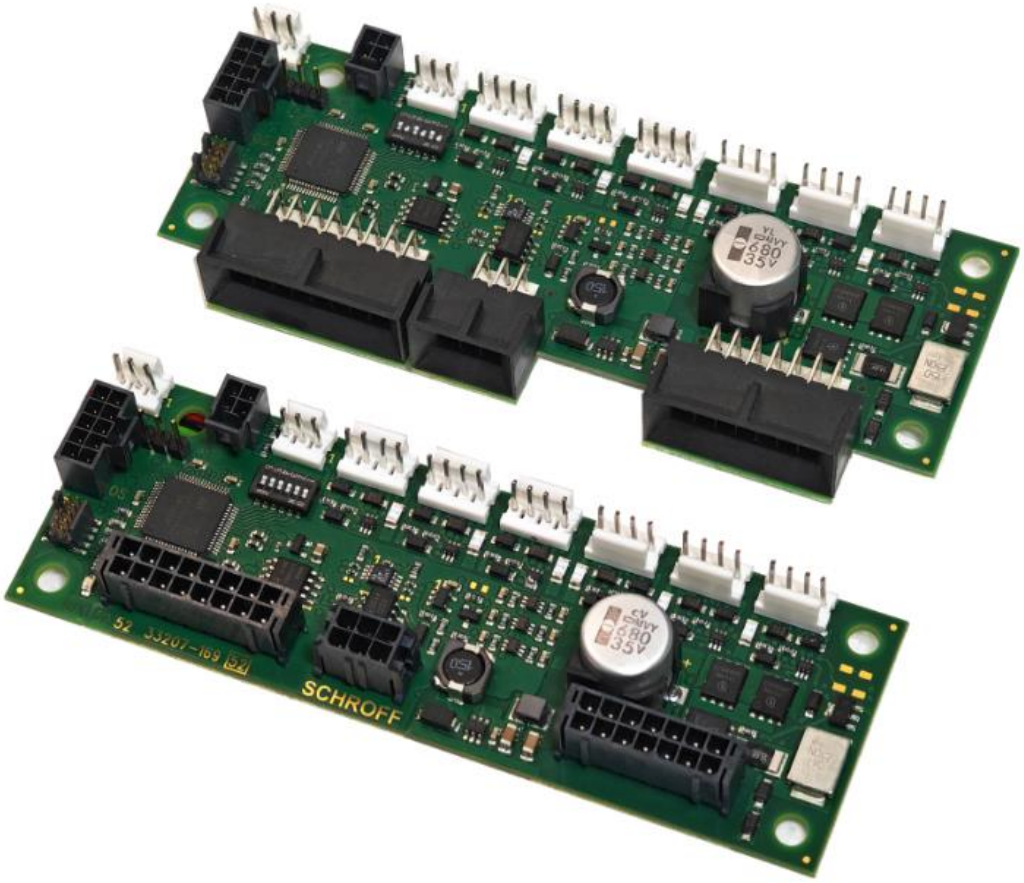
SCHROFF
Fan Control Module FCM3

User Manual

Release 1.2

08.10.2024



Doc-No.: 63972-448

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1 Safety

1.1 Intended Use

The Fan Control Module 3 (FCM3) is a stand-alone fan controller to control and monitor up to 6 fans.

Intended use includes compliance with the terms and conditions for assembly, disassembly, commissioning and operation specified by the manufacturer.

1.2 Safety instructions of the manufacturer

1.2.1 Disclaimer

Schroff accepts no liability for any errors in this documentation. To the maximum extent permissible by law, any liability for damage, direct or indirect, arising from the supply or use of this documentation is excluded.

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1.3 Safety symbols used in this manual

In these original operating instructions, warning notices point out residual risks that cannot be avoided by constructive means when installing or operating the fan tray. The warning notices are classified according to the severity of the damage occurring and the probability of its occurrence.

⚠ WARNING	
Symbol	**Short description of the danger** The signal word WARNING indicates a possible danger. Non-observance can lead to serious injury or death.

⚠ CAUTION	
Symbol	**Short description of the danger** The signal word CAUTION indicates a possible danger. Non-observance can lead to injuries.

ATTENTION
Short description The signal word ATTENTION indicates possible damages to equipment. Non-observance can lead to damage to the device.

	**Important information**

1.4 Safety Information for the Operator

Only trained specialists are authorized to carry out assembly, commissioning and completion, The nationally applicable health and safety regulations must also be adhered to.

⚠ WARNING	
	**Risk of injury due to insufficient personal protective equipment** If you use the wrong protective equipment or no protective equipment at all, you could be seriously injured. - Wear protective equipment adapted to the work processes. - Check the protective equipment before each use to ensure that it is intact! - Use only approved protective equipment.

⚠ WARNING	
	**Risk of injury** This equipment is not suitable for use in locations where children are likely to be present.

	Read manual The nVent SCHROFF Fan Control Module FCM3 intended to be installed and maintained by qualified and trained personnel in compliance with local and national electrical codes and safety regulations.

