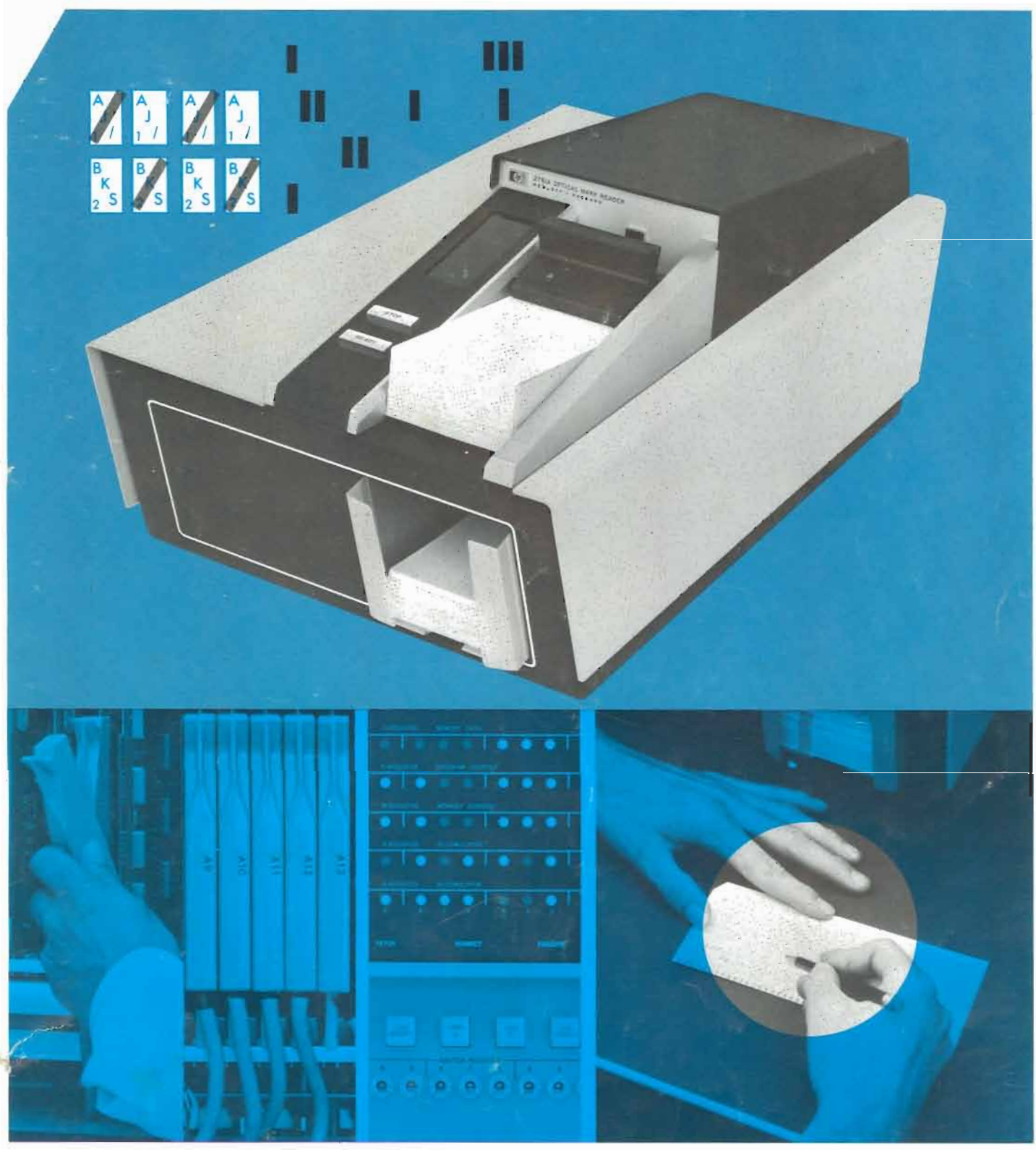
