

PS-VM-RD user manual

Nimag Networks SàRL

April 16, 2024

DIN-mounted power supply, voltage measure and relay drive unit
Full version of manual with external datasheets for certification process



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DEPUIS 1998

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Copyright information

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Legal notice

Only the latest version of this document, available at <https://electro.nimag.net/PS-VM-RD/>, is considered valid. There, you will also get more useful information such as application examples and notes, sample code and **technical assistance**. Should the above URL be unavailable, technical assistance and support is provided by *Nimag Networks SàRL, Rue de Sébeillon 9b, 1004 Lausanne, Switzerland*.

1 Intended use

The PS-VM-RD unit is a 3-in-1 power supply, voltage measure and relay drive unit for continuous use in electrical boxes. It is targetted at OEM and qualified personel only. In case of any doubt regarding the accuracy of the voltage measure function, voltage readings should be compared with a known working and calibrated voltmeter.

2 Technical specification

- Power Supply (+5VDC@500mA, +12V@40mA, -12V@40mA)
- AC voltage measure (12x 250VAC inputs @min 50kHz, multiplexed) over SPI
- Relay drive (2x CPU-controllable 230VAC fuse-protected (5) outputs)
- 2x thermistors (multiplexed, over SPI)
- 16 pin connector for CPU control and DC power output
- Logic works through 74HCT, input signal range is from 3.3V CMOS to 5V TTL. Output is always 5V (for a 3.3V-tolerant CPU, a 4.7k resistor is required on SDO)
- 4-unit wide DIN (IEC 60715 TH 35-7.5 or TH 35-15) rail mounted enclosure

2.1 Equipment rating

- Supply voltage: 230 VAC $\pm 10\%$, 50-60Hz, 100mA max (internal fuse present)
- Transient overvoltages up to the levels of *overvoltage category II* ; temporary overvoltages occuring on the mains supply
- Rated for normal environmental conditions (indoor use only or in a weather-proof enclosure, altitude up to 2000mAMSL, temperature between 5°C and 40°C)
- Pollution degree 1 (no pollution or only dry, non-conductive pollution occurs, which has no influence) ; IP20-rated as per IEC 60529. Pollution degree 2 (only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation is expected) will cause no damage if the equipment is powered off and no safety risk if the equipment is powered on.
- Maximum relative humidity 80% for temperatures up to 31°C decreasing linearly to 50% relative humidity at 40°C
- Impact resistance is IK07 (2J) as per EN 62262 : the equipment was tested with repeated impacts with a 400g 45mm steel sphere dropped from a height of a little more than 500mm and a 1400g 70mm steel sphere from a height of a little more than 150mm and sustained no damage ; dropping the equipment by a height of 150mm on a hard floor resulted in no permanent damage but the rear cover sometimes came off and needed to be placed back. Since the device is intended to be installed in a location where it cannot be touched by unauthorized persons or the general public, since the equipment is intended to be mounted vertically and usually further protected by another enclosure, and since in normal use the equipment is only accessed for occasional operations such as maintenance, *Nimag Networks SàRL* assesses that stronger impacts are likely to be only caused intentionally or by sheer negligence and therefore the lower energy level (<IK08) is acceptable. Should the equipment become damaged, it must not be used and must be either disposed of properly for recycling or sent back to the manufacturer.

2.2 Cleaning and decontamination

Should the device become dirty, it must be disconnected and cleaned with a soft brush or cloth and isopropyl alcohol before it is allowed to fully dry. In case of heavy contamination, fuses must be removed and fuse holders left open, the case and printed circuit boards must be disassembled and dipped in an ultrasonic cleaner filled with isopropyl alcohol, wiped dry and allowed to fully dry in a well ventilated area ; after the device is reassembled, the device must be tested so that proper operation is validated.

2.3 Applicable norms and standards

- **UL27**, ID E479892 (PCB) <https://jlcpcb.com/help/article/27-UL-Certification>
- **UL94-V0**, flame retardant polycarbonate (case, fuse holders)
- **EN 6158-2-6, IEC 61558-2-6, VDE0570 Part 2-6** (safety isolating transformer)

2.4 Device anatomy

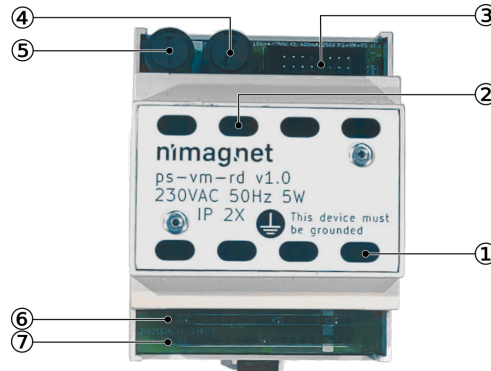


Figure 1: Anatomy of the PS-VM-RD unit

1. *Power OK* LED (on +5VDC power rail)
2. 2x relay status LEDs (on bottom PCB, deep inside unit)
3. 16-pin CPU connector (electrostatic-sensitive connector, should be handled as such)
4. 30V 500mA medium blow fuse (F2, Ø5.0-5.2 x 20mm)
5. 250V 100mA medium blow fuse (F1, Ø5.0-5.2 x 20mm)
6. voltage measure Niconnector
7. power input and measure Niconnector

