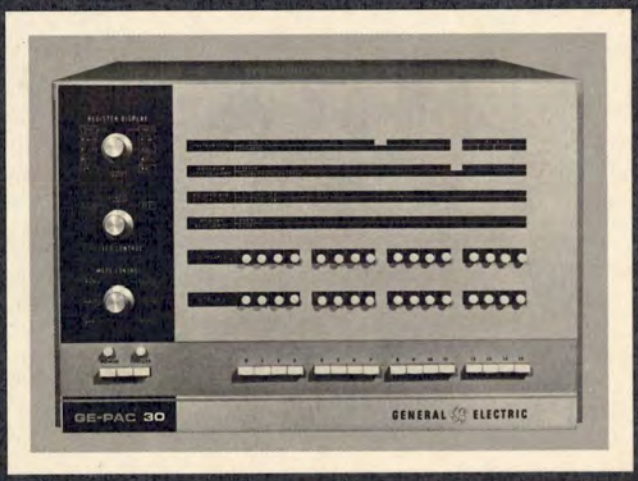
Think Mini



GE-PAC·30
PROCESS COMPUTER

GENERAL ELECTRIC

The GE-PAC* 30: A flexible mini-computer fo solving your control problems

Introducing the GE-PAC 30 series; two minicomputers, each of which gives you a choice of standard or custom read-only memories. The GE-PAC 30 lets you match the capability of the computer to the needs of your business. It is your best buy whether you use it in "one of a kind" applications or in high volume OEM opportunities.

The use of integrated circuits assures you of the highest reliability available in a computer today. It's the type of reliability essential for real-time applications. The GE-PAC 30 lets you replace wired logic at low cost while retaining high flexibility.

Read-only memory for faster computing speed. Read-only memory makes the GE-PAC 30 one of the most flexible machines of its size on the market today. Control functions can be built right into the read-only memory for more efficient, faster control.

GE-PAC 30 can be easily modified. It's built in small functional plug-in modules for easy field modification or expansion.

Party-line I/O structure. Modules can plug in anywhere. Device priority is determined solely by where the card is inserted.

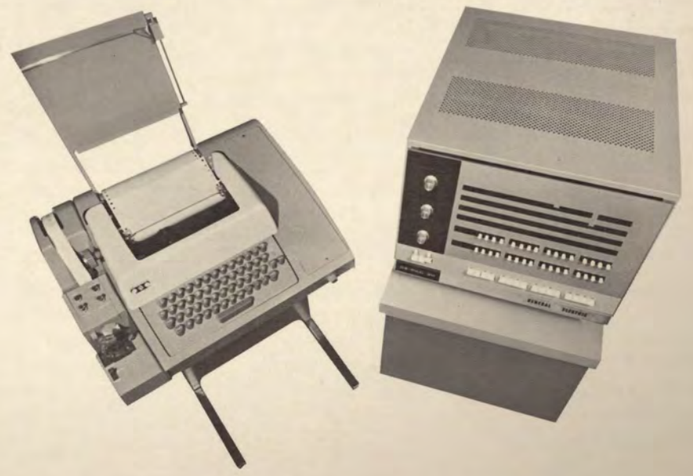
GE-PAC 30 is easy to program. Both models have 16 and 32 bit instructions. You get greater accuracy and a more usable instruction set. Direct addressing to 64K bytes.

Easy to service and maintain. A necessity when dealing with such a low cost computer. The GE-PAC 30's, with modular construction and plug-in boards, make servicing easy. Test points are numerous and easily accessible. The standard read-only memory can be readily unplugged and replaced by a special hardware diagnostic memory called X-RAY. When combined with a test set and symptom dictionary, you can find faults fast. And there are special software test programs for I/O modules and core memory.

*Reg. Trade-mark of General Electric Company

Other important features:

- Software is fully upward compatible between processors. You can grow without reprogramming.
- All peripheral devices and system components are interchangeable between the GE-PAC 30-1 and 30-2.
- You have a choice of instruction execution time, memory size and speed, and instruction repertoire options, with low and high speed I/O channels.
- 16-bit halfword memory can be addressed at the 8-bit byte level.
- Memory is field expandable to 65,536 bytes. No paging or indirect addressing is required.
- 16 general registers, each 16-bits long, are provided for use as accumulators by any instruction. 15 of the general registers can also be used as index registers.
- Register-to-register instructions eliminate redundant loads and stores.
- A comprehensive instruction set including: efficient byte processing instructions, single instructions which increment-test-branch on index values for loop control, as well as instructions that test the condition code and branch directly to any location in memory.
- Logical and arithmetic shift instructions can shift up to fifteen positions with a single instruction.
- Flexible, multiplexed I/O systems include an integrated priority interrupt facility and provide for direct addressing of up to 256 devices.
- High-speed memory access channels permit cycle stealing I/O to byte-oriented peripherals or 16-bit halfword special purpose devices.
- Optional wired or programmable memory protect feature is available.
- Third generation data compatibility using standard ASCII code.
- Comprehensive software packages include: FORTRAN, Assembler, Debugging, Editor, and Mathematical Library.



Need information on other products?

CIRCLE APPROPRIATE NUMBER FOR INFORMATION YOU WISH.

ADJUSTABLE SPEED DRIVES
1. Maxspeed** Crane Drives
2. Silcon VI** D-c Drives 5–1250 hp
3. GP-100** D-c Drives 1–15 hp
4. VT-700** A-c Drives 5–150 hp
5. Statotrol** Adjustable Speed Drives

ATOMIC POWER EQUIPMENT
6. Power Reactor Systems
7. Irradiation Services
8. Nuclear Instrumentation

BALLASTS
9. Mercury
10. Lucalox*
11. Metallic Halide

BATTERIES
12. Rechargeable (Nickel-Cadmium)
13. **BRUSHES, CARBON BUSHINGS**
14. Apparatus Bushings
15. Bushing Potential Devices

CAPACITORS
16. Power (Utility)
17. Power (Industrial)
18. Electronic (Electrolytic Military)
19. Small Industrial
20. Electronic (Electrolytic Industrial)
21. Electronic

CIRCUIT PROTECTIVE DEVICES
22. Molded Case Circuit Breakers
23. Safety Switches
24. Circuit Breakers Load Centers
25. Fuse Puller Panels
26. Three Phase Four Wire Load Centers

COMPUTERS
27. Data Logging Systems
28. TermiNet**—Data Communication Printer
29. Process Control Computers
30. Remote Scanners
31. Information Processing Service
32. Business & Scientific Systems
33. Time-Sharing Equipment
34. Time-Sharing Service

CONTROL EQUIPMENT
35. Numerical Control
36. Motor Starters (Grouped)
37. Motor Starters (Individual)
38. Crane Control
39. Panels, Magnetic and Static
40. Register Control
41. Welding Control

CONTROL COMPONENTS
42. Manual Motor Starters
43. Magnetic Contactors and Starters
44. Reduced Voltage Starters
45. Control Circuit Relays
46. Push Buttons, Oil-tight, Miniature, Standard Heavy Duty, Indicating Lights
47. Limit Switches, Pilot Devices, Solenoids, Terminal Boards
48. Fluidic Control
49. Time Switches
50. Other General Purpose Controls
51. Resistors
52. D-c Contactors and Relays
53. Brakes (A-c and D-c)
54. Voltage and Resistive Sensitive Relays
55. Sealed Relays
56. Reed Relays
57. Photoelectric Controls
58. Radiant Heat Detector
59. Smoke Density Indicators
60. Plate-type Rheostats
61. Navy Control Components
62. Master Switches
63. Appliance Controls
64. Selsyn Controls

COUPLINGS
65. Shaft, flexible, spline-type

DISTRIBUTION ASSEMBLIES
66. Switchboards (600 V. Max.)
67. Busway (A-c or D-c)
68. Motor Control Centers
69. Wireway
70. Panelboards
71. Panel Motor Control
72. Grouped Metering Equipment

DISTRIBUTION PROTECTIVE EQUIPMENT
73. Intermediate Class Lightning Arresters
74. Distribution Class Lightning Arresters
75. Station Class Lightning Arresters
76. Open Cutouts
77. Enclosed Cutouts
78. H R Automatic Reclosers
79. Current Limiting Fuses
80. Automatic Throwover Control
81. Home Lightning Protection
82. Durabute* Sectionalizer/Load-breaker

ELECTRIC DRIVE SYSTEMS
83. Drilling Rigs
84. Steel Mills
85. Paper
86. Power Shovels

