

MP 204

Ⓜ Installation and operating instructions

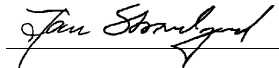


Declaration of Conformity

We **Grundfos** declare under our sole responsibility that the product **MP 204**, to which this declaration relates, is in conformity with the Council Directive on the approximation of the laws of the EC Member States relating to

- Electromagnetic compatibility (89/336/EEC).
Standards used: EN 61000-6-2 and EN 61000-6-3.
- Electrical equipment designed for use within certain voltage limits (73/23/EEC) [95].
Standards used: EN 60335-1: 1994 and EN 60947-5-1.

Bjerringbro, 1st December 2005



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CONTENTS

	Page
1. General description	3
1.1 Applications	3
2. Nameplates	4
3. Product range	4
4. Functions	4
4.1 Factory settings	4
5. Mechanical installation	5
5.1 MP 204 in control cabinet	5
5.2 MP 204 on DIN rail	5
6. Connection	6
6.1 Overview	6
6.2 Input for Pt100/Pt1000	7
6.3 Input for PTC/thermal switch	7
6.4 Back-up fuses	7
6.5 Wiring diagrams	8
6.6 External current transformers	11
7. Start-up	12
7.1 Operation	12
7.2 Setting on control panel	13
7.3 Learning function	15
8. R100 remote control	15
8.1 R100 menus	16
8.2 Operating the R100	17
8.3 Menu structure	17
9. Setting with the R100	18
9.1 Menu 1. OPERATION	18
9.2 Menu 2. STATUS	19
9.3 Menu 3. LIMITS	22
9.4 Menu 4. INSTALLATION	25
10. MP 204 with GENibus	29
11. Approvals and standards	29
12. Pump operation with MP 204	29
12.1 Industrial pumps	29
12.2 Submersible pumps	30
12.3 Wastewater pumps	30
13. Curves	31
13.1 Trip class "P"	31
13.2 IEC trip curves	32
14. Technical data	33
15. Electrical data	33
15.1 Outputs	33
15.2 Inputs	33
15.3 Insulation measurement method	33
15.4 Measuring ranges	34
15.5 Setting ranges	34
16. Fault finding	35
16.1 Warning and trip codes	35
17. Disposal	35

1. General description

The **MP 204** is an electronic motor protector, designed for the protection of an asynchronous motor or a pump.

The motor protector consists of:

- a **cabinet** incorporating instrument transformers and electronics.
- a **control panel** with operating buttons and display for reading of data.

The MP 204 operates with two sets of limits:

- a set of warning limits and
- a set of trip limits.

If one or more of the warning limits are exceeded, the motor continues to run, but the warnings will appear in the MP 204 display.

If one of the trip limits is exceeded, the trip relay stops the motor. At the same time, the signal relay is operating to indicate that the limit has been exceeded.

Some values only have a warning limit.

The warning can also be read out by means of the Grundfos R100 remote control.

1.1 Applications

The MP 204 can be used as a stand-alone motor protector.

The MP 204 may also be incorporated in a Grundfos Modular Controls system in which it functions as a motor protector and data collection unit transmitting measured values via the Grundfos GENibus to the Grundfos CU 401 control unit or other units in the system.

Monitoring of the MP 204 is possible via a Grundfos GENibus.

The power supply to the MP 204 is in parallel with the supply to the motor. Motor currents up to 120 A are passed directly through the MP 204. The MP 204 protects the motor primarily by measuring the motor current by means of a true RMS measurement. The MP 204 disconnects the contactor if, for example, the current exceeds the preset value.

The pump is protected secondarily by measuring the temperature with a Tempcon sensor, a Pt100/Pt1000 sensor and a PTC sensor/thermal switch.

The MP 204 is designed for single- and three-phase motors. In single-phase motors, the starting and run capacitors are also measured. $\cos \varphi$ is measured in both single- and three-phase systems.



Prior to installation, read these installation and operating instructions. Installation and operation must comply with local regulations and accepted codes of good practice.



All cables taken through the MP 204 and the current transformers must be insulated.

2. Nameplates

Rating and approvals of the MP 204.

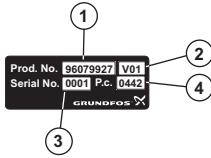


Fig. 1 Nameplate on front cover

These four numbers must be stated when contacting Grundfos:

Pos.	Description
1	Product number
2	Version number
3	Serial number
4	Production code

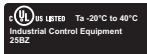
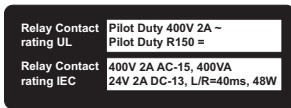
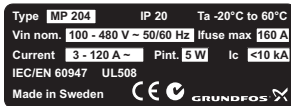


Fig. 2 Nameplates on the side of MP 204

3. Product range

- MP 204
- External current transformers up to 1000 A.

4. Functions

- Phase-sequence monitoring
- Indication of current or temperature (user selection)
- Input for PTC/thermal switch
- Indication of temperature in °C or °F (user selection)
- 4-digit, 7-segment display
- Setting and status reading with the R100
- Setting and status reading via the GENibus.

Tripping conditions

- Overload
- Underload (dry running)
- Temperature (Tempcon sensor, PTC/thermal switch and Pt sensor)
- Missing phase
- Phase sequence
- Overvoltage
- Undervoltage
- Power factor (cos ϕ)
- Current unbalance.

Warnings

- Overload
- Underload
- Temperature (Tempcon, see section 12.2, and Pt sensor)
- Overvoltage
- Undervoltage
- Power factor (cos ϕ)
- **Note:** In connection with single- and three-phase connection.
- Run capacitor (single-phase operation)
- Starting capacitor (single-phase operation)
- Loss of communication in network
- Harmonic distortion.

Learning function

- Phase sequence (three-phase operation)
- Run capacitor (single-phase operation)
- Starting capacitor (single-phase operation)
- Identification and measurement of Pt100/Pt1000 sensor circuit.

4.1 Factory settings

Current limit: 0 A

Nominal voltage: 400 V

Class: P (trip delay: 10 seconds)

Trip delay: 5 seconds

Number of phases: 3, non-earthed

Power-on delay: 2 seconds.

Learning function: Active.

Active trip limits

Overload according to class

Underload: -40%

Overvoltage: +20%

Undervoltage: -20%

Phase-sequence monitoring

Current unbalance: 10%

PTC/thermal switch.

Note: The overvoltage and undervoltage trip limits will be deactivated automatically if the temperature monitoring with Tempcon or Pt100/Pt1000 has been set to active, see sections 9.4.8 and 9.4.9.

Active warnings

Run capacitor, low: -50%

Starting capacitor, low: -50%.

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5. Mechanical installation

5.1 MP 204 in control cabinet

The MP 204 is designed for mounting in a control cabinet, either on a mounting plate or on a DIN rail.

5.2 MP 204 on DIN rail

Mounting and removal of an MP 204 mounted on a DIN rail is shown in figs. 3 and 4.

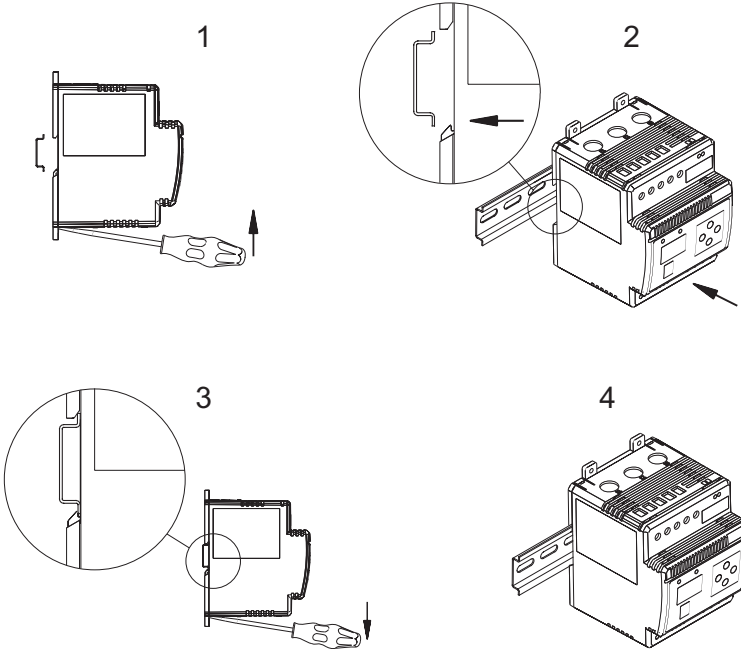


Fig. 3 Mounting

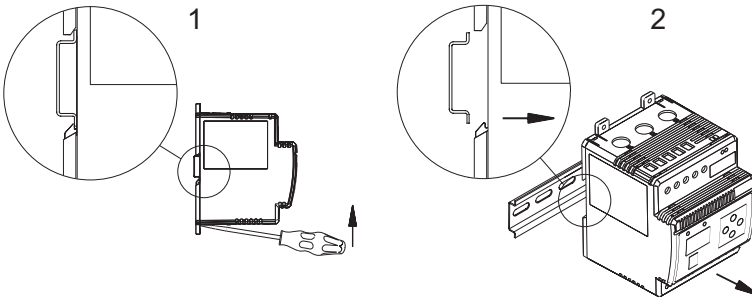


Fig. 4 Removal

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6. Connection

6.1 Overview

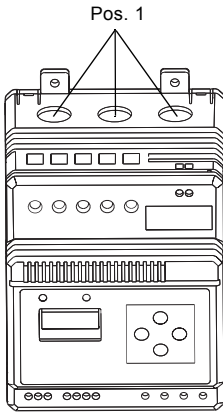


Fig. 5 Cable entries

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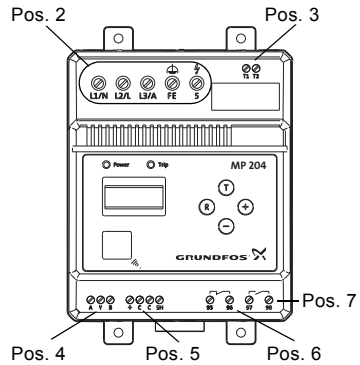