2.5 Mechanical drawings & dimensions

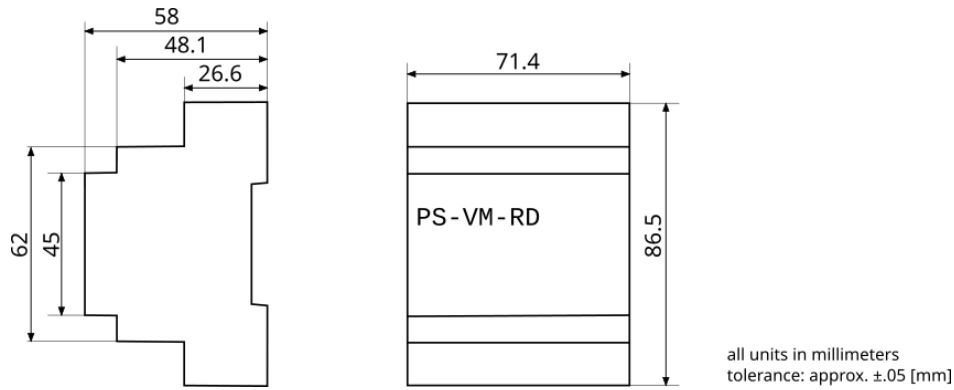


Figure 2: Physical dimensions of PS-VM-RD unit

2.6 Pinout

2.6.1 16-pin CPU connector (3)

Pin n°	Name	Function	Type	Description
1-2	GND	Ref	Ground	Ground
3-4	5V	Output	DC Power	Supply voltage (1)
5	-12V	Output	DC Power	Negative differential voltage
6	+12V	Output	DC Power	Positive differential voltage
7	RAON	Input	Digital	Relay A enable (5), active high
8	RBON	Input	Digital	Relay B enable (5), active high
9	RCON	Input	Digital	Spare (on an internal pad)
10	RDON	Input	Digital	Spare (on an internal pad)
11	1.65BIAS	Output	ARef	1.65[V] Bias voltage (50mA max, sink and source)
12	AOUTA	Output	Analog	Analog Out
13	SDI	Input	Digital	Serial Data In
14	SDO	Output	Digital	Serial Data Out
15	CLK	Input	Digital	SPI Clock
16	LATCH	Input	Digital	SPI Latch enable

Table 1: 16-pin CPU connector pinout

2.6.2 Voltage measure Niconnector (6)

Pin n°	Name	Function	Description
1	GND	PE	Ground
3	NA	Input	Neutral
5	L1A	Input	Phase 1
7	L2A	Input	Phase 2
9	L3A	Input	Phase 3
11	NB	Input	Neutral
13	L1B	Input	Phase 1
15	L2B	Input	Phase 2
17	L3B	Input	Phase 3
19-20	GND	PE	Ground

Table 2: Voltage measure connector pinout (J2)

2.6.3 Power input Niconnector (7)

Pin n°	Name	Function	Description
1	GND	PE	Ground
3	R1	Output	230VAC Relay 1 output
5	R2	Output	230VAC Relay 2 output
7	<i>n/c</i>	<i>Not connected</i>	<i>Not connected</i>
9-10	N	Input/AC Power	Neutral
12-13	L1	Input/AC Power	Phase 1
15	L2	Input	Phase 2
17	L3	Input	Phase 3
19-20	GND	PE	Ground

Table 3: Power input connector pinout (J3)

3 Installation instructions

3.1 Package contents

- 1x PS-VM-RD manual (this document)
- 1x PS-VM-RD unit
- 1x 3-phase+N power input and measure + 2-relay output + (PE) Niconnector with 50cm wires
- 1x 2x 3-phase+N + (PE) relay output measure Niconnector with 50cm wires

3.2 Unboxing and physical installation

- ensure package is complete, with all items listed above
- disconnect the power supply of your electrical switchboard by removing the fuses or with the help of circuit breakers
- install PS-VM-RD unit on a free space of your DIN rail ; the rail should be mounted so that it holds 4 times the weight of the equipment
- study the schematic labelled *Electrical connection of PS-VM-RD* (see appendices) to ensure you are familiar with the required wire sections and the connection is performed according to the specification
- connect relay output measure Niconnector (6) on PS-VM-RD unit ; connect wires to relay outputs ; secure the wires with non-conductive ties (ie. zip ties) so they are not left hanging loose
- connect power input and relay control Niconnector (7) on PS-VM-RD unit ; connect and secure the wires
- re-enable the power supply ; *Power OK* LED (5) should be lit solid green
- connect CPU flat cable to socket (3) on control unit ; connect other side to CPU
- turn on the power supply : PS-VM-RD unit is now ready to use

Note: the safety of any system incorporating the equipment is the responsibility of the assembler of the system.

