TC-900Ri power

DIGITAL CONTROLLER FOR REFRIGERATION AND DEFROST

Ver.01



UL-Underwriters Laboratories

TC900RIPWV02-1T-11548

1. DESCRIPTION

TC-900Ri power is a control for low temperature ventilated units which automates defrosting processes, providing great energy saving.
It has two sensors, one for environment temperature and other that, mounted to the evaporator, commands the end defrost process and puts the fans back to work.
Product complies with UL Inc. (United States and Canada).

2. APPLICATION

- Counters
- Refrigerating balconies

3. TECHNICAL SPECIFICATIONS

- Power supply: TC-900Ri power: 90 - 264Vac ±10%(50/60 Hz)
  TC-900RiL power: 12/24 Vac/dc
- Control temperature: -50 to 75° C / -58 to 167°F
- Operating temperature: 0 to 50°C / 32 to 122°F
- Operating humidity: 10 to 90% RH (without condensation)
- Resolution: 0.1°C from -10 to 75°C and 1°C outside this range /1°F in all range
- Load current (outputs): COMP: 16(8)A / 250Vac 1HP (compressor, solenoid valve or contactor)
  DEFR: 8(3)A / 250Vac 1/4HP (defrost resistance or hot gas)
  FANS: 5(3)A / 250Vac 1/8HP (evaporator fans)
- Dimensions: 71 x 28 x 71mm
- Sensors:

S1: ambient sensor (black cable)
S2: evaporator sensor (gray cable)

4. CONFIGURATIONS

4.1 - Control temperature adjust (SETPOINT):

- Press SET for 2 seconds until appears SEt , and release it after that. The adjusted operation temperature will appear.
- Use ▼ and ▲ to change the value and then press SET to record it.

4.3 - Parameters description

F01 - Access code (123)
To change the parameters it is necessary to use the access code.It is not necessary to use the access code to visualize the adjusted parameters.

F02 - Control differential (hysteresis)
It is the difference of temperature (hysteresis) between to turn OFF and turn ON the refrigeration output.
Example: To control the temperature in 4.0°C with differential of 1.0°C. Soon, the refrigeration will be turned off in 4.0°C and turned on again in 5.0°C (4.0 + 1.0)

F03 - Offset indication for ambient sensor
It allows to compensate eventual shunting lines in the reading of ambient temperature (S1) proceeding from the exchange of the sensor or cable length alteration.

F04 - Minimum setpoint allowed to the end user

F05 - Maximum setpoint allowed to the end user
Electronic limits whose purpose is to prevent that too high or too low setpoint temperatures are regulated.

F06 - Delay when the instrument is powered on
When the instrument is powered on, its control is kept disabled during a time, delaying the start of process. During this time, it works only as temperature indicator. It serves to prevent demand of electric energy peaks, in case of lack or return of the same and when exists a lot of equipment connected on the same net. For this, just adjust different times for each equipment. This delay may be of compressor or defrost (when exist defrost on turn on).

F07 - Act point of high ambient temperature alert
If the ambient temperature (sensor S1) reaches this point during refrigeration, this will be signaled visually through the indication blinking on display.

F08 - Refrigeration time (interval between defrosts)
It is the time which compressor will turn on and turn off only for ambient temperature and starts to be counted when the fan is turned on , after fan-delay stage (fan return after draining).

F09 - Compressor delay after on (on-off)
It is the minimum time that compressor will keep on, it means, space of time between the last drive and the next stop. It serves to prevent high voltage events in the electric network.

F10 - Compressor delay after off (off-on)
It is the minimum time that compressor will keep off, it means, space of time between the last stop and the next drive. It serves to alliviate the discharge pressure and to increase the time of useful life of the compressor.

F11 - Compressor status with detached ambient sensor (S1)
If the ambient sensor (S1) will be damaged or outside the specified range, the compressor assumes the configured status in this function.
Example: For counters of fruits, it is better to keep the compressor off. In counters of meat it is better to keep the compressor on.

F12 - Defrost when the instrument is powered on
It makes possible the accomplishment of a defrost at the moment that controller is energized, for example, in the return of electrical energy (in case of energy lack)

F13 - Evaporator temperature (S2) for end defrost
If the temperature in the evaporator (sensor S2) reaches the adjusted value, the end of defrost will be for temperature. With this, the defrost process is optimized.

4.2 - Parameters table

Fun	Description	CELSIUS				FAHRENHEIT			
		Min	Max	Standar	Unit	Min	Max	Standar	Unit
F01	Access code:123 (one hundred and twenty-three)	-	-	-	-	-	-	-	-
F02	Control differential (hysteresis)	0.1	20.0	1.5	ºC	1	36	3	°F
F03	Offset indication for ambient sensor	-20.0	20.0	0	ºC	-36	36	0	°F
F04	Minimum setpoint allowed to the end user	-50.0	75.0	-50.0	ºC	-58	167	-58	°F
F05	Maximum setpoint allowed to the end user	-50.0	75.0	75.0	ºC	-58	167	167	°F
F06	Delay when the instrument is powered on	0	30	0	min.	0	30	0	min.
F07	Act point of high ambient temperature alert	-50.0	75.0	75.0	ºC	-58	167	167	°F
F08	Refrigeration time (interval between defrosts)	1	999	240	min.	1	999	240	min.
F09	Compressor delay after on (on - off)	0	999	0	sec.	0	999	0	sec.
F10	Compressor delay after off (off - on)	0	999	0	sec.	0	999	0	sec.
F11	Compressor status with detached ambient sensor (S1)	0 - off	1 - on	1 - on	-	0 - off	1 - on	1 - on	-
F12	Defrost when the instrument is powered on	0 - no	1 - yes	0 -no	-	0 - no	1 - yes	0 -no	-
F13	Evaporator temperature (S2) for end defrost	-50.0	75.0	40.0	ºC	-58	167	104	°F
F14	Maximum duration of defrost (for security)	0=disable	90	45	min.	0=disable	90	45	min.
F15	Fan turned on during defrost	0 - no	1 - yes	0	-	0 - no	1 - yes	0	-
F16	Defrost type	0 - electric	1 - hot gas	0	-	0 - electric	1 - hot gas	0	-
F17	Locked temperature indication (S1) during defrost	0 - no	1 - yes	0 - no	-	0 - no	1 - yes	0 - no	-
F18	Draining time (dripping of defrost water)	0	30	10	min.	0	30	10	min.
F19	Evaporator temperature (S2) for fan return after draining	-50	75.0	0	ºC	-58	167	0	°F
F20	Maximum time of fan return after draining (fan-delay)	0	30	1	min.	0	30	1	min.
F21	Fan on with compressor off (refrigeration)	0 - no	1 - yes	1 - yes	-	0 - no	1 - yes	1 - yes	-
F22	Fan stopped for high temperature in the evaporator	-50	75.0	75.0	ºC	-58	167	167	°F
F23	Intensity of the digital filter applied to the sensor 1 (0-off)	0	9	0	-	0	9	0	-

F14 - Maximum duration of defrost (for security)
This function serves to adjust the maximum value of time for defrost. If evaporator temperature does not reach the configured value in F13 in this period a point will blink in the right down side of display indicating that end of defrost ocurred for time and not for temperature.

The end of defrost by time (which is not desired) can happen on the following situations:
- Adjusted temperature (F13) too high
- Maximum time of defrost (F14) too short
- Detached sensor or without contact with evaporator

F15 - Fan turned on during defrost
It makes possible the fan functioning during defrost.
Example: Natural defrost or by resistances installed outside the evaporator.

F16 - Defrost type
"0" = Electrical defrost (resistances), where the defrost output is active.
"1" = Defrost by hot gas, where compressor and defrost outputs are actives.

F17 - Locked temperature indication (S1) during defrost
This function prevents that ambient temperature elevation during defrost be visualized, keeping the last indication before defrost. The indication is released again in the initial of refrigeration cycle, after fan-delay.

F18 - Draining time (dripping of defrost water)
Necessary time for dripping, it means, for draining the last water drops of evaporator. All the outputs are kept off. If this stage will not be desired, adjust this time for "zero".

F19 - Evaporator temperature (S2) for fan return after draining (fan-delay)
The fan-delay cycle starts after draining. The refrigeration output (REFR) is active, therefore the ambient temperature is high, but the fan is activated only after the temperature in evaporator is less than the adjusted value. This process is necessary to remove the heat that still exists in the evaporator because of defrost, preventing to transfer this heat to the ambient.

F20 - Maximum time of fan return after draining (fan-delay)
For security, if the temperature in the evaporator does not reach the adjusted value in F19 or sensor S2 is detached, the fan-delay will happen on the adjusted time in this function.

F21 - Fan on with compressor off
During the refrigeration cycle, the fan activation may depend on the compressor status.
"0" = The fan is actived only while the compressor is active. This alternative, in some cases, allows great economy of electric energy.
"1" = The fan is kept on during all refrigeration cycle.

F22 - Fan stopped for high temperature in evaporator
It has the purpose of cycling the evaporator ventilation until the ambient temperature approaches the desired temperature in the refrigerating installation project, preventing high temperatures and pressures that can damage the compressor. If the temperature in evaporator exceed the adjusted value, the fan is turned off and turned on again with a fixed hysteresis of 2°C below this value.

F23 - Intensity of the digital filter applied to the sensor 1 (0-off)
This filter aims at simulating an increase of the mass of environment sensor (S1), thus increasing its response time (thermal inertia). The larger the value adjusted in this function, the longest the response time of sensor S1.
A typical application requiring this filter is the freezer for ice cream or frozen goods, because when the door is opened a hot air mass reaches the sensor directly, causing the indication of the measured temperature to rise quickly and the compressor to be activated unnecessarily many times.

5. OPERATION

5.1 - Parameters visualization

a) Press at the same time ▼ and ▲ for 2 seconds until appear Fun , releasing them after that. Soon, appears F01 .
b) Use ▼ and ▲ to access the desired function.
c) After selecting the function, press SET (short touch) to visualize the configured value.
d) Press again SET (short touch) to return the functions menu.
e) To reset the menu and return to normal operation (temperature indication), press SET until appear - - - .

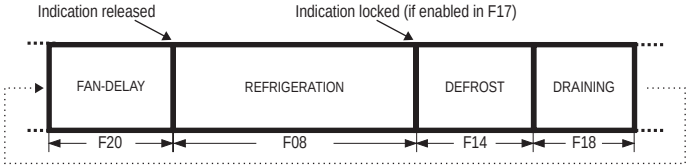
5.2 - Parameters configuration

a) Access the function F01 by pressing at the same time ▼ and ▲ for 2 seconds until appear Fun , releasing then after that. Soon will appear F01 , and then press SET (short touch).
b) Use ▼ and ▲ to enter the access code (123), and then press SET .
c) Select the desired function and visualize the configured value (see itens 5.1-b and 5.1-c).
d) Use ▼ and ▲ to change the value and then press SET to record the configured value and return to the functions menu.
e) To reset the menu and return to normal operation (temperature indication), press SET until appear - - - .

5.3 - Process stage, elapsed time and evaporator temperature (S2)

Press ▼. The stage of the process will appear, the elapsed time (in minutes) and evaporator temperature (S2).
In case of detached sensor or temperature out specified range will appear Er2 .
Process stages:

- dEL Initial delay (delay to start the control)
- FAn Fan-delay (delay to fan return)
- rEF Refrigeration
- dEF Defrost
- drE Draining



5.4 - Manual defrost

To do a manual defrost, regardless of the programming, keep pressed ▲ for 4 seconds, until appears the indication dEF On .
If the instrument is in defrost and you want to finish it, follow the above instructions, until appears the indication dEF OFF .

