# CSNV500 SERIES

**005997**
*Issue 1*

## Closed Loop Current Sensors

### DESCRIPTION

The CSNV500 Series are Hall-effect, closed loop current sensors that use Honeywell's patented technology to bring the best combination of performance and reliability. They are non-intrusive and electrically isolated from the monitored circuit. This ensures a simple and reliable structure without loss of power to the monitored circuit. The CSNV500 Series are rated for a primary current measurement range of ±500 A DC. They are calibrated and temperature compensated for improved accuracy using multi-point temperature characterization.

### DIAGNOSTIC FUNCTIONALITY/ CAN OUTPUT

The CAN output of the CSNV500 Series provides fault detection and communication capability. Also, the digital CAN communication is very immune to electrical interference. Examples of sensor and host system faults are as follows:

- Sensor fault
- Sensor communication error
- Supply voltage over range
- Supply voltage under range
- Current over range

### CUSTOMIZATION

The CSNV500 Series may be customized to best meet application needs. Solutions may be tailored to exact specifications for improved time to market, lower total system costs and enhanced reliability. For technical assistance, we provide global engineering and service support for your needs.

### DIFFERENTIATION

- **Accuracy:** Multi-point temperature characterization and calibration for improved accuracy over temperature range.
- **Magnetic immunity:** Closed loop configuration and optimized magnetic circuit allow for excellent performance in diverse magnetic environments.
- **Flexible:** Customizable on-board firmware to meet specific application requirements.

### VALUE TO CUSTOMERS

- **Accurate:** Designed to enable precise battery state measurement for improved user experience.
- **Ease of use:** Magnetic immunity allows for easy integration into different magnetic environments.
- **Easy system integration:** CAN communication is transmitted using international road vehicle standard ISO 11898. CAN 2.0A is the default protocol, CAN 2.0B is available as a custom variant.

### POTENTIAL INDUSTRIAL APPLICATIONS

- Current measurement for battery management systems in electrified vehicles (EV, HEV, PHEV, BEV)
- Current leakage detection and fault isolation in charging systems
- Current measurement in energy storage systems
- Fault detection in heavy industrial equipment


RoHS COMPLIANT

### FEATURES

- Active closed loop current sensing using Hall-effect technology
- Utilizes proprietary Honeywell technology for temperature compensation
- High accuracy and low temperature drift
- Operating temperature of -40°C to 85°C [-40°F to 185°F]
- Digital output: CAN bus output with configurable ID
- Internal diagnostic function
- Different configuration options: Mounting type, baud rate, CAN ID
- UL and CE certifications; REACH and RoHS compliant

### PORTFOLIO

Honeywell offers a variety of current sensors for potential use in many applications. To view the entire product portfolio, click here.

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**TABLE 1. ABSOLUTE MAXIMUM RATINGS[1]**

| CHARACTERISTIC | SYMBOL | UNIT | PARAMETER | CONDITION |
|---|---|---|---|---|
| Load dump over voltage | $V_S$ | V | 32 | 400 mSec |
| Over voltage | $V_S$ | V | 24<br>20 | 10 min<br>continuous |
| Reverse polarity | $V_S$ | V | -24 | 10 min |
| Supply voltage:<br>minimum<br>maximum | $V_S$ | V | <br>7<br>18 | — |
| CAN operation:<br>supply voltage under range alarm, no measurement<br>supply voltage over range alarm, no measurement | — | V | <br>6 to 7<br>18 to 24 | CAN continuous |
| Insulation resistance | IR | MΩ | >500 | 500 V DC at 1 min |
| Creepage distance | $D_{Cp}$ | mm | 7.5 | — |
| Clearance | $D_{Cl}$ | mm | 7 | — |
| RMS voltage:<br>AC isolation voltage<br>DC isolation voltage | — | kV | <br>5<br>5 | <br>50 Hz, 1 min<br>1 min |

