

**SCHOTT**  
glass made of ideas

**SCHOTT® FLM 4  
Fiber Lighting Module**

Operating Instructions







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# SCHOTT® FLM 4 - Operating Instructions

## 1. Important information

### Symbols used

Symbol	Meaning
	Warning of danger (caution, obey documentation)
	LED-radiation (caution, do not look directly into the beam!)

## 2. Scope of Delivery

The SCHOTT® FLM 4 consists out of a capsuled housing containing the LEDs and focusing optics with permanently attached cooling fan.

The PCB board included in the set is connected via the also included cable and is responsible for the safe operation of the optics module.

The FLM4 is available in two versions

FLM4-2A            order# 1627291

FLM4-4.5A        order # 1640009

This operating instructions covers both versions.



## 3. Intended use

The SCHOTT® FLM 4 is intended for illumination in medical and industrial applications in combination with a glass fiber optic light guide.

Technical documentation proving full compliance of the illumination system with the essential requirements of the CE Directives with the standards listed below is available upon request.

CE (150kHz-30MHz) on DC lines acc. EN 55011

RE (30-1000MHz) acc. EN 55011

ESD acc. EN 61000-4-2

Burst on DC lines acc. EN 61000-4-4

Induced high frequency on DC lines acc. EN 61000-4-6

This test was performed with the power supply Phoenix Contact UNO-PS 12 V / 100 W. In any case the user has to ensure conformity with the directives.

**After installation into a complete illumination system, it is the responsibility of the system integrator to prove conformity with any regional directives, which may apply.**

## **4. Safety information**

**Please read and follow these instructions carefully. The instrument's safety cannot be guaranteed if they are not obeyed.**

**Do not look directly into the open light guide socket or the light guide exit when the light source is switched on (danger of ophthalmic injury)!**

**When installing the SCHOTT® FLM 4 into a light source housing, make sure to label the light source with an appropriate warning label, depending on regional requirements.**

The SCHOTT® FLM 4 emits high-intensity visible light. Because light-absorbing materials have the physical property of converting incident light into heat, damage can arise to heat-sensitive or flammable light-absorbing materials. To avoid such thermal damage and the potential danger of fire or burns, please comply with the following instructions:

- Due to the high optical power in the focal area only fiber optic light guides with glass optical fibers should be used. POF may be damaged due to the high temperatures.
- Never cover up the light output aperture when the SCHOTT® FLM 4 is switched on (danger of fire)!
- Never cover up the light output aperture with your hands or other parts of the body (danger of burns)!
- When illuminating heat-sensitive or flammable light-absorbing objects (e.g. in microscopy), special care must be taken to ensure that an appropriate suitable distance between light guide and object, and a suitable lamp brightness level are selected so that no thermal damage occurs.
- When the SCHOTT® FLM 4 is switched on, all light guide exits not being used in the working procedure must always be a safe distance – at least 10 cm – away from heat-sensitive or flammable light-absorbing materials (prevention of possible danger of fire). Care must, therefore, be taken that each light guide exit is at the above-mentioned safe distance away from, for example, dark/colored textiles and dark/colored wooden or plastic surfaces.

