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# THERMOSTATIC AND HYGROSTATIC CONTROL

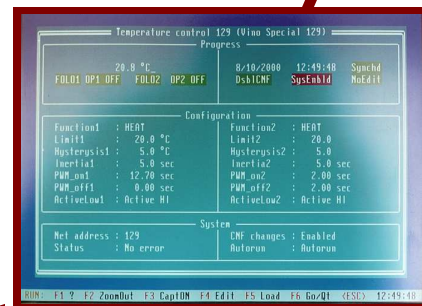
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## 1. AR1/AR1-H Panel Thermostat/Hygrostat

Like most Cognito Quam products, the AR1 Panel Thermostat and AR1-H Panel Hygrostat have been designed for the distributed process control environment with the following user-oriented characteristics:

- Simple, stand-alone, unattended operation by non-specialist personnel,
- Fully, field programmable parameters for each output,
- Complete, "seamless" integration as a slave to an external master or network, and
- Standard panel cut-out dimensions (per DIN 43700).



AR1 Panel Thermostat

Typical applications for the AR1 and AR1-H are (without any other components):

- Direct control of independent cooling and heating circuits,
- Control of three-way valves,
- Control of single cooling or heating circuit selected by external command signal, and
- Thermostatic control with simultaneous driving of alarms (optical or acoustic) or defrosting devices.

Both controllers use a common hardware platform with the following resources:

<b>AR1 and AR1-H Resources</b>	
<b>Pt100 3-conductor input</b>	Compensates the effect of practically unlimited cable length.
<b>2 solid-state 230 VAC outputs</b>	The outputs directly drive solenoids, contactors, vanes, heaters and actuators with integral cycle, low noise AC voltage.
<b>12-bit A/D</b>	Fast conversion and running average processing.
<b>4 optoisolated bit inputs</b>	These inputs offer versatile local control capabilities.
<b>Serial port</b>	Local EIA(RS)232 and network EIA(RS)485 connection.
<b>Display</b>	4-digit-plus-sign LED display.
<b>Front panel</b>	IP54 protected polyester membrane, 4 tactile switches.

The measured values (temperature and humidity) are the result of internal DSP filtering.

The AR1 and AR1-H are parametrically programmable for each output in the following:

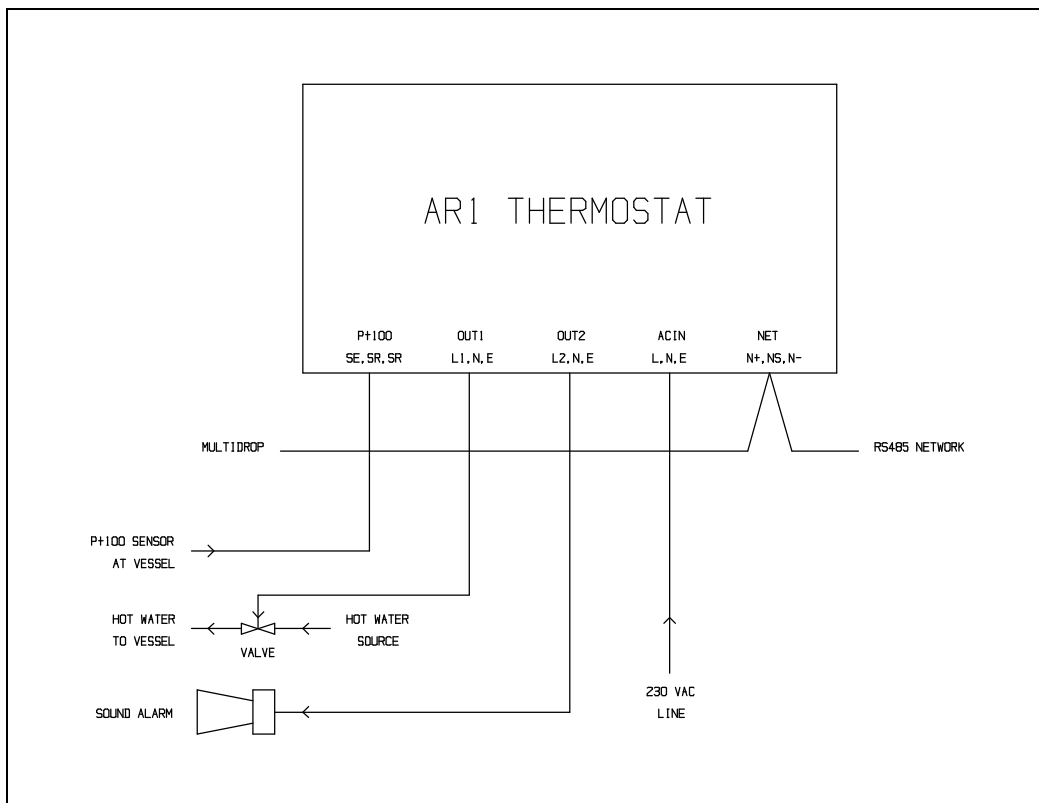
<b>AR1 and AR1-H Programmable Parameters</b>	
<b>Output functions</b>	The output can be “Always ON”, “Always OFF”, “Heat”, “Cool”, “Time” and “Period”. The “Time” and “Period” functions are very effective in implementing timing tasks such as defrosting and self-cleaning cycles.
<b>Reference temperature</b>	Specifies the reference point for the heating and cooling functions.
<b>Reference hysteresis</b>	Specifies the activation and de-activation points above and below the temperature reference.
<b>Inertia duration</b>	Inertia duration to maintain the output state for a minimum time following a change (typically used to limit the number of starts/stops per hour in pump applications).
<b>Turn On/Off times or duration</b>	Specify the turn-on and turn-off time or duration for the “Time” and “Period” functions.
<b>Output PWM</b>	Output PWM mark/space duration. Each output on-state can be a PWM signal of programmable mark/space duration (typically to drive alarms and visual/audible warnings).
<b>Logic complement of each output</b>	Each output can be logically active-low or active-high, enabling the use of all types of actuators (e.g. normally-open and normally-closed valves).
<b>Autorun enable</b>	Enables the unattended, automatic start of operation.
<b>Parameter edit enable</b>	Enables the alteration of programmed parameters by the operator.
<b>Ignore operator enable</b>	Ignores all front panel commands, typically for remote, unattended operation.
<b>Serial port</b>	Serial port baud rate and net address.
<b>Display index</b>	Defines the magnitude/state to be displayed from the panel front.

