



# OPTIDRIVE USER GUIDE



**SAFETY NOTICES**

It is the responsibility of the installer to ensure that the equipment or system into which the product is incorporated complies with the EMC legislation of the country of use. Within the European Union, equipment into which this product is incorporated must comply with 89/336/EEC, Electromagnetic Compatibility.

**WARNING!**

The level of integrity offered by the Optidrive control functions – for example stop/start, forward/reverse and maximum speed, is not sufficient for use in safety-critical applications without independent channels of protection. All applications where malfunction could cause injury or loss of life must be subject to a risk assessment and further protection provided where needed. Within the European Union, all machinery in which this product is used must comply with Directive 89/392/EEC, Safety of Machinery. In particular, the electrical equipment should comply with EN60204-1.

**WARRANTY**

All Invertek Drives Ltd (IDL) products carry a 2-year warranty, valid from the date of manufacture. Complete Warranty Terms and Conditions are available upon request from your IDL Authorised Distributor.

**CAUTION**

- Carefully inspect the Optidrive before installation to ensure it is undamaged
- Store the Optidrive in its box until required. Storage should be clean and dry Temp. Range -40°C to +60°C
- Install the Optidrive on a flat, vertical, flame-resistant vibration-free mounting within a suitable enclosure, according to EN60529 if specific Ingress Protection ratings are required. Installation required in a pollution degree 2 environment.
- Flammable material should not be placed close to the drive
- The entry of conductive or flammable foreign bodies should be prevented
- Max. ambient temperature 50°C, min. -5°C. Refer to table on reverse side.
- Relative humidity must be less than 95% (non-condensing).
- The Optidrive is suitable for use on a circuit capable of delivering not more than 5KA (50Hp) / 10KA (51-200HP) symmetrical amperes, 480V maximum.

**GENERAL TECHNICAL DATA**

- Supply frequency 48 to 62 Hz.
- Max. permissible 3-phase supply imbalance 3%.
- Max. ambient temperature 50 °C.
- Max. altitude 2000 m.
- Derate above 1000 m, 1% / 100 m.
- Derate output current 5%/°C above max. ambient temp up to 55°C
- 1 x 1 protection above 100% output current.
- 150% overload protection for 60 sec.
- 175% overload allowable for 2 sec.
- Storage temperature -40 to +60 °C

**WARNING !**

- Optidrive should be installed only by qualified electrical persons and in accordance with local and national regulations and codes of practice. The Optidrive has an Ingress Protection rating of IP20. For higher IP ratings, use a suitable enclosure.
- Electric shock hazard!** Disconnect and ISOLATE the Optidrive before attempting any work on it. High voltages are present at the terminals and within the drive for up to 10 minutes after disconnection of the electrical supply
- Where supply to the drive is through a plug and socket connector, do not disconnect until 10 minutes have elapsed after turning off the supply
- Ensure correct earthing connections
- The earth cable must be sufficient to carry the maximum supply fault current which normally will be limited by the fuses or MCB

Each drive star connected to system earth point

\* If fitted, a filter should be physically close to the Drive. For maximum effectiveness, the metal case of the filter and the heat sink of the drive should be electrically connected, ie screw both to a metal backplate and ensure metal-to-metal contact.

**Size 6 Input Choke Connection** – When connecting the choke observe the following :-

- The order of the input phases (L1,L2,L3) is not important.
- The choke can be mounted to suit the wiring, either above the drive or anywhere in the panel. Either set of terminals can be used for the Input or Output.
- The choke should NOT be connected directly to the drive to stop any mechanical stress on the terminals of the drive.

**ELECTRICAL INSTALLATION**

Connect drive according to diagram (above), ensuring that motor terminal box connections are correct (see diagram, below). Refer to the **ELECTRICAL DATA** overleaf for the sizes of cabling and wiring. It is recommended that the power cabling should be 3-core or 4-core PVC-insulated screened cable, laid in accordance with local industrial regulations and codes of practice.

**OPERATION – USING THE KEYPAD MANAGING THE KEYPAD**

When the drive is delivered from the factory, only the Standard Parameter Set (see overleaf) is accessible. To access the Standard Parameter Set, press the Navigate key ⇄ for >1 sec.

