


APPLICATION		REVISIONS				
NEXT ASSY	FINAL ASSY	LTR	DESCRIPTION	DATE	APPROVED	
		—	Initial Release. E.O. 30328	94-07-26	B. Lo	
		A	Correct typos \ E.O. 30353	94-08-05	M. Englehart	
		B	Change Cable Part No. \ E.O. 30367	94-08-15	B. Lo	
		C	Add -106 & -151 to Tables and Outlines, Revise Section 4, Correct Typo Sht. 40 \ E.O. 31107	95-07-31	M. Englehart	
		D	Change -105 Current Ratings on Sht. 16 \ E.O. 31186	95-11-15	B. Lo	
		E	Add -120, -121, -130, -134 & -160 to Tables and Outlines, Revise Section 4.4 Sht 29 \ E.O. 32196	96-11-7	B. Lo	
		F	Correct -105 Outline Dimensions \ E.O. 32330	96-12-4	B. Lo	
		G	E.O. 32796	97-4-14	B. Lo	
		H	E.O. 33653	98-4-3	B. Lo	
		J	E.O. 34249	99-3-15	B. Lo	
		K	E.O. 34831	99-11-23	B. Lo	
		L	E.O. 34854	00-01-24	B. Lo	
		M	E.O. 35324	00-05-30	B. Lo	
		N	E.O. 35373	6-27-00	B. Lo	

REV	M	G																						
SHEET	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
REV	G	G	G	G	G	G	G	G	G	G	L	G	G	G	G	G	G	G	G	G	N	J	G	
SHEET	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
REV	N	N	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	H	H	G	G	G	G	
SHEET	CV R	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23

REVISION STATUS

PROJ. NO. 346	CONTRACT	 INDUSTRIAL ELECTRONIC ENGINEERS, INC. VAN NUYS, CALIFORNIA	
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	APPROVED B. Lo / 94-07-26	SIZE A	CODE IDENT NO. 05464
	APPROVED	SCALE None	SHEET 1 OF 49
	APPROVED		



PRODUCT SPECIFICATION

Century Series Flip

Dot Matrix ASCII VFD Modules

TABLE OF CONTENTS

<u>LIST OF ILLUSTRATIONS</u>	3
<u>LIST OF TABLES</u>	4
<u>DEFINITIONS AND CONVENTIONS</u>	5
1.0 <u>SCOPE</u>	6
2.0 <u>APPLICABLE DOCUMENTS</u>	6
3.0 <u>CHARACTERISTICS</u>	6
3.1 <u>GENERAL</u>	6
3.1.1 Environment	6
3.1.2 Useful Life	6
3.1.3 Display Functions	6
3.1.4 Size and Weight	10
3.1.5 Character Cell Features	10
3.1.6 Character Font Data	11
3.2 <u>INTERFACES</u>	17
3.2.1 Power Interface	17
3.2.2 Data Interface	18
3.2.2.1 Serial	18
3.2.2.2 Parallel	18
3.2.3 Personality Interface	18
3.2.4 Power/Data Connector	19
3.3 <u>PERFORMANCE CHARACTERISTICS</u>	21
4.0 <u>PROGRAMMING CODES</u>	25
4.1 <u>NUMERIC ORDER CONTROL CODES</u>	25
4.2 <u>CURSOR CONTROL CODES</u>	27
4.3 <u>DATA DISPLAY MODE CODES</u>	28
4.4 <u>PREPARE TO READ CODES</u>	30
4.5 <u>SCREEN CONTROL CODES</u>	31
4.6 <u>MISCELLANEOUS CODES</u>	33
4.7 <u>LCD MODE CONTROL CODES (WITHOUT INTERFACE CONVERTER)</u>	35
4.8 <u>UNSUPPORTED LCD CONTROL CODES (WITHOUT INTERFACE CONVERTER)</u>	35
4.9 <u>LCD MODE CONTROL CODES (WITH INTERFACE CONVERTER)</u>	36
4.10 <u>UNSUPPORTED LCD CONTROL CODES (WITH INTERFACE CONVERTER)</u>	36
5.0 <u>OPTIONS AND ACCESSORIES</u>	37
5.1 <u>PERFORMANCE OPTIONS</u>	37
5.2 <u>ACCESSORIES</u>	37
6.0 <u>OUTLINE DRAWINGS</u>	38

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX	
	SCALE	N/A	REV N	SHEET 2 of 49

LIST OF ILLUSTRATIONS

<u>Figure</u>	<u>Description</u>	<u>Page</u>
3-1	Functional Block Diagram, Intel Mode	7
3-2	Functional Block Diagram, Motorola Mode	8
3-3	Functional Block Diagram, LCD Mode	9
3-4	ASCII Character Set	12
3-5	Cyrillic Character Set	13
3-6	European Character Set	14
3-7	Hebrew Character Set	15
3-8	Katakana Character Set	15
3-9	LCD (Hitachi) Character Set	16
3-10	Personality Jumper Positions	19
3-11	J1 Contact Arrangement	19
3-12	Timing Characteristics, Intel Mode	22
3-13	Timing Characteristics, Motorola Mode	23
3-14	Timing Characteristics, LCD Mode	24
6-1	Outline Drawing, 036X2-100-05420	39
6-2	Outline Drawing, 036X2-105-05220	40
6-3	Outline Drawing, 036X2-106-04240	41
6-4	Outline Drawing, 036X2-120-09120	41
6-5	Outline Drawing, 036X2-121-11120	42
6-6	Outline Drawing, 036X2-122-09220	44
6-7	Outline Drawing, 036X2-124-09420	45
6-8	Outline Drawing, 036X2-130-11220	45
6-9	Outline Drawing, 036X2-134-11420	46
6-10	Outline Drawing, 036X2-151-05240	48
6-11	Outline Drawing, 036X2-160-05440	48

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX	
	SCALE	N/A	REV N	SHEET 3 of 49

LIST OF TABLES

<u>Table</u>	<u>Description</u>	<u>Page</u>
3-1	Physical Dimensions	10
3-2	Display Character Fonts	11
3-3	Display Supply Current	17
3-4	Connector Pin Assignments	20
3-5	Execution Times	21
4-1	Dot Data for User Defined Characters	29

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX	
	SCALE N/A	REV N	SHEET 4 of 49	

DEFINITIONS AND CONVENTIONS

Conventions:

- ⇒ First Line, Column, Bit or Position is 0 or 00h.
- ⇒ Control Code names are *italicized*.
- ⇒ Upper case A with subscript from 0 to 7 indicates an address bit from LSB to MSB.
- ⇒ Upper case D with subscript from 0 to 7 indicates a data bit from LSB to MSB.
- ⇒ Counting order is left-to-right, top-to-bottom.
- ⇒ Hexadecimal notation is represented as XXh, where X is a numeric 0 – 9, or alpha A – F.
- ⇒ X = “Don’t Care” or Variable Data

Definitions:

- Attributes Blink or Brightness Level.
- Field A display screen area consisting of one or more characters having attributes set.
- Home First line, first column; display screen position 00h.
- Reset Return display or function to its baseline (default condition).
- Restore Return display or function to a previously established state.

Abbreviations:

A	Amperes	LSB	Least Significant Bit
A _n	Address ‘n’	mA	Milliamperes
AC or ac	Alternating Current	max	Maximum
ASCII	American Standard Code for Information Interchange	min	Minimum
°C	Degrees Centigrade (Celsius)	mm	Millimeters
CG	Character Generator	Mot	Motorola
CG RAM	Character Generator RAM	MSB	Most Significant Bit
CR	Carriage Return	msec	Milliseconds
CS	Chip Select	nsec	Nanoseconds
D _n	Data Bit ‘n’	oz	Ounces
DC or dc	Direct Current	RAM	Random Access Memory
DD RAM	Data Display RAM	RD	Read
E	Enable	RS	Register Select
EIA	Electronic Industries Association	RST	Reset
ft-L	Foot-Lamberts	μA	Microamps
g	Gravitational Units	μF	Microfarads
Hz	Hertz (Cycles per Second)	μsec	Microseconds
ID	Identity or Identification	UDC	User Defined Character
I/O	Input/Output	V	Volts
LCD	Liquid Crystal Display	VFD	Vacuum Fluorescent Display
LF	Line Feed	WR	Write

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX	
	SCALE	N/A	REV	N
			SHEET	5 of 49

1.0 **SCOPE**

This document describes the complete performance and interface characteristics of the dot matrix family of Century Series Vacuum Fluorescent Displays (VFD). For the remainder of this document, the Century Series VFDs are referred to as the display.

2.0 **APPLICABLE DOCUMENTS**

The following documents form a part of this specification to the extent specified herein.

EIA-232 Interface Between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange

3.0 **CHARACTERISTICS**

3.1 **General**

The following sections describe the basic or "Standard" Century Series Dot Matrix VFD. For a complete list of options and accessories, see Paragraph 5.0.

3.1.1 **Environment**

The display will operate properly following exposure to any combination of the listed environmental conditions:

Storage Temperature	-50°C to +85°C	
Operating Temperature	-20°C to +70°C (Normal)	-40°C to +85°C (Wide)
Relative Humidity	0 to 90% (Non-condensing)	
Vibration	10 to 500 Hz, 2 mm Peak-to-Peak (any axis)	
Shock	20 g (any axis)	

3.1.2 **Useful Life**

The useful life of the displays ranges from 40,000 to 100,000 hours.

NOTE

Useful life for a vacuum fluorescent tube is defined as the period over which the light output decreases to half of its specified initial minimum brightness. Maximum useful life is achieved by display of random text messages. Users are encouraged to avoid fixed messages wherever possible, and to clear or blank the display when not in use. A screen saver mode is provided.

3.1.3 **Display Functions**

The dot matrix family of Century Series VFDs is able to simulate Intel 8041/42 series, Motorola 6821 and Hitachi 44780 interface characteristics as specified herein.

Critical interface lines are shown in the functional block diagrams, Figures 3-1, 3-2 and 3-3.

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX	
	SCALE	N/A	REV N	SHEET 6 of 49

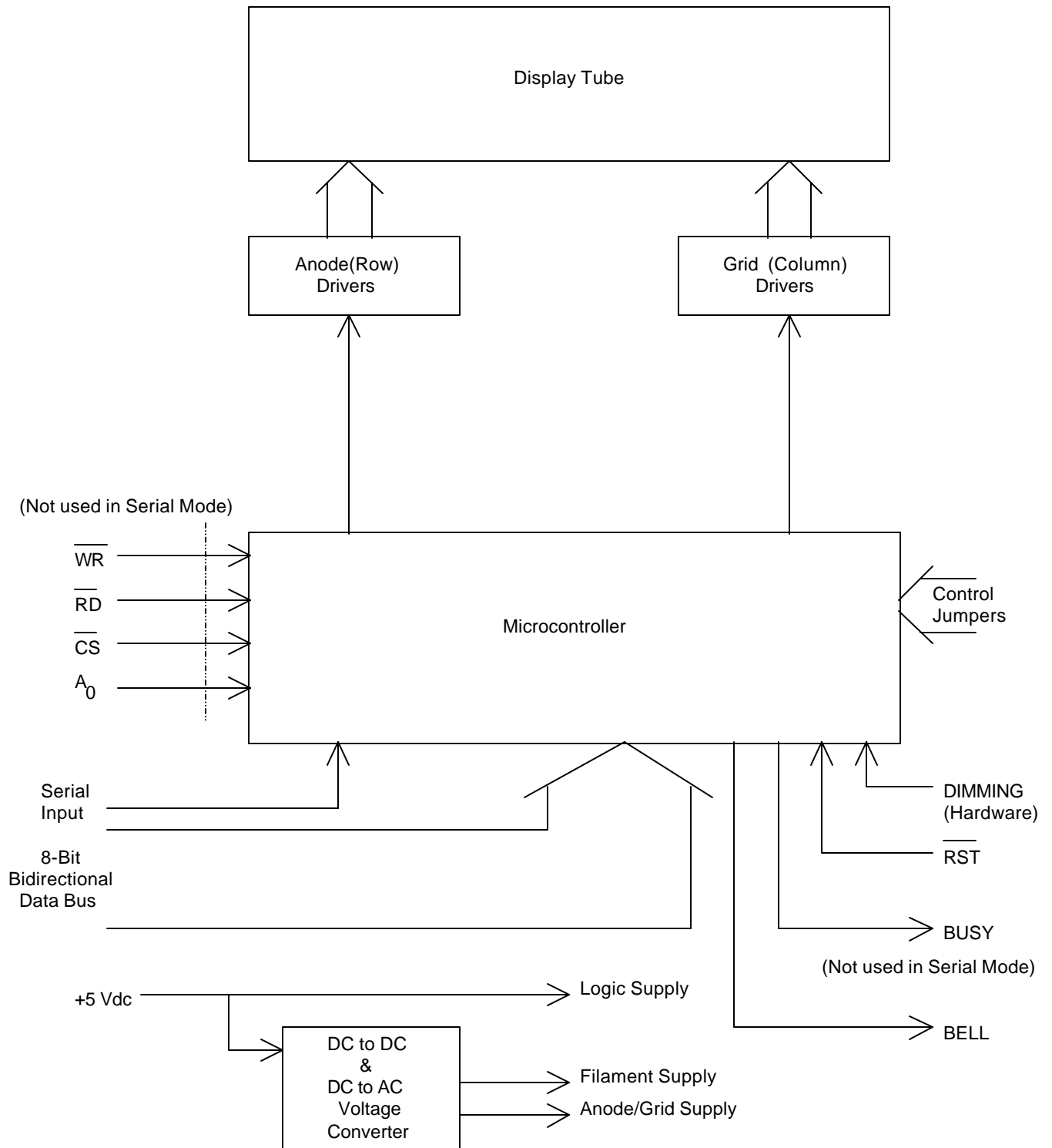


Figure 3-1

Functional Block Diagram, Intel Mode

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX
	SCALE	N/A	REV N
		SHEET	7 of 49

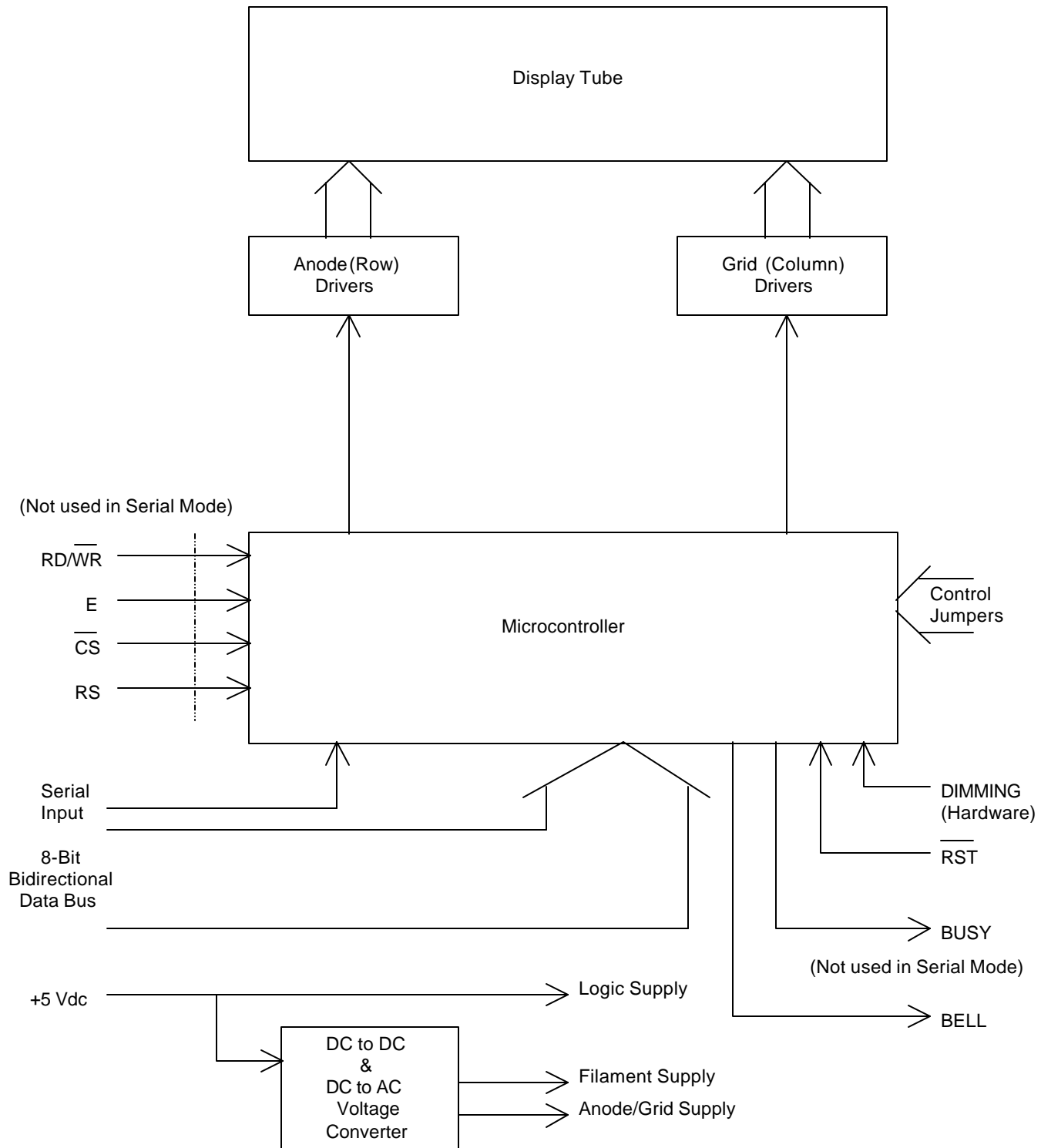


Figure 3-2

Functional Block Diagram, Motorola Mode

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX
	SCALE	N/A	REV N
		SHEET	8 of 49

