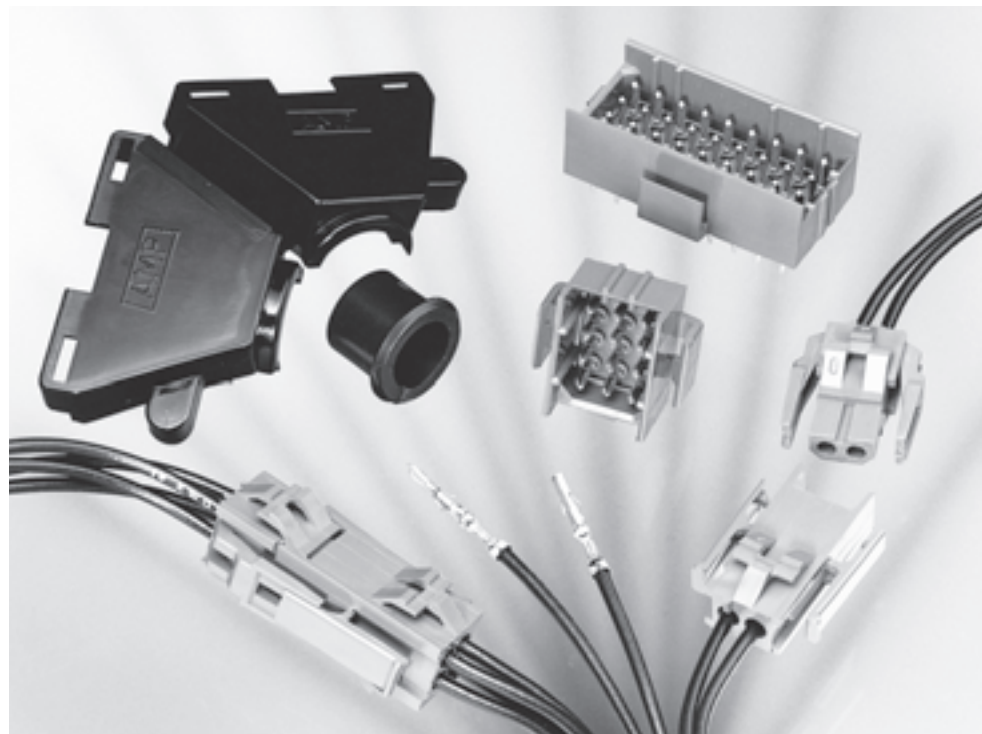


### (MR) Miniature Rectangular Connectors (Continued)

#### Product Facts

- Housings positively lock to help prevent accidental disengagement
- Either cap or plug housing can be mounted in same rectangular panel cutout without additional hardware
- UL94V-0 housings
- Plug and cap design includes molded-in polarizing feature for proper mating
- Numbered cavities for easy circuit identification
- Egg crate design of plug half fully encloses socket contacts, reducing shock hazard
- Molded skirt extension on cap protects pin contacts
- Strain reliefs for 6 through 36 positions are available
- Choice of tin or gold plated contacts
- Not for interrupting current
- Socket solder tail contacts available for hot side PC Board mounting
- High density achieved through .165 [4.19] contact centerline spacing
- Extraction tool removes both pins and sockets
- Contacts accept 26-18 AWG [.12-.8 mm<sup>2</sup>] wire sizes and insulation diameters of .025-.115 [.635-2.92]
- Same applicator crimps pins and sockets
- Vertical PC Board pin headers are available
- Pin header standoffs on housings at board interface facilitates gas venting and cooling during soldering
- Recognized under the Component Program of Underwriters Laboratories Inc., File No. E28476
- Certified by Canadian Standards Association, File No. LR 7189



#### Performance Characteristics

The Miniature Rectangular Connector performance characteristics found on pages 103-104 are based on free hanging and panel mount connectors, loaded with contacts crimped on stranded wire.

**Dielectric Withstanding Voltage**—2.5 KVAC between adjacent circuits

**Insulation Resistance**—1500 megohms minimum initial between adjacent circuits

**Voltage Rating**—250 V AC

**Connector Mating**—Split Pin—1.0 lb. max. per circuit

**Connector Unmating**—Split Pin—.25 lb. min. per circuit

**Contact Insertion Force**—1.75 lb. max. per contact

**Contact Retention**—10 lb. min. per contact

**Durability**—25 cycles, mating and unmating

#### Technical Documents

##### Product Specifications

108-1022 (MR) Miniature Rectangular Connectors

108-1078 (MR) Miniature Rectangular Headers

##### Application Specification

114-1014 (MR) Miniature Rectangular Contacts

##### Instruction Sheet

408-3231 Pin, Socket, Housing, Contacts, and Accessories

### (MR) Miniature Rectangular Connectors (Continued)

#### Performance Characteristics

(Continued)

**Maximum Current**—Maximum current rating of Miniature Rectangular connectors is limited by the maximum operating temperature of the housings which is 105°C including the temperature rise of the contacts which is a maximum of 30°C. There are several variables which have a direct effect on this maximum current-carrying capability for a given connector and must be considered for each application. These variables are:

**Wire Size**—Larger diameter wire will carry more current since it has less internal resistance to current flow and thus generates less heat. Longer wire lengths also enhance current-carrying capabilities since the wire conducts heat away from the connector.

