



SinuMEC **Sinusoidal Motor Efficiency** **Controller**

Manual of Installation, Operation and **Maintenance**

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PowerSines Ltd.
PowerSines has ISO 9001:2000 approval and IQNet

The SinuMEC is EMC approved, and bears the "CE" marking

Patent Pending

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1. Overview

The SinuMEC is a reduced voltage starter and energy controller designed to provide Voltage reduction of 100/180V (120V/216V in 480V 60Hz) during motor startup and during operation in Save mode.

1.1 Features

Three modes of operation

- Manual
- Remote control
- Auto start

Front panel display with the following parameters

- Input line to line voltage (L2-L3 only)
- Calculated output voltage (U-W only)
- Current per phase (I)

Time setting and Programming

- Real time clock

Communication

- A built in RS232 port is available
- All displayed programming data can be transmitted via a cellular net to a control center (cellular adapter is required)

Protection provided by the SinuMEC

- Unbalanced currents
- Missing phase
- Over load current
- Over temperature protection
- Forced cooling is automatically activated if the temperature is too high

1.2 Terms, Abbreviations and Definitions

Term	Description
IBP	Internal bypass
DOL	Direct online (full net voltage minus a fixed reduction)
NO	Normally open
NC	Normally closed

1.3 Safety Precautions and Guidelines



Only qualified electrical personnel may install and operate this instrument, according to local laws and regulations.

As all electrical instruments, the SinuMEC is potentially hazardous. The following safety precautions and guidelines should be followed to ensure safe installation and operation of the SinuMEC device.

The installer is responsible for installing the SinuMEC in accordance with all safety and electrical regulations.

The SinuMEC should be installed and operated only after careful study of this manual.

The SinuMEC is not a galvanic switching device.

Disconnect the supply voltage before any maintenance work on the SinuMEC or on the motor.

Only voltage free contacts may be connected to the control terminals.

The internal printed circuit board carries high (main) voltage; therefore all necessary precautions should be taken when approaching this PCB.

1.4 Device Selection



When selecting a device for a specific load several the following important guidelines must be followed:

1. The device selection is based on the current measurement only.
2. The rated nominal current of the SinuMEC should not be lower than the nominal current of the motor for inline connection, and 58% of nominal current of the motor for inside delta connection.
3. In benefit from energy saving the current measured before the SinuMEC installation should be lower than 50%-70% of the motor rated nominal current during part of the motor operation time.

1.5 Voltage Levels

The SinuMEC provides 3 voltage levels:

- Bypass – the internal bypass contactor is activated and the motor receives the full network voltage.
- Level 1 – the SinuMEC supplies the first level voltage reduction: 100V in 400V/50Hz network or 120V in 480V/60Hz network.
- Level 2 – the SinuMEC supplies the second level voltage reduction: 180V in 400V/50Hz network or 216V in 480V/60Hz network.

When the SinuMEC is connected inside the motor delta, the motor receives its voltages through the SinuMEC from one side, and the full network voltage from the other side. The result is that the motor voltages are 400V, 340V and 290V in 400v/50Hz network or 480V, 410V and 350V in 480v/60Hz network.

Note: The voltage levels are approximated and depends on the voltage input level as well as other operational and design parameters.

2. Unpacking and Mounting

2.1 Unpacking

Unpack the SinuMEC from its packaging and visually check to make sure that the device was not damaged in transport.

Check the label on the SinuMEC and confirm the characteristics / attributes such as power, current, voltage and control voltage.

In the case of any damage or non-conformance, please contact your local distributor.

2.2 Mounting Instructions

The SinuMEC must be mounted in an electrical cabinet, which must be suitably ventilated.

2.2.1 Mounting and Ventilation

The SinuMEC must have a 3 phase main switch in series and a main isolating contactor in series. The size of the contactor (in Amps) should be determined according to the nominal current of the motor and the SinuMEC.

The SinuMEC device should be vertically and horizontally centered in the cabinet to allow easy access and proper ventilation.

The following are the minimum distances between the SinuMEC and its enclosure:

Height (H_1 and H_2) – 150 mm

Width - H_2 – 150, W – 100 mm

Note: These measurements apply to all power ratings

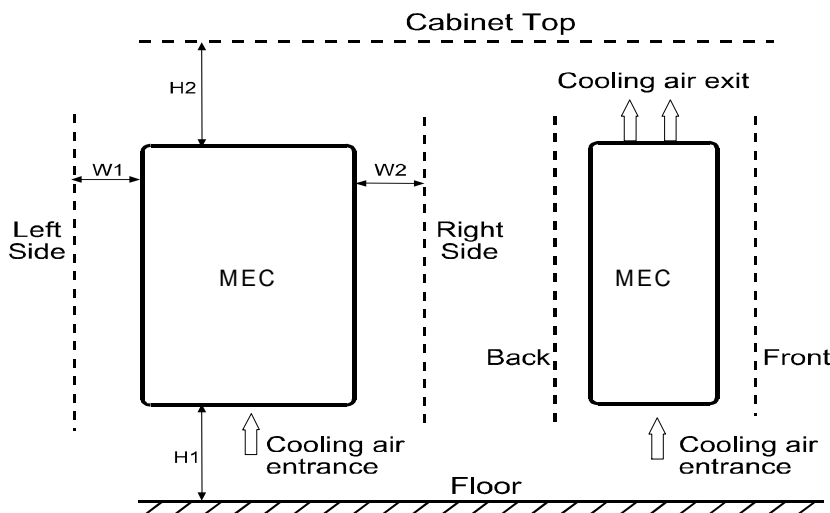


Figure 1: Space required for mounting the SinuMEC

Verify that the SinuMEC surrounding environment is free of liquids, or corrosive fumes.

