APPLICATION		REVISIONS			
NEXT ASSY	FINAL ASSY	LTR	DESCRIPTION	DATE	APPROVED
		-	PRODUCTION RELEASE/E.O. 21430	9-30-87	L.F.
		A	E.O. 22351	3-18-88	E.S.
		B	REVISED & REDRAWN/E.O. 25638	8-14-90	L.F.
		C	E.O. 31557	3-14-96	E.M.
		D	E.O. 34143	1-18-98	B.L.

VACUUM FLUORESCENT DISPLAY
2 X 40 CHARACTER SPECIAL

REV	D	C	C	C	C	C	C	C	D	C	C	C												
SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

REVISION STATUS

PROJ. NO. 418

CONTRACT

INDUSTRIAL ELECTRONIC ENGINEERS, INC.
VAN NUYS, CALIFORNIA

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CHECK		

APPROVED
E. Schumacher 3-18-88

APPROVED
L. Feldberg 9-30-87

VACUUM FLUORESCENT DISPLAY
2 X 40 CHARACTER

SIZE	CODE IDENT NO.	
A	**05464**	S03601-86-080

SCALE | SHEET 1 OF 12

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1.0 GENERAL DESCRIPTION

1.1 Introduction

This specification describes the interface requirements and features of a two-line Vacuum Fluorescent Display, 40 characters wide. The characters are formed using a 5x7 dot matrix.

1.2 Application

This unit may be used as a console display which provides alphanumeric information that is easily readable in high ambient light. It is ideal for point-of-sale terminals, office computers, and a wide range of business and industrial equipment.

1.3 Special Features

"Minimum depth"
Low cost
Hardware interrupt

1.4 Description

This Vacuum Fluorescent Display is a self-contained multiplexed unit which provides a simple interface to a microprocessor system.

This unit consists of a vacuum fluorescent display tube and a minimal amount of electronic hardware. Primary complexity is contained within the microprocessor software, which controls all display functions.

A single +5VDC power supply (approximately 480mA typical) is required for operation. Total power is thus about (3.4) watts.

All display characters and standard control codes are in a 7-bit ASCII. All inputs are TTL compatible. No unusual coding or critical timing is required to interface with and operate this display.

A wide spectrum of color filters is available to fit all applications. The characters are bright, but soft, providing comfortable short or long-term viewing.

An ASCII-coded English font employs a modified 96 character set.

Figure 3 depicts the standard ASCII character set as displayed by the 03601-86-080 module.