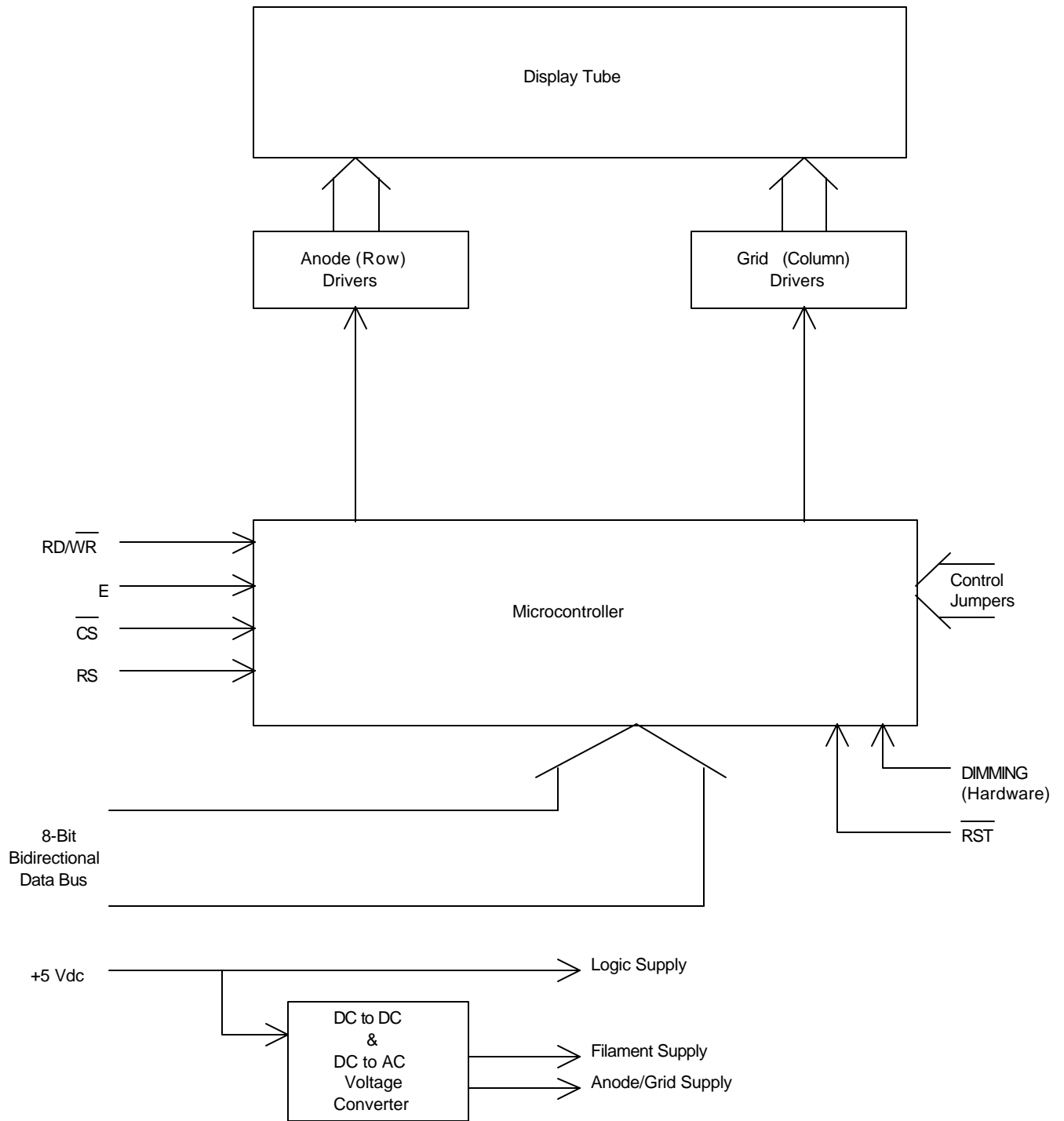


Figure 3-3
Functional Block Diagram, LCD Mode

Note: $\overline{\text{CS}}$ must be grounded when using LCD Mode.

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX
	SCALE	N/A	REV N
		SHEET	9 of 49

3.1.4 Size and Weight

The physical dimensions of the displays vary with the size of the tube. The characteristics shown are for standard configuration display products, some options will affect these data.

Model	Tube Format	Length	Width	Depth	Weight (oz.)
036X2-100-05420	4 X 20	5.00 in.	2.78 in.	0.92 in.	6.5
036X2-105-05220	2 X 20	5.00 in.	2.25 in.	0.88 in.	4.0
036X2-106-04240	2 X 40	7.85 in.	2.10 in.	1.00 in.	5.2
036X2-120-09120	1 X 20	8.05 in.	1.95 in.	0.80 in.	4.6
036X2-121-11120	1 X 20	9.60 in.	2.05 in.	0.86 in.	6.6
036X2-122-09220	2 X 20	7.75 in.	2.58 in.	1.00 in.	7.0
036X2-124-09420	4 X 20	7.75 in.	3.40 in.	1.00 in.	12.5
036X2-130-11220	2 X 20	9.90 in.	2.73 in.	0.95 in.	10.9
036X2-134-11420	4 X 20	9.48 in.	4.00 in.	1.29 in.	15.4
036X2-151-05240	2 X 40	9.50 in.	2.05 in.	1.00 in.	8.0
036X2-160-05440	4 X 40	9.63 in.	2.88 in.	1.03 in.	11.3

Table 3-1
Physical Dimensions

3.1.5 Character Cell Features

Format The display character cells utilize a 5 x 7 dot matrix to produce the available character sets.

Character Sets The displays employ 5 built-in character tables. Four of the tables are for use with the Motorola and Intel modes and the fifth is for use in the Hitachi (LCD) mode.

Motorola/Intel Modes:

Each of the four Motorola/Intel character tables is comprised of the 96 character U.S. ASCII set, a 32 character scientific set, a 19 character set of special characters, a 10 character location for user definable characters and an embedded language specific character set. The embedded character sets occupy the address area between A0h and DFh and include a 64 character European set, a 33 character Cyrillic set, a 63 character Katakana set and a 27 character Hebrew set. The Motorola/Intel character tables are shown in Figures 3-4 through 3-8. Cells shown are exact representations of available characters and their hexadecimal locations. Locations are also shown for UDC's.

Always Present:	
20h – 7Fh	ASCII Character Set.
80h – 9Fh	Scientific Character Set.
E0h – F2h	Special Character Set
F6h – FFh	User Defined Character Locations.
Activated by Control Code:	
A0h – DFh	European Character Set.
A0h – C0h	Cyrillic Character Set.
A0h – DFh	Katakana Character Set.
A0h – BAh	Hebrew Character Set.

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX	
	SCALE	N/A	REV	N
			SHEET	10 of 49

3.1.5 Character Cell Features (Cont.)

Hitachi (LCD) Mode:

The Hitachi (LCD) mode character table also includes the ASCII and scientific character sets and several user definable character locations. The “special charcater set” present in the Motorola/Intel mode is absent, and certain characters from the U.S. ASCII set are different. The address A0h through DFh locations mimic the Katakana character set while address E0h through FFh locations comprise a unique Hitachi set.

The Hitachi (LCD) mode offers 4 UDC's instead of the 10 available in the Motorola/Intel mode. The Hitachi (LCD) character table is shown in Figure 3–9. Cells shown are exact representations of available characters and their hexadecimal locations. Locations are also shown for UDC's.

00h – 03h	User Defined Character Locations.
20h – 7Fh	ASCII Character Set.
80h – 9Fh	Scientific Character Set.
A0h – FFh	Hitachi Character Set.

Cursor Type The displays include a block format cursor indicator.

Color Blue–green, 5000 Angstroms peak.

Brightness Minimum 100 ft–L
 Typical 175 ft–L

3.1.6 Character Font Data

The character font for each model of the dot matrix family of Century Series VFDs is described in the table below.

<u>Model</u>	<u>Tube Format</u>	<u>Character Height</u>	<u>Character Width</u>	<u>Character Pitch</u>
036X2–100–05420	4 X 20	5.00 mm	3.30 mm	4.75 mm
036X2–105–05220	2 X 20	5.05 mm	3.55 mm	4.75 mm
036X2–106–04240	2 X 40	4.70 mm	2.55 mm	4.25 mm
036X2–120–09120	1 X 20	9.00mm	6.30mm	8.30mm
036X2–121–11120	1 X 20	11.30mm	7.25mm	10.90mm
036X2–122–09220	2 X 20	9.20 mm	6.40 mm	5.10 mm
036X2–124–09420	4 X 20	9.10 mm	6.40 mm	8.30 mm
036X2–130–11220	2 X 20	11.30mm	7.25mm	10.90mm
036X2–134–11420	4 X 20	11.30mm	7.25mm	10.25mm
036X2–151–05240	2 X 40	5.00 mm	3.55 mm	4.75 mm
036X2–160–05440	4 X 40	5.00mm	3.30mm	4.9mm

Table 3–2
Display Character Fonts

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2–XXX–XXXXX	
	SCALE N/A	REV N	SHEET 11 of 49	



Figure 3-4

ASCII Character Set
(with Scientific, Specials & UDC's)

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX	
	SCALE	N/A	REV N	SHEET 12 of 49

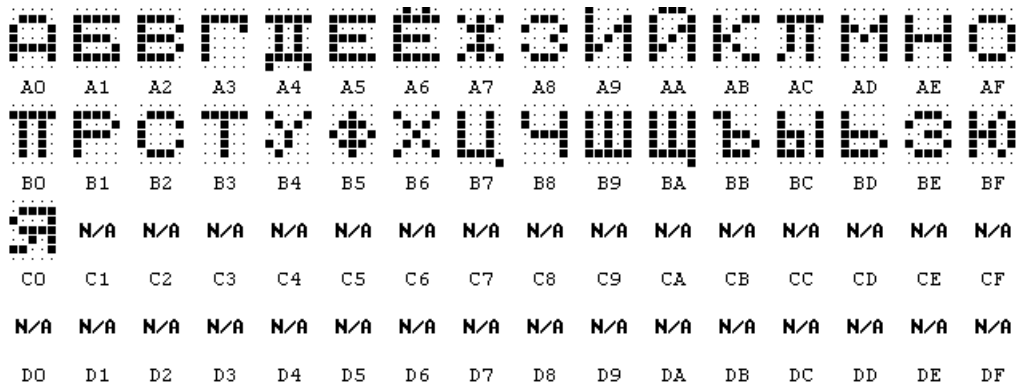


Figure 3-5
Cyrillic Character Set

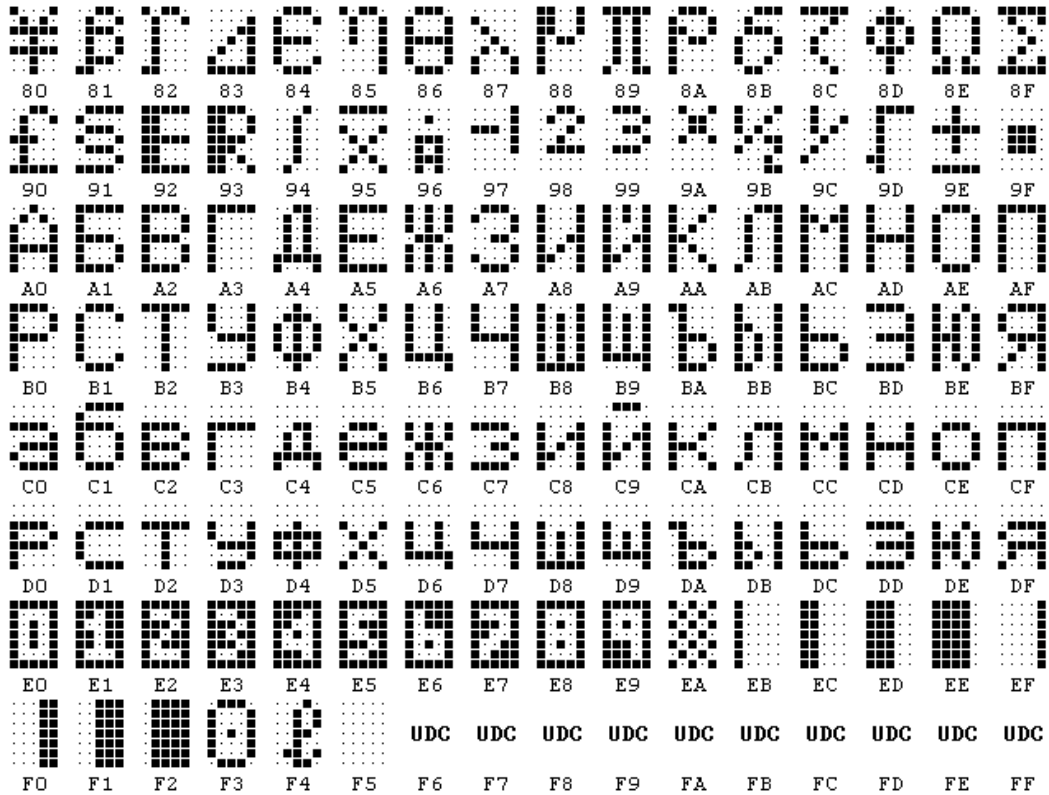


Figure 3-5A
Cyrillic Character Set
(036X2-160-05440 ONLY)

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX
	SCALE	N/A	REV N
		SHEET 13 of 49	

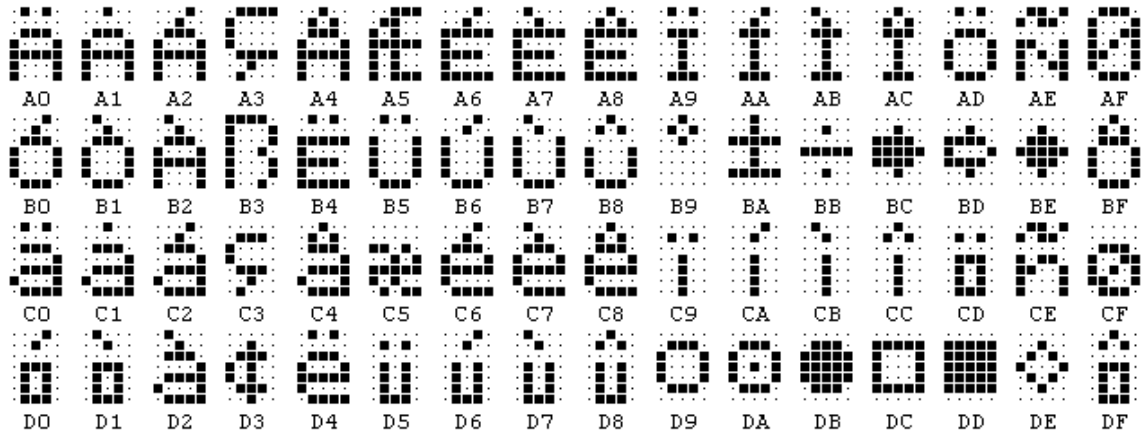


Figure 3-6
European Character Set

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX
	SCALE N/A	REV N	SHEET 14 of 49

