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HA501314U100 Issue 1

650 series Quick Start

Frames 1 - 3

Sensorless (model 650V)
Volts/Hertz (model 650)

aerospace
climate control
electromechanical
filtration
fluid & gas handling
hydraulics
pneumatics
process control
sealing & shielding

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Before You Start

This document covers the steps necessary for a basic start-up of the 650 drive. Drive start ups should be performed by qualified electrical technicians who are familiar with AC drives and their applications. For detailed installation and safety information refer to the Instruction Manual.

Ensure that all local electric codes are met while installing the drive. Check that all live parts are covered to protect against electric shock and that unexpected rotation of the motor will not result in bodily harm or injury.

This document expects that the drive is already installed in its intended location and that all relevant installation procedures have been followed. Please ensure that the drive has adequate ventilation so that ambient temperature does not exceed 40°C (104°F) under normal operating conditions.

To access the terminals, slide down the terminal cover, while applying slight pressure on the drive label.

Frame Ratings

Frame 1	0.3 – 1 HP	230VAC	1 ph
	0.25 – 0.75kW		
Frame 2	1.5 – 2 HP	230VAC	1 ph
	1.1 – 1.5kW		
	0.5 – 3 HP	460VAC	3 ph
	0.37 – 2.2kW	400VAC	
Frame 3	3 – 5 HP	230VAC	3 ph
	2.2 – 4kW	400VAC	
	5 – 10 HP	460VAC	3 ph
	3 - 7.5kW	400VAC	

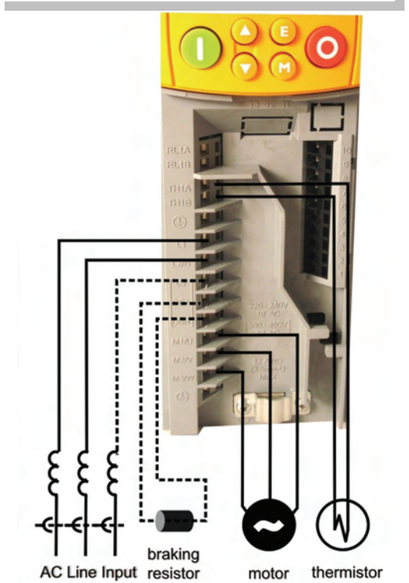
For larger sizes, see 650V Quickstart HA470679U200

Control Modes

Volts/Hertz mode (650 & 650V) – Basic open loop operation, used in fans/pumps and multi-motor applications.

Sensorless Vector mode (650V only) – Tight speed regulation with good transient torque capability, without the need for speed feedback.

Power Connections



The power terminals shown are for frame 2. Although other frames may vary slightly in appearance, their terminal designations and functionality are very similar.

- Single-phase supply to L1, L2/N.
- 3-phase supply to L1, L2, L3.
- Motor connections to M1, M2, M3.
- Brake resistor between DC+, DBR *NOTE*: Frame 1&2 *230V units are not fitted with a braking module. Do not use a braking resistor on them.*
- Motor thermistor to Th1A, Th1B.

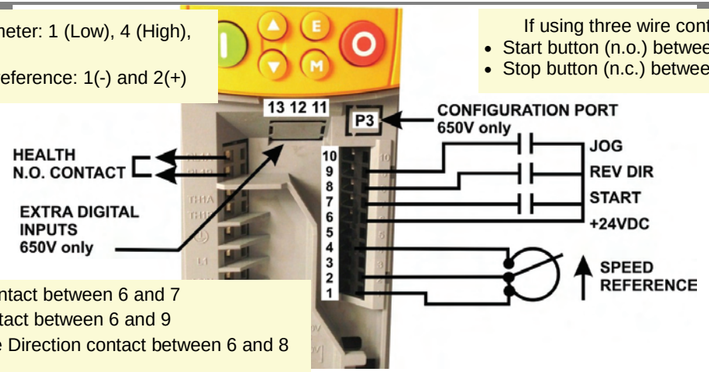
Ground lugs are provided for each power circuit. Follow proper grounding and shielding methods as described in the Instruction Manual.

