

EC Titanium™ Motor Installation and Maintenance NEMA Frames 140 - 210

OVERVIEW

This manual contains general procedures that apply to Baldor EC Titanium Motor product and is not intended to include a comprehensive listing of all details for all procedures required for installation, operation and maintenance. Be sure to read and understand the Safety Notice statements in this manual. For your protection, do not install, operate or attempt to perform maintenance procedures until you understand the Warning and Caution statements. A Warning statement indicates a possible unsafe condition that can cause harm to personnel. A Caution statement indicates a condition that can cause damage to equipment.

The EC Titanium are IE5 efficient motor specifically designed for operation on adjustable speed permanent magnet ac drive controls and is not designed for across the line operation. Information required for proper control and setup of the separate drive is provided on the nameplate of the motor. Detailed information can be found in the EC Titanium Installation Manual MN451 available for download at http://www.baldor.com/support/product_manuals.asp. Be sure to read and understand all of the Safety Notice statements in MN451 EC Titanium Manual for your motor. The basic design includes Class F insulation, Class B temperature rise, 1.5 service factor motor only (1.0 SF integrated motor drive designs), 40°C ambient, continuous duty. Standard enclosures are totally enclosed fan cooled foot mounting. It is important that motors be installed in locations that are compatible with motor enclosure and ambient conditions. Improper selection of the motor enclosure and ambient conditions can lead to reduced operating life of the motor. Proper ventilation for the motor must be provided. Obstructed airflow can lead to reduction of motor life.

RECEIVING AND INSPECTION

The EC Titanium is thoroughly tested at the factory and carefully packaged for shipment. When you receive your motor or the integrated motor and drive, there are several things you should do immediately.

1. Carefully Unpack the EC Titanium and check for any signs of damage. Notify the shipper immediately if any exist.
2. Check the motor and / or motor and drive rating label to ensure it is of the correct type and power requirements for the application.
3. If the motor is to be stored for several weeks before use, be sure that it is stored in a clean and dry environment and within a temperature range of -40°C to +60°C.
4. After storage or after unpacking and inspection to see that all parts are in good condition, rotate the motor shaft by hand to be sure there are no obstructions to free rotation. Motor leads must be isolated before the shaft will turn freely on permanent magnet motors.

On motors received from the factory with the shaft blocked, remove blocking before operating the motor. If motor is to be reshipped alone or installed to another piece of equipment, the shaft block must be installed to prevent axial movement and prevent brinelling of the bearings during shipment.

SAFETY

This equipment contains high voltage! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt installation, operation and maintenance of electrical equipment. Unsafe installation or use can cause conditions that lead to serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment. Be sure that you are completely familiar with safety standards for selection, installation and use of electric motors and generators and local codes and practices. Become familiar with the following:

- NEMA Publication MG-2, Safety Standard for Construction and guide for Selection, Installation and Use of Electric Motors and Generators
- IEC 60034-1 Electrical and IEC60072-1 Mechanical specifications
- NFPA 70® National Electrical Code (NEC) and local codes and practices

INSTALLATION OUTSIDE THE USA:

Refer to MN408 and MN1383 for Compliance with European Directives. Copies are available at: http://www.baldor.com/support/product_manuals.asp

MOTOR ENCLOSURE

TEFC, totally enclosed motors are intended for use where moisture, dirt and/or corrosive materials are present. The EC Titanium motor only is rated for in indoor and outdoor locations. Integrated drive motor units with plastic covers are indoor use and not rated for direct sunlight or outdoor use.

GENERAL

The user must select a ac drive suitable for permanent magnet motor control. The ABB ACH580 is suggested and designed to automatically ID run the EC Titanium motor. For all other ac drive controls, ensure the drive is capable of permanent magnet motor control. Values identified on the motor nameplate must be available to enter into drive parameters. These are shown in the previous section of this guide and include Motor Rated Amps, Motor Back EMF Voltage, Rs (motor stator resistance), Ld (d-axis inductance), Lq (q-axis inductance) and motor rated frequency. Ensure the drive is sized properly for the current rating of the motor and set appropriate overcurrent protection suitable for this motor and its application.

Speed Range

EC Titanium Motors are rated for a 10:1 Constant Torque Speed range below base speed. 140 and 180 Frame motors may be operated to a maximum safe speed of 4000 RPM and 210 Frame motors 3000 RPM.

