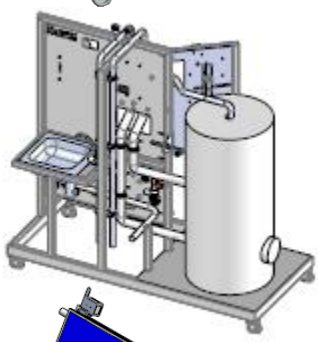
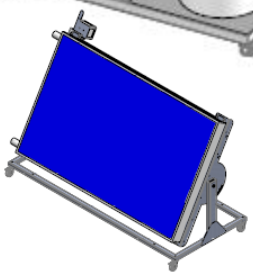
Solerm Thermal Basic

Individual solar water heater training system





Key points

- ✓Real-size study of a solar thermal installation (individual solar water heater: 200L with a 2.2m² collector)
- ✓Local and remote (internet) monitoring of the installation
- ✓Multiple measurement acquisition possibilities (Temperature, Flow, Pressure...) and data communication
- ✓Technical-economic and environmental analyses
- ✓Heat balances, dimensioning and justification of components
- ✓Electrical and hydraulic wiring and connection
- ✓Mobile system allowing the solar collectors to be taken outside only for work sessions

Specific components

- ✓Components of a real individual solar water heater:
  - 2.2m² of flat plate solar collector
  - 200L double exchanger water heater with electric booster
- ✓Electronic differential control unit with temperature sensors and operating data acquisition/recording
- ✓Circulation unit and hydraulic safety components (circulator, valves, expansion tank...)
- ✓Secondary hydraulic circuit with thermostatic mixing valve and tap
- ✓Set of instrumentation components:
  - Temperature sensors
  - Insolation sensor
  - Flow meter/Calorimeter
  - Manometer

Adjustable solar collector tilt

References

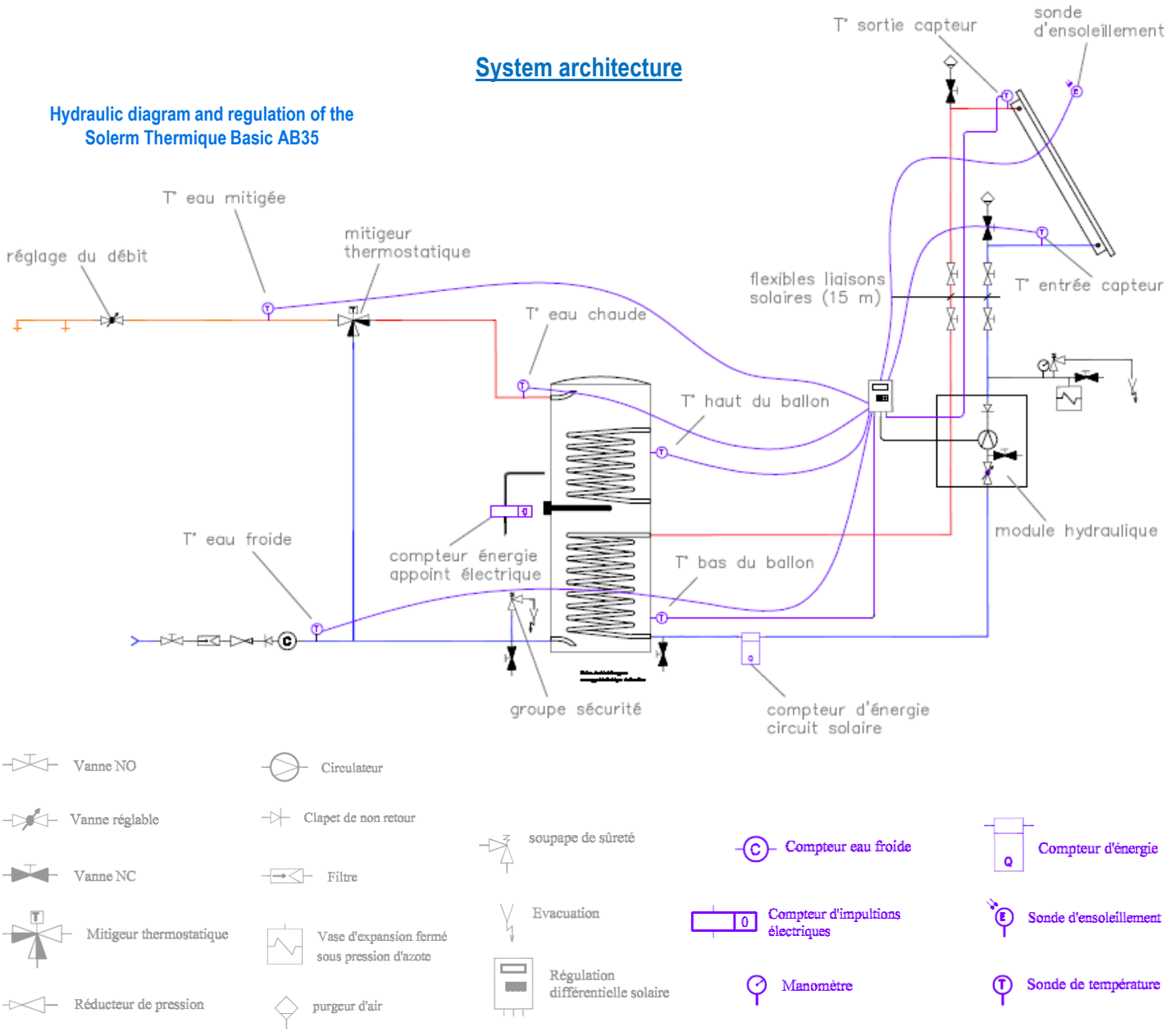
- ✓AB35: Solerm Thermal Basic
- ✓AB36: Filling pump with tank, hose and discharge pump, 230V
- ✓so//PRKO-F: Maintenance case (refractometer for a safe control of the glycol content, clinometer for the control of the panel inclination, set of strips for the pH measurement, manometer for the control of the expansion tank inflation pressure, compass, voltage control device)

