This manual is to be given to the end user.

**VE/B**

Single-phase variable speed drive for D.C. motor

Installation and maintenance
NOTE

**LEROY-SOMER** reserves the right to modify the characteristics of its products at any time in order to incorporate the latest technological developments. The information contained in this document may therefore be changed without notice.

**LEROY-SOMER** gives no contractual guarantee whatsoever concerning the information published in this document and cannot be held responsible for any errors it may contain, nor for any damage resulting from its use.

CAUTION

For the user's own safety, this variable speed drive must be connected to an approved earth (接地) terminal).

If accidentally starting the installation is likely to cause a risk to personnel or the machines being driven, it is essential to supply the equipment via an isolating switch and a circuit-breaking device (power contactor) which can be controlled via an external safety system (emergency stop, detection of errors on the installation).

The variable speed drive is fitted with safety devices which, in the event of a fault, control stopping and thus stop the motor. The motor itself can become jammed for mechanical reasons. Voltage fluctuations, and in particular power cuts, may also cause the motor to stop. The removal of the causes of the shutdown can lead to restarting, which may be dangerous for certain machines or installations. In such cases, it is essential that the user takes appropriate precautions against the motor restarting after an unscheduled stop.

The variable speed drive is designed to be able to supply a motor and the driven machine above its rated speed. If the motor or the machine are not mechanically designed to withstand such speeds, the user may be exposed to serious danger resulting from their mechanical deterioration. It is important that the user checks that the installation can withstand it before programming a high speed.

The variable speed drive which is the subject of this manual is designed to be integrated in an installation or an electrical machine, and can under no circumstances be considered to be a safety device. It is therefore the responsibility of the machine manufacturer, the designer of the installation or the user to take all necessary precautions to ensure that the system complies with current standards, and to provide any devices required to ensure the safety of equipment and personnel.

**LEROY-SOMER** declines all responsibility in the event of the above recommendations not being observed.
SAFETY AND OPERATING INSTRUCTIONS FOR VARIABLE SPEED DRIVES
(in accordance with the low voltage directive 73/23/EEC modified by 93/68/EEC)

Throughout the manual, this symbol warns of consequences which may arise from inappropriate use of the drive, since electrical risks may lead to material or physical damage as well as constituting a fire hazard.

1 - General
Depending on their degree of protection, the variable speed drives, PG P3 M6 operation, may contain unprotected live parts, which may be moving or rotating, as well as hot surfaces, during operation. Unjustified removal of protection devices, incorrect use, faulty installation or inappropriate operation could represent a serious risk to personnel, animals and equipment.

For further information, consult the manual. All work relating to transportation, installation, commissioning and maintenance must be performed by experienced, qualified personnel (see IEC 364 or CENELEC HD 384, or DIN VDE 0100 and national specifications for installation and accident prevention). In these basic safety instructions, qualified personnel means persons competent to install, mount, commission and operate the product and possessing the relevant qualifications.

2 - Use
Variable speed drives are components designed for integration in installations or electrical machines. When integrated in a machine, commissioning must not take place until it has been verified that the machine conforms with directive 97/37/EEC (Machinery Directive). It is also necessary to comply with standard EN 60204-1, which stipulates in particular that electrical actuators (which include variable speed drives) cannot be considered as circuit-breaking devices and certainly not as isolating switches.

Commissioning can take place only if the requirements of the Electromagnetic Compatibility Directive (89/336/EEC, modified by 92/31/EEC) are met. The variable speed drives meet the requirements of the Low Voltage Directive 73/23/EEC, modified by 93/68/EEC. The harmonised standards of the DIN VDE 0160 series in connection with standard VDE 0660, part 500 and EN 60146/VDE 0558 are also applicable.

The technical characteristics and instructions concerning the connection conditions specified on the nameplate and in the documentation provided must be observed without fail.

3 - Transportation, storage
All instructions concerning transportation, storage and correct handling must be observed. The climatic conditions specified in the technical manual must be observed.
4 - Installation
The installation and cooling of equipment must comply with the specifications in the manual supplied with the product. The variable speed drives must be protected against any excessive stress. In particular, there must be no damage to parts and/or modification of the clearance between components during transportation and handling. Avoid touching the electronic components and contact parts. The variable speed drives contain parts which are sensitive to electrostatic stresses and may be easily damaged if handled incorrectly. Electrical components must not be damage or mechanically destructed (risks for health!).

5 - Electrical connection
When work is performed on variable speed drives which are powered up, the national accident prevention regulations must be observed. The electrical installation must comply with the relevant specifications (for example conductor cross-sections, protection via fuse circuit-breaker, connection of protective conductor). More detailed information are given in the manual. Instructions for an installation which meets the requirements for electromagnetic compatibility, such as screening, earthing, presence of filters and correct insertion of cables and conductors, are given in the documentation supplied with the variable speed drives.

These instructions must be followed in all cases, even if the variable speed drive carries the CE mark. Adherence to the limits given in the EMC legislation is the responsibility of the manufacturer of the installation or the machine.

6 - Operation
Installations in which variable speed drives are to be integrated must be fitted with additional protection and monitoring devices as laid down in the current relevant safety regulations, such as the law on technical equipment, accident prevention regulations, etc. Modifications to the variable speed drives using control software are permitted. Active parts of the device and the live power connections must not be touched immediately after the variable speed drive is powered down, as the capacitors may still be charged. In view of this, the warnings fixed to the variable speed drives must be observed. During operation, all doors and protective covers must be kept closed.

7 - Servicing and maintenance
Refer to the manufacturer’s documentation.

This manual is to be given to the end user.
This manual describes the commissioning of VE/B digital technology variable speed drives. It gives details of all the procedures to be carried out during intervention on the drive and presents the various extensions available.

* See possible options depending on the VE/B version (section 7).
# VE/B

**Single-phase variable speed drive for d.c. motor**

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1 - GENERAL INFORMATION

1.1 - Operating principle

1.1.1 - General operating principle

The VE/B variable speed drive is designed to control D.C. motors with permanent magnets for the MFA range - 3000 rpm and separate excitation for the MS range - 3000 rpm. It is powered with a single-phase 230 V A.C. voltage. The VE/B controls a thyristor-based rectifier bridge to regulate the motor speed, irrespective of the load and the mains supply. These drives are protected against overvoltages by resistor-capacitor circuits and peak limiters, and against overcurrents by current limiting. Demagnetisation of the motor magnets is therefore avoided on starting or in case of overloads. They are unidirectional drives with the option of managing a tachogenerator feedback. When combined with D.C. motors, they constitute high-performance variable speed drives.

1.1.2 - Synoptic view

1.1.3 - Product designation

Example: VE/B 37 IP20: VE/B drive, for 370 W motor, IP20 index of protection.
1.2 - Electrical characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-phase power mains voltage</td>
<td>230 V ± 15%</td>
</tr>
<tr>
<td>Mains frequency</td>
<td>50/60 Hz ± 2%</td>
</tr>
<tr>
<td>Maximum excitation voltage</td>
<td>100 V or 190 V</td>
</tr>
<tr>
<td>Armature voltage</td>
<td>0 to 180V</td>
</tr>
<tr>
<td>Drive rating</td>
<td>4 6 7 12 18 25 37</td>
</tr>
<tr>
<td>Continuous line current</td>
<td>1.1 1 1.1 2 2.4 3.5 4.3</td>
</tr>
<tr>
<td>Continuous armature current</td>
<td>0.65 0.55 0.75 1.2 1.5 2.1 2.9</td>
</tr>
<tr>
<td>Motor power</td>
<td>36 60 75 120 180 250 370</td>
</tr>
<tr>
<td>Max. excitation current</td>
<td>0.2 A at 190 V or 0.4 A at 100 V</td>
</tr>
</tbody>
</table>

Note: The VE/A 4 drive is designed only to power a motor with separate excitation, type MS 36-35 - 110/100 V - 4000 min⁻¹ - 36 W.