2.2.2 Heat Dissipation

It is recommended that the SinuMEC be mounted directly on a metallic plate, to improve heat dissipation.

In order to ensure sufficient heat dissipation, the SinuMEC must be mounted vertically (transformers at the top), leaving free space around the device.

Ensure that ventilation openings in cabinets in which the SinuMEC is installed are not be blocked.

2.2.3 Wiring

The SinuMEC terminal blocks can be connected using aluminum or copper wires.

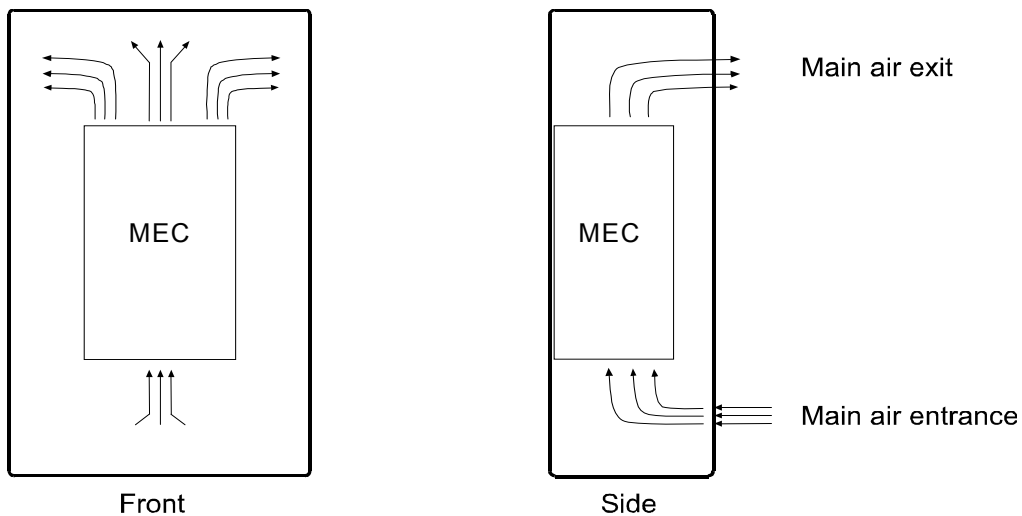


Figure 2: Cooling Air Flows

3. SinuMEC Operation

Upon supply of voltage to its control and power terminals the SinuMEC goes into operation in reduced voltage start mode, provided the control terminals 4 & 6 are bridged via an external dry contact in Remote mode.

At this stage, the main screen is displayed, output voltage is supplied and the system is in start mode.

The motor will receive reduced voltage during the entire startup period, the length of which may be changed on the special configuration screen.

On completion of the startup process, terminals 11 & 12 will provide a signal noting this.

If the potential saving current is detected, reduced voltage will be supplied to the motor, and the message “Save” will be displayed on the main screen.

If the input current is higher than the potential saving current the SinuMEC will provide full net voltage and a “Bypass” message will be displayed on the main screen. Refer to paragraph 4.7.3 (page 17) for further details.

The SinuMEC will only switch to saving mode again if the input current is continuously lower than the set level for user defined period (page 19).

