

Controls & Instrumentation Product Line

Analzers	Oxygen Analyzers & In-Situ Probes Opacity Monitors Combustible Gas Analyzers
Microprocessor-based Multiloop Controllers	BCC Boiler Computer Controller AC Station Multifunction Programmable Controller
Microprocessor-based Single Loop Controllers	Gamma 2 Series Series X and Series Q
Analog Controllers & Stations	Master pressure controllers Positioning controllers Manual/Auto Stations Oxygen Trim Controllers Sequencing and Indicating Draft Controllers
Data Acquisition & Display Systems	AIMAX™ SCADA System MultiTrace™ Paperless Recorder 12" Circular Chart Recorder Integrator with 7-digit Totalizer Counter Single Pointer Gauges for Pressure, Draft, and Differential Pressure Single and Multi-pointer Vertical Scale Indicators Thermocouple Meter
Actuators & Regulators	Electric Rotary Actuators Electric Linear Actuators Pneumatic Rotary Actuators Oxygen Trim-effecting Devices Draft, Pressure and Hydraulic Position Regulators
Sequencing (Lead Lag) Controls	Boiler Alternators Microprocessor-based Firing Rate Modulation and Sequencing Controllers Non-Modulating Sequencers
Ancillary Equipment	Pressure and Differential Pressure Transmitters Signal Conditioning Rack Plug In Modules Alarms, Audible & Visual
Differential Pressure Switches Custom Engineering Services & Systems Integration	

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HC Hays Cleveland Multifunction Loop Controllers



From Single Loop to Mini DCS!

Multifunction Programmable Controllers

AC Station is a series of powerful, flexible, and expandable micro DCS's that fills the gap between SLC and mini DCS with:

- 4 - 8 analog inputs
- 4 - 8 analog outputs
- 8 - 24 digital inputs
- 8 - 24 digital outputs
- 2 - 3 serial communications ports
- 1 LAN communications port
- 4 advanced PID algorithms
- Compact, 72 x 144 mm size, on 260 mm deep
- High resolution graphic display with interactive guided menu, bargraph pages, trends, alarms, etc., for a simple Man/Machine interface.
- Complete freedom to design a custom control strategy with the user-friendly graphics tool.
- No programming language is needed
- 12 of the most common control strategies are pre-programmed.
- Serial communications, Master/Slave, and high-speed Peer-to-Peer for exchange of resources and/or integration in higher level systems.
- 3 protected-access levels for design, start-up, and operation functions.



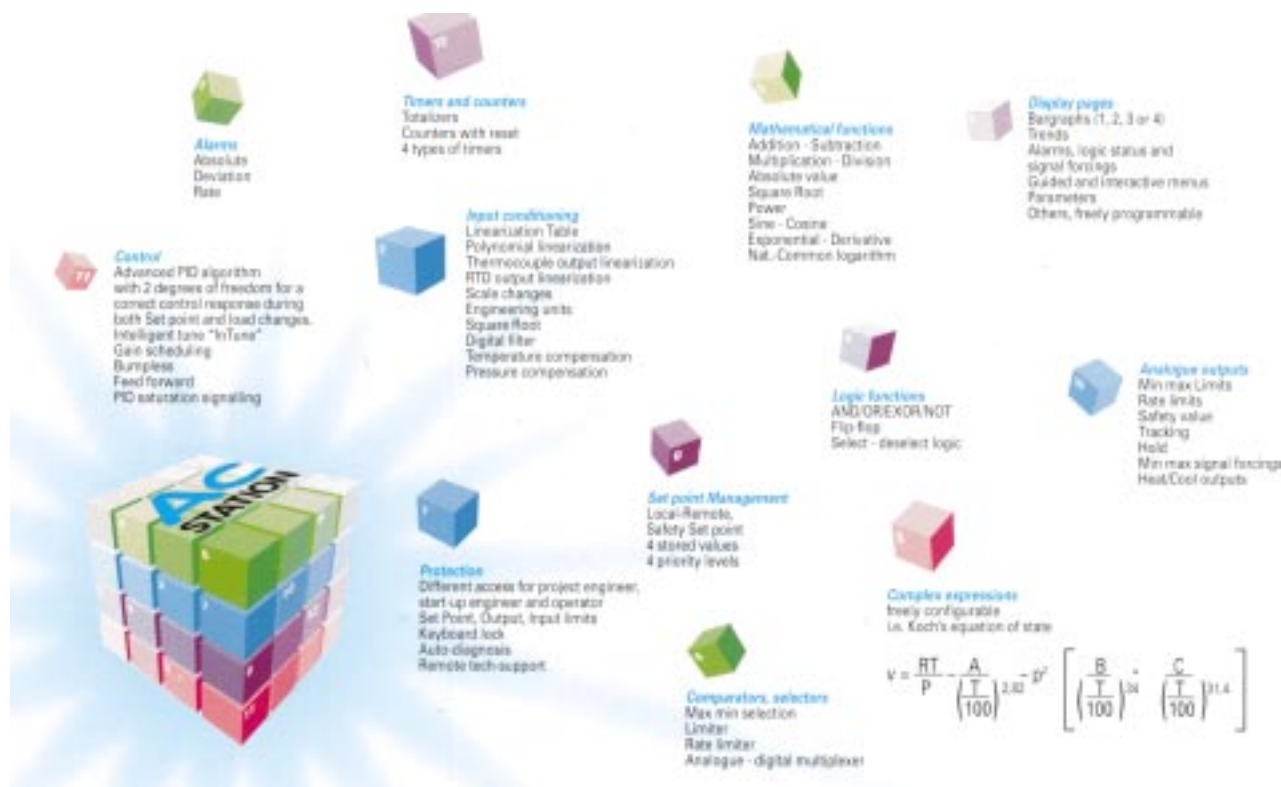
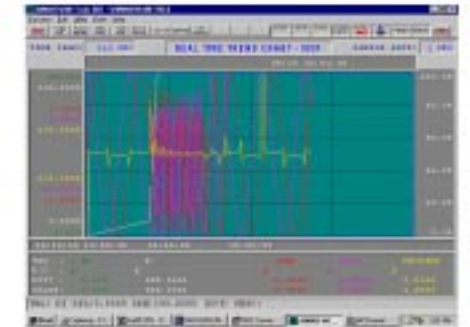
Introducing AIMAX® for WINDOWS®

