

APPLICATION

The R8471 Controller is a single channel rack mounted device, designed for continuous monitoring of a 4 to 20 milliampere signal that is generated by an electrochemical sensor or a catalytic sensor/transmitter combination. Controller models are available to accommodate a variety of combustible gas, oxygen and toxic gas sensors.

The R8471 Controller provides a continuous reading of the sensor input and features both a digital and a bar graph display, as well as high intensity alarm, FAULT and calibration LEDs. Controllers are offered with either solid state or relay outputs. Controllers equipped with relays also include a 4 to 20 ma output. Three independent alarm outputs with field selectable setpoints are provided.

FEATURES

- Controllers are available for detecting a variety of gases.
- Compatible with most sensors or sensor/transmitter combinations that generate a 4 to 20 ma input.
- Digital display, bar graph display, and high intensity LEDs indicate important system status information.
- Three alarm, one fault and one calibrate LED.
- Three alarm and one fault relay available.
- Continuous automatic self-diagnostics, with detected fault identified on digital display.
- Microprocessor based controller allows easy field programming of calibration gas concentration and alarm setpoint levels.
- AutoCal feature ensures easy and accurate sensor calibration.
- Current output is selectable for isolated/non-isolated operation.
- Remote reset capability.
- Rack compatible with Det-Tronics R7400 series flame controllers.
- Variety of racks available in 4U or 3U height configuration.
- 4 to 20 ma output available.
- Current output level while in calibrate mode is adjustable.
- Controller indicates when sensor is approaching end of life.



DESCRIPTION

OUTPUTS

The controller is furnished with three independent alarm outputs and one fault output. Each of the three alarm outputs has a field selectable alarm setpoint. The alarm setpoints can be checked and/or changed using push-buttons located on the faceplate of the controller.

The R8471 Controller is available in a Base version and a Premium version.

Base Model

The base controller is furnished with solid state (open collector transistor) outputs. The three alarm outputs are normally de-energized and become energized when their corresponding setpoints are reached. The fault output is normally energized and becomes de-energized upon detection of a system fault.

Premium Model

The premium model is furnished with a set of four relays in place of the four solid state outputs. The relays have SPST contacts.

This model also includes a 4 to 20 ma dc current output. The current output can be calibrated in the field to ensure maximum accuracy.

Programming Options (Premium model only)

Each of the four relays is field programmable for either normally open or normally closed contacts using jumper plugs located on the printed circuit board inside the controller.

The alarm relays are switch programmable for either normally energized or normally de-energized operation. The fault relay is always normally energized (in normal operation with no faults occurring).

The low and auxiliary alarm relays are switch programmable for either latching or non-latching operation. The high alarm relay is always latching and the Fault relay is non-latching. Latching relays are reset using either a pushbutton on the front panel of the controller or an external reset switch.

The 4 to 20 ma circuit is programmable for isolated or non-isolated operation. The current output level that the controller generates while in the calibrate mode is also field adjustable.

FACEPLATE INDICATORS

The digital display provides a continuous reading of the sensor input in both the Normal and Calibrate modes. In the event of a fault, it identifies the nature of the fault using an alpha-numeric code. In other operating modes it shows the alarm setpoints and calibration gas concentration. The 20 segment bar graph provides a reading of sensor input in increments of 5% full scale. LEDs indicate various system status conditions. System programming and calibration functions as well as controller reset are performed using the SET and RESET pushbuttons located on the controller faceplate.

AUTOMATIC DIAGNOSTICS AND FAULT IDENTIFICATION

The microprocessor based controller features self-testing circuitry that continuously checks for various problems that could prevent proper response. When power is applied, the microprocessor automatically tests memory. A "watchdog" timer is also maintained to ensure that the program is running correctly.

