Computer Controlled **Crystallisation Unit**

QUCC

edibon

Technical Teaching Equipment

EDIBON PATENT

Always included in the supply:

Teaching Technique used

SCADA. EDIBON Computer Control System

② Control Interface Box

③ Data Acquisition Board

④ Software for:
- Computer Control
- Data Acquisition
- Data Management

⑤ Cables and Accessories

⑥ Manuals

Computer (not included in the supply)

① Unit: QUCC. Crystallisation Unit

OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL

Unitary Process Configuration

SCADA. EDIBON Computer Control System:
Computer Control + Data Acquisition + Data Management

1
2
Sensors 3
4
"n" 6 5

Cables to Control Interface Box

Teaching unit

Control Interface Box

Cable to computer

Data acquisition board

Software for:
-Computer Control
-Data Acquisition
-Data Management

Student post
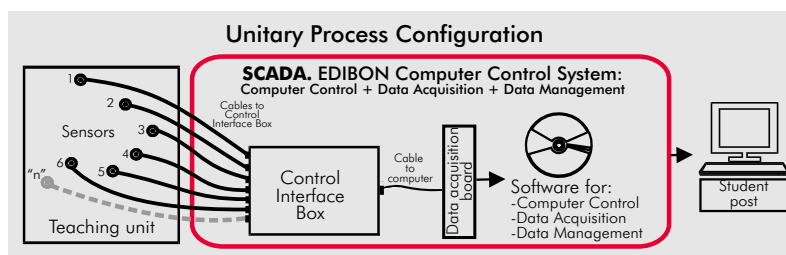
ISO 9001:2000
Certificate of Approval

CE
European Union Certificate

EMAS
Verified environmental management

Certificates ISO 14001: 2004 and
ECO-Management and Audit Scheme
(environmental management)

WQC
Worlddidac Member

Worlddidac Quality Charter
Certificate
Worlddidac Member

INTRODUCTION

Crystallisation is one of the older methods used by the man to purify substances which obtains the separation of a solution components.

To get the crystallisation of the solute of a solution, it has to get the supersaturated condition. A solution is saturated when a product called solute is dissolved in it to the point that it doesn't accept more quantity because it can't be dissolved.

"QUCC" is a bath type crystallisation unit, very recommended to use in laboratories. It is an unit which works by cooling, so, it is appropiate to carry out crystallisation experiments of those components whose solubility change with the temperature.

The solution cooling crystallisation has several advantages against other methods:

- Low energetic costs.

- Quick answer.

- Quick and simple practices (1 laboratory session).

DESCRIPTION

QUCC is an unit to demonstrate the solution cooling crystallisation. EDIBON has developed this unit to carry out the crystallisation reaction study of those components whose solubility changes with the temperature.

QUCC is made in glass, that provides important teaching characteristics. It is thought to do batch crystallisation, that is filling once the crystallisator with the solute and the solvent to get the supersaturated solution from which crystals began to be obtained. It is a batch process because to carry out a new experiment the crystallisator must be refilled.

This unit consists of a Crystallisator, which is basically a jacketed chemical reactor. By the crystallisator external part hot water circulates and with this the reaction temperature control is done. The salt under study is dissolved with the help of a stirred installed in the crystallisator upper part. In the crystallisator upper part are installed a temperature sensor and a conductivity sensor to know, in real time, the solution crystallisation state treated with the SCADA software, from the computer (PC).

To obtain the supersaturated solution it is needed to heat the solution so that it admits bigger solute concentrations at high temperatures. To the water supply to the crystallisator jacket there is a thermostatic bath installed, with PID control over the Crystallisator internal temperature, through the control software from the computer (PC).

An obtained product sample is analysed with the supplied set of sieves. The produced crystals size is obtained.

It has an optional accesory: Continuous Feed Unit (QUCC/C), to turn this unit into a continuous crystallisator.

This Computer Controlled Unit is supplied with the EDIBON Computer Control System (SCADA), including: Control Interface Box + Data Acquisition Board + Computer Control and Data Acquisition Software, for controlling the process and the parameters involved.

