



# TC-900E POWER Ver.06

DIGITAL CONTROLLER FOR REFRIGERATION AND DEFROST

- Fast Freezing
- Functions lockdown
- Control functions shutdown
- Serial programming
- IP 65 FRONT  
Protection level



## 1. DESCRIPTION

For frozen products, it automates the defrost processes according to the need of installation (smart defrost). The ambient temperature control has a normal setpoint and an economic setpoint, apart from the fast freezing function and alarm functions indicating open door. Its output relay directly controls compressors of up to 1HP and its defrost output has a current capacity of 10A. It also features a digital filter, intended to simulate a mass increase in the ambient sensor (S1), thus increasing its response time (thermal inertia) and avoiding unnecessary drives of the compressor. It also includes a smart key, lock system and a control functions shutdown mode.

To drive inductive loads (motors and pumps) of up to 2HP, use the **TC-900E 2HP**. Product complies with UL Inc. (United States and Canada).

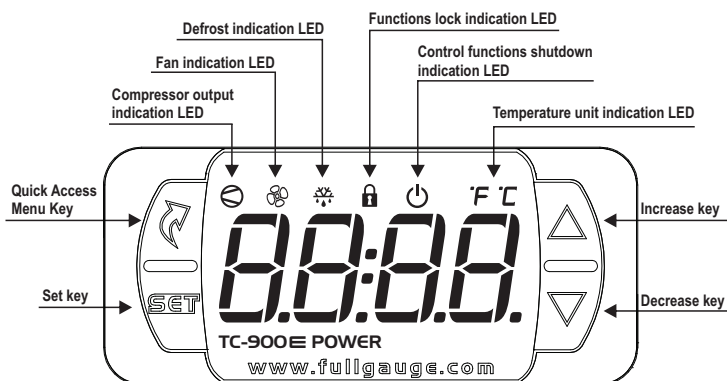
## 2. APPLICATION

- Cold Storage Rooms
- Display freezers

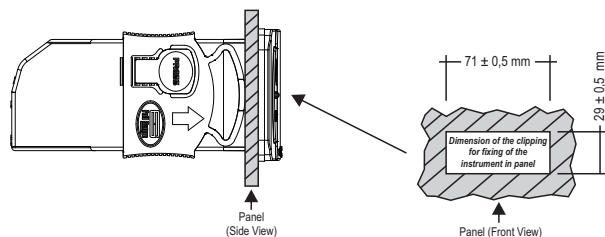
## 3. TECHNICAL SPECIFICATIONS

Power supply	TC-900E POWER: 115 or 230Vac ±10% (50/60Hz) TC-900EL POWER: 12 or 24Vac/dc +10%
Control temperature	-50°C to 105°C / -58°F to 221°F
Operating temperature	0 to 50°C / 32 to 122°F
Load current (outputs)	COMP: 12(8)A / 240Vac 1HP DEFR: 10A / 240Vac 2400W FANS: 5(3)A / 240Vac
Operating humidity	10 to 85 %RH (without condensation)
Dimensions (mm)	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)

## 4. INDICATIONS AND KEYS



## 5. INSTALLATION - ASSEMBLING



### ATTENTION

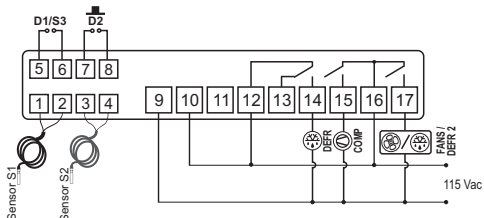
FOR INSTALLATIONS WHERE A SEALING IS REQUIRED TO AVOID LIQUID CONTACT, THE CUT FOR THE CONTROLLER MUST BE OF 70,5x32mm MAXIMUM. THE SIDE LOCKS MUST BE FIXED SO IT PRESSES THE RUBBER SEALING AVOIDING INFILTRATION BETWEEN THE CUT AND THE CONTROLLER.

### IMPORTANT

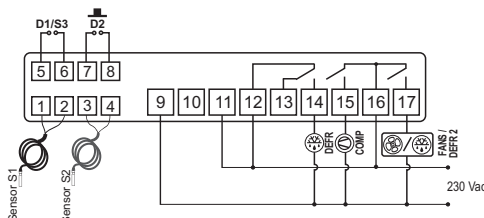
THE USE OF APPROPRIATE TOOLS IS ESSENTIAL TO AVOID DAMAGE IN THE CONNECTION AT INSTRUMENT TERMINALS:  
 ⊖ SCREWDRIVER SLOT 3/32"(2.4mm) FOR ADJUSTMENTS IN THE SIGNAL TERMINALS;  
 ⊕ SCREWDRIVER PHILLIPS #1 FOR ADJUSTMENTS IN THE POWER TERMINALS;

## 5.1 INSTALLATION - ELECTRICAL CONNECTIONS

### Connection 115 Vac



### Connection 230 Vac



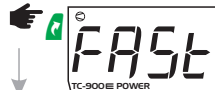
The sensor S1 (black) must be in the ambient. The sensor S2 (gray) must be placed in the evaporator through metallic clamp.