Fig. 6 Terminals

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Pos.	Designation	Three-phase connection	Single-phase connection	Cable
1	I1	Entry for phase L1 to motor	Entry for neutral	Max. ø16 mm
	I2	Entry for phase L2 to motor	Entry for phase	
	I3	Entry for phase L3 to motor	Entry for auxiliary winding	
2	L1/N	Supply: L1	Supply: Neutral	Max. 6 ¹⁾ mm ²
	L2/L	Supply: L2	Supply: Phase	
	L3/A	Supply: L3	Auxiliary winding	
	FE	Functional earth		
	5	Insulation measurement		
3	T1	PTC/thermal switch		
	T2			
4	A	GENIbus data A		
	Y	Reference/screen		
	B	GENIbus data B		
5	+	Pt100/Pt1000 sensor		Max. 2.5 ²⁾ mm ²
	C			
	C			
	SH	Screen		
6	95	Trip relay NC		
	96			
7	97	Signal relay NO		
	98			

¹⁾ 10 mm² with cable terminal

²⁾ 4 mm² with cable terminal



UL requirement:

For field wiring terminals, min. 60/75°C stranded copper conductors must be used.

6.2 Input for Pt100/Pt1000

See fig. 6, pos. 5.

Terminal designation	Description
+	Resistance input.
C	Correction for lead resistance. To be connected by means of a three-core Pt100/Pt1000 connection, otherwise the two "C" terminals are to be short-circuited.
C	Correction for lead resistance. To be connected by means of a three-core Pt100/Pt1000 connection, otherwise the two "C" terminals are to be short-circuited.
SH	0 V (screen).

For examples of Pt100/Pt1000 connection, see figs. 7 and 8.

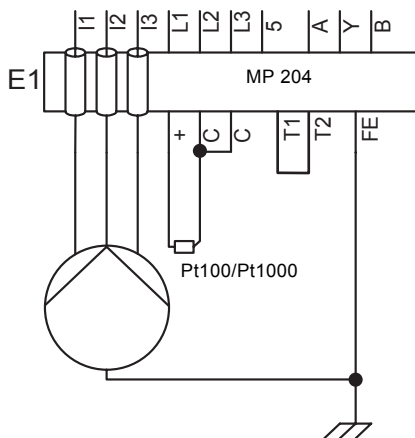


Fig. 7 Two-core Pt100/Pt1000 connection

6.3 Input for PTC/thermal switch

See fig. 6, pos. 3.

Terminal designation	Description
T1	Connection of PTC/thermal switch
T2	

If not used, short-circuit the PTC input using a wire, or deactivate it with the R100. See section 9.4.11.

6.4 Back-up fuses

Maximum back-up fuse sizes which may be used for the MP 204 appear from the table below:

MP 204	Max. size	Type
Without external current transformer	120 A	RK5
With 200/5 external current transformer	200 A	RK5
With 300/5 external current transformer	300 A	RK5
With 500/5 external current transformer	500 A	RK5
With 750/5 external current transformer	750 A	RK5
With 1000/5 external current transformer	1000 A	RK5

At motor currents up to and including 120 A, the cables to the motor can be taken direct through the I1-I2-I3 of the MP 204.

At motor currents above 120 A, current transformers must be used. See fig. 5, pos. 1.

Note: If back-up fuses above 50 A are used, the L1-L2-L3 and "5" to the MP 204 must be protected separately with max. 10 A fuses. See fig. 8.

If current transformers are used, the L1-L2-L3 and "5" to the MP 204 must be protected with max. 10 A fuses.

For installation examples, see figs. 8 to 12.

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6.5 Wiring diagrams

6.5.1 Three-phase system

The wiring diagram, fig. 8, shows an example of a three-phase pump with insulation measurement.

The connections to L1, L2, L3 and "5" can be made with a cable up to 10 mm². A special fuse unit up to approx. 50 A is therefore not required.

If larger back-up fuses are used, the voltage to the L1, L2 and L3 must be protected separately. A maximum of 10 A or less is recommended.

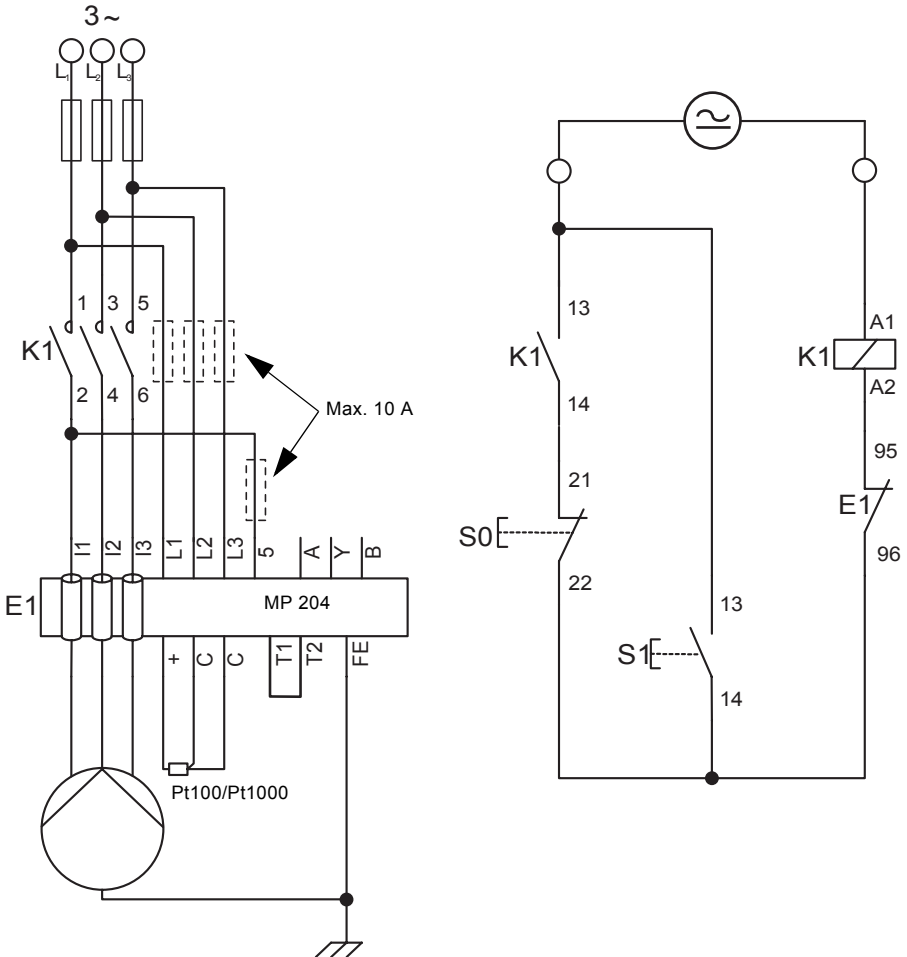


Fig. 8 Three-phase connection

6.5.2 Three-phase system with external current transformers

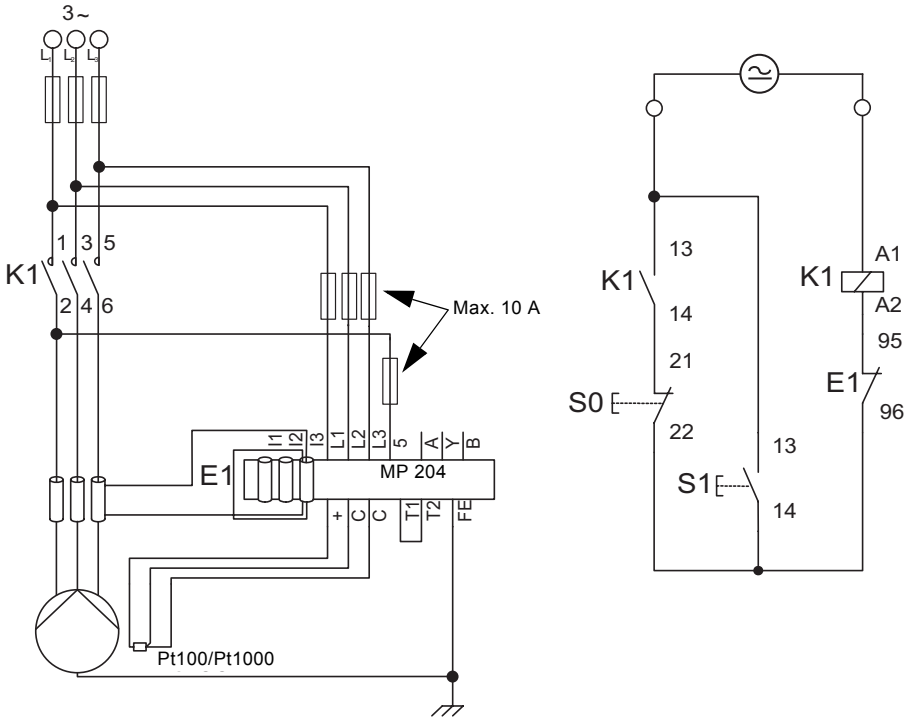
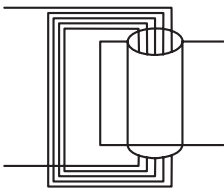


Fig. 9 Three-phase connection with current transformers



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Fig. 10 Five windings per phase through the MP 204