TESTING

If the motor has been in storage for an extensive period or has been subjected to adverse moisture conditions, check the motor insulation resistance with a meg ohm meter. Depending on storage conditions it may be necessary to rotate or change rusted bearings. Contact your local sales office if resistance is less than 5 meg ohms.

WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury.

WARNING: Be sure the system is properly grounded before applying power. Electrical shock can cause serious or fatal injury.

ELECTRICAL INSTALLATION

This motor must be installed in accordance with National Electric Code, NEMA MG-2, IEC standards or local codes.

WARNING: EC Titanium permanent magnet motors can induce voltage and current in the motor leads by rotating the motor shaft. Electrical shock can cause serious or fatal injury. Therefore, do not couple the load to the motor shaft until all motor connections have been made. During any maintenance inspections, be sure the motor shaft will not rotate.

WIRING

Connect the motor as shown in the connection diagrams. If this motor is installed as part of a motor control drive system, connect and protect the motor according to the control manufacturers diagrams. Refer to MN408 for additional details on lead marking. The wiring, fusing and grounding must comply with the National Electrical Code or IEC and local codes. When the motor is connected to the load for proper direction of rotation and started, it should start quickly and run smoothly. If not, stop the motor immediately and determine the cause. Possible causes are: low voltage at the motor, motor connections are not correct or the load is too heavy. Check the motor current after a few minutes of operation and compare the measured current with the nameplate rating.

GROUNDING

Ground the motor according to NEC and local codes. In the USA consult the National Electrical Code, Article 430 for information on grounding of motors and generators, and Article 250 for general information on grounding. In making the ground connection, the installer should make certain that there is a solid and permanent metallic connection between the ground point, the motor or generator terminal housing, and the motor or generator frame. In non-USA locations consult the appropriate national or local code applicable.

Noise

For specific sound power or pressure level information, contact your local sales office.

VIBRATION

This motor is balanced to NEMA MG1, Part 7 standard.

WARNING: Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.

DRAIN PLUGS

One or more condensation drain fittings are provided on each endplate for various motor mounting configurations. The fittings allow drainage and prevent insertion of a 1mm wire probe per the IP54 rating requirements. To avoid condensation inside the motor, do not unpack until the motor has reached room temperature. (Room temperature is the temperature of the room in which it will be installed). The packing provides insulation from temperature changes during transportation.

MOUNTING

Mount the motor on a foundation sufficiently rigid to prevent excessive vibration. Standard stock EC Titanium motors are provided with feet for mounting at any angle. Mounting provisions may also be provided on custom design motors to allow for direct coupled (c-face) or flange mounting at any angle. After careful alignment, bolt motor securely in place. For foot mounted motors, use shim to fill any unevenness in the foundation. Motor feet should sit solidly on the foundation before mounting bolts are tightened.

EC Titanium Stock Motors are designed to be mounted by the "Mounting Feet". Use appropriate hardware (not furnished). The motor should be installed in a location compatible with the motor enclosure and specific ambient. The motor must be securely installed to a rigid foundation or mounting surface to minimize vibration and maintain alignment between the motor and shaft load. Failure to provide a proper mounting surface may cause vibration, misalignment and bearing damage. All hold down bolts must be the correct grade for the type of mounting and must be torqued to their recommended value. The standard motor base is designed for horizontal or vertical mounting.

Belted Drive

Motor slide bases or rails, when used, must be securely anchored to the foundation with the proper bolts. The motor shaft and the load shaft must be parallel and the sheaves aligned. For V-belt drive, mount the sheave pulley close to the motor housing. Allow clearance for end to end movement of the motor shaft. Do not overtighten belts as this may cause premature bearing failure or shaft breakage.

Coupled Drive

Machines should be carefully aligned and the shaft should rotate freely without binding. Standard EC Titanium Motors will operate successfully mounted on the floor, wall or ceiling, and with the shaft at any angle from horizontal to vertical. Special mountings may have duty or thrust demands that may require a different bearing system.

Flange Mount

Machines should be properly seated and aligned. Note: If improper rotation direction is detrimental to the load, check rotation direction prior to coupling the load to the motor shaft.