3.1 Front Panel

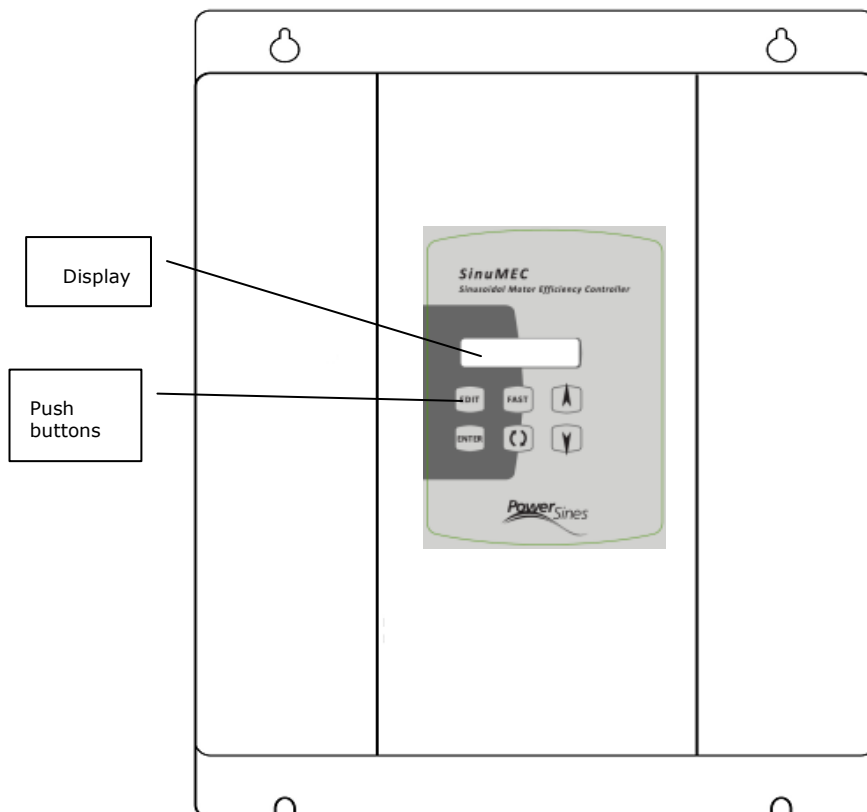








Figure 3: SinuMEC Front Panel

3.2 Keypad

The following six keys are found on the keypad and are used for programming the device and scrolling between screens:

Key	Description
	Used for programming parameters. This key allows you to change a specific parameter. 1. Click Edit ; the parameter value will start to flash. 2. Use the up and down arrow keys to alter the parameter value.
	Used to save a changed value to the memory. Clicking Enter will set the parameter value and stop it from flashing.
	Used to move between screens, or increase parameter values.
	Used to move between screens, or decrease parameter values.
	Used together with the arrow keys in order to accelerate the changes to the value being altered.
	On/Off key for use in manual mode of operation.

4. SinuMEC Screens

The various SinuMEC display screens are explained in the following sections.

If the device is in Remote mode and is inactive for 10 minutes, the main screen will be displayed

Use the arrow keys to navigate between screens: down to move forward and up to move backwards.

To set the parameters on the screens, click **EDIT** on the keypad, set the required value using the arrows, and click **Enter**.

To set

The SinuMEC screens are designed in three levels:

Status screens, which allow only monitoring status and readings

Standard setup screens, which enable the device to be programmed

Advanced setup screens, which allow advanced programming. There is usually no need to program any of these parameters.

4.1 Main screen

This screen displays the current mode of the SinuMEC, and is **not adjustable**.

S	i	n	u	M	E	C	#	#		m	m	m	m	m	m
1	1	1	A			2	2	2	V			3	3	3	V

Table 1: Main Screen

Display	Description
##	Countdown (paragraph 4.7.6)
mmmmm	Status Display: (paragraph 4.1.1).
Ready	Standby status, will appear when control voltage is supplied.
Start	Motor Start – Reduced output voltage is supplied to the motor in order to perform a gradual start
Start>	Motor start – Line voltage is supplied to the motor
Start2	Motor start – Line voltage is supplied to the motor.
Save 1,2	Reduced output voltage is supplied to the motor (Voltage level 1 or 2)
Bypass	Line voltage is supplied to the motor
Ext.BP	Line voltage is supplied to the motor
TestBP	Line voltage is supplied to the motor
ForcBP	Line voltage is supplied to the motor
Alarm!	Fault indication
111A	Maximum current across three phases
222V	Input voltage, phase L2-L3
333V	Calculated output voltage, phases U-W

4.1.1 Status Description

This section briefly describes the different descriptions displayed in the status section of the SinuMEC main screen.

Ready

The SinuMEC did not receive a Start command.

The SinuMEC is ready for motor starting. Motor will start immediately upon receipt of a start signal (in remote mode), from the front panel (in manual mode), or upon detecting of current (in auto mode).

Output voltage level depends on whether or not the startup feature is enabled (paragraph 0):

Enabled - Output voltage is reduced

Disabled - Full voltage is supplied

Start

The SinuMEC supplies reduced voltage to the motor, in order to start the motor (as a sinusoidal bi-level soft starter).

Start>

(Previously ND.O.L. - Nominal Direct OnLine)

The SinuMEC supplies full line voltage.

This status indicates that the input current is higher than the motor nominal current, which occurs when the motor has not completed its startup and it is not possible to save energy by reducing the voltage supplied to the motor.

This status may appear only at the end of the start period.

Start2

The SinuMEC supplies full line voltage to the motor for 30 seconds upon activation.

This status is required in situations where the motor has to be started using an existing soft starter.

Save 1, 2

The SinuMEC supplies reduced voltage to the motor, thus saving energy.

Save 1 The SinuMEC reduces one voltage step (100V for 400v/50Hz, 120V for 480/60Hz).

Save 2 The SinuMEC reduces two voltage steps (180V for 400v/50Hz, 216V for 480/60Hz).

Bypass

(Previously D.O.L. – Direct Online)

The SinuMEC supplies full line voltage to the motor.

Bypass describes a situation in which it is not recommended to maintain energy saving. This status may appear at any time if the actual current does not facilitate saving (paragraph 4.7.3).

In addition, if the SinuMEC should change to "Save Mode" but waits for the time delay parameter to end (section 4.7.6), it displays the remaining time in seconds before the changeover occur.

S	i	n	U	M	E	C	3	0		B	y	p	a	s	S
0	7	0	A			4	0	0	V			4	0	0	V

Ext.BP

The SinuMEC supplies full line voltage to the motor.

This occurs following an external command to bypass status, via input control terminals 13&14 (paragraph 6.1).

TestBP

Due to activation of the testing feature (paragraph 4.7.8), the SinuMEC supplies full line voltage to the motor.

