



# Microsol E<sup>Ver.07</sup>

## DIFFERENTIAL THERMOSTAT FOR SOLAR HEATING

△ Have this manual in the palm of your hand by FG Finder application.



Protection antifreeze



Protection against overheating



Temperature differential



Functions lockdown



Control functions shutdown



Serial Programming



IP 65 FRONT



MCSOLEV7-02T-15766

## 1. DESCRIPTION

Differential thermostat for solar heating that controls the water circulation pump based on the temperature differential between the solar panels and the thermal tank or swimming pool.

**Microsol E** has functions to ensure the yield of the heating system, prevent the freezing in the pipes during winter and control superheating. Additionally, it includes an intelligent functions lock system to prevent those unauthorized from changing the control parameters. Diagram for connecting suppressors to contactors.

## 2. SAFETY RECOMMENDATIONS

- Check the controller for correct fastening;
- Make sure that the power supply is off and that it is not turned on during the controller installation;
- Read the present manual before installing and using the controller;
- Use adequate Personal Protective Equipment (PPE);
- For application at sites subject to water spills, install the protecting vinyl supplied with the controller;
- For protection under more critical conditions, we recommend the Ecace cover, which we make available as an optional item (sold separately);
- The installation procedures should be performed by a qualified technician.

## 3. APPLICATIONS

- Pumped solar heating systems

## 4. TECHNICAL SPECIFICATIONS

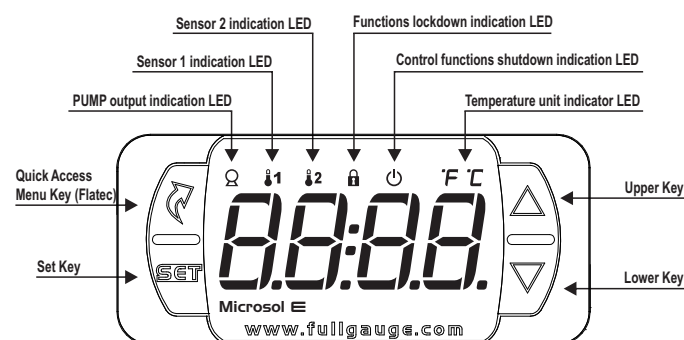
Power Supply	Microsol E: 115 or 230 Vac $\pm 10\%$ (50/60 Hz) Microsol EL: 12 or 24 Vdc or Vac $\pm 10\%$ *
Approximate consumption	0.8 VA
Setpoint Temperature (°C)	-50 to 105°C (-58 to 221°F)
Operating Temperature	0 to 50 °C / 32 to 122°F
Operating humidity	10 to 90% RH (with no condensation)
Maximum current per output	NO - 16A / 2HP NC - 500W / 1/10HP
Protection level	IP 65 (frontal)
Dimensions (mm)	76 x 34 x 77 mm (W x H x D)
Cutout dimensions (mm)	X = 71 $\pm$ 0,5 Y = 29 $\pm$ 0,5 (see Image V)

(\*) Admissible variation in relation to the voltage rating.

(\*\*) This device can measure and control temperatures of up to 200°C/392°F, when used in conjunction with a SB59 model silicon sensor cable (sold separately).

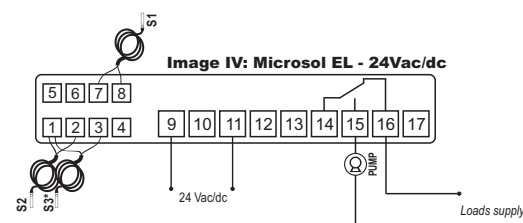
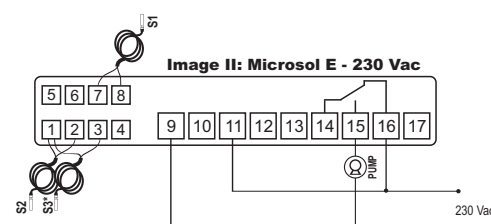
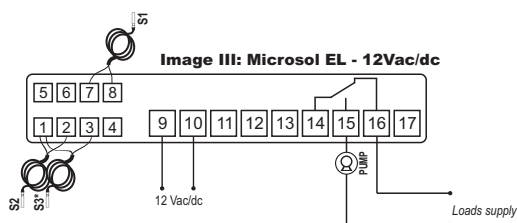
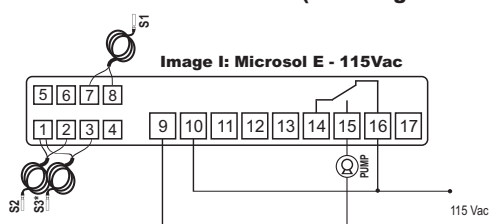
△ **IMPORTANT:** Only sensors 1 and 2 are included with the product. Sensor 3 may be purchased separately.

