

Protection Module for Water and Waste Water Products

Amacontrol

Installation/Operating Manual



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Installation/Operating Manual Amacontrol

Original operating manual

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1 General

1.1 Principles

This operating manual is valid for the type series and variants indicated on the front cover.

The operating manual describes the proper and safe use of this equipment in all phases of operation.

The name plate indicates the type series, the main operating data, the material number and the serial number. The material number and the serial number uniquely describe the product and are used as identification in all further business processes.

In the event of damage, immediately contact your nearest KSB service facility to maintain the right to claim under warranty.

1.2 Target group

This operating manual is aimed at the target group of trained and qualified specialist technical personnel.

1.3 Other applicable documents

Table 1: Overview of other applicable documents

Document	Contents
Operating manual	Description of proper and safe use in all phases of operation
Wiring diagram	Description of electrical connections

Observe the relevant manufacturer's product literature for the accessories.

1.4 Symbols

Table 2: Symbols used in this manual

Symbol	Description
✓	Conditions which need to be fulfilled before proceeding with the step-by-step instructions
▷	Safety instructions
⇒	Result of an action
⇔	Cross-references
1. 2.	Step-by-step instructions
	Note Recommendations and important information on how to handle the product

1.5 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

Symbol	Description
 DANGER	DANGER This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
 WARNING	WARNING This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
CAUTION	CAUTION This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.

Symbol	Description
	General hazard In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.
	Electrical hazard In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.
	Machine damage In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.



2 Safety

All the information contained in this section refers to hazardous situations.

In addition to the present general safety information the action-related safety information given in the other sections must be observed.

2.1 General

- This operating manual contains general installation, operating and maintenance instructions that must be observed to ensure safe operation of the system and prevent personal injury and damage to property.
- Comply with all the safety instructions given in the individual sections of this operating manual.
- The operating manual must be read and understood by the responsible specialist personnel/operators prior to installation and commissioning.
- The contents of this operating manual must be available to the specialist personnel at the site at all times.
- Information and markings attached directly to the product must always be complied with and kept in a perfectly legible condition at all times. This applies to, for example:
 - Markings for connections
 - Name plate
- The operator is responsible for ensuring compliance with all local regulations not taken into account.

2.2 General information

The product described in this document is designed to take on specific functions as part of a complete system or machinery. A complete system usually comprises sensors, analysis units, signalling devices and methods for safe tripping.

It is the system or machinery manufacturer's responsibility to ensure the correct overall functionality. KSB is not in a position to guarantee all properties of an overall system or machinery which was not designed by KSB.

The overall concept of the control system into which this device is integrated must be validated by the user. The general KSB terms and conditions of sale and delivery apply; no further rights to guarantee, warranty or liability claims can be derived from the following description. The KSB INTspecter app is available free of charge for the operating systems iOS, Android and Windows 10 in the corresponding stores; it can be used with smart phones, tablets or computers.

2.3 Intended use

Amacontrol is a versatile protection device for universal use. It serves to protect and monitor pumps, pump systems and submersible mixers in the most diverse of applications. For individual settings (parameterisation) and reading of stored data the KSB INTspecter app and the KRIWAN accessories USB gateway or Bluetooth gateway can be used.

- This product must only be operated within the limit values specified in the technical product literature for the mains voltage, mains frequency, ambient temperature, and in compliance with any other instructions provided in the operating manual or other applicable documents.
- The product must not be used in potentially explosive atmospheres.
- The product may only be used for submersible motor pumps with rated voltages up to 690 V.
- The product must only be operated in the fields of application described in the other applicable documents.

2.4 Personnel qualification and training

- All personnel involved must be fully qualified to install, operate, maintain and inspect the product this manual refers to.
- The responsibilities, competence and supervision of all personnel involved in transport, installation, operation, maintenance and inspection must be clearly defined by the operator.
- Deficits in knowledge must be rectified by means of training and instruction provided by sufficiently trained specialist personnel. If required, the operator can commission the manufacturer/supplier to train the personnel.
- Training on the product must always be supervised by specialist technical personnel.

2.5 Consequences and risks caused by non-compliance with this operating manual

- Non-compliance with this operating manual will lead to forfeiture of warranty cover and of any and all rights to claims for damages.
- Non-compliance can, for example, have the following consequences:
 - Hazards to persons due to electrical, thermal, mechanical and chemical effects and explosions
 - Failure of important product functions
 - Failure of prescribed maintenance and servicing practices

2.6 Safety awareness

In addition to the safety information contained in this operating manual and the intended use, the following safety regulations shall be complied with:

- Accident prevention, health regulations and safety regulations
- Explosion protection regulations
- Safety regulations for handling hazardous substances
- Applicable standards, directives and legislation (e.g. EN 50110-1)

2.7 Safety information for the user/operator

- Provide the personnel with protective equipment and make sure it is used.
- Contain any residues of hazardous fluids (e.g. explosive, toxic, hot) so as to avoid any danger to persons and the environment. Observe all legal requirements.

2.8 Safety information for maintenance, inspection and installation

- Modifications or alterations are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts/components authorised by the manufacturer. The use of other parts/components can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
- Any work on the product shall only be performed when it has been disconnected from the power supply (de-energised).

2.9 Unauthorised modes of operation

Never operate the product outside the limits stated in the data sheet and in this manual.

The warranty relating to the operating reliability and safety of the product supplied is only valid if the product is used in accordance with its intended use.



2.10 Explosion protection

Always observe the information on explosion protection given in this section when operating an explosion-proof pump set.

Sections of the manual marked by the symbol opposite apply to explosion-proof pump sets also when temporarily operated outside potentially explosive atmospheres.

Pumps / pump sets must not be used in potentially explosive atmospheres unless marked as explosion-proof **and** identified as such in the data sheet.

Special conditions apply to the operation of explosion-proof pump sets in accordance with EU Directive *2014/34/EU (ATEX)*.

Especially adhere to the sections in this manual marked with the symbol opposite. The explosion-proof status of the pump is only assured if the pump is used in accordance with its intended use.

Never operate the product outside the limits stated in the data sheet and on the name plate.

Prevent impermissible modes of operation.

2.11 Software changes

The software has been specially created for this product and thoroughly tested. Making changes or additions to the software or parts of the software is prohibited. This does not, however, apply to software updates supplied by KSB.

3 Transport/Storage/Disposal

3.1 Checking the condition upon delivery

1. On transfer of goods, check each packaging unit for damage.
2. In the event of in-transit damage, assess the exact damage, document it and notify KSB or the supplying dealer and the insurer about the damage in writing immediately.

3.2 Transport

The protection module must be shut down for transport.

Table 4: Ambient conditions for transport

Ambient condition	Value
Relative humidity	Max. 80 % (no condensation)
Ambient temperature	-30 °C to +70 °C

	CAUTION
	Improper transport Damage to the protection module! ▷ Always transport the protection module properly and in either its original packaging or suitable individual packaging.

1. Upon receipt, unpack the protection module and check for in-transit damage.
2. Report any in-transit damage to the manufacturer immediately.
3. Dispose of packaging material in accordance with local regulations.

3.3 Storage

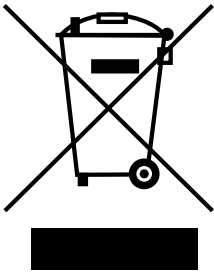
If the ambient conditions for storage are met, the function of the protection module is safeguarded even after a prolonged period of storage.

	CAUTION
	Damage during storage due to humidity, dirt or vermin Corrosion/contamination of the protection module! ▷ For outdoor storage: Cover the (packaged or unpackaged) protection module with water-proof material.

Table 5: Ambient conditions for storage

Ambient condition	Value
Relative humidity	Max. 85 % (non-condensing)
Ambient temperature	- 30 °C to + 70 °C

- Store the protection module in dry, vibration-free conditions and, if possible, in either its original packaging or suitable individual packaging.
- Store the protection module in a dry room where the level of atmospheric humidity is as constant as possible.
- Prevent excessive fluctuations in atmospheric humidity (see the "Ambient conditions for storage" table).



3.4 Disposal/recycling

Electrical or electronic equipment marked with the adjacent symbol must not be disposed of in household waste at the end of its service life.

Contact your local waste disposal partner for returns.

If the used electrical or electronic equipment contains personal data, the operator is responsible for deleting it before the equipment is returned.

The product is classified as special waste due to several installed components:

1. Dismantle the product.
2. Separate materials
e.g.:
 - Aluminium
 - Plastic cover (recyclable plastic)
 - Line chokes with copper windings
 - Copper lines for internal wiring
3. Dispose of materials in accordance with local regulations or in another controlled manner.
PCBs, power electronics, capacitors and electronic components are all special waste.

4 Description

4.1 General description

Protection module for water and waste water products as all-in-one device. Depending on the variant, it can be used for motor temperature measurement, bearing temperature measurement, leakage measurement, vibration measurement, voltage measurement and current measurement as well as for diagnosing a pump, pump system or submersible mixer to ensure trouble-free and reliable operation.

4.2 Product information as per Regulation No. 1907/2006 (REACH)

For information as per chemicals Regulation (EC) No. 1907/2006 (REACH), see <https://www.ksb.com/ksb-en/About-KSB/Corporate-responsibility/reach/>.

4.3 Designation

Table 6: Designation example

Position																													
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	m	a	c	o	n	t	r	o	l	_	4	_	A	0	2	4	_	X	X	X	X	X	X	0	0	X	M	0	0

Table 7: Designation key

Position	Code	Description
1-10	Type series	
12	Design	
14	Type of current	
	A	Alternating current / direct current
	B	Alternating current
15-17	Supply voltage [V]	
	024	24 V ± 10%
	230	115 V - 230 V ± 10%
19	Analysing relay, motor temperature	
	0	Without motor temperature
	B	Bimetal
	P	PTC
	X	Parameters not pre-set, can be set via the app
20	Analysing relay, temperature 1	
	0	Without drive-end temperature monitoring
	B	Bimetal
	1	Pt100 resistance thermometer
	X	Parameters not pre-set, can be set via the app
21	Analysing relay, temperature 2	
	0	Without Pt100 resistance thermometer
	1	With Pt100 resistance thermometer
	X	Parameters not pre-set, can be set via the app
22	Analysing relay, resistance	
	0	Without float switch
	1	With float switch (mechanical seal leakage)
	X	Parameters not pre-set, can be set via the app
23	Analysing relay, conductive 1	
	1	Leakage sensor
	X	Parameters not pre-set, can be set via the app
	0	None

Position	Code	Description
24	Analysing relay 4-20 mA	
	0	Without vibration monitoring
	1	With vibration monitoring
	X	Parameters not pre-set, can be set via the app
25	Analysing relay, temperature 3	
	B	Bimetal
	P	PTC
	1	Pt100
	X	Parameters not pre-set, can be set via the app
	0	None
26	Analysing relay, conductive 2	
	1	Leakage sensor
	X	Parameters not pre-set, can be set via the app
	0	None
27	Analysing relay, current measurement	
	1	Current measurement
	X	Parameters not pre-set, can be set via the app
	0	None
28	Field bus module	
	M	Modbus
	0	None
29	Communication input	
	M	Multi
	0	Single
30	Explosion protection	
	A	ATEX
	0	None

4.4 Name plate

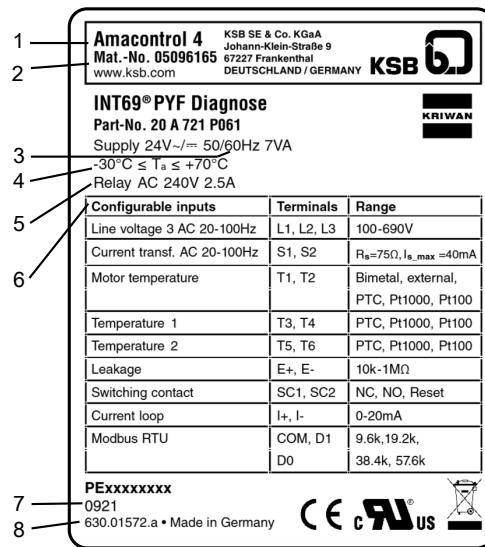


Fig. 1: Name plate (example)

1	Designation (type series and design)	2	KSB material number
3	Frequency	4	Temperature limits
5	Power supply	6	Assignment options / connections
7	Month and year of construction (MMYY)	8	Serial number

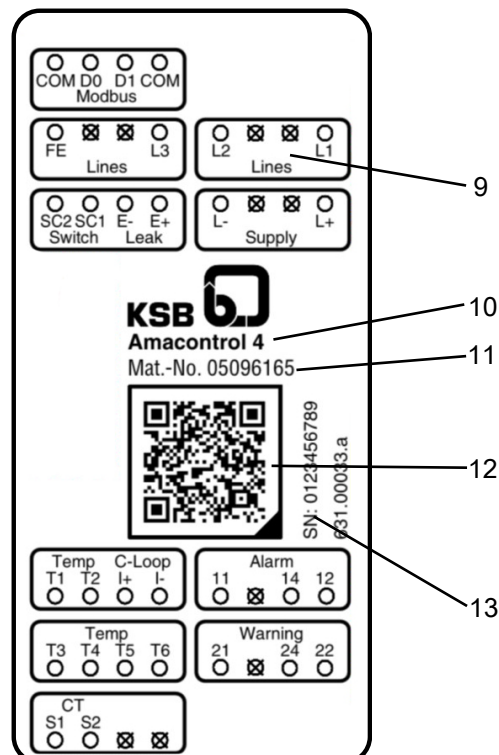


Fig. 2: Additional information label (example)

9	Explanation of terminals	10	Designation (type series and design)
11	KSB material number	12	QR code
13	Serial number		

4.5 Configuration options

Table 8: Symbols key

Symbol	Description
D	Default value
X	Configurable via app

Table 9: Configuration options, sensor inputs

Designation	Amacontrol		
	3 ¹⁾	4	L
Analysing relay, motor temperature			
Bimetal	X	X	D
PTC	D	D	X
Pt100	X	X	X
Pt1000	X	X	X
Disabled	X	X	D
Analysing relay, temperature 1			
Bimetal	-	-	X
PTC	X	X	X
Pt100	D	D	X
Pt1000	X	X	X
Disabled	X	X	X
Analysing relay, temperature 2			
PTC	X	X	-
Pt100	X	D	-
Pt1000	X	X	-
Disabled	D	X	-
Analysing relay, resistance			
With float switch (mechanical seal leakage)	D	D	-
Disabled	X	X	-
Analysing relay, conductive 1			
Leakage sensor	D	D	D
Disabled	X	X	X
Analysing relay 4-20 mA			
With vibration monitoring	X	X	-
Disabled	D	X	-
Analysing relay, current measurement			
Current measurement	-	X	-
Field bus module			
Modbus	-	X	-

¹ Data for Amacontrol 3 (variant 14)

4.6 Configuration and function

Diagnosis and protection module as an all-in-one device that can be used for monitoring the following, depending on the design:

- Temperature
- Conductance (leakage)
- 4-20 mA signal (vibration)
- Phase sequence
- Phase failure
- Overvoltages and undervoltages
- Asymmetry
- Frequency of starts
- Operating hours
- Short circuit
- Open sensor circuit
- Current

Various designs see (⇒ Section 4.5, Page 15) .

Via a digital interface and the app the warning values, setpoints and cut-out values can be individually parameterised. The trip delay and re-start delay or interlocked tripping without automatic re-start can be set via the app.

The inputs have been set at the factory.

Inputs can be parameterised with the KSB INTspecter app (⇒ Section 6.3, Page 34)²⁾.

A fault relay and a warning relay ensure the unit is reliably stopped or, respectively, a warning is emitted.

The diagnosis function provides operating data, fault lists, a fault counter, information on operating hours, start/stop cycles, current measured values, and a detailed fault analysis for the most recent fault (all measured values within a pre-defined time frame). At the digital interface the data can be read out on a smartphone, tablet or computer via the app or transmitted to an external system per gateway.

Connections

Inputs:

Depending on the variant:

- Temperature input, choice of PTC thermistor, bimetal
- Conductance measurement (leakage monitoring)
- Current measurement
- Phase monitoring
- Temperature 1
- Temperature 2
- Phase monitoring L1 - L3 (phase sequence, phase asymmetry, phase failure, undervoltage and overvoltage)
- 4 - 20 mA input (vibration)
- Current transformer input S1, S2 (Amacontrol 4 only)

Outputs:

²⁾ With Amacontrol 3 (variants 1-13), the parameterisation inputs are preset accordingly and cannot be changed using the KSB INTspecter app.

Depending on the variant:

- "Fault" relay
- "Warning" relay³⁾
- LED(s)
- Data interface
- Field bus module (Modbus RTU)

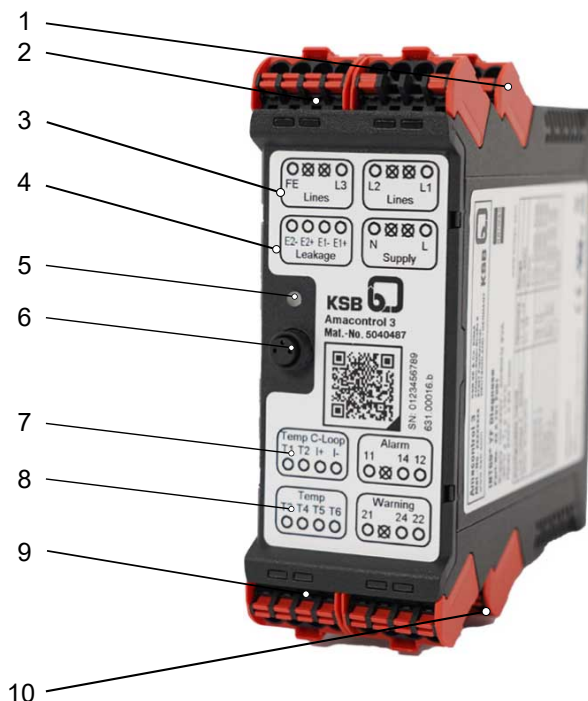


Fig. 3: Amacontrol 3 design (example)

1	Terminals, top, 2nd level
2	Terminals, top, 1st level
3	Terminal assignment, top, 2nd level
4	Terminal assignment, top, 1st level
5	LED
6	Diagnosis port (DP)
7	Terminal assignment, bottom, 1st level
8	Terminal assignment, bottom, 2nd level
9	Terminals, bottom, 1st level
10	Terminals, bottom, 2nd level

4.6.1 Diagnosis port (DP)

The diagnosis port (DP) is the data interface of Amacontrol. This interface is used for setting parameters and reading out information. The KSB Inspector app is available for this purpose. Amacontrol can be connected to a smartphone, tablet or computer via a USB gateway or Bluetooth gateway (accessories). It is also possible to integrate the actual values and states of the protection device into a higher-level system (e.g. a controller or process control system). When using the diagnosis port for a Modbus transmission, an external potential separator must be provided (e.g. KRIWAN Gateway INT600 DM accessory).

