



MT-512 E 2HP Ver.12

DIGITAL CONTROLLER AND INDICATOR FOR HEATING OR COOLING WITH NATURAL DEFROST THROUGH COMPRESSOR SHUTDOWN

- Manual defrost
- Functions lockdown
- Control functions shutdown
- Serial programming
- IP 65 FRONT Protection level



MT512E2HP12-03T-13888

1. DESCRIPTION

The **MT-512 E 2HP** features a single relay output, for cooling or heating purposes, combined to a cyclical timer for natural defrost. The natural defrost can be forced or performed through an off refrigeration cycle. It also features a configurable digital filter, which has the aim of simulating an increase of mass in the environment sensor, thus increasing its response time, that is, the sensor response becomes slower. In addition to those features, the **MT-512 E 2HP** has tamper-proof function that blocks the keypad preventing unauthorized users changing its settings, and a control function shutdown that deactivates the controlling outputs turning the instrument into a digital temperature indicator.

2. APPLICATIONS

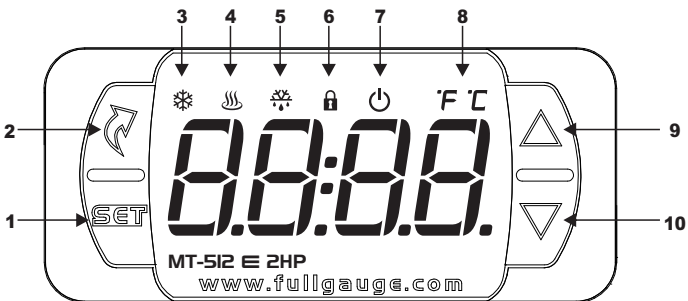
- Cold storages
- Reaching coolers / Stand up coolers
- Industrial heating / Cooling equipment
- Any other type of equipment requiring precise temperature control

3. TECHNICAL SPECIFICATIONS

- **Power supply:** MT-512 E 2HP → 115 or 230 Vac ±10% (50/60 Hz)
MT-512 EL 2HP → 12 or 24 Vac/dc ±10%
- **Control temperature:** -50 to 105°C (-58 to 221°F) (*)
- **Operating temperature:** 0 to 50°C / 32 to 122°F
- **Maximum current:** 16(12)A 250Vac 2HP
- **Operating humidity:** 10 to 90% RH (without condensation)
- **Protection level:** IP 65 (frontal)
- **Dimensions:** 76 x 34 x 77 mm (WxHxD)
- **Dimensions of the clipping for fixing of the instrument:** 71 ± 0,5 x 29 ± 0,5 mm (see item 5)

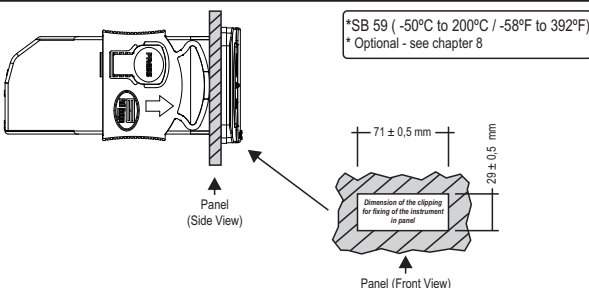
(*) This instrument can measure and control temperatures up to 200°C, as long as SB59 type silicone sensor cable, sold separately, is used.

4. INDICATIONS AND KEYS



1	Set Key
2	User-friendly Menu Key
3	Cooling indication LED
4	Heating indication LED
5	Defrost indication LED
6	Functions lockdown indication LED
7	Control functions OFF indication LED
8	Temperature unit indication LED
9	Upper Key
10	Lower Key