## 6. OPERATIONS

### 6.1 Quick Access Menu Map

To access or navigate the quick access menu using the **Q** (short press) key while the controller is displaying the temperature. For every touch, the next function in the list is displayed. To confirm, use the **Q** (short press) key.

#### FAST FREEZING (ON/OFF)



#### ECONOMIC SETPOINT(ON/OFF)



#### DEFROST (ON/OFF)



#### FUNCTIONS LOCKDOWN



#### CONTROL FUNCTIONS (ON/OFF)



#### NORMAL SETPOINT



#### EXIT FUNCTION



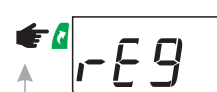
#### FUNCTION SELECTION



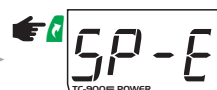
#### ERASE MIN. AND MAX. VALUES



#### MIN. AND MAX. TEMPERATURE RECORD



#### ECONOMIC SETPOINT



### 6.2 Quick access keys map

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

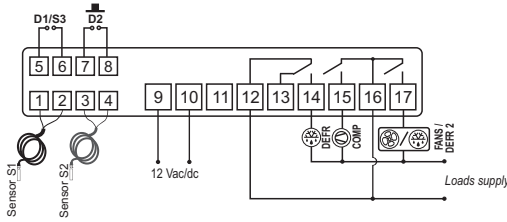
	Pressed for 5 seconds: turn on/turn off the control functions.
	Pressed for 2 seconds: setpoint adjustment.
	Short press: displays process.
	Pressed for 2 seconds: inhibits audible alarm.
	Short press: display of minimum and maximum measurement records.
	Pressed for 2 seconds: when displaying records, it cleans the history.
	Pressed for 4 seconds: performs manual defrost.
	Enters the quick access menu.
	Enters the functions selection.

### 6.3 Basic operations

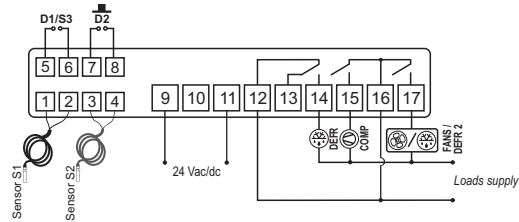
#### 6.3.1 Setting the desired temperature

To access the setpoints setup menu press **Q** for 2 seconds. The message **SP** will appear on the display followed by the normal setpoint set value. Use the **↑** or **↓** to modify the value and confirm by pressing **Q**. Immediately, the message **SP-E** appears indicating the setting of the economic setpoint. Again, use the **↑** or **↓** keys to modify the value and confirm by pressing **Q**. Finally, the **---** indication signals the setup completion. The setpoints can also be adjusted individually in the quick access menu.

### Connection 12 Vac/dc



### Connection 24 Vac/dc



The sensor S1 (black) must be in the ambient. The sensor S2 (gray) must be placed in the evaporator through metallic cramp.

### 6.3.2 Fast Freezing

In the fast freezing mode the cooling output remains permanently activated, thus accelerating the cooling or freezing process. This operating mode can be activated or deactivated in the quick access menu through the **[F55]** option or through an external switch connected to the digital input (F52 or F53). It can also be deactivated automatically by low temperature (F33) or by time (F34). During operation in the fast freezing mode, the compressor on indication flashes quickly and defrost keeps happening. If, when activating the fast freezing mode, the controller identifies that there is a defrost scheduled to start by time in this period, the defrost will be performed immediately before entering the fast freezing mode.

### 6.3.3 Economic setpoint (SPE)

The **[SP-E]** provides the system with greater economy by using more flexible parameters for temperature control (F27- Economic Setpoint and F28- Control Differential). When active, the **[EED]** message is displayed alternating with the temperature and other messages. The operation in economy mode can be activated or deactivated through the commands:

Function	Command	Action
F29	Closed door time to activate	Activates
F30	S3-S1 temperature difference to deactivate	Deactivates
F31	S3-S1 temperature difference to activate	Stays activated
F32	Maximum time in economy mode	Deactivates
F32	Maximum time in economy mode =0(no)	Stays deactivated
F52 / F53	External key (digital input)	Activates / Deactivates
F52 / F53	Open door indication (digital input)	Stays deactivated
-	Action through quick access menu ( <b>[EED]</b> )	Activates / Deactivates
-	Error in ambient temperature reading (S1)	Stays deactivated
-	When switching on the instrument	Deactivates

### 6.3.4 Manual defrost

The defrost process can be activated/deactivated manually in the quick access menu through the **[DEFr]** or pressing the **[A]** for 4 seconds or using external switch connected to digital input (F52 or F53). Activation or deactivation will be indicated by the messages **[DEFr]** or **[DEFr]** respectively.