SPECIFICATIONS

	BASE MODEL	PREMIUM MODEL
OPERATING VOLTAGE— Voltage range: Ripple:	18 to 32 vdc < 5 volts peak-to-peak	
POWER CONSUMPTION— Power, Nominal: Power, Maximum: Current, Nominal: Current, Maximum: Maximum Startup Current:	0.7 watt 1.3 watts 25 ma at 24 vdc 50 ma at 24 vdc	1.2 watts 3.5 watts 50 ma at 24 vdc 145 ma at 24 vdc
TEMPERATURE RANGE— Operating: Storage:	+32°F to +140°F (0°C to +60°C) -49°F to +185°F (-45°C to +85°C)	
OUTPUTS— Solid State:	Open collector transistors 100 ma at 32 vdc maximum	NA
Relay:	NA	SPST relays 5 amp. at 30 vdc/250 vac
Current:	NA	4 to 20 ma 600 ohms max. at 20 to 32 vdc
AVAILABLE GASES—	Combustible, H ₂ S, O ₂ , CO, Cl ₂ , SO ₂ , NO ₂	
OPERATING RANGE—	See Table 1.	
DIMENSIONS—	See Figure 1.	
WIRING—	See Figure 2.	
SHIPPING WEIGHT (Approximate) —	2.0 pounds (0.9 kilogram)	

Table 1—Controller Operating Ranges

Controller	Gas	Range	Alarm Setpoint Ranges		
			Low	High	Aux
R8471A	Combustible	0 to 100 % LFL	5 to 50	10 to 60	5 to 90
R8471B	H ₂ S	0 to 100 ppm	5 to 50	10 to 90	5 to 90
R8471C	O ₂	0 to 25%	1 to 20.7	21.1 to 25	1 to 25
		15 to 25%	16 to 20.7	21.1 to 25	16 to 25
R8471D	Cl ₂	0 to 10 ppm	0.5 to 5	1 to 9	0.5 to 9
R8471E	CO	0 to 100 ppm	5 to 50	10 to 90	5 to 90
		0 to 500 ppm	25 to 250	50 to 450	25 to 450
		0 to 1000 ppm	50 to 500	100 to 900	50 to 900
R8471F	SO ₂	0 to 100 ppm	5 to 50	10 to 90	5 to 90
R8471G	NO ₂	0 to 20 ppm	0.5 to 10	1 to 18	0.5 to 18

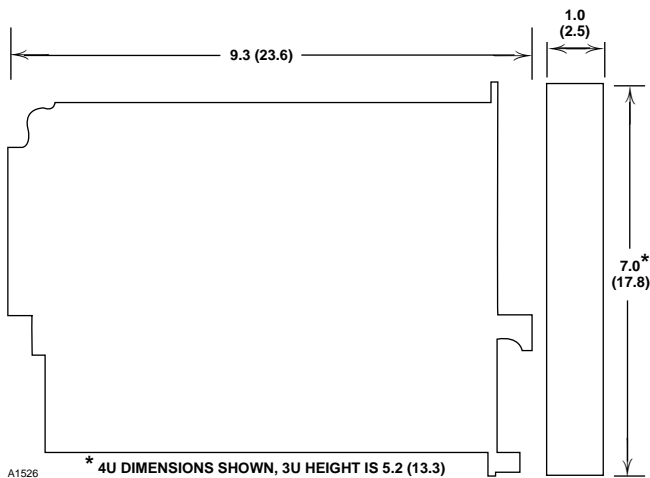


Figure 1—Dimensions in Inches (Centimeters)

If a system fault is detected, the current output drops to less than 1.0 ma, the fault output is de-energized, and the digital display identifies the nature of the fault using an alpha-numeric code.

OPERATING MODES

In addition to the Normal mode, the controller can operate in other modes that are selected by pressing the appropriate pushbutton(s) located on the front panel. These modes include system reset, displaying and programming alarm setpoints, calibration of the 4 to 20 ma output, sensor replacement, and sensor calibration.

CALIBRATION

The R8471 Controller uses a fully automatic calibration procedure in which all “adjustments” are made by the microprocessor in the controller. The Calibrate mode is entered by pressing a button on the controller front panel. The controller performs the zero adjustments, and then signals the operator when to apply and when to remove the calibration gas. Upon completion of a successful calibration, the controller automatically returns to the Normal operating mode.

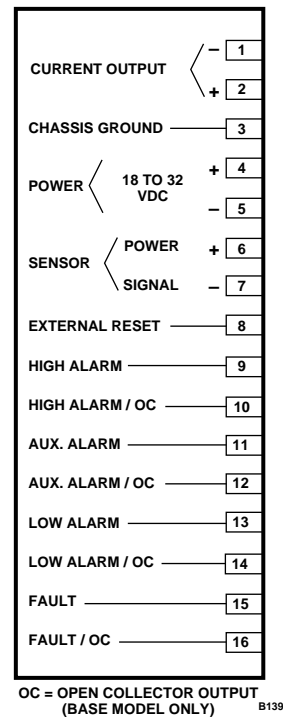


Figure 2—Controller Terminals

NOTE

The actual calibration procedure varies depending on controller model. Refer to the controller instruction manual for complete calibration information.