5. INSTALLATION - ASSEMBLING AND ELECTRICAL CONNECTIONS

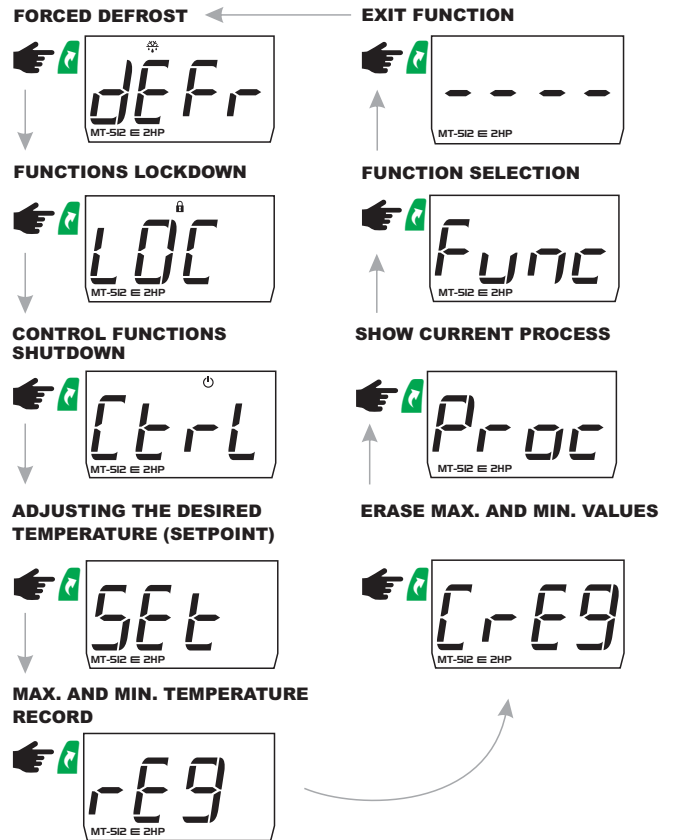


ATTENTION
FOR INSTALLATIONS WHERE A SEALING IS REQUIRED TO AVOID LIQUID CONTACT, THE CUT FOR THE CONTROLLER MUST BE OF 70,5x29mm MAXIMUM. THE SIDE LOCKS MUST BE FIXED SO IT PASSES THE RUBBER SEALING AVOIDING INFILTRATION BETWEEN THE CUT AND THE CONTROLLER.

6. OPERATIONS

6.1 Quick Access Menu Map

By pressing it is possible to navigate through the function menus. For more details, see chapter 6.3. See the functions map below:



6.2 QUICK ACCESS KEYS MAP

When the controller is on temperature display mode, the following keys serve as a shortcut for the following functions:

	Pressed for 2 seconds: Setpoint adjustment.
	Quick touch: Current process display.
	Quick touch: Maximum and minimum temperatures display.
	Enters function selection.

6.3 BASIC OPERATIONS

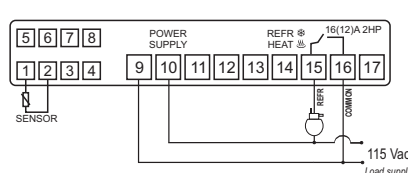
6.3.1 Adjusting the desired temperature (setpoint)

Press key for 2 seconds until the [SET] message appears. When releasing the key, the adjusted control temperature will appear.

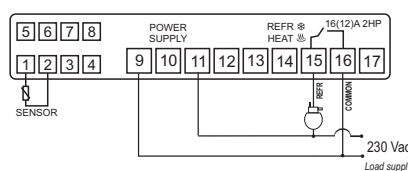
Use keys or to change the value, and when ready, press to record.

The desired temperature can also be changed through the quick access menu (see map in chapter 6.1) or through Function chapter 6.4.

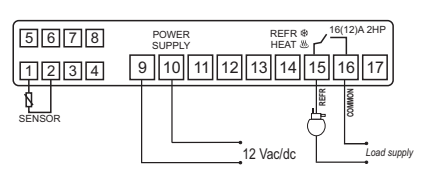
Connection 115 Vac



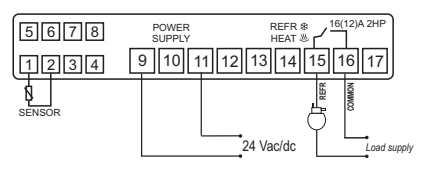
Connection 230 Vac



Connection 12 Vac/dc



Connection 24 Vac/dc



6.3.2 Forced Defrost

Forced defrost is carried out through the quick access menu. Press the **Q** key (quick touch) until the message **dEFr** appears (flashing **LED**), then press key **Q** (quick touch) to select. Then, the message **dEFr** **On** appears (access **LED**).