1.3 - Characteristics and main functions

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>• Armature: mixed bridge (diodes - thyristors)</td>
</tr>
<tr>
<td></td>
<td>• Excitation: half or full wave depending on the wiring</td>
</tr>
<tr>
<td>Insulation</td>
<td>• No insulation: 0 V common with the armature</td>
</tr>
<tr>
<td>Regulation</td>
<td>• Of armature voltage as standard</td>
</tr>
<tr>
<td></td>
<td>• Of speed with optional tachogenerator</td>
</tr>
<tr>
<td>Reference</td>
<td>• By 5 kΩ potentiometer (supplied)</td>
</tr>
<tr>
<td></td>
<td>• Single-pole 0 to +10 V (max. source resistance: 10 kΩ)</td>
</tr>
<tr>
<td>Ramps</td>
<td>• Separate acceleration-deceleration</td>
</tr>
<tr>
<td>Current limiting</td>
<td>• 150% of the rated current (factory setting)</td>
</tr>
<tr>
<td>Settings</td>
<td>• Minimum speed 0 to 30% of the rated speed</td>
</tr>
<tr>
<td></td>
<td>• Maximum speed 50 to 110% of the rated speed</td>
</tr>
<tr>
<td></td>
<td>• Acceleration ramp 0.5 s to 10 s</td>
</tr>
<tr>
<td></td>
<td>• Deceleration ramp 2 s to 10 s</td>
</tr>
<tr>
<td></td>
<td>• IR compensation</td>
</tr>
</tbody>
</table>

Indications

<table>
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<th>Indications</th>
<th>Value</th>
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<tr>
<td>By LED</td>
<td>• Current limiting indication (CL red LED)</td>
</tr>
<tr>
<td></td>
<td>• Voltage presence indication (PWR ON green LED)</td>
</tr>
<tr>
<td>By ON/OFF switch LED (IP 40)</td>
<td>• Voltage presence indication</td>
</tr>
</tbody>
</table>
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**Performance**

<table>
<thead>
<tr>
<th>Performance</th>
<th></th>
</tr>
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<tbody>
<tr>
<td>Speed range</td>
<td>1 to 50*</td>
</tr>
<tr>
<td>Stability (mains variation ± 10%)</td>
<td>0.5% of the rated speed*</td>
</tr>
<tr>
<td>Load stability (0 to 100%)</td>
<td>1% of the rated speed*</td>
</tr>
<tr>
<td>Linearity</td>
<td>2% of the rated speed</td>
</tr>
</tbody>
</table>

**Options**

<table>
<thead>
<tr>
<th>Options</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>RFI filter</td>
<td>Reference FLT VE Class B</td>
</tr>
<tr>
<td>Galvanic isolation</td>
<td>VE galvanic isolation module (IP00 only)</td>
</tr>
<tr>
<td>Terminal block/fuses</td>
<td>Terminal block/fuse card (IP00 only)</td>
</tr>
<tr>
<td>DIN rail</td>
<td>DIN rail mounting kit (IP20 and IP00)</td>
</tr>
<tr>
<td>Ferrite core filter</td>
<td>Ferrite core filter for motor wires</td>
</tr>
<tr>
<td>Potentiometer/Switch</td>
<td>4.7 kΩ potentiometer + switch kit</td>
</tr>
</tbody>
</table>

* Only for motors in the MFA range (permanent magnets) after optimising the IR setting.

### 1.4 - Environmental characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>VE/B</th>
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<tbody>
<tr>
<td>Index of protection</td>
<td>IP40 (with PE) or IP20*</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>0°C to +45°C with 5 to 85% humidity</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-20°C to +55°C with 5 to 95% humidity</td>
</tr>
<tr>
<td>Transport temperature</td>
<td>-25°C to +70°C with 95% maximum humidity</td>
</tr>
<tr>
<td>Altitude</td>
<td>Less than 1000 metres. Derate the current by 0.5% per additional 100 m.</td>
</tr>
<tr>
<td>Non-condensing relative humidity</td>
<td>Conforming to IEC 68-2-3 and IEC 68-2-30</td>
</tr>
<tr>
<td>Shocks</td>
<td>Conforming to IEC 27/02/1968</td>
</tr>
<tr>
<td>Vibration</td>
<td>Conforming to IEC 06/02/1968</td>
</tr>
<tr>
<td>Conformity with standards</td>
<td>Immunity: EN50082-2 and EN61800-3</td>
</tr>
<tr>
<td></td>
<td>Radiated conducted emissions: conforming to EN 50081-1 and EN 61800-3 with FLT VE Class B RFI filter (refer to § 3.7)</td>
</tr>
<tr>
<td></td>
<td>UL: UL approved for USA and Canada</td>
</tr>
</tbody>
</table>

* IP00 index of protection: please consult LEROY-SOMER.
VE/B
Single-phase variable speed drive for d.c. motor

1.5 - Weight and dimensions
1.5.1 - Enclosure - IP 40 version

Dimensions in mm

Weight: 0.5 kg
Note: The outer part of the cable glands measures approx. 20 mm.

1.5.2 - Mounting plate - IP 20 version

Dimensions in mm

Weight: 0.28 kg
2 - MECHANICAL INSTALLATION

- It is the responsibility of the owner or user to ensure that the installation, operation and maintenance of the drive and its options comply with legislation relating to the safety of equipment and personnel and with the current regulations of the country of use.
- Personnel should be qualified and competent in defining the degree of protection required and any environmental restrictions.
- VE/B drive must be installed in an environment free from conducting dust, corrosive fumes, gases and fluids, and condensation (for example class 2 according to UL 840 and IEC 664.1). The drive must not be installed in hazardous areas unless it is in an appropriate enclosure. In this case the installation must be approved.
- In atmospheres where condensation may form, install a heating system which operates when the drive is not in use and is switched off when the drive is in use. It is advisable to control the heating system automatically.
- The VE/B casing is not fireproof. If necessary, use a flameproof cabinet.

2.1 - Checks on receipt

Before installing the drive, check that:
- The drive has not been damaged during transport.
- The nameplate corresponds to the mains supply and the motor.
- The potentiometer, its insulated plastic disk (except for the IP40 version) and the adjustment screwdriver have all been supplied with the drive (in plastic wallet).
- Both cable glands have been supplied for the IP40 version.

2.2 - Installation recommendations

- Fix the drive in a vertical position.
- Do not place the drive above a heat source or another drive.
- Maintain the following spaces around the drive:

2.2.1 - Recommendations for IP20 and IP00 versions

- To ensure that heat is dissipated to the outside adequately, fix side A or side B to one of the outward-facing enclosure vertical walls (see section 2.3.2).
- With the IP20 version, VE/B drives can be placed in an unregulated area, provided that they are not easily accessible (as understood by standard 60204-1).
- With the IP00 version, VE/B drives must always be installed in an enclosure to protect the user against electric shocks. It is important to prevent access by unauthorised personnel (standard 60204-1).

2.2.2 - Recommendation for IP40 version

- To ensure IP40 index of protection, don’t forget to tighten both the cable glands supplied (size 26 key).
2.3 - Mounting

2.3.1 - IP 40 enclosure
The IP40 VE/B is fixed with two M4 screws (button-type holes).

2.3.2 - IP 20 and IP 00 mounting plates
IP20 and IP00 VE/B drives are fixed with four or two M4 screws depending on the mounting position, A or B.

