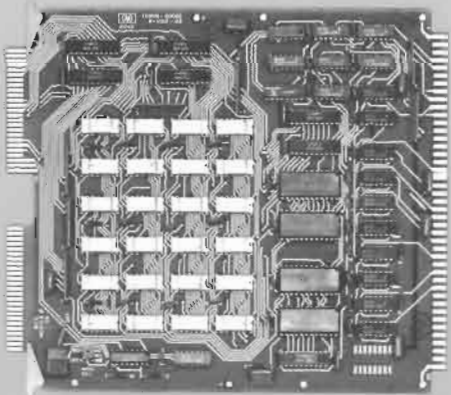
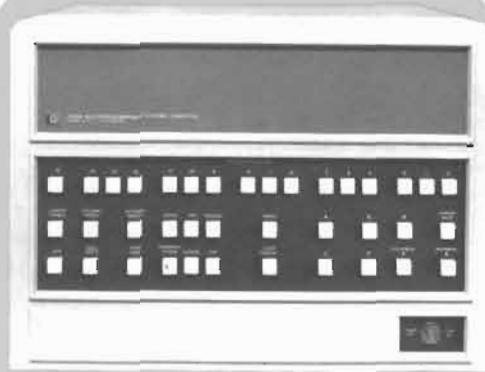


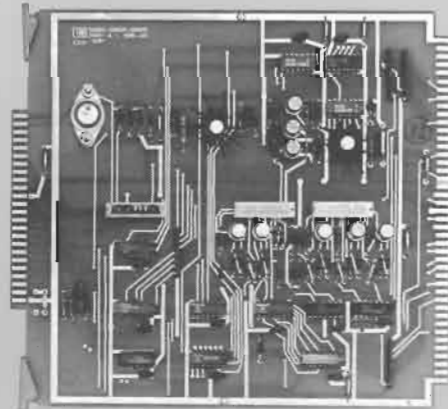


Microprogramming Accessories

For 2100 Series Minicomputers



I2908B Writeable Control Store



I2909A PROM Writer

WRITEABLE CONTROL STORE (WCS)

Features

Incorporates microprograms into computer hardware.

256 24-bit word storage for microprograms.

Enables access to six additional high-speed registers.

- **196 nanosecond cycle time.**
- **Dynamically alterable.**
- **Read/Write capability from memory and disc.**

MICROPROGRAMMING

A microprogram is a computer program written with advanced, concise instructions that are stored in computer hardware rather than in memory. This makes it possible to execute microprograms from 5 to 10 times faster than ordinary software subroutines. In addition your subroutines can be coded using a fraction of the instruction words needed for conventional programming. Microprograms are expressed in 24-bit, 6 field format. These powerful instructions are executed in a mere 196 nanoseconds. All this not only saves vast memory space, but reduces execution time to a fraction of conventional computing time. Microprogramming enables you to use six additional high-speed registers for fast execution of arithmetic and logic functions and it provides your routines with the ultimate in security by storing them in the hardware.

Thus your own specific programming tasks are performed in the most efficient state-of-the-art manner in a fraction of the time formerly required. Computer applications that are unique to your needs can be added by microprograms to customize the 2100 to your own specific requirements. As your computer needs develop, the 2100 can be modified with different microprograms, thus extending the life and capability of your computer system.

WRITEABLE CONTROL STORE

The Writeable Control Store (WCS) Card contains semi-conductor random access memory for storage of microprograms. Each card contains 256 24-bit words. Up to three WCS cards can be inserted in the computer mainframe.

The instruction word format as stored on the WCS is:

Bits:	23-21	20-17	16-12	11-8	7-4	3-0
Field:	R-Bus	S-Bus	Function	Store	Special	Skip

You can even have your own library of microprograms on disc and transfer them to the WCS card as needed. After execution, the microprograms can be swapped with other microprograms on the disc or left on the WCS card.

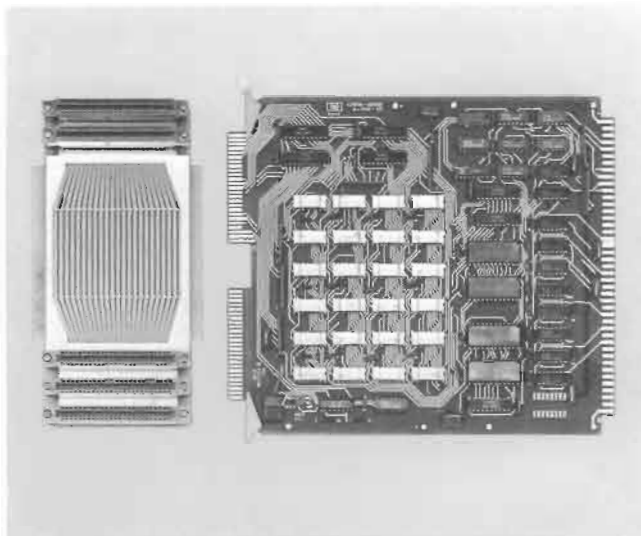
By such use of microprograms and disc files, you can dynamically alter the 2100, configuring its power and speed to your specific purposes. The computer can thus be customized to entirely different system functions as quickly as microprograms can be transferred from disc files.

The microprograms that will not change can be permanently fused on read-only memory chips by the Programmable Read-Only Memory (PROM) Writer.

