INVERTER DRIVE® SUPERMARKET

Invertek Optidrive E3 Frequency Inverter (IP20, 3ph output)

Easy Start Guide

The Invertek Optidrive E3 Frequency Inverter range is available to order from inverterdrive.com

This guide is intended to complement the user manual provided by the manufacturer.
It is provided as a basic introduction to the product for Inverter Drive Supermarket customers.
It should not be used as a replacement for the manual issued by the manufacturer.

This product is not a safety device. All safety considerations including but not limited to Emergency Stop provision should be assessed separately and are outside the scope of this guide.

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1. Power and Motor Connections (Single Phase)

Before commencing, confirm that the Inverter and all cables are completely isolated from the power supply, have been isolated for at least 5 minutes and that the motor is not turning.

Notes:

The illustration on the left is based on frame size 1 (ratings to 1.5kW). The terminal layout for frames 2-3 is similar.

Filtered models are supplied with the internal EMC filter enabled. This can be disabled by removing the screw on the side of the unit marked “EMC” (not usually necessary).

The order of the three motor phases determines the initial direction the motor turns. This can be reversed by physically swapping any two phases, or by changing the Inverter parameters.

Use screened cable between the Inverter and Motor. To minimise electromagnetic interference, ensure the cable screen is grounded.

The supply must match the Inverter specification.

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2. Power and Motor Connections (Three Phase)

Before commencing, confirm that the Inverter and all cables are completely isolated from the power supply, have been isolated for at least 5 minutes and that the motor is not turning.

Notes:

The illustration on the left is based on frame size 1 (ratings to 1.5kW). The terminal layout for frames 2-4 is similar.

The order of the three supply phases is not important.

The order of the three motor phases determines the initial direction the motor turns. This can be reversed by physically swapping any two motor phases. Or by changing the Inverter parameters.

Use screened or armoured cable between the Inverter and Motor. To minimise electromagnetic interference, ensure the cable screen is grounded.

The supply must match the Inverter specification.

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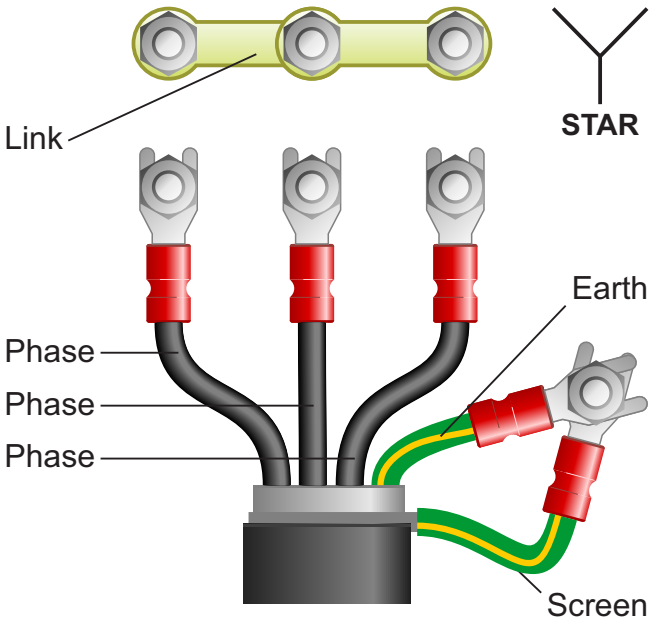
3. Motor Connections - Star and Delta

Dual voltage induction motors typically include terminal boxes with six points. The points can be connected together with links in one of two ways to suit one of the two rated voltages.

The two ways of connecting the links are shown below. These are known as “Star” (the higher voltage) or “Delta” (the lower voltage).

The selection of Star or Delta is not optional and must match the supply voltage.

Dual voltage motor nameplates include symbols to represent voltage and full load current in each configuration.
Delta is represented by a triangle and star by a Y (Wye).