If stop time is expected to be less than the natural coasting time of the load, connect the braking resistor across DC+ and DBR (see Brake resistor note above)

Reference and Sequencing

- Speed potentiometer: 1 (Low), 4 (High), 2 (Wiper) OR
- External speed reference: 1(-) and 2(+)

If using three wire control
- Start button (n.o.) between 6,7
- Stop button (n.c.) between 6,10

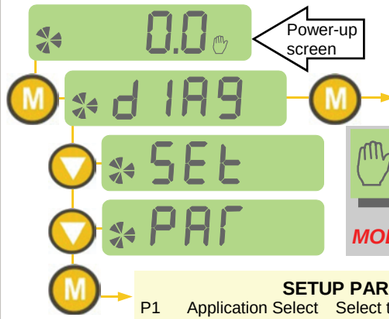


- Start contact between 6 and 7
- Jog contact between 6 and 9
- Reverse Direction contact between 6 and 8

Calibration

All calibration is done in software, through the keypad

POWER ON



DIAGNOSTICS

d1	Frequency	Output frequency (Hz)
d2	Speed Setpoint	Speed SP (% of Max Speed)
d3	DC Link Volts	Voltage of DC Bus
d4	Motor Current	Motor Current (amps)

The drive powers up in ***LOCAL MODE.*** Use the green/red buttons to start/stop and the up/down arrows to adjust speed. To switch to ***REMOTE MODE,*** hold the STOP button down until ***LOC*** disappears. To revert to ***LOCAL MODE:*** At the ***rdy*** screen, push STOP until ***LOC*** appears.

SAVING

Changes take effect as soon as they are entered and parameters are saved automatically in a few seconds

SETUP PARAMETERS

P1	Application Select	Select the application macro
P2	Max Speed	Set max speed in Hz
P3	Min Speed	Set min speed in %
P4	Acceleration time	Accel time to Max Speed in sec
P5	Deceleration time	Decel time from Max Speed in sec
P6	Motor Current	Motor full load current in amps
P7	Base Frequency	Motor nameplate frequency in Hz
P8	Jog Setpoint	Set jog speed in % of max speed
P9	Stop Mode	0=Ramp; 1=Coast; 2=Injection braking
P11	V/Hz shape	0=Linear; 1=Quadratic (fan or square)
P12	Overload Rating	0=150% for 30s.; 1=110% for 10s.
P13	Fixed Boost	Set boost in % volts (V/Hz mode only)
P99	Password	Set from 0001 to FFFF for protection

Cloning

650 and 650V drives may be cloned using the 6514 Clone option that plugs into the keypad slot. Settings include to/from, I/O configuration and full/part transfer.

Serial Comms

The 6513 Serial Communication option can be plugged into the keypad slot. It can be used to exchange information between the Master and Slave drives in RS485/232 format, up to 32 units can be connected together. Front panel LED indicators provide status and health indication.

Advanced Features

The 650 has additional features which can be accessed via the drive menu, or for the 650V using DSE Lite. Refer to the product manual for details.

Flycatching - When enabled, lets the drive start into a spinning load by doing a frequency search.

Skip Frequencies – Two selectable avoidance frequencies and associated window for each.

PID – Provides closed loop process control

S-Ramp – When enabled, introduces a second order slope to the ramp for smoother transitions.

Configurable Outputs – The digital outputs on the 650 can be configured to pick one of 6 parameters. The outputs on the 650V are totally configurable.

Auto Restart - After a fault, the drive attempts a number of restarts after a settable delay.

Custom Screens - Allows the use of a Custom parameter to be displayed. (650V only)

Encoder – Terminals 12 &13 (650V only) can be used for a quadrature (not complementary) encoder input for steady-state speed feedback.

