

D SERIES



FEATURES

- ◆ **Easy-to-setup and program**
- ◆ **Universal Inputs/Outputs**
- ◆ **NEMA 4X (REX-D100 only)**
- ◆ **Dual Set Points**
- ◆ **Digital Communications (Optional)**

Advanced Fuzzy Logic

D Series controllers feature an advanced fuzzy logic inference algorithm that not only suppresses and eliminates overshoot on startup or set point change, but also responds quickly to process upsets. Like the other SYSCON-RKC instruments, the D Series has been designed for easy operation without special training.

With the new, improved fuzzy logic algorithms, the D Series will provide more stable, accurate control in a wide range of process applications. These controllers also perform conventional PID control and can be easily operated with automatic autotuning which calculates optimum PID constants.

Forty-four types of thermocouples, RTD's, DC voltage or DC current ranges can be easily selected through the front keypad. The D Series also has universal output selection for the main control output. The main control output can be selected from a relay contact, a voltage pulse or a 4~20mA output. (Universal output is not available on the REX-D100).

The D Series performs PID control with an enhanced fuzzy logic algorithm at a sampling time of 0.5 seconds and an accuracy of $\pm 0.3\%$ FS. The D Series provides three levels of operation: set point changes only, tuning parameters such as PID constants, etc., and instrument initialization. The availability of these various levels is useful in suppressing the display of unnecessary setup parameters. Programming functions are easily accomplished through the front panel. The D Series, with its accurate and fast-response, is an excellent choice for temperature and process control applications that require tight tolerances.

Applications include processing and manufacturing of the following:

- ◆ Injection Molding
- ◆ Extrusion
- ◆ Furnaces
- ◆ Ovens
- ◆ Semi-conductor
- ◆ Environmental Chambers
- ◆ PC Board Manufacturing
- ◆ Food and Beverage
- ◆ Electronics
- ◆ Test Stands
- ◆ Aerospace
- ◆ Petroleum Processing

Standard Universal Inputs and Outputs

Forty-four types of thermocouple, RTD, DC voltage and DC current types can be easily selected from the front of the controller. In addition, the controller employs a universal main output (except REX-D100) and cooling output on Heat/Cool type to allow free selection of the relay contact output, voltage pulse output or 4~20mA DC output. For 4~20mA DC current input option and externally-mounted KD100-55 250 Ω shunt resistor is required.

Temperature Alarms

The D Series can have two independent alarm contacts that can be easily programmed in the field. These relay contacts can be selected to be deviation alarms, process alarms or a set value alarm.

Heater Break Alarm (HBA)

HBA detects failures in the heater output circuit. The HBA is able to detect these failures by monitoring the load current through the use of an external current transformer. The control will close the alarm contact when the load current falls below a threshold value that has been set by the operator. The D Series can be used on a single phase or three phase WYE or Delta heater circuit. For additional information, refer to the HBA section of Control Theory.

Loop Break Alarm (LBA)

The LBA monitors and protects an entire temperature control system. LBA can detect heater breaks, thermocouple or RTD failures, short circuits or the failure of an operating device such as a mechanical relay, mercury relay or a SSR. For additional information regarding LBA, refer to the LBA section of Control Theory.

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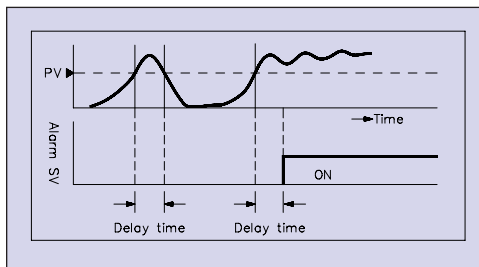
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Alarm Hold Function

The D Series can be set to mask alarms on start-up. Thus, in cases where a low alarm is used, additional logic is not required for machine start-up. An example of this application would be when it is necessary to shut equipment off in low temperature conditions.

Alarm Delay

The alarm delay function is used to delay the alarm action. If the alarm state is released during this delay period, the alarm output will not be activated. External disturbances such as noise may cause a momentary increase of a process value into the alarm area. The alarm delay function prevents alarm output in these cases. (Setting range: 0-600 seconds).



