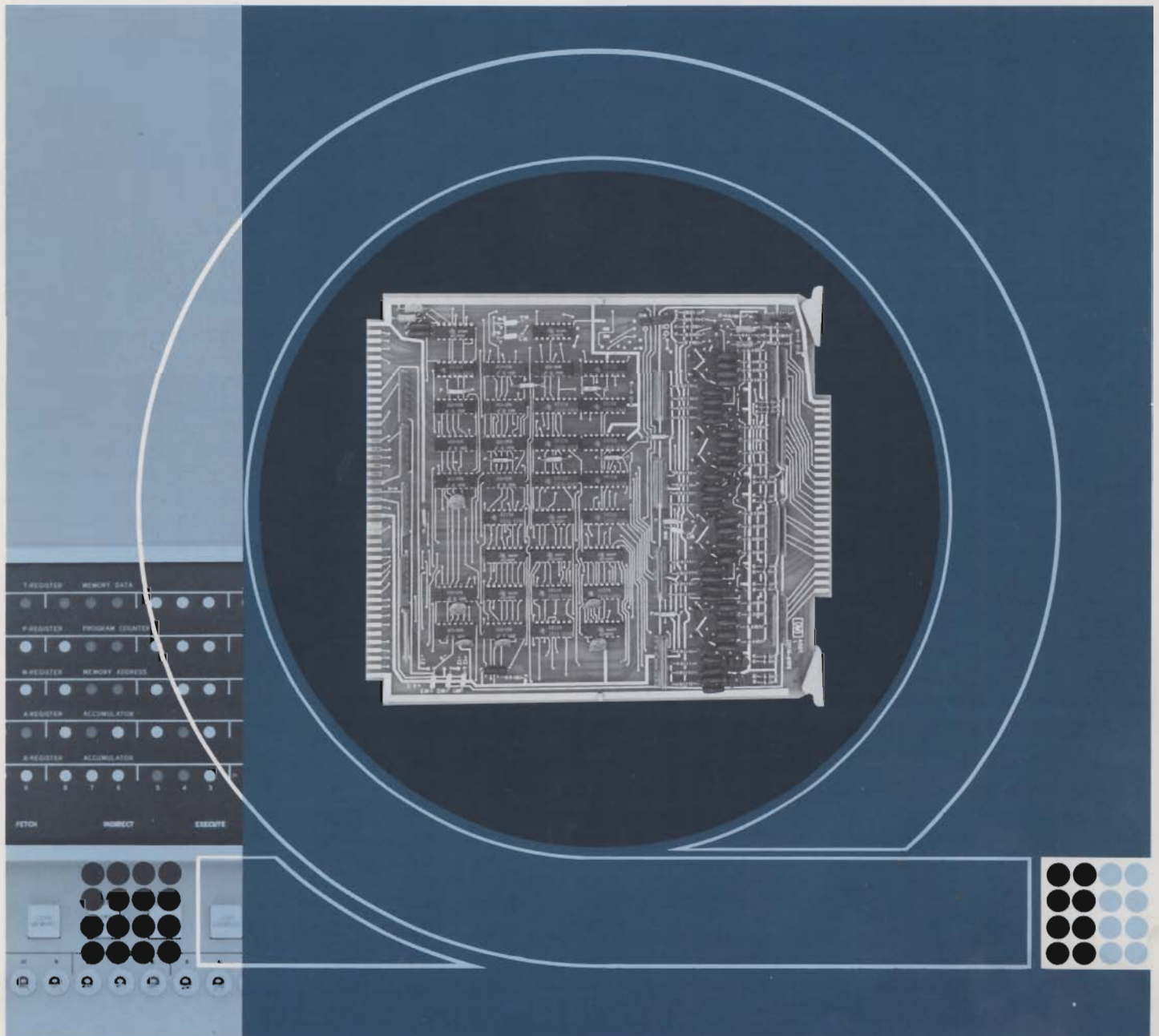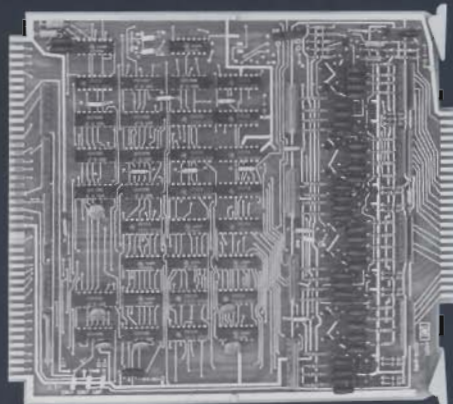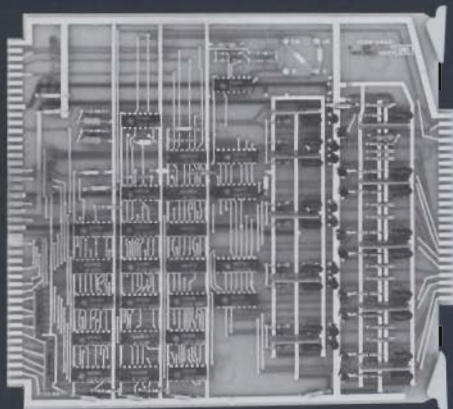HEWLETT **hp** PACKARD