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2.0 BLOCK DIAGRAM

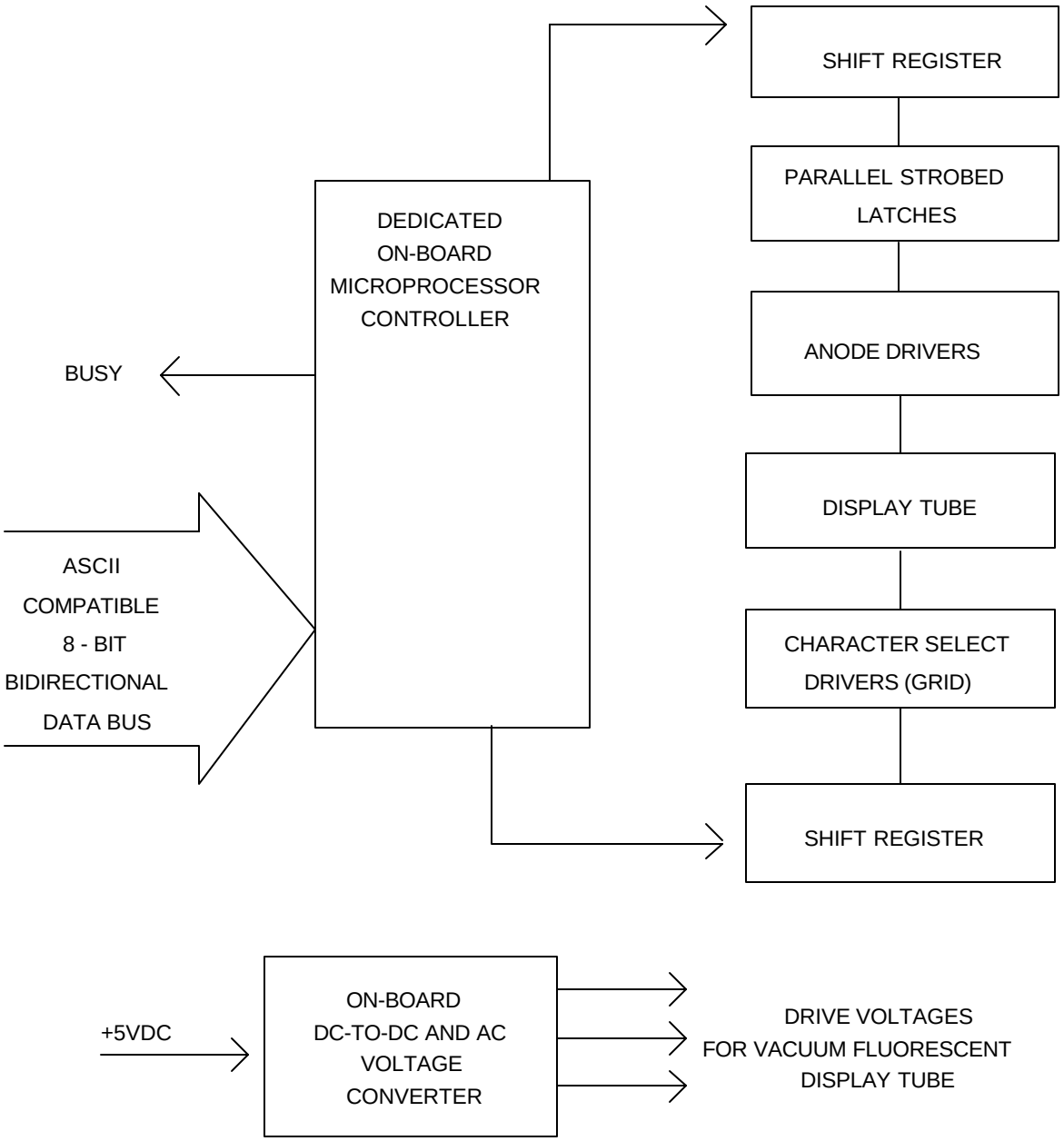

FIGURE 1

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S03601-86-080
	SCALE N/A	REV D	SHEET 4 of 12

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3.0 THEORY OPERATION (Dot Matrix Displays)

The Vacuum Fluorescent Display array consists of three basic electrodes which are enclosed in an evacuated glass chamber. The first electrode is the filament, which spans the entire length of the display, and is made from a small diameter oxide coated tungsten wire. This element is common to all characters and supplies the electron emission needed for operation. Individual grid electrodes are provided, one for each character, to control current passing to the anodes. Each grid is a fine mesh metal screen which provides digit-select electrical control with no visual interference. When the grid is positive with respect to the filament, electrons are allowed to pass on to the third electrode, the anode dots, causing the fluorescent phosphor coating on each positively charged dot to glow. Selectively energizing these fluorescent dots causes the desired character to be displayed.