³ Optional

4.6.2 Motor temperature monitoring

The motor temperature (T1, T2) input monitors the PTC sensors or bimetal switches installed in the motor winding, depending on the design.

PTC: When the nominal trip temperature of the fitted sensors is reached, the sensors increase their resistance and trip the alarm relay without delay. A short circuit or open circuit at the temperature input will also trip the alarm relay. Re-starting is automatic with consideration of the re-start delays set.

Bimetal switch: When the nominal trip temperature of the fitted bimetal switch is reached, the bimetal switch opens and trips the alarm relay without delay. Re-starting takes place automatically without delay when the temperature falls below the nominal trip temperature.

This input can also be parameterised to Pt100 or Pt1000. If the input is parameterised to Pt100 or Pt1000, the temperatures for the warning and alarm limits must also be set.

4.6.3 Temperature monitoring

The temperature 1 (T3, T4) and temperature 2 (T5, T6) inputs monitor a Pt100 temperature sensor, depending on the design.

Pt100: When the warning temperature or trip temperature of the fitted sensors (depending on the design) set in the protection device is reached, the alarm relay trips. A short circuit or open circuit at the temperature input will also trip the alarm relay. Re-starting takes place automatically without delay when the temperature falls below the trip temperature set in the protection device.

This input can also be parameterised to bimetal or Pt1000.

4.6.4 Leakage monitoring

The leakage 1 (E3, E4) or (E1-, E1+) input (depending on the design) monitors a float switch in the leakage chamber of the mechanical seal.

Float switch: When the leakage chamber is full, the contact of the fitted float switch opens and trips the alarm relay after a pre-set trip delay. The trip delay can be set in the protection device. Re-starting of the protection device takes place automatically and without delay (default setting) when the float switch contact closes again due to the leakage chamber being empty. A re-start delay or interlock can be set in the protection device.

4.6.5 Conductance measurement

The leakage 2 (E1+, E1-) or (E+, E-) input monitors the electrodes in the winding space and connection space (depending on the design).

Electrodes (conductance measurement): When liquid enters, the ohmic resistance of the electrode measuring circuit sinks. When the value falls below the warning resistance or trip resistance of the fitted electrodes set in the protection device, the warning relay or alarm relay are tripped. The trip delay can be set in the protection device. A short circuit or open circuit at the leakage input will also trip the alarm relay. Re-starting of the protection device takes place automatically and without delay (default setting) when the value exceeds the set trip resistance. A re-start delay or interlock can be parameterised in the protection device.

4.6.6 Vibration monitoring

The analog input (I+, I-) (depending on the design) monitors a vibration sensor fitted at the bearing. The effective vibration velocity (root-mean-square value) of the sensor is read in the protection device as a 4 - 20 mA signal. In the protection device the values are also displayed in mm/s.

Vibration: When the warning limits or trip limits set in the protection device are reached, the warning relay or alarm relay are tripped. A short circuit or open circuit at the analog input will also trip the alarm relay. Re-starting takes place when the value falls below the value set in the protection device.

4.6.7 Phase monitoring

Phase monitoring (L1, L2, L3, FE) is active when the motor has been started up; it monitors phase sequence, phase failure, phase asymmetry, undervoltage and overvoltage. When the motor is stopped, phase monitoring is disabled for approx. 2 seconds to prevent undesired tripping based on brief reverse rotation of the machinery. Phase monitoring can be set to "disabled" in the protection device.

The phase sequence is monitored. If the phase sequence is incorrect, the alarm relay trips. Re-starting is effected after the fault has been remedied and the protection device has been re-set. Operating mode Phase sequence can be set to "disabled" in the protection device.

Phase failure is monitored the entire time the motor is running. The alarm relay is tripped when the value exceeds 75 % (default setting) of a phase based on the mean value of all three phases. Re-starting takes place automatically without delay (default setting) when the value falls below 75 %. The trip value in % and a re-start delay can be parameterised in the protection device.

Phase asymmetry is monitored the entire time the motor is running for a deviation in percent of a phase based on the mean value of all three phases. The warning relay or alarm relay are tripped without delay (default setting), when the value in % set in the protection device is exceeded. Re-starting takes place automatically and without delay (default setting), when the value falls below the trip value set in the protection device minus the pre-set hysteresis in %. The trip value, warning value, hysteresis, trip delay and re-start delay can be parameterised in the protection device.

Undervoltage and overvoltage are monitored the entire time the motor is running. When the warning limit (limit 1) or trip limit (limit 2) set in the protection device are reached, the warning relay or alarm relay are tripped. Re-starting takes place automatically and without delay (default setting), when the value falls below or rises above the trip value (limit 2) set in the protection device +/- pre-set hysteresis. The operating mode, limit 1, limit 2, hysteresis, trip delay limit 1 and limit 2 as well as the re-start delay can be parameterised in the protection device.

Phase monitoring is also suitable for equipment operated on a frequency inverter from a frequency of 20 Hz.

4.6.8 Service interval function

The protection device has a pre-set service interval. When the configurable service interval has lapsed, the LED illuminates continuously or flashes during machine operation. The operating mode and interval can be parameterised in the protection device. The fitted LED signals the current status of the protection device (⇒ Section 9.1, Page 39) .

4.6.9 Current transformer input (Amacontrol 4 only)

Current monitoring is single-phase by design via an external current transformer and is required to determine the power. The current of phase L1 can be monitored for overcurrent or undercurrent.

The current measurement in Amacontrol 4 is compatible with frequency inverters and a frequency range of 20 to 100 Hz. One of the specially developed current transformers is required for the measurement (⇒ Section 9.4, Page 85) . Different current transformers are available, depending on the motor size.

A warning value and cut-out value as well as a hysteresis can be parameterised in the protection relay. When the set limit values are reached, the alarm relay or warning relay trips following the adjustable trip delay. A re-start delay or interlocked tripping can be parameterised for the alarm relay.

To fine-tune the measuring range and increase measuring accuracy, the number of primary winding turns of the cable passing through the current transformer can be set in the protection relay by parameter. The transmission ratio is determined by the current transformer.

An adjustable starting override interval during which monitoring is delayed after motor start-up prevents tripping at the moment of start-up.

A sensor error (no current transformer connected despite activated current monitoring, broken wire of current transformer, minimum current not reached during motor operation) leads to interlocked tripping of the alarm relay.

Current measurement is only possible when phases are connected to the protection relay.

4.6.10 Field bus module (Modbus RTU) (Amacontrol 4 only)

Amacontrol 4 has an RS485 interface (screw terminal D0, D1, COM). Amacontrol 4 can make settings, operating data and recorded measured values available to a higher-level system (master) such as a control system via Modbus protocol (RTU). The protection relay acts as a slave (Amacontrol 4) by sending specific data values to the master after querying.

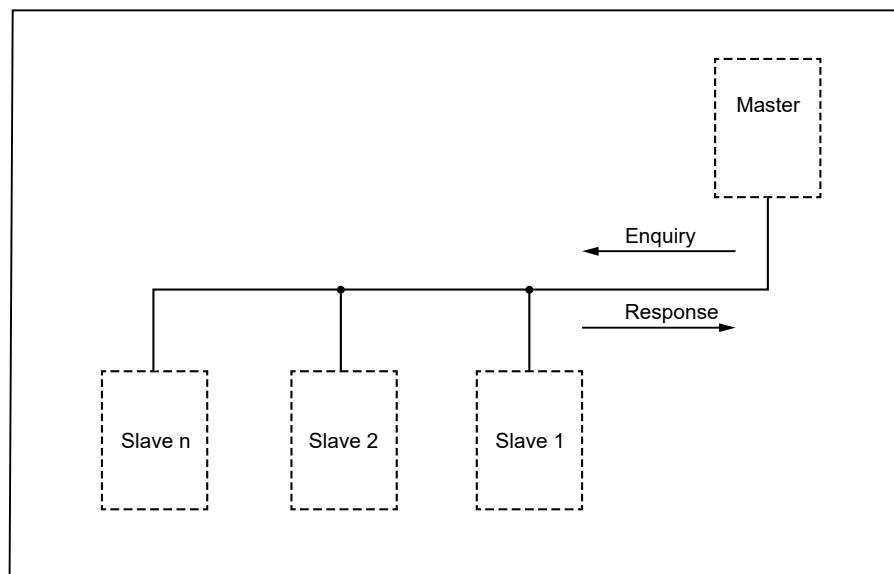


Fig. 4: Communication in a modbus protocol network

Activity on the field bus module (Modbus RTU) can be viewed in the KSB INTspecter app (separate LED not available).

Transmission parameters

These settings include the address (device address), baud rate, parity bits and stop bits and are configured via parameterisation in the protection relay.

The device address of each station must be uniquely assigned, otherwise the master can no longer communicate with all existing slaves on the bus. The address range is 1 to 247.

The baud rate, parity bits and stop bits must be set identically for all stations.

Baud rate The baud rate indicates the transmission speed. Amacontrol 4 supports the following speeds:

- 9600 bits/s
- 19200 bits/s
- 38400 bit/s
- 57600 bit/s

Parity bit The parity bit is used to check whether an error occurs within a byte during transmission. Amacontrol 4 supports the following:

- Even parity
- Odd parity
- No parity

Stop bit The stop bit follows a data transmission and communicates to the master that transmission has ended.

The number of stop bits depends on the parity setting and is as follows:

- 2 for "none"
- 1 for "even" or "odd"

Message structure

The data to be transmitted is always found in a fixed frame.

Table 10: Overview of fields 1-4 of the field bus module (Modbus RTU) frame

Field 1	Field 2	Field 3	Field 4
Address	Function code	Data	CRC

The frame comprises the following 4 elements in the field bus module (Modbus RTU):

Table 11: Elements of the field bus module (Modbus RTU) frame

Field 1	Address	Specific device address, valid range 1 to 247
Field 2	Function code	Defines the function to be performed; see table of function codes supported by the protection relay (⇒ Table 12) .
Field 3	Data	The data block contains the information to be exchanged via the register address (from the parameter table or Modbus table) defined with the function code.
Field 4	CRC	The cyclical redundancy check (CRC) is carried out to detect transmission errors. This information is sent in the last 2 bytes of the frame (16-bit value generated automatically).

The following function codes are supported by Amacontrol 4:

Table 12: Modbus function codes

Function code	Designation	Description
0x03	Read holding registers	Read set parameters; see parameter table
0x04	Read input register	Read diagnostic data (actual values); see Modbus table
0x2B / 0x0E	Read device identification	Read identification register

For more information on the Modbus protocol, see <http://www.modbus.org>

Modbus protocol

The register addresses are required in the data area (field 3) for the targeted master queries to the slave (e.g. temperature actual value - temperature 1). These can be taken from the parameter table (with function code 03) or Modbus table (with function code 04), depending on what is required.

The parameter table and Modbus table of Amacontrol can be downloaded from the product catalogue and do not form part of this installation/operating manual.

The data type and description are also listed in the tables in addition to the register addresses (start and end).

The data type indicates the format in which the data is interpreted.

The following data types are distinguished by Amacontrol 4:

Table 13: Data type of the Modbus table

Data type	Description
U 16bit	Unsigned 16-bit integer value. Occupies 1 parameter address. Value range from 0 to 65535
U 32bit	Unsigned 32-bit integer value. Occupies 2 parameter addresses. Value range from 0 to 2 147 483 647

Data type	Description
U 8bit	Unsigned 8-bit integer value. Occupies 1 parameter address. Value range from 0 to 255
S 16offset	Signed 16-bit value transmitted as unsigned value. Occupies 1 parameter address. Number = (value - 32768)/100 Value range from -327.00...+327.00
List	Unsigned 16-bit integer value. Occupies 1 parameter address Value range from 0 to 65535 Each entry is assigned a number starting with 0, first entry = 0, second entry = 1...

Example 1 - Read sensor type at temperature 1 (default):

Address: 8866

Data type: List

Range: Deactivated; Pt100; Pt1000; PTC

Table 14: Request to slave (device address 01) with register address 8866 (parameter table) and function code 3

Address	Function code	Data				CRC	
		Register address 8866		Number of values			
01	03	22	A2	00	01	DF	90

In the protection relay, the Modbus protocol is used in RTU mode, i.e. each transmitted message byte contains 2 hexadecimal characters (register address 8866 becomes 22 A2).

Table 15: Response of slave to master

Address	Function code	Data			CRC	
		Number of bytes	Value: 2			
01	03	02	00	02	39	85

Assignment of the list (disabled; Pt100; Pt1000; PTC) starts with 0. The 2 is therefore assigned to Pt1000. The response is value 2 (Pt1000).

Example 2 - Read resistance actual value at temperature 1:

Address: 8235

Data type: 16bit

Range: 1...65535Ω

Table 16: Request to slave (device address 01) with register address 8235 (Modbus table) and function code 4

Address	Function code	Data				CRC	
		Register address 8235		Number of values			
01	04	20	2B	00	01	4A	02

Table 17: Response of slave to master

Address	Function code	Data			CRC	
		Number of bytes	Value: 1555			
01	04	02	06	13	FB	5D

The response is value 1555. The resistance actual value at temperature 1 is 1555 Ω.

Example 3 - Read temperature actual value at temperature 1:

Address: 8294

Data type: s 16offset

Range: Temperature = (value - 32768)/100-327.00 °C...+327.00 °C
65535 = Not available

Table 18: Request to slave (device address 01) with register address 8294 (Modbus table) and function code 4

Address	Function code	Data				CRC	
		Register address 8294		Number of values			
01	04	20	66	00	01	DA	15

Table 19: Response of slave to master

Address	Function code	Data			CRC	
		Number of bytes	Value: 47183			
01	04	02	B8	4F	81	16

The answer is value 47183. The temperature actual value at temperature 1 is $(47183 - 32768)/100 = 144.15\text{ °C}$

4.6.11 Output relay/reset function

Trouble-free operation is signalled by the LED being lit in green. The alarm relay and the warning relay pick up. If a fault or warning are recognised, the alarm relay or warning relay open. The two output relays are of the normally closed type.

The alarm relay does not switch back until the fault has been rectified and a RESET has been carried out.

Table 20: Overview of reset functions

Type series	Reset functions		
	Power reset	External reset	Reset key
Amacontrol 3	X	-	-
Amacontrol 4	X	X	-
Amacontrol L	-	X	X

4.7 Technical data

Table 21: Technical data

Feature	Characteristic
Power supply	
Versions	AC/DC 50/60 Hz 24 V ± 10 %, 9 VA AC 50/60 Hz 100-240 V ± 10 %, 9 VA
Permissible ambient temperature	-30...+70 °C
Temperature measuring circuit	
Type	1-2 AMS sensors in series, alternative: 1-9 PTC sensors to DIN 44081/44082 in series
Resistance R25, total	< 1.8 k Ω
Trip resistance R, static	4.5 k Ω ± 20 %
Reset resistance R	2.75 k Ω ± 20 %
Max. power cable length	30 m
Short-circuit monitoring	< 20 Ω
Open-circuit monitoring	> 20 k Ω
Temperature measuring circuit	
Type	Pt100
Measuring range	-50... +300 °C
Resolution	1 K
Accuracy	5 % of full-scale value
Short-circuit monitoring	< 20 Ω
Open-circuit monitoring	> 400 Ω
Switching input	
Type	Resistance measurement between electrode pair
Measuring range	10 k Ω ...1 M Ω
Resolution	1 k Ω
Accuracy	± 10 % of the full-scale value in the measuring range 10 k Ω ...100 k Ω ± 25 % of the full-scale value in the measuring range 101 k Ω ...1 M Ω
Analog input	
Type	0...20 mA / 4...20 mA current signal
Power supply	DC 24 V +5 % -25 %
Measuring range	0...20 mA
Resolution	0.1 mA
Accuracy	2.5 % of full-scale value
Max. power cable length	30 m
Phase monitoring	
Operation on a frequency inverter ⁴⁾	Suitable
Measuring range phase-phase	3 AC 20...100 Hz 100...690 V ± 10 %
Operating frequency range	1...16 kHz
Typ. operating frequency	8 kHz
Min. detection time	8 kHz 100 ms
Monitoring	Phase sequence, phase failure, phase asymmetry, undervoltage and overvoltage

⁴ Use Amacontrol 3 only in frequency range 50 Hz. Measured value fluctuations can occur in the phase monitor for different frequency inverter types.

