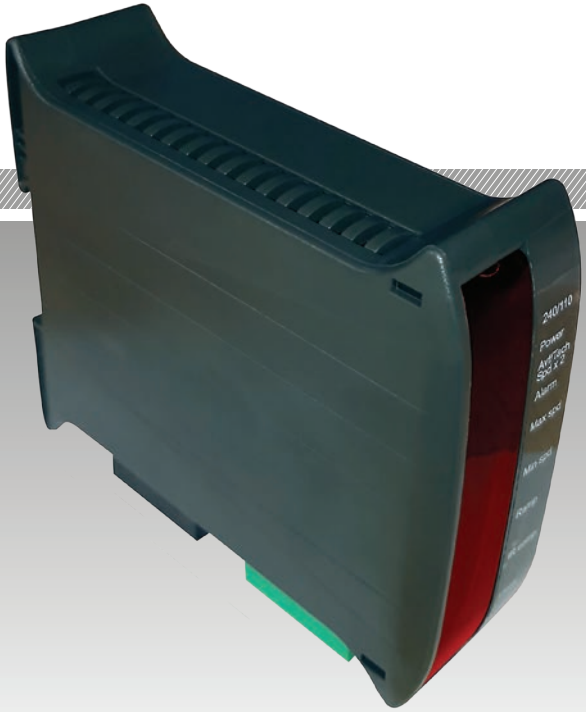
World Class Design | World Class Function | 30 Years Expertise in Industrial Motor Control

DC MOTOR DRIVE

340 / 680 / 1220



SPRINT ELECTRIC

Product Manual

HG105266EN00 Issue 1 (02/2021)

Please read this information before installing or using the product.

Install, use and maintain this product following the procedures provided.
The manual(s) cannot provide all details, variations and contingencies required for your installation, operation and maintenance of this product or the apparatus with this product installed. For further help or information, refer to your local Supplier sales office.

Application area

The equipment described is intended for industrial (non-consumer) motor speed control.

Intended users

To safely enable the user to obtain maximum benefit from the equipment:

- Ensure this information is available to all persons required to install, configure or service the described equipment or any other associated operation.
- Always store the manual in a conveniently accessible area for quick reference.
- Make it available for the next user/owner of the product.

This product is of the restricted sales distribution class according to IEC 61800-3 and has a "professional equipment" designation as defined in EN 61000-3-2.

Safety

Ensure all users and operators understand the included WARNINGS, CAUTIONS and NOTES, which alert the user to safety issues. COMPLY WITH WARNINGS AND CAUTIONS AT ALL TIMES. Each of these carries a special meaning and should be read carefully:



WARNING!

A WARNING is given when non-compliance with the warning may result in personal injury and/or equipment damage.



CAUTION!

A CAUTION is given when non-compliance with the caution may result in permanent equipment damage.

NOTE A note provides specific information to make important instructions clear.

Symbols

 **Attention**	 **Electrostatic Discharge (ESD)**	 **Electric Shock Hazard**
See the instructions for use. Specific warnings not found on the label.	This equipment contains ESD sensitive parts. Observe static control precautions when handling, installing and servicing this product.	Disconnect the mains supply before working on the unit. **Do not touch presets, switches and jumpers!** Always use the correct insulated adjustment tools.



WARNING!

Only qualified personnel must install, operate and maintain this equipment.
A qualified person is someone technically competent and familiar with all safety information, established safety practices, installation, operation, maintenance and the hazards involved with this equipment and any associated machinery.

Hazards

This equipment can endanger life through rotating machinery and high voltages.



WARNING!
PERSONAL INJURY AND/OR ELECTRICAL SHOCK HAZARD

- Always isolate all power supplies from the equipment before starting any work.
- Never perform high voltage resistance checks on the wiring without first disconnecting the product from the circuit under test.
- Use guarding and additional safety systems to prevent injury and electric shock.
- Metal parts may reach 90°C during operation.



CAUTION!
EQUIPMENT DAMAGE HAZARD

- We thoroughly test our products. However, before installation and start-up, inspect all equipment for transit damage, loose parts, packing materials, etc.
- Installation must observe the required environmental conditions for safe and reliable operation.
- In a domestic environment, this product may cause radio interference, requiring adequate measures to be taken. Obtain the permission of the supply authority before connecting to the low voltage supply.