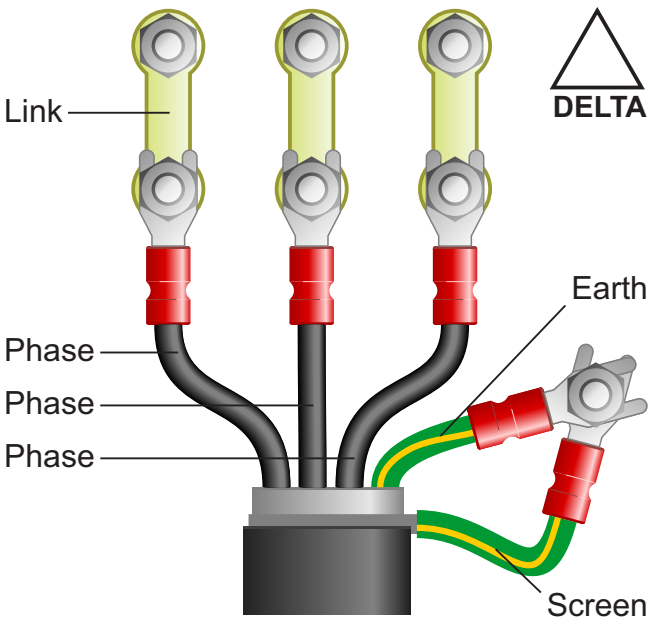
3.1 Motor connected in STAR (or Wye):

For safety purposes, Star (shown opposite) is the default configuration for small motors (usually to 3kW) and is sometimes known as “two at one side”.

Only two links are required for Star. Double-up the links if changing from Delta to allow the motor to be changed back in future.

The order of the three phases determines the direction the motor turns.

Note that the manufacturer recommends that the cable screen is earthed at both ends.



3.2 Motor connected in DELTA:

The link configuration is shown in the illustration opposite and is sometimes referred to as “three-a-breast”.

The order of the three phases determines the direction the motor turns.

Note that the manufacturer recommends that the cable screen is earthed at both ends.

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4. Parameters - overview

The Inverter contains a number of settings which can be changed to tailor it for use in a wide range of applications. These settings are known as parameters.

Parameters are typically referred to by code or number (eg. P-08 = Motor Rated Current) with a description available in the manual.

The parameters contain critical information essential to the correct operation of the Inverter. Therefore, they should at least be checked by the user before the Inverter is operated for the first time.
The parameters listed in section 5 are intended to provide a starting point to allow for basic operation of the Optidrive Inverter.

5. Parameters to set before use

Set the following parameters to allow the Optidrive to control a motor with Run, Stop and Speed Control from the keypad.

If any of the parameters have been changed previously, follow the procedure in section 14 to reset the Inverter to Factory Defaults.

See section 6 to learn how to set a parameter value.

5.1 Parameters to check and values to set

Parameter	Description	How to set
P-01	Maximum Frequency (Hz)	Maximum frequency for the Inverter. Default is **50** which suits many applications.
P-02	Minimum Frequency (Hz)	Minimum frequency for the Inverter. Default is 0; **3** suits many applications.
P-03	First Acceleration Time (s)	Default is **5** seconds; increase or decrease if faster or slower acceleration is required.
P-04	First Deceleration Time (s)	Default is **5** seconds; increase or decrease if faster or slower deceleration is required.
P-05	Stopping Mode	Default is **0**, ramped stop. Change to 1 for coast stop; this may suit some fan loads.
P-07	Motor Rated Voltage (V)	Rated Voltage of the motor. Set to match the motor nameplate eg **230** V
P-08	Motor Rated Current (A)	Rated current of the motor. Set to match the motor nameplate eg **2.4** A
P-09	Motor Rated Frequency (Hz)	Rated frequency of the motor. Default is **50** Hz; change to suit the motor.
P-10	Motor Rated Speed (rpm)	Rated rpm of the motor. Set to match the motor nameplate eg **1460** rpm (min-1) *[1]
P-11	Low Frequency Torque Boost (%)	Default is rating dependent. Can be changed to improve low speed torque performance if required.
P-12	Primary Command Source	Default is **0** for terminal control. For keypad or PID control selection is required.
P-13	Operating Application Type	Default is **0** (constant torque); can be set to 1 for centrifugal pump or 2 for fan applications.
P-14	Extended Menu Access Code	Default is 0. Set to **101** to gain access to “extended” parameters (P-15 to P-50). Set to 201 to gain access to “extended” and “advanced” parameters (P-15 to P-60).
P-15	Digital Input Function Selection (Extended Access Required)	Default is **0**; will suit most applications. 17 different Macros available. Defaults given in this guide are based on P-15 = 0 (default).
P-17	Switching Frequency (Extended Access Required)	Default is **8kHz**. Only change if required; default will suit most applications.

