

Regolatori per Refrigerazione Digitali

FR... 1-2 canali

Manuale d'Uso



1-2 Channel Regulators for Digital Refrigeration System Manual



Vemere
SPA

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Series of digital thermoregulator for regulating the temperature that execute 1B type actions (EN 60730-1).

SAFETY WARNINGS

■ **During the installation and operation of the instrument, the following safety instructions should be followed:**

- 1) **The instrument should be installed by qualified personnel**
- 2) **Read the instructions in this manual carefully**
- 3) **Carefully follow the instruction diagrams to install the device**
- 4) **Before gaining access to the connector terminals, make sure the conductors to be connected to the instrument or already connected are not powered**
- 5) **Make sure the electric panel in which the device is inserted will prevent access to the terminals after installation**
- 6) **Do not supply power to the device if any part of it is damaged**
- 7) **The instrument must be installed and activated in compliance with current electric systems standards.**
- 8) **The connection cables should be able to resist the maximum operating temperature in the form of the maximum ambient temperature + 20 °C**
- 9) **The instruments guarantee main insulation between the low voltage parts (250 V) and the extremely low voltage parts**
- 10) **Any outside switches connected to the control panel should guarantee a minimum insulation of 250 V AC at operating temperature, or should be protected by equivalent insulation**

IMPORTANT: In order to avoid malfunctions, the differential of intervention (DF1 or DF2 parameter) should not be set above 30 °C.

TECHNICAL SPECIFICATIONS

- Series of digital temperature regulators that satisfy the simplest requirements in the field of refrigeration. They may be used as regulators for the handling of:
 - Static refrigeration units (with no fan on the evaporator) operating at normal temperatures (over 0° C)
- The temperature probe to be used is the NTC type. It is also possible to connect a second probe to display the product conservation temperature
- The instruments are available in the following versions:
 - **FR NTC-...** with 1 or 2 relay outputs in exchange for the handling of static refrigeration units. In the two relay model, the second relay is dedicated to the handling of the maximum and minimum alarms. Indicated for the handling of STATIC refrigeration units (with no fans on the evaporator) operating at temperatures greater than 0 °C. The regulator performs all the functions of a thermometer, with the display of the temperature, and an electronic thermostat, with the activation of a compressor or

solenoid valve to maintain the temperature required. It also carries out an automatic defrost function by means of the forced switching off of the compressor. The defrosting frequency and duration can be set.

- The predefined control action is of the ON/OFF DIRECT type (cannot be modified)
- Regulators with 3-digit, seven segment and decimal point led display
- Compressor in operation warning lamp
- Defrost warning lamp
- Continuous cycle active warning lamp
- Alarm intervention warning lamps (FR *NTC-1P3..*, FR *NTC-..DA* models only)
- Display range: $-99 \div +999 \text{ } ^\circ\text{C}$
- Display resolution: $0.1 \text{ } ^\circ\text{C}$ ($-9.9 \div +99.9 \text{ } ^\circ\text{C}$) and $1 \text{ } ^\circ\text{C}$ ($< -9.9 \text{ } ^\circ\text{C}$ and $> +99.9 \text{ } ^\circ\text{C}$)
- Precision: $\pm 0.5 \%$ of measurement ± 1 digit
- Digital mode parameter setting:
 - Set point
 - Differential
 - Output drive times
 - Digital input delay function
 - Alarm / buzzer enable delay time
 - Probe calibration offset
 - Resolution displayed
 - Temperature measurement unit
 - Measurement display filter (update speed)
 - Probe input type
 - Password
 - Interval between defrost operations
 - Duration of defrost operation
 - Continuous cycle duration
 - Duty setting
 - Defrost parameters
- 1 SET POINT
- Operating modes: defrost, duty cycle, continuous cycle and digital input
- 2 temperature measurement probe inputs: the first probe may be used for regulation and the second to display the product conservation temperature (1 or 2 relay models). Relay outputs with 8 A /250 V AC1 relay exchange contact
- In the 2 relay models, the second output is dedicated to the handling of the minimum and maximum alarms
- Rated power output: 4.5VA
- Max absorption: 100 mA at 12V, 50 mA at 24V
- Digital input: 1 for outside consent for configurable function – outside alarm, probe selection, regulation ON/OFF, defrost handling, night operation (when the contact is close, the set is modified to an offset in degrees)
- Acoustic and visual alarm signalling for: outside alarm (from digital input), probe alarm (malfunction), minimum or maximum alarm

