

# Altivar 12P

Baseplate variable speed drives  
for asynchronous motors

## Installation manual

09/2009





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# Important Information

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## NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

## DANGER

DANGER indicates an imminently hazardous situation, which, if not avoided, **will result** in death or serious injury.

## WARNING

WARNING indicates a potentially hazardous situation, which, if not avoided, **can result** in death, serious injury or equipment damage.

## CAUTION

CAUTION indicates a potentially hazardous situation, which, if not avoided, **can result** in injury or equipment damage.

## CAUTION

**CAUTION**, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result** in equipment damage.

## PLEASE NOTE

The word "drive" as used in this manual refers to the controller portion of the adjustable speed drive as defined by NEC.

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this product.

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# Before you begin

Read and understand these instructions before performing any procedure with this drive.

## DANGER

### HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Read and understand this manual before installing the Altivar 12P drive. Installation must be performed by qualified personnel.
- Read and understand the standard user manual before operating the Altivar 12P drive. adjustment, repair, and maintenance must be performed by qualified personnel.
- The user is responsible for compliance with all international and national electrical code requirements with respect to grounding of all equipment.
- Many parts of this drive, including the printed circuit boards, operate at the line voltage. DO NOT TOUCH. Use only electrically insulated tools.
- DO NOT touch unshielded components or terminal strip screw connections with voltage present.
- DO NOT short across terminals PA/+ and PC/- or across the DC bus capacitors.
- Before servicing the drive:
  - Disconnect all power, including external control power that may be present.
  - Place a "DO NOT TURN ON" label on all power disconnects.
  - Lock all power disconnects in the open position.
  - WAIT 15 MINUTES to allow the DC bus capacitors to discharge.
  - Measure the voltage of the DC bus between the PA/+ and PC/- terminals to ensure that the voltage is less than 42 Vdc.
  - If the DC bus capacitors do not discharge completely, contact your local Schneider Electric representative. Do not repair or operate the drive
- Install and close all covers before applying power or starting and stopping the drive.

**Failure to follow these instructions will result in death or serious injury.**

## WARNING

### DAMAGED DRIVE EQUIPMENT

Do not operate or install any drive or drive accessory that appears damaged.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

## CAUTION

### RISK OF HIGH TEMPERATURE ON METAL PARTS

The baseplate of the product can reach a temperature up to 90 °C (194 °F) in normal conditions.

- Do not touch the base of the drive.

When mounted, the immediate proximity of the plate can reach a temperature above 70 °C (158 °F) in normal operating conditions.

- Safety hot surfaces sticker must be applied accordingly to your local standards (ref. ANSI Z535.3-2007, ISO 7000-0535) nearby the product.

**Failure to follow these instructions can result in injury or equipment damage.**

Example of Safety hot surfaces symbol (ref. ANSI Z535.3-2007):



## CAUTION

### RISK OF DAMAGE TO THE DRIVE

As this product has no self cooling (heatsink fins or fan), it is important that it is installed correctly, and that the cooling system is compatible with the demands of the application.

- Mount the drive according to the Conditions of Acceptability.

**Failure to follow these instructions can result in equipment damage.**

# Documentation structure

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The following Altivar 12 technical documents are available on the Schneider Electric website ([www.schneider-electric.com](http://www.schneider-electric.com)) as well as on DVD-ROM (reference VW3A8200).

## **User manual**

This manual describes how to install, program and operate the drive.

## **Simplified manual**

This manual is a simplified version of the User manual. This manual is delivered with the drive.

## **Quick Start sheet**

The Quick Start describes how to wire and configure the drive to start motor quickly and simply for simple applications. This document is delivered with the drive.

## **Modbus Communication manual**

This manual describes the assembly, connection to the bus or network, signaling, diagnostics, and configuration of the communication-specific parameters via the 7 segment LED display.

It also describes the communication services of the Modbus protocol.

