

Instruction and operation manual

S220

Dew point sensor



Dear Customer,

Thank you for choosing our product.

Please read the operating instructions in full and carefully observe them before starting up the device. The manufacturer cannot be held liable for any damage which occurs as a result of non-observance or non-compliance with this manual.

Should the device be tampered with in any manner other than a procedure which is described and specified in the manual, the warranty is cancelled and the manufacturer is exempt from liability.

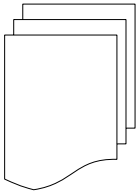
The device is destined exclusively for the described application.

SUTO offers no guarantee for the suitability for any other purpose. SUTO is also not liable for consequential damage resulting from the delivery, capability or use of this device.

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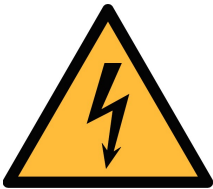
1 Safety instructions



Please check if this instruction manual matches with the product type.

Please observe all notes and instructions indicated in this manual. It contains essential information which have to be observed before and during installation, operation and maintenance. Therefore this instruction manual has to be read carefully by the technician as well as by the responsible user / qualified personnel.

This instruction manual has to be available at the operation site of the dew point sensor at any time. In case of any obscurities or questions, regarding this manual or the product, please contact the manufacturer.



WARNING!

Compressed air!

Any contact with quickly escaping air or bursting parts of the compressed air system can lead to serious injuries or even death!

- Do not exceed the maximum permitted pressure range (see sensors label).
- Only use pressure tight installation material.
- Avoid that persons get hit by escaping air or bursting parts of the instrument.
- The system must be pressureless during maintenance work.



WARNING!

Voltage used for supply!

Any contact with energized parts of the product, may lead to a electrical shock which can lead to serious injuries or even death!

- Consider all regulations for electrical installations.
- The system must be disconnected from any power supply during maintenance work.
- Any electrical work on the system is only allowed by authorized qualified personal.

**WARNING!****Permitted operating parameters!**

Observe the permitted operating parameters, any operation exceeding this parameters can lead to malfunctions and may lead to damage on the instrument or the system.

- Do not exceed the permitted operating parameters.
- Make sure the product is operated in its permitted limitations.
- Do not exceed or undercut the permitted storage and operation temperature and pressure.

General safety instructions

- It is not allowed to use the product in explosive areas.
- Please observe the national regulations before/during installation and operation.

Remarks

- It is not allowed to disassemble the product.
- Always use spanner to mount the product properly.

**ATTENTION!**

Measurement values can be affected by malfunction!

The product must be installed properly and frequently maintained, otherwise it may lead to wrong measurement values, which can lead to wrong results.

Storage and transportation

- Make sure that transportation temperature of the sensor is between $-30 \dots +70^{\circ}\text{C}$.
- For storage and transportation it is recommended to use the packaging which comes with the sensor.
- Please make sure that the storage temperature of the sensor is between $-20 \dots +50^{\circ}\text{C}$.
- Avoid direct UV and solar radiation during storage.
- For the storage the humidity has to be $<95\% \text{ rH}$, no condensation.

2 Registered trademarks

SUTO®

Registered trademark of SUTO iTEC

MODBUS®

Registered trademark of the Modbus Organization, Hopkinton, USA

HART®

Registered trademark of the HART Communication Foundation, Austin, USA

PROFIBUS®

Registered trademark of the PROFIBUS User Organization, Karlsruhe, Germany

3 Application

The S220 is a dew point sensor which is designed to monitor the dew point in industrial application within the permissible operating parameters. These parameters can be found in the technical data section.

The S220 can measure the following values:

- Temperature of the compressed air or gas.
- Humidity of the compressed air or gas.
- Dew point of the compressed air or gas.

The default factory settings are: temperature in °C, Humidity in % rH and dew point in °C Td. Other units can be programmed by the optional display or the service kit.

The S220 dew point sensor is not developed to be used in explosive areas. For the use in explosive areas please contact the manufacturer.

The S220 dew point sensor is mainly used in compressed air systems in industrial environment.

