

DS\_SDB12185A\_En\_Rev250721

The SmartD Clean Power Variable Frequency Drive is a compact AC drive that utilizes SmartD's patented algorithms, combined with Wide Bandgap (WBG) transistor technology.

Producing a clean and pure sine wave to power and control 3-phase AC induction motors has never been easier.

The SmartD VFD features essential built-in benefits for space, wiring, and time savings. It eliminates the need for filters on both the input and output, and guarantees a longer motor lifetime.



#### Variable Frequency Drive for AC motors

- 3-level inverter with SiC technology
- Pure sine wave 3-phase power output, no dV/dt or sine filter required
- Ultra-low harmonics — No input filter needed
- Long cable runs, legacy motor friendly
- V/f open and closed loop
- Field Oriented Control, open and closed loop
- Multifunctional, digital, and analog IOs
- Built-in Torque Deactivation inputs
- 24 VDC power supply input
- Dual Ethernet port
- Fire emergency mode
- Configurable Linear Ramps
- Starting torque boost
- Integrated EMC filters
- Set, monitor, and control it with an app
- Pluggable display
- Natural language user interface

Get the Clean Power VFD mobile App

User Guide:



Download on the App Store



Get it on Google Play



## SDB-1-2185-A

### Power Supply

|                                                        |            |                                                                     |
|--------------------------------------------------------|------------|---------------------------------------------------------------------|
| Supply Type                                            |            | Wye, solidly grounded. TT and TN systems                            |
| Input Voltage                                          | VAC        | 3 ~ 400 .. 480   -15% .. +10%                                       |
| Input Frequency                                        | Hz         | 50 .. 60   -5% .. +5%                                               |
| Input Current                                          | A          | 36                                                                  |
| Apparent Power                                         | kVA @ 480V | 30                                                                  |
| Prospective Line Isc (SCCR)                            | kA         | 50 (with circuit breaker Schneider Electric HLL36070 or equivalent) |
| THDi Total Harmonic Distortion (current)               | %          | <5                                                                  |
| Imbalance max. of nominal phase to phase input voltage | %          | -/+ 3%                                                              |
| Power factor                                           |            | near unity                                                          |

### Output capabilities

|                                                                                              |     |                                              |
|----------------------------------------------------------------------------------------------|-----|----------------------------------------------|
| Output Voltage                                                                               | VAC | up to 400 .. 480, depending on input voltage |
| Continuous Output Current - Normal Duty                                                      | A   | 34 @ 460 VAC<br>35 @ 400 VAC                 |
| Continuous Output Current - Heavy Duty                                                       | A   | 25 @ 460 VAC<br>25 @ 400 VAC                 |
| Max Transient Output current - Normal Duty<br>During 60s, every 10 minutes at 50 °C (122 °F) | A   | 38 @ 460 VAC<br>38 @ 400 VAC                 |
| Max Transient Output current - Heavy Duty<br>During 60s, every 10 minutes at 50 °C (122 °F)  | A   | 38 @ 460 VAC<br>38 @ 400 VAC                 |
| Output Speed Frequency                                                                       | Hz  | 0.1 .. 120                                   |
| Nominal Switching Frequency                                                                  | kHz | 105                                          |
| Effective Switching Frequency                                                                | kHz | 210                                          |

### Indicative Motor Power\*

|                           |    |                                                            |
|---------------------------|----|------------------------------------------------------------|
| Motor power - Normal Duty | kW | 18.5 - 3 ~ 400 VAC 50/60 Hz<br>18.5 - 3 ~ 460 VAC 50/60 Hz |
| Motor power - Normal Duty | hp | 25 - 3 ~ 400 VAC 50/60 Hz<br>25 - 3 ~ 460 VAC 50/60 Hz     |
| Motor power - Heavy Duty  | kW | 15 - 3 ~ 400 VAC 50/60 Hz<br>15 - 3 ~ 460 VAC 50/60 Hz     |
| Motor power - Heavy Duty  | hp | 20 - 3 ~ 400 VAC 50/60 Hz<br>20 - 3 ~ 460 VAC 50/60 Hz     |

\* Motor power values are indicative. They vary depending on the motor type, technology, and manufacturer. The Clean Power VFD must not be selected based on the motor power rating.