GEARS
87. Industrial & Marine Helical, Spur, Bevel

GENERATORS
88. Engine-driven
89. Hydraulic-turbine-driven
90. Kinamatic* D-c generators ¾–800 kw
91. Brushless A-c Synchronous
92. D-c Generators (larger than 0.6 kw per rpm)
93. M-G Sets (includes generators larger than 0.6 kW per rpm)

INDUSTRIAL HEATING
94. Heat Processing Equipment
95. Heaters and Devices
96. Infrared Radiant Heaters
97. Soldering Irons
98. **INDUSTRIAL LIGHTING**
99. **INDUSTRIAL PROCESS CONTROL SYSTEMS**

INSTRUMENTS
100. A Profile of Instrument Capability
101. Recorders for Electric Utility and Industrial Applications
102. Instruments for Switchboard Panel and Control Manufacturers

INDICATION INSTRUMENTS
103. Panel Meters
104. Panel Meters Edgewise
105. Meter Relays
106. Time Meters
107. Hook-on Voltammeters
108. Switchboard Indicators
109. Switchboard Indicators Edgewise

INSTRUMENTATION SYSTEMS
110. Analog Telemetering
111. Data Acquisition Systems
112. Furnace Control
113. GE-MAC* (Electronic Measurement and Control)
114. Supervisory Control Value Analysis
115. GE-TAC** (Telemetering and Control)
116. Turbine Supervisory
117. Vibration Monitoring

LABORATORY AND SPECIAL TESTING INSTRUMENTS
118. Helium Leak Detectors
119. Analytical Instruments Emission
120. Analytical Instruments Diffraction
121. Height-of-fill Monitors
122. Metal Thickness Gages
123. Infrared Moisture Gages
124. Radiographic
125. Halogen Leak Detectors (Industrial H-2, 5P)
126. Halogen Leak Detectors (Service H-10, H-11)
127. Halogen Leak Standard
128. Current Limited Hi-Pot Tester
129. Gauss Meters
130. Light Beam Vibration Indicator
131. Phase Sequence Indicator
132. Portable Double Bridge
133. Recording Spectro-photometer
134. Roughness Scales and Specimens
135. Thickness Gages
136. Vibration Detector
137. Winding Insulation Tester
138. Wire Diameter Gage
139. Zahn Viscosimeter

MARINE
140. Steam Turbine Propulsion

RECORDING INSTRUMENTS
141. Recorders, Direct-operated, Strip-chart (Inking, Inkless, Hook-on)
142. Recorders, Servo-operated, Miniature (4")
143. Recorders, Servo-operated (12") Strip and Round Chart Recorders/-Recorder Controllers (1, 2, or multi-point pen)

OTHER INSTRUMENTATION
144. 3-mode Controller, Type 524
145. D-c Shunts
146. Web Tensiometer
147. Transducers
148. Watt Var Autoswitch

METERS
149. Single-phase—Watthour
150. Polyphase—Watthour & Demand
151. Printing Demand Meters
152. Watthour Demand Registers
153. Meter Sockets

MOTORS
154. Appliance
155. A-c Tri-clad '55'* Induction 1–125 hp
156. Custom 8000* A-c 250 to 5000 hp
157. Custom 8000* A-c 5000 hp and up
158. Vertical Pump
159. Submersible
160. Brushless
161. Hydroelectric Project Machines
162. Acyclic Generators and Motors
163. Tensiometers
164. A-c Single-phase
165. A-c Thinline (for limited space)
166. A-c Fractional
167. A-c Form G Motors, 1/20 to 5 hp
168. A-c Farm Motors
169. D-c Fractional and Miniature
170. D-c Elevator Equipment
171. D-c Planer
172. M-33** Main D-c Mill Motors
173. MD D-c Auxiliary Mill Motors
174. Kinamatic* D-c Motors 1-1250 hp
175. Amplidynes
176. Dynamometers
177. In-line Pump Motors

MECHANICAL POWER TRANSMISSION
178. Gear Motors
179. Speed Reducers and Gearing
180. Polydyne* Mechanical Adjustable Speed Drive
181. Polydyne* Drives—Plastic Extruders

OUTDOOR LIGHTING
182. Street and Highway
183. Private (Dusk-to-Dawn) Lighting
184. Area and Decorative Lighting

SERVICE & MAINTENANCE (ELECTRICAL, ELECTRONIC, MECHANICAL)
185. Transportation
186. Retrofit
187. Selective Maintenance
188. Government & Defense
189. Marine and Utility Switchgear Testing
190. Marine and Utility Transformer Testing
191. Instrumentation and Control
192. Machine Tools
193. Rotating Equipment
194. Contract Maintenance
195. Management Planning Engineering Service
196. Availability Engineering
197. Installation Support Service
198. Maintenance Support Service
199. Complete Installation Service
200. Complete Maintenance Service
201. Customer Training Service

SWITCHGEAR
202. Isolated Phase Bus
203. Power Circuit Breakers, Oil Type FKA (15.5 through 72.5 kv)
204. Power Circuit Breakers, Oil Type FK (15.5 through 72.5 kv)
205. Power Circuit Breakers, Oil Type FK (121, 146, 169 kv)
206. Power Circuit Breakers, Air Type ATB (115 through 345 kv)
207. Power Circuit Breakers, Air Type ATB (500 kv)
208. Power Circuit Breakers, Vacuum Type VIR/VIB (14.4 kv)
209. Indoor Station Equipment
210. FKD Distribution Circuit Breakers (14.4 kv)
211. Current Limiting Fuses (Class J, L, H)
212. A-c Secondary Network Protectors
213. LB-1 Power Protector
214. Metal-clad Switchgear (2.4–13.8 kv)
215. Supervisory Control Equipment
216. Uninterruptible Power Systems
217. High Frequency Lighting
218. SCR-Type Static Inverters (Motor Drives)
219. Fused Power Circuit Breakers AKU-Type
220. Silicon Rectifiers
221. SCR Regulated Battery Charger
222. PLB Power Protector
223. Load-center Unit Substations
224. Switch & Fuse Equipment
225. Protective Relays
226. Silcomatic Equipment (Power Conversion Equipment)
227. SB Control & Transfer Switches

TRANSFORMERS
228. Instrument Transformers 15 kv and Below
229. Instrument Transformers 25 kv to 69 kv
230. Instrument Transformers Liquid-Filled 25 kv to 500 kv
231. Distribution—Pole Type
232. Distribution—Underground
233. Distribution—Network
234. Primary Substation (501–15000 kva)
235. Single-Circuit Unit Substations (1000–7500 kva)
236. Integral Distribution Centers (112½–2000 kva)
237. Compad Transformers (750–2500 kva)
238. Furnace and High Current
239. Mobile Substations and Transformers
240. Oil-immersed Current Limiting Reactors
241. Dry-type Transformers (600 Volts & Below)
242. Dry-Type Reactors
243. Bushing-Type Current Transformers
244. EHV Transformer Capabilities
245. Large Power Transformers (above 15000 kva)
246. Commercial Distribution—Pole & Station Type (167 kva & above)
247. Commercial Distribution—Pad-mounted (1φ, 167–500 kva)
248. Commercial Distribution—Pad-mounted (3φ, 75–500 kva)
249. Commercial Distribution—Subsurface (3φ, 150–500 kva)
250. Commercial Distribution—Network (Submersible, 300–2500 kva)
251. Commercial Distribution—Network (Pad-mounted 300–2500 kva)

TRANSPORTATION SYSTEMS DIVISION
252. Mainline Diesel-Electric Locomotives
253. Mainline Electric Locomotives
254. Mining & Industrial Locomotives
255. Automation Systems Rail Haulage Metropolitan Transit
256. Electric Transmissions Off-highway Vehicle
257. Renewal Parts
258. Diesel Engine

TURBINES, TURBINE-GENERATORS
259. Ship's Service Turbine-Generators
260. Industrial Mechanical Drive Turbines
261. Land-Based Steam Turbine Generators
262. Marine Mechanical Drive Turbines
263. Gas Turbines
264. Centrifugal & Axial Flow Compressors
265. Marine Steam Turbine Propulsion

VOLTAGE REGULATORS
266. Step Voltage
267. Inductrol*
268. Voltage Regulation & Control Devices

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DATA PRODUCT NEWS
08-69 295-001N 11-11-69
GEA-8838

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Thank You . . . for your interest in General Electric products. May we be of further assistance ... help you with a specific application ...prices...or information on other products? If so, fill out this form ...fold it, and send it to me...it's post-paid...and I'll follow through.