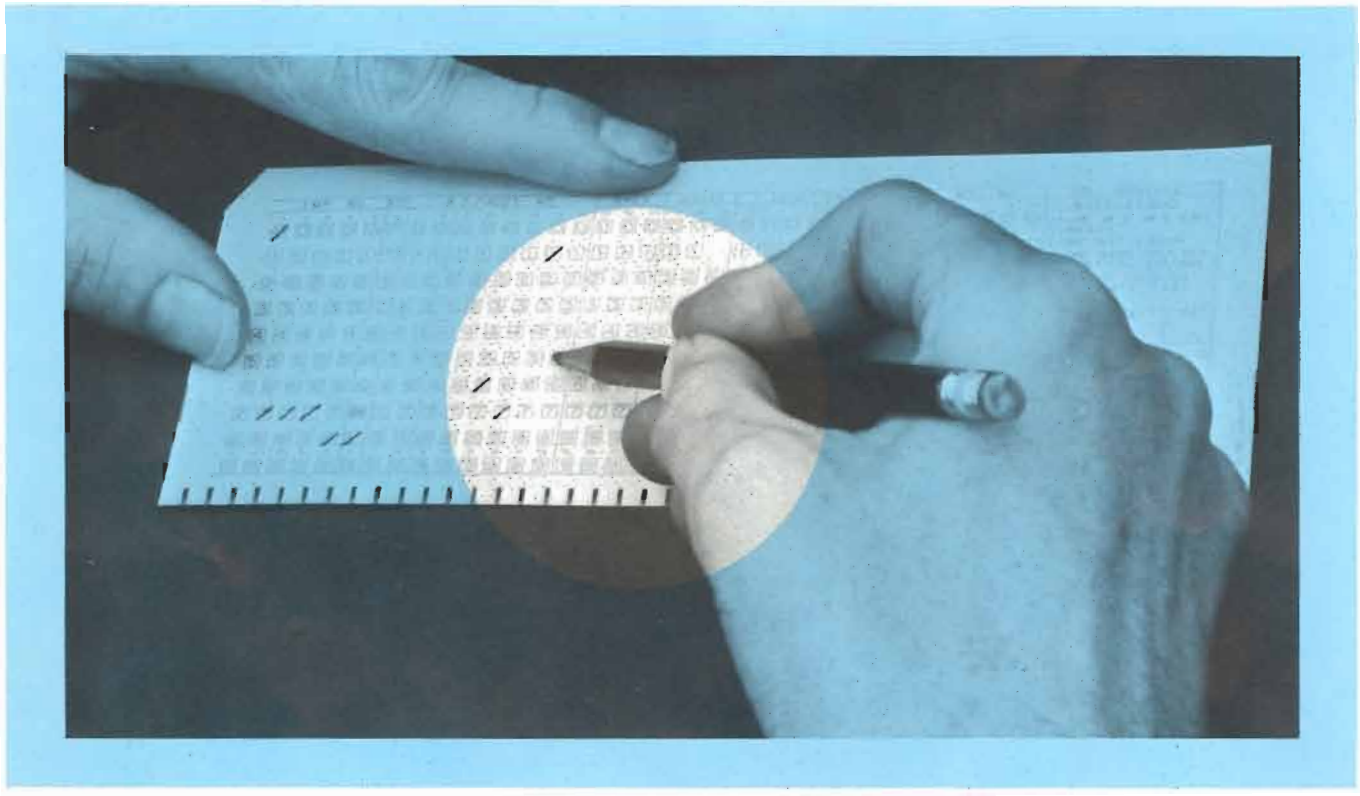
HEWLETT hp PACKARD

