

CRT PROGRAMMING LOADER "UT37P" "A38H"

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I. INTRODUCTION

As general purpose programmable controller (Hereinafter referred to as PC) application range is expanded, simplification of programming work, man-hour saving, PC maintenance ease and simply handled programming tools without requiring special knowledges have been required more and more. To cope with these requirements, Fuji Electric has developed and manufactured CRT programming loader UT37P connected to PC FUJILog- μ T and μ B series and CTR programming loader A38H (hereinafter abbreviated to CRT loader) connected to PC Fujilog- μ H.

This CRT loader has, in addition to the functions of the conventional programming tools, the following features which are provided by the newly installed automatic analysis/conversion function between the ladder diagram and instruction words.

- (1) Ladder diagram can be displayed on the CRT simply by operating the keyboard, programs can be prepared, changed, corrected and processed, and even a converted mnemonic display can be checked immediately. In addition, ladder diagram can be printed out when necessary, and work to draft circuits can be omitted.
- (2) Connecting with an operating PC, each contact or output point operating status on the circuit displayed on the CRT can be monitored on real time, displaying the higher performance in troubleshooting.

In the following paragraphs, specifications, functions and operations of this CRT loader are outlined.

II. SYSTEM CONFIGURATION

Fig. 1 shows this CRT loader under the operating condition. In this figure, the CRT is attached with a keyboard and the front cover is opened. On the front face, the CRT screen, cassette tape deck and EPROM writer are arranged. When moving the CRT loader, the front cover is closed to protect the components.

Fig. 2 is a system configuration of the CRT loader, which shows connections with the external devices centered around this CRT loader and flows of the program loader.

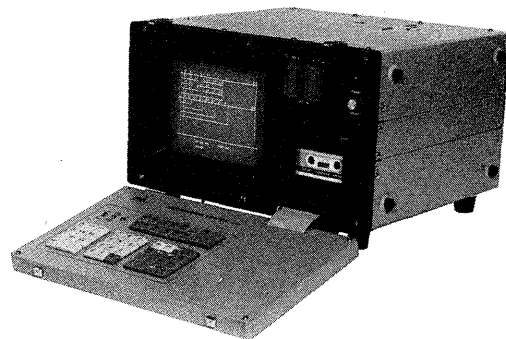


Fig. 1 CRT programming loader

A ladder diagram is prepared in accordance with the control contents, the keys corresponding to the individual circuit elements are depressed directly to draw the same ladder diagram on the CRT screen, and thus, the program is prepared. The ladder diagram is converted to machine words of the PC, and the data are stored in the program memory successively.

The programs stored in the program memory are transferred and processed by the PC and other external equipment as shown in *Fig. 2* as required. For these data transfers, inverse transfer is also possible. For example, programs can be taken out from the operating PC, the program can be displayed on the CRT screen as a ladder diagram and further, the operating status can be displayed over the ladder diagram.

With a commercially available printer connected, ladder diagram or conventional mnemonic type list can be printed on a hard copy. *Fig. 3* shows the appearance of the printer.

III. SPECIFICATIONS AND FUNCTIONS

Table 1 is a list of the specifications and functions. Programming function, monitor function, digital cassette deck, EPROM writer, printer interface and other functions are provided as the standard functions so that the CRT loader can be used for various purposes. The specifications and

