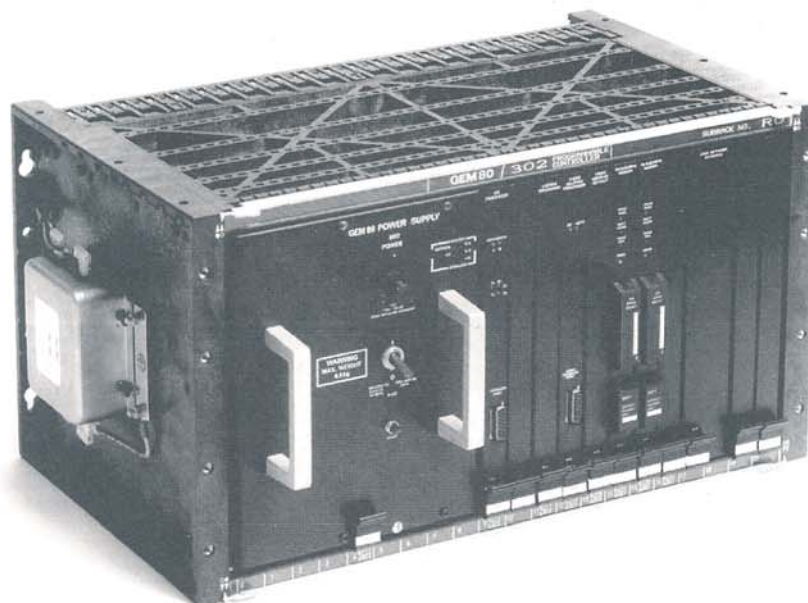


GEM 80/301, 302 and 303 CONTROLLERS



DESCRIPTION

The GEM 80/300 Series is a family of three Controllers. With their powerful 16-bit microprocessors, flexible memory capacities and extensive communication facilities the series is ideally suited to supervision and control of complex industrial plant systems.

A comprehensive set of pre-written Special Function routines is provided in the Ladder Program Instruction set, including functions for logical operations, signal processing and closed loop control.

For distributed systems, several multidrop serial links are provided as standard. Further networking facilities are available using STARNET and CORONET communications modules.

Extensive video plant monitoring facilities can be provided by adding IMAGEM graphic video processors.

FEATURES

- Up to 8192 Basic I/O points
- Large program memory capacity (Up to 37,000 instructions)
- Memory size is field upgradable by plug-in modules
- Fast execution time (5ms per 1000 instructions average)
- On-line programming changes
- Remote programming facilities via serial links
- Optional EPROM module for secure storage of user program and preset data
- Up to 4 serial ports for manufacturing cell and real time communications
- Integral text editor for generation of printer messages
- Large range of pre-written software routines (Special Functions) provided as standard
- Built-in clock for time and date

GEM 80/301, 302 and 303 CONTROLLERS

SPECIFICATION

Power requirements : Input Voltage
: 88-264V ac 45-63Hz,
: 88-250V dc
OR
: 19-60V dc only
Inrush
: 6A max. at 264V ac
: 2.6A max. at 121V ac
: 7.2A at 48V dc
Each Power module
consumes less than 360W

Communication : Up to 4 built-in
serial ports allowing
configuration as control,
tributary or printer ports
via optional termination
units
: Programming port

Environmental : Temperature
: Operating, 0° to 60°C
: Storage, -20° to 70°C
Humidity
: 5% to 95% non-condensing
GEM 80 standard and tests

Mechanical

Dimensions
: Height = 267mm
: Width = 483mm
: Depth = 332mm
(537mm wide over filters)
Mounting
: 19 inch (483mm) panel
mounting
: Conforms to IEC 297-1 (1975)
Dimensions of Panels and
Racks

Weight
: 13 to 17kg. (depending on
equipment fitted)

Capacity : Memory
: Up to 512K RAM program
memory
: 32K Video memory,
expandable to 544K
: Up to 1Mbyte off-line
storage in RAM

I/O
: 256 words (4096 I/O points) of
Concentrated Basic I/O,
doubled with a second I/O
Processor.
: Basic I/O interface is
obtainable via Expander
modules.
Each Expander will handle
32 words (512 I/O points)
of Basic I/O.
: Fast I/O, up to 1024 words
(32 Fast I/O modules)

MEMORY SIZE

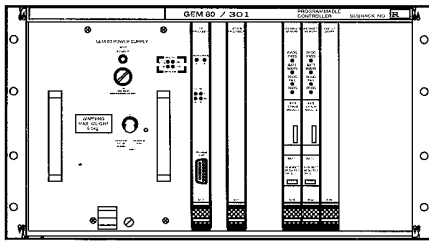
The GEM 80/300 is available in four memory sizes; 192K, 256K, 384K and 512K.