Associated Literature

650	Installation Manual	HA464828Uxxx
650	Software Manual	HA467872Uxxx
650V	Installation Manual	HA467649Uxxx
650V	Software Manual	HA501306Uxxx

Compliance

A comprehensive guide to product compliance is available in the full product manual.

Warning – Where there is a conflict between EMC and safety requirements personnel safety shall always take precedence.

Operation of this equipment requires detailed installation and operation instructions provided in the installation/operation manual intended for use on this product. This information is provided on the CD ROM included in the container this device was packaged in. It should be retained with this device at all times.

Caution: This is a product of the restricted sales distribution class according to IEC 61800-3. It is designated as "professional equipment" as defined in EN61000-3. Permission of the supply authority shall be obtained before connection to the low voltage supply.

In a domestic environment this product may cause radio interference in which case supplementary mitigation measures may be required.

This equipment contains electrostatic discharge (ESD) sensitive parts. Observe static control precautions when handling, installing and servicing this product.

EMC Emissions

The 650 series frame 1-3 is required to be installed in an enclosure providing 15dBs attenuation between 30-1000MHz to ensure compliance with EN61800-3, category C1, unrestricted distribution.

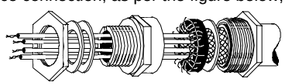
The 650 frame 1 and 2 single phase supply models (TN only) comply with EN61800-3, category C2, restricted distribution with a maximum cable length of 15m.

EMC Connections

For compliance with the EMC requirements, the "0V/signal ground" is to be separately earthed. When a number of units are used in a system, these terminals should be connected together at a single, local earthing point. Control and signal connections should be made with screened cables, with the screen connected only at the VSD end. However, if high frequency noise is still a problem, earth screen at the non VSD end via a 0.1µF capacitor.

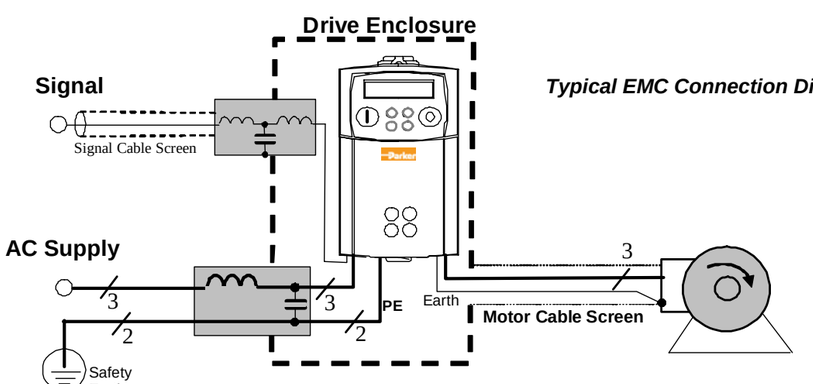
Note: Connect the control and signal screens (at the VSD end) to the VSD protective earth point, and not to the control board terminals.

Motor cables should have a 360° bond to ensure a low impedance connection, as per the figure below;



Planning Cable Runs

- Use the shortest possible motor cable lengths.
- Use a single length of cable to a star junction point to feed multiple motors.
- Keep electrically noisy and sensitive cables apart. If this is not possible parallel cable runs should be separated by at least 0.25 meters, for runs longer than 10 meters, separation should be increased proportionally.
- Sensitive cables should cross noisy cables at 90°.
- Never run sensitive cables close or parallel to the motor, dc link and braking chopper circuit for any distance.
- Never run supply, dc link or motor cables in the same bundle as the signal/control and feedback cables, even if they are screened.
- Ensure EMC filter input and output cables are separately routed and do not couple across the filter.



Typical EMC Connection Diagram

Application Macros

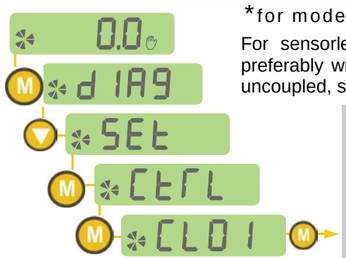
After the first power-up, the 650 defaults to the most basic mode of operation, namely speed control. In addition, it has the capability of being configured for special applications by loading the correct Application Macro.