4 Features

- Small size makes it ideal for dryer installation.
- Measures dew point down to -100°C Td.
- Version with integrated pressure measurement.
- Various output versions available: 1 x 4 ... 20 mA, 2 x 4 ... 20 mA, RS-485 (Modbus), 4 ... 20 mA loop powered.
- IP65 casing provides robust protection in rough industrial environment.
- Very fast response time ensures safe and reliable indication whenever dew points are out of valid ranges.
- Can be installed directly into dryer through G ½" thread.
- High accuracy of ±2 °C dew point.

5 Technical data

5.1 General

CE	
Parameters	Standard unit dew point: °C Td Standard unit temperature: °C other units: °F, K Standard unit humidity: % rH
Principle of measurement	Oscillating crystal
Sensor	QCM
Measuring medium	Air, Argon, O ₂ , N ₂ , CO ₂ *
Measuring range	Dew point: -100 ... 0°C Td Temperature: -30 ... +70°C Pressure: -0.1 ... 1.6 MPa
Ambient temperature	0 ... +50°C
Ambient humidity	0 ... 100% rH
Operating pressure	-0.1 ... 1.6 MPa
Casing material	Process connection: stainless steel Casing: zinc alloy
Protection class	IP65
Dimensions	See dimensional drawing on the page 10
Screwing thread	G ½" thread (ISO 228/1);
Weight	204 g
*To support CO ₂ , the S220 must be configured ex-works or the SFA software must be used. SFA software can be downloaded from the SUTO website.	

5.2 Electrical data

Power supply	12 ... 30 VDC / 30 mA
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5.3 Output-signals

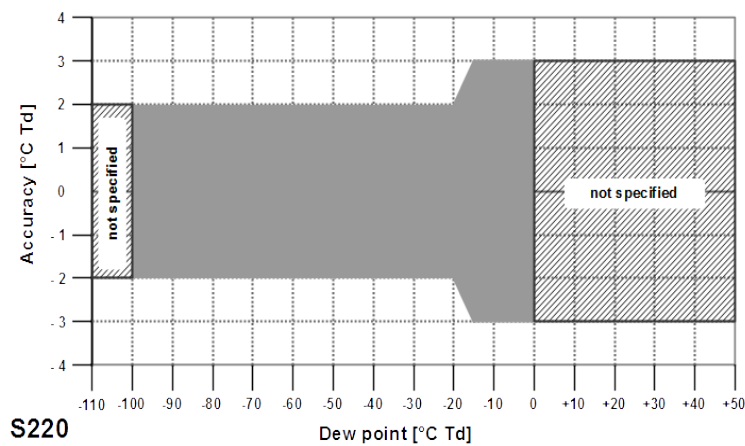
Analog output	4 ... 20 mA, 3-wire 4 ... 20 mA, 2-wire
Analog output scaling	4 mA = -100°C Td

	20 mA = +20°C Td
Modbus output	RS-485

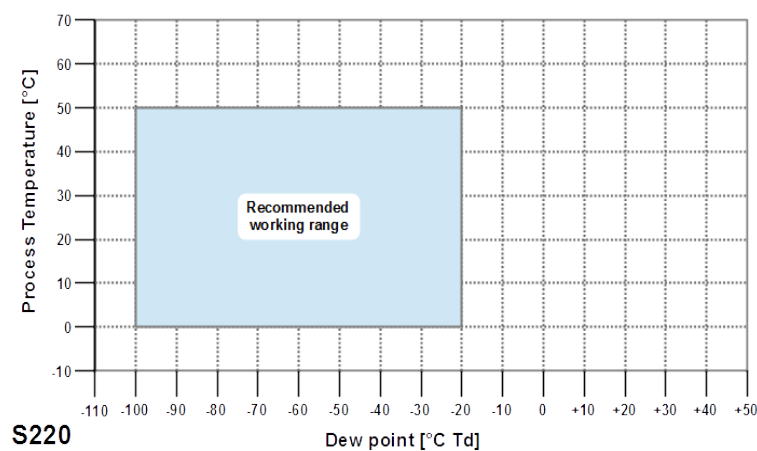
5.4 Accuracy

Accuracy	Dew point: $\pm 2^\circ\text{C Td}$ Temperature: 0.3°C Pressure: 0.05 bar
Repeatability	$\pm 0.5^\circ\text{C}$
Stated accuracy at	Ambient/process temperature $23^\circ\text{C} \pm 3^\circ\text{C}$ Ambient/process humidity $< 95\% \text{ rH}$, no condensation Airflow $> 2 \text{ l/min}$ at the sensor tip

