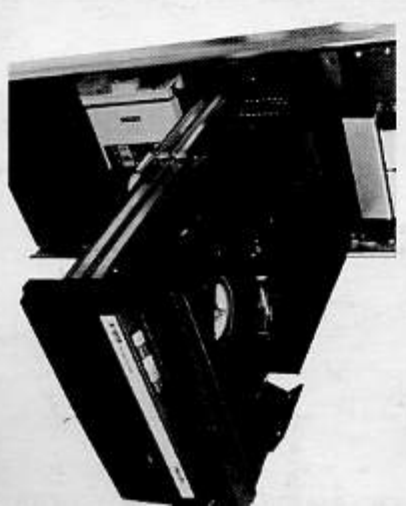
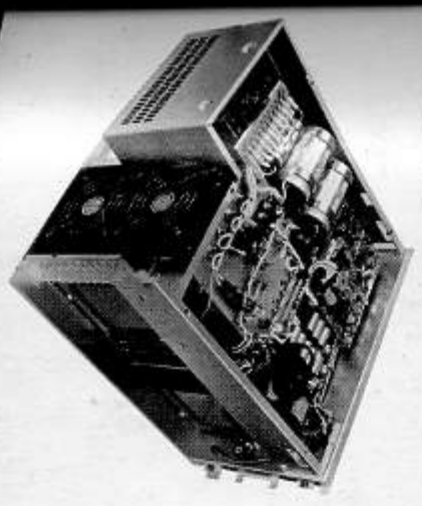
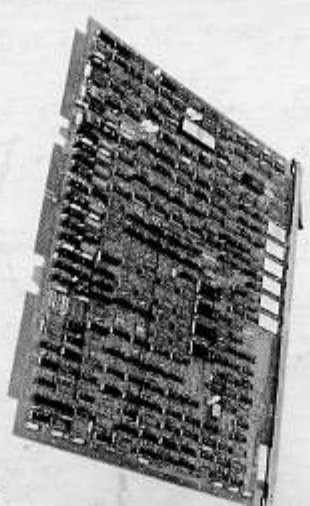


Main features

- ASYNCHRONOUS GENERAL PURPOSE BUS
- SINGLE CARD MICROPROGRAMMED CPU
- INTEGRATED CONSOLE CONTROL UNIT
- CYCLE SPEED OF 1.2 OR 0.7 MICROSECONDS
- MEMORY MODULES OF 8 OR 16K WORDS
- MEMORY CYCLES INTERLEAVING
- MODULAR SYSTEM
- 16-BIT WORD ORIENTED
- 16 GENERAL PURPOSE REGISTERS
- MEMORY MANAGEMENT UNIT (P857M), 2K WORD PAGE SIZE
- FLOATING POINT PROCESSOR (P857M)
- PROGRAMMABLE REAL TIME CLOCK
- DIRECT, INDIRECT, INDEXED, INDEXED INDIRECT ADDRESSING
- 63 INTERRUPT LEVELS
- EXTERNAL REGISTER TRANSFERS
- HARDWARE MULTIPLY/DIVIDE, DOUBLE LENGTH ARITHMETIC
- AUTOMATIC STACK HANDLING
- REAL TIME CLOCK (20 MS, MAINS)
- INTEGRATED V24 SERIAL CONTROL UNIT
- POWER FAILURE DETECTION WITH AUTOMATIC RESTART
- MICRODIAGNOSTICS
- LOW AND HIGH SPEED DATA CHANNELS
- INTERFACES FOR INDUSTRIAL EQUIPMENT
- DATA COMMUNICATION
- POSSIBILITIES TO CONNECT ALL STANDARD PERIPHERALS
- SOFTWARE PACKAGE INCLUDES:
 - STAND ALONE SOFTWARE
 - BASIC AND BASIC REAL TIME MONITORS
 - DISC AND DISC REAL TIME MONITORS
 - MULTI APPLICATION MONITOR (P857M)
 - SMALL REAL TIME MONITOR
 - CASSETTE OPERATING MONITOR
 - MONITOR EXTENSION FOR DATA COMMUNICATION
 - ASSEMBLER, FORTRAN COMPILER, BASIC, FACT, LINKAGE EDITOR, OVERLAY LINKAGE EDITOR, CASSETTE EDITOR, UPDATE PACKAGE, LINE EDITOR, DEBUGGING PACKAGE, HARDWARE TEST PROGRAMS

P856M/P857M System Handbook



This handbook is one of a series of manuals which covers all aspects of the P856M and P857M mini computer system. It is intended to provide general information with respect to the system in the form of short descriptions of the component units and peripheral devices which comprise the system.