**Connector Size**—In general, the more circuits in a connector, the less current can be carried.

**Ambient Temperature**—The higher the ambient temperature, the less current can be carried in any given connector.

**Printed Wiring Board Conductor Size**—The finished trace conductor width and thickness should be maximized to allow for the greatest current-carrying capacity and heat dissipation.

Miniature Rectangular connectors also will withstand the following tests:

**Vibration**—10-55-10 cycles per minute at .06 inch total excursion

**Physical Shock**—18 drops, 50 G saw-tooth at 10 milliseconds

**Housing Panel Retention**—50 lb. min.

**Housing Lock Strength**—20 lb. min.

**Thermal Shock**—-55°C to +85°C

**Temperature-Humidity Cycling**—25°C to 65°C at 95 RH

**Corrosion**—48 hr. at 5% salt concentration

#### Wire-to-Wire MR Calculated Current Table

Number of Circuits	Wire Gauge				
	18	20	22	24	26
2	9.00	8.00	6.50	5.50	5.00
3	8.50	7.00	6.00	5.00	4.50
4	7.00	6.50	5.50	5.00	4.00
6	6.00	6.00	5.00	4.00	4.00
9	5.00	5.00	4.00	4.00	3.50
12	4.50	4.50	4.00	3.50	3.00
15	4.50	4.00	3.50	3.00	2.50
20	4.00	4.00	3.50	3.00	2.50
24	4.00	3.50	3.00	2.50	2.00
36	3.50	3.00	2.50	2.00	2.00

Values are based on initial Temperature Rise versus Current Testing and are intended to be a guide in the selection of a connector family. All applications should be tested by the end user. The values listed are per circuit for fully loaded housings being 100% energized. **Note:** All combinations were not tested and this chart contains interpolated and extrapolated values.

#### Minimum Wire Lengths for T-Rise vs. Current Testing

AWG	Min. Length (in.)	AWG	Min. Length (in.)
30	2.6	18	9.4
28	3.2	16	11.3
26	4.1	14	13.7
24	5.1	12	16.4
20	7.8	10	19.3

**Note:** If wire lengths used are less than those listed above, the current-carrying ability of the system will be reduced due to less heat being conducted away from the connector. The customer should fully test all applications.

#### Wire-to-Board

Due to the vast differences in trace geometry and printed circuit board configurations, we are unable to provide a separate current carrying chart for our printed circuit board header products. However, the above Wire-to-Wire charts may be used as a guideline for headers if the trace width and thickness is equal to the listed wire gauge. For vertical headers, only 95% of the Wire-to-Wire value should be used. For right-angle headers, only 75% of the Wire-to-Wire value should be used. The charted values are only a tool for connector selection and will require the customer to fully test their application.

#### Related Product Data Product Specifications

108-1022 (MR) Miniature Rectangular Connectors

108-1078 (MR) Miniature Rectangular Headers

#### Termination Resistance/Contact Crimp Tensile Force

Wire Size		Termination Resistance		Contact Crimp Tensile Force	
AWG	mm <sup>2</sup>	Test Current (Amps)	Resistance Milliohms (Max. Init.)	Force (Min.) lbs.	N
26	.12	1	5.00	5	22
24	.2	1.5	5.00	8	36
22	.3	3	4.50	14	62
20	.5	4.5	4.00	14	62
18	.8	6	4.00	30	133