The 256K and 384K memory versions can be expanded to 512K by adding extra memory modules to slots provided in the Controller subrack, and modifying the backplane wiring.

Memory Sizes for Program and Table

Memory size	192K	256K	384K	512K
Source code + data tables	64K	64K	64K	64K
Extension space for source codes	—	—	64K	128K
Compiled code	32K	96K	160K	224K
System Use	64K	64K	64K	64K
Video formats	32K	32K	32K	32K
Extension video formats (optional)	512K	512K	512K	512K
Optional additional off-line storage	1024K	1024K	1024K	1024K

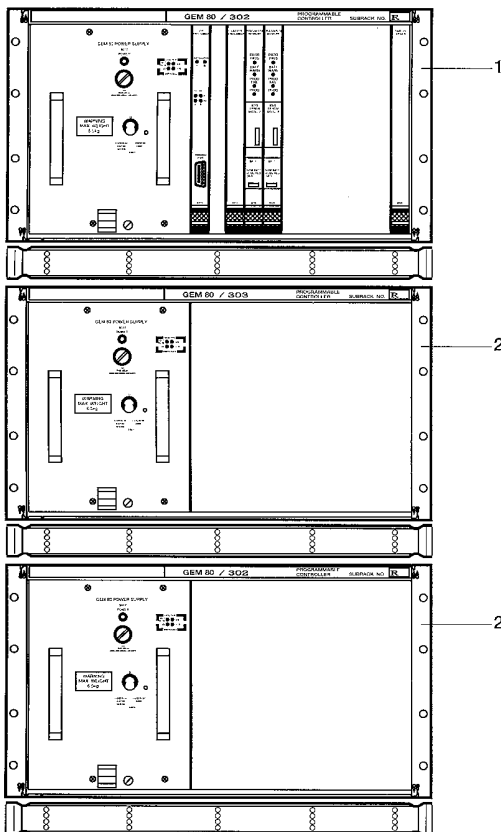
HARDWARE LAYOUTS



GEM 80/301

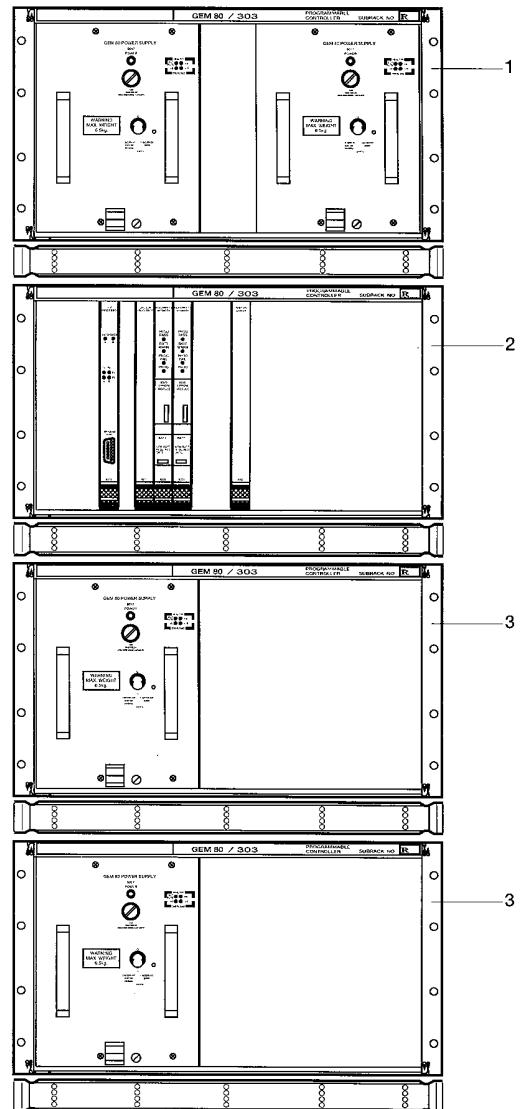
Single subrack containing Master I/O Processor, Ladder Processor, Read/Write memory and Power Module.