**TABLE 2. OPERATING CHARACTERISTICS IN NOMINAL RANGE ($I_{PN}$)**

| CHARACTERISTIC | SYMBOL | UNIT | SPECIFICATION | | | CONDITION |
|---|---|---|---|---|---|---|
| | | | MIN. | TYP. | MAX. | |
| Primary current, nominal measuring range (DC) | $I_{PN}$ | A | -500 | — | 500 | full temperature range |
| Supply voltage | $V_S$ | V | 7 | 12 | 18 | full accuracy |
| Supply voltage hysteresis:<br>maximum<br><br>minimum | <br>$V_{UP}$<br>$V_{UP}$<br>$V_{LOW}$<br>$V_{LOW}$ | <br>V<br>V<br>V<br>V | <br>—<br>—<br>—<br>— | <br>18.1<br>17.7<br>7.1<br>6.8 | <br>—<br>—<br>—<br>— | <br>when $V_S$ increases<br>when $V_S$ decreases<br>when $V_S$ increases<br>when $V_S$ decreases |
| Current consumption:<br>at $I_p$ = 0 A<br>at $I_p$ = 500 A | $I_C$ | mA | <br>—<br>— | <br>21<br>— | <br>30<br>250 | <br>$V_S$ = 12 V, T = 25°C<br>$V_S$ = 12 V, T = 25°C |
| Ambient operating temperature | $T_a$ | °C | -40 | — | 85 | temperature range with accuracy guaranteed |
| Total accuracy | $X_G$ | % | -0.5 | — | 0.5 | at FS, T = -40°C to 85°C, ±3 sigma |
| Error at $I_p$ = 0 A (offset current) | $I_{os}$ | A | -0.2 | — | 0.2 | T = -40°C to 85°C, ±3 sigma |
| Linearity | $\varepsilon_L$ | % | — | ±0.1 | — | room temperature |
| Temperature coefficient of G | TCG | ppm/°C | — | 10 | — | — |

**TABLE 3. MECHANICAL CHARACTERISTICS**

| CATALOG LISTING | DESCRIPTION |
|---|---|
| Housing material | Plastic PBT+ GF30% |
| Mounting screw | M6, torque max. 3 N m |

**TABLE 4. CANBUS CHARACTERISTICS[1, 2, 3]**

| MESSAGE DESCRIPTION | CAN ID | DATA LENGTH | MESSAGE LAUNCH TYPE | SIGNAL DESCRIPTION | SIGNAL NAME | START BIT | LENGTH |
|---|---|---|---|---|---|---|---|
| Primary current Ip (mA) | See Figure 1 | 8 bytes | Cyclic transmitted message 10 mSec cycle. | $I_p$ value:<br>80000000h = 0 mA<br>7FFFFFFFh = -1 mA<br>80000001h = 1 mA | IP_VALUE | 24 | 32 |
| | | | | Error information | ERROR_INFORMATION | 32 | 7 |
| | | | | Error indication (1 bit):<br>0 = normal<br>1 = failure | ERROR_INDICATION | 39 | 1 |
| | | | | Fixed to 0 | VACANT_DATA_2BYTES | 48 | 16 |
| | | | | CRC-8<br>POLY: 8 + X2 + X + 1 | CRC_8 | 56 | 8 |

[1]CANBUS speed: Refer to Figure 1.
[2]CAN oscillator tolerance: 0.3125%.
[3]Byte order: big endian (Motorola).

**TABLE 5. DIAGNOSTIC TROUBLE CODES**

| FAILURE MODE | $I_p$ VALUE | ERROR INDICATION | ERROR INFORMATION |
|---|---|---|---|
| Flash CRC error | FFFF FFFFh | 1 | 0x48 |
| Primary current overrange | FFFF FFFFh | 1 | 0x49 |
| Primary current measurement error | FFFF FFFFh | 1 | 0x50 |
| Internal LUT error | FFFF FFFFh | 1 | 0x51 |
| Power minimum limit | FFFF FFFFh | 1 | 0x54 |
| Power maximum limit | FFFF FFFFh | 1 | 0x55 |

**TABLE 6. ORDER GUIDE**

| CATALOG LISTING | DESCRIPTION |
|---|---|
| CSNV500M-121 | CSNV500 Series Hall-based closed loop current sensors, 500 A, through-hole, 250 k baud rate, 3C1 CAN ID |
| CSNV500M-122 | CSNV500 Series Hall-based closed loop current sensors, 500 A, through-hole, 250 k baud rate, 3C2 CAN ID |
| CSNV500M-151 | CSNV500 Series Hall-based closed loop current sensors, 500 A, through-hole, 500 k baud rate, 3C1 CAN ID |
| CSNV500M-152 | CSNV500 Series Hall-based closed loop current sensors, 500 A, through-hole, 500 k baud rate, 3C2 CAN ID |
| CSNV500M-159 | CSNV500 Series Hall-based closed loop current sensors, 500 A, through-hole, 500 k baud rate, 3C0 CAN ID |
| CSNV500N-152 | CSNV500 Series Hall-based closed loop current sensors, 500 A, through-hole with metal bushing, 12 V supply, 500 k baud rate, 3C2 CAN ID |