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SCHENECTADY, NEW YORK

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Gregory Ellis

ADVERTISING AND SALES PROMOTION DEPARTMENT

1. I need more information on_____
Print product(s) name

_____

☐ Prices_____ ☐ Delivery_____

☐ Other (explain)_____

_____

_____

2. I have this application in mind.

_____

_____

3. Is specification or purchase of this product planned? Yes_____ No_____ If yes, in

☐ 1–3 Mos. ☐ 3–6 Mos. ☐ Over 6 Mos.

4. About what quantity would be involved?_____

5. Comments_____

_____

_____

_____

6. Send me information on other products whose numbers I have circled on reverse side.

If you require more immediate service, please call our nearest distributor who is listed in the yellow pages of your telephone book or check the convenient listing of sales offices on the enclosed sheet. For your easier reference, sales offices are coded according to market interest.

Need information on other products? . . . Turn the page

GEZ-2999K
3-69 (75M)

GENERAL ELECTRIC SALES OFFICES

GEZ-2500-P

READY TO ASSIST YOU ... When You Have Electrical Problems ... Need Further Information ... Require Ordering Instructions

KEY TO SALES OPERATIONS

A – Agency & Distributor
C – Components Sales
I – Industrial Sales
M – Marine & Defense Facilities Sales
U – Electric Utility Sales

ALABAMA

A C I U	Birmingham 35205	2151 Highland Ave.
I	Huntsville 35801	3322 Memorial Pkwy S.
A I	Mobile 36606	1111 S. Beltline Hwy.
A	Montgomery 36107	513 Madison Ave.

ARIZONA

A C I U	Phoenix 84012	3550 N. Central Ave.
A I U	Tucson 85711	40 No. Swan Rd.

ARKANSAS

A C I	N. Little Rock 72119	120 Main St.
U	Pine Bluff 71602	P. O. Box 1033

CALIFORNIA

C	Burlingame 84010	1675 Rollins Rd.
A I	Emeryville 94608	5000 Shellmound St.
A I	Fresno 93728	1532 N. West Ave.
C	Los Angeles 90015	1543 W. Olympic Blvd.
A I M U	Los Angeles 90054	212 N. Vignes St.
A U	Sacramento 95808	2407 "J" St.
A M U	San Diego 92103	2560 First Ave.
A I M U	San Francisco 94106	235 Montgomery St.
A	Santa Clara 95050	1400 Coleman Ave.

COLORADO

A C I U	Denver 80206	201 University Blvd.

CONNECTICUT

I U	Hamden 06518	2905 Dixwell Ave.
A C U	Hartford 06105	764 Asylum Ave.

DISTRICT OF COLUMBIA

I M U	Washington 20005	777-14th St., N. W.

FLORIDA

A M	Cocoa Beach 32931	1325 N. Atlantic Ave.
A I U	Jacksonville 32207	4040 Woodcock Dr.
A U	Miami 33134	4100 W. Flagler St.
A	Orlando 32803	601 N. Fern Creek Ave.
U	Pensacola 32502	P. O. Box 1027
A C I U	Tampa 33609	2106 S. Lois Ave.

GEORGIA

A C I U	Atlanta 30309	1860 Peachtree Rd. N. W.
A	Macon 31201	682 Cherry St.
A I U	Savannah 31405	5002 Paulsen St.

IDAHO

A U	Boise 83701	1524 Idaho St.

ILLINOIS

A I M U	Chicago 60680	840 S. Canal St.
C	Oakbrook 60521	1200 Harger Rd.
A I U	Peoria 61603	2008 N. E. Perry Ave.
A I	Rockford 61108	4223 E. State St.
U	Springfield 62701	607 E. Adams St.

INDIANA

A C U	Evansville 47714	2709 Washington Ave.
C	Fort Wayne 46804	1635 Broadway
A U	Fort Wayne 46806	6001 S. Anthony Blvd.
A I U	Indianapolis 46207	3750 N. Meridian St.
C	Indianapolis 46240	1010 E. 86th St.
A C	South Bend 46601	430 N. Michigan St.

IOWA

C	Bettendorf 52722	2435 Kimberly Rd.
U	Cedar Rapids 52401	210 Second St., S. E.
A I C	Davenport	(1039 State St., Bettendorf 52722)
A U	Des Moines 50310	3839 Merle Hay Rd.
U	Sioux City 51101	520 Pierce St.

KANSAS

C	Overland Park 66204	7219 Metcalf St.
A	Wichita 67211	820 E. Indianapolis Ave.
U	Wichita 67202	104 S. Broadway Suite 1408

KENTUCKY

A U	Lexington 40502	443 S. Ashland Ave.
A I U	Louisville 40218	2300 Meadow Dr.

LOUISIANA

A U	Alexandria 71301	2001 MacArthur Dr.
I	Baton Rouge 70815	633 Oak Villa Blvd.
I	Lake Charles 70601	1424 Ryan St.
I	Monroe 71201	1028 N. Sixth St.
A I	New Orleans 70125	4747 Earhart Blvd.
U	New Orleans 70112	225 Baronne St.
M	New Orleans 70130	930 Inter. Trade Mart.
A U	Shreveport 71101	400 Travis St.

MAINE

U	Augusta 04330	152 State St.
I	Bangor 04402	77 Central St.

MARYLAND

I U	Baltimore 21201	1 N. Charles St.
A	Columbia 21403	10221 Wincopin Circle
A U	Hagerstown 21740	49 E. Franklin St.
A	Salisbury 21801	P. O. Box 424

MASSACHUSETTS

I U	Boston 02117	31 St. James Ave.
I	Springfield 01103	120 Maple St.
A C I M	Wellesley 02181	1 Washington St.

MICHIGAN

A C I U	Detroit 48202	700 Antoinette St.
I	Flint 48502	801 S. Saginaw St.
A C I	Grand Rapids 49508	2821 Madison Ave., S. E.
A U	Jackson 49201	210 W. Franklin St.
I	Saginaw 48601	805 2nd National Bank Bldg.
A	Saginaw 48601	1230 S. Washington Ave.

MINNESOTA

I U	Duluth 55802	14 W. Superior St.
A U	Fergus Falls 56537	201 1/2 Lincoln Ave., W.
C	Minneaplis 55424	4018 W. 65th St.
A I U	Minneaplis 55416	1500 Lilac Dr., S.

MISSISSIPPI

U	Gulfport 39502	P. O. Box 33
A	Jackson 39206	333 No. Mart Plaza
U	Jackson 39205	Rm. 917 Electric Bldg.

MISSOURI

A	Joplin 64802	310 Wall St.
A I U	Kansas City 64105	911 Main St.
A C I U	St. Louis 63101	1015 Locust St.

MONTANA

A	Billings 59101	312 Transwestern Life Bldg.
A I U	Butte 58701	103 N. Wyoming St.

NEBRASKA

A I U	Omaha 68102	409 S. 17th St.

NEVADA

U	Las Vegas 89106	1711 S. 8th St.

NEW HAMPSHIRE

U	Manchester 03104	46 Bay St.

NEW JERSEY

C	East Orange 07017	56 Melmore Gardens
A I U	Millburn 07041	25 E. Willow St.

NEW MEXICO

A I M U	Albuquerque 87108	120 Madeira Dr., N. E.

NEW YORK

A I M U	Albany 12206	8 Colvin Ave.
U	Binghamton 13902	40 Front St.
A I U	Buffalo 14202	625 Delaware Ave.
A	Elmsford 10523	44 N. Central Ave.
A I M U	New York 10022	641 Lexington Ave.
C	Rochester 14618	3380 Monroe Ave.
A I U	Rochester 14604	339 East Ave.
C	Syracuse 13206	2360 James St.
A I U	Syracuse 13206	3532 James St.
A	Vestal 13805	P. O. Box 407

NORTH CAROLINA

A C I U	Charlotte 28207	141 Providence Rd.
A I	Greensboro 27405	801 Summit Ave.
A U	Raleigh 27603	120 N. Boylan Ave.

NORTH DAKOTA

U	Bismarck 58501	418 Rosser Ave.

OHIO

I U	Akron 44313	2858 W. Market St.
A	Akron 44313 (Agency & Distributor)	2855 W. Market St.
I U	Canton 44703	515 Third St., N. W.
A C I U	Cincinnati 45206	2621 Victory Pkwy.
C	Cleveland 44116	20950 Center Ridge Rd.
A I M U	Cleveland 44114	1000 Lakeside Ave.
C	Columbus 43212	937 Burrell Ave.
A I U	Columbus 43215	395 E. Broad St.
C	Dayton 45402	11 W. Monument Bldg.
A I U	Dayton 45439	3430 S. Dixie Hwy.
C	Mansfield 44902	166 Park Ave., W.
A C I	Toledo 43606	3450 W. Central Ave.
U	Toledo 43604	420 Madison Ave.
A I	Youngstown 44507	272 E. Indianola Ave.