2 FCM3 Overview

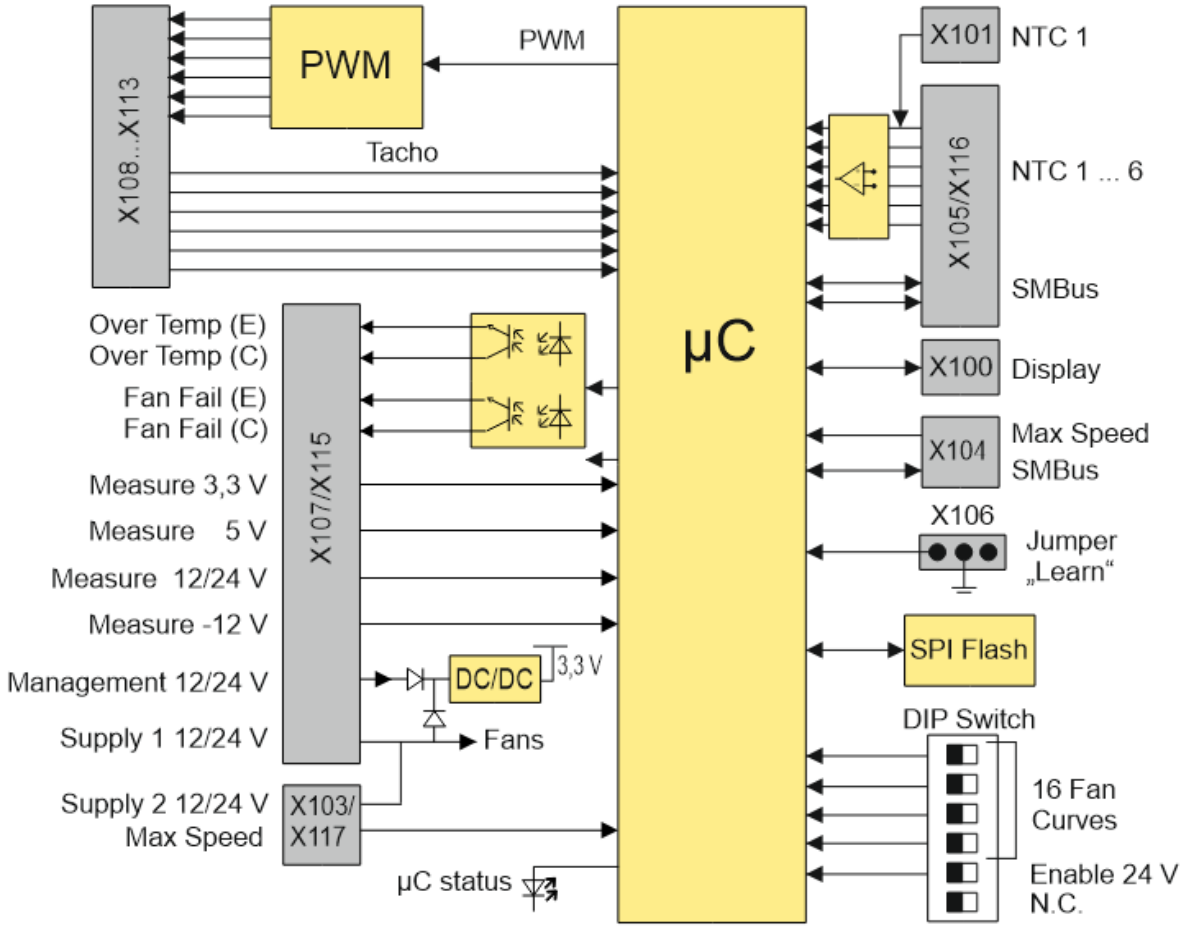
Features:

- Monitors and controls up to 6 fans
- PWM Control
- Monitors the signals from up to 6 temperature sensors
- Can monitor the presence of a 3.3 V, 5 V, 12/24 V and -12 V voltage
- Controls a Display with status LEDs (Over Temp, Fan Fail, 3.3 V, 5 V, 12 V, -12 V) over SMBus
- Speed up the fans in case of a failure of one fan or temperature sensor
- Provide status information through an SMBus Interface
- Hot-Swap Controller

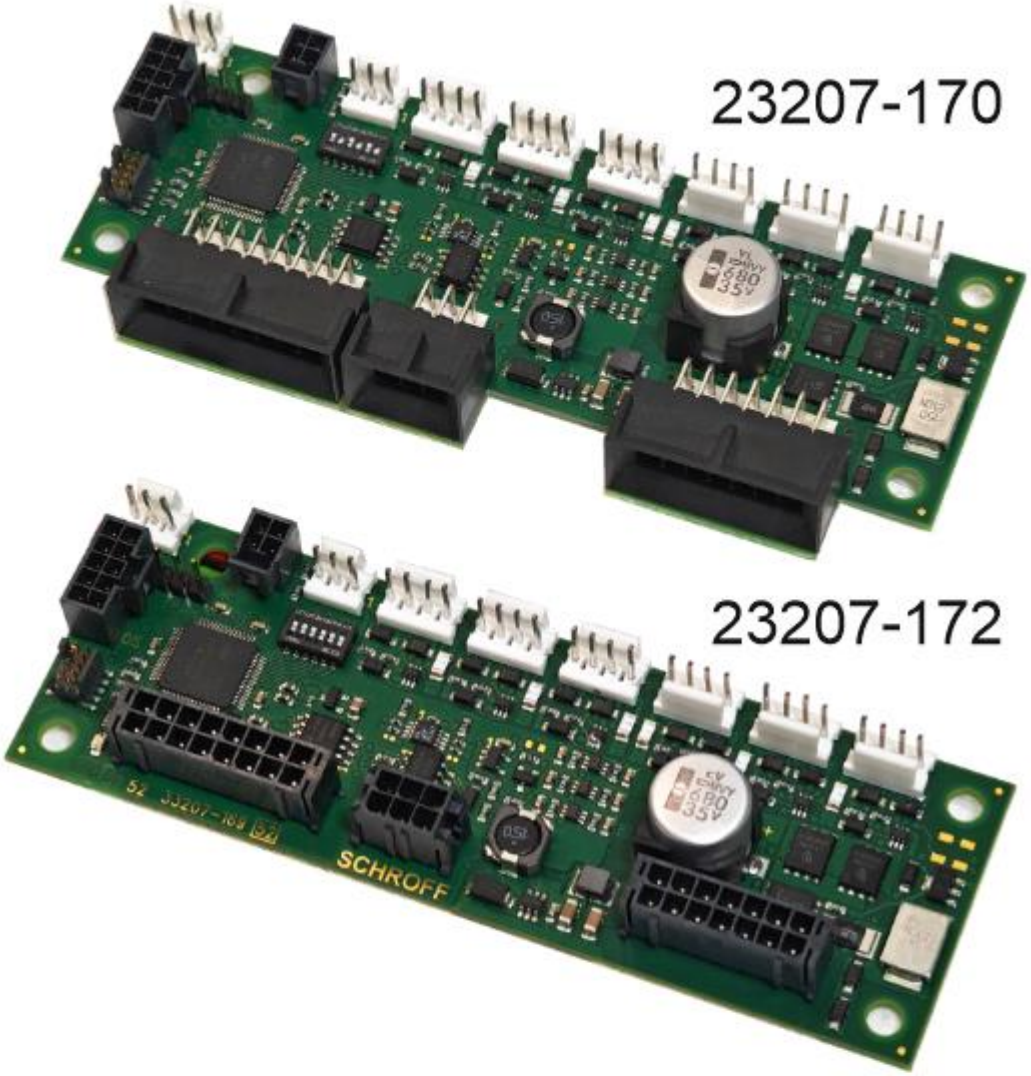
There are 2 different variants available:

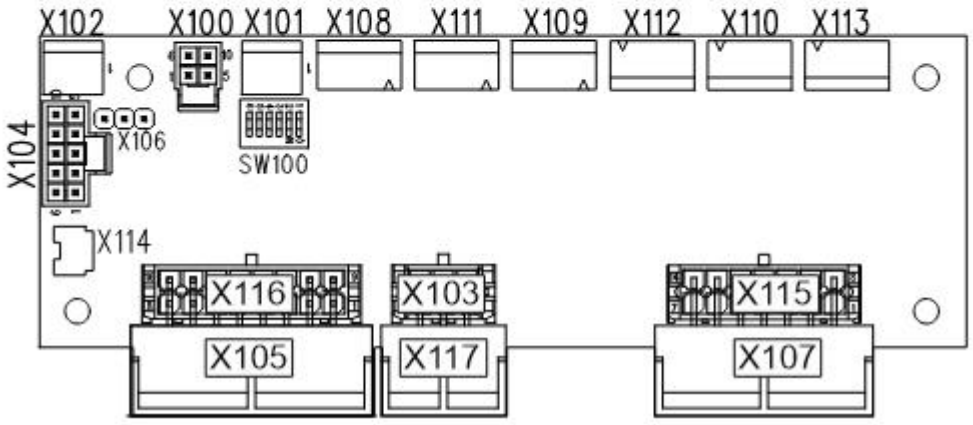
- 23207-170 Connector X105, X107, X117 90°
- 23207-172 Connector X103, X115, X116 180°

Block Diagram

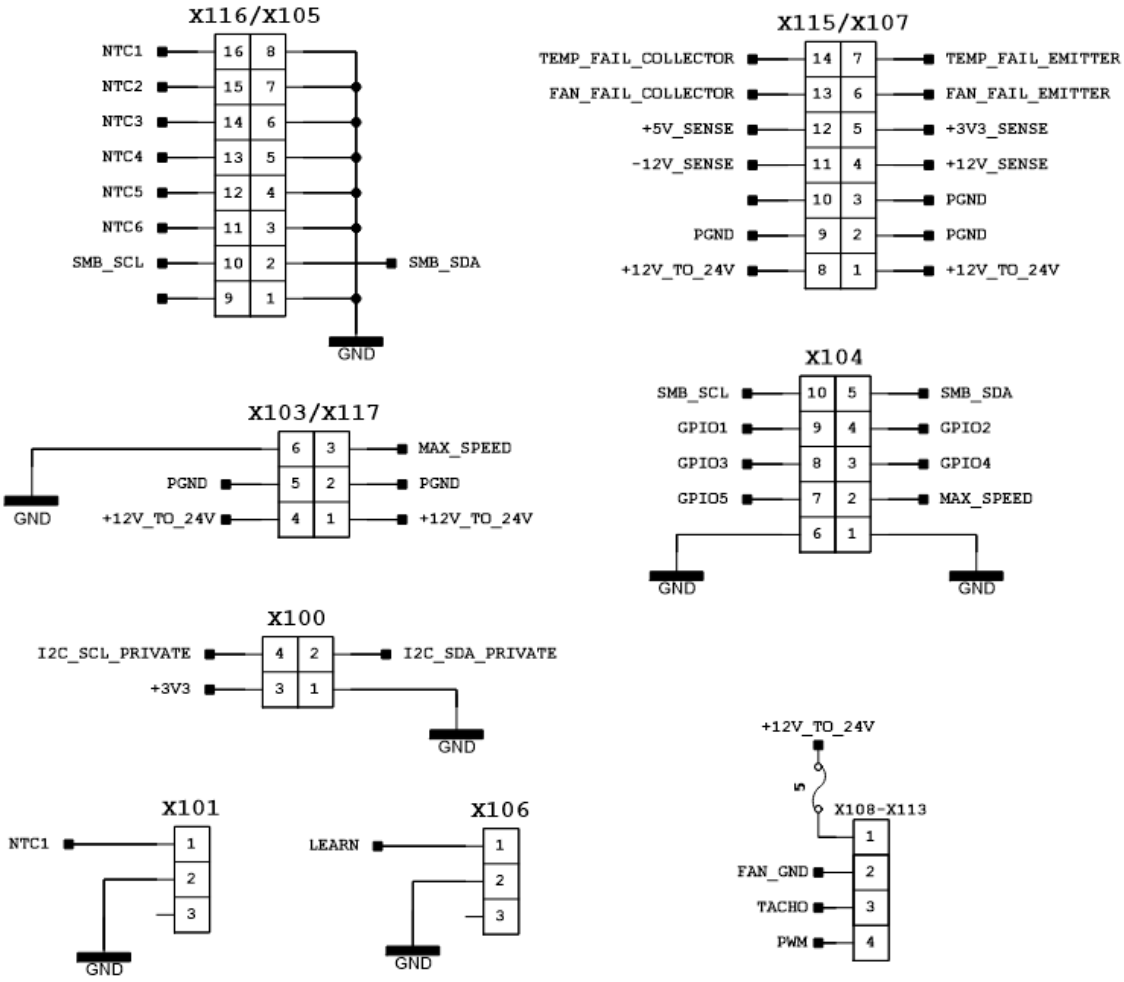


2.1 Overview


23207-170
23207-172
SCHROFF


X102
X100
X101
X108
X111
X109
X112
X110
X113
X104
X106
SW100
X114
X116
X103
X115
X105
X117
X107

3 Connectors



Part No.		Mating Connector	
		Manufacturer	Manuf. Part No
23207172	X116	Molex	43025-1600
23207172	X103	Molex	43025-0600
23207172	X115	Molex	43025-1400
23207170	X105	Molex	44133-1600
23207170	X117	Molex	44133-0600
23207170	X107	Molex	44133-1400
23207170 /172	X104	Molex	105308-1210
23207170 /172	X100	Molex	105308-1204
23207170 /172	X108-X113	TE	3-640441-4
23207170 /172	X101, X102	TE	3-640621-3
23207170 /172	X114	SAMTEC	FFSD-05-D-24.00-01-N