- Side A: Four M4 screws
- Side B: Two M4 screws

2.4 - Installation in cabinet
When installing the drive in a cabinet, special precautions should be taken regarding to the size of the enclosure. It is essential to check that the heat dissipation is adequate. The temperature in the cabinet should not exceed +45°C.
Ideally, the drive should be mounted in the bottom half of the cabinet.

a - Table of losses at rated load

<table>
<thead>
<tr>
<th>Type</th>
<th>VE/B 4 to VE/B 37</th>
</tr>
</thead>
<tbody>
<tr>
<td>Losses (W)</td>
<td>10</td>
</tr>
</tbody>
</table>

b - Installation in a non-ventilated cabinet
The minimum surface area for the required heat exchange is calculated using the following formula:

\[ S = \frac{P_i}{k(T_j - T_{amb})} \]

where:

- \( P_i \) = losses from all heat-producing elements (W)
- \( T_j \) = maximum ambient operating temperature (°C): 45°C
- \( T_{amb} \) = maximum external ambient temperature (°C)
- \( k \) = heat transmission coefficient
- \( S \) = minimum exchange surface area (excluding parts against a wall, for example) (m²)

Table of k factors

<table>
<thead>
<tr>
<th>Materials</th>
<th>k factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 mm pressed steel</td>
<td>5.5</td>
</tr>
</tbody>
</table>
c - Installation in a ventilated cabinet
If a forced ventilation unit (FV) can be used, the size of the cabinet can be reduced. Leave a minimum space of 100 mm around the inverter.
The FV flow rate in m³/h is calculated using the following formula:

\[ V = \frac{P_i}{T_j - T_{amb}} \]

2.5 - Potentiometer installation
• A 5 kΩ reference potentiometer is supplied with the IP20 and IP00 mounting plates. It is designed to be mounted on the user's electrical protection enclosure (front of the cabinet).
  • It is essential to isolate the potentiometer from its mounting surface, using the plastic disk supplied.
3 - CONNECTIONS

- All connection work must be performed in accordance with the laws in force in the country in which the drive is installed. This includes earthing to ensure that no directly accessible part of the drive can be at the mains voltage or any other voltage which may be dangerous.

- The voltages on the cables or connections of the mains supply, the motor, the filter and the controls may cause fatal electric shocks. Contact must be avoided in all circumstances.

- The drive must be supplied via a circuit-breaking device so that it can be powered down safely.

- The drive power supply must be protected against overloads and short-circuits.

- The drive stop function does not protect against high voltages on the terminal blocks.

- Check that the voltage and current of the drive, the motor and the mains supply are compatible.

- As the 0 V of the electronic circuit is the same voltage as the mains, avoid all contact with the drive 0 V when powered up. It is vital to protect the user against direct contact with the control signals or to use insulated equipment.

3.1 - Access to the terminal blocks

- The drive terminal blocks should only be accessed with the drive powered down.

3.1.1 - Access with the IP40

Unscrew the 4 crosshead screws (6-32 x 7/32 no. 1 Phillips recessed) to open the cover. To maintain the IP40 index of protection, both the cable glands supplied must be tightened (size 26 key).

Tightening torque to retighten the cover: 0.7 Nm.
3.1.2 - Access with the IP20
The "fast-on" connectors are accessed directly via the specially designed holes in the IP20 plastic cover. To access connectors which are not used in standard applications (example: tachogenerator feedback), simply knock out the pre-cut pieces in the cover. To access jumper J2 (tachogenerator feedback), simply undo the 2 cover screws (6-32 x 0.25), and don't forget to replace them at the end (tightening torque 0.7 Nm).

3.2 - Terminal block layout
3.2.1 - IP20 and IP00 terminals

The earth terminal is located on the casing, between the cable glands.
# 3.3 - Description of the terminal blocks

<table>
<thead>
<tr>
<th>Label</th>
<th>Functions</th>
<th>Characteristics</th>
<th>IP40 terminals</th>
<th>IP20/IP00 terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td>L 1</td>
<td>Drive single-phase power supply (L1 = phase/ L2 = neutral)</td>
<td>230 V ±15%, 50-60 Hz ±2%</td>
<td>- Screw terminal block - 3 mm flat screwdriver</td>
<td>- 6.35 x 0.81 mm</td>
</tr>
<tr>
<td>L 2</td>
<td>- Mains earth connection - Motor earth connection (1 or 2 screws depending on the model)</td>
<td>- 4 mm ring terminal - 8 mm spanner (nut)</td>
<td>- 4 mm ring terminal - No. 1 Philips recessed screwdriver or 5 mm flat screwdriver</td>
<td>- 6.35 x 0.81 mm</td>
</tr>
</tbody>
</table>

| A +   | Motor armature + | - Voltage rectified by thyristor - Usually set at 180 V with a form factor of 1.6 at rated load | - Screw terminal block - 3 mm flat screwdriver | - 6.35 x 0.81 mm |

| A -   | Motor armature - | - Not isolated from the mains |

| F +   | Field excitation + | - 190 V or 100 V field coil or brake (see section 3.4.3 and section 3.4.4) | - Fast-on connector 6.35 x 0.81 mm | - 6.35 x 0.81 mm |

| F -   | Field excitation - (common Ø V) | - 190 V field coil or brake (see section 3.4.3 and section 3.4.4) - Not isolated from the mains (common with P1 and I2) | - Fast-on connector 6.35 x 0.81 mm | - Fast-on connector 6.35 x 0.81 mm |

| P 1   | Common Ø V | - Reference potentiometer mass - Not isolated from the mains (common with F- and I2) : do not earth ground P1. |

| P 2   | Speed reference input | - 5 KΩ reference potentiometer midpoint or + of isolated external reference 0-10 V (source impedance ≤ 10 kΩ) - 0 V = MIN reference - ≥ 10 V = MAX reference (voltage varying with MAX) - Not isolated from the mains : do not earth ground P1. | - Fast-on connector 6.35 x 0.81 mm | - Factory-wired |

| P 3   | Reference potentiometer power supply | - For 4.7 kΩ or 5 kΩ potentiometer only - Voltage depending on the MAX setting (around 10 V) - Not isolated from the mains : do not earth ground P1. |

| B     | Tachogenerator feedback + 20 or 50 V/1000 min⁻¹ | - Referenced at F-, I2, P1 - Not isolated from the mains - See section 3.5.4 - Resistor to be replaced with a dot of weld in the case of 20V/1000 min⁻¹ | - Fast-on connector 2.86 x 0.81 mm | - Fast-on connector 2.86 x 0.81 mm |

| T     | Tachogenerator feedback + 7V/1000 min⁻¹ | - Referenced at F-, I2, P1 - Not isolated from the mains - See section 3.5.4 |

| I1    | Locking input | - Locking (stops the motor) if linked to I2 - Not isolated from the mains |

| I2    | Common Ø V | - Common with F- and P1 - Not isolated from the mains |
3.4 - Connection of the power

3.4.1 - Mains connection for IP40 VE/B drives

- The IP40 VE/B is equipped with an internal fuse F2 connected to terminal L1. The mains phase should be connected to this terminal L1 and the supply neutral to terminal L2.

- With a phase-to-phase power supply, an external fuse must be added on phase L2 (see section 3.6).

- Tighten the wires on the screw terminal block with a 3 mm flat screwdriver.

- Do not forget to connect the earth with a 4 mm diameter ring terminal with the 8 mm nut provided for this purpose (recommended torque: 1.6 Nm).

3.4.2 - Mains connection for IP20 and IP00 VE/B drives

Connect the single-phase A.C. power supply to L1 and L2, using 6.35 mm x 0.81 mm "fast-on" connectors. Example: ref. AMP 520184-2 or 350820-2.

- It is essential to use the specified insulated connectors.

Fit 6 A fuses (see section 3.6) on the power supply and connect the drive in accordance with the applicable standards (no fuse on the neutral).