Rear panel 33x75 mm

Code	Model	Power supply (*)	Power supply tolerance	n° of relays
VM650900	FR NTC-1P3D	from 12 to 24 V AC/DC	± 10	1
VM651700	FR NTC-1P3A	230 V AC	-15/+10	1

Modular 4 DIN

Code	Model	Power supply (*)	Power supply tolerance	n° of relays
VM659000	FR NTC-1DA	24/230 VAC	± 10	1
VM660800	FR NTC-2DA	24/230 VAC	± 10	2





(*) Power supply in AC - Frequency 50/60 Hz

DESCRIPTION OF INSTRUMENT

Display

- 3-digit led display with decimal point.
For all the models, the display range is:
 - minimum display: -99 °C or -9.9 °C
 - maximum display: 999 °C or 99.9 °C

Relay intervention warning lamp:

-  / **COMP**: LED off if the compressor is off and on if the compressor is on, flashing if the compressor is off and waiting to become on due to active timing
-  / **DEF**: LED off if defrost is off, on if defrost is taking place, flashing if awaiting defrost execution
-  : LED off if continuous cycle inactive, on if continuous cycle is taking place, flashing if awaiting execution of the continuous cycle
-  : LED off if alarm inactive, on if alarm active, flashing if alarm timing taking place

Keys

- Three keys are present for the parameter setting operations:



Confirm and parameter programming/display key



Parameter increase or go to next parameter



Parameter decrease or exit menu

ELECTRICAL CONNECTIONS

- Carefully follow the instructions in the safety warnings and the “**connection diagram**” section.

GLOSSARY

Set point (set or operating point)

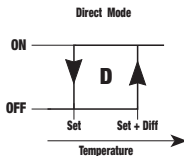
- The set point is the value at which the device has to intervene to maintain the measurement controlled at the required level.

Differential (or hysteresis)

- The differential is the maximum variation from the operating point of the measurement controlled permitted before the intervention of the device. This is normally set in such a way as to prevent rapid swings in the measurement around the operating point from causing frequent starts and stoppages of the device or the driver connected to it.

Direct action

- A regulator acts in **direct** mode when it carries out a containment action on a measurement that is increasing. A typical example is a refrigeration system. As the temperature increases, the refrigeration power produced increases correspondingly, with a view to reducing the temperature.



Defrost

- This is a timed defrosting action that takes place by switching off the compressor. It may be timed (by setting the relevant parameter) or forced manually by holding down the **“up”** (▲) key for at least 3 seconds. The **defrost** procedure terminates if:
 - the defrost time expires;
 - the **“up”** (▲) is held down again for at least 3 seconds;
 - the unit goes into **“duty cycle”** operation due to a probe error.During the **defrost** operation, both the maximum and minimum alarms are bypassed.

Duty Cycle

- This is the operating mode of the instrument in the event of probe failure. The **duty cycle** parameter may take on a whole number value from 0 to 100:
 - 0 compressor constantly off
 - 100 compressor constantly on
 - 1-99 the minutes of continuous operation of the compressor, with intermittent fixed stoppage time intervals of 15 minutes

This type of operation takes place when sensor alarms are detected.

If the instrument is defrosting or in a continuous cycle procedure, these are interrupted, but their timings remain active. If the probe alarm stops, the instrument resumes normal operation. If it was carrying out a continuous or duty cycle procedure and the cycle time has not terminated in the meantime, this will resume at the end of the operation. If the cycle time has terminated, the instrument will return to normal operation.

