MR40 Advanced Electronic Control for Compressor and Defrost management

The MR40 is a digital controller for "static" or "ventilated" refrigeration units working at positive or negative temperatures. It incorporates all the features needed by modern units such as compressor and evaporator fan full management, "off-cycle" or "active" defrost control, additional auxiliary output for alarm signalling or light control.

The MR40 functions can be further expanded through other elements such as the LON or Johnson Controls N2Open serial communication card. It is also optionally equipped with a Real Time Clock card for energy saving and real time scheduling of events such as defrost cycles.

MR44 controller with active defrost and fan management

Features and Benefits	
❑ **Attractive Panel mount enclosure**	Easy and quick installation
❑ **Up to 4 relays in the standard 35 x 72 mm enclosure**	Reduced space
❑ **Temperature display with "decimal" accuracy**	Allows accurate control and reading of temperature.
❑ **Accurate and interchangeable IP 68 sensor**	Accurate control performance No recalibration needed
❑ **Wide range of sensors with various enclosures available**	Possibility to match a wide variety of temperature sensing needs
❑ **SMD technology**	Higher quality and reliable components
❑ **LON and N2Open serial communication cards (optional)**	Compatible with standard Building Automation Systems (BAS) protocols
❑ **Real Time Clock (optional)**	Real Time Scheduling of control activities

Features

Display

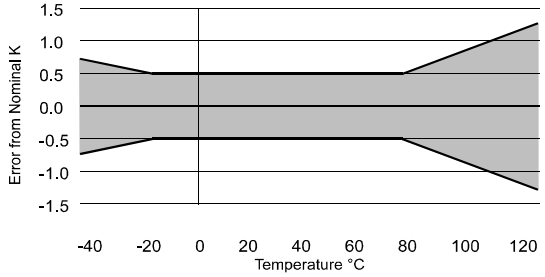
The display has three 7-segment LEDs to display temperatures from –40°C to +70°C (-40 to 158°F) with decimal accuracy between –9.9 and +70.0°C (-9.9 to +99.9°F).

See Individual Status LEDs table:

LED	Status	Meaning
	**ON**	compressor ON
	Blinking	deep-freezing cycle active
	**ON**	defrost cycle active
	Slow blinking	auxiliary output energised
	Fast blinking	auxiliary output energised and defrost active
	**ON**	Fan ON

Sensor input

This series of controllers uses Johnson Controls A99 temperature sensor. Its accuracy is within 0.5°C between -15 and 75°C. Its tolerance increases with temperatures outside this range, as shown below.



Its gas tight packaging (IP68) makes it the best sensor for refrigeration applications. *For details please refer to A99 documentation*. An offset of the measured temperature can be configured for temperature compensation or cable extension.

Adjustable setpoint limits

The setpoint range can be limited in order to avoid “too high” or “too low” setpoint settings of the equipment. The final user cannot set a setpoint value exceeding these limits.

Anti short cycle protection

In order to protect the compressor against short cycling all models have a built-in anti short cycle protection. This feature determines the minimum time that must elapse between two successive start-ups of the compressor.

Serial Communication (Optional)

The MR40 controller can be integrated in a Building Management System (BMS) thanks to plug-in communication cards. Two cards are available depending on the protocol needed: LON or N2Open. In alternative to RTC card.

Real Time Clock (Optional)

RTC plug-in card is available to allow real time scheduling of control activities such as defrost cycles and setpoint bias. In alternative to serial communication card.

Defrost Management

Defrost can be initiated by timer, RTC, digital input, network or manually forced through the keypad and terminated either by timer, evaporator temperature or network command.

Fan Management functions

The evaporator fan can be managed in three different ways, according to the FF parameter:

FF = 0: in parallel with compressor
FF = 1: always ON
FF = 2: based on the evaporator temperature and parameters FS (Fan differential), FH (Fan Hysteresis).

Note: FAN is always OFF during Defrost

Keyboard lock / unlock

A sequence of keystrokes allows you to disable/enable modification of the internal parameters. This prevents accidental tampering from unauthorised personnel.

Deep freezing

From the front keypad or from the network you can force the compressor output ON for a pre-set time in order to start a deep freezing cycle.
This feature is very useful when a cold room or refrigerated case loading operation is performed. Deep freezing is terminated by timer or if at least one of the following situations occur: temp. sensor failure, low temp. alarm, general alarm, OFF state selection, fan only mode selection and manual command from the keypad.

Alarm management

All devices include a high and a low temperature limit alarm. This alarm is related to the main setpoint of the thermostat and displays “Hi” or “Lo” in case of exceeding temperature limits. A delay can be configured in order to prevent non-significant events from triggering the alarm (i.e. door open).
The differential of the alarm is also adjustable.
The high temp. alarm is disabled for a programmable delay after power-up and after defrost end. Events such as a disconnected or short-circuited sensor will be detected, signalled and will result in a selectable status of the output relay(s).

Units

Measurement Unit can be selected: Celsius or Fahrenheit degrees.

Self Test

Through the Keypad is possible to activate the self-test procedure to check control operation by cycling all outputs and testing all LEDs.

Multifunctional Digital Input

All instruments are equipped with a digital input performing the following functions:

1. General Alarm
2. Delayed Alarm
3. Door switch
4. Setpoint Bias
5. Remote Defrost
6. oFF mode
7. Auxiliary command
8. Fan Only Mode

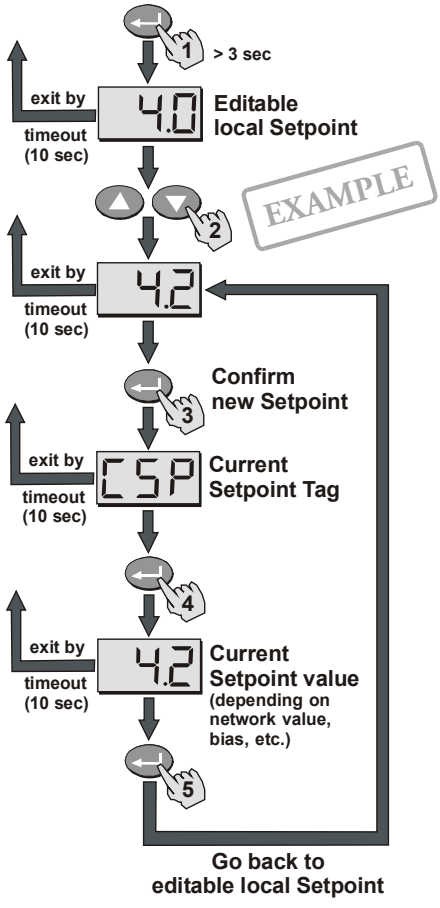
Programmable Digital Output

Some models have a programmable relay output that can be used either as an alarm or an auxiliary output (ex. light switch). This output is configured by configuration parameter (**AA**) or automatically configured as auxiliary by selecting the “auxiliary output control” function for the digital input (**iF = 7**). Once configured as auxiliary the relay can be energised by digital input, network or by simultaneously pressing the UP and DOWN arrows on the keypad.

