TC-900Ri clock

CONTROLLER FOR REFRIGERATION WITH REAL TIME DEFROSTING AND SERIAL OUTPUT

Ver.10



CLOCKV10-03T-11000

1. DESCRIPTION

TC-900Ri clock is a temperature controller for refrigerated products. It automates defrost processes according to the need of the installation, saving energy. It has two sensors, one for room temperature and another that, fixed to the evaporator, controls the end of defrost and fan return. In addition, it has an internal real time clock that enables creating an agenda with up to eight daily defrosts for each day of the week. The controller's internal battery guarantees its synchronism, even during power shortage, tor many years. It has an output for serial communication, and can be managed remotely through Sitrad ® via Internet.
Product complies with CE (European Union) and UL Inc. (United States and Canada).

2. APPLICATION

• Refrigeration chambers
• Counters

3. TECHNICAL SPECIFICATIONS

- Power Supply: TC-900Ri clock -115/230 Vac ±10% (50/60 Hz)
  TC-900RiL clock -12/24 Vac/dc
- Control temperature: -50 to 75°C / -58 to 167°F
- Resolution: 0.1ºC from -10 to 75ºC and 1ºC outside this range / 1°F in all range
- Operating temperature: 0 to 50 ºC / 32 to 122°F
- Operation humidity: 10 to 90% RH (without condensation)
- Dimensions: 71 x 28 x 71mm

- Load current (outputs):
REFR: 5(3)A / 250Vac 1/8HP (compressor, solenoid valve or contactor)
FANS: 5(3)A / 250Vac1/8HP (evaporator fans)
DEFR: 5(3)A / 250Vac (defrost resistance or hot gas)
- Sensors:
S1: ambient sensor (black cable)
S2: evaporator sensor (gray cable)

CLASSIFICATION ACCORDING TO IEC60730-2-9 STANDARD:
- Temperature limit of the installation surface: 50º C
- Type of construction: Built-in electronic controller
- Automatic action: Type 1
- Control of pollution: Level 2
- Impulse voltage: 1,5kV
- Temperature for the test of sphere pressure: 75ºC and 125ºC
- Insulation: Class II

4. CONFIGURATIONS

4.1 - Control temperature adjust (SETPOINT):

- Press SET for 2 seconds until appears SEt , and release it after that. The adjusted temperature will appear.
- Use ▼ and ▲ to change the value and then press SET to record it.
Parâmetros de configuração protegidos por código de acesso:

4.2 - Parameters table

Fun	Description	CELSIUS Min	CELSIUS Max	CELSIUS Unit	CELSIUS Standard	FAHRENHEIT Min	FAHRENHEIT Max	FAHRENHEIT Unit	FAHRENHEIT Standard
F01	Defrost by programmed time (weekly schedule)	0 - no	1 - yes	-	1 - yes	0 - no	1 - yes	-	1 - yes
F02	Control differential (hysteresis)	0.1	20.0	°c	2.0	1	36	°F	4
F03	Minimum setpoint allowed to the end user	-50	F04	°c	-50.0	-58	F04	°F	-58
F04	Maximum setpoint allowed to the end user	F03	75.0	°c	75.0	F03	167	°F	167
F05	Delay when the instrument is powered on	0	30	min.	0	0	30	min.	0
F06	Act point of low ambient temperature alert (S1)	-50.0	75.0	°c	-50.0	-58	167	°F	-58
F07	Act point of high ambient temperature alert (S1)	-50.0	75.0	°c	75.0	-58	167	°F	167
F08	Refrigeration time (interval between defrosts)	1	999	min.	240	1	999	min.	240
F09	Compressor delay after on (on - off)	0	999	sec.	0	0	999	sec.	0
F10	Compressor delay after off (off - on)	0	999	sec.	0	0	999	sec.	0
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	°c	40.0	-58	167	°F	104
F14	Maximum defrost duration (for security)	0=disable	90	min.	45	0=disable	90	min.	45
F15	Fan turned on during defrost	0 - no	1 - yes	-	0 - no	0 - no	1 - yes	-	0 - no
F16	Defrost type	0 - electric	1- hot gas	-	0 - electric	0 - electric	1- hot gas	-	0 - electric
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	min.	10	0	30	min.	10
F19	Evaporator temperature (S2) for fan return after draining	-50	75.0	°C	0.0	-58	167	°F	32
F20	Maximum time of fan return after draining (fan-delay)	0	30	min.	1	0	30	min.	1
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 (S2)	-50	75.0	°C	50.0	-58	167	°F	122
F23	Offset indication for ambient sensor (S1)	-20.0	20.0	°C	0.0	-36	36	°F	0
F24	Network equipment address RS - 485 (serial communication)	001	247	-	001	001	247	-	001