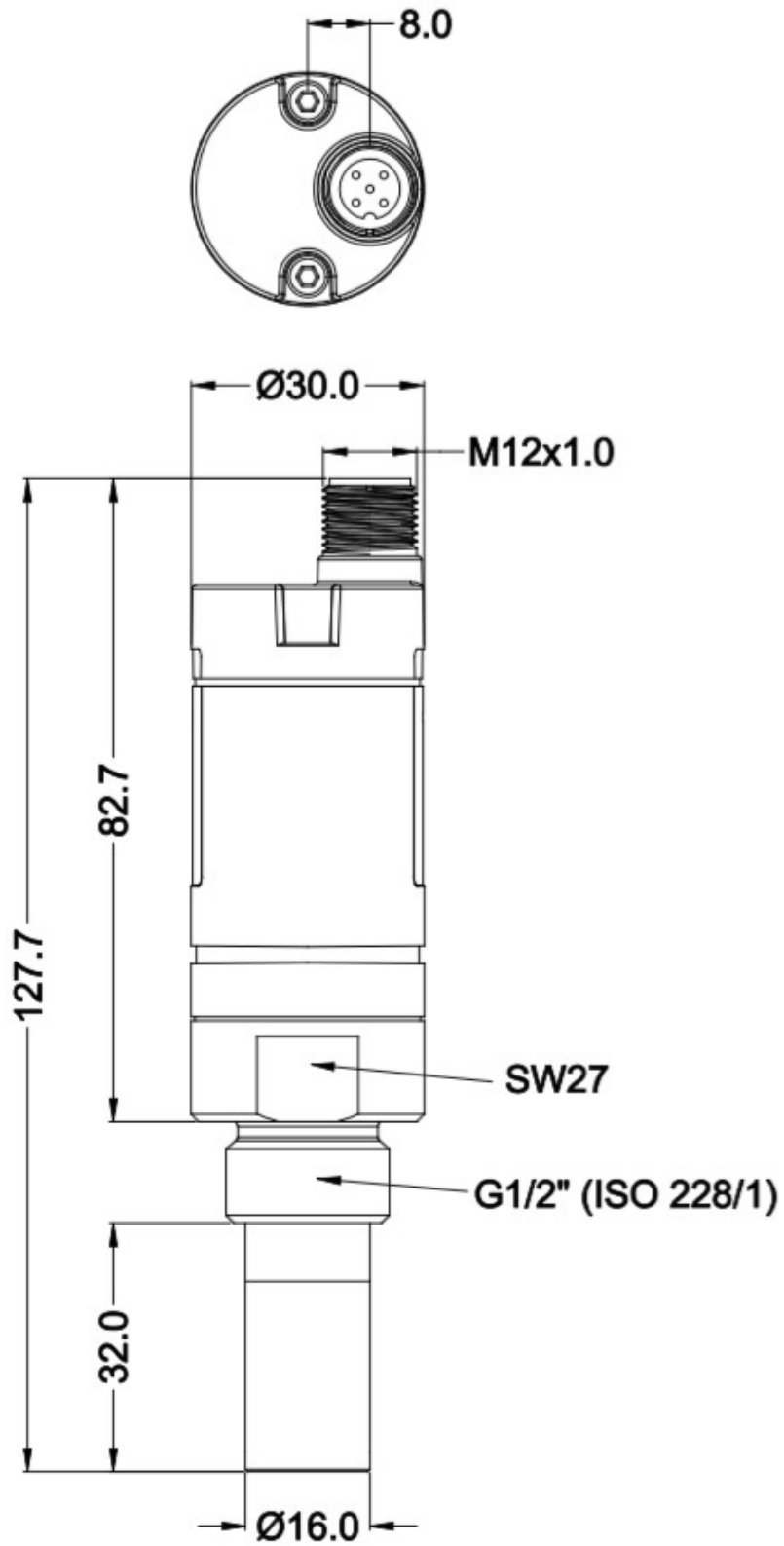
Accuracy:



Valid working range:



6 Dimensional drawing



7 Determination of the installation point

In order to maintain the accuracy stated in the technical data, the sensor must be installed correctly. The air must flow on to the sensor tip, otherwise it will lead to wrong measurement values. For further instructions, please read the next chapter carefully.