ForcBP

Due to activation of the forced bypass feature (see page20), the SinuMEC supplies full line voltage to the motor.

Alarm

The Alarm status describes a situation where the SinuMEC or the motor has experienced a fault (paragraph 5.2).

4.2 Readings Screen

This screen displays the input current on each phase [A], and the input voltage [V] between phases, and is **not adjustable**. For SinuMECs rated 57A or less, the display includes decimal point (indicated by the 'A' sign e.g., 4A5 means 4.5 A).

I	n		R	e	a	d	i	n	g	s		4	0	0	V
1	1	1	A			2	2	2	A			3	3	3	A

4.3 Operation Time Screen

This screen displays the total SinuMEC operation hours in Save and in Bypass modes, and is **adjustable**.

W	o	r	k		S	0	0	1	2	h	2	7	m	0	0
T	i	m	e		B	0	0	1	2	h	2	7	m	0	0

The values shown are as follows:

After S - the accumulated hours of operation in Save status

After B - the accumulated hours of operation in Bypass status (during any one of the 4 bypass statuses, as well as Start>, and Start2)

The meter starts to accumulate time in operation after completion of the startup process.

To reset the meters:

Use the **EDIT** followed by the **Enter** key (both meters will be reset).

4.4 Fault Information Screen

The fault history screen displays the last three faults that were detected by the SinuMEC, including the date, time and the SinuMEC status in which the fault occurred.

The faults are displayed from last to first.

This screen is **not adjustable**.

D	D	/	M	M	/	Y	Y				H	H	:	M	M	
•	=	f	a	u	l	t	s			H	i	s	t	o	r	y

To scroll through the 3 hidden screens use **Arrows** key.

To clear the history of faults, press the **EDIT** followed by **Enter** keys.

4.4.1 Fault Abbreviations

Table 2: Description of Faults

Display	Description
AsymCur	Unbalanced Current
OverTem	Over Temperature
PhasMis	Phase Missing
O.LCur	Overload Current

Last Fault Screen

This screen is adjustable.

1	-	O	v	e	r	T	e	m		B	y	p	a	s	s
A	t		1	5	:	3	0			2	5	/	1	2	

Second fault screen

This screen is **adjustable**.

2	-	P	h	a	s	M	i	s		S	t	a	r	t	
A	T		1	4	:	0	0			2	2	/	1	2	

The third fault screen

This screen is **adjustable**.

3	-	O	.	L	C	u	r			S	a	v	e		
A	t		1	1	:	3	0			2	1	/	1	2	

4.5 Debug Screen

This screen displays the software version currently in use and potentially additional debugging parameters.

I	n	f	o												
V	3	.	2												

4.6 User setup Screens

4.6.1 Enter Setup

This screen is used to enter the section dedicated to setting up various parameters relevant to the SinuMEC operation.

F	o	r		C	o	n	f	i	g		m	e	n	u	s
c	l	i	c	k			E	N	T	E	R				

To exit the Advanced Setup Screens:

Press the *FAST* key once.

4.6.2 Connection Mode

This is an **adjustable** screen.

C	o	n	n	e	c	t	i	o	n	:					
		I	n	l	i	n	e								

This screen is used to specify the connection mode of the SinuMEC:

Inline: The SinuMEC is installed in the line of the motor.

Inside Delta: The SinuMEC is installed inside the motor delta.

Refer to paragraph 4.7.3 (page 24) for further details.

4.6.3 Motor Nominal Current

This is an **adjustable** screen.

M	o	t	o	r		N	o	m	.		1	1	1	A	

The default value in this screen is equal to the *SinuMEC nominal current* value that is set on the "SinuMEC Nominal" advanced configuration screen.

If the SinuMEC controls a load smaller than its nominal configuration, this value **must** be changed to the correct value.

For example, if the SinuMEC is a 142A device controlling a 104A motor, the *Motor Nom.* must be changed to 104.

Updating the value in this screen affects the values in the *S-BP LIMIT* and *SI-2 LIMIT* advanced configuration screen.

Note: It is not recommended to install a SinuMEC device much larger than the motor.

4.6.4 Overload

This screen enables electronic overload protection, according to the overload and overload time factors. This is an **adjustable** screen.

O	v	e	r	l	o	a	d					1	.	1	0
T	i	m	e		F	a	c	t	o	r			0	5	

The overload factor is the permitted factor between the Motor Nom. Current and the actual input current.

By default, the value is equal to 1.1 of the Motor Nom. Current, but the current may be set to 0.8-1.2 of the Motor Nom. Current..

The overload time factor defines the overload curve and allows the selection of eleven (11) possible curves defined from 0-10, where 10 is the slowest.

Default value: 5

The SinuMEC will shut down if the input current is higher than this value, and according to the overload curves defined in the graph in Figure 4 (in terms of time to shutdown).

This can only occur if the SinuMEC controls the preceding contactor.

Note: The Overload protection is inactive by default, and must be activated through the advanced configuration screen Protection Mode (paragraph 4.7.2).