**Please make sure that your SCHOTT® FLM 4 driver electronic is operated only at 12 V DC.**

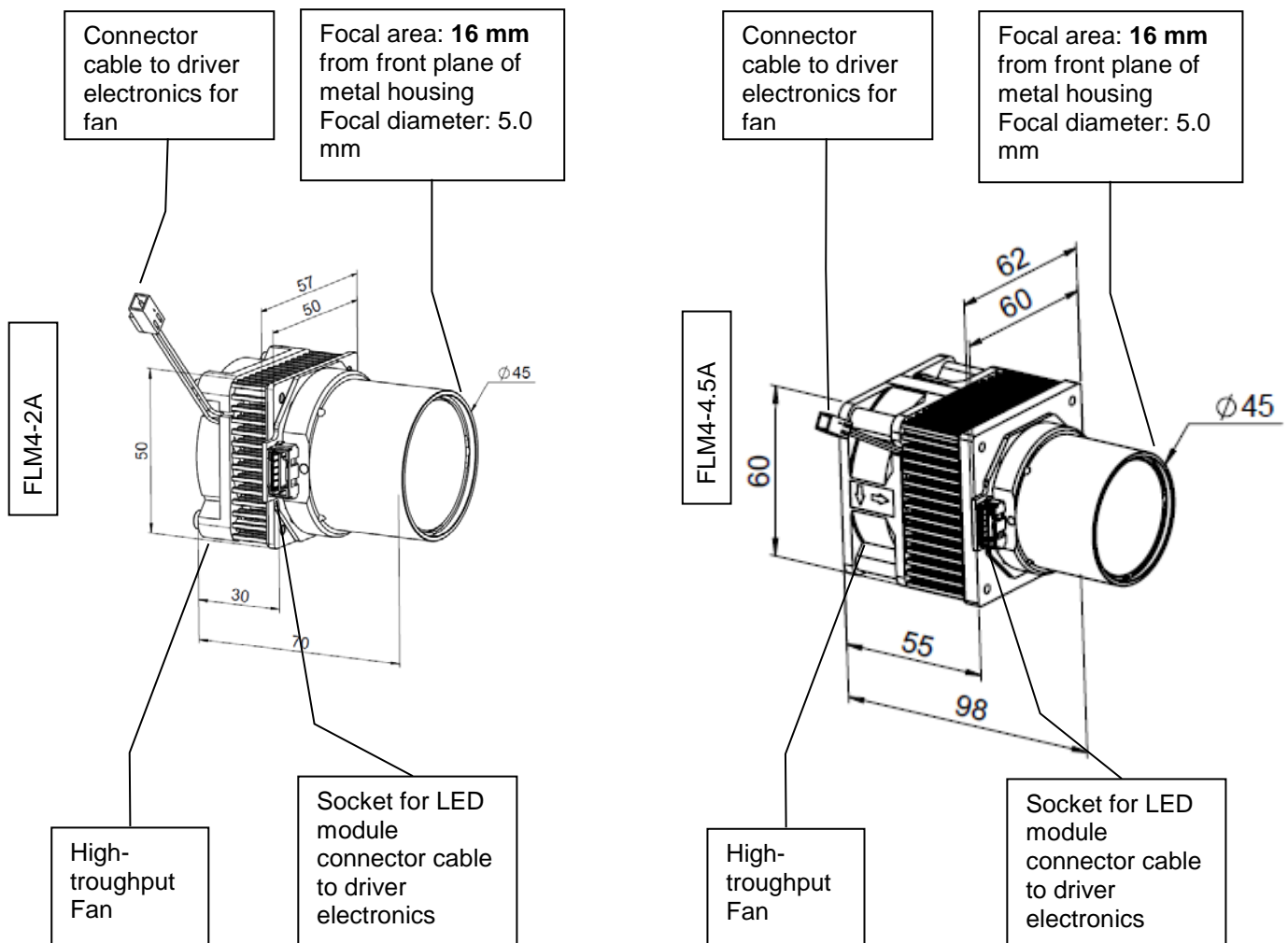
- The SCHOTT® FLM 4 has been developed for operation in dry rooms only!
- The device must not be used in explosive areas.
- Safe disconnection from the power supply occurs only by pulling out the mains plug.
- The instrument may neither be opened nor dismantled. Technical modifications are forbidden. Repairs must only be carried out by the manufacturer or by its authorized customer service agency.
- Please ensure that every user of the system has quick access to these operating instructions.
- The manufacturer is not liable for damage caused by failure to obey these instructions.

## 5. Operation

### 5.1. LED Optics Module

For operation of the SCHOTT® FLM 4 it is necessary to ensure sufficient cooling of the LED's. Therefore a high-throughput fan has been precisely mounted onto the module.

Dimensions of the different SCHOTT® FLM 4 with fan are shown below.



#### Attention:

Do not insert anything into the aperture of the housing - it could damage the lens inside.

Do not remove the fan - It will void warranty of the SCHOTT® FLM 4.

Do not obstruct the fan blades. Ensure sufficient air flow to and from the module.

## 5.2. Driver Control PCB

The SCHOTT® FLM 4 is delivered with a driver control PCB.