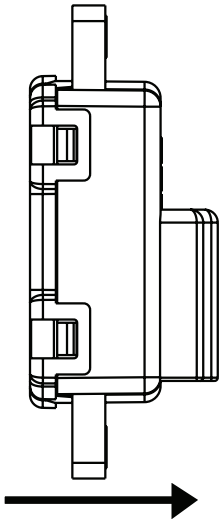
# CLOSED LOOP CURRENT SENSORS
# CSNV500 SERIES

**FIGURE 1. NOMENCLATURE**

| CS | N | V | 500 | M | 1 | 5 | 1 | A |
|---|---|---|---|---|---|---|---|---|
| Type | Principle | Use | Rated Current | Mounting Type | Supply Voltage | Baud Rate | CAN ID | Customization |
| Current Sensor | N Hall-effect based closed loop | V Designed for vehicle applications | 500 500 A | M Through hole  | 1 12 V | 2 250 k | 1 3C1 | A to Z |
| | | | | N Through-hole with metal bushing  | | 5 500 k | 2 3C2 | |
| | | | | | | | 3 3C3 | |
| | | | | | | | 4 3C4 | |
| | | | | | | | 5 3C5 | |
| | | | | | | | 9 3C0 | |

**FIGURE 2. POSITIVE PRIMARY CURRENT DIRECTION (POLARITY)**

**Application condition: Pollution degree PD2**



# CLOSED LOOP CURRENT SENSORS
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**FIGURE 3. DIMENSIONAL DRAWINGS (FOR REFERENCE ONLY: MM/[IN])**