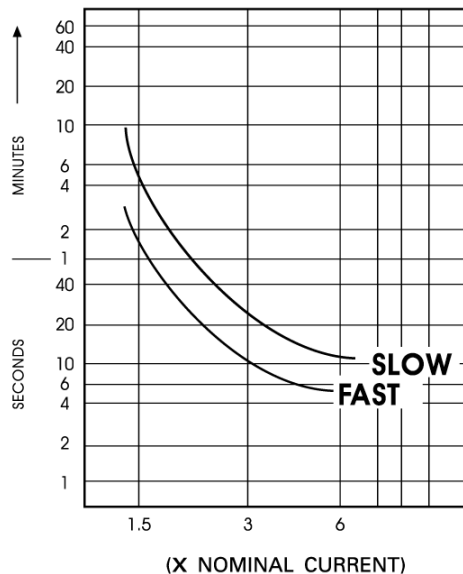


Figure 4: Overload Curve

4.6.5 Control Mode

This screen allows the selected control mode to be defined, as well as the time period of the motor start and motor start behavior. This is an **adjustable** screen.

C	t	r	l		M	o	d	e	:	R	e	m	o	t	e
S	t	a	r	t		P	e	r	i	o	d	:	1	0	s

Control modes

Mode	Description
Remote	<p>Enables starting the SinuMEC via an external dry contact.</p> <p>The start/stop command can be performed in two manners:</p> <ul style="list-style-type: none"> ○ Via an external on-off switch connected between terminals 4&6. ○ Via external start-stop keys connected as follows: <ul style="list-style-type: none"> ○ Terminals 4&5 NC contact. ○ Terminals 5&6 NO contact.
Manual	When manual mode is selected the start/stop command is activated by pressing the ARROWS key on the main screen.
Auto	The SinuMEC will self detect the motor start and stop according the measurement of the currents
Start Period	<p>This parameter defines the length of the start-up period.</p> <p>If a numerical value is selected reduced voltage is supplied to the motor as it begins its operation. On completion of the start period line voltage is supplied to the motor.</p> <p>By default, the lowest voltage level (level 2) is supplied during the first half of the startup period, and the medium voltage level (level 1) is supplied during the second half of the startup period. To change this, refer to 4.7.13</p> <p>If NO is selected full line voltage is supplied to the motor for 30 seconds, after a start command is given to the SinuMEC.</p> <p>This option is necessary when an existing soft starter is still in use.</p> <p>Possible values: 1-29 seconds; No</p> <p>Default value: 10sec</p>

4.6.6 Date & Time Screen

This is an **adjustable** screen.

T	i	m	e	:		H	H	:	M	M	:	S	S		
D	a	t	e	:		D	D	/	M	M	/	Y	Y		

To set the date or time:

1. Press the *EDIT* key
2. Use the arrows keys to set the date and time
3. Press *Enter*.

4.7 Advanced Setup Screens

4.7.1 Enter Advanced Menu

This screen is used to enter the section dedicated to setting up advanced parameters relevant to the SinuMEC operation.

F	o	r		a	d	v	a	n	c	e	d				
M	e	n	u		c	l	i	c	k		E	N	T	E	R

To exit the Advanced Setup Screens:

Press the *FAST* key twice.

Under normal operation conditions, there is no need to perform any advanced programming.

4.7.2 Enabling Protection

This screen enables the activation of the three available motor protections, and is an **adjustable** screen.

P	r	o	t	e	c	t	i	o	n		M	o	d	e	
P	h	a	s	e		N		O		I	o	a	d		N

Protection Mode	Description
Phase	Denotes missing and unbalanced phases Options: Y – enabled; N – disabled Default: (No)
O load	Denotes motor overload protection Options: Y – enabled; N – disabled Default: (No)

4.7.3 Saving Limits

Two screens that allow the current threshold to be programmed:

S-BP Limit – set the limits for changing from bypass to save1 mode and vice versa

S1-2 Limit - set the limits for changing from save2 to save1 modes and vice versa

These are **adjustable** screens.

S	-	B	P		L	i	m	i	t			5	0	%	
U	P		1	2	.	3		D	N		5	2	.	4	A

S	1	-	2		L	I	m	i	t			5	0	%	
U	P		1	2	.	3		D	N		1	2	.	4	A

While the programming is performed on a single parameter for each voltage level (the percentage/saving threshold), the following three parameters are displayed on the screen for ease of use:

For Save –Bypass limit:

Saving threshold in percentage referring to Motor Nominal current. The range is 0% to 50%.

UP (voltage gets higher), indicates the current threshold in Ampere in the SinuMEC input while the SinuMEC is in Save, that will force change to Bypass.

It is equal to “Motor Nominal Current” × “Range in Percent” × 0.75.

DN (voltage gets lower), indicates the current threshold in Ampere in the SinuMEC input while the SinuMEC is in Bypass, that will force change to Save.

It is equal to “Motor Nominal Current” × “Range in Percent”.

For example, the screen above displays a 50% configuration of a 142A 100HP SinuMEC.

The DN threshold is calculated as $142A \times 50\% = 71A$.

When the current goes below 71A, the SinuMEC will switch from Bypass to Save mode.

The UP threshold is calculated as $142A \times 50\% \times 0.75 = 53A$.

When the INPUT current goes above 53A, the SinuMEC will switch from Save to Bypass mode.

For Save1-2 Limit:

The exit and enter Save2 levels are multiplied by 0.75 to adjust the percentage level to the level in amperes. For example, setting the percentage to 50% in a 142A motor will provide levels of $142 \times 50\% \times 0.75$ and $142 \times 50\% \times 0.75 \times 0.75$.