If the operator fails to complete the calibration procedure, if an error in calibrating occurs, or if a successful calibration cannot be completed, the microprocessor will automatically return to the Normal mode and continue to use the previous calibration data. A calibration fault will be indicated on the digital display until reset. If the microprocessor determines that the sensing element is approaching the end of its useful life, this will also be indicated on the digital display.

WIRING REQUIREMENTS

The power wiring from the controller to the field devices being monitored must be sized to ensure that the minimum voltage requirements of those devices are met. Refer to the appropriate instruction manual(s) for complete wiring instructions.

ENGINEERING SPECIFICATION

The controller shall be a rack mounted, single channel device.

The input signal to the controller shall be a 4 to 20 ma signal.

The controller shall operate from a dc input voltage in the range of 18 to 32 vdc, 24 vdc nominal.

The controller shall be furnished with four outputs - one low alarm, one high alarm, one auxiliary alarm, and one fault output. Field adjustable alarm setpoints shall be provided. The controller shall actuate the corresponding alarm output when a setpoint is reached. The gas concentration at the sensor shall be indicated on a digital display and also on a 20 segment bar graph on the front panel of the controller. High intensity LEDs shall be provided for signaling alarm conditions.

The controller shall be furnished with four SPST relays and a 4 to 20 ma output. The relays shall be field selectable for normally open or normally closed contacts. The alarm outputs shall be field programmable for either normally energized or normally de-energized operation. The fault output shall be normally energized. The low and auxiliary alarm outputs shall be programmable for latching or non-latching operation. The high alarm output shall be latching. Remote reset capability shall be provided. The 4 to 20 ma circuit shall be selectable for isolated or non-isolated operation. The current output during calibration shall be field adjustable.

Diagnostic circuitry shall continuously check for system faults. The Fault output, FAULT LED, and current output shall all respond to a detected problem.

Calibration shall be performed using a microprocessor controlled procedure with all calibration adjustments made by the controller. The controller shall indicate to the operator when to apply and remove the calibration

gas, and then automatically return to normal operation upon completion. The controller shall provide an indication when the sensor is approaching the end of its service life.

The device shall be the Det-Tronics R8471 Controller.

ORDERING INFORMATION

Sensors must be ordered separately from the controller.

When ordering please specify:

R8471A Combustible Gas Controller
R8471B Hydrogen Sulfide Controller
R8471C Oxygen Controller

- 0 to 25%
- 15 to 25%

R8471D Chlorine Controller
R8471E Carbon Monoxide Controller

- 0 to 100 PPM
- 0 to 500 PPM
- 0 to 1000 PPM

R8471F Sulfur Dioxide Controller
R8471G Nitrogen Dioxide Controller.

Also specify:

- Base or premium model
- 3U or 4U height.

NOTE

*Operating ranges are **not** field selectable and must be specified when ordering. Operating ranges for the controller and sensor **must match** to ensure proper operation.*

MOUNTING RACKS

A mounting rack is required for housing the controller. 3U racks are used with gas controllers only. 4U racks can house gas or flame controllers in any combination. Rack sizes are available to handle up to 16 controllers.

Q1050 SERIES WALL MOUNT ENCLOSURES

The Q1050 offers up to six channels of gas detection, mounted in a fiberglass wall mount enclosure, with full view window. Designed to meet NEMA 4X rating. Includes the same technology and features as the standard R8471 series. Any combination of gas types is available. An internal power supply is available.



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**Gas Controllers for use with
Electrochemical Sensors
R8471 Series**

DESCRIPTION

The R8471 Controllers, designed for use with Det-Tronics C706X electrochemical sensors, include the following models:

- R8471B for Hydrogen Sulfide (H₂S)
- R8471C for Oxygen (O₂)
- R8471D for Chlorine (Cl₂)
- R8471E for Carbon Monoxide (CO)
- R8471F for Sulfur Dioxide (SO₂)
- R8471G for Nitrogen Dioxide (NO₂)

The single channel, rack mounted controller provides a continuous reading of the sensor input and operates in a variety of ranges depending on the detection range of the electrochemical sensor. Table 1 provides a listing of the available ranges for the different models of the R8471 Toxic and Oxygen Gas Controllers.

