1 ANI-1F1

Module for process control in CO_2 refrigeration plants with rack and gas cooler control

1.1 Front view

Fig. 1: Front view of ANI-1F1 with ANI-C control panel

1.2 Features

- Standard rack controller with 2 or 3 compressors controlled by evaporation temperature
  - Compressor 1 modulated (FC or CRII with IQ module), compressors 2 and 3 controlled directly or stepped (CR 50 / 100%)
  - Frigotakt+ and Frigotakt-G4
  - Base load change
  - Monitoring of suction gas temperature and hot gas temperature
  - Oscillation protection function
  - Blocking time after compressor fault
  - 3-step load shedding including Fastreturn
  - Operating hours counter and cycle counter for each compressor
  - Proactive oil return
- LT control as LT standalone machine or LT compressor rack controller with 1 or 2 compressors
  - Compressor 1 modulating (FC)
  - Monitoring of suction gas temperature
  - Oscillation protection function
  - Blocking time after compressor fault
  - Operating hours counter and cycle counter for each compressor
  - 3-step load shedding including Fastreturn only with LT compressor rack
- High pressure and medium pressure control
- Gas cooler fan control also via Modbus
- Gas cooler monitoring
- Additional control circuits for:
  - LT desuperheater
  - Liquid injection
  - Refrigerant monitoring
  - 4-step heat recovery
  - Control cabinet monitoring
- Integrated relay outputs
- CAN bus connection via patch cable and screw terminals
- Fastening by top-hat rail
- Can be locked to prevent unwanted parameter adjustment (SAC – Security Access Control)
- Connection to the Wurm system via Wurm CAN communication bus (C-BUS) and FRIGODATA XP

Accessories

- Control panel (ANI-C)

Contents

1.3 Safety instructions

Writing conventions

- Avoid the described hazard: Otherwise, **minor** or **medium** bodily injury or property damage will result.

CAUTION

- Avoid the described hazard: Otherwise there is danger from **electric voltage** that can lead to death or **serious** bodily injury.

WARNING

For your safety

For safe operation and to avoid personal injury and equipment damage through operator error, always read these instructions, become familiar with the device, and follow all safety instructions on the product and in this document, as well as the safety guidelines of Wurm GmbH & Co. KG Elektronische Systeme. Keep these instructions ready to hand for quick reference and pass them on with the device if the product is sold. Wurm GmbH & Co. KG Elektronische Systeme accepts no liability in the case of improper use or use for purposes other than the intended purpose.

Target group	This manual is intended for "service technician" personnel.
Intended use	The **ANI-1F1** is a process control module for CO_2 refrigeration plants with rack and gas cooler control.

DANGER TO LIFE FROM ELECTRIC SHOCK AND/OR FIRE!

WARNING

- Switch off the power to the entire plant when carrying out installation, wiring or disassembly work! Otherwise, mains voltage and/or external voltage may still be present, even if the control voltage is switched off!
- The wiring of the device must be carried out only by qualified electricians!
- Use the correct tools for any work!
- Check the entire wiring after connection!
- Observe the maximum loads for all connections!
- Never expose the device to moisture, for example due to condensation or cleaning agents.
- Stop operating the device if it is faulty or damaged and its safe operation is compromised!
- Do not open the device!
- Do not repair the device yourself! If the device requires repairs, send it in with an exact description of the fault!

ELECTROMAGNETIC INTERFERENCE MAY CAUSE FAULTS!

CAUTION

- Always use shielded data cables and place them far away from power lines.

Wurm Infocenter

paperless info

Version and validity of the documentation

Version	Date	
V2.9.0 and higher	2024-11	Documentation created

Any versions not listed are special solutions for individual projects and are not described in detail in this document. This document will automatically become invalid when a new technical description is created.