**[1] Changing P-10 from 0 changes all speed-related parameter values to rpm. If P-10 is not changed from 0 speed-related parameter values are in Hz.*

***Note:** each Optidrive E3 includes a pull-out reference card (marked 🕮). This contains details of parameters P-01 to P-14 and the default control terminal configuration.*

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6. How to set a Parameter value

6.1 Press the navigation key ⬭ to access parameters.

When powered up the Optidrive default display is “Stop”.

To access the parameter list press and hold the navigation key ⬭ for approx. 2 seconds.

P-01 or the last viewed parameter will be displayed with the last digit flashing.

6.2 Select the required parameter.

Use the up and down arrow keys to select the required parameter. In this example, select P-08 (Motor Rated Current).

Note: By default, parameters P-01 to P-14 will be visible. To enable “extended” parameters (P-15 to P-50) set P-14 to 101. For “advanced” parameters (P-15 to P-60) set P-14 to 201.

6.3 Change the parameter value and save.

Press the navigation key ⬭ to show the parameter value.

Use the up and down arrows keys to change the value as required.

Press the navigation key ⬭ to save the changes and return to the parameter list.

6.4 Return to the main operating display.

Once all parameter changes are complete press and hold the navigation key ⬭ for approx. 2 seconds to return to the main operating display.

Note: The parameter list or value will automatically return to the main operating display after approx. 20 seconds of inactivity. Any unsaved changes will be lost.

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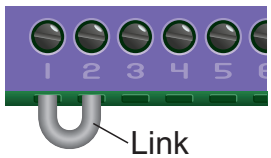
7. How to operate the Inverter from the keypad

7.1 Select “local” control mode.

As default, the Optidrive E3 is set to operate from the integrated IO terminals. To operate from the keypad, the Optidrive needs to be set to “local” control.

To do this, change parameter P-12 from 0 to 1. Terminals 1 and 2 must also be linked to “enable” the Inverter (as shown, right).



7.2 Set the desired speed.

Press the red stop key. The set point value in Hz will be displayed (the default value is 0.0).

Use the up and down keys to change the value as required. This value can set to any value between the minimum (P-02) and maximum (P-01) frequencies.

7.3 Press the green “RUN” key to start the motor.

The green key will start the motor. The display will increase from 0.0 as the motor accelerates. The time taken for the motor to accelerate to the desired speed (in seconds) is proportional to parameter P-03. To change the speed whilst the motor is running, use the up and down keys.
Note: When running, the navigation ⬭ key can be used to cycle through status values such as current in Amps (A) and Power in kW (P).

7.4 Press the red “Stop” key to stop the motor.

The red key will stop the motor. The time taken (in seconds) to stop the motor is proportional to parameter P-04. Once the motor is stopped, the display will show “StoP”.

Note: Once the desired speed has been set the start and stop keys will run the motor to/from this value even if the drive is power-cycled.

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8. How to enable/disable Sensorless Vector mode

The standard motor control mode of the Optidrive E3 is Sensorless Vector. By default, the E3 uses the motor parameters for this mode. However, low-speed torque can be improved further by performing an "Autotune".

The Autotune process improves performance by building a model of the motor. This requires the Inverter to operate the motor for a few seconds to gather the necessary data.

To fully enable Sensorless Vector control by performing an Autotune, first set the parameter values specified in 8.1 (below) and then complete the steps described in 8.2 and 8.3.