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6.5.3 Single-phase system with starting and run capacitors

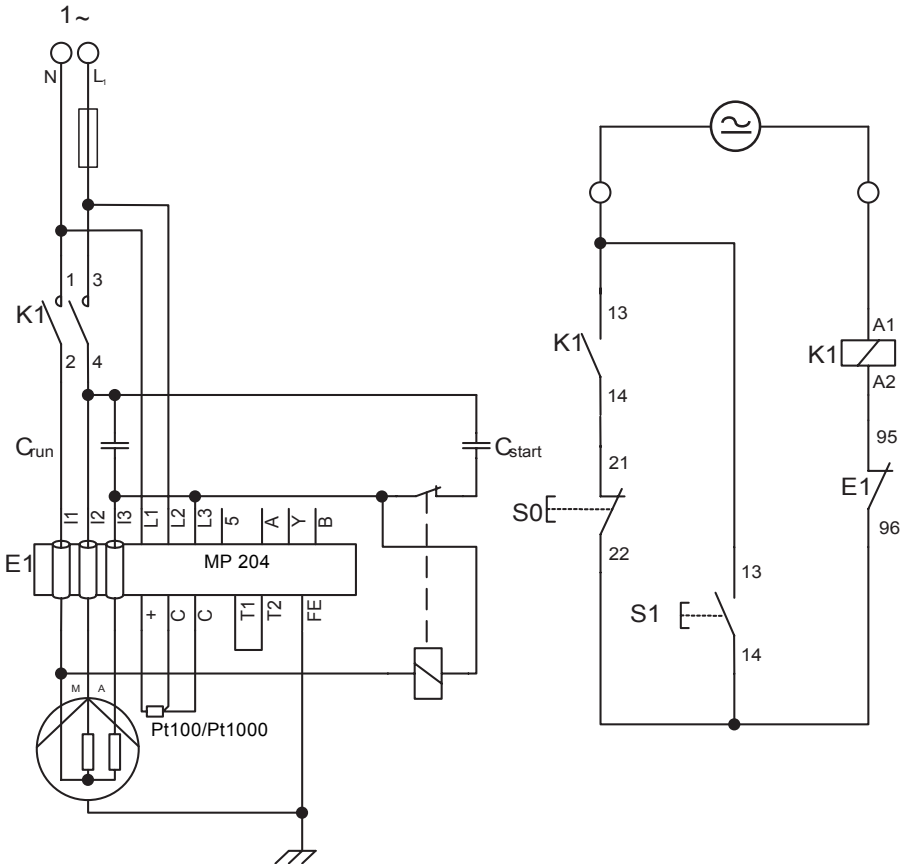


Fig. 11 Single-phase connection

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6.6 External current transformers

At motor currents above 120 A, external current transformers must be used. Fit the transformers as shown in fig. 12.

Note: Take the three measuring cables through the three holes in the MP 204 five times per phase. See fig. 13.

Note: The three current transformers must be fitted in the same direction, and the measuring cables must be connected in the same way.

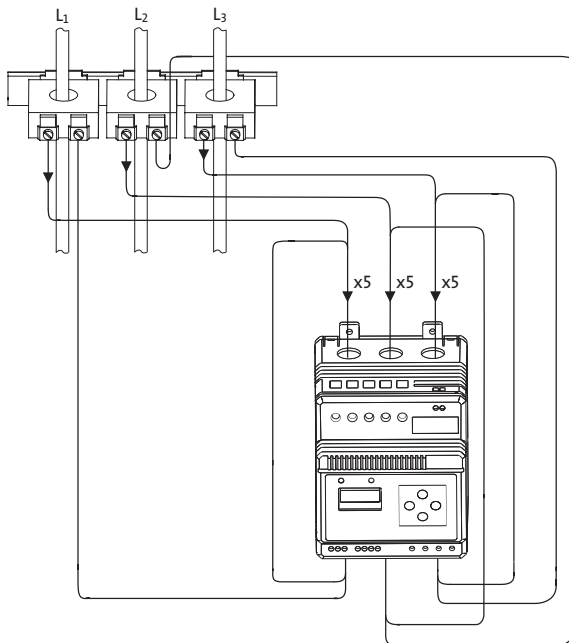


Fig. 12 Current transformers

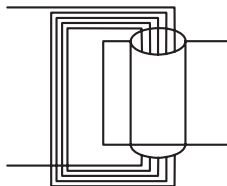


Fig. 13 Five windings per phase through the MP 204

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Product number	Current transformer ratio	I_{\max}	P_{\max}
96095274	200:5	200 A	5 VA
96095275	300:5	300 A	5 VA
96095276	500:5	500 A	5 VA
96095277	750:5	750 A	5 VA
96095278	1000:5	1000 A	5 VA

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7. Start-up

A basic setting of the MP 204 can be made on the control panel.

Additional functions must be set with the R100 remote control.

7.1 Operation

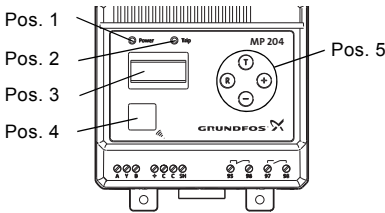


Fig. 14 Control panel

Pos. 1	"Power" indicator light	<ul style="list-style-type: none"> Flashes green until the MP 204 is ready for operation (power-on delay, see section 9.4.5). Is permanently green when the MP 204 is ready for operation. Flashes red when communicating with the R100.
Pos. 2	"Trip" indicator light	Is red when the trip relay is activated.
Pos. 3	Display	4 digits, for basic setting and data reading.
Pos. 4	IR field	R100 communication.
Pos. 5	Operating buttons	 Setting and operation.

7.1.1 Button **T** (Test)

Press the **T** button to open trip relay connection 95-96 and close signal relay connection 97-98. The red "Trip" indicator light is on.

The function is identical to the overload trip.

7.1.2 Button **R** (Reset)

Press the **R** button to change the tripped state to normal state with trip relay connection 95-96 closed and signal relay connection 97-98 open. The red "Trip" indicator light is off. This implies that the tripped state has actually ceased. The **R** button also resets warnings, if any.

7.1.3 Button **+**

Normally the actual current or temperature appears in the display. Press the **+** button to show information in the display, according to the following sequence:

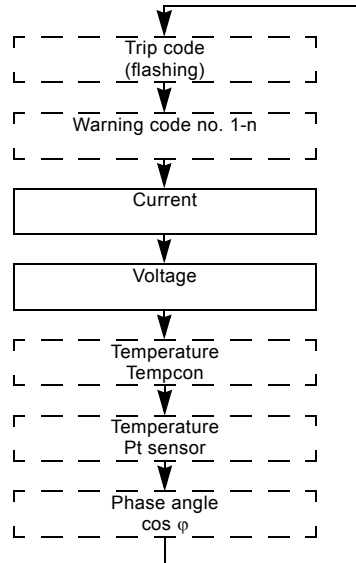


Fig. 15 Sequence in display

- The trip code only appears if the MP 204 is tripped. Switches between "trip" and trip code.
- The warning code only appears if the limit value of one or more warnings has been exceeded, and if warning code indication has been activated. See section 9.4.16.
- Temperatures only appear if the matching sensors have been connected and activated. If no Tempcon signal is received, "----" appears in the MP 204 display.
- Cos ϕ only appears if this indication has been activated with the R100. See section 9.4.16.

When the motor is operating, the display shows the actual value.

When the motor stops, the display shows the last measured value.

7.1.4 Button **-**

Only used in connection with the basic setting of the MP 204.

TM03 0181 4404

7.2 Setting on control panel

Press the **+** and **-** buttons simultaneously for a minimum of 5 seconds to place the MP 204 in the programming mode. When the display shows "...", the buttons can be released.

The set value, e.g. "4.9 A", appears. The unit symbol "A" is flashing.

Enter the values of

- rated current
- nominal voltage
- trip class
- number of phases.

Note: Insulation measurement is only possible of earthed three-phase systems.

If no buttons are activated, the voltage appears after 10 seconds.

After a further 10 seconds, the set voltage is stored automatically, and the programming mode ends. See fig. 16.

Note: Changes in rated current must be finished by pressing **T** to store the change.

7.2.1 Rated current

Set the rated motor current with the **+** and **-** buttons. (See motor nameplate.)

- Press **T** to store the setting and continue, or
- press **R** to cancel the change and finish.

The programming mode ends automatically after 10 seconds, and the change is cancelled. See fig. 16.

7.2.2 Nominal voltage

Set the nominal voltage with the **+** and **-** buttons.

- Press **T** to store the setting and continue, or
- press **R** to store the setting and finish.

The programming mode ends automatically after 10 seconds, and the change is stored. See fig. 16.

7.2.3 Trip class

Set the trip class with the **+** and **-** buttons.

For submersible pumps, manual setting of the trip delay, class "P", is normally selected. The time is factory-set to 10 seconds. It can be changed with the R100.

For other pumps, the required IEC trip class (1-45) is to be set. Normally class 10 is selected. For trip curves, see page 32.

- Press **T** to store the setting and continue, or
- press **R** to store the setting and finish.

The programming mode ends automatically after 10 seconds, and the change is stored. See fig. 16.

7.2.4 Number of phases

Set the number of phases with the **+** and **-** buttons (1 phase, 3 phases (non-earthed) or 3 phases w. FE (functional earth)).

- Press **T** to store the setting and continue, or
- press **R** to store the setting and finish.

The programming mode ends automatically after 10 seconds, and the change is stored. See fig. 16.