Filling pump

Maintenance case

System architecture

Hydraulic diagram and regulation of the Solerm Thermique Basic AB35



Functional description

- ✓This system has been designed for the study of domestic hot water production by solar thermal energy (flat plate collector)
- ✓It implements a complete chain of production, storage and distribution of domestic hot water.

Domestic solar hot water unit

- ✓The main components are:
- ✓200L water heater with two heat exchangers and an electric immersion heater (power 3kW) to provide back-up in case of insufficient solar energy production
- ✓2.2m² flat plate solar collector with 15m of flexible tubes towards the tank
- ✓Transfer unit for the circulation (3-speed variable flow pump) of the heat transfer fluid in the primary circuit, in association with a 12L expansion tank
- ✓Set of safety components (drains, check valve, safety valve, etc.)
- ✓Differential electronic control device with sensors, for the acquisition and communication functions over Ethernet
- ✓The electronic differential control device allows the circulation unit to be switched on according to the temperature difference between the collector outlet (temperature sensor at the solar collector outlet) and the heat exchanger inlet (temperature sensor at the bottom of the heat exchanger)

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Consumption unit and drawing

- ✓The secondary hydraulic system mainly consists of:
- ✓Set of components at the cold water inlet (pressure reducer, filter, check valve, etc.)
- ✓Thermostatic mixing valve
- ✓Safety group for the storage tank
- ✓Washbasin with hot/cold water tap
- ✓Screwed connections for the "cold water" and "waste water" pipes

System architecture (continued)

Measuring unit and production monitoring

✓Many measurement points are available:
- Irradiation sensor (controller)
- Solar panel inlet temperature (controller and circulation unit)
- Solar panel output temperature (controller and circulation unit)
- Temperature at the top of the storage tank (controller)
- Temperature at the bottom of the storage tank (controller)
- Mixed domestic water temperature (controller)
- Domestic cold water temperature (controller)
- Hot water temperature (controller)
- Solar circuit flow and energy (controller)
- Water meter on the cold water supply (water meter reading)
- Pressure measurement in the solar circuit (pressure gauge under the safety valve)
- Electric meter on the electric booster

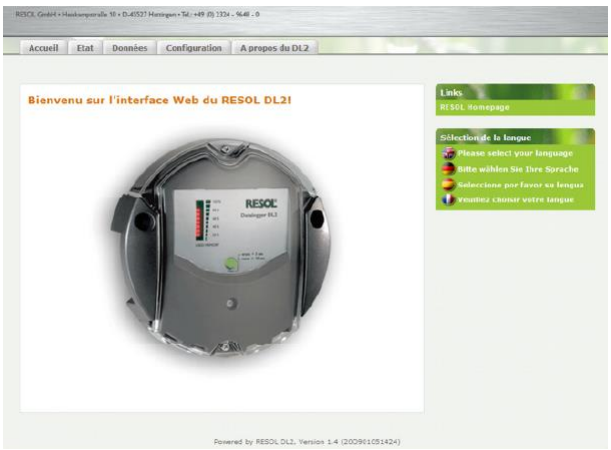
✓Moreover, the Resol Deltasol E differential controller is associated with a datalogger with data logging and Ethernet communication capabilities for instant data display (software). All of the above measurements that can be viewed on the controller can be recorded and exported to a PC via an on-board web server.

✓These data can be used in Excel software.

