



# MT-543Ri plus

THREE OUTPUT DIGITAL CONTROLLER  
WITH ALARM, CYCLICAL TIMER AND  
SERIAL COMMUNICATION

Ver.04



MT543V04-07T-12178

## 1. DESCRIPTION

MT-543Ri plus has three outputs of temperature control and a internal buzzer. Because of its versatility, it allows that the second stage works as alarm and the third, besides to work as cyclical timer, it can work with the first stage in systems that need minimum ventilation. Through the serial output RS-485, it permits communication with SITRAD® software. Product complies with CE (European Union) and UL Inc. (United States and Canada).

## 2. APPLICATION

- Blood banks
- Multistage temperature system
- Air conditioning
- Data centers

**Note:** For climatization and storage of fruits and flowers, as well as environments with condensation use the model AHC-80 plus.

## 3. TECHNICAL SPECIFICATIONS

- **Power Supply:** MT-543Ri plus - 115/230 Vac ±10% (50/60 Hz)  
MT-543RiL plus - 12/24 Vac/dc
- **Control Temperature:** NTC: -50 to 105 °C (± 0.1 °C) / -58 to 221 °F (± 1 °F)  
PT-100: -99 to 300 °C (± 1 °C) / -99 to 572 °F (± 1 °F)

- **Dimensions:** 71 x 28 x 71 mm
- **Operating temperature:** 0 to 50 °C / 32 to 122 °F
- **Operating humidity:** 10 to 90% RH (without condensation)
- **Load Current:** 5(3)A / 250Vac 1/8HP each output

### CLASSIFICATION ACCORDING TO IEC60730-2-9 STANDARD:

- **Temperature limit of the installation surface:** 50 °C / 122 °F
- **Type of construction:** Built-in electronic controller
- **Automatic action:** Type 1
- **Control of pollution:** Level 2
- **Impulse voltage:** 1.5kV
- **Temperature for the test of sphere pressure:** 75 °C and 125 °C / 167 °F and 257 °F
- **Insulation:** Class II

## 5. PARAMETERS DESCRIPTION

### F01 - Access code: 123 (one hundred and twenty-three)

To change the parameters is necessary use the access code. It is not necessary to use the access code to visualize the adjusted parameters.

### F02 - Offset indication

It allows to compensate eventual shunting lines in the reading of ambient temperature proceeding from the exchange of the sensor or cable length alteration.

### F03 - Operation mode of first stage

- 0 - Refrigeration
- 1 - Heating

### F04 - Minimum setpoint allowed to the end user (first stage)

### F05 - Maximum setpoint allowed to the end user (first stage)

Electronic limits whose purpose is prevent that too high or too low setpoint temperatures are regulated.

### F06 - Control differential (hysteresis) of first stage

It is the difference of temperature(hysteresis) between turn ON and turn OFF the OUT1 output.

### F07 - Minimum delay to turn on the first stage output

It is the minimum time that OUT1 will keep turned off, it means, period between the last stop and the next start.

### F08 - Operation mode of second stage

- 0 - Refrigeration
- 1 - Heating
- 2 - Intra-range alarm (F09 and F10)
- 3 - Extra-range alarm (F09 and F10)
- 4 - Relative extra-range to first stage ( **SP1** ) - F09 and **SP1** + F10), It is considered the absolute values of F09 and F10).

### F09 - Minimum setpoint allowed to the end user (second stage)

### F10 - Maximum setpoint allowed to the end user (second stage)

Electronic limits whose purpose is prevent that too high or too low setpoint temperatures are regulated. When the second stage ( F08 ) is defined as alarm, the acting points are defined in F09 and F10.