Please consider that enough space exists at your site for a adequate installation as described in this manual.



ATTENTION!

Wrong measurement is possible, if the sensor is not installed correctly.

- The sensor is for indoor use only! At an outdoor installation, the sensor must be protected from solar radiation and rain.
- It is strongly recommend not to install S220 permanently in wet environment as it exists usually right after a compressor outlet.

8 Installation

Before installing the sensor, please make sure that all components listed below are included in your package.

Qty	Description	Item No.
1	Sensor	S699 0220 S699 0221 S699 0222 S699 0223 S699 0224 S699 0225
1	Depending on orders: M12 plug or M12 cable	Plug: C219 0059 Cable: A553 0104/A553 0105
1	Instruction manual	No P/N
1	Calibration certificate	No P/N

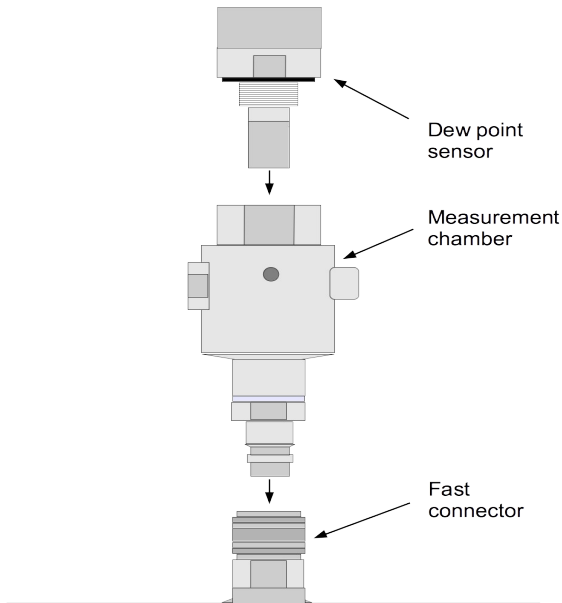
8.1 Installation requirements

The flowing air or gas has to pass the sensor tip for a proper measurement. This can be realized with a measurement chamber. For a installation without measuring chamber you need to concern the installation depth which is described in the next chapter.

8.2 Installation procedure

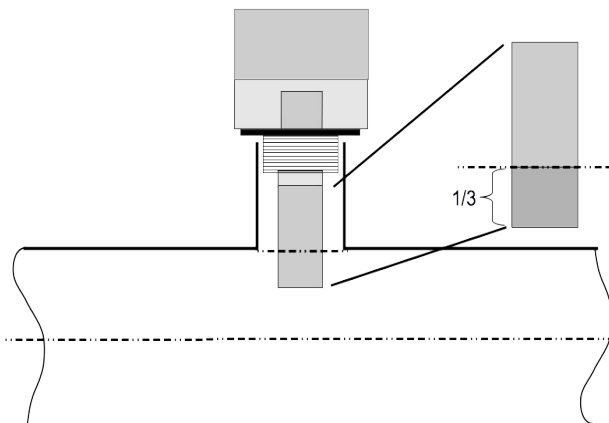
The following steps explain the procedure of an appropriate installation.

Installation of the sensor with measurement chamber



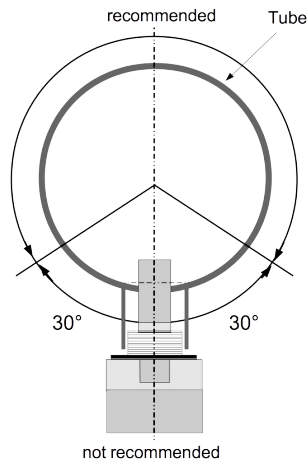
1. Connect the sensor with the measurement chamber.
2. Connect the sensor and the measurement chamber with the fast connector.

Installation of the sensor without measurement chamber



- Install the sensor only if the system is pressureless.
- Not less than 1/3 of the sensor tip should be inside of the pipe. For this please check the size of the nozzle.
- The inner thread has to be G 1/2".

Remarks



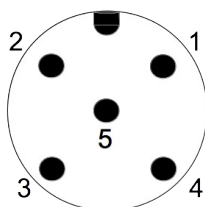
Please install the sensor only in the recommended area like you can see in the picture. A upside down installation is not permitted. Please consider that the distance to the vertical level must be $>30^\circ$.