4 Operation

Up to 6 NTC temperature sensors can be connected to the FCM3. The highest temperature level is the reference for the fan speed. If a sensor temperature exceeds the maximum temperature of the selected fan curve by 5 °C , the output for the temperature fail LED and a digital output are activated.

The FCM3 can monitor up to 6 fan tacho signals and can control the fans as a group by a PWM signal. The FCM3 performs every minute a fan behavior test. If the speed of a single fan is 40% below normal speed, the FCM will send a fan fail alarm.

Learning Mode: (Jumper X106)

When the jumper is assembled in position 1-2 and the FCM3 is powered-up, the FCM3 is in „Learning Mode“. The FCM3 detect all fans and temperature sensors connected and save the speed of each fan at different PWM duty cycles. If a fan or temperature sensor is removed or added in „Normal Mode“, the FCM3 will send a fan-fail or temp-fail signal

.

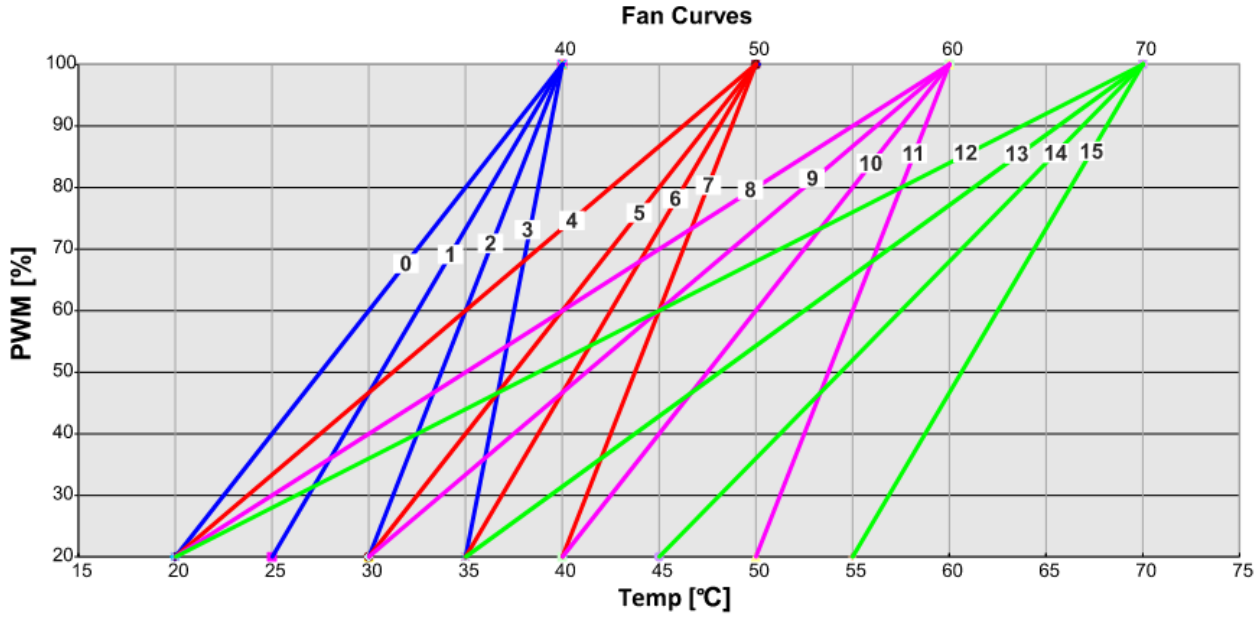
Max. Speed: (Connector X103/117/104)

Connect the max speed pin to GND, to set all fans full speed.

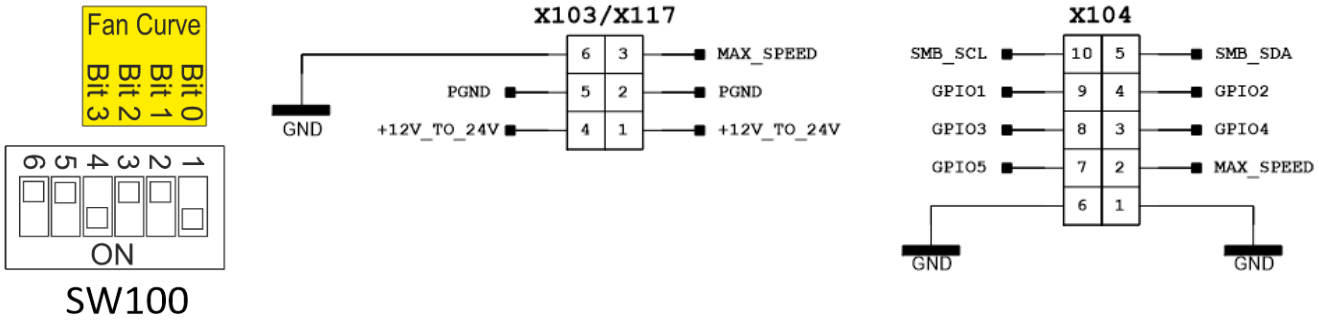
5 Fan Curve and Alarms

5.1 Fan curve

The speed of the fans is controlled via a curve depending on the temperature of the NTC sensors. The reading of the NTC sensor with the highest temperature is used as a reference.



The temperature curve can be selected via the DIP switch SW100 or SMBus. The fan speed can also be set manually between 25 % and 100 % via SMBus.



