



Measuring - Controlling - Regulating
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Milk temperature regulator

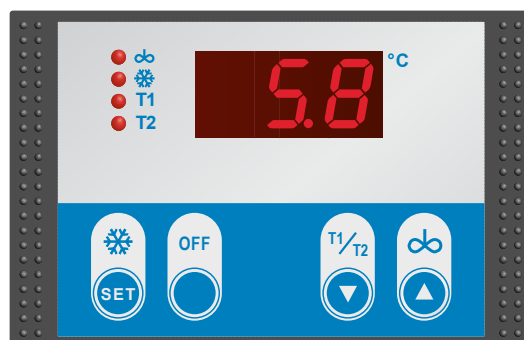
MRF-M2

Installation and operating instructions
for plant engineering companies,
installers and service engineers

Firmware V2.2



**Programmable via
configuration software
WELBA „KONSOFT“**



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Publisher:

Welba GmbH
Electronic Control Engineering
Gewerbepark Siebenmorgen 6
D-53547 Breitscheid

Fon: +49 (0)2638 / 9320-0
Fax: +49 (0)2638 / 9320-20
info@welba.de
www.welba.de

1. Introduction

1.1 Information about this operating instructions

These operating instructions are intended for the use by plant engineers, installers or service technicians of the MRF-M2 milk temperature regulator. This manual contains all necessary suggestions, information, recommendations and advice for the safe and proper installation and commissioning of the milk temperature regulator. It is only with the knowledge of this operating instruction that errors at the regulator can be avoided and a trouble-free operation is guaranteed.

Read the assembly instructions carefully and adhere to the recommendations described in order to ensure proper operation. In addition, the local accident prevention regulations and general safety regulations are to be observed for the field of application of the milk temperature regulator.



WARNING

When delivered, the parameterization of the MRF-M2 does not necessarily correspond to the intended use. This must be adjusted accordingly during the installation.

Basically, the installer of the system is responsible for the commissioning of the regulator.

Operation instruction for the operator

The plant engineers, the installer or the service technician must prepare operating instructions for the operator of the milk temperature regulator (farmer). In this case the parameterization of the delivery state must be clearly documented.

We recommend to only document those parameters which the operator of the regulator needs.

When preparing the operating instructions for the operator the local regulations have to be observed - see chapter "Safety".

NOTICE

These operating instructions include important technical and safety information. It is vital to carefully study all these instructions before the installation of the regulator or in case of any other work with the regulator!

The manufacturer accepts no liability for errors and reserves the right to make technical changes at any time. All rights reserved.

NOTICE

NOTICE for storing the operating instructions

This instruction manual is part of the product and must always be readily available for the service technician.



WELBA „KONSOF“

The free of charge configuration Software KONSOF provides a simple parameterization and updating of the milk temperature regulator as well as a comfortable evaluation of the determined data.

See also section 5.2

1.2 Limitation of liability



The proper function of the MRF-M2 depends on many external factors on which the manufacturer has no influence. The manufacturer accepts no liability for any damages on the milk cooling tank, the connected components or the milk.

All information and instructions in this manual have been compiled taking into account the applicable standards and regulations, the state of the art and our long-term experiences.

These instructions have been compiled with maximum care and attention. However, their content does not constitute an assurance of product features.

The manufacturer accepts no liability for errors and reserves the right to make technical changes at any time. All rights reserved.

WELBA GmbH does not assume any liability for damages due to:

- Non-observance of the installation instruction
- Improper use
- Installation by unqualified staff
- Non-approved outdoor installation
- Unauthorized modifications
- Technical modifications

Otherwise, our general terms and conditions as well as the terms of delivery of WELBA GmbH and the legal regulations valid at the time of conclusion of the contract are applicable.

We reserve the right to make technical changes in the context of improving the properties of use and further developments.

1.3 Warning notices in these operating instructions

Important safety information in these assembly instructions are identified by symbols. These instructions on occupational safety must be adhered to and followed. In these cases, behave particularly carefully in order to avoid accidents, personal injury and property damage.

In addition to the information in these assembly instructions, the general and local safety and accident prevention regulations must also be observed and instructed!



Nature and source of danger

This warning sign warns of an imminent danger to health and life of people. Failure to comply with this warning will result in extremely serious injuries, including death.



Nature and source of danger

This warning sign warns of a possibly dangerous situation for the health of people. Failure to observe these warning notices can result in serious injuries, including death.



Nature and source of danger

This warning sign warns of a possibly dangerous situation for the health of people. Failure to observe these warnings can lead to minor or moderate injuries.

NOTICE

Note

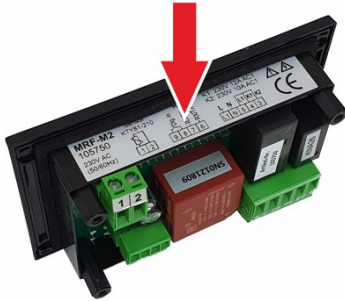
General notes contain application tips and particularly useful information, but no warnings about dangers.

1. Introduction

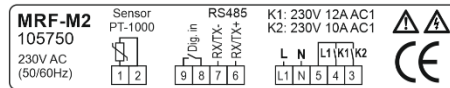
1.4 Model / type plate

These instructions apply to all controllers in the series MRF-M2.

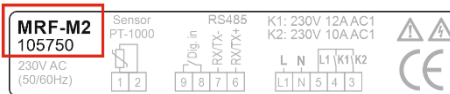
The type designation and the exact connection diagram for your controller can be found on the controller as a connection sticker.



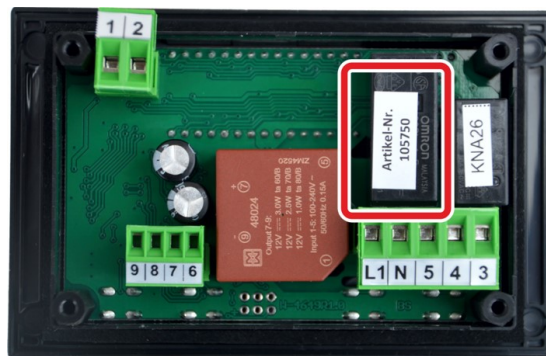
Example:



Controller type designation:



and



1.5 Items supplied

- Milk temperature regulator MRF-M2
- Accompanying documentation
- Holder
- Rubber seal
- Temperature sensor PT-1000
- Fixing screws
- Optional accessories that may have been ordered

1.6 Disposal



For the purposes of disposal, the device is classified as waste electronic equipment within the meaning of European Directive 2002/96/EC (WEEE) and must not be included with household waste. It must be disposed of through the correct channels.

Local and current legislation must be observed.

1.7 Cleaning instructions

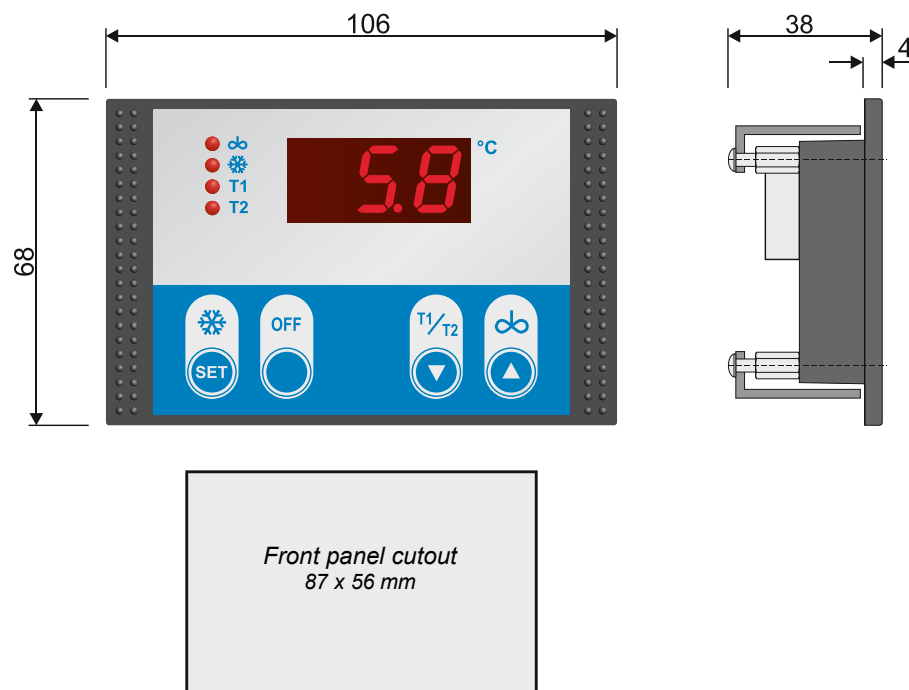
NOTICE

The enclosure front (front foil) can be cleaned with usual detergents.