OKLAHOMA

A U	Oklahoma City 73106	2000 Classen Blvd.
A I	Tulsa 74105	5138 S. Peoria Ave.
U	Tulsa 74103	420 Main St.

OREGON

A I U	Eugene 97401	1170 Pearl St.
A U	Medford 97501	107 E. Main St.
A C I U	Portland 97210	2929 N. W. 29th Ave.

PENNSYLVANIA

A I U	Allentown 18102	732 N. 16th St.
A I	Erie 16501	3001 E. Lake Rd.
I U	Johnstown 15902	841 Oak St.
C	Philadelphia 19114	2417 Welsh Rd.
A I M U	Philadelphia 19102	3 Penn Center Plaza
C	Pittsburgh 15234	300 Mt. Lebanon Blvd.
A I U	Pittsburgh 15222	Oliver Bldg., Mellon Sq.
A	Williamsport 17701	2209 Fink Ave.
A I	York 17403	56 N. Harrison St.
C	York 17403	1617 E. Market St.

RHODE ISLAND

A	Providence 02904	1006 Charles St., N.

SOUTH CAROLINA

A I U	Columbia 29205	2728 Devine St.
A I	Greenville 29606	1403 Laurens Rd.

SOUTH DAKOTA

A	Sioux Falls 57105	513 Main Ave.

TENNESSEE

U	Chattanooga 37402	832 Georgia Ave.
A C I	Chattanooga 37411	5800 Bldg. Eastgate Center
I	Kingsport 37664	1170 E. Eastman Rd.
A U	Knoxville 37921	1301 Hannah Ave., N.W.
A I U	Memphis 38104	1420 Union Ave.
A	Murfreesboro 37130	117 N. W. Broad St.
A	Nashville 37203	1717 West End Bldg.
C	Nashville 37204	2930 Sidco Drive
M	Oak Ridge 37830	253 Main St., East

TEXAS

U	Abilene 79601	442 Cedar St.
U	Amarillo 79101	303 Polk St.
A I U	Beaumont 77701	1385 Calder Ave.
U	Corpus Christi 78401	205 N. Chaparral St.
A C I U	Dallas 75247	8101 Stemmons Freeway
I U	El Paso 79901	215 N. Stanton St.
A	El Paso 79902	2800 N. Stanton St.
A	Fort Worth 76107	100 N. Univ. Dr.
U	Fort Worth 76102	408 W. 7th St.
A C I U	Houston 77027	4219 Richmond Ave.
A I	Lubbock 79408	500 E. 50th St.
A I	Midland 79704	122 N. "N" St.
A U	San Antonio 78204	419 S. Main Ave.

UTAH

A I U	Salt Lake City 84101	431 S. Third E St.
C	Salt Lake City 84110	2425 S. 8th St. W

VERMONT

U	Rutland 05702	38 1/2 Center St.

VIRGINIA

A M	Newport News 23601	311 Main St.
A I U	Richmond 23230	1508 Willow Lawn Dr.
A I U	Roanoke 24015	2018 Colonial Ave., SW

WASHINGTON

U	Pasco 99301	824 W. Lewis St.
A I M U	Seattle 98188	112 Andover Park, E.
A I U	Spokane 99220	E. 1805 Trent Ave.

WEST VIRGINIA

A I	Charleston 25328	306 MacCorkle Ave., SE
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C	Milwaukee 53226	Mayfair Plaza, 2421 N. Mayfair Rd.
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Read-only memory increases overall computer performance

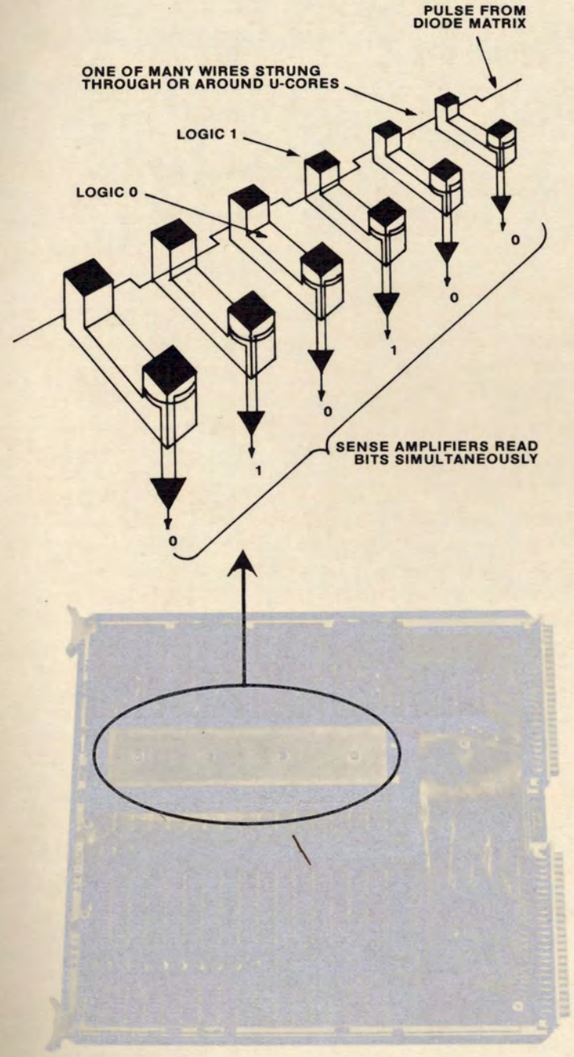
You can think of the GE-PAC 30 as having two levels of architecture — the user-level and the micro-level. The micro-level has a limited set of hardware instructions, groups of which are pre-programmed and pre-wired into a special, high-speed read-only memory. These combinations of micro-level instructions are used to fetch, decode, and execute user-level instructions from core memory. Thus the user-level does not concern itself with dedicated processor hardware. It merely reflects how the micro or "inner" machine happens to be programmed. This technique lets you extend the standard instruction repertoire or, if required, emulate some other user-level instruction set. Or you can program an entire application at the micro-level using core memory merely as a high speed storage device.

Think of the flexibility. You can extend your standard instruction set. You can implement entire application functions by wiring them right into the read-only memory. You can get far better performance from the computer. You can protect key programs and minimize core requirements.

Micro-programming helps eliminate software
Micro-programming can eliminate conventional software subroutines for mathematical functions such as dividing and multiplying. Or it can be used to complement the software, thus accomplishing the end result faster and more efficiently.

We'll wire to your specs
You can design and program your own micro machine. Just send us a tape and we'll wire a special read-only memory board. In this way, your system can be tuned to your particular application at low cost. In a process control situation, for example, high priority functions can be wired into the ROM. You can eliminate much of the normal software and increase computing speed.

The read-only memory also allows us to build-in special user-level control instructions without redesigning machine hardware. You get improvements and new instructions faster.



PARTIALLY WIRED READ-ONLY MEMORY BOARD

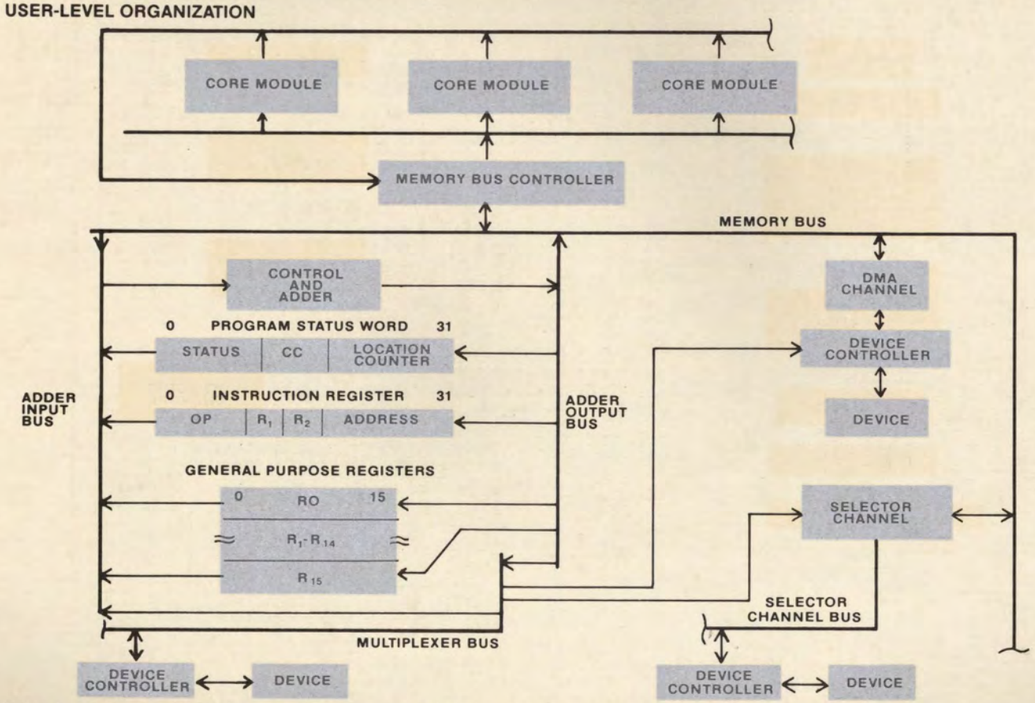
On the read-only memory board, the micro-program is wired into 16-bit micro-instruction words. As shown in the diagram, the "word lines" are threaded through the magnets, one line for each 16-bit word. Depending on whether the wire is threaded inside or outside, you get a "1" or "0" output pulse when an input pulse is sent down the word line. The action is simple and very high speed. In fact, the micro-instructions wired on the ROM are executed many times faster than the user-level instructions.

