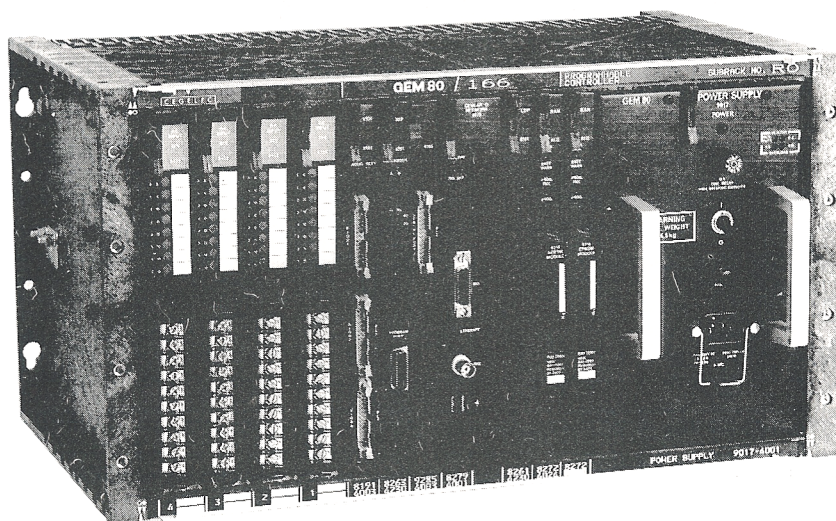


GEM 80/160 CONTROLLERS



Description

The GEM80/160 series programmable controllers are designed for complex industrial control applications. The GEM80/160 series comprises a family of four single subrack controllers each fully compatible with the rest of the GEM80 family, using the same control language and I/O structure.

Verification I/O and floating point mathematics are additional facilities of this series.

Standing alone, these controllers can provide extensive digital and analogue control plus report generation. The flexible structure allows interface to a variety of plant equipment whilst the comprehensive programming instruction set provides an extensive range of process control features.

The GEM80/160 series controllers are ideally suited for centrally supervised or centrally co-ordinated operations.

All GEM80/160 Controllers provide GEM80 standard serial links and CORONET local area network communication.

The GEM80/163 Controller is the base model of the 160 series range and provides the series features at minimum cost.

The GEM80/164 Controller includes the IMAGEM graphics video system which provides video outputs for graphic display of plant information.

The GEM80/165 Controller includes the STARNET serial communications interface which provides high-speed cost effective communication between

GEM80 Controllers and certain GEMDRIVE products.

The GEM80/166 Controller includes the GEMLAN-D module which allows communication on a DECnet network between GEM80 Controllers and other nodes such as VAX computers.

Features

- Up to 8192 I/O points of Verification I/O of which 2048 I/O points can be converted to Basic I/O.
- Large program memory capacity (up to 37,000 instructions).
- Optional EPROM module for secure storage of user program and preset data.

GEM80 163, 164, 165 and 166 Controllers

CONTROLLER	GEM80/163	GEM80/164		GEM80/165 and 166	
Memory Size	256K	256K	512K	256K	512K
Typical Instruction Capacity	20,000 +20,000 data tables	5,400 +20,000 data tables	26,500 +20,000 data tables	11,000 +10,000 data tables	37,000 +20,000 data tables
I/O Capacity	Up to 512 x 16 bit words of Verification I/O, of which 128 words can be converted to Basic I/O.	Up to 512 x 16 bit words of Verification I/O, of which 128 words can be converted to Basic I/O.		Up to 512 x 16 bit words of Verification I/O, of which 128 words can be converted to Basic I/O.	
Video Formats	Not Available	96K		Not Available	
Serial link	2 serial ports for manufacturing cell and real time communications	2 serial ports for manufacturing cell and real time communications		2 serial ports for manufacturing cell and real time communications	
Network communication	CORONET	CORONET		CORONET STARNET (165 only) GEMLAN-D (166 only)	
Program	GEM80 Ladder Diagram. Front port of the I/O Processor used for programming				
Execution Speed	5ms per 1000 instructions average				
Power Input	88V-264V ac 45-63Hz or 88V-250V dc or optional 19V-60V dc only				
Temperature	operating: 0 to 60°C (GEM80, 163, 164 and 165) 0 to 50°C (GEM80 166 only) storage: -20 to 70°C				
Environment	GEM80 Standard				
Mounting	483mm (19 inch) panel				