ATTENTION: The enclosure front is not resistant to aggressive acids and alkalis, abrasive cleaners and cleaning with high-pressure cleaners!

The use of these cleaners and cleaning methods may lead to damages!

1.8 Dimensions

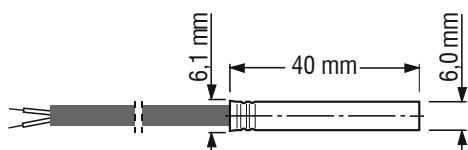


1.9 Technical data regulator

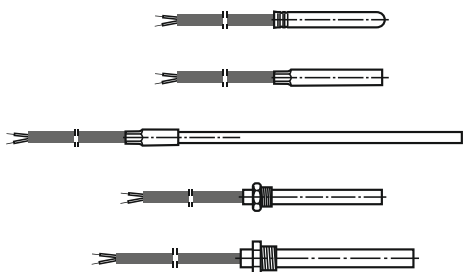
Operating voltage	230V AC +/-10%, 50/60 Hz
Relay contact	2 power relay
max. switching current	K1 = 12A AC1 - 230V AC K2 = 10A AC1 - 230V AC
max. switching voltage	250V AC - 50..60 Hz
Display	13 mm LED-Display, 3 digits
Display range	-99 .. 999
Switching status displays	3 mm LED
Number of sensor inputs	1
Type of sensor	PT-1000
Sensor cable length	2 metres
Measurement range	-20° .. +120°C
Temperature resolution	0.1°C
Control mode	two-step controller
Hysteresis	0,1 K .. 10 K (standard adjusting 0,7 K)
Target temperature T1* Target temperature T2*	standard adjusting 4°C standard adjusting 4°C
Agitator - Rest time (interval) * - Agitating time*	standard adjusting 20 min. standard adjusting 2 min.
Digital input	1
Interface	RS-485
Connection	Plug-in screw connections for cables up to 2.5 mm ²
Housing - Front dimension - Front panel cutout - Insertion depth	86 x 106 mm 56 x 87 mm 38 mm
Protection - Housing front - Rear	The control is open on the rear, as it is designed for installation in a closed housing. IP 64 IP 00
Electrical safety	Protection class II, Overvoltage category III, pollution degree I
Environment specifications: - Operation temperature - Storage temperature - max. humidity	0° .. +50°C -20° .. +70°C 75% (no dew)
Pollution degree	Electrically conductive pollution must not enter the housing interior

* = freely adjustable
Technical data subject to change.

1.10 Sensor dimensions und technical data sensor



Sensor element	PT-1000
Bush material	1.4301 (V2A)
Bush length	40 mm
Bush diameter	6,0 mm +/- 0.1
Cable material	PVC
Measurement range	-10 .. 70° C
Cable length	standard 2 metres



In contrast to our standard sensors, we also offer sensors with other sleeve shapes and diameters or other cable lengths.

2. Safety

2.1 General Information



The plant engineering company, the installer or the service engineer must prepare operating instructions for the operator, taking account of the controller's parameters as supplied.

We recommend referring only to the parameters which the end user needs for safe operation.

In preparing the operating instructions for the end user, especially the chapter on "Safety", account must be taken of local regulations.

IMPORTANT NOTE

The parameter settings of the MRF-M2 as supplied do not correspond to the intended use. This can lead to undefined behaviour by individual components when the system is commissioned.

The general principle is that the plant constructor is responsible for putting the regulator into operation.



These operating instructions contain important technical and safety information. Please read carefully before installation and before any work on or with the regulator.

It is the duty of the party commissioning the system to ensure compliance with the following guidelines.

The regulator may only be installed by an authorised electro specialist, observing all local safety requirements.

Access to the environment when connected must be restricted to specialised personnel.

The regulator contain live components. They must be built into the plant in such a way that contact with such live components is impossible.

The regulator is not suitable for use in explosive atmospheres. Danger of explosion. Use only outside areas subject to explosive atmospheres.

The regulator must not be used if the housing or connection terminals are damaged.

No fluids must penetrate the housing.

The regulator may not be exported to the USA without the manufacturer's express permission!

2.2 Intended use

NOTICE

These operating instructions contain important technical and safety information. Please read carefully before installation and before any work on or with the regulator!

The milk temperature regulator MRF-M2 is used to control agitator motors, compressors and other components in milk cooling tanks. Any other use of the device is permitted only with prior written permission from the manufacturer.

The regulator is intended only for incorporating into machinery, display panels or switchboxes etc. and when fitted corresponding to protection class 2 (double or reinforced insulation). It is only allowed to be put into operation in installed state. The use of the regulator is permitted in devices of protection class 1 and 2. The regulator must not be modified or converted in any way!

The milk temperature regulator is ready for use only when the parameters have been set appropriately. Its use before this has been done would have no benefits and could also damage the equipment or adversely affect the milk to be temperature-controlled.

Responsibility for the faultless functioning of the connected devices lies with the plant engineer or the installer or the service engineer who has installed and commissioned the MFR-M2.

The regulator is fitted with a resistance temperature sensor.



The milk temperature regulator MRF-M2 is not suitable for use in explosive atmospheres. Danger of explosion. Use only outside areas subject to explosive atmospheres.

The regulator fulfils the EC requirements for electromagnetic compatibility (EMC) and the Low Voltage Directive (LVD).

The safety components meet the VDE regulations

2.3 Wiring, screening, earthing

When selecting wiring materials and installing and connecting the temperature controller to the electricity supply, account must be taken of DIN VDE 0100 "Erection of power installations with rated voltages below 1000" or the relevant national regulations (e.g. based on IEC 60364).

- Wherever possible, keep input, output and supply leads and sensor cable physically separate from each other and do not lay them parallel to each other.
- Mains voltage cables and low-voltage cables must not be laid in one cable.
- Use screened and twisted interface and sensor cables.
- Earth the screening of temperature sensors unilaterally in the switchbox.
- Ensure correctly wired potential equalisation.

2.4 Electrical safety

- The regulator itself and the associated control circuits and load circuits must be protected separately and in accordance with the local regulations.
- The separate protection of the control- and load circuit must be carried out according to local conditions!
- In order to prevent destruction of the relay or semiconductor relay outputs in the event of a short-circuit, the load circuit should be fused to the maximum permissible output current.
- As well as incorrect installation, wrong parameter settings can also adversely affect the correct functioning of the controller. For this reason, safety devices that are independent of the controller should always be used, e.g. high and low pressure valves or temperature limiters. Account should be taken of the local safety regulations in this connection.
- The load circuit (relay outputs K1 to K12) must be fused in accordance with the connected components.
- The connection of external voltages to the digital inputs can lead to the destruction of the control.
- Caution: All cables to the digital inputs must be shielded and kept as short as possible. EMC.

3. Installation

3.1 Location and climatic conditions

It is essential not to install the device under the following conditions:

- severe jolting, vibration or magnetic fields
- permanent contact with water
- relative humidity of more than 90%
- sharply fluctuating temperatures (condensation)
- permanent and direct UV radiation
- dust, flammable gases, vapours, solvents,
- operation in an aggressive atmosphere (ammonia or sulphur fumes) - risk of oxidation
- operation in the immediate vicinity of radio transmitters with high levels of spurious radiation.

A physical separation between the device and inductive consumers is recommended.

3.2 Unpacking and storage

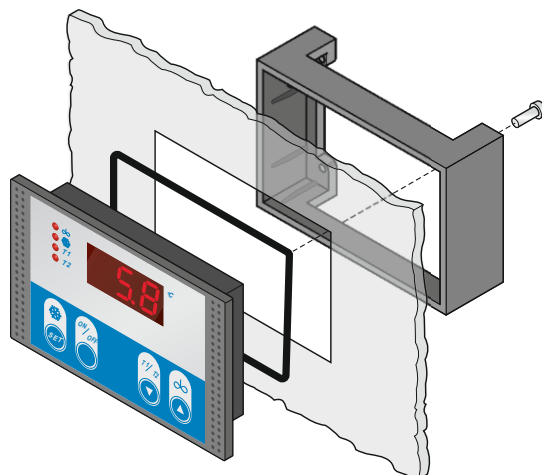
If the packaging is damaged or something is missing, do not fit the temperature controller. In this case please contact Welba.