Manufacturer: Wurm GmbH & Co. KG Elektronische Systeme, Morsbachtalstraße 30, D-42857 Remscheid
You can find more information on our website at www.wurm.de

1.4 Circuit diagram

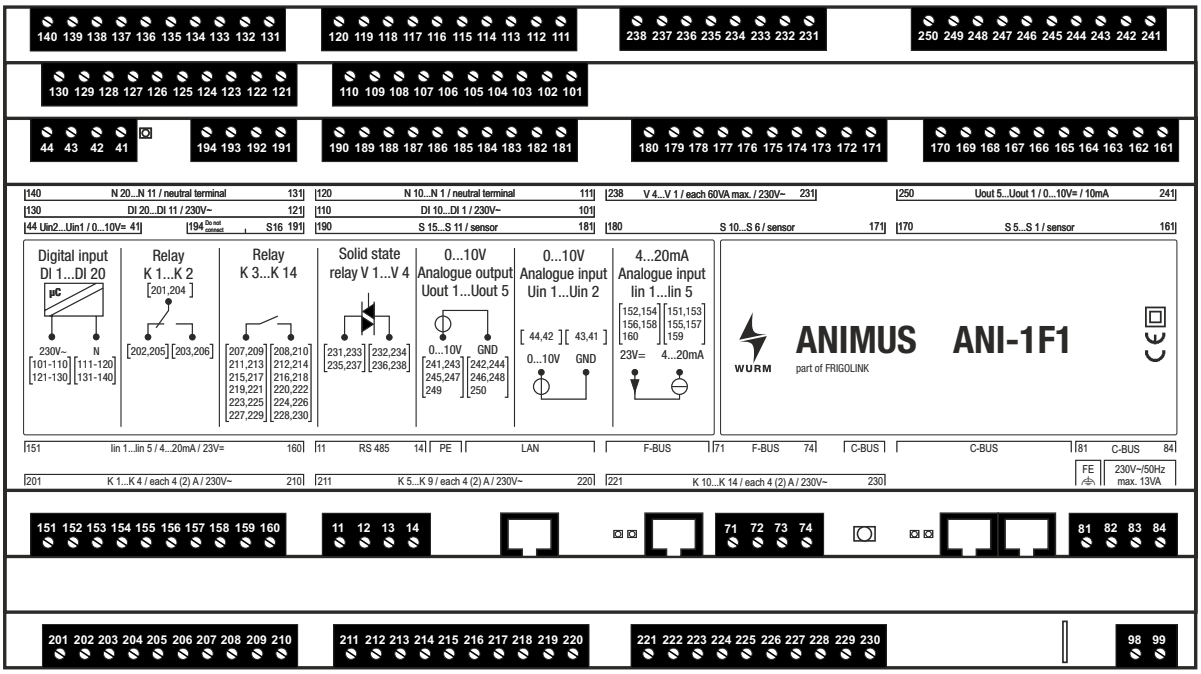

Fig. 2: ANI-1F1 circuit diagram

Power supply

Terminal	Supply	Potential
98	Neutral	N
99	230V~	L

Functional earth (FE)

Terminal	Assignment
⏚	Shield

NOTICE

- To ensure failure-free operation and reliable data communication, connect the functional earth. Connect the functional earth connection via the enclosed earthing terminal and the pre-assembled cable directly to the device with the earthed installation plate.