- Scroll through P-01 to P-14 (and roll over to P-01) by pressing ▲ or ▼
- To display the parameter value, press ⇄
- To edit the parameter value, press ▲ or ▼
- To return to the parameter number, press ⇄
- To store a value and / or exit from edit mode, press ⇄ for >1 sec or press no button for >20 sec.

To access the Extended Parameter Set, set P-14 = 101 and press ⇄

**NOTE** To restrict unauthorised access, make P-37 = any value from 0 to 9999.

- When in the Extended Parameter Set (except P-00), the display will revert to normal if no button is pressed for >20 sec.

**TO RESTORE ALL DEFAULT VALUES,** stop the drive and when display shows StOP, press and hold the ▲, ▼ and STOP keys simultaneously for 1 second. The display will show P-dEF. Access code P-37 will revert to 101 but the hours-run meter P-39 is not affected. Press STOP to resume normal operation.

**CONTROL TERMINAL BLOCK - Default Status**

Refer to the Digital Inputs table overleaf for details of the digital input functions 1 to 3

If screened cabling is used for the control wiring, connect the cable screen to 0V of drive, terminals 1,7 or 9.

**OPERATING IN KEYPAD MODE**

Set P-12 = 1 (this allows the Optidrive to be controlled from the keypad):

- Enable the drive by closing digital input 1. The display will show StOP.
- Press the START key. The display shows H 0.0.
- Press ▲ to increase speed
- The drive will run forward, increasing speed until ▲ is released. **CAUTION:** the rate of acceleration is controlled by the setting of P-03, check this before starting.
- Either Press ▼ to decrease speed
- The drive will decrease speed until ▼ is released. The rate of deceleration is limited by the setting in P-04
- Or Press the STOP key. The drive will decelerate to rest at the rate set in P-04.
- The display will finally show StOP at which point the drive is disabled
- To preset a target speed prior to enable press the stop key whilst the drive is stopped. The display will show the target speed, use the ▲ and ▼ to adjust as required then press the Stop key to return the display to StOP. Pressing the START key will start the drive accelerating to the target speed.

With P-12 set to 2:

- Press the START key. The display changes to H 0.0.
- Press ▲ to increase speed
- The drive will run forward, increasing speed until ▲ is released. Acceleration is limited by the setting in P-03. The maximum speed is the speed set in P-01.
- Press the START key again. The motor will reverse its direction of rotation.

The operation of the keypad can be duplicated using remote pushbuttons connected to the control terminals, see Application Note AN21. In this mode, if P30 is set to Auto-0..4, then the drive will run as soon as the drive enable is applied (terminal 1 & 2 is closed).

**TO SAVE CHANGES** to Parameter settings, switch the power supply off and wait for the drive to power down (screen blank) before switching on. NOTE that this assumes P-38 = 0 (default). If P-38 = 1, changes are not saved.

**User Guide**

All rights reserved. No part of this User Guide may be reproduced or transmitted in any form or by any means, electrical or mechanical including photocopying, recording or by any information storage or retrieval system without permission in writing from the publisher.

Copyright Invertek Drives Ltd © 2005

The manufacturer accepts no liability for any consequences resulting from inappropriate, negligent or incorrect installation, or adjustment of the optional operating parameters of the drive or from mismatching of the drive to the motor.

The contents of this User Guide are believed to be correct at the time of printing. In the interests of a commitment to a policy of continuous improvement, the manufacturer reserves the right to change the specification of the product or its performance or the contents of the User Guide without notice.

**SAFETY**

This variable speed drive product (Optidrive) is intended for professional incorporation into complete equipment or systems. If installed incorrectly it may present a safety hazard. The Optidrive uses high voltages and currents, carries a high level of stored electrical energy, and is used to control mechanical plant that may cause injury. Close attention is required to system design and electrical installation to avoid hazards in either normal operation or in the event of equipment malfunction. System design, installation, commissioning and maintenance must be carried out only by personnel who have the necessary training and experience. They must read carefully this safety information and the instructions in this Guide and follow all information regarding transport, storage, installation and use of the Optidrive, including the specified environmental limitations. Please read the **IMPORTANT SAFETY INFORMATION** below, and all **Warning** and **Caution** boxes elsewhere.