Configuration

Available Keys		Action
▲	**Up**	Scroll sensor readings and DI status. Scroll up parameters or increase a value.
▼	**Down**	Scroll sensor readings and DI status. Scroll down parameters or decrease a value.
↵	**for 3"<t<7"**	GoTo setpoint setting**(*)**
↵	**for 7"<t<15"**	GoTo parameters setting
↵	**for t>15"**	GoTo RTC param. (if present)
❄	**for t>3"**	Manual defrost start
↵ + ▲	**for t>3"**	Manual deep freezing start
	for t>7"	Manual deep freezing stop
▲ + ▼	**for t>3"**	Auxiliar command toggle (if present)
↵ + ▲ + ▼	**t>10"**	Lock/Unlock keyboard
❄ + ▲	**for t>3"**	Self test

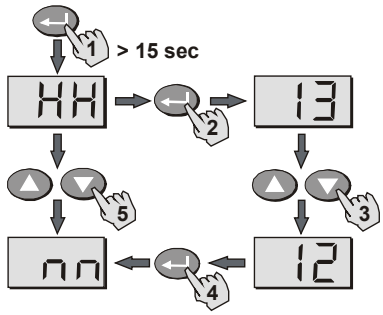
(*) Pressing "Enter" for 3 sec. will display the setpoint value that can be modified by the end user. Pressing "Enter" again will first display the Current Setpoint tag (CSP) and then it's value (Only Reading). This is the value used by the controller in the control algorithm. It can be equal to the setpoint ± the bias value (if inserted) or to the value super imposed by the network (if present).



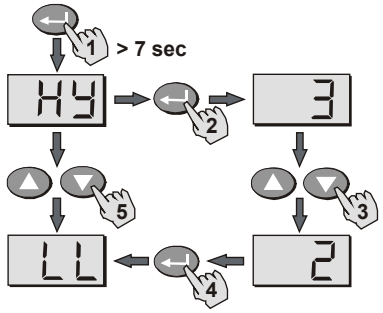
Example of Setpoint

Note

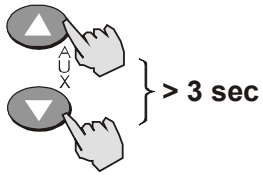
- **If no key is pushed within 10 sec the controller will leave the config. mode and proceed with its normal functions. Changes made on timers will occur only after completing the current ones, while changes on other variables will have immediate effect.**



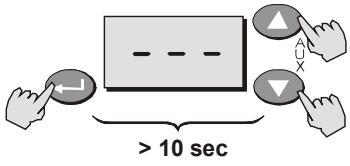
Real Time Clock Parameters



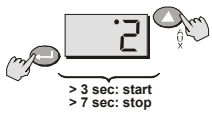
Parameters



Auxiliary

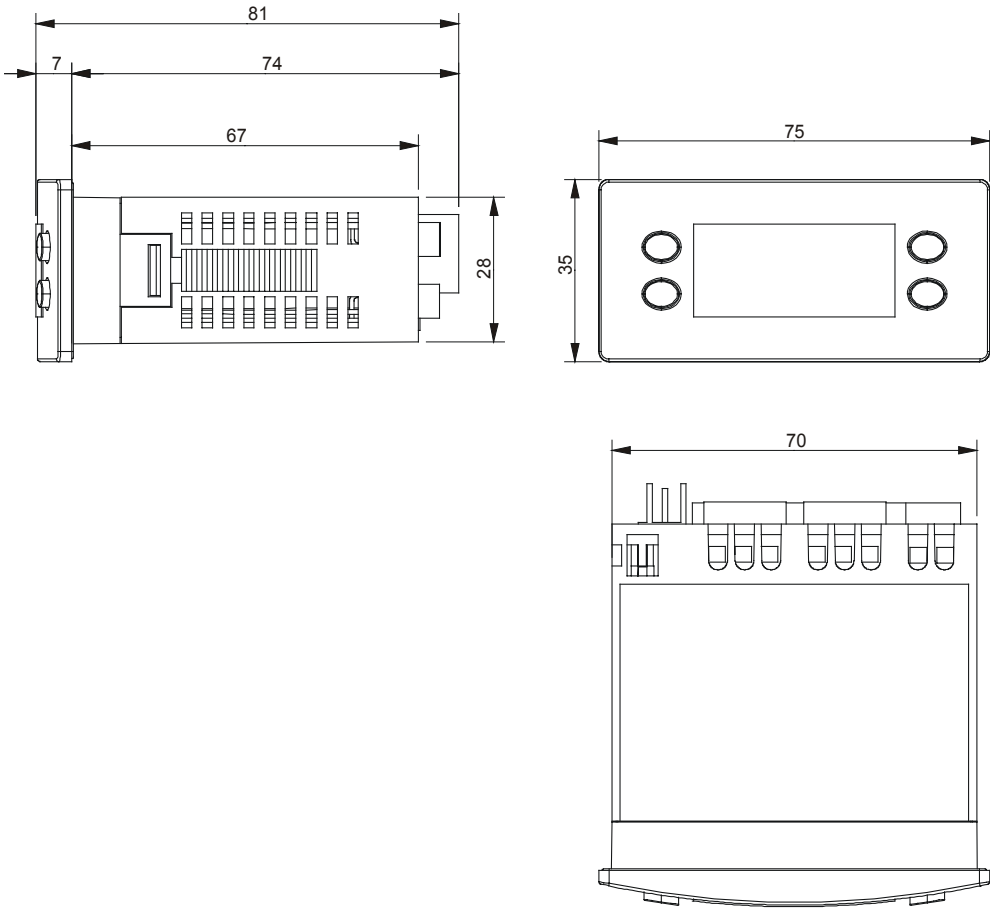


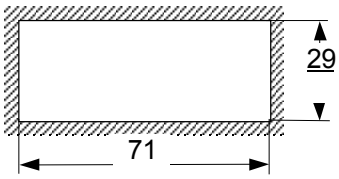
Keyboard Lock/Unlock



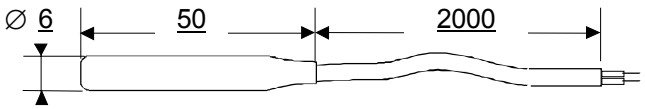
Start/Stop Deep Freezing

Dimensions *(in mm)*





Panel cut-out



A99B-9108 Temperature sensor

Wiring Instruction

WARNING:
When wiring and servicing make sure that:

- **the electric supply to the actuator is switched off to avoid possible damage to the equipment, personal injury or shock.**
- **you do not touch or attempt to connect or disconnect wires when electric power is on.**

Note

- **These MR40 are intended to control equipment under normal operating conditions. Where failure or malfunction of the MR40 could lead to an abnormal operating condition that could cause personal injury or damage to the equipment or other property, other devices (limit or safety controls) or systems (alarm or supervisory systems) intended to warn of or protect against failure or malfunction of the MR40 must be incorporated into and maintained as part of the control system.**

Thermostat with “off cycle” defrost control - MR42

This control is specifically designed for the control of static refrigeration units working at positive temperatures where defrost is performed by compressor stop

Defrost functions

A defrost Cycle can be started by:

- Internal timer
- Real Time Clock (if present)
- Network (if present)
- Digital input
- Keypad

It can be terminated only by internal timer or by a network command.
The user sets the interval between two successive cycles and its duration.
During the defrost cycle, the display can show either the last measured temperature or the setpoint. You can also delay the normal display function after a defrost cycle ends.