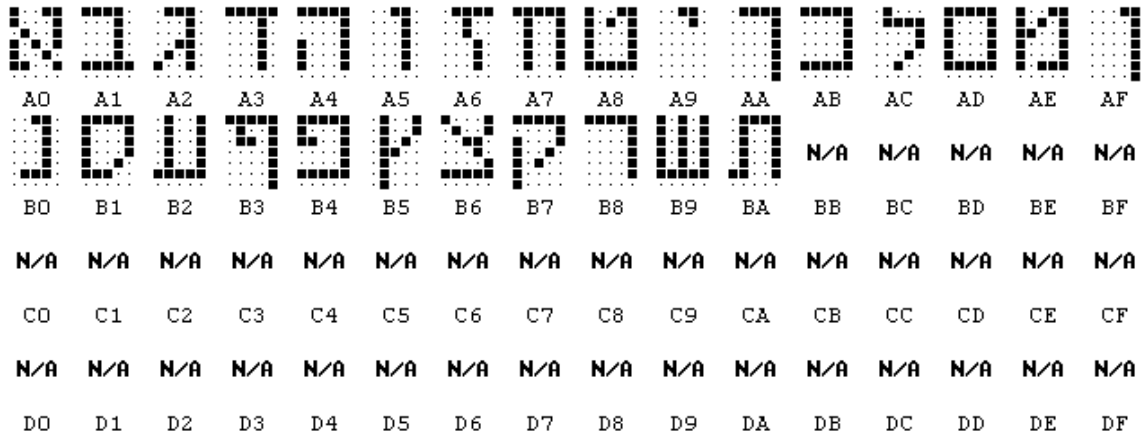


Figure 3-7
Hebrew Character Set

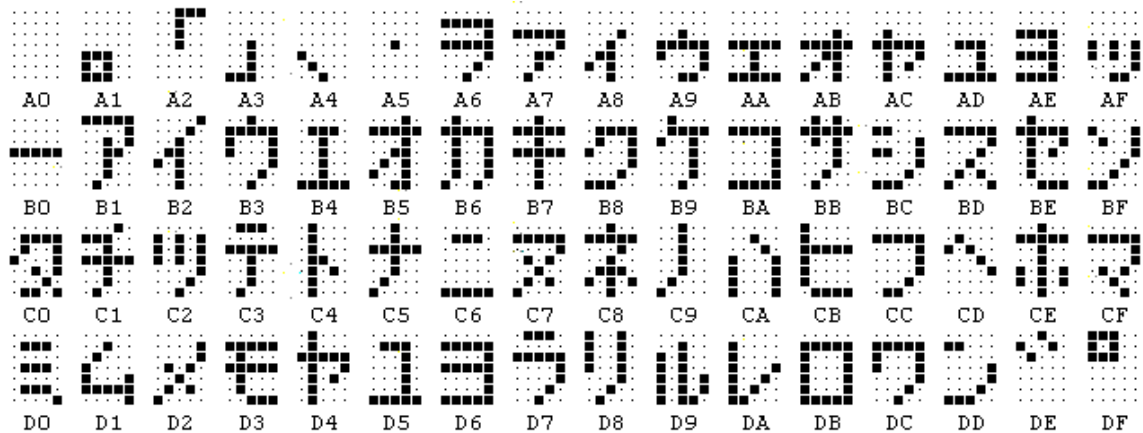


Figure 3-8
Katakana Character Set

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX	
	SCALE	N/A	REV	N
		SHEET		15 of 49



Figure 3-9
Hitachi (LCD) Character Set

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX
	SCALE	N/A	REV N SHEET 16 of 49

3.2 Interfaces

3.2.1 Power Interface

The display power converter is a Constant Power configuration.

Supply Voltage 5 Volts dc \pm 5%.

WARNING

Damage may occur if the supply voltage exceeds 5.5 Volts dc or if data or control signals are applied prior to application of dc power.

Supply Rise Time 100 msec maximum.

Supply Current: Minimum = all dots OFF, 5.25 Vdc; Maximum = all dots ON, 4.75 Vdc

<u>Model</u>	<u>Minimum</u>	<u>Typical</u>	<u>Maximum</u>
036X2-100-05420	650 mA.	770 mA	890 mA.
036X2-105-05220	265 mA	385 mA	510 mA
036X2-106-04240	370 mA	400 mA	450 mA
036X2-120-09120	340mA	450 mA	570 mA
036X2-121-11120	450 mA	500 mA	570 mA
036X2-122-09220	510 mA	590 mA	675 mA
036X2-124-09420	1000 mA	1150 mA	1300 mA
036X2-130-11220	670 mA	890 mA	990 mA
036X2-134-11420	1240mA	1400 mA	1490 mA
036X2-151-05240	625 mA	750 mA	800 mA
036X2-160-05440	1100 mA	1250 mA	1400 mA

Table 3-3
Display Supply Current

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX	
	SCALE	N/A	REV	N
			SHEET	17 of 49

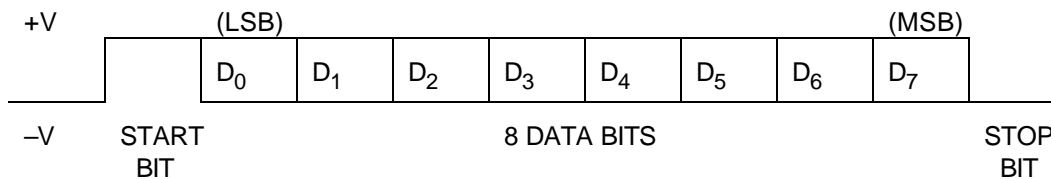
3.2.2 Data Interface

The displays accept either serial or parallel input data and control codes. Internal logic can interface to either Intel and Motorola processors and emulate equivalent Hitachi 44780 LCD features.

3.2.2.1 Serial

Input Levels	High (space/logic 0)	+3 Volts to +15 Volts	(Conforms to EIA-232 specification).
	Low (mark/logic 1)	-3 Volts to -15 Volts.	
Baud Rate	Selectable—1200, 9600 or 19200. Maximum available baud rate depends on execution times. (See Table 3-5)		
Data Word	10 Bits. Eight Data Bits with start bit and 1 stop bit.		
Parity	None		
Error Indicator	If the operating software detects either speed or framing errors during data transmission, each error character received is replaced on the display screen with the symbol # (ASCII 23h).		

Format:

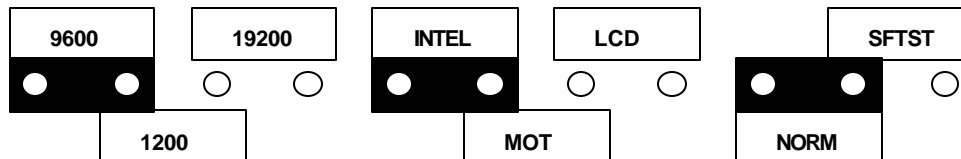


3.2.2.2 Parallel

Input Levels	High	≥ 3.5 Vdc @ 5.0 μ A maximum
	Low	≤ 1.5 Vdc @ 0.5 mA maximum
Output Levels	High	≥ 4.6 Vdc @ 5 mA maximum
	Low	≤ 0.4 Vdc @ 5 mA maximum
Pull-ups	Parallel I/O lines are pulled up to +5 Vdc by internal 10 k Ω resistors.	

3.2.3 Personality Interface

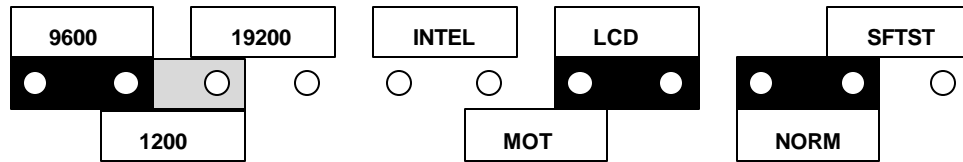
A strip connector on the circuit card allows user selection of Baud Rate, Interface Mode and Start-up Mode. The illustration below matches the appearance of the jumper strip on the circuit card.



Jumpers positions are shown above for the default position. If not installed, the default setting is automatically selected.

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE	CODE IDENT NO.	S036X2-XXX-XXXXX
	A	05464	
	SCALE	N/A	SHEET 18 of 49
		REV	N

3.2.3 Personality Interface (Continued)



Jumper positions are shown above for LCD mode. Filled positions are settings without Interface Converter. Baud rate jumper must be moved to 1200 (hatched) position if an Interface Converter is installed.

Figure 3-10

Personality Jumper Positions

3.2.4 Power/Data Connector

The Power/Data connector (J1) contact arrangement is shown in the illustration below. See Table 3-4 for pin assignments.

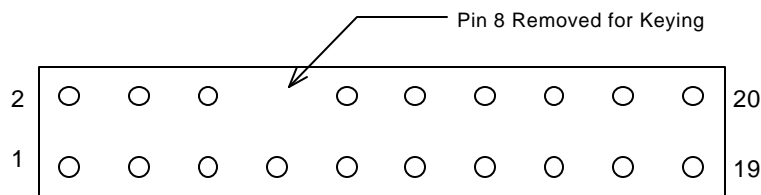


Figure 3-11

J1 Contact Arrangement

The 36X2-134 model has a separate power connector J2 and the pin assignments are:

- J2-1 +5VDC
- J2-2 NC
- J2-3 NC
- J2-4 COMMON (GND)
- J2-5 NC
- J2-6 NC

NOTE

IEE recommends that the user install a keying plug in the mating connector at the Pin 8 location. This will assure that the mating connector is always installed correctly and will avoid damage to the display.

IEE supplied accessory connectors are properly keyed.

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX
	SCALE N/A	REV N	SHEET 19 of 49

Intel Mode

PIN NO.	FUNCTION	MNEM
J1-1	DATA BIT 7 (MSB)	D ₇
J1-2	+5 VDC	
J1-3	DATA BIT 6	D ₆
J1-4	+5 VDC	
J1-5	DATA BIT 5	D ₅
J1-6	COMMON	
J1-7	DATA BIT 4	D ₄
J1-8	REMOVED FOR KEYING	
J1-9	DATA BIT 3	D ₃
J1-10	COMMON	
J1-11	DATA BIT 2	D ₂
J1-12	BUSY	
J1-13	DATA BIT 1	D ₁
J1-14	SERIAL INPUT	
J1-15	DATA BIT 0 (LSB)	D ₀
J1-16	$\overline{\text{RESET}}$	$\overline{\text{RST}}$
J1-17	$\overline{\text{WRITE}}$	$\overline{\text{WR}}$
J1-18	$\overline{\text{CHIP SELECT}}$	$\overline{\text{CS}}$
J1-19	ADDRESS BIT 0	A ₀
J1-20	$\overline{\text{READ}}$	$\overline{\text{RD}}$

Motorola / LCD Mode

PIN NO.	FUNCTION	MNEM
J1-1	DATA BIT 7 (MSB)	D ₇
J1-2	+5 VDC	
J1-3	DATA BIT 6	D ₆
J1-4	+5 VDC	
J1-5	DATA BIT 5	D ₅
J1-6	COMMON	
J1-7	DATA BIT 4	D ₄
J1-8	REMOVED FOR KEYING	
J1-9	DATA BIT 3	D ₃
J1-10	COMMON	
J1-11	DATA BIT 2	D ₂
J1-12	BUSY	
J1-13	DATA BIT 1	D ₁
J1-14	SERIAL INPUT	
J1-15	DATA BIT 0 (LSB)	D ₀
J1-16	$\overline{\text{RESET}}$	$\overline{\text{RST}}$
J1-17	READ/ $\overline{\text{WRITE}}$	RD/ $\overline{\text{WR}}$
J1-18	$\overline{\text{CHIP SELECT}}$	$\overline{\text{CS}}$
J1-19	REGISTER SELECT	RS
J1-20	ENABLE	E

**Table 3-4
Connector Pin Assignments**

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX	
	SCALE	N/A	REV N	SHEET 20 of 49

3.3 Performance Characteristics

Processor Power-up Cycle 500 msec minimum

Part Number	4 X 20 036X2 -100	2 X 20 036X2 -105	2 X 40 036X2 -106	1X20 036X2 -120 -121	2 X 20 036X2 -122 -130	4 X 20 036X2 -124 -134	2 X 40 036X2 -151	4X40 03602 -160
Blink	300	170	176	123	290	470	181	350
Brightness	305	170	175	124	285	465	184	351
Send Character	315	170	171	126	285	460	179	350
Clear	2105	410	715	215	410	1210	746	1726
Cursor Locate	305	170	171	125	285	460	178	352
Home	300	170	171	123	285	460	176	347
Horizontal Scroll	1830	635	1224	755	585	1055	1260	2738
Reset	850	815	802	765	805	1000	780	711
Vertical Scroll	2510	410	901	270	410	1445	901	3504

Table 3-5
Execution Times (in msec)

Brightness Control Software or Hardware. Varies display brightness level in 8 discrete steps.
The Hardware brightness level control sets the upper brightness level limit.
Software control cannot advance brightness level above the hardware set limit.

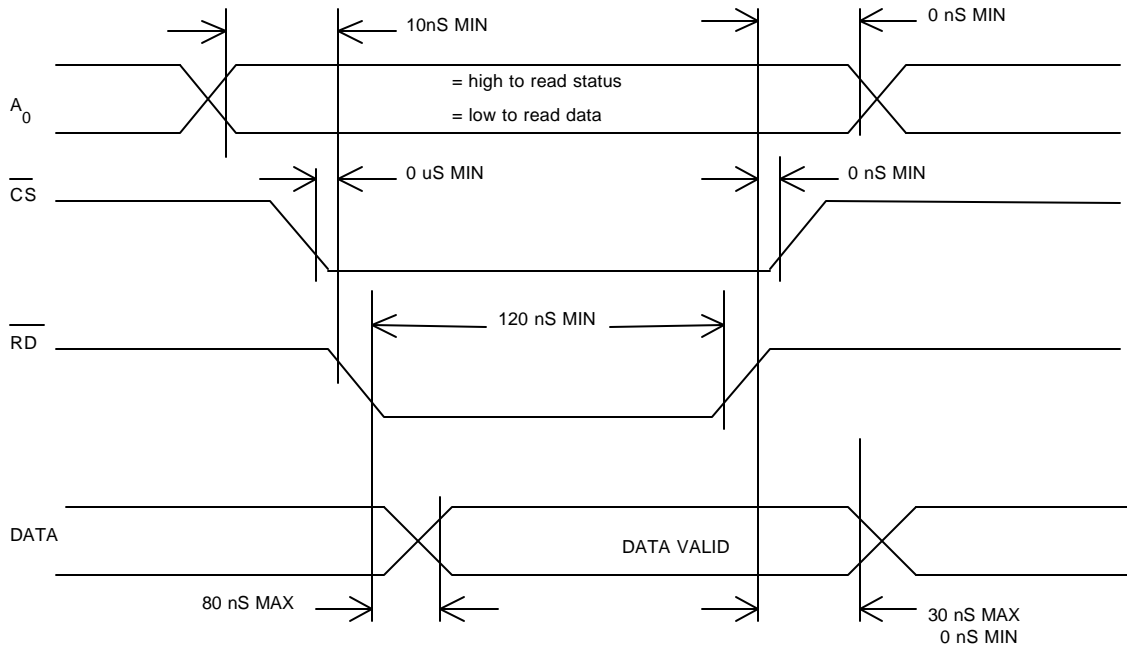
Viewing Angle The displays are readable within a cone of 150°.

Dedicated Interface Lines:

RESET	15 msec (minimum) negative going pulse clears display and initializes processor power-up sequence. (Requires current sink capable of discharging a 4.7 μF internal capacitor and a 10 k Ω resistor to V _{CC} .)
BUSY	High during write or hardware reset. Low when ready for data. (Not used with serial data mode or LCD mode.)
DIMMING	10 kΩ internal pull-up provides hardware brightness level control. (A 100 kΩ potentiometer is recommended.)
BELL	Drive output for audible signalling device. A 160 msec wide output that can sink 0.2 A from a 5.0 Vdc source.

