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ALLEN-BRADLEY

Absolute Encoder Module

(Cat. No. 1771-DE)

Product Data



Description

The Absolute Encoder Module (cat. no. 1771-DE) is an intelligent module that provides high-speed response to machine position independently of the programmable controller scan.

The module is usually used when the following features are required:

- absolute-position feedback
- high-speed position response based on encoder values
- immunity to loss of position from power loss or power interruptions

The absolute encoder module can:

- monitor the position of an absolute encoder that has up to 12 bits of resolution

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- control up to eight high-current outputs based on comparisons between encoder position and your preset values

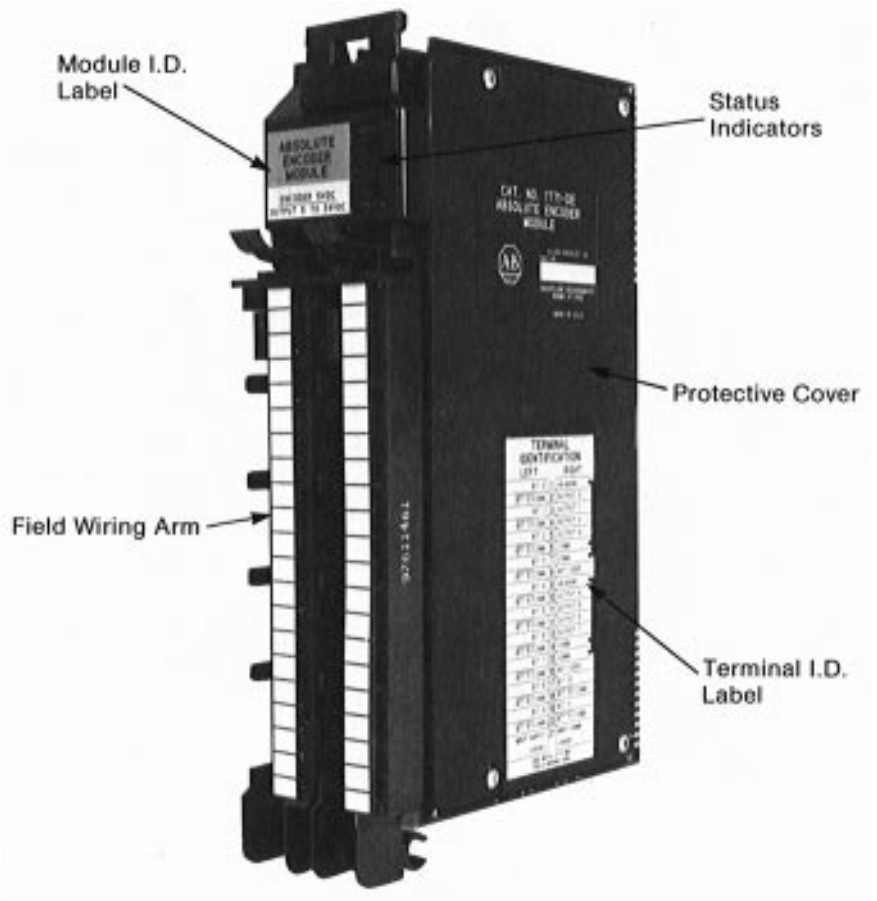
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- provide throughput of all eight outputs in less than 200 µS
- communicate with the programmable controller through block transfers
- report the position of an absolute encoder and status of outputs to the programmable controller

In addition, the module can switch 2A DC per output with no derating when all outputs are on, allowing 16A continuous per module.

Figure 1 shows the major hardware components on the module.

1
Absolute Encoder Module (cat. no. 1771-DE)



You can use the absolute encoder module with any Allen-Bradley programmable controller that uses block transfer programming in local and remote 1771 I/O systems.

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Some Allen-Bradley programmable controllers compatible with the module are:

- Mini-PLC-2 (cat. no. 1772-LN3)
- PLC-2/20 (cat. no. 1772-LP1, -LP2)
- PLC-2/30 (cat. no. 1772-LP3)
- Mini-PLC-2/15 (cat. no. 1772-LV)
- Mini-PLC-2/05 (cat. no. 1772-LS, -LSP)
- PLC-3 (cat. no. 1775-L1, -L2)

You can use Allen-Bradley absolute encoders that use up to 12 bits with the absolute encoder module. Allen-Bradley encoders with the following bulletin numbers are compatible with the absolute encoder module:

- Bulletin 845A
- Bulletin 845B
- Bulletin 845C

The module is also compatible with absolute encoders that have the following specifications:

- single-ended or differential output
- TTL-compatibility (output drivers)
- capability of sinking 11 mA (single-ended) or 18 mA (differential) per channel
- natural binary, BCD, or standard Gray code format

We recommend the use of differential output encoders because of their higher immunity to noise than single-ended output encoders.