digital computers

PARALLEL OUTPUT OPTICAL MARK READER



2761A-07 OPTICAL MARK READER AND 12602A INTERFACE KIT



VERSATILE APPLICATIONS –

Include the advantages of marked or punched cards in your data system. Designed for direct computer input, the HP 2761A-07 furnishes data in 12-bit parallel form. It speeds the input of computer programs, orders, payroll charges, inventory entries, shipments, billings and similar operating data to a central processor. The Optical Mark Reader is easy to use, and operation requires no special skills or training.

INTERFACING –

Computer manufacturers can easily interface with the simplified data, control and status signals. Your general-purpose interface circuits may already provide the necessary mating functions. When ordered with an HP computer, all interface and software requirements are completely supplied by HP. Installation is completed by simply placing the Reader at the desired operating location, plugging one interface card into a computer I/O slot and connecting a cable.

AUTOMATIC CARD FEEDING –

Automatic input hopper holds up to 300 cards. In the free-run mode, cards are fed at 250 cards per minute. In the demand mode, cards are fed under computer control at 200 cards per minute.

DEPENDABLE OPERATION –

Rugged, electrically-conservative design permits operation not only from normal office locations, but also at remote substations, land-based or marine weather stations, industrial plants and other locations where dirt, vibration, temperature and humidity conditions are far from ideal.

INCLUDE THE OPTICAL MARK READER IN YOUR DATA SYSTEM

The HP 2761A-07 Optical Mark Reader is designed to read data directly into a computer or other data acquisition system in 12-bit parallel form. All necessary status and control lines are provided to permit operation of the Reader under program control. A minimum of standard logic and control circuits are required to completely interface the Reader for a variety of applications. Adapting the Optical Mark Reader to HP computers is accomplished by use of a single plug-in interface card.

The document used for data entry is a standard-size tab card. Cards may be coded by marking preprinted boxes with an ordinary soft-lead pencil, keypunching or any combination of marking and punching. The maximum number of characters per card and the encoded characters allowed are a function of the system software. Where card feeding sequence is critical, the 2761A-07 has an important advantage. Cards are fed in face down so they are read from the beginning to the end of the deck. The card feed mechanism returns the card deck in the same order, eliminating any need for manually reverse-ordering the cards.

Use of the 2761A-07 is appropriate with small computer systems as well as large data processing networks where it is desirable to use the original document as direct input to the system. In many cases marked cards can be substituted for vouchers or forms, increasing accuracy and eliminating significant amounts of data preparation costs.

APPLICATION WITH HP COMPUTERS

The 2761A-07 is offered as a standard peripheral to all Hewlett-Packard computers. Hardware provided includes an Optical Mark Reader, a single interface card which plugs into an I/O slot in the computer, plus an interconnect cable between the interface card and the Reader. The simplified logic and timing diagrams show the I/O structure established between the reader and computer. The interface card includes all control and interrupt logic between the computer and reader. Under program control, the tab cards are read character-by-character until the number of cards specified in the program have been read.

CARD DESIGN FLEXIBILITY

The tab card information can be arranged in almost any manner with considerable positional freedom in the horizontal direction. Each tab card can contain a maximum of 12 rows and 80 columns of data. The cards are preprinted with reflective ink that is highly visible to the eye, but not to the photosensors of the Reader. Reading of the cards is controlled by clock marks printed along with bottom edge of the card. The clock marks are used by the Reader to determine when a column of data entry marks (or punched holes) is positioned under the photosensors for data read-in. Clock marks are normally positioned midway between consecutive columns of data marking boxes or punched holes.

FOR COMPLETE TAB CARD DESIGN REQUIREMENTS, SEE THE HP 2760A AND 2761A TAB CARD SPECIFICATIONS DATA SHEET.

RATIO SENSING

Reading accuracy of the 2761A-07 is assured by a unique ratio sensing method. Marks or punched holes on the card are read as a change in reflectivity 'seen' by the photosensors. The outputs from the sensors are pulses that are applied to amplifiers which respond to the ratio of mark-to-background or hole-to-background reflectivity. The sensor amplifiers produce an essentially uniform output over a wide range of conditions. This makes performance of the 2761A-07 virtually independent of card base color, and individual variations of sensor lamps and photo-diodes, including the effects of aging, high or low line voltage, and temperature change.

PUNCHED CARDS

A highly important plus of the 2761A-07 Optical Mark Reader is its ability to read punched holes as well as marks. Cards can be prepunched with identifiers and routine information for turn-around applications, thereby assuring correct identification of the turn-around document. In addition to being more convenient for the card user, the use of prepunching minimizes entry time per card, increasing effectiveness of the overall system.

PROGRAMMING WITH HP COMPUTERS

The Optical Mark Reader may be programmed in Assembly language, FORTRAN, and ALGOL. Programming the unit is easy because HP supplies all the necessary software. Two types of drivers are included in the software supplied. The System Input/Output (SIO) Optical Mark Reader Driver permits reading without interrupt control; the Basic Control System (BCS) Optical Mark Reader Driver is for input under interrupt control.