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX	
	SCALE	N/A	REV N	SHEET 21 of 49

Read Timing



Write Timing

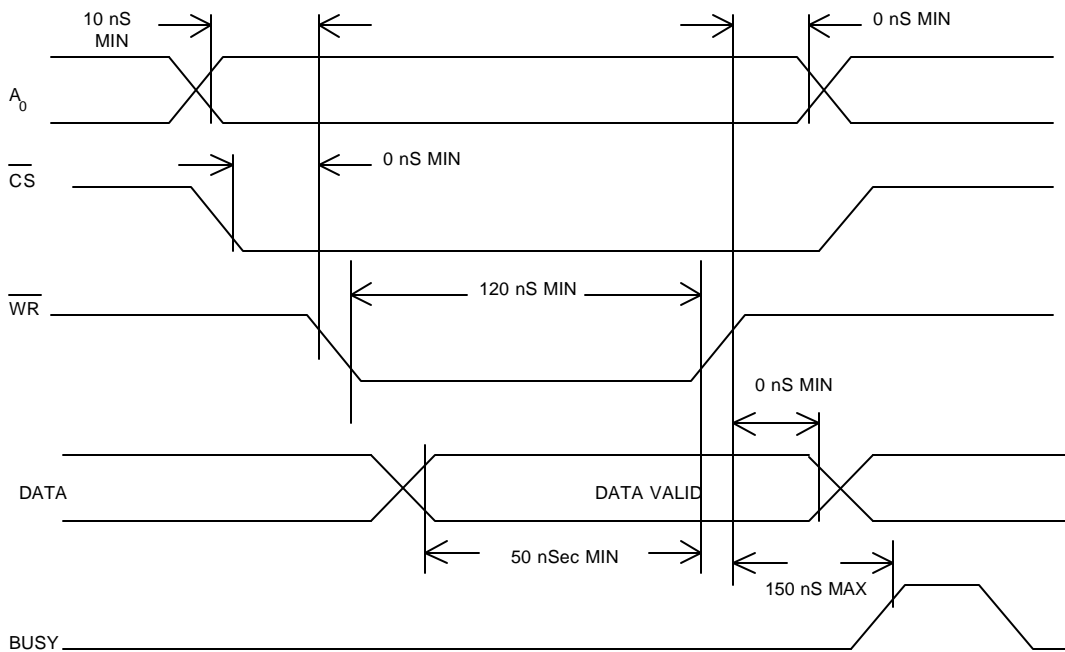


Figure 3-12

Timing Characteristics, Intel Mode

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX
	SCALE	N/A	REV N
		SHEET	22 of 49

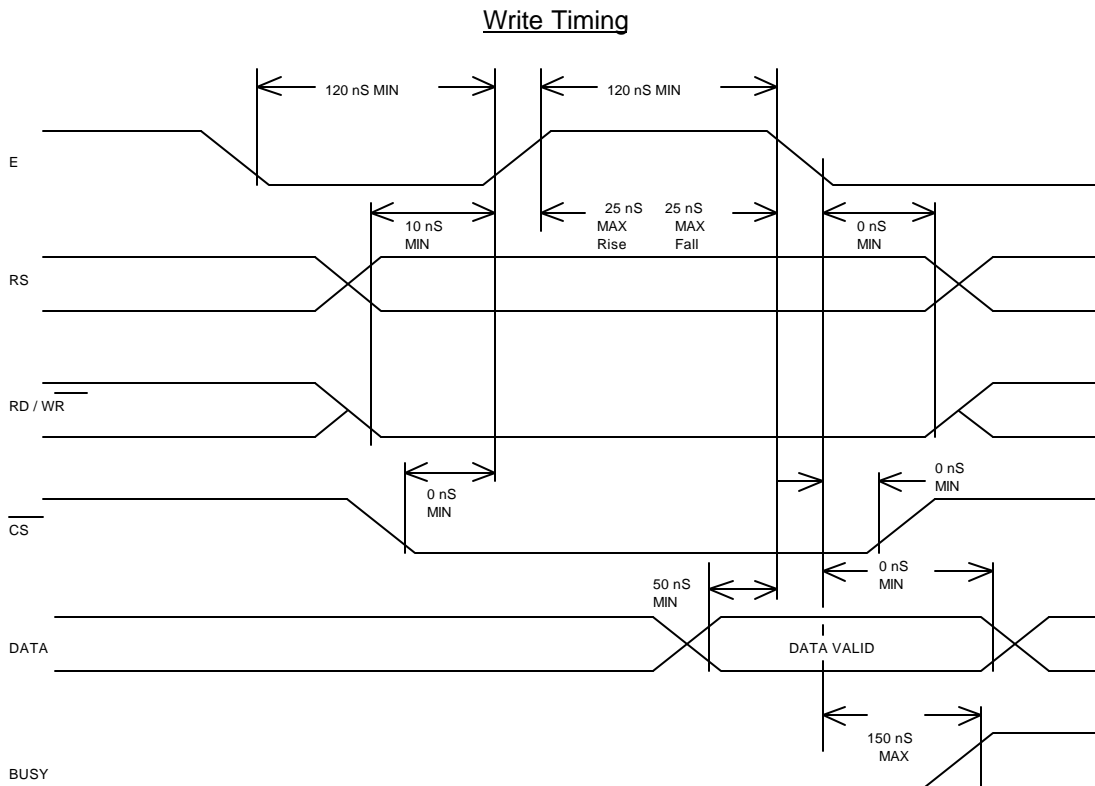
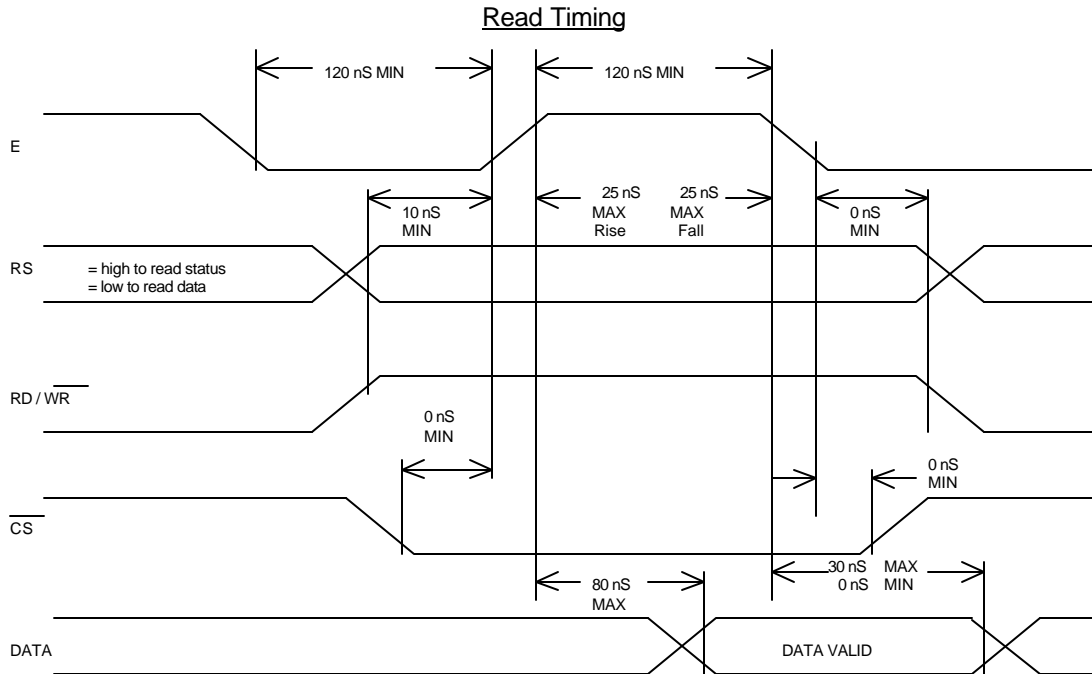
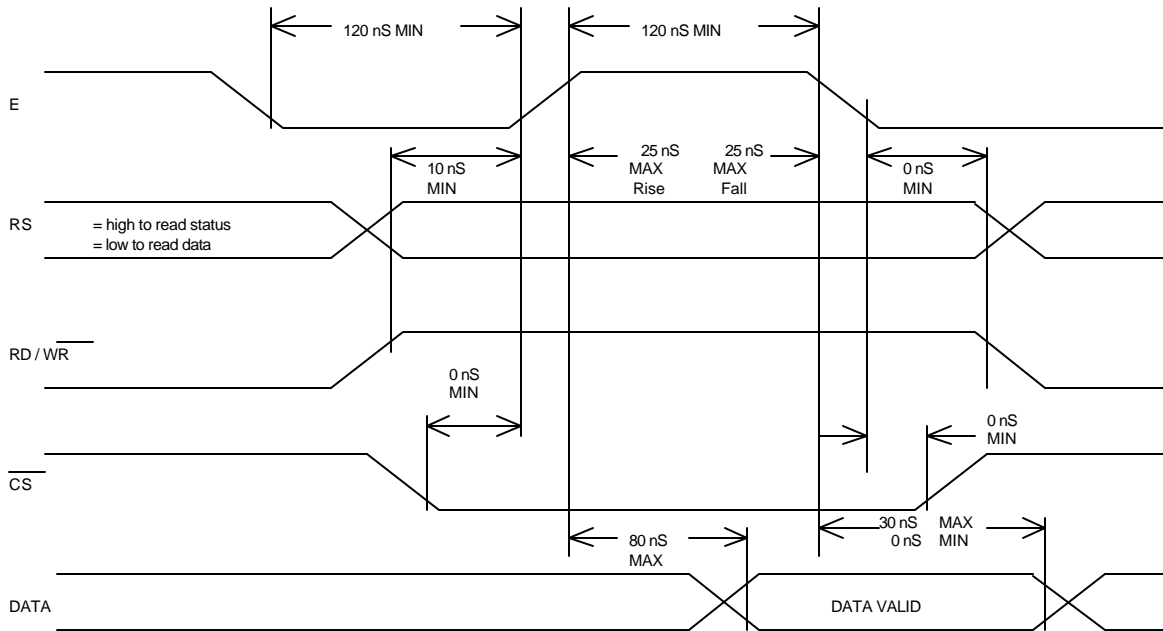


Figure 3-13

Timing Characteristics, Motorola Mode

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX
	SCALE	N/A	REV N
		SHEET	23 of 49

Read Timing



Write Timing

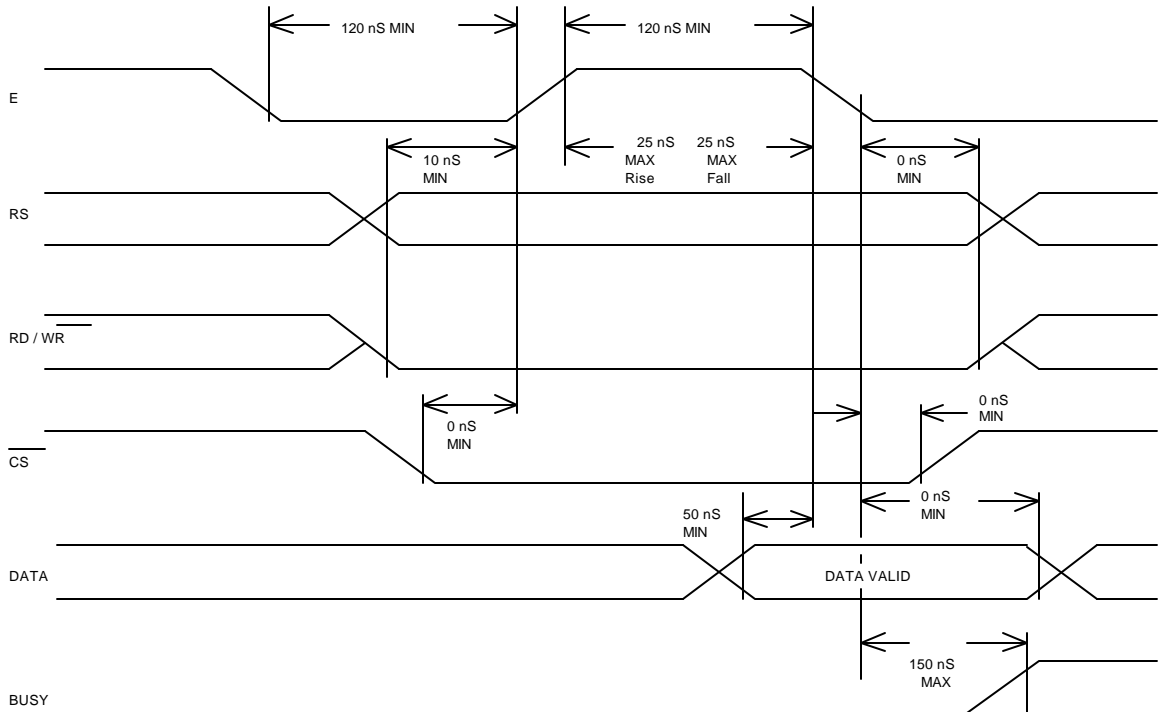


Figure 3-14

Timing Characteristics, LCD Mode

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX
	SCALE	N/A	REV N
		SHEET	24 of 49

4.0 PROGRAMMING CODES

The Century Series control codes occupy two hexadecimal address blocks. The first block is comprised of 00h–1Fh, while the second overlays part of the character table at 30h–3Fh. Control codes shown in **Bold** typeface are power–on defaults.

4.1 Numeric Order Control Codes

[A₀ (RS) = Low for the following Control Codes]

<u>Code</u>	<u>Name</u>		<u>Described in Section</u>	
00h	<i>Null</i>		4.6	Miscellaneous Codes
01h	<i>Prepare to Read Display Identification</i>		4.4	Prepare to Read Codes
02h	<i>Prepare to Read Software Check sum</i>		4.4	Prepare to Read Codes
03h	<i>Prepare to Read Cursor Location</i>	4.4	4.4	Prepare to Read Codes
04h	<i>Prepare to Read Data at Cursor Location</i>	4.4	4.4	Prepare to Read Codes
05h	<i>Prepare to Read Data at Cursor Location and Increment</i>		4.4	Prepare to Read Codes
06h	<i>Unassigned</i>			
07h	<i>Bell/Alarm Output</i>		4.6	Miscellaneous Codes
08h	<i>Backspace Cursor</i>		4.2	Cursor Control Codes
09h	<i>Advance Cursor</i>	4.2	4.2	Cursor Control Codes
0Ah	<i>Line Feed</i>		4.2	Cursor Control Codes
0Bh	<i>Blink Block Cursor</i>		4.2	Cursor Control Codes *
0Ch	<i>Underbar Cursor</i>		4.2	Cursor Control Codes *
0Dh	<i>Carriage Return</i>		4.2	Cursor Control Codes
0Eh	<i>Cursor Off</i>		4.2	Cursor Control Codes
0Fh	Cursor On		4.2	Cursor Control Codes
10h	<i>Scroll Line Lock</i>		4.6	Miscellaneous Codes
11h	Set Vertical Scroll Mode		4.3	Data Display Codes
12h	<i>Unassigned</i>			
13h	<i>Set Horizontal Scroll Mode</i>		4.3	Data Display Codes
14h	<i>Software Reset</i>		4.6	Miscellaneous Codes
15h	<i>Clear Display and Home Cursor</i>		4.2	Cursor Control Codes
16h	<i>Home Cursor</i>		4.2	Cursor Control Codes
17h	<i>Set Data Bit 7 High</i>		4.6	Miscellaneous Codes
18h	<i>Begin User Defined Character</i>		4.3	Data Display Codes
19h	<i>Set Address Bit 0 High</i>		4.6	Miscellaneous Codes
1Ah	<i>Cursor up One Line</i>		4.2	Cursor Control Codes
1Bh	<i>Move Cursor to Designated Location</i>		4.2	Cursor Control Codes
1Ch	Select European Character Set	4.3	4.3	Data Display Codes
1Dh	<i>Select Katakana Character Set</i>		4.3	Data Display Codes
1Eh	<i>Select Cyrillic</i>		4.3	Data Display Codes
1Fh	<i>Select Hebrew Character Set</i>		4.3	Data Display Codes

* Applies to 036X2–151–05240 & 036X2-160-05440 only. Unassigned for all other models.