## 4. PARAMETERS TABLE

Fun	Description	NTC								PT-100							
		CELSIUS				FAHRENHEIT				CELSIUS				FAHRENHEIT			
		Min	Max	Unit	Standard	Min	Max	Unit	Standard	Min	Max	Unit	Standard	Min	Max	Unit	Standard
F01	Access code:123(one hundred and twenty-three)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F02	Offset indication	-5.0	5.0	°C	0	-9	9	°F	0	-50	50	°C	0	-90	90	°F	0
F03	Operation mode of first stage	0	1	-	1	0	1	-	1	0	1	-	1	0	1	-	1
F04	Minimum setpoint allowed to the end user (first stage)	-50	105	°C	-50	-58	221	°F	-58	-99	300	°C	-99	-99	572	°F	-99
F05	Maximum setpoint allowed to the end user (first stage)	-50	105	°C	105	-58	221	°F	221	-99	300	°C	300	-99	572	°F	572
F06	Control differential (hysteresis) of first stage	0.1	20.0	°C	1.0	1	36	°F	2	1	40	°C	2	1	72	°F	4
F07	Minimum delay to turn on the first stage output	0	999	sec.	0	0	999	sec.	0	0	999	sec.	0	0	999	sec.	0
F08	Operation mode of second stage	0	4	-	3	0	4	-	3	0	4	-	3	0	4	-	3
F09	Minimum setpoint allowed to the end user (second stage)	-50	105	°C	21.0	-58	221	°F	70	-99	300	°C	21	-99	572	°F	70
F10	Maximum setpoint allowed to the end user (second stage)	-50	105	°C	27.0	-58	221	°F	81	-99	300	°C	27	-99	572	°F	81
F11	Control differential(hysteresis) of second stage	0.1	20.0	°C	1.0	1	36	°F	2	1	40	°C	2	1	72	°F	4
F12	Minimum delay to turn on the second stage output	0	999	sec.	0	0	999	sec.	0	0	999	sec.	0	0	999	sec.	0
F13	Delay to enable the alarm when the instrument is powered on	0	999	min.	0	0	999	min.	0	0	999	min.	0	0	999	min.	0
F14	Reactivation time of alarm when inhibited manually	<b>AVE</b>	999	min.	<b>AVE</b>	<b>AVE</b>	999	min.	<b>AVE</b>	<b>AVE</b>	999	min.	<b>AVE</b>	<b>AVE</b>	999	min.	<b>AVE</b>
F15	Alarm Time (on cycle)	0	999	sec.	1	0	999	sec.	1	0	999	sec.	1	0	999	sec.	1
F16	Alarm Time (off cycle)	0	999	sec.	1	0	999	sec.	1	0	999	sec.	1	0	999	sec.	1
F17	Operation mode of third stage	0	2	-	0	0	2	-	0	0	2	-	0	0	2	-	0
F18	Minimum setpoint allowed to the end user (third stage)	-50	105	°C	-50	-58	221	°F	-58	-99	300	°C	-99	-99	572	°F	-99
F19	Maximum setpoint allowed to the end user (third stage)	-50	105	°C	105	-58	221	°F	221	-99	300	°C	300	-99	572	°F	572
F20	Control differential (hysteresis) of third stage	0.1	20.0	°C	1.0	1	36	°F	2	1	40	°C	2	1	72	°F	4
F21	Minimum delay to turn on the third stage	0	999	sec.	0	0	999	sec.	0	0	999	sec.	0	0	999	sec.	0
F22	Time base of third stage cyclical timer	0	1	-	0	0	1	-	0	0	1	-	0	0	1	-	0
F23	Activation time for third stage cyclical timer	0	999	sec.	5	0	999	sec.	5	0	999	sec.	5	0	999	sec.	5
F24	Cyclical timer on third stage- time on	0	999	-	0	0	999	-	0	0	999	-	0	0	999	-	0
F25	Cyclical timer on third stage- time off	0	999	-	0	0	999	-	0	0	999	-	0	0	999	-	0
F26	Operation mode of cyclical timer	0	4	-	0	0	4	-	0	0	4	-	0	0	4	-	0
F27	Operation mode of Buzzer	0	2	-	1	0	2	-	1	0	2	-	1	0	2	-	1
F28	Acting point of Buzzer (inferior limit)	-50	105	°C	-50	-58	221	°F	-58	-99	300	°C	-99	-99	572	°F	-99
F29	Acting point of Buzzer (superior limit)	-50	105	°C	105	-58	221	°F	221	-99	300	°C	300	-99	572	°F	572
F30	Buzzer time on	0	999	sec.	1	0	999	sec.	1	0	999	sec.	1	0	999	sec.	1
F31	Buzzer time off	0	999	sec.	1	0	999	sec.	1	0	999	sec.	1	0	999	sec.	1
F32	Inhibition time of Buzzer during electrical supply	0	999	min.	0	0	999	min.	0	0	999	min.	0	0	999	min.	0
F33	Reactivation time of Buzzer when inhibited manually	<b>AVE</b>	999	min.	<b>AVE</b>	<b>AVE</b>	999	min.	<b>AVE</b>	<b>AVE</b>	999	min.	<b>AVE</b>	<b>AVE</b>	999	min.	<b>AVE</b>
F34	Intensity of the digital filter	0	9	-	0	0	9	-	0	0	9	-	0	0	9	-	0
F35	Network equipment address RS - 485	1	247	-	1	1	247	-	1	1	247	-	1	1	247	-	1