Continuous cycle

- The continuous cycle runs the compressor constantly for a programmed period (if the temperature of a refrigeration cell has to be reduced rapidly following a loading operation, for example). To carry out the **continuous cycle** procedure, hold down the **“down”** (▼) key for at least 3 seconds. The procedure terminates it:
 - the continuous cycle time terminates;
 - the **“down”** (▼) key is held down again for at least 3 seconds;
 - **“duty cycle”** operation is started up due to a probe error;
 - the temperature reaches the minimum alarm threshold.During the **continuous cycle**, both the maximum and minimum alarms are bypassed. These alarms will remain bypassed for a set period of time after the cycle has terminated.

OPERATION

Normal operation

- This is the type of operation that takes place when the parameters are not in advanced programming.
The instrument carries out the regulation on the basis of the value measured and the parameters set.
The information displayed is as follows:
 - The temperature measured by the sensor
 - Compressor status indications
 - Defrost taking place indication
 - Continuous cycle taking place indication
 - Alarm relay status indication

SETTING THE REGULATION PARAMETERS

- To set the regulation parameters, two types of programming are available:
 - Simplified programming
 - Advance programming

Note: to restore the default values set in the factory, switch on the instrument while holding down the “OK” key.

Simplified programming

- This is used to modify only the parameters of the **regulation menu [REG]**. In this regulator, the predefined control action is of the ON/OFF DIRECT type (cannot be modified), which means that the only parameters that can be modified are the set point and differential.
Access to this type of programming is gained by pressing “OK”.
Use the “up” (▲) key to scroll through the parameter labels in a circular movement.
Press “down” (▼) at any time to leave the menu and return to normal operation (this also occurs if no key is pressed for at least 40 seconds).
Press “OK” to switch between the display of the parameter label and its numerical value.
To modify a parameter:
 - from the display of its label or value, hold down “OK” for at least three seconds
 - the display will start to flash and show the parameter value
 - use the p and q keys to increase or decrease the value respectively
 - press “OK” to confirm the parameter and leave the modification (the display will stop flashing)

Note: if no key is pressed for at least 40 seconds, the instrument will exit the parameter modification without memorising the changes made. During the display and modification of the parameters, the instrument will go on working with the parameters set previously.

If “password 1” is enabled (access password for the protection of the settings entered – **see system menu**), and the “OK” key is pressed from normal status, the message “- - -” will appear. To proceed with the setting of the parameters, enter the password previously set (a numerical value from 0 to 255) with the “up” (▲) keys “down” (▼) and press “OK” to confirm. If the password has been entered correctly, the label of the first menu will appear. Otherwise the system will return to normal status.

Advanced programming

- Access is gained to advanced programming from normal status by holding down the “up” (▲) and “down” (▼) keys together for at least 3 seconds.

Note: to restore the default values set in the factory, switch on the instrument while holding down the “OK” key.

The parameters are grouped into eight menus by type:

- 1) Regulation** (marked [REG]): set point, differential
- 2) Output** (marked [OUT]): output drive times
- 3) Digital input** (marked [ING]): function, delay time
- 4) Allarme** (marked [ALR]): output status in probe alarm, minimum/maximum shift, differential, delay time, buzzer enable
- 5) Display** (marked [DSP]): set point limits, probe offset, resolution, measurement unit, measurement filter
- 6) Sensore** (marked [SNS]): sensor type, sensor parameters
- 7) Sistema** (marked [SYS]): password, modification enable, operating mode
- 8) Refrigerazione** (marked [REF]): defrost interval, defrost time, defrost parameters

All the parameters in the eight menus and their values are listed in the section that follows.

- Use the key “up” (▲) to scroll through the eight menus in sequence
- Press “OK” to enter the menu required
- It is possible to scroll through the list of parameters inside each menu can be modified by pressing the “up” (▲).
To display the parameter value, press “OK” (if “OK” is pressed a second time, the parameter label is displayed again)
- To change the parameter value, hold down “OK” for at least 3 seconds
- The parameter value will start to flash and it can be increased or decreased by pressing the “up” (▲) and “down” (▼) keys
- Press “OK” to confirm the value set

The parameter will stop flashing and the new value will be displayed
 - It is possible to return to normal operation at any time by pressing the **“down”** (▼) key (or if no key is pressed for at least 40 seconds)

Note: if no key is pressed for at least 40 seconds during the modification process, the system will return to the display of the parameter without saving the changes made.