Feature	Characteristic
Frequency of starts monitoring	Starts per time unit, configurable
Stop limits, general	Configurable unless specified
Re-start delay	Configurable
Re-setting the interlock or re-start delay	Mains re-set > 5 s only possible when no fault is active.
Relay	
Contact	AC 240 V 2.5 A C300 Min. AC/DC 24 V 20 mA
Mechanical service life	Approx. 1 million switching cycles
Interface	Diagnosis port (DP)
Enclosure to EN 60529	IP20
Connection type	Spring-loaded terminals (PUSH IN) 0.2...2.5 mm ²
Housing material	PA 66 GF 30
Mounting	Basic footprint width of the housing 45 mm, for snap-mounting on 35 mm standard rail to EN 60715 in a control cabinet
Dimensions	See dimensions in mm
Weight	Approx. 300 g
Inspection and testing requirements	EN 61000-6-2, EN 61000-6-3, EN 61010-1, overvoltage category III (observe the insulation of the temperature sensor), pollution degree 2
Approval	UL file No. E473026 cURus

4.8 Dimensions

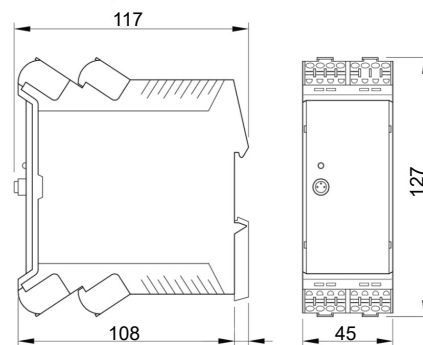


Fig. 5: Dimensions, Amacontrol 3, Amacontrol 4

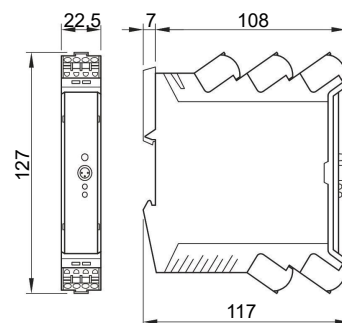


Fig. 6: Dimensions, Amacontrol L

5 Installation at Site

5.1 Safety regulations

	 DANGER Incorrect use Danger of death from explosion! ▸ The device must not be used in potentially explosive atmospheres. ▸ For explosion-proof pump sets or submersible mixers use a thermistor tripping unit with manual reset. ▸ Regarding explosion protection observe the applicable regional regulations. Within the EU, for example, use an ATEX-approved thermistor tripping unit for monitoring the temperature of explosion-proof motors in "flameproof enclosure" Ex d type of protection. Amacontrol is not ATEX-approved for monitoring motor temperatures
	 DANGER Contact with live components Danger of death from electric shock! ▸ Any work on the device shall only be performed when it has been disconnected from the power supply (de-energised).
	 DANGER Incorrect electrical installation Danger of death from electric shock! ▸ The device must only be used for the applications described in the applicable operating manual. The information in the other applicable documents must be observed. The permissible ambient conditions must be observed. ▸ The contact guards of connected elements and the insulation of power cables must be selected for the highest rated voltage of the submersible motor pump (submersible mixer, submersible mixer drive). ▸ Carryover of low voltage to the extra-low voltage level via Modbus must be prevented effectively (e.g. Modbus gateway INT600 DM accessory). ▸ Always have the electrical connections installed by specialist personnel. ▸ Observe the provisions of the IEC 60364 standard. ▸ Observe the technical specifications of the local and national energy supply companies.
	 WARNING Incorrect electrical installation Danger of death, serious injury or damage to property! ▸ The device must only be replaced by equivalent devices marked in accordance with the applicable regulations. ▸ Tripping of Amacontrol must always lead to safe tripping of the equipment, also if the equipment is operated on a frequency inverter.

	CAUTION
	Incorrect electrical installation Danger of minor injury or damage to property. ▷ Devices with visible transport damage must not be used in safety-relevant applications. ▷ Opening of the housing or unauthorised modification will void any and all warranty.
	NOTE When using the Modbus interface, an external potential separator must be provided (e.g. KRIWAN Gateway INT600 DM accessory).

5.2 Mounting Amacontrol

1. Snap-mount Amacontrol in the control cabinet or control box on a standard rail (35 mm).

5.3 Electrical connection

5.3.1 Connecting the spring-loaded terminals

	NOTE
	To ensure the functionality of the protection device when phase monitoring is active, functional earth FE must be connected.
✓ Slotted screwdriver (narrow) 1. Connect the power supply and sensors .	
	NOTE
	If the power supply is connected but the sensors are not, a fault is detected and stored in the internal memory of Amacontrol.



2. Press the spring-loaded terminal down with the screwdriver. Feed the cable or sensor connection into the corresponding hole. Release the spring-loaded terminal.
- ⇒ The cable or sensor connection is now connected.

5.3.2 Individually coding the spring-loaded terminals

The spring-loaded terminals can be individually coded to prevent them from being incorrectly re-connected, e.g. after maintenance work.

✓ Pliers (fine)

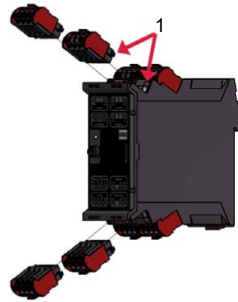
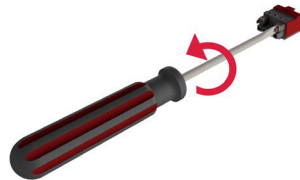


Fig. 7: 1 = pin

1. Pull the terminal block out of the protection module.
2. Remove the pins from the protection module with the pliers.
3. Insert the pins into the designated places on the terminal block.



4. Move the pins now in the terminal block to one of the 4 possible positions using a slotted screwdriver.
- ⇒ When the terminal block is attached to the Amacontrol, the pins are automatically clicked back into position. Coding of the spring-loaded terminals is now complete. We recommend coding each spring-loaded terminal.

5.3.3 Current transformer input (S1, S2) (Amacontrol 4 only)

	 WARNING
	High voltages with unloaded (open) secondary circuit of current transformer Electric shock and/or damage to current transformer ▸ Avoid operating the current transformer without secondary wiring.

1. Connect the conductors of the current transformer to terminals S1 and S2 of the Amacontrol 4 protection relay (⇒ Section 9.3.3, Page 82) , (⇒ Section 9.3.4, Page 83) . The polarity does not need to be observed.
2. Correct number of windings for the current transformer see (⇒ Table 22) . Ensure a measuring range reserve for overcurrent detection of at least 20 % . The parameterised alarm threshold and warning threshold must also be within the measuring range.

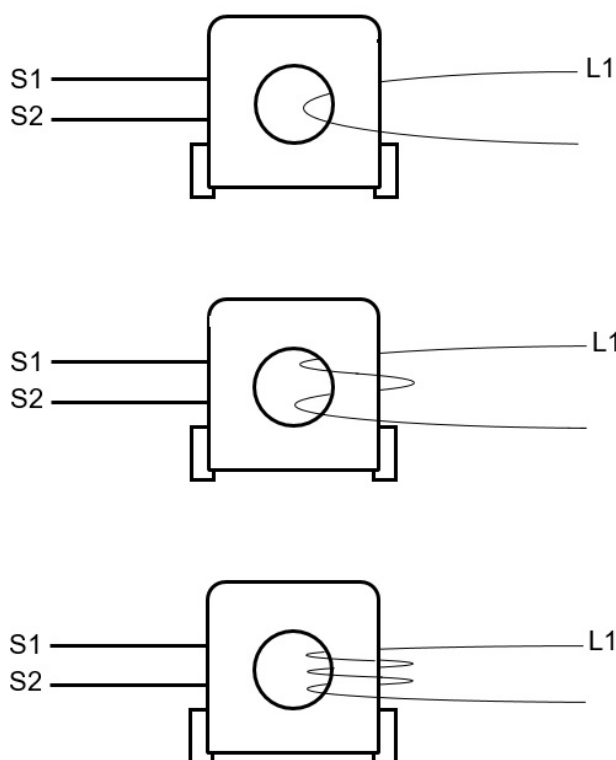


Fig. 8: Current transformer INT185 - example 1, 2 and 3 winding turns

3. Guide the cable of phase L1 of the motor through the opening of the current transformer by the number of winding turns determined in item 2 (⇒ Fig. 8) . The insertion direction does not need to be taken into account.

Table 22: Current transformer INT185 up to 100 A (02D187)

Rated motor current range	Number of winding turns
[A]	
1,0 - 10,0	10
10,1 - 20,0	5
20,1 - 33,3	3
33,4 - 50,0	2
50,1 - 100,0	1

Determining the number of winding turns

Example 1:

Rated motor current = 16.0 A → 16.0 A + 20 % = 19.2 A → Number of winding turns = 5

Example 2:

Rated motor current = 19.5 A → 19.5 A + 20 % = 23.4 A → Number of winding turns = 3

5.3.4 Connecting field bus module (Modbus RTU) (Amacontrol 4 only)

The electrical connection on Amacontrol 4 is established via screw terminals (D0, D1, COM).

Table 23: Assignment of connection between master and Amacontrol 4

Amacontrol 4 (Modbus terminal)	Master (Modbus terminal)
D0	RS485 B/Tx-
D1	RS485 A/Tx+
COM	GND

If there are several Amacontrol 4 devices (slave devices) on one bus, you can loop through at screw terminals D0, D1, COM in a daisy chain configuration. The terminating resistor (150 Ω) included in the scope of supply must be connected between D0 and D1 at the last station. Note: The COM connection on the terminal has a duplicate design and the same potential. Both COM connections can be used. The GND (COM) must be centrally earthed to one point. This is preferably carried out on the master system.

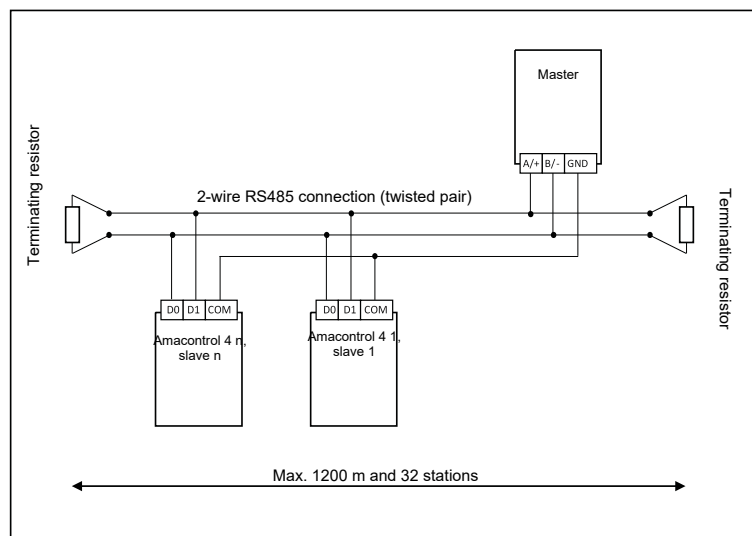


Fig. 9: Field bus module (Modbus RTU) two-wire configuration



Fig. 10: Terminal, field bus module (Modbus RTU), terminating resistor

The electric cable to be used for the RS485 Modbus RTU must be shielded and twisted in pairs, e.g. LiYCY (TP) 2x2x0.25 mm².

The number of stations and length of an RS485 Modbus RTU is limited and depends on external factors (e.g. interference or diameter of electric cables) and the configuration of the system (e.g. baud rate). No more than 32 stations and a maximum bus length of 1200 m are recommended. An extension is possible using repeaters.

Additional information must be taken into account:

- Connect the electric cable in a daisy chain configuration from station to station – not in a star configuration.
- Route the measuring and data lines separately from the power cable.
- Ensure low-interference wiring (EMC).
- Do not install the protection relay near strong electric and magnetic fields.
- The shield of the electric cable must be connected continuously (low impedance) for several stations.
- The bus shield must be centrally earthed to one point.
- Install the supplied electrical resistor as a terminating resistor (⇒ Fig. 9) , (⇒ Fig. 10) .

6 Operation

6.1 Connecting the device

Amacontrol offers several options for reading out data:

- Directly on site
- Via KSB Guard to the KSB Cloud or
- Via a gateway to external systems

6.1.1 Directly on site

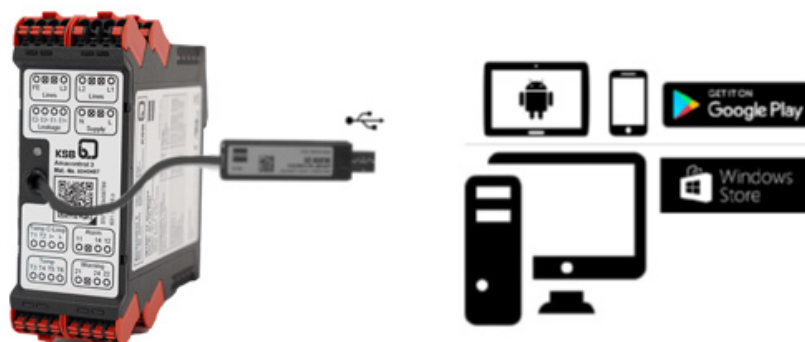


Fig. 11: Connection via USB



Fig. 12: Connection via Bluetooth

Description	Amacontrol			Mat. No.	[kg]
	3	4	L		
Connection cable (Amacontrol - smartphone)	X	-	-	01913080	0,1
Connection cable with Bluetooth interface (Amacontrol - smartphone)	X	-	-	01913079	0,1

6.1.2 KSB Guard

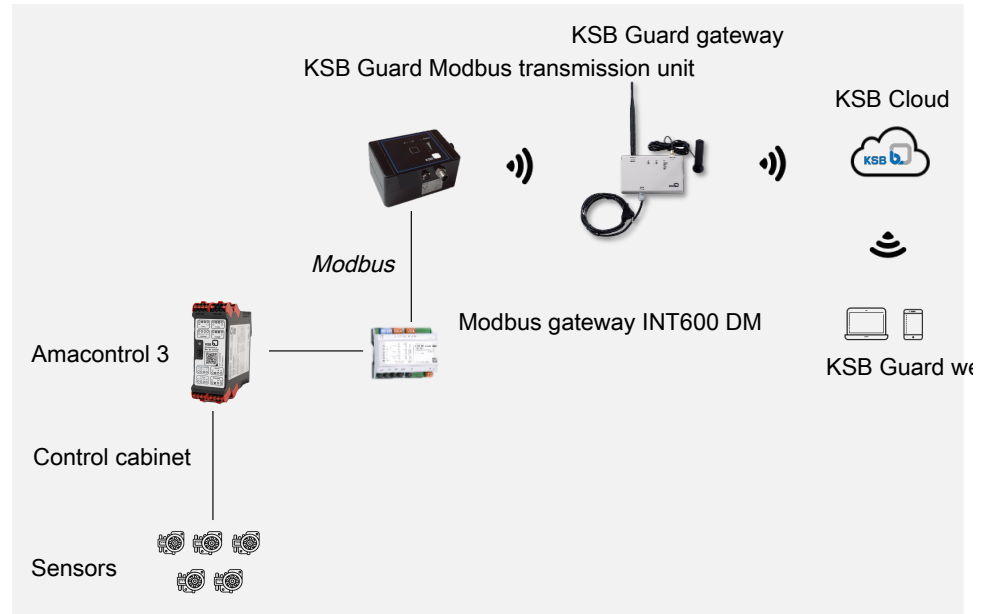


Fig. 13: KSB Guard for submersible pumps and mixers - components and functions

	Cable		Wireless				
Description			Amacontrol			Mat. No.	[kg]
			3	4	L		
KSB Guard Modbus transmission unit			✗	-	-	05068772	0,4
KSB Guard gateway			✗	-	-	01852757	0,6

6.1.2.1 Related documents

Table 24: Information/documents

Document	Reference number
KSB Guard Modbus operating manual	4079.82

6.1.3 External systems

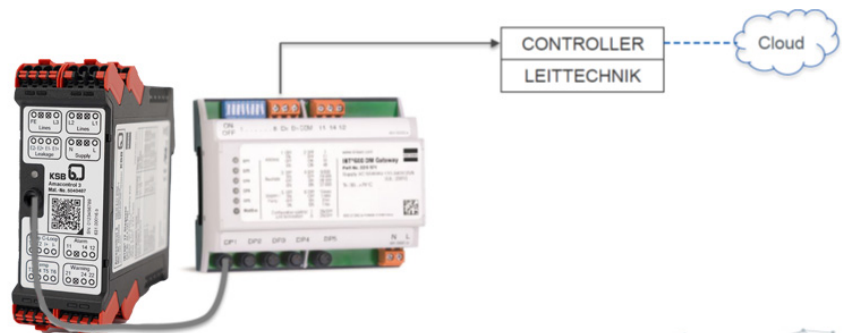


Fig. 14: Connection to a customer system or the cloud via Modbus gateway INT600 DM

Description	Amacontrol			Mat. No.	[kg]
	3	4	L		
Modbus gateway INT600 DM supply voltage 230 V	X	-	-	01913082	0,2
Connection cable (Amacontrol - gateway)	X	-	-	01913083	0,1

6.2 KSB INTspector

The KSB INTspector app is an advanced development of innovative machinery protection and system protection with communication function; it is available for download from the common stores (iOS: App Store, Android: Play Store).

1. Download and open the app.
2. Connect the device.
3. Get started.

Download from Play Store



Android

Download from App Store



iOS

The KSB INTspector offers the following functions:

- Setting and changing parameters (⇒ Section 6.3, Page 34)
- Reading out stored data
- Accessing fault history / fault counter
- Viewing operating data
- Analysing an LED flash code (⇒ Section 6.4, Page 35)
- Performing a diagnosis (⇒ Section 6.5, Page 35)
- PDF-Report ausgeben
- Viewing documentation

6.3 Parameterisation

The parameter mode serves to perfectly set the protection module to the application. Further information see parameter list and Modbus protocol (reference number: 2301.83).

6.3.1 Current transformer input S1, S2 (Amacontrol 4 only)

Operating mode	Selection option for monitoring undershooting or exceeding a parameterised motor current value. If monitoring is not used, the setting must be set to Disabled.
Trip value	When the parameterised current value is reached, the alarm relay trips with the parameterised trip delay.
Warning value	When the parameterised current value is reached, the warning relay trips with the parameterised trip delay. You can parameterise the warning relay to define which warnings it should respond to.
Hysteresis	The hysteresis determines the re-start value of the alarm relay and warning relay. Example alarm relay with operating mode "Exceeded": Re-start value = trip value - hysteresis
Trip delay	The time from detecting the fault (trip value and warning value) up to tripping of the alarm relay and warning relay.
Re-start delay	This function only applies to the alarm relay and refers to the time until re-start after the re-start value has been reached. The re-start delay can also be parameterised as interlocked tripping in the protection relay. The alarm relay then only switches back after a RESET.
Current transformer ratio	The winding ratio of the connected current transformer. The ratio is always expressed as 1:x (x = 2,500 for INT185).
Winding turns through current transformer	The number of guided winding turns of the phase L1 cable through the current transformer push-through opening.