To turn off defrost manually, press key **Q** (quick touch) until the message **dEFr** appears (flashing **LED**). Press the **Q** key (quick touch) to select. Then, the message **dEFr** **Off** appears (LED **LED** off).



6.3.3 Functions Lockdown

For safety reasons, this controller provides the ability to lock functions. With this setting enabled, the setpoint and the other parameters are protected against unauthorized changes. However, they can be visualized. In this condition, when trying to change these values, the message **LdC** appears on display. To perform the functions lockdown it is necessary, first, that parameter "**F20** - Time for functions lockdown" parameter is set to a value higher than 14 (if lower than 15, the message **no** is shown, which means not allowing the lockdown of functions). With key **Q** (quick touch), select **L**, then press **Q** (quick touch), then keep the **Q** key pressed until **LdC** appears. When releasing the key, the message **Off** will appear.



To unlock, turn off the controller and reconnect it with the **Q** key pressed. Keep the key pressed until the message **LdC** appears. When realizing it, the message **Off** will appear on the display.

6.3.4 Control Functions Shutdown

With the shutdown of the control functions the controller will operate only as a temperature indicator and output relay stays off.

The way to operate the control functions shutdown depends on the parameter setting "**F21** - Control functions shutdown":

- 0** Does not allow the shutdown of the control functions.
- 1** Allows to turn on and off the control functions only if the functions are unlocked.
- 2** Allows to turn on and off the control functions even when the functions are locked.

With key **Q** (quick touch), select **0**, then press **Q** (quick touch) to confirm.



Then, the message **Ctrl** **Off** will appear. At this time the temperature display will switch to the **Off** message.

To turn the control functions on again, just follow the same procedure as that for shutdown, selecting with the **Q** key (quick touch), **0**. Once the user presses the **Q** key the message **Ctrl** **On** will appear.

NOTE: When turning the control functions back on, the **MT-S12 E 2HP** will continue respecting functions "**F09** - output off minimum time" and "**F12** - Initial status when energizing the instrument".

6.3.5 Visualization of Processes

To view the status and the elapsed time, press **Q** (short press). Thus, the controller will display the status of the current process. The following messages may appear on the display:

- control off
- dEL** initial delay
- rEFr** cooling
- Hot** heating
- dEFr** defrost

6.3.6 Minimum and Maximum Temperature Record

By pressing key **Q** or also through the quick access menu (see chapter 6), the message **rEg** will appear, followed by the minimum and maximum recorded temperatures.

To turn the current minimum and maximum values off, press key **Q** (short press), until the message **rEg** is displayed. Press key **Q** to confirm.

6.3.7 Unit Selection

To determine the unit in which the instrument will operate, enter function "**F01**" with access code **123** press key **Q** now the user can select the unit by pressing keys **Q** or **Q** where the messages **C** or **F** will alternate. Press key **Q** to confirm the desired unit. Then, the indication that corresponds to the unit **C** or **F** will come on.

Every time the unit is changed, the parameters must be reconfigured, since they are assumed the "standard" values.

6.4 ADVANCED OPERATIONS

6.4.1 Changing the parameters of the controller

Access function **F01** pressing keys **Q** and **Q** simultaneously or through the quick access menu. After that, **F01** will appear, then, press the **Q** key (short press). Use keys **Q** or **Q** to enter with access code **123** and, when ready, press **Q**. Use keys **Q** or **Q** to access the desired function. After selecting the function, press the key **Q** (short press), to visualize the set value for that function. Use keys **Q** or **Q** to change the value, and when ready, press **Q** to memorize the set value and return to the functions menu. To exit the menu and return to normal operation (temperature indication) press **Q** (long press) until **---**.

NOTE: In case temper proof function is active, when pressing keys **Q** or **Q**, the controller will show message **LdC** in the display and will not allow the setting of parameters.