**Note:** This is the total resistance between wire crimps of a mated pin and socket.

**(MR) Miniature Rectangular Connectors** (Continued)

**(MR) Miniature Rectangular Connector Mating Combinations**

Connector Part Number				Mating Connector Part Number			
Number of Circuits	Flammability Rating	Style	Pin Housing (Cap) Part No.	Socket Housing (Plug) Part No.	PC Board Vertical Pin Headers		
					Plating	.062 Board	.120 Board
2	UL94V-0	In-Line	1-640507-0	1-640517-0	Tin	640497-1	640497-3
					Duplex <sup>1</sup>	2-640497-2	2-640497-4
3	UL94V-0	In-Line	1-640508-0	1-640518-0	Tin	640498-1	640498-3
					Duplex <sup>1</sup>	2-640498-2	2-640498-4
4	UL94V-0	Matrix	1-640509-0	1-640519-0	Tin	640499-1	640499-3
					Duplex <sup>1</sup>	2-640499-2	2-640499-4
6	UL94V-0	Matrix	1-640510-0	1-640520-0	Tin	640500-1	640500-3
					Duplex <sup>1</sup>	2-640500-2	2-640500-4
9	UL94V-0	Matrix	1-640511-0	1-640521-0	Tin	640501-1	640501-3
					Duplex <sup>1</sup>	2-640501-2	2-640501-4
12	UL94V-0	Matrix	1-640512-0	1-640522-0	Tin	640502-1	640502-3
					Duplex <sup>1</sup>	2-640502-2	2-640502-4
15	UL94V-0	Matrix	1-640513-0	1-640523-0	Tin	640503-1	640503-3
					Duplex <sup>1</sup>	2-640503-2	2-640503-4
20	UL94V-0	Matrix	1-640514-0	1-640524-0	Tin	640504-1	640504-3
					Duplex <sup>1</sup>	2-640504-2	2-640504-4
24	UL94V-0	Matrix	1-640515-0	1-640525-0	Tin	640505-1	640505-3
					Duplex <sup>1</sup>	2-640505-2	2-640505-4
36	UL94V-0	Matrix	1-640516-0	1-640526-0	Tin	640506-1	640506-3
					Duplex <sup>1</sup>	2-640506-2	2-640506-4

<sup>1</sup>Duplex Finish—Plated with .000030 [.000762] min. gold in mating area, matte tin on solder tail end over .000050 [.00127] min. nickel underplate on entire contact.

**Note:** All part numbers are RoHS Compliant.

High Density  
.165 [4.20] Centerline

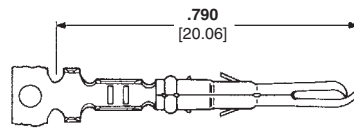
#### Contacts

Pin diameter .068 [1.73]

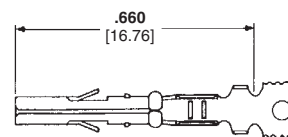
#### Material

Phosphor bronze

Stock thickness .008 [.203]



Live Split Pin



Standard Socket

Wire Size Range AWG [mm <sup>2</sup> ]	Ins. Dia. Range	Finish	Contact Part Numbers				HDM Applicator Part No.	Hand Tool Part No.
			Live Split Pin		Standard Socket			
			Strip Form	Loose Piece	Strip Form	Loose Piece		
26-24 [.12-.2]	.025-.050 .635-1.27	Pre-tin	350968-1	640579-1	794000-1	794001-1	466352-1 <sup>3</sup>	91534-1
		Select Gold <sup>1</sup>	350968-2	640579-2	794000-2	794001-2	466352-3 <sup>3</sup>	
26-18 <sup>2</sup> [.12-.8]	.050-.115 1.27-2.92	Pre-tin	350967-1	640545-1	641294-1	641300-1	466351-1 <sup>3</sup>	91526-1
		Select Gold <sup>1</sup>	350967-2	640545-2	641294-2	641300-2	466351-2 <sup>3</sup> 466351-4 <sup>3</sup>	

<sup>1</sup>Select Gold Finish—Plated with .000030 min. [.000762] gold in mating area over .000050 [.00127] min. nickel underplate on entire contact.

<sup>2</sup>1650 CMA maximum.

<sup>3</sup>HDM Applicator part number ending in -1 is used on AMPOMATOR CLS Machine with T or G Terminators, -2 is used on AMP-O-LECTRIC Model K Machine, -3 or -4 is used on AMP-O-LECTRIC Model G Machine. See pages 201-204 for further information.

#### Grounding Pins

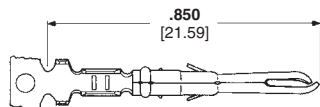
(Mate first, break last, not for interrupting current)

Pin diameter .068 [1.73]

Stock thickness .008 [.203]

#### Material

Phosphor bronze



Wire Size Range AWG [mm <sup>2</sup> ]	Ins. Dia. Range	Finish	Grounding Pin Part Numbers		HDM Applicator Part No.	Hand Tool Part No.
			Strip Form	Loose Piece		
26-18 <sup>2</sup> [.12-.8]	.050-.115 1.27-2.92	Pre-tin	350969-1	640580-1	466351-1 <sup>3</sup>	91526-1
		Select Gold <sup>1</sup>	350969-2	640580-2	466351-2 <sup>3</sup> 466351-4 <sup>3</sup>	

<sup>1</sup>Select Gold Finish—Plated with .000030 [.000762] min. gold in mating area over .000050 [.00127] min. nickel underplate on entire contact.

<sup>2</sup>1650 CMA maximum.

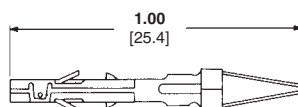
<sup>3</sup>HDM Applicator part number ending in -1 is used on AMPOMATOR CLS Machine with T or G Terminators, -2 is used on AMP-O-LECTRIC Model K Machine, -3 or -4 is used on AMP-O-LECTRIC Model G Machine. See pages 201-204 for further information.