PROCESS DIAGRAM AND ELEMENTS ALLOCATION
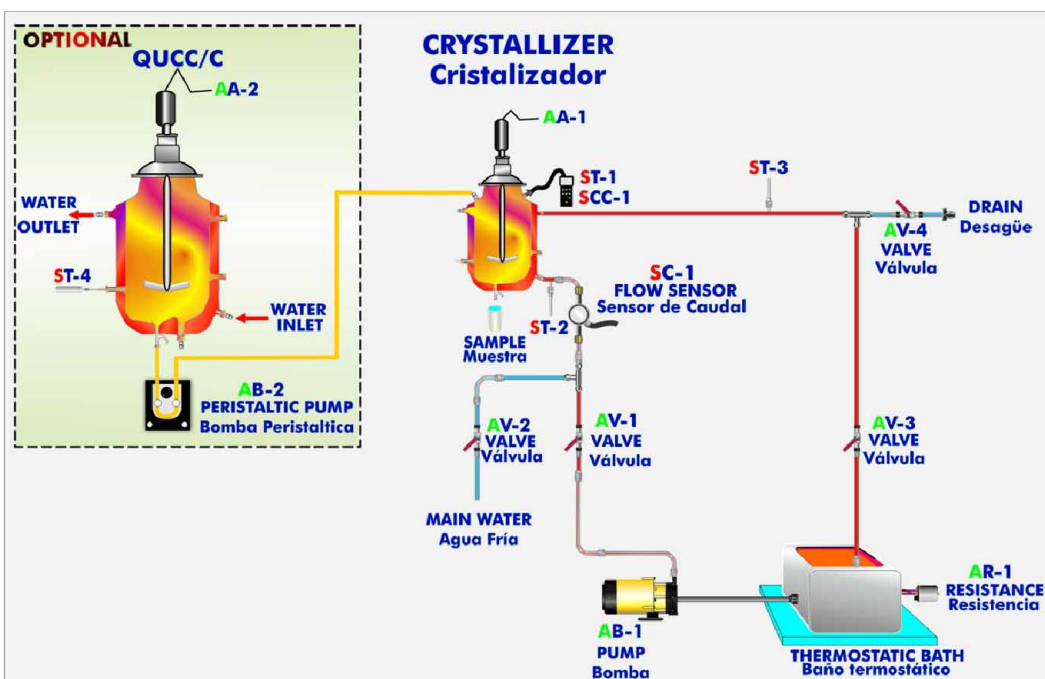
OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL

Note:
ST= Temperature sensor.
SCC= Conductivity sensor.
AA= Stirrer.
SC= Flow sensor.

Items supplied as standard

① **QUCC. Unit:**

Bench-top unit, mounted on 4 legs, with gum protections, height adjustable to equilibrate the unit.

Anodized aluminium structure and panels in painted steel (epoxi paint).

Diagram in the front panel with similar distribution to the elements in the real unit.

Crystallisator composed of jacketed reactor made in glass (1 litre of capacity), which includes temperature sensors and stirrer. Batch operation.

Double blade variable speed stirrer, computer controlled.

The crystallisation reactor is thermally controlled by means of heated water circulating in the reactor jacket. PID control over the reactor temperature.

Thermostatic bath of 600W, with feed water impulsion pump, computer controlled.

Water flow sensor.

4 two way valves to allow the water circulation, according to the process.

3 Temperature sensors, "J" type.

Pressure regulation valve to protect the installation.

Conductivity cell to measure the solution conductivity:

Conductivity sensor, range: to 1000 mS.

Set of sieves, composed of:

3 sieves of different light size: 0.5 mm/1 mm/ 2 mm.

2 litres vessel to collect the crystals.

Protection devices for the electric circuits.