## 5. INDICATORS AND KEYS



## 6. WIRING DIAGRAM

### 6.1. Electrical connections (see Images I to IV)



### IDENTIFICATION OF SENSORS:

S1: Collectors  
S2: Reservoir/pool  
S3\*: Surface

△ **IMPORTANT:** Only the sensors 1 and 2 accompany the product, the sensor 3\* can be purchased separately.

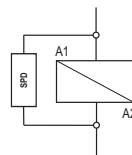
### △ IMPORTANT

INSTRUMENTS IN THE EVOLUTION SERIES HAVE TWO DIFFERENT TERMINAL SIZES, BUT BOTH ARE COMPATIBLE WITH THE SCREWDRIVER 2.0MM. USING THE APPROPRIATE TOOLS DURING INSTALLATION ENSURES A LONGER LIFE AND THE PROPER OPERATION OF THE PRODUCTS.

### Surge Protective Device (SPD) (sold separately)

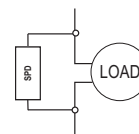
#### Wiring diagram for installation of SPD in magnetic contactor

A1 and A2 are the terminals of the contactor coil.



#### Wiring diagram for installation of SPD in line with loads

For direct drive take in to consideration the specified maximum current.



### 6.2. Temperature sensor connection

- Connect the sensor S1 wires to terminals "7 and 8" / sensor S2 to terminals "1 and 2": the polarity is not relevant, if you use sensor S3, this must be connected to terminals "1 and 3".
- The sensor cable can be extended up to 200 meters by the user, using a PP2x24AWG cable type.
- For immersion in water, we recommend to use a thermowell, available in the Full Gauge Controls product line (sold separately).

### 6.3. Controller power supply

Use the pins according to table below, considering the set version:

Pins	Microsol E	Microsol EL
9 and 10	115 Vac	12 Vac/dc
9 and 11	230 Vac	24 Vac/dc

### 6.4. Recommendations of IEC60364 standard

- Install overload protectors in the controller supply.
- Install transient suppressors – suppressor filter RC – in the circuit to increase the service life of the controller relay.
- The sensor cables may be together, but not in the same conduit where the power supply of the controller and/or of the loads passes through.

## 7. FASTENING PROCEDURE

- Cut out the panel plate (Image V - item 14) where the controller shall be fastened, with sizes X = 71 $\pm$ 0.5 mm and Y = 29 $\pm$ 0.5 mm;
- Remove side locks (Image VI - item 14): to do that, compress the central elliptical part (with the Full Gauge Controls logo) and displace the locks backwards;
- Introduce the controller in the notch made on the panel, inwards;
- Place the locks again and then displace them until they compress into the panel, fastening the controller to the housing (see arrow indication in Image VI - item 14);
- Perform the electric installation as described in item 6;
- Adjust the parameters as described in item 8.

△ **ATTENTION:** for installations requiring liquid tight sealing, the notch sizes for the controller installation should be no more than 70.5x29mm. The side locks should be fastened so that they press the sealing rubber avoiding infiltration between the notch and the controller.

Protector vinyl - Image VII (item 14)

This adhesive vinyl is supplied with the instrument in the package.



△ **IMPORTANT:** Make the application only after completing the electrical connections.

