

# ST2R1

230 VAC TWO-SPEED  
TRANSFORMER CONTROLLER WITH  
DIGITAL TIMER AND LCD DISPLAY

Mounting and operating instructions



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## SAFETY AND PRECAUTIONS

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Read all the information, the datasheet, mounting and operating instructions and study the wiring and connection diagram before working with the product. For personal and equipment safety, and for optimum product performance, make sure you entirely understand the contents before installing, using or maintaining this product.



For safety and licensing (CE) reasons, unauthorised conversion and / or modifications of the product are inadmissible.



The product should not be exposed to abnormal conditions, such as extreme temperatures, direct sunlight or vibrations. Long-term exposure to chemical vapours in high concentration can affect the product performance. Make sure the work environment is as dry as possible; avoid condensation.



All installations shall comply with local health and safety regulations and local electrical standards and approved codes. This product can only be installed by an engineer or a technician who has expert knowledge of the product and the safety precautions.



Avoid contact with energised electrical parts. Always disconnect the power supply before connecting, servicing or repairing the product.



Always verify that you apply appropriate power supply to the product and use appropriate wire size and characteristics. Make sure that all the screws and nuts are well tightened and fuses (if any) are fitted well.



Recycling of equipment and packaging should be taken into consideration and these should be disposed of in accordance with local and national legislation / regulations.



In case there are any questions that are not answered, please contact your technical support or consult a professional.

## PRODUCT DESCRIPTION

The ST2R1 series of transformer fan speed controllers regulate the rotational speed of single-phase voltage controllable motors by varying the output voltage. They are equipped with an auto-transformer and TK monitoring for thermal motor protection. ST2R1 also feature a built-in clock and a 230 VAC alarm output. Thanks to the built-in clock, the ST2R1 controllers can operate autonomously. Two optimal speeds can be selected and switched both manually via the built-in keyboard and automatically via the programmable timer functionality. The controllers up to 7,5 A are available in a plastic enclosure, while the models above 7,5 A are available in a metal enclosure.

## ARTICLE CODE

Article code	Rated max. current [A]	Fuse rating
ST2R1-15L25	1,5	(5*20 mm) T-2,5 A-H
ST2R1-25L25	2,5	(5*20 mm)T-4,0 A-H
ST2R1-35L25	3,5	(5*20 mm) T-5,0 A-H
ST2R1-50L25	5,0	(5*20 mm) T-8,0 A-H
ST2R1-75L25	7,5	(5*20 mm) T-12,5 A-H
ST2R1100L25	10,0	(6*32 mm) T-16,0 A-H
ST2R1130L25	13,0	(6*32 mm) T-20,0 A-H

## INTENDED AREA OF USE

- Speed control of voltage controllable motors in HVAC industry
- For indoor use only

## TECHNICAL DATA

- Wide power range: 1,5 A–13,0 A
- Two speeds: High and Low, selectable out of 80-100-120-150-170-190-230 VAC
- TK monitoring for thermal motor protection
- Alarm output (230 VAC / 1 A) in case of motor overheating
- Two start / stop contacts for thermostat, frost protection, etc.
- Programmable clock with day / night and day / week functions
- LCD display with multilingual menu
- Keyboard interface
- USB port for connection to a computer. Easy reading, changing and writing of all device parameters via the free downloadable 3SMUsb software (part of 3SM Center)
- Protection standard: IP54 (according to EN 60529)
- Operating ambient conditions:
  - ▶ Temperature: -20–35 °C
  - ▶ Rel. humidity: 5–95 % rH (non-condensing)

## STANDARDS

- Low Voltage Directive 2014/35/EC
- EMC Directive 2014/30/EC: EN 61326
- WEEE Directive 2012/19/EC
- RoHs Directive 2011/65/EC



## WIRING AND CONNECTIONS

Wiring and connections	
Pe	Earth terminals
L	Power supply, phase 230 VAC / 50–60 Hz
N	Power supply and unregulated output, neutral
L1	Unregulated output, phase (230 VAC / 50–60 Hz / 2 A)
N	Motor connection
U	
TK	Input - TK monitoring for thermal motor protection
TK	
N	Alarm output (230 VAC / 1 A)
AL	
CC	Input - normally closed contact for remote ON / OFF switching
CC	
OC	Input - normally open contact for remote ON / OFF switching
OC	

 **NOTE**

*Make sure you use cables with an appropriate diameter.*

## MOUNTING INSTRUCTIONS IN STEPS

Before you start mounting the unit, read carefully “**Safety and Precautions**”. Choose a smooth solid surface for installation (a wall, panel, etc.).