**Mounting type M: Through-hole**

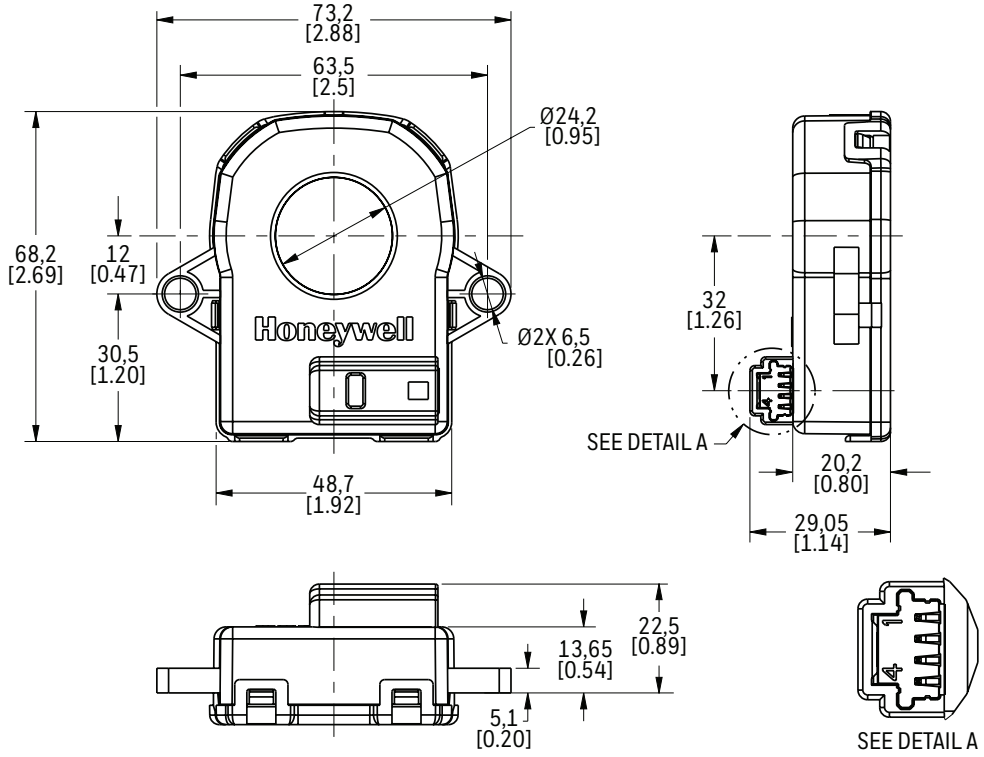


**TABLE 7. PINOUT**

| PIN | OUTPUT |
|---|---|
| 1 | CAN-L |
| 2 | CAN-H |
| 3 | GND |
| 4 | $V_S$ |

Mating connector: TE MPN 1473672-1

**Mounting type N: Through-hole with metal bushing**

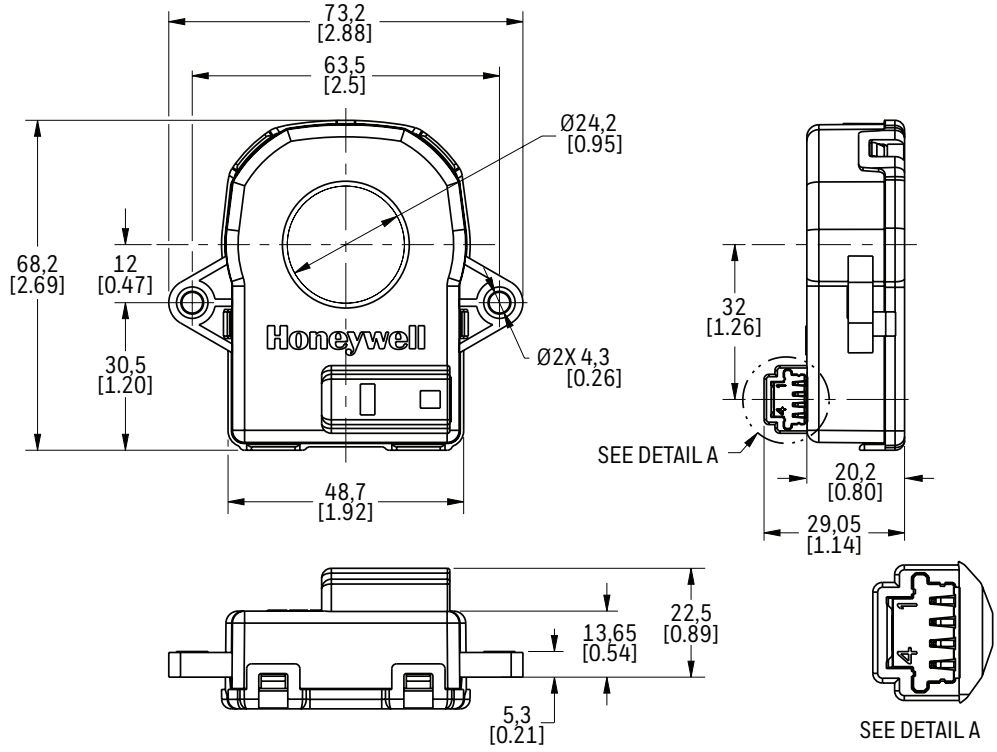


**TABLE 8. PINOUT**

| PIN | OUTPUT |
|---|---|
| 1 | CAN-L |
| 2 | CAN-H |
| 3 | GND |
| 4 | $V_S$ |

Mating connector: TE MPN 1473672-1

**TABLE 9. EMC TEST SPECIFICATIONS**

| TEST | STANDARD | PROCEDURE |
|---|---|---|
| CISPR 25 Conducted RF Emissions - Voltage on Supply Lines | CISPR25 | According to CISPR 25:2008 Commission Form of Testing |
| CISPR 25 Conducted RF Emissions - Voltage on Supply Lines | CISPR25 | According to CISPR 25:2008 Commission Form of Testing |
| CISPR 25 Radiated Emissions | CISPR25 | According to CISPR 25:2008 Commission Form of Testing |
| Bulk Current Injection (BCI) Test | ISO 11452-4 | According to ISO 11452-4 |
| ALSE with a Ground Plane | ISO 11452-2 | According to ISO 11452-2 |
| Transient Disturbances Conducted along Supply Lines | ISO 7637-2 | According to ISO 7637-2 |
| Transient Disturbances Conducted along I/O or Sensor Lines | ISO 7637-3 | According to ISO 7637-3 |
| Immunity to Magnetic Field | ISO 11452-8 | According to ISO 11452-8 |
| Handling Test | — | See "Electrostatic Discharge" |
| Operating Test | — | See "Electrostatic Discharge" |
| Electrostatic Discharge | ISO 10605 | Unpowered direct contact discharge: ±4 kV, ±8 kV<br>Unpowered air discharge: ±8 kV, ±15 kV<br>Powered-up direct contact discharge: ±4 kV<br>Powered-up air discharge: ±8 kV |
| Impulse Noise Test | — | — |
| Fast transient Noise Test | — | 2 kV Power port, 1 kV CAN signal and control port |
| Radio Frequency Electromagnetic Field | IEC 61000-4-3 | 10 V/m (80 MHz to 1 GHz), 3 V/m (1.4 GHz to 2 GHz), 1 V/m (2.0 GHz to 2.7 GHz) |
| Fast Transients Bursts Susceptibility Test | IEC 61000-4-4 | 2 kV Power port, 1 kV CAN signal and control port |
| Radio Frequency Continuous Conducted | IEC 61000-4-6 | 0.15 MHz to 80 MHz, 3 V 80% AM (1 kHz) |
| Radio Frequency Magnetic Field | IEC 61000-4-8 | 30 A/M |
| Radiated Disturbance (3M semi-anechoic chamber) | CISPR-11 | Group 1, Class A |

**TABLE 10. ENVIRONMENTAL TEST SPECIFICATIONS**

| TEST | STANDARD | PROCEDURE |
|---|---|---|