Optional (NOT included in the supply):
- QUCC/C. **Continuous Feed Unit.**

QUCC. Unit

② **QUCC/CIB. Control Interface Box :**

Control interface box with process diagram in the front panel and with the same distribution that the different elements located in the unit, for an easy understanding by the student. All sensors, with their respective signals, are properly manipulated from -10V. to +10V computer output. Sensors connectors in the interface have different pines numbers (from 2 to 16), to avoid connection errors. Single cable between the control interface box and computer.

The unit control elements are permanently computer controlled, without necessity of changes or connections during the whole process test procedure.

Simultaneously visualization in the computer of all parameters involved in the process.

Calibration of all sensors involved in the process.

Real time curves representation about system responses. Storage of all the process data and results in a file. Graphic representation, in real time, of all the process/system responses.

All the actuators' values can be changed at any time from the keyboard allowing the analysis about curves and responses of the whole process. All the actuators and sensors values and their responses are placed in only one computer screen.

Shield and filtered signals to avoid external interferences.

Real time PID control with flexibility of modifications from the computer keyboard of the PID parameters, at any moment during the process. Real time PID and on/off control for pumps, compressors, resistances, control valves, etc. **Real time PID control for parameters involved in the process simultaneously. Proportional control, integral control and derivative control, based on the real PID mathematical formula, by changing the values, at any time,** of the three control constants (proportional, integral and derivative constants).

Open control allowing modifications, at any time and in a real time, of parameters involved in the process simultaneously.

Possibility of automatization of the actuators involved in the process.

Three safety levels, one mechanical in the unit, other electronic in control interface and the third one in the control software.
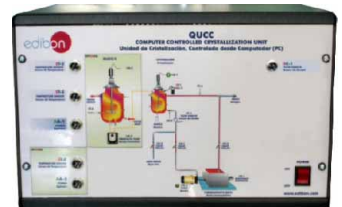

QUCC/CIB

③ **DAB. Data Acquisition Board:**

PCI Data acquisition board (National Instruments) to be placed in a computer slot. Bus PCI.

Analog input: **Channels= 16** single-ended or 8 differential. **Resolution=16 bits**, 1 in 65536.

Sampling rate up to: 250 KS/s (Kilo samples per second). Input range (V)=±10V.

Data transfers=DMA, interrupts, programmed I/0. Number of DMA channels=6.

Analog output:Channels=2. **Resolution=16 bits**, 1 in 65536. Maximum output rate up to: 833 KS/s.

Output range(V)= ±10V. Data transfers=DMA, interrupts, programmed I/0.

Digital Input/Output: Number of **channels=24 inputs/outputs**. D0 or DI Sample Clock frequency: 0 to 1 MHz.

Timing: **Counter/timers=2**. Resolution: Counter/timers: 32 bits.

DAB

④ **QUCC/CCSOF**. **Computer Control+Data Acquisition+Data Management Software:**

Compatible with actual Windows operating systems. Graphic and intuitive simulation of the process in screen. **Compatible with the industry standards.**

Registration and visualization of all process variables in an automatic and simultaneously way.

Flexible, open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters.

Analog and digital PID control. Menu for PID and set point selection required in the whole work range.

Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second guaranteed. Calibration system for the sensors involved in the process.

It allows the registration of the alarms state and the graphic representation in real time.

Comparative analysis of the obtained data, after the process and modification of the conditions during the process.

Open software, allowing to the teacher to modify texts, instructions. Teacher's and student's passwords to facilitate the teacher's control on the student, and allowing the access at different work levels.

This unit allows that the 30 students of the classroom can visualize simultaneously all results and manipulation of the unit, during the process, by using a projector.
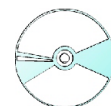
QUCC/CCSOF

⑤ **Cables and Accessories**, for normal operation.

⑥ **Manuals:**This unit is **supplied with 8 manuals:** Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.

✱ **References 1 to 6: QUCC + QUCC/CIB + DAB + QUCC/CCSOF + Cables and Accessories + Manuals are included in the minimum supply, enabling a normal operation.**

Optional

-QUCC/C. **Continuous Feed Unit.**

The Continuous Feed Unit QUCC/C is complementary to the QUCC unit, which allows to turn the Crystallisator into continuous.

