

SERIES: VHK200W | **DESCRIPTION:** DC-DC CONVERTER

FEATURES

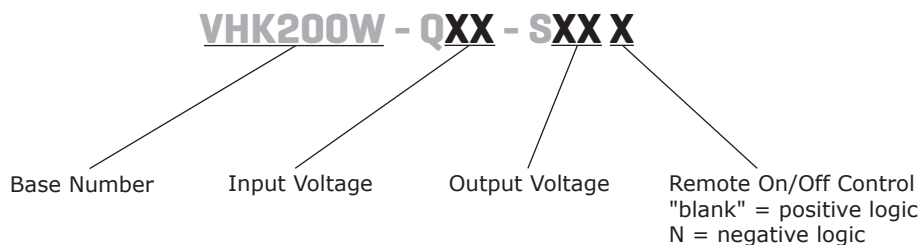
- up to 200 W isolated output
- rugged metal enclosure with integrated heat sink
- 4:1 input range (10~36 Vdc, 18~75 Vdc)
- single output from 12~48 Vdc
- 1,500 Vdc isolation
- over current, over temperature, over voltage, and short circuit protections
- remote on/off
- efficiency up to 88%



| MODEL | input voltage range (Vdc) | output voltage (Vdc) | output current max (A) | output power max (W) | ripple and noise ¹ max (mVp-p) | efficiency typ (%) |
|-----------------|---------------------------|----------------------|------------------------|----------------------|---|--------------------|
| VHK200W-Q24-S12 | 10 ~ 36 | 12 | 16.7 | 200 | 150 | 84 |
| VHK200W-Q24-S15 | 10 ~ 36 | 15 | 13.3 | 200 | 150 | 84 |
| VHK200W-Q24-S24 | 10 ~ 36 | 24 | 8.3 | 200 | 240 | 84 |
| VHK200W-Q24-S28 | 10 ~ 36 | 28 | 7.14 | 200 | 280 | 87 |
| VHK200W-Q24-S48 | 10 ~ 36 | 48 | 4.2 | 200 | 480 | 87 |
| VHK200W-Q48-S12 | 18 ~ 75 | 12 | 16.7 | 200 | 150 | 86 |
| VHK200W-Q48-S15 | 18 ~ 75 | 15 | 13.3 | 200 | 150 | 86 |
| VHK200W-Q48-S24 | 18 ~ 75 | 24 | 8.3 | 200 | 240 | 86 |
| VHK200W-Q48-S28 | 18 ~ 75 | 28 | 7.14 | 200 | 280 | 87 |
| VHK200W-Q48-S48 | 18 ~ 75 | 48 | 4.2 | 200 | 480 | 88 |

Note: 1. Ripple and noise are measured at full load, 20 MHz BW with 10µF tantalum capacitor and 1µF ceramic capacitor across output. The 48 Vdc output models require a 10uF aluminum capacitor and 1uF ceramic capacitor across the output.
 2. An external input capacitor of 470µF for 24 Vdc input models and 47µF for 48 Vdc input models is recommended to reduce input ripple voltage.

PART NUMBER KEY



INPUT

| parameter | conditions/description | min | typ | max | units |
|-------------------------|---|---------------------------------------|------------|-----|------------|
| operating input voltage | 24 Vdc input models | 10 | 24 | 36 | Vdc |
| | 48 Vdc input models | 18 | 48 | 75 | Vdc |
| under voltage shutdown | 24 Vdc input | | 9.5 8.5 | | Vdc Vdc |
| | 48 Vdc input | | 17 16 | | Vdc Vdc |
| CTRL ¹ | positive logic | models ON (>3.5 Vdc or open circuit) | | | |
| | | models OFF (0~1.2 Vdc) | | | |
| | negative logic | models ON (0~1.2 Vdc) | | | |
| | | models OFF (>3.5 Vdc or open circuit) | | | |
| filter | pi filter | | | | |
| input fuse | 40A time delay fuse for 24 Vin models, 20A time delay fuse for 48 Vin models | | | | |