Memory Size

The user creates the required program memory capacity in the GEM80/160 Controllers by the

simple process of inserting GEM80 memory modules (available separately) into specially prepared slots in the controller subrack. Memory sizes can be expanded to a

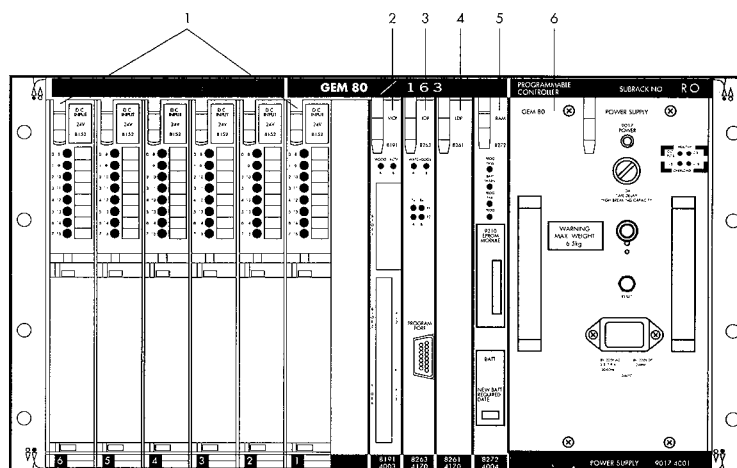
maximum of 512 Kbytes in the GEM80/164, GEM80/165 and GEM80/166 Controllers.

Memory Allocation

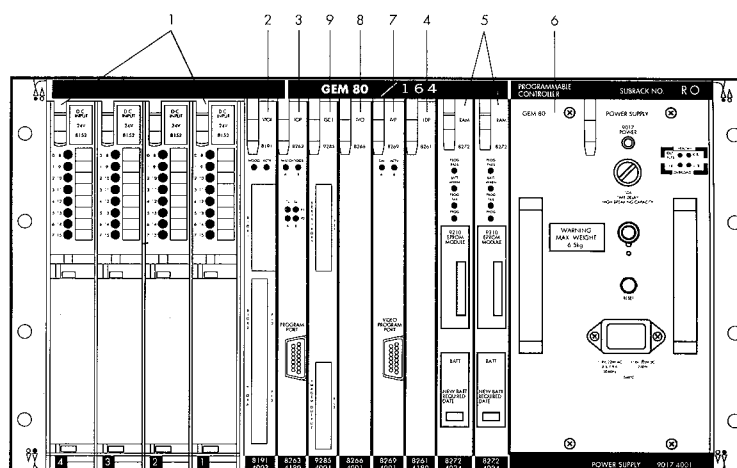
CONTROLLER	GEM80/163	GEM80/164		GEM80/165		GEM80/166	
Memory Size	256K	256K	512K	256K	512K	256K	512K
Source code + data tables	58K	64K	64K	64K	64K	64K	64K
Extension space for source code	64K	–	128K	–	128K	–	128K
Compiled Code	127K	32K	160K	96K	224K	96K	224K
System Use	7K	64K	64K	64K	64K	64K	64K
Video Formats	–	96K	96K	–	–	–	–
Unavailable to the User	–	–	–	32K	32K	32K	32K
Maximum Totals	256K	256K	512K	256K	512K	256K	512K

