INVERTEK DRIVES
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User Guide

# INVERTEK OPTIDRIVE VTC

## Variable Torque Control

**AC Variable Speed Drive 1.5 - 160kW**

**Installation and operating instructions**

**Declaration of Conformity:**

Invertek Drives Ltd hereby states that the Optidrive Plus/VTC product range is CE marked for the low voltage directive and conforms to the following harmonised European directives :

- EN 61800-5-1:2003 Adjustable speed electrical power drive systems. Safety requirements. Electrical, thermal and energy.
- EN 60529:1992 Specification for degrees of protection provided by enclosures (IP Code)
- EN 61800-3:2004 Adjustable speed electrical power drive systems. EMC requirements and specific test methods
- EN 55011:1998 Limits and Methods of measurement of radio disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment (EMC)

**CE - Konformitätserklärung:**

gemäß den Produktnormen für Drehzahlveränderbare Antriebe, die Firma 'Invertek Drives Ltd., UK erklärt dass das Produkt: Optidrive Plus/VTC (statischer Frequenzumrichter zur Drehzahlregelung von Asynchronmotoren) nach den folgenden harmonisierten Produktnormen entwickelt und gebaut wird:

- EN 61800-5-1:2003 Elektrische Leistungsantriebessysteme mit einstellbarer Drehzahl. Anforderungen an die Sicherheit. Elektrische, thermische und energetische Anforderungen
- EN 60529:1992 Schutzarten durch Gehaeuse (IP Code)
- EN 61800-3:2004 Drehzahlveraenderbare elektrische Antriebe. EMV-Anforderungen einschliesslich spezieller Prueverfahren
-
- EN 55011:1998 Industrielle, wissenschaftliche und medizinische Hockfrequenzgeraeten (ISM-Geraeten). Funkstoerungen. Grenzwerte und Messverfahren

**Déclaration de Conformité:**

Invertek Drives Ltd déclare par la présente que le produit Optidrive Plus/VTC porte le marquage CE en relation avec la directive basse tension et est conforme aux norms Européennes harmonisées suivantes :

- EN 61800-5-1:2003 Entrainements electriques de puissance a vitesse variable. Exigences de securite. Electrique, thermique et energetique
- EN 60529:1992 Degres de protection procures par les enveloppes (Code IP)
- EN 61800-3:2004 Entrainements electriques de puissance a vitesse variable. Exigences de CEM et methodes d'essais specifique
- EN 55011:1998 Appareils industriels, scientifiques et medicaux (ISM) a frequence radioelectrique. Caracteristiques de perturbations radioelectriques. Limites et methodes de mesure

**CONTENTS**


| | | Page |
|---|---|---|
| **1.** | **General** | **4** |
| *1.1* | *Important safety information* | *4* |
| *1.2* | *Electromagnetic Compatibility (EMC)* | *4* |
| **2.** | **Mechanical Installation** | **5** |
| *2.1* | *General (IP20)* | *5* |
| *2.2* | *Mechanical dimensions and mounting (IP20)* | *5* |
| *2.3* | *Enclosure mounting (IP20)* | *6* |
| *2.4* | *General (IP55 / NEMA 12K)* | *7* |
| *2.5* | *Mechanical dimensions and mounting (IP55 / NEMA 12K)* | *7* |
| **3.** | **Electrical Installation** | **8** |
| *3.1* | *Safety* | *8* |
| *3.2* | *Precautions* | *8* |
| *3.3* | *Drive and motor connection (IP20)* | *9* |
| *3.4* | *Control terminal connections* | *10* |
| *3.5* | *Drive and motor connection (IP55 / NEMA 12K)* | *11* |
| *3.6* | *Wiring diagram for in-built switches (IP55 / NEMA 12K)* | *12* |
| *3.7* | *Settings for typical switch configurations (IP55 / NEMA 12K)* | *12* |
| **4.** | **Operation** | **13** |
| *4.1* | *Managing the keypad* | *13* |
| *4.2* | *Easy startup* | *13* |
| **5.** | **Configuration** | **14** |
| *5.1* | *Basic parameters* | *14* |
| *5.2* | *Extended parameters* | *15* |
| *5.3* | *User Feedback control* | *18* |
| *5.4* | *High performance Motor control* | *18* |
| *5.5* | *Digital input configuration – terminal mode* | *19* |
| *5.6* | *Digital input configuration – keypad mode* | *20* |
| *5.7* | *Digital input configuration – User PID mode* | *20* |
| *5.8* | *Digital input configuration – Modbus control mode (Optional)* | *21* |
| *5.9* | *Real-time monitoring parameters* | *21* |
| **6.** | **Troubleshooting** | **22** |
| *6.1* | *Fault finding chart* | *22* |
| *6.2* | *Fault messages* | *22* |
| *6.3* | *Auto-tune trouble shooting* | *23* |
| **7.** | **Technical data** | **23** |
| *7.1* | *User interface* | *23* |
| *7.2* | *Power stage protection* | *23* |
| *7.3* | *Environmental* | *23* |
| *7.4* | *Rating tables* | *24* |



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*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.

All Invertek drives products carry a 2-year warranty, valid from the data of manufacture. This data is clearly visible on the rating label.

## 1. General

### *1.1 Important safety information*

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 carefully read 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 information elsewhere.***

**Safety of machinery, and safety-critical applications**

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.

### *1.2 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. Every Optidrive has a built-in filter to reduce conducted emissions. The conducted emission levels are less than those defined in the Generic radiated emissions standard EN61000-6-4 (class A) for the following cable lengths :

Optidrive sizes #1 to #3 : up to 5m of screened cable
Optidrive sizes #4 to #6 : up to 25m of screened cable

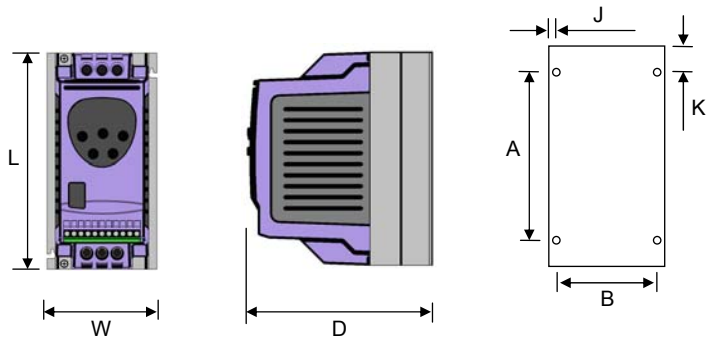
Optidrive sizes #1 to #3 can be fitted with an optional external Optifilter (HF filter). When correctly fitted with this filter, the conducted emission levels are less than those defined in the Generic radiated emissions standard EN61000-6-3 (class B) for screened cable lengths up to 5m and with EN61000-6-4 (class A) for screened cable lengths up to 25m.

## 2. Mechanical Installation (IP20 & IP55)

*General (IP20)*

- 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 and within the temperature 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
- The Optidrive must be installed in a pollution degree 1 or 2 environment
- Flammable material should not be placed close to the drive
- The entry of conductive or flammable foreign bodies should be prevented
- Max. operational ambient temperature 50°C, min. 0°C. Refer to rating tables in section 7.4
- Relative humidity must be less than 95% (non-condensing)
- 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 150mm. The enclosure should either be force-ventilated or large enough to allow natural cooling (refer to tables in section 2.3 for further information).

### *2.2 Mechanical dimensions and mounting (IP20)*




| | Size 2 | Size 3 | Size 4 | Size 5 | Size 6 ** |
|---|---|---|---|---|---|
| Length / mm | 260 | 260 | 520 | 1045 | 1100 |
| Width / mm | 100 | 171 | 340 | 340 | 340 |
| Depth / mm | 175 | 175 | 220 | 220 | 330 |
| Weight/ kg | 2.6 | 5.3 | 28 | 67 | 55 |
| A / mm | 210 | 210 | 420 | 945 | 945 |
| B / mm | 92 | 163 | 320 | 320 | 320 |
| J / mm | 4 | | 9.5 | | |
| K / mm | 25 | | 50 | | |
| Fixings | 2 * M4 | 4 * M4 | 4 * M8 | | |
| Power Terminal torque settings | 1 Nm | | 4 Nm | 8 Nm | |

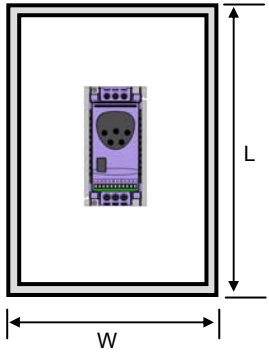
** S6 has external line choke, weight 27kg. Dimensions : 280mm x 280mm x 280mm (W x L x D)

*2.3 Enclosure mounting and dimensions (IP20)*

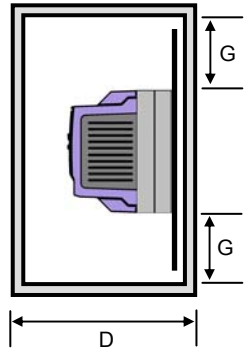
For applications that require a higher IP rating than the IP20 offered by the standard drive, the drive must be mounted in a metallic enclosure. The following guidelines should be observed for these applications:

- Enclosures should be made from a thermally conductive material.
- Enclosures should be made from a thermally conductive material, unless forced ventilation is used.
- When vented enclosures are used, there should be venting above the drive and below the drive to ensure good air circulation. Air should be drawn in below the drive and expelled above the drive.
- If the external environment contains contamination particles (eg dust), a suitable particle filter should be fitted to the vents and forced ventilation implemented. The filter must be serviced / cleaned appropriately.
- High moisture, salt or chemical content environments should use a suitably sealed (non-vented) enclosure.

*Enclosure Front View*




*Enclosure Side View*




*Non-Vented Metallic Enclosure Dimensions (mm)- IP20*

| **Drive Power rating** | **L** | **W** | **D** | **G** |
|---|---|---|---|---|
| Size 2 1.5kW 230V / 2.2kW 400V | 400 | 300 | 300 | 60 |
| Size 2 2.2kW 230V / 4kW 400V | 600 | 450 | 300 | 100 |

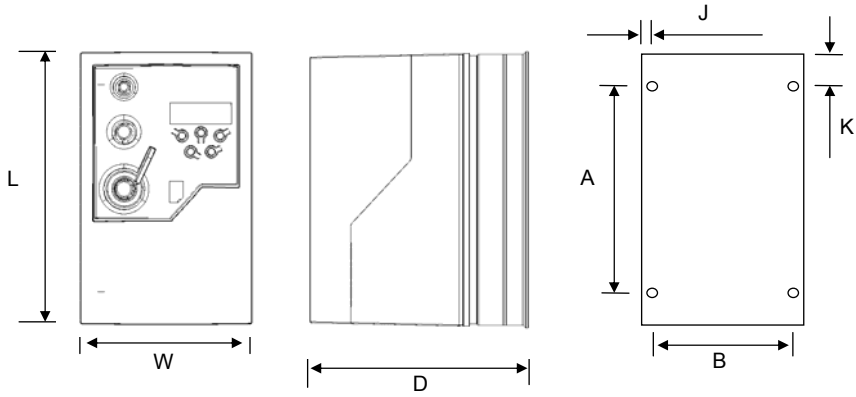
*Vented Metallic Enclosure Dimensions (mm) – IP20*

| **Drive Power rating** | **Free-Vented unit** | | | | **Force-vented unit** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **L** | **W** | **D** | **G** | **L** | **W** | **D** | **G** | **Air Flow** |
| Size 2 4 kW | 600 | 400 | 250 | 100 | 275 | 150 | 150 | 50 | > 45$m^3$ /h |
| Size 3 15 kW | 800 | 600 | 300 | 150 | 320 | 200 | 200 | 75 | > 80$m^3$ /h |
| Size 4 22 kW | 1000 | 600 | 300 | 200 | 400 | 250 | 200 | 100 | > 300$m^3$ /h |
| Size 4 37 kW | - | - | - | - | 800 | 500 | 250 | 130 | > 300$m^3$ /h |
| Size 5 90 kW | - | - | - | - | 1500 | 600 | 400 | 200 | > 900$m^3$ /h |
| Size 6 160 kW | - | - | - | - | 1600 | 600 | 400 | 250 | >1000$m^3$ /h |