The Clean Power VFD must be selected based on the motor Full Load Amperage (FLA), the load's driving force, the movement cycle, and the operating environment.

The Clean Power VFD must be chosen by skilled and experienced personnel.

### Efficiency

|            |   |    |
|------------|---|----|
| IE Class   |   | 2  |
| Efficiency | % | 96 |

# Cables and Environment

## Motor cable length

|                               |        |                                                              |
|-------------------------------|--------|--------------------------------------------------------------|
| Max Motor Cable Length        | m / ft | 4500 / 15,000 without output filter                          |
| Sine Wave Cable Compatibility |        | Standard industrial-grade cables (shielding optional)        |
| Voltage Drop Limit            | %      | Max 3% of rated motor voltage ( $\sqrt{3} \cdot R \cdot I$ ) |

## Important Installation Guidance for Clean Power VFD: Cable Selection, Performance Impacts, and Autotuning Tips:

The Clean Power VFD outputs a pure sine wave, allowing for very long cable lengths without the need for filters or VFD-rated cable. However, performance depends on proper cable sizing:

- Undersized cables increase voltage drop and motor heating
- Excessive length or shielding raises reactive current (charging)
- For best autotuning results, use short cable or manual motor data
- Always evaluate ampacity, voltage drop, and terminal compatibility before final installation.

## Environment and deratings

The Clean Power VFDs are manufactured with precision electronic components.

Therefore, the installation environment can impact on the lifespan and reliability of the product.

The information below describes the recommended operation and installation conditions for the Clean Power VFD.

The user must comply with the environmental conditions listed below to ensure the Clean Power VFD operates safely and correctly.

Failure to adhere to these environmental conditions may shorten the device's lifespan, lead to malfunctioning and failure, and void the warranty.

|                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Installation area                        | The Clean Power VFD must be mounted in a well-ventilated electrical cabinet, respecting the clearance distances described in this document.                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Operating temperature                    | <p>The normal operating range of the Clean Power VFD is <b>-15 to 50°C</b> without derating, <b>50 to 60°C with derating of 2% per °C</b>. If not specified otherwise (e.g., SDB-1-2220-AL)</p> <p>The reliability of the Clean Power VFD increases in environments where temperature fluctuations are limited.</p> <p>When using an enclosure, install a cooling fan or air conditioner in the area to ensure the air temperature inside the housing does not exceed the specified levels.</p> <p>Do not allow ice to form on the frequency converter.</p> |
| Relative humidity                        | Below 95% non-condensing.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Surrounding environment pollution degree | 2, conforming to IEC61800-5-1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Storage temperature                      | -40..70 °C / -40..158 °F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

|                  |                                                                                                                                                                                                                                                                                                                                                                                                                            |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Surrounding area | <p>Mount in an area free of</p> <ul style="list-style-type: none"> <li>oil mist and dust-metal shavings, oil, water, or other foreign materials</li> <li>radioactive materials</li> <li>combustible materials</li> <li>toxic or corrosive gases and liquids</li> <li>excessive vibration</li> <li>chlorides</li> <li>direct sunlight</li> <li>EMI source and other electronic devices that are sensitive to EMI</li> </ul> |
| Altitude         | <p><b>Lower than 2000 m/6600 ft.</b></p> <p>Contact SmartD Technologies Inc. if you intend to use the Clean Power VFD at a higher altitude.</p>                                                                                                                                                                                                                                                                            |
| Vibrations       | <p>Mount in a location where vibrations are less than an amplitude of 1.5 mm peak to peak (f= 2...13 Hz) and acceleration lower than 1 gn (f= 13...200 Hz).</p>                                                                                                                                                                                                                                                            |