- An industrial process control and monitoring software package.
- A world class man/machine interface (MMI) product that continuously collects and integrates realtime data from distributed systems (DCS), programmable controllers (PLC), loop controllers, and I/O systems.

CUSTOMER APPLICATIONS

AIMAX® for WINDOWS® has been used in a variety of process and manufacturing industries worldwide. Chemical, food and beverage, metals, pulp and paper, semiconductor, water, and waste water are just a few of the industries where AIMAX® for WINDOWS® has been successfully employed.

AIMAX® for WINDOWS® runs on an IBM® personal computer or compatible under Windows®.



Innovative Control Technique

Hays Cleveland universal controllers use an innovative technique to provide exceptional control in industrial process applications. This technique is based on **fuzzy logic** combined with the standard **PID** control algorithm. **The fuzzy logic algorithm responds rapidly to both process disturbances and operator changes.**

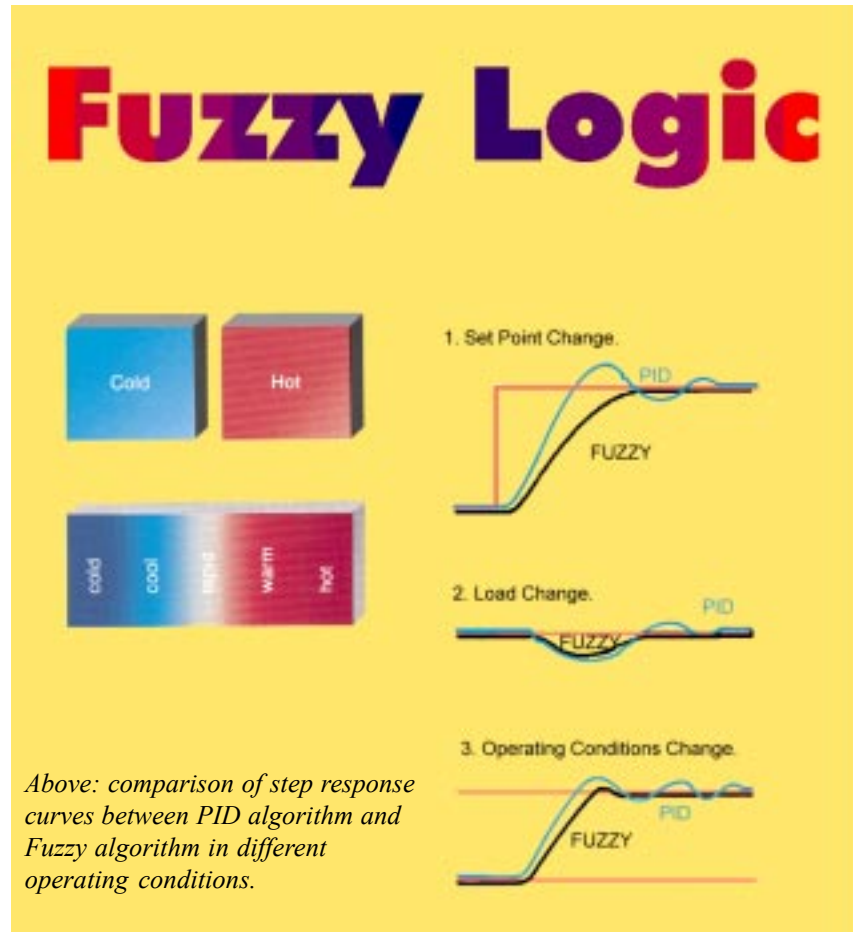
WHAT IS FUZZY LOGIC?