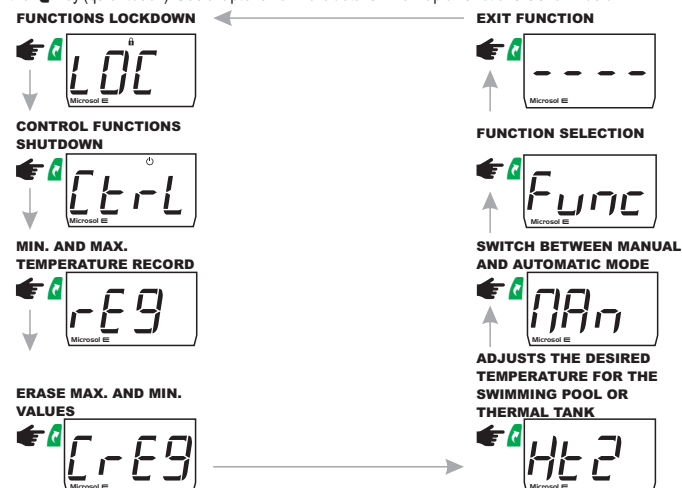
- Retreat the side locks (Image VI - item 14);
- Remove the protective film from the adhesive vinyl face;
- Apply the vinyl over the entire upper part, bending the flaps, as indicated by the arrows - Image VII (item 14);
- Reinstall the locks.

**NOTE:** The vinyl is transparent, allowing visualization of the wiring system of the instrument.

## 8. ADJUSTING THE DESIRED TEMPERATURE AND PARAMETERS










### 8.1. Quick Access Menu Map

To access or browse the quick access menu use the  key (quick touch) while the controller is displaying the temperature. With each touch the next function in the list is displayed. To confirm use the  key (quick touch). See chapter 9. for more details. The map of functions is shown below:








### 8.2. Quick access keys map

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


	Quick touch: confirmation of the function adjustments.
	Hold down for 2 seconds: adjusts the desired temperature for the swimming pool or thermal tank.
	Quick touch: display of the maximum and minimum temperatures recorded.
	Hold down for 2 seconds: clear history when records are being displayed.
	Quick touch: momentarily switches the temperature view.
	Hold down for 5 seconds: switch between manual and automatic pump activation mode.
	Quick touch: quick access menu.
	Hold down for 5 seconds: control functions shutdown.
	Hold down simultaneously: access to the function selection.


## 9. BASIC OPERATIONS

### 9.1 Adjusting HT2 (superheating temperature (S2) to switch the pump off)

Hold the  key down for 2 seconds until the message  is displayed. The adjusted control temperature will be displayed when the key is released. Use the  or  key to change the value and then press  to save. Upon reaching this temperature, the water circulation pump is switched off to avoid thermal discomfort. The desired temperature can also be changed in the quick access menu, (see chart in item 8.1).

### 9.2 Viewing other temperatures


To switch between the temperature views for sensor 1, sensor 2, sensor 3 (if enabled) and temperature difference, press  until the desired temperature is displayed.

 Sensor 1 temperature











 Sensor 2 temperature

 Sensor 3 temperature




 Temperature differential (T1-T2)

The selected temperature will be displayed for 15 seconds and then the default indication will return (as per  parameter setting).






### 9.3 Functions lockdown



The use of the functions lock brings greater security to the operation of the instrument. When it is active, the setpoint and other parameters are visible to the user but are protected against undue changes  = 2 or you can block changes to functions control and leave the adjustment of the setpoint temperature enabled  = 1. Using the  key (quick touch), access the function  in the quick access menu, confirm by pressing  (quick touch), then the message  will be displayed. Keep the  key pressed for the time configured for the functions lockdown  , until  is displayed. The message  will be displayed indicating the functions lockdown is activated upon releasing the key.

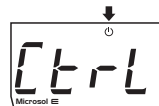


To unlock, turn the controller off and then turn it on again with the  key pressed. Keep the key pressed until  is displayed. Keep the key pressed for 10 seconds and, upon releasing the key, the message  will be displayed indicating the functions lockdown is deactivated.