It consists of a jacketed reactor of a bigger size than the Crystallisator, where the supersaturated solution is obtained. This reactor, in the upper part, has a stirrer to dissolve the salt, under study, in the solution.

The supersaturating reaction temperature is controlled in every moment by a PID, from the EDIBON SCADA Software, from the computer (PC).

A peristaltic pump supplies the supersaturated solution in a continuous way to the Crystallisator.

So, the supply of this accessory will allow to compare the batch crystallisation and the continuous crystallisation.

Specifications:

Jacketed reactor, made in glass, 5 litres approx.

Double blade stirrer, computer controlled.

Peristaltic pump of 0.1-30 ml/min, with variable speed, computer controlled.

Complementary items to the standard supply

PLC. Industrial Control using PLC (7 and 8):

⑦ **PLC-PI. PLC Module:**

Circuit diagram in the front panel.

Front panel:

Digital inputs(X) and Digital outputs (Y) block:

16 Digital inputs, activated by switches and 16 LEDs for confirmation (red).

14 Digital outputs (through SCSI connector) with 14 LEDs for message (green).

Analog inputs block:

16 Analog inputs (-10V. to + 10V.)(through SCSI connector).

Analog outputs block:

4 Analog outputs (-10V. to + 10V.)(through SCSI connector).

Touch screen:

High visibility and multiple functions.

Display of a highly visible status.

Recipe function.

Bar graph function.

Flow display function.

Alarm list.

Multi language function.

True type fonts.

Back panel:

Power supply connector.

Fuse 2A.

RS-232 connector to PC.

Inside:

Power supply outputs: 24 Vdc, 12 Vdc, -12 Vdc, 12 Vdc variable.

Panasonic PLC:

High-speed scan of 0.32 μsec. for a basic instruction.

Program capacity of 32 Ksteps, with a sufficient comment area.

Free input AC voltage(100 to 240 V AC).

DC input:16 (24 V DC).

Relay output: 14 (250 V A AC/2 A).

High-speed counter.

Multi-point PID control.

Digital inputs/outputs and analog inputs/outputs Panasonic modules.

Communication RS232 wire, to computer (PC).

⑧ **QUCC/PLC-SOF. PLC Control Software:**

For this particular unit, always included with PLC supply.

PLC-PI

Items available on request

⑨ **QUCC/CAL. Computer Aided Learning Software (Results Calculation and Analysis)**.

⑩ **QUCC/FSS. Faults Simulation System.**

Some Practical Possibilities of the Unit:

1.- Understanding the principles of solution cooling crystallisation.

2.- Study of crystall size distribution.

3.- Mass and energy balancing.

4.- Batch operation.

5.- Evaluation of crystallisation efficiency and crystallisation kinetics.

6.- Study of the effect of agitation rate.

7.- Study of the effect of cooling rate.

8.- Operation in continuous (optional, if the unit "QUCC/C" is acquired).

Other possible practices:

9.- Sensors calibration.

Practices to be done by PLC Module (PLC-PI) + PLC Control Software:

10.- Control of the QUCC unit process through the control interface box without the computer.

11.- Visualization of all the sensors values used in the QUCC unit process.

12.- Calibration of all sensors included in the QUCC unit process.

13.- Hand on of all the actuators involved in the QUCC unit process.

14.- Realization of different experiments, in automatic way, without having in front the unit. (This experiment can be decided previously).

15.- Simulation of outside actions, in the cases do not exist hardware elements. (Example: test of complementary tanks, complementary industrial environment to the process to be studied, etc).

16.- PLC hardware general use and manipulation.

17.- PLC process application for QUCC unit.

18.- PLC structure.

19.- PLC inputs and outputs configuration.

20.- PLC configuration possibilities.

21.- PLC program languages.

22.- PLC different programming standard languages (literal structured, graphic, etc.).

23.- New configuration and development of new process.

24.- Hand on an established process.