#### Solder Tail Socket

##### Material and Finish

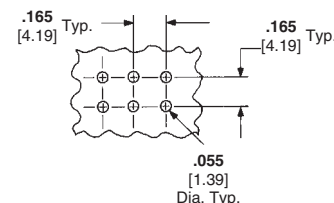
Phosphor bronze, pre-tin

Stock thickness .008 [.203]



Part Number 350838-1

Note: Recommended for use with MR Socket Housings

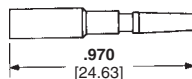


Recommended PC Board Hole Layout

.062 [1.57] or .093 [2.36] thick board

#### Keying Plug

IS 408-3231



Part Number 350591-1

UL94V-0 Nylon material

Note: Use in socket housings only.

#### Related Product Data

##### Product Specification

108-1022 (MR) Miniature Rectangular Connectors

##### Application Specification

114-1014 (MR) Miniature Rectangular Contacts

##### Performance Characteristics—

pages 103-104

Housings—pages 107-108

Technical Documents—pages 103 and 199-200

Application Tooling—pages 201-204



Contact Extraction Tool

Part No. 455822-2

IS 408-9570



Contact Insertion Tool

(For inserting contacts applied to small diameter wire)

Part No. 455830-1

IS 408-7984

Note: All part numbers are RoHS Compliant.

**(MR) Miniature Rectangular Connectors (Continued)**

**Housings**

**Free Hanging or Panel Mount**

.165 [4.19] Centerline spacing

**Material**

Nylon, Natural (Color—Brick Red)