Feature Selection

By setting configuration plugs on the left board of the absolute encoder module you can select:

- BCD, natural binary, or standard Gray encoder format
- single-ended or differential encoder output signals
- direction of shaft rotation that corresponds to increments in the absolute position of Gray encoders

A configuration plug on the right board lets you select the state of the outputs if the module loses input power. The plug allows the outputs to:

- turn off
- remain in their state at loss of input power

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Status Indicators

The module has 10 LED indicators (figure 1):

- Eight output status indicators (one per output) light when the corresponding output circuitry is energized
- One green ACTIVE indicator lights when the module is powered and functioning
- One red FAULT indicator lights when the module detects a fault and momentarily lights at power-up

Power Supplies

You need a minimum of two external power supplies: one to power input circuitry and one to power output devices.

The input circuits of the module require a maximum of 300 mA from a +5V DC supply. You can also use this +5V supply to power the encoder.

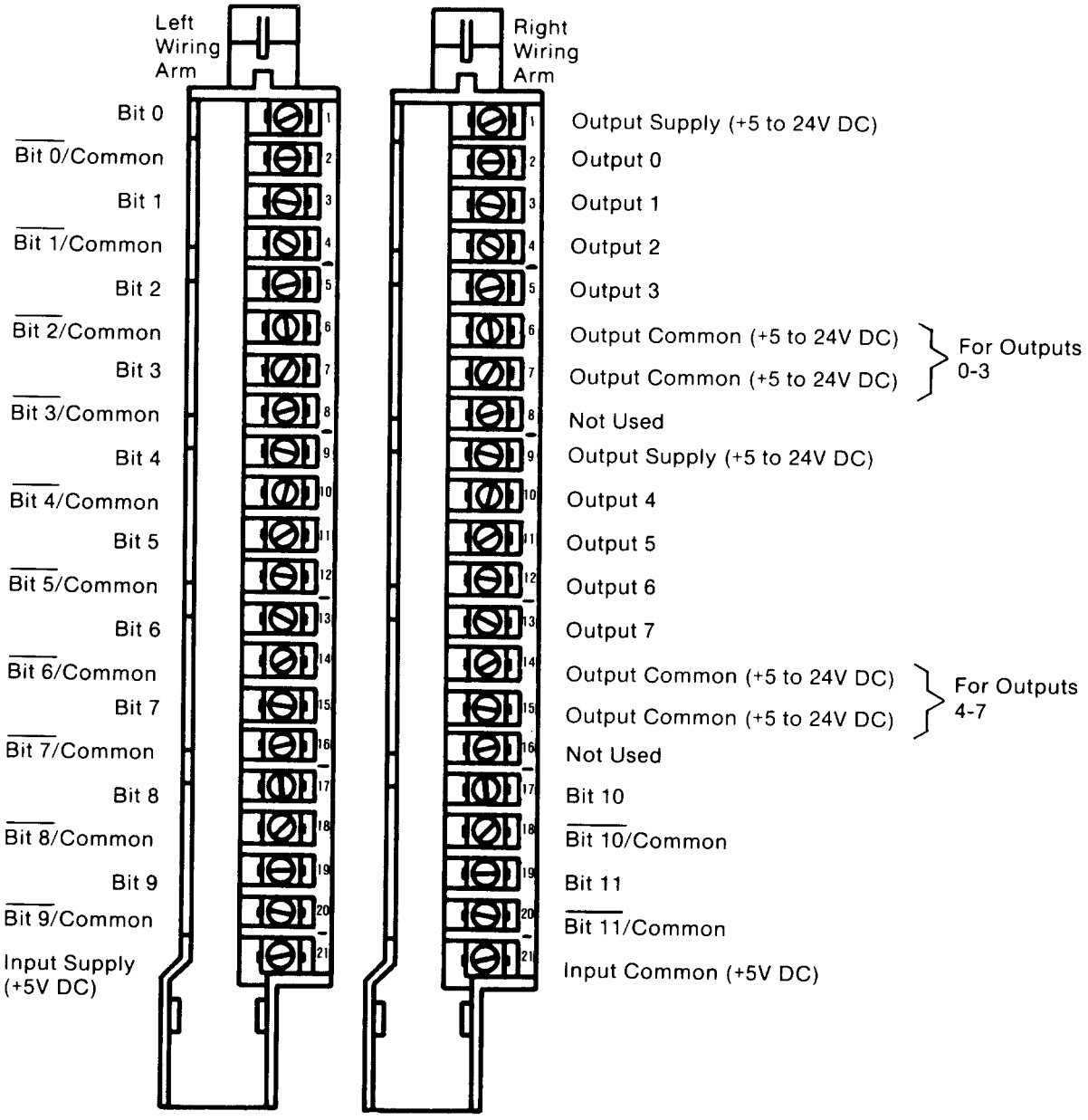
To supply power to the eight outputs, you need at least one +5 to +24V DC power supply. If you need two different load supply voltages to power your outputs, you can connect an additional +5 to +24V DC supply to the module.