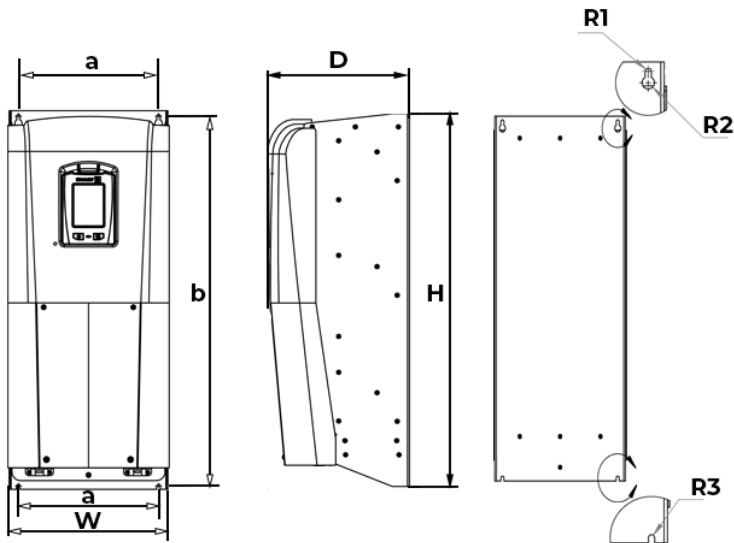
#### Best practices:

To prevent high surrounding air temperature, users should design their electrical panel following the listed best practices:

- No heat stagnation in the panel.
- Sufficient heat dissipation of the panel (Size not too small, proper ventilation).
- Ventilation slits of the Clean Power VFD are not blocked by any object such as cable or cable trays.
- Avoid the proximity of any exothermic device.
- Ensure the mounting orientation of the Clean Power VFD allows an optimized airflow.
- Respect the clearance distances.

# Dimensions size S3 Drives

## Dimensions of VFDs size S3



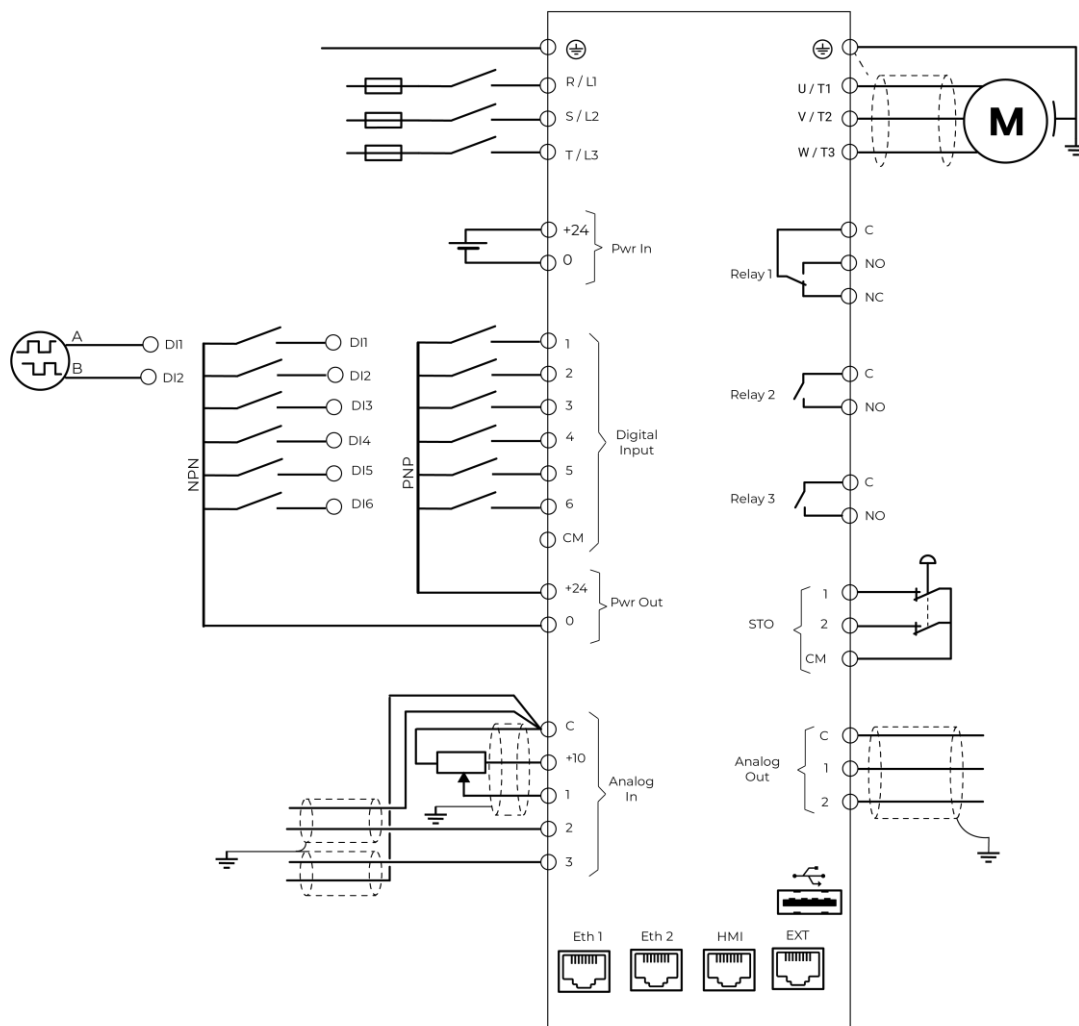
|        |        |           |
|--------|--------|-----------|
| W      | 301 mm | 11.85 in. |
| H      | 650 mm | 25.59 in. |
| D      | 251 mm | 9.88 in.  |
| Weight | 30 kg  | 66 lb     |