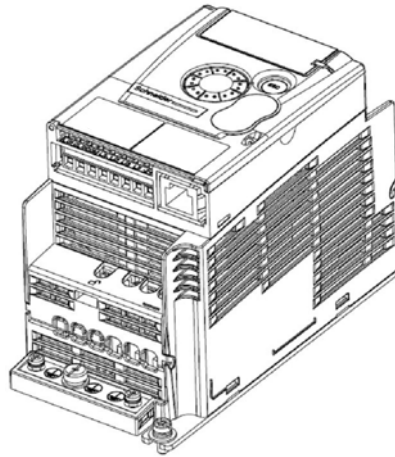
This manual includes all Modbus addresses. It explains the operating mode specific to communication (state chart).

## **ATV12P Installation manual**

This manual describes how to install the drives following the conditions of acceptability.

# Product Overview

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This ATV12 baseplate product is designed for OEM's and factory installation into end user machines where it is not acceptable to install cooling fans.

This document is provided to help selection of cooling system and drive mounting within the conditions of acceptability (page [12](#)).

## 1. Receive and inspect the drive

- Check that the part number printed on the label is the same as that on the purchase order.
- Remove the Altivar from its packaging and check that it has not been damaged in transit.

## 2. Mechanical installation

- For drive mounting types and recommendations on the ambient temperature, please refer to the Mounting and temperature conditions instructions on page [10](#).
- Mount the drive vertically.
- The use of the drive must be in agreement with the environments defined by the standard 60721-3-3 and according to the levels defined in the catalogue.
- Mount the options required for your application, see catalogue.

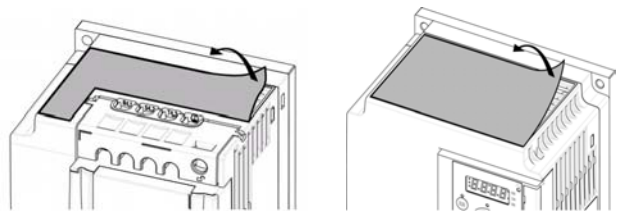
Steps 2 to 4 must be performed with the power off.



## 3. Wire and configure the drive

- Please refer to the ATV12 user manual.

## 4. Remove the vent cover



## 5. Use and run the drive

- Please refer to the ATV12 user manual.



# Drive ratings

## Single-phase supply voltage: 100...120 V 50/60 Hz

For three Phase Output 200/240 V motors

Motor		Line supply (input)						Drive (output)			Reference
Power indicated on plate (1)		Max. current line		Max. prospec. line Isc	Apparent power	Power dissipated at nominal current		Nominal current In	Max. transient current for		
		at 100 V	at 120 V			Product (1)	Plate (2)		60 s	2 s	
kW	HP	A	A	kA	kVA	W	W	A	A	A	
0.37	0.5	11.4	9.3	1	1.9	29	16	2.4	3.6	4	ATV12P037F1

## Single-phase supply voltage: 200...240 V 50/60 Hz

For three Phase Output 200/240 V motors

Motor		Line supply (input)						Drive (output)			Reference
Power indicated on plate (1)		Max. current line		Max. prospec. line Isc	Apparent power	Power dissipated at nominal current		Nominal current In	Max. transient current for		
		at 200 V	at 240 V			Product (1)	Plate (2)		60 s	2 s	
kW	HP	A	A	kA	kVA	W	W	A	A	A	
0.37	0.5	5.9	4.9	1	2	27	16	2.4	3.6	4	ATV12P037M2
0.55	0.75	8	6.7	1	2.8	34	24	3.5	5.3	5.8	ATV12P055M2
0.75	1	10.2	8.5	1	3.5	44	31	4.2	6.3	6.9	ATV12P075M2

## Three-phase supply voltage: 200...240 V 50/60 Hz

For three Phase Output 200/240 V motors

Motor		Line supply (input)						Drive (output)			Reference
Power indicated on plate (1)		Max. current line		Max. prospec. line Isc	Apparent power	Power dissipated at nominal current		Nominal current In	Max. transient current for		
		at 200 V	at 240 V			Product (1)	Plate (2)		60 s	2 s	
kW	HP	A	A	kA	kVA	W	W	A	A	A	
0.37	0.5	3.6	3	5	1.2	24	14	2.4	3.6	4	ATV12P037M3
0.75	1	6.3	5.3	5	2.2	41	29	4.2	6.3	6.9	ATV12P075M3
1.5	2	11.1	9.3	5	3.9	73	57	7.5	11.2	12.4	ATV12PU15M3
2.2	3	14.9	12.5	5	5.2	85	61	10	15	16.5	ATV12PU22M3
3	3	19	15.9	5	6.6	94	72	12.2	18.3	20.1	ATV12PU30M3
4	5	23.8	19.9	5	8.3	128	103	16.7	25	27.6	ATV12PU40M3

(1) These power ratings represent both power and control thermal losses. They are for a switching frequency of 4 kHz, in continuous operation. The switching frequency is adjustable from 2 to 16 kHz.