The subrack contains slots for up to 3 central modules and 4 slots for Fast I/O modules. One slot is reserved for the Fast I/O driver.



GEM 80/302

1. Subrack containing Master I/O Processor, Ladder Processor, Read/Write memory and Power Module. The subrack contains up to 7 slots for central modules. One slot is reserved for the Fast I/O driver.
2. Optional Fast I/O subrack containing 12 slots for Fast I/O modules. An additional Power Module can be fitted where required.



GEM 80/303

1. Subrack containing two Power Modules.
2. Subrack containing Master I/O Processor, Ladder Processor and Read/Write memory. The subrack contains up to 12 slots for central modules. One slot is reserved for the Fast I/O driver.
3. Optional Fast I/O subrack containing 12 slots for Fast I/O modules. An additional Power Module can be fitted where required.

GEM 80/301, 302 and 303 CONTROLLERS

DATA TABLES

The data tables consist of 16-bit binary words stored in the GEM 80 memory.

The contents of each data table address can be interpreted as :

(a) 16 individual bits, each of value 1 or 0;

(b) an equivalent decimal integer;

(c) an equivalent hexadecimal (base 16) integer; Hexadecimal permits a range of values from 0000 to FFFF.

Data Table Sizes

Data Table	Content	Size (No. of 16-bit Words)
A and B	Basic Input/Output	Up to 256 (with one I/O Processor) or Up to 512 (with two I/O Processors)
C and D	Fast I/O	Up to 1024. Dependent upon Fast I/O equipment
E	Overflow flags, timing information and real time clock	9
F	Fault Codes, error reporting.	414
G,H,Q R, and W.	General work space	The size is determined by the number of words being used in the other data tables and the user program source code.
N,O and U	Used by STARNET (if fitted)	Dependent on the number of STARNET modules fitted
I	Serial link control	100
J,K	Serial communications	Up to 512 (with one I/O Processor) or Up to 1024 (with two I/O Processors)
L	Video format control data	32 +
M	Maintainer codes for user programmed tests	0 +
P	Configuration and preset data	150 +
S	RAM/EPROM control	1

INSTRUCTION CAPACITY

Each instruction occupies 4 words of memory and each data table uses 2 words of memory. There is an automatic trade-off between the number of instructions used in the User Program and the number of data tables available.

Memory Size	192K	256K	384K	512K
Number of instructions with 10,000 data tables	5,400	11,000	26,500	37,000
Number of instructions with 20,000 data tables	5,000	6,000	22,000	37,000

USER PROGRAM

- Ladder diagram format
- Up to 10 series elements per rung
- Up to 5 parallel branches per rung
- Up to 20 branch opens + 20 branch closes per rung
- Nesting of conditionally executed blocks of user program up to 16 deep

Standard Instruction Set

Symbol	Instruction	Remarks	Symbol	Instruction	Remarks
-] [-	N/O contact	Single bit input	BLOCK	Start/end	Conditionally executed block of instructions
-]/[-	N/C contact	Inverted single bit input	AND	Logic AND	) Logic executed
-(-)-	Coil	Output to single bit in table	OR	Logic OR	) individually
DELAY	Time delay	0.1s to 54 min. in 0.1s steps	XOR	Exclusive OR	) for all 16 bits
COUNT	Counter	Maximum 32767, resettable	INV	Invert	) in a word
SEQR	Sequencer	16-step with reset	ADD	Addition	) Arithmetic with
			SUB	Subtraction	) limits at +/-32767
			OUT	Output	16-bit or numeric output to table