6.5 PARAMETERS TABLE

Fun	Description	CELSIUS				FAHRENHEIT			
		Min	Max	Unit	Standard	Min	Max	Unit	Standard
F01	Access code: 123 (one hundred and twenty-three)	-	-	-	-	-	-	-	-
F02	Desired temperature (Setpoint)	-	-	°C	4	-	-	°F	39
F03	Indication displacement (Offset)	-5.0	5.0	°C	0	-9	9	°F	0
F04	Minimum set point allowed to the end user	-50	200	°C	-50	-58	392	°F	-58
F05	Maximum set point allowed to the end user	-50	200	°C	75	-58	392	°F	167
F06	Control differential (hysteresis)	0.1	20.0	°C	1.0	1	36	°F	1
F07	Operating mode	0-cool.	1-heat.	-	0-cool.	0-cool.	1-heat.	-	0-cool.
F08	Minimum output time on	no	999	sec	20	no	999	sec	20
F09	Minimum output time off	no	999	sec	20	no	999	sec	20
F10	Cooling time (interval between defrosts)	1	999	min	240	1	999	min	240
F11	Defrost time	no	999	min	30	no	999	min	30
F12	Initial status when energizing the instrument	0-cool.	1-defr.	-	0-cool.	0-cool.	1-defr.	-	0-cool.
F13	Temperature indication locked during defrost	no	yes.	-	no	no	yes.	-	no
F14	Instrument energization delay	no	240	min	no	no	240	min	no
F15	Additional time at the end of the first cycle	no	240	min	no	no	240	min	no
F16	Compressor status with the sensor inoperative	0	2	-	0	0	2	-	0
F17	Compressor time on in case of error	1	999	min	15	1	999	min	15
F18	Compressor time off in case of error	1	999	min	15	1	999	min	15
F19	Digital filter intensity	no	9	-	no	no	9	-	no
F20	Time for functions lockdown	no	60	sec	no	no	60	sec	no
F21	Control functions shutdown	no	2	-	no	no	2	-	no

Legend: **YES** = yes

no = no

6.5.1 Parameters description

F01 - Access code:

The **MT-S12 E 2HP** has 2 different access codes:

123 It allows to modify the advanced parameters

23 It allows to choose the temperature unit, Celsius or Fahrenheit

F02 - Desired temperature (Setpoint):

It is the reference value for temperature control, that is, the temperature to be maintained in a controlled environment.

F03 - Indication displacement (Offset):

It allows to compensate any deviations in temperature caused by a sensor change or alteration of the cable's length.

F04 - Minimum setpoint allowed to the end user:

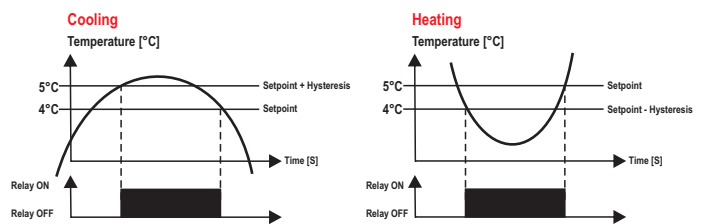
It prevents that, by mistake, the setpoint temperature is set unreasonably low.

F05 - Maximum setpoint allowed to the end user:

It prevents that, by mistake, the setpoint temperature is set unreasonably high.

F06 - Control differential (hysteresis):

It is the difference in temperature (hysteresis) between turning ON and OFF the cooling (or heating)
Example: If it is desired to control the temperature at 4.0 °C with a differential of 1.0 °C. Therefore, the cooling is switched off at 4.0 °C and switched back on at 5.0 °C (4.0 + 1.0).



F07 - Operating mode:

It allows to set the operating mode of the controller.

0 Cooling

1 Heating

F08 - Minimum output time on:

It is the minimum time the compressor will stay on, that is, the time interval between the last start and the next stop.

F09 - Minimum output time off:

It is the minimum time the compressor will stay off, that is, the time interval between the last stop and the next start. It serves to relieve discharge pressure and increase the service life of the compressor.