*2.6 General (IP55)*

- Carefully inspect the IP55 Optidrive before installation to ensure it is undamaged
- Store the IP55 Optidrive in its box until required. Storage should be clean and dry and within the temperature range –40°C to +60°C
- Install the IP55 Optidrive on a flat, vertical, flame-resistant, vibration-free mounting *(NOTE: Drive is for INDOOR USE ONLY)*
- Flammable material should not be placed close to the drive
- The entry of conductive or flammable foreign bodies should be prevented
- Max. Operational ambient temperature 40°C, min. 0°C. Refer to rating tables in section 7.4
- Relative humidity must be less than 95% (non-condensing)
- IP55 Optidrives can be installed side-by-side with their heatsink flanges touching. This gives adequate ventilation space between them. If the IP55 Optidrive is to be installed above another drive or any other heat-producing device, the minimum vertical spacing is 150mm

*2.7 Mechanical dimensions and mounting (IP55)*
*(NOTE: The IP55 drive is intended for INDOOR USE ONLY)*




| | Size 1 | Size 2 |
|---|---|---|
| Length / mm | 200 | 310 |
| Width / mm | 140 | 164.8 |
| Depth / mm | 162 | 176 |
| Weight/ kg | 2.3 | 4.5 |
| A / mm | 141.5 | 251.5 |
| B / mm | 127.5 | 153 |
| J / mm | 6.0 | 6.0 |
| K / mm | 25.0 | 25.0 |
| Fixings | 2 * M4 | 4 * M4 |
| Power Terminal torque settings | 1 Nm | |
| Control terminal torque settings | 0.5Nm | |

## 3. Electrical Installation

### *3.1 Safety*

***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.

- Optidrives 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.
- Where the electrical 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, see diagram below
- The earth cable must be sufficient to carry the maximum supply fault current which normally will be limited by the fuses or MCB

### *3.2 Precautions*

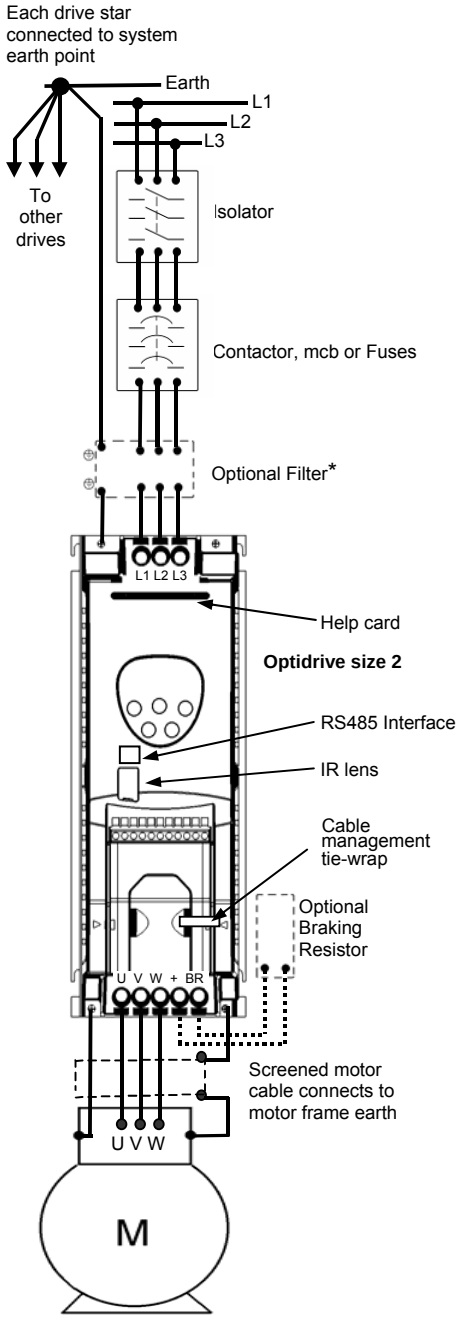
- Ensure that the supply voltage, frequency and number of phases (single or three phase) correspond to the rating of the Optidrive as delivered
- An isolator or similar should be installed between the power supply and the drive
- Never connect the mains power supply to the Optidrive output terminals UVW
- Protect the drive by using slow-blow HRC fuses or an MCB located in the mains supply to 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$^{o}$
- 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, left)

Connect drive according to the following diagram, ensuring that motor terminal box connections are correct. There are two connections in general : Star and Delta. It is essential to ensure that the motor is connected in accordance with the voltage at which it will be operated. For more information, refer to the following diagram

For recommended cabling and wiring sizing, refer to section 7.4.

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.

The ground terminal of each Optidrive should be individually connected DIRECTLY to the site earth (ground) bus-bar (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.




* If fitted, a filter should be mounted 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 back plate and ensure metal-to-metal contact. For 575V Size 2 drives an Input Filter is required on all drive installations.

**Motor terminal box connections**

Most general purpose motors are wound for operation on dual voltage supplies. This is indicated on the nameplate of the motor

This operational voltage is normally selected when installing the motor by selecting either STAR or DELTA connection.

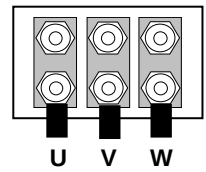
STAR always gives the higher of the two voltage ratings.

Typical ratings are :

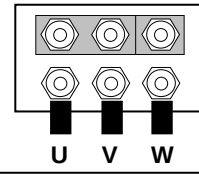
400 / 230 ( 人 / △ )

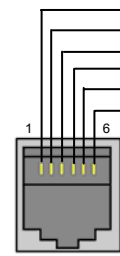
690 / 400 ( 人 / △ )

DELTA ( △ ) Connection




STAR ( 人 ) Connection



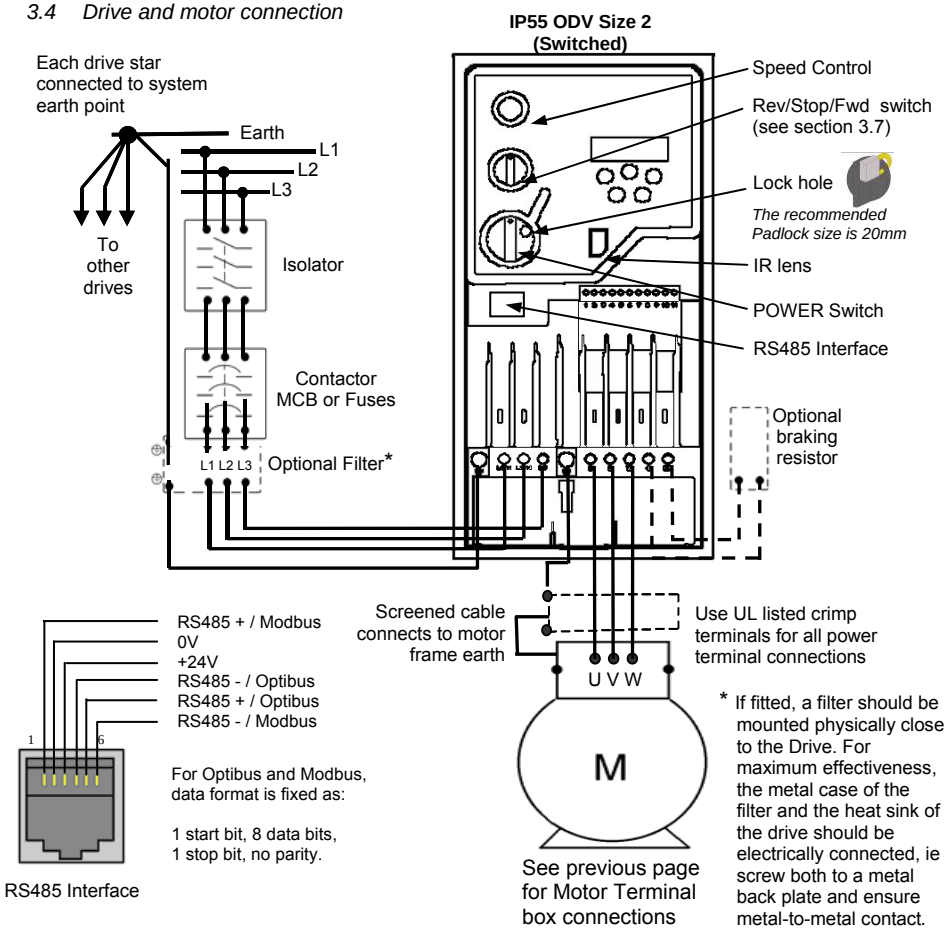




For Optibus and Modbus, data format is fixed as:

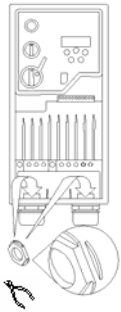
1 start bit, 8 data bits, 1 stop bit, no parity.

RS485 Interface

### *3.4 Drive and motor connection*




*Installation Guidelines (IP55)*



i) Some types of gland nut will require modification for correct installation. Remove one or more flanges as shown until the nut will fit in the apertures.
ii)Any Metal conduit used MUST be earth bonded by means of suitable earthing washer or gland adaptor.
Lock Off:
On the switched models the main power isolator switch can be locked in the 'Off' position using a 20mm standard shackle padlock (not supplied).

Gland Hole Sizes:

| | I/P & O/P Power (Φ) | Centred Knockout (Φ) | Terminal Cover Knockout (Φ) |
|---|---|---|---|
| Size 1 | (22mm) | (22mm) | (17mm) |
| Size 2 | (25mm) | (22mm) | (17mm) |

Recommended Gland Type:

| SkinTop UL approved (UL94-V0) Type12/IP55 non-metallic cable gland or non-rigid conduit | | | |
|---|---|---|---|
| | I/P & O/P Power | Centred Knockout | Terminal Cover Knockout |
| Size 1 | PG13.5 / M20 | PG13.5 / M20 | PG9 / M16 |
| Size 2 | PG16 / M25 | PG13.5 / M20 | PG9 / M16 |

*3.5 Control Terminal Connections*

The User Control terminals are available via an 11-way pluggable connector. All terminals are galvanically isolated, allowing direct connection to other equipment.

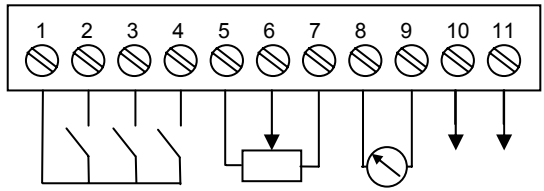
Do not connect mains supply voltages to any terminals other than the User relay output. Permanent damage will otherwise result.

All other inputs will withstand up to 30V dc without damage.

The functionality of the inputs and outputs is user configurable. All operating modes are set up via the parameter set.

Up to 100mA can be sourced from the User +24V output and up to 20mA from the analog output.

The control terminals are defined as follows:




Terminal 1: +24V, 100mA user output.

Terminal 2: Digital input 1, positive logic. "Logic 1" when Vin > 8V DC

Terminal 3: Digital input 2, positive logic. "Logic 1" when Vin > 8V DC
2nd digital output : 0 / 24V, 10mA max

Terminal 4: 2nd analog input, 11-bit (0.05%). 0..10V, 0..20mA, 4..20mA.
Digital input 3, positive logic. "Logic 1" when Vin > 8V DC.

Terminal 5: +24V, 100mA reference output (for user with potentiometer).