Note: during the display and modification of the parameters, the instrument will continue to work with the previously set parameters.

If “password 2” is enabled (access password for the protection of the settings entered – **see system menu**), if the **“up”** (▲) and **“down”** (▼) keys are held down for at least 3 seconds from normal status, the message **“- - - ”** will appear.

To set the parameters, enter the previously set password (a numerical value from 0 to 255) with the **“up”** (▲) and **“down”** (▼) keys and press **“OK”** to confirm.

If the password has been entered correctly, the label of the first menu will appear. Otherwise, the system will return to normal status.

PARAMETER MENU

- To simplify the advanced programming of the instrument, the parameters have been grouped into various menus, in the following order:
 - **[REG]** regulation menu
 - **[OUT]** output menu
 - **[ING]** outside input menu
 - **[ALR]** alarm menu
 - **[DSP]** display menu
 - **[SNS]** sensor menu
 - **[SYS]** system menu
 - **[REF]** refrigeration menu

Description of parameters

- Inside the tables, the labels are presented in the same order as that in which they appear in the various menus of the instrument.

[REG] regulation menu

Labels of parameters that can be modified	Description	unit	Parameter values		default	notes
			min	max		
ST1	set point 1	degrees	L01	H11	4.0	(1)
DF1	differential for set point 1	degrees	0.1	100	2.0	

Notes:

(1) For the values L01/L02 and H11/H12, see the display menu [DSP]

[OUT] output menu

Relay functions:

FR NTC-..P3, FR NTC-..D.. models

- **relay 1:** compressor handling

- **relay 2:** alarm handling

Labels of parameters that can be modified	Description	unit	Parameter values		default	notes
			min	max		
ETR	Time handling enable on relays	-	0	3	3	(2)
DON	Min time between 2 start-ups of the same relay	min	0	200	0	(3)
TOF	Min relay OFF time	min	0	200	0	(4)
TON	Min relay ON time	min	0	200	0	(5)
INI	Initial instrument start-up delay	min	0	200	0	(6)

Notes:

(2) This parameter enables the handling of the times defined by DON, TOF and TON for each output channel corresponding to relays 1 and 2 in the following way:

0 timing not enabled for both channels

1 timing enabled for channel 1 only

2 timing enabled for channel 2 only

3 timing enabled for channels 1 and 2

(3) This parameter limits the number of start-ups per hour of the driver connected to the instrument (parameter frequently used for compressors, for example)

(4) The minimum time for which the output has to remain in OFF status

(5) The minimum time for which the output has to remain in ON status

(6) The output drive delay time from the instant of instrument reset

[ING] outside input menu

Labels of parameters that can be modified	Description	unit	Parameter values		default	notes
			min	max		
TID	Digital input function	-	0	7	7	(7)
DID	Digital input delay	min	0	200	0	(8)
SUI	Output status with active input (open)	-	0	3	0	(9)
DEL	Night-time temperature variation	degrees	-50.0	+50.0	5.0	(10)

Notes:

(7) *The values that can be set are as follows:*

0 inactive

1 Outside alarm (with contact open) with delay time "DID" and automatic reset at end of alarm. The output status becomes "SUI"

2 Outside alarm (with contact open) with manual reset.

3 The input operates as a switch: instrument on with contact closed and off with contact open.

4 The input operates as a switch for the display of probes S0 and S1.

5 Enables defrost with contact closed. If defrost is requested the input is open. The request remains pending until the contact is closed.

If a defrost cycle is taking place and the contact is opened, the instrument suspends the cycle, but without stopping the timings (this means that it is possible to terminate the cycle for the remaining time by reclosing the contact).