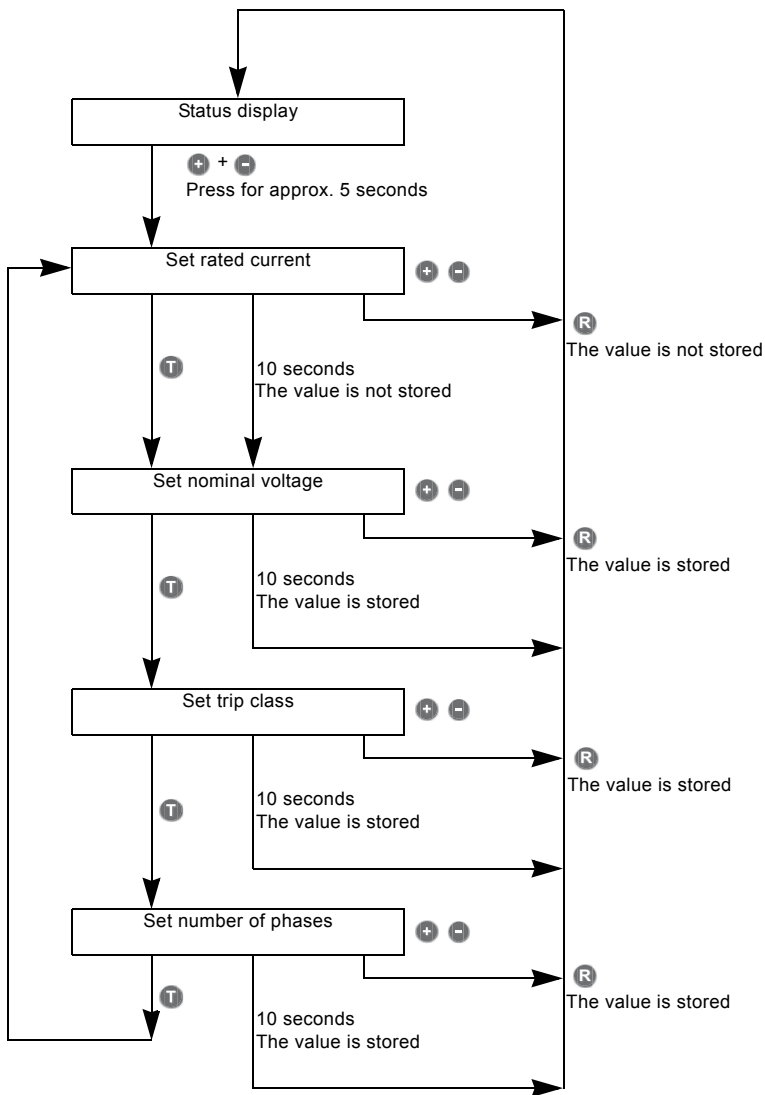


Fig. 16 Example of basic setting

7.3 Learning function

The learning function is factory-set to "Enable".

After two minutes of continuous motor operation, "LRN" appears in the display for approx. 5 seconds, while the values are being stored in the MP 204. See fig. 14, pos. 3.

If, for instance, a Pt sensor or capacitor has been replaced, reactivate the learning function by pressing the **R** and **⊖** buttons for a minimum of 10 seconds.

The dot in the right side of the display is flashing. The MP 204 is waiting for current to pass through the unit for a minimum of 120 seconds. Then the phase sequence is measured and stored.

In single-phase systems, the MP 204 measures the capacity of the starting and run capacitors and stores the values as reference.

If a Pt100/Pt1000 sensor is installed, the cable impedances to the sensor are measured and stored as reference.

8. R100 remote control

The R100 remote control is used for wireless communication with the MP 204. The R100 communicates via infra-red light. During communication, there must be visual contact between the R100 and the MP 204. See fig. 17.

The R100 offers additional settings and status readings for the MP 204.

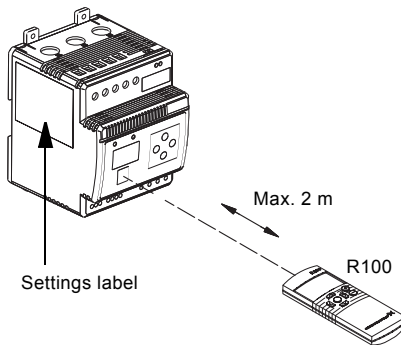


Fig. 17 R100 and label

The settings label, which is enclosed, can be affixed to the MP 204 as required.

If the R100 comes into contact with more than one unit at a time, the number of the desired unit must be entered. See section 9.4.17.

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8.1 R100 menus

0. GENERAL

See operating instructions for the R100.

1. OPERATION

- Operating mode
- Actual trip
- Actual warning 1
- Actual warning 2
- Alarm log 1
- Alarm log 2
- Alarm log 3
- Alarm log 4
- Alarm log 5.

2. STATUS

Display of

- Supply overview
- Average current
- Average voltage
- Tempcon sensor
- Pt100/Pt1000 sensor
- Power input and energy consumption
- Energy trip counter
- Phase sequence
- Current unbalance
- Operating hours and number of starts
- Trip counter of hours and starts
- Starting capacitor
- Run capacitor
- Insulation resistance
- Cos φ
- Harmonic distortion.

3. LIMITS

Display and setting of warning and trip limits.

- Tempcon sensor
- Pt sensor
- Tripping current
- Current warning
- Nominal voltage
- Voltage limits
- Current unbalance
- Starting capacitor
- Run capacitor
- Insulation resistance
- Cos φ trip
- Cos φ warning.

4. INSTALLATION

Setting and display of

- Supply mains
- Trip class
- Trip delay
- External current transformers
- Power-on delay
- Restarting
- Automatic restarting
- Tempcon sensor
- Pt sensor
- Insulation resistance measurement
- PTC/thermal switch
- Resetting of trip counters
- Service interval
- Number of automatic restarts
- Units/display
- MP 204 display
- GENIbus ID number
- Learning function.

8.2 Operating the R100

See operating instructions for the R100.

The function of the buttons and display elements of the R100 is briefly described below.

Change of menu

[<] or [>] steps from one menu to the other. The bottom line of the display shows the actual menu.

Arrows indicate in which direction it is possible to step.

The R100 can be switched off by pressing the buttons simultaneously.



Fig. 18 Change of menu

Rolling field

[v] or [^] moves one display forwards or backwards in each menu. To the right in the display, the position in the menu is indicated. Arrows indicate in which direction it is possible to move.

[<], [>], [v] and [^] In some of the displays, these buttons are also used to select the value field.



Fig. 19 Rolling field

Value field

[+] or [-] changes values in a display. Only values in framed fields can be changed. The actual/last transferred data will appear as light-coloured text on a dark background.

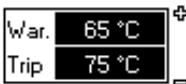


Fig. 20 Value field

Dark-coloured text

When data are changed, the text will be dark-coloured on a light background. When the entered value has been accepted by pressing [OK] and received by the MP 204, the text will again be light-coloured.

Before pressing [OK], the value can be reset by pressing [<] or [>].

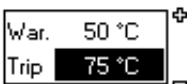


Fig. 21 Dark-coloured text

[OK]

- accepts the entered value or function.
- resets fault indications.

In the menus OPERATION, STATUS, LIMITS and INSTALLATION, data are exchanged between the R100 and the MP 204 each time the button [OK] is pressed.

[No contact]

If the R100 cannot come into contact with the MP 204, make a new attempt by pressing [OK].

Status field

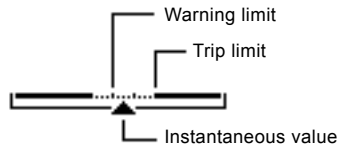


Fig. 22 Status field

In some of the displays in menu STATUS, a graphic display element shows the instantaneous value of the actual function in relation to the warning and trip limits set.

The graphic display element will appear in the following STATUS displays:

- Motor temperature
- Average voltage
- Average current
- Current unbalance
- Starting and run capacitors
- Temperature
- Cos φ
- Insulation resistance.

8.3 Menu structure

The menu structure for the R100 and MP 204 is divided into five parallel menus, each including a number of displays.

0. GENERAL

1. OPERATION

2. STATUS

3. LIMITS

4. INSTALLATION

An overview of the menu is shown at the end of this booklet.

9. Setting with the R100

The individual settings are described by means of matching displays.

An overview of the menu is shown at the end of this booklet.

While the R100 remote control is communicating with the MP 204, "Contact with" appears in the R100 display. The collection of data takes approx. 10 seconds.

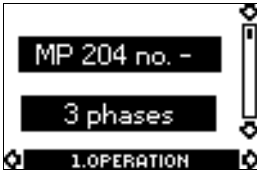
Menu 0. GENERAL

See operating instructions for the R100.

9.1 Menu 1. OPERATION

This menu shows alarms, alarm log and warnings.

9.1.1 Operating mode



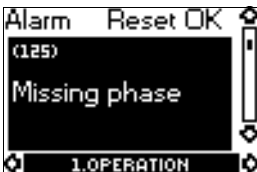
After the first contact, the start-up display shows the main settings.

The display shows that contact with an MP 204 has been established and the number of the MP 204 in the installation.

On delivery, no number has been assigned to the MP 204. The display shows "-". The display also shows that the MP 204 is set to three-phase, non-earthed operation.

Note: This display appears after the initial contact with the MP 204.

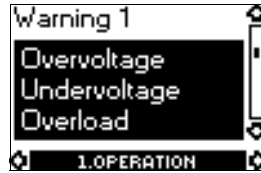
9.1.2 Actual trip



If the MP 204 is tripped, the cause of the trip is indicated.

For a list of trip and warning codes, see section 16.

9.1.3 Actual warning 1

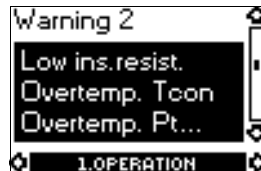


Six warnings can be shown at the same time.