Alarm Delay Relay

Two Set Points

The D Series has two independent set points. Both set point values can be programmed from the front keypad. However, the second set point is accessed by a set of dry contacts wired to the rear terminals. This is ideal for a run and idle condition for standby or batch processes.

Ramp-to-Set Point

The D Series has standard ramp-up and ramp-down to set point features. This is a linear ramp in percent or degrees per second or minute (optional on D100).

Wide Supply Voltage Range

The D Series can be operated from 90-264VAC (50/60 Hz) power supply. As an option, 24VAC or 24VDC are available.

UL Recognized

The D Series instruments are UL Recognized.

CSA Certified

The D Series instruments are CSA Certified.

CE Mark,

The D Series instruments hold the CE Mark.

ASIC

Application Specific Integrated Circuit for optimum control.

Surface Mount Technology

For greater reliability, D Series instruments are manufactured using surface mount technology on the printed circuit board instead of through-hole technology.

STANDARD FEATURES

Standard features of these controllers are:

- ◆ Universal inputs/outputs
- ◆ Fuzzy logic
- ◆ Ramp-to-set point
- ◆ Output limiter
- ◆ Auto/manual control
- ◆ Autotune PID
- ◆ Second set point
- ◆ PV bias
- ◆ Setting limiter

OPTIONAL FEATURES

Heat/Cool PID Control

Heat/Cool PID control is effective for controlling heat-generating processes such as extruders, reactors, etc. The controller can conserve energy by using a deadband function or can perform stable temperature control in processes with large time constants by overlapping the Heat/Cool output. Fuzzy logic is also applied to the Heat/Cool algorithm.

Analog Retransmission Output

Analog retransmission output enhances system performance. When analog retransmission output is added to the D Series controllers, the process value can be retransmitted as an analog current signal (4-20mA) to a remote instrument such as a recorder or DCS network, etc. Measured, deviation, set, or manipulated output values can be selected.

NEMA 4X

For operation in severe environments or when wash-down is required, the REX-D100 controller is available with the NEMA 4X water-proof and dust-proof rating (equivalent to IP65). The standard D Series controller conforms to IP54.

Interface Capability

Up to 31 D Series controllers can be connected to one host computer via the RS-485 or RS-422A communication function.

Fuzzy Logic

Fuzzy logic is the latest development in machine intelligence that enables computers and controllers to determine a wider range of responses. Computers and controllers do not reason like the human mind. They manipulate precise facts that have been reduced to strings of zeros and ones, and statements that are either true or false. Fuzzy logic in controllers emulates human thinking by assisting the instrument to determine responses between two values. This technology allows the temperature controller to function like an expert operator. For additional information, see the Fuzzy logic section of Control Theory. Fuzzy logic technology is particularly effective in:

- ◆ Suppressing overshoot
- ◆ Shortening start-up time
- ◆ Suppressing process upsets when frequent load changes occur
- ◆ Suppressing upsets that occur with set point changes



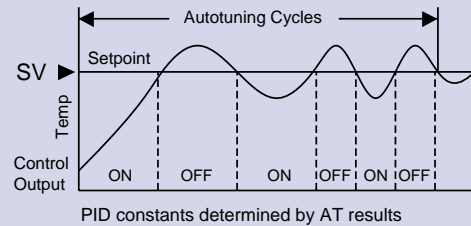
Advanced Fuzzy Logic Algorithm

The D Series controls inhibit overshoot by using a fuzzy logic inference algorithm. Fuzzy logic technology is particularly effective in:

- Suppressing overshoot
- Shortening start-up time
- Suppressing process upset when frequent load changes occur
- Suppressing upsets caused by set point changes

Autotuning on Demand

The D Series will compute the optimum PID values via precise calculations of the microprocessor at a touch of a button.

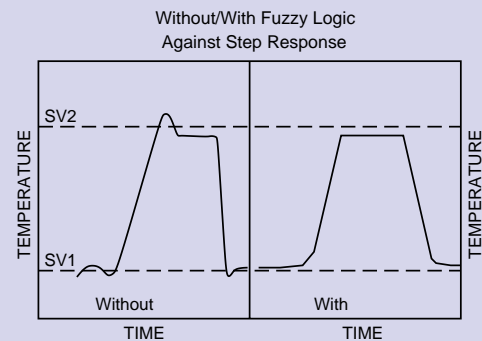


Universal Inputs and Outputs

The D Series instruments accept a choice of ten different thermocouples, two RTD or five different DC linear inputs that are all standard in each instrument. Input types are configured in software.