| Shipping/Storage Temperature Exposure | — | Not tested. Covered by low and high temperature operating test. |
| Low Temperature Operating Endurance | ISO16750-4 | 120 hr at –40°C, power on with 100 A primary current. |
| High Temperature Operating Endurance | ISO16750-4 | 85°C, 6000 hr, power on with 100 A primary current. Performance test before and after test only at 25°C and $V_S$ nom. |
| Powered Thermal Cycle Endurance | ISO16750-4 | 8 hr at 120 cycles, 960 hr. Performance test before and after test only at 25°C and $V_S$ nom. |
| Thermal Shock | IEC60068-2-14 | –40°C (30 min soak)/85°C (30 min soak), 250 cycles |
| Thermal Humidity Cycle | IEC 60068-2-38 | 240 hr, –10°C/65°C, 93% humidity between rise in temperature and constant temperature zone, 80% humidity in drop temperature zone. Performance test before and after test only at 25°C and $V_S$ nom. |
| High Temperature and Humidity Endurance | IEC60068-2-67 | 85°C, 85% humidity, 1000 hr, power on with 100 A primary current. Performance test before and after test only at 25°C and $V_S$ nom. |
| Vibration | IEC60068-2-64 | 5 Hz to 2000 Hz, 20 hr/axis, 3 axis with –40°C/85°C temperature cycle during test. Product power on with 100 A primary current. Performance test before and after test only at 25°C and $V_S$ nom. |
| Mechanical Shock | ISO16750-3 | 500 m/s, 2,20 each direction (60 total), half sine pulse. Product power on with 100 A primary current. Performance test before and after test only at 25°C and $V_S$ nom. |
| Package Drop | ISTA-1A or GB/T 4857.5 | With final packaging, drop in direction at 1 corner, 3 edge, 4 face ≥ total 9 drops, 1 m on concrete floor. |
| Handling Drop | ISO 16750-3 | 1st fall of each DUT at a different dimensional axis, 2nd fall with the given DUT at the same dimensional axis but on the opposite side of the housing, from 1 m on concrete floor. Performance test before and after test only at 25°C and $V_S$ nom. |
| Dust (and other Solid Intrusion) | ISO20653 | IP category: 4 |
| Water Intrusion | — | Not tested. IP category: 0. Not protected. |
| Dew Formation Test | — | — |
| Mixed Flowing Gas | — | Not tested. |
| Salt Fog | ISO16750-4 or GB/T2423.17 | 5% salt water solution, 96 hr at 35°C. Performance test before and after test only at 25°C and $V_S$ nom. |
| Chemical Exposure (outside cabin compartment) | — | Not tested. |