Don't forget to connect the earth with a 4 mm diameter ring terminal using the screw provided for this purpose (recommended torque: 1.6 Nm).

Don't forget the washers under the screw head.
3.4.3 - Motor connection

- Never connect a circuit such as a capacitor bank between the drive output and the motor.
- Never connect the A.C. supply on the drive A+, A-, F+, F- terminals.
- Never insert a contactor between the drive and the motor. If it is necessary to change the direction of rotation, use a 4-quadrant VE/RG variable speed drive.
- In the IP40 version, A+ and A- are connected on the screw terminal block with a 3 mm flat screwdriver.
- F+ and F-, and also A+ and A- in the IP20/IP00 version, are connected using 6.35 mm x 0.81 mm "fast-on" connectors.

- It is essential to use the specified insulated connectors.

**Note:** The IP40 version has a fuse (F1) in series with the armature (see section 3.6).

3.4.3.1 - Motor with permanent magnet

- Power can only be supplied to a brake for motors with permanent magnets.
- Check that the brake used is compatible with the maximum current that the drive can provide on terminals F1, F2 (maximum excitation current).

3.4.3.2 - Motor with separate excitation, 190 V field coil

3.4.3.3 - Motor with separate excitation, 100 V field coil

3.4.4 - Brake connection

- The VE/B can supply a brake instead of the separate excitation.
- Connection is as outlined in section 3.4.3.2 for a 190 V brake and section 3.4.3.3 for a 100 V brake.
- Power can only be supplied to a brake for motors with permanent magnets.
- Check that the brake used is compatible with the maximum current that the drive can provide on terminals F1, F2 (maximum excitation current).
3.5 - Connection of the control

- As the 0 V of the control circuit is at the same voltage as the mains, avoid all contact with the control wires when powered up.
- The drive control inputs are not galvanically isolated from the power (unless the optional galvanic isolation module is being used). It is essential to use insulated contacts to control them (via a PLC).
- If the inverter is connected to a PLC, ensure that the logic levels (positive logic/negative logic) are compatible in order to avoid the inverter starting on power-up.

3.5.1 - Speed reference by potentiometer

In the IP40 version, the potentiometer is already wired and attached to the cover.
In the IP20/IP00 version, the potentiometer provided must be wired using 6.35 mm x 0.81 mm "fast-on" connectors.

- Take care to place the insulated disk provided accurately between the potentiometer and the mounting surface.
- It is essential to use the specified insulated connectors.

3.5.2 - Speed reference by external voltage

- The drive control input is not isolated from the mains, control by an external voltage must be isolated from the mains and earth.

Note: - The reference voltage required to obtain the maximum speed depends on the motor and the MAX setting (voltage around 10 V for an MFA 63 L 0.37 kW).
- If the reference signal is not isolated, the VE galvanic isolation option must be used (see section 7.2). It also allows the input signal to be formatted (0-5 V or 4-20 mA for example).

3.5.3 - Locking input

The locking input can be used to send on/off commands without cutting the VE/B power supply. Its use is recommended for frequent starts (120/hr max).
The reaction time is reduced, and deceleration is quick (irrespective of the DECEL setting).
- volt-free contact between I1 and I2: motor stops
- open contact between I1 and I2: motor rotates (acceleration according to ACCEL).
The contact must switch a few mA at 10 V.
It is connected via 2.86 x 0.81 mm "fast-on" connectors.
Example: ref. AMP 2-0520084-2
It is essential to use the specified insulated connectors.

The drive control input is not isolated from the mains. The contact control must be isolated from the mains and the earth.

If the inverter is connected to a PLC, ensure that the logic levels (positive logic/negative logic) are compatible in order to avoid the inverter starting on power-up.

- 1 tachogenerator feedback: rectified D.C. or A.C. tacho: 50 V/1000 min⁻¹
  The «IR» trimpot must be at 0 with a tachogenerator feedback.

- The drive is supplied for use without a tachometer, and the user needs to perform the following operations.
- Inputs T, B, I₂ are not isolated from the mains voltage: The tachometric signal must be isolated from the mains and the earth.
- It is connected via 2.86 x 0.81 mm "fast-on" connectors.

Note: If the I₂ connector is already being used, the F- connector can replace it.

It is essential to use the specified insulated connectors.

3.5.4.1 - Example for the 50V/1000 min⁻¹ tachogenerator feedback
- Disconnect the 180 V (jumper J2)

3.5.4 - Tachogenerator feedback

The VE/B drive performance is good enough to provide adequate speed regulation for the great majority of applications.

Where applications require stability at low speeds below 1% of the max. speed or a minimum difference between the speed of rotation with a cold motor and a warm motor, closed loop regulation with tachogenerator feedback may prove necessary. VE/B drives have three options for integrated tachogenerator feedback:

- 1 feedback for tacho: 7 V/1000 min⁻¹
- 1 tachogenerator feedback: rectified D.C. or A.C. tacho: 20 V/1000 min⁻¹
VE/B
Single-phase variable speed drive for d.c. motor

3.5.4.2 - Example of feedback for 7 V/1000 min⁻¹ tacho
- Disconnect the 180 V (jumper J2)

3.5.4.3 - Example of the 20 V/1000 min⁻¹ tachogenerator feedback
- Disconnect the 180 V (jumper J2)
- Unsolder the CMS 22 kΩ resistor (223) near terminal B, and replace it with a dot of weld.

3.6 - Description of cables and protection devices

- It is the responsibility of the user to connect and provide protection for the VE/B in accordance with current legislation and regulations in the country of use. This is particularly important as regards the size of the cables, the type and size of fuses, the earth or ground connection, powering down, acknowledging faults, insulation and protection against overcurrents.

- These tables are given for information only, within the scope of the LVD, and must under no circumstances be used in place of the current standards.

<table>
<thead>
<tr>
<th>VE/B</th>
<th>Cable cross-section (mm²)</th>
<th>Mains fuses F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mains</td>
<td>Armat</td>
</tr>
<tr>
<td>4 to 37</td>
<td>1.5</td>
<td>1.5</td>
</tr>
</tbody>
</table>

AWG wire gauge: AWG16
The recommended cross-sections are for electrical cabinet wires and do not take account of line drops due to the length.

Note: - The fuse rating given in the table is suitable for fuses (Fr) external to the drive and internal fuses F1 and F2 on the IP40 version.
- The mains current value is a typical value which depends on the source impedance. The higher the impedance, the lower the current.
- Only replace a defective fuse with a fuse conforming to that specified.
3.6.1 - Control cables
These should be multicore copper with insulation of 600 V for A.C. voltages and 1000 V for D.C. voltages. The temperature withstand for the cables should be at least 105°C. They should be the same diameter as the mains wiring. The conductors should be protected by a casing or a conduit. They should not exceed a length of 3 m (otherwise please contact LEROY-SOMER).

3.6.2 - Power cables
These should be multicore copper type with insulation of 600 V for A.C. voltages and 1000 V for D.C. voltages. The temperature withstand for the cables used should be at least 105°C.

3.6.3 - Fuses
The mains cables should be protected by external fuses : F_r
The neutral wire, if present, must not contain a fuse.
The IP40 version and the terminal block/fuse option card have an internal fuse F2 (LINE FUSE) connected to the mains phase (see section 3.4.1), and a fuse F1 (ARM FUSE) connected in series with the motor. All these fuses must be the same type: 6 A/250 V quick-blow ceramic (reference LITTELFUSE: 314006 UL). The internal fuses on the IP40 version are 6.3 x 32 mm format.

3.7 - Electrical and electromagnetic phenomena

3.7.1 - General
The power structure of variable speed drives leads to the occurrence of two types of phenomenon:
- low frequency harmonic feedback on the mains power supply
- emission of radio frequency signals (RFI)
These are independent phenomena. They have different consequences on the electrical environment.