If the MAX_SPEED pins on connector X103/117 or X104 are connected to GND, the fans rotate permanently at 100 %.

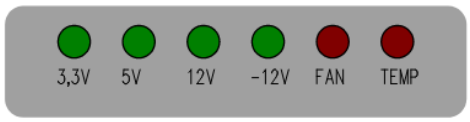
Dip Switch	Fan Curve	Dip Switch	Fan Curve
0000	0	1000	8
0001	1	1001	9
0010	2	1010	10
0011	3	1011	11
0100	4	1100	12
0101	5	1101	13
0110	6	1110	14
0111	7	1111	15

5.2 Alarms

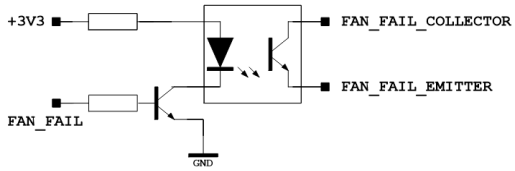
The FCM3 has overtemperature and fan fail alarms.

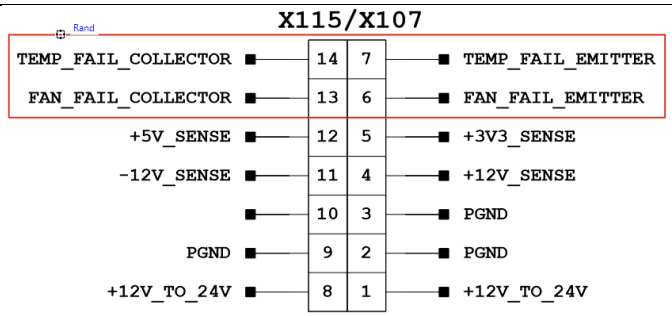
The alarms are signaled via an optional display, open collector outputs (max. 50 mA) or SMBus.

Display



Example Fan Fail optocoupler





5.2.1 Over temperature alarm

If a NTC sensor temperature exceeds the maximum temperature of the selected fan curve by 5 °C , the red temperature TEMP LED and an open collector output are activated and the resp. SMBus register is set.

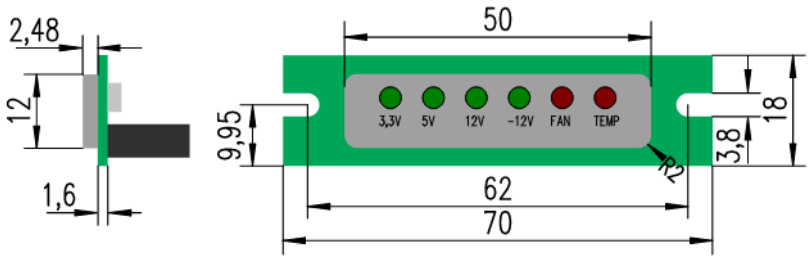
5.2.2 Fan fail alarm

Fan fail alarm is triggered if a fan or a NTC temperature sensor is defective or missing, i.e. the red temperature FAN LED and an open collector output are activated and the resp. SMBus register is set.

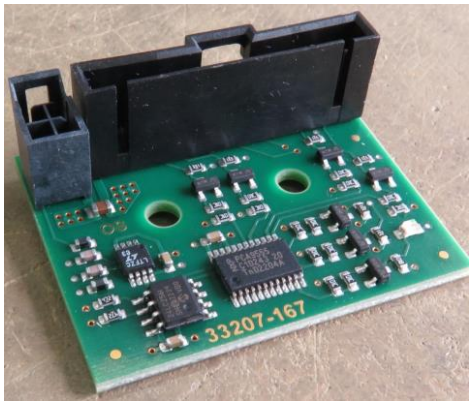
	The fan fail alarm raises the fan speed to full speed.

5.3 Display

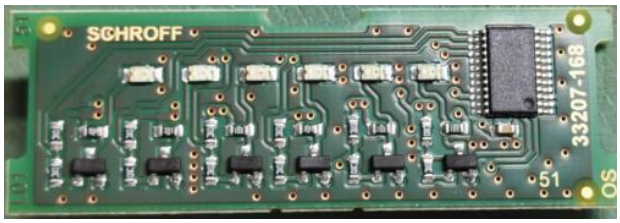
A display with 6 LEDs is available to indicate alarms and check system voltages.
There are 2 different displays available.
The legacy display Part No.: 23204-883
with 6 LEDs and labeling:



The legacy display can only be connected to the FCM3 with an adapter board Part No.: 23207-167.



The current display Part No.: 23207-168
with 6 SMD LEDs



For the current display light pipes must be installed in the system.

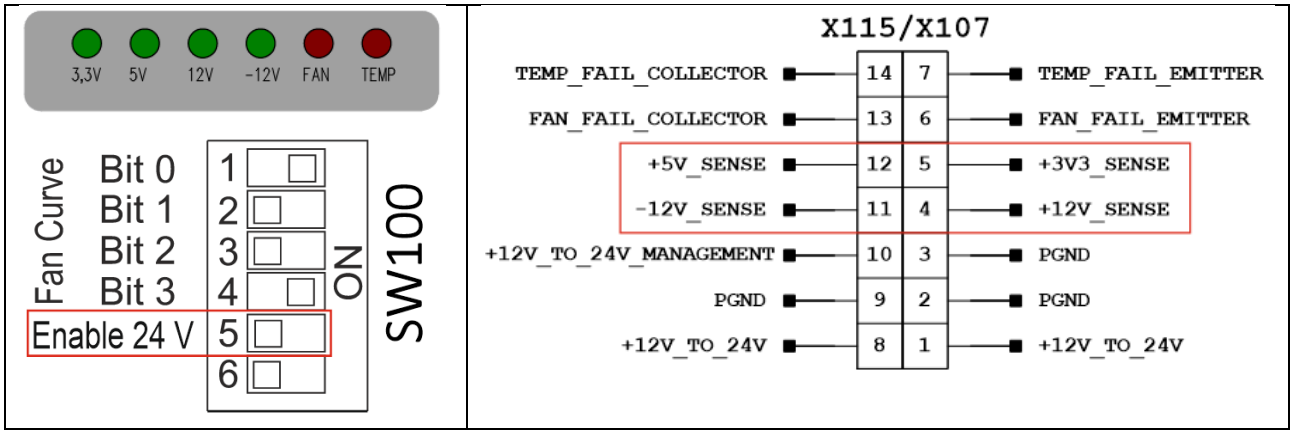
The mating connector for display and FCM is SAMTEC FFSD-05-D-24.00-01-N

5.3.1 Using the voltage status LEDs

The displays provide 4 LEDs for the status of 4 voltages (3.3 V, 5 V, 12 V, -12 V).