### 9.4 Control functions shutdown










Turning the control functions off allows for the controller to operate only as a temperature indicator, keeping the control outputs and the alarms off. Use of this feature is enabled and disabled by the control functions shutdown options  . When enabled, the control functions are turned off ( or on ( ) through the quick access menu in the option  . When the control functions are off the message  will then be displayed alternately with the temperature and the other messages.



Except when  is equal to 3 or 4, in which case the display is switched off, keeping only the  icon on.














**NOTE:** It is also possible to switch the control functions on / off by pressing the  key for five seconds.

### 9.5 Minimum and Maximum Temperature Record

By pressing the  key or also through the quick access menu (see item 8), the message  will be displayed and then message  indicating the temperature of sensor 1 and the maximum and minimum recorded temperatures immediately after, then the temperature of sensor 2  , sensor 3  (if enabled), and differential  . To erase the current minimum and maximum values, press the  key (quick touch) until the message  is displayed. Press  to confirm.







**NOTE:** If the  key is pressed while the records are being displayed the values will be reset and the message  will be displayed.

### 9.6 Unit Selection (°C / °F)

To select the units the instrument will use, access the main menu through the quick access menu ( ), option  or by pressing  and  simultaneously while the temperature is being displayed, and enter function  with the access code  and press  . Then select the desired unit  or  using the  keys, and press  to confirm.

**NOTE:** Whenever the units are changed, the functions configuration returns to the factory default settings so it must be configured again.

### 9.7 Choosing between manual and automatic pump activation mode


















The pump is manually activated by pressing the  key for 5 seconds. It will be deactivated after 6 hours in manual mode. When the manual mode is selected, the pump operation mode remains in that state for 6 hours (fixed time) and then the controller assumes the automatic mode. If you want to return to the automatic mode before the 6 hours have elapsed, press the  key again for 5 seconds to deactivate the manual mode; the message  will be displayed. The message  , is displayed upon manual activation, this message alternates with the display of the default indication  . It is also possible to choose the mode through the quick access menu  .




**NOTE:** It is not possible to activate the manual pump mode when the control shutdown is active.


**NOTE:** Manual pump mode can be activated even with one or more sensor errors.

## 10. ADVANCED OPERATIONS





















### 10.1. Adjustment of the parameters


Access function  by pressing keys  and  simultaneously or through the quick access menu (item 8.1). When  is displayed, press  key (quick touch). Use the keys  or  to enter with access code  and when ready press  . Use the keys  or  to access the desired function. After selecting the function, press  key (quick touch) to view the value configured for that function. Use  or  to change the value and press  to save the configured value and return to the functions menu. To leave the menu and return to the normal operating mode (temperature indication), press  (hold down) until  is displayed.

**NOTE 1:** If the functions lock is active, when pressing the keys  or  the controller will show the message  and will not allow the adjustment of the parameters.

**NOTE 2:** If no button is touched for 15 seconds after providing the access code and / or after configuring the parameter the controller will return to the operating mode and it will be necessary to enter the access code again in function  .