3.7.2 - Low-frequency harmonics
3.7.2.1 - General
The rectifier, at the head of the variable speed drive, generates a non-sinusoidal A.C. line current. This current carries harmonics. Their amplitudes depend on the impedance of the mains supply upstream of the rectifier bridge, and on the structure of the D.C. motor. The more inductive the mains supply and the motor are, the more these harmonics are reduced. They are only significant for high loads on the variable speed drive, if these loads represent more than a quarter of the total load on a site. They have virtually no effect on the electrical energy consumption level. The temperature rises associated with these harmonics in transformers and motors directly connected to the mains supply are negligible. It is very rare for these low-frequency harmonics to cause interference on sensitive equipment.
3.7.2.2 - Reduction of the level of harmonics feed back to the mains supply
In the rare situations where the characteristics of the mains and the total load on the drive prevent compliance with the levels of harmonics recommended by the energy distribution company, LEROY-SOMER will offer every assistance to the installer with calculating an additional mains choke or a harmonic filter.

3.7.3 - Radio frequency interference:
Immunity
3.7.3.1 - General
The immunity level of a device is defined by its ability to operate in an environment which is polluted by external elements or by its electrical connections.

3.7.3.2 - Standards
Each device must undergo a series of standard tests (European standards) and meet a minimum requirement in order to be declared as compliant with the generic industrial (EN 50082-2) and domestic (EN 50082-1) standards.

3.7.3.3 - Recommendations
An installation consisting exclusively of devices which comply with the standards concerning immunity is very unlikely to be subject to a risk of interference.

3.7.4 - Radio frequency interference:
Emission
3.7.4.1 - General
Variable speed drives use high-speed switches (thyristors) which switch high voltages. As a result, they generate radio frequency signals which may disturb operation of other equipment or distort measurements taken by sensors:
- due to high frequency leakage currents which escape to earth via the stray capacity of the drive/motor cable and that of the motor via the metal structures which support the motor.
- by conduction or feedback of R.F. signals on the power supply cable: conducted emissions
- by direct radiation near to the mains supply power cable or the drive/motor cable: radiated emissions
These phenomena are of direct interest to the user.
The frequency range concerned (radio-frequencies) does not affect the energy distribution company.

3.7.4.2 - Standards
The maximum emission level is set by the generic industrial (EN 50081-2) and domestic (EN 50081-1) standards.
When equipped with its FLT VE Class B RFI filter (see section 7.1), the VE/B drive complies with the standards (see section 1.4).

![This filter is designed to be effective in a residential environment (Class B form). It is therefore equally suitable for an industrial environment.]

3.7.4.3 - Recommendations
- Experience has shown that the levels set by standards EN 50081-1 and 50081-2 do not necessarily need to be respected to eliminate interference phenomena.
- Following the basic precautions in the next paragraph generally results in correct operation of the installation.

---

3.7.2.2 - Reduction of the level of harmonics feed back to the mains supply
In the rare situations where the characteristics of the mains and the total load on the drive prevent compliance with the levels of harmonics recommended by the energy distribution company, LEROY-SOMER will offer every assistance to the installer with calculating an additional mains choke or a harmonic filter.

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- Experience has shown that the levels set by standards EN 50081-1 and 50081-2 do not necessarily need to be respected to eliminate interference phenomena.
- Following the basic precautions in the next paragraph generally results in correct operation of the installation.
3.7.5 - Basic precautions
These are to be taken at the design stage and also when wiring the cabinet and the external elements. In each paragraph, they are listed in decreasing order of effect on correct operation of the installation.

3.7.5.1 - Design
1) Choice of equipment
Give priority to components whose level of immunity conforms to the generic immunity standards EN 50082-1 and EN 50082-2, and mount them in a steel cabinet.
2) Location of the drive
Install the drive as close as possible to the motor to reduce the length of the cable.

3.7.5.2 - Installation of the drive and associated components in the cabinet
1) Screw the drive and the components on to a metal grid or a base plate which is unpainted or paint-free at the fixing points.
2) Fix the plate at several paint-free points at the back of the cabinet.

3.7.5.3 - Wiring inside the cabinet
1) Do not run the control cables and the power cables in the same cable conduit.
2) Use a twisted cable for the control cables.
3) Fit an RC filter to relays and contactors which are near the drive or are electrically connected to the drive.

3.7.5.4 - Wiring outside the cabinet
1) Isolate the power cables from the control cables.
2) Connect the motor earth terminal directly to that of the drive.
3) Run the motor power supply cables and the auxiliary cable, which links the motor earth to that of the drive, in a metal cable duct. This cable duct should be mechanically connected to the cabinet and the metal structure supporting the motor. Fix the conductors securely at the end of the conduit.
4) Do not route the control cables (drive and feedback) along metal structures which may be shared by the motor support.
5) Isolate sensitive elements (thermal protectors, sensors, etc) from metal structures which may be linked to the motor support.

3.7.5.5 - Importance of ground wiring
The immunity and radio frequency emission level are directly linked to the quality of the ground connections. Metal grounds should be mechanically connected to each other with the largest possible electrical contact area. Under no circumstances can the earth grounds, which are designed to protect personnel by linking metal grounds to earth via a cable, serve as a substitute for the ground connections.

3.7.6 - Additional precautions
Following the basic precautions in the previous paragraphs generally results in correct operation of the installation. However, it may be necessary to take additional measures:

- Use of the ferrite core filter option on the motor output (see section 7.5).
- Use of a shielded motor cable
Use a 2-phase + earth shielded or armoured cable with low stray capacity between the cables and the shielding or sheathing.
Connecting the shielding
Connect the shielding at both ends: to the earth terminal on both the motor and the drive (or to the fieldbus at the filter output).
- Strip back the cable covering and attach the shielding to the cabinet grille or base plate using a stainless steel clamp.
- If possible, connect the shielding to the cabinet ground at the cable exit point, using brass cable glands for example, and stripping back the cable covering.
- In addition, the installation may require the use of a shielded cable between the controls and the drive:
  . Cable characteristics: use cable with a tight copper shielding mesh.
  . Connect the shielding to earth at one end only (drive end).

Do not under any circumstances connect the shielding to one of the control inputs.

Tip to ensure shielding continuity
- When the motor is connected via an intermediate terminal box in the cabinet, connect the shielding using a terminal which is not isolated from the grille or base plate. If the terminal block is located more than 300 mm from the edge of the grid, attach the shielding using a metal clamp.
- When a switching device is used close to the motor, use a grounding strip (maximum length 100 mm) to provide continuity.

Use of interference suppression chokes to reduce emissions caused by the D.C. motor, place appropriate chokes as close as possible to the motor armature.

<table>
<thead>
<tr>
<th>Motor</th>
<th>Interference suppression elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.C. motor MFA 56S to MFA 63L</td>
<td>2 x 10 ( \mu )H choke</td>
</tr>
<tr>
<td>MS 5685 D.C. motor MS 63110 D.C.</td>
<td>2 x 5 ( \mu )H choke</td>
</tr>
<tr>
<td>MS 3635 D.C. motor</td>
<td>2 x 10 ( \mu )H choke</td>
</tr>
</tbody>
</table>

Note: To find out how to obtain motor interference suppression chokes, please consult Leroy-Somer.
3.8 - Wiring diagrams

3.8.1 - Basic diagram for motor with permanent magnets

**WARNING:** Terminals P1, I2 and F- are common and at the mains voltage.

**Note:**
- The contactor and relay coils are equipped with RCs.
- IP40 VE/B drives contain a switch on L1 and L2, and also a fuse (F2) in series with L1 and a fuse (F1) in series with A+.
3.8.2 - Basic diagram for motor - 190 V excitation

AU: Emergency stop button
SB1: Power off button
SB2: Power on button
Fu1: Remote control fuse
Fr: Drive mains fuses
QS: Fused isolator (Fr)
KM1: Power contactor
TG: Optional D.C. tachogenerator
M: Motor

WARNING: Terminals P1, I2 and F- are common and at the mains voltage.