If Sensorless Vector control is not desired, change parameter P-51 from 0 to 1 to disable Sensorless Vector control and set the motor control mode to simple V/f.

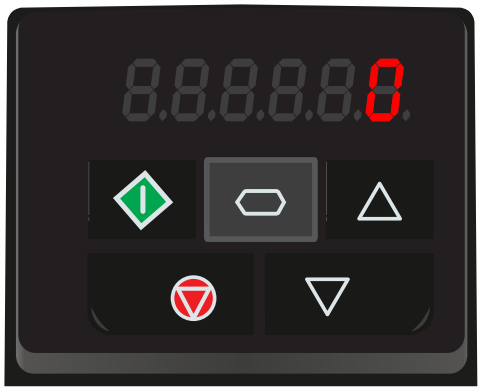
8.1 Parameters to check prior to an Autotune.

Parameter	Description	How to set
P-14	Extended Menu Access Code	Default is 0; set to **201** to gain access to "advanced" parameters (P-15 to P-60).
P-07	Motor Rated Voltage (V)	Rated Voltage of the motor. Set to match the motor nameplate eg **230** V
P-08	Motor Rated Current (A)	Rated current of the motor. Set to match the motor nameplate eg **2.4** A
P-09	Motor Rated Frequency (Hz)	Rated frequency of the motor. Default is **50** Hz; change to suit the motor.
P-10	Motor Rated Speed (rpm)	Rated rpm of the motor. Set to match the motor nameplate eg **1460** rpm (min-1)
P-51	Motor Control Mode	Default is **0** for (Sensorless) Vector Control Mode. Default is required for this example. To disable Sensorless Vector mode set to 1 to change to simple V/f mode.

8.2 Start Autotune.

Once the parameters in 8.1 have been set, select parameter P-52 and press the navigate key to edit the value.

Use the up and down keys to change the value from 0 to 1 then press the navigate key ⬭ again to start the Autotune.



8.3 The Autotune process.

There is no visible indication that an Autotune is in progress but motor excitation noise will be heard for a few seconds whilst the required values are measured.

When complete, the value of P-52 will return to 0.

Press and hold the navigate key ⬭ for approx. 2 seconds to return to the main operating display.

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9. How to connect and configure a Potentiometer for remote speed control

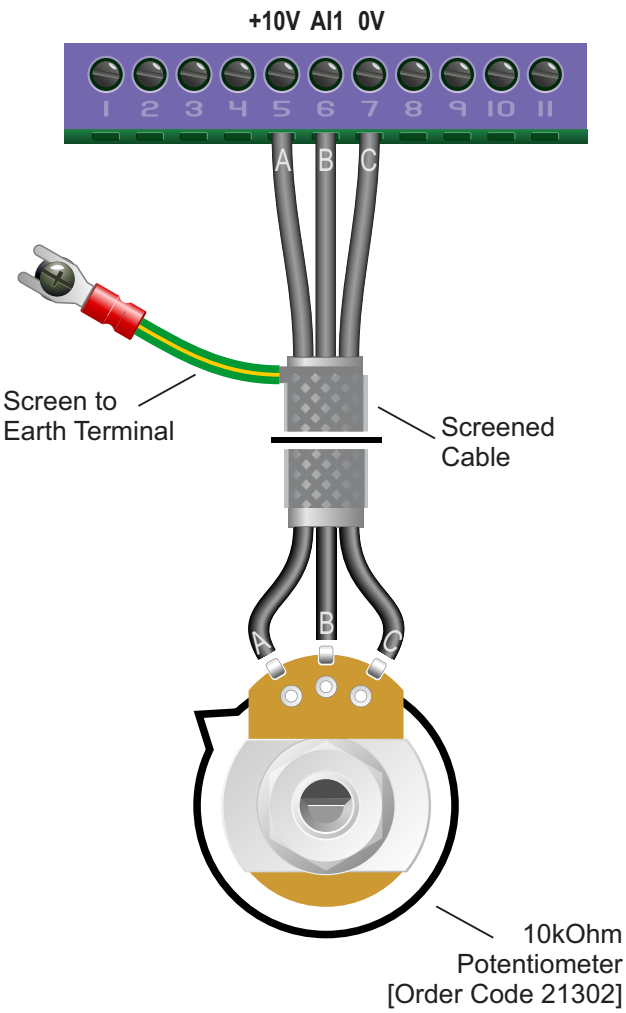
If speed control via the integrated keypad is unsuitable for the application, a remote Potentiometer can be used instead.
This provides the benefit of allowing motor speed to be controlled from a more convenient location such as a cabinet door (if the Optidrive is cabinet-mounted) or on the machine itself.