If you keep the temperature controller for a period before using it, store it in a clean dry place at a temperature of between -20°C and +70°C.

3.3 Installation of housing

For fixing the housing please follow the instructions:

- Place the seal carefully in the groove. Ensure it is not twisted.
- Insert the housing from the front through the switchboard cut-out.
- Attach the holding frame in the rear position as shown by the picture.
- Fasten the housing by using the screws provided.



*Front panel cut-out
87 x 56 mm*

3. Installation

3.4 Fitting the sensor

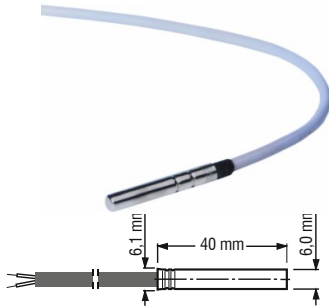


The sensor cable must not be chafed or kinked.

There must be no substantial mechanical pressure on the sensor tube.

Do not place the sensor and the high-voltage cable in the same cable conduit (not even within the switchbox).

Temperature range sensor cable -10°C .. +70°C.



When setting the temperature regulator parameters (and whenever the sensor is replaced) the "actual value correction" [Parameter C91] must be adjusted so that the temperature measured corresponds to that shown on the display. A reference thermometer should be used for this purpose.

See section 7.6



Pay attention to the permitted temperature range for sensor cable exposure.

3.4.1 Changing the sensor cable length

If it is necessary to shorten or lengthen the sensor cable on installation (or if a sensor other than the one supplied is to be fitted), the "actual value correction" parameter must be adjusted accordingly. See section 7.6

4. Electrical connection

4.1 Safety during installation



WARNING

Before connecting ensure that the mains voltage is the same as indicated on the device's type plate.

Incorrect electrical connection can cause damage to the regulator and to the equipment.

The regulator should be disconnected from the mains voltage while connecting plant components or the sensor.

No appliances with current levels in excess of the maximum values indicated in the technical data should be connected to the relay contacts.

No other consumers may be connected to the controller's mains terminals.

4.2 Procedure



WARNING

In order to avoid injury to persons or damage to connected components, connections must in all cases be undertaken in the following order!

- Pull out all the regulator's plug-in terminals.
- Put the controller in position in the housing or switchboard. See section 3.3
- De-energize the system.
- Connect all components and sensors in accordance with section 4.3 (Circuit diagram) to the plug-in terminals.
Do not yet plug the terminals into the controller!
- Connect the mains cable to plug-in terminal A1 / A2.
- Plug terminal A1/ A2 into the regulator.
- Close the switchbox and turn on the mains voltage.

- Switch on the regulator and set the parameters
(possibly using the optional WELBA-KONSOFT configuration software).
- Plug the pre-cabled plug-in terminals of the components into the regulator.
- Close the switchbox.

4. Electrical connection

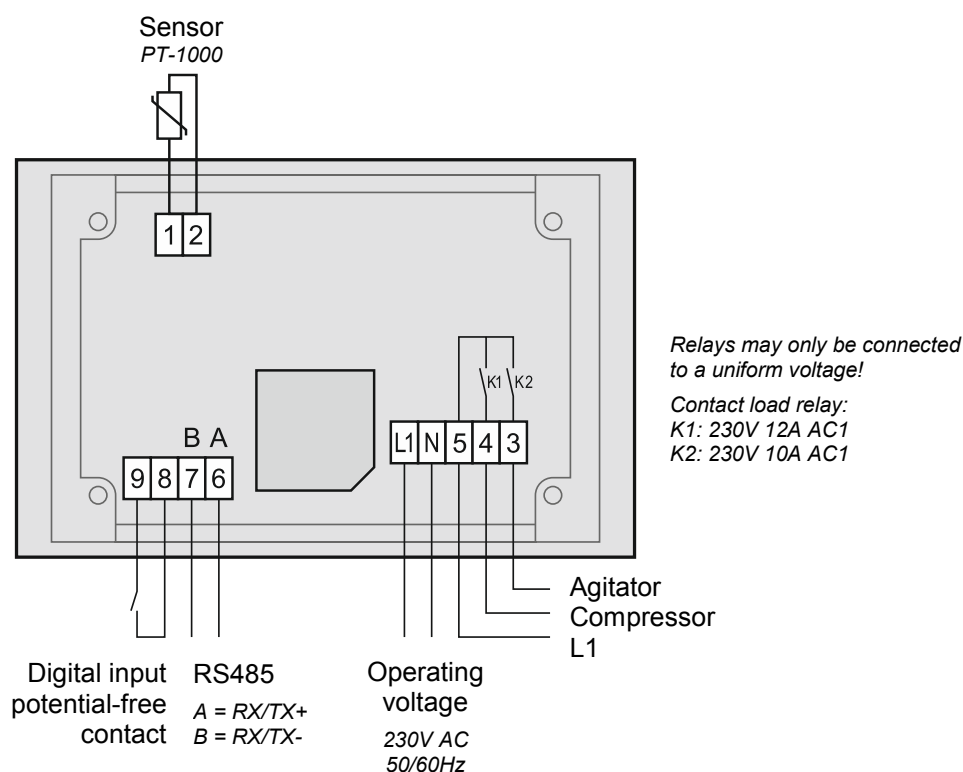
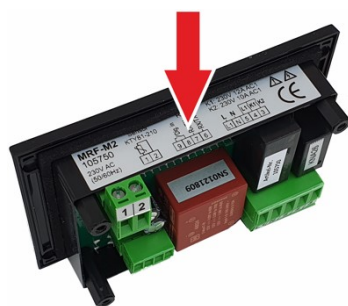
4.3 Wiring / circuit diagram

Correct wiring in accordance with the information in the accompanying description and local regulations is essential.

Please note the following:

- Use cable bushes.
- Make sure that cables cannot chafe!
- Take particular care to ensure that the AC supply is not connected to the sensor input or other low-voltage inputs or outputs.
- The two relay contacts may only be connected with the same voltage.
- When connecting the regulator and selecting the wiring materials to be used, it is essential to comply with the provisions of DIN VDE 0100 "Erection of power installations with rated voltages below 1000" or the relevant national regulations.

The correct circuit diagram for your regulator is affixed to the housing.



- Connect the compressor and agitator etc. according to the circuit diagram. The compressor must not be connected directly to the relays on the control unit. This must be switched using an additional contactor. In individual cases, it must be checked whether additional motor protection switches or other safety devices are to be installed.
- Contactors are to be fitted with an RC protective circuit. See section 7.10

4.3.1 Wiring the digital input

Terminals 8 and 9 may only be connected to a potential-free normally open contact.

ATTENTION: do not apply any external voltage!



5. Operating

5.1 Function overview



The MRF-M2 is a milk temperature regulator. It distinguishes between three different operating modes:



5.1.1 OFF mode (Stand-by)

The controller is in stand-by mode.

- 'OFF' is shown in the display,
- all LEDs are out.
- both output relays are deactivated.



CAUTION: The control unit is live even when switched off!



5.1.2 Cooling mode

The cooling mode can only be started from the OFF mode. When the cooling mode is activated, the currently measured milk temperature is permanently shown on the display.

It is possible to switch between two freely adjustable target temperatures by pressing a button. If the milk temperature exceeds the selected target temperature (T1 or T2) by the hysteresis value, the compressor relay and agitator are automatically activated. Once the target temperature is reached, the compressor switches off, while the agitator continues to operate for the pre-set 'after-stirring' time.

During non-cooling periods the agitator switches on at pre-set intervals in order to ensure an even temperature throughout the milk.

Independently of this a short or long 'intermediate stirring' period can be selected during cooling by pressing a button.

Start cooling mode by pressing button on foil keyboard:

The cooling mode is started by pressing the 'Cooling' button.

If a start delay is activated for the first milking [P61], the cooling start is delayed. Pressing the 'Cooling' button again starts cooling immediately.