### 6.3.5 How to determine the end of defrost by temperature

- Reconfigure the listed functions at the end of the defrost to the maximum value:
  - Cooling time (Interval between defrosts) **F8 = 999min.**
  - Evaporator temperature to end defrost **F13 = 105°C / 221°F**
  - Maximum defrost time **F14 = 90min.**
- Wait for a while until a layer of ice forms in the evaporator.
- Perform a manual defrost (using the **[A]** scroll key up to **[DEFr]** and press **[A]**).
- Follow the melting process.
- Wait until all of the ice in the evaporator has melted to consider the process completed.
- With the defrost finished, check the evaporator temperature (S2) using the **[A]** key (see section 6.3.9).
- Using the value read in S2, set the temperature for end of defrost
  - Evaporator temperature for end of defrost **F13 = Temp. S2**
- For safety, reset the maximum defrost time, according to the type of defrost set.
  - Electrical defrost (by resistance) **F14 = 45min.**
  - Hot gas defrost **F14 = 20min.**
- Finally, set the cooling time (**F8**) at the desired value.

### 6.3.6 Defrost with two evaporators

With S3 configured for the 2nd evaporator (F52), the Fan output allows control of the second resistance. Defrost always starts with the two outputs triggered. The resistors are shut down individually as their evaporators reach the temperature to end defrost. With the two outputs off or having the maximum defrost time elapsed, the draining process is started. **With these settings, all the features of the Fan are disregarded, including the Fan Delay process.**

### 6.3.7 Functions Lockdown

The use of the functions lockdown provides greater safety for the instrument's operation. With it active, the setpoint and other parameters are visible to the user, but protected against unauthorized changes. To activate the functions lockdown, access the **[LDC]** function in the quick access menu. The message **[LD]** (lockdown must be enabled and deactivated), with it on display hold down the **[A]** key for the time set for functions lockdown (F25), the activation is indicated by the message **[LDC]** **[LD]**. To enable the use of this function it is necessary that the time for functions lockdown (F25) is set to a value greater than or equal to 15 seconds. The **[LDC]** message when trying to change the parameters indicates that the functions lockdown is active. To deactivate it, turn the controller off and on again with the **[A]** key pressed. Keep the key pressed until the message **[LDC]** **[OFF]** indicates unlocking (10 seconds).

### 6.5 Table of parameters

Fun	Description	CELSIUS				FAHRENHEIT			
		Min	Max	Unit	Standard	Min	Max	Unit	Standard
<b>[F01]</b>	Access code	0	999	-	0	0	999	-	0
<b>[F02]</b>	Control differential (normal hysteresis)	0.1	20	°C	2	1	36	°F	3
<b>[F03]</b>	Ambient temperature S1 indication offset	-20	20	°C	0	-36	36	°F	0
<b>[F04]</b>	Minimum setpoint allowed to the end user	-50	105	°C	-50	-58	221	°F	-58
<b>[F05]</b>	Maximum setpoint allowed to the end user	-50	105	°C	105	-58	221	°F	221
<b>[F06]</b>	Delay at start (energization)	0 (NO)	30	min.	0 (NO)	0 (NO)	30	min.	0 (NO)

### 6.3.8 Control functions shutdown

The shutdown of the control functions allows the controller to operate only as a temperature indicator, keeping the control outputs and alarms off. The use of this feature is enabled or disabled by the shutdown function of the control functions (F56). When enabled, the control functions and alarms are switched off (**[EEL]** **[OFF]**) or on (**[EEL]** **[ON]**) in the quick access menu through the **[EEL]** option. When the control functions are off, the message **[OFF]** is displayed alternating with the temperature and other messages.

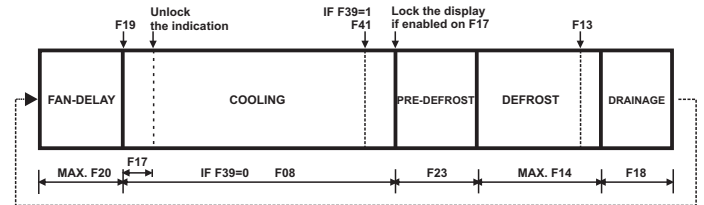
Also is possible turn on/turn off the control functions by pressing the key **[A]** for 5 seconds.

### 6.3.9 Stage of the process, elapsed time and temperature in sensors S2 and S3

The operating status of the controller can be displayed by pressing the **[A]** key (short press). A sequence of messages will be shown, indicating the current process, time (hh:mm) already elapsed in this stage, temperature in the evaporator (S2) and temperature in S3. If the sensors are disabled, their measurements will not be displayed.

Stages of the process:

- [EEL]** Initial delay (delay at start of the instrument)
- [FAN]** Fan-delay (delay for return of the fan)
- [rEr]** Cooling
- [PrE]** Pre-Defrost
- [dEr]** Defrost
- [drA]** Drainage
- [---** Control functions off



### 6.3.10 Minimum and Maximum Temperature Record

The display of the minimum and maximum temperature record can be checked through the quick access menu or by pressing the **[A]** key while displaying the temperature. The minimum and maximum temperatures recorded for each sensor are displayed in sequence preceded by identification messages **[rEg]**, **[t-1]** for ambient sensor (S1), **[t-2]** for S2 (when active) and **[t-3]** for S3 (when active). To delete the minimum and maximum recorded values, hold the **[A]** button for 2s when displaying records or use the **[rEg]** option in the quick access menu. The **[rSE]** message indicates that the records have been deleted.