**SAFETY NOTICES**

**WARNING** is given where there is a hazard that could lead to injury or death of personnel

**CAUTION** is given where there is a hazard that could lead to damage to equipment

**Bardac Corporation** [www.bardac.com](http://www.bardac.com)  
 40 Log Canoe Circle, Stevensville, MD 21666 USA  
 USA Toll Free Phone: 1-888-667-7333 (1-888-ON SPEED)  
 International Phone: 410-604-3400 Fax: 410-604-3500  
 Made in the UK by Invertek Drives Ltd

**WARNING !**

- The STOP function does not remove potentially lethal high voltages. ISOLATE the drive and wait 10 minutes before starting any work on it
- Parameter P-01 can be set to operate the motor at up to 60,000 rpm, hence use this parameter with care
- If it is desired to operate the drive at any frequency/speed above the rated speed (P-09/ P-10) of the motor, consult the manufacturers of the motor and the driven machine about suitability for over-speed operation
- The fan (if fitted) to the heatsink of the Optidrive starts automatically when the heatsink temperature reaches approximately 40°C. When the heatsink is at room temperature the fan will be stopped.

**CAUTION**

- Ensure that the supply voltage, frequency and no. of phases (1 or 3 phase) correspond to the rating of the Optidrive as delivered.
- An isolator should be installed between the power supply and the drive.
- Never connect the mains power supply to the Output terminals U,V,W.
- Protect the drive by using slow-blowing HRC fuses or MCB located in the mains supply of the drive
- Do not install any type of automatic switchgear between the drive and the motor
- Wherever control cabling is close to power cabling, maintain a minimum separation of 100 mm and arrange crossings at 90°
- Ensure that screening or armouring of power cables is effected in accordance with the connections diagram below
- Ensure that all terminals are tightened to the appropriate torque (see table)

**IMPORTANT SAFETY INFORMATION**

Safety of machinery, and safety-critical applications

Optidrive hardware and software are designed and tested to a high standard and failures are unlikely.

Electromagnetic Compatibility (EMC)

Optidrive is designed to high standards of EMC. EMC data is provided in a separate EMC Data Sheet, available on request. Under extreme conditions, the product might cause or suffer disturbance due to electromagnetic interaction with other equipment. It is the responsibility of the installer to ensure that the equipment or system into which the product is incorporated complies with the EMC legislation of the country of use. Within the European Union, equipment into which this product is incorporated must comply with 89/336/EEC, Electromagnetic Compatibility.

When installed as recommended in this User Guide, the radiated emissions levels of all Optidrives are less than those defined in the Generic radiated emissions standard EN61000-6-4. When correctly fitted with an Optifilter (Mains filter), the conducted emission levels are less than those defined in the Generic radiated emissions standard EN61000-6-3 (class B) for screened cable lengths of < 5m and with EN61000-6-4 (class A) for screened cable lengths of < 25m.

**STANDARDS CONFORMITY**

The Optidrive conforms with the following standards

- CE marked for low voltage directive
- UL508C Power conversion equipment
- IEC 664-1 Insulation coordination for equipment within low voltage systems
- EN61800-3 Adjustable Speed electrical power drive systems – Part 3 (EMC)
- EN 61000-6 / -2, -3, -4 Generic Immunity / Emissions standards (EMC)

**MECHANICAL INSTALLATION**

Optidrives can be installed side-by-side with their heatsink flanges touching. This gives adequate ventilation space between them. If the Optidrive is to be installed above another drive or any other heat-producing device, the minimum vertical spacing is 100mm. The enclosure should either be force-ventilated or large enough to allow natural cooling (allow 0.1 m³ per kW of drive rating).

**GROUNDING (EARTHING)**

The ground terminal of each Optidrive should be individually connected DIRECTLY to the site earth (ground) busbar (through the filter if installed) as shown. Optidrive ground connections should not loop from one drive to another, or to, or from any other equipment. Ground loop impedance must conform to local industrial safety regulations. To meet UL regulations, UL approved ring crimp terminals should be used for all earth wiring connections.

**OPERATION – BASICS + GETTING STARTED MOTOR TERMINAL BOX CONNECTIONS**

Motors are connected in either STAR or DELTA. The motor rating plate will indicate the voltage rating for the method of connection, ensure that this matches the Optidrive operating voltage.

U V W Wires from Optidrive

**EASY START-UP**

When delivered, the Optidrive is in the default state, meaning that it is set to operate in terminal mode and all parameters (P-xx) have the default values as shown overleaf.