DUPLEX REGISTERS
...FOR 8- OR 16-BIT INPUT/OUTPUT DATA TRANSFERS

12554A INTERFACE KIT (16-BITS)
12597A INTERFACE KIT (8-BITS)

FEATURES

VERSATILE OPERATION

Both Duplex Registers can interface HP computers with a wide range of external devices such as those used for on-line production testing, lab design work, and those applications involving measuring instrumentation with conventional digital output. The registers permit input and output information flow between the computer and an external device. One Duplex Register features a 16-bit input and a 16-bit output storage register, plus control and interrupt logic. The other Duplex Register has the same logic, except for 8-bit input and output storage registers. Both registers have the features to offer a wide latitude in configuring your instrument measurements to save time and money through computer analysis.

OFF-THE-SHELF INTERFACE

HP has made each Duplex Register as a single plug-in card to meet most computer interface needs. You can put your computer to work immediately with either duplex register and at the same time realize considerable savings in engineering time and money otherwise required to design and make your own computer interface.

EASY TO PROGRAM

Performing input, output, and combined input/output operations through the duplex registers is easy using HP Assembly language. Built-in features such as data storage and interrupt logic reduce your programming time to a minimum.

SIMPLE INSTALLATION

Supplied complete — plug either Duplex Register card into a computer I/O slot and connect the device cable. Hardware and instructions are provided to assist you in making an interconnect cable to your external device. Expensive and time consuming installation and computer down-time is eliminated.

ADDING A DUPLEX REGISTER TO YOUR HP COMPUTER

The Hewlett-Packard Duplex Registers enable you to interface HP computers to exchange input and output information with most digital output measurement devices. And, you can have a single interface card with 8-bit or 16-bit storage registers, depending on your application. Adding a duplex register to your HP computer is quick and easy — merely plug the duplex register card into a computer I/O slot and connect a cable. Although each duplex register is designed as a general purpose interface, it has many of the same features as other HP interface cards designed for specific peripheral devices. Included are 8- or 16-bit input and output storage registers which provide temporary storage during data transfer, plus control and interrupt logic. Also provided is a device command line to the external equipment and a flag (action completed) response line from the external device. These functions are shown in the simplified logic diagram. Input operations, output operations, and combined input/output operations are possible between the computer and the external device when interfaced through either duplex register.

INPUT OPERATIONS

When the external device is ready to supply data to the computer, it must supply a flag signal to the duplex register. This signal enters data into the input data register and sets up a request for service (Interrupt Request, or Skip Flag if interrupt system is not being used). The computer responds with an input instruction (and resulting I/O In signal) that enters the input data into the computer A- or B-register.