With the DIP switch on the board different operating modii can be selected:

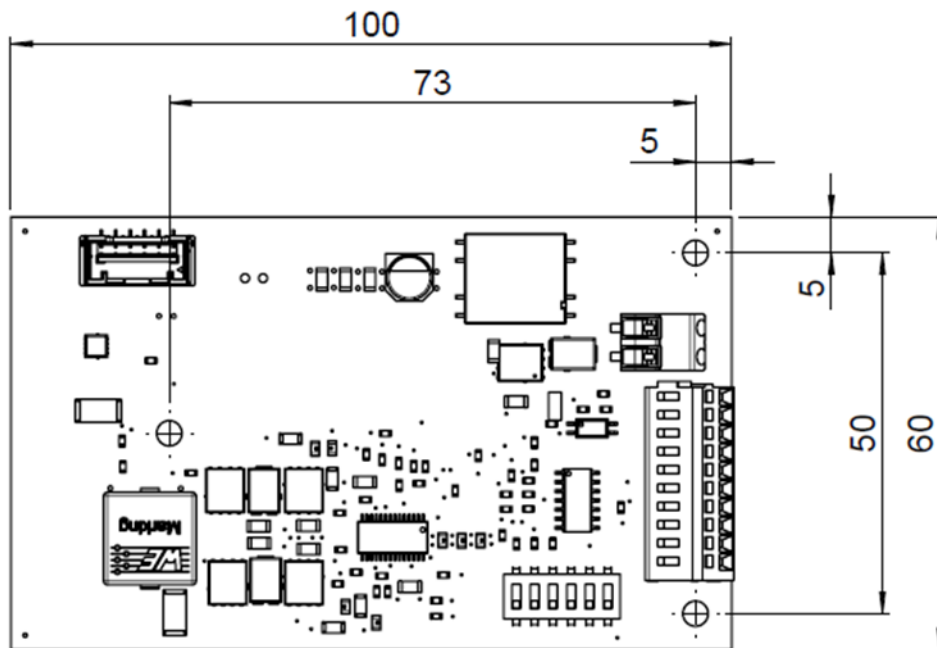
- Analog Dimming or PWM dimming
- Limitation of power consumption @ reduced light output

**Please note:** Using the SCHOTT® FLM 4 module with any other electronics than the SCHOTT original driver control PCBs will void warranty.

### 5.2.1. Electrical Connection of Driver Control PCB

The driver control PCB features serial connection of the LEDs with total power consumption of 72 Watt maximum. The power consumption of the SCHOTT® FLM 4 can be limited for the usage of power supplies with less than 72 Watt. This mode has to be secured by the appropriate settings of the DIP-switch on the PCB board. Analog or PWM dimming is possible, please see chapter 5.2.2 for the DIP switch setting and chapter 6.2 for analog dimming or chapter 6.3 for PWM dimming.

#### Dimensions of Driver Control PCB and Position of mounting holes



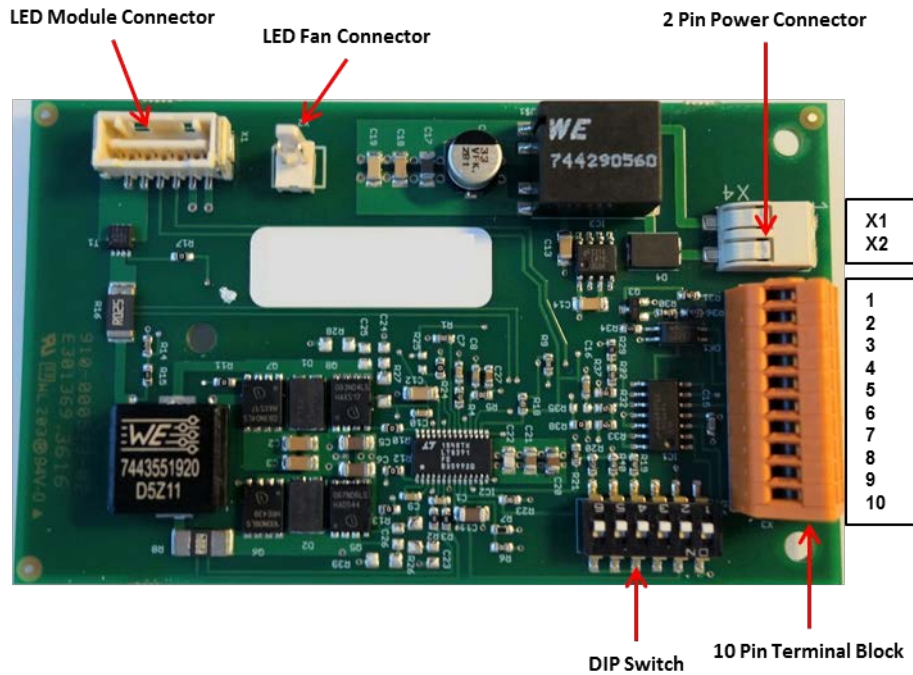
**Note: To avoid damage of the electronic board use only plastic screws for mounting.**