LIFTING PROVISIONS

The EC Titanium motors provided in 180 and 210 frames are provided with lifting provisions. Always lift the motor by the lifting bolt eye or lugs provided. 140 Frame Motors do not require lifting provisions and can be set in place manually. (2) Lifting Lugs are provided on Top Drive Units that are offset to balance the motor weight.

Caution: Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the driven load from the motor shaft before lifting the motor.

Caution: Do not lift the motor by the shaft. The motor is designed to drive a load but it is not intended to have lifting forces and stresses applied to the motor shaft. Damage to the motor may result

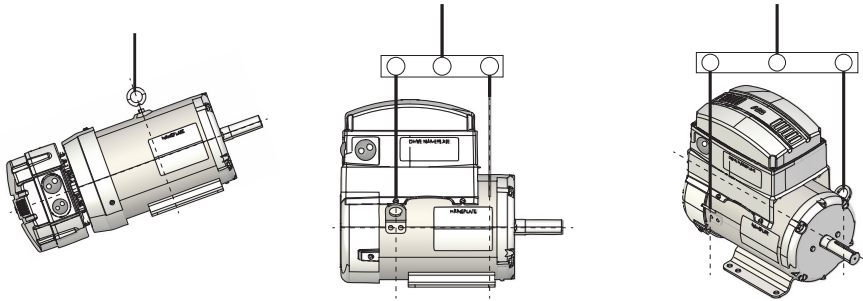
Caution: If eye bolts are used for lifting a motor, be sure they are securely tightened. The lifting direction should not exceed a 20° angle from the shank of the eye bolt or lifting lug. Excessive lifting angles can cause damage.

Single Lifting Bolt

180, 210 Frames EC Motors
20" maximum angle

Dual Offset Lifting Bolts

180, 210 Frames EC Motor & Axial Units



IP (Ingress Protection)

IP designations include two numerals, the first characteristic numeral is for ingress solid bodies and from dust. The second for ingress protection from liquid - water. EC Titanium Motors are marked IP54 for general protection from dust and splashing water when mounted horizontally. Other orientations such as shaft up or down may require additionally sealing, contact the local ABB District Office to review non-horizontal mounting requirements and ingress protection.

GUARDING

After motor installation is complete, a guard of suitable dimensions must be constructed and installed around the motor/gearmotor. This guard must prevent personnel from coming in contact with any moving parts of the motor or drive assembly but must allow sufficient cooling air to pass over the motor. If a motor mounted brake is installed, provide proper safeguards for personnel in case of brake failure. Brush inspection plates and electrical connection cover plates or lids, must be installed before operating the motor.

STARTING

Before starting motor remove all unused shaft keys and loose rotating parts to prevent them from flying off. Check direction of rotation before coupling motor to load. The motor should start quickly and run smoothly and with little noise. If the motor should fail to start the load may be too great for the motor, the voltage is low or the motor has been miss-wired. In any case immediately shut motor off and investigate the cause.

ROTATION

To reverse the direction of rotation, disconnect and lockout power and interchange any two of the three AC power leads for three phase motors. For two-phase four wire, disconnect and lockout power and interchange the AC line leads on any one phase. For two phase three wire, disconnect and lockout power and interchange phase one and phase two AC line leads.

Lubrication Information

EC Titanium Motors use double-shielded sealed bearings and do not require re-lubrication. Non-regreaseable motors when not in normal operation, should have the motor shaft rotated 15 times to redistribute the grease within the bearing every 3 months or more often.

ELECTRICAL INSTALLATION

Flying Leads

Motors with flying lead construction must be properly terminated, connected with bolt, lock washer and nut and wrapped with two full layers of electrical grade tape or heat shrink tubing.

Bypass Mode

All EC Titanium AC motors are inverter duty motors using optimum pole design. They are not intended to be used in bypass mode (across the line). Consult your ABB District Office to determine suitability of motor for specific applications in bypass mode. Permanent magnet motors cannot be run in bypass mode.

WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

WARNING: Surface temperatures of motor enclosures may reach temperatures which can cause discomfort or injury to personnel accidentally coming into contact with hot surfaces. Protection should be provided by the user to protect against accidental contact with hot surfaces. Failure to observe this precaution could result in bodily injury.

WARNING: The Adjustable Speed Controller may apply hazardous voltages to the motor leads after power to the controller has been turned off. Verify that the controller is incapable of delivering hazardous voltages and that the voltage at the motor leads is zero before proceeding. Failure to observe this precaution may result in severe bodily injury or death.