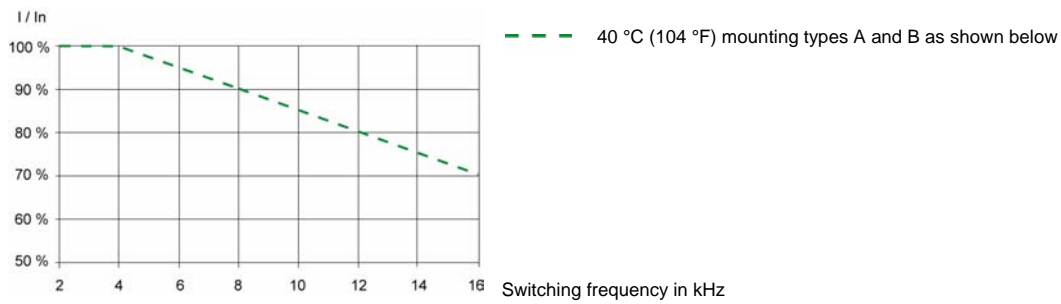
Above 4 kHz, the drive will reduce the switching frequency if an excessive temperature rise occurs. The temperature rise is detected by a PTC probe in the power module. Nonetheless, derating should be applied to the nominal drive current if continuous operation above 4 kHz is required: 10% derating for 8 kHz, 20% derating for 12 kHz, 30% derating for 16 kHz. Please refer to derating curve provided in this manual.

(2) This power represents thermal losses dissipated by plate.

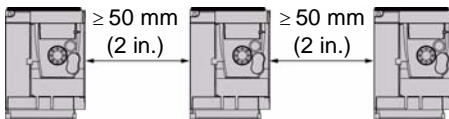
# Drive ratings

## Derating curve

Derating curve for the nominal drive current ( $I_n$ ) as a function of temperature, switching frequency and mounting type.

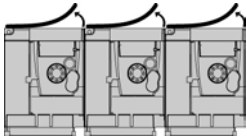


### Type A mounting



Free space  $\geq 50$  mm (2 in.) on each side, with vent cover fitted. Mounting type A is suitable for drive operation at surrounding air temperature less than or equal to 50°C (122°F).

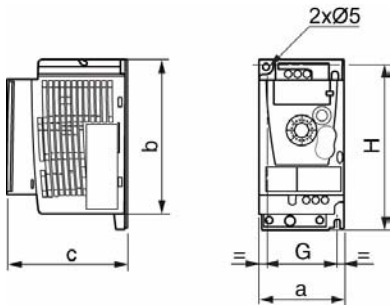
### Type B mounting



Drives mounted side-by-side, vent cover should be removed (the degree of protection becomes IP20).