### 6.3.11 Unit Selection

To select the temperature unit in which the instrument will operate enter the **[F01]** function with access code **[237]** and press the **[A]** key. Then, select the desired unit **[°C]** or **[°F]** using the **[A]** or **[V]** keys. To confirm, press **[A]**. Whenever the unit is changed, the function settings assume the default value, therefore needing to be reconfigured.

### 6.4 Advanced operations

The functions menu can be accessed through the quick access menu, option **[FUN]** or simultaneously pressing **[A]** and **[V]** while displaying the temperature. To allow changing the parameters, enter **[F01]** by pressing **[A]** (short press), and using the **[A]** or **[V]** keys enter code 123 (one hundred and twenty three). Confirm with **[A]**. To modify the other functions, navigate the menu using the **[A]** or **[V]** keys and follow the same procedure to set them. To exit the menu and return to normal operation, press and hold **[A]** until **[---** appears.

**NOTE:** If the functions lockdown is active when pressing the **[A]** or **[V]** keys, the controller will show the **[LDC]** message on the display and will not allow the setting of parameters.

Fun	Description	CELSIUS				FAHRENHEIT			
		Mn	Max	Unit	Standard	Min	Max	Unit	Standard
F07	High ambient temperature alarm (S1)	-50	105	°C	105	-58	221	°F	221
F08	Cooling time (interval between defrosts)	1	999	sec.	240	1	999	min.	240
F09	Minimum time for compressor on	0 (NO)	999	sec.	0	0 (NO)	999	sec.	0
F10	Minimum time for compressor off	0 (NO)	999	sec.	0	0 (NO)	999	sec.	0
F11	Compressor status with ambient sensor (S1) disconnected	0	2	-	1	0	2	-	1
F12	Defrost at start of instrument	NO	YES	-	NO	NO	YES	-	NO
F13	Temperature at evaporator (S2 / S3) to determine the end of defrost	-50	105	°C	30	-58	221	°F	86
F14	Maximum defrost time	0 (NO)	90	min.	30	0 (NO)	90	min.	30
F15	Fan on during defrost	0 (OFF)	1 (ON)	-	0 (OFF)	0 (OFF)	1 (ON)	-	0 (OFF)
F16	Defrost type (0-Electric / 1-Hot gas)	0	1	-	0	0	1	-	0
F17	Temperature indication (S1) locked during defrost	-1 (NO)	99	min.	-1 (NO)	-1 (NO)	99	min.	-1 (NO)
F18	Draining time (dripping of defrost water)	0 (NO)	99	min.	1	0 (NO)	99	min.	1
F19	Evaporator temperature (S2 / S3) for fan return after drainage	-50	105	°C	20	-58	221	°F	68
F20	Maximum time for fan return after drainage (fan-delay)	0 (NO)	30	min.	1	0	30	min.	1
F21	Fan operating mode	0	7	-	4	0	7	-	4
F22	Fan stop for high temperature in evaporator	-50	105	°C	30	-58	221	°F	86
F23	Time for gas collection before starting defrost (pre-defrost)	0 (NO)	999	min.	0 (NO)	0 (NO)	999	min.	0 (NO)
F24	Intensity of digital filter applied to sensor 1 (0-deactivated)	0	9	-	0	0	9	-	0
F25	Time for functions lockdown	14 (NO)	60	sec.	14 (NO)	14 (NO)	60	sec.	14 (NO)
F26	Normal setpoint	-50	105	°C	-15	-58	221	°F	5
F27	Economic setpoint (SPE)	-50	105	°C	-10	-58	221	°F	14
F28	Control differential (economic hysteresis)	0.1	20	°C	2	1	36	°F	3
F29	Time for closed door to enter economy mode	0 (NO)	999	min.	0 (NO)	0 (NO)	999	min.	0 (NO)
F30	Temperature difference (S3-S1) below which the economic setpoint is activate	0.1	20	°C	2	1	36	°F	3
F31	Temperature difference (S3-S1) above which the normal setpoint is activated	0.1	20	°C	5	1	36	°F	9
F32	Maximum time in economy mode	0 (NO)	100(OFF)	h.	0 (NO)	0 (NO)	100(OFF)	h.	0 (NO)
F33	Temperature limit for Fast Freezing	-50	105	°C	-25	-58	221	°F	-13
F34	Fast Freezing time	0 (NO)	999	min.	0 (NO)	0 (NO)	999	min.	0 (NO)
F35	Time of fan on	1	99	min.	2	1	99	min.	2
F36	Time of fan off	1	99	min.	8	1	99	min.	8
F37	Compressor on time in case of S1 failure	0	999	min.	0	0	999	min.	0
F38	Compressor off time in case of S1 failure	0	999	min.	0	0	999	min.	0
F39	Condition for starting defrost (0-time / 1-temperature)	0	1	-	0	0	1	-	0
F40	Maximum open door time for instant defrost	0 (NO)	999	min.	0 (NO)	0 (NO)	999	min.	0 (NO)
F41	Temperature at evaporator (S2 / S3) to start defrost	-50	105	°C	-50	-58	221	°F	-58
F42	Open door time to shut down fan	-1 (NO)	999	min.	-1 (NO)	-1 (NO)	999	min.	-1 (NO)
F43	Open door time to shut down control outputs	0 (NO)	999	min.	0 (NO)	0 (NO)	999	min.	0 (NO)
F44	Maximum temperature at condenser (S3) to shut down control outputs	0 (NO)	105	°C	55	32 (NO)	221	°F	131
F45	Control differential (hysteresis) for sensor S3 when set as sensor of the condenser	0.1	20	°C	5	1	36	°F	9
F46	Compressor on time without reaching the setpoint to shut down the control outputs	0 (NO)	999	min.	0 (NO)	0 (NO)	999	min.	0 (NO)
F47	Low ambient temperature alarm (S1)	-50	105	°C	-50	-58	221	°F	-58
F48	Alarm inhibition time by temperature	0 (NO)	99	min.	0 (NO)	0 (NO)	99	min.	0 (NO)
F49	Temperature of sensor S3 (condenser) to give an alarm	0	105	°C	45	32	221	°F	113
F50	Time of open door to give an alarm	0 (NO)	999	min.	0 (NO)	0 (NO)	999	min.	0 (NO)
F51	Enabling the buzzer	0 (OFF)	1 (ON)	-	0 (OFF)	0 (OFF)	1 (ON)	-	0 (OFF)
F52	Function of digital input 1 / sensor S3	0 (OFF)	13	-	0 (OFF)	0 (OFF)	13	-	0 (OFF)
F53	Function of digital input 2	0 (OFF)	10	-	0 (OFF)	0 (OFF)	10	-	0 (OFF)
F54	Evaporator S2 temperature indication offset	-20.1 (OFF)	20	°C	0	-36 (OFF)	36	°F	0
F55	Sensor S3 temperature indication offset	-20	20	°C	0	-36	36	°F	0
F56	Control functions shutdown	0 (NO)	4	-	0 (NO)	0 (NO)	4	-	0 (NO)