F10 - Cooling time (interval between defrosts):

It corresponds to the time the controller will act on cooling. At the end of this time, the controller enters the defrost process.

F11 - Defrost time:

It is the defrost time. During this period, the relay will remain off. At its end, the controller will return to the cooling state.

F12 - Initial status when energizing the instrument:

It allows to carry out a defrost at the time the controller is energized.

F13 - Temperature indication locked during defrost:

If [F13] is enabled, the indication is only released in the next cooling cycle after the temperature reaches this "locked" value again or after 15 minutes of cooling (for safety).

F14 - Instrument energization delay:

When the instrument is turned on, it may remain for a while with its control functions disabled, delaying the start of the process. During this time, it only works as a temperature indicator. It serves to avoid peak electricity demands, in case of failure and return of it when there are multiple devices connected to the same grid. To do this, simply set different times for each device. This delay may be the compressor or defrost (when defrost is configured at startup).

NOTE: After its completion, the minimum off output timing, if any, is started.

F15 - Additional time at the end of the first cycle:

It serves to increase the cooling time only the first refrigeration cycle, increasing the efficiency there of.

F16 - Compressor status with the sensor damaged:

If the temperature sensor is short-circuited, disconnected or out of the measuring range, the compressor assumes the set status in this function.

- 0] Compressor OFF
- 1] Compressor ON
- 2] Cycling according to the times defined in [F17] and [F18]

NOTE: If it is in heating mode and in error, the output is switched off.

F17 - Compressor time on in case of error:

F18 - Compressor time off in case of error:

It sets the minimum time the compressor will stay on/off, respectively, if the ambient sensor is disconnected or out of the measuring range.

F19 - Digital filter intensity:

This filter is intended to simulate an increase in thermal mass in the sensor thereby increasing its response time (thermal inertia). The higher is the value set in this function, the greater is the response time of the sensor.

F20 - Time for functions lockdown:

With this setting enabled, the setpoint and the other parameters are protected against unauthorized changes. With the lockdown of the controller the user will only be able to visualize the setpoint and the parameters. To lock the functions, see chapter 6.3.3 - Basic Operations, Functions lockdown item.

F21 - Control functions shutdown:

It allows to switch off the output to perform maintenance, see chapter 6.3.4 - Basic Operations, Control functions shutdown item.

7. SIGNALS

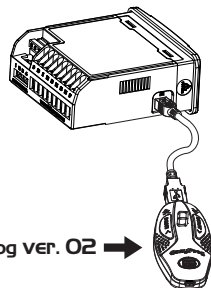
[Er1]	Error in sensor: Sensor disconnected or damaged.
[OFF]	Control functions off.
[DEFr On]	Manual activation of the defrost process.
[DEFr OFF]	Manual activation of the cooling process.
[LOC On]	Temper proof function.
[LOC OFF]	Unlocking of functions.
[PPPP]	Loss of parameters.

8. OPTIONAL ITEMS - Sold Separately

8.1 EasyProg ver. 02

It is an accessory that has as its main function to store the parameters of the controllers. At any time, you can load new parameters of a controller and unload them on a production line (of the same controller), for example. It has three types of connections to load or unload the parameters:

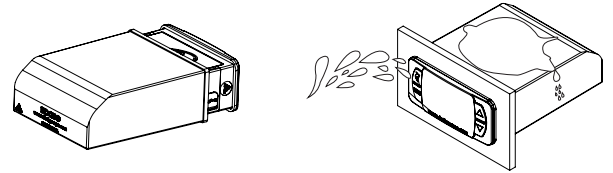
- **Serial RS-485:** It connects via RS-485 network to the controller (only for controllers that have RS-485).
- **USB:** it can be connected to the computer via the USB port, using Sitrad's Recipe Editor. The parameters can be copied, edited and saved in **EasyProg ver. 02**. The USB port can also have the function of electrically feeding the **EasyProg ver. 02** and the controller (when the USB and Serial TTL are used together).
- **Serial TTL:** The controller can be connected directly to **EasyProg ver. 02** by the TTL Serial connection. Thus the **EasyProg ver. 02** may be fed by **MT-512 E 2HP**, or vice versa.