Hardware Layouts

GEM80/163



GEM80/164



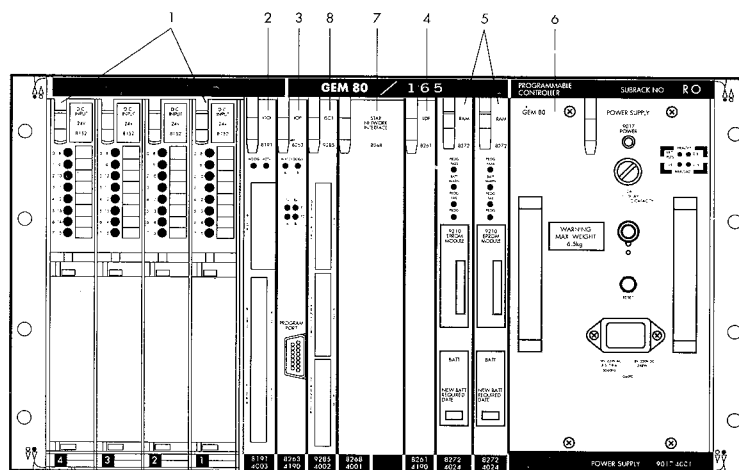
1. Slots for I/O Modules
2. 8191 Verification I/O Expander
3. 8263 I/O Processor (IOP)
4. 8261 Ladder Processor

5. 8272 Memory Module
6. Power Module
7. 8269 IMAGEM Video Processor

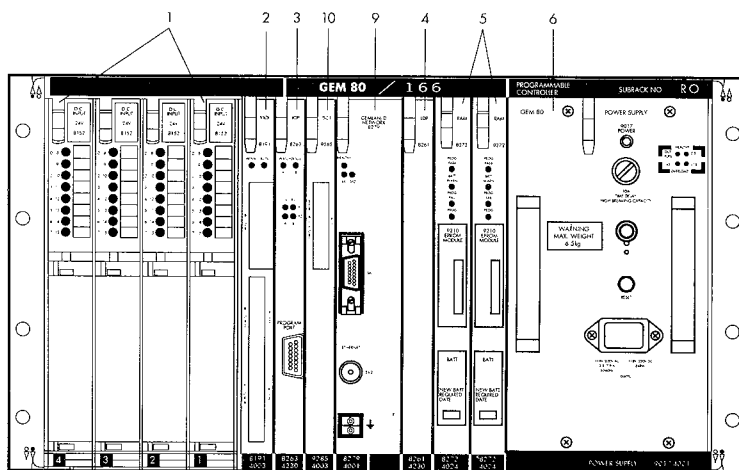
8. 8266 IMAGEM Video output
9. 9285-4001 IMAGEM and IOP Communications Interface

Hardware Layouts

GEM80/165



GEM80/166



1. Slots for I/O Modules
2. 8191 Verification I/O Expander
3. 8263 I/O Processor (IOP)
4. 8261 Ladder Processor
5. 8272 Memory Module

6. Power Module
7. 8268 STARNET Module#
8. 9285-4002 STARNET and IOP Communications Interface#
9. 8279 GEMLAN-D Module~

10. 9285-4003 Serial Communications Interface~

GEM80/165 only
~ GEM80/166 only

Data Tables

The data tables consist of 16-bit binary words stored in the GEM80 memory.

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

- 16 individual bits, each of value 1 or 0.
- an equivalent decimal integer.
- an equivalent hexadecimal (base 16) integer. Hexadecimal permits a range of values from 0000 to FFFF.

- part of a 32-bit floating point number. Each floating point number is held as two consecutive locations in the 'Q' table. Thus the floating point locations are addressed as Q0, Q2, Q4, Q6 etc..

Instruction Capacity

Each instruction occupies 4 bytes of memory and each data table uses 2 bytes 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.