Pre-written Software Special Functions

Logic Functions: ANDGRP T24 Logical AND of 2 word groups ORGRP T25 Logical OR of 2 word groups XORGRP T26 Exclusive OR of 2 word groups SEQDIAG T19 Sequential monitoring			Numerical Manipulation: NEGATE S5 Change sign of number ABS S6 Absolute value of input NONZERO S7 Output -1 if input is non-zero		
Maths Functions: ADDARRAY T12 Array addition SUBARRAY T13 Array Subtraction MULT T10 Value multiplication MULARAY T14 Array multiplication DIV T11 Value division DIVARAY T15 Array division LINCON S11 Linear equation calculation CONARAY S10 Linear conversion of array SQRT S12 Square Root CHKSUM T9 Table checksum calculation STDDEV T18 Mean and Standard Deviation			Data Moving: LOCATE S20 Locate data table address MOVE T20 Move data between addresses STORE T30 First in first out store GETWORD S19 Indirect data access FILL T17 Array set up PUTWORD T29 Indirect output COLLATE T37 Store bits consecutively OUT S8 Intermediate output		
Signal Processing: DBOUNCE S0 Digital signal debounce FGEN S30 Function generator DEDBAND S31 Unity gain with dead band LIMIT S32 High and low limit RAMP S33 Ramp signal (rate dependent) ANALAG S37 1st order time constant lag			Code Conversion: BCDIN S1 Convert BCD to binary BCDOUT S2 Convert binary to BCD GRAYBIN S9 Convert gray code to binary		
Closed Loop Control: PIDABS S34 3-term control, absolute output PIDINC S35 3-term incremental control INCOUT S36 Incremental output			Serial Port Control: PRITEXT S38 Output text to serial port PRINT T38 Output user defined message CHARIN T39 Store text from serial port GETTEXT S21 Access stored message strings		
Binary Tests: HISTATE S3 Find highest bit set to 1 BITSON S26 Total number of bits set ON CMPGRP T21 1st difference between words GETBIT T22 Test individual bits of word			Off-Line Data: CLEAR S29 Reset off-line data RAM PUT T31 Store data in off-line RAM GET T32 Retrieve data from off-line RAM		
Numerical Tests: COMPARE T0 Comparison functions EQ T1 X equal Y; NE T2 X not equal Y; GT T3 X greater than Y; LT T4 X less than Y; GE T5 X greater than or equal Y; LE T6 X less than or equal Y; MAXARAY S13 Maximum value in array MINARAY S14 Minimum value in array MAX T7 Maximum of two inputs MIN T8 Minimum of two inputs CMPARAY T16 Compare arrays DELARAY S15 Multiple delay array SORT S16 Data array numerical sort			STARNET Functions: CONFIG T33 Configure STARNET SEND T34 Transmit data on STARNET RECEIVE T35 Receive incoming data STATS T36 Flag STARNET errors		
			Binary Manipulation: SWAP S4 Swap 1/2 locations INVGRP S25 Invert each bit of word SHIFT S27 Left and right word shift ROTATE S28 Left and right word rotation PUTBIT T23 Set and reset bits of word QSHIFT T27 Shift bits left or right QROTATE T28 Rotate bits left or right		

DIMENSIONS AND FIXING CENTRES

Subrack Specification

267mm high X 483mm wide X 332mm deep.

Depth includes modules with front connectors fitted.

The 6U subrack conforms to IEC297-1 (1975) - Dimensions of Panels and Racks.

Multi-rack systems will require a spacer to be fitted between subracks. This spacer increases the height of a single subrack by 2U (88.9mm).