4.2.1 - Parameters description

F01 - Defrost by programmed time (weekly schedule)
This function allows that the defrosts scheduled by time are enabled.
"0" = The defrosts normally happen after the end of the refrigeration stage.
"1" = The defrosts are activated by the programmed time that is set in the weekly schedule.

F02 - Control differential (hysteresis)
It is the difference of temperature (hysteresis) between to turn OFF and turn ON the refrigeration output.

Exemple: 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 - Minimum setpoint allowed to the end user

F04 - Maximum setpoint allowed to the end user
Electronic limits whose purpose is prevent that too high or too low setpoint temperatures are regulated.

F05 - 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).

F06 - Act point of low ambient temperature alert

F07 - Act point of high ambient temperature alert
If the ambient temperature (S1) reaches this point during the refrigeration, this will be visually signaled by the indication of a blinking light on the 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 becounted when the fan is turned on , after fan-delay stage (fan return after draining).
Caution: The defrost will only begin if the temperature indicated in S2 (evaporator sensor) is less than indicated in F13.

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 danified 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
Enables the defrost cycle to occur when the controller is activated. For example at the return of electrical energy (in case of a power outage)

F13 - Evaporator temperature (S2) for end defrost
If the evaporator temperature (sensor S2) reaches the set value, the defrost cycle will be determined by the temperature, witch is preferred. Due to this the defrost cycle is optimized.

F14 - Maximum defrost duration (for safety)
This function enables the adjustment of the maximum defrost cycle time period. If during this time period the evaporator the temperature does not reach the F13 set value, a blinking light will appear on the displays lower right hand corner indicating the defrost cycle was initiated by the set time and not by the temperature.

F15 - Fan turned on during defrost
Enables fan function during the defrost cycle. For example, a natural defrost or a heating element installed outside of the evaporator.

F16 - Defrost type
"O" Electrical defrost (heating elements), activates only the defrost output.
"1" Hot gas defrost, where the compressor and defrost outputs are activated

F17 - Locked temperature indication (S1) during defrost
This function prevents the visualization of ambient temperature elevation during defrost, maintaining the last temperature indication prior to defrost. At the beginning of the refrigeration cycle, a normal temperature indication will again take place after fan delay.

F18 - Draining time (dripping of defrost water)
Time necessary for all evaporator water to be drained. All outputs are remained off. Adjust this time to zero if this stage is not desired.

F19 - Evaporator temperature (S2) for fan return after draining
After drainage the fan delay cycle is enabled. The refrigeration (REFR.) is immediately turned on because of the high ambient temperature. The fan is only enabled after the evaporator temperature lowers to the set programmed value. This process is required to remove heat (caused by defrost) that still exists on the evaporator, preventing ambient release.

F20 - Maximum time of fan return after draining (fan-delay)
For security, in case the evaporator temperature does not reach F19 set value or S2 sensor is disconnected, fan reactivation will happen in this function's set time.

F21 - Fan on with compressor off (refrigeration)
During refrigeration, the fan activation can be conditional to the compressor.
"O" = The fan only stays on while the compressor is on. (In some cases this option can generate a great electrical energy economy)
"1" = The fan stays on during all of the refrigeration cycle.