If there are more than three warnings, the first three warnings are shown in this display, and the last three in the next display. See section 9.1.4.

Note: There is no time indication of the warnings. The warnings are not indicated in the order of occurrence.

9.1.4 Actual warning 2



If there are more than three warnings, warnings nos. 4 to 6 are shown in this display.

If there are more than six warnings, three dots "..." are shown after the last warning.

9.1.5 Alarm log 1



For a list of trip and warning codes, see section 16.

The last five tripping causes are stored in the alarm log. The time "1min" indicates the time which has passed since the MP 204 tripped.

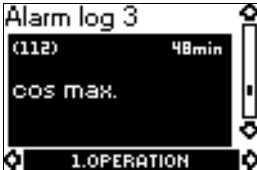
Note: The time is measured only as long as the MP 204 is powered. The clock stops when the MP 204 is no longer powered.

9.1.6 Alarm log 2



For a list of trip and warning codes, see section 16.

9.1.7 Alarm log 3



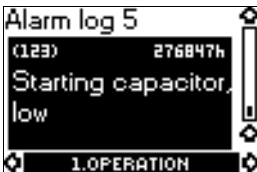
For a list of trip and warning codes, see section 16.

9.1.8 Alarm log 4



For a list of trip and warning codes, see section 16.

9.1.9 Alarm log 5



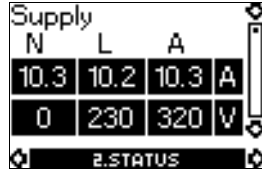
For a list of trip and warning codes, see section 16.

9.2 Menu 2. STATUS

The displays appearing in this menu are status displays only, i.e. actual operating data. It is not possible to change values. For measuring accuracies, see section 15.4.

When [OK] is pressed continuously, the displayed value is updated.

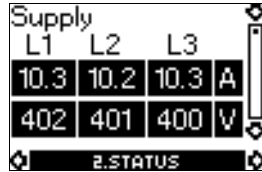
9.2.1 Supply overview



Example of a single-phase current and voltage measurement.

When a single-phase motor is connected correctly, the "N" shows 0 V.

The MP 204 measures the phase voltage as well as the voltage across the auxiliary winding. The current value is the actual phase current and the current through the auxiliary winding.



Example of a three-phase current and voltage measurement.

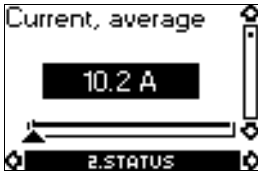
The MP 204 measures all mains voltages and currents.

The voltage is indicated as follows:

L1	L2	L3
U_{L1-L2}	U_{L2-L3}	U_{L3-L1}

The currents are actual values measured through the I1, I2, I3.

9.2.2 Average current

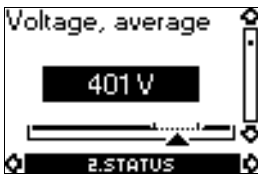


In the case of single-phase connection, the display shows the current in the neutral lead.

In the case of three-phase connection, the display shows the average current of all three phases, calculated as follows:

$$I_{\text{average}} = \frac{I_{L1} + I_{L2} + I_{L3}}{3} [\text{A}]$$

9.2.3 Average voltage

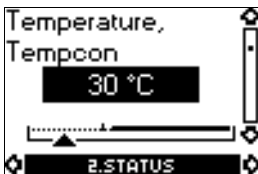


In the case of single-phase connection, the display shows the mains voltage U_{L-N} .

In the case of three-phase connection, the display shows the average mains voltage of all three phases, calculated as follows:

$$U_{\text{average}} = \frac{U_{L1-L2} + U_{L2-L3} + U_{L3-L1}}{3} [\text{V}]$$

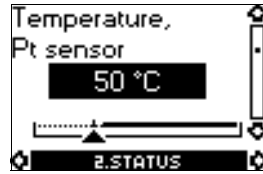
9.2.4 Tempcon sensor



Actual motor temperature measured with a Tempcon sensor.

It is presumed that the motor incorporates a Tempcon sensor, and that the function is active. See section 9.4.8.

9.2.5 Pt100/Pt1000 sensor

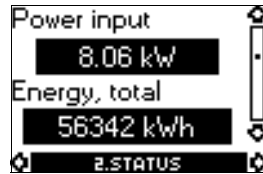


Actual temperature measured with a Pt100/Pt1000 sensor.

It is presumed that a Pt sensor has been connected, and that the function is active. See section 9.4.9.

Note: The learning function registers whether a Pt100/Pt1000 sensor is connected. When using a three-core Pt-sensor connection, the MP 204 automatically compensates for cable impedances.

9.2.6 Power input and energy consumption



Actual input power and motor energy consumption. The energy consumption is an accumulated value which cannot be reset.

The power is calculated like this:

$$U_{\text{average}} = \frac{U_{L1-L2} + U_{L2-L3} + U_{L3-L1}}{3} [\text{V}]$$

$$I_{\text{average}} = \frac{I_{L1} + I_{L2} + I_{L3}}{3} [\text{A}]$$

$$\cos\varphi_{\text{average}} = \frac{\cos\varphi_{L1} + \cos\varphi_{L2} + \cos\varphi_{L3}}{3} [-]$$

$$P = U_{\text{average}} \cdot I_{\text{average}} \cdot \sqrt{3} \cdot \cos\varphi_{\text{average}} [\text{W}]$$

9.2.7 Energy trip counter



Counter for measuring energy consumption. Can be reset. See section 9.4.12.

9.2.8 Phase sequence

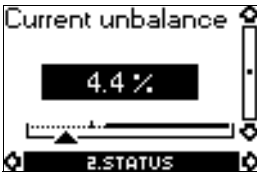


Actual phase sequence and frequency:

- L1-L2-L3 (correct direction of rotation)
- L1-L3-L2.

Note: The actual phase sequence is accepted as correct and stored when the learning function is terminated.

9.2.9 Current unbalance



The display shows the highest value of the following two calculations:

1.

$$I_{\text{unbalance}1} = \frac{I_{\text{fmax}} - I_{\text{average}}}{I_{\text{average}}} \cdot 100[\%]$$

2.

$$I_{\text{unbalance}2} = \frac{I_{\text{average}} - I_{\text{fmin}}}{I_{\text{average}}} \cdot 100[\%]$$

I_{fmax} : Highest phase current.

I_{fmin} : Lowest phase current.

I_{average} : Average current in all three phases.

9.2.10 Operating hours and number of starts



Number of operating hours and number of motor starts.

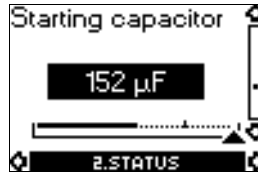
Note: The values cannot be reset.

9.2.11 Trip counter of hours and starts



Trip counter counting the number of operating hours and the number of motor starts. Can be reset.

9.2.12 Starting capacitor

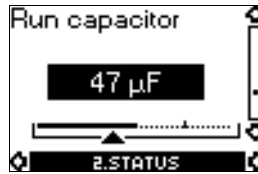


Actual value of the starting capacitor.

Note:

- The display is shown only in the case of single-phase connection.
- If the learning function is active, this value will be stored for future reference when the learning function is terminated. See section 9.3.8.

9.2.13 Run capacitor



Actual value of the run capacitor.

Note:

- The display is shown only in the case of single-phase connection.
- If the learning function is active, this value will be stored for future reference when the learning function is terminated. See section 9.3.9.

9.2.14 Insulation resistance

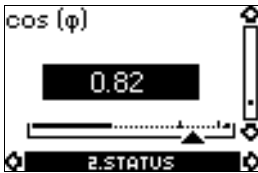


The insulation resistance to earth is measured on supply cables as well as on motor windings.

Note:

- The value is shown only if the MP 204 has been set up for three-phase, earthed operation.
- The insulation resistance is measured when the pump has stopped. If the trip limit has been exceeded, the motor is not capable of restarting.
- Terminal "5" must be connected as shown in figs. 8 and 9.

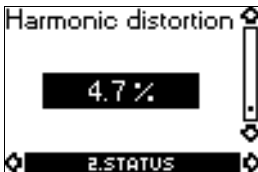
9.2.15 Cos φ



The actual cos φ of the motor.

Note: Functions in the case of single- as well as three-phase connection.

9.2.16 Harmonic distortion



Measured distortion on connected mains.

The heat dissipation in the motor windings increases with the distortion.

In case of distortion qualities above 15%, the supply mains should be checked for faults and noisy equipment.

9.3 Menu 3. LIMITS

The MP 204 operates with two sets of limits:

- a set of warning limits and
- a set of trip limits.

Some values only have a warning limit. See the table in section 16.

If one of the trip limits is exceeded, the trip relay stops the motor. Outputs 95-96 open, causing the control current to the contactor to be disconnected. At the same time, the signal relay, terminals 97-98, is closed. See fig. 6, pos. 6 and 7.

The limit values should not be changed unless the pump has stopped.

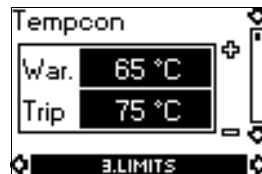
The trip limits must be set in accordance with the motor manufacturer's specifications.

The warning limits should be set to a less critical level than the trip limits.

If one or more of the warning limits are exceeded, the motor continues to run, but the warnings will appear in the MP 204 display, provided that this indication has been activated with the R100.

The warnings can also be read out with the R100.

9.3.1 Tempcon sensor



Set the warning and trip limits for the Tempcon sensor.

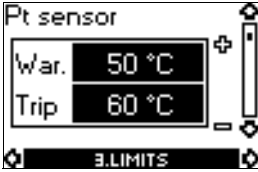
Factory setting:

- Warning: 65 °C.
- Trip: 75 °C.