4 Appendices

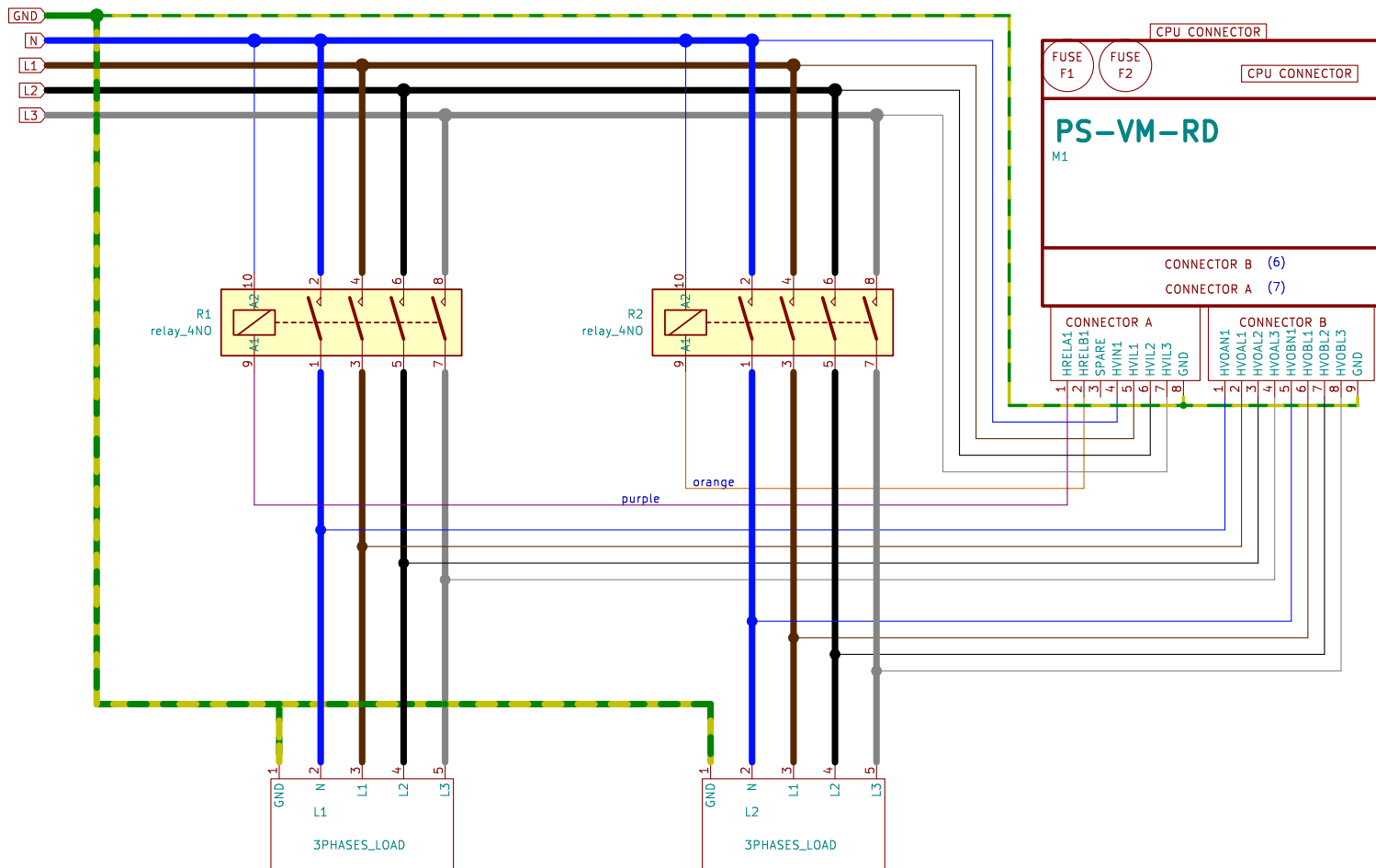
Schematics

- Electrical connection of PS-VM-RD
- PS-VM-RD Mainboard
- Voltage measure board for PS-VM-RD

External datasheets

- CNMB-4-KIT (case drawing and specs)
- Safety isolating transformer
- Shocksafe fuse holder for PCB
- Female Headers

AC MAINS



Recommended wire cross-sections

- 0.75 mm²
- 0.75 to 1.5 mm²
- 2.5 mm² or more depending on application

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Sheet: /
File: PS-VM-RD_electrical-connection.kicad_sch

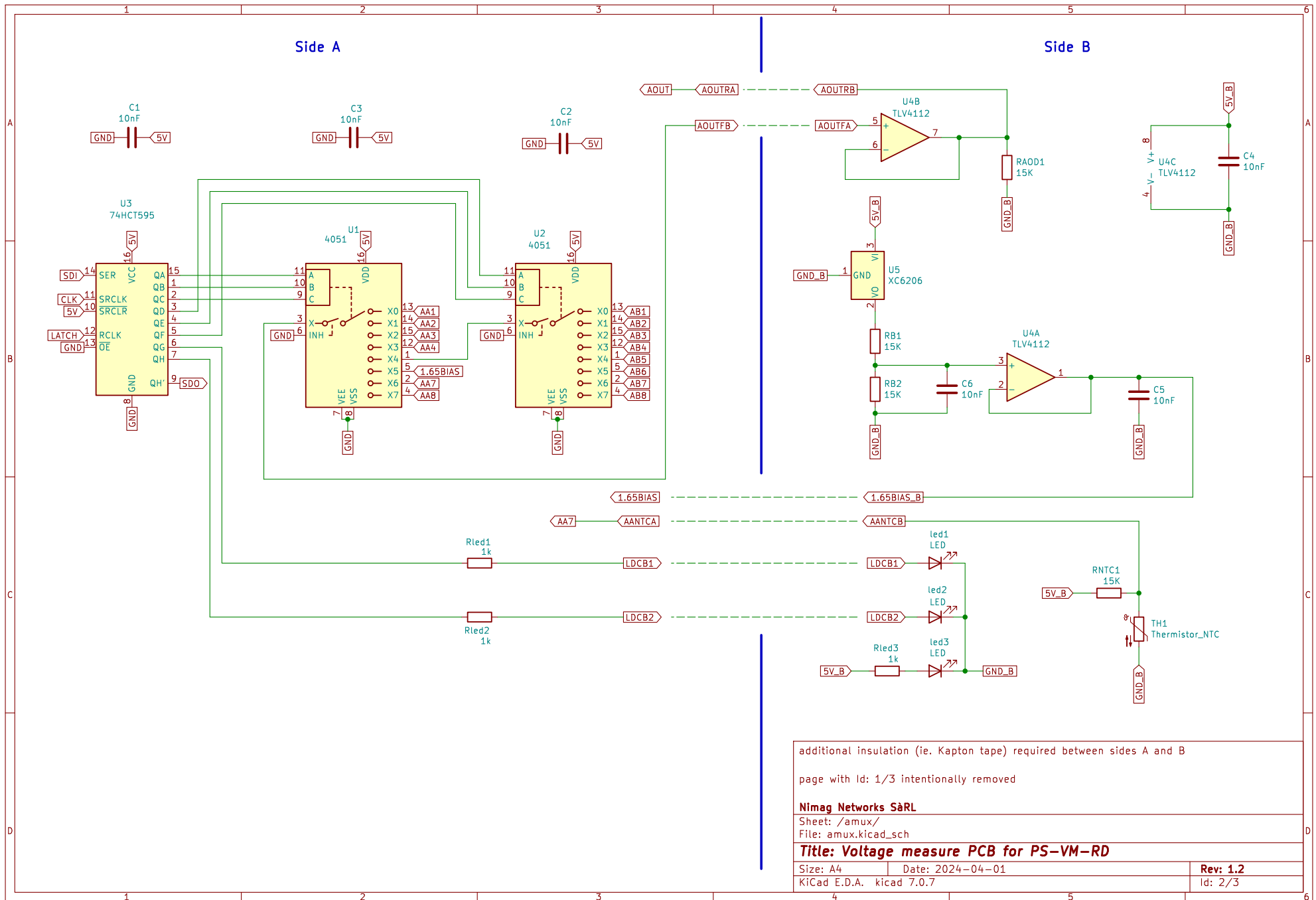
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Size: A4 Date: 2024-04-01