The **AR1-H Panel Hygrostat** uses our humidity sensors and in addition to the above features offers:

<b>Additional AR1-H Features</b>	
<b>Output functions</b>	“Dry” and “Wet”.
<b>Reference limit and hysteresis</b>	Humidity control limit and hysteresis for the “Dry” and “Wet” functions”.
<b>Calibration table</b>	Humidity calibration table to convert to user units.

All parameters are programmable (separately or in groups) at all times (including during normal operation) via the serial port. This enables the Thermostat to be used as a slave to a master which dynamically alters set-points or performs fuzzy control.

Like all our products with serial communication facilities, the AR1 and AR1-H are automatically detected when in a Quamatic network. In this case, all its data, parameters, settings etc. are available on-line in hard real time.



Typical AR1 thermostatic application

The four bit inputs enable control by local hardware. Each output function can be individually reversed (between “Heat” and “Cool”, “Dry” and “Wet”), parameter changes can be enabled and disable the outputs. (Output disabling is not available at the AR1-H, as the respective input is used for the humidity signal).

For ordering information, see page 11.

## 2. Humidity Sensors for the Processing Industry



Drying Chamber Moisture and Pt100 Temperature Sensor



In-line Humidity Sensor

Our humidity/moisture sensors address the problem of measuring humidity in-line production and without interfering chemically, physically or mechanically with the processes taking place. They are the result of a recent FAIR project (IMPROLIVE, EU funded) involving the processing of olive oil production wastes.

The features of this technology are:

Humidity Sensor Technology Features	
<b>Robust, no moving parts, inert</b>	Being based on the capacitive principle, our sensor is robust, has no moving parts and is chemically, physically and mechanically inert.
<b>Sensor shape</b>	Detecting capacitance does not react in any way with the monitored process, so the sensor can be of any physical shape.
<b>State of monitored mass</b>	The absolute quantity of water in the monitored mass is detected, which can be in any substance, form or phase.
<b>Electronics</b>	The specialist electronics are part of the sensor.

The AR1-H Panel Hygrostat (page 1) is a suitable controller to process the output of these sensors in hygrostatic (drying or wetting) applications.

For ordering information, see page 11.

### 3. CSNS Capacitive Humidity/Moisture Sensor and Controller

The CSNS Sensor and Controller combines sensing in remote locations with local control functions.