|            |           |            |
|------------|-----------|------------|
| a          | 165.10 mm | 6.50 in.   |
| b          | 575.55 mm | 22.659 in. |
| R1         | 3.47 mm   | 0.137 in.  |
| R2         | 6.72 mm   | 0.265 in.  |
| R3         | 3.47 mm   | 0.137 in.  |
| Screw size | M6        | 10         |

# Wiring diagram

## Wiring diagram

This diagram illustrates the typical connections of the Clean Power VFD, part numbers that embed an active front end (AFE)



# Power Terminals

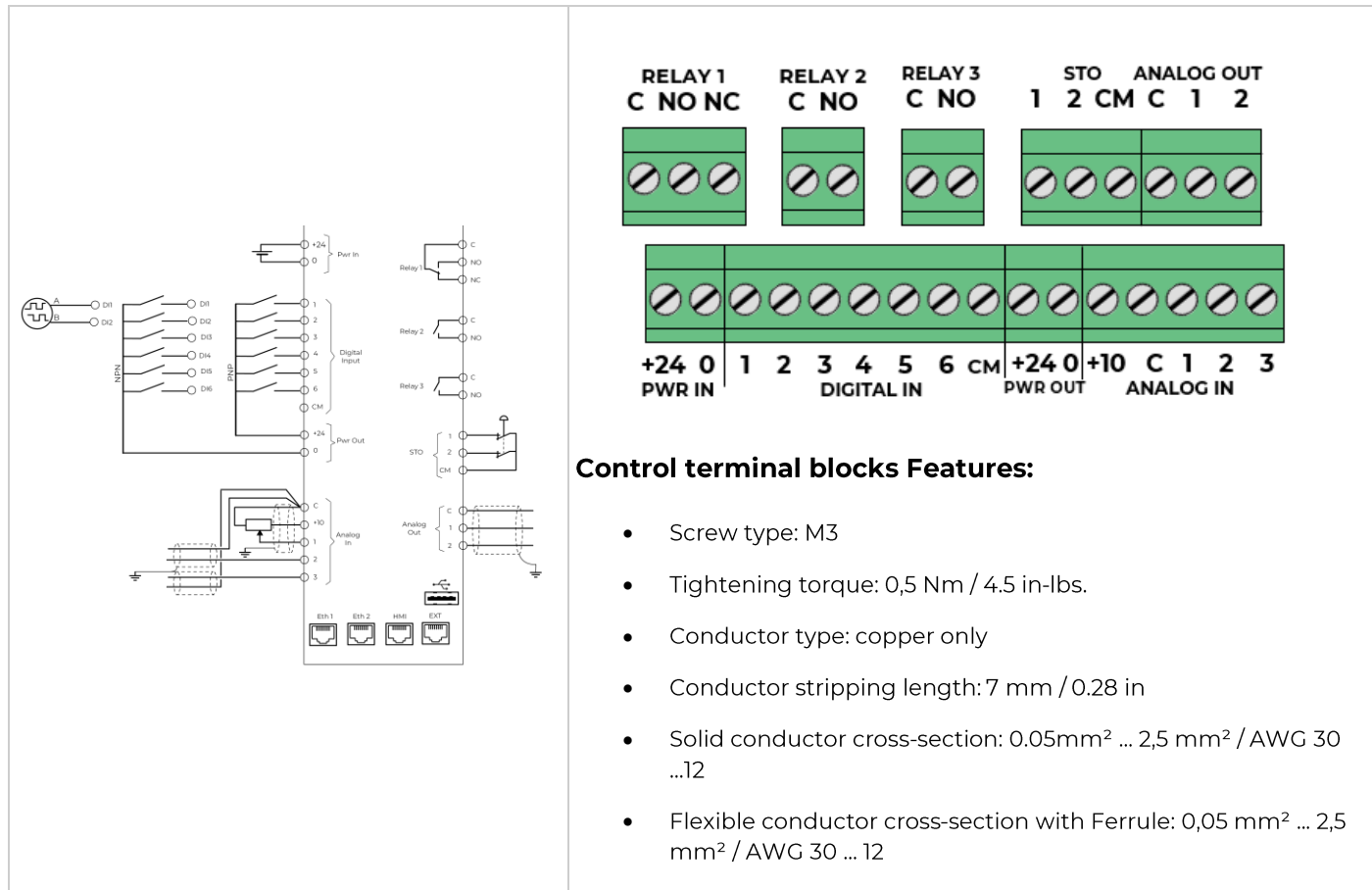
## Power terminals specifications

| Clean Power<br>VFD<br>models  | Terminal            | Screw                                                                                                                                                                               | Tightening<br>torque                                                                                                                                                                   | Conductor<br>stripping length   | Solid conductor<br>cross-section    |
|-------------------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|-------------------------------------|
| Models size S3<br>and size S4 | Ground              | <ul style="list-style-type: none"> <li>- Thread: M5,</li> <li>- Slotted screwdriver size (Blade thickness x Width)(mm): 1.0x5.5</li> <li>- Philips screwdriver size: PH2</li> </ul> | <ul style="list-style-type: none"> <li>- Rated: 3.8 N.m / 33.6 in-lbs</li> <li>- Recommended min: 3.73 N.m / 33.01 in-lbs</li> <li>- Recommended max: 4.5 N.m / 39.8 in-lbs</li> </ul> | 18 to 19 mm<br>0.71 to 0.75 in. | max 35 mm <sup>2</sup><br>max AWG 2 |