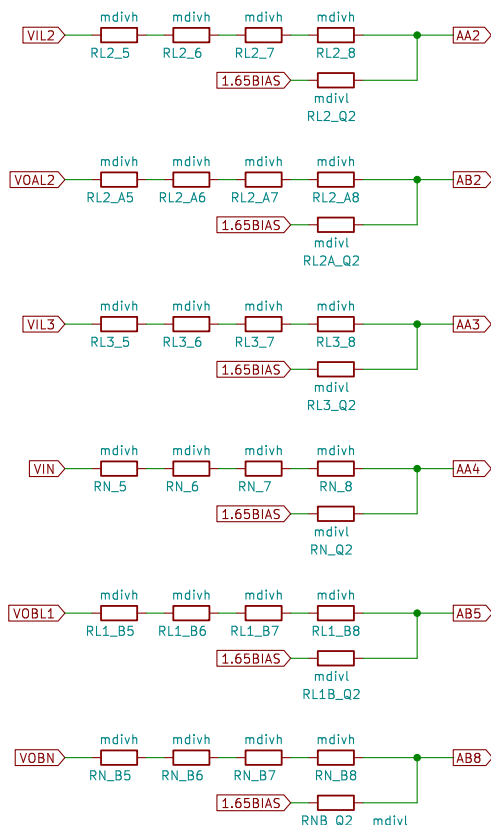
KiCad E.D.A. kicad 7.0.7

Rev: 1.1

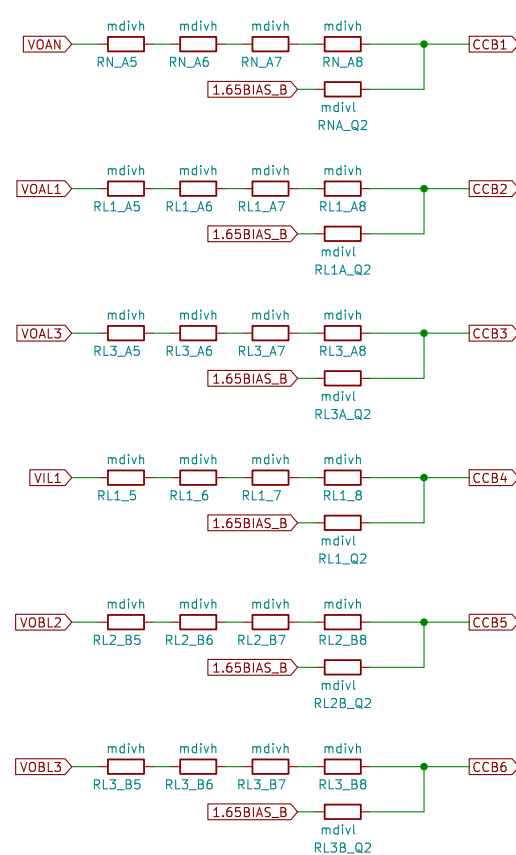
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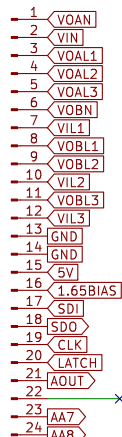
Side A



Side B

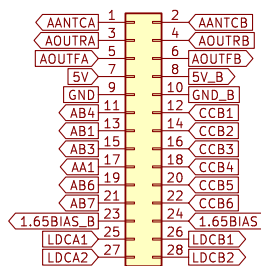


to/from PS-VM-RD mainboard



J2
Conn_01x24_Male

board interconnection



pads, back side of PCB

castellated edge

mdivl: 15kOhm

mdivh: 1MOhm 250mW

0.1 mA @ 400V : 40mW

0.25 mA @ 1000V: 250mW

0.5 mA @ 2000V: 1W (each 1MOhms R is rated 250 mW,
should sustain this voltage several minutes)

1 mA @ 4000V: 4W (can resist several seconds, but not one minute)