Start cooling mode via digital input:

The cooling mode starts immediately - depending on the setting in parameter [P61] - or with a delayed start cooling.



5.1.3 Continuous stirring mode

From OFF mode, the agitator can be switched on by pressing the AGITATOR button and then switched off again by pressing the OFF button. Parameter [C25] can be used to set the time after which the agitator is to switch off automatically. The count-down can be interrupted at any time using the OFF button.

If [C25] is set to '0', the agitator will run continuously, but can be switched off at any time using the OFF button.

In parameter [C26] the display can be set during continuous stirring:

0: rotating bars. Stirrer LED on.

1: current temperature. Stirrer LED flashes

5.2 The configuration software KONSOF



*For software
description see
separate instructions*

The user-friendly configuration software "KONSOF" can be used for

- Configuration and parameter setting
- visualize the temperature profile for the last 48 hours
- updating (firmware)

Configuration

All setting parameters can be entered and stored, with reference to levels, on your PC using a clearly designed template. A description is available for every parameter.

Once all parameters are entered, the complete configuration can be transferred to the control unit via USB interface

Visualisation

Also by USB transfer, temperature profile over the last 48 hours can be obtained from the regulator, displayed on screen graphically or in tabular form, and stored. This allows rapid analysis in the event of a fault.

Bootloader function

This allows the controller to be updated to the new operating software at the push of a button.

NOTICE

NOTE: The KONSOF PC-Software has been thoroughly tested and has proven itself hundreds of times in customer use. Despite all care, we point out that the use of the free PC-Software is at your own risk. WELBA does not accept any liability for damages or loss of data resulting from the installation or use of the Software.

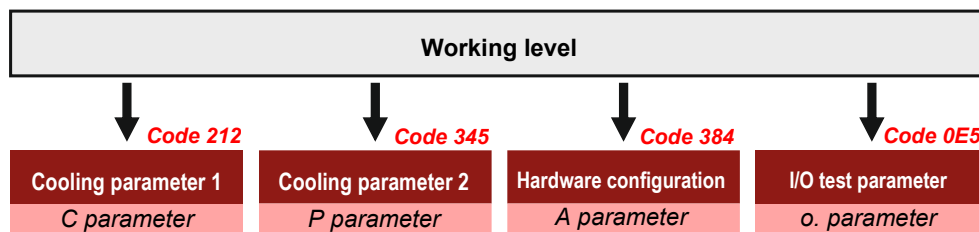
5.3 Operation in levels

The working level is used for operation and control in everyday operation.

The MRF-M2 is parameterized in 4 different parameter levels.

NOTICE

The subordinate parameter levels are only entered after entering a code in order to avoid inadvertent adjustment of the parameters.



Cooling parameter 1 - (C parameter)

Parameters such as setpoints, hysteresis etc. can be set here.

Cooling parameter 2 - (P parameter)

Setting of plant-specific functions such as Emergency cooling, agitator function, Cooling start delay eg.

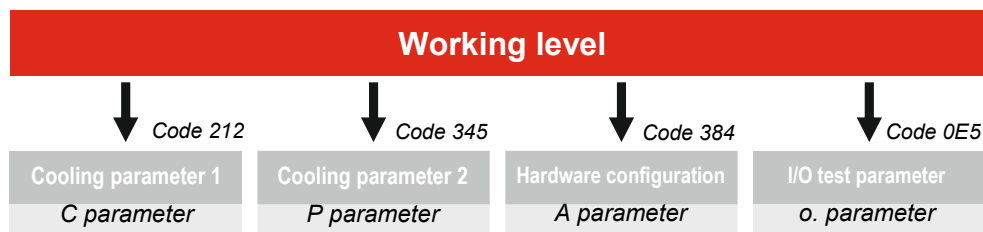
Hardware configuration - (A parameter)

Determination / parameterization of the hardware configuration such as digital input and RS485 settings eg.

I/O test parameter - (A parameter)

Is intended for commissioning the control system.

5.4 Operation of working level



The working level is used for operation in everyday operation:

- OFF mode = switch off the control (Stand-by)
- Cooling mode = start the automatic cooling mode
- Continuous stirring = start the continuous stirring
- Parameter level = changing of setting values

5.4.1 Button functions



„COOLING“ button (SET)	
in OFF mode =	Start the automatic cooling mode
in cooling mode =	- display of the setpoint that has been set (change value in conjunction with arrow keys) - acknowledging fault messages
Press twice =	- skipping the cooling start delay (if set)
in event of sensor fault =	- activation of emergency cooling (see section 7.3)
parameter setting =	- displays the value of the current parameter (change value in conjunction with arrow keys)



„OFF“ button	
Active modes are ended by pressing the OFF button.	
- switch the controller to STAND-BY mode, - continuous agitating mode prematurely - change to programming mode (hold down button for 3 seconds)	

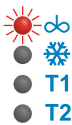
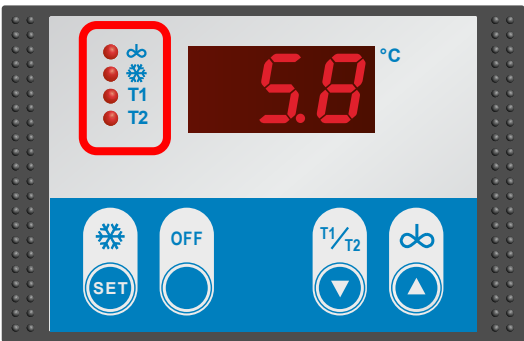


„T1 / T2“ button	
in cooling mode =	press 3 sec.: change target temperature T1 / T2
parameter setting =	- scroll down the parameter list - decrease set value



„AGITATOR“ button	
in OFF mode =	start continuous stirring mode
in cooling mode =	press for 1 sec.: " Intermediate stirring SHORT " press for 3 sec.: " Intermediate stirring LONG " See also section 7.2
parameter setting =	- scroll up the parameter list - increase set value

5.4.2 Meaning of the LED's



LED „AGITATOR“	
LED off =	Agitator is switched off
LED permanently on =	Agitator is switched on
* LED permanently on, a rotating bar appears in the display =	The regulator is in continuous agitating mode
* LED flashes, the current temperature appears on the display =	

* * depending on the setting in parameter [C26]



LED „COMPRESSOR“	
LED off =	Compressor contactor is switched off
LED permanently on =	Compressor contactor is switched on
LED flashes =	Compressor is blocked by: - The cooling start delay is active - Compressor pendulum protection - see [P71] - blocked externally via digital input - 'Freeze protection' function



LED „T1“	
LED permanently on =	Target temperature "T1" is selected



LED „T2“	
LED permanently on =	Target temperature "T2" is selected
LED flashes =	Target temperature "T2" is selected and switches back to "T1" after time [P81]

5.5 Explanation of the operating modes

5.5.1 OFF mode (Stand-by)



If 'OFF' is shown in the display, the controller is in stand-by mode.

CAUTION: The control unit is live even when switched off!

5.5.2 Cooling mode



The **cooling mode is started** from the OFF mode.

MANUALLY by pressing the COOL button

DIGITAL via digital input "Remote start to cooling"
(If parameterized – [A21=1])

Subject: Cooling start delay

If "Cooling start delay" [P61] is programmed, the compressor starts after a delay, in order to prevent a small amount of milk in the tank from freezing. During the cooling-start-delay LED "COMPRESSOR" is blinking

Note: If you push the button "COOLING" twice, cooling will start immediately without a delay - the LED will be lit continuously.

There are various cooling start delay options. See section 7.7

After the start of the cooling mode

- the "COMPRESSOR" LED lights up (or flashes in the case of a cooling start delay). The "COMPRESSOR" LED shows the current switching status of the compressor.
- the "AGITATOR" LED lights up.
- the "T1" or "T2" LED (for target temperature 1 or 2) lights up.
- The pre-set target temperature T1 or T2 flashes three times in the display, then the current temperature of the milk is shown.

If the other target temperature is required: Press the "T1 / T2" button for 3 seconds. (Various switching options can be set. See parameter [P80]).

The milk is now cooled down to the set target temperature, and the agitator runs continuously during cooling. If the milk temperature is already below the target, just the agitator runs for the time being.