Note: 1. Open collector refer to -Vin

OUTPUT

| parameter | conditions/description | min | typ | max | units |
|------------------------------|--------------------------------------|-----|-------|-------|-------|
| maximum capacitive load | 12, 15, & 24 V output models | | | 2,200 | μF |
| | 28 V output models | 100 | | 2,200 | μF |
| | 48 V output models | 47 | | 2,200 | μF |
| line regulation ² | measured from low line to high line | | | ±0.2 | % |
| load regulation ² | measured from zero load to full load | | | ±0.2 | % |
| voltage accuracy | | | | ±1.5 | % |
| adjustability | | | ±10 | | % |
| switching frequency | | | 250 | | kHz |
| transient response | 25% step load change | | | 500 | μs |
| temperature coefficient | | | ±0.03 | | %/°C |

Note: 2. A 100 μF aluminum capacitor is required on the output for the 28 Vdc output models. A 47 μF aluminum capacitor is required on the output for 48 Vdc output models.

PROTECTIONS

| parameter | conditions/description | min | typ | max | units |
|-----------------------------|------------------------|-----|-----|-----|-------|
| short circuit protection | continuous | | | | |
| over current protection | at 90% output voltage | 110 | | 160 | % |
| over voltage protection | | 115 | | 140 | % |
| over temperature protection | shutdown | | 110 | | °C |

SAFETY AND COMPLIANCE

| parameter | conditions/description | min | typ | max | units |
|----------------------|---|-------|-----|-----|-------|
| isolation voltage | for 1 minute: input to output; input to case; output to case | 1,500 | | | Vdc |
| isolation resistance | | 10 | | | MΩ |
| RoHS | 2011/65/EU (CE) | | | | |

ENVIRONMENTAL

| parameter | conditions/description | min | typ | max | units |
|-----------------------|------------------------|-----|-----|-----|-------|
| operating temperature | see derating curve | -40 | | 85 | °C |
| storage temperature | | -55 | | 105 | °C |

MECHANICAL

| parameter | conditions/description | min | typ | max | units |
|---------------|---|-----|-----|-----|-------|
| dimensions | 4.23 x 4.01 x 1.50 (107.5 x 101.76 x 38.0 mm) | | | | inch |
| case material | steel and aluminum extrusion | | | | |
| weight | | | 502 | | g |

MECHANICAL DRAWING

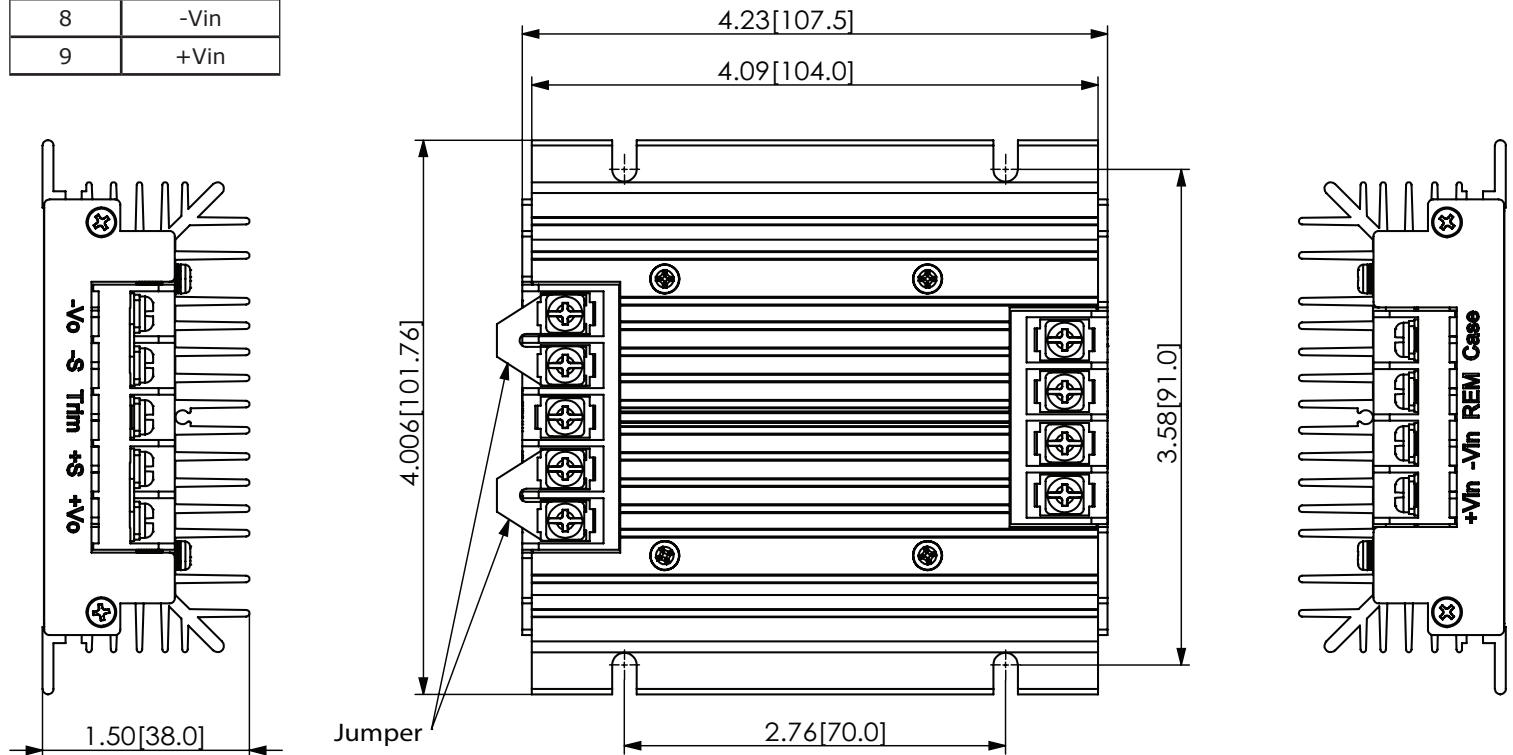
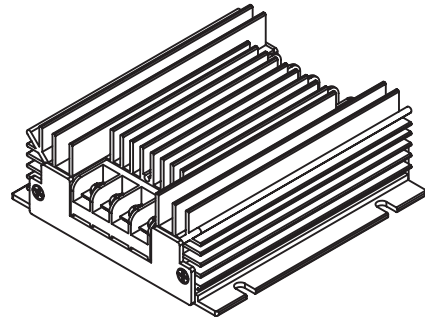
units: inch[mm]