25.- To visualize and see the results and to make comparisons with the QUCC unit process.

26.- Possibility of creating new process in relation with the QUCC unit.

27.- PLC Programming Exercises.

28.- Own PLC applications in accordance with teacher and student requirements.

POSSIBILITIES OF OTHER AVAILABLE EXPANSIONS

Expansion 1:

⑪ **Mini ESN. Multipost EDIBON Mini Scada-Net System**

Teaching Technique used

1 UNIT = 30 STUDENTS can work simultaneously

Crystallisation Unit (QUCC)

Computer Control Software: Computer Control+Data Acquisition+Data Management

Control Interface Box

Teacher's Central Computer

Mini Scada-Net Software

30 Student Post

LOCAL NET

OPEN CONTROL + MULTICONTROL + MULTI STUDENT POST

Note: The Mini ESN system can be used with any EDIBON computer controlled unit.

Expansion 2:

⑫ **ESN. Multipost EDIBON Scada-Net System**

Teaching Technique used

Continuous Distillation Unit (UDCC)

Gas Absorption Column (CAGC)

Liquid-Liquid Extraction Unit (UELLC)

Chemical Reactors Training System (QRQC)

Crystallisation Unit (QUCC)

"n" Any other additional computer controlled unit

PLC

PLC

PLC

CENTRAL PLC

PLC

PLC

"n"(1)Control Interface

"n" PLC

"REAL TIME MULTICONTROL SYSTEMS"

"SCADA" CENTRAL COMPUTER

Option

"ETDL" EDIBON TECHNICAL DISTANCE LEARNING SYSTEM

30 Student Post

LOCAL NET

30 students can work at the same time

OPEN CONTROL + MULTICONTROL + MULTI STUDENT POST

Note: The ESN system can use any EDIBON computer controlled unit.

ORDER INFORMATION

Items supplied as standard

Minimum configuration for normal operation includes:

① **Unit: QUCC. Crystallisation Unit.**

② **QUCC/CIB.Control Interface Box.**

③ **DAB.Data Acquisition Board.**

④ **QUCC/CCSOF. Computer Control + Data Acquisition + Data Management Software.**

⑤ **Cables and Accessories**, for normal operation.

⑥ **Manuals.**

* **IMPORTANT: Under QUCC we always supply all the elements for immediate running as 1, 2, 3, 4, 5 and 6.**

Complementary items to the standard supply

PLC. Industrial Control using PLC (7 and 8):

⑦ PCL-PI.PLC Module.

⑧ QUCC/PLC-SOF. PLC Control Software.

⑨ QUCC/CAL. Computer Aided Learning Software (Results Calculation and Analysis). (Available on request).

⑩ QUCC/FSS. Faults Simulation System. (Available on request).

Expansions

⑪ Mini ESN. Multipost EDIBON Mini Scada-Net System.

⑫ ESN. Multipost EDIBON Scada-Net System.

REQUIRED SERVICES

-Electrical supply: single-phase. 220V./50Hz or 110V./60Hz.
-Water supply.
-Computer (PC).

DIMENSIONS & WEIGHTS

QUCC Unit: -Dimensions:1000 x 550 x 700 mm. approx.
                            -Weight : 50 Kg. approx.
Control Interface Box:-Dimensions: 490 x 330 x 310 mm. approx.
                            -Weight: 10 Kg. approx.
PLC Module (PLC-PI): -Dimensions: 490 x 330 x 310 mm. approx.
                            -Weight: 30 Kg. approx.

OPTIONAL ACCESSORY

-QUCC/C. Continuous Feed Unit.

RECOMMENDED ACCESSORIES

-Laboratory oven to dry the crystals sample.
-Laboratory balance.

AVAILABLE VERSIONS

Offered in this catalogue:

- QUCC. **Computer Controlled Crystallisation Unit**.

Offered in other catalogue:

- QUCB. **Crystallisation Unit**.

✱ Specifications subject to change without previous notice, due to the convenience of improvements of the product.

REPRESENTATIVE: