TC-970E+ECO Faston Ver.01
TC-970E+ECO EasyCon Ver.01

DIGITAL COOLING CONTROLLER

Full Gauge CONTROLS

Quick coupling connection | Variable compressor | Economy mode | Lamp on/off | Buzzer | Function Lock | Switch Off Control Functions | Programming in Series | IP 65 FRONT Degree of protection

TC970E+ECOV01-01T-18762

1. DESCRIPTION

TC970E +ECO Faston and **TC970E +ECO Easycon** are electronic controllers for refrigerating freezers, beverage displays, refrigerated islands and counters. These controllers can activate the cooling, defrost, fan and lighting system. In addition to those features, they allow users to pre-define up to 4 operating temperatures that are easily changed using a keyboard, in addition to specific keys to activate/deactivate the economy mode and turn the lamp on/off.

The controller has 2 temperature sensors for controlling the refrigerated environment and intelligent defrost control (start and end of defrost by time or temperature). For better use of energy, ventilation can be controlled during the compressor off cycle and use Smooth Defrost, a defrosting technique that reduces the final temperature of the electrical resistance and the amount of heat emmited.

Through its digital input it is possible to monitor the opening of the door, activation of economy setpoint, temperature control of the door or condenser, defrost or Fast-Freezing. The Fast Freezing feature is an alternative used after the process of replacing products in the freezer to speed up the cooling process.

The +ECO line adds control of VCC - Variable Capacity Compressor. The +ECO controllers provide a series of benefits to the cooling system, such as: reduced energy consumption, less temperature fluctuation, greater speed in reaching the desired temperature. From the configuration of its parameters, it is possible to make the controller compatible with the main brands of variable compressors on the market.

2. SAFETY RECOMMENDATIONS

- Make sure you know the correct way to install the controller;
- Make sure that the power supply is turned off and that it is not going to turn in during the installation of the controller;
- Read this manual before installing and using the controller;
- Use appropriate Personal Protective Equipment (PPE);
- Where it will be used in areas subject to splashing water, such as refrigerated counters, install the protective film that comes with the controller;
- For protection under more critical conditions, we recommend the Ecase cover, which we offer as an option (sold separately);
- The installation procedures must be carried out by a competent engineer, with regard to current regulations.

3. APPLICATIONS

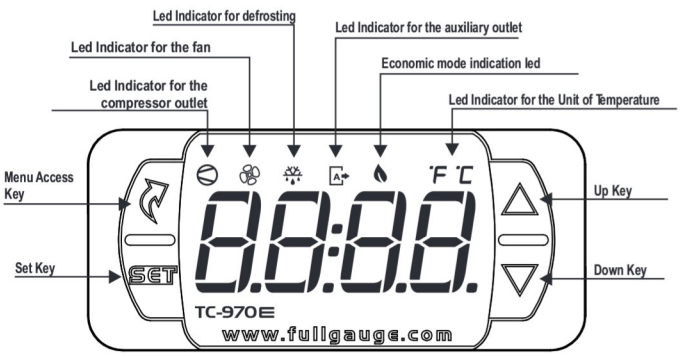
- Beverage Display;
- Frozen counters.

4. TECHNICAL SPECIFICATIONS

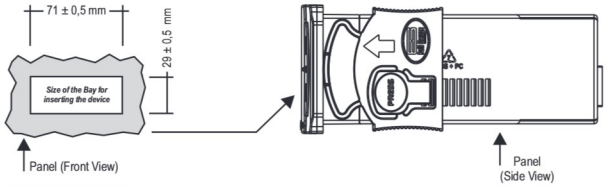
Power supply	TC-970E + Eco Faston: 115 or 230Vac ± 10%(*) (50/60Hz) TC-970EL + Eco Faston: 12 or 24Vac/dc + 10%(*) TC-970E + Eco Easycon: 115 or 230Vac ± 10%(*) (50/60Hz) TC-970EL + Eco Easycon: 12 or 24Vac/dc + 10%(*)
Control Temperature	-50 to 105°C / -58 to 221°F
Operating Temperature	0 to 50°C / 32 to 122°F
Temperature Resolution	0,1°C / 0,1°F
Average consumption	± 4VA
Maximum relay current	**DEFR:** 8A / 250Vac - defrost output **FAN:** 1/8HP / 250Vac - output of the Fan **AUX:** 1/8HP/1A E-Ballast / 250Vac - auxiliary output
Digital input	Configurable Dry Contact type
Frequency output	12Vcc (± 25%) 0...300Hz (duty-cycle = 50%)
Operating humidity	10 a 90% UR (without condensation)
Degree of protection	IP 65 (frontal)
Maximum Sizes (**) (mm)	TC-970E + Eco Faston: 76 x 34 x 84 (WxHxD) TC-970E + Eco Easycon: 76 x 34 x 78 (WxHxD)
Bay Size (mm)	X = 71±0,5 Y= 29±0,5 (see Image 5)

(*) Permissible variation in relation to the rated voltage.
(**) Maximum dimensions without connectors.

5. INDICATIONS AND KEYS



6. INSTALLATION - PANEL E ELECTRICAL CONNECTIONS



⚠ WARNING

WHERE THE INSTALLATION LOCATION NEEDS TO BE SEALED AGAINST LIQUIDS, THE OPENING IN WHICH THE CONTROLLER IS TO BE INSTALLED MUST BE NO MORE THAN 70.5x29mm. THE SIDE CLASPS MUST BE SECURED IN SUCH A WAY AS TO CREATE A TIGHT RUBBER SEAL THAT PREVENTS ANY LIQUIDS ENTERING THE OPENING AND THE CONTROLLER.

7. WIRING DIAGRAM

Image I - Connection 115 Vac

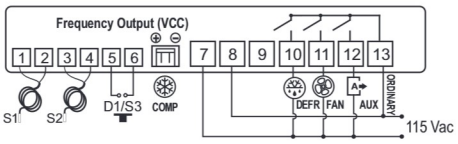


Image II - Connection 230 Vac

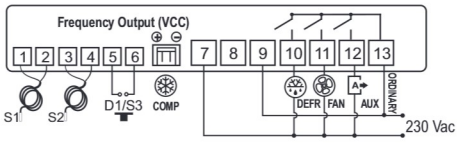


Image III - Connection 12 Vac/dc

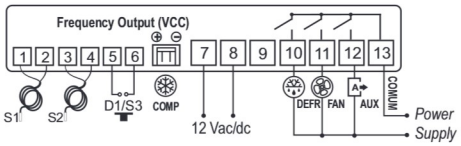
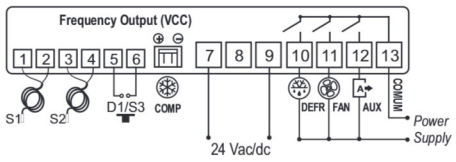


Image IV - Connection 24 Vac/dc



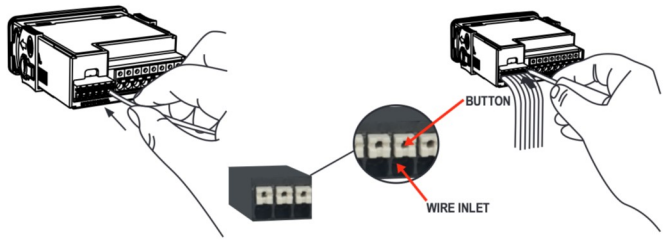
Controller power supply

Use the pins according to the table below, depending on the device version:

Pins	TC970E Faston / Easycon	TC970E Faston / Easycon
7 and 8	115 Vac	12 Vac/dc
7 and 9	230 Vac	24 Vac/dc

The **S1 sensor** must be in the environment.
The **S2 sensor** must be fixed to the evaporator using a metal clamp.

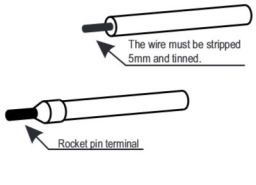
CONNECTION SYSTEM (QUICK COUPLING):



CONNECTION:
- Hold the wire close to its end and insert it into the required opening.
- If necessary, press the button to help make the connection.

NOTE:
- In the push-in connectors the maximum gauge that is used is 1,5mm²;
- The wires must be tinned or use Rocket Pin type terminals;
- For connections 1 to 6, use Rocket Pin type terminals with a maximum gauge 0,75mm²;
- For connections from 7 to 13 (Easycon model), use the Rocket Pin terminal with a maximum gauge of 1,5mm².

DISCONNECTION:
- To disconnect the wire, press the button and remove it.



6.1. Connecting the temperature sensors

- Connect the wires of the **S1 sensor** to terminals "1 and 2" ,the wires of the **S2 sensor** to terminals "3 and 4" and the wires of the **S3 sensor** to terminals "5 and 6" the polarity is indifferent.
- The length of the sensor cables can be increased by the user themselves by up to 200 meters, using a 2x24 AWG PP cable.

6.2. Recommendations from NBR5410 and IEC60364 standards

a) Install surge protectors to the controller's power supply.
b) Install transient suppressors - suppressor filter (type RC) - in the circuit to increase the working life of the controller's relay.
c) The sensor cables can be together, but not in the same conduit as the power supply for the controller or the loads.

7. INSTALLATION PROCEDURE

a) Cut out the panel plate (Diagram 5 - item 13) where the controller is going to be installed, to a size where X = 71 ± 0.5 mm and Y = 29 ± 0.5 mm;
b) Remove the side clasps (Diagram 6 - item 13): to do this, press on the elliptical central part (with the Full Gauge Controls Logo) and slide the clasps back;
c) Pass the wires through the opening (Diagram 7 - Item 13) and install the electrics as described in item 6;
d) Insert the controller into the opening made in the panel, from the outside;
e) Replace the clasps and move them until they are pressed against the panel, securing the controller to the housing (see arrow in Diagram 6 - item 13);
f) Adjust the parameters as described in item 9.

⚠ **WARNING:** Where the installation needs to be sealed tight against liquids, the opening for the controller must be no more than 70.5x29mm. The side clasps must be secured in such a way as to create a tight rubber seal that prevents any liquids entering the opening and the controller.

Protective Film - Diagram 9 (item 13)

This protects the controller when it is installed somewhere subject to splashing water, such as refrigerated counters. This adhesive film will be covering the device, in the packaging.

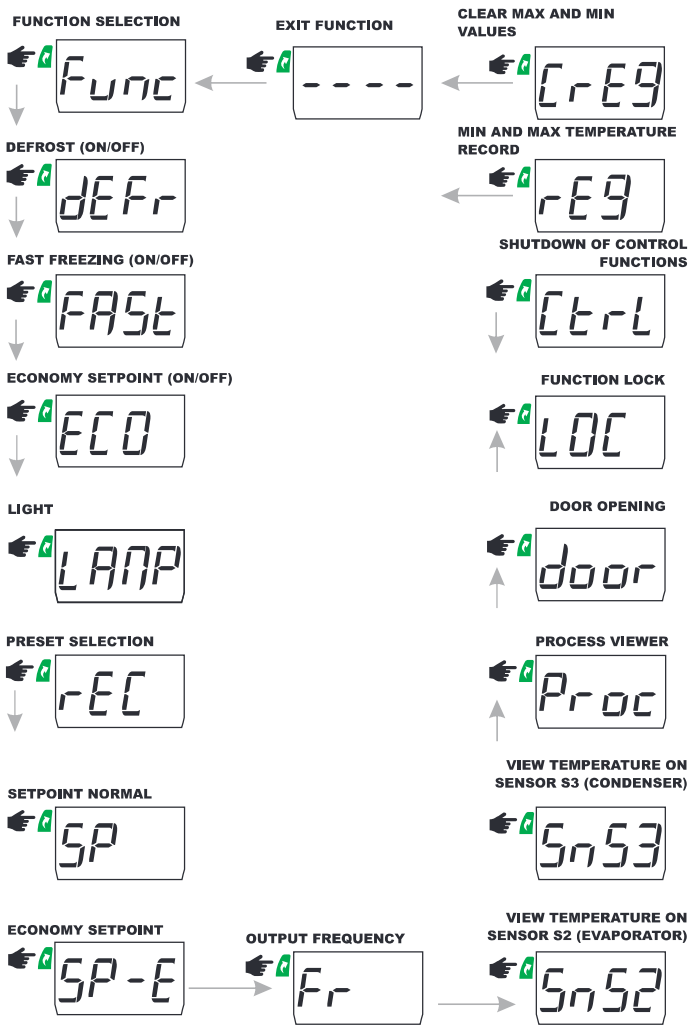
⚠ **IMPORTANT: Only apply it after you have finished making the electrical connections.**

a) Pull the side clasps back (Diagram 6 - item 13);
b) Remove the protective film from the adhesive vinyl strip;
c) Apply the film to the entire upper part, folding the flaps, as indicated by the arrows - Diagram 9 (item 13);
d) Replace the clasps.
OBS: The film is transparent, so that the electrical layout of the device can be seen.

8. OPERATIONS

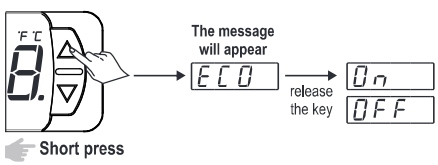
8.1 Access Menu Map

Press the ▲ key (short press) to navigate through the menu functions. Each press will display the next function in the list. To confirm press the SET key (short press). The menu function map is below:



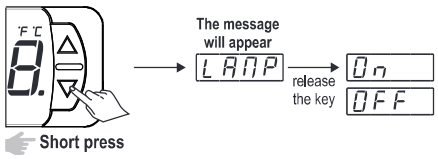
8.2 Turning on/off the economy mode

To switch on / off the power saving mode, press the ▲ key with a short press or through the easy menu (item 8.1).



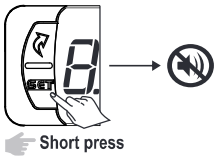
8.3 Turn the light on / off

To switch the lamp on / off, short press the ▼ key or through the easy menu (item 8.1).



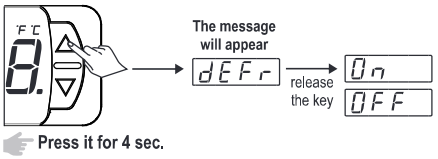
8.4 Inhibiting the audible alarm

To inhibit the audible alarm, briefly press the SET key.



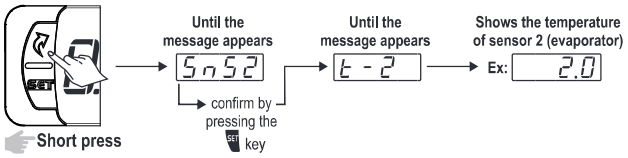
8.5 Manual defrost

To start/stop defrost, regardless of the schedule, press the ▲ key for 4s, until the message dEFr appears. Then release it. The message On will be displayed when it starts and OFF when it is stopped. Access is also possible through the easy menu (item 8.1).



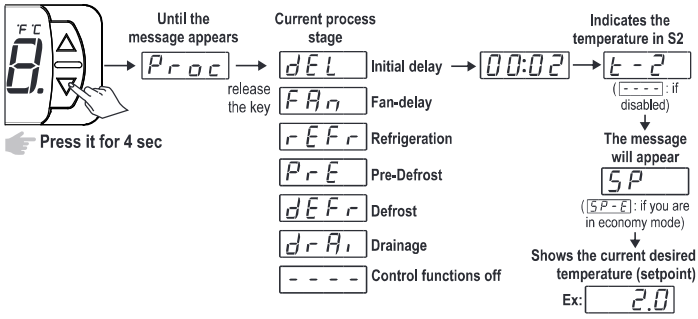
8.6 Temperature display on sensor S2 (evaporator)

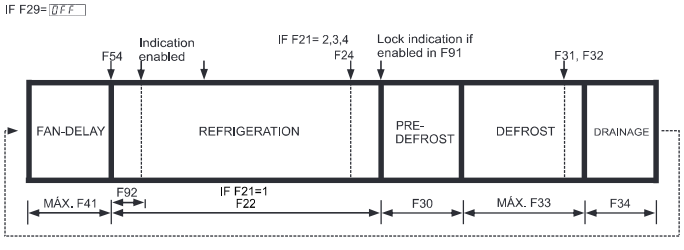
The temperature in sensor S2 (evaporator) can be viewed by pressing the ▲ key (short press) until the message SnS2 appears. If this sensor is disabled, - - - - will be displayed.

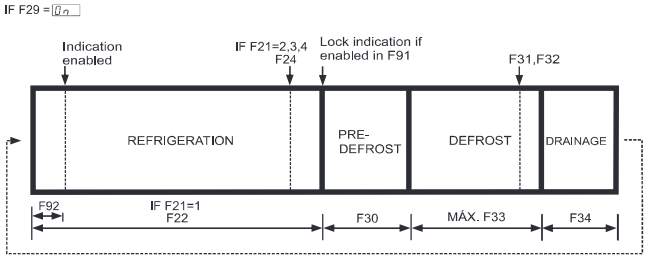


8.7 View process stage and current setpoint

To see which stage of the process is being performed, press the ▼ key for 4s, until the message Proc appears. Then release it. The current process step will be displayed, the time (hh:mm) already elapsed in this process and then the temperature setpoint that is in operation, relative to the mode of operation (normal / economy). It is also possible to access it through the easy menu (Item 8.1).

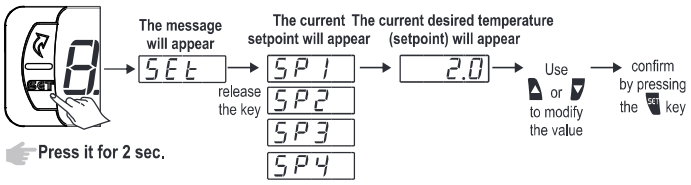






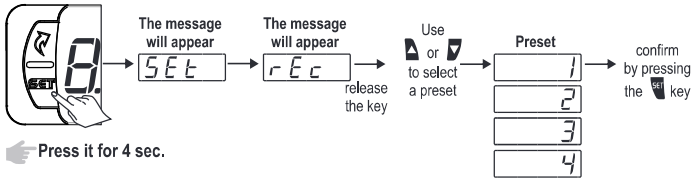
8.8 Setting the desired temperature (setpoint)

To adjust the desired temperature, press the SET key for 2s, until the message SEt appears. Then release it. The message SP1 or SP2 or SP3 or SP4 will be displayed according to the currently active recipe and then the value for adjusting the normal setpoint of this recipe. Use the ▲ or ▼ keys to change the value and confirm by pressing SET.



8.9 Change the preset

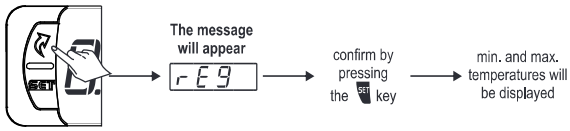
To select the desired preset, press the SET key for 4s, until the message rEc appears. Then release it. Use the ▲ or ▼ keys to select the desired recipe (1, 2, 3 or 4) and confirm with the SET key.



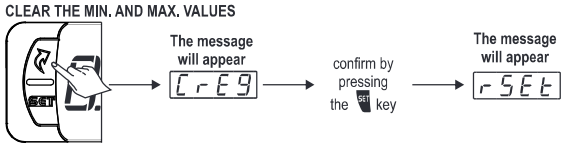
8.10 Minimum and Maximum Temperature Record

The Record of Minimum and Maximum Temperatures can be viewed by pressing the ⏻ key until the message rE9 appears (see map in item 8.1):

To clear the current minimum and maximum values, press the ⏻ (short press) until the message CrE9 is displayed. Press the SET key to confirm. Another way to delete the records is by pressing the SET key for 2s while the minimum and maximum records are being displayed. The rSEt message confirms that the data has been deleted.



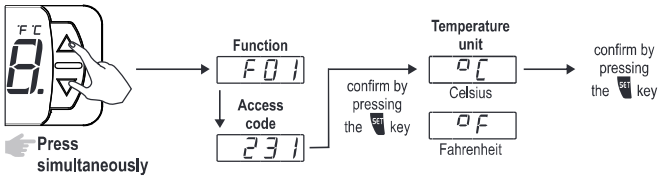
CLEAR THE MIN. AND MAX. VALUES



8.11 Selecting the temperature unit

The controller temperature can be viewed in either degress Celsius (°C) or degress Fahrenheit (°F). To select the units that the device will use, use function F01 with access code 231 and press the SET key. Then select the desired unit (C or F) using the ▲ or ▼ keys. To confirm, press SET.

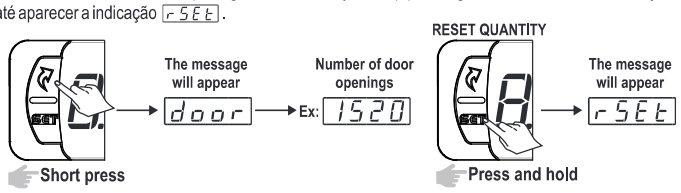
Whenever the unit is changed, the function settings assume the factory value, requiring a new configuration.



8.12 Viewing the number of door openings

The number of door openings can be viewed by pressing the ⏻ key (short press), until the message door appears, then the number of door openings will be displayed.

To reset the number of door openings, it is necessary to keep pressing the SET durante a visualização até aparecer a indicação rSEt.



8.13 Fast Freezing

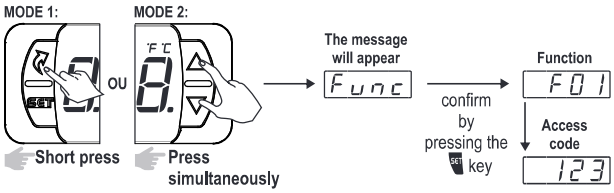
In fast freezing mode, the refrigeration output is permanently on and therefore the refrigeration or freezing process is accelerated. This operating mode can be activated or deactivated in the acess menu, using option FASt or an external switch connected to the digital input (F42 = 9 or 10). In can also be deactivated automatically by temperature. (F14, F15, F16 or F17) according to the selected recipe or by time (F18). While fast freezing is on, the connected compressor display will flash rapidly, and defrosting will continue. If, on activating the fast freezing mode, the controller identifies that there is a defrost cycle programmed to start during this period of time, the defrost will be run first and then it will go into fast freezing mode.

8.14 Display output frequency

The output frequency applied to the variable compressor can be viewed by pressing the ⏻ key until the message Fr appears (see map in item 8.1).

8.15 Changing the configured parameters

The function menu can be accessed through the access menu, option Func or by simultaneously ▲ and ▼ while the temperature is being displayed. To allow changing the parameters, enter F01 by pressing the SET (short press) and enter **code 123**.



8.16 Turn Off Control Functions:

When the control functions are turned off, the controller starts to operate only as a temperature indicator and the outputs are turned off. The way in which the control functions are switched off depends on the setting of parameter "F95 - Control functions shutdown":

0 Does not allow the control functions to be turned off;
1 Only allows control functions to be turned on or off if the functions are unlocked;
2 Allows control functions to be turned on or off even if the functions are locked.

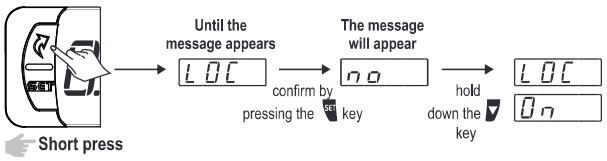
With the ⏻ key (short press), select CtrL, then press SET (short press) to confirm. It is also possible to switch off and on the control functions by pressing the SET key ⏻ for 5 seconds.

8.17 Function Lock

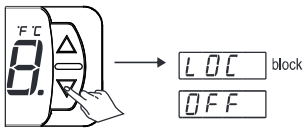
The use of the function lock brings greater security to the operation of the instrument. When active, the presets and other parameters may be visible to the user but protected against undue changes (F93=2) or it is only possible to block the changes in the functions of the controle leaving the preset selection released (F93=1). To lock the functions, access the LOC option from the access menu using the ⏻ (Flatec) key and confirm it by presssing the SET key. The message no will be displayed if the lock is disabled. Now press and hold the ▼ key for the time configured for this function F94. When enabled, the message LOC On will displayed. It can only be enabled if the function F93 is set to 1 or 2.

To disabled the lock, turn the controller off and on again with the ▼ key pressed. Keep this key pressed until the LOC OFF message is displayed.

LOCKING:



UNLOCK:



With the controller turned off, press and turn it on again by holding down the ▼ key.

8.18 Variable compressor control

The control settings of the variable compressor differ depending on the brand and model of the variable compressor used. Consult the compressor's technical manual.

In traditional cooling applications, the demand for using the compressor at full load is rare and restricted to a few days a year. The control of the operating frequency of a variable capacity compressor adapts its use to the real demand. This way, the compressor runs at a low speed most of the time, minimizing energy consumption.

The operating frequency is proportional to the cooling capacity defined in parameters F53 and F54. The parameter F55 defines the maximum operating frequency of the compressor and is used in situations where it is needed to quickly lower the temperature of the controlled environment stable and reducing the number of compressor starts, thereby resulting in energy savings.

To use this characteristic, parameter F63 - Variable compressor time on after reaching the setpoint must be programmed.

8.19 Table of Parameters

			CELSIUS (°C)				FAHRENHEIT (°F)			
	Fun	Description	Mín	Máx	Unit	Default	Mín	Máx	Unit	Default
	F01	Access code	0	999	-	0	0	999	-	0
COOL	F02	Desired temperature (setpoint) (r1)	F10	F11	°C	-9,0	F10	F11	°F	15,8
	F03	Desired temperature (setpoint) (r2)	F10	F11	°C	-6,0	F10	F11	°F	21,2
	F04	Desired temperature (setpoint) (r3)	F10	F11	°C	-1,0	F10	F11	°F	30,2
	F05	Desired temperature (setpoint) (r4)	F10	F11	°C	2,0	F10	F11	°F	35,6
	F06	Desired temperature (economy setpoint) (r1)	F10	F11	°C	-4,0	F10	F11	°F	24,8
	F07	Desired temperature (economy setpoint) (r2)	F10	F11	°C	-1,0	F10	F11	°F	30,2
	F08	Desired temperature (economy setpoint) (r3)	F10	F11	°C	4,0	F10	F11	°F	39,2
	F09	Desired temperature (economy setpoint) (r4)	F10	F11	°C	7,0	F10	F11	°F	44,6
	F10	Minimum desired temperature (setpoint) allowed to the user	-50,0	F11	°C	-50,0	-58,0	F11	°F	-58,0
	F11	Maximum desired temperature (setpoint) allowed to the user	F10	105,0	°C	105,0	F10	221,0	°F	221,0
	F12	Differential control of the operation setpoint	0,1	20,0	°C	3,0	0,1	36,0	°F	5,4
	F13	Differential control of the economy setpoint	0,1	20,0	°C	3,0	0,1	36,0	°F	5,4
	F14	Temperature limit for Fast Freezing (r1)	F10	F11	°C	-14,0	F10	F11	°F	6,8
	F15	Temperature limit for Fast Freezing (r2)	F10	F11	°C	-11,0	F10	F11	°F	12,2
	F16	Temperature limit for Fast Freezing (r3)	F10	F11	°C	-6,0	F10	F11	°F	21,2
	F17	Temperature limit for Fast Freezing (r4)	F10	F11	°C	-3,0	F10	F11	°F	26,6
	F18	Maximum Fast Freezing time	0 (Off)	999	minutes	0 (Off)	0 (Off)	999	minutes	0 (Off)
	F19	Delay time when powering up the controller	0 (Off)	999	minutes	0 (Off)	0 (Off)	999	minutes	0 (Off)
DEFROST	F20	Defrost type	0	2	-	0	0	2	-	0
	F21	Condition for starting defrosting	0 (Off)	4	-	1	0 (Off)	4	-	1
	F22	Interval between defrosting periods if F21 = 1 or the Maximum time without defrosting if F21 = 2, 3 or 4	1	9999	minutes	720	1	9999	minutes	720
	F23	Additional time at the end of the first refrigeration cycle	0 (Off)	999	minutes	0 (Off)	0 (Off)	999	minutes	0 (Off)
	F24	Temperature of the evaporator (sensor S2) in order to begin defrosting if F21 = 2, 3 or 4	-50,0	105,0	°C	-20,0	-58,0	221,0	°F	-4,0
	F25	Temperature Difference in order to start defrosting (S1 - S2) if F21 = 3 or 4	-50,0	105,0	°C	15,0	-58,0	221,0	°F	59,0
	F26	Time to confirm the lower temperature (sensor S2) to start the pre-defrost setting if F21 = 2, 3 or 4	0 (Off)	999	minutes	10	0 (Off)	999	minutes	10
	F27	Defrost when the controller is powered on	0 (Off)	1 (On)	-	1 (On)	0 (Off)	1 (On)	-	1 (On)
	F28	Smooth Defrost if F20 = 0	10	100 (Off)	%	100 (Off)	10	100 (Off)	%	100 (Off)
	F29	Enable Tray Defrost	0 (Off)	1 (On)	-	0 (Off)	0 (Off)	1 (On)	-	0 (Off)
	F30	Pre-defrost time (gas collection)	0 (Off)	999	minutes	0 (Off)	0 (Off)	999	minutes	0 (Off)
	F31	Temperature of the Evaporator (S2 sensor) to finish the defrost	-50,0	105,0	°C	40,0	-58,0	221,0	°F	104
	F32	Room temperature (S1 sensor) required to end the defrost	-50,0	105,0	°C	20,0	-58,0	221,0	°F	68,0
	F33	Maximum time on defrost (for safety)	1	999	minutes	30	1	999	minutes	30
	F34	Draining time (from water collected from defrosting)	0 (Off)	999	minutes	1	0 (Off)	999	minutes	1
FAN	F35	Fan operation mode	0	4	-	4	0	4	-	4
	F36	Time fan is on if F35 = 0 or 4	1	999	minutes	2	1	999	minutes	2
	F37	Time fan is turned off if F35 = 0 (automatic timed mode)	1	999	minutes	8	1	999	minutes	8
	F38	Length of time door is open until fan is turned off F42 = 1 or 2	-1 (Off)	9999	seconds	0	-1 (Off)	9999	seconds	0
	F39	Fan cut off due to high temperature in the evaporator (S2 sensor)	-50,0	105,0	°C	50,0	-58	221,0	°F	122,0
	F40	Temperature in the evaporator to switch the fan back on after draining	-50,0	105,0	°C	2,0	-58	221,0	°F	35,6
	F41	Maximum length of time until the fan is switched back on after drainage (fan-delay)	0 (Off)	999	minutes	1	0 (Off)	999	minutes	1
DOOR	F42	Function mode of the digital input	0 (Off)	13	-	2	0 (Off)	13	-	2
	F43	Length of time door is open for instant defrost if F42 = 1 or 2	0 (Off)	999	minutes	30	0 (Off)	999	minutes	30
	F44	Length of time door is open until fan and compressor are turned off F42 = 1 or 2	0 (Off)	999	minutes	5	0 (Off)	999	minutes	5
	F45	Length of time door is closed until light is switched off if F42 = 1 or 2 and F70 = 1	0 (Off)	999	minutes	120	0 (Off)	999	minutes	120
	F46	Length of time door is closed until economy mode is activated if F42 = 1 or 2	0 (Off)	999	minutes	180	0 (Off)	999	minutes	180
	F47	Maximum time in economy mode with door closed if F42 = 1 or 2	0 (Off)	9999	minutes	0 (Off)	0 (Off)	9999	minutes	0 (Off)
VARIABLE COMPRESSOR	F48	Minimum variable compressor on time	0 (Off)	9999	seconds	0 (Off)	0 (Off)	9999	seconds	0 (Off)
	F49	Minimum variable compressor time off	0 (Off)	9999	seconds	0 (Off)	0 (Off)	9999	seconds	0 (Off)
	F50	Proportional Gain (P)	1,0	100,0	-	2,0	1,0	100,0	-	2,0
	F51	Total Time (I)	1	500	seconds	50	1	500	seconds	50
	F52	Derivative Time (D)	0 (Off)	500	seconds	0 (Off)	0 (Off)	500	seconds	0 (Off)
	F53	Minimum frequency for variable compressor PID control	30	F54	Hz	60	30	F54	Hz	60
	F54	Maximum frequency for variable compressor PID control	F53	F55	Hz	120	F53	F55	Hz	120
	F55	Maximum frequency for variable compressor operation	30	300	Hz	150	30	300	Hz	150
	F56	Compressor stop frequency (switch-off)	0	50	Hz	30	0	50	Hz	30
	F57	Variable compressor frequency during a hot gas defrost	F53	F55	Hz	120	F53	F55	Hz	120
	F58	Variable compressor frequency in the event of an error in sensor S1 (room sensor)	F53	F54	Hz	100	F53	F54	Hz	100
	F59	Variable compressor time on in case of error in sensor S1 (room sensor)	0 (Off)	999	minutes	20	0 (Off)	999	minutes	20
	F60	Variable compressor time off in the event of an error in sensor S1 (room sensor)	0 (Off)	999	minutes	10	0 (Off)	999	minutes	10
	F61	Variable compressor smooth start frequency	F53	F54	Hz	60	F53	F54	Hz	60
	F62	Variable compressor smooth start time	1	999	seconds	30	1	999	seconds	30
	F63	Variable compressor time on after reaching the setpoint	0 (Off)	999 (On)	minutes	120	0 (Off)	999 (On)	minutes	120
	F64	Variable compressor time below limit frequency F66 for lubrication	10 (Off)	1440	minutes	10 (Off)	10 (Off)	1440	minutes	0 (Off)
	F65	Variable compressor time on frequency F54 for compressor lubrication	10	999	seconds	30	10	999	seconds	30
	F66	Minimum frequency for variable compressor lubrication control	F53	F54	Hz	80	F53	F54	Hz	80
	F67	Maximum time for the variable compressor turned on to maximum frequency	0 (Off)	9999	minutes	600	0 (Off)	9999	minutes	600
	F68	Low temperature limit (differential for the temperature setpoint)	1,0 (Off)	99,9	°C	3,0	1,8 (Off)	179,8	°F	5,4
	F69	High temperature limit (differential for the temperature setpoint)	1,0 (Off)	99,9	°C	11,0	1,8 (Off)	179,8	°F	19,8
AUX. OUTPUT/ ALARMS	F70	AUX output mode	0	4	-	1	0	4	-	1
	F71	Desired temperature differential (setpoint) for minimum room temperature alarm (sensor S1)	0 (Off)	99,9	°C	10,0	0 (Off)	179,8	°F	18,0
	F72	Desired temperature differential (setpoint) for maximum room temperature alarm (sensor S1)	0 (Off)	99,9	°C	50,0	0 (Off)	179,8	°F	90,0
	F73	Door open time for audible alarm	0 (Off)	999	minutes	5	0 (Off)	999	minutes	5
	F74	Alarm validation time by temperature	0 (Off)	999	minutes	0 (Off)	0 (Off)	999	minutes	0 (Off)
	F75	Alarm inhibit time on power-up	0 (Off)	999	minutes	0 (Off)	0 (Off)	999	minutes	0 (Off)
	F76	Maximum compressor on time without reaching the desired temperature (setpoint)	0 (Off)	999	hours	0 (Off)	0 (Off)	999	hours	0 (Off)
	F77	Trigger for alarm when defrosting is over based on time	0 (Off)	1 (On)	-	0 (Off)	0 (Off)	1 (On)	-	0 (Off)
	F78	Desired temperature for anti-condensation (sensor 3 heating setpoint) if F42 = 13 and F70 = 4	-50,0	105,0	°C	30,0	-58,0	221,0	°F	86,0
	F79	Control differential for anti-condensation (S3) if F42 = 13 (visual and audible only)	0,1	20,0	°C	3,0	0,1	36,0	°F	5,4
	F80	Enables audible alarm (buzzer)	0 (Off)	1 (On)	-	1 (On)	0 (Off)	1 (On)	-	1 (On)