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## Electrical Connection of Driver Control PCB “Basic”

Four connector sockets are available on the circuit board:

- 2-pin connector for 12V cooling fan
- 6-pin connector for LED-Optics module
- 10-pin terminal block for external connection
- 2-pin connector for power supply connection



**Note:** To avoid damage of the electronic components make sure to use proper polarity!

### Pin-configuration 2-pin power connector

Pin-Number	Function
X1	GND
X2	12V DC, 6.5A max.

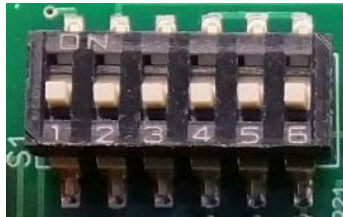


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### Pin-configuration 10-pin terminal block

Pin-Number	Function
1	output signal for over temperature of LED Module (f.e. red LED Anode)
2	GND
3	output signal for temperature of LED Module OK (f.e. green LED Anode)
4	Optocoupler (+) output (open collector)
5	Optocoupler (-) output (open emitter)
6	GND
7	+5V DC (from SCHOTT® FLM 4-2A Controller)
8	Analog Dimming (0-5V)
9	GND
10	PWM Dimming

### 5.2.2. Possible DIP switch settings



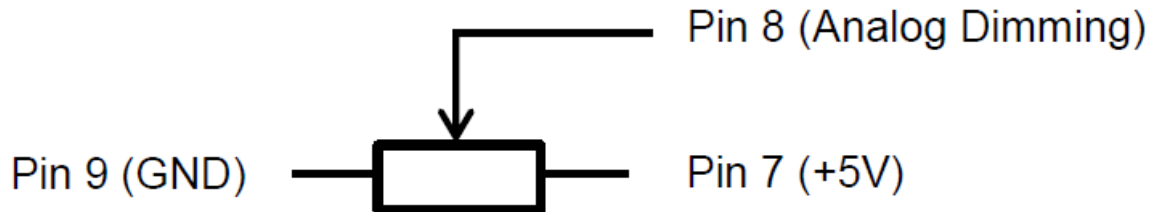
**Standard Setting is Analog Dimming @ 2A LED Current (FLM 4-2A) or @ 4.5A LED Current (FLM 4-4.5A).** If another setting is desired, please change the switches according to the following table:

	Function	ON	OFF
<b>Dimming</b>	<b>Analog</b> <i>Standard Setting</i>	<b>Switch 2</b>	<b>Switch 1,3</b>
	<b>PWM</b>	<b>Switch 1</b>	<b>Switch 2,3</b>
<b>Current Limitation</b>	<b>2A LED Current</b> <i>Standard for FLM 4-2A</i>	<b>Switch 4</b>	<b>Switch 5,6</b>
	<b>3A LED Current</b>	<b>Switch 5</b>	<b>Switch 4,6</b>
	<b>4.5A LED Current</b> <i>Standard for FLM 4-4.5A</i>	<b>Switch 6</b>	<b>Switch 4,5</b>

**Note: If switch 3 is set to ON, the current limitation is disabled and the SCHOTT® FLM 4 will operate with 4.5A LED current, independent of the switch settings 4-6!**

### 5.2.3. Connection of external potentiometer

For operation with manual potentiometer for dimming connect the potentiometer according to the illustrated plan. For continuous operation at maximum intensity without dimming connect PIN 3 and PIN 9.