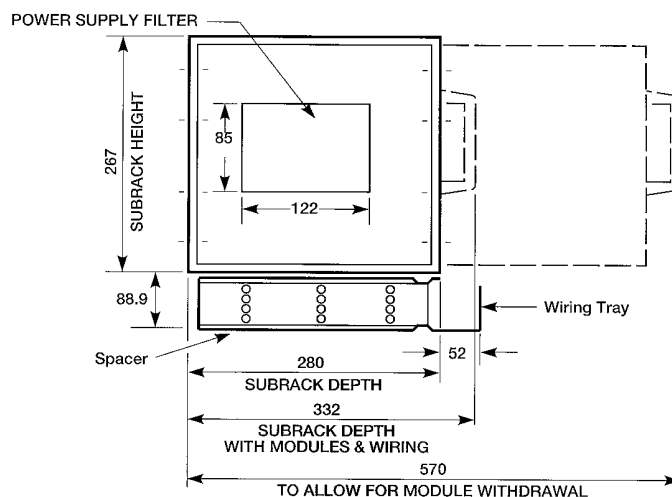
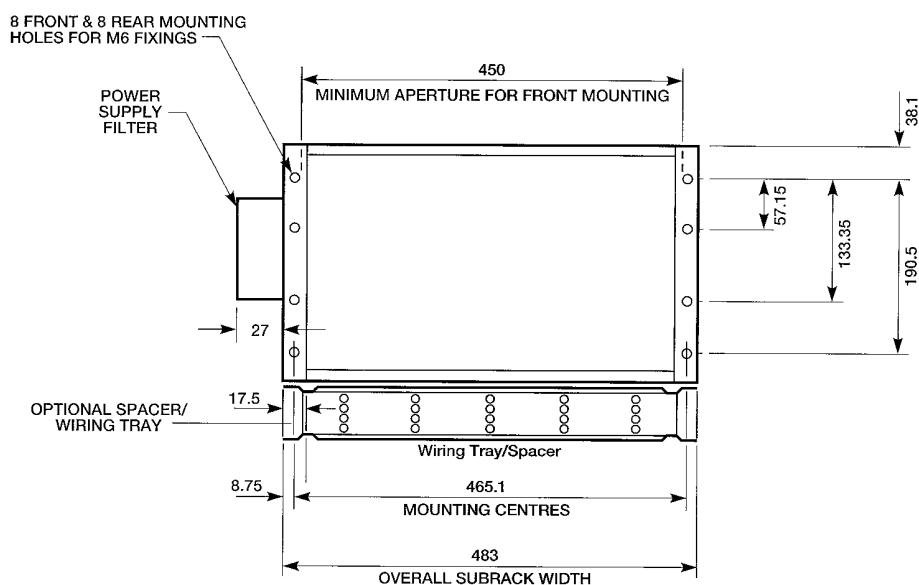
The illustration shows the subrack fitted with an RFI filter. This filter is fitted to subracks containing a Power Module. Where two Power Modules are used in the same subrack (GEM 80/303) two filters are fitted, (one on each side).

All dimensions in millimetres.

Mounting

Each subrack has a very simple mounting procedure which utilises the side plate front or rear flange for fixing purposes. Both front and rear flanges have four fixing holes. Under normal circumstances only the top and bottom holes will be required to secure the subrack assembly. In conditions where shock or vibration are unavoidable, it is recommended that the other four holes are also used. To aid rear mounting, the top hole of each rear flange is "keyhole" shaped.

Each moulded subrack is rear mounted with front mounting facility. For front mounting, the subrack is fitted to the rear face of the panel/swing frame. Rear access is normally required, but the subrack can be inserted from the front provided the dimensions at the rear of the front panel are 600mm wide x 500mm deep. The rear mounting face of the front panel/swing frame must be flat.



ORDERING CODES
Processor Subracks

Model	Sub-rack Qty	Power Module		Modules included					Slots provided for:		Ordering Code
		Type	Qty	I/O Proc 8213	Ladder Proc 8211	128K RAM 8222	192K RAM 8222	256K RAM 8222	Optional Central modules	Optional Fast I/O	
301(192K)	1	8917 ac/dc	1	1	1	0	1	0	3	4	8870-4757
301(192K)	1	8918dc only	1	1	1	0	1	0	3	4	8870-4758
301(256K)	1	8917 ac/dc	1	1	1	0	0	1	3	4	8870-4751
301(256K)	1	8918 dc only	1	1	1	0	0	1	3	4	8870-4752
301(384K)	1	8917 ac/dc	1	1	1	1	1	0	2	4	8870-4753
301(384K)	1	8918 dc only	1	1	1	1	1	0	2	4	8870-4754
301(512K)	1	8917 ac/dc	1	1	1	0	0	2	2	4	8870-4755
301(512K)	1	8918 dc only	1	1	1	0	0	2	2	4	8870-4756
302(192K)	1	8917 ac/dc	1	1	1	0	1	0	7	0	8870-4767
302(192K)	1	8918 dc only	1	1	1	0	1	0	7	0	8870-4768
302(256K)	1	8917 ac/dc	1	1	1	0	0	1	7	0	8870-4761
302(256K)	1	8918 dc only	1	1	1	0	0	1	7	0	8870-4762
302(384K)	1	8917 ac/dc	1	1	1	1	1	0	6	0	8870-4763
302(384K)	1	8918 dc only	1	1	1	1	1	0	6	0	8870-4764
302(512K)	1	8917 ac/dc	1	1	1	0	0	2	6	0	8870-4765
302(512K)	1	8918 dc only	1	1	1	0	0	2	6	0	8870-4766
303(192K)	2	8917 ac/dc	2	1	1	0	1	0	12	0	8870-4777
303(192K)	2	8918 dc only	2	1	1	0	1	0	12	0	8870-4778
303(256K)	2	8917 ac/dc	2	1	1	0	0	1	12	0	8870-4771
303(256K)	2	8918 dc only	2	1	1	0	0	1	12	0	8870-4772
303(384K)	2	8917 ac/dc	2	1	1	1	1	0	11	0	8870-4773
303(384K)	2	8918 dc only	2	1	1	1	1	0	11	0	8870-4774
303(512K)	2	8917 ac/dc	2	1	1	0	0	2	11	0	8870-4775
303(512K)	2	8918 dc only	2	1	1	0	0	2	11	0	8870-4776