OUTPUT OPERATIONS

An output instruction and an accompanying I/O Out signal from the computer transfers 8 or 16 data bits (depending on which register is used) from the computer A- or B-register to

PROGRAMMING
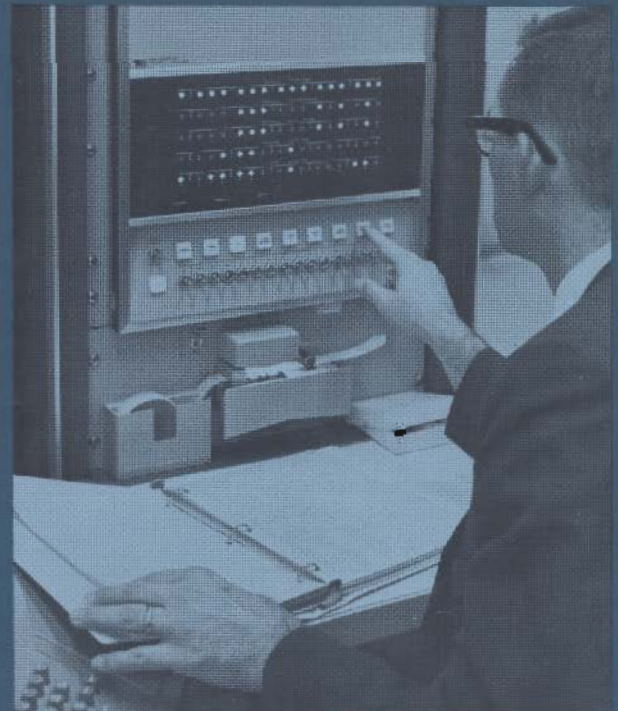
The following sequences illustrate the ease of programming input, output, and combined input/output through the 16-bit duplex register using Assembly language. (The 8-bit duplex register is programmed identically except that only 8 bits are transferred.) The duplex register is assumed to be assigned select code GPR; the computer interrupt system is disabled.

Note: Both duplex registers can be programmed with FORTRAN and ALGOL by calling Assembly language subroutines.

INPUT

Command the external device to acquire and transfer 16 bits of information to the computer. The results are left in the A-register.

MAIN PROGRAM

Label	Operation	Operand	
	:		
	JSB	INPUT	Jump to input subroutine.
	STA	CODE	Store A-register contents in memory location CODE.
	:		

SUBROUTINE

Label	Operation	Operand	
INPUT	NOP		Entry point.
	STC	GPR,C	Encode external device to perform its function.
	SFS	GPR	Is operation complete?
	JMP	*-1	No, jump back to SFS instruction.
	LIA	GPR	Yes, transfer input data to A-register.
	JMP	INPUT,I	Jump to main program.

OUTPUT

Output 16 bits of information from the A-register to the external device and command it to accept the data.

MAIN PROGRAM

Label	Operation	Operand	
	:		
	LDA	N	Load A-register with contents of memory location N.
	JSB	OUTPT	Jump to output subroutine.
	:		

SUBROUTINE

Label	Operation	Operand	
OUTPT	NOP		Entry point.
	SFS	GPR	Is external device busy?
	JMP	*-1	Yes, jump back to SFS instruction.
	OTA	GPR	No, transfer output data to duplex register.
	STC	GPR,C	Encode external device to accept the data.
	JMP	OUTPT,I	Jump to main program.