Controller response includes actuation of solid state or



optional relay outputs for direct control of field response devices, a full array of faceplate indicators, as well as an optional 4 to 20 milliampere output for transmitting system information to other equipment. Three independent alarm outputs with field selectable setpoints are provided.

Table 1—Controller Operating and Setpoint Ranges

Controller	Gas	Operating Range	Low Alarm Setpoint Range	High Alarm Setpoint Range	Auxiliary Alarm Setpoint Range
R8471B	H ₂ S	0 to 100 ppm	5.0 to 50 ppm	10 to 90 ppm	5.0 to 90 ppm
R8471C	O ₂	0 to 25% 15 to 25%	1.0 to 20.7% 16 to 20.7%	21.1 to 25% 21.1 to 25%	1.0 to 25% 16 to 20.7% or 21.1 to 25%
R8471D	Cl ₂	0 to 10 ppm	0.5 to 5.0 ppm	1 to 9.0 ppm	0.5 to 9.0 ppm
R8471E	CO	0 to 100 ppm 0 to 500 ppm 0 to 1000 ppm	5.0 to 50 ppm 25 to 250 ppm 50 to 500 ppm	10 to 90 ppm 50 to 450 ppm 100 to 900 ppm	5.0 to 90 ppm 25 to 450 ppm 50 to 900 ppm
R8471F	SO ₂	0 to 100 ppm	5.0 to 50 ppm	10 to 90 ppm	5.0 to 90 ppm
R8471G	NO ₂	0 to 20 ppm	0.5 to 10 ppm	1.0 to 18 ppm	0.5 to 18 ppm

FEATURES

- Digital display, bar graph display, and high intensity LEDs indicate important system status information.
- Microprocessor based controller allows easy field programming of calibration gas concentration and alarm setpoint levels.
- Continuous automatic self-diagnostics, with detected fault identified on digital display.
- Current output is selectable for isolated/non-isolated operation.
- Controller indicates when sensor is approaching end of life.
- Compatible with most sensors or sensor/transmitter combinations that generate a 4 to 20 ma input.
- Rack compatible with Det-Tronics R7400 series flame controllers (4U height configuration only).
- Models available for use with the Det-Tronics Combustible Gas Sensor and PointWatch™ PIR9400 Gas Detector.

SPECIFICATIONS

SENSOR

Refer to Table 2.

CONTROLLER

OPERATING VOLTAGE—

24 vdc. Can operate in the range of 18 to 32 vdc.

POWER CONSUMPTION (Controller only)—

Base model: 0.7 watts nominal, 1.3 watts maximum (25 ma nominal, 50 ma maximum at 24 vdc).

Premium model: 1.2 watts nominal, 3.5 watts maximum (50 ma nominal, 145 ma maximum at 24 vdc).

Maximum startup current is 0.6 ampere for 10 milliseconds. Power supplies with fold back current limiting are not recommended.

MAXIMUM RIPPLE—

Not to exceed 5 volts peak-to-peak.

TEMPERATURE RANGE—

Operating: +32°F to +140°F (0°C to +60°C)
Storage: -49°F to +185°F (-45°C to +85°C).

SOLID STATE OUTPUTS (Base model only)—

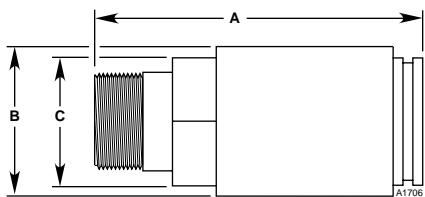
The outputs are open collector transistors with a 100K resistor from the collector to emitter with the emitter grounded, rated 100 milliamperes at 32 vdc maximum.