### 10.2. Parameters table

Fun	Description	CELSIUS (°C)				FAHRENHEIT (°F)			
		Min	Max	Unit	Default	Min	Max	Unit	Default
	Access Code	0	999	-	0	0	999	-	0
	Preferred indication	t1	all	-	t2	t1	all	-	t2
	Differential (T1-T2) to switch the pump on	-1.0	40.0	°C	8.0	1	72	°F	14
	Differential (T1-T2) to switch the pump off	-1.0	40.0	°C	4.0	1	72	°F	7
	Antifreeze temperature (S1) to switch the pump on	-18(off)	10.0	°C	8.0	0(off)	50	°F	46
	Superheating temperature (S1) to switch the pump off - Ht1	0.0	200	°C	90.0	32	392	°F	194
	Superheating temperature (S2) to switch the pump off - Ht2	0.0	200	°C	32	32	392	°F	89
	Superheating temperature (S3) to switch the pump off - Ht3	0.0	200.1(off)	°C	200.1(off)	32	392(off)	°F	392(off)
	Cooling (S3)	off	on	-	off	off	on	-	off
	Superheating temperature hysteresis of sensor S2	0.1	5.0	°C	1.0	1	9	°F	2
	Superheating temperature hysteresis of sensor S3	0.1	5.0	°C	1.0	1	9	°F	2
	Indication offset of sensor S1	-5.0	5.0	°C	0.0	-9	9	°F	0
	Indication offset of sensor 2	-5.0	5.0	°C	0.0	-9	9	°F	0
	Indication offset of sensor 3	-5.0	5.0	°C	0.0	-9	9	°F	0
	Linking of sensor S3 to the automatic mode	no	yes	-	no	no	yes	-	no
	Minimum temperature in S1 to activate the pump	-50(off)	200.0	°C	-50(off)	-58(off)	392	°F	-58(off)
	Instrument energization delay	0(no)	999	sec.	0(no)	0(no)	999	sec.	0(no)
	Functions lock mode	0	2	-	0	0	2	-	0
	Time for functions lockdown	15	60	sec.	15	15	60	sec.	15
	Control functions shutdown	0(no)	4	-	0(no)	0(no)	4	-	0(no)






Legend:  = alternate display of the temperatures

10.2.1. Description of parameters

F01 - Access Code:

Microsol  has two different access codes:  
 Allows changing the advanced parameters.  
 Allows choosing the units of temperature: Celsius or Fahrenheit.


F02 - Preferred indication:

This function allows configuring the default temperature indication. The options are:  
 Displays the temperature of sensor 1  
 Displays the temperature of sensor 2  
 Displays the temperature of sensor 3 (if enabled)  
 Displays the differential temperature (T1-T2)  
 Alternate display of the temperatures  
When the differential temperature is being displayed (T1-T2) the two LEDs corresponding to these sensors remain on.

F03 - Differential (T1-T2) to switch the pump on:

As the solar panels receive energy, the temperature in sensor 1 increases. When this temperature is at an ascertainable value above the temperature of sensor 2, the pump is switched on and circulates the heated water down, storing it in the tank for example.





F04 - Differential (T1-T2) to switch the pump off:

Allows configuring the temperature difference in degrees between sensor 1 and sensor 2 for Microsol  to switch on the water circulation pump.



Example:

 = 8.0  
 = 4.0



When sensor 1 (panel) is at 35°C and sensor 2 (tank or pool) is at 23°C, the difference will be 12°C. Thus the circulation pump will be on (35-23 = 12 greater than 8). With the pump on, the warm water circulates down and the cold water circulates up. Thus the temperature difference between 1 and 2 decreases. Thus, when the difference between sensor 1 and sensor 2 reaches 4° C (function F03), the circulation pump will be switched off (35-31 = 4).

 **IMPORTANT:** The value adjusted in function  must be higher than the value adjusted in function . Therefore Microsol  does not allow making invalid adjustments in order to ensure its perfect operation.

Ex.: Current configuration:



 : 10.0°C  
 : 5.0°C

You want to change it to:


 : 4.0°C  
 : 2.0°C

First adjust  to 2.0°C and then adjust  to 4.0°C.



F05 - Antifreeze temperature (S1) to switch the pump on:

When the temperature at the panels (sensor 1) is too low (e.g. winter nighttime), the pump is switched on at regular intervals to prevent the water from freezing and damaging the pipes. The hysteresis is fixed at 2°C (4°F). The minimum time the pump is on is 3 minutes. While the pump is switched on due to the antifreeze, message  is alternated with the default temperature indication. This function can be disabled by adjusting it to the minimum value .




F06 - Superheating temperature (S1) to switch the pump off:

When the temperature at the collectors (sensor 1) is higher than an adjustable value, the pump is switched off to prevent the superheated water from circulating through the pipes and damaging them (if PVC pipes are used). The hysteresis is fixed at 2°C (4°F). When superheating is detected in sensor 1, message  is alternated with the default temperature indication.