Configurable output

The model **MR42PM12R-A1C** has a 2nd relay which can be used either as an alarm or an auxiliary output. The auxiliary output can be energised by digital input, network or by simultaneously pressing the “▲ + ▼“ buttons on the keypad.

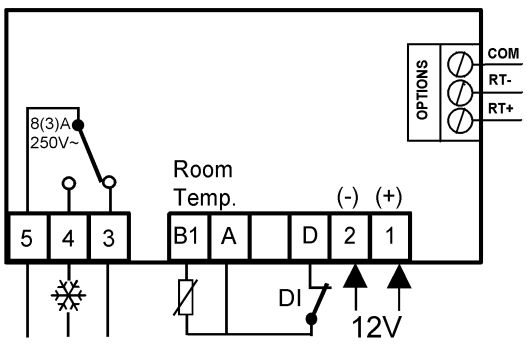
Multifunctional digital input

The digital input (normally closed) can be configured according to the unit requirements.
The functions available are:

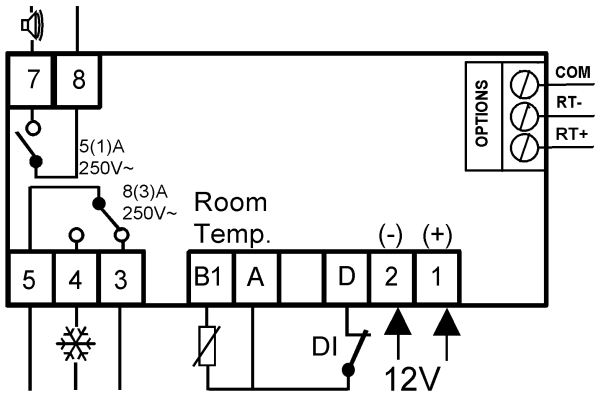
- General Alarm
- Delayed Alarm
- Door Switch
- Setpoint Bias
- Remote Defrost
- OFF mode
- Auxiliary Output Control *(MR42PM12R-A1C only)*

Note: A detailed list of available parameters and their description can be found at the end of this documentation

Wiring diagrams



Wiring diagram a)



Wiring diagram b)

Selection table:

Item code	Enclosure	Power supply	Shipping weight	Wiring diagram
MR42PM12R-1C	Panel 75x35	12 Vac/dc 50/60 Hz	240 g	a)
MR42PM12R-A1C	Panel 75 x 35	12 Vac/dc 50/60 Hz	240 g	b)

Note: One temperature sensor is included in the package.

Thermostat with active defrost management - MR43

This control is specifically designed for the control of static units working at medium, low temperatures, requiring active defrost.

This control is equipped with two sensors, one for the control of the refrigeration unit, the other sensor manages the evaporator temperature.

Defrost functions

A defrost Cycle can be started by:

- Internal timer
- Real Time Clock (if present)
- Network (if present)
- Digital input
- Keypad

It can be terminated by internal timer,
by evaporator temperature or by a network command.
Defrost can be chosen between hot gas and electrical defrost.
You can stop the compressor for an additional configurable period called dripping time.
This will allow the evaporator to dry prior to resuming normal operation.
In case of evaporator sensor failure, the defrost cycle will be terminated by 130% of the maximum defrost duration.

During defrost the display can be configured to show the last measurement before defrost or the setpoint.

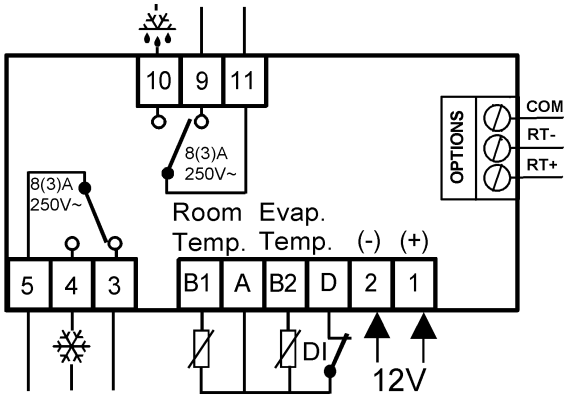
Multifunctional digital input

The digital input (normally closed) can be configured according to the unit requirements.
The functions available are:

- General Alarm
- Delayed Alarm
- Door Switch
- Setpoint Bias
- Remote Defrost
- OFF mode

Note: A detailed list of available parameters and their description can be found at the end of this documentation.

Wiring diagram



Wiring diagram a)

Selection table:

Item code	Enclosure	Power supply	Shipping weight	Wiring diagram
MR43PM12R-2C	Panel 75x35	12 Vac/dc 50/60 Hz	330 g	a)

Note: Two temperature sensors are included in the package.

Thermostat with defrost and fan management - MR44

This control is specifically designed for the control of ventilated units working at negative temperature.

This control is equipped with two sensors, one for the control of the refrigeration unit, the other sensor manages the evaporator temperature.

Defrost functions

A defrost Cycle can be started by:

- Internal timer
- Real Time Clock (if present)
- Network (if present)
- Digital input
- Keypad

It can be terminated by internal timer, by evaporator temperature or by a network command. Defrost can be chosen between hot gas, electrical or ambient defrost(by compressor stop only).
You can stop the compressor for an additional configurable period called dripping time. This will allow the evaporator to dry prior to resuming normal operation.
In case of evaporator sensor failure and end of defrost by temperature selected, as a fail safe, the defrost cycle will be terminated at 130% of the maximum defrost duration (**dd**)
During defrost the display can be configured to show the last measurement before defrost or the setpoint.

Configurable output

This model has a relay which can be used either as an alarm or an auxiliary output. The auxiliary output can be energise by digital input, network or by simultaneously pressing the "▲ + ▼" buttons on the keypad.