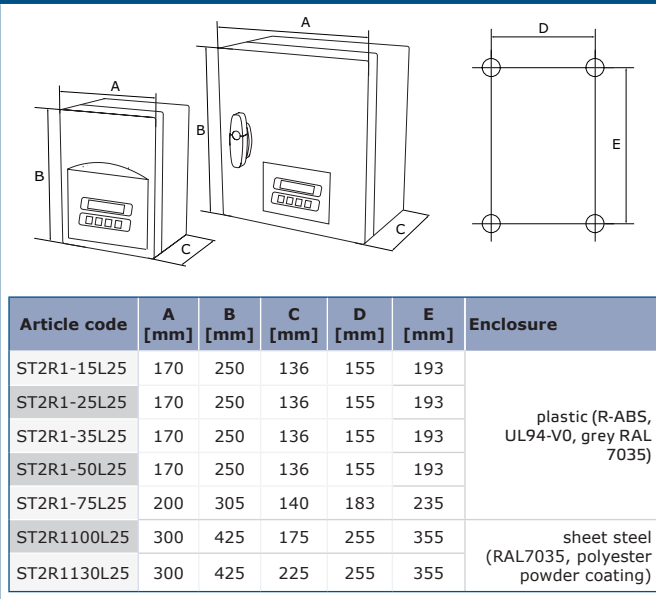
**Follow these steps:**

1. Open the controller.
2. Mount the enclosure using corrosion resistant screws or bolts. Mind the correct mounting position and unit mounting dimensions (see **Fig. 1 Mounting dimensions** and **Fig. 2 Mounting position**). The mounting holes are on the inside back panel of the enclosure and are covered with blanking plugs.
3. Pay attention to the following instructions in order to minimise the operating temperature:
  - 3.1 Respect the distances both between the wall /ceiling and the device and between two devices as shown in **Fig. 2**. In order to ensure sufficient ventilation of the controller, clearance on every side has to be maintained.
  - 3.2 When installing the device, please keep in mind that the higher you install it, the warmer the device will get. For example, in a technical room the correct installation height can be of great importance.
  - 3.3 If maximum ambient temperature cannot be adhered to, please provide extra forced ventilation / cooling.

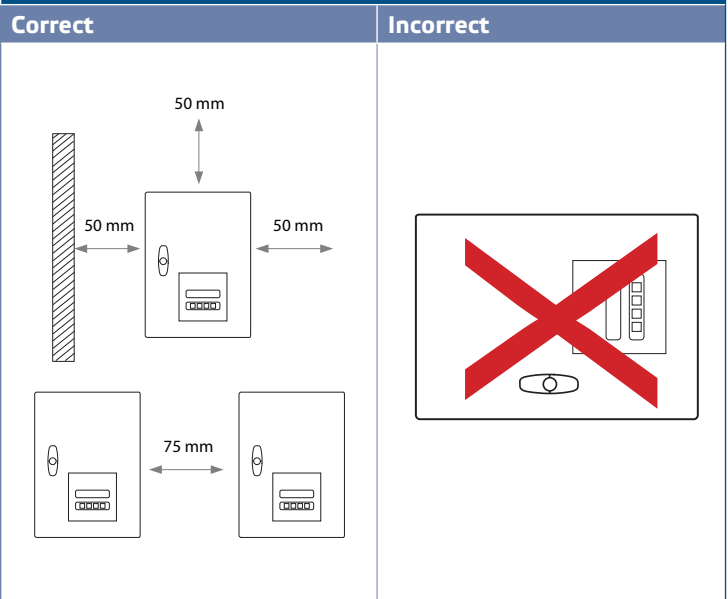
**Not respecting the abovelisted rules can reduce service life and relieves the manufacturer of any responsibilities.**

4. Once secured in position, the mounting screws or bolts should be sealed to maintain the IP rating of the enclosure.
5. Because the controller enclosure is made of metal, it must be earthed and bonded to other existing metal surfaces.