Note: Above limits are not active until the Tempcon sensor has been activated. See section 9.4.8.

Note: The overvoltage and undervoltage trip limits will be deactivated automatically if the temperature monitoring with Tempcon has been set to active. See section 9.4.8.

9.3.2 Pt sensor



Set the warning and trip limits for the Pt sensor.

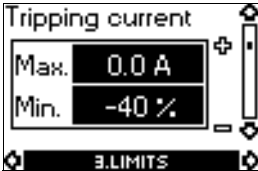
Factory setting:

- Warning: 50 °C.
- Trip: 60 °C.

Note: Above limits are not active until the Pt sensor has been activated. See section 9.4.9.

Note: The overvoltage and undervoltage trip limits will be deactivated automatically if the temperature monitoring with Pt100/Pt1000 has been set to active. See section 9.4.9.

9.3.3 Tripping current



Set the rated motor current in the "Max." field. (See motor nameplate.)

Factory setting:

- Max.: 0.0 A.

Set the min. current limit in the "Min." field. The min. current limit is typically a dry-running limit. The value is set in % of max. value.

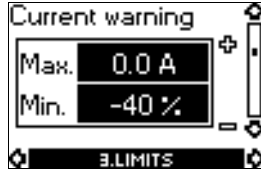
Factory setting:

- Min.: -40%.

Example:

The rated motor current is 10 A.
The motor is to cut out (trip) at a current below 6 A.
Set "-40%" in the "Min." field.

9.3.4 Current warning



Set the warning limits for "Max." and "Min.". Set the max. warning limit in the "Max." field. The value is set in ampere.

Factory setting:

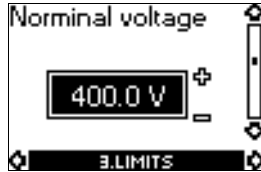
- Max.: 0.0 A.

Set the min. warning limit in the "Min." field. The value is set in % of max. value.

Factory setting:

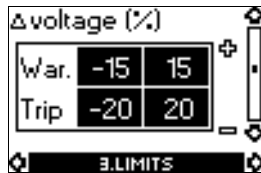
- Min.: -40%.

9.3.5 Nominal voltage



Set the nominal supply voltage.

9.3.6 Voltage limits



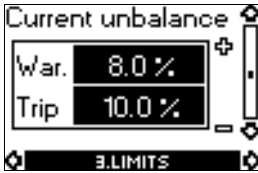
Set the warning and trip limits for under- and over-voltage.

Factory setting:

- Warning: ±15%.
- Trip: ±20%.

The values are set in % of nominal voltage.

9.3.7 Current unbalance

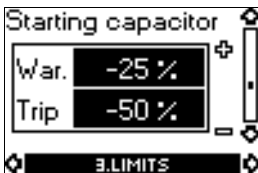


Set the warning and trip limits for current unbalance. For calculation, see section 9.2.9.

Factory setting:

- Warning: 8.0%.
- Trip: 10.0%.

9.3.8 Starting capacitor



Set the warning and trip limits for the capacity of the starting capacitor.

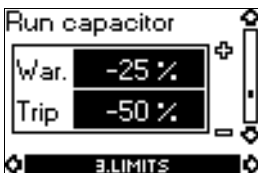
Factory setting:

- Warning: -25%.
- Trip: -50%.

The values are set as % of the value measured by the learning function. See section 9.2.12.

Note: Setting is only possible when single-phase operation has been selected. See section 9.4.1.

9.3.9 Run capacitor



Set the warning and trip limits for the capacity of the run capacitor.

Factory setting:

- Warning: -25%.
- Trip: -50%.

The values are set as % of the value measured by the learning function. See section 9.2.13.

Note: Setting is only possible when single-phase operation has been selected. See section 9.4.1.

9.3.10 Insulation resistance



Set the warning and trip limits for the insulation resistance in the installation. The value set should be low enough to allow for an early indication of faults in the installation.

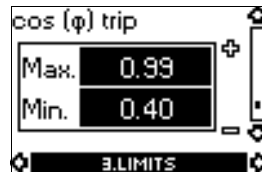
Factory setting:

- Warning: 100 kΩ.
- Trip: 20 kΩ.

Note:

- Insulation faults must be set to active to enable these limits. See section 9.4.10.
- Setting is only possible when "3 phases w. FE" (functional earth) has been selected. See section 9.4.1.

9.3.11 Cos φ trip



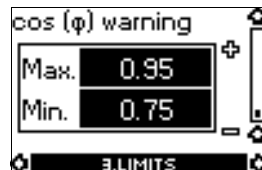
Set the trip limits for cos φ.

Factory setting:

- Max.: 0.99.
- Min.: 0.40.

This function can be used as dry-running protection when dry running cannot be detected by means of a current measurement.

9.3.12 Cos φ warning



Set the warning limits for cos φ.

Factory setting:

- Max.: 0.95.
- Min.: 0.75.

9.4 Menu 4. INSTALLATION

In this menu, it is possible to set a number of operating data and thus match the MP 204 to the actual installation.

The installation values should not be changed unless the pump has stopped.

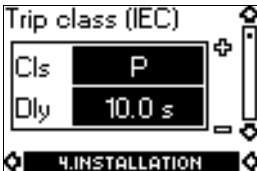
9.4.1 Supply mains



Set the supply mains to which the MP 204 is connected:

- **3 phases** (non-earthed) (factory setting)
- **3 phases w. FE** (functional earth)
- **1 phase**.

9.4.2 Trip class



Line 1: Select IEC trip class (1 to 45).

If manual indication of trip delay in the case of overload is required, select trip class "P".

Factory setting:

- Cls (trip class): P.

Line 2: Select trip delay.

Factory setting:

- Dly (trip delay): 10.0 s.

9.4.3 Trip delay



Set the trip delay before the MP 204 trips.

Note: This does not apply to overload. For tripping due to overload, see the curves, pages 31 and 32.

Factory setting:

- 5 s.

9.4.4 External current transformers



Set the external current transformer factor.

If no external current transformer is used, the factor is 1.

Factory setting:

- 1.

Note: Set the actual factor.

Example:

A current transformer with a 200:5 ratio is used and five windings through the MP 204 are made, as shown in fig. 9.

$$CT = \frac{200}{5 \cdot 5} = 8$$

Grundfos current transformers	Set CT factor
200:5	8
300:5	12
500:5	20
750:5	30
1000:5	40

Note: The above table only applies to Grundfos current transformers, connected as shown in figs. 9 and 10.

9.4.5 Power-on delay



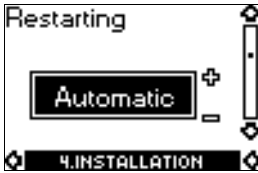
Number of seconds elapsing from the moment voltage is applied to the MP 204 until the activation of the trip relay (terminals 95-96) and signal relay (terminals 97-98).

Factory setting:

- 5 s.

Note: If the MP 204 and the contactor are mounted as shown in figs. 8 and 9, the motor cannot start during this delay.

9.4.6 Restarting



Set whether restarting after tripping is to be

- **Automatic** (factory setting)
- *Manual*.

For setting of time, see section 9.4.7.

9.4.7 Automatic restarting



Set the time after which the MP 204 is to attempt automatic restarting of motor after cut-out.

The time runs from the moment when the value which triggered the fault has returned to normal.

Factory setting:

- 300 s.

9.4.8 Tempcon sensor



Set whether a Tempcon sensor is incorporated in the motor.

- *Enable*
- **Disable** (factory setting).

If the Tempcon sensor is set to active and no Tempcon signal is received from the pump, the MP 204 display shows "----" instead of Tempcon temperature.

Note: The overvoltage and undervoltage trip limits will be deactivated automatically if the temperature monitoring with Tempcon has been set to active.

9.4.9 Pt sensor



Set whether a Pt sensor is connected.

- *Enable*
- **Disable** (factory setting).

If the Pt sensor is set to active and no signal is received from the sensor, the MP 204 display shows "----" instead of Pt temperature.

Note: The overvoltage and undervoltage trip limits will be deactivated automatically if the temperature monitoring with Pt100/Pt1000 has been set to active.

Note: The learning function registers automatically whether a Pt100/Pt1000 sensor is connected.

9.4.10 Insulation resistance measurement



Set whether insulation resistance measurement is to be made.

- *Enable*
- **Disable** (factory setting).

If three-phase, earthed mains is selected (see section 9.4.1), this setting is automatically changed to "Enable".

If single-phase mains is selected (see section 9.4.1), this setting is automatically changed to "Disable".

Note:

- The insulation resistance can only be measured if terminal "FE" is earthed and the supply mains is set to "3 phases w. FE".
- The leakage is measured when the MP 204 is powered and the motor stopped.
- The MP 204 must be connected in front of the contactor, and terminal "5" after the contactor. See figs. 8 and 9.

9.4.11 PTC/thermal switch



Set whether a PTC/thermal switch is connected.

- **Enable** (factory setting)
- *Disable*.

9.4.12 Resetting of trip counters

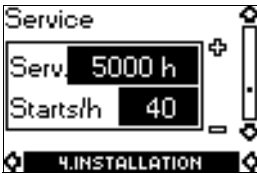


Select the trip counters to be reset.

- **All** (all trip counters) (factory setting)
- *Hours* (operating hours)
- *Starts* (number of starts)
- *Energy* (energy consumption).

See sections 9.2.7 and 9.2.11.

9.4.13 Service interval



Line 1: Set the number of hours of motor operation at which the MP 204 is to give a service warning in the display.

Factory setting:

- Service: 5000 h.