Caution: Use only a shielded motor power cable with a complete circumferential braided or copper film/tape ground jacket around the power leads. This ground should be secured to the motor frame from within the motor terminal box and must return without interruption to the drive ground. In addition, if the motor and coupled equipment are not on a single common metal base plate, it is important to equalize the equipment ground potentials by bonding the motor frame to the coupled equipment using a high frequency conductor such as a braided strap.

Note: Main power leads for CE Marked Motors may be marked U, V, W – for standard configurations, please consult connection diagrams.

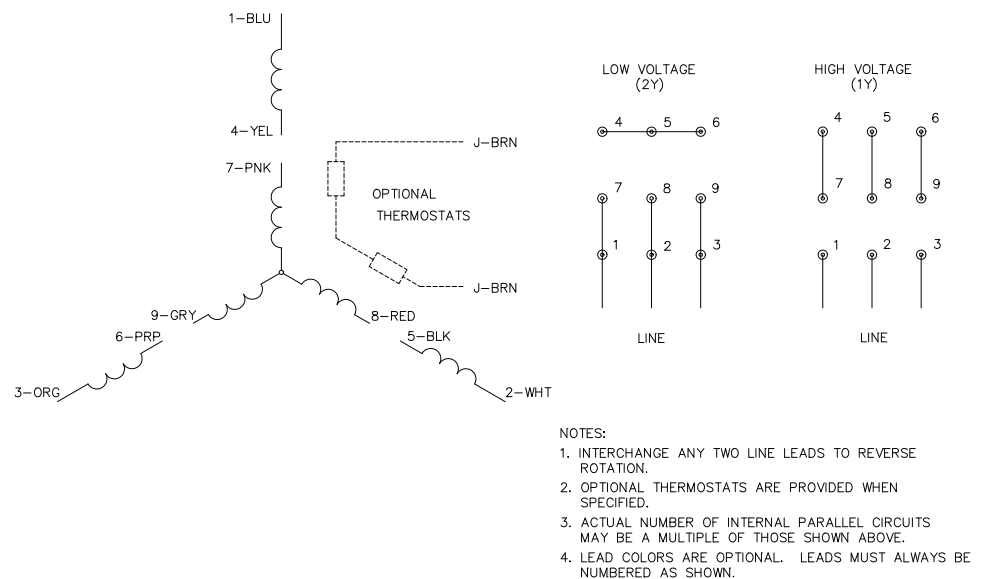
1. Single Voltage/Three Lead Motors. Connect leads marked U/T1, V/T2 and W/T3 to the appropriate control output terminals (refer to the Controller Instruction Manual). See Figure 1-1.
2. Dual Voltage Motors

Be sure the motor leads are connected properly for “Low” or “High” voltage connection, see Figure 1-1.

Connect leads marked U/T1, V/T2 and W/T3 to the appropriate control output terminals (refer to the Controller Instruction Manual).