General risks

Installation

- Ensure mechanically secure fixings are in use as recommended.
- Ensure cooling airflow around the product is as recommended.
- Ensure cables/wire terminations are as recommended and are torqued correctly.
- Ensure the product rating is correct - do not exceed the rating.

Application risk

Electromechanical safety is the responsibility of the user. The integration of this product into other apparatus or systems is not the manufacturer's or distributor of the product's responsibility. It is the user's responsibility to ensure the compliance of the installation with any regulations in force.

Health and safety at work

Electrical devices can constitute a safety hazard. Thorough personnel training is an aid to SAFETY and productivity. SAFETY awareness not only reduces the risk of accidents and injuries in your plant but also has a direct impact on improving product quality and costs. If you have any doubts about the SAFETY of your system or process, consult an expert immediately. Do not proceed without doing so. If in doubt, refer to the Supplier.

Weight

Consideration should be given to the weight of our heavier products when handling.

Risk assessment

Under fault conditions or conditions not intended: the motor speed may be incorrect; the motor speed may be excessive; the direction of rotation may be incorrect; the motor may be energised.

In all situations, the user should provide sufficient guarding and/or additional redundant monitoring and safety systems to prevent risk of injury.

NOTE: During a power loss event, the product will commence a sequenced shut-down procedure. Therefore, the system designer must provide suitable protection for this case.

Maintenance

Only qualified personnel should maintain and effect repair using only the recommended spares, alternatively return the equipment to the factory for repair. The use of unapproved parts may create a hazard and risk of injury.



WARNING!

PERSONAL INJURY AND/OR EQUIPMENT DAMAGE HAZARD

When replacing a product, all user-defined parameters that define the product's operation must be installed correctly before returning to use. Failure to do so may create a hazard and risk of injury.

The packaging is inflammable and incorrect disposal may lead to the generation of lethal toxic fumes.

Repairs

Repair reports can only be given if the user makes sufficient and accurate defect reporting. Remember that the product without the required precautions can represent an electrical hazard and risk of injury, and that rotating machinery is a mechanical hazard.

Protective insulation

Non-isolated product



WARNING!

The motor must be connected to an appropriate safety earth.
Failure to do so presents an electrical shock hazard. Exposed metal work in this equipment is protected by basic insulation and bonding to a safety earth.

This product is classified as a component and must be used in a suitable enclosure.

1. **There is no isolation between the Power and Control Circuits. ALL connections to the Drive are HAZARDOUS. Mount the drive in an earthed enclosure.**
2. **The Installer MUST provide Protection for the End User** by using Double or Re-inforced Insulation. The drive's Control signal terminals operate at the output voltage of the drive. Therefore, User controls **MUST** be made safe by the use of suitably insulated components, i.e. Potentiometer, Run Switch.
3. **DO NOT** connect these Control signal terminals to low voltage equipment or any non-isolated potential as this will cause significant damage to both the Drive and attached equipment.

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1 Introduction

The 340 / 680/ 1220 DC Drive is a non-isolated speed controller for small brushed shunt wound or permanent magnet DC motors.

This "non-isolated" drive has control signals that are NOT isolated from the mains supply, therefore, do not connect any of the terminals to earth or to other non-isolated equipment as when power is applied to the drive ALL terminals are at dangerous line potential.

To control the motor speed the drive uses speed feedback derived from either the armature voltage or a shaft-mounted tachogenerator. It incorporates an accurate current control loop to protect itself and the motor.

Current loop:	full P+I current shunt feedback
Speed loop:	full P+I armature voltage or tach feedback
Speed range:	0-100% (motor dependent)
Load regulation:	typically 0.2% Tacho, 2% Armature Volts

The LV60 suffix, for example 340 LV60, denotes a low voltage version.

This component is hazardous. Please obtain expert help if you are not qualified to install this equipment. Make safety a priority.

Read about the general risks and warnings at the front of this manual.

CE This apparatus complies with the protection requirements of the relevant EU Directives. UL file: E168302.

WARNING!
PERSONAL INJURY HAZARD

This product is non-isolated and so, when power is applied to the drive, ALL terminals are at dangerous line potential.