**Flammability Rating**—UL94V-0

**Related Product Data**

**Product Specification**

108-1022 (MR) Miniature Rectangular Connectors

**Performance Characteristics**—pages 103-104

**Panel Cutout Recommendations**—page 109

**Contacts**—page 106

**Keying Plug**—page 106

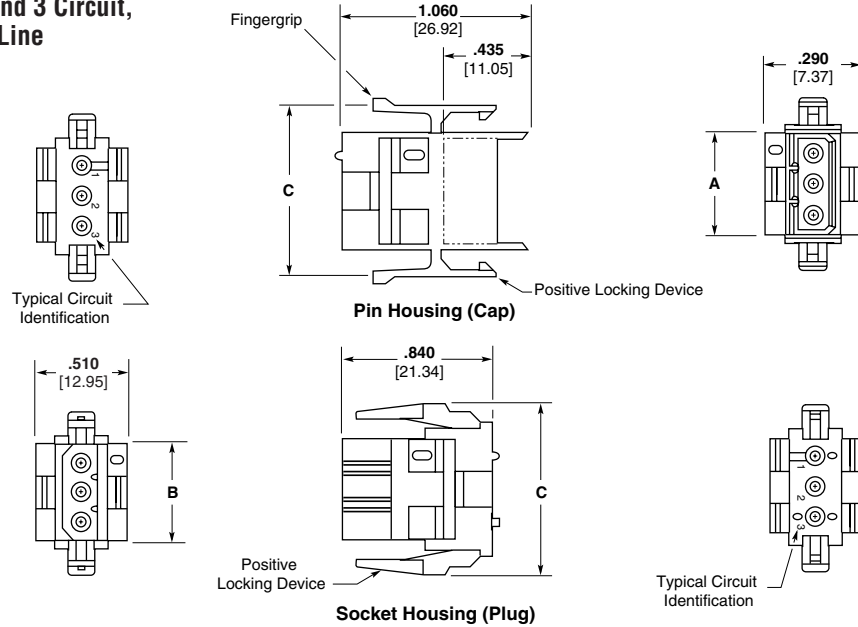
**Strain Reliefs**—page 110

**Commoning Bars**—page 110

**Technical Documents**—pages 103 and 199-200

**Mating Headers**—pages 111-112

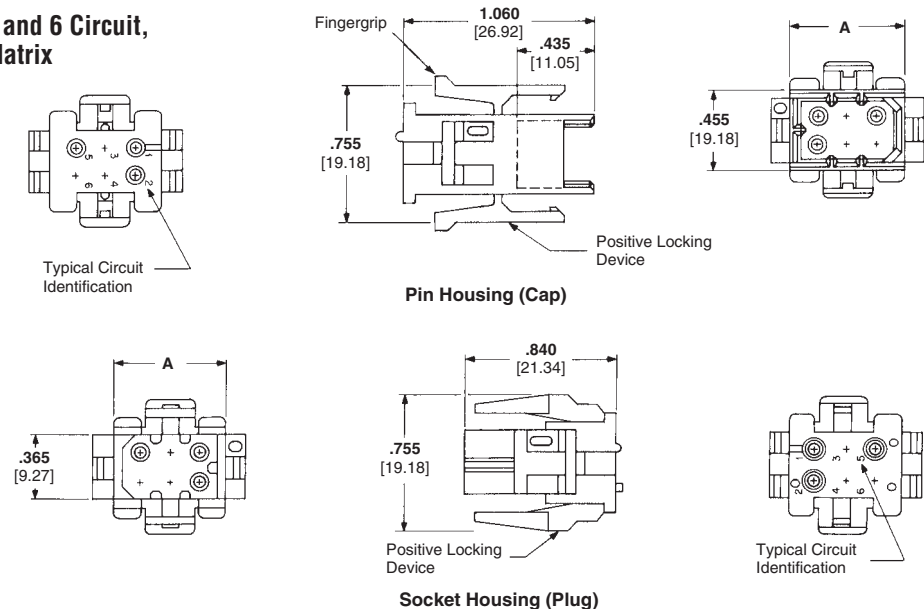
**2 and 3 Circuit, In-Line**



Number of Circuits	Dimensions			Part Numbers	
	A	B	C	Pin Housing (Cap)	Socket Housing (Plug)
2	.455 11.56	.365 9.27	.755 19.18	1-640507-0	1-640517-0
3	.620 15.75	.530 13.46	.920 23.37	1-640508-0	1-640518-0

**Note:** All part numbers are RoHS Compliant.

**4 and 6 Circuit, Matrix**



Number of Circuits	A Dim.	Part Numbers	
		Pin Housing (Cap)	Socket Housing (Plug)
4	.455 11.56	1-640509-0	1-640519-0
6	.620 15.75	1-640510-0	1-640520-0

**Note:** All part numbers are RoHS Compliant.

High Density  
.165 [4.20] Centerline

**(MR) Miniature Rectangular Connectors (Continued)**

**Housings**

**Free Hanging or Panel Mount**

.165 [4.19] Centerline spacing

**Material**

Nylon, Natural (Color—Brick Red)

**Flammability Rating**—UL94V-0

**Related Product Data**

**Product Specification**

108-1022 (MR) Miniature Rectangular Connectors

**Performance Characteristics**—pages 103-104

**Panel Cutout Recommendations**—page 109

**Contacts**—page 106

**Keying Plug**—page 106

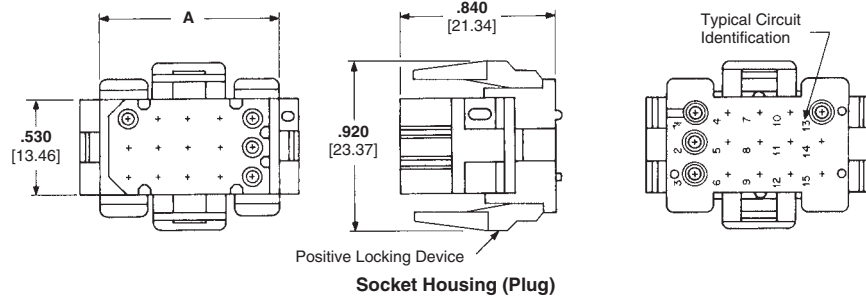
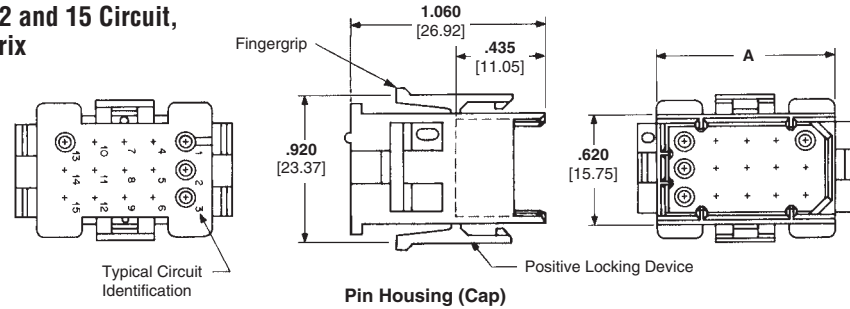
**Strain Reliefs**—page 110