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464		S036X2–XXX–XXXXX	
	SCALE	N/A	REV	N	SHEET 25 of 49

4.1 Numeric Order Control Codes (Cont.)

[A₀ (RS) = High for the following Control Codes]

<u>Code</u>	<u>Name</u>		<u>Described in Section</u>
30h	<i>Set Display Screen or Column Brightness Level</i>		4.5 Screen Control Codes
31h	<i>Begin Blinking Character(s)</i>		4.5 Screen Control Codes
32h	<i>End Blinking Character(s)</i>		4.5 Screen Control Codes
33h	<i>Blank Display Screen</i>		4.5 Screen Control Codes
34h	<i>Unblank Display Screen</i>		4.5 Screen Control Codes
+35h	<i>Comma/Period/Triangle Function</i>	4.5	Screen Control Codes
36h	<i>Erase Line data With End Blink</i>		4.5 Screen Control Codes
37h	<i>Set Carriage Return and Line Feed Definitions</i>		4.5 Screen Control Codes
38h	<i>Underbar On</i>		4.2 Cursor Control Codes *
39h	<i>Underbar Off</i>		4.2 Cursor Control Codes *
3Ah	<i>Select Right to Left Data Entry</i>		4.5 Screen Control Codes
3Bh	<i>Select Left to Right Data Entry</i>	4.5	Screen Control Codes
3Ch	<i>Screen Saver On</i>		4.5 Screen Control Codes
3Dh	<i>Screen Saver Off</i>		4.5 Screen Control Codes
3Eh	<i>Execute Self-test</i>		4.6 Miscellaneous Codes
3Fh	<i>Terminate Self-test</i>		4.6 Miscellaneous Codes

* **Applies to 036X2-151-05240 & 036X2-160-05440 only. Unassigned for all other models.**

+ **Applies to 036X2-121-11120 only. Unassigned for all other models.**

While unassigned Control Codes have no function, they are viewed as activity if received by the display and will cause the Screen Saver function to reset.

CAUTION

While the display software will ignore erroneous single byte control codes, errors in multibyte commands will cause the software to “jump” out of the control mode.

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX	
	SCALE	N/A	REV N	SHEET 26 of 49

4.2 Cursor Control Codes

[A₀ (RS) = Low for the following Control Codes]

- 08h *Backspace Cursor*
 Moves the cursor one position left. (Right if 3Ah is selected.)
 Functions only on current line, does not move cursor to previous line.
- 09h *Advance Cursor*
 Moves the cursor one position right. (Left if 3Ah is selected.)
 If the cursor is in the last position on a line (other than the last line of the display screen), it will move to the first position of the next line.
 If the cursor is in the last position of the last line, it will be blanked and remain in the same location.
- 0Ah *Line Feed*
 On single line displays, clears data from the display screen. Cursor remains in same column.
 On multi-line displays, moves the cursor down one line with no change in horizontal position unless on the last line.
 If on the last line, cursor unblanked, executes a vertical scroll with no change in horizontal position.
 If on the last line, last position, cursor blanked, executes a vertical scroll with no change in horizontal position and cursor becomes visible.
 The function of this command is described for the default setting and can be modified by using control code 37h.
- 0Bh *Blinking Block Cursor* *
 Sets the cursor style to a blinking block cursor.
- 0Ch *Underbar Cursor* *
 Sets the cursor style to an underbar cursor.
- 0Dh *Carriage Return*
 Returns the cursor to the left most position on the current line. (Rightmost if 3Ah is selected.)
 The function of this command can be modified by using control code 37h.
- 15h *Clear Display and Home Cursor*
 Clears the display screen and sets the cursor to the home position.
- 16h *Home Cursor*
 Sets the cursor to the home position.
- 1Ah *Cursor Up One Line*
 Moves the cursor up 1 line on multi-line displays. No function on single line displays or on the top line of multi-line displays.
- 1Bh *Move Cursor to Designated Location*
 Moves the cursor to a specific display screen location using a 2 byte command consisting of control code 1Bh and a position ID. Screen positions are numbered from left to right, top to bottom starting with 00h.

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX	
	SCALE	N/A	REV N	SHEET 27 of 49

4.2 Cursor Control Codes (Cont.)

[A₀ (RS) = Low for the following Control Codes]

0Eh *Cursor Off*
Makes cursor invisible. Other cursor functions are not affected.

0Fh *Cursor On*
Makes cursor visible at 4 Hz blink rate. (Default)

* **Applies to 036X2-151-05240 & 036X2-160-05440 only. Unassigned for all other models.**

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX
	SCALE N/A	REV N	SHEET 28 of 49

4.3 Data Display Mode Codes

The following control codes define the way the display behaves after the last character has been written to the screen.

[A₀ (RS) = Low for the following Control Codes]

11h *Set Vertical Scroll Mode*

Causes data to scroll up one line, upon receipt of a displayable character, after the last character is written to the last line of the display screen.
Generates automatic *Carriage Return + Line Feed*. (Default)

13h *Set Horizontal Scroll Mode*

Causes the last line of the display screen to scroll from right to left after the last character is written to the last line as successive characters are written.

18h *User Defined Character*

A 7 byte command which may be used to define up to 10 custom characters. Each character must be separately defined and stored in locations F6h – FFh. The command consists of the control code 18h, a location code and 5 bytes of character dot data.

18 XX PP PP PP PP PP XX = F6 – FF

PP = Dot data from tables below

0 = Dot Off

1 = Dot On

BYTE	DATA BIT (036X2-100,-105,-122,-124,-134,-130)							
	7	6	5	4	3	2	1	0
3	33	15	34	16	35	17	0	18
4	29	11	30	12	31	13	32	14
5	25	07	26	08	27	09	28	10
6	21	03	22	04	23	05	24	06
7	0	0	0	0	19	01	20	02

CHARACTER MATRIX				
1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25
26	27	28	29	30
31	32	33	34	35

BYTE	DATA BIT (036X2-106,-120,-121,-151,-116,-160)							
	7	6	5	4	3	2	1	0
3	29	20	11	02	28	19	10	01
4	31	22	13	04	30	21	12	03
5	33	24	15	06	32	23	14	05
6	35	26	17	08	34	25	16	07
7	0	0	0	0	0	27	18	09

Table 4-1

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE	CODE IDENT NO.	S036X2-XXX-XXXXX
	A	05464	
	SCALE	REV	SHEET
	N/A	N	29 of 49

4.3 Data Display Mode Codes(Cont'd)

Dot Data for User Defined Characters

- 1Ch *Select European Character Set*
Selects character set shown in Figure 3–6. (Default)
- 1Dh *Select Katakana Character Set*
Selects character set shown in Figure 3–8.
- 1Eh *Select Cyrillic Character Set*
Selects character set shown in Figure 3–5.
- 1Fh *Select Hebrew Character Set*
Selects character set shown in figure 3–7.

4.4 Prepare To Read Codes

The following control codes allow data to be read from the display. All *Prepare To Read* commands must be followed by a **READ DATA** operation for each byte of output.

[A₀ (RS) = Low for the following Control Codes]

(See timing diagrams in Figures 3–12, 3–13 and 3–14 for read operation details.)

- 01h *Prepare to Read Firmware Identification Number & Display Format*
Outputs a 19 byte string representing the firmware ID number and line/column format.
e.g., IEE,35062–01,LXXCXX (for model: 036X2-100, -105, -122, -124, -130, -134)
e.g., IEE,35440-01,LXXCXX (for model: 036X2-106, -116, -120, -121, -151)
e.g., IEE,35973-01,L04C40 (for model: 036X2-160)
- 02h *Prepare to Read Software Check Sum*
Outputs a 4 byte string representing the hexadecimal check sum.
- 03h *Prepare to Read Cursor Location*
Outputs a 1 byte string representing the cursor location.
- 04h *Prepare to Read Data at Cursor Location*
Outputs a 1 byte string representing character data at current cursor location.
- 05h *Prepare to Read Data at Cursor Location and Increment*
Outputs a 1 byte string representing character data at current cursor location and generates an *Advance Cursor* command.

NOTE

Data cannot be read in serial mode.

Status Read Operation

[A₀ (RS) = High for the following Read Operation]

Status Returned to the Host on the Data Lines

<u>Data Lines</u>	O = 0 Output Buffer Empty (READY)
XXXX XXIO	O = 1 Output Buffer Full (BUSY)
	I = 0 Input Buffer Empty (READY)
	I = 1 Input Buffer Full (BUSY)

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2–XXX–XXXXX	
	SCALE	N/A	REV N	SHEET 30 of 49

4.5 Screen Control Codes

[A₀ (RS) = High for the following Control Codes]

30h *Set Display Screen or Column Brightness Level*
Sets the display brightness level using a 3 byte command consisting of control code 30h, column ID, and brightness level. Column ID code FFh sets all columns. Brightness levels range from 00h (brightest) through 07h (dimkest). (Default is 00h)

Note

Brightness levels must be set by columns rather than by characters because of the construction of the vacuum fluorescent tube.

31h *Begin Blinking Character(s)*
Sets the start of blinking character(s) or underbar(s) and the blink rate using a 2 byte command consisting of control code 31h and blink code. Subsequent characters will blink until Control Code 32h is sent. (If a character is written at the current cursor location, that character will blink).

The “Underbar” and “Both” code sets apply only to 36X2–151–05240.

<u>Character Code</u>	<u>Rate</u>	<u>Underbar Code</u>	<u>Rate</u>	<u>Both Code</u>	<u>Rate</u>
00h	OFF (Default)	60h	OFF	80h	OFF
01h	1 Hz	61h	1 Hz	81h	1 Hz
02h	2 Hz	62h	2 Hz	82	2 Hz
04h	4 Hz	64h	4 Hz	84h	4 Hz

32h *End Blinking Character(s)*
Sets the end of blinking character(s) at the current cursor location. Subsequent characters will not blink until Control Code 31h is sent. (A character written to the current cursor location will not blink).

If a blinking character is overwritten by a non-blinking character, or if the *Erase Line* command is executed, the blink attribute is turned off.

33h *Blank Display Screen*
Sets the display screen to OFF. Data and attribute settings are not affected.

34h *Unblank Display Screen*
Returns the display screen to ON after 33h.

35h *Comma/Period/Triangle Function*

- 35-01-n: display character with period
n = display character 20-FF
- 35-02-n: display character with comma
n = display character 20-FF
- 35-03-n: display character with comma & period
n = display character 20-FF
- 35-04-n: display character with triangle
n = display character 20-FF

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2–XXX–XXXXX	
	SCALE	N/A	REV N	SHEET 31 of 49

4.5 Screen Control Codes (Cont.)

[A₀ (RS) = High for the following Control Codes]

36h *Erase Line Data With End Blink*
Erases 1 or more lines of data (with blink) using a 2 byte command consisting of control code 36h and blink field/line data.

Bits 0 through 3 retain (0) or erase (1) lines 0 through 3 respectively.

For example:

<u>Blink Field ON/OFF</u>				<u>Line Position</u>				
D ₇	D ₆	D ₅	D ₄	D ₃	D ₂	D ₁	D ₀	
X	X	X	X	0	0	0	1	Erase line 0, retain lines 1, 2, 3.
X	X	X	X	1	1	0	0	Erase lines 2 & 3, retain lines 0 & 1.

38h *Underbar On* *
Sets the underbar to ON at the current character position.

39h *Underbar Off* *
Sets the underbar to OFF at the current character position.

3Ch *Screen Saver On*
Sets the display screen to brightness level 07h (dimkest) after a 10 minute idle time.

(Any new control or data input resets the Screen Saver function for another 10 minute cycle, The Screen Saver function remains active.)

3Dh *Screen Saver Off*
Restores the screen display to previously established brightness level(s) and deactivates the Screen Saver function. (Default)

37h *Set Carriage Return and Line Feed Definitions*
Sets the functions of the Line Feed (0Ah) and Carriage Return (0Dh) commands using a 2 byte command consisting of control code 37h and the function ID.

<u>Function ID</u>	<u>Definition</u>	
00h	LF = LF	CR = CR (Default)
01h	LF = LF + CR	CR = CR
02h	LF = LF	CR = CR + LF
03h	LF = LF + CR	CR = CR + LF

3Ah *Set Right to Left Data Entry*
Reverses data entry mode for use with Hebrew Character Set.

3Bh *Set Left to Right Data Entry*
Restores data entry mode to normal ASCII. (Default)

* **Applies to 036X2-151-05240 & 036X2-160-05440 only. Unassigned for all other models.**

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX	
	SCALE	N/A	REV N	SHEET 32 of 49

4.6 Miscellaneous Codes

[A₀ (RS) = Low for the following Control Codes]

- 00h *Null*
No operation. Sending a 00h to the display is viewed by software as activity, and will reset a Screen Saver code (3Ch).
- 07h *Bell/Alarm Output*
Activates 160 msec drive signal for alarm tone.
- 10h *Scroll Line Lock*
Sets 1 or more lines to be locked out from the Vertical Scroll function using a 2 byte command consisting of the control code 10h and a line ID.

<u>Line ID</u>	<u>Function</u>
00h	Locks line 0
01h	Locks lines 0 and 1
02h	Locks lines 0, 1 and 2
FFh	Cancel Line Lock

- 14h *Software Reset*
Clears the display screen, homes the cursor and resets modes and attributes to their default settings.

Note

If Hardware Self-test is programmed, sending control code 14h restarts self-test.

If Self-test was called by sending control code 3Eh, sending control code 14h has no effect.

- 17h *Set Data Bit 7 High*
Sets data bit 7 high for the following data byte.
- 19h *Set Address Bit 0 High*
Sets address bit 0 (A₀) high for the following byte only. The following byte must be a control code.
(In Motorola Mode, replace A₀ with RS).

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX	
	SCALE	N/A	REV N	SHEET 33 of 49

4.6 Miscellaneous Codes (Cont.)

[A₀ (RS) = High for the following Control Codes]

3Eh *Execute Self-test*

Displays the following data in sequence:

1. Software version number.
S/W NUMBER :
XXXX-XX
2. Baud Rate selected.
BAUD : NNNN
3. Interface Mode selected.
INTERFACE:
INTEL(MOTOROLA)[LCD]
4. Present (hardware) display brightness level.
HARDWARE BRIGHTNESS
LEVEL: N
5. Displays 8 brightness levels in a numeric representation of brightness levels.
DIM LEVELS: 01234567
6. Displays the 3 blink rates in a numeric representation of blink rates.
BLINK RATES :
1Hz 2Hz 4Hz
7. Displays the entire character font with vertical scrolling.

(Single line displays scroll continuously in *Horizontal Scroll Mode*).

Self-test overrides the hardware brightness level control setting and displays information at the highest brightness level (level 0).

Self-test may be invoked by setting a jumper on the circuit card prior to power up.

Self-test runs continuously until terminated by 3Fh.

3Fh *Terminate Self-test*

Terminates either a hardware or software induced self-test and sets display screen to the highest brightness level.