Ensure that connected items (e.g. speed potentiometer, Tacho etc.) are NOT earthed, and have sufficient dielectric strength to avoid breakdown.

2 Installation

2.1 Motor installation

- Foot-mounted motors must be level and secure.
- Ensure accurate alignment of the motor shaft and couplings.
- Do not hammer pulleys or couplings onto the motor shaft.
- Protect the motor from ingress of foreign matter during installation.

NOTE: This drive does not provide motor over-temperature protection. If required, fit an external thermal sensor device to the motor that will remove the supply when activated by over-temperature.

Earthing: Connect the motor to the system enclosure earth.

2.2 Drive installation

Requirements during installation and operation:

- Avoid vibration.
- Protect the drive from pollutants.
- Avoid ambient temperatures below –10°C and above +40°C. To comply with UL requirements, the temperature of the surrounding air must not exceed 50ºC.
- The heat dissipation of the drive in Watts approximates to 5 x Armature Current value in Amps. Ensure there is an adequate supply of clean cool air to ventilate the unit and the enclosure it is mounted in.

2.2.1 Initial settings - without power

1. **To avoid damage, ensure the supply selection jumper on the drive matches the incoming ac supply: 240 Vac or 110 Vac, (60 Vac or 30 Vac for LV60 models).**



2. With the unit on the work bench, open the red cover on the front of the drive by inserting a small screwdriver at the bottom of the cover.
3. Set the **I MAX** preset to match the motor armature current rating as closely as possible:
   - fully anti-clockwise = 0%
   - fully clockwise = 100% of the drive rating,
     i.e. 3.4 A (340 drive), 6.8 A (680 drive), 12.2 A (1220 drive)
     For example, to adjust the preset on a 340 drive for a motor with an armature current rating of 1.7 A, set it to 50%. Use a suitable current meter temporarily connected in series with the armature to achieve accurate settings.
4. Set **Max spd**, **Min spd**, **Ramp** and **IR comp** presets to fully anti-clockwise.
5. The preferred strategy for initial commissioning is to use the armature voltage feedback mode. To use armature voltage feedback:
   - set the **Avf/Tach** switch to ON (left)
   - set the **Spd x 2** switch to OFF (right)

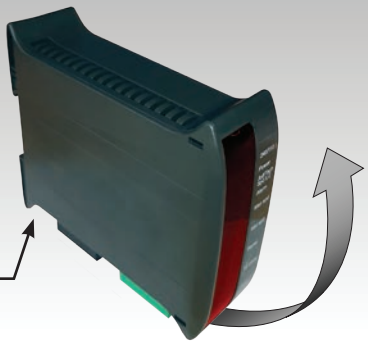


(Temporarily remove any tachogenerator connection made to Terminal 6. Make the wire end safe until later).

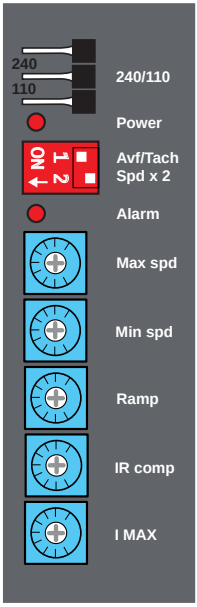
The suggested Commissioning strategy starts in the safest possible mode of operation and progressively exercises each element of the system to achieve full functionality.

WARNING!

When power is applied to the drive, ALWAYS use an insulated tool when adjusting the presets.



USER ADJUSTMENTS



Supply jumper: (LV60 model will indicate 60/30 Vac)

Power is present when lit.

Refer to "3.2 Operating the drive" on page 6.

"Fan failure" alarm is active when lit.

Maximum speed: rotate clockwise to increase speed, 40 V to 200 V (armature or tach feedback Volts).
LV60 model has Avf range 10 V to 50 V.

* **Minimum speed**: rotate clockwise to increase minimum speed.
0 to 30% of maximum speed.

Ramp: Rotate clockwise for a faster response. 20 to 1 seconds up ramp rate.

IR compensation: rotate clockwise to increase level of armature voltage droop compensation. 0 to 30%. Excessive rotation may cause instability. Always set fully anti-clockwise in Tacho mode.

Maximum current: rotate clockwise to increase current limit.
0 to 100% current limit.