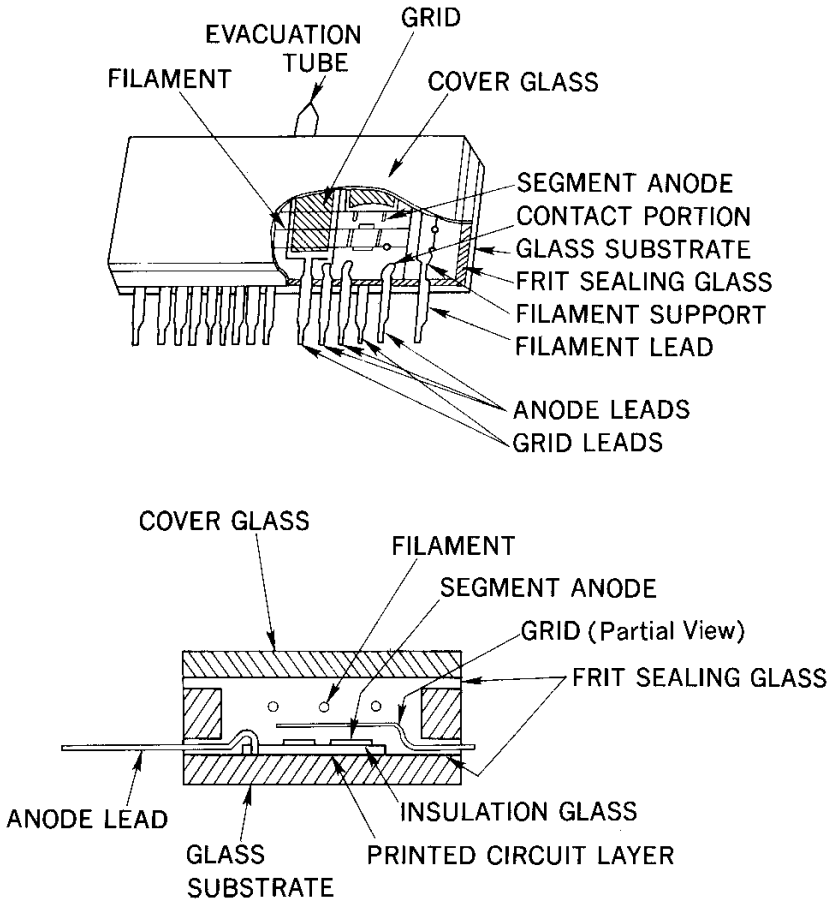

FIGURE 2

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4.0 OPERATION

4.1 Loading ASCII Character Data

All printing characters are located in standard ASCII code locations from 20 (HEX) to 7F (HEX). Control character assignments are as follows.

4.2 Control Codes

NOTE: CARE SHOULD BE TAKEN NOT TO SEND UNDEFINED CONTROL OR COMMAND CODES TO THE FLIP DISPLAY MODULE AS THIS MAY CAUSE A SOFTWARE MALFUNCTION OF THE MODULE.

DATA (HEX)		DESCRIPTION
08		BACK SPACE CURSOR LOCATION ONE POSITION
09		ADVANCE CURSOR LOCATION ONE POSITION
0A		LINE FEED (vertical scroll from bottom line; cursor positions to the left-most grid).
0D		CARRIAGE RETURN (returns cursor to left-most character position of the same line; does not clear display).
0E	+	MAKE CURSOR INDICATOR INVISIBLE (the cursor location counter continues to function but there is no visible indicator of next location).
0F		MAKE CURSOR INDICATOR VISIBLE (Flashing “rubout character”, 7F hex).
15	+	DISPLAY CLEAR (returns cursor to upper left-most position of multi-line displays).
16	+	CURSOR HOME (returns cursor to upper left-most position of multi-line displays).

+ Display automatically defaults to these conditions after power-up.

4.2.1 Cursor Positioning Instruction

DATA (b_7-b_0)	DESCRIPTION
1B HEX (0001 1011)	MOVE CURSOR TO FOLLOWING POSITION (2 byte instruction to locate cursor)
XXXX XXXX	*SECOND BYTE (Location in binary - upper left most location is zero)

* For numbers greater than 4F Hex, cursor location will remain unchanged.

4.3 Reading Data and Status Information

Busy status is available on J1-1. This signal may be used as a hardware interrupt for the host processor when the display is busy.

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4.4 Character Chart (5x7 Dot Matrix)

FIGURE 3

Note: N/A = Non-Applicable

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4.5 Alternate Character Codes

Not available at this time.

4.6 External Font Loading

Not available at this time.

4.7 Execution Times (Maximum)

Character entry:	270µS	
Line feed:		525µS
Display clear:		445µS
Reset power-up:	500mS	
Other control codes:		275µS

4.8 Dedicated Hardware Lines

See section 4.3.

4.9 Serial Data and Self-Test

Not available at this time.

4.10 Connector Pin Assignments

J1 (POWER & DATA)

PIN NO.	FUNCTION
J1-1	BUSY
J1-2	WRITE STROBE
J1-3	D_7 (MSB)
J1-4	D_6
J1-5	D_5
J1-6	D_4
J1-7	D_3
J1-8	D_2
J1-9	D_1
J1-10	D_0 (LSB)
J1-11	+5V @ 480mA (TYP.)
J1-12	GROUND (COMMON)

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4.10 Connector Pin Assignments (Cont'd)

CMOS Note: Care must be taken to insure that input signals do not exceed the supply voltage or ground levels. Data cables must be as short as possible to reduce signal overshoots.

5.0 ELECTRICAL CHARACTERISTICS

5.1 Power ON / OFF Sequence

There are no deleterious effects associated with power ON and OFF of this display; however, rapid ON/OFF sequencing is not recommended. The power/data connector should not be connected/disconnected while power is applied.

CAUTION: Do not apply data or strobe signals unless logic power is also applied; otherwise, the input circuits may be damaged.

Because of the power-up cycle within the microprocessor, rise time of the power supply should be less than 100mS. The display module is not ready to accept data for 500mS

5.2 Interface Signals

All logic signals abide by the following convention: logic "1" is a high, logic "0" is a low.