Multifunctional digital input

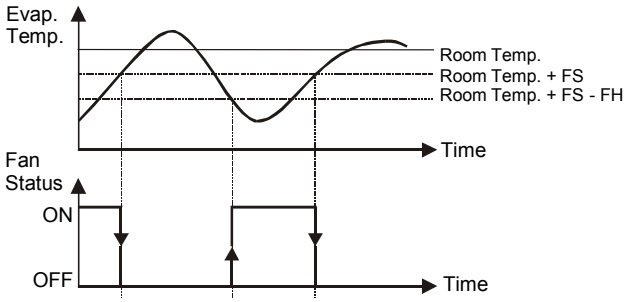
The digital input (normally closed) can be configured according to the unit requirements.
The functions available are:

1. General Alarm
2. Delayed Alarm
3. Door Switch
4. Setpoint Bias
5. Remote Defrost
6. OFF mode
7. Auxiliary Output Control
8. Fan Only Mode

Fan Management functions

The fan operations can be managed in three different ways, accordingly with the **FF** parameter:

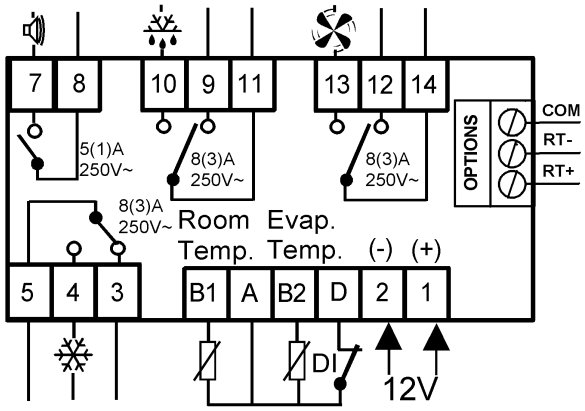
FF = 0: in parallel with compressor
FF = 1: always ON
FF = 2: based on the evaporator temperature and parameters **FS** (Fan differential), **FH** (Fan Hysteresis).



Note: FAN is always OFF during Defrost and for a programmable time after power-up and defrost end.

Note: A detailed list of available parameters and their description can be found at the end of this documentation.

Wiring diagram



Wiring diagram a)

Selection table:

Item code	Enclosure	Power supply	Shipping weight	Wiring diagram
MR44PM12R-A2C	Panel 75x35	12 Vac/dc 50/60 Hz	330 g	a)

Note: Two temperature sensors are included in the package

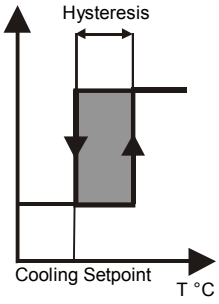
Description of each parameter

Setpoint:

is defined as the relay cut OFF.

Hy **Hysteresis**

This is the difference between the temperature at which the compressor output is switched OFF and the temperature at which the output is switched ON. This is an absolute value, related to the setpoint.



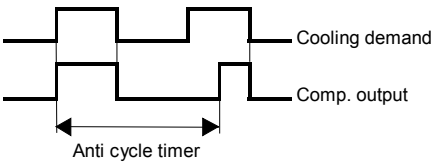
Example:
Cooling Setpoint = 4°C
Differential = 2 K
The compressor is switched ON when the temperature goes over 6°C, and is turned OFF when the temperature decreases to 4°C.

LL/HL **Lower & Higher setpoint limit**

The setpoint value cannot be adjusted outside the limits defined by these parameters, to avoid improper setpoint setting by the user.

CC **Anti short cycle protection**

This parameter prevents the compressor from being turned ON / OFF too often.
The value that you set is the minimum time between two subsequent switches ON of the output.



Co **Deep freezing time**

This is the time for which the compressor is forced ON when a deep freezing cycle is selected.

AH **High temperature alarm**

High temperature alarm value relative to setpoint. I.e. if your set point is at 4°C
AH = 5K the alarm will be triggered at 9°C.

AL **Low temperature alarm**

Low temperature alarm value relative to setpoint. I.e. if your set point is at 4°C
AL = -3K the alarm will be triggered at 1°C.

Ad **Alarm differential**

Useful to avoid alarm oscillation.
For example:
Setpoint = 4°C
High temperature alarm = 6K
Alarm differential = 2K
When the case temp. exceeds 4+6 = 10°C for a time greater than **At** the alarm is activated; when the temp. drops below 4+6-2 = 8°C the alarm is reset.

At **Alarm time delay**

Delay between the detection of the temperature alarm and the activation of the alarm sequences. This is useful to prevent temporary conditions from causing an alarm.

AC **Alarm delay after power-up and defrost end**

At power-up and after a defrost cycles the high temperature alarm will be disabled for "**AC**" minutes. The high temp. alarm is always disabled during defrost.

dF **Defrost function**

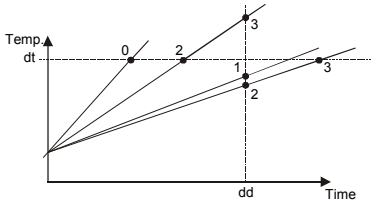
Select the type of your installation and the way defrost is performed
oFF = "Off-cycle" defrost (Compressor OFF)
ELE = Electric defrost (Compressor OFF)
HGA = Hot gas defrost (Compressor ON)

dn **Defrost initiation mode**

0 = Internal timer
1 = Real Time Clock
Note: to perform RTC defrost scheduling, RTC param. have to be configured (see RTC parameters)

dE **Defrost end function**

Select the defrost termination type:
0 = termination by evaporator temperature (parameter (**dt**))
1 = termination by time (parameter (**dd**))
2 = termination by first occurrence of the two: temperature or time
3 = termination by the last occurrence of the two: temperature or time.
In any case, should the evaporator sensor fail or for any other reason that may hinder the defrost end temperature to be reached, the defrost will end at 130% of the maximum defrost duration (**dd**).



dt **Defrost termination temperature**

When the evaporator temperature reaches this value, the defrost automatically ends.

di **Defrost interval time**

This is the time between two subsequent defrost cycles. This timer will initiate every defrost cycle. If (**di**) and (**dd**) are set to zero defrost is disabled.

dd **Maximum defrost duration**

If defrost end by time has been selected (parameter **dE**) this is duration of a defrost cycle.

dC **Dripping time**

After defrost is terminated, the compressor is stopped to allow the evaporator to drip. Only if an active defrost is performed.

dU **First defrost cycle after power-on**

This parameter allows to delay a defrost cycle, after power-up. This will prevent a cycle from occurring before the cold room has reached its operation temperature.
This function is disabled when set to "oFF".

dP **Display during defrost**

You can select what to display during the defrost cycle. This is meant to avoid misleading users during the defrost cycle.
0 = last measured value before defrost cycle
1 = setpoint

dr **Delay displayed temperature after defrost**

During defrost cycles the ambient temperature is not displayed
(see parameter **dP**). The actual temperature returns to be displayed after the time delay defined by this parameter.

iF **Digital input function**

The digital input (normally closed) can be configured according to the plant requirements:

0 = Not connected

1 = General Alarm: If the contact stays open (ON) for longer than parameter id then:
• all outputs are de-energised
• an alarm message (A1) is displayed and sent to the network
• the alarm output is energised
The alarm condition automatically resets as soon as the contact closes back.