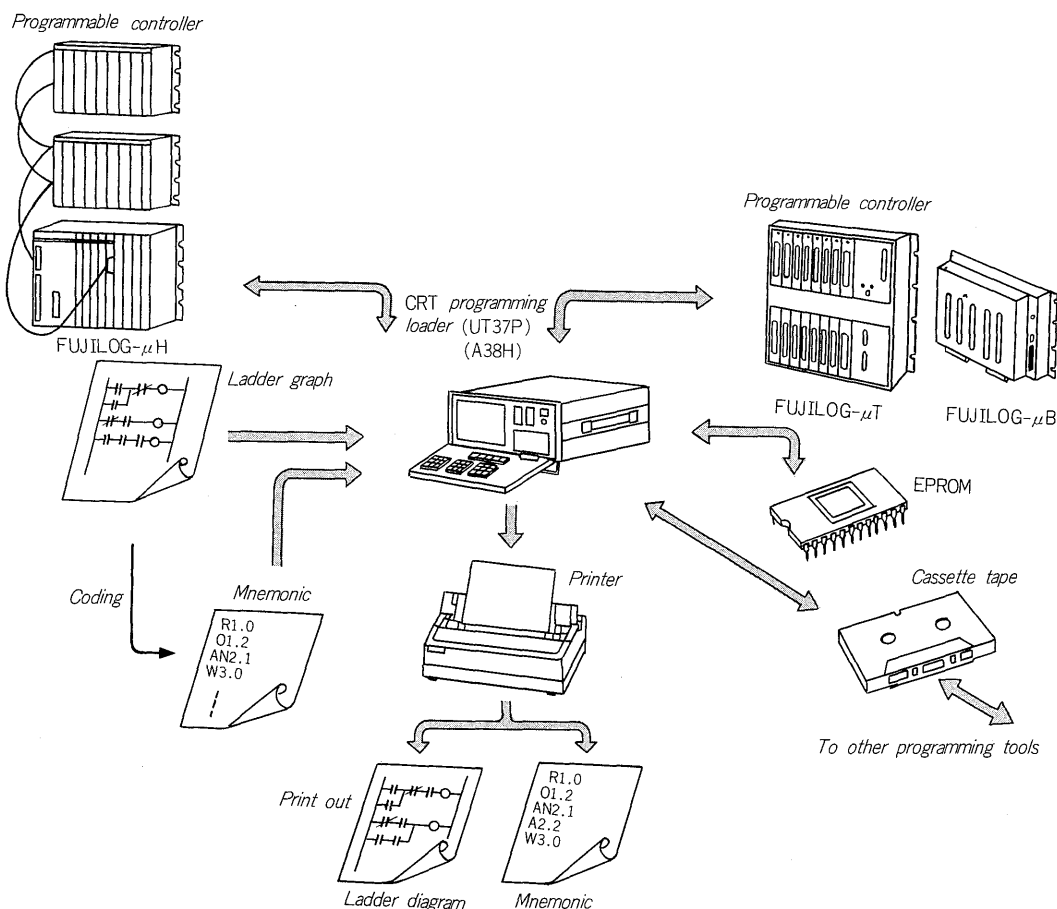


Fig. 2 System outline of UT37P and A38H

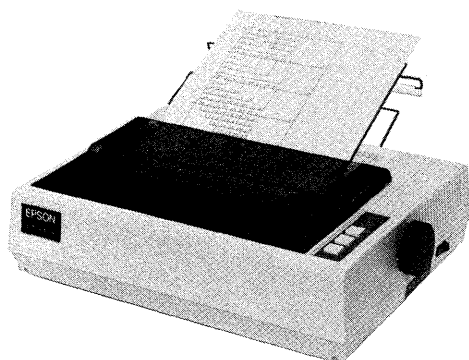


Fig. 3 Printer

functions of the programming and monitoring are set mainly to handle the data based on the ladder graph, and it is also possible to handle the conventional mnemonic type data. Specifications of the control keyboard and display specifications of the CRT screen are explained next.

1. Specifications of keyboard

Fig. 4 shows the keyboard layout of CRT loader UT37P. A group of keys to set up operation mode is in the left side, symbolic keys and function keys are in the upper

portion, number keys are in the center, and a group of control keys at each mode is in the right side. Each one of the key layouts and name are decided to minimize number of key controls.

In the upper left portion, there are three control switches. The one in the left side is changeover a displayed circuit instantaneously to the ladder diagram and mnemonic list format display which corresponds to the ladder diagram. With this switch, the circuit diagram and coded result can be checked immediately. The one in the center is to select display object of a circuit. With this switch, program memory in the CRT loader is selected when the CRT loader is operated offline, or when the CRT loader is operated online, program memory of the PC is selected. When the mode is under monitor mode, display is made by switching the operating mode to online. The switch in the right side is an interlock switch used to forcedly turns on and off the data memory.