The general form of the three types of programming is shown in the following samples.

ASSEMBLY LANGUAGE PROGRAMMING

USING THE SIO DRIVER

This calling sequence is for input without interrupt control; its general form is:

```
        Operation   Operand
            LDA     Buffer length (1)
            LDB     Buffer address
            JSB     101B,I
```

(1) Denote characters using positive numbers only.

EXAMPLE: Read 40 Hollerith* characters into 20 consecutive memory locations beginning at the address contained in 'TBLE'.

```
            LDA     LNGTH
            LDB     TBLE
            JSB     101B,I
LNGTH       DEC     40
```

*Hollerith coded card data is converted to ASCII characters by driver software.

USING THE BCS DRIVER

This calling sequence is for programs that require data input under interrupt control; its general form is:

```
        Operation   Operand
            JSB     .IOC.
            OCT     Function (1)
            JMP     Reject address
            DEF     Buffer address
            DEC     Buffer length (2)
```

(1) Read Hollerith* = 10005
Read packed binary = 10105
Read binary right justified = 10205

(2) Use negative number for character mode, positive number for binary mode.

EXAMPLE: Read 40 Hollerith* characters into 20 consecutive memory locations beginning at 'TBLE'. If I/O request is rejected, go to 'REJ'.

```
            JSB     .IOC.
            OCT     10005
            JMP     REJ
            DEF     TBLE
            DEC     -40
```

FORTRAN PROGRAMMING

```
            READ    (unit, format) List (1)
            READ    (unit) List (2)
```

(1) For Hollerith* records
(2) For binary records, right justified

*Hollerith coded card data is converted to ASCII characters by driver software.

EXAMPLE: Read four values for variables A1, A2, A3, A4.

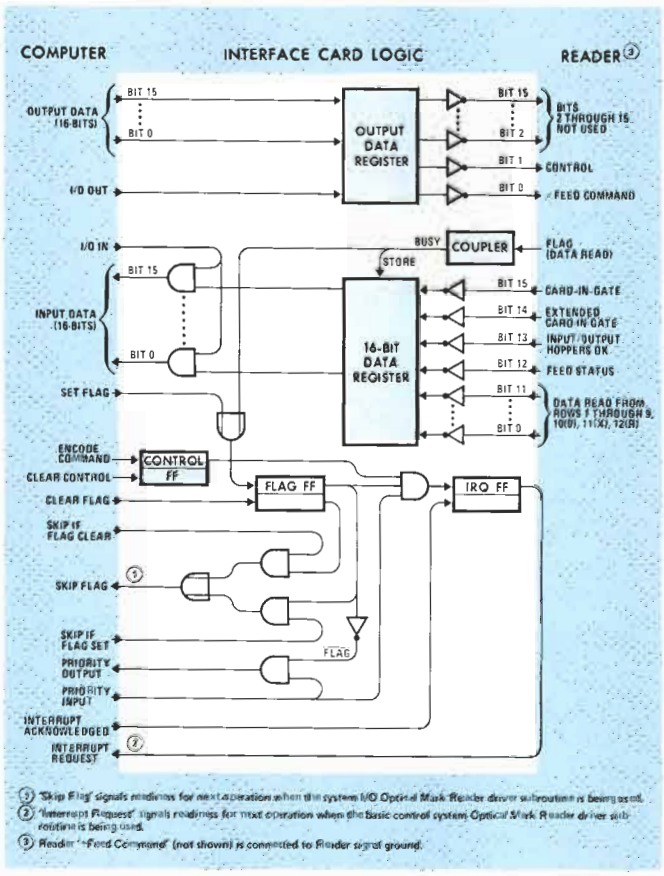
```
            READ    (5, 101) A1, A2, A3, A4.
101 FORMAT  (4F 10.3)
```