- When the target temperature is reached, the compressor switches off.
- At the end of the set "after-stirring" period [c20], the agitator also switches off.
- During cooling breaks the agitator switches on periodically, in line with the set "pause time" [c21] for the "after-stirring" period [c20], in order to ensure an even temperature throughout the milk.
- If the milk temperature rises again, and exceeds the selected target temperature by the hysteresis value [c10 or c11], the compressor and agitator are switched on again automatically.

to section 5.5.2: Explanation of the operating modes



*Agitating in cooling mode = **INTERMEDIATE STIRRING***

only during the breaks in cooling mode, and

if parameter [P22 = 1]:

- In cooling mode, briefly press the AGITATOR button:
"Sho" appears in the display. If the button is released now, a "brief intermediate agitating" is triggered. [Duration = c23]
- If the "AGITATING" button is held down for a longer period of time:
The display changes from "Sho" to "Lon". A "long intermediate agitating" is triggered. [Duration = c24]

if parameter [P22 = 2]:

- If ,toggling' is parametrized:
 - Press the "AGITATOR" button in cooling mode - switch on the agitator.
 - Press the "AGITATOR" button again - switch off the agitator again.

5.5.3 Continuous stirring mode



if parameter [c25] = '0'

- Press the "AGITATOR" button: (from OFF mode)
Switches on continuous stirring mode.
- Press "OFF" button:
Switches off continuous stirring mode.

if parameter [c25] > '0'

- Press the "AGITATOR" button: (from OFF mode)
If parameter [c25] is set higher than '0', when the button is pressed the agitator runs for the set number of minutes.
- Press "OFF" button:
Switches off continuous stirring mode prematurely.

Displays for continuous stirring mode:

In [C26] the display can be set during continuous stirring:

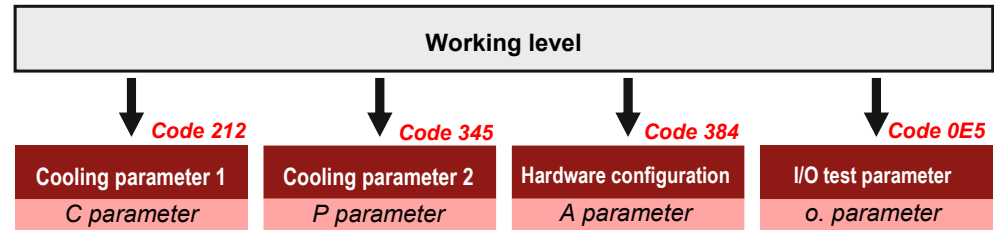
- if parameter [c26] = '0' => Rotating bars. Agitator LED on.
- if parameter [c26] = '1' => Current temperature. Agitator LED flashes.

6. Setting of parameters

6.1 Change and save parameter values

The MRF-M2 is configured in 4 different parameter levels.

To change parameters in one of the lower levels, enter the corresponding 'level code'.



6.1.1 Enter the level code

Proceed as follows (control must be in OFF mode):

- Press the "OFF" button for 5 seconds:
The display shows '0000' - the first '0' flashes.
- Use the arrow keys to set the first digit of the desired code
- Confirm the correct digit with "SET".
The set digit has been accepted - the second '0' flashes.
- Set the second digit with the arrow keys and confirm with SET.
- Set third and fourth digits as well:
The first parameter of the selected level now appears.

If an incorrect code is entered, the control switches back to the OFF mode.

6.1.2 Display and change parameter value

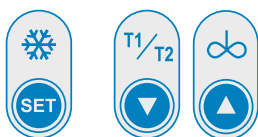
Display parameter value

- Use the arrow keys to select the desired parameter.
- Press the "SET" button: The parameter value is displayed.

Change parameter value:

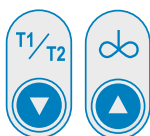
- Use the arrow keys to select the desired parameter,
- Hold down the "SET" button and use the arrow buttons to set the desired value.

NOTE: In order to store the value in the memory, first release the arrow button and then the "SET" button.



6.1.3 Save parameters and return to working level

(possible from any parameter)



Standard with saving the values:

- Press both arrow keys at the same time.
The regulator switches to OFF mode.

NOTICE

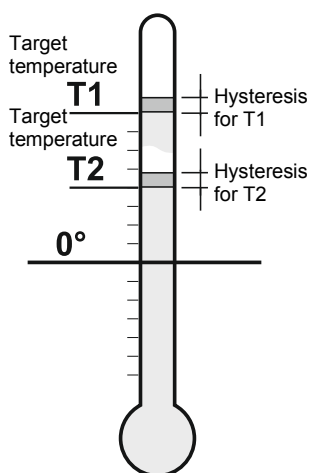
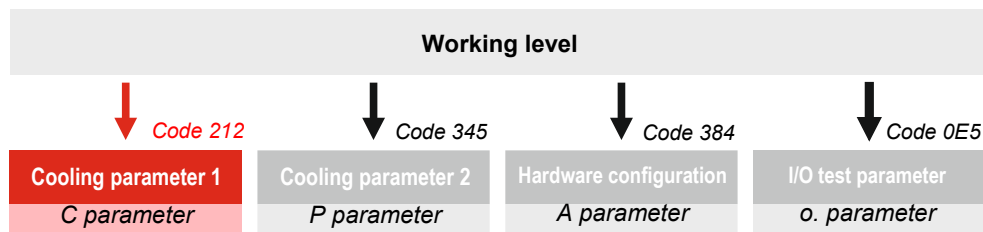
Return without saving the values:

- If no button is pressed for 60 seconds:
The regulator automatically returns to the OFF mode. All changes are lost.

6. Setting of parameters

6.2 Level “Cooling parameters 1” (C-Parameter)

Switch to level “Cooling parameters 1” see section 6.1



Temperature settings

		Range	Default
C1	Target temperature for T1	2,0 .. 8,0°C	4,0
C2	Target temperature for T2	2,0 .. 8,0°C	4,0
The target temperature is the temperature to which the milk is to be cooled down. When the target temperature is reached the compressor switches off. See diagram.			
C10	Hysteresis for target temperature 1	0,1 .. 2,0 K	0,7
C11	Hysteresis for target temperature 2	0,1 .. 2,0 K	0,7
The hysteresis determines the amount by which the milk temperature is allowed to differ from target temperature T1 or T2 before the cooling compressor is switched on again. See diagram.			

Agitator running time settings

		Range	Default
C20	Duration of after-stirring	0 .. 999 sec.	120
Period in seconds for which the agitator continues to operate after compressor is switched off.			
C21	Pause duration	0 .. 999 min.	20
Period in minutes between agitator switching off and switching on again (for the duration of the after-stirring period selected).			
C23	Duration of 'intermediate stirring SHORT'	0 .. 999 min.	2
Period in minutes during which the agitator operates if the UP arrow button is pressed for <u>approx. 1 second</u> during a cooling pause.			
C24	Duration of 'intermediate stirring LONG'	0 .. 999 min.	10
Period in minutes during which the agitator operates if the UP arrow button is pressed for <u>approx. 3 seconds</u> during a cooling pause.			
C25	Maximum continuous stirring period in mode 'continuous stirring'	0 .. 999 min.	30
see section 5.5.3			
Setting of maximum continuous stirring period.			
0: indefinite stirring (to end, the OFF button must be pressed)			
1..999: max. stirring period in minutes			

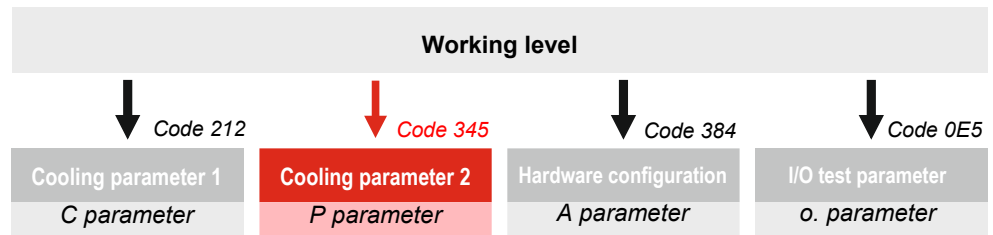
to section 6.2: Level "Cooling parameters 1" (C parameters)