	Fun	Descrição	CELSIUS (°C)				FAHRENHEIT (°F)			
			Mín	Máx	Unit	Default	Mín	Máx	Unit	Default
CONDEN SER	F81	High condenser temperature alarm (S3) if F42 = 13 (visual and audible only)	0(Off)	105,0	°C	105,0	0 (Off)	221,0	°F	221,0
	F82	Maximum capacitor temperature (S3) to switch off control outputs if F42 = 13	0 (Off)	105,0	°C	105,0	0 (Off)	221,0	°F	221,0
	F83	Control differential for maximum condenser temperature (hysteresis) if F42 = 13	0,1	20,0	°C	3,0	0,1	36,0	°F	5,4
SENSORS	F84	Digital filter actuation mode	0	1	-	0	0	1	-	0
	F85	Intensity of the digital filter on the room temperature sensor (S1 sensor) (Rising)	0 (Off)	20	seconds	0 (Off)	0 (Off)	20	seconds	0 (Off)
	F86	Intensity of the digital filter on the room temperature sensor (S1 sensor) (Descending)	0 (Off)	20	seconds	0 (Off)	0 (Off)	20	seconds	0 (Off)
	F87	Displacement of the values from the room sensor (S1 sensor)	-20,0	20	°C	0,0	-36,0	36,0	°F	0,0
	F88	Displacement of the values from the evaporator sensor (S2 sensor)	-21,1 (Off)	20,0	°C	0,0	-36 (Off)	36,0	°F	0,0
	F89	Displacement of the auxiliary sensor indication (sensor S3) if F42 = 13	-20,0	20,0	°C	0,0	-36,0	36,0	°F	0,0
FUNCTIONS	F90	Preferred indication on the display	1	3	-	1	1	3	-	1
	F91	Ambient Temperature (S1 sensor) value locked in during defrosting	0	2	-	1	0	2	-	1
	F92	Maximum length of time that the temperature is locked during defrosting	0 (Off)	999	minutes	15	0 (Off)	999	minutes	15
	F93	Mode for locking functions	0	2	-	0	0	2	-	0
	F94	Function Lock Period	15	60	seconds	15	15	60	seconds	15
	F95	Shutdown of control functions	0 (Off)	2	-	0 (Off)	0 (Off)	2	-	0 (Off)

8.19.1 Description of the parameters

F01 - Access Code:
This is required to change the settings of the parameters. This code does not need to be entered to view the adjusted parameters.
Allows you to enter the access codes provided:
123 - Enables you to change the table parameters;
231 - Allows you to configure the temperature measurement units;

F02 - Desired temperature (setpoint) (r1):
F03 - Desired temperature (setpoint) (r2):
F04 - Desired temperature (setpoint) (r3):
F05 - Desired temperature (setpoint) (r4):
It is the control temperature of the normal operating mode. When the temperature of the S1 sensor (room sensor) is lower than the value set for this function, the compressor will be turned off.

F06 - Desired temperature (economy setpoint) (r1):
F07 - Desired temperature (economy setpoint) (r2):
F08 - Desired temperature (economy setpoint) (r3):
F09 - Desired temperature (economy setpoint) (r4):
It is the control temperature when the economy operating mode is on. When the temperature of the S1 sensor (room sensor) is lower than the value set for this function, the compressor will be turned off.

F10 - Minimum desired temperature (setpoint) allowed to the user:
F11 - Maximum desired temperature (setpoint) allowed to the user:
Limits set in order to avoid excessively high or low temperatures being accidentally set for the temperature setpoint, which could lead to high energy consumption by keeping the system on continuously.

F12 - Operating setpoint control differential:
F13 - Differe control of economy setpoint:
It is the temperature difference between turning the cooling off and on again.

F14 - Fast Freezing Temperature Limit (r1):
F15 - Fast Freezing Temperature Limit (r2):
F16 - Fast Freezing Temperature Limit (r3):
F17 - Fast Freezing Temperature Limit (r4):
This is the minimum temperature that the instrument can reach during the Fast Freezing process.

F18 - Maximum Fast Freezing time:
This the duration of the Fast Freezing process.

F19 - Delay time when powering up the controller:
When the instrument is turned on, it can remain disabled for a while, delaying the start of the process. During this time, it only works as a temperature gauge. Helps to avoid high demands for power, when power returns after a power cut, where several pieces of equipment are all on the same connection. Therefore, you can set different times for each device. This delay can relate to the compressor or defrosting (where defrosting is part of the sequence).

F20 - Defrost type (0 = resistance/ 1 = hot gas / 2 = natural):
0 - Electrical Defrosting (using coils), which only applies to the defrost outlet.
1 - Hot Gas Defrosting, which only applies to the compressor and defrosting outlets.
2 - Natural defrosting, which only applies to the fan outlet.

F21 - Condition for starting defrosting:
OFF - No automatic defrosting, only manual defrosting;
1 - Set time to start defrosting;
2 - Set temperature to start defrosting;
3 - Set temperature difference (S1-S2) to start defrosting;
4 - Set temperature and temperature difference (S1-S2) to start defrosting.

F22 - Interval between defrosting periods if F21 =1 or the Maximum time without defrosting if F21 = 3 or 4:
It determines how often and after how long defrosting take place, based on the time of the last defrosting. If the controller is configured to defrost according to temperature (F21 = 2, 3 or 4), this time acts as a level of safety in situations in which the evaporator temperature (S2 sensor) does not reach the values programmed in F24 or F25. This function determines the maximum time that the controller will wait before carrying out defrosting.

F23 - Additional time at the end of the first refrigeration cycle:
This is to set a longer period of time for the first refrigeration cycle. Where there are setups with several pieces of equipment, you can avoid high demand peaks by ensuring that defrosting takes place at different times by assigning different values to this function.

F24 - Temperature of the evaporator (S2 sensor) in order to begin defrosting if F21 = 2, 3 or 4:
When the temperature of the evaporator (S2 sensor) reaches a value using this function, the controller will wait for the length of time before beginning defrosting.

F25 - Temperature Difference in order to start defrosting (S1-S2) if F21 = 3 or 4:
When the difference between the temperature of the room sensor (S1 sensor) and the temperature of the evaporator (S2 sensor) reaches a value using this function, the controller will wait for the length of time before beginning defrosting.