CSNS Humidity/Moisture Sensor and Controller

The CSNS Sensor and Controller features the following resources:

<b>CSNS Sensor and Controller Features</b>	
<b>Isolated capacitance measurement</b>	The sensor capacitance is measured in galvanic isolation to all other CSNS circuits. This enhances noise immunity and protects from adverse external conditions.
<b>Two configurable multifunction analog ports</b>	The sensor and controller features two configurable multifunction analog ports for voltage, potentiometer or 2-wire/3-wire Pt100 temperature element input.
<b>Isolated Bit I/O</b>	Two configurable galvanically isolated 24 VDC universal connection single bit inputs and two configurable galvanically isolated single bit outputs.
<b>Serial communications port</b>	Dual standard serial communication port: EIA(RS)232 for local communications and/or galvanically isolated EIA(RS)485 for connection to Quamatic, Modbus and similar networks.
<b>Dual voltage power supply</b>	Dual 230/115 VAC power supply for worldwide application.
<b>IP65 enclosure</b>	The CSNS Sensor and Controller is housed in an aluminum cast enclosure protected to IP65.

The CSNS Sensor and Controller firmware allows for:

- **Simple, self-contained, unattended operation** by non-specialist personnel,
- **Fully programmable** (locally or via the network connection) parameters and functions for each port, input and output,
- **Five point calibration table** to convert the internal humidity reading to user units,
- **Compensation functions** for temperature dependencies, series capacitance and similar effects,
- **Complete integration** within a Quamatic network (automatically detected) or other supervisory systems.

The BAO-1 Panel Controller and Logger (next page) is a suitable master mode displaying device to monitor one or more CSNSs in a network.



CSNS based in-line moisture sensor measuring olive oil production waste. (The sensor body is offered on a custom, per order basis).

For ordering information, see page 11.

#### 4. BAO-1 Panel Controller and Logger

The fully programmable and versatile BAO-1 Panel Controller and Logger has been designed for the distributed process/batch control environment with the following user-oriented characteristics:

BAO-1 Panel Controller and Logger Characteristics	
<b>Operation</b>	Simple, self-contained, unattended operation by non-specialist personnel.
<b>Management and control of remote Quamatic satellite</b>	Complete master mode management and control of remote Quamatic network satellites such as a CSNS moisture/humidity sensor or a NSFT/ICCD controller.
<b>Calibration table</b>	Ten point calibration table converts the remote satellite data to user units.
<b>Encoder and material sensor interface</b>	Rotary encoder and material sensor interface monitors processed material length, workpiece count and production time.
<b>Workpiece count, length, duration</b>	Production is logged in two sets: batch and accumulated workpiece count, length and duration.
<b>Isolated bit inputs and outputs</b>	These are general purpose galvanically isolated bit inputs and outputs to interface to local automation devices.
<b>Input and output parameters</b>	The parameters and function for each input and output are fully programmable.
<b>PID controlled analog output</b>	Analog output can also be the result of a variable setpoint and PID parameter calculation.
<b>Running average</b>	Running average filtering of all measured variables.
<b>Network integration</b>	Complete integration within a Quamatic or Modbus network or other supervisory systems.
<b>Standard enclosure</b>	Standard enclosure and front panel cut-out dimensions (per DIN 43700).



BAO-1 Panel Controller and Logger

Typical applications for the BAO-1 are:

- Large scale drying stations/ovens,
- Plant ventilation control,
- Pumpstation control and monitoring,
- In-line workpiece processing and handling,
- General material transport, handling and logging, and
- Production plant and machinery control.

The Controller is automatically detected when in a Quamatic network. In this case, all its data, parameters, settings etc. are available on-line in hard real time.



The Controller features the following hardware resources:

<b>BAO-1 Controller and Logger Resources</b>	
<b>Encoder and material sensor interface</b>	Four galvanically isolated fast bit inputs interface to a rotary encoder and material sensor to detect and measure machine speed, processed material length and count.
<b>Isolated bit inputs</b>	Eight galvanically isolated, DSP filtered bit inputs to interface to external events and states.
<b>Isolated bit outputs</b>	Eight galvanically isolated bit outputs to drive local automation.
<b>Serial communications</b>	Dual standard serial communication port: EIA(RS)232 for local communications and/or EIA(RS)485 for connection to Quamatic, Modbus and similar networks and remote sensors.
<b>Three isolated operation potentials</b>	Triple isolated output power supply to the unit's circuits: EIA(RS)485 net port, internal logic and external interface.
<b>Front panel</b>	Five digit plus sign LED display and four operator switches on the front panel.