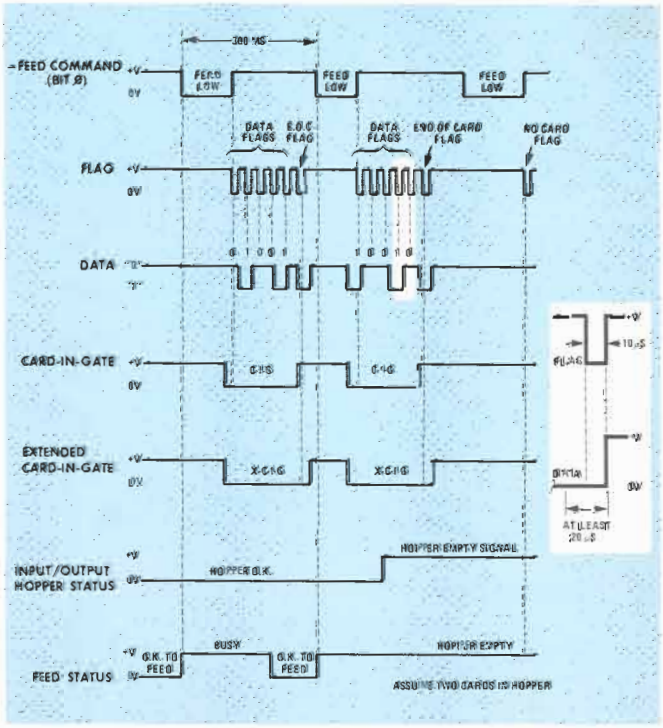
ALGOL PROGRAMMING

```
            READ    (unit, format, list) (1)
            READ    (unit) List (2)
```

EXAMPLE: Read four values for variables A1, A2, A3, A4.

```
FORMAT P1   (4F 10.3)
READ        (5, P, A1, A2, A3, A4)
```


COMPUTER
INTERFACE CARD LOGIC
READER ③
OUTPUT DATA (16-BITS)
BIT 15
BIT 0
OUTPUT DATA REGISTER
BIT 15
BIT 2
BITS 2 THROUGH 15 NOT USED
BIT 1
CONTROL
BIT 0
FEED COMMAND
I/O OUT
I/O IN
BUSY
COUPLER
FLAG (DATA READ)
STORE
INPUT DATA (16-BITS)
BIT 15
BIT 0
16-BIT DATA REGISTER
BIT 15
CARD-IN-GATE
BIT 14
EXTENDED CARD-IN-GATE
BIT 13
INPUT/OUTPUT HOPPERS OK
BIT 12
FEED STATUS
BIT 11
BIT 0
DATA READ FROM ROWS 1 THROUGH 9, 10(0), 11(X), 12(R)
SET FLAG
ENCODE COMMAND
CONTROL FF
CLEAR CONTROL
FLAG FF
IRQ FF
CLEAR FLAG
SKIP IF FLAG CLEAR
SKIP FLAG ①
SKIP IF FLAG SET
FLAG
PRIORITY OUTPUT
PRIORITY INPUT
INTERRUPT ACKNOWLEDGED
INTERRUPT REQUEST ②
① 'Skip Flag' signals readiness for next operation when the system I/O Optical Mark Reader driver subroutine is being used.
② 'Interrupt Request' signals readiness for next operation when the basic control system Optical Mark Reader driver sub-routine is being used.
③ Reader "Feed Command" (not shown) is connected to Reader signal ground.


300 MS
FEED COMMAND (BIT 8)
+V
0V
FEED LOW
FEED LOW
FEED LOW
DATA FLAGS
E.O.C FLAG
DATA FLAGS
END OF CARD FLAG
NO CARD FLAG
FLAG
DATA
CARD-IN-GATE
EXTENDED CARD-IN-GATE
INPUT/OUTPUT HOPPER STATUS
HOPPER O.K.
HOPPER EMPTY SIGNAL
FEED STATUS
O.K. TO FEED
BUSY
O.K. TO FEED
HOPPER EMPTY
ASSUME TWO CARDS IN HOPPER
10 µS
AT LEAST 20 µS

SPECIFICATIONS

CARD DIMENSIONS
Standard 3-1/4 by 7-3/8 inch tab cards.