**Fig. 1 Mounting dimensions**



**Fig. 2 Mounting position**

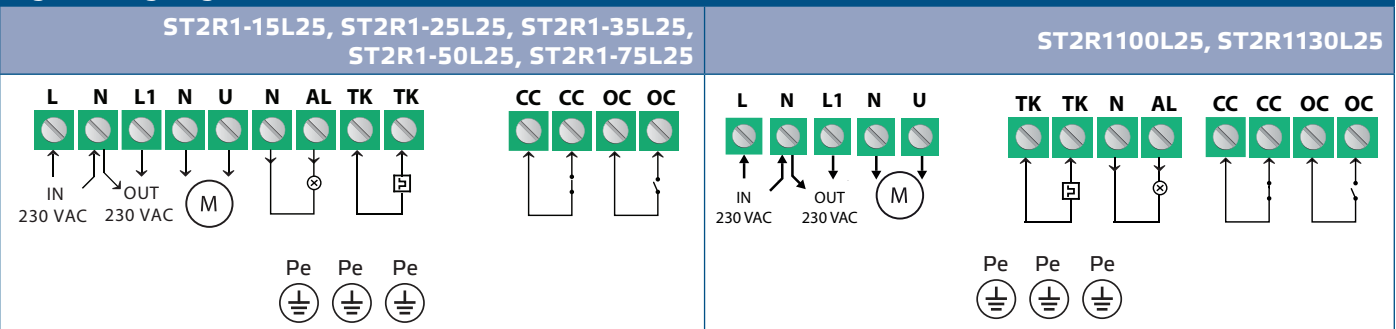


6. Insert the cables through the cable glands and do the wiring according to the wiring diagram (see Fig. 3) while adhering to the information from section "Wiring and connections" above.
  - 6.1 Connect the power supply lines (terminals R, S, T and PE).
  - 6.2 Connect the motor(s) (terminals U, V, W and PE).
  - 6.3 If applicable, connect the unregulated output (L1 and N). It can be used to supply a 230 VAC valve, lamp, etc.
  - 6.4 If applicable, connect the TK contacts for monitoring of the thermal motor protection to the motor TK terminals. As standard, there is a bridge between the TK terminals.
  - 6.5 If applicable, connect the alarm output (L1 and N).
  - 6.6 If applicable, connect the normally closed (CC and CC) and normally open (OC and OC) contacts for remote switching.
  - 6.7 The factory connected output voltages are 80 VAC for LOW speed and 190 VAC for HIGH speed. However, these can be changed to the desired ones, if applicable, as the incorporated autotransformer features a screw terminal block.

**ATTENTION**

A safety isolator / disconnect switch should be installed on the mains electricity side of all motor drives.

**Fig. 3 Wiring diagram**



**ATTENTION**

Make sure the connections are correct before you power the unit.

7. Close the controller.

8. Tighten the cable glands.
9. Switch on the mains supply.

## OPERATING INSTRUCTIONS

The ST2R1 controller has four basic modes. Each mode is displayed on the LCD

- **STANDBY:** the motor does not work (according to clock setting)
- **STOPPED:** the motor does not work (the controller has been stopped by pressing the I/O button or a TK alarm condition has occurred)
- **AUTO:** the motor speed depends on the clock setting (High mode/ Low mode/ Standby)
- **MANUAL SETTING:** the controller enters High mode by pressing the UP button and Low mode by pressing the DOWN button.

There are two ways to change the mode

- Setting real-time clock
- Via the buttons on the front panel (if the user or installer password has been set, the buttons are disabled until the correct password is entered when prompted)

Passwords

- **User code:** provides protection against mode changing in manual mode.
- **Installer code:** provides protection against changing the controller status via the buttons (Auto / Stopped / Hand setting) and Menu.
  - ▶ The default value is '0000'. It unlocks the keypad. When the default code is different from '0000', i.e. it has been changed, the user has to enter the correct code in order to enter the menu.
  - ▶ After the password has been entered correctly, re-entering it will not be required for 60 minutes.
- **Installer code:** provides protection against changing the controller status via the buttons (Auto / Stopped / Hand setting) and entering the Menu.
  - ▶ The default value is '0000'. It unlocks the keypad. When the default code is different from '0000', i.e. it has been changed, the user has to enter the correct code in order to enter the menu.
  - ▶ After the password has been entered correctly, re-entering it will not be required for 60 minutes.

The ST2R changes modes according to the real time clock (RTC) settings:

**Table 1 Modes changing (keypad unlocked)**

FROM/TO	AUTO	MANUAL SETTING	STOP	STAND-BY
AUTO		A/M-	I/O	AUTOMATICALLY (RTC)
MANUAL SETTING	A/M or High/Low change (RTC)		I/O	RTC
STOP	I/O	-		I/O
STANDBY	AUTOMATICALLY (RTC)	A/M	I/O	

**Table 2 Modes changing (keypad locked)**

FROM/TO	AUTO	MANUAL SETTING	STOP	STAND-BY
AUTO		A/M & code	I/O & code	AUTOMATICALLY (RTC)
MANUAL SETTING	A/M & code or High/Low change (RTC)		I/O & code	RTC
STOP	I/O & code	-		I/O & code
STAND-BY	AUTOMATICALLY (RTC)	A/M & code	I/O & code	

**Switching times**

When powered, the controller enters AUTO mode. In this mode the user can enter MANUAL SETTING mode by pressing the A/M button shortly or can enter INSTALLER MENU by pressing the A/M button for 3 seconds.