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

Data Table Sizes

Data Table	Content	Size (No. of 16-bit Words)
A and B	Verification Input/Output	Up to 512
E	Overflow flags, timing information and real time clock	9
F	Fault Codes, error reporting.	414
G,H, 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 (GEM80/165 only)	0+
I	Serial link control	100
J,K	Serial communications	Up to 512
L	Video format control data	0 (163, 165 and 166) 32 (164)
M	Maintainer codes for user programmed tests	0+
P	Configuration and preset data	100 (163), 150 (164, 165 and 166)
Q	Floating point data	0+
S	RAM/EPROM control	1

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 individually for all 16 bits in a word.
-(-)-	Coil	Output to single bit in table	OR	Logic OR	
DELAY	Time delay	0.1s to 54 min. in 0.1s steps	XOR	Exclusive OR	
COUNT	Counter	Maximum 32767, resettable	INV	Invert	
SEQR	Sequencer	16 step with reset	ADD	Addition	Floating Point and Integer arithmetic.
			SUB	Subtraction	
			OUT	Output	16 bit or numeric output to table

Pre-written Software Special Functions

Logic Functions			Numerical Tests:		
ANDGRP	T24	Logical AND of 2 word groups	COMPARE	T0	Comparison functions
ORGRP	T25	Logical OR of 2 word groups	EQ	T1	X equal Y
XORGRP	T26	Exclusive OR of 2 word groups	NE	T2	X not equal Y
SEQDIAG	T19	Sequential monitoring	GT	T3	X greater than Y
Maths Functions:			LT	T4	X less than Y
ADDARRAY	T12	Array addition	GE	T5	X greater than or equal Y
SUBARRAY	T13	Array Subtraction	LE	T6	X less than or equal Y
MULT	T10	Value multiplication	MAXARRAY	S13	Maximum value in array
MULARAY	T14	Array multiplication	MINARRAY	S14	Minimum value in array
DIV	T11	Value division	MAX	T7	Maximum of two inputs
DIVARRAY	T15	Array division	MIN	T8	Minimum of two inputs
LINCON	S11	Linear equation calculation	CMPARRAY	T16	Compare arrays
CONARRAY	S10	Linear conversion of array	DELARRAY	S15	Multiple delay array
SQRT	S12	Square Root	SORT	S16	Data array numerical sort
CHKSUM	T9	Table checksum calculation	Numerical Manipulation:		
STDDEV	T18	Mean and Standard Deviation	NEGATE	S5	Change sign of number
SIN	S70	Sine	ABS	S6	Absolute value of input
COSINE	S71	Cosine	NONZERO	S7	Output -1 if input is non-zero
TANGENT	S72	Tangent	FPOINT	S76	Floating point to integer
ASIN	S80	Inverse sine	FPFLAGS	S78	Floating point maths error
ACOS	S81	Inverse cosine	FIX	S79	F.P. to multiple integer
ARCTAN	S82	Inverse tangent	Data Moving:		
DEGRAD	S75	Degree to radian conversion	LOCATE	S20	Locate data table address
RADDEG	S85	Radian to degree conversion	MOVE	T20	Move data between addresses
LOG 10	S73	Logarithm to the base 10	STORE	T30	First in first out store
LOGE	S74	Natural logarithm	GETWORD	S19	Indirect data access
PI	S77	Pi	FILL	T17	Array set up
EXP	S84	'e' raised to power	PUTWORD	T29	Indirect output
POWER	T70	Value raised to power	COLLATE	T37	Store bits consecutively
FSCALE	T73	Floating point scale	OUT	S8	Intermediate output