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX	
	SCALE N/A	REV N	SHEET 34 of 49	

4.7 LCD Mode Control Codes (Without Interface Converter)

[See Figure 3–10 on Sheet 18 for personality jumper settings]

RS	RD/ \overline{WR}	Data					
0	0	0000 0001	Clear Display Clears display and homes cursor.				
0	0	0000 001X	Home Cursor Sets cursor to the home position.				
0	0	0000 1DCB	Display Controls				
		D=0	Blank Display				
		D=1	Unblank Display				
		B=0	Blinking Block Cursor OFF				
		B=1	Blinking Block Cursor ON				
		C=0	Blinking Cursor OFF				
		C=1	Blinking Cursor ON				
<table border="1"> <thead> <tr> <th colspan="2">Note</th> </tr> </thead> <tbody> <tr> <td colspan="2">Bit "B" is used to control character blinking on models which have an underbar cursor. Bit "C" is used to control the underbar cursor on models which support that style. For models which support only the block cursor, either bit "C" or bit "B" will activate the block cursor.</td> </tr> </tbody> </table>				Note		Bit "B" is used to control character blinking on models which have an underbar cursor. Bit "C" is used to control the underbar cursor on models which support that style. For models which support only the block cursor, either bit "C" or bit "B" will activate the block cursor.	
Note							
Bit "B" is used to control character blinking on models which have an underbar cursor. Bit "C" is used to control the underbar cursor on models which support that style. For models which support only the block cursor, either bit "C" or bit "B" will activate the block cursor.							
0	0	0001 0D00	Cursor Position Controls D=0 Shift Cursor Left D=1 Shift Cursor Right				
0	0	010A AAAA	Set CG RAM Address (up to 4 character patterns).				
0	0	1AAA AAAA	Set DD RAM Address Sets cursor to address AAAAAAA, first address is 0.				
1	1	XXXX XXDX	Read BUSY Flag (<i>D=0, Ready; D=1, Busy</i>) Returns BUSY flag on Bit 1. (<i>Standard LCD BUSY Flag is Bit 7 & RS = 0.</i>)				
1	0	DDDD DDDD	Write to DD RAM or CG RAM Writes data DDDDDDDD to display at current cursor location or CG RAM.				
0	1	DDDD DDDD	Read from DD RAM or CG RAM Reads data DDDDDDDD from display at current location or from CG RAM, cursor does not advance. (<i>Standard LCD – RS = 1, cursor advances.</i>)				

4.8 Unsupported LCD Control Codes (Without Interface Converter)

- Simultaneous Block and Underbar Cursors
- Underbar Cursor
- Entry Mode Set
- Display Shift
- Function Set

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX
	SCALE	N/A	REV N
		SHEET	35 of 49

4.9 LCD Mode Control Codes (With Interface Converter)

[See Figure 3–10 on Sheet 18 for personality jumper settings]

RS	RD/ \overline{WR}	Data					
0	0	0000 0001	Clear Display Clears display and homes cursor.				
0	0	0000 001X	Home Cursor Sets cursor to the home position.				
0	0	0000 1DCB	Display Controls				
		D=0	Blank Display				
		D=1	Unblank Display				
		B=0	Blinking Block Cursor OFF				
		B=1	Blinking Block Cursor ON				
		C=0	Blinking Cursor OFF				
		C=1	Blinking Cursor ON				
<table border="1"> <thead> <tr> <th colspan="2">Note</th> </tr> </thead> <tbody> <tr> <td colspan="2"> Bit "B" is used to control character blinking on models which have an underbar cursor. Bit "C" is used to control the underbar cursor on models which support that style. For models which support only the block cursor, either bit "C" or bit "B" will activate the block cursor. </td> </tr> </tbody> </table>				Note		Bit "B" is used to control character blinking on models which have an underbar cursor. Bit "C" is used to control the underbar cursor on models which support that style. For models which support only the block cursor, either bit "C" or bit "B" will activate the block cursor.	
Note							
Bit "B" is used to control character blinking on models which have an underbar cursor. Bit "C" is used to control the underbar cursor on models which support that style. For models which support only the block cursor, either bit "C" or bit "B" will activate the block cursor.							
0	0	0001 0D00	Cursor Position Controls D=0 Shift Cursor Left D=1 Shift Cursor Right				
0	0	010A AAAA	Set CG RAM Address (up to 4 character patterns).				
0	0	1AAA AAAA	Set DD RAM Address Sets cursor to address AAAAAAA, first address is 0.				
0	1	DXXX XXXX	Read BUSY Flag (D=0, Ready; D=1, Busy) Returns BUSY flag on Bit 7.				
1	0	DDDD DDDD	Write to DD RAM or CG RAM Writes data DDDDDDDD to display at current cursor location or CG RAM.				
1	1	DDDD DDDD	Read from DD RAM or CG RAM Reads data DDDDDDDD from display at current location or from CG RAM, cursor does not advance.				

4.10 Unsupported LCD Control Codes (With Interface Converter)

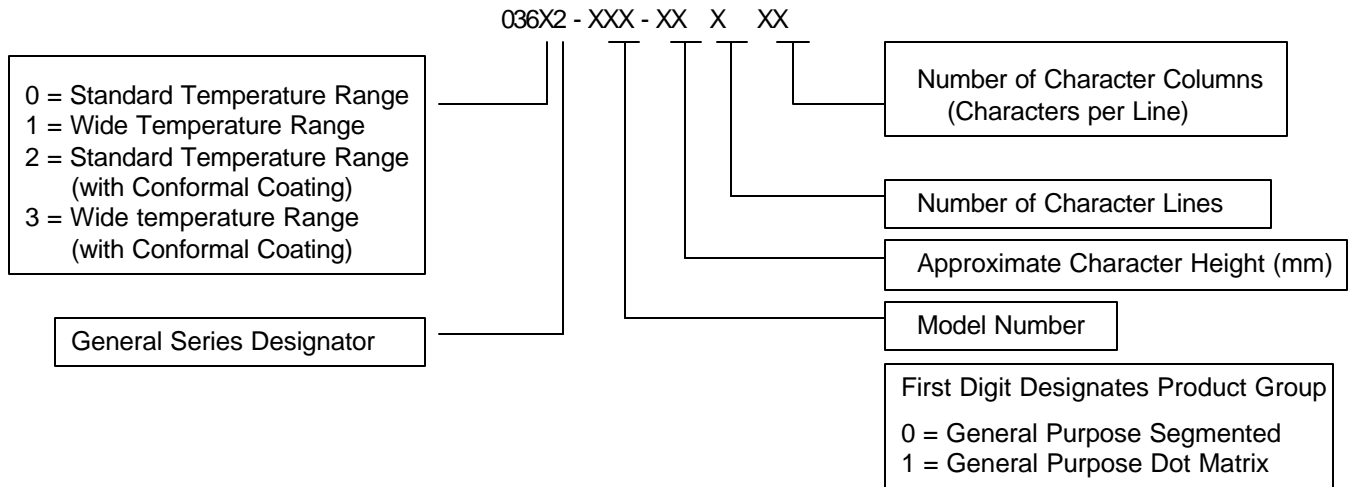
- Simultaneous Block and Underbar Cursors
- Underbar Cursor
- Entry Mode Set
- Display Shift
- Function Set

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX
	SCALE	N/A	REV N
		SHEET	36 of 49

5.0 OPTIONS AND ACCESSORIES

The following sections list commonly available options and accessories to the Century Series of Vacuum Fluorescent Displays which can enhance performance or utility for specific applications.

5.1 Performance Options



Note
 Spaces shown in Part Number above are for clarity only.

5.2 Accessories

ITEM	Part Number
Connector Key	43866-03
Mating Connector, Power/Data	43866-05
Mating Connector, Dimming	48272-02
Cable Assembly, Single Ended	35406-XX*
Cable Assembly, Double Ended	35407-XX*
Filters	35064-XXX** -NN***

- * Dash number indicates cable length in whole inches.
- ** 3 Digit dash number (XXX) indicates Display Model Number.
- *** 2 digit dash number (NN) indicates filter color.
 - 01 Neutral Gray
 - 02 Blue
 - 04 Aqua
 - 05 Neon
 - 07 Green
 - 09 Neutral(CP)
 - 10 Yellow(CP)

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX
	SCALE	N/A	REV N
		SHEET	37 of 49

6.0 OUTLINE DRAWINGS

The following pages contain Outline Drawings of the available Century Series Dot Matrix Vacuum Fluorescent Displays. Each outline drawing includes:

1. Mounting and elevation dimensions to assist the user in packaging design.
2. Interface connector location, contact arrangement and keying.
3. Location and arrangement of personality jumpers.
4. Recommended panel cutout.

Note

The outline drawings which follow are **NOT** to scale. Refer to numeric dimensions for design data.

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX
	SCALE N/A	REV N	SHEET 38 of 49

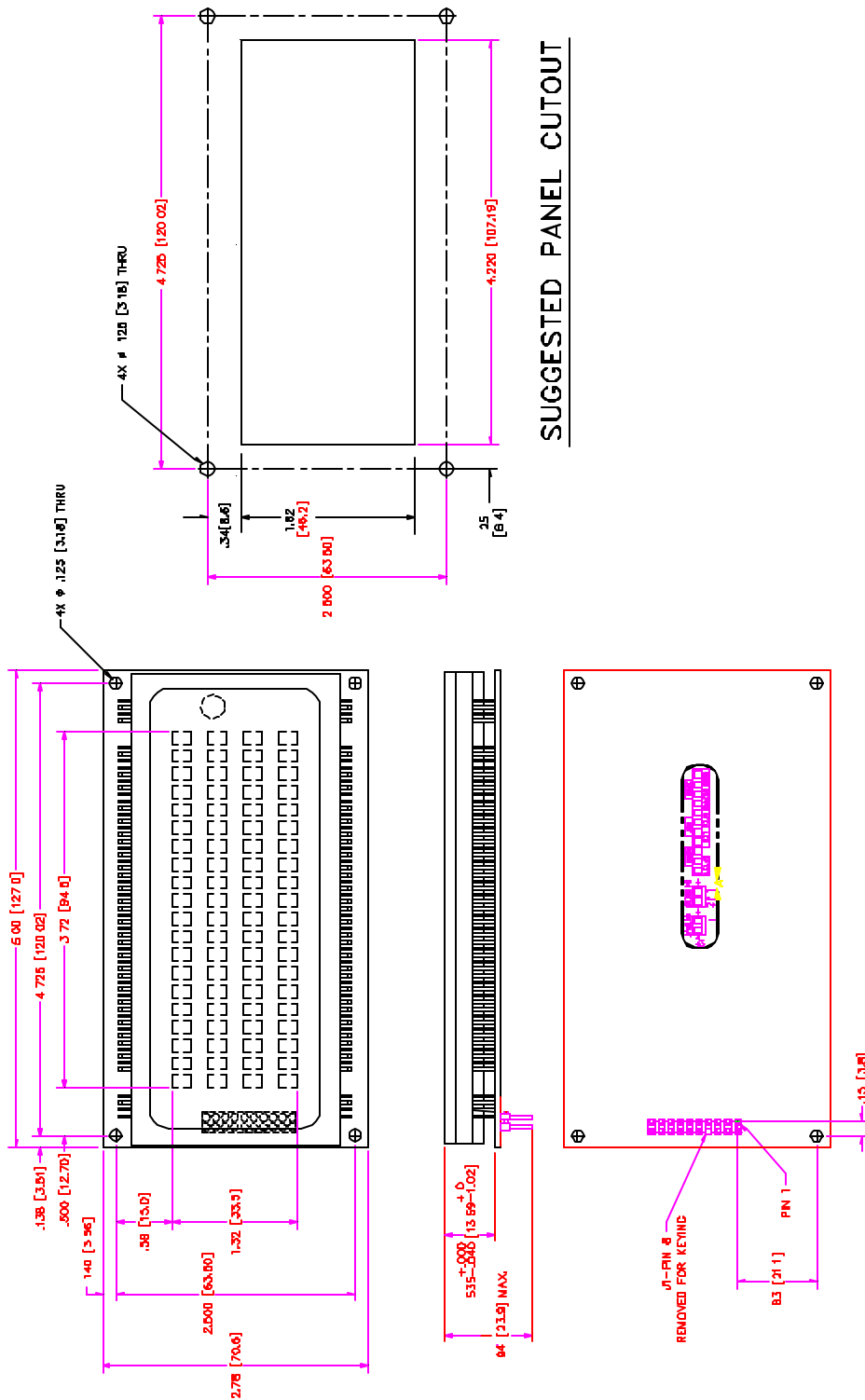


Figure 6-1

036X2-100-05420, 4X20 5mm

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX
	SCALE	N/A	REV N SHEET 39 of 49

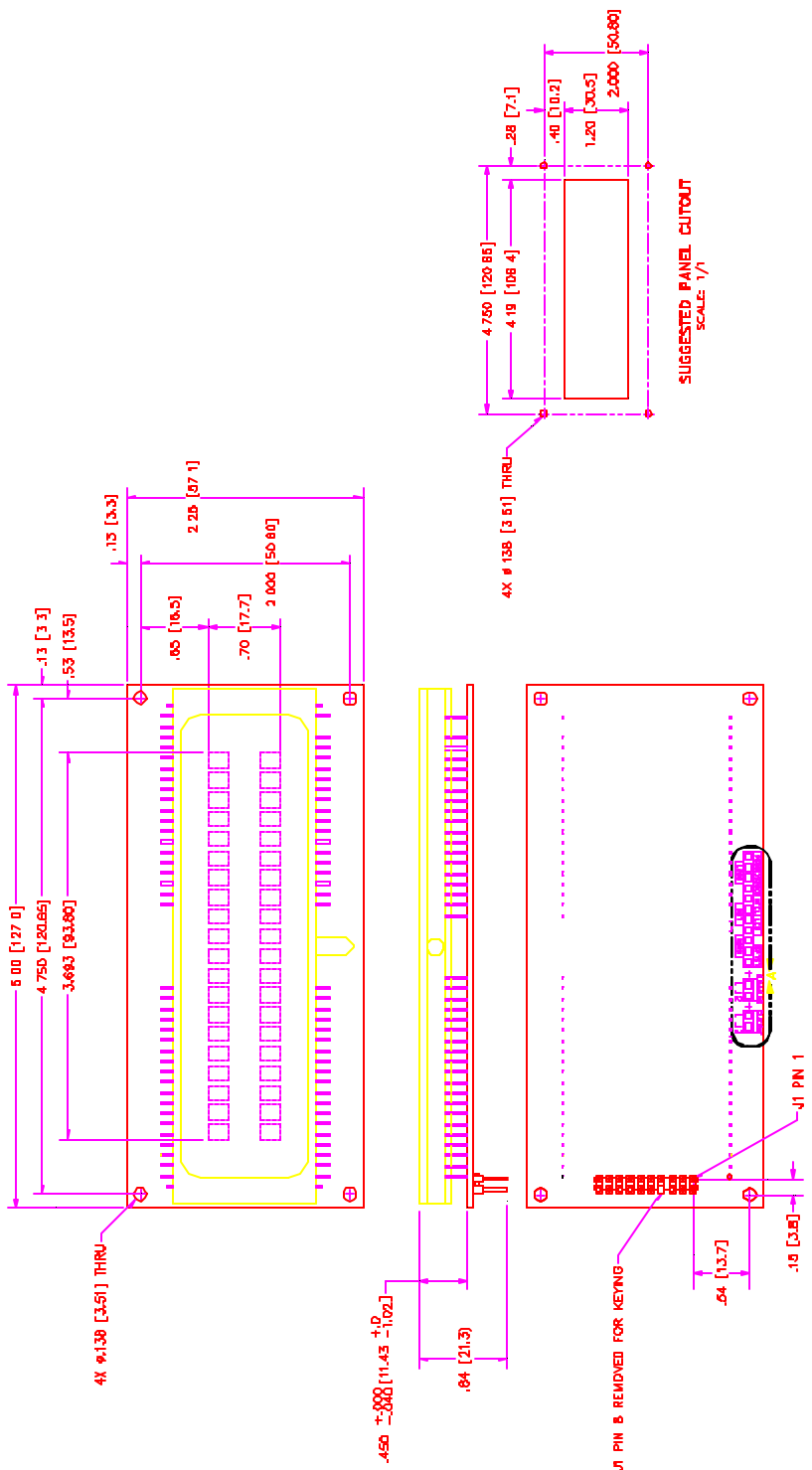


Figure 6-2

036X2-105-05220, 2X20 5mm

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX
	SCALE N/A	REV N	SHEET 40 of 49