Setting the parameter to a value lower than 50% will reduce the saving time and actual power saving.

To operate the SinuMEC in continuous bypass mode (after motor start-up stage), set the percentage to 0%. A better option to running the SinuMEC in continuous bypass mode is to run the device in Test Mode (paragraph 4.7.8)

Limits: 0%-50%

Default value: 50%

Note: the switching between voltage levels is also affected by the Hysteresis (paragraph 4.7.104.7.11) and PF limits (paragraph 4.7.10).

4.7.5 SinuMEC Nominal

This screen defines the nominal current and voltage values for the SinuMEC, and is **adjustable**.

S	I	n	u	M	E	C		N	o	m	i	n	a	l	
4	0	0	V			5	0	H	z			1	3	0	A

The **factory-set** values **must not** be changed since these affect the real-time current measurements and SinuMEC behavior.

There are two voltage networks available: 400V L-L 50Hz or 480V L-L 60Hz.

Note: The values in this screen must not be changed.

4.7.6 Time delays

This screen enables setting the time periods relevant to the Save Limit S->B, and B->S actions, and is **adjustable**.

t	i	m	e		d	e	l	a	y	s		e	x	i	t
	S	a	v	e	-	0	2	s		B	P	-	3	0	s

Exit Save defines the time period for which the input current has to be higher than the pre-set value in order to stop saving and switch to Bypass.

BP defines the time period in which the current must be low enough to switch to Save mode. This parameter influences the Bypass countdown.

Default values:

Exit Save – 2 seconds

BP – 30 seconds.

4.7.7 Min. Cycle Time

This screen enables setting a minimum total operation cycle time, and is an **adjustable** screen.

M	i	n		C	y	c	l	e		t	i	m	e		
				3	0	s	e	c							

The delay count starts when the SinuMEC switches to Save mode.

The load may vary and require the SinuMEC to switch to Bypass and then back to Save, but the SinuMEC will remain in Bypass until the end of this counter.

This delay is used to increase switching efficiency and is very useful for certain applications. For example, in plastic injection machines it is recommended to set this parameter to 15 seconds.

Default value: 30 seconds

4.7.8 Test mode

This screen enables the SinuMEC to switch between Save and Bypass according to pre-set time periods, in order to test the motor saving when using the SinuMEC. This screen is **adjustable**.

T	e	s	T		M	o	d	e						
P	e	r	I	o	d		0	1		h	o	u	r	

According to the value configured, the SinuMEC will go into Save mode and then to Bypass every one (1) hour or every one (1) day. The countdown and relevant status are shown on the main screen.

In conjunction with an external logged measurement device, these actions will display the differences in power consumption, current, Cos f, etc. between Save and Bypass modes.

Possible Modes: Off; 01 hour; 01 day; ForcBP

When set for ForcBP the SinuMEC ignores all possible situations that enable saving and remains in Bypass status continuously.

Default value: Off

4.7.9 Communication

This screen displays the communication options necessary for the SinuMEC, via a Modbus RTU protocol, and is an **adjustable** screen.

A	d	d			B	.	R			P	a	r	i	t	y
0	0	1		0	4	8	0	0			N	O			

Add – Modbus address; default is 1

B.R – Baud rate; default is 4800 bps

Parity – default is NO

4.7.10 Hysteresis

This screen enables setting hysteresis parameters for current limits, and is an **adjustable** screen.

H	y	s	t	e	r	e	s	i	s				0	2	A

The hysteresis parameter specifies additional margin between the UP and DN current values of the save limits (paragraph 4.7.3). By increasing this value reduces the sensitivity of the SinuMEC to switch between one voltage level to the other.

Default setting: 1A for SinuMECs up to 43A, 2A for other models.

4.7.11 Power Factor Limits

This screen enables setting parameters for the power factor limits for the advanced control (see below), and is an **adjustable** screen.

P	F		L	I	m	i	t	-		7	0	%	I	n	
P	F	1	-	.	4	0		P	F	2	-	.	0	0	

The power factor limits are intended to provide solutions for cases in which the motor current is high and the power factor is low, which means the motor has partial load. In such cases, regardless of the current limits (paragraph 4.7.3), the SinuMEC reduces the voltage levels. The expected results are significant reduction in current (due to the low power factor). Following this voltage change, the SinuMEC continues to operate according to the current limits.

The power factor algorithm has three parameters:

- Current limit – the maximum current level for this mechanism to work (default: 70% from nominal current)
- PF1 – power factor limit to change from bypass to save1 (default: 0.4, range 0-0.6) the SinuMEC will not switch to any save mode if PF1 is set to 0.
- PF2 – power factor limit to change directly from bypass to save2 (default: 0.0, range 0-0.4)

4.7.12 Parameter Lock

This **adjustable** screen can disable the *EDIT* key, which is used to change parameters throughout the SinuMEC screens.

P	a	r	a	m	e	t	e	r		L	o	c	k		
							N	O							

Activating this lock will prevent accidental change to data by untrained personnel.

The *EDIT* key will be enabled in select screens only, including the current screen.