2 = ***Delayed Alarm:*** If the contact stays open (ON) for longer than parameter **id** then:
• an alarm message (A2) is displayed;
• the alarm output energises.
• an alarm is sent to the network.
All other functions continue as usual, the alarm condition resets as soon as the contact closes back (OFF).

3 = ***Door Switch:*** As soon as the contact opens (ON) the fan is switched off
(if applicable) and if it stays open for longer parameter **id** then:
• an alarm message (A3) is displayed;
• the alarm output is energised.
• an alarm is sent to the network.
The condition automatically resets as soon as the contact closes back (OFF).

4 = ***Setpoint Bias:*** As soon as the digital input opens (ON) we have a setpoint increase or decrease by the value set in parameter (**ib**).

5 = ***Remote Defrost:*** If the contact opens (ON) a defrost cycle will start as soon as a preset delay (**id**) has elapsed. The command to the digital input has to be longer than 1 sec to be detected.

6 = ***OFF mode:*** If the digital input opens then:
• all outputs are switched OFF;
• temperature is measured and displayed alternatively with OFF.
Controller will resume normal operations as soon as the contact closes back (OFF).

7 = ***Auxiliary Output Control:*** if the digital input opens (ON) the auxiliary output is energised. Configuring **id** = 7 will automatically define the alarm/aux output as auxiliary. No alarm will effect the status of this relay any longer. (Applicable only for MR42PM12R-A1C, MR44PM12R-A2C).

8 = ***Fan Only Mode:*** As soon as the digital input opens the controller enters this special mode:
• all outputs but the evaporator fan will be de-energised;
• all alarms disabled
• “Fon” displayed
This mode is applicable only for the 4 relay model (MR44). Normal operation resumes as soon as the digital input closes back.
Especially useful for the cabinet complete defrosting prior to cleaning.

id **Digital input time delay**

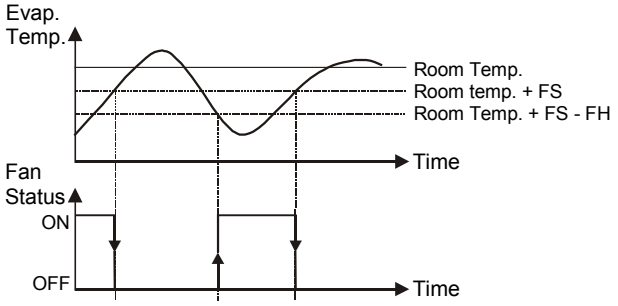
Time between the detection of the digital input opening and the enabling of the function selected through parameter (**iF**).

ib **Setpoint bias**

This value is added to the setpoint when the digital input opens (if param. **iF** = 4)

FF **Fan operating function**

0 = fan runs in parallel to the compressor
1 = fan is always ON
2 = fan managed in function of the evaporator temperature and parameters **FS** (Fan setpoint temperature)
and **FH** (Fan Hysteresis).



Note: in any case, the fan is switched OFF during the defrost cycle.

Fd **Fan start-up delay after defrost end and power up**

After defrost end and after start-up the fan start is delayed in order to make sure the evaporator temperature has dropped down. This is also a safety feature, the fan is activated after this time even if the temperature set through parameter (**Fr**) has not been reached.

Fr **Fan start-up temp. after defrost end and after power-up:**

Evaporator sensor temperature at which the fan is switched ON, after defrost cycle and after power-up.

Note: in any case the fan is switched ON after the time set through param. (**Fd**).

FS **Fan differential**

The sum of measured Room Temperature and Fan differential determines the point at which the fan is switched OFF.

FH **Fan Hysteresis**

Value used to avoid successive, too close, starts and stops of the evaporator fan.
The value RoomTemp + **FS** - **FH** is the evaporator temperature below which the fan will start.

SF **Thermostat operating function if sensor fails:**

This defines the cycle of the thermostat output in case of failure:
on = Always ON
oFF = Always OFF
AUt = Automatic
In the automatic mode, the controller will cycle the compressor On and Off with a period based on historical cycles.

So **Sensor Offset:**

This value is added to or subtracted from the measured value to compensate for possible field measurement offset errors. To compensate for extra long copper cabling use the following formula:

$$Compensation = -\frac{5 \times length}{1000 \times area} \quad \mathbf{K}$$

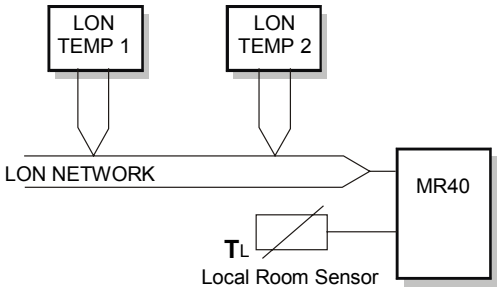
Where:
length = length of the cable in meters
area = section of the cable in square millimetres and compensate for the calculated value

Un **Temperature units**

0 = Celsius degrees
1 = Fahrenheit degrees.

Pd **Virtual Temperature**

Up to two LON temperature sensors can be used to determine the room temperature.



The temperature value used by the control algorithm is the result of following operation:

$$T_{Room} = T_X \times \frac{Pd}{100} + T_2\left(1 - \frac{Pd}{100}\right)$$

Where:
$T_X = T_L$ if T_1 is not connected or invalid
$T_X = T_1$ if connected and valid
The Pd parameter is useful to have a weighted average between two temperatures that can be measured very far apart and also very far from the controllers itself if both Lon sensors are included. The sensor failure is related to a malfunctioning of the local probe T_L or of the LON T_1 sensor.

AA **Programmable Digital Output**

The Alarm output, when present, can be configured either as alarm or auxiliary (ex. Light switch) output.

0 = ***Alarm output.*** The relay is *energised if an alarm situation occurs.*

1 = ***Auxiliary output.*** The output can be used for example to control the light of the cabinet or the door frame heater on a cold room application. The output can be activated by digital input (**iF**=7), by serial network or pressing simultaneously the UP and DOWN key on the key pad.

Add **Serial Address**

Unit address for serial communication

HH **RTC Hour setting**

It configures the hour of the Real Time Clock

nn **RTC Minute setting**

It configures the minute of the Real Time Clock.