**TABLE 11. ELECTRICAL TEST SPECIFICATIONS**

| TEST | STANDARD | PROCEDURE |
|---|---|---|
| Supply Voltage Range | ISO 16750-2 | 7 V to 18 V, at 25°C, with 100 A primary current |
| Supply Voltage Ripple | — | — |
| Supply Voltage Drop Out | — | — |
| Supply Voltage Dips | — | — |
| Slow Decrease and Increase of Supply Voltage | ISO 16750-2 | Power supply changes from 18 V to 0 V with 0.5 V ±0.1 V step. At any step, power supply maintain 1 min. Power supply changes from 0 V to 18 V with 0.5 V ±0.1 V step. At any step, power supply maintain 1 min. Performance test before and after test only at 25°C and $V_S$ nom. |
| Defective Regulation (full-fielded alternator) | — | — |
| Jump Start | — | Refer to "Overvoltage". |
| Load Dump | — | 32 V, 400 mSec, 5 pulses |
| Overvoltage | ISO 16750-2 | 18 V, 60 min at 85°C, 24 V for 10 min at 25°C |
| Reverse Supply Voltage | ISO 16750-2 | -50 V, 10 min |
| Superimposed Alternating Voltage | ISO 16750-2 | Conduct test as per ISO 16750-2 4.4. Test voltage US max 18 V for UN = 12 V systems, AC voltage (sinusoidal), severity 2, UPP = 4 V. Performance test before and after test only at 25°C and $V_S$ nom. |
| Discontinuities in Supply Voltage | ISO 16750-2 | Conduct test as per ISO 16750-2 4.6. Momentary drop in supply voltage reset behavior at voltage drop starting profile. |
| Immunity to Short Circuits in the Supply Voltage Input and Load Output Lines | — | See "Short circuit protection". |
| Immunity to Short Circuits in I/O Signal Lines | — | See "Short circuit protection". |
| Short Circuit Protection | ISO 16750-2 | Sensor supply of 18 Vdc and 24 Vdc. Connect CAN-H and GND and hold for 60 s. Connect CAN-L and GND and hold for 60 s. Connect CAN-H and $V_S$ and hold for 60 s. Connect CAN-L and $V_S$ and hold for 60 s. Performance test before and after test only at 25°C and $V_S$ nom. |
| Insulation Resistance | ISO 16750-2 | Test voltage: 500 Vdc ±10 Vdc between primary bar and the short-circuited secondary circuit. Test duration: 60 s, insulation resistance ≥500 MΩ |
| AC Dielectric Voltage Test | IEC60664-1 | Test voltage: 5000 Vac, test voltage frequency: 50 Hz to 60 Hz, test duration: 60 s, leakage current ≤1 mA |
| DC Dielectric Voltage Test | IEC60664-1 | Test voltage: 5000 Vdc, test duration: 60, leakage current ≤1 mA |
| High Current Transient Shock Test | — | Product power on with 12 V supply voltage. Monitor product CAN bus output and power supply current. Apply primary transient current shock at 2000 A, 5000 A, 7000 A, 9000 A, 10000 A Performance test before and after test only at 25°C and $V_S$ nom. |

## ADDITIONAL MATERIALS

The following associated literature is available at sps.honeywell.com/ast:

- Product range guide
- Installation drawings

## NOTICE
### PRELIMINARY DOCUMENTATION

The information contained in this document is preliminary and for reference only. Preliminary means that the product described has not been or is currently being formally tested. Specifications are subject to change without notice. Reliance on the information contained herein is at the reader's own risk.

## FOR MORE INFORMATION

Honeywell services its customers through a worldwide network of sales offices and distributors. For application assistance, current specifications, pricing or the nearest Authorized Distributor, visit our website or call:

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Specifications may change without notice. The information we supply is believed to be accurate and reliable as of this writing. However, Honeywell assumes no responsibility for its use.

## ⚠ WARNING
### PERSONAL INJURY

DO NOT USE these products as safety or emergency stop devices or in any other application where failure of the product could result in personal injury.

**Failure to comply with these instructions could result in death or serious injury.**

## ⚠ WARNING
### MISUSE OF DOCUMENTATION

- The information presented in this product sheet is for reference only. Do not use this document as a product installation guide.
- Complete installation, operation, and maintenance information is provided in the instructions supplied with each product.

**Failure to comply with these instructions could result in death or serious injury.**

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