Fuzzy logic is "shaded" logic. The concept resembles **AI (artificial intelligence)** in that it is based upon a block of rules permitting action determined not by **binary states** (for instance: black/white, open/closed, heat/cool) but rather on the evaluation of **intermediate states** (for instance: hot, warm, tepid, cool, cold). The resulting process control mode mimics human reasoning, wherein degrees of information are evaluated so that more specific corrective actions may be taken.

PID VS. FUZZY LOGIC

The standard **PID** control algorithm relies on parameters (P, I, and D values) calculated from the characteristics of the process to be controlled--its gain and time **constants**.

By comparison, the **Fuzzy** algorithm selects, by means of a complex group of rules, from an array of parameters calculated from characteristics of the process **as it reacts to various operating conditions.**



Above: comparison of step response curves between PID algorithm and Fuzzy algorithm in different operating conditions.

PID PLUS FUZZY LOGIC

Combined, **PID** and **Fuzzy Logic** produce a truly universal control algorithm, as responsive to changes in **process conditions** as it is to changes in **operator requirements**. The **PID + Fuzzy** combination therefore provides an excellent control solution for many "difficult" processes--especially those characterized by frequently changing operating conditions--which were practically impossible to control with standard **PID** alone. The **PID** action, when integrated with **Fuzzy Logic**, reacts quickly to either **load or set point changes**--without the unwanted

oscillations ("hunting") characteristic of **PID** action alone.

With **PID + Fuzzy**, the operator retains the maximum range of control and flexibility. While the factory-set PID/Fuzzy parameters are suitable for many processes, the control algorithm can be configured manually, starting with the standard PID adjustments, and then applying the desired per cent of Fuzzy. Or the controller can compute the Fuzzy parameters automatically, starting from the manually selected PID parameters. When the automatic self-tuning procedure is launched, it carries out the automatic searching and loading of the optimum values.