DAy **RTC day of the week**

It configures the day of the week:

0 = Sunday
1 = Monday
2 = Tuesday
3 = Wednesday
4 = Thursday
5 = Friday
6 = Saturday

dHx **Defrost event No. x, start Hour**

It configures the defrost start **hour** of event number x (x = 1 to 6)

dnx **Defrost event No. x, start Minute**

It configures the defrost start **minute** of event number x (x = 1 to 6)

ddx **Defrost event No. x, week days**

This parameter allows to specify in which days of the week the event number x (x = 1 to 6) has to be carried out:

0 = Never
1 = all days
2 = from Monday to Friday
3 = Saturdays & Sundays
4 = from Monday to Saturday
5 = Sunday only

biH **Set point bias, Start Hour**

It configures the **hour** at which the set point will be biased to the value specified by parameter (**ib**)

bin **Set point bias, Start Minute**

It configures the **minute** of the setpoint bias insertion.

bi **Set point bias, Status**

The set point bias can be turned ON or OFF. When ON, it will be performed every day of the week.

bSH **Set point bias, Stop Hour**

It configures the **hour** at which the set point will return to its original value.

bSn **Set point bias, Stop Minute**

It configures the **minute** at which the set point will return to its original value.

Display parameters

Display code	Parameter	Setting Range	Default	MR42	MR43	MR44
Temperature control parameters						
Hy	Hysteresis	1 to 9 K	2	•	•	•
LL	Lower setpoint limit	-40°C to 70°C	-40	•	•	•
HL	Higher setpoint limit	-40°C to 70°C	70	•	•	•
CC	Anti short cycling	0 to 9 min	2	•	•	•
Co	Deep freezing time	0 to 99 min	60	•	•	•
Alarm parameters						
AH	Higher temperature alarm	0 to 50°C	10	•	•	•
AL	Low temperature alarm	-50 to 0°C	-10	•	•	•
Ad	Alarm differential	1 to 9 K	1	•	•	•
At	Alarm time delay	0 to 99 min	30	•	•	•
AC	Alarm delay after power-up and defrost	0 to 99 min	20	•	•	•
Defrost parameters						
dF	Defrost function	**oFF**(0) = "Off-Cycle" **ELE**(1) = Electric heater **HGA**(2) = Hot gas	ELE		•	•
dn	Defrost initiation mode	**0=** Internal timer **1=** Real Time Clock	0	•	•	•
dE	Defrost end function	**0=** by temperature **1=** by time **2=** first occurrence **3=** last occurrence	0		•	•
dt	Defrost termination temp	0 to 20°C	7		•	•
di	Defrost interval time	0 to 99 hours	6	•	•	•
dd	Max. defrost duration	0 to 99 min	40	•	•	•
dC	Dripping time	0 to 99 min	5	•	•	•
dU	First defrost after power on	oFF, 0 to 99 min	oFF	•	•	•
dP	Display during defrost	**0=** Last value before defrost **1=** Set point	0	•	•	•
dr	Delay displayed temp after defrost	1 to 99 min	20	•	•	•
Digital input parameters						
iF	Digital input function	**0=** Not connected **1=** General alarm **2=** Delayed alarm **3=** Door switch **4=** Setpoint bias **5=** Defrost start **6=** oFF mode **7=** AUX output control **8=** Fan only mode	0	•	•	•
id	Digital input time delay	0 to 99 min	5	•	•	•
ib	Set point bias	-10 to +10k	3	•	•	•

Display code	Parameter	Setting Range	Default	MR42	MR43	MR44
Fan control parameters						
FF	Fan operating function	**0 =** Parallel to compressor **1 =** Always ON **2 =** by temperature *Fan always OFF during defrost*	0			•
Fd	Fan start-up delay after defrost end and power-up	0 to 99 min.	5			•
Fr	Fan start-up temperature after defrost end and after power-up	-30 to +5 °C	5			•
FS	Fan differential	-30 to +5 °C	-5			•
FH	Fan hysteresis	0 to 20 °C	2			•
Other parameters						
SF	Thermostat functioning if sensor failure	**on**(1) **=** Always ON **oFF**(0)**=** Always OFF **AUt**(2)**=** Automatic	AUt	•	•	•
So	Sensor offset	-20 to +20 units	0	•	•	•
Un	Temperature units	**0 =** °C **1 =** °F	0	•	•	•
Pd	Virtual temperature weight	0 to 100 %	0	•	•	•
AA	Programmable digital output	**0 =** alarm **1 =** auxiliary	0	•		•
Add	Serial address	1 to 255	255	•	•	•
Real Time Clock parameters						
HH	Hour setting	0 to 23	0	•	•	•
nn	Minute setting	0 to 59	0	•	•	•
dAy	Day of the week setting	**0 =** Sunday **1 =** Monday **2 =** Tuesday **3 =** Wednesday **4 =** Thursday **5 =** Friday **6 =** Saturday	0	•	•	•
dHx **x=1 to 6**	Event No. x Hour setting	0 to 23	8	•	•	•
dnx **x=1 to 6**	Event No. x Minute setting	0 to 59	0	•	•	•
ddx **x=1 to 6**	Event No. x weekday setting	**0 =** Never **1 =** all days **2 =** from Monday to Friday **3 =** Saturdays & Sundays **4 =** from Monday to Saturday **5 =** Sundays only	0	•	•	•
biH	Bias Start Hour	0 to 23	20	•	•	•
bin	Bias Start Minute	0 to 59	0	•	•	•
bi	Bias Status	on / oFF	oFF	•	•	•
bSH	Bias Stop Hour	0 to 23	0	•	•	•
bSn	Bias Stop Minute	0 to 59	0	•	•	•

Network parameters

Name	N2 Region	Addr	Short Name	LON type	SNVT #	Information Flow	Unit	Description	MR42	MR43	MR44
Network Variable Inputs (NVI)											
nviAirTemp1	ADF	5	adf-6	SNVT_temp_p	105	WRITE	°C	Network Case Temp. Sensor 1	●	●	●
nviAirTemp2	ADF	6	adf-7	SNVT_temp_p	105	WRITE	°C	Network Case Temp. Sensor 2	●	●	●
nviTemperature1	ADF	7	adf-8	SNVT_temp_p	105	WRITE	°C	Network Evaporator Sensor 1		●	●
nviTemperature2	ADF	8	adf-9	SNVT_temp_p	105	WRITE	°C	Network Evaporator Sensor 2		●	●
nviCutoutTemp	ADF	9	adf-10	SNVT_temp_p	105	WRITE	°C	Network Set Point	●	●	●
nviDefrostEnable (*)	BD	2	bd-3	SNVT_lev_disc	22	WRITE		Network defrost command	●	●	●
nviDayNight (*)	BD	3	bd-4	SNVT_lev_disc	22	WRITE		Network bias insertion command	●	●	●
nviOffNet (**)	ADF	10	adf-11	SNVT_switch	95	WRITE	%	Network selection of the OFF state	●	●	●
nviOffNet	BD	4	bd-5	SNVT_switch	95	WRITE		Network selection of the OFF state	●	●	●
nviFanOnly (**)	ADF	11	adf-12	SNVT_switch	95	WRITE	%	Network selection of the FAN Only Mode state			●
nviFanOnly	BD	5	bd-6	SNVT_switch	95	WRITE		Network selection of the FAN Only Mode state			●
NviDeepFreezing (**)	ADF	12	adf-13	SNVT_switch	95	WRITE	%	Network selection of the Deep Freezing mode	●	●	●
nviDeepFreezing	BD	6	bd-7	SNVT_switch	95	WRITE		Network selection of the Deep Freezing mode	●	●	●
NviAuxiliary (**)	ADF	13	adf-14	SNVT_switch	95	WRITE	%	Network command to the auxiliary output.	●		●
nviAuxiliary	BD	7	bd-8	SNVT_switch	95	WRITE		Network command to the auxiliary output.	●		●