The D Series instruments have a choice of three different standard outputs in each instrument. Relay, voltage pulse SSR drive or 4~20mA DC outputs are selectable in the unit's software configuration thus eliminating the need for plug-in modules or hard soldered modifications.

Fuzzy Logic Against Step Response



Dual Temperature Alarms

Field-programmable Process or Deviation Alarms:

Process Alarm: Independent of the set point, the alarm output turns ON or OFF when the input value reaches the alarm value.

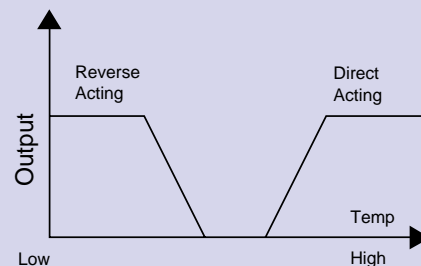
Deviation Alarm: Alarm turns ON or OFF when the input reaches plus or minus the alarm value from set point.

High Alarm	OFF	ON	
Low Alarm	ON	OFF	
High/Low Alarm	ON	OFF	ON
Band Alarm	OFF	ON	OFF

°C/°F, Direct Action / Reverse Action

The D Series is field-selectable for °C/°F and Reverse or Direct Action

Reverse Action...Heat / Direct Action...Cool

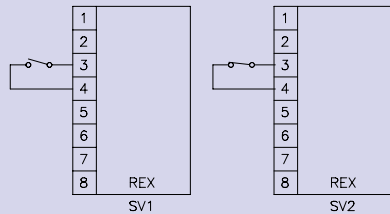


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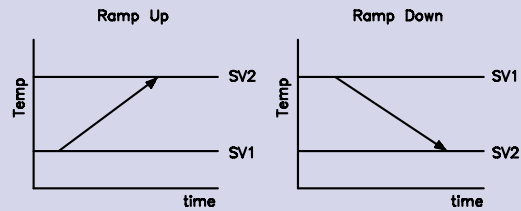
Two Setpoints

The D Series has two independent set points. You can program both set point values via the front keypad. However, the second set point is accessed by a set of dry contacts wired to the rear terminals. This is ideal for a run and idle condition for standby or batch processes.



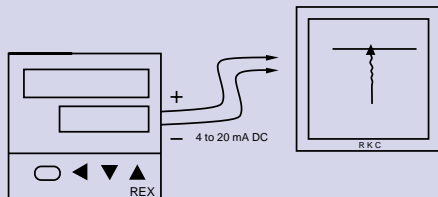
Ramp-to-Set Point

The D Series has standard ramp-up and ramp-down to set point features. This is a linear ramp in percent or degrees per second or minute.



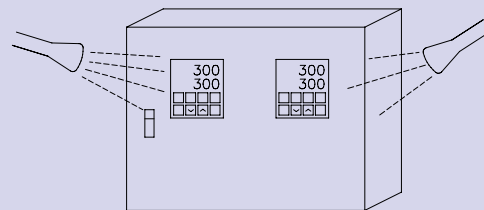
Analog Retransmission Output

If analog retransmission output is added, the process value can be retransmitted as an analog current signal (4-20mA) to a remote instrument such as a recorder or DCS network, etc.



NEMA 4X

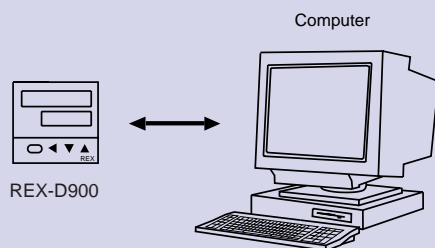
For operation in severe environments or when wash-down is required, the REX-D100 controller is available with the NEMA 4X water-proof and dust-proof rating (equivalent to IP65). The standard D Series controller conforms to IP54.



Digital Communications

An RS-422A or RS485 digital interface can be specified for communication with a host computer, PLC or man-machine-interface (MMI)

- Set value, change, etc
- Data acquisition for SPC/SQC analysis, etc.