### F11 - Control differential(hysteresis) of second stage

It is the difference of temperature(hysteresis) between turn ON and turn OFF the output OUT2.

### F12- Minimum delay to turn on the second stage output

It is the minimum time that the output OUT2 will keep turned off, it means, the space of time between the last stop and the next start. Only if programmed in F08 = 0 or 1.

### F13- Delay to enable the alarm when the instrument is powered on

During this time the alarm is kept turned off waiting that the system reaches the working control temperature (only if F08 is set as alarm).

### F14-Reactivation time of alarm when inhibited manually

This function allows three different settings (only if F08 is set as alarm):

- Auto** - The alarm is inhibited by an indefinite period or until the temperature range in normal working condition and return the alarm again;
- 0** - The alarm can not be inhibited by facilitating access keys;
- 1 to 999** - The alarm will be inhibited during this period (in minutes), returning the call if the alarm condition persists;

### F15 - Alarm time (on cycle)

It allows to adjust the time that OUT2 output will keep turned on (only if F08 is set as alarm).

### F16 - Alarm time (off cycle)

It allows to adjust the time that OUT2 output will keep turned off(only if F08 is set as alarm). To keep the alarm always activated just set "0" in this function.

### F17 - Operation mode of third stage

- 0 - Refrigeration
- 1 - Heating
- 2 - Cyclical Timer

### F18 - Minimum setpoint allowed to the end user (third stage)

### F19 - Maximum setpoint allowed to the end user (third stage)

Electronic limits whose purpose is prevent that too high or too low setpoint temperatures are regulated.

### F20 - Control differential (hysteresis) of third stage

It is the difference temperature (hysteresis) between turn ON and turn OFF the output OUT3.

### F21- Minimum delay to turn on the third stage

It is the minimum time that the output OUT3 will keep turned off, it means, the space of time between the last stop and the next start. Only if programmed in F17 = 0 or 1.

### F22-Time base of third stage cyclical timer

- 0 - seconds
- 1 - minutes

### F23 - Activation time of third stage cyclical timer

This function depends of F26. Every time that the temperature reach the configured value in **SP1**, the configured time in this function is respected, to be activated the cyclical timer after. To activate the timer when **SP1** is reached just set "0" in this function.

### F24 - Cyclical timer on third stage- time on

It is the time that the timer will be turned on.

### F25 - Cyclical timer on third stage- time off

It is the time that the timer will be turned off.

### F26 - Operation mode of cyclical timer

- 0 - Independent timer
- 1 - Timer started by the first stage setpoint
- 2 - First stage linked with cyclical timer (Timer starts on)
- 3 - First stage linked with cyclical timer (Timer starts off)
- 4 - Cyclical timer output turned on whenever the the first stage output is turned on

### F27-Operation mode of Buzzer

- 0 - Intra-range alarm (F28 and F29)
- 1 - Extra-range alarm (F28 and F29)
- 2 - Relative extra-range to first stage ( **SP1** - F28 and **SP1** + F29), It is considered the absolute values of F28 and F29).