1.4.1 Input circuit diagram

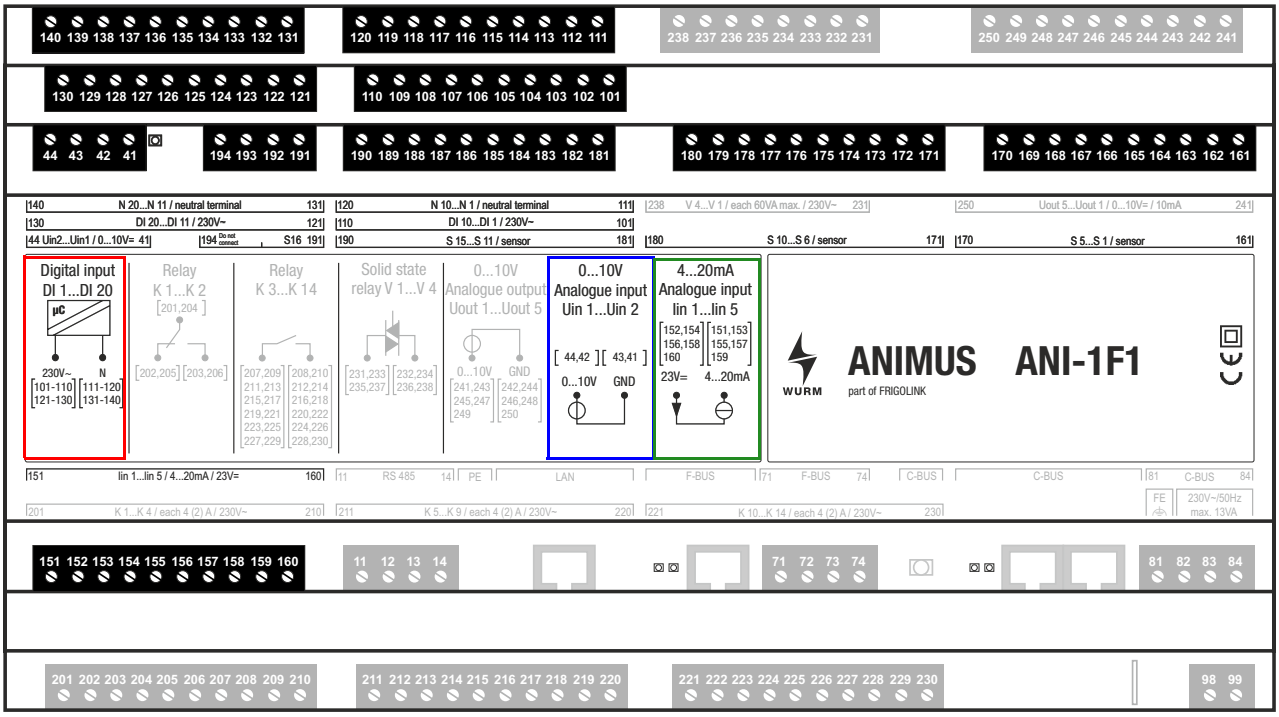

Fig. 3: ANI-1F1 input circuit diagram

Digital inputs DI 1...DI 20

Terminal	Digital input	Potential	Assignment	Optional / Required
101	DI 1	230V~	LT CP 2 fault	Required if LT compressor rack is installed with 2 compressors
111		N		
102	DI 2	230V~	Night signal/op. feedback LT-CP 2	Night signal: optional (alternatively via C-BUS). Op. feedback LT CP 2: required if LT compressor rack is installed with 2 compressors.
112		N		
103	DI 3	230V~	Load shedding 1	Optional
113		N		
104	DI 4	230V~	HR request	Optional (alternatively via C-BUS)
114		N		
105	DI 5	230V~	Pressure increase request	Optional (alternatively via C-BUS)
115		N		
106	DI 6	230V~	Op. feedback MT CP 1	Required
116		N		
107	DI 7	230V~	Op. feedback MT CP 2	Required
117		N		
108	DI 8	230V~	Op. feedback MT CP 3	Required with 3 CP
118		N		
109	DI 9	230V~	Op. feedback LT CP 1	Required with suction gas monitoring + statistics
119		N		
110	DI 10	230V~	MT CP 1 fault	Required
120		N		
121	DI 11	230V~	MT CP 2 fault	Required
131		N		

Terminal	Digital input	Potential	Assignment	Optional / Required
122	DI 12	230V~	MT CP 3 fault	Required with 3 CP
132		N		
123	DI 13	230V~	LT CP 1 fault	Required
133		N		
124	DI 14	230V~	Min. refrigerant fault	Required for alarm
134		N		
125	DI 15	230V~	Max. refrigerant fault	Required for alarm + MP valve closing
135		N		
126	DI 16	230V~	LP rack fault	Recommended for alarm + recording
136		N		
127	DI 17	230V~	HP rack fault	Required
137		N		
128	DI 18	230V~	GC fan fault	Required
138		N		
129	DI 19	230V~	Alarm input 1 (NC)	Optional (can be deactivated)
139		N		
130	DI 20	230V~	Alarm input 2 (NC)	Optional (can be deactivated)
140		N		

Analogue inputs Uin 1...Uin 2

Terminal	Analogue input	Potential	Assignment
41	Uin 1	GND	Not available
42		0...10V	
43	Uin 2	GND	Not available
44		0...10V	

Analogue inputs Iin 1...Iin 5

Terminal	Analogue input	Potential	Assignment	Optional / Required
151	Iin 1	4...20mA	MT 1 p0	Required
152		23V=		
153	Iin 2	4...20mA	p.mp	Required
154		23V=		
155	Iin 3	4...20mA	p.gc	Required
156		23V=		
157	Iin 4	4...20mA	LT p0	Required with pump-down operating mode
158		23V=		
159	Iin 5	4...20mA	MT 2 p0	Optional
160		23V=		