Pre-written Software Special Functions

Signal Processing:			STARNET Functions:		
DBOUNCE	S0	Digital signal debounce	CONFIG	T33	Configure STARNET
FGEN	S30	Function generator	SEND	T34	Transmit data on STARNET
DEDBAND	S31	Unity gain with dead band	RECEIVE	T35	Receive incoming data
LIMIT	S32	High and Low Limit	STATS	T36	Flag STARNET errors
RAMP	S33	Ramp signal (rate dependent)	Code Conversion:		
RAMPGEN	S61	Ramp signal (time dependent)	BCDIN	S1	Convert BCD to binary
ANALAG	S37	1st order time constant lag	BCDOUT	S2	Convert binary to BCD
TCNST	S60	Programmable time constant	GRAYBIN	S9	Convert gray code to binary
Closed Loop Control:			Binary Manipulation:		
PIDABS	S34	3-term control, absolute output	SWAP	S4	Swap 1/2 locations
PIDINC	S35	3-term control, incremental output	INVGRP	S25	Invert each bit for groups of words
INCOUT	S36	Incremental output	SHIFT	S27	Left and right word shift
PIDCON	T60	3-term control with mode select	ROTATE	S28	Left and right word rotation
PIDSIM	T61	Programmable 3-term control	PUTBIT	T23	Set and re-set bits of word
Serial Port Control:			QSHIFT	T27	Shift bits left or right
PRITEXT	S38	Output text to serial port	QROTATE	T28	Rotate bits left or right
PRINT	T38	Output user defined message	Binary Tests:		
CHARIN	T39	Store text from serial port	HISTATE	S3	Find highest bit set to 1
GETTEXT	S21	Access stored message strings	BITSON	S26	Total number of bits set ON
GEMLAN-D Functions:			CMPGRP	T21	1st difference between words
LOPEN	T62	Allocates a channel to a DECnet connection	GETBIT	T22	Test individual bits of word
LCLOSE	S62	Deallocates a channel & closes the connection			
LWRITE	T63	Transfers data to a partner machine			
LREAD	T64	Requests data from a partner machine			
LSTATUS	S63	Requests channel status			

Dimensions and Fixing Centres

Subrack Specification

Dimensions

356mm high

510mm wide

332mm deep

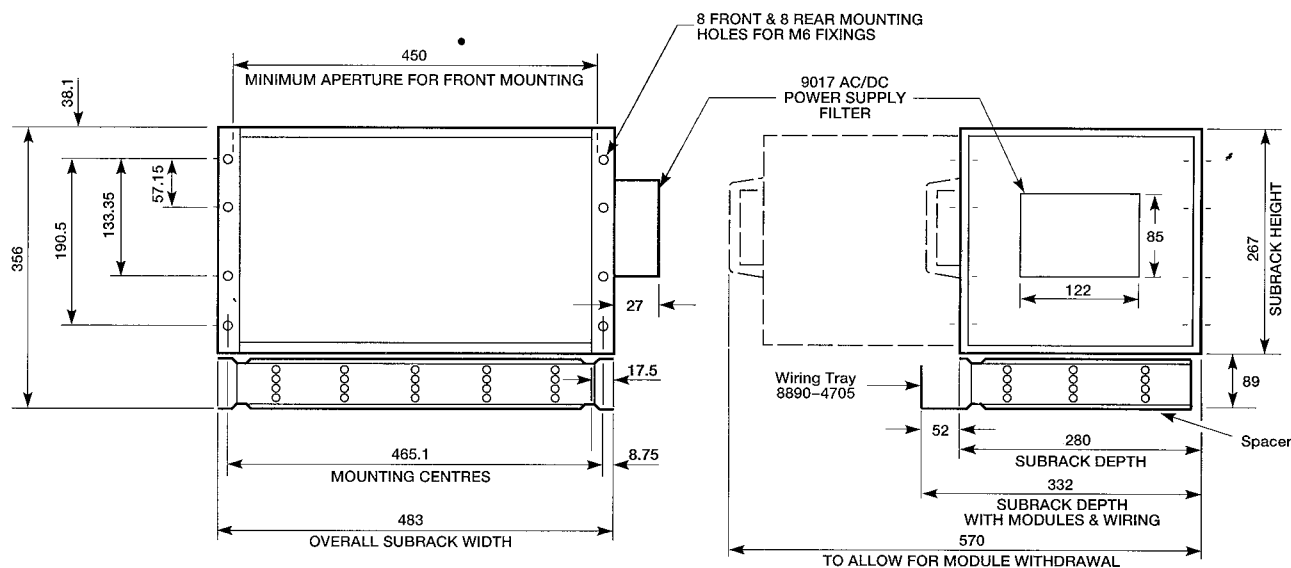
Weight

15 kg (without I/O modules)

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

Mounting

The subrack has a very simple mounting procedure which utilises the front or rear flanges of the sideplates for fixing purposes.