tolerance: X.XX = $\pm 0.02[\pm 0.5]$
 X.XXX = $\pm 0.010[\pm 0.25]$

wire range: 22~12 AWG

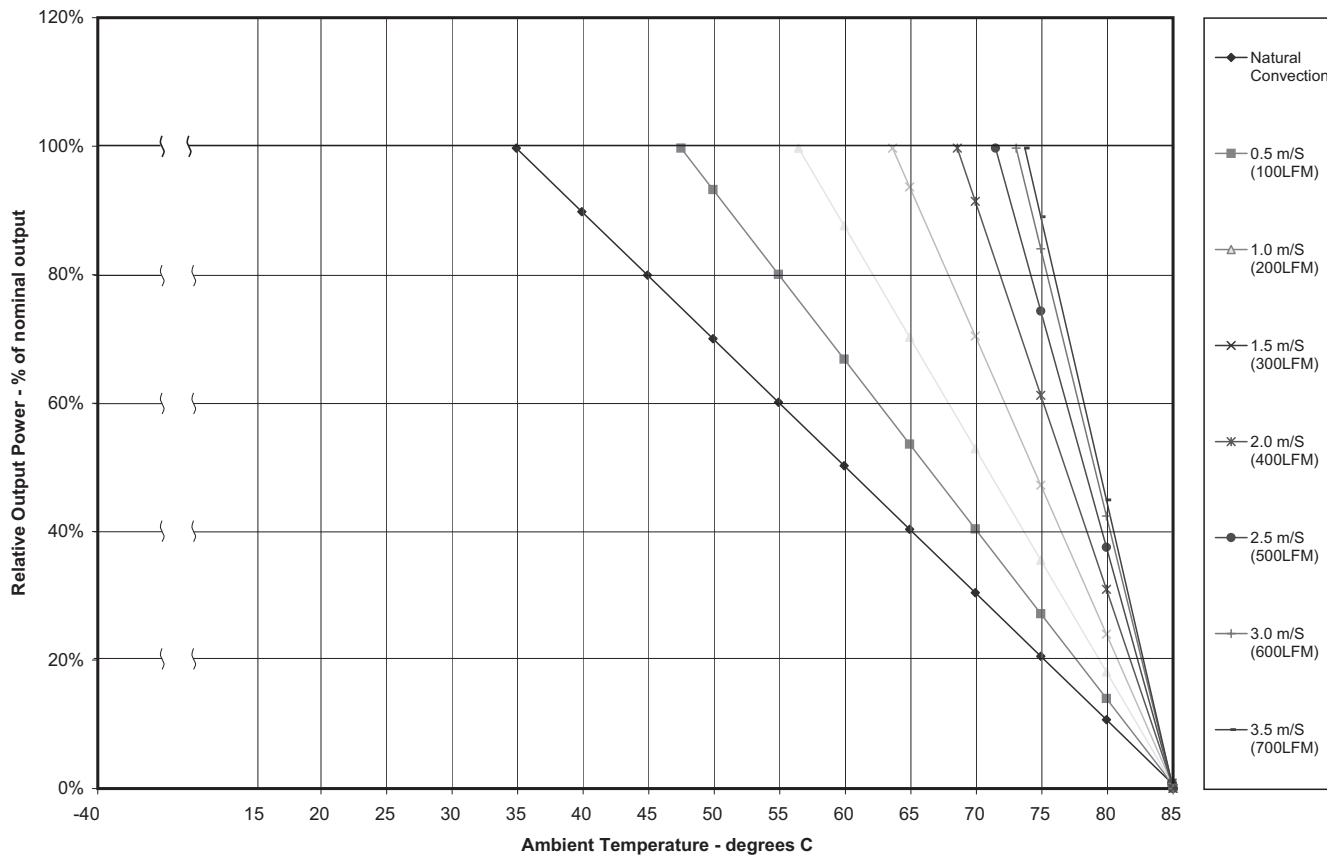
screw size: #6-32

| PIN CONNECTIONS | |
|-----------------|----------|
| PIN | FUNCTION |
| 1 | -Vo |
| 2 | -S |
| 3 | trim |
| 4 | +S |
| 5 | +Vo |
| 6 | case |
| 7 | on/off |
| 8 | -Vin |
| 9 | +Vin |



DERATING CURVES

VHK200W Power Derating Curves At Nominal Input



TEST CONFIGURATION

Figure 1

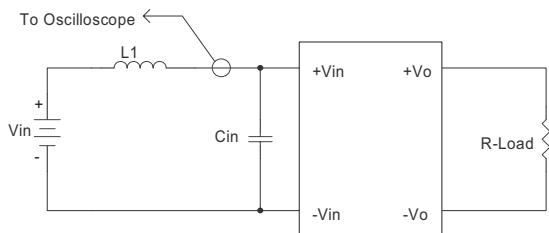


Table 1

| External components | |
|-------------------------|------------------------------|
| for 24 Vdc input models | |
| L1 | 1.2μH |
| Cin | 470μF, ESR < 0.2Ω at 100 KHz |
| for 48 Vdc input models | |
| L1 | 12μH |
| Cin | 47μF, ESR < 0.7Ω at 100 KHz |

Note: Input reflected-ripple current is measured with an inductor L1 to simulate source impedance.

EMC RECOMMENDED CIRCUITS

EN55022 CLASS A

Figure 2
Recommended Circuit for EN55022 Class A
(for all 12, 15, 24, & 28 Vdc output models)