Analogue inputs S 1...S 16

Terminal	Sensor input	Sensor type	Assignment	Optional / Required
161/162	S 1	TRK	Ts MT	Required
163/164	S 2	DGF	MT T.hg	Required
165/166	S 3	DGF	LT T.dsh	Required with LT desuperheater
167/168	S 4	TRK	T.out	Required
169/170	S 5	DGF	T.gc 1	Required
171/172	S 6	DGF	T.gc 2	Optional (redundancy)
173/174	S 7	DGF	HR CO2 T.outlet	Required with HR
175/176	S 8	DGF	HR medium T.outlet	Required with HR
177/178	S 9	DGF	HR medium T.inlet	Required with HR
179/180	S 10		Not available	
181/182	S 11	TRK	MT cold locations Ts	Optional (recording)
183/184	S 12	TRK	LT Ts	Required with suction gas monitoring + recording
185/186	S 13		Not available	
187/188	S 14		Not available	
189/190	S 15		Not available	
191/192	S 16	TRK	Control cabinet sensor	Required with fan control + monitoring

NOTICE

- Terminals 193/194 cannot be wired, they are empty.

1.4.2 Output circuit diagram

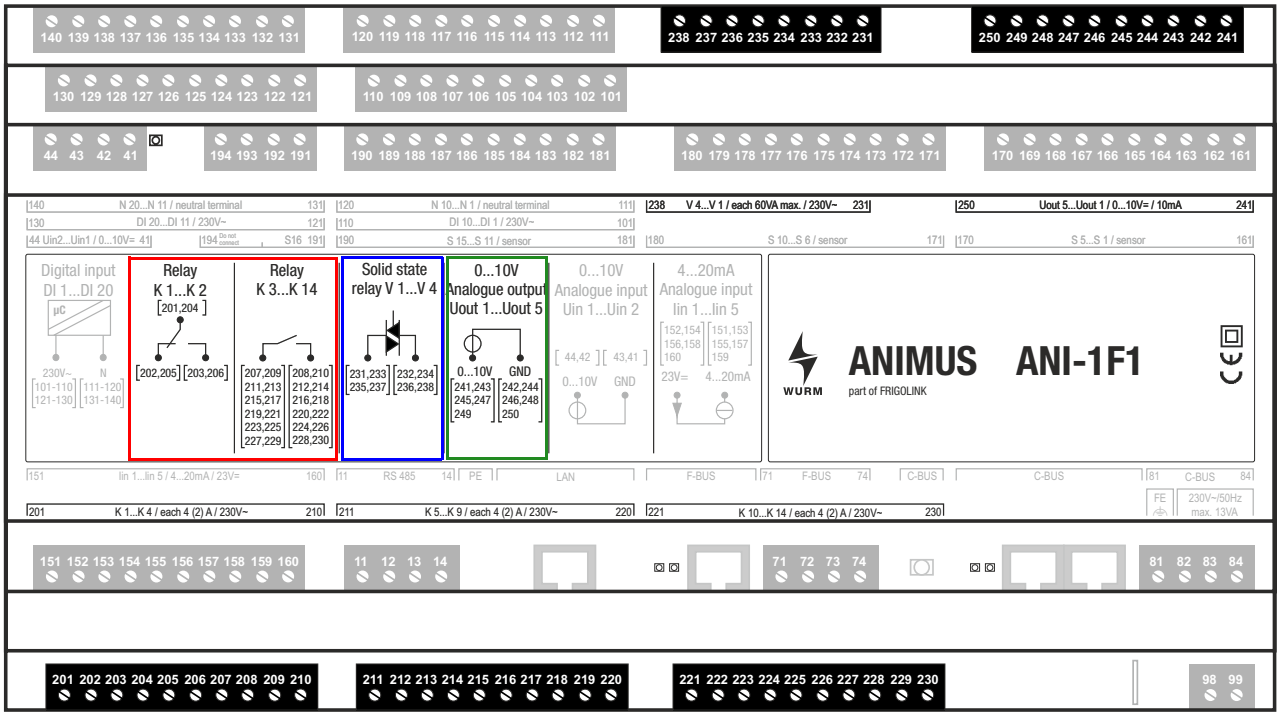

Fig. 4: ANI-1F1 output circuit diagram

Digital outputs (relays) K 1...K 14

Terminal	Digital output	Contact arrangement	Assignment
201	Change-over contact K 1 / 4(2)A / 230V~	COM	Alarm prio 1
202		NC	
203		NO	
204	Change-over contact K 2/ 4(2)A / 230V~	COM	Alarm prio 2
205		NC	
206		NO	
207	NO contact K 3 / 4(2)A / 230V~	COM	MT CP 1 operation
208		NO	
209	NO contact K 4 / 4(2)A / 230V~	COM	MT CP 2 operation
210		NO	