F07 - Superheating temperature (S2) to switch the pump off:



When the temperature in sensor 2 reaches an ascertainable value the pump is switched off to avoid thermal discomfort. This function is used in swimming pool heating systems without the third sensor. The hysteresis may be adjusted from 0.1 to 5.0°C (see function ). When superheating is detected in sensor 2, message  is alternated with the default temperature indication.

F08 - Superheating temperature (S3) to switch the pump off:

When the temperature in sensor 3 reaches a configured value the pump is switched off to avoid thermal discomfort. This function is used in swimming pool heating systems with the third sensor to measure the temperature on the water surface. The hysteresis may be adjusted from 0.1 to 5.0°C (see function ). When superheating is detected in sensor 3, message  is alternated with the default temperature indication. This function may be disabled by adjusting it to the maximum value , and thus sensor 3 will be disabled too.

F09 - Cooling (if sensor 3 is enabled):

Cools the pool during the night whenever the superheating temperature of this sensor is exceeded and the temperature difference between sensor 1 and sensor 2 reaches -4°C (-7°F), the pump is then switched on using the panel as a radiator to cool the pool water. When the difference (T1-T2) drops to -2°C (-4°F) or the temperature in sensor 3 displays superheating, the pump is switched off.

**NOTE:** If the value of this function is , and disabled the sensor 3 the value of this function returns to .



F10/F11 - Superheating temperature hysteresis of sensor 2 / sensor 3:

If the pump is off due to superheating in sensor 2 or sensor 3 this function can define a temperature range within which the pump will remain off.

F12/F13/F14 - Indication offset of sensor 1/sensor 2/sensor 3:

It allows compensating possible deviations in the temperature reading caused by the replacement of the sensor or changes in the cable length.


F15 - Linking of sensor S3 to the automatic mode (if sensor 3 is enabled):

 Circulation pump operating in automatic mode and not linked to sensor 3. With this mode the pump is activated only by the temperature differential (S1-S2).  
 Circulation pump operating in automatic mode and linked to sensor 3. With this mode the pump is activated by the temperature differential and when the temperature at sensor 1 is higher than that at sensor 3.

**NOTE:** When the value of this function is  it will return to  when sensor 3 is disabled.


F16 - Minimum temperature in S1 to activate the pump:

Prevents the pump from being turned on when the temperature of the panel (collector) is below the desired temperature, thus preventing warm or cold water from circulating through the system, which would cause higher power consumption.




**Example:** If the panels are at 27°C and the pool is at 28°C the circulation pump does not need to be activated. This function can be disabled by adjusting it to the minimum value .

**NOTE:** This function has priority over the other pump activation functions except for the manual activation.



F17 - Instrument energization delay:

With this function enabled, when the instrument is energized, it only works as a temperature indicator remaining with the output off during the defined time. In installations with several units of equipment, configuring different values for the start-up delay time of each instrument, it is possible to avoid demand peaks by activating the loads at different times. This function can be disabled by adjusting it to the minimum value 0 .






F18 - Functions lock mode:

It allows and configures the functions lock.  
 Do not allow the functions lock.  
 It allows a partial lock where the control functions will be locked but the adjustment of the setpoint and maximum and minimum record views are allowed.  
 It allows the full lock, enabling only view and maximum and minimum record.














F19 - Time for functions lock:

Allows lockdown of control functions (see item 9.3).  
 -  - Defines the time in seconds for the controller to activate.

F20 - Control functions shutdown:

Allows the turning off of the control functions (see item 9.4).  
 Disables the control functions shutdown.  
 Enables activation/deactivation of the control functions only if the functions are unlocked.  
 Enables activation/deactivation of the control functions even if the functions are locked.  
 Enables the activation/deactivation of the control functions only if the functions are unlocked, switching off the display.  
 Enables activation/deactivation of the control functions even if the functions are locked, switching off the display.  
**NOTE:** In options 3 and 4 the display is switched off if no keys are pressed and switched on when any key is pressed, remaining on for five seconds.