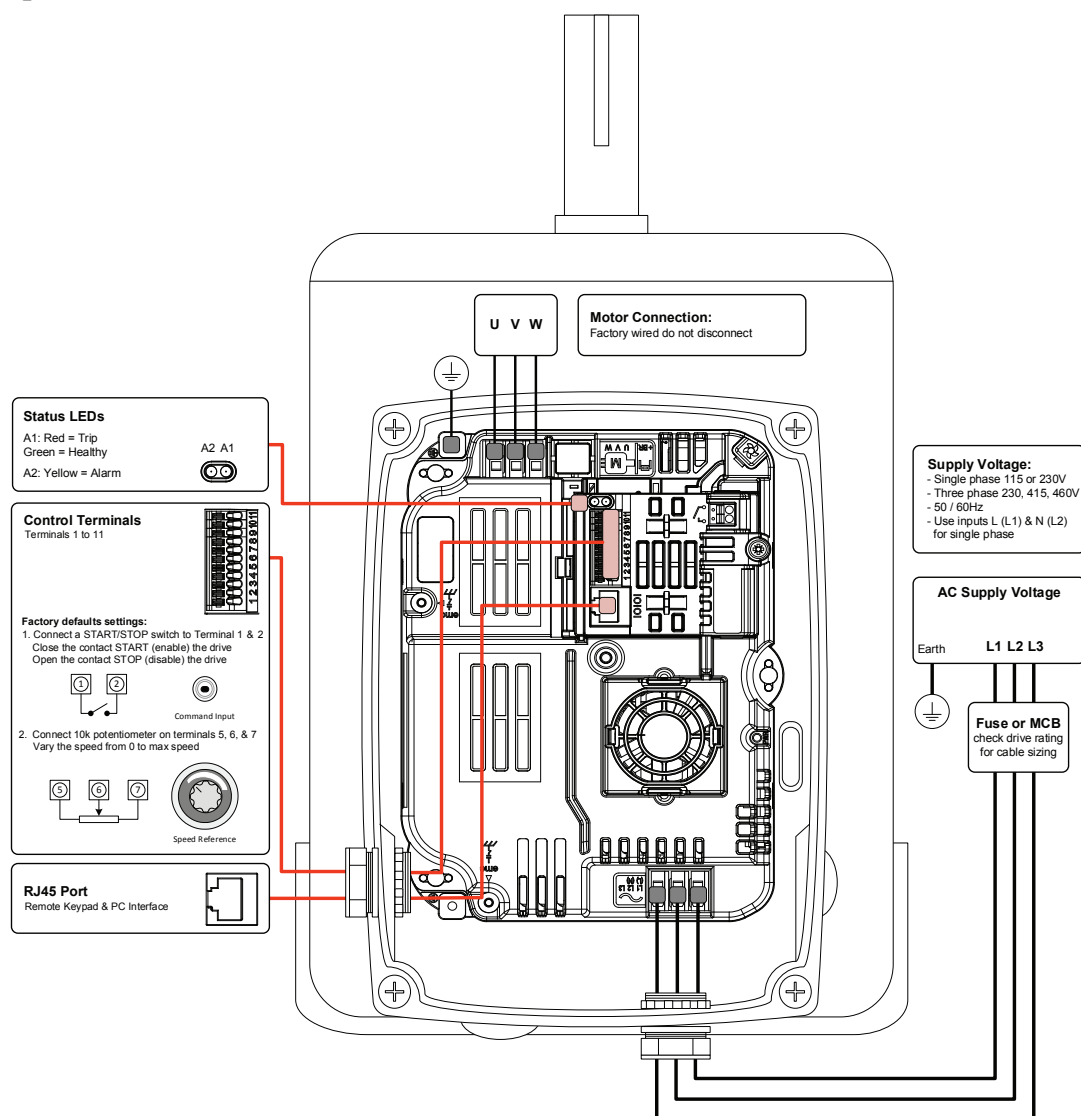
For motors supplied with temperature protection, leads P1 & P2 are thermostat leads. They are to be connected in series with the holding coil of the motor controller, which uses a manual momentary start switch. These are not standard with stock EC Titanium motors.

Figure 1-1 Connection Diagram

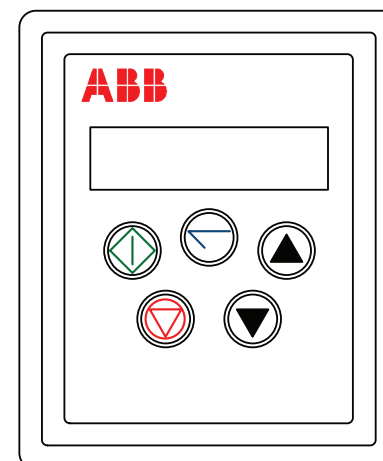


EC Titanium™ Quick Start Guide

Input Power & Control Connections



Remote Keypad ECS100L



	NAVIGATE	Used to display real-time information, to access and exit parameter edit mode and to store parameter changes.
	UP	Increase speed in real-time mode or scroll through values in parameter edit mode.
	DOWN	Decrease speed in real-time mode or scroll through values in parameter edit mode.
	STOP	In normal application, when in Keypad mode, this button is used to stop a running drive. If in trip mode, the key is used to reset the drive.
	START	When in keypad mode, the button is used to start a stopped drive or to reverse the direction of rotation.

NOTE: For keypad control set parameter 1103=1 and 9902 to the desired I/O configuration.

Quick Startup Guide

When delivered, the EC Titanium™ is pre-programmed to run from remote inputs wired to the terminal strip. This default digital input configuration provides a general purpose I/O setup with a hard wired start / stop enable, forward / reverse input and a selection between an analog speed reference or preset speed input.