**Commoning Bars**—page 110

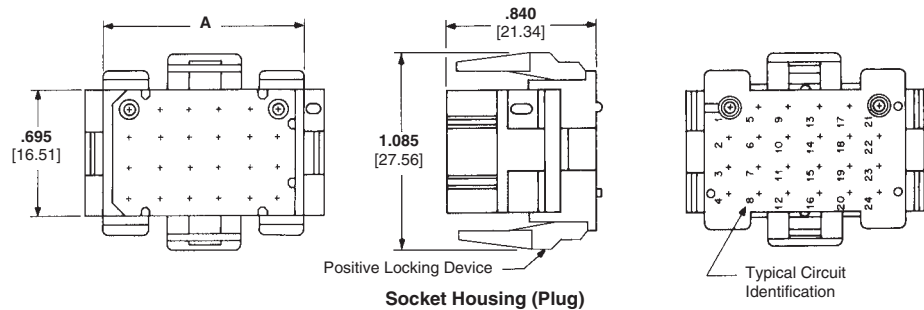
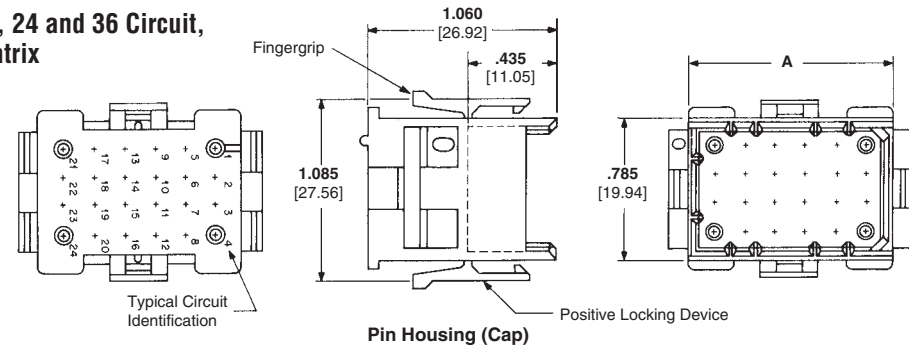
**Technical Documents**—pages 103 and 199-200

**Mating Headers**—pages 111-112

**9, 12 and 15 Circuit, Matrix**



**20, 24 and 36 Circuit, Matrix**



Number of Circuits	A Dim.	Part Numbers	
		Pin Housing (Cap)	Socket Housing (Plug)
9	.620 [15.75]	1-640511-0	1-640521-0
12	.785 [19.94]	1-640512-0	1-640522-0
15	.950 [24.13]	1-640513-0	1-640523-0
20	.950 [24.13]	1-640514-0	1-640524-0
24	1.115 [28.32]	1-640515-0	1-640525-0
36	1.610 [40.89]	1-640516-0	1-640526-0

**Note:** All part numbers are RoHS Compliant.

**Recommended Panel  
Cutouts for Pin and Socket  
Housings**

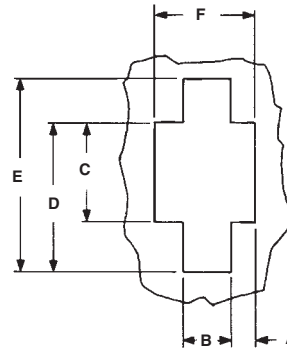
**Related Product Data**

**Product Specification**

108-1022 (MR) Miniature Rectangular  
Connectors

**Housings**—pages 107-108

**Technical Documents**—pages 103  
and 199-200



View is from housing entry side

Panel Thickness .068 [1.75] Max.

Number of Circuits	Panel Cutout Dimensions					
	A	B	C	D	E	F
2	.105 2.67	.220 5.59	.475 12.07	.630 16.00	.785 19.94	.430 10.92
3	.105 2.67	.220 5.59	.640 16.26	.795 20.19	.950 24.13	.430 10.92
4	.157 3.99	.280 5.28	.475 12.07	.630 16.00	.785 19.94	.595 15.11
6	.208 5.28	.345 8.76	.475 12.07	.630 16.00	.785 19.94	.760 19.30
9	.208 5.28	.345 8.76	.640 16.26	.795 20.19	.950 24.13	.760 19.30
12	.225 5.72	.475 12.07	.640 16.26	.795 20.19	.950 24.13	.925 23.50
15	.308 7.82	.475 12.07	.640 16.26	.795 20.19	.950 24.13	1.090 27.69
20	.308 7.82	.475 12.07	.805 20.45	.960 24.38	1.115 28.32	1.090 27.69
24	.390 9.91	.475 12.07	.805 20.45	.960 24.38	1.115 28.32	1.255 31.88
36	.625 15.86	.500 12.70	.800 20.32	.950 24.13	1.100 27.94	1.750 44.45

**Notes:**

1. When mounted in a .060 [1.52] thick panel, the cap's mating end extends .800 [20.32] beyond the panel front; wire end extends .220 [55.88] from the panel rear. Plug mating end extends .580 [14.73] beyond the panel front; wire end extends .220 [55.88] from the panel rear.
2. The panel should be punched so that the housing enters the panel in the same direction as the punch for ease of assembly.

High Density  
.165 [4.20] Centerline

**Strain Reliefs**

**One Piece — Clam Shell**

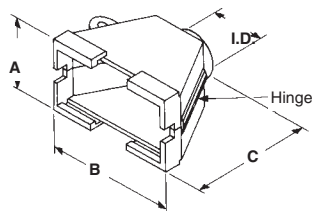
(Illustrated in closed position)

IS 408-3231

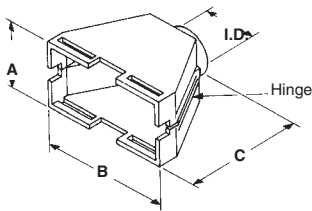
**Material**

Nylon, Natural (Color—Brick Red)