F26 - Time to confirm the lower temperature (sensor S2) to start the pre-defrost setting if F21 = 2, 3 or 4
If the controller is configured to defrost according to temperature, the moment the temperature reaches the set value, it will run a delay before starting the pre-defrost stage.
If the temperature remains low, while this stage is running, the pre-defrost process is started. If it doesn't and the temperature rises above the set value, the system will return to a refrigeration cycle.

F27 - Defrost when the controller is powered on:
This enables a defrosting to be conducted when the controller is powered on. For example, when the electricity returns after a power cut.

F28 - Smooth Defrost if F20 = 0:
Smooth Defrost mode provides a smoother defrosting, saving energy and preventing the room temperature from rising as much as in a standard defrost. In this mode, the defrost output remains on as long as the evaporator temperature (S2 sensor) is less than 2°C (35.6°F) and, after passing that temperature, the output remains on for the percentage of time configured in this function, within a 2 minute period.

F29 - Enable Tray Defrost:
With this function active, the FAN output starts to operate as a Second defrost output. This output is activated during the pre-defrost, defrost and drain periods.
Note: *With F29 = On, the functionalities related to the fan control are disregarded.*

F30 - Length of pre-defrost (collecting in gas):
When the defrost starts, the controller will only use the fan during this time, in order to take advantage of the residual energy of the gas.

F31 - Temperature of the Evaporator (S2 sensor) to finish the defrost:
If the temperature in the evaporator (sensor S2) reaches the set value, the defrost cycle will be halted, i.e., temperature controlled. This way it improves the defrosting process.

F32 - Temperature of the Ambient Sensor (S1 sensor) to finish the defrost:
If the room temperature (sensor S1) reaches the set value, the defrost cycle will be halted due to temperature.

F33 - Maximum time on defrost (for safety):
This function adjusts the maximum duration of a defrost cycle. If the defrosting is not complete, during this period, according to the temperature, a dot will begin flashing in the lower right corner of the display (if it's enabled in F77), indicating that the time set for the defrost has ended by the required temperature has not been reached. This can happen when the temperature set is too high, the time limit is insufficient, the S2 sensor is disconnected, or it isn't in contact with the evaporator.

F34 - Draining time (from water collected from defrosting):
Time required for removing excess water, i.e., for the last drops of water to drain from the evaporator. During this period, all outputs remain switched off. This function can be turned off by setting it to the minimum value OFF.

F35 - Fan operation mode:
0 - Automatic according to time: the fan will be on when the compressor is on. When the compressor is off, the fan will oscillate according to the times set in F36 and F37;
1 - With the compressor on, the fan is on. With the compressor off, the fan turns on when the temperature is higher than the setpoint + 60% of the hysteresis and turns off when the temperature is lower than the setpoint +20% of the hysteresis;
2 - Continuous: the fan is always on;
3 - Dependent: the fan operates together with the compressor;
4 - For a period of time after the compressor is turned off: after turning off the compressor, the fan will remain on for the time set in F36.

Note 1: Modes 0 and 1 will only switch the fan on if the temperature of the S2 sensor is lower than the temperature of the S1 sensor.
Note 2: Mode 1 will activate the fan only if the temperature of sensor S2 is lower than the configured setpoint.

F36 - Time fan is on if F35 = 0 or 4:
This is how long the fan is on for.

F37 - Time fan is turned off is F35 =0 (automatic timed mode) :
This is how long the fan is off for.

F38 - Length of time door is open until fan is turned off F42 = 1 or2:
This is the length of time that the fan will continue to run after the door is opened.
If you set a minimum value of OFF, the fan will not switch off if the door is opened.
If you set a value of 0, the fan will switch off immediately if the door is opened.

F39 - Fan cut off due to high temperature in the evaporator (S2 sensor):
This is intended to disconnect the evaporator fan when the room temperature is not within the design range for the refrigeration device, avoiding high temperatures and suction pressures that could damage the compressor. If the evaporator temperature exceeds the set value, the fan is turned off and will be restarted at a fixed hysteresis of 2°C (3.6°F). This is a useful function to use when, for example, a refrigerator is used that has been idle for days or when restocking units or counters with products.

F40 - Temperature in the evaporator to switch the fan back on after draining:
After drainage is complete, it starts a fan-delay cycle. The compressor will start up immediately, because the temperature in the evaporator is high, but the fan will only start after the temperature in the evaporator falls below the set value. This function is used to remove the heat that still exists in the evaporator due to the defrost, avoiding throwing it into the environment.

F41 -Maximum length of time until the fan is switched back on after drainage (fan-delay):
For safety, if the temperature in the evaporator does not reach the value set by function F40 or the S2 sensor is disconnected, the fan will only come on after the time set for this function has expired.

F42 - Function mode of the digital input:
0 : Digital input disabled;
1 : Contact NO - Door sensor;
2 : Contact NC - Door sensor;
3 : Contact NO - External alarm (indication only);
4 : Contact NC - External alarm (indication only);
5 : Contact NO - Control shutdown;
6 : Contact NC - Control shutdown;
7 : Pushbutton NO - Economy mode;
8 : Pushbutton NC - Economy mode;
9 : Pushbutton NO - Fast Freezing;
10 : Pushbutton NC - Fast Freezing;
11 : Pushbutton NO - Defrost;
12 : Pushbutton NC - Defrost;
13 : Door temperature sensor, anti condensation (S3 sensor).

F43 - Length of time door is open for instant defrost if F42 = 1 or 2:
If the door is kept open for a period longer than that defined in this function, instant defrosting will take place, as long as the temperature in the evaporator (S2 sensor) is less than F31 and the room temperature (S1 sensor) is less than F32.

F44 - Length of time door is open until fan and compressor are turned off F42 = 1 or 2:
For safety, if the door remains open longer than the time set here, both the compressor and fan will be switched off.

F45 - Length of time door is closed until light is switched off if F42 = 1 or 2 and F70 = 1:
With the door closed, this parameter defines how long it will be until the lamp is turned off. Helps save electricity.

F46 - Length of time door is closed until economy mode is activated if F42 = 1 or 2:
With the door closed, this parameter defines how long until economy mode is activated. The ouputs fot the lamp will be deactivated if it is turned on and the operational setpoint is switched to the economy setpoint.

F47 - Maximum time in economy mode with closed door if F42 = 1 or 2:
Allows you to configure a maximum time for the economy mode to operate while the door is closed. After this time, the setpoint returns to economy mode in normal operation.

F48 - Minimum variable compressor on time:
This is the minimum amount of time the compressor will be on, i.e. The period of time between the last section and the next time it is stopped. This helps to avoid power surges from the electricity grid.

F49 - Minimum time of variable compressor off:
This is the minimum amount of time the compressor will be off, i.e. The period of time between the last time it stops and the next section. This helps to relieve the discharge pressure and increases the working life of the compressor.

F50 - Proportional Gain (P):
Determines the proportional increase based on the PID Control Algorithm.

F51 - Full Time (I):
Determines the Integral Time based on the PID Control Algorithm.

F52 - Derivative Time (D):
Determines the derivative time of the PID Control Algorithm.

F53 -Minimum frequency for variable compressor PID control:
Defines the minimum working frequency of the variable compressor in automatic control mode (PID algorithm).
Note: check the technical manual of the variable compressor.

F54 - Maximum frequency for variable compressor PID control:
Defines the maximum working frequency of the variable compressor in automatic control mode (PID algorithm).
Note: Check the technical manual of the variable compressor.

F55 -Maximum operating frequency of the variable compressor:
Defines the maximum operating frequency of the compressor. This frequency is used when it is necessary to quickly cool the controlled environment, for example, high temperature in the controlling environment, for example, high temperature in the environment F69, Fast Freezing process or after a defrost cycle.
Note: Check the technical manual of the variable compressor.

F56 - Compressor stop frequency (switch-off):
Defines the output frequency to inform the compressor to stop. This frequency is lower than the minimum working frequency
Note: Check the technical manual of the variable compressor,

F57 - Variable compressor frequency during a hot gas defrost:
Sets the frequency of the variable compressor during the hot gas defrost process, when F20 = 1.

F58 - Variable compressor frequency in the event of and error in sensor S1 (room sensor):
Defines the frequency of the variable compressor if an error is detected for temperature sensor S1 (room sensor). This parameter works in conjunction with F59 and F60.

