

# MOTOR CONTROLLER SPECIFICATION

400S, 240V

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## 1. Scope

This specification defines the characteristics for a 400S motor controller, originally developed for laundry applications. This motor will drive Fisher & Paykel Technologies' motors using Sensorless Vector Control and provides the features listed in this specification.

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## 2. Motor Controller Operation

### ***Control Features***

- Accurate motor speed control based on Sensorless technology.
- Input to read an external temperature sensor;
- Communication port allowing customers to define acceleration ramp, speed, running time, pause time, etc.
- Increasing the reliability of system, controller is able to identify:
  - Locked Rotor Detection;
  - Motor Loss of Phase;
  - Motor Overcurrent;
  - Over and under voltage;
  - Winding over temperature;
  - Communication timeout

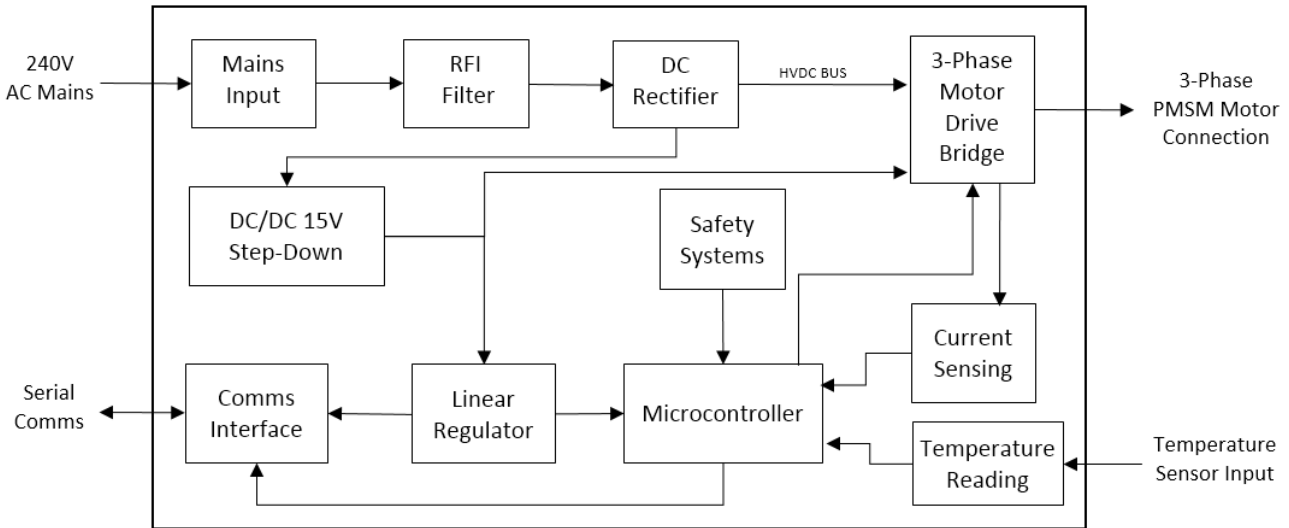
### ***Feedback Features***

The controller can measure and report the following quantities during operation:

- Fault Registers –fault status of the controller and connected motor
- Inverter Bridge Temperature – the measured temperature of the power section of the controller
- DC-link bus voltage
- Instantaneous and Average motor current
- Motor status – what mode of operation the motor is currently in (Idle, Spinning, Agitation etc.)
- Motor Temperature –the estimated motor temperature using the built-in thermal model and motor winding resistance measurement during start-up.
- Motor Speed – the current motor speed in RPM.

### 3. Specification – Motor Controller

#### Functional Block Diagram



*Functional block diagram of the Motor Control Module and external connections*

#### Absolute Maximum Ratings

Use of the control outside of these maximum ratings may cause irreversible damage or improper operation of the controller.