Because of the flexibility of the system it is possible to include non-standard and customer designed equipment within any system and where such possibilities exist the connection facilities available have also been generally described. A user should however refer to the more detailed publications within the series before using such facilities.

Great care has been taken to ensure that the information contained in this manual is accurate and complete. Should a user, however, find any errors or omissions, or wish to suggest improvements, he is invited to write his comments on the sheet provided at the end of this book and send it to:

Manual Writing Small Computers
at the address on the opposite page.

A publication of

Philips Data Systems B.V.
Marketing Group Small Computers
Apeldoorn, The Netherlands

Publication number 5122 991 26932

April 1976

Copyright © by Philips Data Systems B.V. 1976
All rights strictly reserved. Reproduction or issue to third parties in any form whatever is not permitted without written authority from the publisher.

Printed in the Netherlands

Table of Contents

	Page
Preface	I
List of Figures	VIII
Definitions and Abbreviations	X
Introduction	XI
Chapter 1 General	1-1
The System	1-1
Memories	1-2
Interleaving	1-3
Control Panel	1-4
General Specifications	1-4
Chapter 2 Hardware Structure	2-1
Central Processing Unit	2-1
Arithmetic Unit	2-1
P register	2-1
The PSW register	2-1
The Scratchpad	2-2
The L register	2-4
The M register	2-4
The Q register	2-4
The D multiplexer	2-4
The C multiplexer	2-4
The S register	2-4
The K register	2-5
Address Generator GA	2-5
ROM Address Register RA	2-5
Control ROM and Microprogram	2-5
Control and Data Flow	2-5
Chapter 3 The Basic Word	3-1
Data Format	3-2
Chapter 4 Memory	4-1
Memory Addressing	4-3
Chapter 5 Memory Management Unit MMU	5-1
Description	5-1
Layout of segment table word	5-2
Page Fault Handling	5-3

Chapter 6 Floating Point Processor FPP	6-1
Introduction	6-1
Operation	6-1
Floating Point Format	6-3
Floating Point Instructions	6-4
Chapter 7 Instructions	7-1
Instruction Formats	7-1
Forming the Operand	7-4
Instruction Timing	7-5
Trap Action	7-5
The Instruction Set	7-5
Load/Store Instructions	7-6
Arithmetic Instructions	7-6
Logical Instructions	7-8
Character Handling Instructions	7-8
Branch Instructions	7-8
Shift Instructions	7-9
Control Instructions	7-9
Input/Output Instructions	7-10
External Transfer Instructions	7-10
Move Table Instructions	7-10
Chapter 8 Data Flow and Control	8-1
Chapter 9 General Purpose Bus	9-1
Bus Control Functions	9-1
Priority Chain	9-2
Data or Command Exchanges	9-2
Timing Control	9-5
Interrupt Handling	9-5
Miscellaneous Functions	9-5
Bus Signal Lines	9-5
Bus Control Signals	9-5
Data or Command Exchange Signals	9-6
Bus Data Lines	9-7
Bus Interrupt Lines	9-8
Miscellaneous Signals	9-8
Chapter 10 Interrupt System	10-1
Organization	10-1
Operation of the Priority System	10-1
Interrupt Action	10-3
Stacking	10-7
Chapter 11 Input/Output	11-1

Control Units	11-2
Control Units Connected Directly to the GP Bus	11-4
Definition of Units	11-5
Programmed Channel	11-7
Wait Mode	11-7
Interrupt Mode	11-7
Commands and Responses	11-8
Control and Data Flow	11-8
Input/Output Processor Channels	11-12
Organization	11-12
Control and Data Flow	11-14
Direct Memory Access	11-18
Transfers CPU/External Registers	11-18
Chapter 12 Control Panels	12-1
Full Control Panel	12-1
Safety Key Switch	12-1
Display Lamps	12-2
Data Switches	12-2
Register Address Switches	12-2
Control Buttons	12-2
Mode Buttons	12-3
Service Buttons	12-4
Transportable Panel	12-4
Minipanel	12-4
Extended Control Panel	12-5
Display Lamps	12-5
Address Switches	12-5
Load Switch	12-5
Load Switch	12-5
Preset Switch	12-5
Read Memory Procedure	12-6
Load Memory Procedure	12-6
Chapter 13 Basic Loading and Operating	13-1
Program Loading	13-1
Initial Program Loader	13-1
Load Memory (Full Control Panel)	13-6
Load Memory (Extended Control Panel)	13-7
Read Memory (Full Control Panel)	13-8
Read Memory (Extended Control Panel)	13-9
Load Register	13-10
Read Register	13-11
Chapter 14 Additional Standard Features	14-1
Power Failure-Automatic Restart	14-1
Real Time Clock	14-2