6 The defrost cycle is started by closing the contact.

7 Night operation. With the contact closed, the "Set" is varied by a quantity in degrees equivalent to "DEL".

(8) *This is the delay following which the instrument responds to a single received at the digital input.*

(9) *When the digital input is active and a period of time "DID" has lapsed, the outputs may take on the following states:*

0 Both channels OFF

1 Channel 1 ON and channel 2 OFF

2 Channel 1 OFF and channel 2 ON

3 Both channels ON

(10) *This is the variation of the "Set" in degrees when the instrument switches to night operation.*

[ALR] alarm menu

Labels of parameters that can be modified	Description	unit	Parameter values		default	notes
			min	max		
SUA	Output status in probe alarm condition	-	0	3	0	(11)
LOA	Minimum alarm shift	degrees	0.1	100	50	(12)
HIA	Maximum alarm shift	degrees	0.1	100	50	(12)
DFA	Alarm differential	degrees	0.1	100	2	
TRA	Alarm activation delay time	min	0	200	0	
SOU	Buzzer enable	-	no	yes	no	(13)
EAC	Alarm message enable in timing	-	no	yes	no	(14)

Notes:

- (11) The outputs take on this status in probe alarm condition (see note 9).
- (12) This value is added to or subtracted from the set point defined for the maximum or minimum alarms respectively.
- (13) If “yes”, the acoustic signal and buzzer are enabled in alarm condition. If “no”, both are disabled.
- (14) If “yes”, the type of alarm is also displayed during its timing. If “no”, the type of alarm is displayed only at the end of the timing.

[DSP] display menu

Labels of parameters that can be modified	Description	unit	Parameter values		default	notes
			min	max		
LO1	Lower limit of set point 1	degrees	-99	HI1	-99	
HI1	Upper limit of set point 1	degrees	LO1	999	999	
SOF	Probe calibration offset	degrees	-50	+50	0.0	(15)
RIS	Resolution displayed	-	HI	LO	HI	(16)
UNI	Temperature measurement unit	-	C	F	C	(17)
FIL	Measurement filter	-	no	yes	yes	(18)

Notes:

- (15) This value is added to the measurement to compensate for imprecision.
- (16) The resolution with which the measurement is displayed: 0.1 if “HI” or 1.0 if “LO”.
- (17) **Important:** when the unit of measurement is modified, the parameters set are not converted automatically but recalibrated.
- (18) If the parameter is set to “yes”, a mobile mean is taken from 8 measurement values (that is, over 4 seconds approx). If “no”, this mean is not calculated.

[SNS] sensor menu

Labels of parameters that can be modified	Description	unit	Parameter values		default	notes
			min	max		
TY0	Sensor type 0	-	0	3	nt2	(19)
TY1	Sensor type 1	-	0	3	nt2	(19)
S01	Display of sensor 0 or 1	flag	S0	S1	S0	

Notes:

(19) The four parameter values are in fact indicated as in the table below:

NTC thermal resistances

Sensor type	Display format
(**)	nt0
(**)	nt1
type 4	nt2 (*)
(**)	CSt

* The instrument is set to this parameter by default. It corresponds to the use of the NTC code VN870200 temperature sensor

** For the use of sensors other than the type 4 referred to above (see note *), it is possible to select one of the three items "nt0, nt1, CSt", corresponding to probes with different temperature/resistance ratios. In such cases, we recommend contacting the Technical Assistance Service directly to identify the sensor to select.

[SYS] system menu

Labels of parameters that can be modified	Description	unit	Parameter values		default	notes
			min	max		
PS1	Password 1	-	0	255	0	(20)
PS2	Password 2	-	0	255	0	(20)
NEN	Parameter modification enable	-	yes	no	yes	(21)

Notes:

(20) The password is enabled if the parameter is different from 000.

(21) If set to "no", it is not possible to modify any of the other parameters, only to display them.

[REF] refrigeration menu

Labels of parameters that can be modified	Description	unit	Parameter values		default	notes
			min	max		
DDF	Interval between defrost cycles	h/min	0	200	8 h	(22)
TDF	Defrost duration	min/s	1	200	30 min	(23)
TCC	Continuous cycle duration	h	0	15	4	(24)
TEC	Alarm bypass time after cycle	h	0	15	2	(25)
TED	Alarm bypass time after defrost	h	0	15	1	(26)
DUT	Duty setting	-	0	100	100	(27)
BLD	Display block during defrost	-	no	yes	no	(28)
PRT	Defrost priority over compressor protection	-	no	yes	no	(29)
BTE	Time base	-	h-min	s-min	h-min	
DAC	Defrost on start-up	-	no	yes	no	(30)