211	NO contact K 5 / 4(2)A / 230V~	COM	MT CP 3 operation
212		NO	
213	NO contact K 6 / 4(2)A / 230V~	COM	LT CP 1 operation / enable
214		NO	
215	NO contact K 7 / 4(2)A / 230V~	COM	MP too low
216		NO	
217	NO contact K 8 / 4(2)A / 230V~	COM	HR valve operation
218		NO	
219	NO contact K 9 / 4(2)A / 230V~	COM	HR pump operation
220		NO	
221	NO contact K 10 / 4(2)A / 230V~	COM	External HR operation
222		NO	
223	NO contact K 11 / 4(2)A / 230V~	COM	Desuperheater fan operation
224		NO	
225	NO contact K 12 / 4(2)A / 230V~	COM	Valve CR MT CP 2
226		NO	

Terminal	Digital output	Contact arrangement	Assignment
227	NO contact K 13 / 4(2)A / 230V~	COM	Valve CR MT CP 3
228		NO	
229	NO contact K 14 / 4(2)A / 230V~	COM	Control cabinet fan
230		NO	

Digital outputs (SSR) V 1...V 4

Terminal	Digital output (SSR)	Contact arrangement	Assignment
231	Semiconductor V 1 4...60VA / 230V~	NO	Hot gas bypass
232		COM	
233	Semiconductor V 2 4...60VA / 230V~	NO	Liquid injection
234		COM	
235	Semiconductor V 3 4...60VA / 230V~	NO	Modulated liquid injection
236		COM	
237	Semiconductor V 4 4...60VA / 230V~	NO	LT CP 2 operation
238		COM	

Analogue outputs Uout 1...Uout 5

Terminal	Analogue output	Potential	Assignment
241	Uout 1	0...10V	FC MT CP 1
242		GND	
243	Uout 2	0...10V	GC fan
244		GND	
245	Uout 3	0...10V	MP valve 1
246		GND	
247	Uout 4	0...10V	HP valve
248		GND	
249	Uout 5	0...10V	MPV 2 / FC LT CP 1
250		GND	