**Flammability Rating**—UL94V-0



6, 9, 12, 15 and 20 Circuit



24 and 36 Circuit

Number of Circuits	Dimensions				Part Numbers
	I.D.	A	B	C	
6	.374	.634	.760	1.000	350373-1
	9.50	16.10	19.30	25.4	
9	.420	.800	.760	1.000	350522-1
	10.67	20.32	19.30	25.4	
12	.420	.790	.925	1.000	350374-1
	10.67	20.07	23.50	25.4	
15	.420	.790	1.090	1.000	350523-1
	10.67	20.07	27.69	25.4	
20	.560	.960	1.090	1.280	480634-1
	14.22	24.38	27.69	23.51	
24	.560	.900	1.255	1.280	350524-1
	14.22	22.86	31.88	23.51	
36	.560	.900	1.750	1.280	480594-1
	14.22	22.86	44.45	23.51	

**Notes:**

- These strain reliefs can be used with either pin or socket housings.
- Customer supplied:** One No. 6 Panhead Type B self-taping screw, 3/8 long. Plating is optional to conform to customer requirements.
- Strain reliefs are also available in UL94V-2 nylon, black in color. To order strain reliefs in this material use the appropriate dash numbers: 1-XXXXXX-9.

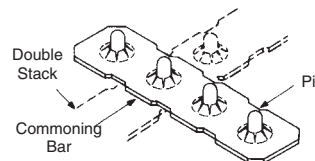
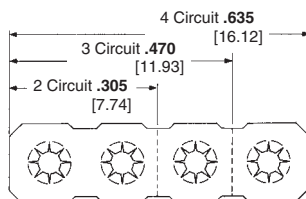
**Commoning Bars**

IS 408-3231

**Material**

Brass

Stock thickness .008 [.203]



Finish	Part Numbers		
	2 Circuit	3 Circuit	4 Circuit
Pre-tin	350020-1	350021-1	350022-1
Gold <sup>1</sup>	350020-2	350021-2	350022-2

<sup>1</sup>Gold Finish—Plated with .000030 [.000762] min. gold over .000050 [.00127] min. nickel underplate on entire contact.

**Related Product Data**

**Housings**—pages 107-108

**Notes:**

- Commoning bars can be used to common adjacent pin contacts in any column or row. Maximum stack per pin is two.
- The above illustrates the proper insertion of the Commoning Bar.
- Use the mating socket housing to assemble the Commoning Bar onto the pins.



**Commoning Bar Extraction Tool**  
Part No. 457306-1  
IS 408-3231

**Note:** All part numbers are RoHS Compliant.



**(MR) Miniature Rectangular Connectors** (Continued)

**PC Board Vertical Pin Headers**

.165 [4.19] Centerline spacing

**Material**

**Housing**— Nylon, Natural (Color— Brick Red)

**Flammability Rating**— UL94V-0

**Contacts**— Phosphor bronze  
Solder tail diameter .040 [1.02]

**Related Product Data**

**Product Specification**

108-1078 (MR) Miniature Rectangular Headers

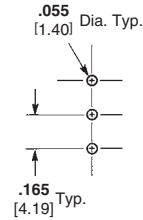
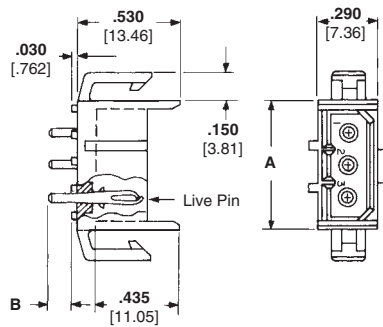
**Dimensions A and B**— page 112

**Performance Characteristics**— pages 103-104

**Technical Documents**— pages 103 and 199-200

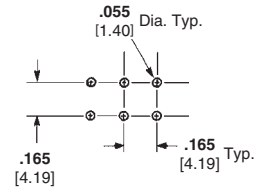
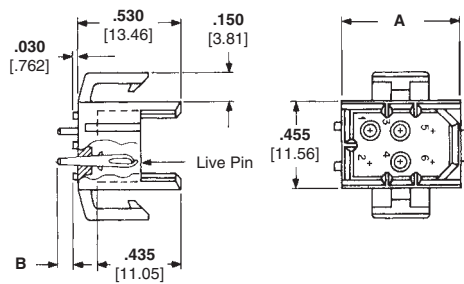
**Mating Socket Housings**— pages 107-108

**2 and 3 Circuit, In-Line**



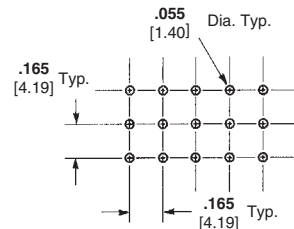
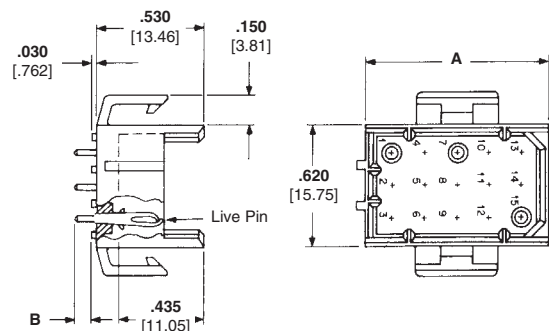
Recommended PC Board Hole Layout