Wide Supply Voltage Range

The D Series can be operated from 95-264VAC (50/60 Hz) power supply. As an option, 24VAC or 24VDC power supply can be specified.

The D Series is UL Recognized, CSA Certified and holds the CE Mark.





INPUT	OPTIONS
<p>Input Thermocouples Contact factory for Input Codes</p> <p>Sampling Time 0.5 seconds</p> <p>Setting Range Set Value (SV)Same as input range Heat Proportional Band0 (0.0) to setting limit span Cool Proportional Band1~3000% of heat proportional band Integral Time.....0~3600 seconds Derivative Time.....0~3600 seconds Anti-reset windup1~100% of heat proportional band Deadband/overlap-10 (-10.0) to 10 (10.0) Proportional Cycle1~100 seconds Output Limiter High-5.0~105%.0 Output Limiter Low-5.0~105%.0 Manual Reset-50.0~50%.0 Manual Control:-5.0~105%. Heat/Cool Type-105.0~105%. Set Value Rate Limiter0 (.0) to setting limit span/min (OFF by setting zero)</p>	<p>Digital Communication RS-485 (2 wire type) RS-422A (4 wire type)</p> <p>Communication speed Speed1200, 2400, 4800, 9600, 19200 bps. Address1 to 31 Parity:With (Even or Odd) or Without Stop Bit:1 or 2 Data Bit7 or 8</p> <p>External Contact Signal Off (SP1), On (SP2)</p> <p>Retransmission Output 4~20mA DC, 0~20mA DC, 1~5VDC, 0~10VDC, 0~5VDC</p>
CONTROL	ALARM
<p>Control Method a.) PID control with autotuning and fuzzy logic. Direct/Reverse Action field programmable b.) Heat/Cool PID control with autotuning and fuzzy logic</p> <p>Control Cycle Time 0.5 seconds</p> <p>Control Output Relay contact output 250VAC 3A (Resistive load)</p> <p>Voltage Pulse Output 0/12VDC (Load resistance - More than 600Ω) Output 1 of REX-D400/900 0/15VDC (Load resistance - More than 1KΩ)</p> <p>Current Output 0~20mA, 4~20A DC (Load Resistance - Less than 600Ω) 0~20 mA DC for REX-D100 or REX-D400/900 cool output</p> <p>Continuous Voltage Output Cool output 0~5V, 0~10V, 1~5V DC (Load resistance - More than 1KΩ) NOTE: REX-D400/900 Output 1 is universal</p>	<p>Maximum of two alarms. Alarm Action is field-programmable (Process, Deviation, SV, FAIL)</p> <p>Loop Break Alarm LBA Time Setting0~7200 seconds LBA Deadband.....0~9999°C or 100% of span (OFF by setting zero) Output.....Relay contact output 250V 0.5A AC (Output from alarm 1, temperature alarm common output) Note: LBA cannot be added to heat/cool type.</p> <p>Heater Break Alarm HBA Inputs1 or 2 Inputs (2 points for 3-phase heater) CTL-6-P-N (30A), CTL-12-S56-10L-N (100A) Display Range: 0.0~100.0A Accuracy ±0.5% of input value or 2A</p>
PERFORMANCE	GENERAL
<p>Measurement Accuracy ±0.3% of range span + 1 digit Accuracy is not guaranteed between: 0~400°C (0~752°F) for type B 0~32°F for type PLII, W5RE/W26Re thermocouple input. Cold junction compensation error within ±1.5°C (Between 0~50°C)</p> <p>Insulation Resistance a.) Between input and ground terminals - More than 20MΩ(DC500V) b.) Between power and ground terminals - More than 20MΩ(DC500V)</p> <p>Dielectric Strength a.) Between input and ground terminals - 1000VAC for one minute b.) Between input and ground terminals - 1500VAC for one minute</p>	<p>External Dimensions/Weight REX-D100:48 x 48 x 100 mm.....180g REX-D400:96 x 48 x 100 mm.....250g REX-D900:96 x 96 x 100 mm.....360g</p> <p>Supply Voltage a.) 95~264VAC (50/60Hz) including supply voltage variation [Rating: 100~240VAC] b.) 21.6~26.4VAC (Rating: 24VAC) c.) 21.6~26.4VDC (Rating: 24VDC)</p> <p>Power Consumption a.) (100~240VAC Approximately 11VA for D-100 (Approximately 12 VA for REX-D400/900) b.) 24VAC Approximately 7 VA for REX-D100 24VAC Approximately 7.5 VA for REX-D400 c.) 24VDC Approximately 180mA for REX-D100 24VDC Approximately 200mA for REX-D400/900</p> <p>Power Failure Affect Not affected by power failure shorter than 20ms, otherwise reset to initial state.</p> <p>Operating Environments 0~50°C (32~122°F), 20~80%RH</p> <p>Memory Backup Backed by EEPROM (Data retaining period approximately 10 years).</p>