F22 - Fan stopped for high temperature in the evaporator
This functions purpose is to cycle the evaporator ventilation until the ambient temperature approaches that of the toreseen temperature in the installation manual, therefore preventing high temperature and released pressure that can damage the compressor, If the evaporator temperature surpasses that of the set value, the fan is turned off again with a set hysteresis of 2°C bellow its value. Valuable resource when refrigeration equipment that had been inactive for a few days or refrigerated cases are restocked with its proper merchandise.

F23 - Offset indication for ambient sensor
Allows it to compensate for eventual ambient temperature misreading, usually due to a sensor replacement.

F24 - Network equipment address RS - 485 (serial communication)
Each controller connected to the RS-485 network must have its own address different from the others so that the computer will be able to identify it.
Attention: To avoid communication problems, make sure that there are no controllers with the same address.

4.2.2 - Advanced function adjustment

a) Hold at the same time the ▼ and ▲ for 2 seconds until SEL appears, them let go, soon the Cod indication will appear requesting that the access code be inputed.
b) Press SET then use the ▼ and ▲ to input the access code (123) confirm it by pressing the SET key. The Cod indication will appear again.
c) Press ▲ . The Fun message will appear.
d) Quickly press SET to enter the advanced function menu. The F01 will then appear.
e) Use ▼ and ▲ to access the desired function.
f) After selecting a function, press SET to visualize the set value for that function.
g) Use ▼ and ▲ to change the value and when ready, press SET to record the set value and return to the function menu.
h) To exit the function menu, hold SET for 2 seconds until Fun appears.
i) To return to normal operation (temperature indication), hold again the SET key for 2 seconds until --- appears.
Note: To visualize the set configuration value (without changing them) it is not necessary to enter the access code.

4.3 - Defrost schedule

1P1, 1P2,..., 1P8 >> Defrosts programmed for Sunday
2P1, 2P2,..., 2P8 >> Defrosts programmed for Monday
3P1, 3P2,..., 3P8 >> Defrosts programmed for Tuesday
4P1, 4P2,.... 4P8 >> Defrosts programmed for Wednesday
5P1, 5P2,.... 5P8 >> Defrosts programmed for Thursday
6P1, 6P2,..., 6P8 >> Defrosts programmed for Friday
7P1, 7P2,..., 7P8 >> Defrosts programmed for Saturday

OBS: To make it so the defrost cycles are activated by the programmed time schedule, the programming for at least one defrosts each day of the week is required. If not, the defrosts will take place at the normal process (after the time of refrigeration is finished) the function F01 will be automatically set to "O".

* The code that appears on the screen is formatted in the following manner:

P

Day of the week	Number of programmed defrost
1-Sunday	1 - 1st program of the day
2-Monday	2 - 2nd program of the day
3-Tuesday	3 - 3rd program of the day
4-Wednesday	4 - 4th program of the day
5-Thursday	5 - 5th program of the day
6-Friday	6 - 6th program of the day
7-Saturday	7 - 7th program of the day
	8 - 8th program of the day

Ex.: 4P2 { Wednesday / Program 2

4.3.1 - Adjusting the defrost schedules

a) Hold ▼ and ▲ at the same time for 2 seconds until SEL appears, then let go. The Cod indication will appear requiring that the access code be inserted .
b) Press SET and insert the access code 123 (one hundred and twenty three) by using the ▼ and ▲ , confirming with SET . The Cod will appear again
c) Press ▲ twice, the Pro message will appear.
d) Press SET to enter the defrost program menu. 1P1 will appear,
e) Use ▼ and ▲ to access the desired program.
f) After selecting the program press SET to visualize the time adjusted for that defrost.
g) Use ▼ and ▲ to change the time adjusted when ready press SET to record the time and return to the defrost programmed times.
h) To exit the defrost program menu you must hold SET for two seconds until Pro appears.
i) To return to the normal operation (temperature indication) press SET again for 2 seconds until --- appears.
Notes:
1) To disable the undesired programmed defrost times, adjust the amount to the maximum until OFF appears.
2) To visualize the scheduled programmed defrost times (without changing them), it is not necessary to enter the access code.