Default setting: No

4.7.13 Start Sequence

This screen enables setting the division between low (level 2) and medium voltage levels (level 1) during startup.

S	t	a	r	t		s	e	q	u	e	n	c	e		
L	O	:	0	5	0	%			H	I	:	0	5	0	%

5. Protections

The SinuMEC has several key electronic protections and alerts related to the SinuMEC itself and the motor to which it is connected.



Standard overload/thermal and magnetic protections **must not** be removed from the motor.



An external preceding isolating contactor is mandatory in order to enable these protections. When the contactor receives a Stop command it disconnects the SinuMEC from operation.

When an alarm is activated the word "ALARM" will be displayed on the main screen.

5.1 Alarm Reset

Alarms should be reset only after inspection by a qualified technician.

The alarms, except the Over Temperature alarm, can be cleared on the Alarms screen, which is accessed by pressing the *Up* arrow while viewing the Main screen.

The Alarms screen displays the details of the active alarm, and is an **adjustable** screen.

A	L	A	R	M		A	s	y	m	m	e	t	r	i	c
C	u	r	r	e	n	t		L	i	n	e				

To clear the alarm:

Click the **EDIT** followed by the **Enter** key.

The device must be restarted following an Over Temperature alarm.

To restart the SinuMEC:

Disconnect and reconnect the control voltage to the SinuMEC.

5.2 Motor protection

5.2.1 Unbalanced current

If there is a difference of more than 40% in the motor currents, the SinuMEC will automatically send a stop command to the external isolating contactor via terminals 7&8.

An alarm will be displayed on the main screen and the SinuMEC will not supply voltage to the motor.

The message "Asymmetric Current Line RST" will be displayed on the Alarms screen.

This is an **adjustable** screen.

A	L	A	R	M		A	S	y	m	m	e	t	r	i	c
C	u	r	r	e	n	t		L	i	n	e		R	S	T

5.2.2 Phase missing

If a missing phase is detected (the current in one of the phases is equal to zero), the SinuMEC will automatically supply a stop command to the external isolating contactor via terminals 7&8.

An alarm will be displayed on the main screen and the SinuMEC will not supply voltage to the motor.

The message "Phase Missing Line RST" will be displayed on the Alarms screen

This is an **adjustable** screen.

A	L	A	R	M	!		P	h	a	s	e			
M	i	s	s	i	n	g	L	i	n	e	R	S	T	

5.3 Overload Current

If a current overload is detected, the SinuMEC will automatically supply a stop command to the external isolating contactor via terminals 7&8.

Current overload is configured on the configuration screens.

An alarm will be displayed on the main screen and the SinuMEC will not supply voltage to the motor.

The message "Overload Current" will be displayed on the Alarms screen.

This is an **adjustable** screen.

A	L	A	R	M	!				0	5	:	3	2	
O	v	e	r	l	o	a	d	C	u	r	r	e	n	t

The time displayed on the right-hand side is the countdown period recommended for the SinuMEC to cool down.

5.4 SinuMEC protection

5.4.1 Over Temperature

The SinuMEC will automatically switch to Bypass mode when the internal core temperature of the transformer reaches 140°C.

An alarm message will be displayed on the main screen until user reset.

The message "Over Temperature" will be displayed on the Alarms screen.

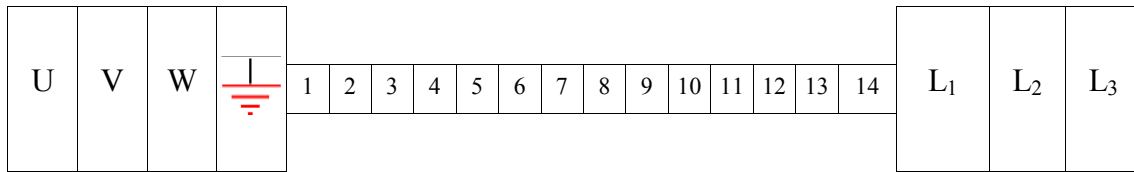
This is a **non-adjustable** screen.


A	L	A	R	M	!									
O	v	e	r	T	e	m	p	e	r	a	t	u	r	a

To cancel the alarm:

Disconnect and reconnect the control voltage to the SinuMEC.

6. Connections



L1, L2, L3	-	Input lines voltage
	-	Ground connection
U, V, W	-	Load connections
Terminals 9, 10	-	Input terminals supplying control voltage to the SinuMEC. Terminal 10 should be connected to the phase. See the product nameplate for the rating (typically, 230v for 400v/50Hz products and 277v for 480v/60Hz products). Terminal 9 should be Neutral.
Terminals 1, 2	-	Output fault terminals (auxiliary voltage free contact). These terminals will provide a signal when a failure is detected. Maximum allowed load: 5A, 230V
Terminals 4, 5, 6	-	Input control terminals used in Remote mode. The start \stop command can be performed in two ways (see page 15 for details)
Terminals 7, 8	-	Output terminals (auxiliary voltage free contact), activating the incoming isolating contactor. The contact will open after identification of a stop command, or in case of motor failure. The control voltage will be supplied from terminal 11 to terminal 7.
Terminals 11, 12	-	Output terminals signaling end of start-up. The dry contact is closed if , at the end of the start period, the measured input current is lower than the nominal motor current. Maximum allowed load: 5A, 230V
Terminals 13, 14	-	Input control terminals These terminals allow the user to activate the bypass feature externally.