Removal of the sensor

To remove the sensor unscrew the sensor from the measurement chamber or from the nozzle. Please observe that the system is pressureless when the sensor is removed.

8.3 Electrical connection

Connection pins connector plug M12



Connection pins
(view from the clamping side)

Pin assignment connector plug M12

Model	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5
0220	SDI	$-V_B$	$+V_B$	$+I_1$	NA
0221	SDI	$-V_B$	$+V_B$	$+I_1$	$+I_2$
0222	SDI	$-V_B$	$+V_B$	+D	-D
0223	SDI	$-V_B$	$+V_B$	$+I_1$	$+I_2$
0224	SDI	$-V_B$	$+V_B$	+D	-D
0225	SDI	$-V_B$	$+V_B$		
Wire colour	brown	white	blue	black	grey

Legend to pin assignment

SDI	Digital signal (internal use)
-V _B	Negative supply voltage
+V _B	Positive supply voltage
+I ₁	Active 4 ... 20 mA signal

+I ₂	Active 4 ... 20 mA signal
+D	Positive data Modbus
-D	Negative data Modbus
NA	Not applicable

9 Signal outputs

9.1 Analog output

The sensor has an analog output range of 4 ... 20 mA. Depending on the model it is a 3-wire active analog output or a 2-wire passive analog, please have a look to the table below. This output is scaled to:

- 4 mA = -100°C Td
- 20 mA = +20°C Td

For other ranges, please contact the manufacturer. The analog output can be allocated to the temperature, the dew point and the humidity.

Model	Analog output
S699 0220	1 x 4 ... 20 mA, 3-wire (active)
S699 0221/S699 0223	2 x 4 ... 20 mA, 3-wire (active)
S699 0225	1 x 4 ... 20 mA, 2-wire (passive)

9.2 Modbus output

Model	Digital output
S699 0222, S699 0224	RS-485, Modbus RTU

Mode	: RTU
Baud rate	: 19200
Device address	: last two digits of serial number
Framing / parity / stop bit	: 8, N, 1
Response time	: 1 second
Response delay	: 0 ms
Inter-frame spacing	: 7 char

Modbus address	Data type	Data Length	Channel description	Unit
0	FLOAT	4-Byte	Temperature	°C or °F
2	FLOAT	4-Byte	Relative humidity	% rH
4	FLOAT	4-Byte	Pressure	bar
6	FLOAT	4-Byte	Pressure dew point	°C Td or ° F
8	FLOAT	4-Byte	Atmosphere dew point	°C Td or ° F
10	FLOAT	4-Byte	Mixing ratio	g/kg
12	FLOAT	4-Byte	Absolute humidity	g/m ³ or mg/m ³
14	FLOAT	4-Byte	Atmosphere absolute humidity	g/m ³ or mg/m ³
16	FLOAT	4-Byte	Volume ration	ppmv
18	Reserve	4-Byte	Reserved	

In the response message that the device returns to the master:

- Function code: 03
- Byte order (32-bit data): MID-LITTLE-ENDIAN.

Remarks: To properly decode the 4-byte float and unsigned integer data in the response message, the master must change the byte order from MID-LITTLE-ENDIAN to the order that it is using (LITTLE-ENDIAN or BIG-ENDIAN).

Byte sequencing of byte orders:

Byte order	Byte sequencing (HEX)	Example
MID-LITTLE-ENDIAN (Read from the device)	A B C D	0x 0A 11 42 C5
LITTLE-ENDIAN	B A D C	0x 11 0A C5 42
BIG-ENDIAN	C D A B	0x 42 C5 0A 11

10 Optional extra accessories

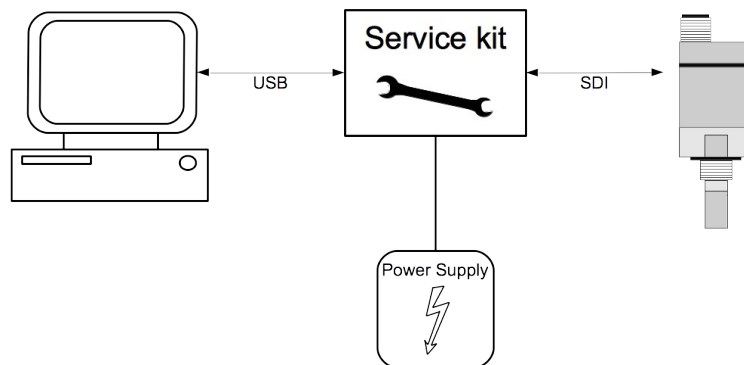
10.1 Measuring chambers

There are different types of measuring chambers, for example measuring chamber with fast connector, by-pass-by chamber with in and out connection, measuring chamber for dryer installation or high pressure chamber. For more information please contact your retailer or the manufacturer.