Note: - The contactor and relay coils are equipped with RCs.
- IP40 VE/B drives contain a switch on L1 and L2,
  and also a fuse (F2) in series with L1 and a fuse (F1) in series with A+.
VE/B
Single-phase variable speed drive for d.c. motor

3.8.3 - Basic diagram for motor - 100 V excitation

WARNING: Terminals P1, I2 and F- are common and at the mains voltage.

Note: - The contactor and relay coils are equipped with RCs.
       - IP40 VE/B drives contain a switch on L1 and L2, and
         also a fuse (F2) in series with L1 and a fuse (F1) in series with A+.
4 - COMMISSIONING
4.1 - Layout of functions and settings
4.1.1 - IP20/IP00 layout

4.1.2 - IP40 layout
4.2 - Setting up and selection

- Any adjustment to the trimpots must be made with the cover closed (IP20), by passing a non-conducting screwdriver through the special holes. Otherwise (IP40 and IP00) adjustments should be made with the power off, after the PWR ON LED has gone out.

- Incorrect settings may have serious consequences. They should only be adjusted by appropriate qualified personnel.

Summary of settings

<table>
<thead>
<tr>
<th>Label</th>
<th>Function</th>
<th>Values</th>
<th>Factory settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCEL</td>
<td>Acceleration ramp</td>
<td>0.5 to 10 s</td>
<td>10 %</td>
</tr>
<tr>
<td>DECEL</td>
<td>Deceleration ramp</td>
<td>2 to 10 s</td>
<td>50 %</td>
</tr>
<tr>
<td>MAX</td>
<td>Maximum speed</td>
<td>50 to 110% of the rated speed</td>
<td>100 %</td>
</tr>
<tr>
<td>MIN</td>
<td>Minimum speed</td>
<td>0 to 50% of the rated speed</td>
<td>0 %</td>
</tr>
<tr>
<td>CL</td>
<td>Current limiting</td>
<td>50 to 200% of I rated</td>
<td>150 %</td>
</tr>
<tr>
<td>IR*</td>
<td>IR loss compensation</td>
<td>-</td>
<td>3% of rated speed</td>
</tr>
</tbody>
</table>

* This is preset on motors with permanent magnets (see section 4.3.5).

4.3 - Setup instructions

4.3.1 - Setting the acceleration and deceleration ramps: ACCEL/DECEL

The position of the ACCEL/DECEL potentiometers gives speed pick-up times which can be set between 0.5 and 10 seconds (2 to 10 sec. for deceleration).

- These times are dependent on the inertia and the resistive torque of the driven system.

4.3.2 - Maximum speed: MAX

This potentiometer can be used to limit the max. operating speed of the driven machine.

- Do not try to set the maximum speed above the motor rated speed as this may lead to instabilities in the speed. Resetting the maximum speed may affect the minimum speed: in this case re-enter the minimum speed setting.

4.3.3 - Minimum speed: MIN

This trimpot sets the minimum speed obtained when the reference is zero. The factory setting is zero (motor stopped).

- Resetting the minimum speed may affect the maximum speed. The maximum speed setting must be re-entered... then the minimum speed again so that the desired levels are obtained.
4.3.4 - Current limiting: CL
The current limiting circuit protects the motor or drive on starting but does not provide extended protection of the motor winding. The CL cermet is factory-set to approximately 1.5 times the rated motor current, and should not normally be touched. The red CL LED lights up to indicate switching to current limiting mode (decrease in the motor voltage). **This device does not provide thermal protection of the motor.**

4.3.5 - IR compensation: IR
This function is used to compensate for the IR voltage drop on the motor. The VE/B increases its output voltage at the same time as the current, thus avoiding the loss of speed relating to the load. The IR compensation is factory-preset to obtain good stability of around 3% of the rated speed on a motor with permanent magnets. If better performance is required, compensation must then be implemented as follows:

**Procedure**
1 - Set the IR potentiometer to 25% rotation, turn on the motor at no load at approximately 1/3 of its rated speed and measure the speed obtained.
2 - Without modifying any settings, turn on the motor under load and adjust the IR potentiometer until you achieve the same speed as in section 1.
3 - Eliminate the load and recheck the speed at no load. If the no-load speed has increased, or decreased, repeat the above procedure more precisely.

**Note:** IR compensation that has been set too high may cause instability in the drive which may result in bursts of motor speed. IR overcompensation is highlighted by the fact that the motor speed increases with the load (on-load speed > no-load speed).

4.3.6 - Example of a motor with wound field
The factory settings have been entered using a motor with permanent magnets. If you are using a motor with wound field, it is preferable to re-enter the minimum and maximum speed, current limiting and IR compensation settings.

**Note:** Precision of 1% on the IR compensation is difficult to achieve on motors with wound field.

4.4 - Commissioning the drive

- **Before powering up the drive,** check that the power connections are correct, and that any moving parts are mechanically protected.

- Use an insulated screwdriver to adjust the potentiometers.

- Users of the drive should take particular care to avoid starting it accidentally.
4.4.1 - Standard procedure

- **Checks:**
  - Check that the drive is wired according to the diagram in section 3.8.
  - Check that the settings have been entered as indicated in section 4.2.
  - Check that the reference is at zero (0 V or potentiometer fully anti-clockwise).
  - Check that the supply voltage is suitable for the drive.

- **Powering up the drive:**
  - Power up using SB2 (mains contactor control).
  - For IP40 drives, set the switch on the front panel to the ON position. The red LED then lights up.
  - Check that the PWR ON LED lights up green.

- **Run command:**
  - Open the locking contact between terminals I1 and I2 (if used).
  - Turn the reference potentiometer slightly.
  - The motor starts on its preset acceleration ramp.

- **Adjustment of the output speed:**
  - Adjust the speed using the reference potentiometer. Re-adjust the MIN and MAX settings, if necessary.

- **Stopping the motor:**
  - Give a stop command by changing the reference to 0 or closing the I1 I2 locking contact. The motor stops according to its deceleration ramp (or faster if I1 I2).

- **Powering down the drive:**
  - Power down the drive using SB1.

4.4.2 - Example of tachogenerator feedback (closed loop speed regulation)

In addition to the standard procedure, you should also:

- Check that jumper J2 (180 V) is indeed open circuit.
- Check that the wiring corresponds to the tachogenerator feedback voltage (see section 3.5.4).
- Set the IR setting to 0.
- Check the tachogenerator feedback polarity. The measurement must be positive (with the - on terminal I2) in the direction of rotation imposed by the motor. Otherwise, regulation will not take place and the motor will turn at high speed irrespective of the reference.
5 - FAULTS - DIAGNOSTICS

5.1 - Display
- The power LED (PWR-ON) lights up (green) when the drive is supplied with power.
- The current limiting LED (CL) lights up (red) in the event of an overload (see section 4.3.4).
- On the IP40 version, the switch LED (red) lights up in the ON position when the drive is supplied with power.