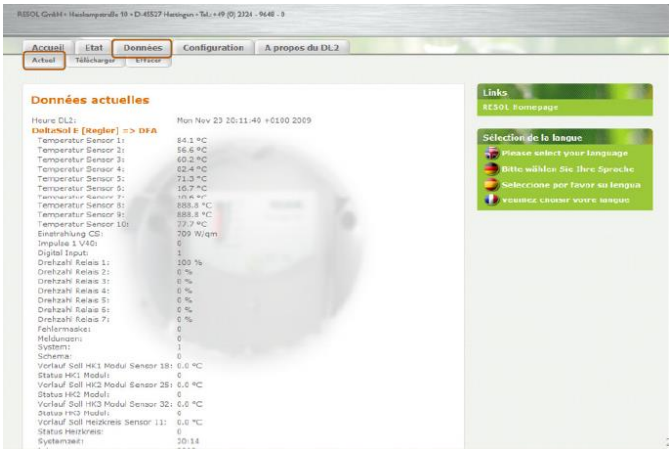
Differential regulator

Flow meter / electronic heat meter on the solar circuit

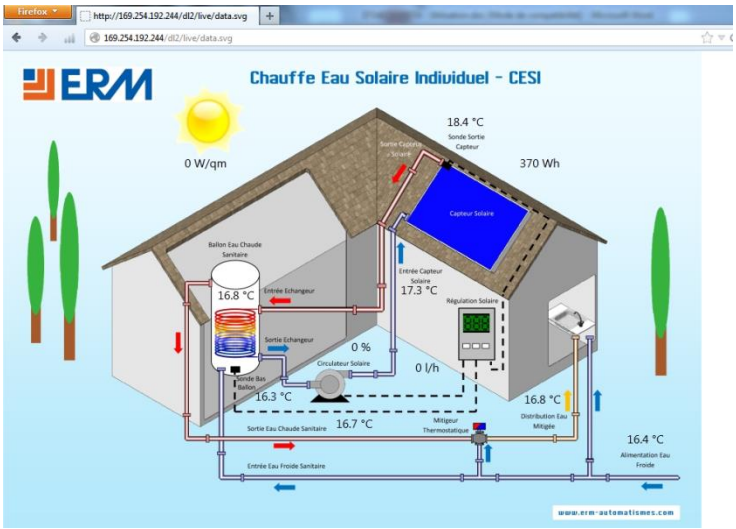
Datalogger with embedded web server associated with the differential controller



Datalogger supervision homepage



« Current Data » page of the Datalogger supervision



Synoptic of the installation with instant display of the variables

System architecture (continued)

Filling pump

➢ Applications in maintenance and control:
✓Filling and pressurising the primary circuit of a solar thermal system
➢ Features:
✓Supplied with tank, hose and discharge pump
✓230V
✓Discharge head: 50m
➢ Catalogue number: AB36

Maintenance kit for solar thermal systems

➢ Applications in maintenance and control:
✓ Maintenance of solar thermal systems
➢ Highlights & Features:
✓ Refractometer
✓ Clinometer and compass
✓ Set of test strips for pH measurement
✓ Manometer for the inflation pressure of the expansion tank
✓ Pipette for water intake and analysis bottle
➢ Reference: So//PRKO

Training activities

➢ **Training activities**
✓ Technical and economic analyses
✓ Heat consumption saved over the lifetime of the heater
✓ Greenhouse gas emissions avoided
✓ Sizing an installation
✓ Coverage rate according to use and external parameters (shading, etc.)
✓ Use of software for sizing an installation
✓ Measurement, data acquisition and interpretation
✓ Study of the heat transfer fluid according to the flow rate
✓ Energy balance: efficiency according to irradiation
✓ Justification of components
✓ Insulation on the primary circuit
✓ Influence of the B (optical factor of the sensor) and K (thermal conductance of the losses) parameters on the coverage rate
✓ Study of the circulator operation
✓ Regulation: Study of the controller operation
✓ Wiring and connection to the primary and secondary circuits

➢ **Applied science activities**
✓ Study of the sun mask with a clinometer (instrument designed to measure the inclination of a plane with respect to a horizontal plane)
✓ Highlighting the physical characteristics of a heat transfer fluid

➢ Examples of tutorials proposed by ERM Automatismes
✓ TP0: System
✓ Identifying the components of the installation
✓ Understanding the function of each of these components
✓ Understanding the operation of the installation

✓ TP1: Functional analysis
✓ Identification of the components of the installation
✓ Operation principle of the installation (solar energy, thermal energy, power, liquid expansion, circulator's function, regulation function)
✓ Hot water production: measurements and calculations

✓ TP2: Generating a shade report
✓ Calculating the shading profile on the solar radiation diagram using an inclinometer
✓ Calculatiing the shading profile from map and trigonometric functions
✓ Choosing the right location

✓ TP3: Measurements and settings (solar circuit)
✓ Drawing a schematic diagram
✓ Measuring temperatures, flow rates and power
✓ Setting the solar circuit pump
✓ Measuring the performance of the installation

✓ TP4: Studying the refilling / backup
✓ Identifying what kind of refill / backup can be implemented on the installation
✓ Studying the electrical backup
✓ Commissioning of the booster and measuring the energies