Input Levels:	Output Levels:
Logic 1 > 2.4VDC @ 1µA	Logic 1 > 3.5VDC @ 150µA
Logic 0 < 0.5VDC @ 1.6mA	Logic 0 < 0.5VDC @ 4mA

All parallel interface lines are internally pulled up using 10K resistors connected to the +5V supply.

5.3 Absolute Maximum Ratings

Primary voltage: +5.5VDC
Logic range: -0.5VDC thru +5.5VDC

5.4 Normal Operating Ratings

Primary voltage: +5.0 ± 0.25VDC

Default Condition - Current Required (at 5.0VDC):

Preproduction	Production	
670mA Max.	620mA Max.	(Screen filled with "@" character)
665mA Typ.	615mA Typ.	(Screen filled with "H" character)
590mA Min.	540mA Min.	(Screen clear)

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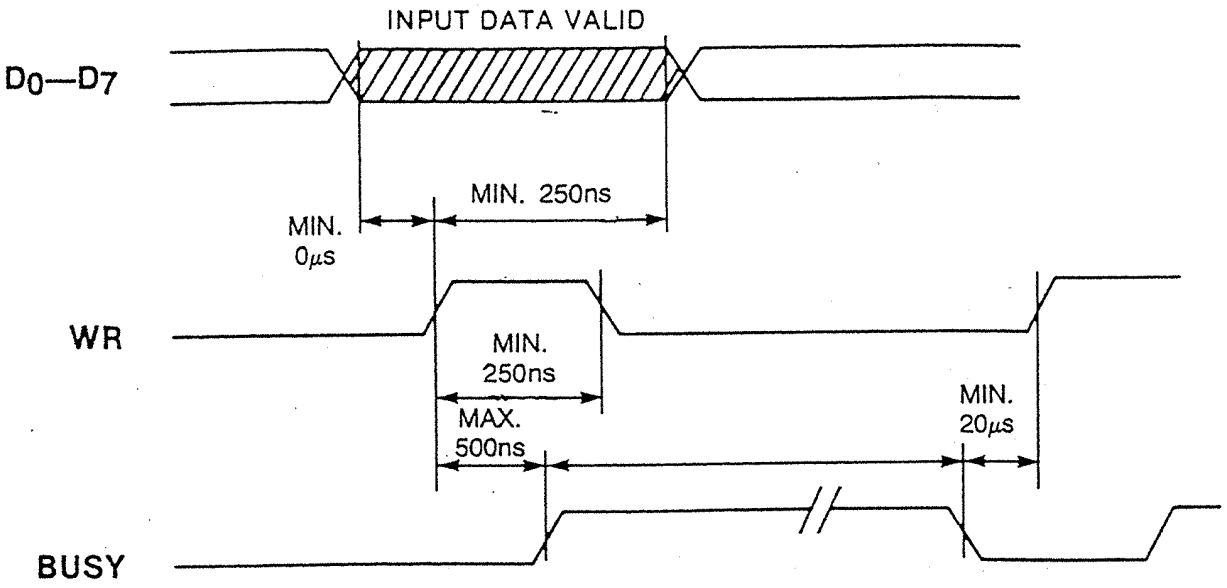
5.5 Timing Characteristics And Timing Diagrams

DATA WRITE TIMING



6.0 OPTICAL CHARACTERISTICS

Format:	2 line of 40 characters
Character height:	0.183 in. (4.65mm)
Character width:	0.10 in. (2.55mm)
Character spacing:	0.167 in. (4.25mm) center-to-center
Character design:	5 x 7 dot matrix
Type of cursor indicator:	Block
Character sets:	96-character U.S. ASCII-7
Color:	Blue-green, peak at 5000 Angstroms
Viewing angle:	150 degrees
Brightness: (22°C)	100 fL (min), 200 fL (typ)
Projected life at rated operating conditions:	40,000 to 100,000 hours*

*Note: End of useful life is defined as the point when the display tube light output has decreased to half its initial minimum rated brightness. This life rating is based on use with random text messages. To obtain maximum life, users are encouraged to avoid fixed messages and to blank or clear the display when it is not in use.