Parameter 1103 = 0 defines control from the terminal strip (for Keypad Control 1103 =1) and Parameter 9902 = 0 sets up the configuration for the inputs and outputs as shown below.

- Step 1 Connect a control switch between the control terminals 1 and 2 and ensure that the contact is open (drive disabled). Connect a potentiometer (1kΩ min to 10 kΩ max) between terminals 5 and 7 with the wiper to terminal 6 of the control terminal. With the potentiometer set to zero, switch on the supply to the drive.
- Step 2 The status LED is slow flashing green and a connected EC100L Keypad will display **StOP**. Close the control switch, terminals 1-2, the drive is now 'enabled' and the output frequency speed are controlled by the potentiometer. The status LED will change to constant on green.
- Step 3 The display shows zero speed in Hertz as **H 0.0** with the potentiometer turned to minimum. If the display is not showing **H**, change it with the navigate key. Adjust the speed using the potentiometer, the motor will accelerate to the speed set by the potentiometer up to the value set in parameter 2008 (maximum frequency limit.)
- Step 4 Stop the motor, disable the drive by opening the control switch (terminal 1-2).

Terminal Mode (1103=0) Digital Input Function (9902=0)	2-Wire Forward Reverse
Active input across terminal 1 & 2 will cause the drive to run. When terminal 3 is open the drive will operate in the forward direction. Closing input 3 reverses the commanded direction. Closing terminal 4 will force operation at preset speed 1 (parameter 1202) or function as a jog command.	
Speed Reference Input	Connection Example
Potentiometer 1-10K Ohm Potentiometer Recommended (2 Watt Min.)	
Analog Input Analog Input Format (parameter 1300) selects Voltage or Current Source. Voltage 0-10 or 10-0 Vdc Current 0-20, 4-20 or 20-4 mA	

Keypad Operation

Setting parameter **1103** to a value of 1 enables keypad mode with forward direction only, while a value of 2 enables keypad mode with forward and reverse rotation.

Set parameter **1100** to 1 or 3 to enable the drive to start from the set keypad reference speed.

While the drive is stopped, press the **STOP** key. The value of the digital potentiometer will be displayed, indicating the target speed. Use the **UP** and **DOWN** keys to select the required target speed.

Press the **STOP** key to return to the real time display showing **StOP** or the **START** key to start the drive ramping up to the target speed. To reverse direction, press the **START** key again.

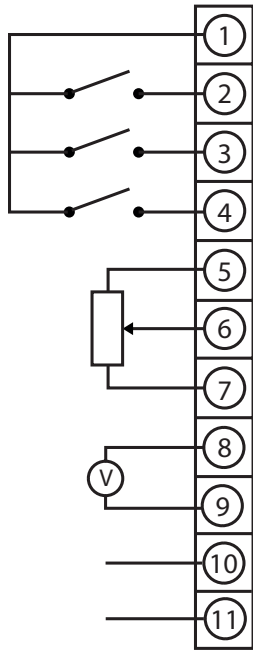
Keypad Display Screens

Prior to operation the keypad will show **StOP**, pressing the **STOP** key allows setting the preset speed on the display (**H x.x**) While in operation the following displays can be accessed by briefly pressing the Navigate Key.



StOP	Drive power applied and no Enable or Run signal
Drive Running	
H 0.0	Output Frequency (Hz)
A 0.0	Motor Current (Amps)
P 0.0	Motor Power (kW)
Drive Running, Speed Reference = 0	
Stndby	Enable / disable switch open drive will decelerate to stop and display shows StOP A zero reference and enable/disable closed the display will show H 0.0 (0.0Hz) >60 seconds at zero speed drive standby mode Stndby waiting for a speed reference