6.1 Line Diagram of SinuMEC in Remote Mode

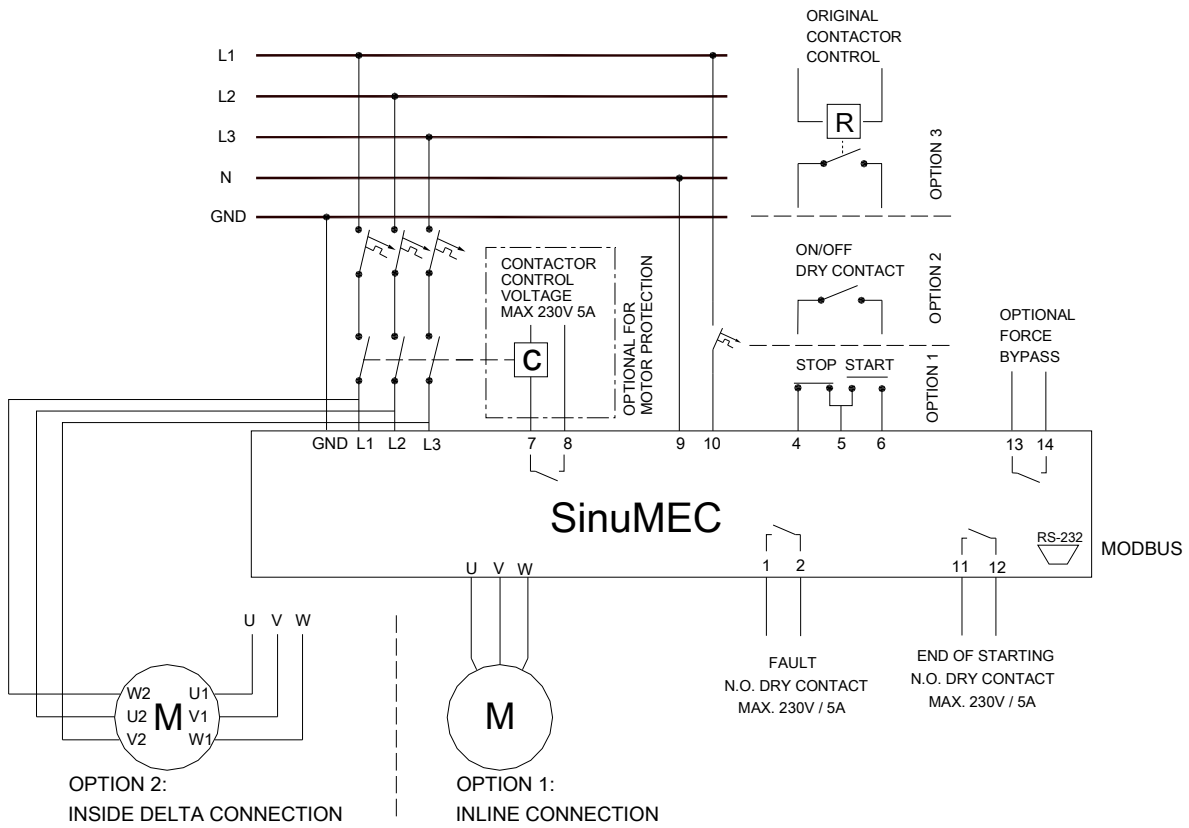


Figure 5: Line Diagram

7. Troubleshooting

This section describes the steps to be taken for troubleshooting the SinuMEC in the case of a problem or malfunction during operation.

Use the following table to detect and repair faults that may occur.

Table 3: Troubleshooting

Fault	Reason	Repair
The output voltage is higher than the input voltage during save status.	The SinuMEC was wired inaccurately.	Check that the input and output power cables are wired correctly.
The display and the SinuMEC do not work	Control voltage to the SinuMEC is disconnected.	Check the connection and voltage of input terminals 9&10.

8. Technical Data

Input Voltage: 3x400 Vac (L-L) 50Hz or 3x480 Vac (L-L) 60Hz

50Hz Dimensions

Model [A]	Max. Motor Power				Dimensions H×D×W [mm]	Weight [Kg]	Max. Power Terminal [mm ²]
	In-line connection		Inside Delta				
	[kW]	[HP]	[kW]	[HP]			
15	7.5	10	12	15	436×235×275	19	16
30	15	20	25	35	436×235×275	26	16
43	22	30	37	50	436×235×275	34	16
57	30	40	50	65	612×295×396	37	35
75	37	50	60	80	612×295×396	41	35
85	40	60	75	100	612×295×396	58	35
104	55	75	95	125	612×295×396	62	70
142	75	100	132	175	643×295×537	70	70

All SinuMEC control terminals are sized to fit a wire with a 4 mm² cross section.

Efficiency	99.5%
Temperature	-20° - +60°
Humidity	0% - 97%
Harmonic Distortion	less than 1%
NET class	IT / TT
Frequency	50/60 Hz
Surge voltage	2KV

Power Switch Gear

Save/Bypass contactor

Communication

RS 232

Electronic Protections

Over temperature
Current unbalance
Phase missing
Overload current

Climate Class

4K4H