User-level hardware characteristics

	GE-PAC 30-1	GE-PAC 30-2
Memory cycle time	1.5 us	1.0 us
Memory word length	16 bit	16 bit
Instruction register	32 bit (core)	32 bit (hardware)
Program status register	32 bit (core)	32 bit (hardware)
General purpose registers	16 x 16 bit (core)	16 x 16 bit (hardware)
Number of instructions	77	93 (incl. fl. pt. option)
Add halfword (RX)	38 us	5.6 us
Load halfword (RX)	37 us	4.8 us
Multiply (H/W option)	107/155 us	24/40 us
Write block	(50 + 10n) us	(14 + 6n) us
Multiplexer I/O (8 bit):		
Max. number of devices	256	256
Max. transfer rate	6KBS	20KBS
Block transfer option	100KBS	150KBS
Selector (I/O 8 bit):		
Max. number of devices (per channel)	25	25
Transfer rate	500KBS	500KBS
DMA channel I/O (16 bit):		
Max. number of devices (per DMA)	1	1
Transfer rate	750KBS	900KBS

The most significant difference between the GE-PAC 30-1 and 30-2 is in instruction execution times. The 30-1 costs less and is highly flexible, while the 30-2 is far more powerful at the user level. As you can see, floating point hardware is available only on the GE-PAC 30-2.

USER-LEVEL ORGANIZATION



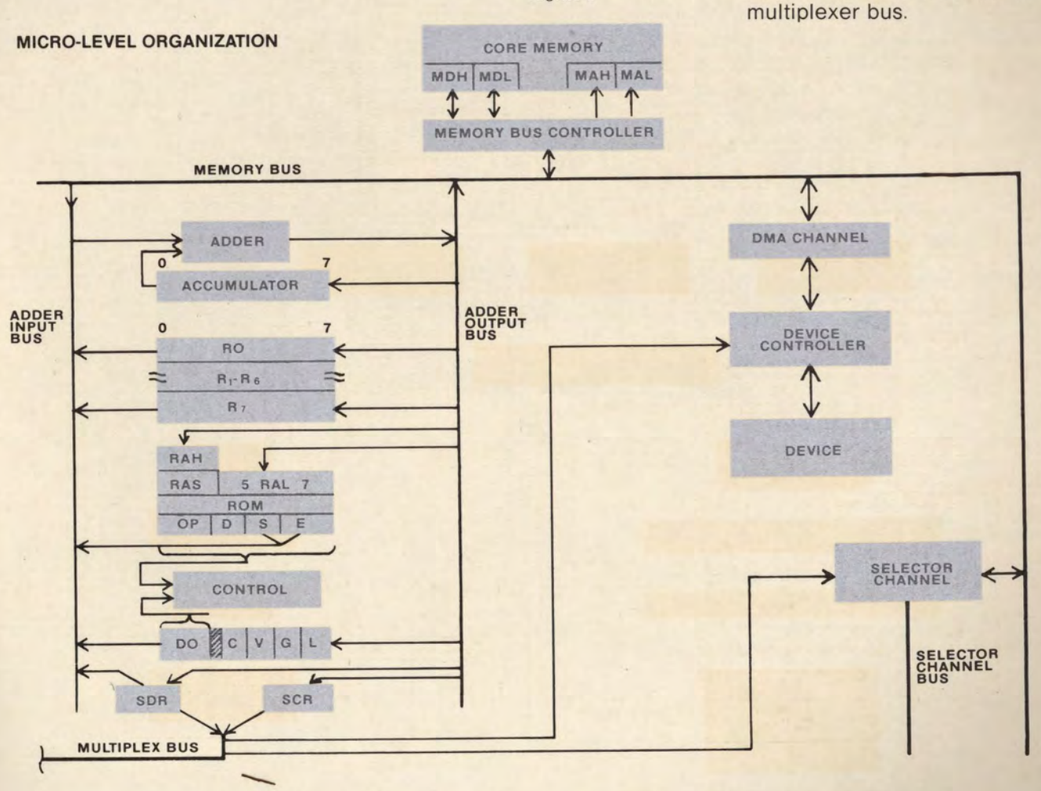
At this level, the GE-PAC 30's have 16 general purpose registers, a 32-bit instruction register, and 32-bit program status words. The R_1 and R_2 fields in the instruction word are typically used to determine the destination and source of data for a particular instruction. Input/output can be at three levels: *programmed*, via the multiplexer bus; *interleaved*, via the selector channel; or *cycle-stealing*, via the Direct Memory Access channel. The system, though very real to the user, is merely the result of the micro-programming in the inner machine.

Micro-level hardware characteristics

	GE-PAC 30-1	GE-PAC 30-2
ROM memory cycle time	0.19 us	0.20 us
Memory word length	16 bit	16 bit
Accumulator	8 bit	16 bit
General Registers	8 x 8 bit	6 x 16 bit
ROM instruction register	16 bit	16 bit
Parallel adder	8 bit	16 bit
Instruction decoding	ROM program	special ROM (DROM)
No. of instructions	16	16
Add	0.76 us (8 bit + 8 bit)	0.80 us (16 bit + 16 bit)
Load	0.38 us (8 bit)	0.40 us (16 bit)
Input/output (multiplexer)	via I/O registers	single instruction direct from general registers

At the micro-level, the GE-PAC 30-1 has a slightly faster instruction time than the 30-2. However, the 30-2 is far more powerful, having a 16-bit adder, 16-bit general registers, and 16-bit data paths, while the 30-1 has an 8-bit organization. Input/output on the 30-2 is faster because the data is transferred directly from a general register to the multiplexer bus.

MICRO-LEVEL ORGANIZATION

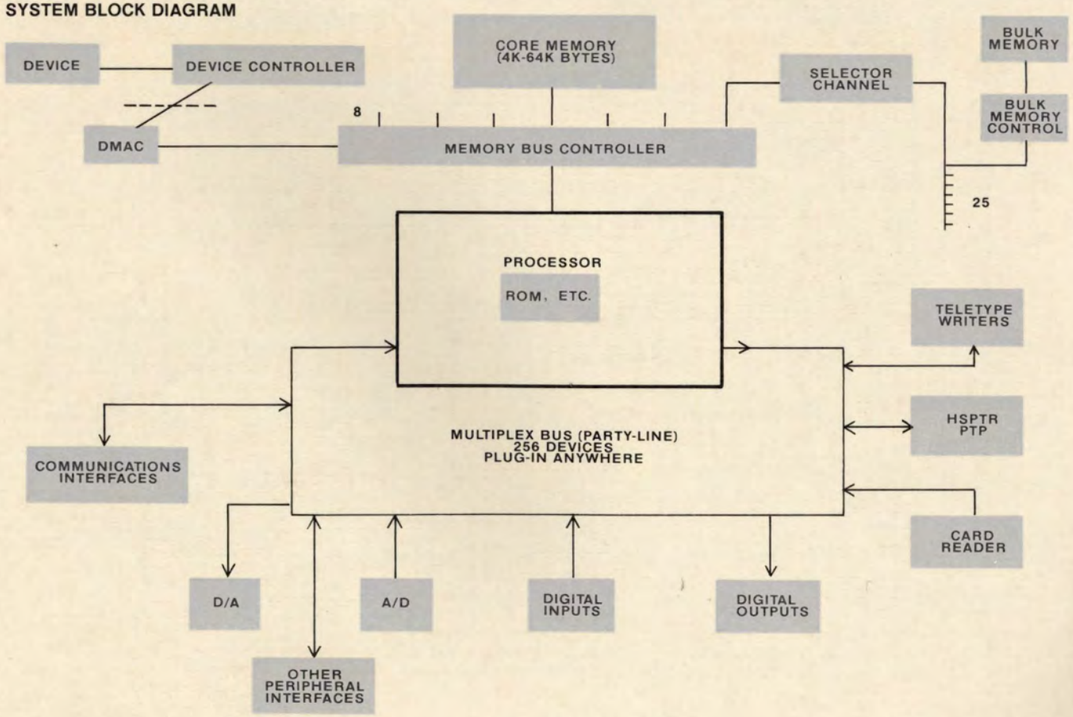


In this micro-level machine organization of a GE-PAC 30-1, the "control" function is concerned only with executing instructions from the read-only memory. The system shows a very general purpose organization, not biased toward emulating any specific machine. The GE-PAC 30-2, however, goes to considerable lengths to enhance emulation of the user-level system, thus the significant difference in user-level performance.