10.2 Service kit

The service kit is used to connect the sensor with the PC. Sensor parameters such as analog output scaling, alarm values, units etc. can be easily changed by using the service kit.

The diagram below shows the connection when using the optional service kit. Please ensure that also in this case the power supply of either S220 or of the service kit is connected because the USB port cannot supply enough power.



11 Calibration

The sensor is calibrated ex work. The exact calibration date is printed on the certificate which is supplied together with the sensor. The accuracy of the sensor is regulated by the on site conditions, parameters like oil, high humidity or other impurities can affect the calibration and furthermore the accuracy. However we recommend to calibrate the instrument at least once per year. The calibration is excluded from the instruments warranty. For this please contact the manufacturer.

12 Maintenance

Please observe from time to time the sinter cap. If it appears to be dirty, it is recommended to replace it for this please contact the manufacturer.



ATTENTION!

A dirty/wet/contaminated sinter cap or sensor tip may lead to a longer response time and to wrong measurements.

13 Disposal or waste



Electronic devices are recyclable material and do not belong in the household waste.

The sensor, the accessories and its packings must be disposed according to your local statutory requirements.

The dispose can also be carried by the manufacturer of the product, for this please contact the manufacturer.

14 Appendix A - Modbus communication example

03 (0x03) Read holding register

Request		Response	
Slave address	1 byte	Slave address	1 byte
Function code	1 byte	Function code	1 byte
Starting address Hi	1 byte	Byte count	1 byte
Starting address Lo	1 byte	Register Hi	1 byte
No. of points Hi	1 byte	Register Lo	1 byte
No. of points Lo	1 byte	:	:
CRC	2 bytes	Register Hi	1 byte
		Register Lo	1 byte
		CRC	2 bytes

05 (0x05) Write single coil

Request		Response	
Slave address	1 byte	Slave address	1 byte
Function code	1 byte	Function code	1 byte
Coil address Hi	1 byte	Coil address Hi	1 byte
Coil address Lo	1 byte	Coil address Lo	1 byte
Data Hi	1 byte	Data Hi	1 byte
Data Lo	1 byte	Data L	1 byte
CRC	2 bytes	CRC	2 bytes

16 (0x10) Write multiple registers

Request		Response	
Slave address	1 byte	Slave address	1 byte
Function code	1 byte	Function code	1 byte
Starting address Hi	1 byte	Starting address Hi	1 byte
Starting address Lo	1 byte	Starting address Lo	1 byte
No. of registers Hi	1 byte	No. of registers Hi	1 byte
No. of registers Lo	1 byte	No. of registers Lo	1 byte
Byte count	1 byte	CRC	2 bytes
Data Hi	1 byte		
Data Lo	1 byte		
:	:		
Data Hi	1 byte		
Data Lo	1 byte		
CRC	2 bytes		

17 (0x11) Report slave ID

Request		Response	
Slave address	1 byte	Slave address	1 byte
Function code	1 byte	Function code	1 byte
CRC	2 bytes	Byte count	1 byte
		Slave ID	2 bytes
		Device run indicator	2 bytes
		Product code	2 bytes
		Product name	20 bytes
		CRC	2 bytes

SUTO iTEC GmbH

Grißheimer Weg 21
D-79423 Heitersheim
Germany

Tel: +49 (0) 7634 50488 00

Fax: +49 (0) 7634 50488 19

Email: sales@suto-itec.com

Website: <http://www.suto-itec.com>

SUTO iTEC (ASIA) Co., Ltd.

Room 10, 6/F, Block B, Cambridge Plaza
188 San Wan Road, Sheung Shui, N.T.
Hong Kong

Tel: +852 2328 9782

Fax: +852 2671 3863

Email: sales@suto-itec.asia

Website: <http://www.suto-itec.com>

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