Terminal 6: Bipolar analog input, +/-12-bit (0.025%).
Configurable for : 0..24V, 0..10V, -10V...10V, -24V…24V

Terminal 7: 0V (User GND). Connected to terminal 9

Terminal 8: Analog output, 8-bit (0.25%). 0..10V, 4..20mA.
Digital output : 0 / 24V, 20mA max

Terminal 9: 0V (User GND). Connected to terminal 7

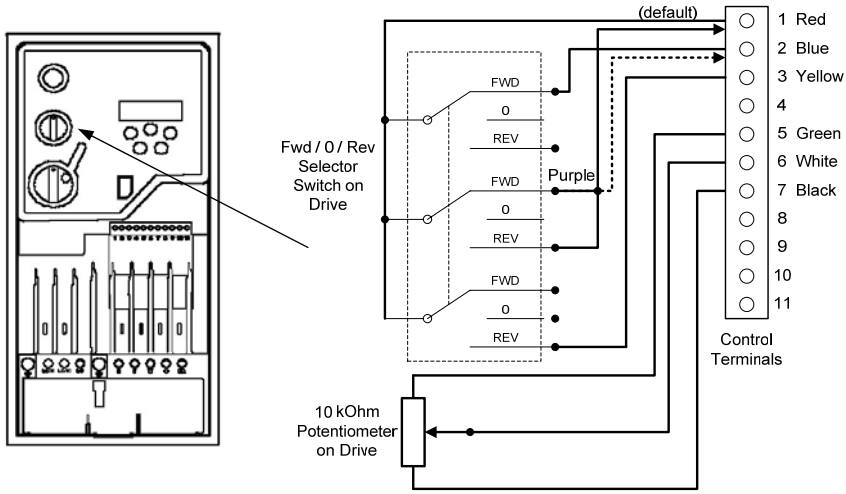
Terminal 10: User relay output. Potential free contacts. 30Vdc 5A, 250Vac 6A

Terminal 11: User relay output. Potential free contacts. 30Vdc 5A, 250Vac 6A

**Key control terminal information :**

- Maximum input voltage on any terminal 30V dc
- All outputs short circuit proof
- Recommended potentiometer resistance : 10k Ohm
- Digital input response time < 8ms
- Bipolar analog input response time < 16ms. Resolution +/-12 bit (0.025%)
- Second analog input response time < 16ms. Resolution +11-bit (0.05%)
- Analog / Digital output response time < 16ms. Resolution 8-bit (0.25%)

### 3.6 Wiring diagram for "Run / Stop" switch (IP55)




### 3.7 Settings for typical Run / Stop switch configurations (IP55)

Unless otherwise stated, each of the following configurations utilise the potentiometer mounted on the front of the IP55S drive (switched variant) for speed variation and control.

| Switch Function | Drive settings |
|---|---|
| REV / STOP / FWD | P1-12 = 0 (default), potentiometer speed control<br>P2-01 = 3, 4, 5 or 6 |
| STOP / STOP / RUN | P1-12 = 0 (default), potentiometer speed control<br>P2-01 = 7, 8, 9 or 10 |
| JOG / STOP / RUN | P1-12 = 0 (default), potentiometer speed control<br>P2-01 = 0 (default), jog speed set by P1-11 |
| *PID Control :*<br>HAND / OFF / AUTO | P1-12 = 3 (PID control – AUTO position)<br>P2-01 = 11, preset speed set by P1-11 (HAND)<br>P2-01 = 17, potentiometer speed control (HAND) |
| *Modbus Control :*<br>HAND / OFF / AUTO | P1-12 = 4 (Modbus control – AUTO position)<br>P2-01 = 11, preset speed set by P1-11 (HAND)<br>P2-01 = 17, potentiometer speed control (HAND) |

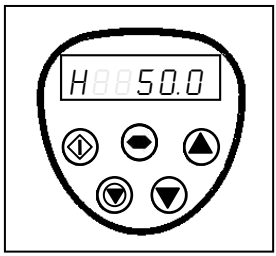
**Notes :**

1) For $3^{GV}$ drives, Modbus control requires the $3^{GV}$ -M firmware upgrade

## 4. Operation

### *4.1 Managing the keypad*

The drive is configured and its operation monitored via the keypad and display




**NAVIGATE:** Used to display real-time information, to access and exit parameter edit mode and to store parameter changes

**UP:** Used to increase speed in real-time mode or to increase parameter values in parameter edit mode

**DOWN:** Used to decrease speed in real-time mode or to decrease parameter values in parameter edit mode

**RESET / STOP:** Used to reset a tripped drive. When in Keypad mode (see below and P1-12 in the parameter section) is used to Stop a running drive.

**START:** When in keypad mode, used to Start a stopped drive or to reverse the direction of rotation if bi-directional keypad mode is enabled (see P1-12 in the parameter section)

**To change a parameter value** press and hold the NAVIGATE key for >1s whilst the drive displays STOP. The display changes to P1-01, indicating parameter 01 in parameter group 1. Press and release the NAVIGATE key to display the value of this parameter. Change to the required value using the UP and DOWN keys. Press and release the NAVIGATE key once more to store the change. Press and hold the NAVIGATE key for >1s to return to real-time mode. The display shows STOP if the drive is stopped or the real-time information (eg speed) if the drive is running.
**To change parameter group,** ensure that extended menu access is enabled then press NAVIGATE, simultaneously pressing and releasing the UP key until the required parameter group is displayed.
**To reset factory default parameters**, press UP, DOWN and STOP for >2s. The display shows "P-dEF". Press the STOP button to acknowledge and reset the drive.

### *4.2 Easy startup*

1. Connect motor to drive, checking star/delta connection for the voltage rating
2. Enter motor data from motor nameplate :

   P1-07 = motor rated voltage
   P1-08 = motor rated current
   P1-09 = motor rated frequency

**3.** Enable the drive. The drive automatically carries out a static Auto-tune

**To operate in terminal mode (default setting),** connect a switch between terminals 1 and 2 on the user terminal block. Connect a potentiometer (2k2 to 10k) between terminals 5, 6 and 7 with the wiper connected to pin 6.
Close the switch to enable the drive. Adjust speed with the potentiometer.

**To operate in keypad mode,** set P1-12 = 1 (uni-directional) or 2 (bi-directional). Place a wire link or switch between terminals 1 and 2 on the user terminal block to enable the drive. Now press START. The drive enables at 0Hz. Press the UP button to increase speed. Press the STOP button to ramp to stop.
*The desired target speed can be preset by pressing STOP whilst the drive is stopped. When the START key is subsequently pressed, drive will then ramp to this speed.*

**Key Parameters**

- *Adjust the maximum / minimum speed limit using P1-01 and P1-02*
- *Adjust the acceleration and deceleration times using P1-03 and P1-04*

## 5. Drive configuration

### *5.1 Group 1 : Basic Parameters*

| *Par.* | *Description* | *Range* | *Default* | *Explanation* |
|---|---|---|---|---|
| P1-01 | Max speed limit | P1-02 to 120Hz max. | 50 Hz | Sets the maximum speed limit. Display of Hz or rpm dependent on P1-10. |
| P1-02 | Min speed limit | 0 to P1-01 | 0 Hz | Minimum speed limit. Hz or rpm display depending on P1-10. |
| P1-03 | Accel ramp time | 0 to 3 000s | 30.0s | Time to ramp from 0 to rated frequency (P1-09) |
| P1-04 | Decel ramp time | 0 to 3 000s | 30.0s | Time to ramp from rated frequency (P1-09) to 0. When P1-04 = 0, the ramp is varied dynamically to give the fastest possible ramp to STOP. |
| P1-05 | Stop mode select | 0: Ramp to stop<br>1: Coast to stop<br>2: Ramp to stop | 0 | *P1-05 = 0* : If the supply is lost, the drive will try to continue running by reducing load speed, using the load as a generator<br>*If P1-05 = 2* : if the supply is lost, the drive ramps on 2nd decel ramp P2-25 to stop; if P2-25 = 0, drive coasts to stop. |
| P1-06 | Energy Optimiser | 0: Disabled<br>1: Enabled | 0 | When enabled, automatically reduces applied motor voltage on light load. Used in V/F mode only. |
| P1-07 | Motor rated voltage | 0V, 20V to 250V<br>0V, 20V to 500V<br><br>0V, 20V to 575V | 230V<br>400V<br>(460V)<br>575V | Set to motor rated voltage from nameplate. When in V/F mode, P1-07 = 0 gives faster deceleration ramp without over-voltage trip |
| P1-08 | Motor rated current | 20% to 100% of drive rated current | Drive rating | Set to motor rated current from nameplate (Amps) |
| P1-09 | Motor rated frequency | 25 to 120Hz | 50Hz<br>(60Hz) | Set to motor rated frequency from nameplate (Hz). |
| P1-10 | Motor rated speed | 0 to 7 200rpm | 0 | When 0, drive operates in Hz. Upper limit set to 60 x P1-09. This value usually can be found in the motor nameplate. |
| P1-11 | Preset speed 1 | -P1-01 to P1-01 | 50Hz<br>(60Hz) | Sets jog / preset speed at which drive runs when preset speed 1 selected via digital inputs<br>(see also P2-01) |
| P1-12 | Terminal / Keypad control of drive | 0: Terminal control<br>1: Keypad control (Fwd only)<br>2: Keypad control (Fwd and Rev)<br>3: Enable User PID<br>4: Modbus control | 0 | 0 : Terminal control<br>1 : Uni-direction keypad control.<br>2 : Bi-directional keypad control. Keypad START button toggles between forward and reverse.<br>3 : User PID (feedback control) active, setup in parameter group 3.<br>4 : Drive controlled via integrated Modbus RTU interface. |
| P1-13 | Trip Log | Last 4 trips stored | - | Latest 4 trips stored. Most recent displayed first. |
| P1-14 | Extended Menu Access code | 0 to 30 000 | 0 | Permits access to extended menu when P1-14 = P2-37. Default access value = 101. |