Modular building blocks are field expandable

The GE-PAC 30 is built in easy-to-install, easy to maintain modules so you can customize to fit particular applications even in the field. Both the memory bus and multiplexer bus provide plug-in capability. Up to 256 devices can be handled by the multiplexer bus. The memory bus can handle combinations of up to 8 processors, selector channels, or direct memory access channels.

SYSTEM BLOCK DIAGRAM



Three I/O modes match the GE-PAC 30 to your application needs

Input/output channels, ranging in speed from modest to very fast, give you all the input/output flexibility you need:

Multiplexer channel transfers byte-oriented data between the central processor and peripheral devices at speeds varying from 10 to 150,000 bytes per second.

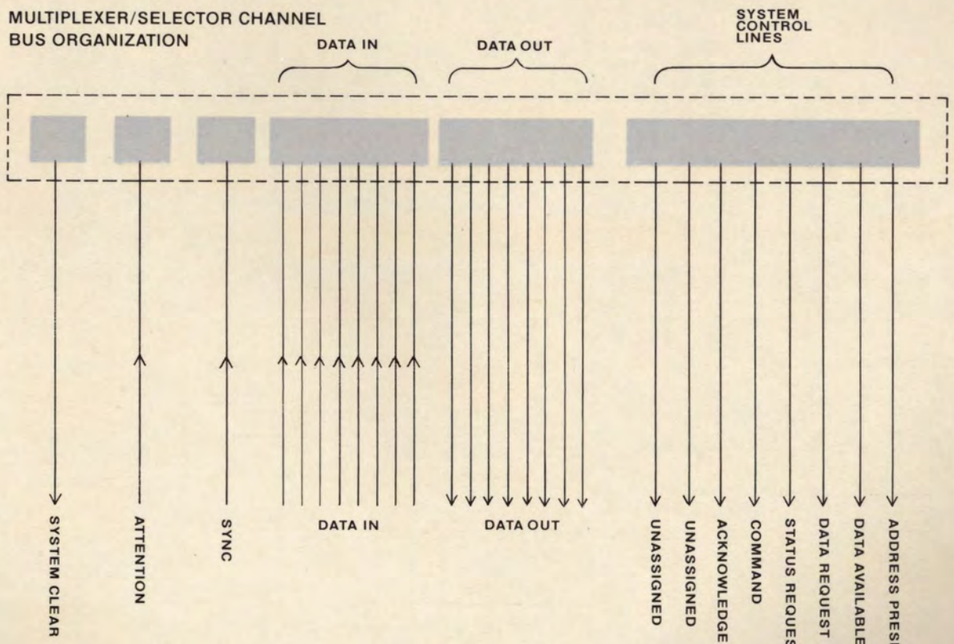
Depending on the instruction used, either single bytes or whole blocks of bytes can be transferred. Up to 256 separate devices can be run off the multiplexer channel—simultaneously, which provides the kind of I/O flexibility needed in many control applications.

Selector channel is the medium-speed mode. It transfers data in bytes between memory and high speed peripheral devices. Twenty-five such devices can be connected to a single selector channel bus. The central processor is used only to set up and start data transfer. At any one time, only one device on a bus may be operational. Simultaneity can be provided by multiple selector channels.

Once underway, the selector channel does the transfer by itself, thus freeing the processor for other work.

The direct memory access channel is a high-speed, 16-bit data path from memory to a special purpose device. The special device transmits data directly to memory so that a single "go" instruction is all that is required of the processor.

MULTIPLEXER/SELECTOR CHANNEL BUS ORGANIZATION



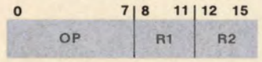
The system control bus defines the type of data. All data being transferred is fully buffered in both directions. The Sync system serves as master control. It eliminates the need for precise timing and furnishes the interlocks needed to match each of the devices and modules connected to the interface.

"Attention" is the common line devices use to interrupt the processor. The device or module physically closer to the processor gets highest interrupt priority. Up to 256 devices, modules, or signals can be identified by the interrupt organization.

GE-PAC 30 instructions

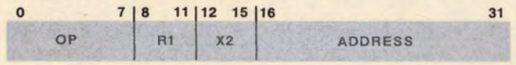
Your GE-PAC 30 comes with three instruction formats, RR, RX, and RS. The 4-bit R1, R2, and X2 fields each specify one of the 16 general registers.

RR format:



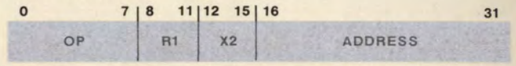
RR instructions are for operations between the general registers.

RX format:



RX instructions are for operations between the general registers and memory.

RS format:



RS instructions are for shifting, branching, and immediate-operand instructions.

A powerful instruction repertoire comes with the GE-PAC 30 in both the user and micro levels:

USER-LEVEL INSTRUCTIONS

Type	Operation	Mnemonic	Format	GE-PAC 30-1 us	GE-PAC 30-2 us
Load and Store Instructions	Load Halfword	LHR	RR	2.5	2.8
		LH	RX	3.7	4.8
		LHI	RS	3.7	3.2
	Store Halfword	STH	RX	3.2	6.0
	Load Byte	LBR	RR	2.2	3.6
		LB	RX	3.2	5.2
	Store Byte	STBR	RR	2.4	4.8
		STB	RX	3.4	6.0
	Load Program Status Word	LPSW	RS	4.3	8.0
	*Load Multiple	LM	RX	—	8.4 + 3.2n
	*Store Multiple	STM	RX	—	8.0 + 3.6n
	*Autoload	AL	RX	—	14 + 10.8n
Fixed Point Arithmetic Instructions	Add	AHR	RR	2.8	3.2
		AH	RX	3.8	5.6
		AHI	RS	3.8	4.0
	Add with Carry	ACHR	RR	3.0	3.6
		ACH	RX	4.0	6.0
	Subtract	SHR	RR	2.8	3.2
		SH	RX	3.8	5.6
		SHI	RS	3.8	4.0
	Subtract with Carry	SCHR	RR	3.0	3.6
		SCH	RX	4.0	6.0
	Multiply (optional)	MHR	RR	107-146	22.8-35
		MH	RX	141-154	24-40
	Divide (optional)	DHR	RR	98-180	38-44
		DH	RX	102-195	38.1-45
Floating Point Arithmetic Instructions (optional)	*Add	AE	RX	—	56 av.
	*Subtract	SE	RX	—	57 av.
	*Multiply	ME	RX	—	157 av.
	*Divide	DE	RX	—	213 av.
	*Load	LE	RX	—	23 av.
	*Store	STE	RX	—	14 av.
	*Compare	CE	RX	—	20 av.
Logical Instructions	AND	NHR	RR	2.7	2.8
		NH	RX	3.7	5.6
		NHI	RS	3.7	3.6
	OR	OHR	RR	2.7	2.8
		OH	RX	3.7	5.6
		OHI	RS	3.7	3.6
	Exclusive OR	XHR	RR	2.7	2.8
		XH	RX	3.7	5.2
		XHI	RS	3.7	3.6
	Compare Logical	CLHR	RR	2.9	3.2
		CLH	RX	3.9	5.6
		CLHI	RS	3.9	4.0
Shift Instructions	Shift Left Arithmetic	SLHA	RS	2.4 + 3n 0≤n≤15	5.2 + 4n
	Shift Right Arithmetic	SRHA	RS		4.8 + 4n
	Shift Left Logical	SLHL	RS		4.0 + 4n
	Shift Right Logical	SRHL	RS		4.0 + 4n
Branch Instructions	Branch and Link	BALR	RR	2.5	3.6
		BAL	RX	3.3	4.8
	Branch on False Condition	BFCR	RR	2.8	4.8
		BFC	RX	3.4	6.0
	Branch on True Condition	BTCR	RR	2.9	4.8
		BTC	RX	3.4	5.6
	Branch on Index Low or Equal	BXLE	RS	4.4	11.2
	Branch on Index High	BXH	RS	4.4	11.6
	Branch Unconditional	BR	RR	2.8	4.8
		B	RX	3.4	6.0
	Branch on Zero	BZ	RX	3.4	6.0
	Branch on Not Zero	BNZ	RX	3.4	5.6
	Branch on Plus	BP	RX	3.4	5.6
	Branch on Not Plus	BNP	RX	3.4	6.0
	Branch on Minus	BM	RX	3.4	5.6
	Branch on Not Minus	BNM	RX	3.4	6.0
	Branch on Carry	BC	RX	3.4	5.6
	Branch on Overflow	BO	RX	3.4	5.6
	Branch on Low	BL	RX	3.4	5.6
	Branch on Not-Low	BNL	RX	3.4	6.0
	Branch on Equal	BE	RX	3.4	6.0
	Branch on Not Equal	BNE	RX	3.4	5.6
	No operation	NOPR	RR	2.9	4.8
		NOP	RX	3.4	5.6
Input/Output	Read Data	RDR	RR	3.8	6.0
		RD	RX	4.0	8.0
	Write Data	WDR	RR	3.3	6.0
		WD	RX	4.1	7.2
	Read Block (optional)	RBR	RR	5.0 + 10n	16 + 6.5n
		RB	RX	5.1 + 10n	14 + 6.4n
	Write Block (optional)	WBR	RR	5.0 + 10n	16 + 6n
		WB	RX	5.1 + 10n	14 + 6n
	Acknowledge Interrupt	AIR	RR	4.1	8.0
		AI	RX	4.9	10.0
	Sense Status	SSR	RR	3.8	7.2
		SS	RX	4.0	8.4
	Output Command	OCR	RR	3.3	6.0
		OC	RX	4.1	7.2