F59 - Variable compressor time on in case of error in sensor S1 (room sensor):
F60 - Variable compressor time off in case of error in sensor S1 (room sensor):
If the room sensor (S1 sensor) is disconnected or goes out of the measurement range, the compressor will switch on or off according to the parameters set in these functions.

F61 - Variable compressor smooth start frequency:
When switching on the variable compressor, it is kept at a low speed for a few seconds, as set in F62. The purpose of this feature is to improve the lubrication of the compressor.

F62 - Variable compressor smooth start time:
When switching on the variable compressor, it is kept at a low speed for a few seconds, as set in F62. The purpose of this feature is to improve the lubrication of the compressor.

F63 - Variable compressor time on after reaching the setpoint:
After reaching the temperature setpoint, it is possible to keep the compressor running at a speed calculated by the PID control algorithm. The purpose is to avoid successive starts of the compressor, obtaining a reduction in energy consumption (energy efficiency) as well as low oscillation of the room temperature (sensor S1).
If set to OFF, the variable compressor is switched off immediately after reaching the temperature setpoint. If set to On, the compressor will always be on.
In case the temperature reaches the low temperature limit F68, the compressor is switched off and will start again according to the setpoint and the control hysteresis.

F64 - Variable compressor time below the limit frequency F66 for lubrication:
Time in which the variable compressor must be turned on with the frequency below the limit set in F66 to operate at the frequency set in F54 for the time set in F65.
This process of periodic acceleration of the control frequency promotes lubrication of the variable compressor through the migration of the lubricating oil.

F65 - Variable compressor time on frequency F54 for lubrication:
Time that the variable compressor will stay on at the frequency defined in F54 for lubricating the compressor.

F66 - Minimum frequency for variable compressor lubrication control:
Limit frequency for the instrument to use the variable compressor lubrication process.

F67 - Maximum time for the variable compressor turned on the maximum frequency:
Maximum time for the variable compressor at maximum frequency. This parameter works in conjunction with F55.

F68 - Low temperature limit (differential for the temperature setpoint):
Sets the low temperature limit to be used to turn off the variable compressor. In this parameter, the differential for the setpoint is adjusted.
Example: Setpoint = -6.0 and F68 = 3.0. In this case, the temperature limit for turning off the compressor will be -9.0 (-6.0 - 3.0).

F69 - High temperature limit (differential for the temperature setpoint):
Sets the high temperature limit to activate the variable compressor at its maximum operating frequency. The purpose of this parameter is to quickly lower the temperature of the controller environment.
In this parameter, the differential for the setpoint is adjusted. The hysteresis of this parameter is fixed at 1.0°C (1.8°F).
Example: Setpoint = -6.0 and F69 = 11.0
In this case, the compressor will operate at maximum speed F55 when the temperature is above 5.0 (-6.0 + 11.0), and will return to operating at normal speed (between F54 and F55 when the temperature is below 4.0 (-6.0 + 11.0 - 1.0)

F70 - AUX output mode:
0 : Output off;
1 : Lamp - Controls lighting;
2 : Alarm - Activates the output during the occurrence of the alarms of functions F71, F72, F73 and F76;
3 : Door resistance (without S3 sensor): The door heater remains on, regardless of the door temperature. The resistor is switched off only during the occurrence of the alarms of functions F71, F72, F73 and F76;
The buzzer is not activated during the occurrence of the alarms.
4 : Door resistance (with sensor S3, if F42 = 13 : The door resistance to prevent condensation is controlled by the temperature of the S3 sensor and the values configured in functions F78 and F79. The output is switched off in the event of alarms in functions F71, F72, F73 and F76. The buzzer is not activated during the occurrence of the alarms.

F71 - Desired temperature differential (setpoint) for minimum room temperature alarm (sensor S1):
It is the temperature difference in relation to the current setpoint to activate the low temperature alarm.
Example: Setpoint = 3.0 and F71 = 2.0 .In this case, the alarm will only be triggered if the room temperature is less than 1.0 (3.0 - 2.0).

F72 - Desired temperature differential (setpoint) for maximum room temperature alarm (sensor S1):
It is the temperature difference in relation to the current setpoint to activate the high temperature alarm.
Example: Setpoint = 3.0 and F72 = 10.0. In this case, the alarm will only be triggered if the room temperature is greater than 130 130 (3.0 - 10.0).

F73 - Length of time the door is open to trigger alarm :
When the door is opened, the message OPEn appears on the display and the door open timer starts. If this time is longer than the time configured in this function, the audible alarm (buzzer) will be triggered and the message AOPn will be displayed.

F74 -Time for validating the alarm by temperature:
This function serves to inhibit the alarm for a period due to an eventual rise in temperature.

F75 - Alarm inhibition time on power-on:
During this time the alarm remains off while waiting for the system to go back to an operating mode.

F76- Maximum compressor time on without reaching the desired temperature (setpoint):
The alarm is triggered if the compressor remains on without reaching the setpoint, for a longer time than the length specified in this function.

F77-Trigger for alarm when defrosting is over based on time:
When the defrost cycle has been running for the length of time set, but has not reached the temperature set, the user is notified via a decimal dot in the lower right corner of the display [ ].

F78 - Desired temperature for anti-condensation (sensor 3 heating setpoint) if [F42] = 13 and [F70] = 4:
It is the control temperature to avoid condensation of air humidity in the door. When the temperature of the S3 sensor (door) is higher than the value configured in this function, the door resistance will be turned off.

F79 - Control differential for anti-condensation (S3) if [F42] = 13 and [F70] = 4:
It is the temperature difference between turning the door resistance off and on again to prevent condensation.

F80 - Enables audible alarm (buzzer):
Enables or disables the internal buzzer to sound alarms.

F81 - High condenser temperature alarm (S3) if [F42] = 13 (visual and audible only):
It is the condenser temperature above which the instrument will indicate visual high temperature alarm [AtC1] and audible (buzzer), the loads driven by the outputs will be turned off. This alarm is ignored until the time set in [F75] is exceeded.

F82 - Maximum temperature in the capacitor (S3) to switch off control outputs if [F42] = 13:
Above this temperature, in addition to the visual alarm [AtC2] and audible (buzzer) alarm indications, the loads driven by the outputs will be switched off. This alarm is ignored until the time set in [F75] is exceeded.

F83 - Control differential for maximum capacitor temperature (hysteresis) if [F42] = 13:
For the loads to be switched on again, the temperature of the S3 sensor (capacitor) must drop to the value set in [F82] minus the value set in this parameter. In this condition, the process moves to the refrigeration stage.

F84 - Mode of operation of the digital filter:
[0] : The digital filter acts in the visualization of the display and in the control routines;
[1] : The digital filter acts only in the display view.

F85 - Intensity of the digital filter on the room temperature sensor (S1 sensor) (Rising):
F86 - Intensity of the digital filter on the room temperature sensor (S1 sensor) (Descending):
The value set by these functions represents the time (in seconds) in which the temperature may vary 0.1°C/0.1°F either up or down.
Note: A typical use for this type of filter is in freezers for ice cream and frozen foods. When the door is opened, a quantity of hot air will fall directly on the sensor, causing a rapid rise in the temperature reading and, often, activating the compressor unnecessarily.

F87 - Displacement of the values from the room sensor (S1 sensor):
F88 - Displacement of the values from the evaporator sensor (S2 sensor):
F89 - Displacement of the auxiliary sensor indication (sensor S3) if [F42] = 13:
This allows you to compensate for possible deviations in the reading of the sensor, due to changing the sensor or changing the cable length.

F90 - Preferred indication on the display:
[1] : S1 Temperature;
[2] : S2 Temperature;
[3] : Current setpoint.

F91 -Ambient Temperature (S1 sensor) value locked in during defrosting:
[0] : Sensor temperature indication;
[1] : Reading locked in - last temperature before defrosting;
[3] : Display [dEFr].
This function is intended to prevent the display reflecting an increase in the room temperature due to defrosting.

F92 - Maximum length of time that the temperature is locked during defrosting:
During a defrost cycle, either the last temperature measured during the refrigeration cycle or the [dEFr] message will be kept on the display. The display will be released when the temperature shown is reached again or the time set for this function has been exceeded, after the start of the next refrigeration cycle (whichever comes first). If set to the [OFF] value, the temperature display will be frozen only while defrosting.

F93 - Function Lock Mode:
Enables and configures the Function Lock.
[0] : Function Lock can't be enabled;
[1] : Enables partial locking, where the control functions will be blocked but the adjustment of the setpoints and the alteration of the recipes remain released;
[2] : Enables total locking, leaving only access to the functions of the facilitated menu available.