Line 2: Set the number of starts allowed per hour at which the MP 204 is to give a warning in the display.

Factory setting:

- Starts/h: 40.

9.4.14 Number of automatic restarts



Set the number of automatic restarts that the motor is allowed to make within 24 hours before cutting out.

Alarm:

- *Enable*
- **Disable** (factory setting).

Number:

- 3 (factory setting).

Note: If this tripped state occurs, the motor can only be restarted manually.

9.4.15 Units/display



Line 1: Set unit.

Temperature:

- **SI** (factory setting)
- *US*.

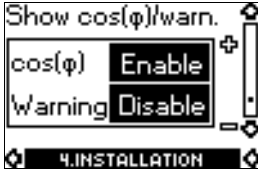
Note: If SI units have been selected, the temperature is indicated in degree Celsius (°C). If US units have been selected, the temperature is indicated in Fahrenheit (°F).

Line 2: Select the MP 204 display indication during normal operation.

Display:

- **Crnt** (current) (factory setting)
- *Tcon* (Tempcon temperature)
- *Pt sen.* (Pt100/Pt1000 temperature).

9.4.16 MP 204 display



Line 1: Set whether the $\cos \varphi$ value is to be shown in the MP 204 display by means of the + button. See section 7.1.3.

cos φ :

- **Enable** (factory setting)
- *Disable*.

Line 2: Set whether warnings are to be shown in the display.

Warning:

- *Enable*
- **Disable** (factory setting).

If display of warnings is active, the MP 204 display will switch from standard display (e.g. current) to warning code display when the limit value is exceeded. The remaining values can still be read out by means of the + button. See section 7.1.3.

9.4.17 GENibus ID number



Set ID number.

If several units are connected to the same GENibus, each unit must be assigned a unique ID number.

Factory setting:

- - (no number assigned).

9.4.18 Learning function



The learning function is active until the motor has been operating for a minimum of 120 seconds. The dot in the right side of the MP 204 display is flashing. During the storing of the measured values, "LRN" appears in the MP 204 display.

Three-phase operation:

- Accepts the actual phase sequence as correct.
- If a Pt100/Pt1000 sensor is connected, the cable impedances to the sensor are measured.

Single-phase operation:

- Starting and run capacitors are measured.
- If a Pt100/Pt1000 sensor is connected, the cable impedances to the sensor are measured.

Note: The learning function changes to "Disable" when the measurements have been made.

- **Enable** (factory setting)
- *Disable*.

10. MP 204 with GENIbus

If several MP 204 units are connected to the same GENIbus, the connection is to be made as shown in fig. 23.

Note the connection of screen to conductive support.

If the GENIbus has been in use, and bus communication monitoring has been activated, the MP 204 will continue to monitor the bus activity. If the MP 204 does not receive GENIbus telegrams, the MP 204 presumes that the GENIbus connection has been disconnected and indicates a fault on the individual units.

Each of the units in the chain must be assigned an identification number with the R100, see section 9.4.7.

For further information about the GENIbus, see WebCAPS at www.grundfos.com.

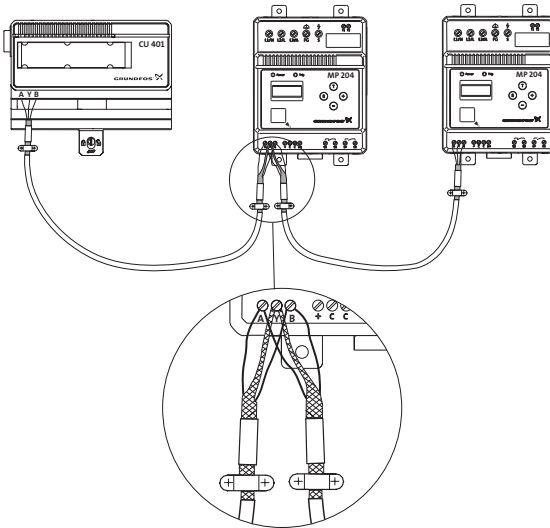


Fig. 23 GENIbus

11. Approvals and standards

The MP 204 conforms to:

- UL 508
- IEC 947
- IEC/EN 60335-1
- IEC/EN 61000-5-1
- IEC 61000-6-3
- IEC 61000-6-2
- EN 61000-6-3
- EN 61000-4-5
- EN 61000-4-4
- EN 61000-4-6.

12. Pump operation with MP 204

12.1 Industrial pumps

Industrial pumps may incorporate a PTC/thermal switch to be connected direct to the MP 204.

Industrial pumps mainly apply IEC trip classes 20 to 30, depending on the liquid viscosity.

TM03 0173 4304

12.2 Submersible pumps

Submersible pumps normally have a short start-up time. Trip class "P" can therefore be applied with advantage for these pumps. It is possible to set very short times down to for example 900 ms, used for certain specific applications.

To prevent the Tempcon signal from one submersible pump from interfering with the signal from another, cabling must be carefully made to allow measurements to be made of both pumps at the same time. The motor cables must be kept apart and not installed in the same cable tray. To avoid interference, it may be necessary to fit a filter on the supply cables. See fig. 24.

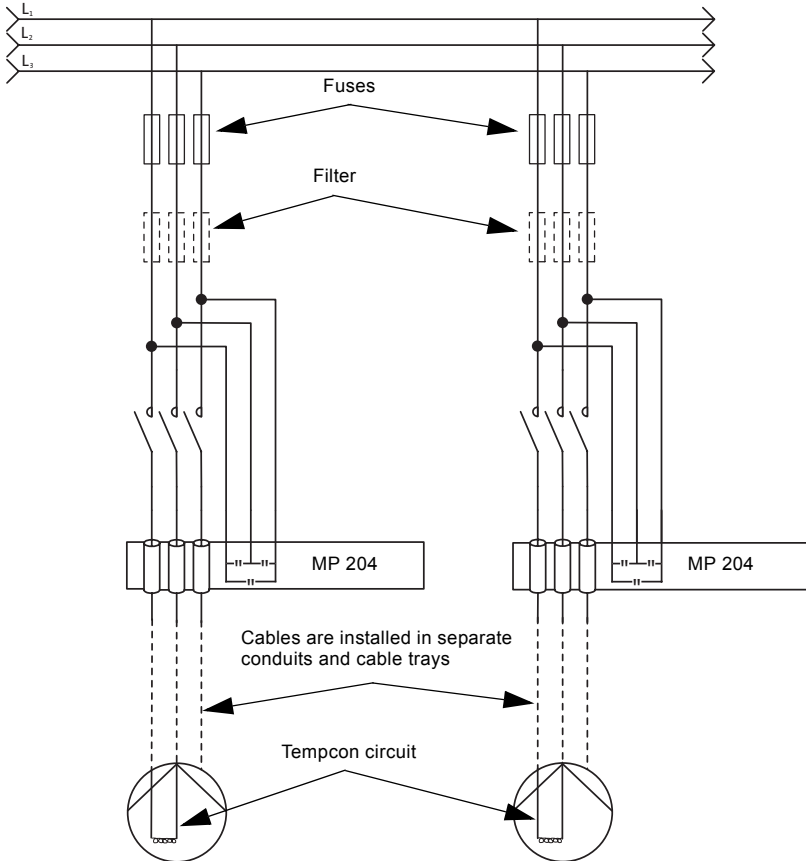


Fig. 24 Submersible pump installation with Tempcon

12.3 Wastewater pumps

Wastewater pumps may incorporate a PTC/thermal switch to be connected direct to the MP 204.

Wastewater pumps may also be connected to a Pt100/Pt1000 sensor. The sensor can also be connected direct to the MP 204.

The Pt100/Pt1000 can be activated with the R100, see section 9.4.9, or via a CU 401 control unit and an OD 401 control panel.

A high IEC trip class is to be applied for wastewater pumps, especially grinder-type pumps. Classes 25 to 35 are the optimum choice. Apply IEC trip class 45 for the pumping of liquids of extremely high viscosity or liquids containing many solid particles.

13. Curves

13.1 Trip class "P"

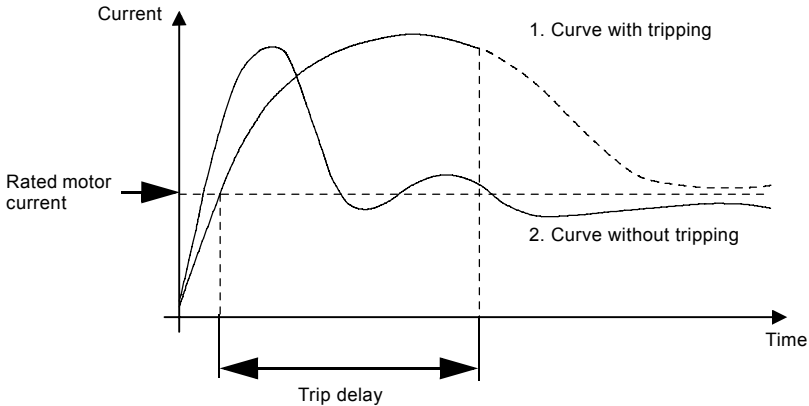


Fig. 25 Curves for trip class "P"

The trip delay indicates the maximum period of time during which the overload condition is allowed to exist, for example 5 seconds.

Example:

A pump is to cut out after 900 ms because the rated current has been exceeded.

- Select trip class "P".
- Set the overload limit to 10 A (the rated motor current is stated on the nameplate).
- Set the trip delay to 900 ms.

Fig. 25, curve 1:

The pump has an abnormal start-up time, and the current exceeds 10 A. The MP 204 trips after 900 ms.

Fig. 25, curve 2:

The pump has a normal start-up time, and the current exceeds 10 A only briefly (< 900 ms). The MP 204 does not trip.