**Notes:**

- Default parameter values for Horse Power rated drives are shown in brackets

*5.2 Group 2 : Extended Parameters*

| Par. | Description | Range | Default | Explanation |
|---|---|---|---|---|
| P2-01 | Digital input function select | 0 to 23 | 0 | Defines the function of the digital inputs. See sections 5.5 … 5.7 on pages 16…18 for more details. |
| P2-02 | Preset speed 2 | -P1-01 to P1-01 | 0 Hz | Sets jog / preset speed 2 |
| P2-03 | Preset speed 3 | -P1-01 to P1-01 | 0 Hz | Sets jog / preset speed 3 |
| P2-04 | Preset speed 4 | -P1-01 to P1-01 | 0 Hz | Sets jog / preset speed 4 |
| P2-05 | Preset speed 5 | -P1-01 to P1-01 | 0 Hz | Sets jog / preset speed 5 |
| P2-06 | Preset speed 6 | -P1-01 to P1-01 | 0 Hz | Sets jog / preset speed 6 |
| P2-07 | Preset speed 7 | -P1-01 to P1-01 | 0 Hz | Sets jog / preset speed 7 |
| P2-08 | Preset speed 8 | -P1-01 to P1-01 | 0 Hz | Sets jog / preset speed 8 |
| P2-09 | Skip frequency | P1-02 to P1-01 | 0 | Centre point of skip frequency band set up in conjunction with P2-10. |
| P2-10 | Skip frequency band | 0 to P1-01 | 0 (disable) | Width of skip frequency band centred on frequency set in P2-09. |
| P2-11 | Analog output function select | (Digital output mode)<br>0: Drive enabled<br>1: Drive healthy<br>2: Motor at target speed<br>3: Motor speed > 0<br>4: Motor speed > limit<br>5: Motor current> limit<br>6: 2nd analog input > limit<br><br>(Analog output mode)<br>7: Motor speed<br>8: Motor current<br>9: Motor power (kW) | 7 | For values 0 to 6, analog output functions as a digital output. (0V or 24V output)<br>The control limit used for settings 4, 5 and 6 is defined in P2-12(h) and P2-12(L).<br>For values between 7 and 9, the output is analog signal, operating between 0..10V or 4..20mA. (as set in P2-36)<br>Full scale analog output results at max speed (P1-01), 2x rated motor current (P1-08) or 1.5x rated power of the drive. |
| P2-12 (h) | Digital output control high limit | Speed : 0..100% (100% = max speed)<br>Current : 0..200% (100% = rated current)<br>PID feedback : 0..100% (100% = max 2nd analog input) | 100% | Digital output state set to logic 1 when selected value in P2-11 larger than this limit.<br>Limit in P2-12 relates to speed if P2-11 = 4, to motor current if P2-11 = 5 or to the PID feedback value (2nd analog input) if P2-11=6. |
| P2-12 (L) | Digital output control low limit | 0 … P2-12(h) | 100% | Digital output state back to logic 0 when selected value in P2-11 less than or equal to this limit. (P2-11 = 4,5 or 6) |
| P2-13 | User relay output function select | 0: Drive Enabled<br>1: Drive healthy<br>2: Motor at target speed<br>3: Motor speed > 0<br>4: Motor speed > limit<br>5: Motor current > limit<br>6: 2nd analog input > limit | 1 | If P2-15 = 0 (Normally Open), the relay contacts are closed when the selected condition is fulfilled.<br>If P2-15 = 1 (Normally Closed), the relay contacts are open when the selected condition is fulfilled. |
| P2-14 (h) | User relay output control high limit | Speed : 0..100% (100% = max speed)<br>Current: 0..200% (100% = rated current)<br>PID feedback : 0..100% (100% = max 2nd analog input) | 100% | User relay output closes (P2-15=0) when selected value in P2-13 larger than this limit.<br>Limit in P2-14 relates to speed if P2-13 = 4, to motor current if P2-13 = 5 or to the PID feedback value (2nd analog input) if P2-13=6 |
| P2-14 (L) | User relay output control low limit | 0 … P2-14(h) | 100% | Digital output state back to logic 0 when selected value in P2-13 less than or equal to this limit. (P2-13 = 4,5 or 6) |
| P2-15 | Relay output mode | 0: Normally Open (NO)<br>1: Normally Closed (NC) | 0 (N.O.) | The drive must be powered up for the relay contacts to be closed. |
| P2-16 | Standby mode wake-up speed | 0…100% | 0.0% | Drive will wake up from standby mode if the speed reference exceeds this limit. 100% = P1-01. |

| | | | | |
|---|---|---|---|---|
| P2-17 | Start mode select | Edgr-r :<br>Close digital input 1*after* power up to start drive<br><br>Auto-0 :<br>drive runs whenever digital input 1 is closed<br><br>Auto-1…5 :<br>as Auto-0, except 1..5 attempts to restart after a trip | Auto-0 | When set to Edge-r, if drive is powered up with digital Input 1 closed (enabled), drive will not run. The switch (digital input 1) must be opened and closed *after* power up or after resetting a trip for the drive to run.<br>When set to Auto-0, drive will run whenever digital input 1 is closed (if not tripped).<br>Auto-1…5 makes 1…5 attempts to automatically restart after a trip (20s between attempts in default). Drive must be powered down to reset the counter. |
| P2-18 | Spin Start Enable | 0: Disable<br>1: Enable | 0 | When enabled, drive detects motor speed and starts driving the motor from this speed.<br>(the motor speed can be in both direction: forward or reverse)<br>A short delay of approx 1s will result after enabling the drive before speed is detected. |
| P2-19 | Keypad restart mode | 0: Minimum speed<br>1: previous speed<br>2: Min-speed (Auto-r)<br>3: prev. speed (Auto-r) | 1 | If set to 0 or 2, drive will always start from minimum speed.<br>If set to 1 or 3, drive ramps up to the operating speed prior to the last STOP command.<br>If set to 2 or 3, the status of digital input 1 controls drive to start or stop. The start and stop button will not work in this case. |
| P2-20 | Standby mode | 0: Disable<br>1 … 60s | 0 | If P2-20 >0, drive enters standby mode (disables output) if minimum speed (P1-02) is maintained for the time specified in P2-20. Drive wakes up automatically if the speed ref is greater than P1-02 or the value set in P2-16, whichever is the higher. |
| P2-21 | Display scaling factor | 0.000 to 30.000 | 0.000 | Disabled if set to zero.<br>The variable selected in P2-22 is multiplied by this factor and displayed as a real-time value on the drive, in addition to speed, current and power. |
| P2-22 | Display scaling source | 0: 2nd analog input<br>1: Speed | 0 | Selects the variable to be scaled by the factor set in P2-21. |
| P2-23 | Brake circuit enable | 0: Disable<br>1: Enable + lo power<br>2: Enable + hi power<br>3: Enable, no protection | 0 | Enables the internal brake chopper Overload protection in software when set to 1 or 2. See rating tables for resistor sizing guidelines. |
| P2-24 | Effective switching frequency | S2 230V : 4..32kHz<br>S2 400V : 4..32kHz<br>S3 400V : 4..24kHz<br>S4 400V : 4..24kHz<br>S5* 400V : 4..16kHz<br>S6* 400V : 4..16kHz<br>** Max limit dependent on power rating* | 16 kHz<br>8 kHz<br>4 kHz<br>4 kHz<br>4 kHz<br>4 kHz | Effective power stage switching frequency. Improved acoustic noise and output current waveform results from increasing switching frequency, but at the expense of increased losses within the drive. "Auto" selects minimum possible switching frequency for the speed range selected (when "Auto" set, P2-24 = 16x P1-01). |
| P2-25 | Second deceleration ramp time | 0s … 3 000s | 0s | Selected automatically on mains loss if P1-05 = 2. Can also be selected via digital inputs during operation. (see section 5.5 & 5.6) |

| | | | | |
|---|---|---|---|---|
| P2-26 | Modbus RTU baud rate | 9600bps to 115200bps | 115.2 | Modbus network communication baudrate. |
| P2-27 | Drive communication address | 0: Disable 1..63 | 1 | Distinct drive address used for all drive serial communications. |
| P2-28 | Master / Slave mode select | 0: Slave mode<br>1: Master mode | 0 | When in Master mode, the drive transmits its operational status via the serial data link. Used to control slave drives via the serial link. P2-27 must be 1 for Master mode. |
| P2-29 | Digital speed reference preset scaling factor | 0…500%, steps of 0.1% | 100.0% | The digital speed reference input to the drive is scaled by this factor. Operates on references originating from the serial data link. Can be used as an electronic gearbox for Master / Slave applications. This preset value only works when P2-35=1(see P2-35 for details).<br>And it is usually used in a Master / Slave network application. |
| P2-30 | Bipolar analog input format | 0..24V, 0..10V, -10..10V, -24..24V | 0..24V | Configures the analog input format to match that of the reference signal. |
| P2-31 | Bipolar analog input scaling | 0…500.0% | 100.0% | Scales the analog input by this factor. Set to 200% to give full speed range control with 0..5V input (when P2-30 = 0..10V) |
| P2-32 | Bipolar analog input offset | -500.0…500.0% | 0.0% | Sets the offset from zero at which speed starts to ramp up. Value is "%" of the full scale input voltage. |
| P2-33 | 2nd analog input format | 0 / 24V (digital input)<br>0..10V,<br>4..20mA, 0..20mA | 0 / 24V | Determines the format of the 2nd analog input. Selecting 0 / 24V sets up the input as a digital input. |
| P2-34 | 2nd analog input scaling | 0…500.0% | 100.0% | Scales the 2nd analog input by the factor set in this parameter. |
| P2-35 | Digital speed reference scaling control | 0: Disabled (no scaling)<br>1: Scaling set by preset value in P2-29<br>2: Slave speed scaled by preset value in P2-29, then bipolar analog input added as offset<br>3: Slave speed scaled by preset value in P2-29 *and* by bipolar analog input | 0 | Only active in keypad control mode and usually used in a Master/Slave network application.<br>When P2-35 = 1, actual speed = Digital speed * P2-29.<br>When P2-35 = 2, actual speed = (Digital speed x P2-29) + bipolar analog input<br>Max analog input is equal to P1-01<br>When P2-35 = 3, actual speed = (Digital speed x P2-29) x bipolar analog input<br>Analog input scales 0% … 200% |
| P2-36 | Analog output format | 0..10V<br>4..20mA<br>10..0V<br>20..4mA | 0..10V | Determines the analog output format.<br>Min load impedance in voltage mode 1k Ohm.<br>Max load impedance in current mode 1k Ohm. |
| P2-37 | Extended menu access code define | 0…9999 | 101 | Defines the extended menu access code used in P1-14. |
| P2-38 | Parameter Lock | 0: Unlocked<br>1: Locked | 0 | When locked, all parameter changes are prevented. |
| P2-39 | Hours run clock | 0 to 99999 hours | Read only | Indicates the number of hours the drive has been running since new. |
| P2-40 | Drive type / rating | " 0.37", "0 230" : 3GV 230V 0.37kW<br>"HP 20", "1 460" : VTC, 460V 20HP | Read only | Indicates drive power rating, type code and voltage rating.<br>Drive type code indicates 3GV (0), VTC (1) or other drive type |

### *5.3 Group 3 : User feedback control (PID control)*

| | | | | |
|---|---|---|---|---|
| P3-01 | User PID controller Proprtional Gain | 0.1 ... 30.0 | 2 | Higher value used for high inertia. Too high a value gives instability. |
| P3-02 | User PID controller Integral time constant | 0.0s … 30.0s | 1s | Higher value gives slower, more damped response. |
| P3-03 | User PID controller Differential time constant | 0.00s … 1.00s | 0.00 | Set to zero (disabled) for most applications. |
| P3-04 | User PID controller operating mode | 0: Direct<br>1: Inverse | 0 | Most applications use 'Direct' mode. If an increasing feedback signal should increase the speed of the motor, set to 'Inverse' mode |
| P3-05 | User PID controller reference select | 0: Digital<br>1: Analog | 0 | Sets the source for the PID control reference signal. When set to 1, the bipolar analog input is used |
| P3-06 | User PID digital reference | 0 … 100% | 0.0 % | Sets the preset reference used when P3-05 = 0 |
| P3-07 | User PID controller output high limit | P3-08 to 100% of control range | 100% | Preset PID controller output upper (speed) limit.<br>100% = P1-01 |
| P3-08 | User PID controller output low limit | 0 to P3-07 | 0 | Preset PID controller output lower (speed) limit.<br>100% = P1-01 |
| P3-09 | User PID output limit control | 0: Digital output limits<br>1: Analog upper limit<br>2: Analog lower limit<br>3: PID output + Bipolar Analog input | 0 | When set to 1 or 2, the bipolar analog input is used to vary the PID output limit between P1-02 and P1-01.<br>When set to 3, the bipolar analog input value will be added to the PID output. |
| P3-10 | User PID feedback select | 0: 2nd Analog input<br>1: Bipolar analog input | 0 | This parameter selects feedback signal source. |

### *5.4 Group 4 : VTC control functions*

| | | | | |
|---|---|---|---|---|
| P4-01 | *Reserved* | | 0 | This parameter is reserved |
| P4-02 | Motor parameter auto-tune | 0: Disable<br>1: Enable | 0 | When set to 1, drive immediately carries out a static (non-rotating) motor parameter measurement operation to configure the motor parameters.<br>***No hardware enable is required.***<br>Parameter P1-07, P1-08 and P1-09 must be set correctly according to the motor nameplate before enabling this function.<br>Auto-tune runs automatically on first enable after parameter default operation and P1-08 was changed. |

**Fire Mode**

The fire mode function is provided to ensure that the Optidrive VTC can continue to operate without interruption when fire mode is activated. Fire mode disables non-critical trip functions so that the Optidrive will continue to operate until either the drive itself, the motor or the cabling is destroyed by the fire.