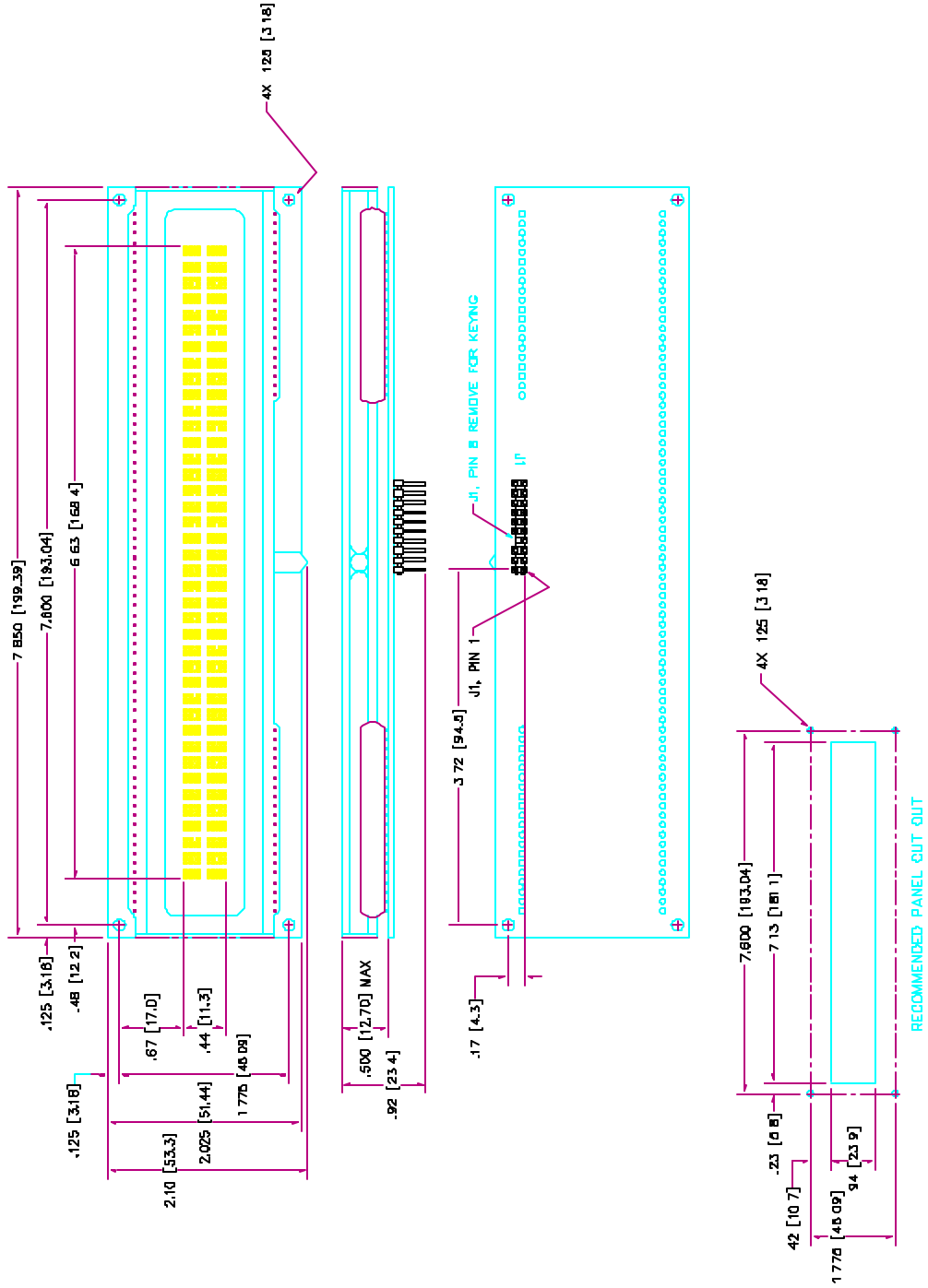


Figure 6-3

036X2-106-04240, 2X40 4.7mm

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX
	SCALE	N/A	REV N
		SHEET	41 of 49

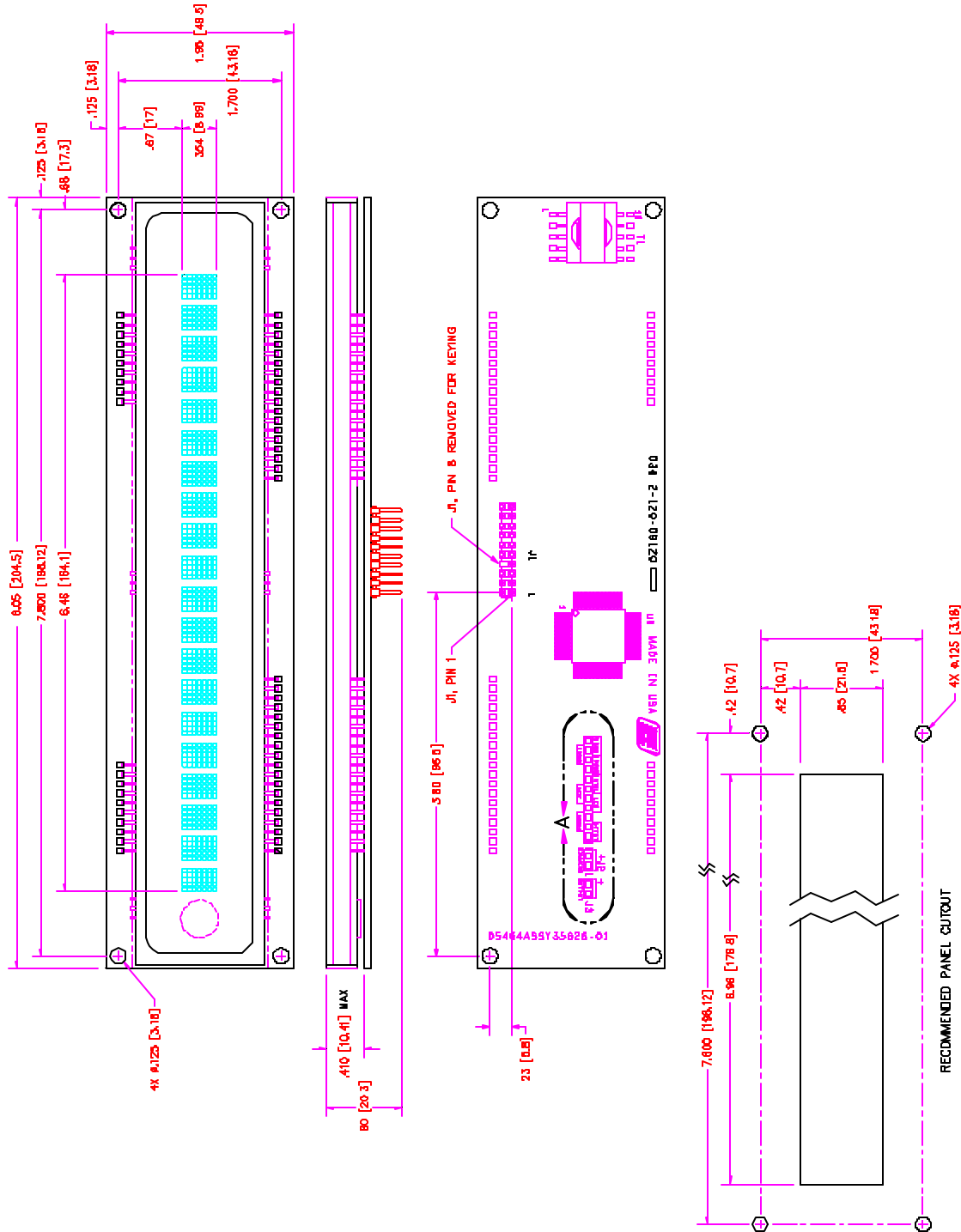


Figure 6-4

036X2-120-09120, 1X20 9mm

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX
	SCALE N/A	REV N	SHEET 42 of 49

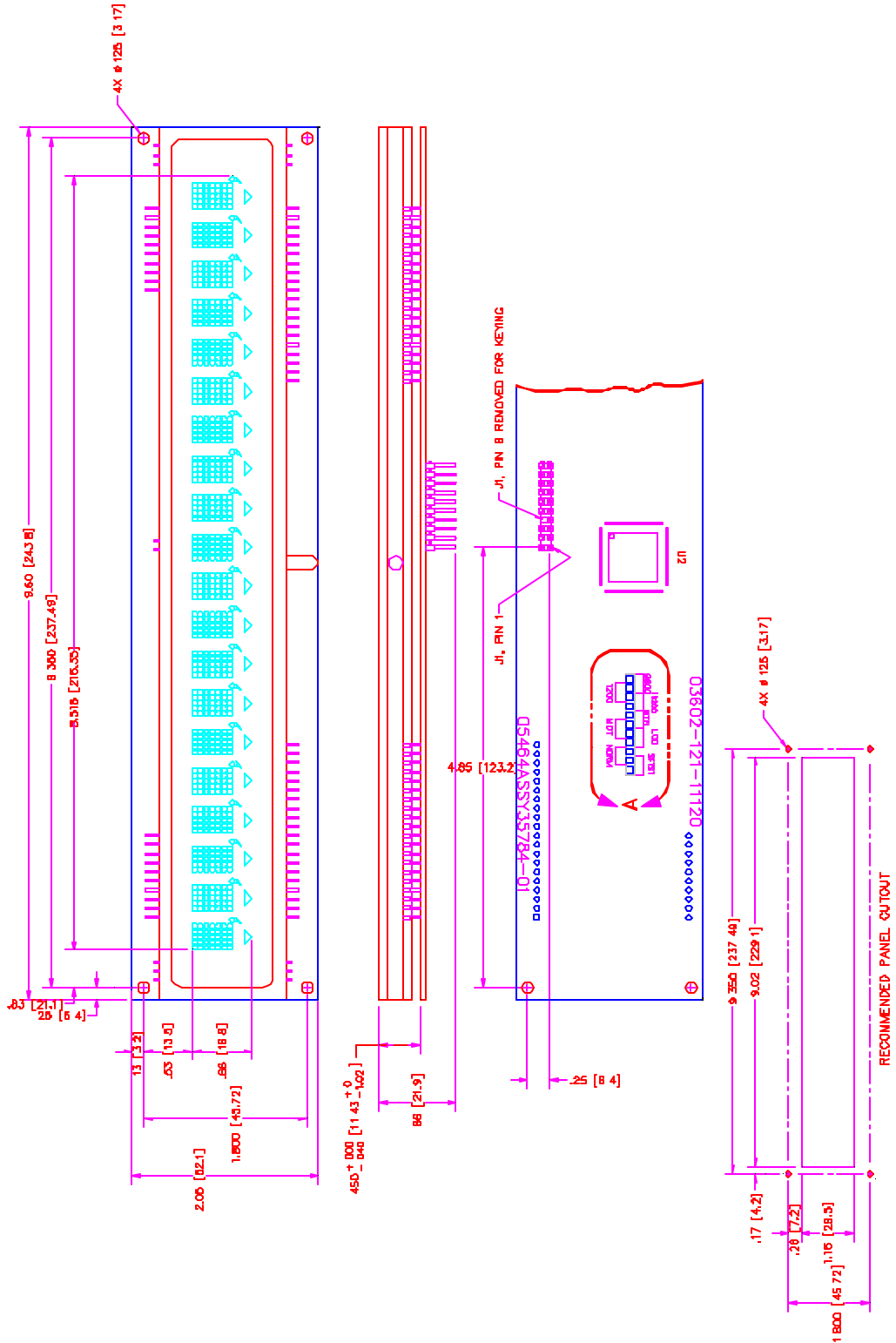


Figure 6-5

036X2-121-11120, 1X20 11mm

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX
	SCALE N/A	REV N	SHEET 43 of 49

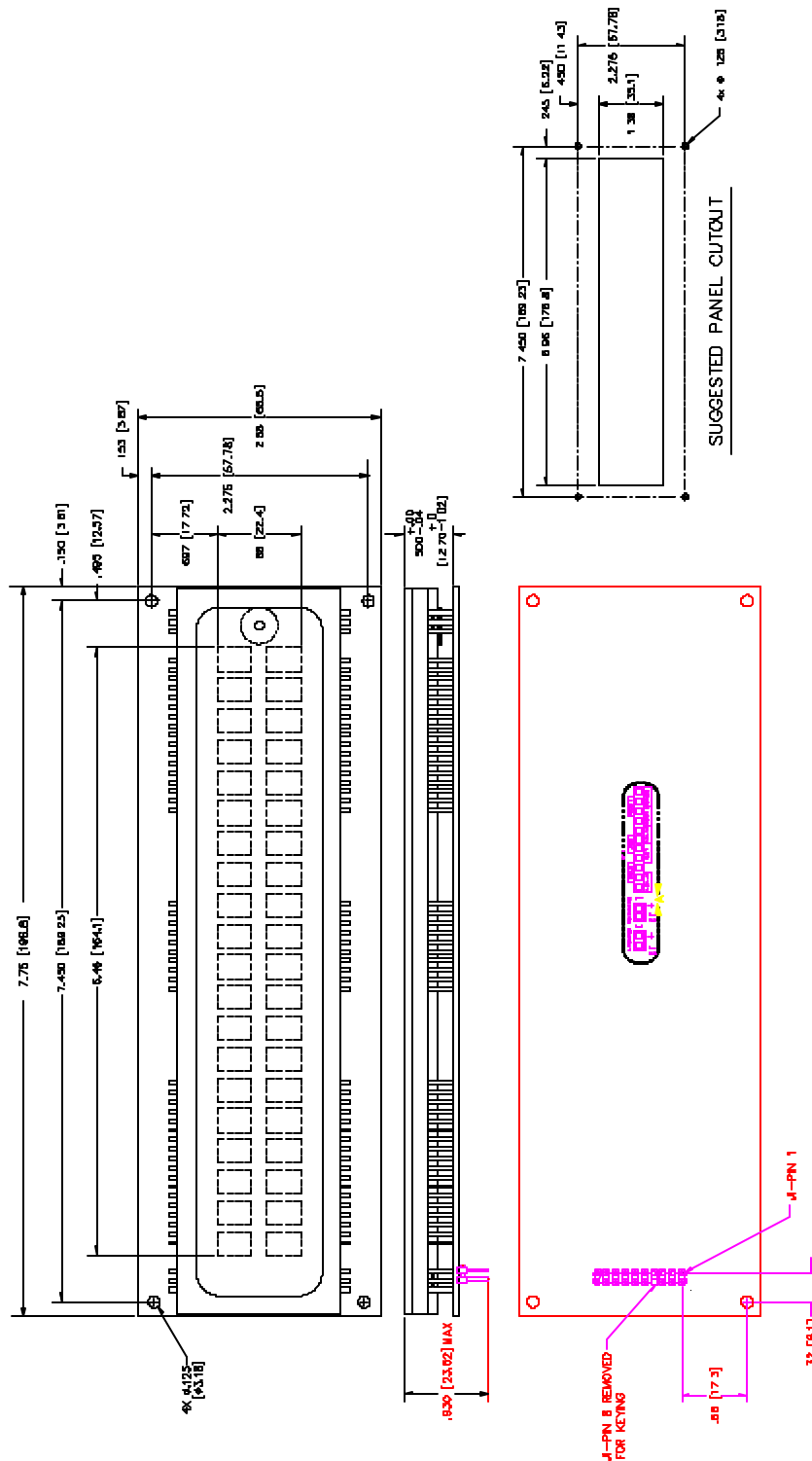


Figure 6-6

036X2-122-09220, 2X20 9mm

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464		S036X2-XXX-XXXXX
	SCALE N/A	REV N	SHEET 44 of 49	

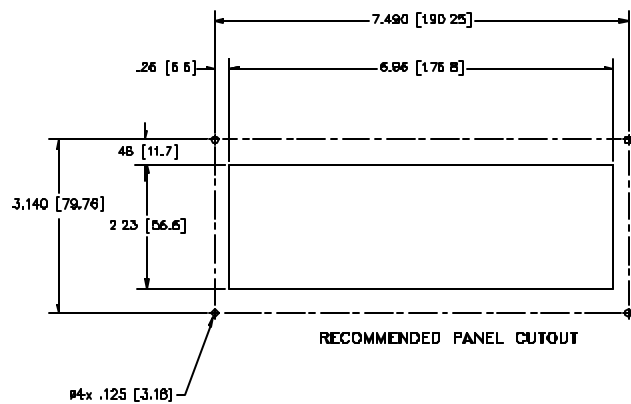
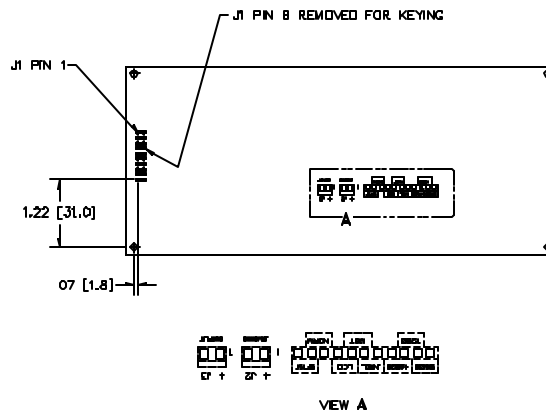
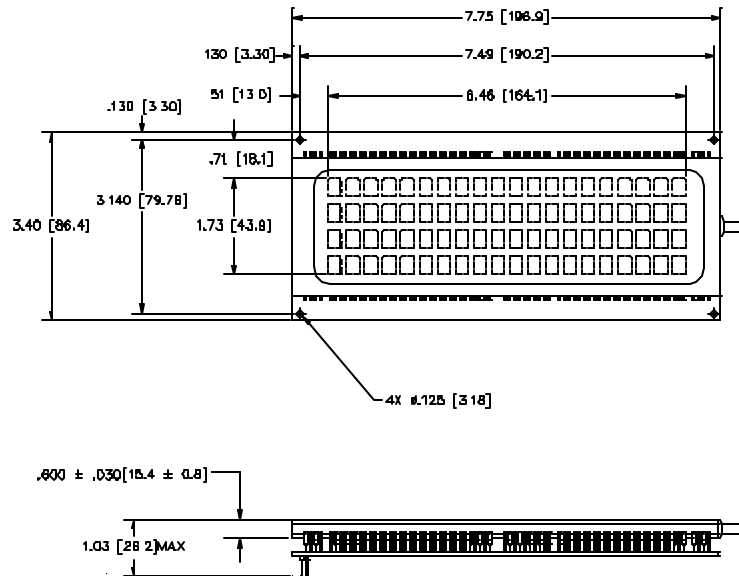