F94 - Function Lock Period:
With this feature active, the parameters are protected against undue changes and are only available for viewing. In this condition, when trying to change these values, the message [LOC] will appear on the display.

F95 - Turns Off Control Functions:
When the control functions are turned off, the controller starts to operate only as a temperature indicator with all outputs deactivated. This function can operate in the following ways:
[no] : Does not allow the control functions to be turned off;
[1] : Only allows control functions to be turned on or off if the functions are unlocked;
[2] : Allows control functions to be turned on or off even if the functions are locked.

9. PID CONTROL

The PID controller is made up of a combination of three control actions: Proportional action (P), Integral action (I) and Derivative action (D). Each action receives a weighting (adjustable via parameters) which represents a gain or adjustment time. This enables the PID to perform better when controlling the process.
Any control action is limited by the quality and capacity of the existing actuators in the process.
P - Proportional gain (Pg) - The use of proportional action in a control system enables the difference (error) between the desired output (reference, setpoint) and the current value of the process, to be reduced. The proportional gain speeds up process's response, however, the increased gains can result in control oscillating.
I - Integral time (It) - The integral action has an energy storage function, which allows it to remove the error between the reference and the output. It accumulates the error at a "It" rate and attempts to reduce it to zero. Low It values can cause the control to oscillate, however, long It times tend to slow down the process Integral action must not be used on its own.
D - Derivative time (Dt) - The use of derivative action enables the process's response time to be increased and reduces oscillation, as it tries to anticipate the process's behavior. Low values of Dt act in a way to reduce the oscillatory anticipating the behavior of the process, however, high Dt values will make the control very reactive, causing instability. Integral action must not be used on its own.

SUMMARY TABLE - GENERAL GUIDANCE*

PID PARAMETER	OVERSHOOT *(peak, sobressinal)*	STABILIZATION TIME *(delay in stabilizing the controller)*	ERROR *(the difference between the setpoint and the sensor)*
Increase KP**	Increase	Little Effect	Reduce
Reduce Ti	Increase	Increase	Null error
Increase Td	Reduce	Reduce	No effect

Note: Change the parameters individually, check the response and then modify another parameter. Proceed with caution, to monitor the behavior of the process, analyze and modify the control parameters*. This guide is widely applied in the technical literature on PID controllers, however processes with latency in their response may differ from the indication in the table. The technician responsible for the process must correct small deviations manually. ** In specific applications, the behavior can be reversed to that indicated.

10. WARNINGS / ALARMS / ERRORS

10.1 Warnings

[oPEn]	Door open
[t-1]	Temperature sensor 1
[t-2]	Temperature sensor 2
[t-3]	Temperature sensor 3
[dEFr]	Temperature locked on defrosting cycle
[.]	Indicates that the final defrosting temperature has not been reached
Flashing Led	Tray is defrosting - pre-defrost and draining stages.
Flashing Led	Fast Freezing Mode indicated
[LOC] [On]	Function Lock
[LOC] [OFF]	Functions unlocked
[OFF]	Control functions off

10.2 Alarms

[AoPn]	Open door alarm
[Ath1]	High room temperature alarm
[AtLO]	Low room temperature alarm
[AtC1]	High condenser temperature alarm (level 1)
[AtC2]	High condenser temperature alarm (level 2)
[ALrc]	Compressor exceeded maximum on time without reaching control temperature (setpoint)
[Adin]	External alarm (digital input)
[inib]	Audible alarm deactivated

10.3 Errors

[Err1]	Error in temperature sensor 1
[Err2]	Error in temperature sensor 2
[Err3]	Error in temperature sensor 3
[ECAL]	Contact Full Gauge
[PPPP]	Reset function values

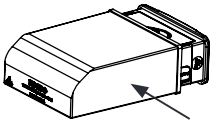
11. GLOSSARY

- **°C:** *Temperature in degrees Celsius.*
- **°F:** *Temperature in degrees Fahrenheit.*
- **Defr (defrost)**: *Defrosting.*
- **LOC:** *Locked.*
- **No:** *No.*
- **OFF:** *Turned Off/ deactivated.*
- **ON:** *Turned On / activated.*
- **Refr:** *Refrigeration.*
- **SET :** *set or configure.*

12. OPTIONAL ITEMS - Sold separately

Ecase protective cover

Recommended for the Evolution line, it prevents water from entering the back of the instrument. Protects the product when washed in the installation site.



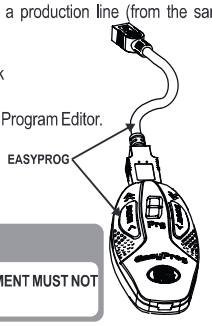
Note: Ecase is compatible with the use of small type Faston terminals, usually with silicone protection.

EasyProg - version 2 or higher

This is an accessory, whose main function is to store the parameters of the controllers. You can load new parameters from a controller at any time, and download them to a production line (from the same controller), for example.

It has three types of connection for loading or clearing parameters:

- **Serial RS-485:** Connect it to the controller using the RS-485 network (only controllers that can access RS-485).
- **USB:** If connected to the computer by a USB port, it can use Sitrad's Program Editor.
- **Serial TTL:** The controller can connect directly to **EasyProg** by a Serial TTL connection.

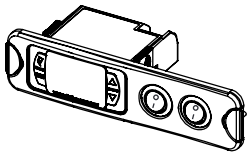


IMPORTANT

IN ORDER TO COMMUNICATE WITH EASYPROG, THE EQUIPMENT MUST NOT BE LINKED TO SITRAD SOFTWARE.

Extended Panel

Full Gauge Controls extended panel allows controllers to be installed in Evolution and Ri lines (the opening must measure 71x29mm for the extended panel to be installed), as the opening does not need to be precise for the device to be properly installed. The panel has space to be branded with the company logo and contact information, and it has 10A switches (250 V ac) that can be used for switching on internal lighting, ventilation or fan systems.



13. ANNEXES - Reference Diagrams

Image V

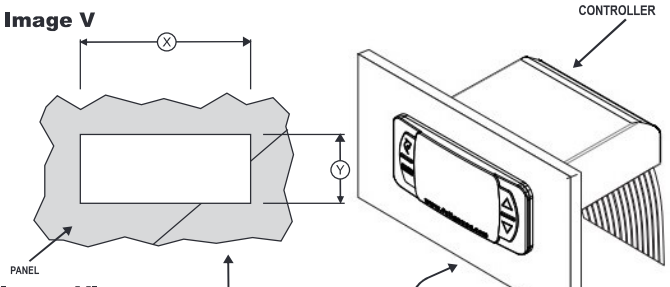
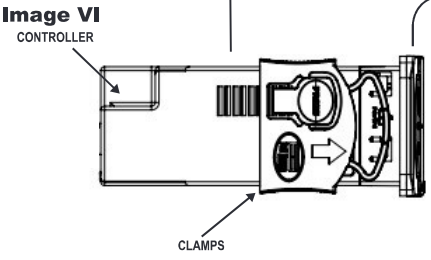


Image VI



To ensure it is properly and safely installed, connect all leads before putting the controller in position.

Image VII

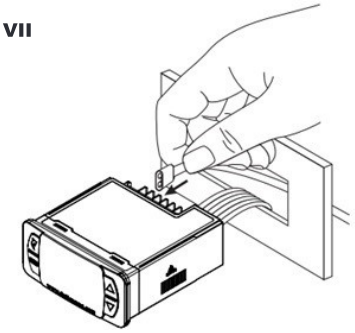
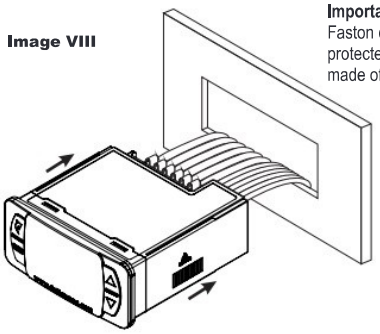


Image VIII



Important Note:
Faston connectors must be protected with covers, preferably made of silicone.

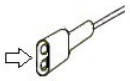
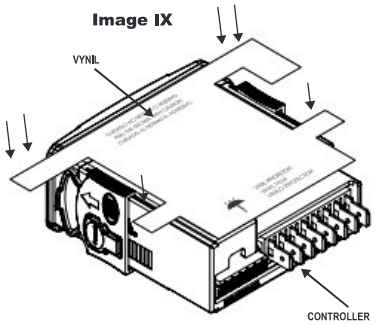


Image IX



14. WARRANTY

ENVIRONMENTALINFORMATION

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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