To use this functionality, the corresponding voltages must be connected to connector X115/X107.

The 12 V input or the 12 V LED can also monitor a voltage of 24 V. To monitor 24 V, bit 5 on the DIP switch SW100 must be set.



5.5 Control and monitoring via SMBus

If required, the fan tray can be controlled and monitored via SMBus.

Bus voltage is 3.3 V, pull-ups must be provided by the master. General call is not provided, the typical read cycle is > 10 ms.

The fan controller can hold down the clock to reduce the bus speed and supports SMBus standard mode up to 100 kbit/s.

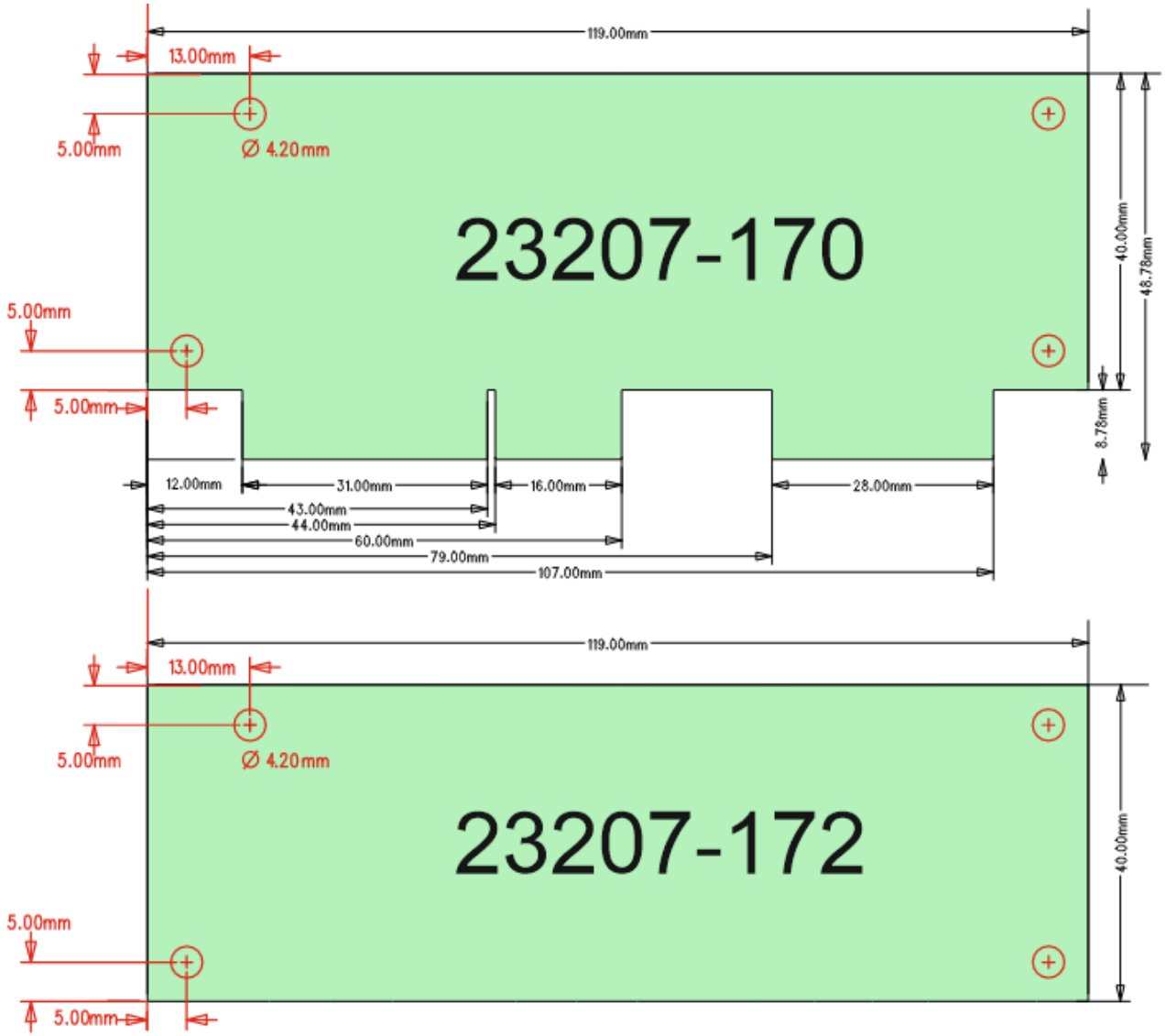
See the following table which parameters can be read or set via SMBus.