### F28 - Acting point of Buzzer (inferior limit)

It is the inferior value of temperature to the buzzer alarm act as the configured Operation Mode of Buzzer (F27).

### F29 - Acting point of Buzzer (superior limit)

It is the superior value of temperature to the buzzer alarm act as the configured Operation Mode of Buzzer (F27)

### F30 - Buzzer time on

It is the time that the Buzzer will be turned on (cycle on). To turn it off the sonore alarm (Buzzer) adjust the value "0" to this function.

### F31 - Buzzer time off

It is the time that the buzzer will be turned off (cycle off). To turn it off the sonore alarm (Buzzer) adjust the value "0" to this function.

### F32 - Inhibition time of Buzzer during electrical supply

It is the time were the Buzzer will kept turned off even if in alarm conditions for a certain period after startup, because the system has not yet reached working temperature.

### F33-Reactivation time of Buzzer when inhibited manually

This function allows three different settings:

- Auto** - The Buzzer is inhibited by an indefinite period or until the temperature range in normal working condition and return the alarm again;
- 0** - The Buzzer can not be inhibited by facilitating access keys;
- 1 to 999** - The Buzzer will be inhibited during this period (in minutes), returning the call if the alarm condition persists;

### F34 - Intensity of the digital filter

This filter aims at simulating an increase of the mass of sensor, thus increasing its response time (thermal inertia). The larger the value adjusted in this function, the longest the response time of sensor. A typical application requiring this filter is the freezer for ice cream or frozen goods, because when the door is opened a hot air mass reaches the sensor directly, causing the indication of the measured temperature to rise quickly and the compressor to be activated

### F35 - Network equipment address RS - 485

Each controller connected to the RS-485 network must have its own address different from the others so that the computer will be able to identify it.

**Attention:** To avoid communication problems, make sure that there are no controllers with the same address.

## 6. CONFIGURATIONS

### 6.1 - Control temperature adjust (SETPOINT)

- Press **SET** for 2 seconds until **SET** appears, then release it.
- SP1** will appear and the temperature will be adjusted for the first stage.
- Use **▼** and **▲** to change the value and, when ready, press **SET**.
- Adjust in the same way **SP2** (2nd stage) and **SP3** (3rd stage).

## 7. PARAMETERS ALTERATION

- Access function "F01" by simultaneously pressing keys **▼** and **▲** for 2 seconds.
- When the message **F01** appears release the keys and wait for the **F01** indication. When the indication appears on the display press the **SET** key and use **▼** and **▲** to enter the access code (123) When ready press the **SET** button to confirm.
- Use keys **▼** and **▲** to access the desired function.
- After selecting the function, press **SET** (press once quickly) to view the value configured for that function.
- Use the **▼** and **▲** keys to change the value and, when ready, press **SET** to memorize the configured value and return to the function menu.
- To exit the menu and return to the normal operation (temperature indication), press **SET** (hold it in) until **---** appears.

## 8. FUNCTIONS WITH FACILITATED ACCESS

### 8.1 Register of minimum and maximum temperatures

Press **▲**, appear the minimum registered temperatures. Soon will appear the the maximum registered temperature.

**Note:** To reset the registers, keep the key **▲** pressed during the visualization of minimum and maximum registers until **rSE** to be showed.

### 8.2 Alarm and Buzzer inhibition

To inhibit the OUT2 press the **▲** and **SET** keys simultaneously .  
To inhibit the Buzzer press the **▼** and **SET** keys simultaneously.

## 9. SIGNALING

**OUT 1** - Output 1 turn on

**OUT 2** - Output 2 turn on

**OUT 3** - Output 3 turn on

**BUZZ** - Buzzer activated

**Err** - Detached temperature sensor or outside the specified range

## 10. SELECTION OF THE UNIT (°C / °F)

In order to define the unit that the instrument will operate in, enter function "F01" with the access code 231 and confirm with the **SET** key. Press the **▲** key and the indication **Uni** will appear.