Note: The curves are examples and cannot be used for readings.

13.2 IEC trip curves

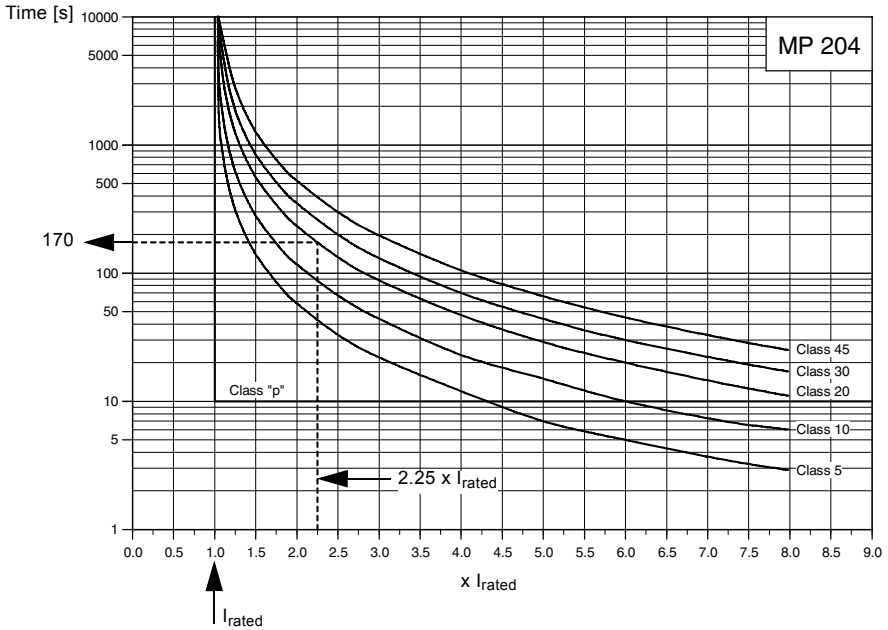


Fig. 26 IEC trip curves

Example:

- Set the MP 204 to IEC trip class 20.
- Set the overload limit to 10 A (the rated motor current is stated on the nameplate).

At a motor current of 22.5 A (10×2.25), the MP 204 trips after approx. 170 seconds.

14. Technical data

Ambient temperature

- During operation: -20°C to +60°C (must not be exposed to direct sunlight).
- In stock: -25°C to +85°C.
- During transportation: -25°C to +85°C.

Relative air humidity

From 5% to 95%.

Materials

Enclosure class: IP 20.

Plastic type: Black PC / ABS.

15. Electrical data

Supply voltage

100-480 VAC, 50/60 Hz.

Current consumption

Max. 5 W.

Short-circuit rating

Suitable for use on a circuit capable of delivering not more than 15000 RMS symmetrical amperes, 480 V maximum.

15.1 Outputs

Trip relay



Voltage category	III
Insulation voltage	400 V (to all other terminals)
Insulation test voltage	4 kVAC
Max. load	400 VAC, 2 A, AC-15/24 VDC, 2 A, DC-13, L/R = 40 ms
Min. load	5 V/10 mA
Max. load power AC/DC	400 VA/48 W
Contact type	NC (normally closed contact)

Signal relay

Voltage category	III
Insulation voltage	400 V (to all other terminals)
Insulation test voltage	4 kVAC
Max. load	400 VAC, 2 A, AC-15/24 VDC, 2 A, DC-13, L/R = 40 ms
Min. load	5 V/10 mA
Max. load power AC/DC	400 VA/48 W
Contact type	NO (normally open contact)

15.2 Inputs

Input for PTC/thermal switch

Voltage category	III
Insulation voltage	400 V (to all other terminals)
Insulation test voltage	4 kVAC
Output voltage (open contact)	5 V
Output current (closed contact)	2 mA
Voltage step from high to low	 2.0 V
Equivalent external load	1.5 kΩ
Voltage step from low to high	 2.5 V
Equivalent external load	2.2 kΩ
Input filter time	41 ±7 ms

Input for Pt100/Pt1000 sensor

Voltage category	II
Insulation voltage	50 V (to system earth)
Insulation test voltage	700 VDC
Temperature range	0-200°C
Sensor type	Screened 2- or 3-core cable
Sensor current (Pt100)	2.5 mA
Sensor current (Pt1000)	0.25 mA
Mains frequency suppression	50-60 Hz
Filter times:	
Integration time	100 ms
Reading interval	400 ms

15.3 Insulation measurement method

The insulation resistance is measured applying a rectified alternating voltage. The test voltage can therefore not be measured using an ordinary voltmeter.

The open-circuit test voltage is calculated as follows:

$$U_{\text{test}} \cong \sqrt{\frac{2}{3}} \cdot U_{\text{mains}}[\text{V}]$$

Example:

The MP 204 is connected to 3 x 400 V.

$$U_{\text{test}} \cong \sqrt{\frac{2}{3}} \cdot 400 = 327[\text{V}]$$

15.4 Measuring ranges

	Measuring range	Accuracy	Resolution
Current without external current transformer	3 - 120 A	±1%	0.1 A
Current with external current transformer	120 - 999 A	±1%	1 A
Phase-to-phase voltage	80 - 610 VAC	±1%	1 V
Frequency	47 - 63 Hz	±1%	0.5 Hz
Insulation resistance	10 - 1 MΩ	±10%	10 kΩ
Temperature via Pt100/Pt1000	0 - 180°C	±1°C	1°C
Temperature via Tempcon	0 - 125°C	±3°C	1°C
Power consumption	0 - 16 MW	±2%	1 W
Power factor (cos φ)	0 - 0.99	±2%	0.01
Run capacitor (single-phase)	10 - 1000 μF	±10%	1 μF
Starting capacitor (single-phase)	10 - 1000 μF	±10%	1 μF
Number of starts	0 - 65535	–	1
Energy consumption	0 - 4*10 ⁹ kWh	±5%	1 kWh

15.5 Setting ranges

	Setting range	Resolution
Current without external current transformer	3 - 120 A	0.1 A
Current with external current transformer	120 - 999 A	1 A
Phase-to-phase voltage	80 - 610 VAC	1 V
Temperature via Pt100/Pt1000	0 - 180°C	1°C
Temperature via Tempcon	0 - 125°C	1°C
Power factor (cos φ)	0 - 0.99	0.01
IEC trip class	1 - 45 and "P"	1
Special trip class "P" (pump), trip delay	0.1 - 30 s	0.1 s
External current transformer factor	1 - 100	1
Run capacitor (single-phase)	10 - 1000 μF	1 μF
Starting capacitor (single-phase)	10 - 1000 μF	1 μF
Number of starts per hour	0 - 65535	1
Number of starts per 24 hours	0 - 65535	1
Trip delay (other than current)	1 - 100 s	1 s
Automatic restarting time	10 - 3000 s	10 s
Power-on delay	1 - 19 s	1 s

16. Fault finding

16.1 Warning and trip codes

MP 204 display	A	32
A = Trip E = Warning		
Fault code		

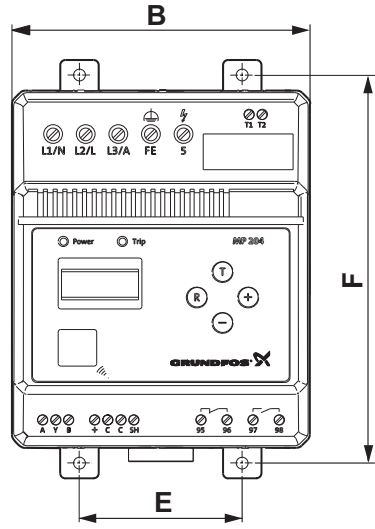
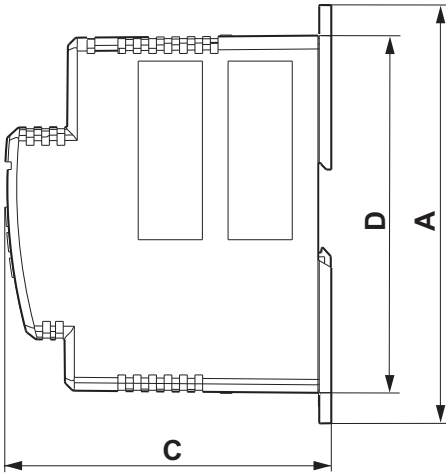
Fault code	Trip	Warning	Cause of trip/warning
2	A	–	Missing phase
3	A	–	PTC/thermal switch
4	A	–	Too many automatic restarts per 24 hours
9	A	–	Wrong phase sequence
12	–	E	Service warning
15	A	–	Communication alarm for main system
18	A	–	Commanded trip (not in alarm log)
20	A	E	Low insulation resistance
21	–	E	Too many starts per hour
26	–	E	The motor is operating even if the MP 204 is tripped
32	A	E	Overvoltage
40	A	E	Undervoltage
48	A	E	Overload
56	A	E	Underload
64	A	E	Overtemperature, Tempcon measurement
71	A	E	Overtemperature, Pt100/Pt1000 measurement
91	–	E	Signal fault, Tempcon sensor
111	A	E	Current unbalance
112	A	E	Cos ϕ , max.
113	A	E	Cos ϕ , min.
120	A	–	Auxiliary winding fault
123	A	E	Starting capacitor, low
124	A	E	Run capacitor, low
175	–	E	Signal fault, Pt100/Pt1000 sensor

17. Disposal

This product or parts of it must be disposed of in an environmentally sound way:

1. Use the public or private waste collection service.
2. If this is not possible, contact the nearest Grundfos company or service workshop.

Dimensions



TM03 0150 4204

A	B	C	D	E	F
164	116	127	140	63	151

All dimensions in mm.

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