COMBINED INPUT/OUTPUT

Output 16 bits of command information, command the external device to take action, then read in 16 bits from the device. Command data is retained in the A-register; input data is read into the B-register.
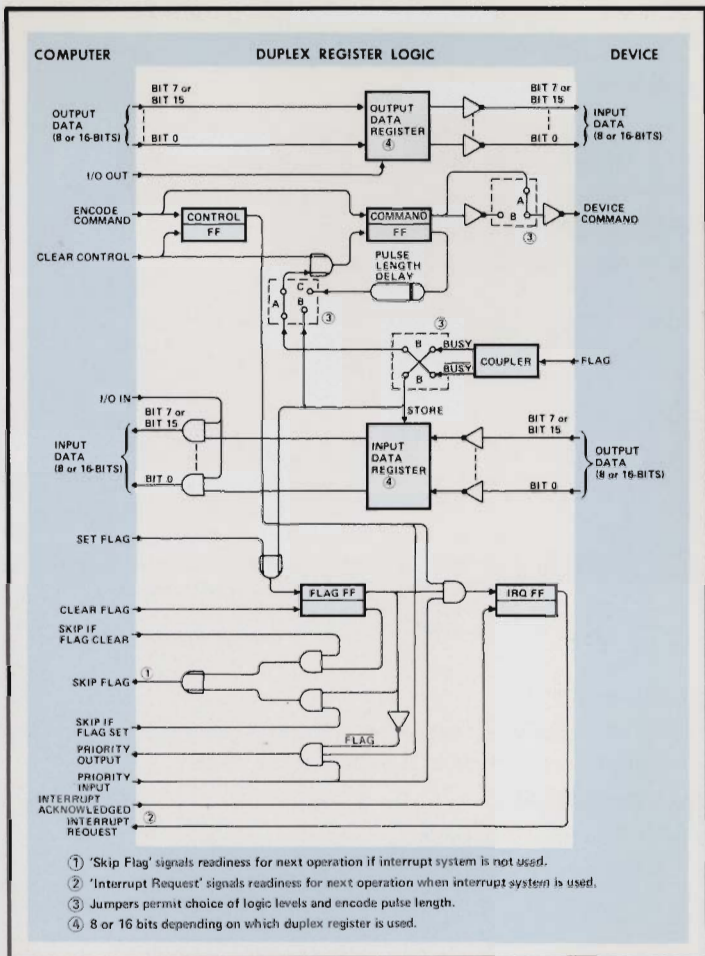
MAIN PROGRAM

Label	Operation	Operand	
	:		
	LDA	N	Load A-register with contents of memory location N.
	JSB	IOSB	Jump to input/output subroutine.
	STB	CODE	Store B-register contents in memory location CODE.
	:		

SUBROUTINE

Label	Operation	Operand	
IOSB	NOP		Entry point.
	OTA	GPR	Transfer data to duplex register.
	STC	GPR,C	Encode external device to accept or act on the data.
	SFS	GPR	Is external device busy?
	JMP	*-1	Yes, jump back to SFS instruction.
	LIB	GPR	No, transfer input data to B-register.
	JMP	IOSB,I	Jump to main program.

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① 'Skip Flag' signals readiness for next operation if interrupt system is not used.
② 'Interrupt Request' signals readiness for next operation when interrupt system is used.
③ Jumpers permit choice of logic levels and encode pulse length.
④ 8 or 16 bits depending on which duplex register is used.

the output data register on the card. These bits are then applied to the external device without further intervention by the computer. The next step is issuance of a device command by the computer which "tells" the external device that the data is ready to be acted upon.

When the external device is ready for the next data word it simply returns the flag signal to the duplex register. This signal sets up a request for service (Interrupt Request, or Skip Flag if interrupt system is not being used.) The computer responds by outputting the next 8 (or 16) bits of data and a device command.

COMBINED INPUT/OUTPUT OPERATIONS

Each duplex register includes two independent registers which allow a two-way flow of information between the computer and an external device. A typical combined input/ output operation would be output of control information to a measuring device that measures data from several input channels. The output register would provide control information to the external device and the input register would accept the results of the measurements. If the external device is a printer, data is transferred through the output register and status information is read back into the input register.

DIRECT MEMORY ACCESS OPERATIONS

When coupled through the Direct Memory Access (DMA) section of an HP computer, the duplex registers can handle inputs from A-to-D Converters* or outputs to telemetry command links at high data rates. The basic duplex registers are capable of 100,000 8- or 16-bit transfers per second.

*High-speed A-to-D Converters are available from Hewlett-Packard. Ask for the High Speed A/D Selection Guide.