* *Assumes using a 10K speed reference potentiometer*



2.2.2 Mechanical installation

6. Remove the plug-in terminal blocks from the bottom of the unit.
7. Clip the drive onto the DIN rail.
    - To release the drive from the DIN rail (with terminal blocks unplugged), insert a screwdriver into the slot in the (red) release catch at the back of the unit and move the catch downwards.

drive model	height/width/depth (mm)
340	105/35/120
340 LV60	
680	105/45/120
680 LV60	
1220	105/45/120
1220 LV60	

2.2.3 Electrical installation



WARNING!
PERSONAL INJURY AND/OR EQUIPMENT DAMAGE HAZARD

Never work on any control equipment without first isolating all power supplies from the equipment.
Protection must be provided by a correctly rated semi-conductor fuse, fitted upstream of the drive. The fuse must have an I^2t rating of less than 150 A^2s at the applied supply voltage.

8. Wire the plug-in terminal blocks and re-attach to the drive; black-to-black, green-to-green. **DO NOT APPLY POWER AT THIS TIME.**

Control cable	1.5 mm^2
External control options:	Speed setpoint from external 10K potentiometer *
	External RUN contact (Terminal 5) for electronic STOP/START
* Potentiometer, graduated dial and knob - Sprint Electric part number: POTKIT	

EMC wiring: If the unit is going to be used in the domestic environment, then for installations in the EU, a supply filter is recommended in order to comply with EN6800-3. Sprint Electric part number: FRLN16.

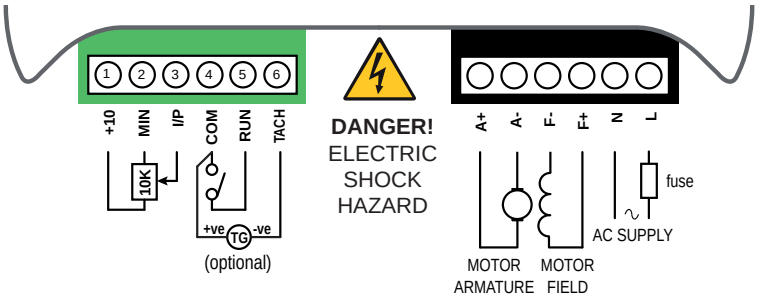
FUSE - Class aR Series semiconductor - fitted upstream of the drive
To satisfy UL requirements for branch circuit short-circuit protection, the fuse MUST be of type FWH5-020A6FR (part number CH00620A), or a lower rated fuse from the same series.

drive model	drive rating	fuse rating	Sprint standard fuses	Fuses for UL compliance
340	3.4 A	6.3 A	CH0066A3	Bussmann FWH-6.30A6F
340 LV60				
680	6.8 A	12.5 A	CH00612A	Bussmann FWH5-12.5A6FR
680 LV60				
1220	12.2 A	20 A	CH00620A	Bussmann FWH5-020A6FR CH00620A
1220 LV60				
6 x 32 mm Panel-mount fuse holder - CP102071; DIN rail clip for fuse holder - FE101969				

Short Circuit Rating
Suitable for use on a circuit capable of delivering not more than 5000 A RMS Symmetrical Amperes when protected by a Class aR Series semiconductor fuse.

WARNING!
PERSONAL INJURY HAZARD

Terminals A+, A-, F-, F+, N & L are at high potential.
Do not touch the terminals or any connected conductor.



L1/L2/L3, A+/A-	Use correctly rated cable - minimum 600 Vac, 1.5 x armature current

Earthing: All control inputs to the drive are NON-ISOLATED. Do not connect any of the terminals to earth or to other non-isolated equipment. **A common cause of damage is accidental earthing of the external potentiometer or RUN contact wiring.**