- Connect a control switch between the control terminals 1 and 2.
- Connect a potentiometer (500 Ω min to 10 kΩ max) between terminals 5 and 7, and wiper to terminal 6.
- Set the control switch between pins 1 and 2 open so that the drive is 'disabled'.
- With the potentiometer set to zero, switch on the supply to the drive. The display will show StOP.
- Close the control switch, terminals 1-2. The drive is now 'enabled' and the output frequency/speed are controlled by the potentiometer. The display shows zero speed in Hz (H 0.0) with the potentiometer turned to minimum.
- Turn the potentiometer to maximum. The motor will accelerate to 50Hz (the default value of P-01) under the control of the accelerating ramp time P-03. The display shows H 50.0 (50Hz) at max speed.
- To display motor current (A), briefly press the Navigate key ⇄.
- Press ⇄ again to return to speed display.
- To stop the motor, either turn the potentiometer back to zero or disable the drive by opening the control switch (terminals 1-2).

If the enable/disable switch is opened the drive will decelerate to stop at which time the display will show StOP. If the potentiometer is turned to zero and the enable/disable is closed the display will show 0.0Hz, if left like this for 20 seconds the drive will go into standby mode, display shows Stndby, waiting for a speed reference.

**SIMPLE PARAMETER ADJUSTMENTS**

The factory-set default parameter values may give satisfactory performance, however certain adjustments may be beneficial. Maximum and Minimum Speeds P-01 & P-02

Set P-01 to the maximum speed and P-02 to the minimum speed for your application. These limits are mirrored for negative speeds. If a non-zero minimum speed is set in P-02, the motor will ramp (P-03) to this minimum speed as soon as the drive is enabled.

Acceleration and Deceleration P-03 & P04

Ramps which are too short will cause the drive to deliver currents in excess of full load current and may result in it tripping out or the motor stalling

Stop Mode P-05

Select method of stopping required when drive is disabled. Ramp to stop (P-05 = 0) decelerates the motor at the rate set by deceleration ramp time P-04. Freewheel/ Coast to stop (P-05=1) disables the drive output immediately, allowing the motor to decelerate naturally due to friction or under the control of a mechanical brake

Torque/Speed Characteristic P-06

Certain loads such as fans and centrifugal pumps need very little torque at low speed. Set P-06=1 to reduce power loss at low speeds for this load type

Rated Current, Rated Frequency and Rated Speed P-08, P-09, P-10.

Parameters P-08 and P-09 should be set to correspond with the rated current and frequency shown on the motor rating plate. Parameter P-10 is optional. If this parameter is set to zero (default state), speed will be displayed in Hz; if speed indication is required in rpm, enter the motor rated speed (speed at full load) from the motor rating plate.

Voltage Boost P-11

Any load which is 'sticky' to start will benefit from a voltage boost on starting. P-11 permits a boost of up to 25% of full motor voltage to be applied.

NOTE: Use of this parameter increases motor heating at low speeds

Terminal or Keypad Control P-12

Terminal control (P-12=0) is used when the drive needs to be controlled from some remote point, such as a control panel interface or machine system.

Keypad control (P12=1 or 2) is used for local, manual control and commissioning

Extended Parameter Set P15 to P-40 and P-90

The Extended Parameter Set is intended for use by specialist drives engineers and technicians and will not generally be required for simple applications.

**PARAMETER ZERO**

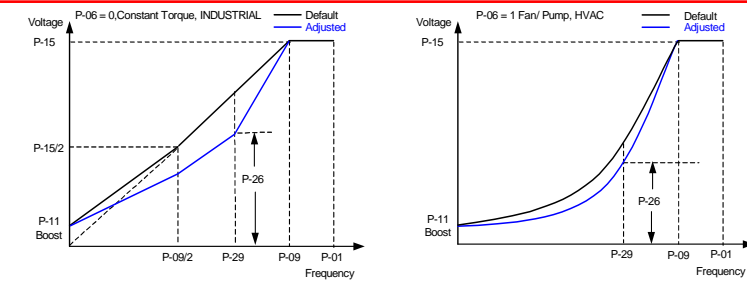
- Provides a read only window into the motor control software allowing key internal values to be viewed. This is useful for following signals through the drive control system when troubleshooting.
- Access, scroll, change and exit are as for any other parameter. The selected variable is at the left hand side of the display.
- There are 9 different windows listed below:
  - Unscaled analog input (%)
  - Speed ref. via scaled analog input (Hz)
  - Pre-ramp speed ref. (Hz)
  - Post-ramp speed ref. (Hz)
  - Not used
  - Stator field frequency (Hz)
  - Applied motor voltage (V)
  - DC bus voltage (V)
  - Internal thermistor (NTC) value

STANDARD PARAMETER SET

Table with 6 columns: Par., Description, Range, Default, Explanations, Set to. Contains parameters P-01 to P-14.