ORDERING CODES

Controller Subracks

	Power Module	Modules included									Slots for:		
Model	Type	I/O Proc	Ladder Proc	Gemlan-D		Starnet		Imagem		I/O Expander	Ram I/O Modules	Ordering Code	
				Module	I/Face	Module	I/Face	Modules	I/Face				
GEM80/163	9017 ac/dc	1	1	-	-	-	-	-	-	1	1 6	8870-4188	
GEM80/163	9018 dc only	1	1	-	-	-	-	-	-	1	1 6	8870-4189	
GEM80/164	9017 ac/dc	1	1	-	-	-	-	2	1	1	2 4	8870-4437	
GEM80/164	9018 dc only	1	1	-	-	-	-	2	1	1	2 4	8870-4447	
GEM80/165	9017 ac/dc	1	1	-	-	1	1	-	-	1	2 4	8870-4487	
GEM80/165	9018 dc only	1	1	-	-	1	1	-	-	1	2 4	8870-4497	
GEM80/166	9017 ac/dc	1	1	1	1	-	-	-	-	1	2 4	8870-4466	
GEM80/166	9018 dc only	1	1	1	1	-	-	-	-	1	2 4	8870-4467	

Memory Modules

Controller	Capacity		Ordering Code
GEM80/163	256K RAM ²		8272-4004
GEM80/164	256K RAM 512K RAM ¹		8272-4024
GEM80/165 and GEM80/166	256K RAM 512K RAM ¹		8272-4024

Note: ¹ For 512K controller memory, 2 x 256K RAM modules must be fitted.

² The RAM modules of the GEM80/163 cannot be interchanged with the RAM modules of the GEM80/164, GEM80/165 and GEM80/166.

I/O Subracks

Ordering Code

12-slot Subrack for Verification and Basic I/O	Space for Verification I/O Expander	8859-4003
Verification I/O Expander		8191-4004
Wiring tray		8890-4705
Rear cover for subrack		8891-4247
Blanking Panel (single)		8122-4001
Blanking Panel (double)		8122-4002

Note: Verification I/O Expander 8191-4004 must be mounted in an I/O subrack.

Serial Link Equipment

20mA serial termination unit		8924-0000
RS485 serial termination unit	(for use with STARNET)	8587-4003
RS232 serial termination unit		9009-4001
26 Way ribbon cables for 8587/8924/9009		8891-4077

Spares

Power Module for Controller Subracks	For 110/220V ac/dc For 24/48V dc	9017-4001 9018-4001
I/O Processor	for GEM80/163 for GEM80/164 for GEM80/165 for GEM80/166	8263-417* 8263-418* 8263-419* 8263-423*
Ladder Processor	for GEM80/163 for GEM80/164 for GEM80/165 for GEM80/166	8261-417* 8261-418* 8261-419* 8261-423*
Verification I/O Expander	for Controller Subrack for I/O Subrack	8191-4003 8191-4004
GEMLAND Module	(166 only)	8279-4001
Serial Communications Interface Module	(166 only)	9285-4003

STARNET Module	(165 only)	8268-4001
STARNET Communications Interface Module	(165 only)	9285-4002
IMAGEM Video Processor Module	(164 only)	8269-4001
IMAGEM Video Output Module	(164 only)	8266-4001
IMAGEM Communications Interface Module	(164 only)	9285-4001
Video Termination Panel	(164 only)	8562-4002
EPROM sub-module	for program storage	9210-4001
Fuse for ac/dc power input on 9017-4001 power module	(10A, time delay, high breaking capacity)	82030/111
Fuse for dc power input on 9018-4001 power module	(15A, medium time lag, high breaking capacity)	82030/190
Battery for memory module		20T 0319/01

*Replace asterisks 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 representative,
Customer Service Dept.
Tel. 0782 783511.
International Code
44 782 783511



Kidsgrove, Stoke-on-Trent, ST7 1TW, England
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