In MANUAL SETTING mode you can switch the controller in High or Low Mode by pressing the UP or DOWN buttons. UP corresponds to High Mode and DOWN corresponds to Low Mode. By a single pressing of the A/M button the controller returns in AUTO MODE or when holding the A/M button for 3 seconds the user can access the INSTALLER MENU.

The status of the controller in AUTO mode depends on the real time clock settings. By default these settings are:

Table 3 Time settings		
	Monday – Friday	Saturday - Sunday
High Setpoint	00:00-24:00	00:00-24:00
Low Setpoint	--:--	--:--
Standby (automatically calculated)	--:--	--:--

The user can change these predefined values either by adjusting them for the whole weekdays / weekends or for a particular day (Monday, Tuesday, Wednesday, etc.). Also, there is the option to set date exceptions with switching times different from the abovementioned.

**Menu parameters**

- Time format can be: "h", "hh", "hh:mm", "h:mm", "hh/mm" or "h/mm". Start times must precede end times.
- When a change is made in the start or end time, it is automatically transferred to the switching times field (for the corresponding day of the week).
- Switching times: switching times for the particular day of week can be set here.
- Exceptions: there are 50 user programmable exceptions which can set switching times different from the previously mentioned. The date of the exception must be a future date, otherwise it is not allowed.
- Standby intervals are all automatically calculated and are updated after each change.

**Alarm conditions**

TK protection is an alarm condition, indicated via a blinking message on the LCD display: "Motor High Temp, Check Motor" and the AI output is activated (230 VAC). When the problem has been eliminated, the user must press any button (except the AM button) for at least 5 seconds. The messages on the LCD guide the user through the steps required for controller restart after TK detection. After completing the last step, the controller enters STOPPED mode and the AI output is deactivated.

**Other conditions**

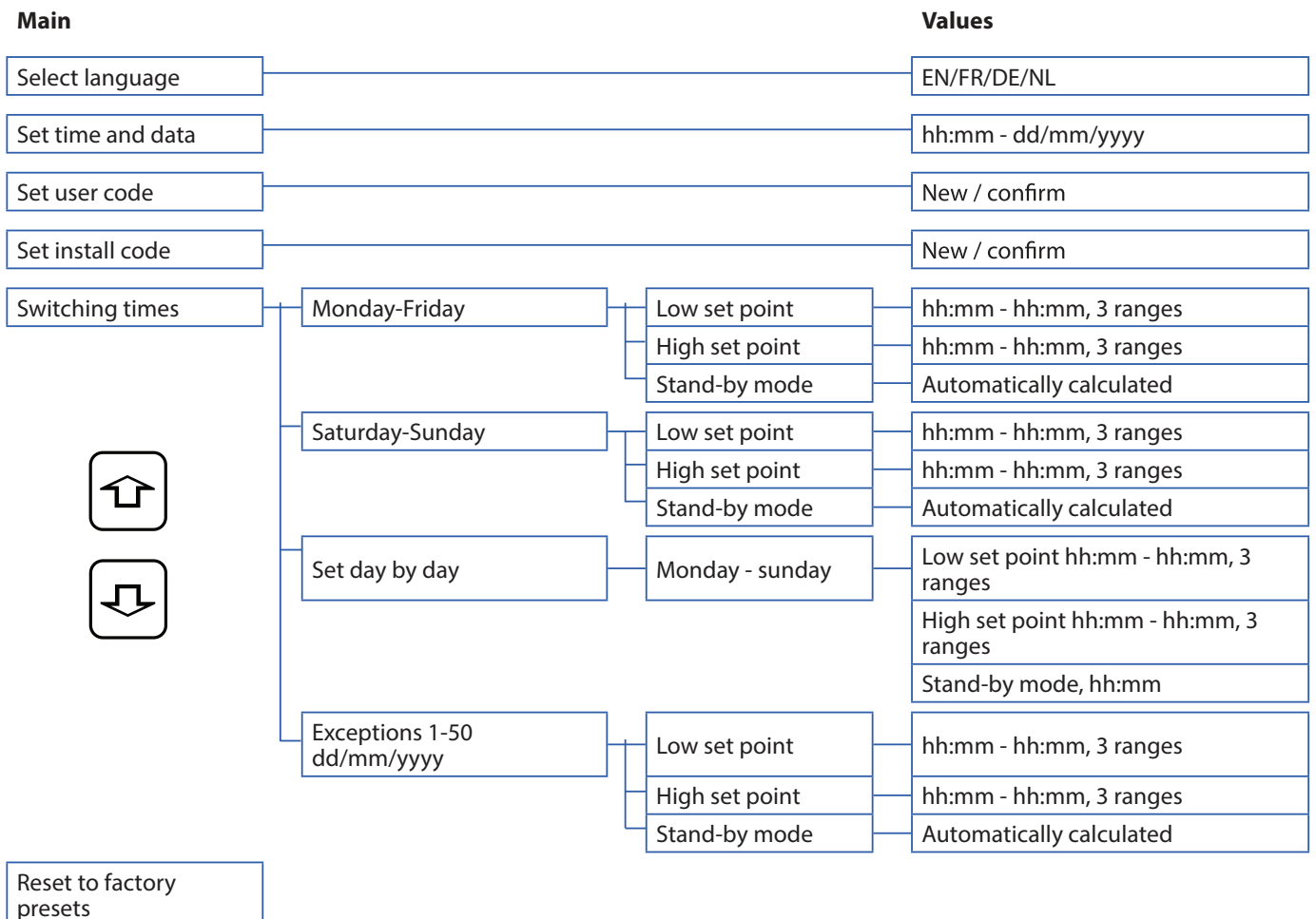
- CC – room thermostat. External devices which can stop and start the motor can be connected to these terminals. Breaking the control circuit stops the motor ("Standby CC" message is displayed on the LCD) and the controller remains in standby. When the control circuit is closed, the controller returns to its previous status (AUTO, MANUAL SETTING, STOPPED, etc.).
- OC – frost protection. External devices which can stop and start the motor can be connected to these terminals. The normal operating status of the contact is opened. Closing the control circuit stops the motor ("Standby OC" message is displayed on the LCD) and the controller remains in standby. When the control circuit is opened again, the controller returns to its previous status (AUTO, MANUAL SETTING, STOPPED, etc.).
- The TK alarm condition has priority over the other two CC/OC conditions. The CC and OC feature equal priority levels.