Starting override The time after motor operation is detected by the protection relay up to the start of current monitoring. This interval serves to avoid tripping if the inrush current is too high.

6.3.2 Field bus module (Modbus RTU) (Amacontrol 4 only)

- Address** The device address of each station must be uniquely assigned.
- Baud rate** The setting must be chosen such that it corresponds to the master setting.
- Stop bit** The setting must be chosen such that it corresponds to the master setting.
- Parity** The setting must be chosen such that it corresponds to the master setting.

6.4 LED flash code

The system condition can be analysed via the LED flash code (⇒ Section 9.1, Page 39) . The flash code can also be entered in the INTspector app, which will display the corresponding message. The current message is directly displayed.

6.5 Diagnosis

The diagnostic system enables data recorded with Amacontrol to be output via the DP interface. This enables users to assess the operating status of the machine in the actual application and respond quicker to prevent failures.

The data recorded by Amacontrol can be displayed directly on a smartphone, tablet or notebook or integrated in a higher-level system (e.g. controller or process control system).

6.6 Reading the serial number

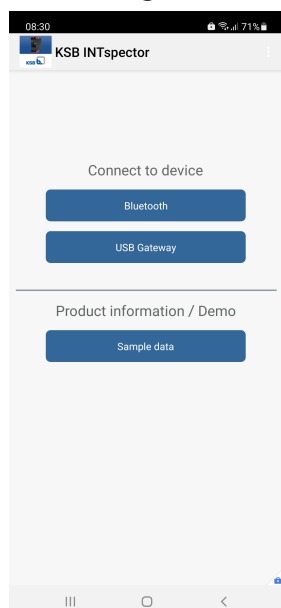


Fig. 15: Connecting the device

1. Connect the device.

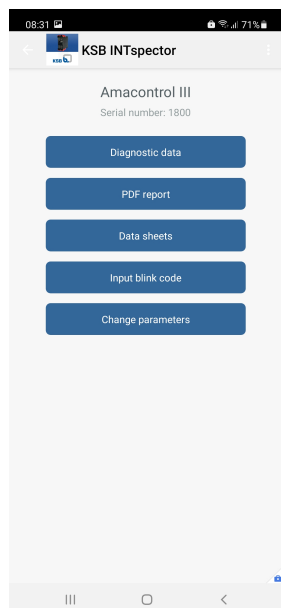


Fig. 16: Opening the menu

7 Dismantling

7.1 Removing Amacontrol

	 DANGER Incorrect electrical installation Risk of fatal injury due to electric shock! ▷ Always have the electrical connections installed by specialist personnel. ▷ Observe the technical specifications of the local and national energy supply companies.
	 DANGER Electric shock Danger to life! ▷ De-energise the mains connections for all devices. ▷ Ensure that the mains connections cannot be re-energised unintentionally.

1. Press the spring-loaded terminals down with the screwdriver. Remove the cable or sensor connections.
2. Remove Amacontrol from the standard rail (35 mm) in the control cabinet or control box.

8 Servicing/Maintenance

The protection module is maintenance-free. No fixed inspection intervals have been specified.

9 Related Documents

9.1 LED flash code

The flash code serves as a quick and easy status display and helps with trouble-shooting. It uses a cyclical flash sequence. In the event of a fault, the flash sequence comprises red and orange impulses. If warnings are active, the sequence comprises green and orange impulses. The number of flashing impulses indicates the current status.

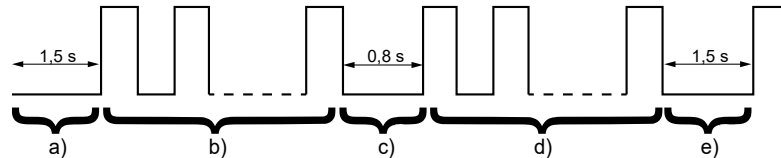


Fig. 17: LED flash code

a)	Pause 1
b)	Red (1 - 5 impulses)
c)	Pause 2
d)	Orange (1 - 5 impulses)
e)	Pause 1

Table 25: Overview of LED flash codes

LED flash codes	Description
Steady green	Machine ready for operation
Flashing green	Machine running
Steady orange	Machine ready for operation, service due
Flashing orange	Machine running, service due
Flashing green / orange	Warning, machine in critical range (⇒ Table 26)
Flashing red / orange	Fault, machine tripped (⇒ Table 26)

Table 26: Flash sequences and description

1st flash sequence (LED red)	2nd flash sequence (LED orange)	Description
1	1	Motor temperature: Static tripping, permissible winding temperature exceeded
1	4	Motor temperature: Sensor input detected open circuit or short circuit.
2	1	Phase monitoring: Incorrect phase sequence
2	2	Phase monitoring: Phase failure / phase asymmetry
2	3	Phase monitoring: Undervoltage / overvoltage
3	1	Temperature input 1: Static tripping / warning, permissible temperature exceeded
3	2	Temperature input 2: Static tripping/warning, permissible temperature exceeded
3	4	Temperature input 1: Sensor input detected open circuit or short circuit.
3	5	Temperature input 2: Sensor input detected open circuit or short circuit
4	1	Leakage 1: Static tripping / warning, permissible limit underrun / exceeded
4	3	Leakage 2: Static tripping/warning, permissible limit underrun/exceeded
5	1	General: Internal fault
5	2	General: Supply voltage too low
5	3	General: Current loop static tripping / warning, permissible limit underrun / exceeded

1st flash sequence (LED red)	2nd flash sequence (LED orange)	Description
5	4	General: Current loop sensor fault detected, base current underrun
5	5	General: Frequency of starts static warning, permissible number of starts exceeded

9.2 Parameter lists

The parameters can be set in Amacontrol III (depending on the design) using the KSB INTspector app. The min. values, max. values and default value are shown for the following variants. The default value is the actual value set in Amacontrol III in as-delivered condition.

9.2.1 Amacontrol 3, variant 1

Table 27: Parameter table: Amacontrol 3, variant 1 (AC/DC 50/60 Hz 24 V and AC 50/60Hz 100-240 V)

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Motor temperature 1					X	-
Sensor type	Disabled	Pt100/Pt1000/PTC/bimetal	Bimetal	-	X	-
Trip delay	0.1	3600	0.1	s	X	-
Reset delay	0	Locked	0	s	X	-
Temperature 1					X	-
Sensor type	Disabled	Pt100/Pt1000/PTC	Disabled	-	X	-
Temperature 2					X	-
Sensor type	Disabled	Pt100/Pt1000/PTC	Disabled	-	X	-
Leakage 1					X	-
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Disabled	-	X	-
Leakage 2					X	-
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Resistance below	-	X	-
Trip value	1	1000	60	kΩ	X	-
Warning value	1	1000	75	kΩ	X	-
Hysteresis	1	999	10	kΩ	X	-
Trip delay	0.1	3600	60	s	-	X
Reset delay	0	Locked	0	s	-	X
Analog input 1					X	-
Operating mode	Disabled	Limit value below / Limit value exceeded	Disabled	-	X	-
Phase monitor 1					-	X
Operating mode Phase monitor	Disabled	Active	Active	-	-	X
Phase failure Trip value	0	100	75	%	-	X
Phase failure Reset delay	0.3	Locked	10	s	-	X

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Operating mode Phase sequence	Disabled	Active	Active	-	-	✗
Phase asymmetry Trip value	1	100	15	%	-	✗
Phase asymmetry Warning value	1	100	10	%	-	✗
Phase asymmetry Hysteresis	1	99	10	%	-	✗
Phase asymmetry Trip delay	0.1	360	0.3	s	-	✗
Phase asymmetry Reset delay	0.3	Locked	10	s	-	✗
Operating mode Undervoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	✗	-
Undervoltage limit 1	100	690	207	V	-	✗
Undervoltage limit 2	100	690	195	V	-	✗
Undervoltage hysteresis	1	600	20	V	-	✗
Undervoltage limit 1 Trip delay	0.1	360	3.0	s	-	✗
Undervoltage limit 2 Trip delay	0.1	360	3.0	s	-	✗
Undervoltage Reset delay	0.3	Locked	10	s	-	✗
Operating mode Overvoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	-	✗
Overvoltage limit 1	100	690	253	V	-	✗
Overvoltage limit 2	100	690	265	V	-	✗
Overvoltage hysteresis	1	600	20	V	-	✗
Overvoltage limit 1 Trip delay	0.1	360	3	s	-	✗
Overvoltage limit 2 Trip delay	0.1	360	3	s	-	✗
Overvoltage Reset delay	0.3	Locked	10	s	-	✗
Frequency of starts					✗	-
Operating mode	Disabled	Warning/alarm	Disabled	-	✗	-
Service interval					-	✗
Operating mode	Disabled	Disabled / Re-start / Active / Expired	Re-start	-	-	✗
Interval	100	65535	24000	h	-	✗

9.2.2 Amacontrol 3, variant 2

Table 28: Parameter table: Amacontrol 3, variant 2 (AC/DC 50/60 Hz 24 V and AC 50/60 Hz 100-240 V)

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Motor temperature 1					X	-
Sensor type	Disabled	Pt100/Pt1000/PTC/bimetal	PTC	-	X	-
Trip delay	0.1	3600	0.1	s	X	-
Reset delay	0	Locked	Locked	s	X	-
Temperature 1					X	-
Sensor type	Disabled	Pt100/Pt1000/PTC	Disabled	-	X	-
Temperature 2					X	-
Sensor type	Disabled	Pt100/Pt1000/PTC	Disabled	-	X	-
Leakage 1					X	-
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Disabled	-	X	-
Leakage 2					X	-
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Resistance below	-	X	-
Trip value	1	1000	60	kΩ	X	-
Warning value	1	1000	75	kΩ	X	-
Hysteresis	1	999	10	kΩ	X	-
Trip delay	0.1	3600	60	s	-	X
Reset delay	0	Locked	0	s	-	X
Analog input 1					X	-
Operating mode	Disabled	Limit value below / Limit value exceeded	Disabled	-	X	-
Phase monitor 1					-	X
Operating mode Phase monitor	Disabled	Active	Active	-	-	X
Phase failure Trip value	0	100	75	%	-	X
Phase failure Reset delay	0.3	Locked	10	s	-	X
Operating mode Phase sequence	Disabled	Active	Active	-	-	X
Phase asymmetry Trip value	1	100	15	%	-	X
Phase asymmetry Warning value	1	100	10	%	-	X
Phase asymmetry Hysteresis	1	99	10	%	-	X

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Phase asymmetry Trip delay	0.1	360	0.3	s	-	✗
Phase asymmetry Reset delay	0.3	Locked	10	s	-	✗
Operating mode Undervoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	✗	-
Undervoltage limit 1	100	690	207	V	-	✗
Undervoltage limit 2	100	690	195	V	-	✗
Undervoltage hysteresis	1	600	20	V	-	✗
Undervoltage limit 1 Trip delay	0.1	360	3.0	s	-	✗
Undervoltage limit 2 Trip delay	0.1	360	3.0	s	-	✗
Undervoltage Reset delay	0.3	Locked	10	s	-	✗
Operating mode Overvoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	-	✗
Overvoltage limit 1	100	690	253	V	-	✗
Overvoltage limit 2	100	690	265	V	-	✗
Overvoltage hysteresis	1	600	20	V	-	✗
Overvoltage limit 1 Trip delay	0.1	360	3	s	-	✗
Overvoltage limit 2 Trip delay	0.1	360	3	s	-	✗
Overvoltage Reset delay	0.3	Locked	10	s	-	✗
Frequency of starts					✗	-
Operating mode	Disabled	Warning/alarm	Disabled	-	✗	-
Service interval					-	✗
Operating mode	Disabled	Disabled / Re-start / Active / Expired	Re-start	-	-	✗
Interval	100	65535	24000	h	-	✗

9.2.3 Amacontrol 3, variant 3

Table 29: Parameter table: Amacontrol 3, variant 3 (AC/DC 50/60 Hz 24 V and AC 50/60Hz 100-240V)

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Motor temperature 1					✗	-
Sensor type	Disabled	Pt100/Pt1000/PTC/bimetal	Disabled	-	✗	-

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Temperature 1					X	-
Sensor type	Disabled	Pt100/Pt1000/PTC	Disabled	-	X	-
Temperature 2					X	-
Sensor type	Disabled	Pt100/Pt1000/PTC	Disabled	-	X	-
Leakage 1					X	-
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Disabled	-	X	-
Leakage 2					X	-
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Resistance below	-	X	-
Trip value	1	1000	60	kΩ	X	-
Warning value	1	1000	75	kΩ	X	-
Hysteresis	1	999	10	kΩ	X	-
Trip delay	0.1	3600	60	s	-	X
Reset delay	0	Locked	0	s	-	X
Analog input 1					X	-
Operating mode	Disabled	Limit value below / Limit value exceeded	Disabled	-	X	-
Phase monitor 1					-	X
Operating mode Phase monitor	Disabled	Active	Active	-	-	X
Phase failure Trip value	0	100	75	%	-	X
Phase failure Reset delay	0.3	Locked	10	s	-	X
Operating mode Phase sequence	Disabled	Active	Active	-	-	X
Phase asymmetry Trip value	1	100	15	%	-	X
Phase asymmetry Warning value	1	100	10	%	-	X
Phase asymmetry Hysteresis	1	99	10	%	-	X
Phase asymmetry Trip delay	0.1	360	0.3	s	-	X
Phase asymmetry Reset delay	0.3	Locked	10	s	-	X
Operating mode Undervoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	X	-
Undervoltage limit 1	100	690	207	V	-	X
Undervoltage limit 2	100	690	195	V	-	X
Undervoltage hysteresis	1	600	20	V	-	X

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Undervoltage limit 1 Trip delay	0.1	360	3.0	s	-	✗
Undervoltage limit 2 Trip delay	0.1	360	3.0	s	-	✗
Undervoltage Reset delay	0.3	Locked	10	s	-	✗
Operating mode Overvoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	-	✗
Overvoltage limit 1	100	690	253	V	-	✗
Overvoltage limit 2	100	690	265	V	-	✗
Overvoltage hysteresis	1	600	20	V	-	✗
Overvoltage limit 1 Trip delay	0.1	360	3	s	-	✗
Overvoltage limit 2 Trip delay	0.1	360	3	s	-	✗
Overvoltage Reset delay	0.3	Locked	10	s	-	✗
Frequency of starts					✗	-
Operating mode	Disabled	Warning/alarm	Disabled	-	✗	-
Service interval					-	✗
Operating mode	Disabled	Disabled / Re-start / Active / Expired	Re-start	-	-	✗
Interval	100	65535	24000	h	-	✗

9.2.4 Amacontrol 3, variant 4

Table 30: Parameter table: Amacontrol 3, variant 4 (AC/DC 50/60 Hz 24 V and AC 50/60Hz 100-240V)

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Motor temperature 1					✗	-
Sensor type	Disabled	Pt100/Pt1000/PTC/bimetal	Bimetal	-	✗	-
Trip delay	0.1	3600	0.1	s	✗	-
Reset delay	0	Locked	0	s	✗	-
Temperature 1					✗	-
Sensor type	Disabled	Pt100/Pt1000/PTC	Disabled	-	✗	-
Temperature 2					✗	-
Sensor type	Disabled	Pt100/Pt1000/PTC	Pt100	-	✗	-

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Trip temperature	-100	300	150	°C	X	-
Warning temperature	-100	300	130	°C	X	-
Hysteresis	0	300	30	K	X	-
Trip delay	0.1	3600	60	s	X	-
Reset delay	0	Locked	0	s	X	-
Leakage 1					X	-
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Switching input (NC)	-	X	-
Trip delay	0.1	3600	60	s	-	X
Reset delay	0	Locked	0	s	-	X
Leakage 2					X	-
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Resistance below	-	X	-
Trip value	1	1000	60	kΩ	X	-
Warning value	1	1000	75	kΩ	X	-
Hysteresis	1	999	10	kΩ	X	-
Trip delay	0.1	3600	60	s	-	X
Reset delay	0	Locked	0	s	-	X
Analog input 1					X	-
Operating mode	Disabled	Limit value below / Limit value exceeded	Disabled	-	X	-
Phase monitor 1					-	X
Operating mode Phase monitor	Disabled	Active	Active	-	-	X
Phase failure Trip value	0	100	75	%	-	X
Phase failure Reset delay	0.3	Locked	10	s	-	X
Operating mode Phase sequence	Disabled	Active	Active	-	-	X
Phase asymmetry Trip value	1	100	15	%	-	X
Phase asymmetry Warning value	1	100	10	%	-	X
Phase asymmetry Hysteresis	1	99	10	%	-	X
Phase asymmetry Trip delay	0.1	360	0.3	s	-	X
Phase asymmetry Reset delay	0.3	Locked	10	s	-	X
Operating mode Undervoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	X	-

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Undervoltage limit 1	100	690	207	V	-	✗
Undervoltage limit 2	100	690	195	V	-	✗
Undervoltage hysteresis	1	600	20	V	-	✗
Undervoltage limit 1 Trip delay	0.1	360	3.0	s	-	✗
Undervoltage limit 2 Trip delay	0.1	360	3.0	s	-	✗
Undervoltage Reset delay	0.3	Locked	10	s	-	✗
Operating mode Overvoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	-	✗
Overvoltage limit 1	100	690	253	V	-	✗
Overvoltage limit 2	100	690	265	V	-	✗
Overvoltage hysteresis	1	600	20	V	-	✗
Overvoltage limit 1 Trip delay	0.1	360	3	s	-	✗
Overvoltage limit 2 Trip delay	0.1	360	3	s	-	✗
Overvoltage Reset delay	0.3	Locked	10	s	-	✗
Frequency of starts					✗	-
Operating mode	Disabled	Warning/alarm	Disabled	-	✗	-
Service interval					-	✗
Operating mode	Disabled	Disabled / Re-start / Active / Expired	Re-start	-	-	✗
Interval	100	65535	24000	h	-	✗