Any potentiometer rated from 1kOhm to 10kOhm can be used.

The number of turns depends on the application. Both single and multiturn Potentiometers are available from The Inverter Drive Supermarket at InverterDrive.com.

9.1 Parameters to check for remote Potentiometer speed control

Parameter	Description	How to set
P-14	Extended Menu Access Code	Default is 0; set to **101** to gain access to "extended" parameters (P-15 to P-50).
P-16	Analogue Input 1 Signal Format	Default is **U0-10** (0 to 10V). Default is required for this example.



9.2 Connecting the Potentiometer

A wiring diagram is shown in the illustration opposite. The most important connection at the Potentiometer end is the centre terminal or "wiper". The wiper will output a variable voltage between 0 and 10 Volts and should be connected to terminal 6 (AI1) on the Inverter. It is this voltage which provides the speed signal with 0V being slowest and 10V fastest.

The default output frequency at 0V is the minimum frequency of the Inverter. To change this, edit parameter P-02. The default output frequency at 10V is 50Hz. To change this, edit parameter P-01.

If the rotation of the Potentiometer is the opposite to that required (ie. turn anti-clockwise to increase speed instead of clockwise) reverse the connections to terminals 7 (0V) and 5 (+10V).

Use shielded cable between Potentiometer and Inverter and ensure that the cable screen is connected to the Inverter earth terminal only.

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10. How to connect and configure a Run Forward or Run Reverse switch

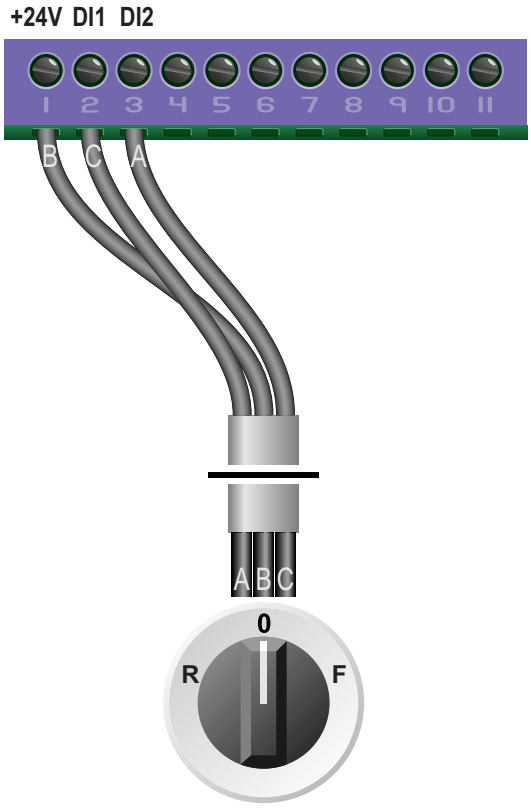
The procedure described in section 7 enables Run/Stop operation via the start and stop buttons on the Inverter keypad.

If this is unsuitable for the application, a remote switch can be used instead.

This section explains how to enable 2-wire control with Run Forward / Stop / Run Reverse commands via a single selector switch.
When set to operate in this way, the Inverter can no longer be operated via the integrated keypad.