2. Screen composition

As for the CRT screen composition, the area is divided into the ladder area and reference area as shown in Fig. 5, and the reference area is further divided into set area, message area and monitor area. The ladder area consists of 11

Table 1 Specifications of UT37P and A38H

Item			Specifications		Remarks
			UT37P	A38H	
Objective equipment			FUJIOLOG- μ T, - μ B	FUJIOLOG- μ H	Special interface
Function		Read	Displayed on CRT in ladder diagram designaging output element, head circuit and end circuit		Mnemonic display can be designated
		Write	Ladder diagram is prepared on CRT, and write processing is made		Converted to machine word when transferring to the program Memory
		Charge, Correction	Changed and corrected on ladder diagram		
		Deletion	Deleted by each circuit on ladder diagram		
		Insertion	A new circuit unit or element within a circuit is added.		
		Search	Output element is designated and read out		
		Memory erase	All program memories (PC or loader) aré deleted.	All program memories (PC or loader) are deleted.	
	Monitor		The real time status of all contacts or outputs is indicated on a ladder diagram.		
	Transfer		Program contents of PROM, cassette MT, program memory (PC or loader) are transferred mutually.		
	Collation		Program contents are collated among the above indicated units.		
	Hard copy		Program contents of program memory (PC or loader), cassette MT, PROM are printed out in the form of a ladder diagram.		Printed out circuit range can be designated.
	Test function		Data memory is forcedly turned on and off by each point.		
	Other function			Keep relay area set freely.	
	Operation		Key operation by push-button		By special keyboard
Individual specifications	Internal program memory		Program memory for 2048 steps are self-contained.	Program memory for 8192 steps are self-contained.	Non-volatized by charging capacitor in case of power failure. Held for 24 hours.
	Display	Display range per screen	Horizontal direction: 11 contact element + 1 output element Vertical direction: 12 lines Maximum 20 steps in mnemonic format.		When displaying area exceeds for one circuit, display can be made over the area for two picture.
		CRT	9 inch, green.		
	Auxiliary device		Writer/reader of cassette tape		TEAC MT2-04 self-contained.
			EPROM writer, Maximum (2k steps)	EPROM writer, Maximum (8k steps)	
Printer interface (centronix)			Commercially available.		
General specifications	Power supply		AC100V 50/60Hz		About 100VA
	Ambient conditions		5~40°C 20~80% RH (without condensation)		When no cassette deck is used: 0 to 45°C
	Cooling method		Forced air cooling		Exhausting by using a fan
	External dimensions		238 x 414 x 401 (mm)		Projects such as the knob are not included
	Weight		About 17kg		

contact elements and one output elements toward the horizontal direction and 12 lines toward the vertical direction. When one circuit exceeds this range, processing can be made up to two screen components. To be more specific, when more than 11 contacts are connected in series toward the horizontal direction, processing can be done up to 23 lines (series connections of 241 contacts) or up to 24 lines (parallel 24 contacts) by the turn function. With the scroll function, the overall screen can be seen by moving the picture vertically. Multiple number of circuit units which are accommodated in one picture range are displayed in the sequence of the program step. In the head of the circuit

unit, the corresponding program step value is displayed. Further, for each displayed circuit element, the address bit number of the data memory is also indicated.

In the set area, circuit elements to be set in the ladder area are set in advance. A circuit is prepared by inserting the preset circuit element into the cursor position. In the message area, operation mode, error message, etc. are displayed.

In the monitor area, under monitor mode, signal status of the data memory and input/output distanced from the displayed circuit are indicated in the unit of one or eight points.