MICRO-LEVEL INSTRUCTIONS

Type	Operation	Mnemonic	GE-PAC 30-1 nsec	GE-PAC 30-2 nsec
			(8 bit)	(16 bit)
	Add	A	760	800
	Add Immediate		760	800
	Subtract	S	760	800
	Subtract Immediate		760	800
	Exclusive OR	X	380	400
	Exclusive OR Immediate		380	400
	And	N	380	400
	And Immediate		380	400
	Inclusive OR	O	380	400
	Inclusive OR Immediate		380	400
	Load	L	380	400
	Load Immediate		380	400
	Load I/O	L	—	1200
	Command	C	380	400
	Test	T	380	400
	Branch on Condition	B	760	800
	Branch on Counter		—	800
	Do	D	Special	—
	Decode		—	Special

*GE-PAC 30-2

Peripherals to complement your GE-PAC 30

Teletypewriters — ASR 33, ASR 35, KSR 35, or RO 35.

High speed paper tape reader and punch — 300 character/sec. reader and 60 character/sec. punch.

Card reader — 200 cards per minute.

Bulk memory — drum.

Plus interfaces:

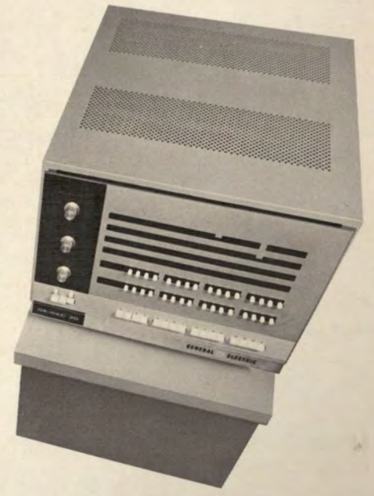
Printer — 300 lines per minute.

X-Y plotter.

X-Y scope.

CRT subsystem.

Digital voltmeter.



Wide range of software is available...plus other special General Electric services

Standard software offerings with the GE-PAC 30 come under both the user and micro-levels:

User-level software

Utility—Three loaders are available including absolute, relocatable, and general. Also, there is Editor for paper tape preparation and a number of math routines.

Language processing—Assembler including single-pass and multi-pass for paper tapes or cards. FORTRAN is interactive. Linkage capability exists between the interpretive FORTRAN system and Assembly written routines to permit building a real-time system.

Debugging—Hexadecimal debug package allows you to debug or modify a program from the Teletypewriter keyboard.

Diagnostic—Available for many GE-PAC 30 functional modules.

Micro-level software

All micro-level software is coded to run on the standard versions of both the GE-PAC 30-1 and 30-2. Included is an Assembler and a Debug/Simulator package which will simulate the micro-machine in user core. This lets you execute and checkout the micro-program before it is committed to a wired ROM. When the program is debugged, the system generates a tape which in turn generates ROM wiring instructions and finally checkout of the wired board.

You can add special instructions or put whole functions in the ROM. Your system designer or programmer has the flexibility to decide what belongs in the ROM or in user-level code.

Application library

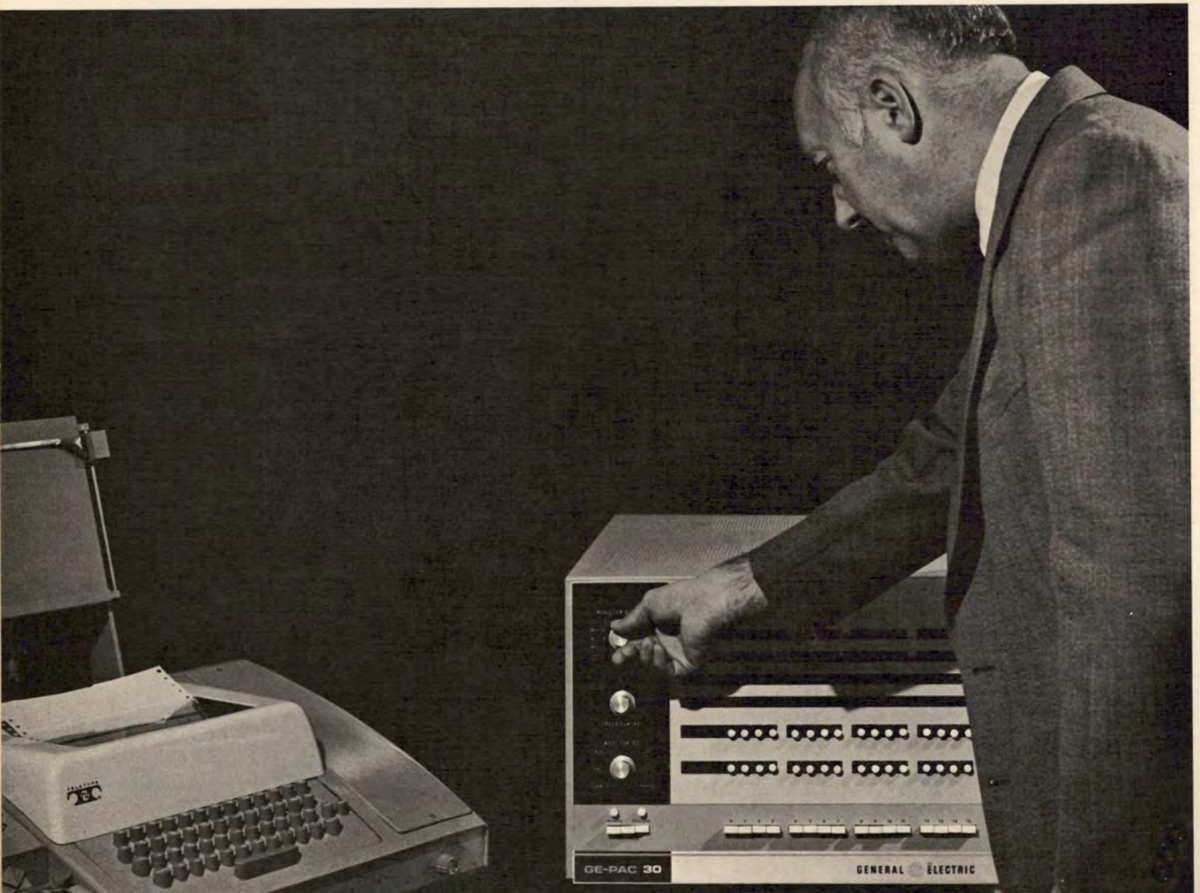
General Electric is presently planning to build a library of application software which, when completed, will be made available to customers. Many programs developed by other General Electric components will be incorporated in the library. By making such software available to you, you can save much of your own development costs. General Electric plans to make documentation guidelines available to customers who are willing to aid in the development of this application software library.