10.1 Parameters to check for remote Run/Stop

Parameter	Description	How to set
P-12	Primary Command Source	Default is **0** for terminal control. Default is required for this example.
P-14	Extended Menu Access Code	Default is 0; set to **101** to gain access to "extended" parameters (P-15 to P-50).
P-15	Digital Input Function Selection (Extended Access Required)	Default is 0; set to **5** to select run fwd/run rev control. This value can be set to 0 if reverse is not required and a 2 position switch will be used.



Switch, 3 Position
Normally Open
"Run Forward / Stop / Run Reverse"
[Order Code 32901]

10.2 Connecting the Switch

A wiring diagram is shown in the illustration opposite.

A suitable 3 position NO (Normally Open) switch should be installed between terminals 1 (+24V), 2 (DI1) and 3 (DI2). The centre position should remain open circuit for stop.

When a connection is made between terminals 1 (+24V) and 2 (DI1), the motor will run forward. When terminals 1 (+24V) and 3 (DI2) are connected, the motor will run in reverse.

If terminals 2 (DI1) and 3 (DI2) are connected to terminal 1 (+24V) at the same time the motor will stop. Parameter P-24 can be used to set the time to stop in seconds.

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11. How to connect and configure a Run/Stop switch with Forward/Reverse selection

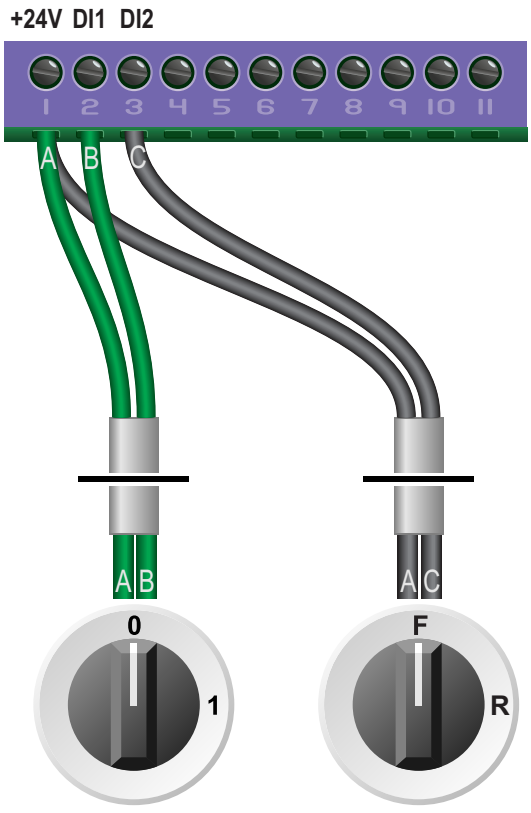
The procedure described in section 7 enables Run/Stop operation via the start and stop buttons on the Inverter keypad.

If this is unsuitable for the application, remote switches can be used instead.

This section explains how to enable 2-wire control with Run/Stop and Forward/Reverse commands via separate selector switches.
When set to operate in this way, the Inverter can no longer be operated via the integrated keypad.

11.1 Parameters to check for remote Run/Stop

Parameter	Description	How to set
P-12	Primary Command Source	Default is **0** for terminal control. Default is required for this example.
P-14	Extended Menu Access Code	Default is 0; set to **101** to gain access to "extended" parameters (P-15 to P-50).
P-15	Digital Input Function Selection (Extended Access Required)	Default is 0; default is required for this example.



Switch, 2 Position Normally Open "Run / Stop"

Switch, 2 Position Normally Open "Forward / Reverse"

[Order Code 32902 each]

11.2 Connecting the Switches

A wiring diagram is shown in the illustration opposite.

Two suitable 2 position NO (Normally Open) switches should be installed: One between terminals 1 (+24V) and 2 (DI1, Run / Stop) and the other between terminals 1 (+24V) and 3 (DI2, Forward / Reverse).

Note that the Forward/Reverse switch only selects the direction of rotation - it will not start or stop the motor. The direction can be set either before the motor is started or whilst it is running.

If the application only requires the motor to turn in one direction, the Forward/Reverse switch can be omitted.