FCM3 SMBus Register Description						
Code	**Command Name**	**SMBus Transaction Type:**			**Bytes**	**Comment**
		Write	**Read**	**NVM**		
Voltage Measurement						
00h	3V3	N/A	Read Word	N/A	2	3V3 voltage (mV)
02h	5V	N/A	Read Word	N/A	2	5V voltage (mV)
04h	12V	N/A	Read Word	N/A	2	12V voltage (mV)
06h	(-)12V	N/A	Read Word	N/A	2	(-)12V voltage (mV)
08h	VOLTAGE_GOOD	N/A	READ Byte	N/A	1	Bit 0 == '1': 3V3 good … Bit 0 == '0': 3V3 out of range Bit 1 == '1': 5V good … Bit 1 == '0': 5V out of range Bit 2 == '1': 12V good … Bit 2 == '0': 12V out of range Bit 3 == '1': (-)12V good … Bit 3 == '0': (-)12V out of range
09h - 1Fh	RESERVED					
Temperature						
20h	TEMPERATURE_1	N/A	READ Byte	N/A	1	Temperature NTC 1 (°C)
21h	TEMPERATURE_2	N/A	READ Byte	N/A	1	Temperature NTC 2 (°C)
22h	TEMPERATURE_3	N/A	READ Byte	N/A	1	Temperature NTC 3 (°C)
23h	TEMPERATURE_4	N/A	READ Byte	N/A	1	Temperature NTC 4 (°C)
24h	TEMPERATURE_5	N/A	READ Byte	N/A	1	Temperature NTC 5 (°C)
25h	TEMPERATURE_6	N/A	READ Byte	N/A	1	Temperature NTC 6 (°C)
26h	TEMP_LEARNED	N/A	READ Byte	N/A	1	Bit 5 == '0': temperature NTC 6 not learned … Bit 0 == '0': temperature NTC 1 not learned Bit 5 == '1': temperature NTC 6 learned … Bit 0 == '1': temperature NTC 1 learned default value: N/A

27h	TEMP_FAIL	N/A	READ Byte	N/A	1	Bit 5 == '0': Temperature NTC 6 ok … Bit 0 == '0': Temperature NTC 1 ok Bit 5 == '1': Temperature NTC 6 failed … Bit 0 == '1': Temperature NTC 1 failed
28h - 3Fh	RESERVED					
Fans						
40h	FAN_TACHO_1	N/A	Read Word	N/A	2	Fan 1 speed (rpm)
42h	FAN_TACHO_2	N/A	Read Word	N/A	2	Fan 2 speed (rpm)
44h	FAN_TACHO_3	N/A	Read Word	N/A	2	Fan 3 speed (rpm)
46h	FAN_TACHO_4	N/A	Read Word	N/A	2	Fan 4 speed (rpm)
48h	FAN_TACHO_5	N/A	Read Word	N/A	2	Fan 5 speed (rpm)
4Ah	FAN_TACHO_6	N/A	Read Word	N/A	2	Fan 6 speed (rpm)
4Ch	FAN_LEARNED	N/A	Read Byte	N/A	1	Bit 5 == '0': Fan 6 not learned … Bit 0 == '0': Fan 1 not learned Bit 5 == '1': Fan 6 learned … Bit 0 == '1': Fan 1 learned default value: N/A
4Dh	FAN_FAIL	N/A	Read Byte	N/A	1	Bit 5 == '0': Fan 6 ok … Bit 0 == '0': Fan 1 ok Bit 5 == '1': Fan 6 failed … Bit 0 == '1': Fan 1 failed default value: N/A
4Eh	CONTROL_MODE	Write Byte	Read Byte	N/A	1	'0" : Auto Fan Control Mode "1" : Manual Fan Control Mode "2" to "255": Auto Fan Control Mode default: "0"
4Fh	MANUAL_FAN_REQUEST	Write Byte	Read Byte	N/A	1	"0" to "24": 25% Fan Request "25" to "100": 25 - 100% Fan Request "101" to "255": 100% Fan Request default: "25"
50h	CHOOSE_FAN_CURVE	Write Byte	Read Byte	saved to EEPROM	1	"0" : Fan Curve from Dip-Switch "1" : Fan Curve from EEPROM "2" to "255": Fan Curve from Dip-Switch default: "0"
51h	FAN_CURVE_EEPROM	Write Byte	Read Byte	saved to EEPROM	1	"0" to "15": Fan Curve 0 - 15 "16" to "255": default: '0'
52h	FAN_CURVE_DIP_SWITCH	N/A	Read Byte	N/A	1	"0" to "15": Fan Curve 0 - 15
53h	MAX_SPEED	N/A	Read Byte	N/A	1	'0' : Auto Speed '1' : Max Speed
54h	CURRENT_FAN_REQUEST	N/A	Read Byte	N/A	1	"25" to "100": 25% - 100% Fan Request
55h - 5Fh	RESERVED					
Configuration Status						
60h	LEARN_FLAG	Write Byte	Read Byte	N/A	1	"0": Learn at the next power cycle "1": Fans and Temperature Sensors are learned

61h	FAN_PWM_FREQUENCY	Write Byte	Read Byte	N/A	1	"0": 300 Hz "1": 1250 Hz "2": 5000 Hz "3": 10000 Hz "4": 20000 Hz "5" to "255": 5000 Hz default: "2"
62h	FAN_PULSES_PER_ ROTATION	Write Byte	Read Byte	N/A	1	"0": 2 Pulses per rotation "1" to "10": 1 - 10 Pulses per rotation "11" to "255": 2 Pulses per rotation default: "2"
63h - 7Eh	RESERVED					
7Fh	CONF_CHANGE_ENABLE	Write Byte	Read Byte	N/A	1	Value = 42: Configuration can be changed Value != 42: Configuration can not be changed
Product Info						
80h	PRODUCT_NUMBER	Write Byte	Read Byte	saved to EEPROM	8	Product number (ASCII Values) of the FCM3, can only be changed if CHANGE_ENABLE is set to "42"
88h	SERIAL_NUMBER	Write Byte	Read Byte	saved to EEPROM	12	Serial number (ASCII Values) of the FCM3, can only be changed if CHANGE_ENABLE is set to "42"
94h	FIRMWARE_NUMBER	N/A	Read Byte	N/A	10	Firmware number of the FCM3
9Eh - BEh	RESERVED					
BFh	INFO_CHANGE_ENABLE	Write Byte	Read Byte	N/A	1	Value = 42: PRODUCT_NUMBER, SERIAL_NUMBER and FIRMWARE NUMBER can be changed Value != 42: PRODUCT_NUMBER, SERIAL_NUMBER and FIRMWARE_NUMBER can not be changed
CMM Firmware Upgrade						
F0h	CMM_UPDATE_GET_STATUS	N/A	Read Byte	N/A	1	Do not use SMBus Command code without counsulting nVent SCHROFF
F1h	CMM_UPGRADE_START	Write Byte	Read Byte	N/A	1	
F2h	CMM_UPGRADE_ SEND_DATA	Block Write	N/A	write to EEPROM	1	
F3h	CMM_UPGRADE_ ACTIVATE	Write Byte	Read Byte	N/A	1	
F4h - FFh	RESERVED					

6 Mounting



To mount the FCM3 inside a system, Schroff recommends to use locking supports, as example ETTINGER Part No.: 006.27.086

6.1 Initial Operation

⚠ WARNING

Risk of injury and accidents due to insufficiently qualified personnel!