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MODEL CODE

REX-D100 [] - [] [] * [] [] - [] [] - [] [] []

Control Action: ² _____

- F: PID Autotune
- W: PID Heat/Cool Autotune

Control Output (Heat): _____

- M: Relay Contact
- V: Voltage Pulse
- []: Specify Signal Code

Control Output (Cool): ² _____

- N: None (Control Action F)
- M: Relay Contact
- V: Voltage Pulse
- []: Specify Signal Code

Alarms: _____

- N: Not supplied
- D: Dual alarms (programmable)

HBA Alarm: ^{1,3} _____

- N: Not Supplied
- S: Single Phase use (CT included - specify 30 or 100 Amp)
- D: 3-Phase use (Two CT's included - specify 30 or 100 Amp)

Contact Input: ¹ _____

- N: Not supplied
- 1: Supplied

Retransmission: ¹ _____

- N: Not supplied
- []: Specify Signal Code

Communication: ¹ _____

- N: Not supplied
- []: RS-485 (2 wire)

NEMA 4X: _____

- N: Not supplied
- 1: NEMA 4X supplied

Option:

Shunt resistor for current input (KD100-55 - 250Ω)

¹ Select one from the following: Contact Input, Analog Retransmission Output, 3-Phase HBA or Communication Function.

² If Heat/Cool PID Control with AT is selected, Contact Input, Analog Retransmission Output, 3-Phase HBA and Communication Function cannot be selected.

³ If continuous voltage/current output is specified, HBA cannot be selected.

Notes:

When used for current input, the controller requires a shunt resistor which is sold separately.

For 3-phase HBA, two current transformers are required.

When Dual Alarms and HBA are specified, HBA is assigned to Alarm Relay #2.

Signal Code	
4	0-5 VDC
5	0-10 VDC
6	1-5 VDC
7	0-20 mA DC
8	4-20 mA DC



REX-D400 [] - [] * [] [] - [] [] []
 REX-D900 [] - [] * [] [] - [] [] []

Control Action: ^{1,2} _____

- F: PID Autotune
(Universal Outputs - relay, voltage SSR pulse, 4~20mA)
- W: PID Heat/Cool Autotune

Control Output (Cool): ² _____

- N: None (Control Action F)
- M: Relay Contact
- V: Voltage Pulse
- []: Specify Signal Code

Alarms: _____

- N: Not supplied
- D: Dual alarms (Field-programmable)

HBA Alarm: ^{1,3} _____

- N: No HBA/Step Function included
- S: Single Phase use / Step Function included
(CT included - specify 30 or 100 Amp)
- D: 3-Phase use / No Step Function available
(Two CT's included - specify 30 or 100 Amp)

Retransmission: ^{1,2} _____

- N: Not supplied
- []: Specify Signal Code

Communication: ¹ _____

- N: Not supplied
- 4: RS-422A (4 wire)
- 5: RS-485 (2 wire)

Signal Code	
4	0~5 VDC
5	0~10 VDC
6	1~5 VDC
7	0~20 mA DC
8	4~20 mA DC

¹ If Heat/Cool PID control with AT is selected, Analog Retransmission Output cannot be added.

² If Heat/Cool PID control with AT or Analog Retransmission Output is selected, the Communications Function becomes RS-485 (2 wire).

³ If continuous voltage/current output is specified, HBA cannot be added.

Notes:

- When used for current input, the controller requires a shunt resistor KD100-55-250Ω which is sold separately.
- Control output #1 is a universal output which can be set as a relay contact, voltage pulse, or continuous current (4~20mA DC).
- For 3-phase HBA, two current transformers are required.
- When Dual Alarms and HBA are specified, HBA is assigned to Alarm Relay #2.