4.4 - Seeting the clock and the day for the week

a) Hold ▼ and ▲ at the same time for 2 seconds Until SEL appears, then release Cod will now appear requiring the access code to be inserted.
b) Press SET and input the access code 123 (one hundred and twenty three) by using the ▼ and ▲ , and reaffirming with SET . Then Cod will appear again.
c) Press ▲ three times. The CLo message will then appear on the display.
d) Press SET , the adjustments will appear in the following order.
HOURS → MINUTES → DAY OF THE WEEK
Ex.:12h43min - Friday
12h Hours
43' Minutes
6 Day of the week

4.5 - Parameters setting diagram

Hold ▼ and ▲ for 2 seconds. Until SEL appears, then let go.

By ▼ and ▲ keys it is possible to alternate between Cod ↔ Fun ↔ Pro ↔ Clo

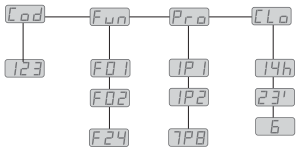
Cod Access code (123)

Fun Process functions menu (F01 a F24)

Pro Weekly programming for defrost times (1P1 a 7P8)

Clo Clock (hours and minutes) and weekday adjustment (1 a 7)

▼ ▲ for 2 seconds = SEL



5. FUNCTIONS WITH FACILITATED ACCESS

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

By pressing the ▼ key, the process stage will appear and the elapsed time (in minutes) already occurred in this stage, followed by the appearance of the (S2) evaporator temperature.

In case of a disconnected sensor or temperature out specified range a Er2 will appear on the display.

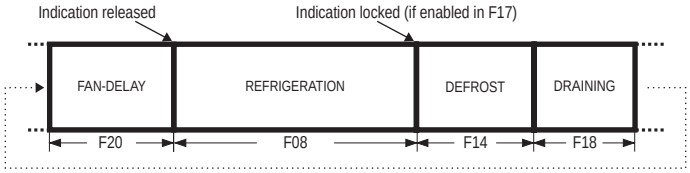
Process stages: dEL Initial delay (control disable)

FAn Fan-Delay

rEF Refrigeration

dEF Defrost

drE Drainage



5.2 - Manual defrost

Realize a manual defrost, regardless of the programming, by holding the ▲ key for 4 seconds, until dEF On appears.

If the instrument is realizing the defrost cycle and you want to finish it, follow the same instructions above, until dEF OFF appears.

5.3 - Minimum and maximum temperature register

By pressing ▲, the t-1 sign will appear and the maximum and minimum temperatures of the black sensor (ambient temperature) will appear. Soon t-2 will appear showing the minimum and maximum temperatures of the gray sensor (evaporator).

Note: To reset settings, hold the ▲ key through all the minimum and maximum temperature visualization until rSt appears.

5.4 - Visualizing the current weekday and time

Press quickly the SET key. The following information's will appear:

HOURS → MINUTES → DAY OF THE WEEK

5.5 - How to determine the end of the defrost by temperature

a) Set the following functions to their maximum values:

- Interval between defrosts (F08 = 999 min)
- Evaporator temperature to end defrost (F13 = 75 °C)
- Maximum defrost duration (F14 = 90 min)

b) Wait until a layer of ice layer is created around the evaporator

c) A manual defrost, holding the ▲ key for 4 seconds, until dEF appears.

d) Visually follow the melting.

e) Wait until the ice around the evaporator is melted to consider the defrost finalized.

f) Check the temperature in evaporator detected by the sensor S2 at this moment by pressing the ▼ Key and copy this value to the function F13 - Evaporator temperature (S2) to determine the end of the defrost.

g) For security, adjust again the function F14 - Maximum duration of defrost, that depends of the defrost type. *Example: Electrical defrost (heating element) = maximum of 45 minutes*

Defrost by hot gas = maximum of 20 minutes 45

h) Now adjust the function F08 Refrigeration time with the desired value.

6. SIGNALLING

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.