- The installation may only be carried out by qualified personnel who are authorized to do so according to the valid safety regulations, e.g. by authorized specialized companies or authorized departments of the company.

⚠ WARNING

Risk of injury and accidents due to turning fans

- When the FCM3 is powered, the fans start to turn immediately.

ATTENTION

Damage due to incorrect operating voltage

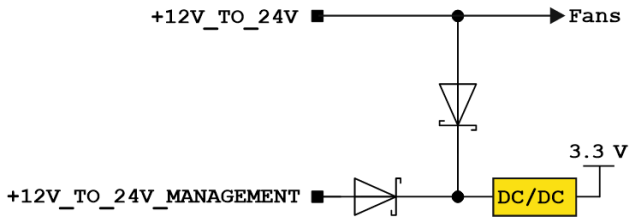
Note the permissible operating voltage range!

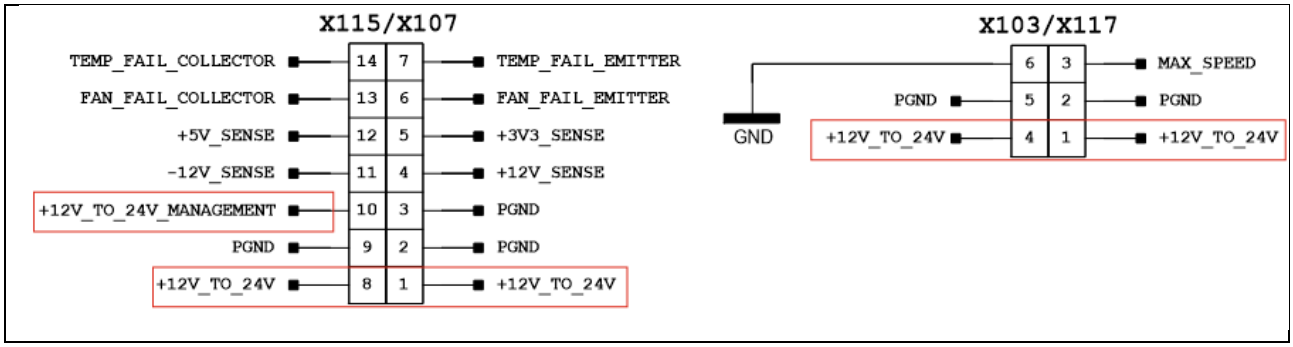
Conditions

The current consumption of all fans must not exceed 18 A.
The current at one fan connector (X108-X113) must not exceed 3 A.

The FCM3 has 2 connectors, each with 2 pins for the fan power supply.
If the current consumption of the fans is <10 A, 2 pins must be connected to at least one connector; if the current consumption of the fans is > 10 A, all 4 pins must be connected to both connectors.

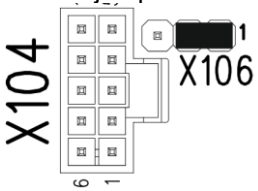
The supply voltage is 12-24 VDC. The connection of the management supply voltage is optional.





Initial operation:

- Mount the FCM3 inside your system
- Connect the power supply but don't switch the power on
- Connect all fans and temperature sensors.
- Connect the display with the LEDs
- Set the jumper X106 to learning mode (position 1-2).



	When the FCM is in factory state (never powered-up before) it is not necessary to set the jumper in learning mode, just connect the fans and sensors and power-up the FCM, the learning mode will start automatically.

- Switch on the power supply.
- All fans run with full speed and then slowly reduce the speed. Thereby the FCM determines the reference speed for various PWM values.
- Upon completion of the learning mode, the Fan Fail LED at the display start blinking according to the number of fans found, and the Temp Fail LED start blinking according to the number of sensors found. If no display is connected wait 5 min to ensure that the configuration is terminated.
- • Switch off the power supply and set the jumper X106 to position 2-3.

	Minimum 1 temperature sensor is required to be connected, otherwise a temp fail alarm is triggered and the fans rotate at full speed.

- If necessary, connect your equipment for signaling/detection of the Fan Fail or Over Temp alarm to the open collector outputs

Temperature sensor specifications:

Schroff temperature sensor 20710-138 is recommended.

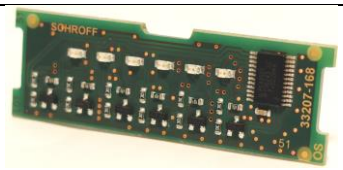
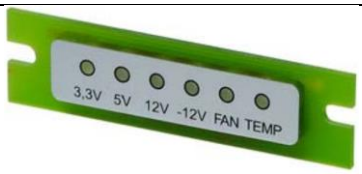
R25 = 30 kOhm

B25/50 = 4177 K

7 Technical Data

TECHNICAL DATA	
Operating Voltage	12 - 24 VDC +/- 10 %
Max. current for all fans	18 A
Max. current for a single fan	3.5 A (fused)
Ambient Temperature Operating	0 °C .....+70 °C
Ambient Temperature Storage	-40 °C … +85 °C
Humidity	20 – 80 % RH non-condensing

7.1 Part Numbers

ITEM	P/N	
FCM3, Connector X105, X107, X117 90°	23207-170	
FCM3, Connector X103, X115, X116 180°	23207-172	
NTC Sensor with 400 mm cable and connector	23204-882	
Display Unit with 6 SMD LEDs (3.3 V, 5 V, 12 V, -12 V, Fan Fail, Temp Fail)	23207-168	
Legacy Display Unit with 6 SMD LEDs (3.3 V, 5 V, 12 V, -12 V, Fan Fail, Temp Fail)	23204-883	
Adapter board to connect the legacy display to FCM3	23207-167