SPECIFICATIONS

CHARACTERISTIC	DUPLEX REGISTER CARD Part No. 12554-60023 (16 bits) Part No. 12597-6001 (8 bits) (Pos In/Pos Out)	DUPLEX REGISTER CARD Part No. 12554-60024 (16 bits) Part No. 12597-6002 (8 bits) (Neg In/Neg Out)
OUTPUT LEVELS "1" state "0" state	0 to +0.5V, 12 mA sink max. +12V, 10K source	-12V, 10K source 0 to -0.5V, 12 mA sink max.
INPUT LEVELS "1" state "0" state	0 to +0.5V, 12 mA sink max. +8V	-8V 0 to -0.5V, 12 mA sink max.
BIAS AND IMPEDANCE	+8V through 700 ohms	-8V through 700 ohms
DEVICE COMMAND OUTPUT	Command signal to external device: 1. Indicates data is ready in Output Register 2. Is terminated by a device Flag signal input	
DEVICE FLAG INPUT	External device command to interface card: 1. Strobes data to Input Storage Register 2. Sets interface-card Flag FF	

INTERFACE CURRENT SUPPLIED BY THE COMPUTER

Interface Kit	+12V	-12V	-2V	+4.5V
12554A	0.023A	0.03A	0.06A	1.11A
12554A-01	0.025A	0.25A	0.06A	1.11A
12597A	0.05A	0.02A	0.05A	0.75A
12597A-01	0.02A	0.05A	0.05A	0.75A

(Note: An auxiliary HP Power Supply may be necessary for installations which use several I/O devices with high-current requirements. Consult your nearest HP Field Sales Office.)
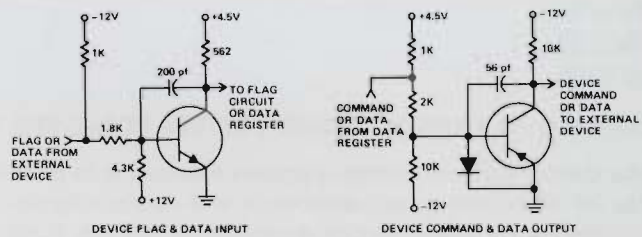
DUPLEX CARD DIMENSIONS

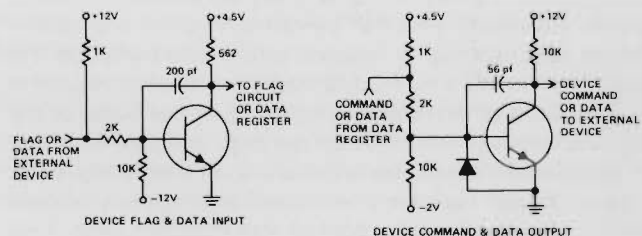**Width:** 7-3/4 inches (196,8 mm)
Height: 8-11/16 inches (220,7 mm)

INTERFACE KIT WEIGHT

Net weight: 18 oz (675 gm)
Shipping weight: 4 lb (1.8 kg)

NEGATIVE IN/NEGATIVE OUT

DEVICE FLAG & DATA INPUT — DEVICE COMMAND & DATA OUTPUT

POSITIVE IN/POSITIVE OUT

DEVICE FLAG & DATA INPUT — DEVICE COMMAND & DATA OUTPUT

EQUIPMENT SUPPLIED

16-BIT DUPLEX REGISTER

HP 12554A Interface Kit, consisting of:

16-Bit Duplex Register Interface Card, Part No. 12554-60023 (Positive in/Positive out)

Connector Kit (for interconnect cable), Part No. 02116-6178.

Test Connector, 24-pin, Part No. 1251-0332

HP 12554A-01 Interface Kit, consisting of:

16-Bit Duplex Register Interface Card, Part No. 12554-60024 (Negative in/Negative out)

Connector Kit (for interconnect cable), Part No. 02116-6178

Test Connector, 24-pin, Part No. 1251-0332

8-BIT DUPLEX REGISTER

HP 12597A Interface Kit, consisting of:

8-Bit Duplex Register Interface Card, Part No. 12597-6001 (Positive in/Positive out)

Connector Kit (for interconnect cable), Part No. 02116-6178

Test connector, 24-pin, Part No. 1251-0332

HP 12597A-01 Interface Kit, consisting of:

8-Bit Duplex Register Interface Card, Part No. 12597-6002 (Negative in/Negative out)

Connector Kit (for interconnect cable), Part No. 02116-6178

Test Connector, 24-pin, Part No. 1251-0332

● Ordering information for the Duplex Registers is contained on a separate sheet, available from any Hewlett-Packard Field Sales Office.