EXTENDED PARAMETER SET

Table with 6 columns: Par., Description, Range, Default, Explanations, Set to. Contains parameters P-15 to P-40.



Voltage / Frequency (V/f) Characteristic
The V/f characteristic is defined by several parameters as shown.
Reducing the voltage at a particular frequency reduces the current in the motor and hence the torque and power...

ENCLOSURE - NON VENTED DIMENSIONS
DRIVE POWER RATING table with columns for W, H, D and rows for various power ratings.

ENCLOSURE - VENTED DIMENSIONS
DRIVE POWER RATING table with columns for W, H, D, Air Flow and rows for various power ratings.

DIGITAL INPUTS - TERMINAL MODE (P-12 = 0, 3 or 4)

Table with 5 columns: P-19, Input 1 function, Input 2 function, Input 3 function, Additional Information. Contains parameters P-19 to P-12.

DIGITAL INPUTS - KEYPAD MODE (P-12 = 1 or 2)

Table with 5 columns: P-19, Input 1 function, Input 2 function, Input 3 function, Additional Information. Contains parameters P-19 to P-12.

TO CLEAR A TRIP CONDITION

Remove the condition which caused the trip and press the STOP key or re-enable the drive. The drive will restart according to the mode selected by P-30.

TROUBLESHOOTING table with columns: Fault Code, What has happened, What to do. Lists various fault codes like P-deF, O-I, O-Uolt, U-Uolt, I.t-trP, th-Fit, E-triP, EE-F, PS-Trp, O-t, lin-F.

FURTHER INFORMATION
The Website, www.invertek.co.uk, contains:
General information, inc Product & Options Manuals
App notes & S/ware upgrade files
Company and IDL authorised dealer information

OPTIDRIVE DIMENSIONS - Control terminal torque settings : 0.5Nm

Table with 8 columns: Size, Size 2, Size 3, Size 4, Size 5, Size 6, S6 Input Choke, Torque. Lists dimensions for various sizes.

OPTIDRIVE OPTIONS

- The following additional products are available:
EMC filters to meet EN 61000-6-3 & EN 61000-6-4 for conducted emissions
Optiwand: multi-language LCD IR remote control and programming unit
Optistor: PC based program for storing, editing and printing parameter sets
Braking resistor (Sizes 2 to Size 6)
RS232/485 serial communications interface unit (Optibus protocol)
Optidrive Fieldbus Gateway for connection to Profibus DP, DeviceNet, & Modbus communication systems
Optiport: remote keypad and LED display, with scalable display and PI for feedback control systems
Optilink: fibre optic cable used to connect drive networks.
Dual relay output and dual analog input
Enclosed (IP54) Optidrive
Optidrive Coolplate with heatsink removed for mounting to a cooled surface
Optidrive sizes 4, 5 & 6 for 525V supplies
Optidrive for control of single phase motors

ELECTRICAL DATA

Multiple tables for ELECTRICAL DATA, OPTIDRIVE SIZE 1, OPTIDRIVE SIZE 2 (INTEGRAL BRAKING TRANSISTOR), OPTIDRIVE SIZE 3 (INTEGRAL BRAKING TRANSISTOR), OPTIDRIVE SIZE 4 (INTEGRAL LINE CHOKE, RFI FILTER & BRAKING TRANSISTOR), OPTIDRIVE SIZE 5 (INTEGRAL LINE CHOKE, RFI FILTER & BRAKING TRANSISTOR), OPTIDRIVE SIZE 6 (INTEGRAL LINE CHOKE, RFI FILTER & BRAKING TRANSISTOR). Each table lists Model, Supply voltage, Phases, Motor O/P rating, Output Amps, Motor output, Fuse or MCB rating, Max ambient temperature, Motor cable size, Cu 75C, Max motor cable length, Min brake resistor.