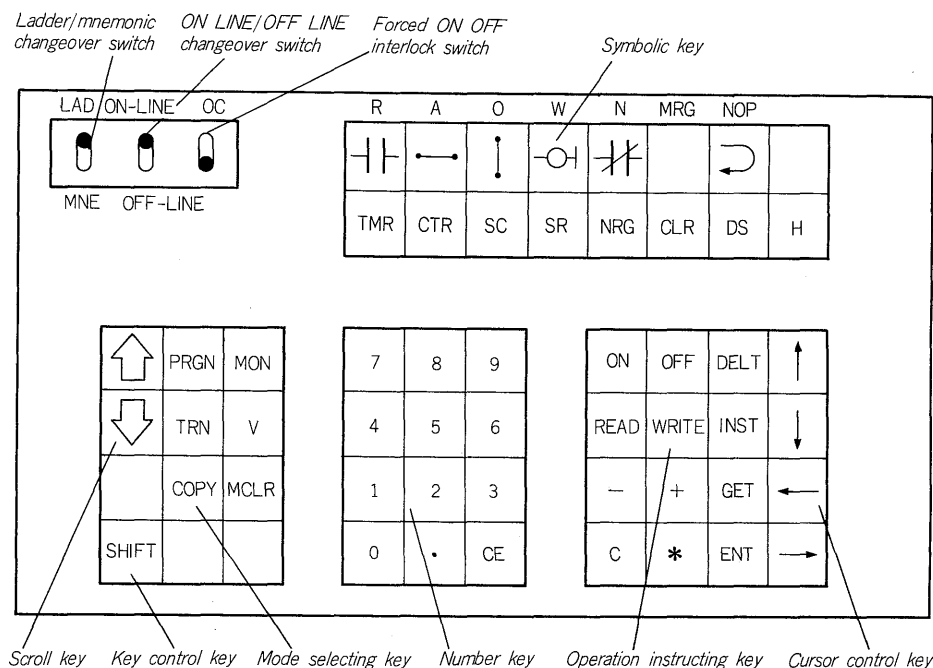


Fig. 4 Keyboard layout

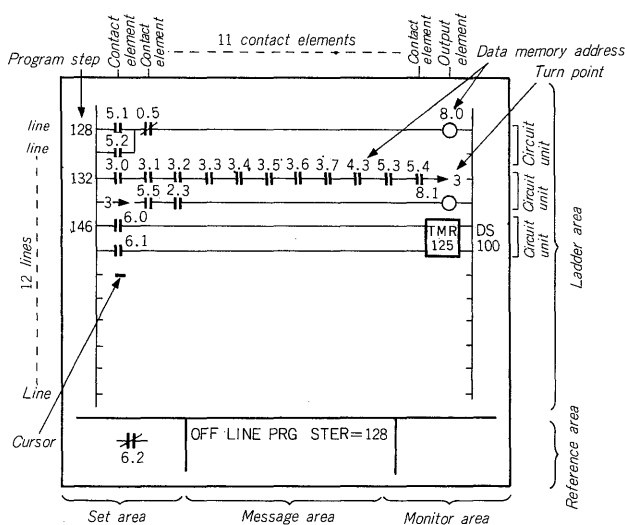


Fig. 5 CRT screen layout

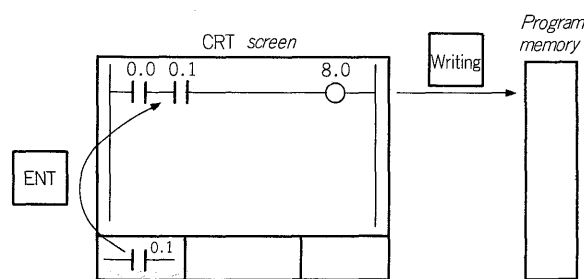


Fig. 6 Programming

IV. PROGRAMMING

For this CRT loader, programming can be made in the same manner as the conventional mnemonic format and ladder diagram. The programming by the mnemonic format is basically same as the conventional programming tool, and therefore, the programming by the use of ladder diagram is explained.

Control functions such as scroll, insertion/deletion of circuit unit and extraction of required circuit (GET) are used effectively so that the optimum circuit can be prepared fast on the CRT screen.

1. Preparing program

When preparing a ladder circuit on the CRT screen, symbol and device number are registered in the set area once, and then, with the ENT key, they are set in the position where the cursor is placed. The objective circuit is prepared by repeating the above operations, and by using the write key, the data are stored into the loader or program memory of the PC.

Recognitions of operations of ARG and MRG register which are required by mnemonic format programming are not required at all, but ladder circuit may be prepared on the CRT screen as if the ladder circuit is drawn on a table.

When many number of contacts are connected in series and parallel as shown in Fig. 7, the circuit exceeds the screen area range. In this case, the turn function is used and the circuit is rewritten by adding the numbers to the corresponding lines. Using both the turn function and programming range for two screens, normally prepared ladder circuits can be expressed sufficiently. Taking easiness of debug and change after programming into considerations,