Integrated V24/V28 Serial Control Unit	14-2
Break Feature	14-4
Microdiagnostics	14-7
Test Procedures	14-7
Detection Of Privileged Instructions	14-10
System Mode	14-10
User Mode	14-10

Chapter 15 Data Communication and Digital or Analog Input/Output	15-1
Data Communication	15-1
Digital Input/Output System	15-2
Modular I/O System	15-2

Chapter 16 Cabinets, Installation and Interfacing	16-1
Cabinets	16-1
Mounting Boxes and Equipment Shelves	16-1
M1 Mounting Box	16-1
M4 Mounting Box	16-3
M4M Mounting Box	16-3
M5M Mounting Box	16-4
Equipment Shelf	16-5
Interconnection between Units	16-5
Installation	16-5
Electrical Supplies	16-5
Environmental Control	16-6
Safety	16-6
Interfacing	16-6

Chapter 17 Peripheral Equipment	17-1
Standard Peripheral Equipment	17-1
Power Supplies	17-2
Connection to the System	17-2
Control Units	17-2
Input/Output Typewriters	17-4
Punched Tape Equipment	17-9
Card Reader	17-13
Line Printers	17-15
Magnetic Tape Equipment	17-19
Magnetic Disc Equipment	17-24
Display Equipment	17-28

Chapter 18 Software	18-1
Control Programs	18-7
Basic Operating Monitor	18-7
Basic Real Time Monitor	18-7

Disc Operating Monitor	18-8
Disc Real Time Monitor	18-8
Cassette Operating Monitor	18-8
Small Real Time Monitor	18-9
Multi Application Monitor	18-9
DATEM	18-10
BSC	18-11
Processing Programs	18-11
Assemblers	18-11
FORTRAN Compilers	18-11
Linkage Editor	18-12
Overlay Linkage Editor	18-12
Service and Utility Programs	18-12
Debugging	18-12
Update	18-12
Line Editor	18-13
Cassette Update	18-13
Utility Programs	18-13
BASIC	18-13
FACT	18-14

Appendix 1 Peripheral Manufacturers
Index

List of Figures

	page
Index	
Figure	
1.1 System Main Components	1-2
1.2 Survey of peripherals and their control units	1-3
2.1 General structure of cpu	2-2
2.2 Data flow in data handling unit	2-3
4.1 Operation of memory in character mode	4-1
4.2 Layout of words and characters in memory	4-3
5.1 MMU operation	5-2
6.1 Connection of Floating Point Processor	6-1
6.2 Floating Point Processor	6-2
7.1 Layout of instruction formats	7-2
8.1 Instruction Microprogram	8-2
8.2 Microprogram Addressing routine	8-3
8.3 Accessing an instruction	8-4
8.4 Addressing cycle (T1) (T3)	8-5
8.5 Addressing cycle (T2) (T4-T7)	8-6
8.6 Execute cycle	8-7
9.1 Connection of standard units to the Bus	9-1
9.2 Bus priority and selection system	9-3
9.3 Exchange example	9-4
10.1 Diagram of interrupt sequence	10-6
11.1 Units concerned with transfers	11-2
11.2 Four states of standard control unit	11-3
11.3 Signal exchange	11-6
11.4 OTR/CIO Instruction flow	11-9
11.5 INR/SST/TST Instruction flow	11-10
11.6 I/O Processor control words	11-13
11.7 I/O Processor within the system	11-13
11.8 Read/Write External Register Layout	11-14
11.9 WER instruction flow	11-15
11.10 Exchange action	11-16
11.11 Exchange cycle CW1	11-17
11.12 Exchange cycle CW2	11-17
12.1 Full Control Panel	12-1
12.2 Display of status	12-2
12.3 Extended Control Panel	12-5
13.1 Loading the IPL	13-3
13.2 Load data in memory (full control panel)	13-4
13.3 Load data in memory (extended control panel)	13-5