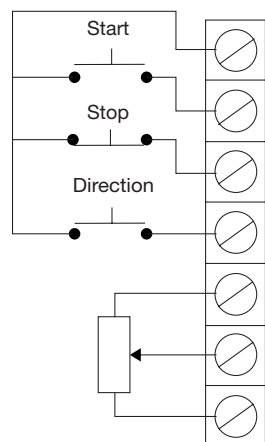
Control Terminals



Control Terminal	Signal
1	+24V User Output, 100mA
2	Digital Input 1
3	Digital Input 2
4	Digital Input 3 / Analog Input 2
5	+10VDC (10mA) 1kΩ minimum Reference for Potentiometer
6	Analog Input 1 / Digital Input 4
7	0V common, internally connected to terminal 9
8	Analog Output (0 to 10V) Digital Output (0 to 24V) 20mA maximum
9	0V
10	Modbus RTU -
11	Modbus RTU +
RL1-A	Relay Common
RL1-B	Relay NO Contact 250Vac, 6A / 30Vdc, 5A

Additional Connection Examples

3-Wire Start/Stop with Forward/Reverse Terminal Control Mode (1103 = 0)
Digital input configuration when the drive is controlled using momentary push-buttons. It provides a general purpose I/O setup with a momentary input for start, forward / reverse, stop interlock and an analog speed reference.

9902 = 11	3-Wire Forward Reverse
<p>A momentary input on terminal 2 will start the drive in the forward direction with a closed input on terminal 3.</p> <p>A momentary open input to I/O terminal 3 will stop the drive as specified in 2101 (Stop Mode).</p> <p>A momentary input on terminal 4 will reverse the drive direction.</p>	 <p>1 +24V User Input</p> <p>2 Digital Input 1</p> <p>3 Digital Input 2</p> <p>4 Digital Input 3</p> <p>5 +10 Volts</p> <p>6 Analog Input</p> <p>7 0 Volts</p>

Customizing your Application

Factory settings may give satisfactory performance however certain adjustment.





Parameter Name	Parameter	Adjustment
Minimum Frequency Limit	2007	Minimum output frequency
Maximum Frequency Limit	2008	Maximum output frequency ①
Primary Command Source	1103	Selects the reference input for the drive.
Digital Input Function Select	9902	Defines the function of the digital inputs
Stop Mode	2102	Select method of stopping required when drive is disabled.
Acceleration Ramp	2202	Adjust as need for your application. Short Acceleration or Deceleration times may cause excess motor current and may result in it tripping or the motor stalling.
Deceleration Ramp	2203	
Analog Input Format	1300	Set as required by the application (0-10V, 10-0V, 4-20mA)
Voltage Boost	2603	Any hard to start load will benefit from voltage boost. Permits a boost of up to 25% of full motor voltage to be applied.

① **NOTE:** The Analog Input Value scales with the maximum output frequency setting in 2008.

Example: The motor will run at 1800 RPM with a 10V DC reference and when parameter 2008 = 60 HZ.

Accessing Parameters and Program Navigation

The parameters are arranged in Groups according to the following structure.

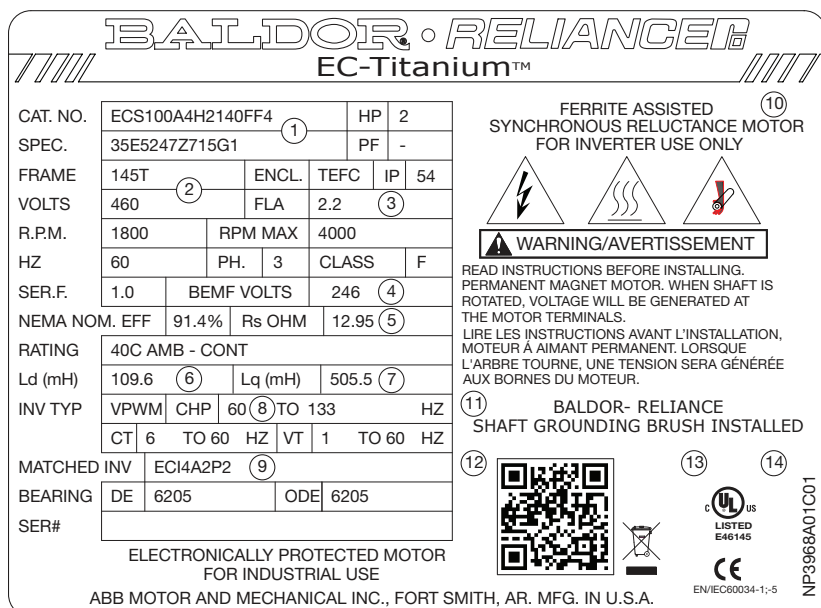
	Short Parameter Group	Basic Setup Parameters
	Long Parameter Group	Sequential List all Parameters Access to Display Group
	Advanced Group	Advanced Motor Control
	Read Only Display Group	Parameter 0000 Par L Group