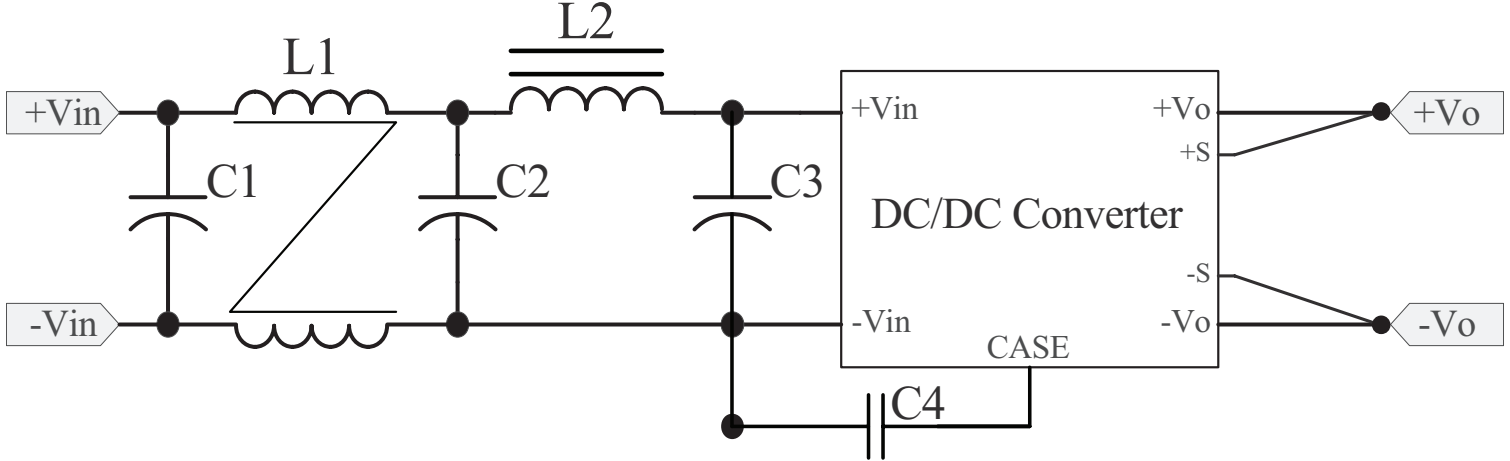


Figure 3
Recommended Circuit for EN55022 Class A
(for all 48 Vdc output models)