additional insulation (ie. Kapton tape) required between sides A and B

page with Id: 1/3 intentionally removed

Nimag Networks SàRL

Sheet: /vm_rdiv/

File: vm_rdiv.kicad_sch

Title: Voltage measure PCB for PS-VM-RD

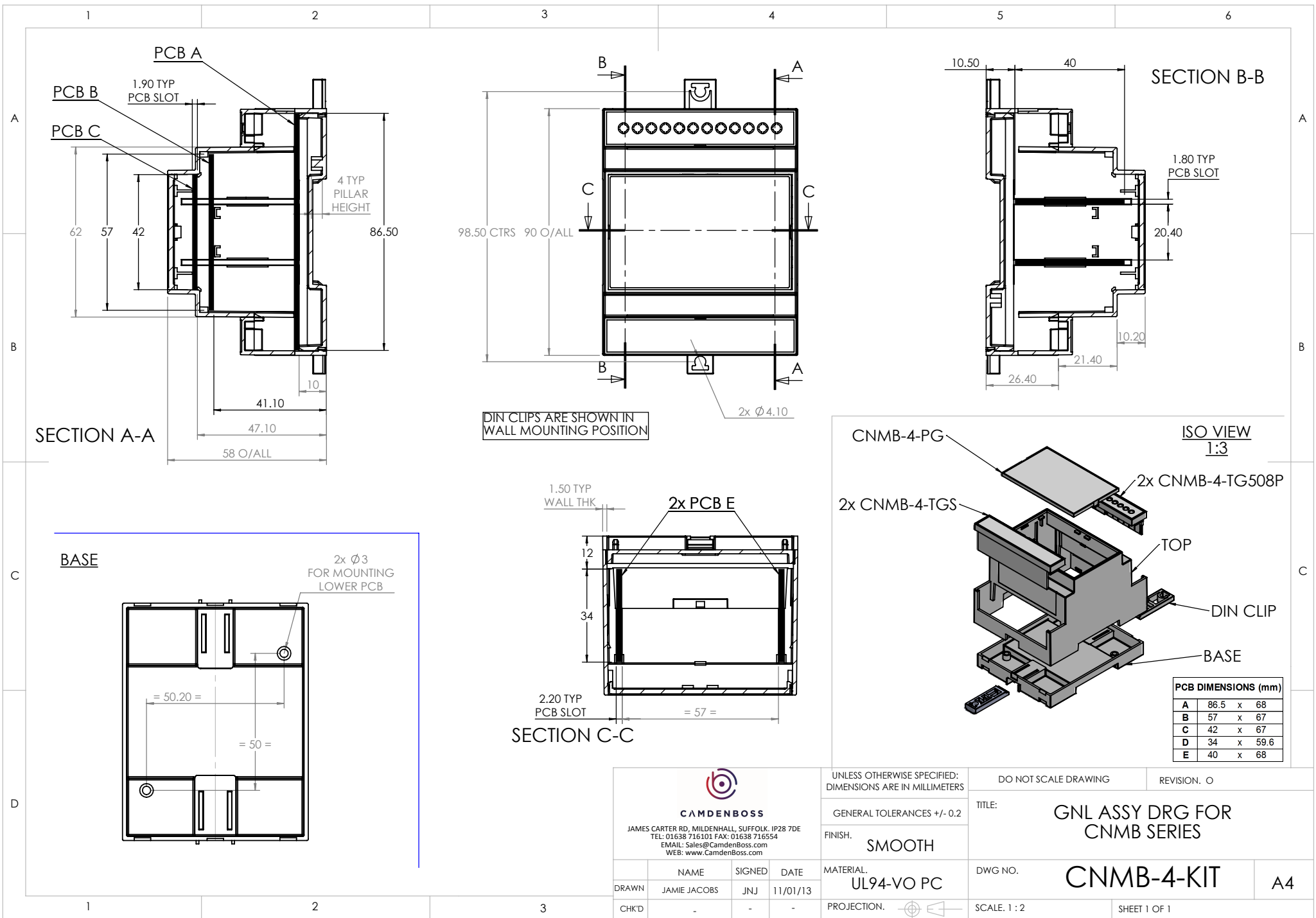
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Date: 2024-04-01

Rev: 1.2

KiCad E.D.A. kicad 7.0.7

Id: 3/3



CAMDENBOSS
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	NAME	SIGNED	DATE
DRAWN	JAMIE JACOBS	JNJ	11/01/13
CHK'D	-	-	-

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MILLIMETERS

GENERAL TOLERANCES +/- 0.2

FINISH. SMOOTH

MATERIAL. UL94-VO PC

PROJECTION.

DO NOT SCALE DRAWING

REVISION. 0

TITLE: GNL ASSY DRG FOR CNMB SERIES

DWG NO. CNMB-4-KIT

SCALE: 1 : 2

SHEET 1 OF 1

A4

FUSIBILE TIPO
FUSE LINK

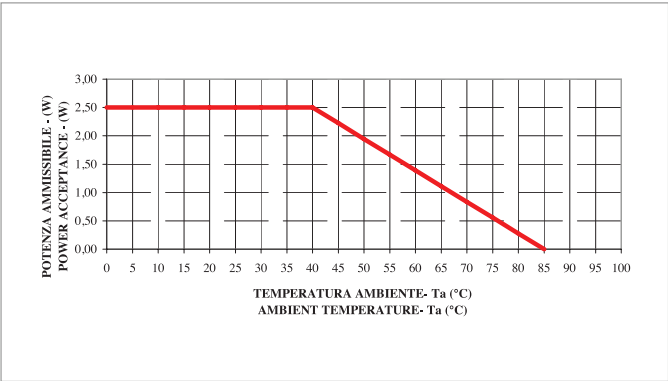
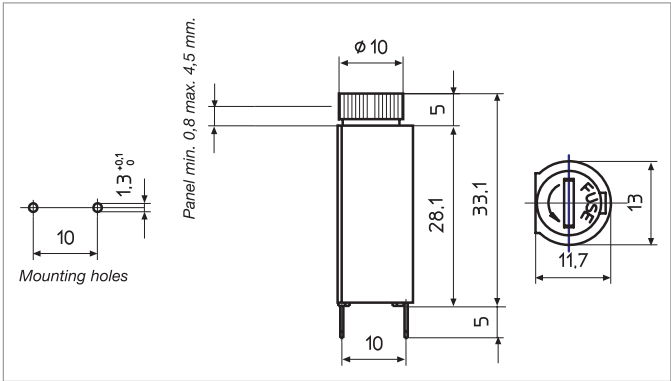
5 x 20 mm