Parameter Navigation

- Press and hold the NAVIGATE key for more than 1 second when the drive is displaying **STOP**. The display changes to **PAR 5**, indicating the short (**S**) parameters group. Use the ▲ (UP) and ▼ (DOWN) keys to select between the **S**, **L** or **A** parameter groups.
- To enter a parameter group, press and release the ◀ (Navigate) key while the group letter is flashing. Use the ▲ (UP) and ▼ (DOWN) keys to change to the desired parameter number.
- To change parameter values, press and hold the ◀ (Navigate) key then use the ▲ (UP) and ▼ (DOWN) keys to change to the required value. Press and release the ◀ (Navigate) key once more to store the change.
- Press and hold the ◀ (Navigate) key for more than 1 second to return to real-time mode. The display shows **STOP** if the drive is stopped or the real-time information (e.g. speed, current or power) if the drive is running.
- To access Read Only Parameters, navigate to **PAR L** Group and scroll to Parameter 0000, then press and release the navigate key.

Motor Nameplate Information

The EC Titanium Motor nameplate is located on the side of the motor and includes NEMA rating, appropriate marking, a type designation and a serial number, which allow identification of each unit. The motor nameplate contains electrical information necessary for proper setup of a drive control.



BALDOR-RELIANCE EC-Titanium™

CAT. NO. ECS100A4H2140FF4 HP 2
SPEC. 35E5247Z715G1 PF -

FRAME 145T ENCL. TEFC IP 54
VOLTS 460 FLA 2.2
R.P.M. 1800 RPM MAX 4000
HZ 60 PH. 3 CLASS F

SER.F. 1.0 BEMF VOLTS 246
NEMA NOM. EFF 91.4% Rs OHM 12.95

RATING 40C AMB - CONT
Ld (mH) 109.6 Lq (mH) 505.5
INV TYP VPWM CHP 60 TO 133 HZ
CT 6 TO 60 HZ VT 1 TO 60 HZ

MATCHED INV EC14A2P2
BEARING DE 6205 ODE 6205
SER#

ELECTRONICALLY PROTECTED MOTOR FOR INDUSTRIAL USE
ABB MOTOR AND MECHANICAL INC., FORT SMITH, AR. MFG. IN U.S.A.

FERRITE ASSISTED SYNCHRONOUS RELUCTANCE MOTOR FOR INVERTER USE ONLY

WARNING/AVERTISSEMENT
READ INSTRUCTIONS BEFORE INSTALLING. PERMANENT MAGNET MOTOR. WHEN SHAFT IS ROTATED, VOLTAGE WILL BE GENERATED AT THE MOTOR TERMINALS.
LIRE LES INSTRUCTIONS AVANT L'INSTALLATION. MOTEUR À AIMANT PERMANENT. LORSQUE L'ARBRE TOURNE, UNE TENSION SERA GÉNÉRÉE AUX BORNES DU MOTEUR.

BALDOR-RELIANCE SHAFT GROUNDING BRUSH INSTALLED

Region	Description	Factory Set Parameters ②
1	Catalog Number	
2	General Motor Information	
3	Motor Rated Amps	9906
4	BEMF (Back EMF) Voltage	9905
5	Motor Stator Resistance (Rs)	11201
6	Ld (mH) Motor Inductance (Lsd)	11203
7	Lq (mH) Motor q-axis Inductance (Lsq)	11206
8	Motor Rated Frequency	9907 (Rated Speed)
	Motor Maximum Frequency	2208 (Max Speed)
9	Matched Inverter Model Number	
10	PM Motor Warning Information	
11	Shaft Ground Provision Marking	
12	QR Code for motor information	
13	CE Marking	
14	UL Agency Listing	
Additional Factory Preset Parameters		
	Start Stop Mode 1 = Coast to Stop	2102 = 1 Coast to stop
	Minimum Speed	2007 = 15 HZ
	Control Mode	9903 = 2 PM Control

Motor values shown on the nameplate are utilized for proper control and setup of a drive used to run the EC Titanium motor.

② **NOTE:** Integrated units are factory programmed and parameters do not need to be adjusted unless a software reset was implemented.

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MN451

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