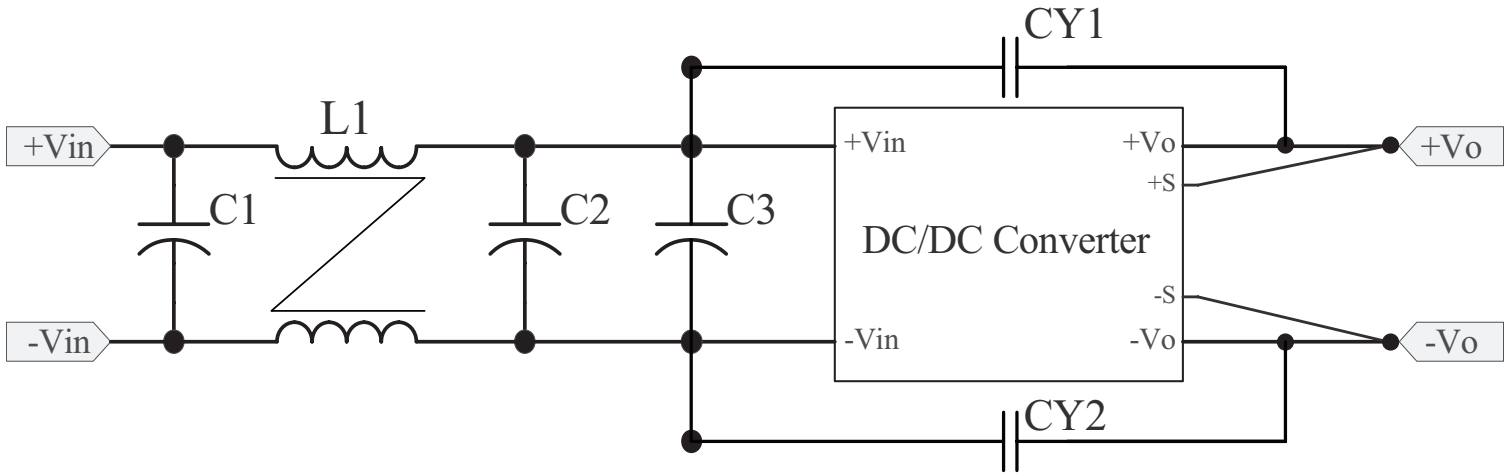


Table 2
Class A Recommended Components

| Model | C1 ¹ | C2 ¹ | C3 ¹ | CY1 ² | CY2 ² | L1 | L2 |
|-----------------|-----------------|-----------------|-----------------|------------------|------------------|--------|-------|
| VHK200W-Q24-S12 | 120 µF/100 V | 120 µF/100 V | NC | NC | NC | 0.5 mH | SHORT |
| VHK200W-Q24-S15 | 47 µF/100 V | 47 µF/100 V | NC | NC | NC | 0.5 mH | SHORT |
| VHK200W-Q24-S24 | 100 µF/100 V | 100 µF/100 V | NC | NC | NC | 0.5 mH | SHORT |
| VHK200W-Q24-S28 | 100 µF/100 V | 100 µF/100 V | NC | NC | NC | 0.5 mH | SHORT |
| VHK200W-Q24-S48 | 100 µF/100 V | 100 µF/100 V | 100 µF/100 V | 680 pF/2 KV | 680 pF/2 KV | 1.0 mH | NC |
| VHK200W-Q48-S12 | 82 µF/100 V | 82 µF/100 V | NC | NC | NC | 0.5 mH | SHORT |
| VHK200W-Q48-S15 | 82 µF/100 V | 82 µF/100 V | NC | NC | NC | 0.5 mH | SHORT |
| VHK200W-Q48-S24 | 82 µF/100 V | 82 µF/100 V | NC | NC | NC | 0.7 mH | SHORT |
| VHK200W-Q48-S28 | 150 µF/100 V | 150 µF/100 V | NC | NC | NC | 0.5 mH | SHORT |
| VHK200W-Q48-S48 | 100 µF/100 V | 100 µF/100 V | 100 µF/100 V | 680 pF/2 KV | 680 pF/2 KV | 1.0 mH | NC |

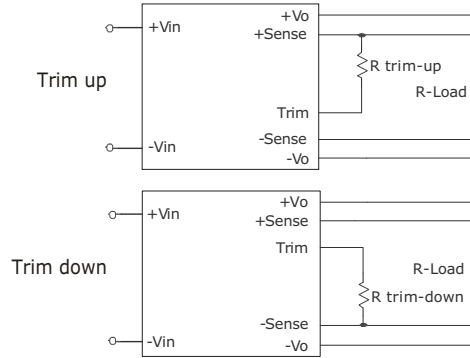
Notes: 1. Aluminum capacitors.
2. Ceramic capacitors.

APPLICATION NOTES

1. Output Voltage Trimming

Leave open if not used.

Figure 4
Application Circuit for Trim pin



Formula for Trim Resistor

$$\Delta\% = \left(\frac{V_{o, nom} - V_o}{V_{o, nom}} \right) 100$$

Trim-Up Formula

(for all 12, 15, 24, & 28¹ Vdc Output Models)

$$R_{trim - up} = \left(\frac{5.11V_{o, nom}(100 + \Delta\%)}{1.225 \times \Delta\%} - \frac{511}{\Delta\%} - 10.22 \right) (K\Omega)$$

Trim-Up Formula

(for all 48 Vdc Output Models)