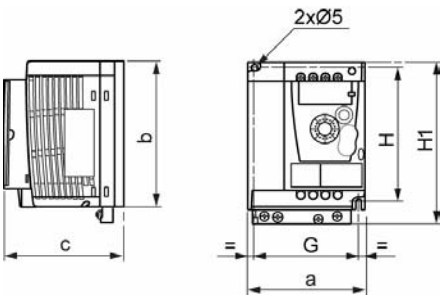
# Dimensions and weights

ATV12P037F1, 037M2, 055M2, 075M2,  
037M3, 075M3



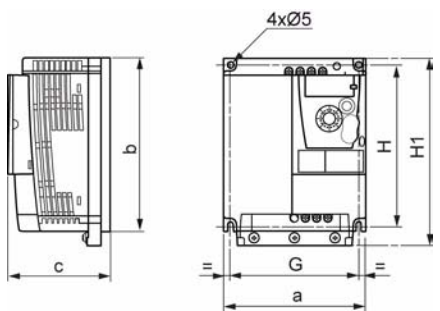
ATV12P	a mm (in.)	b mm (in.)	c mm (in.)	G mm (in.)	H mm (in.)	H1 mm (in.)	Ø mm (in.)	For screws	Weight kg (lb)
<b>Size 1C1</b> 037F1 037M2	72 (2.83)	142 (5.59)	102.2 (4.02)	60 (2.36)	131 (5.16)	143 (5.63)	2 x 5 (2 x 0.20)	M4	0.6 (1.3)
<b>Size 1C1</b> 055M2 075M2 <b>Size 1C3</b> 037M3 075M3	72 (2.83)	142 (5.59)	102.2 (4.02)	60 (2.36)	120 (4.72)	143 (5.63)	2 x 5 (2 x 0.20)	M4	0.7 (1.5)

ATV12PU15M3, U22M3



ATV12P	a mm (in.)	b mm (in.)	c mm (in.)	G mm (in.)	H mm (in.)	H1 mm (in.)	Ø mm (in.)	For screws	Weight kg (lb)
<b>Size 2F3</b> U15M3 U22M3	105 (4.13)	130 (5.12)	98.2 (3.87)	93 (3.66)	120 (4.72)	143 (5.63)	2 x 5 (2 x 0.20)	M4	1.0 (2.2)

ATV12PU30M3, U40M3



ATV12P	a mm (in.)	b mm (in.)	c mm (in.)	G mm (in.)	H mm (in.)	H1 mm (in.)	Ø mm (in.)	For screws	Weight kg (lb)
<b>Size 3F3</b> U30M3 U40M3	140 (5.51)	170 (6.69)	100.2 (3.94)	126 (4.96)	159 (6.26)	184 (7.24)	4 x 5 (4 x 0.20)	M4	1.6 (3.5)

# Conditions of Acceptability (CA)

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Please read the following section before selection and mounting installation of your product.

## Environmental limits

The drive electronics are designed for installation in a maximum surrounding air temperature of 40 °C (104 °F). Any air temperature above this will require derating.

## Baseplate temperature limit

The absolute limit for the baseplate is **90 °C (194 °F)**.

Operating conditions such as current and switching frequency will affect baseplate temperature. Please refer to tables on page [17](#) for a definition of thermal losses with respect to current and switching frequency.

Mounting conditions such as material flatness, thermal grease properties and mounting screw torque will all affect baseplate temperature.

## Possible mounting types

Mounting could be made following three different methods.

1. **Metal sheet.**
2. **Machine framework.**
3. **External heatsink.**

## Mounting restrictions

- Maximum surrounding air Temperature of 40 °C (104 °F)
- Vertical mounting at  $\pm 10^\circ$ .
- No other heat source on the surface.
- The metal sheet must have a clearance, front and rear, of 50 mm.
- Free space in front of unit: 10 mm (0.39 in.) minimum.
- When increasing the thickness from 10 (0.39 in.) to 20 mm (0.78 in.) the metal sheet area can only be reduced by 5%.

## Thermal properties of mounting

The drive must be mounted to a thermally conductive surface with sufficient thermal capacity to maintain the baseplate below the 90 °C (194 °F).

## Thermal grease

This should be applied as per the manufacturers recommendations.

The following grease are recommended, but the user may use any local equivalent meeting the requirements of the complete thermal design.

Manufacturer	Type	Reference	Thermal conductivity	Thickness
Electrolube	Ester system oil, silicone free	HTC	0.9 W/(m.K)	100 $\mu$ m
GE Bayer Silicones	Alkyl modified oil, contains some silicone	YG 6260	0.84 W/(m.K)	

## Mechanical restrictions

The mounting surface must be machined to respect a flatness of 100  $\mu$ m max with a corresponding maximum roughness of 3.2  $\mu$ m. Be sure to remove any burrs of the mounting holes before fitting the drive to the mounting surface.

# Mounting

## Mounting the drive on a metal sheet

ATV12P●●●●● drives can be mounted on a steel or aluminium machine frame, observing the conditions described in the Mounting restriction, page 12.