5.5 - How to determine the end defrost by temperature

a) Adjust the follow functions with maximum values:
- Refrigeration time (F08 = 999 min)
- Evaporator temperature for end defrost (F13 = 75.0 ºC / 167°F)
- Maximum duration of defrost (F14 = 90 min)
b) Wait until an ice layer to be created on the evaporator
c) Do a manual defrost, pressing ▲ for 4 seconds, until appear dEF On .
d) Observe the melting process.
e) Wait until melt all ice layer on the evaporator to consider the defrost finished.
f) Check the evaporator temperature read by the sensor S2 at this moment, pressing the key ▼ (see item 5.3) and copy this value to the function F13 - Evaporator temperature (S2) for end defrost.
g) As security, adjust again the function F14 - *Maximum duration of defrost,* that depends of the defrost type.
Exemple: Electrical defrost (resistance) =45 minutes as maximum
Defrost for by hot gas = 20 minutes as maximum
h) Now adjust the function F08 - *Refrigeration time with the desired value.*

5.6 - Indicators and alarms

The led's signals indicate the status of the outputs:
REFR: Compressor or liquid gas solenoid
FANS: Evaporator fans
DEFR: Defrost (resistance or hot gas)
Er1 Ambient sensor disconnected or out of range.
Er2 Evaporator sensor disconnected or out of range.
AHi High ambient temperature alarm.
* Whenever the defrost ends due to time and not temperature, a point located in the lower right-hand corner of the display will continue to blink until the next defrost, and will indicate the following possibilities:
- The interval between defrost cycles is too long;
- There are burned heating elements;
- The hot gas is not circulating;
- There is a nonworking fan or the set maximum defrost time is not enough;
PPP Invalid configuration parameters;
- In this situation the outputs are turned off;
- Check which parameters have invalid data and correct them to return to normal operation.

5.7 - Minimum and maximum temperatures register

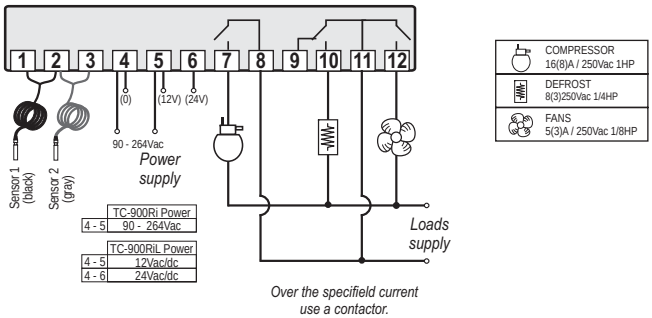
Press ▲ , soon t-1 appears and the minimum and maximum temperatures of S1 sensor (ambient temperature). After soon t-2 appears and the minimum and maximum temperatures of S2 sensor (evaporator).

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

5.8 SELECTION OF THE UNIT (Cº / Fº)

In order to define the unit that the instrument will operate in, enter function "F01" with the access code "231" and confirm with the SET key. Press the ▲ key and the indication Uni will appear. Press SET to choose between °C or °F and confirm. After selecting the unit the FAC message will appear, and the instrument will return to the function "F01". Every time that the unit is changed, the parameters should be reconfigured, since they assume the "standard" values.

6. ELECTRICAL CONNECTIONS

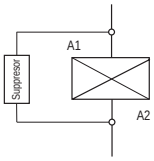


Over the specifield current use a contactor.

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

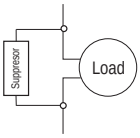
IMPORTANT
According to the chapters from the IEC60364 standard:
1: Install protectors against over voltage on power supply
2: Sensor cables and computer signals can be together, however not at the same place where power supply and load wires pass for
3: Install suppresor of transient in parallel to loads to increase the usefull life of the relays
For more information contact our application eng. department through e-mail support@ fullgauge.com or dial +55 51 3475.3308.

Contact suppresor connection diagram



A1 e A2 are the contactor coils.

Diagram for suppresor installation for direct drive load inputs



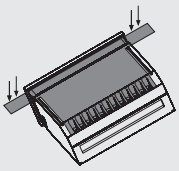
For direct activation the maximum specified current should be taken into consideration.

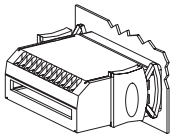
Note: The sensor cable lenght can be increased by the user until 200 meters using 2 x 24 AWG cable.

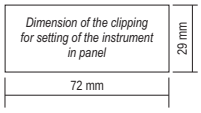
PROTECTIVE VINYL:

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

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







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