MONTAGGIO
MOUNTING

CS
PCB



Corrente nominale Rated Current		A	10 Pending
Tensione nominale Rated Voltage		VAC	250
Potenza dissipabile Rated Power Acceptance		W	2,5
Corpo isolante Housing		—	PBT - UL 94 V0
Temperatura ambiente ammissibile Admissible ambient air temperature		°C	-30 °C to 85 °C
Protezione contro le scosse elettriche Shocksafe category		PC	PC2
Grado di protezione Degree of protection		IP	IP20
Resistenza di contatto Contact Resistance		mΩ	< 5
 EN 60127-6	Corrente Nominale Rated Current	A	10 Pending
	Tensione nominale Rated Voltage	VAC	250
	Potenza dissipabile Rated Power Acceptance	W	2,5
 UL 512 + C22.2 no. 39	Corrente Nominale Rated Current	A	10
	Tensione nominale Rated Voltage	VAC	250
	Potenza dissipabile Rated Power Acceptance	W	—
Colore standard Standard colour		—	nero - black
Altri colori Other colours		—	A richiesta - On demand
Accessori Accessories		Pag	
Altri dati Other information		Pag	sezione B/A2- section B/A2



BAUREIHE

SERIES

420

Sicherheitstransformator

safety isolating transformer

Typenreihe type		Kerntype core type	Leistung output	Seite page
421	Nicht kurzschlussfest / non-short-circuit-proof	EI42/14,8	4,8VA	2
421T	mit Temperatursicherung) / with integrated thermal fuse	EI42/14,8	4,8VA	3
422	Nicht kurzschlussfest / non-short-circuit-proof	EI42/14,8	5,6VA	4
422T	mit Temperatursicherung) / with integrated thermal fuse	EI42/14,8	5,6VA	5
426	Nicht kurzschlussfest / non-short-circuit-proof	EI42/20	8VA	6
426T	mit Temperatursicherung) / with integrated thermal fuse	EI42/20	8VA	7



Sicherheitstransformator zur sicheren elektrischen Trennung von Ein- und Ausgang nach ...
safety isolating transformer for safe isolation between in- und output according ...

... EN 61558-2-6,
... IEC 61558-2-6,
... VDE0570 Teil 2-6

Leiterplattentransformator mit verstärkter oder doppelter Isolierung
pcb transformer with reinforced or double insulation

Eingangsspannung
Frequenz

input voltage
frequency

230V
50 - 60Hz

Umgebungstemperatur
Isolierstoffklasse

max. ambient temperature
class of insulation

$t_a \leq 70^\circ\text{C}$
B

Schutzart

protection index

IP00

Schutzklasse: vorbereitet Klasse

safety class: prepared class

II

Imprägnierung: vakuumvergossen

impregnation: vacuum potted

Wicklung: 2-Kammer

bobbin: 2 chamber

Prüfspannung

test voltage

4000Vac

Prüfzeichen

approval marks

RoHS konform

RoHS compliant



Anzahl der Ausgangswicklungen
Verpackungseinheit Stück

number of output windings
packaging unit / pieces

1 oder 2 / 1 or 2
10

TYPENREIHE

TYPE

421.XX

Nicht kurzschlussfest
Leistung

non-short-circuit-proof
output rating

4,8VA



Absicherung sekundär durch träge
G-Sicherungen nach ...
Gewicht kg / Stk.
Kupfergewicht kg / Stk.
Kerntype

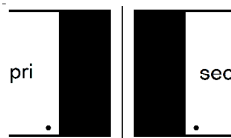
use delay fuse at the secondary
terminals according ...
weight kg / pc
copper weight kg / pc
core type

... EN 60127-2/3 (Normblatt 3)
0,2kg
0,1kg
EI42/14,8

1 Ausgangswicklung

1 secondary winding

Best.-Nr. ref. no.	Sekundär V secondary V	Sicherung fuse	Leerlaufspannung no-load voltage	Fig.	Verfügbarkeit / availability
421.06	6V	800mA	7,8V	1	ab Lager / from stock
421.08	8V	500mA	10,4V	1	auf Anfrage / on request
421.09	9V	500mA	11,7V	1	ab Lager / from stock
421.12	12V	400mA	15,6V	1	ab Lager / from stock
421.15	15V	315mA	19,5V	1	ab Lager / from stock
421.18	18V	250mA	23,4V	1	ab Lager / from stock
421.24	24V	200mA	31,2V	1	ab Lager / from stock
421.30	30V	160mA	39V	1	auf Anfrage / on request
421.36	36V	125mA	46,8V	1	auf Anfrage / on request



H = 32,4mm

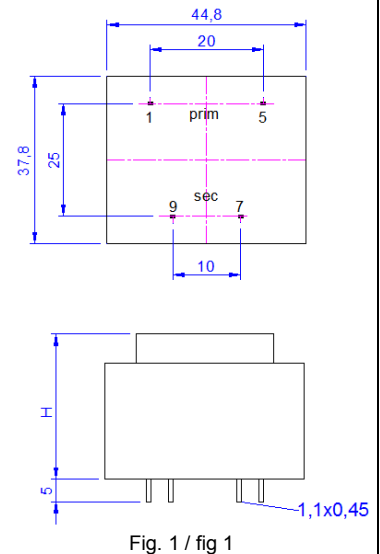


Fig. 1 / fig 1

2 identische Ausgangswicklungen

2 identical secondary windings

Best.-Nr. ref. no.	Sekundär V secondary V	Sicherung fuse	Leerlaufspannung no-load voltage	Fig.	Verfügbarkeit / availability
421.12.2	2x 6V	2x 400mA	2x 7,8V	2	ab Lager / from stock
421.15.2	2x 7,5V	2x 315mA	2x 9,8V	2	ab Lager / from stock
421.18.2	2x 9V	2x 250mA	2x 11,7V	2	ab Lager / from stock
421.24.2	2x 12V	2x 200mA	2x 15,6V	2	ab Lager / from stock
421.30.2	2x 15V	2x 160mA	2x 19,5V	2	ab Lager / from stock
421.36.2	2x 18V	2x 125mA	2x 23,4V	2	ab Lager / from stock
*421.48.2	2x 24V	2x 100mA	2x 31,2V	2	kurzfristig / at short notice
*421.60.2	2x 30V	2x 80mA	2x 39V	2	kurzfristig / at short notice