5.2 - Diagnostics

<table>
<thead>
<tr>
<th>Symptom Description</th>
<th>Possible cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor not running. The PWR ON LED is off. The IP40 switch- LED is off.</td>
<td>- No power supplied to the drive.</td>
<td>- Check the mains voltage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- On the IP40 version, set the switch to ON.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Check the F1 and F2 mains fuses (on the IP40 version).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Check the wiring of the L1 L2 power supply wires</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(&quot;fast on&quot; connectors attached to the conductive part, not the insulation).</td>
</tr>
<tr>
<td>Motor not running. The PWR ON LED is on (green). The IP40 switch LED is on (red).</td>
<td>- Locking command.</td>
<td>- Open the contact between I1 and I2.</td>
</tr>
<tr>
<td></td>
<td>- Zero reference.</td>
<td>- Check the voltage between P1 and P2 by turning the potentiometer.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Check the reference wiring (&quot;fast on&quot; connectors attached to the conductive part, not the insulation).</td>
</tr>
<tr>
<td></td>
<td>- Motor fuse disconnected (IP40).</td>
<td>- Check the F1 motor fuse (IP40 version or terminal block/fuse card option).</td>
</tr>
<tr>
<td></td>
<td>- Motor not connected.</td>
<td>- Check the connections on the motor, whether the brushes are present and measure the resistance between the brushes which should be between 0 and 30 Ω depending on the motor.</td>
</tr>
<tr>
<td>The motor does not run but vibrates or turns over at low speed despite a high speed being displayed. or the speed drops significantly when the load is applied.</td>
<td>- Supply voltage too low.</td>
<td>- Check the mains voltage at the drive input.</td>
</tr>
<tr>
<td></td>
<td>- Motor and drive unit overloaded (OL red LED on).</td>
<td>- A motor-drive unit with a higher power rating is needed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Measure the output current.</td>
</tr>
<tr>
<td></td>
<td>- Drive rating does not correspond to the supplied motor.</td>
<td>- Check that the motor/drive are compatible.</td>
</tr>
<tr>
<td></td>
<td>- Connection error (armature and excitation swapped over).</td>
<td>- Redo the wiring (see section 3.2 and 3.3).</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Warning:</strong> This connection error may have damaged the motor and the drive.</td>
</tr>
<tr>
<td>The motor runs when the main potentiometer is at zero.</td>
<td>- Minimum speed setting incorrect.</td>
<td>- Re-adjust the MIN cermet to 0.</td>
</tr>
<tr>
<td></td>
<td>- IR compensation too high.</td>
<td>- Reduce the IR compensation by re-adjusting the IR cermet setting (see section 4.3.5).</td>
</tr>
</tbody>
</table>

Look for the cause, check the wiring, the mains voltage. If the fuse is burnt-out as a result of a connection error, the drive may be damaged.

**Note:** Drive malfunctions are often due to settings not being optimised.
6 - MAINTENANCE

6.1 - Introduction and warning

• All work relating to installation, commissioning and maintenance must be carried out by experienced, qualified personnel.
• When a fault detected by the drive causes it to switch off, fatal residual voltages remain at the output terminals and in the drive.
• Before carrying out any work, disconnect and lock the drive power supply and wait 5 minutes to make sure that the capacitors have discharged.
• During maintenance operations performed with the drive switched on, the operator must stand on an insulated surface which is not connected to earth.
• During work on a motor or its power supply cables, check that the power supply for the corresponding drive is disconnected and locked.
• All protective covers must remain in place during tests.

There are very few maintenance and repair operations on VE drives to be performed by the user. Regular servicing operations and simple methods for checking that the drive is operating correctly are described below.

6.2 - Maintenance care

For the drive, bear in mind that problems may occur on any electronic equipment following exposure to too high a temperature, humidity, oil, dust, or after penetration of any external matter.

From time to time, check that the power connections are correctly tightened and in particular check the quality of the earth connection.

Clean the installation vents from time to time. Printed circuits and their components do not normally require any maintenance. Contact your vendor or the nearest approved repair company in the event of a problem.

Do not dismantle the drive while it is still under warranty, as this would then immediately become null and void.

Do not touch the integrated circuits either with your fingers or with materials which are charged or live. Earth yourself, as well as the workbench or the soldering iron, when performing any work on the circuits.

Do not handle the integrated circuits on the base located on the control printed circuit (risk of damage).

6.3 - Voltage, current and power measurements

6.3.1 - Measuring the voltage at the drive output

The drive output voltage can be measured using ordinary instruments or digital equipment.

6.3.2 - Measuring the motor current

The current drawn by the motor and the drive input current can be measured approximately using a conventional moving coil ammeter.

6.3.3 - Measuring the inverter input and output power

The drive input and output power can be measured using an electrodynamic instrument.
6.4 - Drive power stage tests

6.4.1 - Preliminary remarks
The tests outlined below are designed to run a qualitative test of the state of the power stages. Use an ohmmeter placed on the 1 MΩ scale and take the measurements after powering down the drive. Each measurement should last at least 10 seconds in order to avoid false readings due to loads that might still be present in the drive circuits. If you have any doubts about the power stages, make a visual check of the state of the control modules which may also have been damaged.

6.4.2 - Test via the terminal block
This test is fairly basic. A positive response does not necessarily mean that the power stages are correct. However a negative response usually means that they are damaged.

<table>
<thead>
<tr>
<th>Ohmmeter position</th>
<th>Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>L2</td>
</tr>
<tr>
<td>L1</td>
<td>A+ – A-</td>
</tr>
<tr>
<td>L2</td>
<td>A+ – A-</td>
</tr>
<tr>
<td>A +</td>
<td>F+ – F-</td>
</tr>
<tr>
<td>A -</td>
<td>F+ – F-</td>
</tr>
</tbody>
</table>

6.5 - Drive insulation and voltage withstand tests

6.5.1 - Introduction
⚠️ The tests described below should be conducted with great care. If the power stages were to be destroyed by an error in handling or by failure to follow the instructions, the warranty would be invalidated.

6.5.2 - Drive insulation test
Short-circuit all the terminals in the power terminal block except the terminal (earth), as indicated in the diagram below. Use a megohmmeter to measure the resistance between these terminals and the earth. This resistance should be at least 5 MΩ.

⚠️ Do not perform an insulation or voltage withstand test on any terminals other than those indicated above.

6.5.3 - Drive voltage withstand test
Apply a D.C. voltage of 2100 V_DC for one minute (having increased it gradually) between the earth and the power terminal block short-circuited as described in the above diagrams. Check that nothing abnormal happens during the test.
• Never perform a voltage withstand test on any terminals other than those indicated above. Such an operation would damage the drive and would cause the warranty to be suspended. Reduce the voltage applied by 20% for each new test.

6.6 - Spare parts list
Protective fuse kit: please consult Leroy-Somer.

6.7 - Exchanging products
• Products must be returned in their original packaging or, if this is not possible, in antistatic packaging (to avoid damage to sensitive components) designed to prevent any damage to the unit during transport. Otherwise, replacement under warranty could be refused.
7 - OPERATING EXTENSIONS
Options can be added to the VE/B, as outlined in the table below:

<table>
<thead>
<tr>
<th>Option</th>
<th>IP40 VE/B</th>
<th>IP20 VE/B</th>
<th>IP00 VE/B</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLT VE Class B RFI filter</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>VE galvanic isolation module</td>
<td></td>
<td>X*</td>
<td></td>
</tr>
<tr>
<td>Terminal block/fuse card</td>
<td></td>
<td></td>
<td>X*</td>
</tr>
<tr>
<td>DIN rail mounting kit</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Ferrite core filter</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Potentiometer + switch kit</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

* Options cannot be combined

**Note:** The VE/A options (tachogenerator feedback, frequent starts, external reference and connection of brake motor) already exist as standard on the VE/B.

7.1 - FLT VE Class B RFI filter

7.1.1 - General
The FLT VE class B RFI filter is used to reduce electromagnetic emissions on VE/B and VE/RG drives.
To achieve the level of interference suppression set by standard EN 55011 Class B, certain constructional measures must be complied with (see section 3.7.5 and 3.7.6.).
The component type has been determined by a specially-equipped laboratory. However, due to specific environmental conditions that may apply on the installation site, in some cases it may be necessary to check the choice of components by measurements taken on site.