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12. How to configure “3-Wire” control with Run Forward Run Reverse and Stop pushbuttons

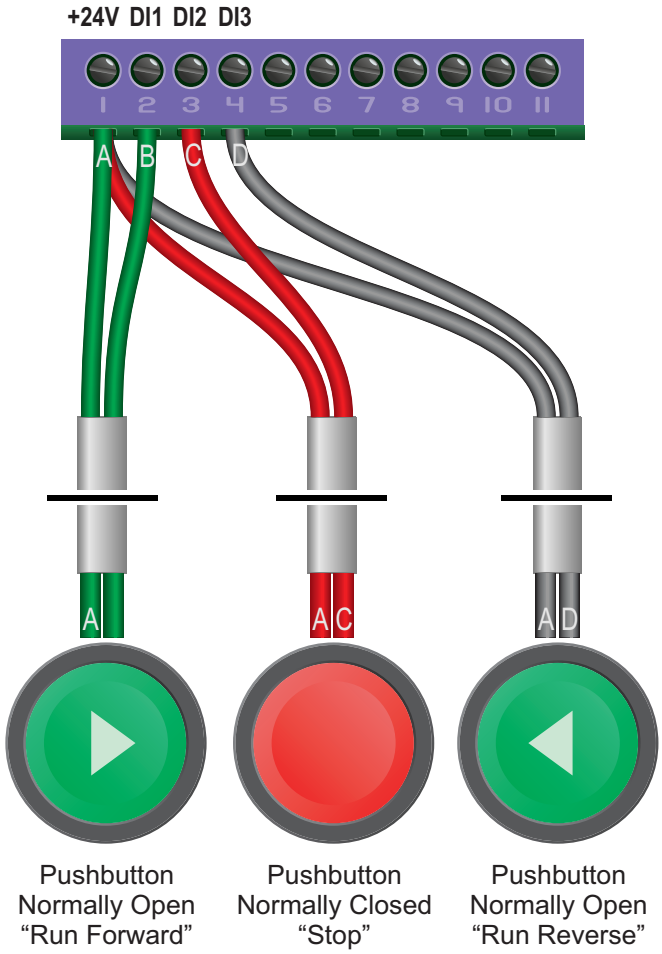
The procedure described in section 7 enables Run/Stop operation via the start and stop buttons on the Inverter keypad.

If this is unsuitable for the application, remote switches can be used instead.

This section explains how to enable 3-wire control with Run Forward, Run Reverse and Stop commands via separate pushbuttons.
When set to operate in this way, the Inverter can no longer be operated via the integrated keypad.

12.1 Parameters to check for remote 3-wire control

Parameter	Description	How to set
P-12	Primary Command Source	Default is **0** for terminal control. Default is required for this example.
P-14	Extended Menu Access Code	Default is 0; set to **101** to gain access to “extended” parameters (P-15 to P-50).
P-15	Digital Input Function Selection (Extended Access Required)	Default is 0; set to **11** for 3 wire control.



Pushbutton Normally Open “Run Forward”

Pushbutton Normally Closed “Stop”

Pushbutton Normally Open “Run Reverse”

[Order Codes 1 x 32895, 2 x 32896]

12.2 Connecting the Switches

A wiring diagram is shown in the illustration opposite.
Three suitable pushbuttons should be installed:-
Stop: a normally closed contact between terminals 1 (+24V) and 3 (DI2)
Run Forward: a normally open contact between terminals 1 (+24V) and 2 (DI1).
Run Reverse: a normally open contact between terminals 1 (+24V) and 4 (DI3).

A momentary connection between terminals 1 (+24V) and 2 (DI1) will start the motor (forward). It will continue to run until the connection between terminals 1 (+24V) and 3 (DI2) is broken. A momentary connection between terminals 1 (+24V) and 4 (DI3) will behave in the same way but the motor will run in reverse.

If the application only requires the motor to turn in one direction, the “Run Reverse” pushbutton can be omitted.