* = Netztransformator nach EN 61558-2-1, kein Sicherheitstransformator, kein Prüfzeichen

* = power transformer according to EN 61558-2-1, no safety isolating transformer, no approval

* = (Use no-load > 50V)



H = 32,4mm

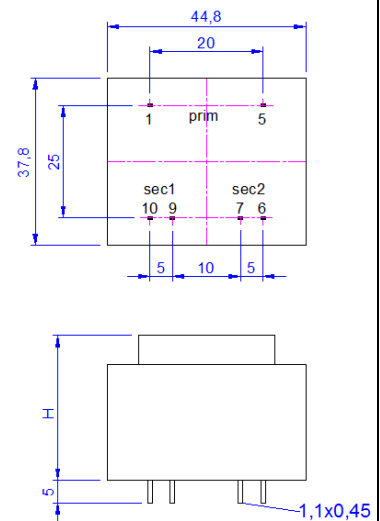
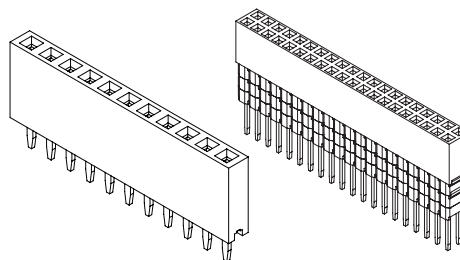
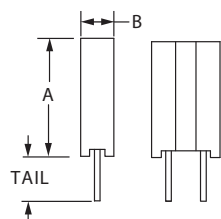


Fig. 2 / fig 2

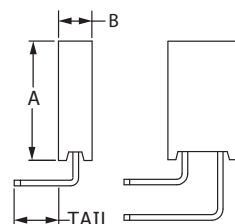
Abweichende Primär- oder Sekundärspannungen auf Anfrage. Different primary or secondary voltage on request.
Befestigungslaschen auf Anfrage. Fixing straps on request.

**.100" [2.54 mm] Contact Centers, Female Headers, Straight/Right Angle/SMT****SPECIFICATIONS**

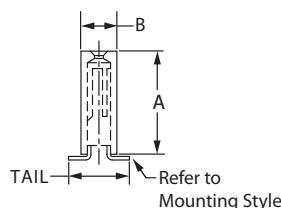
- 3 Amps current rating
- UL Flammability Rating : 94V-0
- Insulator Material : PBT, Nylon
- Contact Material : Phosphor Bronze

**TERMINATION TYPE****STRAIGHT**

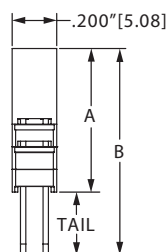
P/N CODE	ROWS	TERMINATION TYPE	A	B	TAIL
LFB	1	STRAIGHT	.335" [8.50]	.100" [2.54]	.126" [3.20]
	2	STRAIGHT	.335" [8.50]	.200" [5.08]	.126" [3.20]

**RIGHT ANGLE**

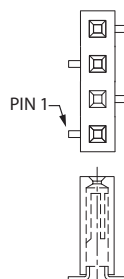
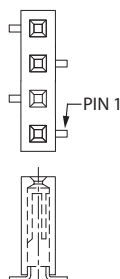
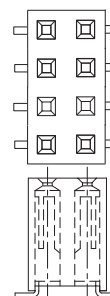
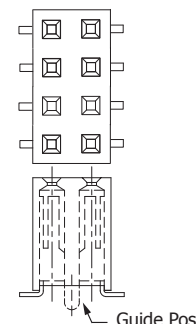
P/N CODE	ROWS	TERMINATION TYPE	A	B	TAIL
LGB	1	RIGHT ANGLE	.335" [8.50]	0.100" [2.54]	.124" [3.15]
LJB	2	RIGHT ANGLE	.335" [8.50]	0.200" [5.08]	.124" [3.15]

**SMT**

P/N CODE	ROWS	TERMINATION TYPE	ENTRY	A	B	TAIL
KFX	1	SMT	TOP ENTRY	.280" [7.10]	.098" [2.50]	.169" [4.30]
KFM	2	SMT	TOP ENTRY	.280" [7.10]	.197" [5.00]	.270" [6.85]

**2 ROW STRAIGHT WITH ELEVATED SPACER**

P/N CODE	ROWS	MODIFICATION	# OF SPACERS	A	B	TAIL
LFH	2	M44	1	.435" [11.04]	.725" [18.42]	.291" [7.38]
	2	M45	2	.535" [13.58]	.725" [18.42]	.191" [4.84]
	2	M46	3	.635" [16.12]	.725" [18.42]	.091" [2.30]
	2	M50	1	.435" [11.04]	.525" [13.34]	.091" [2.30]
	2	M51	1	.435" [11.04]	.915" [23.24]	.480" [12.20]
	2	M52	2	.535" [13.58]	.915" [23.24]	.380" [9.65]
	2	M53	3	.635" [16.12]	.914" [23.22]	.280" [7.10]
	2	M54	4	.735" [18.66]	.916" [23.26]	.181" [4.60]

MOUNTING STYLE**No Mounting Standard (N)****One Row SMT, Pin 1 Left (C)****One Row SMT, Pin 1 Right (D)****Two Row SMT, Without Guide Post (S)****Two Row SMT, With Guide Post (P)**