C26	Monitoring continuous stirring mode Here you can set the display during continuous stirring: 0: Circulating bars. Agitator LED on 1: Current temperature. Agitator LED flashes	0 .. 1	0
<u>Cooling time monitoring</u>		Range	Default
C81	Monitoring of the max. compressor run time A timer starts each time the compressor starts. If the compressor run time exceeds the value entered here, the fault message 'F20' appears on the display. Value '0' = function deactivated.	0 .. 999 min.	0
<u>Sensor correction adjustment</u> (see also section 7.6)		Range	Default
c90	Display actual temperature sensor		
c91	Sensor correction sensor A correction can be applied to the value measured by the sensor. Then applies it cumulatively throughout the entire measurement range.	10 .. 10 K	
<u>Software version</u>		Range	Default
C98	Installed software version The software version installed is shown to help service technicians.		
<u>Button lock</u>		Range	Default
C99	Button lock The adjustment of the target temperatures in the working level can be blocked by setting the button lock. 0: Buttons not locked 1: Buttons locked.	0 .. 1	0

6. Setting of parameters

6.3 Level “Cooling parameters 2” (P parameters)

Switch to level “Cooling parameters 2” see section 6.1



<u>EMERGENCY COOLING, behaviour on sensor failure</u>		Range	Default
P4	Manual start of compressor for x min. in case of sensor failure. Function see 7.3	0 .. 60 min.	0

<u>Limit setting for set temperatures and hysteresis</u>		Range	Default
Setting of limitations for target temperatures and hysteresis in C parameter level.			
P10	Lower limit for target temperature T1	0 .. 50,0 °C	2,0
P11	Upper limit for target temperature T1	0 .. 50,0 °C	8,0
P12	Lower limit for target temperature T2	0 .. 50,0 °C	2,0
P13	Upper limit for target temperature T2	0 .. 50,0 °C	8,0
P15	Lower limit for hysteresis T1	0,1 .. 30,0 K	0,1
P16	Upper limit for hysteresis T1	0,1 .. 30,0 K	2,0
P17	Lower limit for hysteresis T2	0,1 .. 30,0 K	0,1
P18	Upper limit for hysteresis T2	0,1 .. 30,0 K	2,0

<u>Agitator settings</u>		Range	Default
P22	Function intermediate stirring see also section 7.2	0 .. 2	1
0: deactivated			
1: intermediate stirring (short / long) by button			
2: manual intermediate stirring ON / OFF			

to section 6.3: Level "Cooling parameters 2" (P parameters)

<u>Cooling start settings</u>		Range	Def.
P61	Variations of the cooling start delay for the first milk see section 7.7	0 .. 3	1
	0: deactivated (without cooling start delay) 1: cooling start delay 2: Interval cooling boosts (power reduction by cycles) 3: Interval cooling boosts after switch-on delay		
P62	Duration of cooling start delay if [P61] = 1..3	0..999 min.	30
P63	„ON“ time cooling boost if [P61] = 2, 3	1 .. 30 min.	5
P64	„OFF“ time cooling boost if [P61] = 2, 3	5 .. 60 min.	20
P65	Number of cooling boosts if [P61] = 2, 3	1 .. 50	5

<u>Compressor settings</u>		Range	Default
P71	Minimum pause time compressor (Pendulum protection)	0 .. 999 sec.	60
	Prevents the compressor from running against pressure. The LED compressor is flashing during the pause time.		
P72	Thermo protection and fault monitoring compressor See also section 7.4	0 .. 4	0
	(Only possible if digital input [A21 = 5])		
	0: deactivated		
	<u>Evaluation of motor protection relay or motor protection switch</u>		
	1: Thermal protection high-activated (error "F53" when open)		
	2: Thermal protection low-active (error „F53" when closed)		
	<u>Evaluation of auxiliary contact compressor contactor</u>		
	3: Fault monitoring through switch-on feedback from the compressor contactor <u>normally open contact</u> .		
	4: Fault monitoring through switch-on feedback from the compressor contactor <u>normally close contact</u> .		
	Choice 3 or 4:		
	When a compressor is switched on, feedback is expected at the digital input after 60 seconds at the latest.		
	If this feedback does not come, fault F53 is triggered.		

6. Setting of parameters

to section 6.3: Level "Cooling parameters 2" (P parameters)

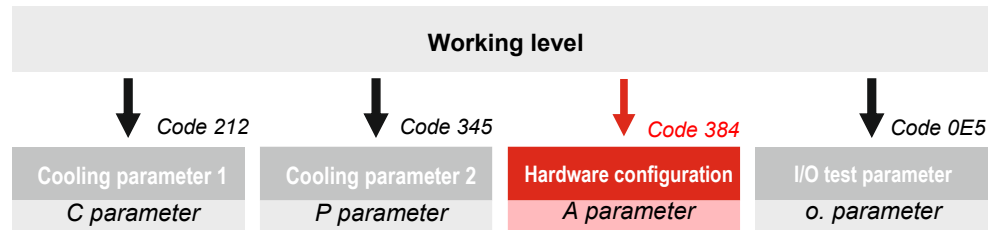
<u>Settings for target temperature switchover T1 / T2</u>		Range	Default
P80	Settings for target temperature switchover	0 .. 4	1
0: deactivated (always T1 active) 1: only manual switchover T1 / T2 via button. <i>Press "Cooling" button in cooling mode to change to the other target temperature.</i> - the corresponding LED switches over, - The preset target temperature is briefly shown in the display, then the current milk temperature. 2*: manual switchover to T2 with switch-back after a period. Press the "T1/T2" button in cooling mode: The regulator switches to "T2" for a period of [P81] and then back to "T1". As long as "T2" is active, the "T2" LED flashes" 3*: automatic switchover to "T2" at cooling start, with automatic switch back to "T1" after time [P81] (note the setting of the cooling start delay) 4: Switchover T1 / T2 externally (via digital input) <i>NOTE: When the contact is closed, "T2" is active</i> <i>NOTE: Parameter [A21] must be set to 2!</i>			

* In the case of 2 and 3: - If T1 is active, the LED for T1 is permanently on. - If T2 is active, the LED for T2 flashes and shows that switch-back to T2 will happen automatically.			
P81	Duration until switch-back to T1	1 .. 999 min.	120
Enter the switch-back time to the target temperature T1. (Parameter [P80] = 2 or 3)			

<u>Freezing protection by low pressure monitoring</u>		Range	Default
<i>Explanations see also section 7.7.2</i>			
<i>(Can only be used if the digital input is set to [A21 = 4])</i>			
P84	Type of low pressure switch	1 .. 2	1
1: Compressor off when digital input is closed 2: Compressor off when digital input is open			
P87	Monitoring delay after start compressor	10 .. 999 sec.	120
P88	Switch off time compressor in case of too low pressure	1 .. 15 min.	10
P89	Monitoring time from the start of cooling	0 .. 600 min.	300
0: no time limit 1..600: minutes after starting the cooling, the low pressure monitoring switches itself off until the next cooling activation.			

6.4 Level “Hardware configuration” (A parameters)

Switch to level “Hardware configuration” see section 6.1



This configuration is very important and should be the first step when setting the parameters for a system!

Assignment of digital input

Def.

A21 Functional access digital input

0

One of the following functions can be assigned to the digital input here. The digital input must be connected to a corresponding potential-free switch contact.



WARNING

The digital input of the regulator may only be connected to a potential-free switch contact!!

Do not apply any external voltage - risk of destruction!!

0: deactivated

1: Remote start cooling

The cooling can be started from the OFF mode via the digital input. No further parameters need to be set to use this function.

2: external temperature switching T1/T2 [P80=4]

The digital input is used to switch the target temperature. For this, this option must also be activated in parameter [P80] = 4

3: external compressor lock (see section 7.7.2)

4: Freeze protection via low pressure switch (see section 7.7.3)

5: Compressor fault monitoring (see section 7.4)

6: Safety switch cover of the milk cooling vat

(Switch off the agitator when the lid is on) see section 7.5

PC interface setting RS485

Range

Def.