9.2.5 Amacontrol 3, variant 5

Table 31: Parameter table: Amacontrol 3, variant 5 (AC/DC 50/60 Hz 24 V and AC 50/60Hz 100-240V)

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Motor temperature 1					✗	-
Sensor type	Disabled	Pt100/Pt1000/PTC/bimetal	Bimetal	-	✗	-
Trip delay	0.1	3600	0.1	s	✗	-
Reset delay	0	Locked	0	s	✗	-
Temperature 1					✗	-

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Sensor type	Disabled	Pt100/Pt1000/PTC	Pt100	-	X	-
Trip temperature	-100	300	150	°C	X	-
Warning temperature	-100	300	130	°C	X	-
Hysteresis	0	300	30	K	X	-
Trip delay	0.1	3600	60	s	X	-
Reset delay	0	Locked	0	s	X	-
Temperature 2					X	-
Sensor type	Disabled	Pt100/Pt1000/PTC	Pt100	-	X	-
Trip temperature	-100	300	150	°C	X	-
Warning temperature	-100	300	130	°C	X	-
Hysteresis	0	300	30	K	X	-
Trip delay	0.1	3600	60	s	X	-
Reset delay	0	Locked	0	s	X	-
Leakage 1					X	-
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Switching input (NC)	-	X	-
Trip delay	0.1	3600	60	s	-	X
Reset delay	0	Locked	0	s	-	X
Leakage 2					X	-
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Resistance below	-	X	-
Trip value	1	1000	60	kΩ	X	-
Warning value	1	1000	75	kΩ	X	-
Hysteresis	1	999	10	kΩ	X	-
Trip delay	0.1	3600	60	s	-	X
Reset delay	0	Locked	0	s	-	X
Analog input 1					X	-
Operating mode	Disabled	Limit value below / Limit value exceeded	Disabled	-	X	-
Phase monitor 1					-	X
Operating mode Phase monitor	Disabled	Active	Active	-	-	X
Phase failure Trip value	0	100	75	%	-	X

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Phase failure Reset delay	0.3	Locked	10	s	-	✗
Operating mode Phase sequence	Disabled	Active	Active	-	-	✗
Phase asymmetry Trip value	1	100	15	%	-	✗
Phase asymmetry Warning value	1	100	10	%	-	✗
Phase asymmetry Hysteresis	1	99	10	%	-	✗
Phase asymmetry Trip delay	0.1	360	0.3	s	-	✗
Phase asymmetry Reset delay	0.3	Locked	10	s	-	✗
Operating mode Undervoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	✗	-
Undervoltage limit 1	100	690	207	V	-	✗
Undervoltage limit 2	100	690	195	V	-	✗
Undervoltage hysteresis	1	600	20	V	-	✗
Undervoltage limit 1 Trip delay	0.1	360	3.0	s	-	✗
Undervoltage limit 2 Trip delay	0.1	360	3.0	s	-	✗
Undervoltage Reset delay	0.3	Locked	10	s	-	✗
Operating mode Overvoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	-	✗
Overvoltage limit 1	100	690	253	V	-	✗
Overvoltage limit 2	100	690	265	V	-	✗
Overvoltage hysteresis	1	600	20	V	-	✗
Overvoltage limit 1 Trip delay	0.1	360	3	s	-	✗
Overvoltage limit 2 Trip delay	0.1	360	3	s	-	✗
Overvoltage Reset delay	0.3	Locked	10	s	-	✗
Frequency of starts					✗	-
Operating mode	Disabled	Warning/alarm	Disabled	-	✗	-
Service interval					-	✗
Operating mode	Disabled	Disabled / Re-start / Active / Expired	Re-start	-	-	✗
Interval	100	65535	24000	h	-	✗

9.2.6 Amacontrol 3, variant 6

Table 32: Parameter table: Amacontrol 3, variant 6 (AC/DC 50/60 Hz 24 V and AC 50/60Hz 100-240V)

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Motor temperature 1					X	-
Sensor type	Disabled	Pt100/Pt1000/PTC/bimetal	Bimetal	-	X	-
Trip delay	0.1	3600	0.1	s	X	-
Reset delay	0	Locked	0	s	X	-
Temperature 1					X	-
Sensor type	Disabled	Pt100/Pt1000/PTC	Pt100	-	X	-
Trip temperature	-100	300	150	°C	X	-
Warning temperature	-100	300	130	°C	X	-
Hysteresis	0	300	30	K	X	-
Trip delay	0.1	3600	60	s	X	-
Reset delay	0	Locked	0	s	X	-
Temperature 2					X	-
Sensor type	Disabled	Pt100/Pt1000/PTC	Pt100	-	X	-
Trip temperature	-100	300	150	°C	X	-
Warning temperature	-100	300	130	°C	X	-
Hysteresis	0	300	30	K	X	-
Trip delay	0.1	3600	60	s	X	-
Reset delay	0	Locked	0	s	X	-
Leakage 1					X	-
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Switching input (NC)	-	X	-
Trip delay	0.1	3600	60	s	-	X
Reset delay	0	Locked	0	s	-	X
Leakage 2					X	-
Operating mode	Disabled	Resistance below/resistance exceeded/ switching input (NO)/switching input (NC)	Resistance below	-	X	-
Trip value	1	1000	60	kΩ	X	-
Warning value	1	1000	75	kΩ	X	-
Hysteresis	1	999	10	kΩ	X	-

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Trip delay	0.1	3600	60	s	-	✗
Reset delay	0	Locked	0	s	-	✗
Analog input 1					✗	-
Operating mode	Disabled	Limit value below / Limit value exceeded	Limit value exceeded	-	✗	-
Base current	0 = disabled	19.9	4.0	mA		
Trip value	0.1	19.9	15.2	mA		
Warning value	0.1	19.9	12.8	mA		
Hysteresis	0.1	19.9	2.0	mA		
Trip delay	0.1	3600	120	s		
Reset delay	0	Locked	0	s		
Conversion value min	-500.0	5999.9	0.0	-		
Conversion value max	-499.9	6000.0	20.0	-		
Conversion unit characters 1 & 2	0	65535	mm	-		
Conversion unit characters 3 & 4	0	65535	/s	-		
Analog input Active delay	0.5	6553.5	10	s		
Phase monitor 1					-	✗
Operating mode Phase monitor	Disabled	Active	Active	-	-	✗
Phase failure Trip value	0	100	75	%	-	✗
Phase failure Reset delay	0.3	Locked	10	s	-	✗
Operating mode Phase sequence	Disabled	Active	Active	-	-	✗
Phase asymmetry Trip value	1	100	15	%	-	✗
Phase asymmetry Warning value	1	100	10	%	-	✗
Phase asymmetry Hysteresis	1	99	10	%	-	✗
Phase asymmetry Trip delay	0.1	360	0.3	s	-	✗
Phase asymmetry Reset delay	0.3	Locked	10	s	-	✗
Operating mode Undervoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	✗	-
Undervoltage limit 1	100	690	207	V	-	✗
Undervoltage limit 2	100	690	195	V	-	✗
Undervoltage hysteresis	1	600	20	V	-	✗
Undervoltage limit 1 Trip delay	0.1	360	3.0	s	-	✗

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Undervoltage limit 2 Trip delay	0.1	360	3.0	s	-	✗
Undervoltage Reset delay	0.3	Locked	10	s	-	✗
Operating mode Overvoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	-	✗
Overvoltage limit 1	100	690	253	V	-	✗
Overvoltage limit 2	100	690	265	V	-	✗
Overvoltage hysteresis	1	600	20	V	-	✗
Overvoltage limit 1 Trip delay	0.1	360	3	s	-	✗
Overvoltage limit 2 Trip delay	0.1	360	3	s	-	✗
Overvoltage Reset delay	0.3	Locked	10	s	-	✗
Frequency of starts					✗	-
Operating mode	Disabled	Warning/alarm	Disabled	-	✗	-
Service interval					-	✗
Operating mode	Disabled	Disabled / Re-start / Active / Expired	Re-start	-	-	✗
Interval	100	65535	24000	h	-	✗

9.2.7 Amacontrol 3, variant 7

Table 33: Parameter table: Amacontrol 3, variant 7 (AC/DC 50/60 Hz 24 V and AC 50/60 Hz 100-240V)

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Motor temperature 1					✗	-
Sensor type	Disabled	Pt100/Pt1000/PTC/bimetal	PTC	-	✗	-
Trip delay	0.1	3600	0.1	s	✗	-
Reset delay	0	Locked	Locked	s	✗	-
Temperature 1					✗	-
Sensor type	Disabled	Pt100/Pt1000/PTC	Disabled	-	✗	-
Temperature 2					✗	-
Sensor type	Disabled	Pt100/Pt1000/PTC	Pt100	-	✗	-
Trip temperature	-100	300	150	°C	✗	-

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Warning temperature	-100	300	130	°C	X	-
Hysteresis	0	300	30	K	X	-
Trip delay	0.1	3600	60	s	X	-
Reset delay	0	Locked	0	s	X	-
Leakage 1					X	-
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Switching input (NC)	-	X	-
Trip delay	0.1	3600	60	s	-	X
Reset delay	0	Locked	0	s	-	X
Leakage 2					X	-
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Resistance below	-	X	-
Trip value	1	1000	60	kΩ	X	-
Warning value	1	1000	75	kΩ	X	-
Hysteresis	1	999	10	kΩ	X	-
Trip delay	0.1	3600	60	s	-	X
Reset delay	0	Locked	0	s	-	X
Analog input 1					X	-
Operating mode	Disabled	Limit value below / Limit value exceeded	Disabled	-	X	-
Phase monitor 1					-	X
Operating mode Phase monitor	Disabled	Active	Active	-	-	X
Phase failure Trip value	0	100	75	%	-	X
Phase failure Reset delay	0.3	Locked	10	s	-	X
Operating mode Phase sequence	Disabled	Active	Active	-	-	X
Phase asymmetry Trip value	1	100	15	%	-	X
Phase asymmetry Warning value	1	100	10	%	-	X
Phase asymmetry Hysteresis	1	99	10	%	-	X
Phase asymmetry Trip delay	0.1	360	0.3	s	-	X
Phase asymmetry Reset delay	0.3	Locked	10	s	-	X
Operating mode Undervoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	X	-
Undervoltage limit 1	100	690	207	V	-	X

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Undervoltage limit 2	100	690	195	V	-	✗
Undervoltage hysteresis	1	600	20	V	-	✗
Undervoltage limit 1 Trip delay	0.1	360	3.0	s	-	✗
Undervoltage limit 2 Trip delay	0.1	360	3.0	s	-	✗
Undervoltage Reset delay	0.3	Locked	10	s	-	✗
Operating mode Overvoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	-	✗
Overvoltage limit 1	100	690	253	V	-	✗
Overvoltage limit 2	100	690	265	V	-	✗
Overvoltage hysteresis	1	600	20	V	-	✗
Overvoltage limit 1 Trip delay	0.1	360	3	s	-	✗
Overvoltage limit 2 Trip delay	0.1	360	3	s	-	✗
Overvoltage Reset delay	0.3	Locked	10	s	-	✗
Frequency of starts					✗	-
Operating mode	Disabled	Warning/alarm	Disabled	-	✗	-
Service interval					-	✗
Operating mode	Disabled	Disabled / Re-start / Active / Expired	Re-start	-	-	✗
Interval	100	65535	24000	h	-	✗

9.2.8 Amacontrol 3, variant 8

Table 34: Parameter table: Amacontrol 3, variant 8 (AC/DC 50/60 Hz 24 V and AC 50/60 Hz 100-240V)

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Motor temperature 1					✗	-
Sensor type	Disabled	Pt100/Pt1000/PTC/bimetal	PTC	-	✗	-
Trip delay	0.1	3600	0.1	s	✗	-
Reset delay	0	Locked	Locked	s	✗	-
Temperature 1					✗	-
Sensor type	Disabled	Pt100/Pt1000/PTC	Pt100	-	✗	-

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Trip temperature	-100	300	150	°C	X	-
Warning temperature	-100	300	130	°C	X	-
Hysteresis	0	300	30	K	X	-
Trip delay	0.1	3600	60	s	X	-
Reset delay	0	Locked	0	s	X	-
Temperature 2					X	-
Sensor type	Disabled	Pt100/Pt1000/PTC	Pt100	-	X	-
Trip temperature	-100	300	150	°C	X	-
Warning temperature	-100	300	130	°C	X	-
Hysteresis	0	300	30	K	X	-
Trip delay	0.1	3600	60	s	X	-
Reset delay	0	Locked	0	s	X	-
Leakage 1					X	-
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Switching input (NC)	-	X	-
Trip delay	0.1	3600	60	s	-	X
Reset delay	0	Locked	0	s	-	X
Leakage 2					X	-
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Resistance below	-	X	-
Trip value	1	1000	60	kΩ	X	-
Warning value	1	1000	75	kΩ	X	-
Hysteresis	1	999	10	kΩ	X	-
Trip delay	0.1	3600	60	s	-	X
Reset delay	0	Locked	0	s	-	X
Analog input 1					X	-
Operating mode	Disabled	Limit value below / Limit value exceeded	Disabled	-	X	-
Phase monitor 1					-	X
Operating mode Phase monitor	Disabled	Active	Active	-	-	X
Phase failure Trip value	0	100	75	%	-	X
Phase failure Reset delay	0.3	Locked	10	s	-	X

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Operating mode Phase sequence	Disabled	Active	Active	-	-	✗
Phase asymmetry Trip value	1	100	15	%	-	✗
Phase asymmetry Warning value	1	100	10	%	-	✗
Phase asymmetry Hysteresis	1	99	10	%	-	✗
Phase asymmetry Trip delay	0.1	360	0.3	s	-	✗
Phase asymmetry Reset delay	0.3	Locked	10	s	-	✗
Operating mode Undervoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	✗	-
Undervoltage limit 1	100	690	207	V	-	✗
Undervoltage limit 2	100	690	195	V	-	✗
Undervoltage hysteresis	1	600	20	V	-	✗
Undervoltage limit 1 Trip delay	0.1	360	3.0	s	-	✗
Undervoltage limit 2 Trip delay	0.1	360	3.0	s	-	✗
Undervoltage Reset delay	0.3	Locked	10	s	-	✗
Operating mode Overvoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	-	✗
Overvoltage limit 1	100	690	253	V	-	✗
Overvoltage limit 2	100	690	265	V	-	✗
Overvoltage hysteresis	1	600	20	V	-	✗
Overvoltage limit 1 Trip delay	0.1	360	3	s	-	✗
Overvoltage limit 2 Trip delay	0.1	360	3	s	-	✗
Overvoltage Reset delay	0.3	Locked	10	s	-	✗
Frequency of starts					✗	-
Operating mode	Disabled	Warning/alarm	Disabled	-	✗	-
Service interval					-	✗
Operating mode	Disabled	Disabled / Re-start / Active / Expired	Re-start	-	-	✗
Interval	100	65535	24000	h	-	✗

9.2.9 Amacontrol 3, variant 9

Table 35: Parameter table: Amacontrol 3, variant 9 (AC/DC 50/60 Hz 24 V and AC 50/60 Hz 100-240V)

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Motor temperature 1					X	-
Sensor type	Disabled	Pt100/Pt1000/PTC/bimetal	PTC	-	X	-
Trip delay	0.1	3600	0.1	s	X	-
Reset delay	0	Locked	Locked	s	X	-
Temperature 1					X	-
Sensor type	Disabled	Pt100/Pt1000/PTC	Pt100	-	X	-
Trip temperature	-100	300	150	°C	X	-
Warning temperature	-100	300	130	°C	X	-
Hysteresis	0	300	30	K	X	-
Trip delay	0.1	3600	60	s	X	-
Reset delay	0	Locked	0	s	X	-
Temperature 2					X	-
Sensor type	Disabled	Pt100/Pt1000/PTC	Pt100	-	X	-
Trip temperature	-100	300	150	°C	X	-
Warning temperature	-100	300	130	°C	X	-
Hysteresis	0	300	30	K	X	-
Trip delay	0.1	3600	60	s	X	-
Reset delay	0	Locked	0	s	X	-
Leakage 1					X	-
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Switching input (NC)	-	X	-
Trip delay	0.1	3600	60	s	-	X
Reset delay	0	Locked	0	s	-	X
Leakage 2					X	-
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Resistance below	-	X	-
Trip value	1	1000	60	kΩ	X	-
Warning value	1	1000	75	kΩ	X	-
Hysteresis	1	999	10	kΩ	X	-

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Trip delay	0.1	3600	60	s	-	✗
Reset delay	0	Locked	0	s	-	✗
Analog input 1					✗	-
Operating mode	Disabled	Limit value below / Limit value exceeded	Limit value exceeded	-	✗	-
Base current	0 = disabled	19.9	4.0	mA	✗	-
Trip value	0.1	19.9	15.2	mA	✗	-
Warning value	0.1	19.9	12.8	mA	✗	-
Hysteresis	0.1	19.9	2.0	mA	✗	-
Trip delay	0.1	3600	120	s	✗	-
Reset delay	0	Locked	0	s	✗	-
Conversion value min	-500.0	5999.9	0.0	-	✗	-
Conversion value max	-499.9	6000.0	20.0	-	✗	-
Conversion unit characters 1 & 2	0	65535	mm	-	✗	-
Conversion unit characters 3 & 4	0	65535	/s	-	✗	-
Analog input Active delay	0.5	6553.5	10	s	✗	-
Phase monitor 1					-	✗
Operating mode Phase monitor	Disabled	Active	Active	-	-	✗
Phase failure Trip value	0	100	75	%	-	✗
Phase failure Reset delay	0.3	Locked	10	s	-	✗
Operating mode Phase sequence	Disabled	Active	Active	-	-	✗
Phase asymmetry Trip value	1	100	15	%	-	✗
Phase asymmetry Warning value	1	100	10	%	-	✗
Phase asymmetry Hysteresis	1	99	10	%	-	✗
Phase asymmetry Trip delay	0.1	360	0.3	s	-	✗
Phase asymmetry Reset delay	0.3	Locked	10	s	-	✗
Operating mode Undervoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	✗	-
Undervoltage limit 1	100	690	207	V	-	✗
Undervoltage limit 2	100	690	195	V	-	✗
Undervoltage hysteresis	1	600	20	V	-	✗
Undervoltage limit 1 Trip delay	0.1	360	3.0	s	-	✗