Selecting an Application: Applications may be loaded during power-up by pressing and holding the STOP button, or by setting P1 from the Parameters menu. 1=Speed Control; 2=Manual/Auto; 3=Preset Speeds; 4=Raise/Lower; 5=PI Control; 6=Aux Comms (650Vonly) 9=Custom (650Vonly).

Terminal Assigments: Different applications require different setup parameters, inputs and outputs. When an application is selected, the 650 internally reassigns its control terminals for the relevant functionality. Also, depending on the application selected, an enhanced application-specific set of parameters will be visible, in addition to the regular parameters.

	SpeedControl P1=1	Manual/Auto P1=2	Preset Speeds P1=3	Raise/Lower P1=4	PI Control P1=5	AUX COMMS* P1=6
App-Specific Parameters	None	None	650 650V P301 AP1 Preset 1 P302 AP2 Preset 2 P303 AP3 Preset 3 P304 AP4 Preset 4 P305 AP5 Preset 5 P306 AP6 Preset 6 P307 AP7 Preset 7 P308 AP8 Preset 8	650 650V P401 AP1 Ramp Time P402 AP2 Max Value P403 AP3 Min Value P404 AP4 Reset Value	650 650V P501 AP1 P Gain P502 AP2 I Gain P503 AP3 D Gain P504 AP4 D filter TC P505 AP5 FeedbkGain P506 AP6 Limit AP7 Low limit AP8 Symmetric limit P507 AP9 OP scale P508 AP10 Error	650V AP1 Command AP2 Setpoint AP3 Status
Control Terminal Assign	1 Common 0V 2 Speed In (V) 3 Speed In (mA) 4 +10V Supply 5 Speed Output 6 +24V Supply 7 Start button 8 Fwd/Rev 9 Jog 10 Stop button	1 Common 0V 2 Manual Re(V) 3 Auto Ref(mA) 4 +10V Supply 5 Speed Output 6 +24V Supply 7 Manual Start 8 Auto Start 9 Man/Auto 10 Fwd/Rev	1 Common 0V 2 Speed In (V) 3 Speed In (mA) 4 +10V Supply 5 Speed Output 6 +24V Supply 7 Start 8 Preset Digital 1 9 Preset Digital 2 10 Preset Digital 3	1 Common 0V 2 Unused 3 Unused 4 +10V Supply 5 Speed Output 6 +24V Supply 7 Start 8 Raise Input 9 Lower Input 10 Ramp Reset	1 Common 0V 2 Reference (V) 3 Feedback(mA) 4 +10V Supply 5 Speed Output 6 +24V Supply 7 Start button 8 Fwd/Rev 9 Jog 10 Stop button	1 Common 0V 2 Speed In 3 Speed In 4 +10V Supply 5 Speed Output 6 +24V Supply 7 Unused 8 Unused 9 Unused 10 Unused

650V and Autotune*



*for model 650V only. Autotune will not activate if in V/Hz mode.

For sensorless vector (SV) operation, an autotune is highly recommended, preferably with the motor uncoupled and free to rotate. (if the motor cannot be uncoupled, set CL20=0. See below).

CONTROL PARAMETERS

CL01	Control Mode	0 = V/Hz; 1 = Sensorless Vector (SV)
CL02	Nameplate RPM	Enter RPM from motor nameplate
CL10	Motor Current	Enter full load amps from motor nameplate
CL11	Motor Poles	2=3600rpm; 4=1800rpm; 6=1200rpm
CL12	Motor Voltage	Enter motor nameplate voltage
CL20	Autotune Mode	0=stationary; 1=rotating (preferred)
CL21	Autotune Enable	set to 1 and run the drive to autotune
CL81	Current Limit	Current Limit setting as a % of CL10