### 5.2.4. External Connection of Optocoupler

An internal Optocoupler can be used to read out the status of the LED temperature and to generate an error signal.

The drawing shows an example of an external circuit which consists out of an error LED which will shine in the error case.

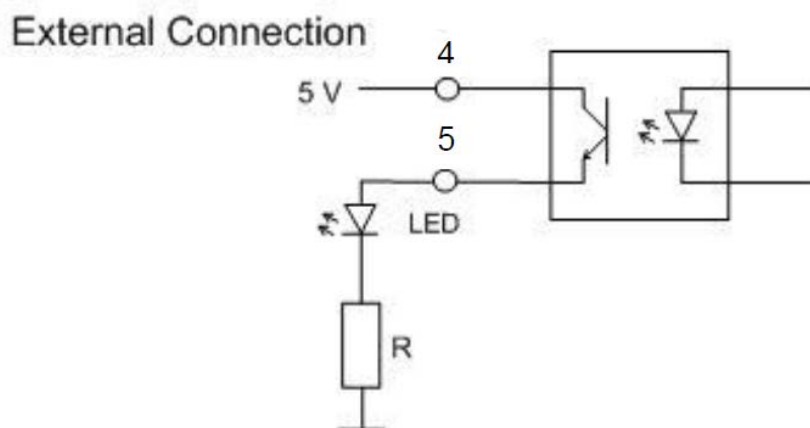
Technical data of transistor stage of Optocoupler:

$V_{CE}$  (on state): ~0,2V

$I_{max}$  : 50 mA

Using a resistor value of 330 Ohm, an LED with  $V_f = 2$  V and a  $V_{cc}$  of 5 V

--> LED current ~ 8.5 mA



## 6. Operation

### 6.1. Start-up Procedure



To avoid damage of the driver control PCB, it is only allowed to operate the electronics with correctly connected LED-module.

The module is ready for use after connecting supply voltage (12 V DC, 6.5 A), LED-module and potentiometer.



Ensure right polarity of supply voltage!

There is no “power on” switch on the board; power switching has to be implemented by the system integrator.

### 6.2. Light Intensity Setting via Analog Dimming

The light intensity level of the module is adjustable between 0% and 100% by changing the analog voltage (0 to 5 V) via 10-Pin connector. If no dimming is required, please shortcut PIN 7 and PIN 8. The power consumption of the unit can be limited by setting the DIP switch according to chapter 5.2.2. Limitation of the power consumption will also limit the light output!

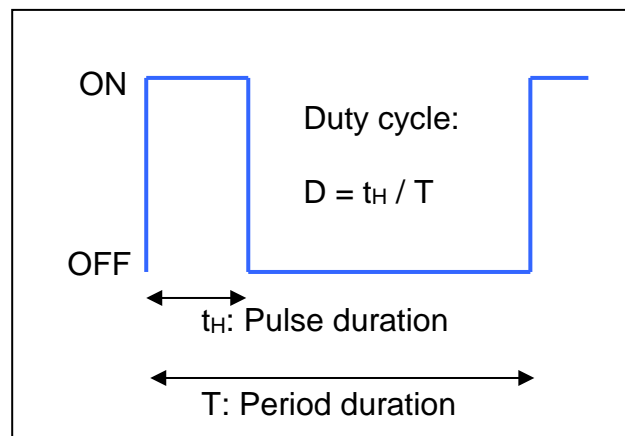
### 6.3. Light Intensity Setting via PWM / External triggering

The Driver Control PCB enables fast on/off switching via an external trigger signal with frequencies from 5 Hz up to 1.2 kHz with variable pulse/pause ratios.

For connection of trigger input use pin 9 and 10 and shortcut pin 7 and 8 (see chapter 5.2.1).

The power consumption of the unit can be limited by setting the DIP switch according to chapter 5.2.2. Limitation of the power consumption will also limit the light output!

The following diagrams shall illustrate the possible pulse / interval ratios.