Table 2—Electrochemical Sensor Specifications

Controller	R8471B	R8471C	R8471D	R8471E	R8471F	R8471G
Gas	H ₂ S	O ₂	Cl ₂	CO	SO ₂	NO ₂
Temperature Range (Operating)	-40° to +122°F (-40° to +50°C)	-4° to +122°F (-20° to +50°C)	-4° to +122°F (-20° to +50°C)	-4° to +122°F (-20° to +50°C)	-4° to +122°F (-20° to +50°C)	-4° to +122°F (-20° to +50°C)
Temperature Range (Storage):	+32° to +68°F (0° to +20°C)	+32° to +68°F (0° to +20°C)	+32° to +68°F (0° to +20°C)	+32° to +68°F (0° to +20°C)	+32° to +68°F (0° to +20°C)	+32° to +68°F (0° to +20°C)
Enclosure Material:	Stainless Steel	Aluminum	Aluminum	Aluminum	Stainless Steel	Stainless Steel
Sensor Rating:	Intrinsically Safe ¹	Explosion Proof ²	Intrinsically Safe ¹	Explosion Proof ²	Explosion Proof ²	Explosion Proof ²
Dimensions:	See Figure 1	See Figure 1	See Figure 1	See Figure 1	See Figure 1	See Figure 1

¹ Intrinsically safe sensors are designed to meet FM and CSA intrinsic safety requirements for Class I, Division 1, Groups A, B, C and D; and CENELEC EEx ia IIC T6. In order to maintain the intrinsically safe rating of the sensor, the device must be powered through an approved IS barrier.

² Explosion Proof sensors are designed to meet FM and CSA requirements for Class I, Division 1, Groups C and D; CENELEC EEx d IIB + H₂ T6.



Sensor	A	B	C
H ₂ S	3.75 (9.6)	2.0 (5.0)	1.75 (4.5)
O ₂	6.1 (15.5)	2.2 (5.6)	1.1 (2.8)
CO	5.0 (12.7)	2.2 (5.6)	1.1 (2.8)
Cl ₂	5.0 (12.7)	2.2 (5.6)	1.1 (2.8)
SO ₂	3.75 (9.6)	2.0 (5.0)	1.75 (4.5)
NO ₂	3.75 (9.6)	2.0 (5.0)	1.75 (4.5)

Available thread sizes = 3/4 inch NPT or 20 mm

Figure 1—Sensor Dimensions in Inches (Centimeters)

RELAY CONTACTS (Premium model only)—

SPST relays with selectable normally open/normally closed contacts, rated 5 amperes at 30 vdc/250 vac.

CURRENT OUTPUT (Premium model only)—

4 to 20 milliamperes, with a maximum external loop resistance of 600 ohms at 20 to 32 vdc. Can be configured for isolated or non-isolated operation.

DIMENSIONS—

See Figure 2.

SHIPPING WEIGHT (Approximate) –

2.0 pounds (0.9 kilogram).

WARRANTY—

Limited warranty 12 months on hardware, 24 months on sensor cell.

SYSTEM OPERATION

C706X SERIES SENSOR/TRANSMITTER

The Det-Tronics toxic and oxygen sensors consist of a sensor housing and a field replaceable electrochemical sensor cell. The transmitter circuitry for generating a 4 to 20 mA output signal is contained within the sensor housing, eliminating the need for a separate trans-

mitter. The linear 4 to 20 mA dc output signal corresponds to the detection range for the sensor (See Table 1).

The housing for the H₂S and Cl₂ sensors are intrinsically safe (when used with an approved intrinsically safe barrier) and are designed for use in Class I, Division 1, Groups A, B, C and D locations.

The housing for the CO, SO₂, NO₂, and Cl₂ sensors are explosion-proof and are designed for use in Class I, Division 1, Groups C and D locations.

SETPOINTS

The R8471 Controller has three independent alarm outputs with field selectable setpoints. The alarm setpoints can be checked and/or changed using push-buttons located on the faceplate of the controller. The calibration gas value is displayed and adjusted along with the alarm setpoints. The adjustment ranges are provided in Table 1.

CONTROLLER OUTPUTS

The R8471 Controllers are available in a Base model and a Premium model.

Base Model

The base controller is furnished with solid state (open collector transistor) outputs for the Low alarm, High alarm, Auxiliary alarm, and Fault circuits. The normally de-energized alarm outputs are energized when their corresponding setpoints are reached. The fault output is normally energized and becomes de-energized upon detection of a system fault.