Legend:  = on  = off  
 = yes  = no

### 6.5.1 Description of parameters

#### F01-Access code:

It is necessary when one wants to modify the configuration parameters or the temperature unit. To only view the adjusted parameters, it is not required to enter any access code.

It allows modifying the advanced parameters

It allows choosing the temperature unit, Celsius or Fahrenheit

#### F02 - Control differential (normal hysteresis):

It is the temperature difference (hysteresis) between TURNING ON and OFF the cooling control output in normal and Fast Freezing mode.

#### F03-Ambient temperature S1 indication offset:

This function allows compensating for eventual deviations in the ambient temperature reading (S1), resulting from the change of sensor or modification of the cable length.

#### F04 - Minimum setpoint allowed to the end user:

Electronic stop whose purpose is to prevent that, by mistake, the setpoint temperature is set unreasonably low.

#### F05 - Maximum setpoint allowed to the end user:

Electronic stop whose purpose is to prevent that, by mistake, the setpoint temperature is set unreasonably high.

#### F06 - Delay at start (energization):

With this function enabled, when the instrument is energized it only indicates temperature, remaining with all the outputs off during the set time. In installations with multiple equipment, assigning different values for the delay time at the start of each instrument, it is possible to avoid power surges by activating the loads at different times.

#### F07 - High ambient temperature alarm (S1):

It is the ambient temperature (S1) above which the instrument will indicate a high temperature visual and sound alarm ( (F51)). The differential for the alarm's shutdown is fixed at 0.1°C/1°F. This alarm considers the temperature shown on the display, being so influenced, by temperature indication locked during defrost (F17). The alarm is ignored until the instrument reaches the control temperature for the first time.

#### F08 - Cooling time (interval between defrosts):

When defrost is set to start by time (F39), this function sets the maximum time for the cooling process. In this case defrost will start whenever the elapsed time in cooling mode reaches the value set in this function. If the condition for starting defrost is temperature in the evaporator and the controller is not indicating a reading error in this sensor, the cooling time will not be taken into account.

#### F09 - Minimum time for compressor on:

It is the minimum time the compressor will stay on, that is, the time interval between the last start and the next stop. It serves to prevent voltage spikes in the power grid.

#### F10 - Minimum time for compressor 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.

#### F11 - Compressor status with ambient sensor (S1) disconnected:

If the ambient temperature sensor (S1) is short-circuited, disconnected or out of the measuring range, the compressor assumes the set status in this function.

Compressor off

Compressor on

Cycling according to the times defined in F37 and F38.

#### F12 - Defrost at start of instrument:

It allows defrost to happen at the time the controller is energized, like for example when power returns (in case of power failure).

#### F13 - Temperature at evaporator (S2 / S3) to determine the end of defrost:

When the evaporator temperature is greater than or equal to the value set in this function, defrost will be terminated. If sensor S3 is set as a sensor of the second evaporator (F52), the controller will shut down the defrost outputs individually and the defrost process will be terminated when the two of them are off.