Terminal Identification

The encoder signal lines and the power supply for the input circuits are connected to the terminals on the left board and terminals 17 through 21 on the right board. The output power supply(ies) and output devices are connected to terminals 1 through 15 of the right board (figure 2).

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2
Terminal Identification



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Cabling

We recommend the following Belden cable or its equivalent to connect the encoder to the module. Use extra twisted pair(s) of wire to connect power to the encoder.

Encoder Bits	No. of twisted pairs in cable	Belden Cable No.	
		18 AWG	20 AWG
8	9	9775	9875
10	11	—	9976
	12	9776	9877
12	15	9777	9879

Module/Processor Communication

The absolute encoder module and the processor communicate through block-transfer programming.

Block-transfer-write Data

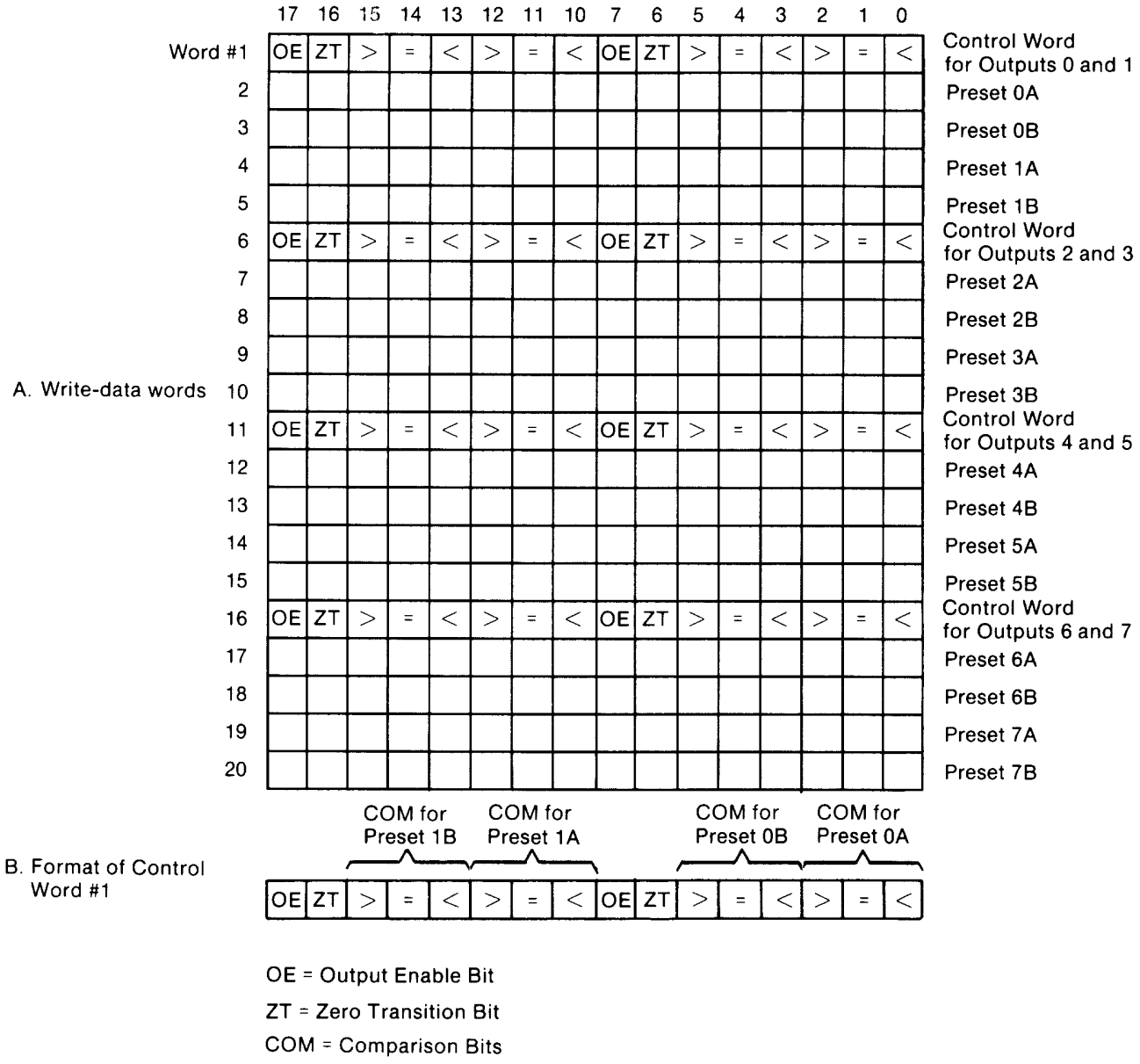
You write data to the module in blocks. You can write 5, 10, 15, or 20 words in one block-transfer operation. Each block is associated with two outputs and is identical to the other blocks in format:

words 1–5	outputs 0 and 1
words 6–10	outputs 2 and 3
words 11–15	outputs 4 and 5
words 16–20	outputs 6 and 7

The first word of each block is a control word. The last four words are preset words. The format of the write-data words and control word 1 is shown in figure 3.

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3
Format of Block-transfer-write Data



You can send a maximum of 20 words (four blocks of five words) in one block-transfer operation. The number of words you send to the module determines how many outputs it controls.

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Control Words

The lower byte of control word 1 is associated with output 0.Its format is as follows:

- Bits 0 through 2 are the comparison bits for output 0, preset A (greater than, less than, or equal to)
- Bits 3 through 5 are the comparison bits for output 0, preset B
- Bit 6 is the zero transition (ZT) bit. Set this bit when you want an output energized during a transition through 0.
- Bit 7 is the output enable (OE) bit. This bit is examined along with comparison bits 0 through 5 and the absolute position of the encoder in turning on a module's output. Although comparisons for both presets may be true, if you don't set this bit the output is not turned on.

The upper byte of control word 1 is associated with output 1. The format of this byte is similar to the format of the lower byte:

- Bits 10 through 12 are the comparison bits for output 1, preset A.
- Bits 13 through 15 are the comparison bits for output 1, preset B.
- Bit 16 is the ZT bit.
- Bit 17 is the OE bit.

The remaining control words and their corresponding outputs are:

word 6 – outputs 2 and 3
word 11 – outputs 4 and 5
word 16 – outputs 6 and 7

Preset Words

Preset words define the values you choose for turn-on and turn-off points of the corresponding output. You program them in BCD. Each block of four preset words is associated with two outputs and is identical in format to that for outputs 0 and 1:

word 2 – preset A for output 0
word 3 – preset B for output 0
word 4 – preset A for output 1
word 5 – preset B for output 1

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Block-transfer-read Data

The processor reads data from the module and transfers it to its data table in two read-data words (figure 4):

- The upper byte of word 1 indicates the status of the eight outputs. The module sets each bit when the corresponding output is turned on.
- The format of the lower byte of word 1 (by bit) is:

  Bit 7 is the loss-of-input-power bit. It is set when input power is lost; it is reset when power is restored and bit 6 is reset.