DATA RATE
200 cards per minute externally controlled, or 250 cards per minute when operated at the internal read rate. Maximum of 80 marked or punched columns per card, exact requirements being determined by computer software. 80 column cards; 455 char/sec ±10%, 40 column cards; 227 char/sec ±10%.

CARD TIMING
Minimum interval feed command to first data; 90 +40 −10 msec.

Card Reading Time; 190 ± 10 msec.

Time between cards; feed control, 90 −10 +40 msec, no control, 50 ±25 msec.

HOPPER CAPACITIES
Input hopper for 300 cards. Output hopper capacity of 300 cards.

INTERFACE CONNECTOR
Cinch or Cannon DBM-25S on rear panel. Pin assignments and logic levels are summarized below.

PIN	SIGNAL	TRUE	FALSE
1-12	Data Outputs; rows R (12), X(11), 0(10), and 1-9.	+0.5V①	Open to +V②
13	Card-in-Gate (C-I-G)	+0.5V	Open to +V
14	+5V test		
15	+17V test		
16	Not busy (Feed Status)	+0.5V	Open to +V
17	+Feed Command in	Open to +V	+0.5V
18	Not used		
19	On-Line (Control)	Open to +V	+0.5V
20	−Feed Command in	+0.5V	Open to +V
21	Input/Output Hoppers OK	+0.5V	Open to +V
22	Extended card-in-gate (X-C-I-G)	+0.5V	Open to +V
23	Flag	+0.5V	Open to +V
24	Signal Ground		
25	Signal Ground		

① 12 mA maximum current. (Up to 25 mA maximum for 10° to 40°C operating temperatures.)
② +20V maximum, impedance determined by external circuit.

ENVIRONMENTAL CONDITIONS
Operating temperatures: 0° to 55°C (32° to 131°F)
Relative humidity: 95% at 40°C (not applicable to cards)
Storage temperatures: −40° to +75°C (−40° to +167°F)

INPUT POWER REQUIRED
115V ±10%, 60 Hz ±5%, 130W or 230V ±10%, 50 Hz ±5%, 130W, single phase.

WEIGHT
Net: 28 lb (12,7 kg); shipping: 37 lb (16,8 kg)

FINISH
Baked suede enamel. Beige covers and dark brown base is standard. Other color combinations are available on special order.

DIMENSIONS
Reader is fully-enclosed for desk-top use. 12-3/4 inches (324 mm) wide by 20 inches deep (508 mm) including cable clearances, and 9-1/4 inches (235 mm) high.

ACCESSORIES FURNISHED
Power cord, 7-1/2 feet, HP Part No. 8120-0078.
Kit of sample data entry cards, HP Part No. 02760-9054.
Test Card, HP Part No. 02760-9067.
Extender board for servicing plug-in circuit boards, Part No. 02760-6013.
Card Feed Weight, HP Part No. 02760-2085.

OPTIONAL ACCESSORIES
HP 12602A Interface Kit for Optical Mark Reader use with an HP computer. Consists of:
- Duplex Register Interface Card, HP Part No. 12554-60023 (Positive in/Positive out logic).
- Interconnecting Cable, HP Part No. 12602-6002.
- BCS Optical Mark Reader Driver Tape.
- SIO Optical Mark Reader Driver Tape.
- Optical Mark Reader Diagnostic; consists of binary diagnostic tape plus corresponding diagnostic card deck.

PRICE

Model 2761A-07 Optical Mark Reader (115V, 60 Hz)	$2750.00
Model 2761A-08 Optical Mark Reader (230V, 50 Hz)	$2900.00
Model 12602A Interface Kit for reader use with an HP Computer	$ 950.00

FOR ADDITIONAL INFORMATION SEE THE DATA SHEETS FOR THE HP 2760A AND 2761A OPTICAL MARK READERS AND THE HP 2760A AND 2761A TAB CARD SPECIFICATIONS.

HEWLETT PACKARD

For more information, call your local HP Sales Office or East (201) 265-5000 • Midwest (312) 677-0400 • South (404) 436-6181
West (213) 877-1282. Or, write: Hewlett-Packard, 1501 Page Mill Road, Palo Alto, California 94303. In Europe, 1217 Meyrin-Geneva, Switzerland

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