TERMINAL LISTING - tightening torque: 0.5 Nm (4.4 lbf.in)			
1	**+10** +10 V output, 2 mA maximum. Use a 10K potentiometer for external speed reference	**A+**	* Motor armature +
2	**MIN** Minimum Speed: connect to minimum end of internal speed potentiometer 5K preset to common	**A-**	* Motor armature –
3	**IP** Speed Input: 0 to +10 V speed input from the potentiometer wiper. 39K internal pull-down	**F-**	** Motor field – For half wave field Volts 0.45 x AC, connect field to F– and N.
4	**COM** Common. 0 V (zero)	**F+**	** Motor field +
5	**RUN** Internal 12K pull-up to 12 V. Close Terminal 5 to COMMON to run the drive. **See the WARNING below.**	**N**	NEUTRAL/RETURN : ac supply
6	**TACH** When using Tach feedback, the tach feedback polarity must be negative with respect to COMMON, Terminal 4	**L**	LIVE : ac supply

* Form factor typically 1.5 (load dependent)
** No connection required for permanent magnet motors

WARNING!
PERSONAL INJURY HAZARD

RUN is an electronic inhibit function. The field remains energised, and all power terminals 'live'. During hazardous operations remove the power source to the system. **RUN must not be relied on to ensure the machine is stationary.** The motor FIELD output remains energised with RUN open, please beware of overheating the motor when stopped (does not apply to permanent magnet motors).

3 Operation

3.1 Pre-operation motor check list

9. **With no power applied, complete the following check list:**
   - Check for the correct insulation between individual motor elements, and between these elements and the earthed motor frame. Disconnect all drive cables before testing. The motor elements are: armature winding, field winding*, temperature sensors*, tachogenerator* (* where applicable).
   - Check inside the motor connection box for foreign objects, damaged terminals, etc.
   - Check that motor brushes are in good condition, correctly seated and free to move in brush boxes. Check for the correct action of brush springs.
   - Check that motor vents are free of any obstruction and that any protective covers have been removed.

3.2 Operating the drive

REFER TO THE WARNING ON PAGE 7.



WARNING!
PERSONAL INJURY HAZARD

This product is non-isolated and so, when power is applied to the drive, ALL terminals are at dangerous line potential.

Ensure that connected items (e.g. speed potentiometer, Tacho etc.) are NOT earthed, and have sufficient dielectric strength to avoid breakdown.

10. **For this initial start, disconnect and insulate the (optional) Tacho connection to Terminal 6** as the drive will be using **Armature Voltage** feedback.
11. **Apply power to the drive.** The drive's Power lamp will light.
12. Operate the RUN switch to turn the motor.
13. Slowly increase the external speed potentiometer setting to maximum. The motor will ramp up slowly to about 40 V on the motor armature (to about 10 V for LV60 units).
14. **Is the motor turning in the required direction?** If not, reverse the system by transposing the A+ and A- motor armature connections.



CAUTION!

When reversing the system: To prevent damage, do not transpose the motor armature connections until the motor has stopped rotating.

15. **Speed Feedback selection** Set the correct **Armature Voltage** using the **Spd x 2** switch and the **Max spd** preset:



WARNING!

PERSONAL INJURY AND/OR EQUIPMENT DAMAGE HAZARD

If you change the Spd x 2 switch position while running, the speed will undergo an immediate step change.

a. Set the **Spd x 2** switch to suit the motor armature voltage rating:

340 / 680 / 1220

OFF: 40 to 100 V armature voltage range

ON: 90 to 200 V armature voltage range

340 LV60 / 680 LV60 / 1220 LV60

OFF: 10 to 25 V armature voltage range

ON: 23 to 50 V armature voltage range

b. Adjust the **Max spd** potentiometer setting to achieve the required shaft speed.

16. **MIN SPEED:** The **Min spd** potentiometer can now adjust between 0% and 30%. (This assumes that a 10K potentiometer is being used to provide the speed setpoint at terminal 1, 2 and 3.)

17. **RAMP:** Set the ramp up rate as required (from 20 seconds to 1 second).

18. **IR COMP:** Speed droop on heavy loads may occur where armature voltage feedback is used. Compensate for this by clockwise adjustment of the **IR comp** preset. Excessive rotation may lead to instability.

The drive is now commisioned to use Armature Voltage feedback.

4 Options

- **Speed Feedback selection:** If the system is to use **Tacho** feedback you can now adjust for the tachogenerator's output voltage, and hence the speed of the motor:

  Run the drive in **Armature Voltage** feedback mode and check the polarity of the tacho using a voltmeter. The tacho feedback polarity must be negative with respect to COMMON, Terminal 4.