## 6.4. Over-temperature Protection

To protect the LED`s from overheating the driver electronic includes an over-temperature control. The LED current will be reduced, if the temperature **at the heat-sink** exceeds the following temperatures due to non-sufficient cooling. Measures must be taken to ensure sufficient air-flow to the optics module/ heat sink, when built into any housing.

	Driver Control PCB
Reduction of LED current	T > 40°C / 104°F
Red status LED turns "on" ( if connected)	T > 40°C / 115°F

Please note: This safety feature protects the LED`s from thermal damage, but will also reduce intensity by reducing the LED current.

## 7. Maintenance

The SCHOTT® FLM 4 and driver control PCBs are maintenance-free.  
To clean the outside of the Optics Module, please use a soft dry cloth or commercially available plastic cleaning cloths.

## 8. Troubleshooting

Should you be unable to solve the faults by the measures listed below, please contact your SCHOTT representative. Repairs must be carried out by an authorized service.

Error	Possible cause	Remedial action
<b>Too low light output</b>	Wrong setting of DIP switch	Correct DIP switch setting (see chapter 5.2.2)
<b>No light output</b>	Instrument not switched on	Switch instrument on
	Fault connection of potentiometer or analog or PWM input	See chapter 6.2 or 6.3 for correct connection
	Wrong connection of LED module to driver control PCB	Verify connections to driver control PCB. For Reference see Chapter 5.2.1
	No mains electricity voltage	Check mains voltage (12 V DC, 6 A min.)
<b>Light intensity drop during operation</b>	LED module overheated (see red status LED – if connected)	Switch off instrument. Ensure adequate cooling, switch on after sufficient cooling time

## 9. Spare Parts

	Article-Number
<b>FLM 4-2A Set, complete</b>	162 7291
<b>FLM 4-2A Optics Module only (without Control PCB and Cable)</b>	162 7292
<b>FLM 4-4.5A Set, complete</b>	164 0009
<b>FLM 4-4.5A Optics Module only (without Control PCB and Cable)</b>	164 0010
<b>Driver Control PCB</b>	632 5609
<b>Cable Set</b>	632 5610

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10. Technical Data for SCHOTT® FLM 4			
		FLM4-2A (162 7291)	FLM4-4.5A (164 0009)
<b>Optical Data</b>	LED Type	White High Brightness LED	
	Typical Color Temperature CCT	5700 Kelvin (initial value)	
	Color Rendering Index CRI	Approximately 70	
	Typical Luminous Flux	<b>900 lm in Focal Area for 5 mm Aperture</b> 400 lm out of SCHOTT® Light Guide (4.8mm, 2300mm)	<b>2000 lm in Focal Area for 5 mm Aperture</b> 750 lm out of SCHOTT® Light Guide (4.8mm, 2300mm)
	Aperture angle	65°	
	Av. LED Lifetime	30,000 hours (Luminous Flux reduced to 70% of Max.)	
	Please note	LEDs are subject to certain manufacturing variations and can change their intensity and chromaticity depending on the type, power rate, life time and environmental conditions.	
<b>Electronic Data</b>	Operating Voltage / Current	12 V DC +2V/-1V max 6.5 A	
	LED Safety / Redundancy	Serial Chain	
	Power Consumption	72 W max.	
	Analog Input Voltage Range for Dimming	0 - 5 V	
	Potentiometer for Dimming	10 kΩ	
	Method of LED Dimming	Only for analog dimming : Linear Current Control, 0-4500 mA/LED	
	External Trigger Input	5 Hz – 1.2 KHz, Var. pulse/pause ratio	
	Optics Module / Fan Weight	Diameter 45 mm / 50mm x 50 mm, Length 70 mm Approximately 220 g	Diameter 45 mm / 50mm x 50 mm, Length 98 mm Approximately 240 g
<b>Dimensions</b>	PCB Dimension (LxW)	100 mm x 60 mm	
<b>Operating Conditions</b>	Temperature	+5°C - +35 °C	
	Relative Humidity	85% max. (non-condensing)	

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<b>Transportation and Storage</b>	Ambient Temperature Relative Humidity	-20°C - +70°C 10% - 95% (non-condensing)
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We reserve the right to make changes in design and supplied items within the scope of on-going technical improvements.

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