#### F14 - Maximum defrost time:

This parameter is used to set the maximum allowed time for the defrost process. If at the end of this period the defrost process is not finished by temperature, a dot will stay flashing on the lower right-hand corner of the display. If sensor 2 is shut down, the end of the defrost process will always be determined by time, so there is no need for a warning sign. When the maximum defrost time is set to 0 () the defrost process stops.

**F15 - Fan on during defrost:**

It defines whether the fan will always stay on or off during defrost. They are examples using the fan on, in cases of natural defrost and defrost by finned resistors installed outside the evaporator.

**F16 - Defrost type:**

- 0 Electrical defrost (by resistance), where only the defrost output is triggered
- 1 Hot gas defrost, where the compressor and defrost outputs are triggered

**F17 - Temperature indication (S1) locked during defrost:**

This function is intended to prevent the visualization of a rise in ambient temperature due to defrost. During defrost, the last temperature measured in the cooling cycle will be locked on the display. The indication will be released after the start of the next cooling cycle, when this temperature is reached again or exceeds the time set in this function (whichever comes first). This function can be disabled if set to  (-1).

**F18 - Draining time (dripping of defrost water):**

Time required for dripping, i.e. to drain the last drops of water from the evaporator. During this period, all outputs remain off. If this step is not desired, set this time to .

**F19 - Evaporator temperature (S2 / S3) for fan return after drainage:**

After drainage starts the fan-delay cycle. The compressor is driven immediately, because the evaporator temperature is high, but the fan is only activated after the temperature in the evaporator decreases from the set value. This process is necessary to remove the heat still existing in the evaporator because of the defrost, thus avoiding throwing it into the environment.

**F20 - Maximum time for fan return after drainage (fan-delay):**

For safety reasons, in case the evaporator temperature does not reach the set value in function F19 or sensor (S2 / S3) is disconnected, the fan return will happen after the time set in this function has elapsed.

**F21 - Fan operating mode:**

This parameter allows setting how the fan output will behave during the cooling cycle. In this case, its operating options consider the compressor's output status and the setpoint the instrument is operating with. When set to cycle, the on and off times are defined by F35 and F36.

Mode	Comp. Relay ON	Comp. Relay off with Normal or FF* SP*	Comp. Relay off with Economic SP*
0	Fan Relay ON	Fan Relay CYCLING	Fan Relay CYCLING
1	Fan Relay ON	Fan Relay CYCLING	Fan Relay ON
2	Fan Relay ON	Fan Relay CYCLING	Fan Relay OFF
3	Fan Relay ON	Fan Relay ON	Fan Relay CYCLING
4	Fan Relay ON	Fan Relay ON	Fan Relay ON
5	Fan Relay ON	Fan Relay ON	Fan Relay OFF
6	Fan Relay ON	Fan Relay OFF	Fan Relay CYCLING
7	Fan Relay ON	Fan Relay OFF	Fan Relay OFF

\*LEGEND:  
 SP: Setpoint  
 FF: Fast Freezing

**F22 - Fan stop for high temperature in evaporator:**

The purpose of this function is to shut the evaporator fan down until the ambient temperature approaches that predicted in the refrigerating installation project, avoiding high temperatures and suction pressures that can damage the compressor. During the cooling process, if the evaporator temperature exceeds the set value, the fan is turned off, turning it on again with a hysteresis fixed at 0,1°C/1°F. This is a valuable feature when, for example, refrigeration equipment that has been inactive for days is put into operation or when storage rooms or display freezers are restocked.

**F23 - Time for gas collection before starting defrost (pre-defrost):**

When defrost starts, the controller will maintain, during this time, only the fan on exploiting the residual energy of the gas. In the case of defrost in energization, this time will be disregarded.

**F24 - Intensity of digital filter applied to sensor 1 (0-deactivated):**

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

**F25 - Time for functions lockdown:**

It authorizes the locking of the control functions (see section 6.3.7).

- It does not authorize the locking of functions.
- 15 -  60 - It authorizes the locking of functions and sets the time in seconds for the command to activate.

**F26 - Normal setpoint:**

It is the desired temperature in the room to be cooled. It is the reference value for temperature control.

**F27 - Economic setpoint (SPE):**

It is the desired temperature in the room to be cooled when the instrument is operating in economy mode.

**F28 - Control differential (economic hysteresis):**

It is the temperature difference (hysteresis) between TURNING ON and OFF the cooling control output in economy mode.

**F29 - Time for closed door to enter economy mode:**

If the door is kept closed for a time greater than or equal to that set in this function and the normal setpoint is or has already been reached, the controller activates the economy mode. With this, it starts operating with the economic setpoint until any condition for deactivation is met (see 6.3.3). This function is disabled when set to  (0).

**F30 - Temperature difference (S3-S1) below which the economic setpoint is activated:**

When the temperature difference between sensor 3 and sensor 1 is less than the value set in this parameter, the controller starts operating in economy mode

**F31 - Temperature difference (S3-S1) above which the normal setpoint is activated:**

When the temperature difference between sensor 3 and sensor 1 is greater than the value set in this parameter, the controller starts operating with normal setpoint.