13.4 Read memory (full control panel)	13-6
13.5 Read memory (extended control panel)	13-7
13.6 Load register	13-8
13.7 Read register	13-9
14.1 Integrated serial control unit	14-3
14.2 Wait mode	14-5
14.3 Interrupt mode	14-6
16.1 M1 Mounting Box backplane arrangement	16-1
16.2 Example of equipment mounted in cabinet	16-2
16.3 M4 Mounting Box side view	16-3
17.1 I/O Typewriter ASR33	17-4
17.2 PER3100 Matrix printer	17-6
17.3 Punched Tape Reader	17-9
17.4 Tape Punch	17-11
17.5 Card Reader	17-13
17.6 X1415 Matrix Line Printer	17-15
17.7 Line Printer	17-17
17.8 Magnetic Tape Unit	17-19
17.9 Cassette Drive Unit	17-22
17.10 X1215 Moving Head Disc Unit	17-24
17.11 P825-007 Moving Head Disc Unit	17-26
17.12 Display	17-26
18.1 Standard System Software and Application Software	18-1
18.2 Modular structure of monitor	18-2
18.3 Stand Alone software	18-3
18.4 Software for Basic Operating System	18-3
18.5 Software for Basic and Disc Real Time System	18-4
18.6 Software for Disc Operating System	18-5
18.7 Software for Multi Application System	18-5
18.8 Software for Cassette Operating System	18-6
18.9 Software for Small Real Time Monitor	18-6

- Cabinet Rack
 - The basic structure containing 19" racks
 - The structure within the cabinet to which rack mounted units may be secured.
- Basic Cabinet Extension
 - A cabinet in which the CPU is mounted.
 - A cabinet containing system equipment other than the CPU.
- Cabinet Mounting Box
 - The rack in which the CPU is plugged.
- Equipment Shelf
 - The rack in which system equipment other than the CPU is plugged.
 - One which is listed in the Catalogue.
- Standard Device Unit or Package
- Microdiagnostics
 - A microprogram standard available on the CPU board, which tests panel drivers, data path, bus dialogue and memory.
- Character
 - One half-word: 8 bits.
- MSI
 - Medium Scale Integration.
- LSI
 - Large Scale Integration.
- TTL
 - Transistor to Transistor Logic.
- ROM
 - Read Only Memory.
- PROM
 - Programmable Read Only Memory.
- MOS
 - Metal Oxide Semi-conductor.
- IPL
 - Initial Program Loader.
- GP BUS
 - General Purpose Bus.
- MMU
 - Memory Management Unit.
- FPP
 - Floating Point Processor

The P856M and the P857M mini computers are general purpose digital processors designed for industrial and scientific applications. These computers are the newest members of the successful P800M series family which were placed in all Western-European countries as well as in the United States and Japan.

The P856M and the P857M are fast, compact and easy to interface thanks to the asynchronous General Purpose Bus around which all I/O facilities are centered and two types of memory available. The P856M is the smaller computer of the two with a maximum of 32k memory. Memory modules for this computer are 8k 16-bit words with a cycle time of 1.2 μ s. Also available are 16k 16-bit word memory modules with either 0.7 μ s or 1.2 μ s cycle time. If two 16k fast memory modules are used memory cycles interleaving is possible.

The P857M offers a tremendous increase in memory size and programming power thanks to a one-board Floating Point Processor and a one-board Memory Management Unit.

The Floating Point Processor gives a hardware execution of floating point instructions. The Memory Management Unit provides the user with two important features: it permits word and character addressing in up to 128k words memory and it implements memory protection on a 2k word page basis.

Together with a backing store, such as disc, the system offers a practically unlimited programming space and gives the user all the advantages of a real-time environment, under control of a Multi Application Monitor.

Standard memory modules are 16k 16-bit words with 0.7 μ s cycle time. On option, 16k 1.2 μ s cycle time memory modules may also be used.

The high speed memory allows interleaving when at least two 16k modules are used.

Standard features for both CPU's are:

- 16 hardware registers of which 14 are fully programmable
- integrated V24 serial control unit
- power failure/automatic restart
- line frequency real time clock (20 ms)
- general purpose bus
- 63 program interrupt levels
- direct access for up to 256 external registers
- direct memory access facility
- microprogrammed standard instruction set
- addressing for up to 32k 16-bit words
- hardware bootstrap loader