A95 Baud setting

1 .. 3

3

1: 9600

2: 19200

3: 38400

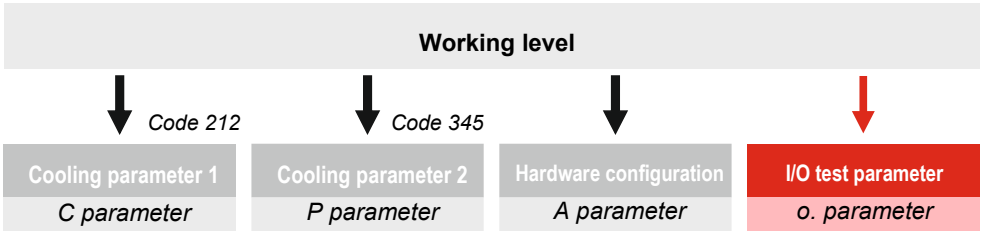
A96 Device address

1 .. 4

1

6.5 Level “I / O test parameters” (o. parameters)

Switch to level“ I / O test parameter” see section 6.1



Meaning of the parameters

All inputs and outputs of the individual components can be tested in this parameter level. For this purpose the corresponding relays are set to 'I' or 'O'.

Test relay outputs

Switched-on relays remain switched on until they are reset manually.

	Range	Def.
o.1 Test agitator	0 .. 1	0
o.2 Test compressor	0 .. 1	0
0: Relay switched off		
1: Relay energized		

Test digital input

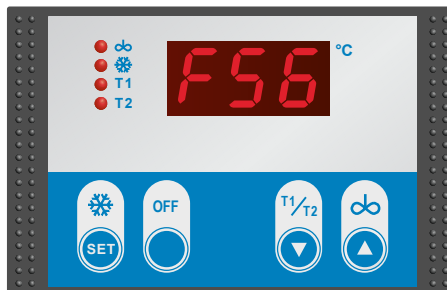
Select parameter [o.21] with the arrow keys and test as follows:

- Press the SET key briefly: '0' or '1' appears in the display (depending on the current switching state of the respective component).
- Change switch state. (e.g. with a wire bridge at the digital input)
- The display toggles between '0' and '1'.
- Press the SET key again: The display shows the current parameter name again.

	Range	Def.
o.21 Test digital input	0 .. 1	---
0: Input not connected		
1: Input wired (bridged)		

7. Other information

7.1 Fault messages



Any faults that occur are displayed in cooling mode. The display then alternates between temperature and error code. Optionally, the error codes can be sent by SMS or email.



The fault messages F20 | F30 | F53 can be confirmed without stopping cooling. (Fault message is no longer displayed).

For all remaining fault messages, the respective fault must be eliminated in order to reset the message.

Display	Fault
F20	Maximum compressor run time
F30	Power failure in cooling When switching on again, it was found that the regulator was in cooling mode before the power interruption.
F53	Compressor failure
F56	Sensor short circuit The sensor or sensor cable is faulty and must be replaced or repaired. Parameter [C91] 'Actual value correction' must then be adjusted at programming level.
F57	Broken sensor The sensor or sensor cable is faulty and must be replaced or repaired. Parameter [C91] 'Actual value correction' must then be adjusted at programming level.
F58	Exceeding the measuring range The sensor fitted can only measure temperatures between -20° and +70°C.
F77	Lid open in cooling mode The lid of the milk cooling vat was opened in cooling mode.

7.2 Function “intermediate agitating” in cooling mode [P22]



The MRF-M2 has a function that enables manual ‘intermediate agitating’ in cooling mode during the agitator break. This can be done in different ways.

Regardless of the chosen option the corresponding LED always indicates when the agitator is operating.

The function is defined in the ‘Cooling parameter 2’ level via the parameter [P22].

Parameter [P22] is set to 0:

“Intermediate stirring” is not possible.

Parameter [P22] is set to 1 (standard):

“Intermediate agitating SHORT or LONG” can be switched on via the regulator’s foil keyboard. In this case:



- Briefly press the “AGITATOR” button in cooling mode:
“Sho” appears in the display. If the button is released now, a ‘short intermediate agitating’ is triggered. [Duration = c23]
- If the “AGITATOR” key is held down for a longer period of time:
The display changes from “Sho” to “Lon”. A “long intermediate agitating” is triggered. [Duration = c24]

Parameter [P22] is set to 2:

Function: Intermediate agitating ON / OFF

- Press the ‘agitator’ key: the agitator is switched ON.
- Press the ‘agitator’ key again: the agitator is switched OFF again.

7.3 Emergency cooling in the event of a sensor fault

In the event of a defective temperature sensor, the fault code appears on the display only during cooling mode:

- F56 = Broken sensor
- F57 = Sensor short circuit
- F58 = Sensor range exceeded

Switch on emergency cooling:

Requirement:

- in parameter [P4] a timer must be set,
 - one of the above error messages must flash on the display.
-
- Press the COOLING button for at least 4 seconds:
Compressor and agitator are switched on for the time set [P4]
“not” appears in the display alternating with the remaining running time in minutes.
The timer can be ended prematurely at any time with the OFF button.

7.4 Compressor fault monitoring [P72]

Fault monitoring is used to indicate problems with the proper running of the compressor.

The fault message occurs depending on the parameterisation

- by evaluating the potential-free auxiliary contact of the motor protection switch (setting 1, 2),
- by evaluation of the potential-free auxiliary contact of the compressor contactor (setting 3, 4),

Fault monitoring is only possible if the digital input - parameter [A21] - is set to '5'.

The following settings of fault monitoring are possible:

Parameter [P72] is set to 0

Fault monitoring is deactivated

Parameter [P72] is set to 1

The auxiliary contact of the motor protection relay or of the motor protection switch is queried.

Is this auxiliary contact opened = fault "F53" is displayed.

Parameter [P72] is set to 2

The auxiliary contact of the motor protection relay or of the motor protection switch is queried.

Is this auxiliary contact closed = fault "F53" is displayed.

Parameter [P72] is set to 3 *

Fault monitoring by switch-on feedback from the compressor contactor-auxiliary contact (N/O contact).

Parameter [P72] is set to 4 *

Same as 3, but switch-on feedback from the compressor contactor auxiliary contact (NC contact).

* Settings 3 and 4:

NOTICE

When the compressor is switched on, feedback information is expected at the digital input of the controller after 60 seconds at the latest. If this feedback is not received, error "F53" is triggered.

7.5 Milk cooling tank lid open in cooling mode

Parameter [A21] = 6

In cooling mode:

When the lid is opened, the stirrer is switched off immediately. Fault message "F77" appears in the display, alternating with the temperature.

If the lid is open more than 1 minute, the compressor is also switched off.

Closing the lid continues the cooling mode.

Continuous stirring-mode

If the lid is opened during continuous stirring-mode, the stirrer is also switched off immediately and the controller switches to OFF mode.

7.6 Sensor correction procedure

Sensor correction means:

A correction is applied to the value measured by the sensor. This is then cumulatively effective over the whole measurement range.

An adjustment to the sensor correction is then necessary only:

- in conjunction with first installation,
- if the sensor cable length is altered,
- when replacing a faulty sensor.

In order to adjust the sensor correction, a reference thermometer is needed.

Proceed as follows:

- Switch off power supply
- Install / change sensor
- Use the reference thermometer to establish the milk temperature.
- Switch on control unit and set [c90] to the measured number of degrees.
- The control unit calculates the difference between the reference thermometer reading and temperature sensor 1 and automatically sets this in parameter [c91].
- Parameter [c91] can be displayed and adjusted at any time.
- Hold down the up and down arrow buttons simultaneously:
The settings are stored.

Proceed with the setting for sensor 2 (if present) in the same way. In this case parameters [c92 and c93] must be set.

7.7 Topic “Protection against icing“

The MRF-M2 basically offers three different options for preventing small amounts of milk from freezing in the milk cooling tub:

- Cooling start delay (see section 7.7.1)
- Anti-icing protection by means of low pressure monitoring (see section 7.7.2)
- Anti-icing protection through external compressor shutdown (see section 7.7.2)

Cooling start delay is set using parameters [P61 - P65].

7.7.1 Different variants for cooling start delay

The regulator can be programmed to delay the start of the compressor after the cooling mode has been triggered, to prevent a slight freezing of milk in the tank.

The regulator offers different variants of cooling start delays:

0. no cooling start delay

Cooling starts immediately

Cooling immediately temperature-regulated



1. simple cooling start delay

Cooling starts after a set time.

defined time



temperature-regulated

2. periodic cooling phases (Power reduction through clocking)

Cooling starts in the form of periodic cooling phases at set intervals before then switching over to temperature regulation.

defined time



temperature-regulated

3. periodic cooling phases after switch-on delay

Cooling starts after a set time, in the form of pre-set periodic cooling phases at set intervals before then switching over to temp. regulation.

defined time



defined phases

temperature-regulated

7.7.2 Anti-icing protection by switching off the compressor with a robot

Protection against icing is provided by the robot switching off the compressor. (Thus, the robot controls the cooling capacity, or releases the compressor only after a certain amount of milk).