Rating	Symbol	Minimum	Maximum	Units
Utility Mains Input Voltage (240V)	$V_{MAINS}$	187	264	V
Utility Mains Input Voltage (120V)	$V_{MAINS}$	108	127	V
RMS Motor Output Current (per motor phase)	$I_{MOTOR}$	-	1.3	A
Motor Output Power* <sup>1</sup>	$P_{MOTOR(AV)}$	-	400	W
Supply Voltage for Communications Interface	$V_{CC(COMMS)}$	9	12	V
Ambient Temperature of Surrounding Air	$T_{AMB}$	0	45	°C
Ambient Humidity of Surrounding Air * <sup>2</sup>	$RH_{AMB}$	20	90	%RH

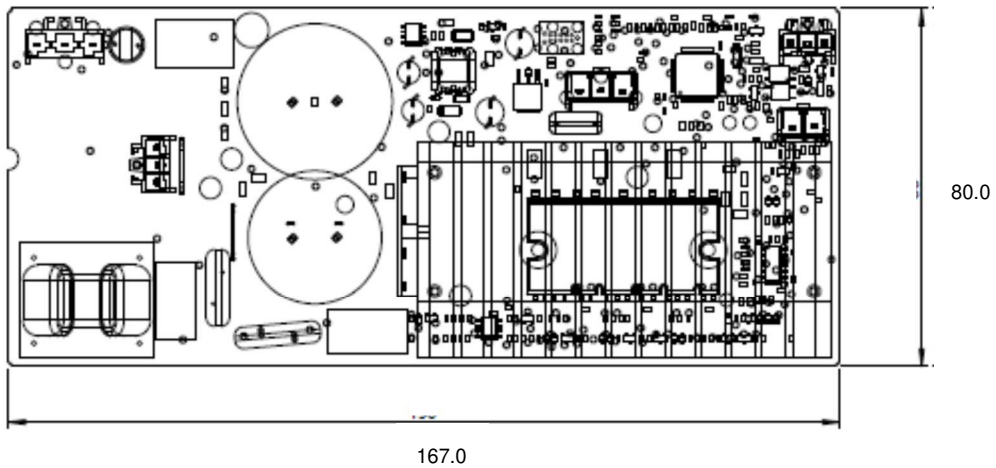
\*1 – Averaged over a 10 second period

\*2 – Ambient temperature and humidity conditions should be maintained such that condensation does not form on or inside the controller module

**Connector Pin Description**

Connector	Pin	Name	Function
Mains Input (P3,P7)	1	EARTH	Earth connection to the RFI Filter (not used)
	2	NEUTRAL	Utility mains voltage input connection – Neutral line
	3	PHASE	Utility mains voltage input connection – Phase / Active line
Motor Connection (P4,P8)	1	MTR_A_OUT	Output connections to the motor. It is important that these are connected in the correct polarity or the motor may not spin in the correct direction when driven
	2	MTR_C_OUT	
	3	MTR_B_OUT	
Isolated Comms (P5,P9)	1	0V	0V reference connection for the isolated comms bus
	2	Rx/Tx	Serial communications signal
	3	+9V/+12V	+9V/+12V power supply for the isolated comms bus

**Physical Dimensions**



\*\*\*All dimensions are in mm

## Serial Communications Interface

The serial communications interface is implemented as a single-wire open-collector half-duplex serial communications link. The signaling rate is 4800bps, using UART communications signaling standard with 8 Data bits, No Parity, 1 Stop bit.

The open-collector interface is non-inverting, NPN output with the open-collector pulling down to 0V. Nominal input/output impedance is 10KΩ.

The communication protocol for the motor control is the F&P protocol

## 4. Compliance and Standards

This controller has been evaluated by CQC to GB/T17499-2008 and GB4706.1-2005 and issued CQC Compliance Number CQC17002173203.

This controller has been evaluated to IEC 60730 4th edition. This section contains the conditions of usage that are required to maintain this compliance in the end-use installation.

## Safety Functions

The following safety functions of the controller are declared as part of this evaluation:

- Locked-Rotor protection – detects the motor locked-rotor condition and prevents operation under this condition
- Loss-of-Phase protection – detects an open-circuit condition in any of the motor winding circuits and prevents operation under this condition
- Motor Winding Over-Temperature protection – uses a thermal model to prevent over-temperature conditions in the motor windings
- Automatic Restart – the minimum automatic recovery period after a fault condition is detected is guaranteed

Rating	Symbol	Minimum	Typical	Maximum	Units
Locked Rotor Detection Time	$t_{\text{DETECT(LR)}}$	5	-	10	s
Loss of Phase Detection Time	$t_{\text{DETECT(LOP)}}$	0.5	-	10	s
Motor Winding Temperature Limit	$T_{\text{OVERTEMP}}$	-	170	200	°C
Automatic Restart Time	$t_{\text{RESTART}}$	3	-	10	s