1.4.3 Communication circuit diagram

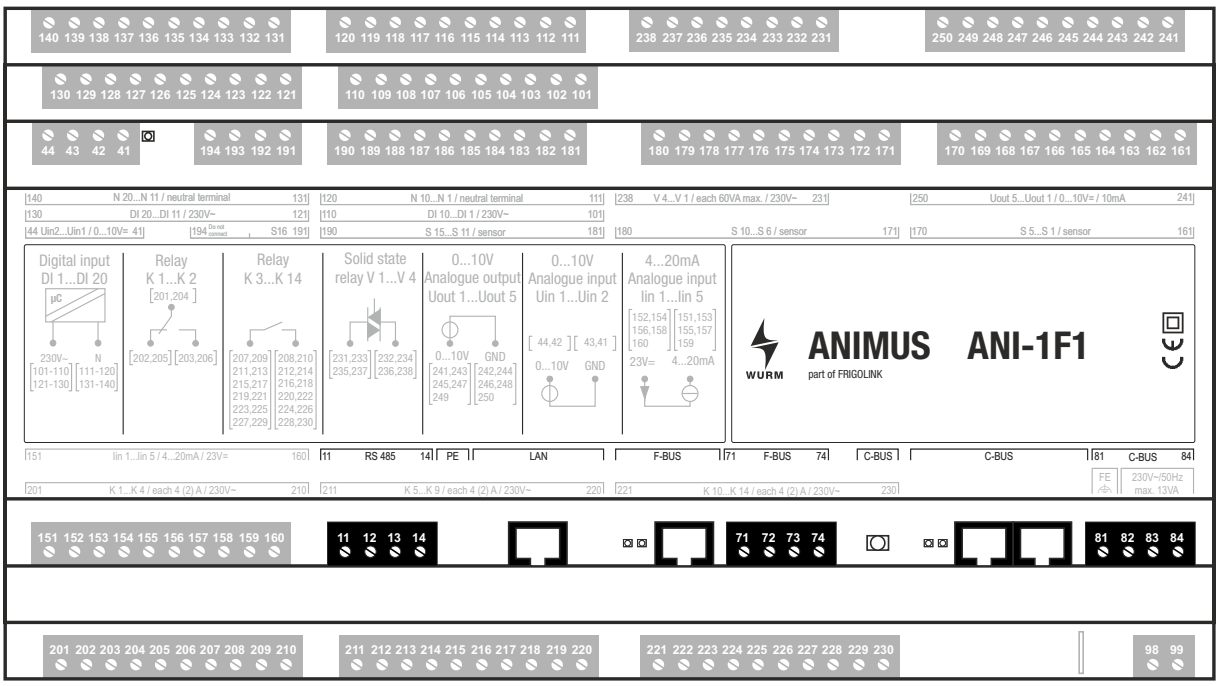

Fig. 5: ANI-1F1 communication circuit diagram

Communication

Terminal	Potential	Assignment
81	0V	C-BUS
82	L	
83	S	
84	H	
71	0V	F-BUS
72	L	
73	S	
74	H	
11	0V	RS485 (Modbus)
12	B/+	
13	A/-	
14	5V	

1.5 Installing

The module is designed for top-hat rail installation. The housing is also suitable for installation in fuse boxes or distribution switch cabinets. Modules can be positioned side by side without gaps.

DANGER TO LIFE FROM ELECTRIC SHOCK AND/OR FIRE! **WARNING**

- Switch off the power to the entire plant before installing! Otherwise, mains voltage and/or external voltage may still be present, even if the control voltage is switched off!

Top-hat rail installation

1. There are 2 fastening safety catches located on the back of the module. **(A)** Press both fastening safety catches **(a)** downward until they engage with a click.
2. There are 4 retaining lugs located on the back of the module. **(B)** Set the module with retaining lugs **(b)** on the top-hat rail **(c)**. Make sure that you position the module **parallel** to the top-hat rail with both hands and that all retaining lugs are located behind the edge of the top-hat rail.
3. Push the module down onto the top-hat rail.
4. **(C)** Swivel the bottom of the module towards the top-hat rail.
5. **(D)** Press the fastening safety catches **(a)** towards the module until they engage in the top-hat rail.