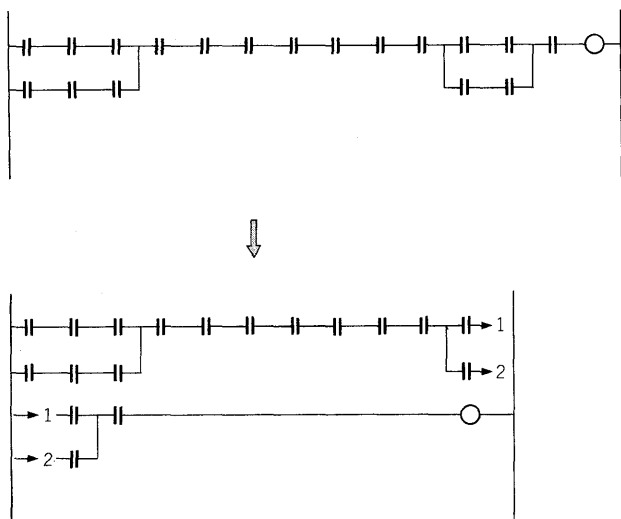


Fig. 7 Turn

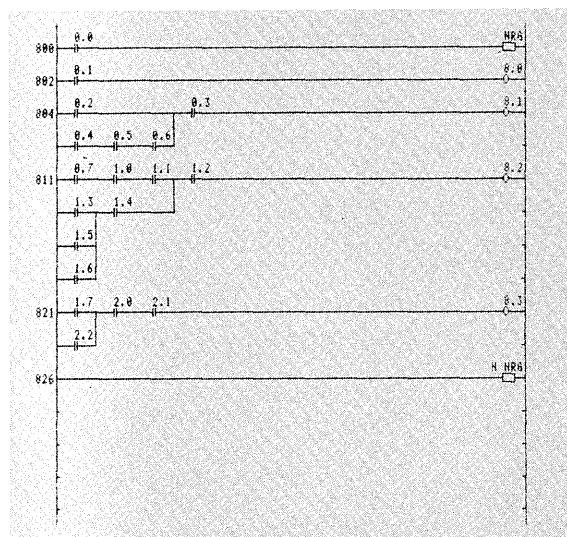


Fig. 9 Hard copy

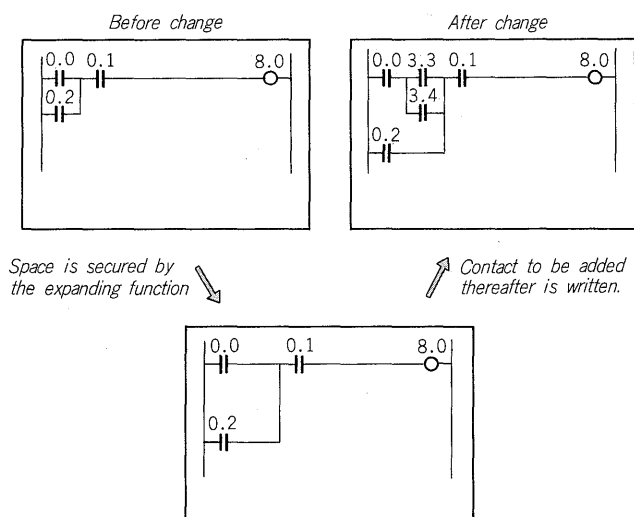


Fig. 8 Expansion

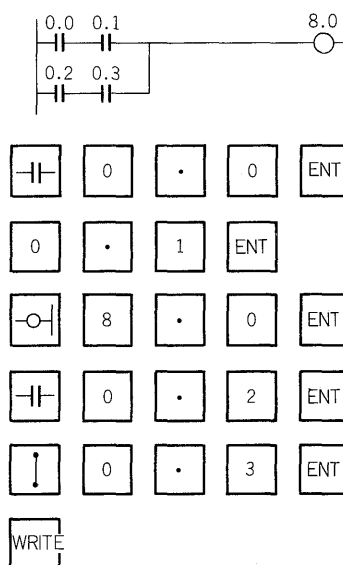


Fig. 10 Programming example (1)

it is desired that the unit of a ladder circuit be expressed within this range.

2. Changing program

To add or delete a contact to or from the completely prepared circuit or to change device number due to specification change or after debugging, it may be done simply by rewriting the imate of the circuit preparation. However, when a change occurs as shown in Fig. 8, the contact to be added is written and the data are stored into the program memory after securing an additional space by using the horizontal and vertical enlarging functions of this CRT loader. When making an addition or deletion in the unit of a circuit, the inserting/deleting/GET function is used.

3. Keeping program

When the program is set up completely after ending the debugging and test operation, the program and circuit diagram must be kept. They are copied into a cassette tape. This cassette tape is interchangeable with other programming tools. Drawings can be printed into hard copy in the ladder format by using a printer and copying function of the CRT loader. This hard copy is, as shown in Fig. 9, highly accurate, and it can be used as a circuit diagram.