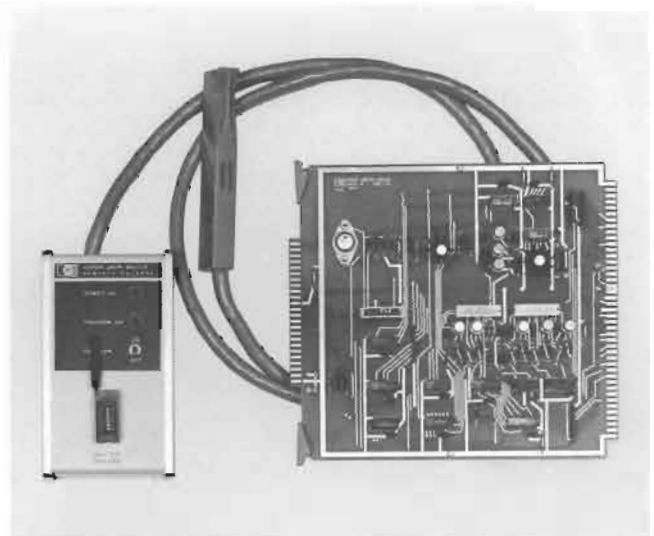
PROGRAMMABLE READ-ONLY MEMORY (PROM) WRITER

The Programmable Read-Only Memory Writer consists of one card that is temporarily inserted into a 2100 I/O slot and a small box in which the read-only memory chips are fused. Your microprograms can be transferred from memory to PROM chips by the PROM Writer.

The software provided with the PROM Writer enables the system operator to control the fusing. Microprogrammed chips are automatically verified and any missed bits are immediately fused.



HP 12908B Writeable Control Store Interface Kit



HP 12909A Programmable Read-Only Memory Writer Interface Kit

Microinstruction Commentary

MOV	P	IOR	M	RW	GET 'TO' ADDRESS
	T	IOR	Q		PUT IT IN Q
Get the TO address and store it in the Q-register. The TO address cannot be indirect.					
LOOP	B	RRS	IOR	M	RW
	T		IOR	S1	READ A DATA WORD
					PUT IT IN S1
Read a data word from the core memory location pointed to by the FROM address and store the data word in Scratch Pad Register 1.					
Q	IOR	S2			PUT 'TO' ADDRESS IN S2
F	S2	DEC	M	CW	NMPV
		JMP			OUT
S1	IOR	T			WRITE A DATA WORD TO MEMORY
Put the TO address in Scratch Pad Register 2. Address the TO core memory location. Write the data word into the core memory location pointed to by the TO address. The F, DEC, and NMPV micro-orders in the "write into memory" microinstruction test the TO address to make sure it does not refer to a location in the protected portion of core memory. If a memory protect violation is detected, control passes to OUT (otherwise the "write into memory" operation is performed).					
B	INC	B			INCREMENT THE 'FROM' ADDRESS
Q	INC	Q			INCREMENT THE 'TO' ADDRESS
A	INC	A		TBZ	DECREMENT AND TEST THE COUNTER
	JMP		LOOP		REPEAT THE MOVE LOOP
Increment the FROM address. Increment the TO address. Increment and test the number of words (remember that the number of words is in two's complement form; consequently, the number is effectively decremented). If the number = 0, control passes to OUT. Otherwise, the move loop is repeated.					
OUT	P	INC	P		EOP
		IOR			INCREMENT THE P REGISTER
					EXIT
Increment the P-register and exit.					

Microprogram Mnemonics

R-bus	S-bus	Function	Store	Special	Skip
NOP	NOP	IOR	NOP	NOP	NOP
A	P	XOR	M	CNTR	EOP
B	S1	AND	T	CW	COUT
Q	S2	NOR	IR	ECYN	CTR
F	S3	LWF	A	ECYZ	CTRI
AAB	S4	ARS	B	IOG1	FLG
CAB	M	LGS	Q	L1	ICTR
CQ	T	CRS	F	R1	NEG
	ADR	JMP	P	RSS	NMPV
	CNTR	CJMP	S1	RW	ODD
	CL	JSB	S2	AAB	OVF
	CR	RSB	S3	ASG1	RPT
	CIR	ADD	S4	ASG2	TBZ
	IOI	ADDO	IOO	LEP	UNC
	RRS	SUB	AAB	SRG1	AAB
	COND	MPY	CAB	SRG2	NAAB
		DIV			
		DEC			
		INC			
		INCO			
		SOV			
		CLO			
		SFLG			
		CFLG			
		RFE			
		RFI			
		PIA			

SPECIFICATIONS

WRITEABLE CONTROL STORE CARD

PHYSICAL

Dimensions

Width: 7-3/4 inches (196 millimeters)
Height: 8-11/16 inches (22 millimeters)

CURRENT REQUIRED

+4.85 volts supply 4.6 amperes
+2.00 volts supply 0.15 amperes

EQUIPMENT SUPPLIED

12908B Writeable Control Store PCA (12908-60006)
Jumper Board Assembly (12908-60003)
Operating and Service Manuals (12908-90001)

PROGRAMMABLE

READ ONLY MEMORY WRITER

PHYSICAL

Width: 7-3/4 inches (196 millimeters)
Height: 8-11/16 inches (222 millimeters)

Prom Writer Mounting Fixture

Width: 3 inches (76 millimeters)
Height: 5-3/4 inches (146 millimeters)
Depth: 1-1/2 inches (38 millimeters)

CURRENT REQUIRED

+5 volt supply \leq 0.500 amperes
-2 volt supply \leq 0.040 amperes
+12 volt supply \leq 0.250 amperes
+30 volt supply \leq 0.250 amperes

EQUIPMENT SUPPLIED

12909A PROM Writer Printed-circuit Assembly
(12909-60001)
PROM Writer Mounting Fixture (12909-60002)
Test ROM (1816-0250)
Operating and Service Manual (12909-90001)