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Undervoltage limit 2 Trip delay	0.1	360	3.0	s	-	✗
Undervoltage Reset delay	0.3	Locked	10	s	-	✗
Operating mode Overvoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	-	✗
Overvoltage limit 1	100	690	253	V	-	✗
Overvoltage limit 2	100	690	265	V	-	✗
Overvoltage hysteresis	1	600	20	V	-	✗
Overvoltage limit 1 Trip delay	0.1	360	3	s	-	✗
Overvoltage limit 2 Trip delay	0.1	360	3	s	-	✗
Overvoltage Reset delay	0.3	Locked	10	s	-	✗
Frequency of starts					✗	-
Operating mode	Disabled	Warning/alarm	Disabled	-	✗	-
Service interval					-	✗
Operating mode	Disabled	Disabled / Re-start / Active / Expired	Re-start	-	-	✗
Interval	100	65535	24000	h	-	✗

9.2.10 Amacontrol 3, variant 10

Table 36: Parameter table: Amacontrol 3, variant 10 (AC/DC 50/60 Hz 24 V and AC 50/60Hz 100-240V)

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Motor temperature 1					✗	-
Sensor type	Disabled	Pt100/Pt1000/PTC/bimetal	Disabled	-	✗	-
Temperature 1					✗	-
Sensor type	Disabled	Pt100/Pt1000/PTC	Pt100	-	✗	-
Trip temperature	-100	300	150	°C	✗	-
Warning temperature	-100	300	130	°C	✗	-
Hysteresis	0	300	30	K	✗	-
Trip delay	0.1	3600	60	s	✗	-
Reset delay	0	Locked	0	s	✗	-

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Temperature 2					X	-
Sensor type	Disabled	Pt100/Pt1000/PTC	Pt100	-	X	-
Trip temperature	-100	300	150	°C	X	-
Warning temperature	-100	300	130	°C	X	-
Hysteresis	0	300	30	K	X	-
Trip delay	0.1	3600	60	s	X	-
Reset delay	0	Locked	0	s	X	-
Leakage 1					X	-
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Switching input (NC)	-	X	-
Trip delay	0.1	3600	60	s	-	X
Reset delay	0	Locked	0	s	-	X
Leakage 2					X	-
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Resistance below	-	X	-
Trip value	1	1000	60	kΩ	X	-
Warning value	1	1000	75	kΩ	X	-
Hysteresis	1	999	10	kΩ	X	-
Trip delay	0.1	3600	60	s	-	X
Reset delay	0	Locked	0	s	-	X
Analog input 1					X	-
Operating mode	Disabled	Limit value below / Limit value exceeded	Disabled	-	X	-
Phase monitor 1					-	X
Operating mode Phase monitor	Disabled	Active	Active	-	-	X
Phase failure Trip value	0	100	75	%	-	X
Phase failure Reset delay	0.3	Locked	10	s	-	X
Operating mode Phase sequence	Disabled	Active	Active	-	-	X
Phase asymmetry Trip value	1	100	15	%	-	X
Phase asymmetry Warning value	1	100	10	%	-	X
Phase asymmetry Hysteresis	1	99	10	%	-	X
Phase asymmetry Trip delay	0.1	360	0.3	s	-	X

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Phase asymmetry Reset delay	0.3	Locked	10	s	-	✗
Operating mode Undervoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	✗	-
Undervoltage limit 1	100	690	207	V	-	✗
Undervoltage limit 2	100	690	195	V	-	✗
Undervoltage hysteresis	1	600	20	V	-	✗
Undervoltage limit 1 Trip delay	0.1	360	3.0	s	-	✗
Undervoltage limit 2 Trip delay	0.1	360	3.0	s	-	✗
Undervoltage Reset delay	0.3	Locked	10	s	-	✗
Operating mode Overvoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	-	✗
Overvoltage limit 1	100	690	253	V	-	✗
Overvoltage limit 2	100	690	265	V	-	✗
Overvoltage hysteresis	1	600	20	V	-	✗
Overvoltage limit 1 Trip delay	0.1	360	3	s	-	✗
Overvoltage limit 2 Trip delay	0.1	360	3	s	-	✗
Overvoltage Reset delay	0.3	Locked	10	s	-	✗
Frequency of starts					✗	-
Operating mode	Disabled	Warning/alarm	Disabled	-	✗	-
Service interval					-	✗
Operating mode	Disabled	Disabled / Re-start / Active / Expired	Re-start	-	-	✗
Interval	100	65535	24000	h	-	✗

9.2.11 Amacontrol 3, variant 11

Table 37: Parameter table: Amacontrol 3, variant 11 (AC/DC 50/60 Hz 24 V and AC 50/60 Hz 100-240V)

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Motor temperature 1					✗	-
Sensor type	Disabled	Pt100/Pt1000/PTC/bimetal	Disabled	-	✗	-
Temperature 1					✗	-

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Sensor type	Disabled	Pt100/Pt1000/PTC	Disabled	-	X	-
Temperature 2					X	-
Sensor type	Disabled	Pt100/Pt1000/PTC	Pt100	-	X	-
Trip temperature	-100	300	150	°C	X	-
Warning temperature	-100	300	130	°C	X	-
Hysteresis	0	300	30	K	X	-
Trip delay	0.1	3600	60	s	X	-
Reset delay	0	Locked	0	s	X	-
Leakage 1					X	-
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Switching input (NC)	-	X	-
Trip delay	0.1	3600	60	s	-	X
Reset delay	0	Locked	0	s	-	X
Leakage 2					X	-
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Resistance below	-	X	-
Trip value	1	1000	60	kΩ	X	-
Warning value	1	1000	75	kΩ	X	-
Hysteresis	1	999	10	kΩ	X	-
Trip delay	0.1	3600	60	s	-	X
Reset delay	0	Locked	0	s	-	X
Analog input 1					X	-
Operating mode	Disabled	Limit value below / Limit value exceeded	Disabled	-	X	-
Phase monitor 1					-	X
Operating mode Phase monitor	Disabled	Active	Active	-	-	X
Phase failure Trip value	0	100	75	%	-	X
Phase failure Reset delay	0.3	Locked	10	s	-	X
Operating mode Phase sequence	Disabled	Active	Active	-	-	X
Phase asymmetry Trip value	1	100	15	%	-	X
Phase asymmetry Warning value	1	100	10	%	-	X
Phase asymmetry Hysteresis	1	99	10	%	-	X

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Phase asymmetry Trip delay	0.1	360	0.3	s	-	✗
Phase asymmetry Reset delay	0.3	Locked	10	s	-	✗
Operating mode Undervoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	✗	-
Undervoltage limit 1	100	690	207	V	-	✗
Undervoltage limit 2	100	690	195	V	-	✗
Undervoltage hysteresis	1	600	20	V	-	✗
Undervoltage limit 1 Trip delay	0.1	360	3.0	s	-	✗
Undervoltage limit 2 Trip delay	0.1	360	3.0	s	-	✗
Undervoltage Reset delay	0.3	Locked	10	s	-	✗
Operating mode Overvoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	-	✗
Overvoltage limit 1	100	690	253	V	-	✗
Overvoltage limit 2	100	690	265	V	-	✗
Overvoltage hysteresis	1	600	20	V	-	✗
Overvoltage limit 1 Trip delay	0.1	360	3	s	-	✗
Overvoltage limit 2 Trip delay	0.1	360	3	s	-	✗
Overvoltage Reset delay	0.3	Locked	10	s	-	✗
Frequency of starts					✗	-
Operating mode	Disabled	Warning/alarm	Disabled	-	✗	-
Service interval					-	✗
Operating mode	Disabled	Disabled / Re-start / Active / Expired	Re-start	-	-	✗
Interval	100	65535	24000	h	-	✗

9.2.12 Amacontrol 3, variant 12

Table 38: Parameter table: Amacontrol 3, variant 12 (AC/DC 50/60 Hz 24 V and AC 50/60 Hz 100-240V)

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Motor temperature 1					✗	-
Sensor type	Disabled	Pt100/Pt1000/PTC/bimetal	Disabled	-	✗	-

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Temperature 1					X	-
Sensor type	Disabled	Pt100/Pt1000/PTC	Pt100	-	X	-
Trip temperature	-100	300	150	°C	X	-
Warning temperature	-100	300	130	°C	X	-
Hysteresis	0	300	30	K	X	-
Trip delay	0.1	3600	60	s	X	-
Reset delay	0	Locked	0	s	X	-
Temperature 2					X	-
Sensor type	Disabled	Pt100/Pt1000/PTC	Pt100	-	X	-
Trip temperature	-100	300	150	°C	X	-
Warning temperature	-100	300	130	°C	X	-
Hysteresis	0	300	30	K	X	-
Trip delay	0.1	3600	60	s	X	-
Reset delay	0	Locked	0	s	X	-
Leakage 1					X	-
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Switching input (NC)	-	X	-
Trip delay	0.1	3600	60	s	-	X
Reset delay	0	Locked	0	s	-	X
Leakage 2					X	-
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Resistance below	-	X	-
Trip value	1	1000	60	kΩ	X	-
Warning value	1	1000	75	kΩ	X	-
Hysteresis	1	999	10	kΩ	X	-
Trip delay	0.1	3600	60	s	-	X
Reset delay	0	Locked	0	s	-	X
Analog input 1					X	-
Operating mode	Disabled	Limit value below / Limit value exceeded	Limit value exceeded	-	X	-
Base current	0 = disabled	19.9	4.0	mA	X	-

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Trip value	0.1	19.9	15.2	mA	X	-
Warning value	0.1	19.9	12.8	mA	X	-
Hysteresis	0.1	19.9	2.0	mA	X	-
Trip delay	0.1	3600	120	s	X	-
Reset delay	0	Locked	0	s	X	-
Conversion value min	-500.0	5999.9	0.0	-	X	-
Conversion value max	-499.9	6000.0	20.0	-	X	-
Conversion unit characters 1 & 2	0	65535	mm	-	X	-
Conversion unit characters 3 & 4	0	65535	/s	-	X	-
Analog input Active delay	0.5	6553.5	10	s	X	-
Phase monitor 1					-	X
Operating mode Phase monitor	Disabled	Active	Active	-	-	X
Phase failure Trip value	0	100	75	%	-	X
Phase failure Reset delay	0.3	Locked	10	s	-	X
Operating mode Phase sequence	Disabled	Active	Active	-	-	X
Phase asymmetry Trip value	1	100	15	%	-	X
Phase asymmetry Warning value	1	100	10	%	-	X
Phase asymmetry Hysteresis	1	99	10	%	-	X
Phase asymmetry Trip delay	0.1	360	0.3	s	-	X
Phase asymmetry Reset delay	0.3	Locked	10	s	-	X
Operating mode Undervoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	X	-
Undervoltage limit 1	100	690	207	V	-	X
Undervoltage limit 2	100	690	195	V	-	X
Undervoltage hysteresis	1	600	20	V	-	X
Undervoltage limit 1 Trip delay	0.1	360	3.0	s	-	X
Undervoltage limit 2 Trip delay	0.1	360	3.0	s	-	X
Undervoltage Reset delay	0.3	Locked	10	s	-	X
Operating mode Overvoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	-	X
Overvoltage limit 1	100	690	253	V	-	X
Overvoltage limit 2	100	690	265	V	-	X
Overvoltage hysteresis	1	600	20	V	-	X

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Overvoltage limit 1 Trip delay	0.1	360	3	s	-	✗
Overvoltage limit 2 Trip delay	0.1	360	3	s	-	✗
Overvoltage Reset delay	0.3	Locked	10	s	-	✗
Frequency of starts					✗	-
Operating mode	Disabled	Warning/alarm	Disabled	-	✗	-
Service interval					-	✗
Operating mode	Disabled	Disabled / Re-start / Active / Expired	Re-start	-	-	✗
Interval	100	65535	24000	h	-	✗

9.2.13 Amacontrol 3, variant 13

Table 39: Parameter table: Amacontrol 3, variant 13 (AC/DC 50/60 Hz 24 V and AC 50/60 Hz 100-240V)

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Motor temperature 1					✗	-
Sensor type	Disabled	Pt100/Pt1000/PTC/bimetal	PTC	-	✗	-
Trip delay	0.1	3600	0.1	s	✗	-
Reset delay	0	Locked	Locked	s	✗	-
Temperature 1					✗	-
Sensor type	Disabled	Pt100/Pt1000/PTC	Pt100	-	✗	-
Trip temperature	-100	300	90	°C	✗	-
Warning temperature	-100	300	85	°C	✗	-
Hysteresis	0	300	30	K	✗	-
Trip delay	0.1	3600	60	s	✗	-
Reset delay	0	Locked	0	s	✗	-
Temperature 2					✗	-
Sensor type	Disabled	Pt100/Pt1000/PTC	Pt100	-	✗	-
Trip temperature	-100	300	90	°C	✗	-
Warning temperature	-100	300	85	°C	✗	-

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Hysteresis	0	300	30	K	X	-
Trip delay	0.1	3600	60	s	X	-
Reset delay	0	Locked	0	s	X	-
Leakage 1					X	-
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Disabled	-	X	-
Leakage 2					X	-
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Resistance below	-	X	-
Trip value	1	1000	60	kΩ	X	-
Warning value	1	1000	75	kΩ	X	-
Hysteresis	1	999	10	kΩ	X	-
Trip delay	0.1	3600	60	s	-	X
Reset delay	0	Locked	0	s	-	X
Analog input 1					X	-
Operating mode	Disabled	Limit value below / Limit value exceeded	Limit value exceeded	-	X	-
Base current	0 = disabled	19.9	4.0	mA	X	-
Trip value	0.1	19.9	9.5	mA	X	-
Warning value	0.1	19.9	6.3	mA	X	-
Hysteresis	0.1	19.9	2.0	mA	X	-
Trip delay	0.1	3600	120	s	X	-
Reset delay	0	Locked	0	s	X	-
Conversion value min	-500.0	5999.9	0.0	-	X	-
Conversion value max	-499.9	6000.0	20.0	-	X	-
Conversion unit characters 1 & 2	0	65535	mm	-	X	-
Conversion unit characters 3 & 4	0	65535	/s	-	X	-
Analog input Active delay	0.5	6553.5	10	s	X	-
Phase monitor 1					-	X
Operating mode Phase monitor	Disabled	Active	Active	-	-	X
Phase failure Trip value	0	100	75	%	-	X

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Phase failure Reset delay	0.3	Locked	10	s	-	✗
Operating mode Phase sequence	Disabled	Active	Active	-	-	✗
Phase asymmetry Trip value	1	100	15	%	-	✗
Phase asymmetry Warning value	1	100	10	%	-	✗
Phase asymmetry Hysteresis	1	99	10	%	-	✗
Phase asymmetry Trip delay	0.1	360	0.3	s	-	✗
Phase asymmetry Reset delay	0.3	Locked	10	s	-	✗
Operating mode Undervoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	✗	-
Undervoltage limit 1	100	690	207	V	-	✗
Undervoltage limit 2	100	690	195	V	-	✗
Undervoltage hysteresis	1	600	20	V	-	✗
Undervoltage limit 1 Trip delay	0.1	360	3.0	s	-	✗
Undervoltage limit 2 Trip delay	0.1	360	3.0	s	-	✗
Undervoltage Reset delay	0.3	Locked	10	s	-	✗
Operating mode Overvoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	-	✗
Overvoltage limit 1	100	690	253	V	-	✗
Overvoltage limit 2	100	690	265	V	-	✗
Overvoltage hysteresis	1	600	20	V	-	✗
Overvoltage limit 1 Trip delay	0.1	360	3	s	-	✗
Overvoltage limit 2 Trip delay	0.1	360	3	s	-	✗
Overvoltage Reset delay	0.3	Locked	10	s	-	✗
Frequency of starts					✗	-
Operating mode	Disabled	Warning/alarm	Disabled	-	✗	-
Service interval					-	✗
Operating mode	Disabled	Disabled / Re-start / Active / Expired	Re-start	-	-	✗
Interval	100	65535	24000	h	-	✗

9.2.14 Amacontrol 3, variant 14

Table 40: Parameter table: Amacontrol 3, variant 14 (AC/DC 50/60 Hz 24 V and AC 50/60 Hz 100-240 V)

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Motor temperature 1					X	X
Sensor type	Disabled	Pt100/Pt1000/PTC/bimetal	PTC	-	X	X
Trip temperature	-100	300	140	°C	X	X
Warning temperature	-100	300	110	°C	X	X
Hysteresis	0	300	40	K	X	X
Trip delay	0.1	3600	0.1	s	X	X
Reset delay	0	Locked	Locked	s	X	X
Correction factor wire resistance	0	100	0	Ω	X	X
Temperature 1					X	X
Sensor type	Disabled	Pt100/Pt1000/PTC	Pt100	-	X	X
Trip temperature	-100	300	150	°C	X	X
Warning temperature	-100	300	130	°C	X	X
Hysteresis	0	300	30	K	X	X
Trip delay	0.1	3600	60	s	X	X
Reset delay	0	Locked	0	s	X	X
Correction factor wire resistance	0	100	0	Ω	X	X
Temperature 2					X	X
Sensor type	Disabled	Pt100/Pt1000/PTC	Disabled	-	X	X
Trip temperature	-100	300	150	°C	X	X
Warning temperature	-100	300	130	°C	X	X
Hysteresis	0	300	30	K	X	X
Trip delay	0.1	3600	60	s	X	X
Reset delay	0	Locked	0	s	X	X
Correction factor wire resistance	0	100	0	Ω	X	X
Leakage 1					X	X
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Switching input (NC)	-	X	X
Trip value	1	1000	60	kΩ	X	X