(*): set the BD variable to 0 for OFF, to 4 for ON and to 255 for invalid: 0 (OFF), 4 (ON), 255 (invalid)
(**): set the ADF variable ≠ 0 at least once and then work with the correspondent BD variable: 0 (ON), 1 (OFF), 255 (invalid)

Name	N2 Region	Addr	Short Name	LON type	SNVT #	Information Flow	Unit	Description	MR42	MR43	MR44
Network Variable Outputs (NVO)											
NvoAirTemp	ADF	0	adf-1	SNVT_temp_p	105	READ	°C	Case temperature	●	●	●
NvoCutOutTemp	ADF	1	adf-2	SNVT_temp_p	105	READ	°C	Current setpoint (CSP)	●	●	●
NvoTemperature1	ADF	2	adf-3	SNVT_temp_p	105	READ	°C	Evaporator temperature		●	●
NvoDisplay	ADF	4	adf-5	SNVT_count_f	51	READ	°C	Case temperature shown on the display	●	●	●
NvoDefrostState	BD	0	bd-1	SNVT_defr_state	122	READ		Defrost Status: 0 (standby), 2 (defrost), 3 (Draindown)	●	●	●
NvoDigitalInput	BD	1	bd-2	SNVT_switch	95	READ		Status of the digital input: 0 (closed), 1 (open)	●	●	●
NvoOffState	BD	8	bd-9	SNVT_switch	95	READ		Thermostat status: OFF / ON; 0 (OFF), 1 (ON)	●	●	●
NvoThermostateState	ADI	0	Adi-1	SNVT_state	83	READ		Current state of the thermostat **(*)**	●	●	●
NvoState	DI1	1	Adi-2	SNVT_state	83	READ		I/O state **(**)**	●	●	●

(*): *NvoThermostatState* value depends from the activated bits with the following meanings:

Bit #	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Value	32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1
Function	Controller in Alarm	Door Open	High temp. alarm	Low temp. alarm	Alarm level	Case temp. sensor failure	Evaporator coil sensor failure	General alarm from DI	Not used	Not used	Not used	Not used	Bias setpoint inserted	Not used	**1** if cooling required **0** if cooling not required	Always at 1

(**): *NvoState* value depends from the activated bits with the following meanings:

Bit #	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Value	32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1
Function	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not used	Not used	Not used	Not used	Defrost Output	Alarm/ Aux Output	Fan Output	Compr Output

Name	Display Code	N2 Region	Addr	Short Name	LON type	SNVT #	Inform. Flow	Unit	Min	Max	Def	Description	MR42	MR43	MR44
Network Configuration Parameters (CP)															
nciCutOutValue		ADF	17	adf-18	SNVT_temp_p	105	RD/WR	°C	-45	99	4	Setpoint	●	●	●
nciDifferenceValue	**Hy**	ADF	18	adf-19	SNVT_temp_p	105	RD/WR	°C	1	9	2	Hysteresis	●	●	●
nciLowSetpointLimit	**LL**	ADF	21	adf-22	SNVT_temp_p	105	RD/WR	°C	-40	70	-40	Lower setpoint limit	●	●	●
nciHighSetpointLimit	**HL**	ADF	20	adf-21	SNVT_temp_p	105	RD/WR	°C	-40	70	70	Higher setpoint limit	●	●	●
nciAntiShortCycle	**CC**	ADF	22	adf-23	SNVT_time_sec	107	RD/WR	sec	0	540	120	Anti short-cycling	●	●	●
nciDeepFreezingTime	**Co**	ADI	3	adi-4	SNVT_time_min	123	RD/WR	min	0	99	60	Deep freezing time	●	●	●
nciHighLimitTemp	**AH**	ADF	23	adf-24	SNVT_temp_p	105	RD/WR	°C	2	50	10	High temperature alarm	●	●	●
nciLowLimitTemp	**AL**	ADF	24	adf-25	SNVT_temp_p	105	RD/WR	°C	-50	-2	-10	Low temperature alarm	●	●	●
nciAlarmDifference	**Ad**	ADF	26	adf-27	SNVT_temp_p	105	RD/WR	°C	1	9	1	Alarm differential	●	●	●
nciAlarmDelay	**At**	ADF	25	adf-26	SNVT_time_sec	107	RD/WR	sec	120	5940	1800	Alarm time delay	●	●	●
nciTimealarmDis	**AC**	ADI	9	adi-10	SNVT_time_min	123	RD/WR	min	0	99	20	Alarm delay after power-up and defrost end.	●	●	●
nciDefrostMode	**dF**	BD	11	bd-12	SNVT_defr_mode	120	RD/WR		0	2	1	Defrost function		●	●
nciDefrostInitiationMode	**dn**	BD	21	bd-22	UNVT_enumeration	10175	RD/WR		0	1	0	Defrost initiation mode See **dn** parameter description	●	●	●
nciTerminateTimeTemp	**dE**	BD	12	bd-13	SNVT_defr_term	121	RD/WR		0	3	0	Defrost end function See **dE** parameter description		●	●
nciDefrostStopTemp	**dt**	ADF	27	adf-28	SNVT_temp_p	105	RD/WR	°C	0	20	7	Defrost termination temperature		●	●
nciDefrostInterval	**di**	ADI	6	adi-7	SNVT_time_min	123	RD/WR	min	0	5940	360	Defrost interval time	●	●	●
nciMaxDefrostTime	**dd**	ADI	4	adi-5	SNVT_time_min	123	RD/WR	min	0	99	40	Max. defrost duration	●	●	●
nciDrainDelay	**dC**	ADI	5	adi-6	SNVT_time_min	123	RD/WR	min	0	99	5	Dripping time	●	●	●
nciFirstDefrost	**dU**	ADI	7	adi-8	SNVT_time_min	123	RD/WR	min	0	99	65535 (OFF)	first defrost after power-up	●	●	●
nciDisplayDuringDef	**dP**	BD	13	bd-14	UNVT_logic	10149	RD/WR		0	1	0	Display during defrost See **dP** parameter description	●	●	●