ALo Low 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;
- The hot gas is not circulating;
- There is a nonworking fan or the set maximum defrost time is not enough;

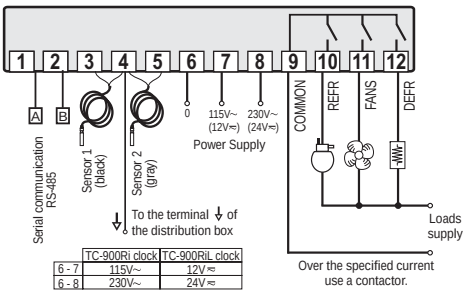
PPP Invalid configuration parameters;

- In this situation the outputs are turned off;
- Check which parameters have invalid data and correct them to return to normal operation.

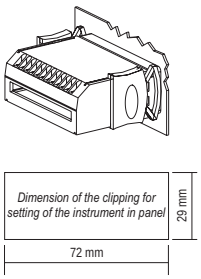
7. UNIT SELECTION (°C / °F)

To define the unit that the system will use to operate, enter into the functions menu Cod using the access code "231" and confirm it by hitting key SET. The indication Uni will appear, press ▼ or ▲ to choose between °C or °F and confirm with key SET. After selecting the unit the FAC figure will appear, and the instrument will return to the function Cod. Whenever the unit is altered, the parameters should be reconfigured, since they assume "standard" values.

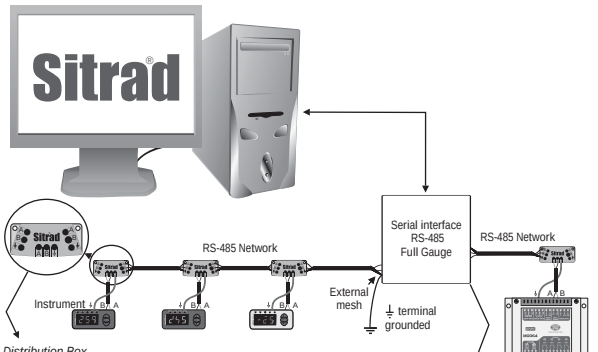
8. WIRING DIAGRAM



	TC-900Ri clock	TC-900RiL clock
6 - 7	115V~	12V≂
6 - 8	230V~	24V≂



Integrating Controllers, RS-485 Serial Interface and Computer



Distribution Box

Used to connect more than one instrument to the Interface. The wire's connections must be made in agreement with the following rules: terminal A of the instrument connects to the terminal A of the distribution box, that must be connected with the terminal A of the Interface. Repeat the action for terminals B and ⏚, being ⏚ the cable shield.

The terminal ⏚ of distribution box must be connected to the respective terminals ⏚ of each instrument.

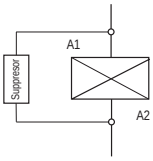
RS-485 Serial Interface

Device used to establish the connection Full Gauge Controls' instruments with the Sitrad®.

- The sensor S1 (black) must be in the ambient.
- The sensor S2 (gray) must be placed in the evaporator through metallic cramp.
- The sensor cable length can be increased by the user until 200 meters using the PP 2 x 24 AWG cable.

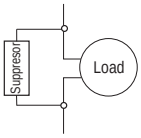
IMPORTANT
As chapters of IEC 60 364 norms:
1: Install protectors against over voltage on power supply
2: Sensor cables and computer signals can be together, however not at the same place where power supply And load drive pass for.
3: Install suppresor of transient (RC filters) in parallel to loads, as for to increase the useful life of the relays for more information contact our application eng. department through e-mail support@fullgauge.com or dial +55 51 3475.3308.

Wiring diagram of suppresor in contactors



A1 and A2 are the contactor coil.

Wiring diagram of suppresor linking in loads direct drive

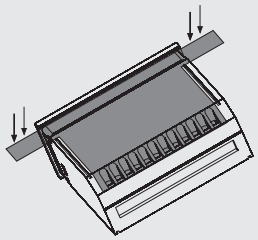


For direct drive, considers the maximum load current specified.

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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