### USB Mode

- The USB interface provides the option to easily read, change and write all device parameters using a computer. All parameters can be stored in a file on a disk and loaded afterwards.
- Just download the [3SMCenter](#) suite from our website and connect the ST2R1 controller to your computer using a USB cable.
- Run the 3SMCentre, select 3SMUsb and wait for the computer to recognise the connected device.
- You can perform the following operations:
  - ▶ Read device parameters
  - ▶ Save device parameters
  - ▶ Export hex file (save parameters to external file in 'IntelHEX format' on PC)
  - ▶ Import hex file (load parameters from external file on PC)
  - ▶ Display the defaults of the parameters
  - ▶ Update firmware (select program file)
- The latest software version can be downloaded from [www.sentera.eu](http://www.sentera.eu).
- In USB mode the ST2R1 controller is in STOPPED mode and the functionality of the buttons and alarm conditions are disabled.

## MENU STRUCTURE



- **User:** can change the speed (until the next switching point set via the clock)
- **Installer:** can programme the clock

## VERIFICATION OF INSTALLATION

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### **ATTENTION**

*Use only tools and equipment with non-conducting handles when working on electrical devices.*

After connecting the unit to the mains supply, the green LED on its cover should light up indicating that the controller is supplied.

Safe operation depends on proper installation. Before start-up, ensure the following:

- The mains supply is connected correctly;
- Protection is provided against electrical shock;
- The cables are the appropriate size and fuse-protected;
- There is sufficient air flow around the unit.

The controller is equipped with TK terminals to connect to the thermal contact integrated in the motor. When actuated (in case of an overheated motor), the thermal contact cuts the voltage supply to the motor and switches on the red LED to indicate that it does not work.

### **ATTENTION**

*The unit is supplied with electrical energy at voltages high enough to inflict personal injury or threat to health. Take the relevant safety measures.*

### **ATTENTION**

*Disconnect and confirm that there is no live current flowing to the unit before servicing.*

### **ATTENTION**

*Avoid exposing the controller to direct sunlight!*

## TRANSPORT AND STORAGE

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Avoid shocks and extreme conditions; stock in original packing.

## WARRANTY AND RESTRICTIONS

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The warranty against manufacturing flaws is valid for two years starting from the date of delivery. Any alterations or adjustments to the product absolve the manufacturer of all liability. The manufacturer disclaims all liability for typographical or other errors in this document.

## MAINTENANCE

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In normal conditions this product is maintenance-free. If soiled, clean with a dry or damp cloth. In case of heavy pollution, clean with a non-aggressive product. In these circumstances the unit should be disconnected from the supply. Pay attention that no fluids enter the unit. Only reconnect it to the supply when it is completely dry.