EasyProg ver. 02 →

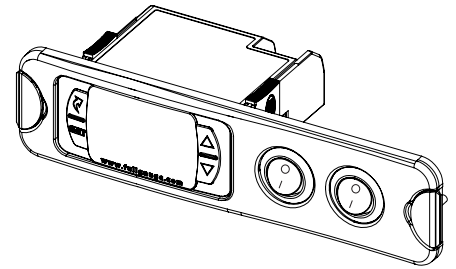
8.2 Ecase

Protective cover for controllers (Evolution line), which prevents the entrance of water and inner moisture. It protects the product when washing is carried out in the location where the controller is installed.



8.3 Extended Frame

The extended frame of Full Gauge Controls allows the installation of controllers of the Evolution and Ri lines with measures of 76 x 34 x 77 mm in varied situations, since it eliminates precision in the cutting to embed the instrument. It allows customization through a sticker with the brand and contact of the company (installer), apart from accompanying two 10 amp switches that can trigger internal light, air curtain and on/off of the system or fan.



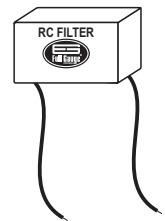
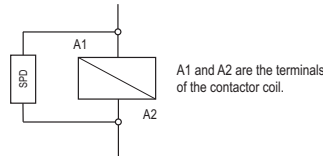
8.4 Sensor SB 59

For measuring and controlling temperatures up to 200° C, it uses this silicone sensor cable. (-50°C to 200°C / -58°F to 392°F)

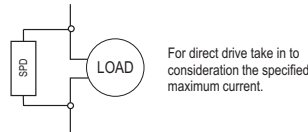
Note 1: The length of the sensor cable can be increased by the user himself up to 200 meters, using the PP 2 x 24 AWG cable.

8.5 Surge Protective Device (SPD)

Wiring diagram for installation of SPD in magnetic contactor



Wiring diagram for installation of SPD in line with loads



ENVIRONMENTAL INFORMATION

Packaging:
The materials used in the packaging of Full Gauge products are 100% recyclable. Try to perform disposal through specialized recyclers.

Product:
The components used in Full Gauge controllers can be recycled and reused if disassembled by specialized companies.

Disposal:
Do not incinerate or dispose the controllers that have reached the end of their service as household garbage. Observe the laws in your area regarding disposal of electronic waste. If in doubt, please contact Full Gauge Controls.

WARRANTY - FULL GAUGE CONTROLS

Products manufactured by Full Gauge Controls, as of May 2005, have a two (02) year warranty, as of the date of the consigned sale, as stated on the invoice. They are guaranteed against manufacturing defects that make them unsuitable or inadequate for their intended use.

EXCEPTIONS TO WARRANTY

The Warranty does not cover expenses incurred for freight and/or insurance when sending products with signs of defect or faulty functioning to an authorized provider of technical support services. The following events are not covered either: natural wear and tear of parts; external damage caused by falls or inadequate packaging of products.

LOSS OF WARRANTY

Products will automatically lose its warranty in the following cases:
 - The instructions for assembly and use found in the technical description and installation procedures in Standard IEC60364 are not obeyed;
 - The product is submitted to conditions beyond the limits specified in its technical description;
 - The product is violated or repaired by any person not a member of the technical team of Full Gauge Controls;
 - Damage has been caused by a fall, blow and/or impact, infiltration of water, overload and/or atmospheric discharge.

USE OF WARRANTY

To make use of the warranty, customers must send the properly packaged product to Full Gauge Controls together with the invoice or receipt for the corresponding purchase. As much information as possible in relation to the issue detected must be sent to facilitate analysis, testing and execution of the service.

These procedures and any maintenance of the product may only be provided by Full Gauge Controls Technical Support services in the company's headquarters at Rua Júlio de Castilhos, 250 - CEP 92120-030 - Canoas - Rio Grande do Sul - Brasil

Rev. 03

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