Since normal operation of the Optidrive is overridden when fire mode is active, it is possible that damage to the ventilation system may result from over-pressure. It is also possible that the Optidrive may itself fail or cause damage to the motor.

Invertek Drives Ltd accepts no liability for damage to the Optidrive VTC itself, other components or equipment, HVAC installations, property or injury to personnel when operated in Fire mode.
In no event shall Invertek Drives Ltd be liable to any party for loss or damage, whether direct or indirect as a result of operating the drive in Fire Mode.

## 5.5 Digital input configuration – terminal mode (P1-12 = 0)

<table>
<tr><th>P2-01</th><th>Digi input 1 function</th><th>Digi input 2 function</th><th>Digi input 3 function</th><th>Analog input function</th></tr>
<tr><td>0</td><td>O : Stop (Disable)<br>C : Run (Enable)</td><td>O : Bipolar analog input<br>C : Preset speed 1, 2</td><td>O : Preset speed 1<br>C : Preset speed 2</td><td>Bipolar analog input</td></tr>
<tr><td>1</td><td>O : Stop (Disable)<br>C : Run (Enable)</td><td>O : Preset speed 1<br>C : Preset speed 2</td><td>O : Preset speed 1, 2<br>C : Preset speed 3</td><td>O : Preset speed 1,2,3<br>C : Preset speed 4</td></tr>
<tr><td rowspan="9">2</td><td rowspan="9">O : Stop (Disable)<br>C : Run (Enable)</td><td colspan="3"><table>
<tr><th>Digi input 2</th><th>Digi input 3</th><th>Analog input</th><th>Preset value</th></tr>
<tr><td>Open</td><td>Open</td><td>Open</td><td>Preset speed 1</td></tr>
<tr><td>Closed</td><td>Open</td><td>Open</td><td>Preset speed 2</td></tr>
<tr><td>Open</td><td>Closed</td><td>Open</td><td>Preset speed 3</td></tr>
<tr><td>Closed</td><td>Closed</td><td>Open</td><td>Preset speed 4</td></tr>
<tr><td>Open</td><td>Open</td><td>Closed</td><td>Preset speed 5</td></tr>
<tr><td>Closed</td><td>Open</td><td>Closed</td><td>Preset speed 6</td></tr>
<tr><td>Open</td><td>Closed</td><td>Closed</td><td>Preset speed 7</td></tr>
<tr><td>Closed</td><td>Closed</td><td>Closed</td><td>Preset speed 8</td></tr>
</table></td></tr>
<tr><td>3</td><td>O : Stop (Disable)<br>C : Run (Enable)</td><td>O : Forward<br>C : Reverse</td><td>O : Bipolar analog input<br>C : Preset speed 1</td><td>Bipolar analog input</td></tr>
<tr><td>4</td><td>O : Stop (Disable)<br>C : Run (Enable)</td><td>O : Forward<br>C : Reverse</td><td>2nd Analog input</td><td>O : 2nd analog input<br>C : Preset speed 1</td></tr>
<tr><td rowspan="5">5</td><td rowspan="5">O : Stop (Disable)<br>C : Run (Enable)</td><td rowspan="5">O : Forward<br>C : Reverse</td><td colspan="2"><table>
<tr><th>Digi input 3</th><th>Analog input</th><th>Preset value</th></tr>
<tr><td>Open</td><td>Open</td><td>Preset speed 1</td></tr>
<tr><td>Closed</td><td>Open</td><td>Preset speed 2</td></tr>
<tr><td>Open</td><td>Closed</td><td>Preset speed 3</td></tr>
<tr><td>Closed</td><td>Closed</td><td>Preset speed 4</td></tr>
</table></td></tr>
<tr><td>6</td><td>O : Stop (Disable)<br>C : Run (Enable)</td><td>O : Forward<br>C : Reverse</td><td>External trip input :<br>O : trip C : OK</td><td>Bipolar analog input</td></tr>
<tr><td>7</td><td>O : Stop (Disable)<br>C : Run Forward</td><td>O : Stop (Disable)<br>C : Run Reverse</td><td>O : Bipolar analog input<br>C : Preset speed 1</td><td>Bipolar analog input</td></tr>
<tr><td>8</td><td>O : Stop (Disable)<br>C : Run Forward</td><td>O : Stop (Disable)<br>C : Run Reverse</td><td>O : Preset speed 1<br>C : Bipolar analog input</td><td>Bipolar analog input</td></tr>
<tr><td rowspan="5">9</td><td rowspan="5">O : Stop (Disable)<br>C : Run Forward</td><td rowspan="5">O : Stop (Disable)<br>C : Run Reverse</td><td colspan="2"><table>
<tr><th>Digi input 3</th><th>Analog input</th><th>Preset value</th></tr>
<tr><td>Open</td><td>Open</td><td>Preset speed 1</td></tr>
<tr><td>Closed</td><td>Open</td><td>Preset speed 2</td></tr>
<tr><td>Open</td><td>Closed</td><td>Preset speed 3</td></tr>
<tr><td>Closed</td><td>Closed</td><td>Preset speed 4</td></tr>
</table></td></tr>
<tr><td>10</td><td>O : Stop (Disable)<br>C : Run Forward</td><td>O : Stop (Disable)<br>C : Run Reverse</td><td>External trip input :<br>O : trip C : OK</td><td>Bipolar analog input</td></tr>
<tr><td>11</td><td>O : Stop (Disable)<br>C : Run (Enable)</td><td>O : Bipolar analog input<br>C : Preset speed 1</td><td>External trip input :<br>O : trip C : OK</td><td>Bipolar analog input</td></tr>
<tr><td>12</td><td>O : Stop (Disable)<br>C : Run (Enable)</td><td>O : Preset speed 1<br>C : Bipolar analog input</td><td>External trip input :<br>O : trip C : OK</td><td>Bipolar analog input</td></tr>
<tr><td>13</td><td>Normally open (NO)<br>Momentarily close to run</td><td>Normally closed (NC)<br>Momentarily open to stop</td><td>O : Bipolar analog input<br>C : Preset speed 1</td><td>Bipolar analog input</td></tr>
<tr><td>14</td><td>Normally open (NO)<br>Momentarily close to run forward</td><td>Normally closed (NC)<br>Momentarily open to stop</td><td>Normally open (NO)<br>Momentarily close to run reverse</td><td>Bipolar analog input</td></tr>
<tr><td>15</td><td>O : Stop (Disable)<br>C : Run (Enable)</td><td>O : Forward<br>C : Reverse</td><td>O : Decel ramp 1<br>C : Decel ramp 2</td><td>Bipolar analog input</td></tr>
<tr><td>16</td><td>O : Stop (Disable)<br>C : Run (Enable)</td><td>O : Forward<br>C : Reverse</td><td>O : Decel ramp 1<br>C : Decel ramp 2</td><td>O : Preset speed1<br>C : Preset speed 2</td></tr>
<tr><td>17</td><td>Normally open (NO)<br>Momentarily close to run forward</td><td>Normally closed (NC)<br>Momentarily open to stop</td><td>Normally open (NO)<br>Momentarily close to run reverse</td><td>O : Preset speed 1<br>C : Keypad mode</td></tr>
<tr><td rowspan="5">18</td><td rowspan="5">O : Stop (Disable)<br>C : Run (Enable)</td><td colspan="3"><table>
<tr><th>Digi input 2</th><th>Digi input 3</th><th>Preset value</th></tr>
<tr><td>Open</td><td>Open</td><td>Preset speed 1</td></tr>
<tr><td>Closed</td><td>Open</td><td>Preset speed 2</td></tr>
<tr><td>Open</td><td>Closed</td><td>Preset speed 3</td></tr>
<tr><td>Closed</td><td>Closed</td><td>Preset speed 4</td></tr>
</table></td><td>O : Terminal mode<br>C : Keypad mode</td></tr>
<tr><td>19</td><td>O : Stop (Disable)<br>C : Run (Enable)</td><td>O : Bipolar analog input<br>C : 2nd Analog input</td><td>2nd Analog input</td><td>Bipolar analog input</td></tr>
<tr><td>20 1)</td><td>O : Stop (Disable)<br>C : Run (Enable)</td><td>2nd digital output :<br>Drive healthy = +24V</td><td>O : Bipolar analog input<br>C : Preset speed 1</td><td>Bipolar analog input</td></tr>
<tr><td>21</td><td>O : Stop (Disable)<br>C : Run (Enable)</td><td>2nd digital output :<br>Drive healthy = +24V</td><td>O : Forward<br>C : Reverse</td><td>Bipolar analog input</td></tr>
<tr><td>22</td><td>O : Stop (Disable)<br>C : Run (Enable)</td><td>2nd digital output :<br>Drive healthy = +24V</td><td>External trip input :<br>O : trip C : OK</td><td>Bipolar analog input</td></tr>
<tr><td>23 2)</td><td>O : Stop (Disable)<br>C : Run (Enable)</td><td>O : Normal control<br>C : Fire mode</td><td>O : Bipolar analog input<br>C : Preset speed 1</td><td>Bipolar analog input</td></tr>
</table>

**Notes:**

1) When P2-01=20, the 2nd digital input is configured as an output, +24V when healthy, 0V otherwise.
2) When Fire mode enabled, the switching frequency is set to minimum (4kHz) and the following trips are disabled : I.t-trP, OL-br, U-t, O-t, Ph-Ib and P-Loss.

## *5.6 Digital input configuration – keypad mode (P1-12 = 1 or 2)*

The following table defines the function of the digital inputs in keypad mode (set using P1-12).

| ***P2-01*** | ***Digi input 1 function*** | ***Digi input 2 function*** | ***Digi input 3 function*** | ***Analog input function*** |
|---|---|---|---|---|
| 0 [1] | O : Stop (Disable)<br>C : Run (Enable) | Closed : Remote pushbutton UP | Closed : Remote pushbutton DOWN | When drive is stopped, closing digital inputs 2 & 3 together starts drive. Bipolar analog input has no effect |
| 1 | O : Stop (Disable)<br>C : Run (Enable) | Closed : Remote pushbutton UP | External trip input :<br>O : Trip C : OK | Closed : Remote pushbutton DOWN |
| 2 | O : Stop (Disable)<br>C : Run (Enable) | Closed : Remote pushbutton UP | O : Digital speed ref<br>C : Preset speed 1 | Bipolar analog input > 5V reverses rotation |
| 3…9, 13,14, 16 [1] | O : Stop (Disable)<br>C : Run (Enable) | Closed : Remote pushbutton UP | Closed : Remote pushbutton DOWN | When drive is stopped, closing digital inputs 2 & 3 together starts the drive.<br>Bipolar analog input > 5V reverses rotation |
| 10 | O : Stop (Disable)<br>C : Run (Enable) | O : Digital speed ref<br>C : Bipolar analog input | External trip input :<br>O : Trip C : OK | Analog speed reference |
| 11 | O : Stop (Disable)<br>C : Run (Enable) | O : Digital speed ref<br>C : Preset speed 1 | External trip input :<br>O : trip C : OK | Allows connection of motor thermistor on terminal 4.<br>Bipolar analog input > 5V reverses rotation |
| 12 | O : Stop (Disable)<br>C : Run (Enable) | O : Preset speed 1<br>C : Digital speed ref | External trip input :<br>O : trip C : OK | |
| 15 | O : Stop (Disable)<br>C : Run (Enable) | O : Digital speed ref<br>C : Preset speed 1 | O : Decel ramp 1<br>C : Decel ramp 2 | Bipolar analog input > 5V reverses rotation |
| 17 | O : Stop (Disable)<br>C : Run (Enable) | O : Digital speed ref<br>C : Bipolar analog input | O : Digital / analog speed<br>C : Preset speed 1 | Analog speed reference |
| 18 | O : Stop (Disable)<br>C : Run (Enable) | O : Digital speed ref<br>C : Preset speed | ***Digi input 3*** / ***Analog input*** / ***Preset value***<br>Open / Open / Preset speed 1<br>Closed / Open / Preset speed 2<br>Open / Closed / Preset speed 3<br>Closed / Closed / Preset speed 4 | |
| 19 | O : Stop (Disable)<br>C : Run (Enable) | O : Digital speed ref<br>C : 2nd analog input | 2nd analog input | Bipolar analog input > 5V reverses rotation |
| 20,21 | O : Stop (Disable)<br>C : Run (Enable) | 2nd digital output :<br>Drive healthy = +24V | O : Digital speed ref<br>C : Preset speed 1 | |
| 22 | O : Stop (Disable)<br>C : Run (Enable) | 2nd digital output :<br>Drive healthy = +24V | External trip input :<br>O : trip C : OK | |
| 23 [2] | O : Stop (Disable)<br>C : Run (Enable) | O : Normal control<br>C : Fire mode | O : Digital speed ref<br>C : Preset speed 1 | |