Press **SET** to choose between **°C** or **°F** and confirm. After selecting the unit the **F01** message will appear, and the instrument will return to the function "F01". Every time that the unit is changed, the parameters should be reconfigured, since they assume the "standard" values.

## 11. SELECTION OF THE SENSOR TYPE

### F01 - Access code (312)

It is necessary when it is desired to select the sensor type.

After entering the code 312, use **SET** to confirm. Access the function **SEn** and select between **ntc** for NTC thermistor or **PE-** for PT100 sensor.

Everytime that a new sensor is selected the parameters must be adjusted.

### 11.1 - NTC SENSOR

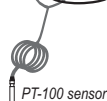
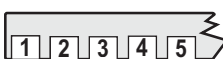
It must be connected to the terminals 3 and 4, as showed below:



\* Sensor supplied with the controller.

### 11.2 - PT-100 SENSOR

It must be connected to the terminals 3 and 4 and with the terminals 3 and 5 interconnected, as showed below:

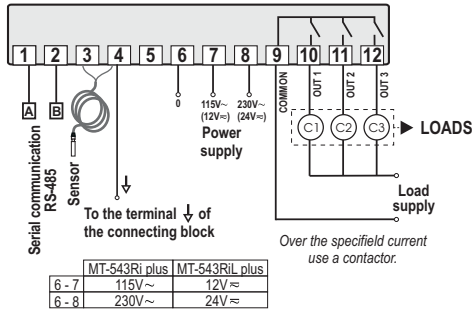


\* Sensor not supplied with the controller.

Table of relation, wire gauge/maximum distance for two wires PT-100.

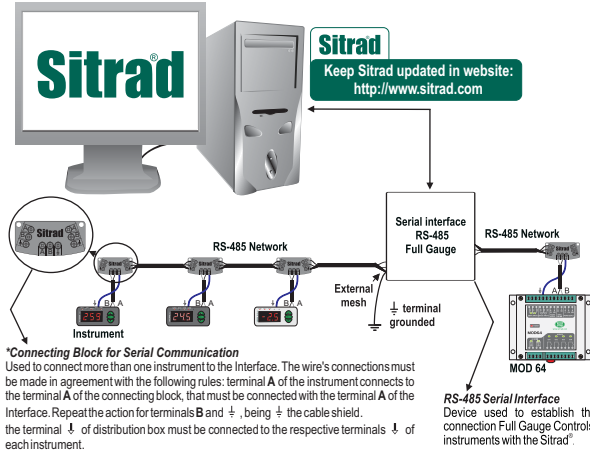
Diameter (AWG)	(mm)	Max. Dist. (meters)
14	1.63	18.1
16	1.29	11.4
18	1.02	7.2
20	0.81	3.0
22	0.64	1.9
24	0.51	1.8
26	0.40	1.1

## 12. WIRING DIAGRAM



**Note:** The length of the sensor cable may be increased by the user up to 200 meters, using a PP 2 x 24 AWG cable. For immersion in water, use thermometric wall.

### Integrating Controllers, RS-485 Serial Interface and Computer

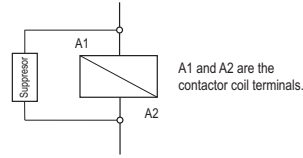


## IMPORTANT

According to the chapters of norm IEC 60364:

- 1: Install protector against overvoltage on the power supply
- 2: Sensor cables and signal cables of the computer may be joined, but not in the same electric conduit through which the electric input and the activation of the loads run
- 3: Install transient suppressors (RC filters) parallel to the loads as to increase the product life of the relays.

### Schematic for the connection of suppressors to contactors



### Schematic for the connection of suppressors to direct activation loads



### PROTECTIVE VINYL:

This adhesive vinyl (included inside the packing) protects the instruments against water drippings, as in commercial refrigerators, for example. Do the application after finishing the electrical connections.

Remove the protective paper and apply the vinyl on the entire superior part of the device, folding the flaps as indicated by the arrows.