As long as the digital input is bridged, the compressor remains switched off.

To use this function, parameter [A21] must be set to 3.

Robot:

On the robot a corresponding switch contact must be available and set.

7.7.3 Anti-Icing protection by means of low pressure monitoring

The controller can be used to set up "anti-icing protection" via the low pressure monitoring of the compressor.

For this purpose, a low-pressure switch must be connected to the digital input of the controller and parameterised.

Note: For the "anti-icing" function, the correct switch-off pressure must be set on the low-pressure switch.

NOTICE

Settings:

- Setting of function digital input [A21 = 4]
- Setting of the type of switching contact of the low-pressure switch [P84]:
 - 1: Compressor off when digital input is closed
 - 2: Compressor off when digital input is open

If the low-pressure switch reports "pressure undercut", the compressor is switched off for the pre-set time [P88].

When the compressor restarts, the low-pressure switch query is suppressed by the set time [P87] (to prevent the compressor from switching off again due to system-related pressure fluctuations in the evaporator)

NOTICE

Via [P89] can be set whether the low pressure monitoring is to be permanent or temporally limited.

The advantage of permanent monitoring is that even the loss of cooling agent is detected!

7.8 Procedure following power failure

After an interruption in the power supply in cooling mode:

- the regulator returns to cooling mode,
- Fault message "F30" is displayed alternately with the milk temperature.

After an interruption in all other cases:

- the regulator returns to the OFF mode.

Incorrect parameter configuration when switching on:



Factory configuration is restored automatically

If "dEF" occurs in the display after switching on, the standard configuration (factory setting) has been restored automatically. The regulator will not be ready for use until confirmed with the SET-button.

This behavior occurs after a firmware-update.

Procedure:

- Press button SET to confirm the factory reset
- Set and store original parameterization for the tank.

Displayed when invalid storage areas are detected.



When the regulator is switched on, it checks whether the parameter values in the EEPROM-storage have been changed inappropriately. (This is possible in rare cases due to EMC-effect or lightning, for example).

If an impermissible change is detected, "EEP" is displayed, the regulator is not ready for operation.

Procedure:

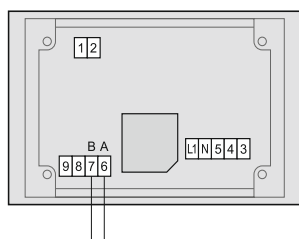
- Press and hold the SET button until "dEF" appears in the display:
The default configuration (factory setting) has been restored.
- Press button SET to confirm the factory reset.
- Set and store original parameterization for the tank.

NOTICE

NOTE:

If "EEP" appears again on the display after the factory reset and after another OFF and ON-switching, the regulator is irreparably defective.

7.9 RS485 interface



The regulator has an RS485 interface as a connection option for:

- a PC with Welba-Konsoft (see section xx)
for parameterizing, updating and reading out the data
- SMS, alarm and remote maintenance modem ESGSM
for remote configuration and sending of SMS error messages
- EMAIL, alarm and remote maintenance modem ESIPM
for remote configuration and sending of email error messages

7.10 General measures when using electronic control systems

So that even complicated regulatory tasks can be presented to the user in a manner which is clear and simple and ensures high measurement accuracy, today's electronic control systems make increasing use of microprocessors. However, the benefits of these systems are countered by the disadvantage that increased measurement accuracy is accompanied by sensitivity to interference. In order to minimise the effect which interference may have on the regulator the user also must take account of a number of points when installing a new regulator.

Assistance here is provided by standard DIN VDE 0843 on the electromagnetic compatibility (EMC) of measurement, control and regulatory devices in industrial process technology. The following table shows, for example, the maximum interference levels to which (according to the standard), an appliance may be exposed.

Degree of severity	Environment class	Test voltage Power supply	Test voltage Signal/control line
1	well-protected environment	0.5 kV	0.25 kV
2	protected environment	1.0 kV	0.5 kV
3	typical industrial environment	2.0 kV	1.0 kV
4	industrial environment with very high interference level	4.0 kV	2.0 kV

As the values given in the table are maximum values, operational values should remain well below them. However, in practice this is possible only with difficulty, as even a normal contactor without interference suppression produces interference pulses of up to 3.0 kV. For this reason we recommend that the following principles be taken into account during installation:

- a. Try to eliminate all sources of interference by carrying out interference suppression and minimising the interference level. Radio interference suppression is required under VDE 0875 and confirmed by VDE 0874. In principle the interference must be eliminated at source. The nearer the interference suppresser is to the source of interference the greater its effect.

Interference spreads through wires or by electromagnetic radiation. It is usually the former which interferes most seriously with regulation systems.

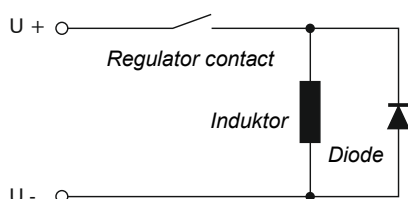
Possible interference sources (to name a few) include:

- bouncing contacts when switching loads
- switching off inductive loads (contactors, motors, solenoid valves, etc.)
- unsatisfactory routing of wires, too small cross-sections
- loose contacts
- rhythmically changing power stages (power converters)
- power breakers
- high-frequency generators

Section 7.10: General measures when using electronic control systems

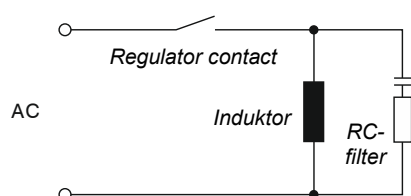
- b. If specific interference sources cannot be avoided they should at least be kept at a distance from the regulator system.
- c. Capacitive and inductive couplings can cause crosstalk between high-voltage lines and parallel low-voltage and sensor lines. This distorts measured values and signals and can disrupt the entire regulatory process. It is therefore recommended that all sensors and signal lines be placed separately from the control and mains voltage lines.
- d. If possible a separate main line should be provided to feed the regulator system. This helps reduce any interference penetrating the regulator via the mains supply line. Voltage surges resulting from switching substantial loads will also then be less of a problem.
- e. In the case of contactors, solenoid valves and other inductive consumers the induction voltage occurring during switching has to be reduced by appropriate protection methods. The choice of methods depends on whether the consumer runs on DC or AC voltage.

Right !



DC voltage

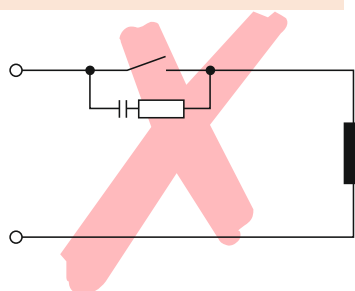
In the case of d/c voltage systems the induction voltage occurring can, for example, be limited by using self-induction diodes, varistors or suppresser diodes. The diagram on the left shows one possibility using a self-induction diode.



AC voltage

In the case of a/c voltage interference suppression as described above is not possible. Instead an RC combination must be used. An RC filter must be connected as directly as possible to the inductance in order to ensure a short line. In addition the component ratings of the RC combination must be geared to the inductance. Too low ratings lead to excessive voltage and too high ratings cause significant losses in the interference suppresser component. Another point to note here is that only capacitors which meet VDE 0656 may be used. They must be suited to the mains voltage and designed for very high switching voltages. The diagram on the left shows inductance interference suppression using an RC filter.

Wrong !



An RC filter should not be fitted directly to the regulator's switching contact (as shown on the left), as an idle current will flow through the RC combination even when the switching contact is open. This current may be enough to mean that a downstream contactor is not de-energised and a closed protective contact does not reopen.

7. Other information

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- f. Semiconductor switches such as thyristors or triacs also produce interference voltages. They occur as a result of non-linear characteristics and finite ignition voltages. These components must be protected against excessive voltages, for which mainly varistors, RC combinations or choke coils are used. The use of zero-voltage switches is also recommended.

The suggestions made represent only a few of the possible ways of protecting a microprocessor-controlled regulator system from interference. The suggested measures have the advantage that they will increase the lifetime of the devices as lower induction voltages (reduced spark formation) will also reduce contact burn.