.100" [2.54 mm] Contact Centers, Female Headers, Straight/Right Angle/SMT

PART NUMBER OPTIONS

MATERIALS (INSULATOR/CONTACT)
 PP = Polyester/Phosphor Bronze (Thru Hole Only)
 NP = Nylon /Phosphor Bronze

CONTACT FINISH - RoHS Compliant
 P = Gold Flash Overall
 T = Tin Overall

CONTACT CENTERS
 C = .100" [2.54 mm]

NUMBER OF POSITIONS
 Contact per row, 02 Thru 40

NUMBER OF ROWS (Opposite Page)
 1 = Single Row
 2 = Dual Row

PP P C 36 1 LFB N - Mxx RC

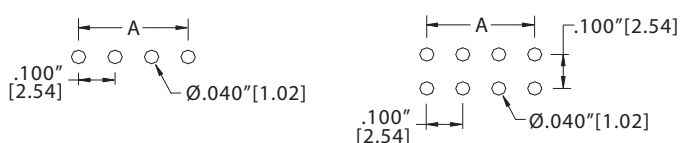
RoHS Compliant

MODIFICATION (Consult Factory)
 Required for LFH Termination
 See Termination Type on Opposite Page

MOUNTING STYLE
 N = No Mounting
 C = SMT, Single Row, pin 1 Left
 D = SMT, Single Row, pin 1 Right
 P = SMT, Dual Row with guide posts
 S = SMT, Dual Row without guide posts

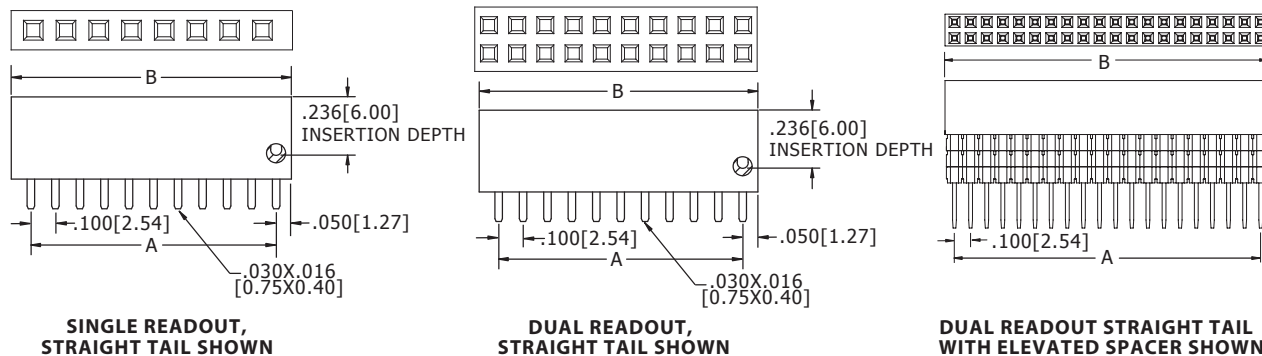
TERMINATION TYPE
 LFB = Straight
 LGB = Single Row Right Angle
 LJB = Dual Row Right Angle
 KFX = Single Row SMT (NP SERIES ONLY)
 KFM = Dual Row SMT (NP SERIES ONLY)
 LFH = Dual Row Straight with Elevated Spacer (Requires Modification see Opposite Page)

PCB LAYOUT



Recommended P.C.Board Hole Layout

DIMENSIONS Dimensions in [] are in millimeters, all others are in inches.



NUMBER OF POSITIONS	NUMBER OF CONTACTS		A		B	
	1 Row	2 Row	in	mm	in	mm
02	2	4	.100	2.54	.220	5.58
03	3	6	.200	5.08	.320	8.12
04	4	8	.300	7.62	.420	10.66
05	5	10	.400	10.16	.520	13.20
06	6	12	.500	12.70	.620	15.74
07	7	14	.600	15.24	.720	18.28
08	8	16	.700	17.78	.820	20.82
09	9	18	.800	20.32	.920	23.36
10	10	20	.900	22.86	1.020	25.90
11	11	22	1.000	25.40	1.120	28.44
12	12	24	1.100	27.94	1.220	30.98
13	13	26	1.200	30.48	1.320	33.52
14	14	28	1.300	33.02	1.420	36.06
15	15	30	1.400	35.56	1.520	38.60
16	16	32	1.500	38.10	1.620	41.14
17	17	34	1.600	40.64	1.720	43.68
18	18	36	1.700	43.18	1.820	46.22
19	19	38	1.800	45.72	1.920	48.76
20	20	40	1.900	48.26	2.020	51.30
21	21	42	2.000	50.80	2.120	53.84

NUMBER OF POSITIONS	NUMBER OF CONTACTS		A		B	
	1 Row	2 Row	in	mm	in	mm
22	22	44	2.100	53.34	2.220	56.38
23	23	46	2.200	55.88	2.320	58.92
24	24	48	2.300	58.42	2.420	61.46
25	25	50	2.400	60.96	2.520	64.00
26	26	52	2.500	63.50	2.620	66.54
27	27	54	2.600	66.04	2.720	69.08
28	28	56	2.700	68.58	2.820	71.62
29	29	58	2.800	71.12	2.920	74.16
30	30	60	2.900	73.66	3.020	76.70
31	31	62	3.000	76.20	3.120	79.24
32	32	64	3.100	78.74	3.220	81.78
33	33	66	3.200	81.28	3.320	84.32
34	34	68	3.300	83.82	3.420	86.86
35	35	70	3.400	86.36	3.520	89.40
36	36	72	3.500	88.90	3.620	91.94
37	37	74	3.600	91.44	3.720	94.48
38	38	76	3.700	93.98	3.820	97.02
39	39	78	3.800	96.52	3.920	99.56
40	40	80	3.900	99.06	4.020	102.10