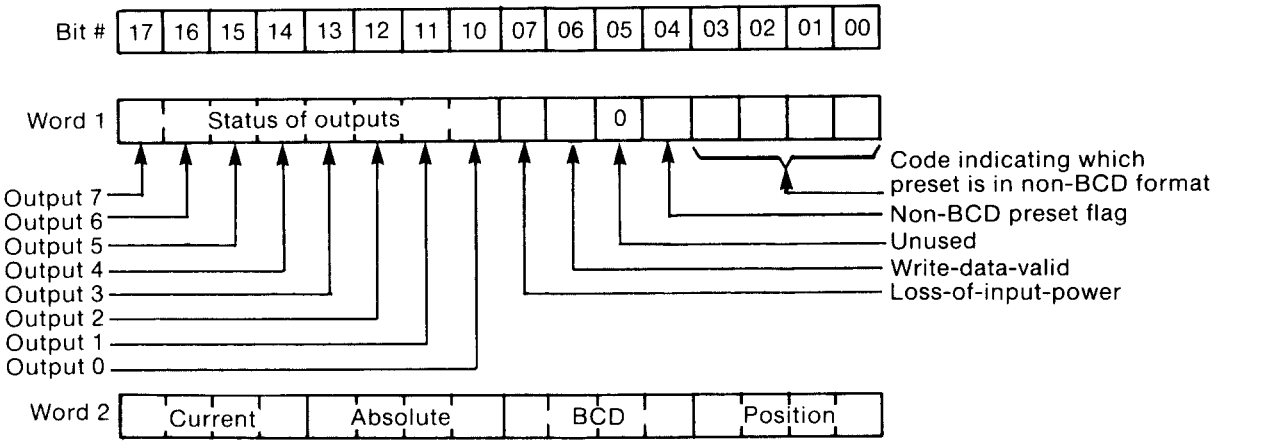
  Bit 6 is the write-data-valid bit. It is set at power-up and when the processor changes from the program to run mode; it is reset when the module receives valid data in a block transfer-write operation.

  Bit 5 is unused.

  Bit 4 is the non-BCD preset flag. It is set when any preset is in non-BCD format.

  Bits 3 through 0 make up a code that indicates which preset is not in BCD format. Refer to the User's Manual of the module, publication number 1771-6.5.32, for details of these bits.
- Word 2 indicates the current absolute position of the encoder in BCD.

4
Format of Block-Transfer-Read Data



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Maximum Encoder Shaft Speed

The absolute encoder module can control outputs within a one count resolution (turn an output on at position 065 and off at position 066) if shaft speed does not exceed a certain limit. This speed limit depends on the number of outputs and the number of counts on the encoder. It can be found from:

$$S = K/N$$

where S = maximum shaft speed for one-count resolution; K = a constant; and N = number of counts on the encoder. The value of K depends on whether you want to express shaft speed in revolutions per second (rps) or revolutions per minute (rpm).

If you control:	**Then K =** OR **K=** (for rps) (for rpm)	
8 outputs	5000	300,000
6 outputs	6493	389,610
4 outputs	9009	540,540
2 outputs	14,084	845,070

For example, if you control eight outputs with a 0 to 359-count encoder, and the encoder shaft speed is given in revolutions per minute, the equation is:

$$S = 300{,}000\ 360$$

$$= 833 \text{ rpm}$$

The maximum encoder shaft speed at which you can control eight outputs within a one-count resolution is 833 rpm.

Refer to the User's Manual for the absolute encoder module (publication 1771-6.5.32) for details on operating the encoder at its maximum speed.

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Specifications

Module Location
- Any 1771 I/O chassis; any 2-slot I/O group

Number of Inputs
- Up to 12 encoder input bits per module

Encoder Formats
- BCD
- Natural binary
- Standard Gray

Digital Resolution
- Up to one part in 4,095 with natural binary and standard Gray encoders
- Up to one part in 999 with BCD encoders

High-true Logic
- From totem pole, open collector, or differential line drivers
- Can select direction of rotation of increasing position for Gray code encoders

Input Voltage Range and Logic State
- Logic 1: 2.4V to 5.0V DC
- Logic 0: 0.0V to 0.6V DC

Input Current per Channel
(sunk by encoder device)
- 11 mA for single-ended drivers
- 18 mA for differential drivers

Maximum Input Frequency
- 50 KHz

Encoder Data Settling Time
- 100ns

New Position Throughput Time
- 200µs

New Write-data Throughput Time
- 3 ms

Input Power Supply
- +5V DC ±0.25V (total output voltage tolerance includes line regulation, load regulation, drift, and ripple)

Current Requirement (maximum)
- 300 mA
- Number of Outputs
- 8

Output Current Rating
- 2A sourced per output (no derating with all outputs on)

VA Rating
- 48W per output
- 384W per module

Surge Rating
- 4A for 10ms

Input and Output Isolation
- 1500V RMS

Output Power Supply
- Selectable: +5 to +24V DC

Backplane Current
- 800 mA at 5V DC

Output Fuses
- 3A rectifier fuses (Littelfuse 322003, Buss GBB003, or equivalent)

Environmental Conditions
- Operating Temperature
  0 to 60° C (32 to 140°F)
- Storage Temperature
  40 to 85° C (-40 to 185° F)
- Relative Humidity
  5 to 95% (without condensation)

Keying (for slot 0 only)
- Between 2 and 4
- Between 26 and 28

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