|                               | R/L1, S/L2,<br>T/L3 | Thread: M5,<br><ul style="list-style-type: none"> <li>- Slotted screwdriver size (Blade thickness x Width)(mm): 1.0x5.5</li> <li>- Philips screwdriver size: PH2</li> </ul>         | <ul style="list-style-type: none"> <li>- Rated: 3.8 N.m / 33.6 in-lbs</li> <li>- Recommended min: 3.73 N.m / 33.01 in-lbs</li> <li>- Recommended max: 4.5 N.m / 39.8 in-lbs</li> </ul> | 18 to 19 mm<br>0.71 to 0.75 in. | max 35 mm <sup>2</sup><br>max AWG 2 |
|                               | U/T1, V/T2,<br>W/T3 | Thread: M5,<br><ul style="list-style-type: none"> <li>- Slotted screwdriver size (Blade thickness x Width)(mm): 1.0x5.5</li> <li>- Philips screwdriver size: PH2</li> </ul>         | <ul style="list-style-type: none"> <li>- Rated: 3.8 N.m / 33.6 in-lbs</li> <li>- Recommended min: 3.73 N.m / 33.01 in-lbs</li> <li>- Recommended max: 4.5 N.m / 39.8 in-lbs</li> </ul> | 18 to 19 mm<br>0.71 to 0.75 in. | max 35 mm <sup>2</sup><br>max AWG 2 |

# Control specifications

## Control Circuit Connection Diagram and functions

The illustration below shows the detailed layout of control wiring terminals.



## 24VDC power in

The 24VDC auxiliary supply will power the Clean Power VFD control board without line power, allowing the control board, communications, and the HMI to continue to operate.