V. PROGRAMMING EXAMPLE

Fig. 10 shows a programming example. The circuit

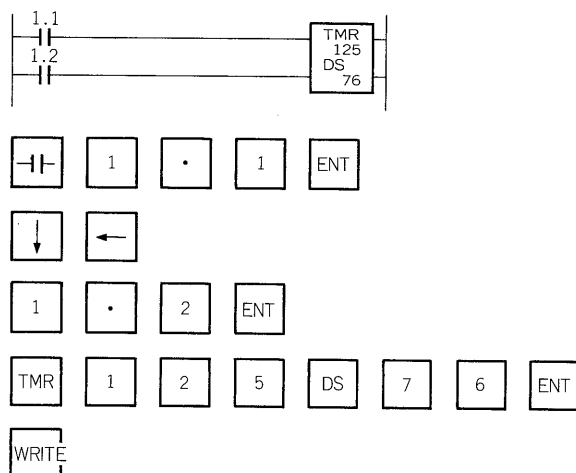


Fig. 11 Programming example (2)

shown in the figure is displayed on the CRT screen by setting the program mode on the keyboard shown in the Fig. 4 and by controlling the push buttons as shown in the Fig. 10. When the write processing is made finally, the displayed circuit is automatically analyzed, and the data are converted to machine words and transferred to the program memory. Now, when the ladder-mnemonic changeover switch in the upper left portion of the keyboard is set to

“MNE”, the displayed circuit goes out, the corresponding mnemonic format list is displayed immediately, and the circuit conversion result can be checked. When the switch is returned to “LAD”, the original circuit is displayed again on the screen. This circuit requires one step of MRG, however, the analyzation and generation are made automatically, no considerations are required at all for circuit preparation.

Fig. 11 shows an example of timer circuit preparation. A timer circuit can be prepared simply by applying the card address and time limit set value to the timer unit.

VI. POST SCRIPT

It is considered that the CRT loader introduced in this paper, which places the emphasis on the controllability has been completed as a practical product having the ladder graphic programming function. With the features such as the visual and simple programming, hard copy of ladder diagram and monitor function fully utilized, design and maintenance work are simplified, and work rationalization is expected to be further promoted.

Fuji Electric is successively proceeding the development so that the graphic programming tools of this kind will further be applied to other general purpose programmable controllers.

TOPICS

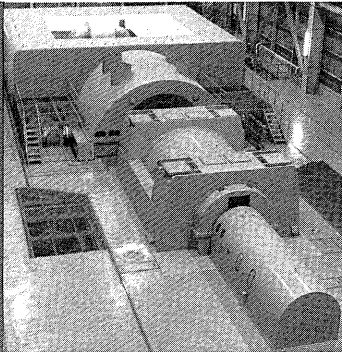
SEMINAR AND DISPLAY IN PAKISTAN EXPORT-ASIA DEPARTMENT STANDARD PRODUCTS GROUP

The Export-Asia Department Standard Products Group held a display of standard products (distribution and control products mainly the Fuji Auto Breaker, ELCB, Magnetic Motor Starter, etc.) and technical seminar in Karachi and Lahore, Pakistan on March 5 and 10. A large number of general manufacturer and user engineers, including engineers from government and power companies and scholars, attended, and answers to their questions increased the trust of Fuji Electric in this field and served to raised our technical image and promote our business activity.



Outline of Products

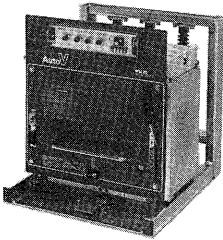
Power and Industrial Electrical Machinery Instrumentation



- Nuclear Power
- Power Generation and Distribution
- Transportation
- Environmental Equipment
- Industry
- Electrical Installation
- Mechatronics Equipment

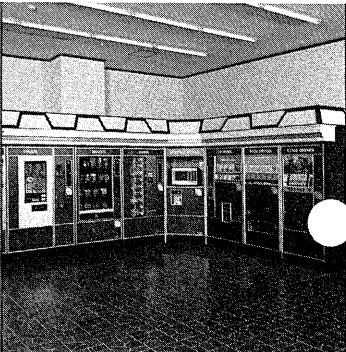
- Industrial Instrumentation
- Water Treatment
- Data Process Engineering

Standard Electrical Products



- Semiconductors
- Rotating Machines
- Standard Electrical Equipment

Vending Machines and Specialty Appliances



- Vending Machines
- Freezing & Refrigerating Open Showcases
- P.O.S. for Versatile Purpose Appliances
- Air Conditioning