Central Modules

Module type	Function	Slots Used	Equipment called up by ordering code	Ordering Code
Second I/O Processor	For an extra 4096 I/O points	2	I/O Processor module Processor backplane	8800-4123
IMAGEM graphic video	For displaying data from the controller data tables on a video monitor	2	Video processor module Video output module Video backplane Ribbon cable Isolating termination panel	8815-4107
STARNET module	For inter-controller communications	2	Module and backplane	8816-4101
128K RAM module	For additional video formats	1	Module	8810-4119
256K RAM module	For additional video formats	1	Module	8810-4117
128K RAM module	For off-line data storage	1	Module	8810-4129
256K RAM module	For off-line data storage	1	Module	8810-4127
128K RAM module	For ladder expansion	1	Module	8222-4012
256K RAM module	For ladder expansion	1	Module	8222-4001
EPROM Sub-module for use with 8222 RAM/EPROM module	Secure storage of User Program	1	Sub-module	9210-4001
Fast I/O Driver	Required whenever the system contains Fast I/O Modules. Must not be fitted if there is no Fast I/O.	1	Module only	8300-4003

GEM 80/301, 302 and 303 CONTROLLERS

Fast I/O Subracks

12-slot with Power Module 8917 (110/220V ac/dc)
12-slot with Power Module 8918 (24/48V dc)
12-slot Excluding Power Module

Ordering Code

8870-4115
8870-4114
8870-4365

I/O Subracks

12-slot for Basic I/O with space for Basic I/O Expander
8-slot for Basic I/O with space for Power Module 9032-4002
Basic I/O Expander
2U Spacer/Wiring tray
Rear cover for subrack

8859-4003
8857-4006
9284-4002
8891-4604
8891-4247

Serial Link Equipment

20mA serial termination unit
RS485 serial termination unit (for use with STARNET)
RS485 serial termination unit (for use with I/O Processor)
RS232 serial termination unit (isolated)
Fibre-optic termination panel (20mA)
2-Way ribbon cables for 8587/8594/8924/9009

8924-0000
8587-4001
8587-4003
9009-4001
8927-0000
8891-4077

SPARES

Power Module for Controller subracks:

For 110/220V ac/dc
For 24/48V dc

8917-4003
8918-4003

Power Module for I/O subracks:

For 110/220V ac (isolated)
or 24/48V dc (non-isolated)

9032-4002

Ladder Processor module

8211-430*

Master I/O Processor module

8213-430*

10A Power fuse for 8917 Power Module

82030/111

20A Power fuse for 8918 Power Module

82022/287

Battery for memory module

20T0319/01

* Replace the asterisk with the final digit of the original module order number.

ADDITIONAL INFORMATION

Further information and help on GEM 80 products
or applications can be obtained from:

or Your local GEM 80 representative,
GEM 80 Customer Services Dept.
Tel. 0782 783511. Ext. 2651 or 2574
International Code 44 782 783511

GEC Industrial Controls Ltd



Programmable Controllers Division
Kidsgrove, Stoke-on-Trent,
Staffordshire, ST7 1TW,
England.

Tel: (0782) 783511
Fax: (0782) 776329
Telex: 36293/4 GECICK G

Int. (44 782) 783511
Int. (44 782) 776329

Registered in England No: 2259095 Registered Office: Kidsgrove, Stoke-on-Trent, Staffordshire, ST7 1TW
England. Holding Company: GEC Controls Ltd, Boughton Road, Rugby, Warwickshire, CV21 1BU, England

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