  REFER TO THE WARNING ON PAGE 7.

  NOTE: IR COMP must not be used with Tacho feedback - set the potentiometer fully anti-clockwise.

  a. With the power off, connect the tachogenerator's output voltage to Terminal 6. Set the **Avf/Tach** switch to OFF (right).

     Calculate the output voltage from the tachogenerator:

     For example, if quoted as "100 V per 1000 revs/min" then feedback voltage = (motor speed/1000) x 100 V

  b. Set the **Spd x 2** switch to suit the calculated feedback voltage (refer to the switch ranges given for Armature Voltage).

  c. With the drive running, adjust the **Max spd** preset to achieve the required shaft speed.

- **Jogging** We recommend using the RUN input (Terminal 5) for stopping or jogging. If you use a mains contactor, connect a spare normally-open contact of the contactor in series with the RUN input.

- **Auxiliary input**: If the system is using **Armature Voltage** feedback, then Terminal 6 (TACH) may be used as an auxiliary fast ± speed trim (approximately 5-10%).

- **Alarms:**

WARNING!
PERSONAL INJURY HAZARD

The following alarm provides an electronic armature current inhibit function.
The field output remains energised and
all power terminals are LIVE (shock hazard),
hence these terminals must not be relied upon to ensure the machine is stationary during hazardous operations.
The motor FIELD output remains energised; please beware of overheating the motor when stopped - this does not apply to permanent magnet motors.

- **"Fan Failure" Alarm**: Models 680 and 1220 use an internal fan for cooling. The **Alarm** lamp will light if the internal fan fails - the drive will electronically shut down.

  These units may be run at currents below 3 A without a fan.
  To inhibit the Alarm, link the pair of solder pads adjacent to Terminal 6 (TACH).

5 Specifications

All specifications in this document are nominal.

This product conforms to IP00 protection.

RATINGS					
drive model	**AC supply input 1 ph 50-60 Hz**	**maximum output**			**power rating**
		armature voltage	**armature current**	**field current ****	
	(Vac ±10%)	**(Vdc)**	**(Adc)**	**(Adc max)**	**(kW / hp)**
340 **340 LV60**	110 or 240 30 or 60	90–180 (200 V max) 24–48 (50 V max)	3.4 3.4	1 1	0.55 / 0.75 *
680 **680 LV60**	110 or 240 30 or 60	90–180 (200 V max) 24–48 (50 V max)	6.8 6.8	1 1	0.75 / 1 *
1220 **1220 LV60**	110 or 240 30 or 60	90–180 (200 V max) 24–48 (50 V max)	12.2 12.2	1 1	1.8 / 2 *

kW / hp ratings are for typical motor ratings at or below the available terminal ratings of Watts = armature Volts x armature Amps.

***** Note that the power output of LV60 versions will be proportionately lower than is shown above.

****** Volts DC = 0.9 x AC supply Volts (0.45 x AC supply Volts for field connected to F- and N)

A+ / A- motor armature terminals have Form Factor typically 1.5 (load dependent).

Disposal

This product contains materials that are consignable waste under the Hazardous Waste Regulations 2005. Metal and plastic materials can be recycled, however, disposal of the printed circuit board requires compliance with all valid environmental control laws.



Products that must be recycled in accordance with the WEEE Regulations are marked with the symbol opposite. Contact us when recyling the product.

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We accept no liability whatsoever for the installation, fitness for purpose or application of this product.

It is the user's responsibility to ensure the unit is correctly used and installed.

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The information in this publication was correct at the time of going to print.

We reserve the right to modify or improve the product without notification.

The contents of this manual shall not become part of or modify any prior existing agreement, commitment, or relationship. The sales contract contains the entire obligation of Sprint Electric. The warranty contained in the contract between the parties is the sole warranty of Sprint Electric. Any statements contained herein do not create new warranties or modify the existing warranty.

We will be under no liability for any defect arising from fair wear and tear, negligence, wilful damage, misuse, abnormal working conditions, failure to follow the manufacturer's instructions, unauthorised alteration or repair of hardware, unauthorised or accidental alteration of software or configuration, lost profits, commercial loss, economic loss, or loss arising from personal injury. We may, at our discretion, raise a charge for any faults repaired that fall outside the warranty cover.

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