ✓ Temperature measurements □ PT100
- ✓ Various measurements □ CO₂ dissolved in Option
- ✓ Valves □ CO thermal mass controller meter₂
- ✓ Storage □ Pressure vessel: CO₂ cylinder with heater (cylinder not supplied)
- ✓ Process components □ Static mixer
- ✓ Communication & Fieldbus □ Profibus
- ✓ Process control □ Controller, PID PLC, SNCC

Highlights

- ✓ Three types of commands can be used
- ✓ Ideal product for industrial instrumentation and flow and pressure control
- ✓ System based on a real application (Carbonation of the water/syrup mixture 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

- ✓ RG10: Carbonation (Flow Control Pressure)
- ✓ RL10: System Power and Safety Cabinet (Can be used with one or more systems)
- ✓ RG11: Flow control valve option (For complex controls)
- ✓ RG12: Optional In-line Dissolved CO₂ 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): 160kg

BTS CIRA - BTS ME - Bac Pro Me

Grandes thématiques

Control - Servo control Instrumentation
Measurement - Maintenance





Technical description

Module N°4 (RG10)

Functional description

Carbonation consists of uniformly dissolving the CO₂ gas in the water+syrup mixture.

Products used: CO₂ + Water+syrup mixture (or Water)

Variable set: CO content, CO₂ dissolved

Control variable CO mass flow rate, Water volume flow rate, CO injection pressure and temperature

Disturbance variables: Flow rate, temperature and pressure of the water+syrup mixture

How it works

- ✓ The volume flow, temperature and pressure of the water+syrup mixture are measured. The pressure and mass flow rate of the CO₂ gas at the inlet of the static mixer are controlled according to the measured values.
- ✓ The CO₂ content of the liquid is measured at the outlet of the mixer.

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

Control valve (option RG11)

A control valve placed at the inlet of the module can be implemented to allow autonomous use of the RG10. This option also allows for water flow regulation.

Dissolved CO₂ transmitter (option RG12)

A dissolved CO₂ transmitter can be used to provide: a control loop that measures the amount of CO₂ in the liquid and acts on the mass flow controller (or the RG11 control valve).

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°1 (RN10) - Buffer tank (Level/Flow): Study system for level, flow and instrumentation control
 - 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°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

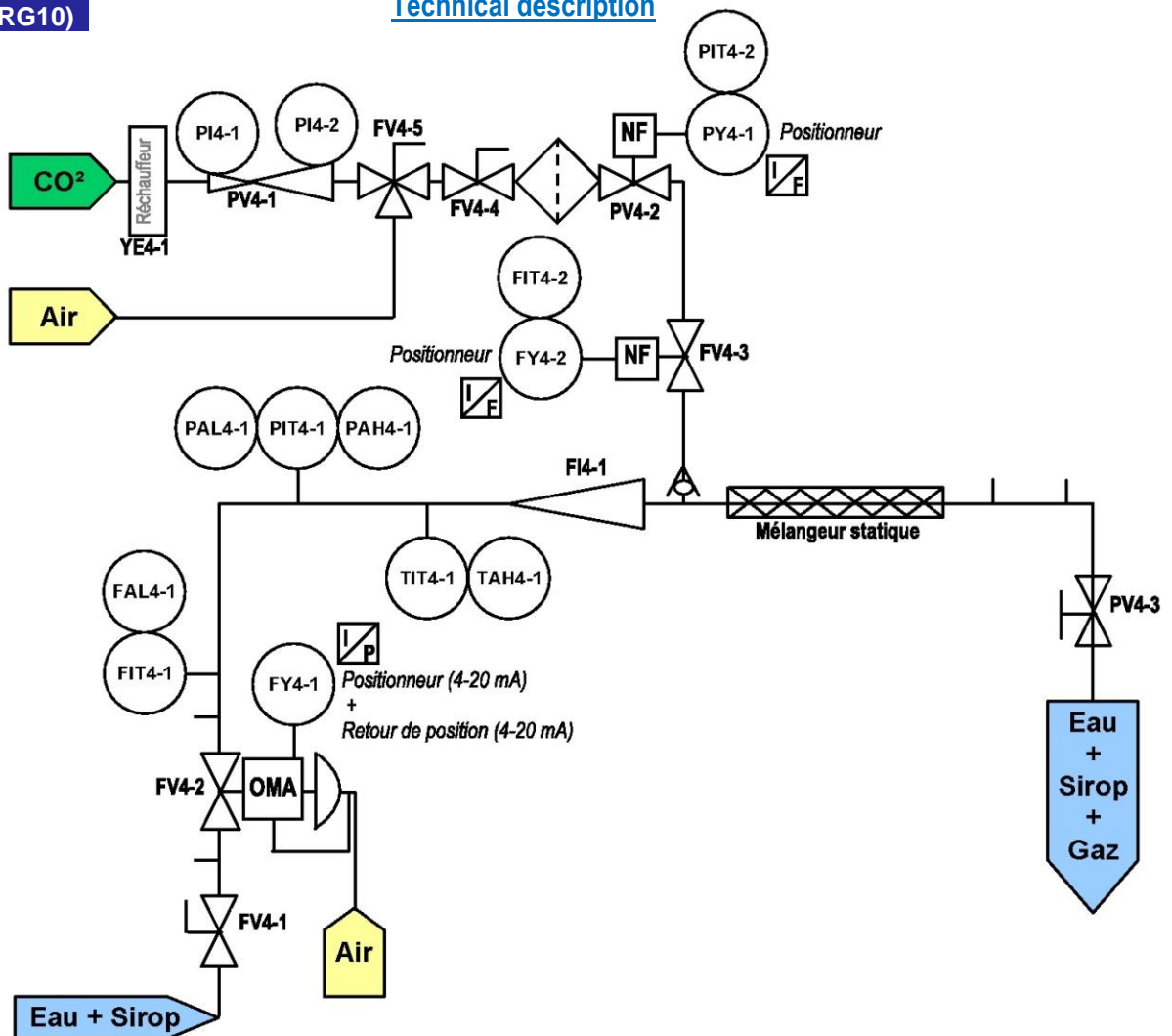
The option "4-20mA/Hart pressure sensor" (RM11) allows to realize control loops via a transmitter communicating through a fieldbus HART protocol.