Premium Model

The premium model is furnished with a set of four SPST relays in place of the four solid state outputs. This model also includes a 4 to 20 ma current output, which can be calibrated in the field to ensure maximum accuracy and can be configured for isolated or non-isolated operation.

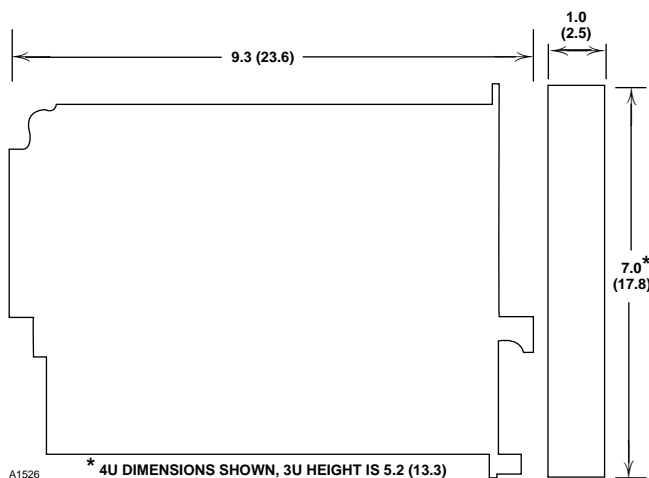


Figure 2—Controller Dimensions in Inches (Centimeters)

Table 3—Field Selectable Relay Options

Relay	Selectable Normally Open/Closed	Selectable Normally Energized/ De-Energized	Selectable Latching/ Non-Latching
Low	Y	Y ¹	Y ¹
High	Y	Y ¹	N ²
Auxiliary	Y	Y ¹	Y ¹
Fault	Y	N ³	N ⁴

Y = Yes N = No

¹Selectable as a group, not individually ²Latching only

³Normally energized only ⁴No latching option

Programming Options (Premium model only)

Refer to Table 3.

AUTOMATIC DIAGNOSTICS AND FAULT IDENTIFICATION

The microprocessor based controller features self-testing circuitry that continuously checks for various problems. If a system fault is detected, the current output drops to less than 1.0 ma, the fault output is de-energized, and the digital display identifies the nature of the fault using an alpha-numeric code.

OPERATING MODES

In addition to the Normal mode, the controller can operate in other modes that are selected by pressing the appropriate pushbutton(s) located on the controller front panel. These modes include system reset, displaying and programming alarm setpoints, calibration of the 4 to 20 ma output, and sensor replacement.

CALIBRATION

The R8471 Controller uses a fully automatic calibration procedure in which all "adjustments" are made by the microprocessor in the controller. Upon completion of a successful calibration, the controller automatically returns to the Normal operating mode. If a successful calibration cannot be completed, the microprocessor will automatically return to the Normal mode and continue to use the previous calibration data. A calibration fault will be indicated on the digital display.

NOTE

The actual calibration procedure varies depending on the controller model. Refer to the controller instruction manual for complete calibration information.

ORDERING INFORMATION

Sensors must be ordered separately from the controller. When ordering please specify:

R8471B H₂S Controller

- 0 to 20 ppm
- 0 to 50 ppm
- 0 to 100 ppm

R8471C O₂ Controller

- 0 to 25%
- 15 to 25%

R8471D Cl₂ Controller

R8471E CO Controller

- 0 to 100 ppm
- 0 to 500 ppm
- 0 to 1000 ppm

R8471F SO₂ Controller

R8471G NO₂ Controller.

Also specify:

- Base or premium model
- 3U or 4U height.

NOTE

Operating ranges are not field selectable and must be specified when ordering. Operating ranges for the controller and sensor must match to ensure proper operation.

MOUNTING RACKS

A mounting rack is required for housing the controller. Q4003 (3U model) and Q4004 (4U model) Mounting Racks are recommended for ease of installation and servicing. 4U racks can house gas and/or flame controllers in any combination.

Q1050 SERIES WALL MOUNT ENCLOSURE

Offers up to six channels of R8471 gas controllers, mounted in a fiberglass wall mount enclosure, with full view window. Designed to meet NEMA 4X rating. Includes the same technology and features as the standard R8471 series. Any combination of R8471 gas controllers is available. A self-contained power supply is available.

For additional information, please refer to the Det-Tronics Product Catalog or visit our web site at www.detrronics.com.

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