**Notes:**

1) In addition to the speed being set using the pushbuttons on the front of the drive, these settings for P2-01 allow the speed to be controlled remotely using remote pushbuttons connected to digital inputs 2 and 3.
2) When Fire mode is enabled (P2-01 = 23), the switching frequency is set to minimum (4kHz) and the following trips are disabled : I.t-trP, OL-br, U-t, O-t, Ph-Ib and P-Loss.
3) When P2-19 = 2 or 3 in keypad mode, the drive START and STOP is controlled from the hardware enable input (terminal 2). In this case, the START / STOP buttons will have no effect.
4) Reverse rotation control using the analog input only works in keypad mode. If P1-12=1, the rotation control only works when P2-19 = 2 or 3. If P2-35 = 2 or 3, the function is disabled.
5) When connecting a motor thermistor, connect between terminals 1 & 4, set P2-01 = 6, 10, 11, 12 or 22 (Uses external trip input)

## *5.7 Digital input configuration – User PID mode (P1-12 = 3)*

The following table defines the function of the digital inputs when the drive is in User PID control mode.

| ***P2-01*** | ***Digi input 1 function*** | ***Digi input 2 function*** | ***Digi input 3 function*** | ***Analog input function*** |
|---|---|---|---|---|
| 0..10, 13..16,18 | O : Stop (Disable)<br>C : Run (Enable) | No effect | No effect | Digital input 1 must be closed to run the drive<br><br>External trip function only possible when bipolar analog input is selected as feedback signal (P3-10=1). |
| 11 | O : Stop (Disable)<br>C : Run (Enable) | O : PID control<br>C : Preset speed 1 | External trip input :<br>O : Trip C : OK | |
| 12 | O : Stop (Disable)<br>C : Run (Enable) | O : Preset speed 1<br>C : PID control | External trip input :<br>O : Trip C : OK | |
| 17 | O : Stop (Disable)<br>C : Run (Enable) | O : PID control<br>C : Bipolar analog input | No effect | |
| 19 | O : Stop (Disable)<br>C : Run (Enable) | O : PID control<br>C : 2nd analog input | No effect | |
| 20, 21 | O : Stop (Disable)<br>C : Run (Enable) | 2nd digital output :<br>Drive healthy = +24V | No effect | |
| 22 | O : Stop (Disable)<br>C : Run (Enable) | 2nd digital output :<br>Drive healthy = +24V | External trip input :<br>O : Trip C : OK | |
| 23 | O : Stop (Disable)<br>C : Run (Enable) | O : Normal control<br>C : Fire mode | No effect | |

## *5.8 Digital input configuration – Fieldbus control mode (P1-12 = 4)*

The following table defines the digital input functionality when the drive is in Modbus control mode

| ***P2-01*** | ***Digi input 1 function*** | ***Digi input 2 function*** | ***Digi input 3 function*** | ***Analog input function*** |
|---|---|---|---|---|
| 0..2,4 6…9, 13..16,18 | O : Stop (Disable)<br>C : Run (Enable) | No effect | No effect | Not Used |
| 3 | O : Stop (Disable)<br>C : Run (Enable) | O : Forward<br>C : Reverse | O : Master speed ref<br>C : Preset speed 1 | Not Used |
| 5 | O : Stop (Disable)<br>C : Run (Enable) | O : Master speed ref<br>C : Preset speed | ***Digi input 3*** / ***Analog input*** / ***Preset value*** | |
| | | | Open / Open / Preset speed 1 | |
| | | | Closed / Open / Preset speed 2 | |
| | | | Open / Closed / Preset speed 3 | |
| | | | Closed / Closed / Preset speed 4 | |
| 10 | O : Stop (Disable)<br>C : Run (Enable) | O : Master speed ref<br>C : Digital speed ref | External trip input :<br>O : trip C : OK | Not Used |
| 11 | O : Stop (Disable)<br>C : Run (Enable) | O : Master speed ref<br>C : Preset speed 1 | External trip input :<br>O : trip C : OK | Not Used |
| 12 | O : Stop (Disable)<br>C : Run (Enable) | O : Master speed ref<br>C : Bipolar analog input | External trip input :<br>O : trip C : OK | Bipolar analog input |
| 17 | O : Stop (Disable)<br>C : Run (Enable) | O : Master speed ref<br>C : Bipolar analog input | No effect | Bipolar analog input |
| 19 | O : Stop (Disable)<br>C : Run (Enable) | O : Master speed ref<br>C : 2nd analog input | 2nd analog input | Not Used |
| 20,21 | O : Stop (Disable)<br>C : Run (Enable) | 2nd digital output :<br>Drive healthy = +24V | O : Master speed ref<br>C : Preset speed 1 | Not Used |
| 22 | O : Stop (Disable)<br>C : Run (Enable) | 2nd digital output :<br>Drive healthy = +24V | External trip input :<br>O : trip C : OK | Not Used |
| 23 | O : Stop (Disable)<br>C : Run (Enable) | O : Normal control<br>C : Fire mode | O : Master speed ref<br>C : Preset speed 1 | Not Used |

**Notes:**
- If P2-19 = 2 or 3, drive can only be started / stopped by closing / opening digital input 1. If P2-19 = 0 or 2, the master speed reference will be automatically reset to zero each time when drive is stopped.
- Digital input 1 must be closed in all cases to enable the drive

## *5.9 Real-time monitoring parameters*

Parameter group zero provides access to internal drive read-only parameters for monitoring purposes.

| ***Par*** | ***Description*** | ***Display range*** | ***Explanation*** |
|---|---|---|---|
| P0-01 | Bipolar analog input value | -100%...100% | 100% = max input voltage |
| P0-02 | 2nd analog input value | 0..100% | 100% = max input voltage |
| P0-03 | Speed controller reference | -500%...500% | 100% = Base frequency (P1-09) |
| P0-04 | Digital speed ref (digi pot) | - P1-01 … P1-01 | Speed displayed in Hz / rpm |
| P0-05 | *Reserved* | | |
| P0-06 | User PID ref input | 0..100% | PID controller reference value |
| P0-07 | User PID feedback | 0..100% | PID controller feedback value |
| P0-08 | User PID error input | 0..100% | Reference – Feedback |
| P0-09 | User PID P-term | 0..100% | Proportional component |
| P0-10 | User PID I-term | 0..100% | Integral component |
| P0-11 | User PID D-term | 0..100% | Differential component |
| P0-12 | User PID output | 0..100% | Combined output |
| P0-13 | *Reserved* | | |
| P0-14 | Magnetising current | A rms | Magnetising current in A rms |
| P0-15 | *Reserved* | | |
| P0-16 | Field strength | 0..100% | Magnetic field strength |
| P0-17 | Stator resistance | Ohm | Phase - Phase stator resistance |
| P0-18 | *Reserved* | | |
| P0-19 | *Reserved* | | |
| P0-20 | DC bus voltage | V dc | Internal DC bus voltage |
| P0-21 | Drive temperature | °C | Internal drive temperature |
| P0-22 | Supply voltage L1 – L2 | V rms, ph-ph | Phase – phase supply voltage |
| P0-23 | Supply voltage L2 – L3 | V rms, ph-ph | Phase – phase supply voltage |
| P0-24 | Supply voltage L3 – L1 | V rms, ph-ph | Phase – phase supply voltage |
| P0-25 | *Reserved* | | |
| P0-26 | kWh meter | 0.0 … 999.9 kWh | Cumulative energy consumption |
| P0-27 | MWh meter | 0.0 … 60000 MWh | Cumulative energy consumption |
| P0-28 | Software ID, IO processor | eg “1.00”, “493F” | Version number and checksum |
| P0-29 | Software ID, Motor control | eg “1.00”, “7A5C” | Version number and checksum |
| P0-30 | Drive serial number | 000000 … 999999<br>00-000 … 99-999 | Unique drive serial number<br>eg 540102 / 24 / 003 |

## 6. Troubleshooting

### *6.1 Fault-finding chart*

| Symptom | Cause and Solution |
|---|---|
| Overload or over-current trip on unloaded motor during acceleration | Check Star / Delta terminal connection in motor. Rated operating voltage of drive and motor should match. The Delta connection always gives the lower voltage rating of a dual voltage motor |
| Overload or over-current – motor does not spin | Check for locked rotor. Check that the mechanical brake is released (if fitted) |
| Drive will not enable – display remains on 'StoP' | Check that the hardware enable signal is applied to digital input 1. Ensure that the User +24V output voltage (between terminals 5 and 7) is correct. If not, check wiring to user terminal strip. Check P1-12 for terminal / keypad mode. If keypad mode selected, press the START button. Check that supply voltage is within specification |
| In very cold ambient conditions, drive will not power up | If the ambient temperature is less than -10 $^{O}$C, the drive may not power up. Ensure that a local heating source keeps the ambient above 0 $^{O}$C in these conditions. |
| Extended menus cannot be accessed | Ensure that P1-14 is set to the extended access code. This is "101" unless the code in P2-37 has been changed by the user. |

### *6.2 Fault messages*

| Trip message | Explanation |
|---|---|
| P-dEF | Default parameters loaded, usually after pressing STOP, UP & DOWN keys for 1s. Press STOP to reset the trip. Display then reads "StoP" |
| "O-I"<br>"h O-I" | Over-current on drive output to motor.<br>Trip on drive enable : check for wiring error or short circuit<br>Trip on motor starting : check for stalled or jammed motor<br>Trip during operation : check for sudden overload or malfunction<br>If "h O-I" occurs, check for short circuit on output. If wiring correct, contact your supplier. |
| "I.t-trP" | Drive overload trip, occurring when the drive has been delivering >100% rated current (set in P1-08) for a period of time. The display flashes to indicate an overload condition. |
| "O-Uolt" | Over-voltage on DC bus. Check supply voltage is within limits. If trip occurs on deceleration, increase deceleration time or fit braking resistor. |
| "U-Uolt" | Under-voltage trip. Happens routinely when drive powered down. If it occurs whilst running, check supply voltage |
| "OI-b" | Over current in the brake resistor circuit. Check cabling to brake resistor |
| "OL-br" | Brake resistor overload. Increase deceleration time, reduce load inertia or add further brake resistors in parallel. Ensure minimum resistance values from ratings tables in section 7.4 are observed. |
| "O-t" | Over-temperature trip. Check drive cooling and possible enclosure dimensions |
| "U-t" | Under-temperature trip. Trip occurs if ambient is less than 0 $^{0}$C. Drive ambient temperature must be raised above zero in order to start the drive. |
| "th-Flt" | Thermistor hardware fault. Contact your local distributor for further information. |
| "PS-trP" | Trip on drive enable : check for wiring error or short circuit<br>Trip during operation : check for sudden overload or over-temperature |
| "dAtA-F" | Occurs routinely after Flash upgrade. Reset using the STOP button or after a power down cycle. All parameters set to default after an upgrade. |
| "P-LOSS" | Drive intended for use with a 3-phase supply has lost one phase. Condition must persist for >15s before a trip occurs. Phase loss detection disabled if parameters defaulted (P-dEF) when L3 has been removed. |
| "Ph-Ib" | Phase imbalance. Trips if the phase imbalance exceeds 3%. Condition must persist for >30s before a trip occurs. |
| "SC-trP" | Check integrity of OptiLink (communication link) between drives interconnected optically. Check that each drive in a network has a unique drive address (P2-27) |
| "E-triP" | External trip (connected to digital input 3). Check motor thermistor (if connected) |
| "At-Fxx" | Auto-tune failed to complete successfully. (xx = 01…02) See 6.3 for more details. |
| "SPIN-F" | Spin start function failed to detect the motor speed. Check cable connection between drive and motor. Make sure that the motor actual speed is less than the maximum speed limit (P1-01). Make sure that the motor base frequency (P1-09) is less than 100Hz. |

*6.3 Auto-tune trouble shooting*

| Trip message | Explanation and check point |
|---|---|
| At-F01 | Measured motor stator resistance varies between phases. Ensure that all motor phases are connected to the drive. Check motor for winding imbalance. |
| At-F02 | Measured motor stator resistance is too large. Ensure that motor is connected. Check that the motor power matches the drive power rating. |

Notes: Ensure that the correct motor nameplate parameters are entered in P1-07…P1-09 before the Auto-tune is carried out. Ensure that the motor winding (star or delta) connection is correct and that the motor is connected to the drive.