Figure 6-7

036X2-124-09420, 4X20 9mm

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX
	SCALE	N/A	REV N
		SHEET	45 of 49

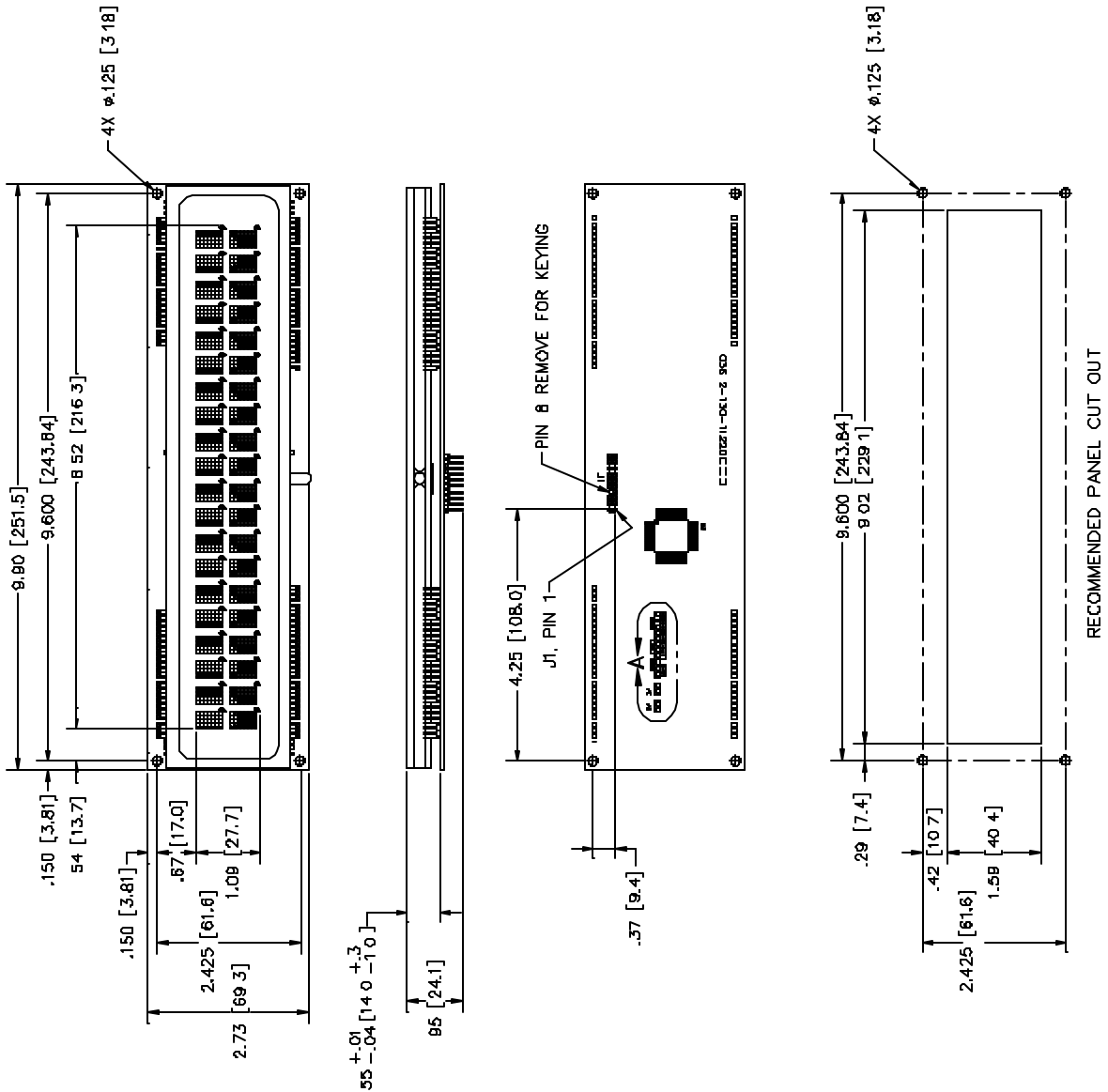


Figure 6-8

036X2-130-11220, 1X20 11mm

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464		S036X2-XXX-XXXXX
	SCALE N/A	REV N	SHEET 46 of 49	

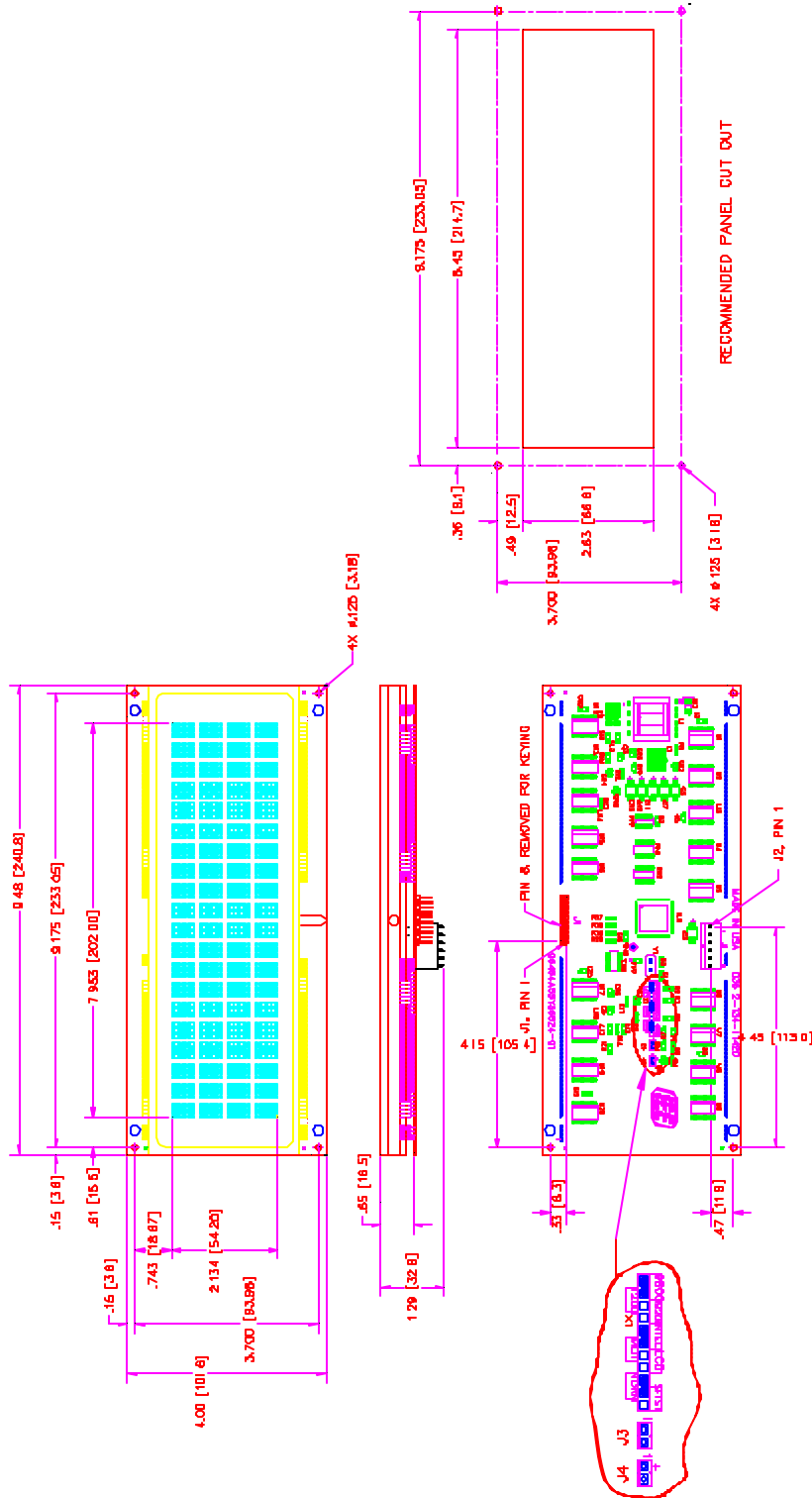


Figure 6-9
036X2-134-11420, 4X20 11mm

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX
	SCALE	N/A	REV N SHEET 47 of 49

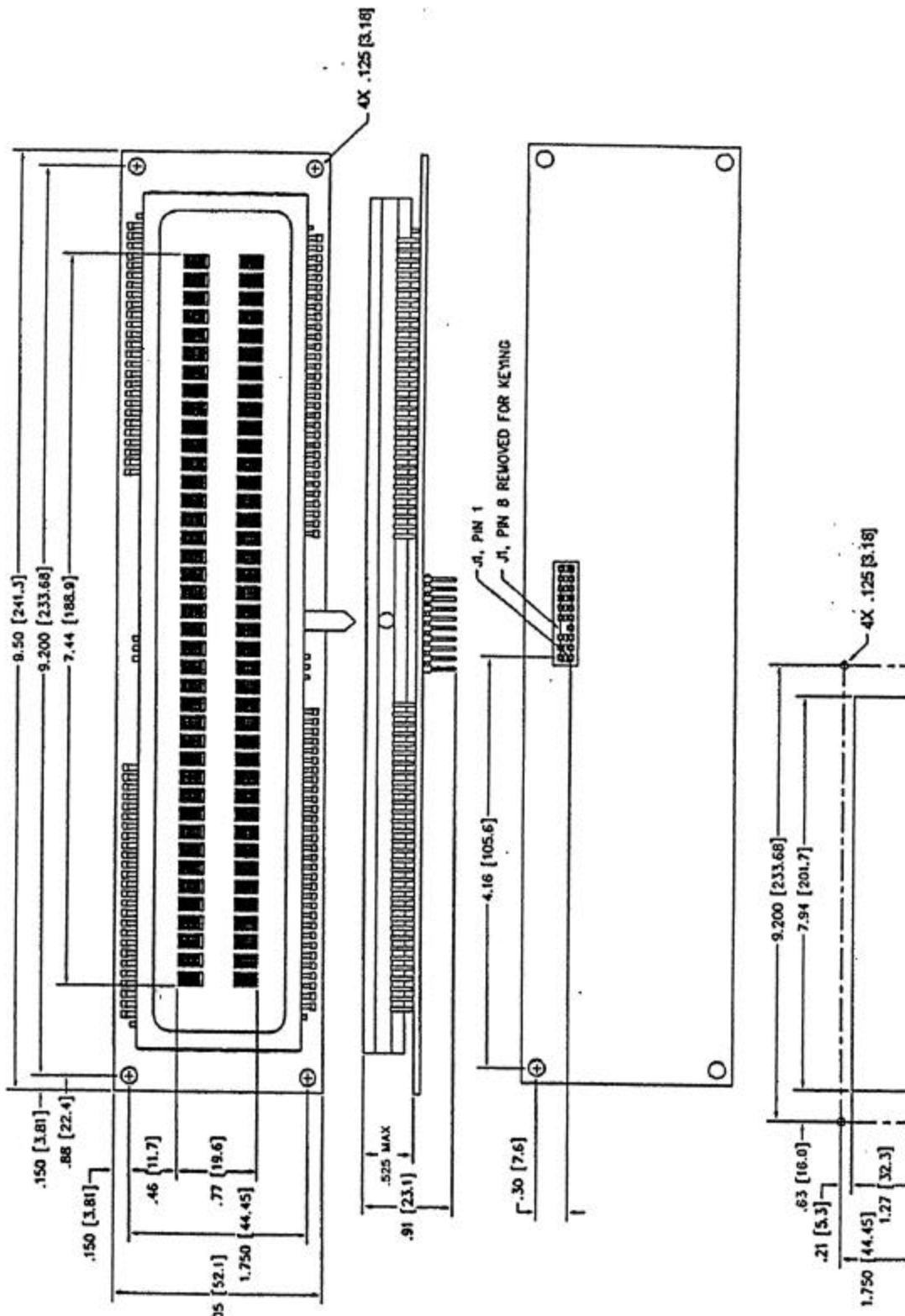


Figure 6-10

036X2-151-05240, 2X40 5mm

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX
	SCALE	N/A	REV N
		SHEET	48 of 49

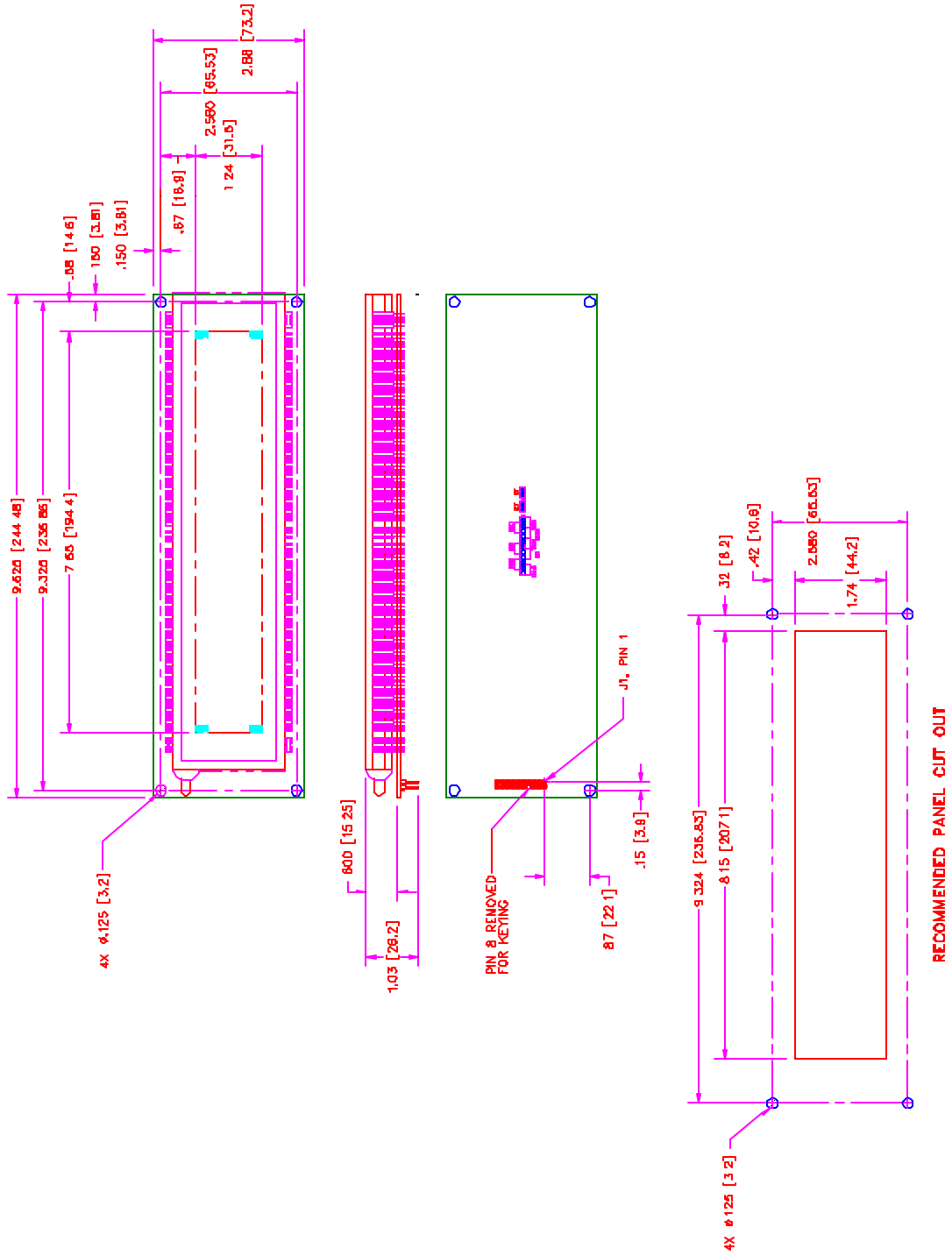


Figure 6-11
036X2-160-05440, 4X40 5mm

Industrial Electronic Engineers, Inc. Van Nuys, California	SIZE A	CODE IDENT NO. 05464	S036X2-XXX-XXXXX
	SCALE	N/A	REV N
		SHEET	49 of 49