It is recommended that you connect a 24VDC to this auxiliary power input, as this allows you to export logs for support and troubleshooting purposes if needed.

If a 24VDC is used while commissioning the Clean Power VFD and line power is absent, the Clean Power VFD will be in the under-voltage alarm state.

Ensure to use a DC power supply that meets the following specifications:

- Nominal operating voltage: 24 VDC
- Minimum continuous operating voltage: 19.2 VDC
- Maximum continuous operating voltage: 28.8 VDC
- Maximum power supply requirement at 24V: 50 W
- Recommended protection fuse: 4A - 50 VDC



**!** To ensure proper operation and avoid potential issues like ground loops, noise interference, and malfunctions, do not connect the 24VDC common terminal to the ground.

Read carefully and apply the recommendations from the user guide chapter [Grounding](#)

24VDC power out

This power is used to energize the digital inputs or to energize some sensors.

Ensure that the maximum current level, as defined in the following specifications, is respected.

- Nominal operating voltage: 24 VDC
- Minimum continuous operating voltage: 19.2 VDC
- Maximum continuous operating voltage: 28.8 VDC
- Maximum output current at 24V: 100mA
- Recommended protection fuse: 4A - 50 VDC

Digital input terminals

| Marking | Name                               | Default Operation                                                              |
|---------|------------------------------------|--------------------------------------------------------------------------------|
| 1       | Digital input 1                    | User-settable. It can be used for an encoder, phase A. Default setting: unused |
| 2       | Digital input 2                    | User-settable. It can be used for an encoder, phase B. Default setting: unused |
| 3       | Digital input 3                    | Run forward                                                                    |
| 4       | Digital input 4                    | Run Reverse                                                                    |
| 5       | Digital input 5                    | Stop                                                                           |
| 6       | Digital input 6                    | Select reference speed between preset 1 and analog input 1                     |
| +24     | Common terminal for digital inputs |                                                                                |

The user can assign the digital inputs to various functions:

- Rotation direction,
- Stop,
- Selection of the speed setpoint source
- Selection of the local/remote control mode

Their logic operation is also user-settable; the choices are between:

- rising or falling edge
- level high or low

Last, a debounce delay is also user-settable to avoid false input triggering. This timer's range is 0 to 5000 ms; its default value is 200 ms.

### Analog Input Terminals

| Marking | Name                              | Default Operation                                               |
|---------|-----------------------------------|-----------------------------------------------------------------|
| 1       | Analog input 1                    | Speed reference (Hz) - preset to be used as potentiometer input |
| 2       | Analog input 2                    | un-assigned                                                     |
| 3       | Analog input 3                    | un-assigned                                                     |
| +10V    | Reference power supply            | 10VDC - 10 mA max                                               |
| C       | Common terminal for Analog inputs |                                                                 |

The user can assign analog inputs from AI1 to AI3 to various functions and electrical signals.

Available choices for the functions are

- Speed (frequency - Hz) setpoint
- Velocity (RPM) setpoint
- PTC motor thermal sensor
- Unused.

The signal that can be wired to the Analog input can be either

- 0..10VDC,
- 0..20mA,
- 4..20mA,
- PTC.

### Relay output terminals

Relay 1: SPDT

| Marking | Name                    | Default Operation                                                                                                                                                                                                                              |
|---------|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| C       | Common of the contacts  | Relay 1 (SPDT) is assigned by default to be the alarm relay.<br>The relay is energized when there is no alarm present (C and NO connected).<br>The relay is de-energized when there is an alarm or a loss of power supply (C and NC connected) |
| NO      | Normally opened contact |                                                                                                                                                                                                                                                |
| NC      | Normally closed contact |                                                                                                                                                                                                                                                |

Relays 2 and 3: NO

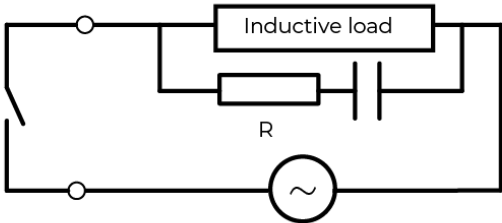
| Marking | Name                    | Default Operation                                                                                                                                                                                                    |
|---------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| C       | Common of the contact   | Relay 2 (NO) is the factory default setting to be closed when the drive is in the state "ready to run".<br><br>Relay 3 (NO) is the factory default setting to be closed when the drive is in the state of "running". |
| NO      | Normally opened contact |                                                                                                                                                                                                                      |

The operation of the 3 independent relay outputs of the Clean Power VFD can be set by the user.