The front panel is protected to IP54 and is covered by a polyester membrane. The display digits are visible through a contrast enhancing window and the switches are of the tactile type.

The Controller is parametrically programmable for the following:

<b>BAO-1 Controller Programmable Parameters</b>	
<b>Bit output function</b>	Each output can be a logical function of a bit input, other bit output or internal logical state or the result of a value comparison or function to an internal variable (e.g. encoder speed, workpiece count, workpiece position etc.). The activated state is further programmed in terms of timing (wait delay, duration, or PWM repetition). The timing can be specified in terms of workpiece position thus allowing for speed independent material processing.
<b>Variable display units</b>	Individually programmable display units for the batch and accumulated count, length and duration variables.
<b>Encoder prescaler</b>	Encoder prescaler and length conversion multiplier to define the internal units and accuracy of position measurement and control.
<b>Running average samples</b>	Number of running average samples to filter the measured data effectively and efficiently.
<b>Network parameters</b>	All network parameters ensuring reliable and optimum communication traffic with the network members.
<b>Operation flags</b>	Operation flags (autorun/manual, enable/disable panel editing, displayed variable etc.) enable adapting to the exact requirements of the specific application.
<b>Analog output function</b>	The analog output can be a replica of an internal variable or the PID control result to a setpoint value of any internal variable (e.g. encoder speed, remote data etc.).

All parameters are programmable (separately or in groups) at all times while the Controller is powered. In this way the Controller operation can be determined dynamically (as in the case of fuzzy control).

For ordering information, see page 11.

## 5. ICCDxx Integral Cycle Thermal Load Drive

The ICCDxx line employs thyristor switches to drive thermal loads with complete cycles minimizing supply and load line disturbances and noise.



ICCD60 Thermal Load Drive

They interface with most (if not all) automation equipment in the market and are an effective thermal load drive in many applications. They are all fully protected, digitally-controlled and programmable units.

They are simple to install and are effectively employed in applications driving:

- All types of resistive and inductive heaters,
- Ovens, and
- Boilers.

ICCDxx Features	
<b>Low noise integral cycle thyristor control</b>	Complete cycles only are conducted to the load, thus eliminating all di/dt and dV/dt caused interference.
<b>Power circuit</b>	3-phase, 15-75 A/phase. The employed 1600 VDC power circuit allows use in up to 3x480 VAC systems.
<b>All types of load connection</b>	Drives both, Wye/Star and Mesh/Delta connected loads.
<b>Complete electronic protection</b>	Overcurrent, undercurrent, overvoltage, undervoltage, against noise, faults and disturbances in the supply, phase integrity, internal temperature.
<b>Interface</b>	Versatile two input user/control interface.
<b>Isolated bit outputs</b>	Galvanically isolated "Idle", "Run", "Load Fault", "Fault".
<b>Small power 24 V supply</b>	To power a local sensor or other automation device.

ICCDxx Line Characteristics at 3x400 VAC			
Model	Power, kVA	Current, A/phase	Maximum heat dissipation, W
ICCD15	10	15	61
ICCD30	20	30	109
ICCD45	30	45	150
ICCD60	40	60	202
ICCD75	50	75	252

Units above 75 A/phase are produced on a per order, custom base.

For ordering information, see page 11.

## 6. NSFT/ICCD Panel Controller

The NSFT/ICCD Panel Controller gives local and distributed control capabilities to the ICCDxx thermal load drive and extends its power resolution by extending the available PWM integration period without introducing any further subharmonic disturbances to the line.



NSFT/ICCD Panel Controller

The NSFT/ICCD controller features:

- Standard panel mounting enclosure (DIN 43700) with an IP54 polyester membrane face,
- Two user tactile switches on the front panel,
- Three status indicating LEDs,
- Comprehensive signal and power connections with the ICCDxx hardware, and
- Optional Quamatic, Modbus or similar network connectivity.