$$R_{trim - up} = \left(\frac{20V_{o, nom}(100 + \Delta\%)}{1.225 \times \Delta\%} - \frac{2000}{\Delta\%} - 40 \right) (K\Omega)$$

Trim-Down Formula

(for all 12, 15, 24, & 28¹ Vdc Output Models)

$$R_{trim - down} = \left(\frac{511}{\Delta\%} - 10.22 \right) (K\Omega)$$

Trim-Down Formula

(for all 48 Vdc Output Models)

$$R_{trim - down} = \left(\frac{2000}{\Delta\%} - 40 \right) (K\Omega)$$

Note: $R_{trim-up}$ is the external resistor in $K\Omega$
 $R_{trim-down}$ is the external resistor in $K\Omega$
 $V_{o, nom}$ is the nominal output voltage
 V_o is the desired output voltage

Notes: 1. For the 28 Vdc output models, a minimum input voltage of 10.8 Vdc is required to trim the 24 Vdc input models up 10%, and a minimum input voltage of 19 Vdc is required to trim the 48 Vdc input models up 10%.
 2. All specifications are measured at $T_a=25^\circ C$, nominal input voltage and full output load unless otherwise specified.

REVISION HISTORY

| rev. | description | date |
|------|------------------------------------|------------|
| 1.0 | initial release | 10/11/2006 |
| 1.01 | new template applied | 12/21/2011 |
| 1.02 | misc. updates and corrections | 03/13/2012 |
| 1.03 | updated mechanical drawing | 03/27/2012 |
| 1.04 | V-Infinity branding removed | 06/27/2012 |
| 1.05 | updated spec | 03/18/2013 |
| 1.06 | updated spec | 05/08/2013 |
| 1.07 | added trimming and EMI information | 12/16/2013 |

The revision history provided is for informational purposes only and is believed to be accurate.



CUI INC[®]

Headquarters
20050 SW 112th Ave.
Tualatin, OR 97062
800.275.4899

Fax 503.612.2383
cui.com
techsupport@cui.com

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