## *7. Technical data*

*7.1 User interface*

| | |
|---|---|
| Bipolar Analog Input :<br>(terminal 6) | Resolution = +/-12-bits (0.025%), 8ms sampling time<br>Range settings: 0..10V, 0..24V, -10..10V. Max input voltage 30V DC<br>Input impedance: 22 kOhm |
| 2nd Analog input :<br>(terminal 4) | Resolution = +11-bits (0.05%), 8ms sampling time<br>Range settings: 0..10V, 4..20mA, 0..20mA. Max input voltage 30V DC<br>Input impedance: 70 kOhm |
| Digital inputs :<br>(terminals 2, 3, 4) | Positive logic only. Sampling interval : 8ms sampling time<br>"Logic 1" input voltage range: 8V … 30V DC.<br>"Logic 0" input voltage range: 0 … 4V DC. |
| User +24V output :<br>(terminals 1, 5) | Output load regulation +/-0.4% over full load range.<br>Max output current = 100mA total. Short circuit proof. |
| Analog output :<br>(terminal 8) | Resolution = 8-bits, 16ms update cycle time<br>Output formats: 0…10V, 4…20mA. Max current = 20mA.<br>Short circuit proof. |
| 2nd digital output :<br>(terminal 3) | PNP output, max output current = 10mA.<br>Short circuit proof. |
| User relay :<br>(terminals 10, 11) | Contact rating : 250Vac, 6A / 30Vdc, 5A. |

*7.2 Power stage protection*

- Output short-circuit, phase-to-phase, phase-to-earth
- Output over-current. Trip set at 200% of rated drive current
- Overload protection. Drive delivers 110% of rated motor current for 60s
- Braking transistor protected against short-circuit.
- Braking resistor overload (when enabled)
- Over-voltage trip. Set at 123% of drive maximum rated supply voltage
- Under-voltage trip.
- Over temperature trip
- Under temperature trip. (Drive will trip if enabled below 0 $^{O}$C)
- Supply Phase imbalance. A supply imbalance of >3% persisting for more than 30s will trip a running drive.
- Supply Phase loss. If one phase of a 3-phase supply is lost for more than 15s, a running drive will trip.

*7.3 Environmental*

Operational ambient temperature range : 0 … 50 $^{O}$C
Storage ambient temperature range : -40 … 60 $^{O}$C
Maximum altitude : 2000m. Derate above 1000m 1% / 100m
Maximum humidity : 95%, non-condensing

## *7.4 Drive rating tables*

**SIZE 2 (INTEGRAL RFI FILTER, INTEGRAL BRAKING TRANSISTOR)**

| Model ODV-xxxxx-zz [1] / ODV-xxxxx-zz-I55 / -I55S [1] | | 22150 | 22220 | - | - |
|---|---|---|---|---|---|
| Motor output rating – industrial 110% o/l | kW | 1.5 | 2.2 | - | - |
| Model ODV-xxxxx-USA / ODV-xxxxx-USA-I55 / -I55S | | 22020 | 22030 | - | - |
| Motor output rating – industrial 110% o/l | HP | 2 | 3 | - | - |
| Model ODV3-xxxxx-zz [1] / ODV3-xxxxx-zz-I55 / -I55S [1] | | - | - | 22150 | 22220 |
| Motor output rating – industrial 110% o/l | kW | - | - | 1.5 | 2.2 |
| Model ODV3-xxxxx-USA / ODV3-xxxxx-USA-I55 / -I55S | | - | - | 22020 | 22030 |
| Motor output rating – industrial 110% o/l | HP | - | - | 2 | 3 |
| Supply voltage / phases | V±10% | 220-240 / 1Ø [3] | | 220-240 / 3Ø [3] | |
| Supply current, (110% overload) | A | 19.3 (21.2) | 28.8 (31.7) | 9.2 (13.8) | 13.7 (20.1) |
| Supply fuse or MCB (type B) [2] | A | 20 | 32 | 16 | 20 |
| Supply cable size | $mm^2$ | 4 | 6 | 2.5 | 4 |
| Output voltage / phases | V | 0-240V / 3Ø | | | |
| Output Amps – industrial 110% overload | A | 7 | 10.5 (* 9) | 7 | 10.5 (* 9) |
| Motor cable size, Copper 75 °C | $mm^2$ | 1.5 | | | |
| Max motor cable length | m | 100 | | | |
| Min brake resistor | Ω | 33 | 22 | 33 | 22 |

| Model ODV-xxxxx-zz [1] / ODV-xxxxx-zz-I55 / -I55S [1] | | 24150 | 24220 | 24400 |
|---|---|---|---|---|
| Motor output rating – industrial 110% o/l | kW | 1.5 | 2.2 | 4.0 |
| Model ODV-xxxxx-USA / ODV-xxxxx-USA-I55 / -I55S | | 24020 | 24030 | 24050 |
| Motor output rating – industrial 110% o/l | HP | 2 | 3 | 5 |
| Supply voltage / phases | V±10% | 380-480 / 3Ø (or 1Ø with 50% derating) | | |
| Supply current, (110% overload) | A | 5.4 (5.9) | 7.6 (8.4) | 12.4 (13.6) |
| Supply fuse or MCB (type B) [2] | A | 6 | 10 | 16 |
| Supply cable size | $mm^2$ | 1 | 1.5 | 2.5 |
| Output voltage / phases | V | 0-480 / 3Ø | | |
| Output Amps – industrial 110% overload | A | 4.1 | 5.8 | 9.5 |
| Motor cable size, Copper 75 °C | $mm^2$ | 1.0 | 1.5 | |
| Max motor cable length | m | 100 | 100 | 100 |
| Min brake resistor | Ω | 47 | 47 | 33 |

| Model ODV-xxxxx-zz [1] / ODV-xxxxx-zz-I55 / -I55S [1] | | 25150 [4] | 25220 [4] | 25370 [4] | 25550 [4] |
|---|---|---|---|---|---|
| Motor output rating – industrial 110% o/l | kW | 1.5 | 2.2 | 3.7 | 5.5 |
| Model ODV-xxxxx-USA / ODV-xxxxx-USA-I55 / -I55S | | 25020 [4] | 25030 [4] | 25050 [4] | 25075 [4] |
| Motor output rating – industrial 110% o/l | HP | 2.0 | 3.0 | 5.0 | 7.5 |
| Supply voltage / phases | V±10% | 500-600 / 3Ø (or 1Ø with 50% derating) | | | |
| Supply current, (110% overload) | A | 4.1 (4.5) | 5.4 (5.9) | 7.6 (8.4) | 11.7 (12.9) |
| Supply fuse or MCB (type B) [2] | A | 6 | 6 | 10 | 16 |
| Supply cable size | $mm^2$ | 1 | 1 | 1.5 | 2.5 |
| Output voltage / phases | V | 0-575V / 3Ø | | | |
| Output Amps – industrial 110% overload | A | 3.1 | 4.1 | 6.1 | 9.0 |
| Motor cable size, Copper 75 °C | $mm^2$ | 1.0 | | 1.5 | |
| Max motor cable length | m | 100 | 100 | 100 | 100 |
| Min brake resistor | Ω | 47 | | | |

ODV-xxxxx-zz-I55 = Unswitched IP55 drive ODV-xxxxx-zz-I55S = Switched IP55 drive

* Maximum rating for UL applications ** Models not UL listed

1) "-zz" in the part number refers to the country variation
2) For cUL compliance, use fuse type Bussmann KTN-R / KTS-R or equivalent
3) Part number for 1-phase supply different to part number for 3-phase supply
4) Input Filter must be fitted for all Size 2 500..600V drive installations.

**SIZE 3 (INTEGRAL RFI FILTER, INTEGRAL DC LINK CHOKE & BRAKING TRANSISTOR)**

| Model ODV-xxxxx-zz [1] | | 32030 | 32040 | 32055 |
|---|---|---|---|---|
| Motor output rating – industrial 110% o/l | kW | 3.0 | 4.0 | 5.5 |
| Model ODV-xxxxx-USA | | 32040 | 32050 | 32075 |
| Motor output rating – industrial 110% o/l | HP | 4 | 5 | 7.5 |
| Supply voltage / phases | V±10% | 220-240 / 3Ø (or 1Ø with 50% derating) | | |
| Supply current, (110% overload) | A | 16.1 (17.7) | 17.3 (19.0) | 25.0 (27.5) |
| Supply fuse or MCB (type B) [2] | A | 16 | 20 | 32 |
| Supply cable size | $mm^2$ | 2.5 | 4 | 6 |
| Output voltage / phases | V | 0-240 / 3Ø | | |
| Output Amps – industrial 110% overload | A | 14 | 18 | 25 (* 24) |
| Motor cable size, Copper 75 °C | $mm^2$ | 2.5 | 2.5 | 4 |
| Max motor cable length | m | 100 | | |
| Min brake resistor | Ω | 15 | | |

| Model ODV-xxxxx-zz [1] | | 34055 | 34075 | 34110 | 34150 ** |
|---|---|---|---|---|---|
| Motor output rating – industrial 110% o/l | kW | 5.5 | 7.5 | 11.0 | 15.0 |
| Model ODV-xxxxx-USA | | 34075 | 34100 | 34150 | 34200 ** |
| Motor output rating – industrial 110% o/l | HP | 7.5 | 10 | 15 | 20 |
| Supply voltage / phases | V±10% | 380-480 / 3Ø (or 1Ø with 50% derating) | | | |
| Supply current, (110% overload) | A | 16.1 (17.7) | 17.3 (19.0) | 25 (27.5) | 32.9 (36.2) |
| Supply fuse or MCB (type B) [2] | A | 16 | 20 | 25 | 32 |
| Supply cable size | $mm^2$ | 2.5 | 4 | 4 | 6 |
| Output voltage / phases | V | 0-480 / 3Ø | | | |
| Output Amps – industrial 110% overload | A | 14 | 18 | 25 (* 24) | 30 |
| Motor cable size, Copper 75 °C | $mm^2$ | 2.5 | 2.5 | 4 | 6 |
| Max motor cable length | m | 100 | | | |
| Min brake resistor | Ω | 22 | | | |

| Model ODV-xxxxx-zz [1] | | 35075 | 35110 | 35150 |
|---|---|---|---|---|
| Motor output rating – industrial 110% o/l | kW | 7.5 | 11.0 | 15.0 |
| Model ODV-xxxxx-USA | | 35100 | 35150 | 35200 |
| Motor output rating – industrial 110% o/l | HP | 10 | 15 | 20 |
| Supply voltage / phases | V±10% | 500-600 / 3Ø (or 1Ø with 50% derating) | | |
| Supply current, (110% overload) | A | 16.1 (17.7) | 17.3 (19.0) | 24.1 (26.5) |
| Supply fuse or MCB (type B) [2] | A | 16 | 20 | 25 |
| Supply cable size | $mm^2$ | 2.5 | 4 | 4 |
| Output voltage / phases | V | 0-575V / 3Ø | | |
| Output Amps – industrial 110% overload | A | 14 | 18 | 24 |
| Motor cable size, Copper 75 °C | $mm^2$ | 2.5 | | 4 |
| Max motor cable length | m | 100 | | |
| Min brake resistor | Ω | 22 | | |

ODV-xxxxx-zz-I55 = Unswitched IP55 drive ODV-xxxxx-zz-I55S = Switched IP55 drive

* Maximum rating for UL applications ** Models not UL listed

1) "-zz" in the part number refers to the country variation
2) For cUL compliance, use fuse type Bussmann KTN-R / KTS-R or equivalent
3) Part number for 1-phase supply different to part number for 3-phase supply
4) Input line choke must be fitted for all Size 2 500..600V drive installations.