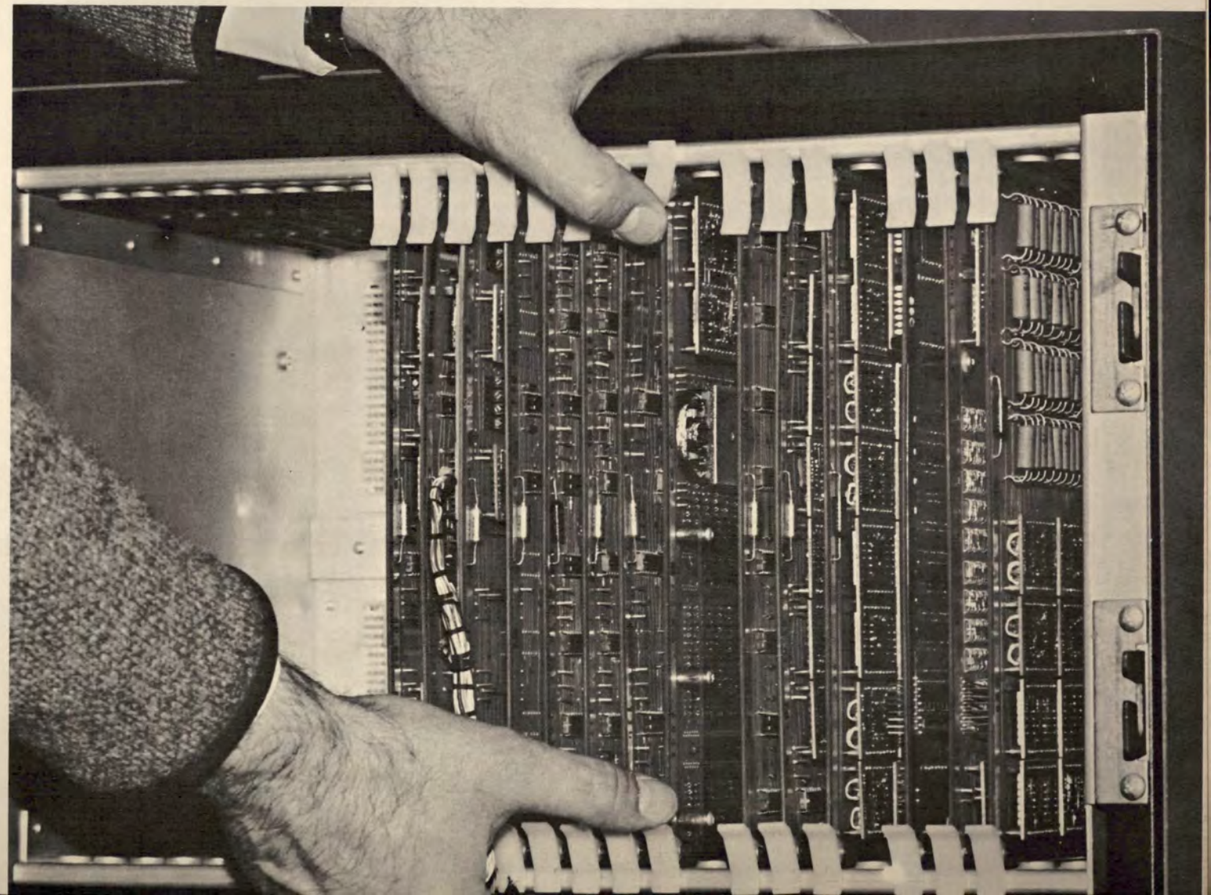
Engineering and programming assistance

This assistance is available on a contract basis. The Process Computer Department and our Process Measurement and Control Systems Operations stand behind you with complete hardware and software back-up. We can also draw from the nearest of six regional systems offices or from a wealth of other General Electric resources.

Nationwide Service

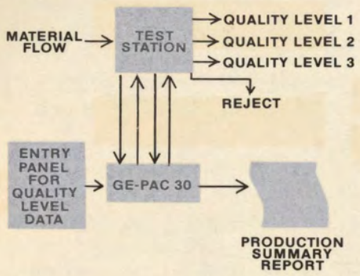
You can arrange for installation and monthly maintenance to best fit your needs. Our installation and service engineers and service shops are situated throughout the country ready to offer assistance when you need it. Regional depots can supply spare parts fast. In short, when you buy from General Electric, you not only buy quality, but you get unmatched support whenever you need it.





Typical applications and how you can benefit from a GE-PAC 30

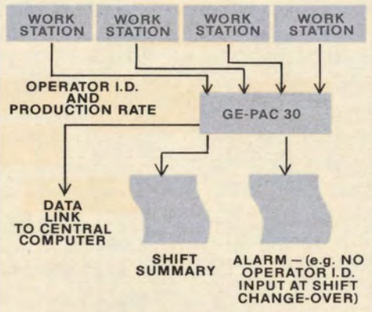
PRODUCTION TEST (ELECTRONIC COMPONENTS)



Functions
- Sequence tests
- Evaluate test data
- Separate components by quality
- Prepare production summary

Benefits
- Testing can be more complete
- Increased production rate
- Finer product structure
- Complete production record

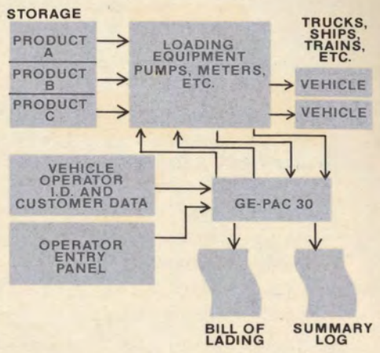
PRODUCTION PROCESS MONITORING



Functions
- Summarize production rate by operator
- Print-out local shift summary
- Pass on production data to central computer

Benefits
- Shift-to-shift variations
- Operator-to-operator variations
- Reduced paperwork at work stations
- Real-time production data for scheduling
- Reduced inventory

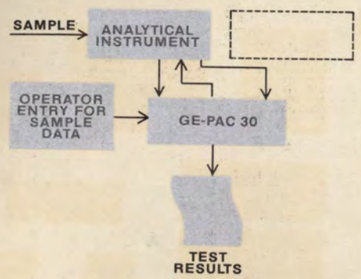
LOADING TERMINAL AUTOMATION



Functions
- Determine vehicle operator validity
- Check equipment interlocks
- Initiate and measure product transfer
- Halt product transfer
- Prepare bill of lading, etc.
- Prepare operations summary

Benefits
- Reduced product losses
- Reduced clerical labor
- Faster turnaround
- Increased capacity

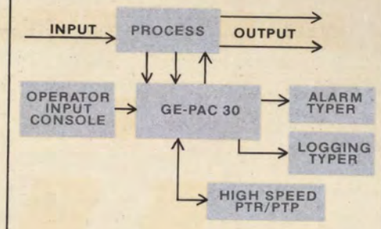
INSTRUMENT CONTROL



Functions
- Calibration
- Admit or position sample
- Activate instruments
- Store data
- Calculate parameters
- Print-out results

Benefits
- Reduced manual computations
- Improved accuracy
- Automatic calibration
- Reduced instrument idle time
- Multi-instrument potential

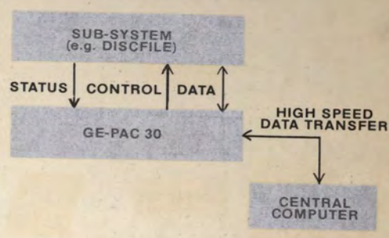
PROCESS CONTROL (SMALL-SCALE)



Functions
- Measure flows, pressures, temperatures, etc.
- Calculate operating parameters
- Provide operating set point
- Monitor and alarm critical points
- Provide periodic operator information

Benefits
- Better control
- More uniform product
- Better allocation of manpower
- More accurate process data
- Higher production capacity
- Lower per-unit production costs

SUB-SYSTEM CONTROLLER



Functions
- Monitor sub-system status
- Halt operations if required
- Initiate sub-system
- Transfer data to and from subsystem
- Format data for central computer
- Transfer data to and from central computer

Benefits
- Reduced development time
- Easily modified
- Allows pre-formatting and processing, thus easing central computer load