Name	Display Code	N2 Region	Addr	Short Name	LON type	SNVT #	Inform. Flow	Unit	Min	Max	Def	Description	MR42	MR43	MR44
Network Configuration Parameters (CP)															
nciDelayDisplay	**dr**	ADI	8	adi-9	SNVT_time_min	123	RD/WR		1	99	20	Delay displayed temp. after defrost	●	●	●
nciDIFunction	**iF**	BD	9	bd-10	SNVT_enumeration	10175	RD/WR		0	8	0	Digital input function. See **iF** parameter description	●	●	●
nciDigitalInputDelay	**id**	ADI	2	adi-3	SNVT_time_min	123	RD/WR	min	1	99	5	digital input time delay	●	●	●
nciDeltaNight	**ib**	ADF	19	adf-20	SNVT_temp_p	105	RD/WR	°C	-10	10	3	Setpoint bias for night time operations	●	●	●
nciFanFunction	**FF**	BD	10	bd-11	SNVT_enumeration	10175	RD/WR		0	2	0	Fan operating functions. See **FF** param. description			●
nciFanDelay	**Fd**	ADI	10	adi-11	SNVT_time_min	123	RD/WR	min	0	99	5	Fan start up delay after power-up and defrost end			●
nciFanTemperature	**Fr**	ADF	28	adf-29	SNVT_temp_p	105	RD/WR	°C	-30	5	5	Fan start up temperature after defrost end			●
nciEvapFanSetpoint	**FS**	ADF	29	adf-30	SNVT_temp_p	105	RD/WR	°C	-30	5	-5	Fan differential			●
nciEvapFanHist	**FH**	ADF	30	adf-31	SNVT_temp_p	105	RD/WR	°C	0	20	2	Fan hysteresis			●
nciSensorFailure	**SF**	BD	16	bd-17	UNVT_logic	10149	RD/WR		0	2	2	Thermostat function if sensor failure. See **SF** parameter description	●	●	●
nciSensorOffset	**So**	ADF	16	adf-17	SNVT_temp_p	105	RD/WR	°C	-20	20	0	Sensor offset	●	●	●
nciAirTempPercent	**Pd**	ADF	15	adf-16	SNVT_lev_percent	81	RD/WR	%	0	100	0	Virtual temper. weight	●	●	●
nciAlarmAux	**AA**	DB	13	bd-14	UNVT_sf_function	10158	RD/WR		0	1	0	Programmable digital output. See **AA** parameter description	●		●
nciLocation					SNVT_str_asc	36	RD/WR		0	255	0	LON address of the specific device	●	●	●
nciMaxSendTime					SNVT_time_sec	107	RD/WR		5	6553	5	Minimum frequency of production of Network Variable Outputs (LON compatibility)	●	●	●
nciMinSendTime					SNVT_time_sec	107	RD/WR		0	6553	0	Present only for LON compatibility but not used			
nciRcvHrtBt					SNVT_time_sec	107	RD/WR		0	6553	0	Receiving heart bit	●	●	●

Accessories

Item Code	Description
TR230/12-1	Transformer 230/12 - 3 VA
A99B-9108	Sensor, cable length: 2mt IP68
LP-RTC05-001C	Plug-in Real Time Card
LP-RTC05-001D	Plug-in Real Time Card, bulk pack 50 pcs
LP-NET051-000C	Plug-in N2Open communication card
LP-NET051-000D	Plug-in N2Open communication card, bulk pack 50 pcs
LP-NET052-001C	Plug-in LON communication card, MR40 profile
LP-NET052-001D	Plug-in LON communication card, MR40 profile, bulk pack 50 pcs

Alarm Codes and Messages

Code	Cause	System Status
F1	Open or shorted room temperature sensor	• Alarm output energised (if present) • Compressor output in function of param. **SF** • Automatic reset
F2	Open or shorted evaporator temperature sensor	• Alarm output energised (if present) • Defrost end only by time • Fan managed in parallel to compressor • Automatic reset
A1	General Alarm: Digital input open for longer than param. **id** and **iF** = 1	• Alarm output energised (if present) • All other outputs go OFF • Automatic reset
A2	Delayed Alarm: Digital input open for longer than param. **id** and **iF** = 2	• Alarm output energised (if present) • Automatic reset
A3	Door Switch: Digital input open after delay **id,** and **iF** = 3	• Far forced OFF immediately • Alarm output energised (if present) • Automatic reset
Hi	Room temperature has reached or exceeded (Setpoint + **AH**) and delay **At** elapsed.	• Alarm output energised (if present) • Automatic reset
Lo	Room temperature has reached or fallen below (Setpoint + **AL**) and delay **At** elapsed.	• Alarm output energised (if present) • Compressor output OFF • Automatic reset
EE	Program failure	• Replace controller
Fon	**iF** = 8 and digital input open	• Controller in Fan Only Mode. See parameter **iF** = 8
oFF	**iF** = 6 and digital input open	• Controller in OFF Mode. See parameter **iF** = 6

Repair and replacement

Field repair is not possible. In case of defective or improperly functioning control, please check with your nearest supplier. When contacting the supplier for replacement, you should state the type-model number of the control. This number can be found on the data plate.

Technical Data

Product	MR40				
Power Requirements	12 Vac/dc ±10%; 50/60 Hz				
Power Consumption	2.5 VA				
Protection Class	Front plate IP 54 Rear IP 20				
Ambient Operating Conditions	-10° to +55 °C (14° to 131°F) 10 to 95 % RH (non condensing)				
Ambient Storage Conditions	-30° to +80 °C (-22° to +176°F) 10 to 95 % RH (non condensing)				
Range	-40 to +70°C				
Display Resolution	± 0.1°C between -9.9°C and +99.9°C				
Control Accuracy	± 0.3 (sensor not included)				
Sensor Cable	2 meters				
Output Ratings	**(250Vac)**	**Compressor**	**Alarm / AUX**	**Defrost**	**Fan**
	MR42PM12R-1C	SPDT 8(3)A			
	MR42PM12R-A1C	SPDT 8(3)A	SPST 5(1)A		
	MR43PM12R-2C	SPDT 8(3)A		SPDT 8(3)A	
	MR44PM12R-A2C*	SPDT 8(3)A	SPST 5(1)A	SPDT 8(3)A	SPDT 8(3)A
	*** Max. current on common = 20 Amps**				
Dimensions (H x W x D)	35 x 75 x 81mm				
CE Compliance	73/23/EEC directive: EN 60730 89/336/EEC directive: EN 50081-1, EN 50082-2				

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office or representative. Johnson Controls shall not be liable for damages resulting from misapplication or misuse of its products. This document is subject to change without prior notice.

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