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Warning value	1	1000	75	kΩ	X	X
Hysteresis	1	999	10	kΩ	X	X
Trip delay	0.1	3600	60	s	X	X
Reset delay	0	Locked	0	s	X	X
Leakage 2					X	X
Operating mode	Disabled	Resistance below / Resistance exceeded / Switching input (NO) / Switching input (NC)	Disabled	-	X	X
Trip value	1	1000	60	kΩ	X	X
Warning value	1	1000	75	kΩ	X	X
Hysteresis	1	999	10	kΩ	X	X
Trip delay	0.1	3600	60	s	X	X
Reset delay	0	Locked	0	s	X	X
Analog input 1					X	X
Operating mode	Disabled	Limit value below / Limit value exceeded	Disabled	-	X	X
Base current	0 = disabled	19.9	4.0	mA	X	X
Trip value	0.1	19.9	15.2	mA	X	X
Warning value	0.1	19.9	12.8	mA	X	X
Hysteresis	0.1	19.9	2.0	mA	X	X
Trip delay	0.1	3600	120	s	X	X
Reset delay	0	Locked	Locked	s	X	X
Conversion value min	-500.0	5999.9	4.0	s	X	X
Conversion value max	-499.9	6000.0	20.0	s	X	X
Analog input Active delay	0.5	6553.5	3	s	X	X
Phase monitor 1					X	X
Operating mode Phase monitor	Disabled	Active	Active	-	X	X
Phase failure Trip value	0	100	75	%	X	X
Phase failure Reset delay	0	Locked	Locked	s	X	X
Operating mode Phase sequence	Disabled	Active	Active	-	X	X
Phase asymmetry Trip value	1	100	15	%	X	X
Phase asymmetry Warning value	1	100	10	%	X	X
Phase asymmetry Hysteresis	1	99	10	%	X	X

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Phase asymmetry Trip delay	0.1	360	0.3	s	X	X
Phase asymmetry Reset delay	0	Locked	Locked	s	X	X
Operating mode Undervoltage	Disabled	Limit 1 warning / limit 1 tripping	Disabled	-	X	X
Undervoltage limit 1	100	690	207	V	X	X
Undervoltage limit 2	100	690	195	V	X	X
Undervoltage hysteresis	1	600	20	V	X	X
Undervoltage limit 1 Trip delay	0.1	360	3.0	s	X	X
Undervoltage limit 2 Trip delay	0.1	360	3.0	s	X	X
Undervoltage Reset delay	0	Locked	Locked	s	X	X
Operating mode Overvoltage	Disabled	Limit 1 warning / limit 1 tripping	Limit 1 warning	-	X	X
Overvoltage limit 1	100	690	253	V	X	X
Overvoltage limit 2	100	690	265	V	X	X
Overvoltage hysteresis	1	600	20	V	X	X
Overvoltage limit 1 Trip delay	0.1	360	3	s	X	X
Overvoltage limit 2 Trip delay	0.1	360	3	s	X	X
Overvoltage Reset delay	0	Locked	Locked	s	X	X
Frequency of starts						
Operating mode	Disabled	Warning/alarm	Disabled	-	X	X
Reset delay	0	Locked	Locked	s	X	X
Switching per time range	2	10	3	-	X	X
Time range	1	43200	30	s	X	X
Service interval					X	X
Operating mode	Disabled	Disabled / Re-start / Active / Expired	Disabled	-	X	X
Interval	100	65535	1000	h	X	X
INTspection Memory					X	X
Basic time grid, range 1	1	3600	1	s	X	X
Time factor, range 2	1	3600	60	-	X	X
Time factor, range 3	1	3600	60	-	X	X
INTspection memory, error, offset	1	100	100	-	X	X
Evaluation, measured value 1	Minimum	Mean value/Maximum	Mean value	-	X	X
Evaluation, measured value 2	Minimum	Mean value/Maximum	Mean value	-	X	X

Parameter name	Parameter values				Read access	Write access
	Min.	Max.	Default	Unit		
Evaluation, measured value 3	Minimum	Mean value/Maximum	Mean value	-	X	X
Evaluation, measured value 4	Minimum	Mean value/Maximum	Mean value	-	X	X
Evaluation, measured value 5	Minimum	Mean value/Maximum	Mean value	-	X	X
Evaluation, measured value 6	Minimum	Mean value/Maximum	Mean value	-	X	X
Evaluation, measured value 7	Minimum	Mean value/Maximum	Mean value	-	X	X
Evaluation, measured value 8	Minimum	Mean value/Maximum	Mean value	-	X	X
Evaluation, measured value 9	Minimum	Mean value/Maximum	Mean value	-	X	X
Evaluation, measured value 10	Minimum	Mean value/Maximum	Mean value	-	X	X

9.2.15 Amacontrol 4

Table 41: Parameter table: Amacontrol 4 (AC/DC 50/60 Hz 24 V and AC 50/60 Hz 100-240 V)

Parameter name	Parameter values			Read access	Write access	
	Setting range	Default	Unit			
Device					X	X
Password parameterisation per DP	0 = no password ... 65535		0 = no password	-	X	X
Motor temperature 1					X	X
Sensor type	Disabled/Pt100/Pt1000/PTC/bimetal/external relay contact		PTC	-	X	X
Trip temperature	-100 ... 300		140	°C	X	X
Warning temperature	-100 ... 300		110	°C	X	X
Hysteresis	0 ... 300		30	K	X	X
Trip delay	00:00.1 ... 59:59.9		00:00.1	mm:ss.f	X	X
Reset delay	00:00:00...18:12:14/locked		Locked	hh:mm:ss	X	X
Correction factor wire resistance	0.0 ... 100.0		0.0	Ω	X	X
Designation of external relay contact	0 ... 40 characters		Designation	-	X	X
Temperature 1					X	X
Sensor type	Disabled/Pt100/Pt1000/PTC		Pt100	-	X	X
Trip temperature	-100 ... 300		150	°C	X	X

Parameter name	Parameter values			Read access	Write access
	Setting range	Default	Unit		
Warning temperature	-100 ... 300	130	°C	X	X
Hysteresis	0 ... 300	30	K	X	X
Trip delay	00:00.1 ... 59:59.9	01:00.0	mm:ss.f	X	X
Reset delay	00:00:00...18:12:14/locked	00:00:00	hh:mm:ss	X	X
Correction factor wire resistance	0.0 ... 100.0	0.0	Ω	X	X
Temperature 2				X	X
Sensor type	Disabled/Pt100/Pt1000/PTC	Pt100	-	X	X
Trip temperature	-100 ... 300	150	°C	X	X
Warning temperature	-100 ... 300	130	°C	X	X
Hysteresis	0 ... 300	30	K	X	X
Trip delay	00:00.1 ... 59:59.9	01:00.0	mm:ss.f	X	X
Reset delay	00:00:00...18:12:14/locked	00:00:00	hh:mm:ss	X	X
Correction factor wire resistance	0.0 ... 100.0	0.0	Ω	X	X
Leakage 1				X	X
Operating mode	Disabled / R exceeded / R below	R below	-	X	X
Trip value	10 ... 1000	60	kΩ	X	X
Warning value	10 ... 1000	75	kΩ	X	X
Hysteresis	10 ... 999	15	kΩ	X	X
Trip delay	00:00.1 ... 59:59.9	01:00.0	mm:ss.f	X	X
Reset delay	00:00:00...18:12:14/locked	00:00:00	hh:mm:ss	X	X
Switching input 1				X	X
Operating mode	Disabled/NC contact/NO contact/Reset	Normally closed contact	-	X	X
Reset delay	00:00:00...18:12:14/locked	00:00:00	hh:mm:ss	X	X
Designation	0 ... 40 characters	Designation	-	X	X
Analog input 1				X	X
Operating mode	Disabled / exceeded / below	Disabled	-	X	X
Base current	0 = disabled... 19.9	4.0	mA	X	X
Trip value	0.1 ... 19.9	15.2	mA	X	X
Warning value	0.1 ... 19.9	12.8	mA	X	X
Hysteresis	0.1 ... 19.9	2.0	mA	X	X

Parameter name	Parameter values			Read access	Write access
	Setting range	Default	Unit		
Trip delay	00:00.1 ... 59:59.9	02:00.0	mm:ss.f	X	X
Reset delay	00:00:00...18:12:14/locked	00:00:00	hh:mm:ss	X	X
Conversion value min	-500.0 ... 5999.9	0.0	s	X	X
Conversion value max	-499.9 ... 6000.0	20.0	s	X	X
Conversion unit	0 ... 8 characters	mm/s	-	X	X
Time to monitoring	00:00.5 ... 49:13.5	00:10.0	mm:ss.f	X	X
Phase monitoring				X	X
Operating mode	Disabled / monitoring 3 phases / monitoring 1 phase	Monitoring 3 phases	-	X	X
Setting	Sinusoidal operation / operation on frequency inverter	Sinusoidal operation	-	X	X
Phase failure Operating mode	Disabled/active	Active	-	X	X
Phase failure Trip value	0 ... 100	75	%	X	X
Phase failure Reset delay	00:00:03...18:12:14/locked	00:00:10	hh:mm:ss	X	X
Phase asymmetry Operating mode	Disabled/active	Active	-		
Phase asymmetry Trip value	1 ... 100	15	%	X	X
Phase asymmetry Warning value	1 ... 100	10	%	X	X
Phase asymmetry Hysteresis	1 ... 99	10	%	X	X
Phase asymmetry Trip delay	00:00.1 ... 59:59.9	00:00.3	mm:ss.f	X	X
Phase asymmetry Reset delay	00:00:03...18:12:14/locked	00:00:10	hh:mm:ss	X	X
FI monitoring Operating mode	Disabled/active	Active	-	X	X
FI monitoring Trip delay	00:00.1 ... 59:59.9	00:00.3	mm:ss.f	X	X
FI Reset delay	00:00:03...18:12:14/locked	00:00:10	hh:mm:ss	X	X
Phase sequence Operating mode	Disabled/active	Active	-	X	X
Undervoltage monitoring				X	X
Operating mode	Disabled / limit 1 warning / limit 1 tripping	Disabled	-	X	X
Undervoltage limit 1	1 ... 400 (690)	207	V	X	X
Undervoltage limit 2	1 ... 400 (690)	195	V	X	X
Undervoltage hysteresis	1 ... 399 (600)	20	V	X	X
Undervoltage limit 1 Trip delay	00:00.1 ... 59:59.9	00:03.0	mm:ss.f	X	X
Undervoltage limit 2 Trip delay	00:00.1 ... 59:59.9	00:03.0	mm:ss.f	X	X

Parameter name	Parameter values			Read access	Write access
	Setting range	Default	Unit		
Undervoltage Reset delay	00:00:03...18:12:14/locked	00:00:10	hh:mm:ss	X	X
Overvoltage monitoring				X	X
Operating mode	Disabled / limit 1 warning / limit 1 tripping	Disabled	-	X	X
Overvoltage limit 1	1 ... 400 (690)	207	V	X	X
Overvoltage limit 2	1 ... 400 (690)	195	V	X	X
Overvoltage hysteresis	1 ... 399 (600)	20	V	X	X
Overvoltage limit 1 Trip delay	00:00.1 ... 59:59.9	00:03.0	mm:ss.f	X	X
Overvoltage limit 2 Trip delay	00:00.1 ... 59:59.9	00:03.0	mm:ss.f	X	X
Overvoltage Reset delay	00:00:03...18:12:14/locked	00:00:10	hh:mm:ss	X	X
Current transformer input 1				X	X
Operating mode	Disabled / exceeded / below	Disabled	-	X	X
Trip value	1.00 ... 250.00	10.0	A	X	X
Warning value	1.00 ... 250.00	8.00	A	X	X
Hysteresis	0.10 ... 50.00	2.00	A	X	X
Trip delay	00:00.1 ... 59:59.9	00:00.1	mm:ss.f	X	X
Reset delay	00:00:00...18:12:14/locked	Locked	hh:mm:ss	X	X
Transformer ratio	500 ... 12500	2500	-	X	X
Winding turns through transformer	1 ... 10	5	-	X	X
Starting override	00:00.5 ... 59:59.9	00:05.0	mm:ss.f	X	X
cosφ monitoring				X	X
Operating mode	Disabled / exceeded / below	Disabled	-	X	X
Trip value	0.01 ... 1.00	0.60		X	X
Warning value	0.01 ... 1.00	0.80		X	X
Hysteresis	0.01 ... 0.99	0.20		X	X
Trip delay	00:00.1 ... 59:59.9	01:00.0	mm:ss.f	X	X
Reset delay	00:00:00...18:12:14/locked	00:00:00	hh:mm:ss	X	X
Starting override	00:00.5 ... 59:59.9	00:00.5	mm:ss.f	X	X
Frequency of starts				X	X
Operating mode	Disabled / warning / alarm	Disabled	-	X	X

Parameter name	Parameter values			Read access	Write access
	Setting range	Default	Unit		
Time range	00:00:01 ... 12:00:00	00:00:30	hh:mm:ss	X	X
Switching per time range	2 ... 10	3	-	X	X
Reset delay	00:00:00...18:12:14/locked	0	hh:mm:ss	X	X
Service interval				X	X
Status	Disabled / Re-start / Active / Expired	Disabled	-	X	X
Interval	100 ... 26280	24000	h	X	X
Warning relay				X	X
Operating mode	Disabled / all warnings / selected warnings	Selected warnings	-	X	X
Selection	Bit 00: Motor temperature	-	-	X	X
	Bit 01: Temperature 1	Temperature 1	-	X	X
	Bit 02: Temperature 2	Temperature 2	-	X	X
	Bit 03: Leakage	-	-	X	X
	Bit 04: Unassigned (switching input)	-	-	X	X
	Bit 05: Asymmetry	-	-	X	X
	Bit 06: Undervoltage	-	-	X	X
	Bit 07: Overvoltage	-	-	X	X
	Bit 08: FI monitoring	-	-	X	X
	Bit 09: Current transformer input	-	-	X	X
	Bit 10: Analog input	-	-	X	X
	Bit 11: Switching frequency	-	-	X	X
	Bit 12: Relay bypass	-	-	X	X
	Bit 13: Cosφ monitoring	-	-	X	X
	Bit 14: Service interval	-	-	X	X
Modbus				X	X
Address	1 ... 247	1	-	X	X
Baud rate	9600/19200/38400/57600	19200	-	X	X
Stop bit	One/two	Two	-	X	X
Parity	None/even/odd	None	-	X	X

9.2.16 Amacontrol L

Table 42: Parameter table: Amacontrol L (AC/DC 50/60 Hz 24 V and AC 50/60 Hz 100-240 V)

Parameter name	Parameter values			Read access	Write access
	Setting range	Default	Unit		
Device				X	X
Password parameterisation per DP	0 = no password ... 65535	0 = no password	-	X	X
Motor temperature 1				X	X
Sensor type	Disabled/Pt100/Pt1000/PTC/bimetal	Bimetal	-	X	X
Trip temperature	-100 ... 300	140	°C	X	X
Warning temperature	-100 ... 300	110	°C	X	X
Hysteresis	0 ... 300	30	K	X	X
Trip delay	00:00.1 ... 59:59.9	00:00.1	mm:ss.f	X	X
Reset delay	00:00:00...18:12:14/locked	Locked	hh:mm:ss	X	X
Correction factor wire resistance	0.0 ... 100.0	0.0	Ω	X	X
Temperature 1				X	X
Sensor type	Disabled/Pt100/Pt1000/PTC/bimetal	Disabled	-	X	X
Trip temperature	-100 ... 300	140	°C	X	X
Warning temperature	-100 ... 300	110	°C	X	X
Hysteresis	0 ... 300	30	K	X	X
Trip delay	00:00.1 ... 59:59.9	00:00.1	mm:ss.f	X	X
Reset delay	00:00:00...18:12:14/locked	00:00:00	hh:mm:ss	X	X
Correction factor wire resistance	0.0 ... 100.0	0.0	Ω	X	X
Leakage 1				X	X
Operating mode	Disabled / R exceeded / R below	R below	-	X	X
Trip value	10 ... 1000	60	kΩ	X	X
Warning value	10 ... 1000	75	kΩ	X	X
Hysteresis	10 ... 999	10	kΩ	X	X
Trip delay	00:00.1 ... 59:59.9	01:00.0	mm:ss.f	X	X
Reset delay	00:00:00...18:12:14/locked	00:00:00	hh:mm:ss	X	X
Relay 1				X	X
Function	Selective alarms	Selective alarms	-	X	X

Parameter name	Parameter values			Read access	Write access
	Setting range	Default	Unit		
Function	Bit 00: Motor temperature	Motor temperature	-	X	X
	Bit 01: Temperature 1	Temperature 1	-	X	X
Alarm selection	Bit 02: Leakage	-	-	X	X
Relay 2				X	X
Function	Disabled / all warnings / all alarms / selective alarms	Selective alarms	-	X	X
	Bit 00: Motor temperature	-	-	X	X
	Bit 01: Temperature 1	-	-	X	X
	Bit 02: Leakage	Leakage	-	X	X
Alarm selection	Bit 03: Device error	-	-	X	X
	Bit 00: Motor temperature	-	-	X	X
	Bit 01: Temperature 1	-	-	X	X
	Bit 02: Leakage	-	-	X	X