• This filter is designed to be effective in a residential environment (class B form). It is therefore equally suitable for an industrial environment.

7.1.2 - Characteristics
- Filter for VE/B 4 to VE/B 37 and VE/RG 6 to VE/RG 37
- Supply: 115/230 V - 50/60 Hz single-phase
- Maximum current: 24 mA
- Operating temperature: 0 - 50°C
- Earth leakage current at 250 V - 50 Hz: 4 mA
- Metal housing
- Index of protection: IP00
VE/B
Single-phase variable speed drive for d.c. motor

7.1.3 - Weight and dimensions

Dimensions in mm

Weight: 0.25 kg - Mounting: Two M4 screws

7.1.4 - Connection
• The FLT VE class B filter must be installed in an enclosure to protect the user against electric shocks. This is not necessary if sleeving tubes are used to maintain the electrical index of protection on the "fast-on" connectors.
  - The filter should be mounted as close as possible to the drive (30 cm max.)
  - The motor wires must not be longer than 30 cm.
  - The earth nut is tightened with a 7 mm spanner.
• Always use 6.35 mm x 0.81 mm insulated "fast-on" connectors for connection.

7.2 - Add-on VE galvanic isolation module (IP00)

The galvanic isolation module isolates the speed reference from the power part and hence from the mains.

It also enables use of 0-5 V, 0-10 V or 4-20 mA references, and in addition, use of a screw terminal to simplify connection.

7.2.1 - Mounting

The module is mounted on the IP00 VE/B, by inserting the 7 "fast-on" connectors.
  • If applicable, fitting the I1 wire (section 7.2.3), modification of the VE/B MIN and MAX trimpots settings or selection of the tachogenerator feedback (section 3.5.4) must be undertaken before installing the module.
  • With the IP00 version, the VE/B drives must always be installed in an enclosure to protect the user against electric shocks (standard 60204-1).
7.2.2 - Weight and dimensions

Weight: 0.15 kg  
(module only)

7.2.3 - Description of terminal block

The VE/B power terminals L1, L2, A+, A-, F+, F- (see section 3.3) are mounted remotely on the galvanic isolation module. They can be accessed on both the screw terminal block and on the 6.35 x 0.81 mm "fast-on" connectors.

Terminals I1, I2, T, B on the VE/B are not initially connected to the module. But one wire, fitted with 2 connectors, is provided to link one of these terminals to the module I1 connector and hence to the terminal block I1 input. **These signals are not isolated from the power and the mains.** Terminal F- can replace the I2 terminal.

Terminals P1, P2, P3 are replaced by the following terminals:

<table>
<thead>
<tr>
<th>Label</th>
<th>Functions</th>
<th>Characteristics</th>
<th>Terminal</th>
<th>Connector</th>
</tr>
</thead>
</table>
| COM   | Isolated Ø V reference | - Earth of reference or potentiometer  
- Isolated from the power part, the mains and the earth | Screw terminal block  
- 3 mm flat screwdriver | 6.35 x 0.81 mm "fast-on" connector |
| SIG   | Isolated speed reference input | - External reference + or potentiometer midpoint  
- 0-5 V or 0-10 V (or 4-20 mA with 270 Ω-1/2 w resistor)  
- Isolated from the power part, the mains and the earth | Screw terminal block  
- 3 mm flat screwdriver | 6.35 x 0.81 mm "fast-on" connector |
| +12   | Reference potentiometer power supply | - 10 mA max. output  
- Isolated from the power part, the mains and the earth | Screw terminal block  
- 3 mm flat screwdriver |  |
7.2.4 - Reference wiring

**Potentiometer reference**

- **5 K**
- Increase in the speed

**0-10 V voltage reference**

- **10 V**

**0-5 V voltage reference**

- **5 V**

**4-20 mA current reference**

- **4-20 mA**
- **270 Ω/1/2 W resistor**
7.2.5 - Setting up and selection
The module MAX and MIN trimpots are used to format the reference voltage. However, the VE/B MAX and MIN settings are still active. A jumper located near the +12 terminal is used to select the input voltage range (0-10 V or 0-5 V).
The modules are factory-set for use at 0-10 V. The jumper must be in the 10 V position to use the potentiometer. The jumper must be in the 5 V position for a 4-20 mA reference.
- Any adjustment to the jumper and the trimpots must be made with the power off, once the PWR ON LED has gone out.
- The insulated screwdriver provided is not suitable for this card.

7.3 - Add-on terminal block/fuse card (IP00)
The terminal block/fuse card is used to connect cables to a screw terminal block. It also has a "LINE FUSE" fuse on terminal L1 and an "ARM FUSE" fuse in series with the motor armature. These fuses are the same as F2 and F1 on the IP40 version (section 3.6.3).
- The card is mounted on the IP00 VE/B, by inserting the 9 "fast-on" connectors. This operation must be performed by the user with the power off.
- If applicable, fitting the I/T wire or selection of the tachogenerator feedback (section 3.5.4) must be undertaken before installing the card.
- With the IP00 version, the VE/B drives must always be installed in an enclosure to protect the user against electric shocks (standard 60204-1).
- Terminals I1, I2, T, B on the VE/B are not connected to the card. But one wire, fitted with 2 connectors, is provided to link one of these terminals to the card I/T connector. This signal then becomes accessible on the terminal block I/T input. Terminal F- can replace the I2 terminal.
- Any adjustment to the trimpots must be made with the power off, once the PWR ON LED has gone out.

Weight: 0.060 kg

Overall height with the card fitted: 47 mm
VE/B
Single-phase variable speed drive for d.c. motor

7.4 - DIN rail mounting kit
This kit is used to fix the drive on a DIN rail.
1 - Choose one of the 3 mounting positions
2 - Depending on the mounting, insert 1 or 2 clamps into the plastic plate
3 - Lock the clamps by rotating them by 90°
4 - Fix the plate to the drive using the 2 screws provided

Horizontal mounting

Vertical mounting

This kit is not suitable for the IP40 version.

Note: In the event of EMC problems, it may be necessary to use a grounding strip between the heatsink and the ground wiring.
7.5 - Ferrite core filter

The ferrite filter is used to reduce electromagnetic emissions on VE/A and VE/RG drives.

To achieve the level of interference suppression set by standard EN 55011 Class B, certain constructional measures must be complied with (see section 3.7.5 and 3.7.6) and especially use of the FLT VE Class B RFI filter (see section 7.1).

The component type has been determined by a specially-equipped laboratory. However, due to specific environmental conditions that may apply on the installation site, in some cases it may be necessary to check the choice of components by measurements taken on site.

⚠️ This ferrite is designed to be effective in a residential environment (class B form). It is therefore equally suitable for an industrial environment.

- Max. current: 18 A
- 30 dB attenuation from 10 MHz to 200 MHz
- Weight: 0.08 kg

The ferrite should be placed as near as possible to the drive output, using “fast-on” connectors. With the IP 40 version or when using the terminal block/fuse option card, cut the 2 male connectors and strip the wires in order to connect them on the terminal block.
7.6 - Potentiometer + switch kit

This kit consists of a 4.7 kΩ reference potentiometer and a run/stop switch for connection to the VE/B.

- Take care to place the insulated disk provided accurately between the potentiometer and the mounting surface.

- Always use insulated terminals for connection. The control signals are not galvanically isolated from the mains.
<table>
<thead>
<tr>
<th>LEROY-SOMER</th>
<th>INSTALLATION AND MAINTENANCE</th>
<th>3735 en - 05.2003 / a</th>
</tr>
</thead>
</table>

**VE/B**

Single-phase variable speed drive for d.c. motor