11. INDICATIONS ON THE DISPLAY

	Sensor 1 disconnected or damaged.
	Sensor 2 disconnected or damaged.
	Sensor 3 disconnected or damaged.
	Sensor 1 superheating
	Sensor 2 superheating.
	Sensor 3 superheating.
	Pump manually activated.
 	Functions lockdown activated.
 	Functions lockdown disabled.
	Contact Full Gauge Controls.
	Reconfigure the values of the functions.

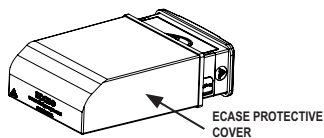
12. GLOSSARY OF ACRONYMS

- °C: Temperature in Celsius degrees.
- °F: Temperature in Fahrenheit degrees.
- **Auto:** Automatic.
- **LOC:** Blocked.
- **No:** No.
- **OFF:** Turned off/disabled.
- **ON:** Turned on, enabled.
- **SET** (as in "Setting") (setting or configuration).
- **Vac:** Electrical voltage (volts) of alternating current.
- **Vdc:** Electrical voltage (volts) of direct current.
- **Yes:** Yes.

### 13. OPTIONAL ITEMS - Sold Separately

#### Ecase protective cover

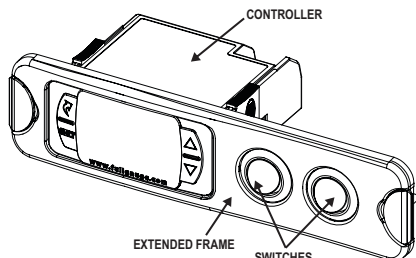
It is recommended for the Evolution line, keeps water from entering the back part of the instrument. It also protects the product when the installation site is washed.



#### Extended frame

It allows the installation of Evolution line controllers with sizes 76 x 34 x 77 mm in various situations, since it does not require precision in the notch of the instrument fitting panel.

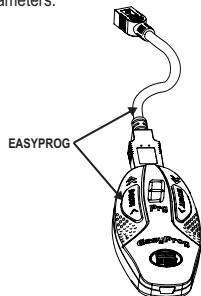
The frame integrates two switches of 10 Amperes that may be used to actuate interior light, air curtain, fan, and others.



#### EasyProg - version 2 or higher

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.
- **Serial TTL:** The controller can be connected directly to **EasyProg** by the TTL Serial connection.



### 14. ANNEXES - Reference Images

Image V

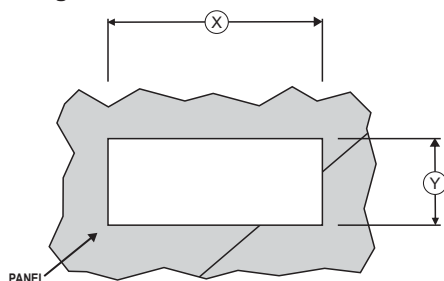


Image VI

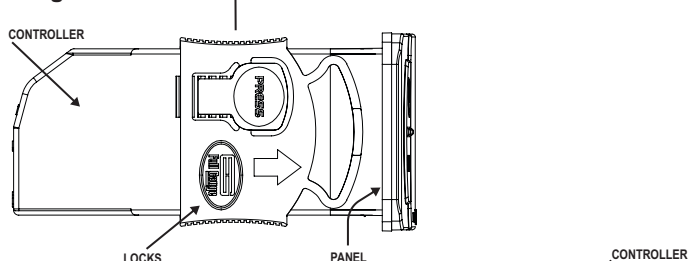
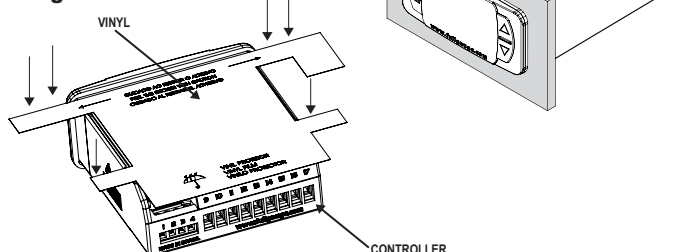


Image VII



#### 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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