**SIZE 4 (INTEGRAL RFI FILTER, LINE CHOKE & BRAKING TRANSISTOR)**

| Model ODV-xxxxx-zz [1] | | 42075 | 42110 | 42150 | 42185 | 42220 |
|---|---|---|---|---|---|---|
| Motor output rating – industrial 110% o/l | KW | 7.5 | 11 | 15 | 18.5 | 22 |
| Model ODV-xxxxx-USA | | 42100 | 42150 | 42200 | 42250 | 42300 |
| Motor output rating – industrial 110% o/l | HP | 10 | 15 | 20 | 25 | 30 |
| Supply voltage / phases | V±10% | 220-240 / 3Ø (or 1Ø with 50% derating) | | | | |
| Supply current, (110% overload) | A | 46.6 (51.3) | 54.1 (59.5) | 69.6 (76.6) | 76.9 (84.6) | 92.3 (101.5) |
| Supply fuse or MCB (type B) [2] | A | 50 | 63 | 80 | 80 | 100 |
| Supply cable size | $mm^2$ | 10 | 16 | 25 | 25 | 35 |
| Output voltage / phases | V | 0-240 / 3Ø | | | | |
| Output Amps – industrial 110% overload | A | 39 | 46 | 61 | 72 | 90 |
| Motor cable size, Copper 75 °C | $mm^2$ | 10 | 10 | 16 | 16 | 25 |
| Max motor cable length | m | 100 | | | | |
| Min brake resistor | Ω | 6 | | | | |

| Model | ODV-xxxxx-zz [1] | 44185 | 44220 | 44300 | 44370 | 44450 |
|---|---|---|---|---|---|---|
| Motor output rating – industrial 110% o/l | KW | 18.5 | 22 | 30 | 37 | 45 |
| Model | ODV-xxxxx-USA | 44250 | 44300 | 44400 | 44500 | 44600 |
| Motor output rating – industrial 110% o/l | HP | 25 | 30 | 40 | 50 | 60 |
| | | | | | | |
| Supply voltage / phases | V±10% | 380-480 / 3Ø (or 1Ø with 50% derating) | | | | |
| Supply current, (110% overload) | A | 46.6 (51.3) | 54.1 (59.5) | 69.6 (76.6) | 76.9 (84.6) | 92.3 (101.5) |
| Supply fuse or MCB (type B) 2) | A | 50 | 63 | 80 | 80 | 100 |
| Supply cable size | $mm^2$ | 10 | 16 | 25 | 25 | 35 |
| Output voltage / phases | V | 0-480 / 3Ø | | | | |
| Output Amps – industrial 110% overload | A | 39 | 46 | 61 | 72 | 90 |
| Motor cable size, Copper 75 °C | $mm^2$ | 10 | 10 | 16 | 16 | 25 |
| Max motor cable length | m | 100 | | | | |
| Min brake resistor | Ω | 12 | | | | |

| Model | ODV-xxxxx-zz [1] | 45220 | 45300 | 45450 |
|---|---|---|---|---|
| Motor output rating – industrial 110% o/l | KW | 22 | 30 | 45 |
| Model | ODV-xxxxx-USA | 45300 | 45400 | 45600 |
| Motor output rating – industrial 110% o/l | HP | 30 | 40 | 60 |
| Supply voltage / phases | V±10% | 500-600 / 3Ø (or 1Ø with 50% derating) | | |
| Supply current, (110% overload) | A | 46.6 (51.3) | 54.1 (59.5) | 69.6 (76.6) |
| Supply fuse or MCB (type B) 2) | A | 50 | 63 | 80 |
| Supply cable size | $mm^2$ | 10 | 16 | 25 |
| Output voltage / phases | V | 0-575 / 3Ø | | |
| Output Amps – industrial 110% overload | A | 39 | 46 | 62 |
| Motor cable size, Copper 75 °C | $mm^2$ | 10 | 10 | 16 |
| Max motor cable length | m | 100 | | |
| Min brake resistor | Ω | 12 | | |

1) "-zz" in the part number refers to the country variation
2) For cUL compliance, use fuse type Bussmann KTN-R / KTS-R or equivalent

## SIZE 5 (INTEGRAL RFI FILTER, LINE CHOKE & BRAKING TRANSISTOR)

| Model | ODV-xxxxx-zz [1] | 52300 | 52370 | 52450 |
|---|---|---|---|---|
| Motor output rating – industrial 110% o/l | kW | 30 | 37 | 45 |
| Model | ODV-xxxxx-USA | 52400 | 52500 | 52600 |
| Motor output rating – industrial 110% o/l | HP | 40 | 50 | 60 |
| Supply voltage / phases | V±10% | 220-240 / 3Ø (or 1Ø with 50% derating) | | |
| Supply current, (110% overload) | A | 116.9 (128.6) | 150.2 (165.2) | 176.5 (194.2) |
| Supply fuse or MCB (type B) 2) | A | 160 | 160 | 200 |
| Supply cable size | $mm^2$ | 50 | 70 | 90 |
| Output voltage / phases | V | 0-240 / 3Ø | | |
| Output Amps – industrial 110% overload | A | 110 | 150 | 180 |
| Motor cable size, Copper 75 °C | $mm^2$ | 35 | 55 | 70 |
| Max motor cable length | m | 100 | | |
| Min brake resistor | Ω | 3 | | |

| Model | ODV-xxxxx-zz [1] | 54550 | 54750 | 54900 |
|---|---|---|---|---|
| Motor output rating – industrial 110% o/l | kW | 55 | 75 | 90 |
| Model | ODV-xxxxx-USA | 54750 | 54100 | 54120 |
| Motor output rating – industrial 110% o/l | HP | 75 | 100 | 120 |
| Supply voltage / phases | V±10% | 380-480 / 3Ø (or 1Ø with 50% derating) | | |
| Supply current, (110% overload) | A | 116.9 (128.6) | 150.2 (165.2) | 176.5 (194.2) |
| Supply fuse or MCB (type B) 2) | A | 160 | 160 | 200 |
| Supply cable size | $mm^2$ | 50 | 70 | 90 |
| Output voltage / phases | V | 0-480 / 3Ø | | |
| Output Amps – industrial 110% overload | A | 110 | 150 | 180 |
| Motor cable size, Copper 75 °C | $mm^2$ | 35 | 55 | 70 |
| Max motor cable length | m | 100 | | |
| Min brake resistor | Ω | 6 | | |

| Model ODV-xxxxx-zz [1] | | 55550** | 55750** | 55900** |
|---|---|---|---|---|
| Motor output rating – industrial 110% o/l | kW | 55 | 75 | 90 |
| Supply voltage / phases | V±10% | 480-525 / 3Ø (or 1Ø with 50% derating) | | |
| Supply current, (110% overload) | A | 92.3 (101.5) | 116.9 (128.6) | 150.2 (165.2) |
| Supply fuse or MCB (type B) [2] | A | 100 | 160 | 160 |
| Supply cable size | $mm^2$ | 35 | 50 | 70 |
| Output voltage / phases | V | 0-525 / 3Ø | | |
| Output Amps – industrial 110% overload | A | 90 | 110 | 150 |
| Motor cable size, Copper 75 °C | $mm^2$ | 25 | 35 | 55 |
| Max motor cable length | m | 100 | | |
| Min brake resistor | Ω | 6 | | |

** Models not UL listed

1) "-zz" in the part number refers to the country variation
2) For cUL compliance, use fuse type Bussmann KTN-R / KTS-R or equivalent

**SIZE 6 (EXTERNAL LINE CHOKE, INTEGRAL RFI FILTER & BRAKING TRANSISTOR)**

| Model ODV-xxxxx-zz [1] | | 64110 | 64132 | 64160 |
|---|---|---|---|---|
| Motor output rating – industrial 110% o/l | kW | 110 | 132 | 160 |
| Model ODV-xxxxx-USA | | 64150 | 64175 | 64210 |
| Motor output rating – industrial 110% o/l | HP | 150 | 175 | 210 |
| Supply voltage / phases | V±10% | 380-480 / 3Ø (or 1Ø with 50% derating) | | |
| Supply current, (110% overload) | A | 217.2 (238.9) | 255.7 (281.3) | 302.4 (332.6) |
| Supply fuse or MCB (type B) [2] | A | 250 | 250 | 315 |
| Supply cable size | $mm^2$ | 120 | 120 | 170 |
| Output voltage / phases | V | 0-480 / 3Ø | | |
| Output Amps – industrial 110% overload | A | 202 | 240 | 300 |
| Motor cable size, Copper 75 °C | $mm^2$ | 90 | 120 | 170 |
| Max motor cable length | m | 100 | | |
| Min brake resistor | Ω | 6 | | |

| Model ODV-xxxxx-zz [1] | | 65132** | 65160** |
|---|---|---|---|
| Motor output rating – industrial 110% o/l | kW | 132 | 160 |
| Supply voltage / phases | V±10% | 480-525 / 3Ø (or 1Ø with 50% derating) | |
| Supply current, (110% overload) | A | 217.2 (238.9) | 255.7 (281.3) |
| Supply fuse or MCB (type B) [2] | A | 250 | 250 |
| Supply cable size | $mm^2$ | 120 | 120 |
| Output voltage / phases | V | 0-525 / 3Ø | |
| Output Amps – industrial 110% overload | A | 202 | 240 |
| Motor cable size, Copper 75 °C | $mm^2$ | 90 | 120 |
| Max motor cable length | m | 100 | |
| Min brake resistor | Ω | 6 | |

** Models not UL listed

1) "-zz" in the part number refers to the country variation
2) For cUL compliance, use fuse type Bussmann KTN-R / KTS-R or equivalent

**Maximum supply ratings for UL compliance :**

| Drive rating | Maximum supply voltage | Maximum short circuit current |
|---|---|---|
| 230V ratings<br>0.37kW (0.5HP) to 18.5kW (25HP) | 240V rms (AC) | 5kA rms (AC) |
| 230V ratings<br>22kW (30HP) to 90kW (120HP) | 240V rms (AC) | 10kA rms (AC) |
| 400/460V/600V ratings<br>0.75kW (1.0HP) to 37kW (50HP) | 500V/600Vrms (AC) | 5kA rms (AC) |
| 400/460V/600V ratings<br>45kW (60HP) to 160kW (210HP) | 500V/600V rms (AC) | 10kA rms (AC) |



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Invertek Drives Ltd.
Offa's Dyke Business Park,
Welshpool,
Powys. SY21 8JF
United Kingdom

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INVERTEK DRIVES
www.invertek.co.uk

**Phone:** +44 (0) 1938 55 68 68 **Fax:** +44 (0) 1938 55 68 69
**e-mail:** sales@invertek.co.uk **web:** www.invertek.co.uk