The network capability turns the controller to a Quamatic or Modbus satellite with the following functions:

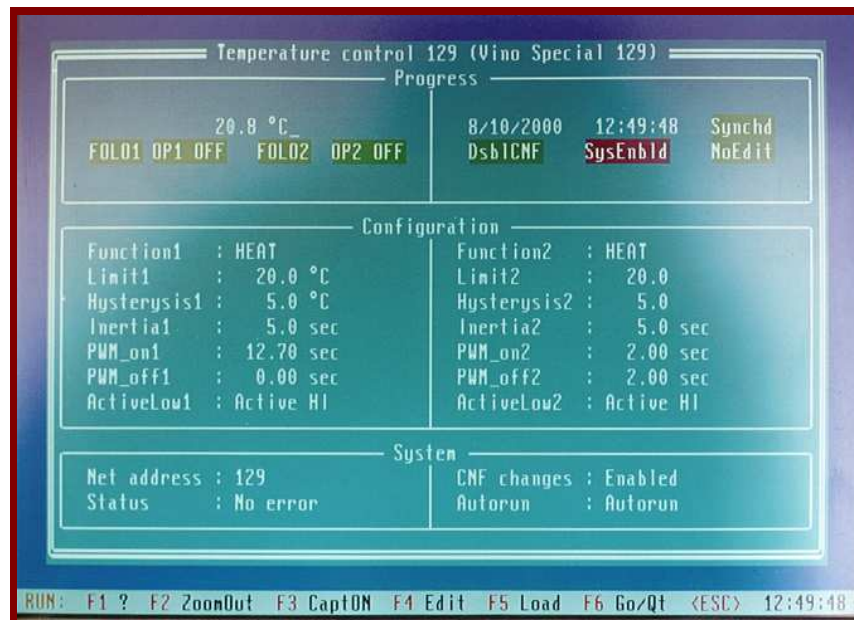
<b>NSFT/ICCD Panel Controller Quamatic Functions</b>	
<b>Record exchange</b>	Identity, Status, Progress and Configuration
<b>Timestamping</b>	Record Timestamping
<b>Commands</b>	Go and Quiet (Start/Stop)

The four ICCDxx hardware bit state outputs ("Idle-Run-Load\_Fault-Fault") are repeated, galvanically isolated, for further processing by any local automation devices.

For ordering information, see page 11.

## 7. Quamatic Software

All Cognito Quam products with serial communications are automatically detected by Quamatic software. Quamatic is our open, freely available, free-to-use and easy-to-implement byte level protocol described and specified fully in the product's manual.



Detailed projection screen of AR1 data

Diagnostic, setup and operation binaries are also available for free on request by e-mail from <thtsw@cognitoquam.gr>.

## 8. Ordering Information

Ordering Information	
Model	Description
AR1	Panel Thermostat
AR1-H	Panel Hygrostat and Thermostat
HumPt100	Humidity and Pt100 Temperature Sensor
HumSns	Humidity only Sensor
BAO-1	12+8 Bit I/O and Analog Output Panel Quamatic Controller and Logger
CSNS	Network Capacitive Sensor and Controller
ICCDxx	Integral Cycle Thermal Load Drive, xx A/phase
NSFTQ-L	NSFT/ICCD Panel Controller, local control only
NSFTQ-N	NSFT/ICCD Panel Controller, local and network control
XFR400230	Control Voltage Supply Transformer, 90VA, 400/230 VAC

## 9. Cognito Quam Profile

Cognito Quam Electrotechnologies Ltd. (established in 1990) is a privately held engineering and commercial company specializing in industrial electronics and their application. The company expertise covers all aspects of applications for the factory environment namely measurement (transducers and sensors), data processing and communication, control and actuation, automation and robotics and power and energy electronics.

Cognito Quam has contributed and been involved in the design and development of the following technologies, machinery and devices:

- Motor voltage and frequency inverters and converters,
- Thermal load control and management,
- Robotic interfaces and protocol converters,
- Adaptive panel controllers,
- Robotics controllers,
- Variable speed drives,
- Olive oil processing rejects control equipment (FAIR contract),
- Low Voltage and EMC CE marking compliance devices and equipment for production lines,
- Portable dioxine-furan instrumentation (SMT contract),
- Three-phase programmable soft-starters,
- Hard real time job scheduling systems,
- Hard real time industrial distributed data systems (Brite-EuRam subcontract),
- Calibration rig and supplies for power meters,
- Electrical utility Hall effect energy and power meters,
- Industrial data networks,
- Battery chargers and UPS inverters,
- Solar power air conditioning telemetry and control systems (Thermie subcontract)
- Small switching power supplies,
- Multi-port communication PC cards,
- Ship oily water separators, and
- Modem controllers.

Cognito Quam also offers its research and development services in integrating its products in larger industrial systems products as well as in the design of new and challenging devices and equipment. As such the company cooperates closely and supports its customers in their efforts for a better product.