Universal Controller Selector Guide

PRODUCT FEATURES	GAMMA 2				X-SERIES				Q-SERIES		
	C1	M1	M3	M5	XE	XF	XP	XS	QF	QP	QD
PID CONTROL											
NUMBER OF LOOPS	1	1	1	1	1	1	1	1	1	1	2
PID WITH AUTOTUNE					S		S	S			
PID WITH FUZZY LOGIC & AUTOTUNE						S			S	S	S
PID WITH FUZZY AUTOTUNE	S	S	S	S							
PID WITH AUTOTUNE & ADAPTIVE TUNE				S							
HEAT COOL (SPLIT RANGE)			S	S	O	S		S	S	S	S
TIME PROPORTIONAL	S	S	S	S	S	S		S	S	S	S
CASCADE CONTROL											S
RATIO CONTROL											S
3 POINT STEPPING FOR ELECTRIC ACTUATORS				S		S	S		S	S	S
SIZE											
1/32 DIN 48X24	S										
1/16 DIN 48X48		S	S	S							
1/8 DIN 48X96					S	S	S	S			
1/4 DIN 96X96									S	S	S
MAIN INPUTS											
UNIVERSAL INPUTS (T/C, RTD OR ANALOG)	1	1	1	1	1	1	1	1	1	1	2
DIGITAL INPUTS (LOGIC)				2	3	3			3	3	3
REMOTE SETPOINT				O	S	S	S		S	S	S
POTENTIOMETER				1	1	1			1	1	1
MAIN OUTPUT											
CONTACT DIGITAL	1	1	1	1	1	1	1	1	1	1	1
ANALOG OUTPUT				1	1		1	1	1	1	1
AUXILIARY OUTPUTS											
RELAY	1	1	2	2	1	2	2	2	2	2	2
ANALOG (RETRANSMISSION)	1	1	1		1	1	1		1	1	1
FRONT PANEL FUNCTIONS											
DISPLAY PROCESS VARIABLE	S	S	S	S	S	S	S	S	S	S	S
DISPLAY SETPOINT	S	S	S	S	S	S	S	S	S	S	S
DISPLAY OUTPUT (MV)	S	S	S	S	S	S	S	S	S	S	S
AUTO MANUAL STATION				S	S	S	S		S	S	S
COMMUNICATIONS											
SERIAL MODBUS (REQUIRES THE ALS MODULE)					O	O	O	O			
RS485 MODBUS	O	O	O	O	O				O	O	O
PROGRAMMABLE SETPOINT											
STORED SETPOINTS				2	4	4	4				3
1 PROFILE WITH 11 SEGMENTS						O	O				
16 PROFILES WITH 99 SEGMENTS (MAX 255 SEGMENTS)										O	
1 PROFILE WITH 16 SEGMENTS				O							
OTHER FEATURES											
TRANSMITTER POWER SUPPLY	O	O	O	S	S	S	S		S	S	S
CONFIGURATION STORAGE											
MEMORY CHIP				O							
DISK FILE	O	O	O	O					O	O	O
PROTECTION											
IP54: INDOOR; LIMITED DUST & WATER PROTECTION					S	S	S	S	S	S	S
IP65: INDOOR; COMPLETE DUST & WATER PROTECTION	S	S	S	S	O	O	O	O	O	O	O

S STANDARD # STANDARD - # OF ITEMS
 O OPTION # OPTION - # OF ITEMS

Universal Controllers



SERIES X CONFIGURABLE 1/8 DIN CONTROLLERS WITH UNIVERSAL INPUT AND TIME-PROPORTIONING OUTPUT.

- Universal input: thermocouples, RTD's, mA, and voltage.
- Main output: relay, logic.
- PID Algorithm.
- Hot/Cool Control.
- Auto-tuning.
- Auto/Manual Station.
- 2 auxiliary relay outputs.
- Loop break alarm.
- Serial communications, modbus protocol.
- Switching power supply.
- Auxiliary power supply for transmitter.
- IP54 or IP65 front panel protection.
- Protected parameter access.

GAMMA 2 SERIES CONFIGURABLE 1/32 TO 1/16 DIN CONTROLLERS WITH UNIVERSAL INPUT

- Universal input: thermocouples, RTD's, mA, and voltage.
- Main output: relay, logic, or continuous.
- PID with 2 degrees of freedom.
- Hot/Cool Control.
- Auto-tuning or Fuzzy Logic.
- Auxiliary relay output.
- Loop break alarm.
- Serial communications, modbus RS485 protocol.
- Switching power supply.
- Auxiliary power supply for transmitter.
- Programmable set point profile.



Universal Controllers

SERIES Q 1/4 DIN PROGRAMMABLE CONTROLLERS FOR 1 OR 2 LOOPS QE - QF - QD - QP

- basic, cascade, or ratio control
- one or two universal inputs for thermocouples, RTD's, mA, and voltage
- 3 logic inputs
- main output: relay logic, continuous mA or voltage, three-point stepping
- PID plus Fuzzy algorithm
- Auto-tuning
- Auto/Manual station
- Up to 4 auxiliary relay outputs
- Retransmission output, mA or voltage
- Local/Remote set point, 3 stored set points
- Programmable set point (QP models)
- RS485 communications port, Modbus protocol
- Switching power supply
- Auxiliary power supply for transmitter
- IP54 or IP55 front panel protection
- Protected parameter access



SERIES J CONFIGURABLE 1/8 DIN INDICATING TRANSMITTER WITH UP TO 4 ALARMS

- Universal input for thermocouples, RTD's, mA, voltage, and transducers (JT models)
- Fast sampling time: 62 msec
- 3 logic inputs
- Measurement retransmission output: mA or voltage
- 2 or 4 relay outputs also with ISA alarm sequence
- Hold: Peak, Valley, and Actual value
- Serial communications, Modbus protocol
- Switching power supply
- Auxiliary power supply for transmitter or transducer (JT models)
- IP54 or IP55 front panel protection
- Protected parameter access