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7.0 ENVIRONMENTAL CHARACTERISTICS

Operating temperature:	0 to +55 (°C) +32 to +131 (°F)
Storage temperature:	-20 to +70 (°C) -4 to +158 (°F)
Relative humidity:	0 to 95% (non-condensing)
Vibration:	10 to 50 Hz 2mm peak-to-peak (3 axis)
Shock:	20 G (3 axis)
Weight:	6.3 ounces (177 grams)

8.0 **ACCESSORIES**

Cables	**Part Number**	**Qty Required**
Data and Power	28736-XX*	1

Filters	**31939-XX**
Gray	-01
Blue	-02
Aqua	-04
Neon Yellow-Orange	-05
Green	-07
Neutral Gray CP	-09
Yellow CP	-10

Connectors	**Mates With:**
Data and Power	Molex 5046-12

* XX-Length in inches: -99 omits cables

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9.0 **OUTLINE AND INSTALLATION DRAWING**

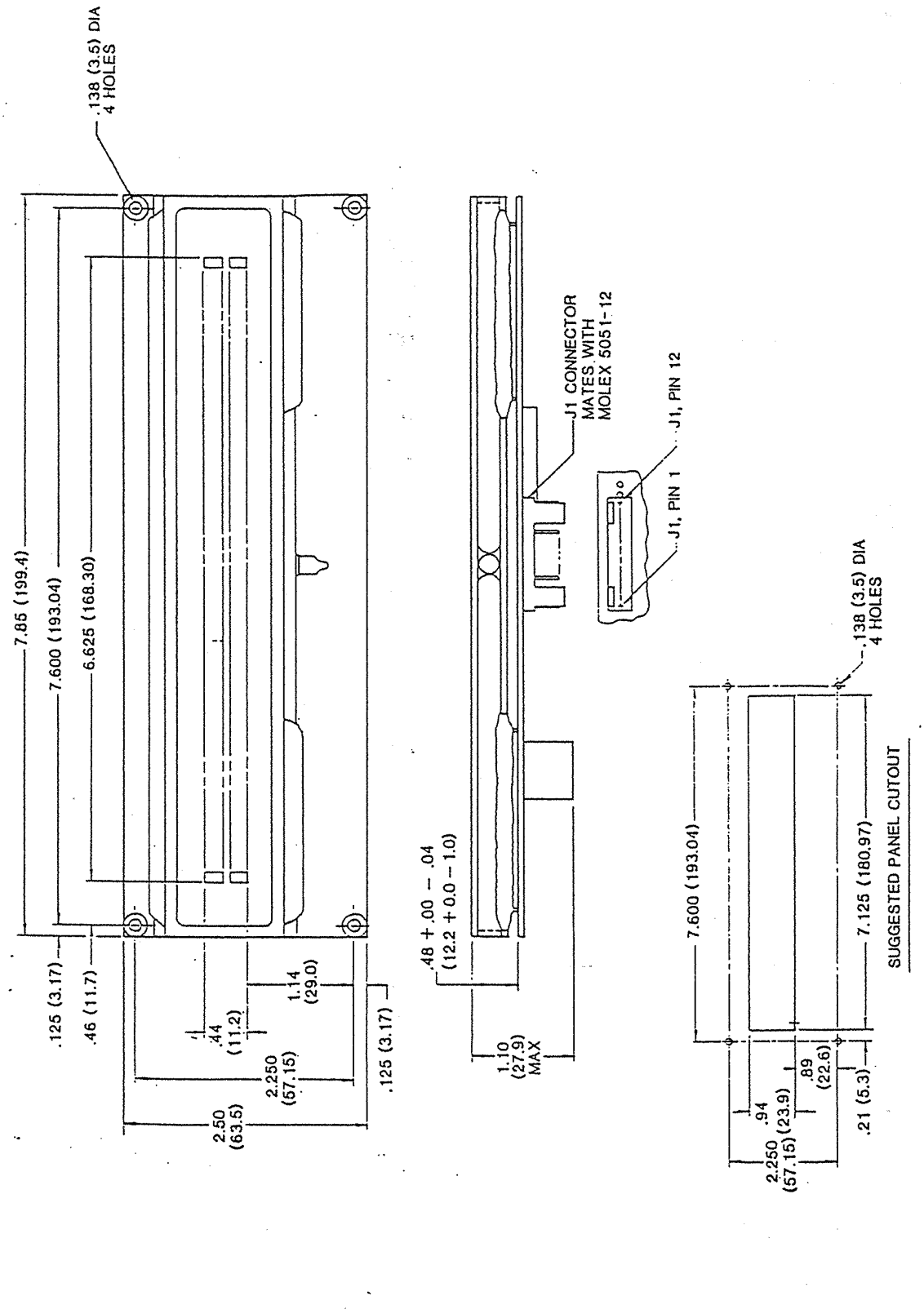

FIGURE 4

TOLERANCES:
.XX = ± .03 (0.8)
.XXX = ± .010(0.25)
Dimensions in inches (mm)

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