Drive alone	Metal sheet characteristics (square shape)
ATV12P037F1 ATV12P037M2 ATV12P055M2 ATV12P075M2	thickness: 10 mm (0.39 in.) area: 0.12 m <sup>2</sup> (1.3 sqft) for steel sheet area: 0.09 m <sup>2</sup> (1 sqft) for aluminium sheet
ATV12P037M3 ATV12P055M3 ATV12P075M3	
ATV12PU15M3 ATV12PU22M3	thickness: 10 mm (0.39 in.) area: 0.18 m <sup>2</sup> (1.94 sqft) for aluminium sheet(*)
ATV12PU30M3 ATV12PU40M3	thickness: 10 mm (0.39 in.) area: 0.42 m <sup>2</sup> (4.52 sqft) for aluminium sheet(*)

Three identical drives side by side	Metal sheet characteristics (square shape)
ATV12P037F1 ATV12P037M2 ATV12P055M2 ATV12P075M2 ATV12P037M3 ATV12P055M3 ATV12P075M3	thickness: 20 mm(0.78 in.) area: 0.41 m <sup>2</sup> (4.41 sqft) for steel sheet or thickness: 10 mm (0.39 in.) area: 0.31 m <sup>2</sup> (3.37 sqft) for aluminium sheet

(\*) Steel plate is not proposed because size will exceed 1 m<sup>2</sup> (10.76 sqft).

### Mounting procedure

- Deburr the tapped holes.
- Apply a thermal contact grease, or equivalent, to the entire support surface of the drive.

### Screw size and tightening torque

The table below details the specifications for the mounting screws.

Model	Power mains voltage	Rating	Screw	Torque
ATV12P037F1	110 V 1PH	0.37 kW	2 x M4	1.1 to 1.7 Nm (9.7 to 15 lb.in)
ATV12P037M2	200 V 1PH	0.37 kW		
ATV12P055M2	200 V 1PH	0.55 kW		
ATV12P075M2	200 V 1PH	0.75 kW		
ATV12P037M3	200 V 3PH	0.37 kW		
ATV12P075M3	200 V 3PH	0.75 kW		
ATV12PU15M3	200 V 3PH	1.50 kW		
ATV12PU22M3	200 V 3PH	2.20 kW	4 x M4	
ATV12PU30M3	200 V 3PH	3.00 kW		
ATV12PU40M3	200 V 3PH	4.00 kW		

# Mounting

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## Mounting the drive on an external heatsink and machine framework

The following conditions must be followed for correct installation:

- Determination of the suitable thermal resistance ( $R_{th}$ ), see page [15](#).
- Selection of heatsink or framework which has a thermal resistance lower or equal to the determined value ( $R_{th}$ ).

### CAUTION

#### RISK OF DAMAGE TO DRIVE

When using external heatsink, the cooling solution must be calculated assuming the heat source is of the concentrated type.

The following information is to be given to the cooling solution manufacturer:

- required concentrated  $R_{th}$ ,
- source dimension,
- thermal losses.

**Failure to follow these instructions can result in equipment damage**

#### Mounting procedure

- Deburr the tapped holes.
- Apply a thermal contact grease, or equivalent, to the entire support surface of the drive.
- Follow mounting restrictions page [12](#).

# Thermal resistances and losses

The global thermal resistance of your system  $R_{th}$ , expressed in K/W (for kelvin per watt), is defined by the following formula:

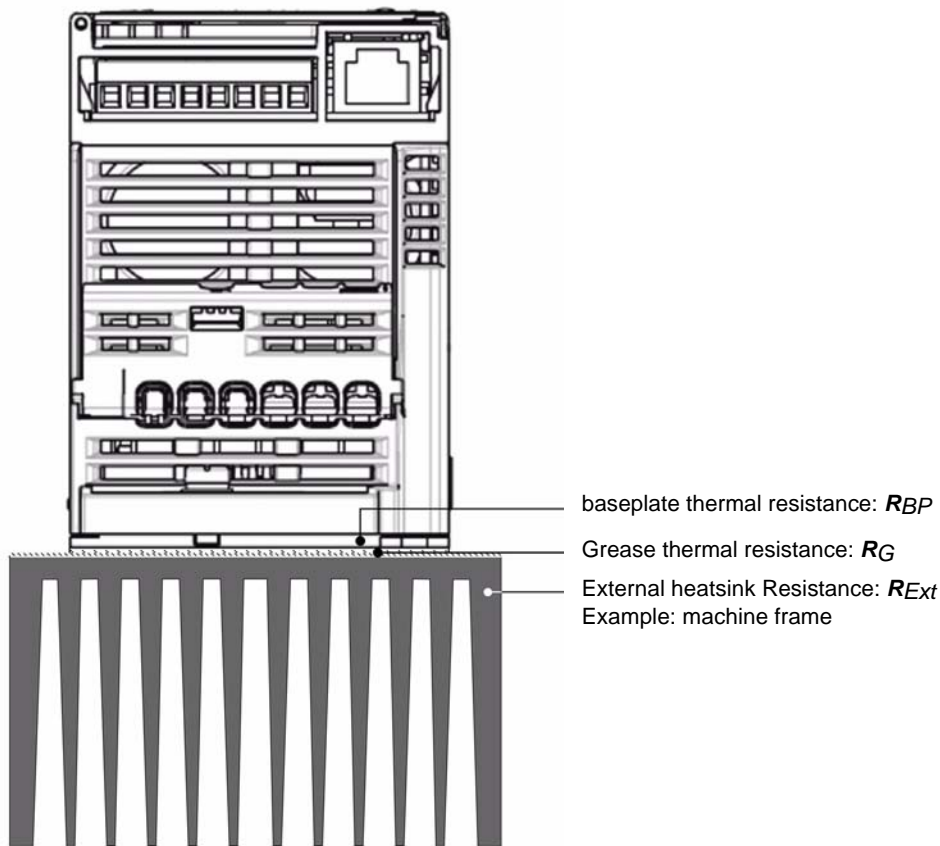
$$R_{th} = \frac{90 - T_{ambient}}{L_{oad}} \quad \text{Equ. 1}$$

See Thermal losses  $L_{oad}$  values in the table page [17](#).

The global thermal resistance  $R_{th}$  is equal to the sum of 3 components:

- " $R_{BP}$ : baseplate thermal resistance, see page [17](#).
- " $R_G$ : grease thermal resistance, see page [17](#).
- " $R_{Ext}$ : External heatsink thermal resistance, see page [17](#)

$$R_{th} = R_{BP} + R_G + R_{Ext} \quad \text{Equ. 2}$$



Re-arranging equation (1) and (2), we can calculate the thermal resistance of external heatsink required to satisfy the 90 °C (194 °F) requirement for the baseplate, namely:

$$R_{Ext} = \frac{90 - T_{ambient}}{L_{oad}} - R_{BP} - R_G \quad \text{Equ. 3}$$

The calculated  $R_{Ext}$  is the maximum thermal resistance value for a heat sink that would fit for the application. We recommend to incorporate a 10% margin ; this margin is already included in the values on table page [17](#).

# Thermal resistances and losses

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## Choosing a heat sink for the product

The choice of a heat sink depends on your installation. Here are a few tips to help you find the correct heat sink for your application :

- Heat sink base shall be at least as large as the product baseplate (please refer to table page [9](#) for dimensional information),
- Heat sink thermal resistance shall fit with the values given on page [9](#).

**Note:** Thermal resistance is not a characteristic of a heat sink, but it is actually of a {heat sink + source} system, as the source shape strongly affects the value. Most heat sink manufacturers give their products with a thermal resistance value calculated accordingly to a source which has the same surface than the heat sink base. If your heat sink is larger than your ATV 12 P product, please refer to the manufacturer to get the corrected thermal resistance. This corrected value is to be compared to the specifications page [9](#).



## Thermal resistances and losses

### Single-phase supply voltage: 100...120 V 50/60 Hz

Drive	Frequency	Thermal losses (4) <i>LOAD</i>	Thermal density	Concentrated heatsource surface area	Thermal resistance $R_{th}$ (1)		
					baseplate <i>R<sub>BP</sub></i>	grease <i>R<sub>G</sub></i>	External heatsink <i>R<sub>Ext</sub></i> (3)
ATV12P	kHz	W	W/m <sup>2</sup> (W/sqft)	mm (in.)	K/W (2)	K/W (2)	K/W (2)
037F1	4 to 16	17	1816 (169)	72 x 130 (2.83 x 5.12)	0,04	0,012	2,6