**4 and 6 Circuit, Matrix**



Recommended PC Board Hole Layout

**9, 12 and 15 Circuit, Matrix**



Recommended PC Board Hole Layout

High Density  
.165 [4.20] Centerline

**(MR) Miniature Rectangular Connectors** (Continued)

**PC Board Vertical Pin Headers**

.165 [4.19] Centerline spacing

**Material**

**Housing**— Nylon, Natural (Color— Brick Red)

**Flammability Rating**— UL94V-0

**Contacts**— Phosphor bronze  
Solder tail diameter .040 [1.02]

**Related Product Data**

**Product Specification**

108-1078 (MR) Miniature Rectangular Headers

**Dimensions** (2 and 3 Circuit, In-Line; 4, 6, 9, 12 and 15 Circuit, Matrix)  
— page 112

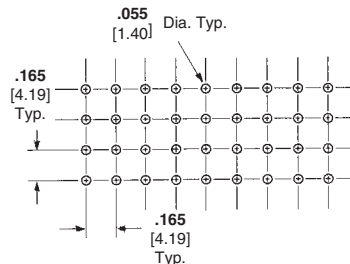
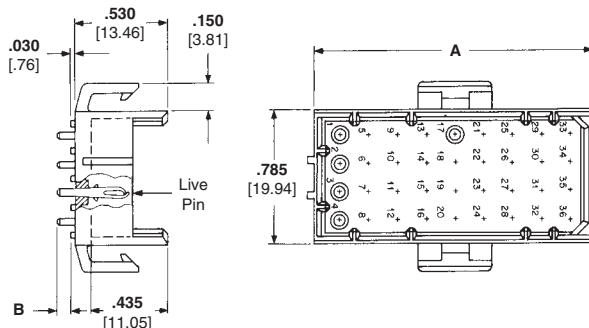
**Performance Characteristics**— pages 103-104

**Vertical Pin Headers and Recommended PC Board Hole Layouts**—pages 111-112

**Technical Documents**— pages 103 and 199-200

**Mating Socket Housings**— pages 107-108

**20, 24 and 36 Circuit, Matrix**



Recommended PC Board Hole Layout

Number of Circuits	Board Thickness	Dimensions		Header Part Numbers		Mates with Socket Housing Part No.
		A	B	Tin Finish	Duplex Finish <sup>1</sup>	
2 In-Line	.062 1.57	.455 11.56	.120 3.05	640497-1	2-640497-2	1-640517-0
	.120 3.05	.455 11.56	.180 4.57	640497-3	2-640497-4	
3 In-Line	.062 1.57	.620 15.75	.120 3.05	640498-1	2-640498-2	1-640518-0
	.120 3.05	.620 15.75	.180 4.57	640498-3	2-640498-4	
4	.062 1.57	.455 11.56	.120 3.05	640499-1	2-640499-2	1-640519-0
	.120 3.05	.455 11.56	.180 4.57	640499-3	2-640499-4	
6	.062 1.57	.620 15.75	.120 3.05	640500-1	2-640500-2	1-640520-0
	.120 3.05	.620 15.75	.180 4.57	640500-3	2-640500-4	
9	.062 1.57	.620 15.75	.120 3.05	640501-1	2-640501-2	1-640521-0
	.120 3.05	.620 15.75	.180 4.57	640501-3	2-640501-4	
12	.062 1.57	.785 19.94	.120 3.05	640502-1	2-640502-2	1-640522-0
	.120 3.05	.785 19.94	.180 4.57	640502-3	2-640502-4	
15	.062 1.57	.950 24.13	.120 3.05	640503-1	2-640503-2	1-640523-0
	.120 3.05	.950 24.13	.180 4.57	640503-3	2-640503-4	
20	.062 1.57	.950 24.13	.120 3.05	640504-1	2-640504-2	1-640524-0
	.120 3.05	.950 24.13	.180 4.57	640504-3	2-640504-4	
24	.062 1.57	1.115 28.32	.120 3.05	640505-1	2-640505-2	1-640525-0
	.120 3.05	1.115 28.32	.180 4.57	640505-3	2-640505-4	
36	.062 1.57	1.610 40.89	.120 3.05	640506-1	2-640506-2	1-640526-0
	.120 3.05	1.610 40.89	.180 4.57	640506-3	2-640506-4	

<sup>1</sup>Duplex Finish— Plated with .000030 [.000762] min. gold in mating area, matte tin on solder tail end over .000050 [.00127] min. nickel underplate on entire contact.

**Note:** All part numbers are RoHS Compliant.