**F32 - Maximum time in economy mode:**

It allows setting the maximum time of operation of the economy mode. After this time, the setpoint returns to normal operating mode. If configured as  this time is disregarded.

**F33 - Temperature limit for Fast Freezing:**

It is the minimum temperature that the instrument can achieve during the fast freezing.

**F34 - Fast Freezing time:**

It is the duration of the fast freezing process.

**F35 - Time of fan on:****F36 - Time of fan off:**

They define the length of time the fan is on and off, in case it is operating in cyclic mode.

**F37 - Compressor on time in case of S1 failure:****F38 - Compressor off time in case of S1 failure:**

They define the length of time the compressor is on and off, in case it is being driven in cyclic mode. This condition occurs if sensor S1 is disconnected (or faulty) and if parameter F11 is set to .

**F39 - Condition for starting defrost (0-time / 1-temperature):**

It sets the condition for starting the defrost process:

- 0 Time
- 1 Temperature

Before entering the defrost process, the controller will respect the compressor's minimum time on or off (F09 and F10) and the gas collection stage (F23).

**F40 - Maximum open door time for instant defrost:**

If in the cooling stage the door is kept open for a period greater than that defined in this function, instant defrost will occur. In case the door is open at the beginning of the cooling process, the count of this time is restarted. This function is disabled when set to  (0).

**F41 - Temperature at evaporator (S2 / S3) to start defrost:**

When the evaporator temperature is lower than the value set in this function, the controller will start defrost. If sensor S3 is set as a sensor of the second evaporator (F52), the controller will start the defrost soon as any of the two sensors, S2 or S3, meets this condition. In case the condition to start defrost (F39) is time, this function is ignored.

**F42 - Open door time to shut down fan:**

For safety reasons, after an open door time greater than or equal to that defined in this function has elapsed, the fan will be shut down in the cooling stage. This function is disabled when set to  (-1).

**F43 - Open door time to shut down control outputs:**

For safety reasons, after an open door time greater than or equal to that defined in this function has elapsed, the outputs will be shut down (compressor, fan and defrost). This function is disabled when set to  (0).

**F44 - Maximum temperature at condenser (S3) to shut down control outputs:**

Above this temperature, beyond the visual and sound alarm indications (), the loads activated by the outputs will be disconnected. In case the S3 input is set (F52) for another function, this alarm is deactivated. This alarm is ignored until the instrument reaches the control temperature for the first time.

**F45 - Control differential (hysteresis) for sensor S3 when set as sensor of the condenser:**

For the loads to be reconnected, the temperature of sensor S3 (condenser) will need to descend to the value set in F44 minus the value set in this parameter.

**F46 - Compressor on time without reaching the setpoint to shut down the control outputs:**

It is the maximum time until which the compressor can remain on without reaching the setpoint during the cooling process. When this time has elapsed, the outputs will be shut down (compressor, defrost fan) and a visual and sound alarm () will also be triggered. This function can be disabled if set to the minimum value  (0).

**F47 - Low ambient temperature alarm (S1):**

It is the ambient temperature (S1) below which the instrument will indicate a low temperature visual and sound alarm () (F51). The differential for the alarm's shutdown is fixed at 0,1°C/1°F. This alarm is ignored until the instrument reaches the control temperature for the first time. During the Fast Freezing operation mode, the low temperature alarm is disabled; it will be enabled automatically when the Fast Freezing process finishes and the temperature reaches a value higher than the alarm value.

**F48 - Alarm inhibition time by temperature:**

With this configuration active, the temperature will need to remain in the alarm condition during the inhibition time set, for the alarm to be indicated. That way one can prevent alerts resulting from specific temperature variations, and after defrost.

**F49 - Temperature of sensor S3 (condenser) to give an alarm:**

It is the condenser's temperature (S1) above which the instrument will indicate a high temperature visual and sound alarm () (F51). In case the S3 input is set (F52) for another function, this alarm is deactivated. This alarm is ignored until the instrument reaches the control temperature for the first time.

**F50 - Time of open door to give an alarm:**

If the door is left open for a time greater than or equal to that set in this parameter, the controller will activate a visual and sound "open door" alarm (F51). The alarms are suspended upon closing the door. The audible alert can be inhibited by pressing the  key (hold for 2s). For the "open door" alarm to operate, it is necessary to configure one of the digital inputs as door contact (F52 and F53). This function is disabled when set to  (0).

**F51 - Enabling the buzzer:**

It allows enabling and disabling the internal buzzer for alarm signaling.