The settings are described in the section: [Functions and Parameters](#).

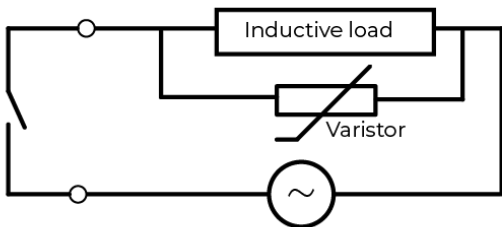
### Relays protection

Always protect relay outputs from inductive load damage, using an appropriate external protective circuit or device.

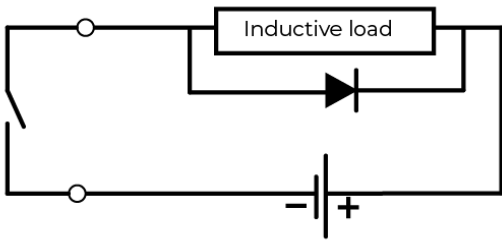


C: a capacitor from 0.1 to 1  $\mu\text{F}$ .

R: resistor of approximately the same resistance value as the load.



In applications where the inductive load is switched on and off frequently and/or rapidly, ensure that the continuous energy rating (J) of the varistor exceeds the peak load energy by 20 % or more.



Use a diode with the following ratings:

Reverse withstand voltage: power voltage of the load circuit x 10.

Forward current: more than the load current.

### Analog Output Terminals

| Marking | Name                               | Default Operation                                                                                                 |
|---------|------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| 1       | Analog output 1                    | Analog Output 1 is factory-preset to be assigned to the motor frequency. The preset signal is 0..10VDC            |
| 2       | Analog output 2                    | Analog Out 2 is factory-preset to be assigned to the motor current $I_{rms}$ total. The preset signal is 0..10VDC |
| C       | Common terminal for Analog outputs |                                                                                                                   |

The user can assign analog outputs 1 and 2 to various functions and electrical signals.

Available choices for the functions are

- Motor Current
- Motor Frequency
- Motor Torque
- Motor Power
- Drive thermal state
- Unused.

The signal that is delivered by the analog output can be either

- 0..10VDC
- 0..20mA
- 4..20mA.

Selection and scaling are made using the mobile App.

#### Torque Deactivation terminals

The Torque Deactivation enabling terminals are positive logic input only.

The user is responsible for ensuring the complete system is safe and designed correctly according to the relevant safety standards.

If the Torque Deactivation function is not required, the terminals STO1 and STO2 must remain connected to +24VDC.

| Marking  | Name                                  | Default settings                                                                                                                                                                                                                                                                                                                                      |
|----------|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| STO1     | Torque Deactivation - input 1         | <p>Open: Torque Deactivation is enabled, and the Clean Power VFD output is de-energized.</p> <p>Closed: Torque Deactivation is disabled, and the Clean Power VFD is in normal operation</p> <p>Note: Remove the jumper between STO1 and +24V using the torque deactivation input.</p> <p>The length of the wire should not exceed 30 m (98.4 ft).</p> |
| STO2     | Torque Deactivation - input 2         | <p>Open: Torque Deactivation is enabled, and the Clean Power VFD output is de-energized.</p> <p>Closed: Torque Deactivation is disabled, and the Clean Power VFD is in normal operation</p> <p>Note: Remove the jumper between STO1 and +24V using the torque deactivation input.</p> <p>The length of the wire should not exceed 30 m (98.4 ft).</p> |
| +24 / CM | Torque Deactivation supply connection | <p>Delivers +24V for the Torque Deactivation inputs when the VFD is configured in Source logic mode.</p> <p>Refer to the <a href="#">digital input logic connection</a> section to wire the Torque Deactivation terminals correctly</p>                                                                                                               |