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13. Brake Resistor Connection (size 2 and above)

Before commencing, confirm that the Inverter and all cables are completely isolated from the power supply, have been isolated for at least 5 minutes and that the motor is not turning.

High inertia loads can cause overvoltage trips during deceleration and lead to “O-Volt" error messages. In many cases, the solution is to increase the deceleration time to compensate.

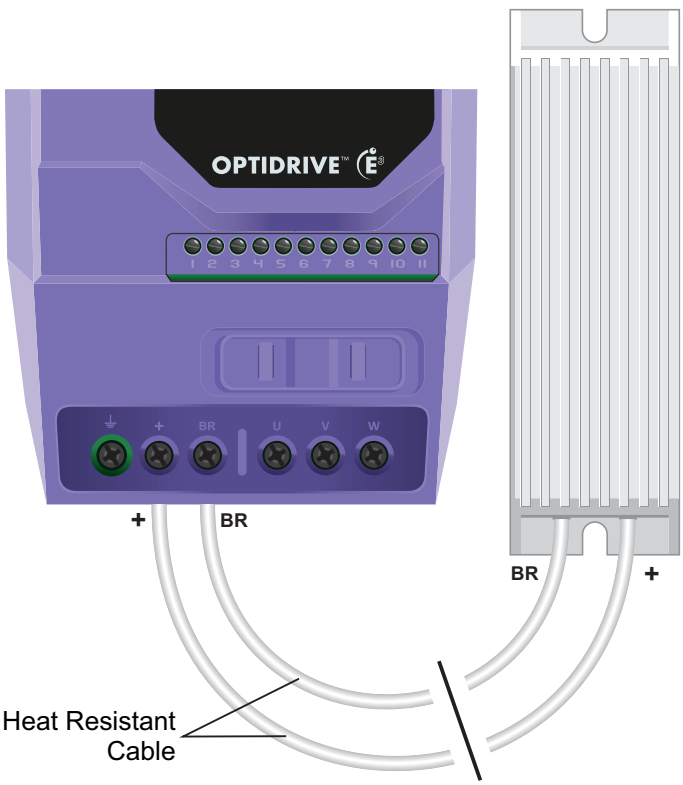
However, if the application requires it, dynamic braking can be enabled to maintain or reduce deceleration times by absorbing the energy generated by such loads.

A Brake Resistor is first installed to absorb braking energy and dissipate it as heat. The resistor must be correctly sized for both the Inverter and application.

The “brake chopper” within the Inverter detects excessive braking energy and redirects it to the resistor when required.

13.1 Parameters to check for Dynamic Braking

Parameter	Description	How to set
P-14	Extended Menu Access Code	Default is 0; set to **101** to gain access to “extended” parameters (P-15 to P-50).
P-34	Brake Chopper Enable (Extended Access Required)	Default is 0; set to **3** for “Enabled With Software Protection” to suit most applications.



13.2 Connecting the Resistor

A wiring diagram is shown in the illustration opposite. Connect the brake resistor to the + and BR terminals on the Inverter. The order of the connections is unimportant.

The braking resistor may get hot during operation. Ensure that it is suitably-mounted so any heat generated will not affect other equipment. Some resistors may include a thermal relay for additional protection.

It is essential that a resistor of the correct rating is used. Consult the Inverter product listing at InverterDrive.com or manual issued by the manufacturer for details.

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14. How to reset the Inverter to Factory Defaults

14.1 Three Button Reset

To reset all parameters to their factory default values, press and hold the up, down and stop keys together for approx. 2 seconds.

The display will show “P-dEF” to indicate “Parameter Defaults”.

14.2 Confirm the Reset

Press the red stop key to confirm the reset.

The display will show “StoP” indicating that the process is complete.

14.3 Enable Extended or Advanced Parameters (optional)

Parameters above P-14 will not be visible once a factory reset has been completed.

If access to “extended” parameters (P-15 to P-50) is required, set P-14 to 101. For “advanced” parameters (P-15 to P-60) set P-14 to 201.

Note: see section 6 to learn how to set a parameter value.

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