9.3 Wiring diagrams

9.3.1 Amacontrol 3, without vibration sensor

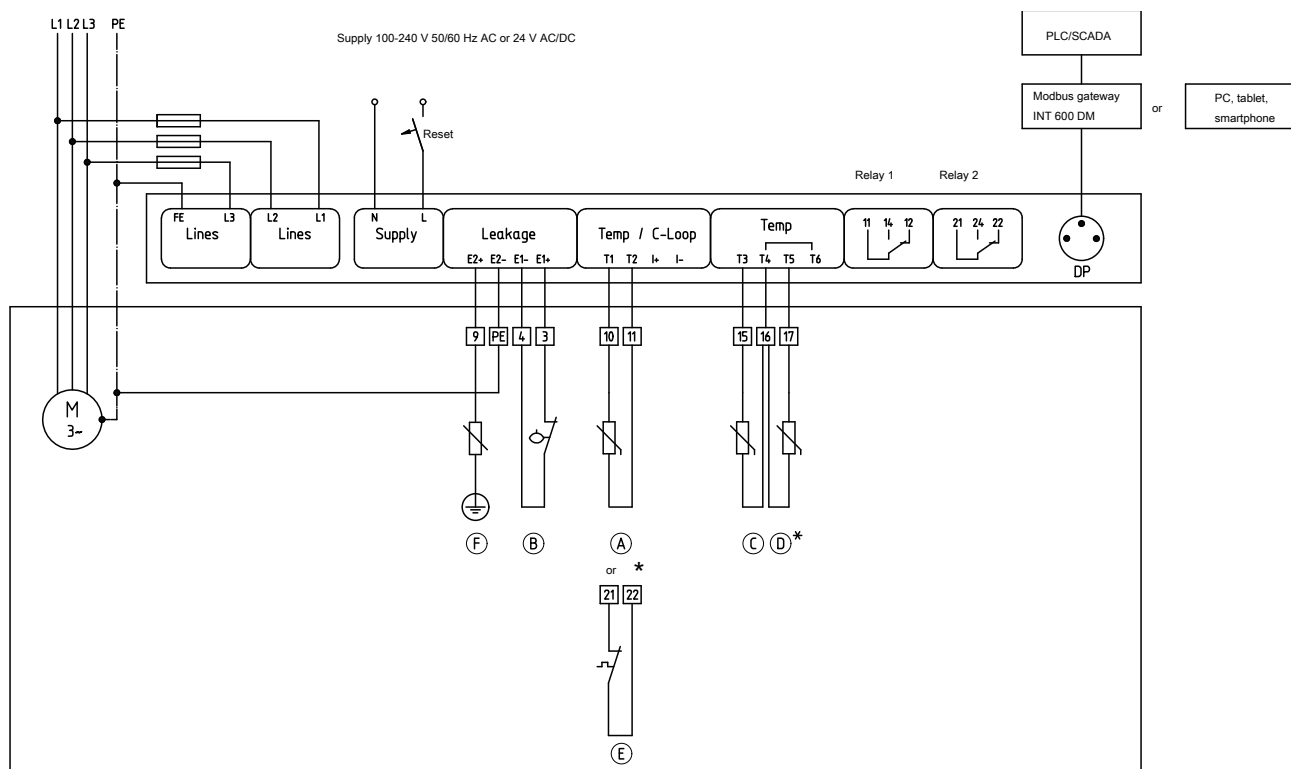


Fig. 18: Amacontrol 3, without vibration sensor

(A)	Motor temperature (PTC)
(B)	Mechanical seal leakage
(C)	Bearing temperature (pump end)
(D)	Bearing temperature (motor end*)
(E)	Motor temperature
(F)	Leakage inside the motor
*	Optional / Adapt configuration

9.3.2 Amacontrol 3, with vibration sensor

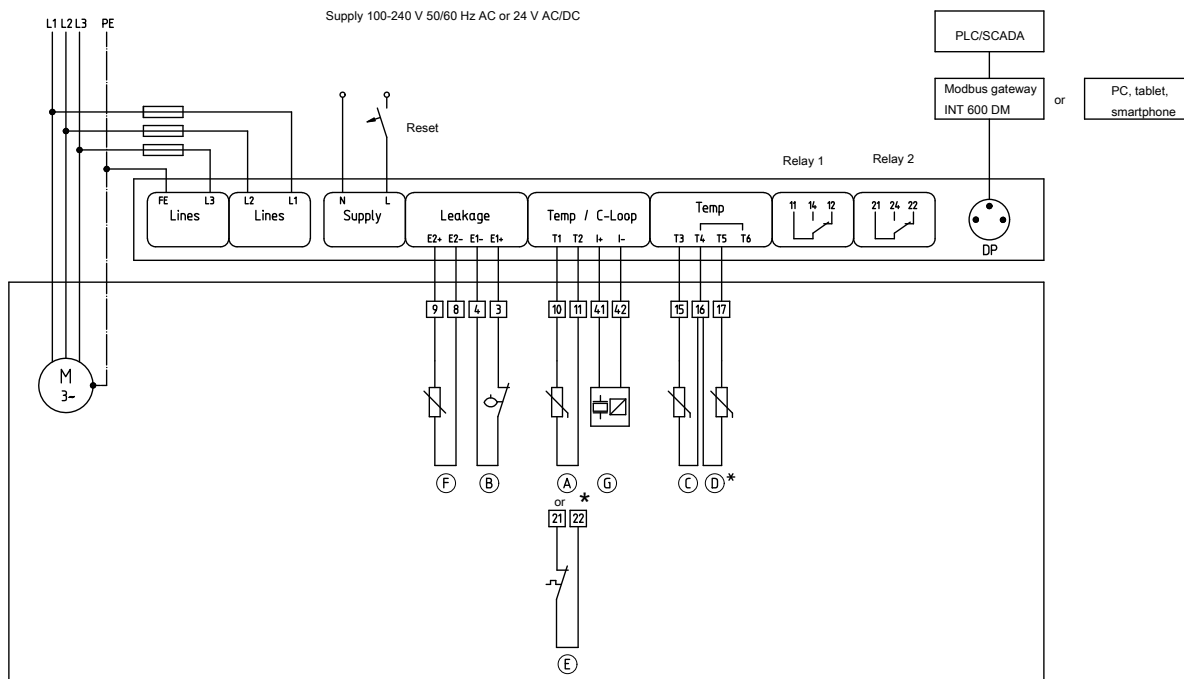


Fig. 19: Amacontrol 3, with vibration sensor

(A)	Motor temperature (PTC)
(B)	Mechanical seal leakage
(C)	Bearing temperature (pump end)
(D)	Bearing temperature (motor end*)
(E)	Motor temperature
(F)	Leakage inside the motor
(G)	Vibration sensor
*	Optional / Adapt configuration

9.3.3 Amacontrol 4, without vibration sensor

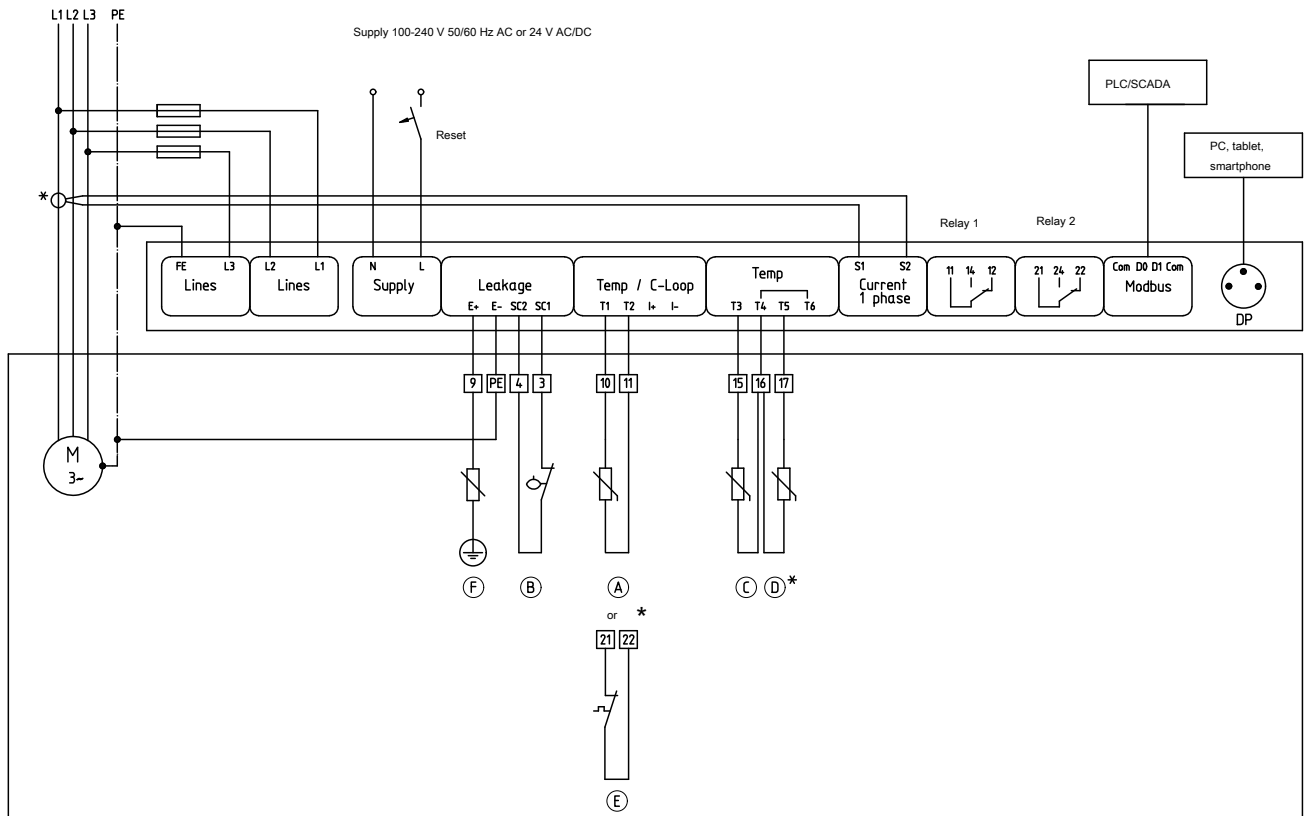


Fig. 20: Amacontrol 4, without vibration sensor

(A)	Motor temperature (PTC)
(B)	Mechanical seal leakage
(C)	Bearing temperature (pump end)
(D)	Bearing temperature (motor end*)
(E)	Motor temperature
(F)	Leakage inside the motor
*	Optional / Adapt configuration

9.3.4 Amacontrol 4, with vibration sensor

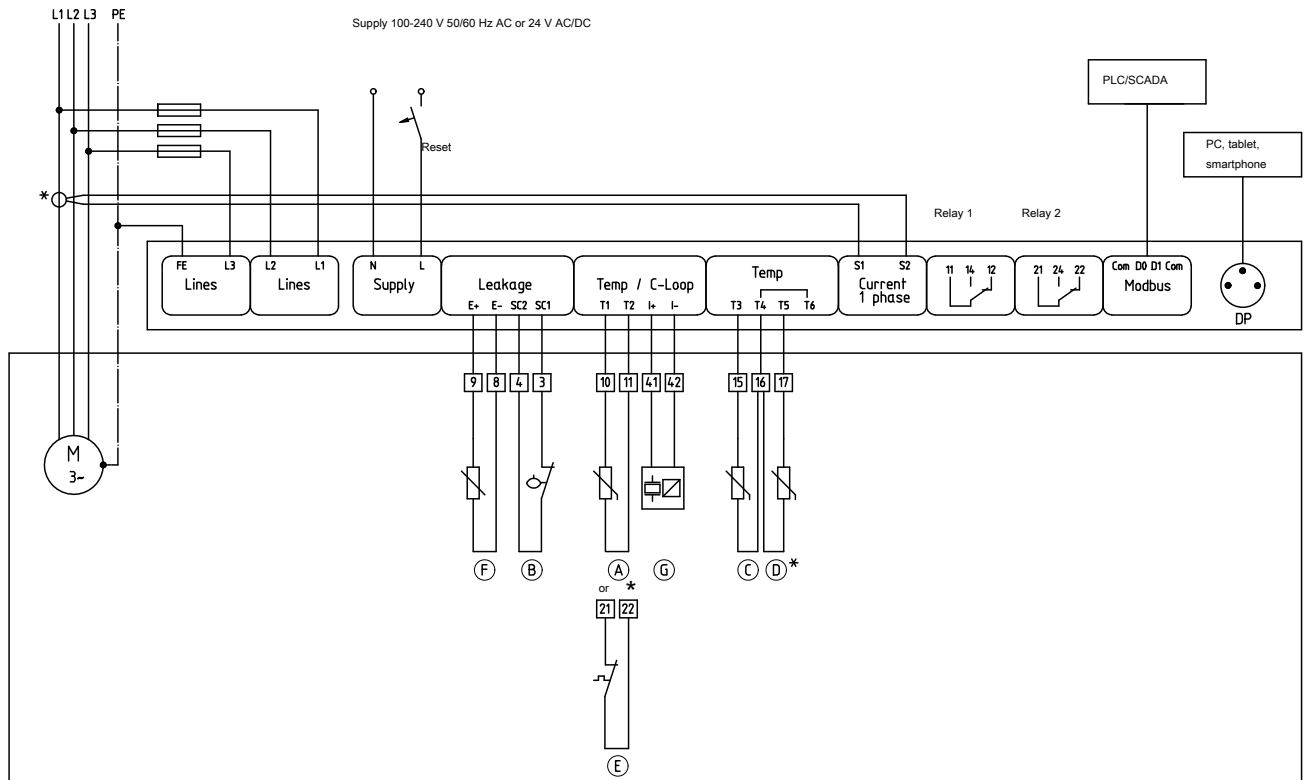


Fig. 21: Amacontrol 4, with vibration sensor

Ⓐ	Motor temperature (PTC)
Ⓑ	Mechanical seal leakage
Ⓒ	Bearing temperature (pump end)
Ⓓ	Bearing temperature (motor end*)
Ⓔ	Motor temperature
Ⓕ	Leakage inside the motor
Ⓖ	Vibration sensor
*	Optional / Adapt configuration

9.3.5 Amacontrol L

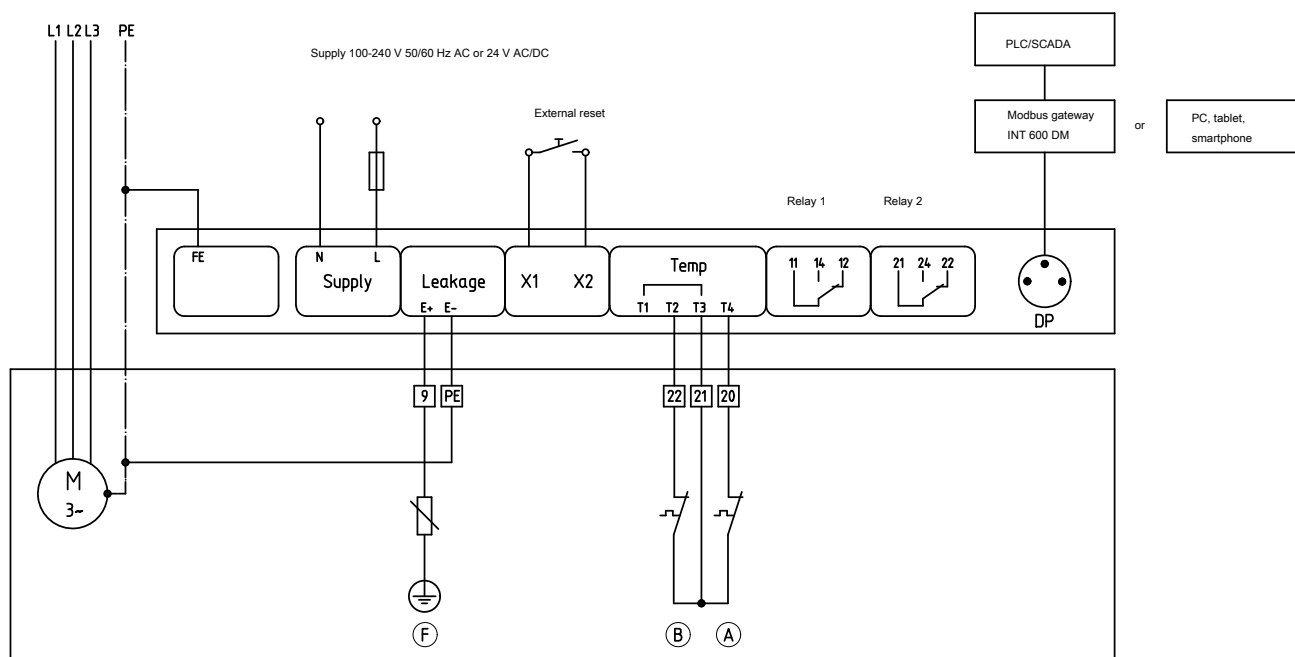


Fig. 22: Amacontrol L

Ⓐ	Motor temperature 1
Ⓑ	Motor temperature 2
Ⓕ	Leakage inside the motor

9.4 Accessories

Description	Amacontrol			Mat. No.	[kg]
	3	4	L		
Connection cable (Amacontrol - smartphone)	X	-	-	01913080	0,1
Connection cable with Bluetooth interface (Amacontrol - smartphone)	X	-	-	01913079	0,1
Modbus gateway INT600 DM supply voltage 230 V	X	-	-	01913082	0,2
Connection cable (Amacontrol - gateway)	X	-	-	01913083	0,1
Current transformer 100 A for current measurement	-	X	-	05096163	0,15
Current transformer 200 A for current measurement	-	X	-	05096164	0,15
KSB Guard Modbus transmission unit	X	-	-	05068772	0,4
KSB Guard gateway	X	-	-	01852757	0,6

10 EU Declaration of Conformity

Manufacturer:

KSB SE & Co. KGaA
Johann-Klein-Straße 9
67227 Frankenthal (Germany)

The manufacturer herewith declares that the product:

Amacontrol

Serial number:

Amacontrol 3: 630.01516.d

Amacontrol 4: 630.01573.a

Amacontrol L: 630.01571.a

- is in conformity with the provisions of the following directives / regulations as amended from time to time:
 - 2014/30/EU: Electromagnetic Compatibility (EMC)
 - 2014/35/EU: Electrical Equipment Designed for Use within Specific Voltage Limits (Low Voltage)
 - 2011/65/EU: Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS)

The manufacturer also declares that

- the following harmonised international standards have been applied:
 - EN 61000-6-2:2005, EN 61000-6-3+A1:2007,2011
 - EN 61010-1:2010

The EU Declaration of Conformity was issued in/on:

Frankenthal, 31 January 2022



Jochen Schaab
Head of Product Development Pump Systems and Drives
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