### Single-phase supply voltage: 200...240 V 50/60 Hz

Drive	Frequency	Thermal losses (4) <i>LOAD</i>	Thermal density	Concentrated heatsource surface area	Thermal resistance $R_{th}$ (1)		
					baseplate <i>R<sub>BP</sub></i>	grease <i>R<sub>G</sub></i>	External heatsink <i>R<sub>Ext</sub></i> (3)
ATV12P	kHz	W	W/m <sup>2</sup> (W/sqft)	mm (in.)	K/W (2)	K/W (2)	K/W (2)
037M2	4	16	1709 (159)	72 x 130 (2.83 x 5.12)	0,04	0,012	2,75
	8	17	1816 (169)	72 x 130 (2.83 x 5.12)	0,04	0,012	2,6
	12	18	1923 (179)	72 x 130 (2.83 x 5.12)	0,04	0,012	2,45
	16	18	1923 (179)	72 x 130 (2.83 x 5.12)	0,04	0,012	2,45
055M2	4 to 16	24	2564 (238)	72 x 130 (2.83 x 5.12)	0,04	0,012	1.82
075M2	4 to 16	31	3312 (308)	72 x 130 (2.83 x 5.12)	0,04	0,012	1.4

### Three-phase supply voltage: 200...240 V 50/60 Hz

Drive	Frequency	Thermal losses (4) <i>LOAD</i>	Thermal density	Concentrated heatsource surface area	Thermal resistance $R_{th}$ (1)		
					baseplate <i>R<sub>BP</sub></i>	grease <i>R<sub>G</sub></i>	External heatsink <i>R<sub>Ext</sub></i> (3)
ATV12P	kHz	W	W/m <sup>2</sup> (W/sqft)	mm (in.)	K/W (2)	K/W (2)	K/W (2)
037M3	4	14	1496 (139)	72 x 130 (2.83 x 5.12)	0,04	0,012	3,16
	8	15	1603 (149)	72 x 130 (2.83 x 5.12)	0,04	0,012	2,95
	12	16	1709 (159)	72 x 130 (2.83 x 5.12)	0,04	0,012	2,76
	16	16	1709 (159)	72 x 130 (2.83 x 5.12)	0,04	0,012	2,76
055M3	4	23	2457 (228)	72 x 130 (2.83 x 5.12)	0,04	0,012	1.9
075M3	4 to 16	29	3098 (288)	72 x 130 (2.83 x 5.12)	0,04	0,012	1.5
U15M3	4	57	4176 (388)	72 x 130 (2.83 x 5.12)	0,012	0,008	0,77
	8	64	4689 (436)	72 x 130 (2.83 x 5.12)	0,012	0,008	0,68
	12	69	5055 (470)	72 x 130 (2.83 x 5.12)	0,012	0,008	0,63
	16	71	5201 (483)	72 x 130 (2.83 x 5.12)	0,012	0,008	0,61
U22M3	4	61	4469 (415)	72 x 130 (2.83 x 5.12)	0,012	0,008	0,71
	8	62	4542 (422)	72 x 130 (2.83 x 5.12)	0,012	0,008	0,7
	12	63	4615 (429)	72 x 130 (2.83 x 5.12)	0,012	0,008	0,69
	16	63	4615 (429)	72 x 130 (2.83 x 5.12)	0,012	0,008	0,69
U30M3	4	72	3025 (281)	140 x 170 (5.51 x 6.69)	0,004	0,0036	0,61
	8	74	3109 (289)	140 x 170 (5.51 x 6.69)	0,004	0,0036	0,6
	12	75	3151 (293)	140 x 170 (5.51 x 6.69)	0,004	0,0036	0,59
	16	75	3151 (293)	140 x 170 (5.51 x 6.69)	0,004	0,0036	0,59
U40M3	4	103	4328 (402)	140 x 170 (5.51 x 6.69)	0,004	0,0036	0,43
	8 to 16	110	4622 (429)	140 x 170 (5.51 x 6.69)	0,004	0,0036	0,4

(1) See definition on page 15. The table takes into account a 10% margin.

(2) K/W: kelvin per watt

(3) Concentrated heatsource

(4) These losses take into account the derating used for switching frequency.