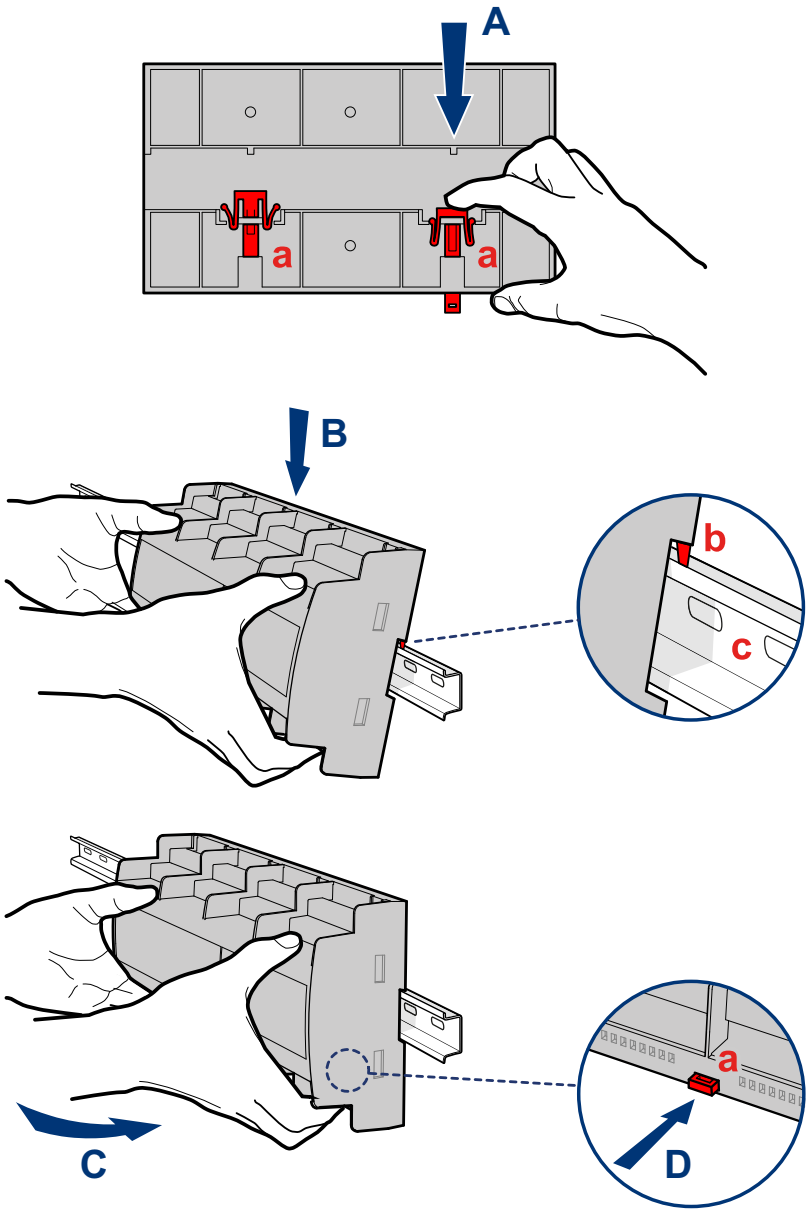

Fig. 6: ANI-1F1 top-hat rail installation

Dismantling

1. Insert a flat-tip screwdriver in the openings in the fastening safety catches.
2. Pull the two fastening safety catches away from the housing until they are heard to click.
3. Swivel the bottom of the module gently away from the top-hat rail and towards yourself.
4. Lift the module upwards away from the top-hat rail.

1.6 Technical data

Power supply	230V~, +10% / -15%, 50Hz, max. 13VA
Display	Optional control panel with graphic display 1 x LED (green/red), operating voltage: green, fault: red 4 x LED (green), CAN bus data traffic (CAN Tx, CAN Rx)
Sensors	16 x DGF/TRK
C-BUS communication	3-conductor CAN bus interface, shielded, galvanically isolated, screw terminals 2.5mm^2 and RJ45 socket for communicating with system devices
F-BUS communication	3-conductor CAN bus interface, shielded, galvanically isolated, screw terminals 2.5mm^2 and RJ45 socket for communication with field modules
Modbus communication	3-conductor Modbus interface RS485, shielded, galvanically isolated, master, complete termination, screw terminals 2.5mm^2
Analogue inputs	5 x 4...20mA, 23V=power supply 2 x 0...10V=
Digital inputs	20 x floating for 230V~ (neutral conductor per input)
Analogue outputs	5 x 0...10V=, non-floating, max. load 10mA
Digital outputs	2 x electromechanical relays, change-over contacts, 4(2)A, 230V~ 12 x electromechanical relays, normally open contact, 4(2)A, 230V~ 4 x semiconductor relay, 4...60VA, 230V~, note the minimum power! ⚠ Residual voltage is measurable! Integrated semiconductor protection (no isolator)
Dimensions	(W x H x D) 270 x 80 x 165mm
Housing	Plastic
Fastening	Top-hat rail TH 35-15 or TH 35-7.5 (DIN EN 60715)
Ambient temperature	Operation: -20...+55°C, storage: -25...+70°C
Vibration	Test in accordance with DIN EN 60068-2-64: frequency range 10–100Hz, noise excitation, RMS 1.0g, test in 3 spatial directions, test duration 1h per spatial direction
Shock	Test in accordance with DIN EN 60068-2-27: amplitude 15g, shock duration 11ms, semi-sinusoidal shock, test in 6 spatial directions, 3 shocks per spatial direction
Weight	About 1125g
CE conformity	- 2014/30/EU (EMC Directive) - 2014/35/EU (Low Voltage Directive) CE
	RoHS II

For details of input assignments, see: chapter 1.4.1 "Input circuit diagram" on page 5.
For details of output assignments, see: chapter 1.4.2 "Output circuit diagram" on page 8.
For details of sensor assignments, see: chapter "Analogue inputs S 1...S 16" on page 7.