**F52 - Function of digital input1 / sensor S3:**

- FF Not in use
- 1 Digital input: Activate economic setpoint (N.O. push-button)
- 2 Digital input: Perform defrost (N.O. push-button)
- 3 Digital input: Perform fast freezing (N.O. push-button)
- 4 Digital input: External alarm (N.O.)
- 5 Digital input: Door contact (N.O.)
- 6 Digital input: Activate economic setpoint (N.C. push-button)
- 7 Digital input: Perform defrost (N.C. push-button)
- 8 Digital input: Perform fast freezing (N.C. push-button)
- 9 Digital input: External alarm (N.C.)
- 10 Digital input: Door contact (N.C.)
- 11 Sensor S3: Temperature differential for economic setpoint (S3-S1)
- 12 Sensor S3: Condenser temperature control
- 13 Sensor S3: Temperature control of second evaporator

### F53 - Function of digital input 2:

- 0FF Not in use
- 1 Digital input: Activate economic setpoint (N.O. push-button)
- 2 Digital input: Perform defrost (N.O. push-button)
- 3 Digital input: Perform fast freezing (N.O. push-button)
- 4 Digital input: External alarm (N.O.)
- 5 Digital input: Door contact (N.O.)
- 6 Digital input: Activate economic setpoint (N.C. push-button)
- 7 Digital input: Perform defrost (N.C. push-button)
- 8 Digital input: Perform fast freezing (N.C. push-button)
- 9 Digital input: External alarm (N.C.)
- 10 Digital input: Door contact (N.C.)

### F54 - Evaporator S2 temperature indication offset:

This function allows compensating for eventual deviations in the evaporator temperature reading (S2), resulting from the change of sensor or modification of the cable length. Sensor S2 can be shut down by setting this function at minimum until the message  0FF appears. In this condition, all functions dependent on the reading of sensor S2 cease to operate.


### F55 - Sensor S3 temperature indication offset:

This function allows compensating for eventual deviations in the reading of sensor S3 temperature, resulting from the change of sensor or modification of the cable length. Sensor S3 can be shut down by setting the function of digital input 1 / Sensor S3 (F52) with the  0FF(0) value, or making it operate as a digital input.

### F56 - Control functions shutdown:

Authorizes switching off the control functions (see section 6.3.8).

- 0 Disables the control functions shutdown.
- 1 Enables activation/deactivation of the control functions only if the functions are unlocked.
- 2 Enables activation/deactivation of the control functions even if the functions are locked.
- 3 Enables activation/deactivation of the control functions only if the functions are unlocked.\*
- 4 Enables activation/deactivation of the control functions even if the functions are locked.\*

\* When F56 is configured as 3 or 4 and the control functions shutdown is activated, the controller will turn off the display, keeping only the indication  light on.

If any key is touched the display turns on by 5 seconds, turning off again until a new key is touched.

## 7. SIGNALS

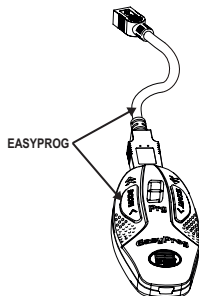
<input type="checkbox"/> Err 1	Ambient sensor disconnected or out of range.
<input type="checkbox"/> Err 2	Evaporator sensor disconnected or out of range.
<input type="checkbox"/> Err 3	Sensor 3 disconnected or out of range.
<input type="checkbox"/> ALrE	External alarm (digital input).
<input type="checkbox"/> ECo	Operating with economic setpoint.
<input type="checkbox"/> OPn	Open door indication.
<input type="checkbox"/> AOPn	Open door alarm indication.
<input type="checkbox"/> Ah1	High ambient temperature alarm (sensor1).
<input type="checkbox"/> ALo	Low ambient temperature alarm (sensor1).
<input type="checkbox"/> AC1	High temperature in condenser alarm (level 1).
<input type="checkbox"/> AC2	High temperature in condenser alarm (level 2).
<input type="checkbox"/> ALrC	Compressor reached the maximum time on without reaching the SP.
<input type="checkbox"/> 0FF	Control routines off.
<input type="checkbox"/> [ ]	It indicates that the temperature for end of defrost has not been reached.
<input type="checkbox"/> ECal	Please contact Full Gauge Controls.
<input type="checkbox"/> P P P P	Reconfigure the values of the functions.

## 8. OPTIONAL ITEMS - Sold Separately

### 8.1 EasyProg - version 2 or higher

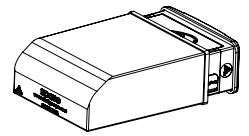
It is an accessory that has as its main function to store the parameters of the controllers. At any time, you can load new parameters of a controller and unload them on a production line (of the same controller), for example. It has three types of connections to load or unload the parameters:

- **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.



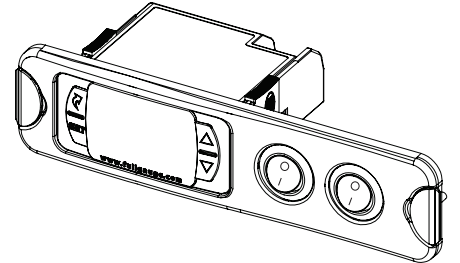
## 8.2 Ecase

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.



## 8.3 Extension Frame

The Full Gauge Controls extension frame allows the installation of Evolution / Ri line with measures 76x34x77 mm (dimensions of the clipping for fixing in the extension frame is 71x29mm) in varied situations, since it eliminates precision cut to embed the instrument. Allows customization via a sticker with the brand and the company contact, and accompany two 10A (250 Vac) switches that can trigger internal light, air curtain, on / off system or fan.



### 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

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