Notes:

- (22) Defines how often the defrost cycle takes place. In hours (h) if the BTE parameter is set to "h-min", and in minutes (min) if the BTE parameter is set to "min-s".
- (23) Defines the defrost cycle duration; in minutes (min) if the BTE parameter is set to "h-min", and in seconds (s) if the BTE parameter is set to "min-s".
- (24) Defines the duration of the continuous cycle (to quickly reduce the temperature after the cell has been loaded).
- (25) Defines the time following the continuous cycle in which the maximum and minimum alarms are disabled.
- (26) Defines the time following defrost in which the maximum and minimum alarms are disabled.
- (27) Compressor ON time in the event of probe failure:
 0 always off
 100 always on
 1-99 ON time (in minutes) followed by a fixed pause of 15 minutes.
- (28) If set to yes, the temperature displayed is not updated during the defrost cycle.
- (29) If set to yes, all the [OUT] menu (output menu) timings are bypassed during the defrost phase.
- (30) If set to yes, a defrost cycle takes place after each instrument reset, even when the DDF parameter is different from 0.
 If set to no, the first defrost takes place after a time DDF.

ERROR MESSAGES

- Due to alarms or malfunctions, the measurement display may alternate with messages describing the type of alarm. The table below describes the alarm/error messages that may be displayed during operation.

Message	Type of error	Output status
ER0	Sensor 1 disconnected or in short circuit	As parameter [SUA]
ER1	Sensor 2 disconnected or in short circuit	As parameter [SUA]
ALL	Minimum alarm	Relay 2 activation (if present)
ALH	Maximum alarm	Relay 2 activation (if present)
ALE	Alarm from outside input	As parameter [SUA]
OFF	Regulation inhibited from outside input	As parameter [SUA]

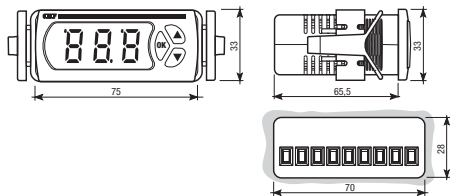
Notes: the "OFF" message does not alternate with the measurement, but remains fixed on the display.

REFERENCE STANDARDS

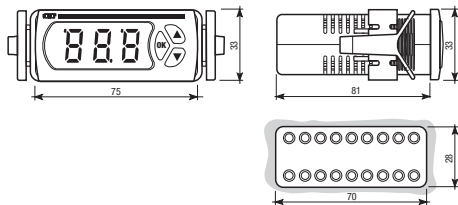
- Compliance to the Community Directives:
2006/95/EC (Low Voltage - LVD)
2004/108/EC (Electromagnetic compatibility- EMC)
is declared with reference to the follow Harmonised Standard:
EN 60730-2-9

33x75 mm REAR PANEL DIMENSIONS

FR NTC-1P3D



FR NTC-1P3A

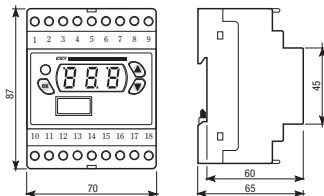


33x75 mm REAR PANEL DIAGRAMS

Model	Connection diagram
<p>FR NTC-1P3A</p>	
<p>FR NTC-1P3D</p>	

4 DIN DIMENSION MODULARS

FR NTC...DA

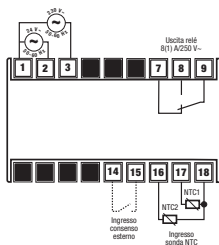


4 DIN DIAGRAM MODULARS

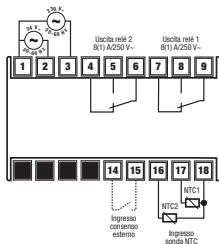
Model

Connection diagram

FR NTC-1DA



FR NTC-2DA





Vemer S.p.A.

I - 32032 Feltre (BL)

Via Camp Lonc, 16

Tel +39 0439 80638

Fax +39 0439 80619

e-mail: info@vemer.it - web site: www.vemer.it