Technical description

Module N°4 (RG10)

► IT Scheme



FI4-1: Float Flow Indicator (Rotameter)

FIT4-1: Electromagnetic flow transmitter with display (4-20 mA / 0.8-16l/m)

FIT4-2/FAL4-1: Mass flow transmitter with display (4-20 mA / 0-20 NL/min with CO₂) + Alarm contact for "low" flow detection (24Vdc digital signal)

FV4-1: Manual ¼ turn valve with full bore

FV4-2 (OPTION) : Pneumatic flow control valve ("Open by Lack of Air" valve)

FV4-3: Gas flow control solenoid valve ("Normally Closed" valve)

FV4-4: ¼ turn manual shut-off valve

FV4-5: Manual "3-way" ball valve with full bore

FY4-1 (OPTION) : Positioner Current/Pressure "I/P" flow control valve + position feedback (4-20 mA)

FY4-2: Current/Frequency positioner "I/F" for gas flow control solenoid valve (4-20 mA)

PIT4-1/PAL4-1/PAH4-1: Pressure transmitter with display (4-20 mA / 0-10 bar) + Alarm contacts for "high" and "low" flow detection (24Vdc digital signal)

PIT4-2: Pressure transmitter with display (4-20 mA / 0-10 bar)

PV4-1 / PI4-1 / PI4-2: Manual pressure regulator for CO₂ gases with upstream and downstream pressure indicators

PV4-2: Solenoid valve for gas pressure regulation ("Normally Closed" valve)

PV4-3: Manual needle valve to pressurise the circuit

PY4-1: Current/Frequency Positioner "I/F" for Gas Pressure Control Valve (4-20 mA)

TIT4-1: Temperature transmitter with display (4-20 mA / -10 to +40°C) + Alarm contact for "high" temperature detection (24Vdc digital signal)

YE4-1: Gas heater (P=500W)



Pedagogical approach

Module N°4 (RG10)

Educational activities

- ✓ Study of the different sensors (pressure, flow, temperature) and the dissolved CO₂ analyser.
- ✓ Calibration of various measuring devices (pressure, flow, temperature)
- ✓ Study of a PID control
- ✓ Gas mass flow control (Air or CO₂)
- ✓ Ratio control

Examples of Practical Work offered by ERM

- ✓ TP1 Generic Regulflex: Methods of identification and regulation of "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 measurement, Method, Calculations...
- ✓ TP3 Generic Regulflex: Sizing and implementation of depressors
- ✓ TP4 Generic Regulflex: Complex regulations that can be implemented on the system (Cascades, Predictive...)
- ✓ TP5: Study of pressure regulation