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Prepared by:	Schiller Anastasia
Approved by:	AG E-KAZ

This document is valid for the following part number:

- L5031202 SKiiP®3 F-Option

Technical Explanation SKiiP®3 F-Option Board

Please note:
Unless otherwise specified, all values in this technical explanation are typical values. Typical values are the average values expected in large quantities and are provided for information purposes only. These values can and do vary in different applications. All operating parameters should be validated by user's technical experts for each application.
The document remains effective until replaced by subsequent revision of this document.

Table of content:

1 Related documents

- Technical Explanation SKiiP®3, Rev. 02
- Data sheets SKiiP®3
- Data sheet SKiiP®3 F-Option
- Data sheets SKHBP SKiiP®3
- Technical Explanation SKiiP®3 Parallel Board

2 Application and handling instructions

- Please provide static discharge protection during handling. As long as the board is not completely assembled, the input terminals have to be short-circuited. Persons working with devices have to wear a grounded bracelet. Any synthetic floor coverings must not be statically chargeable. Even during transportation the input terminals have to be short-circuited using, for example, conductive rubber. Worktables have to be grounded.
- When first operating a newly developed circuit, SEMIKRON recommends to apply low collector voltage and load current in the beginning and to increase these values gradually, observing the turn-off behavior of the free-wheeling diode and the turn-off voltage spikes generated across the IGBT. An oscillographic control will be necessary. Additionally, the case temperature of the module has to be monitored. When the circuit works correctly under rated operation conditions, short-circuit testing may be done, starting again with low collector voltage.
- It is important to feed any errors back to the control circuit and to switch off the device immediately in failure events. Repeated turn-on of the IGBT into a short circuit with a high frequency may destroy the device.

3 General description

The SKiiP®3 F-Option Board allows the controlling of:

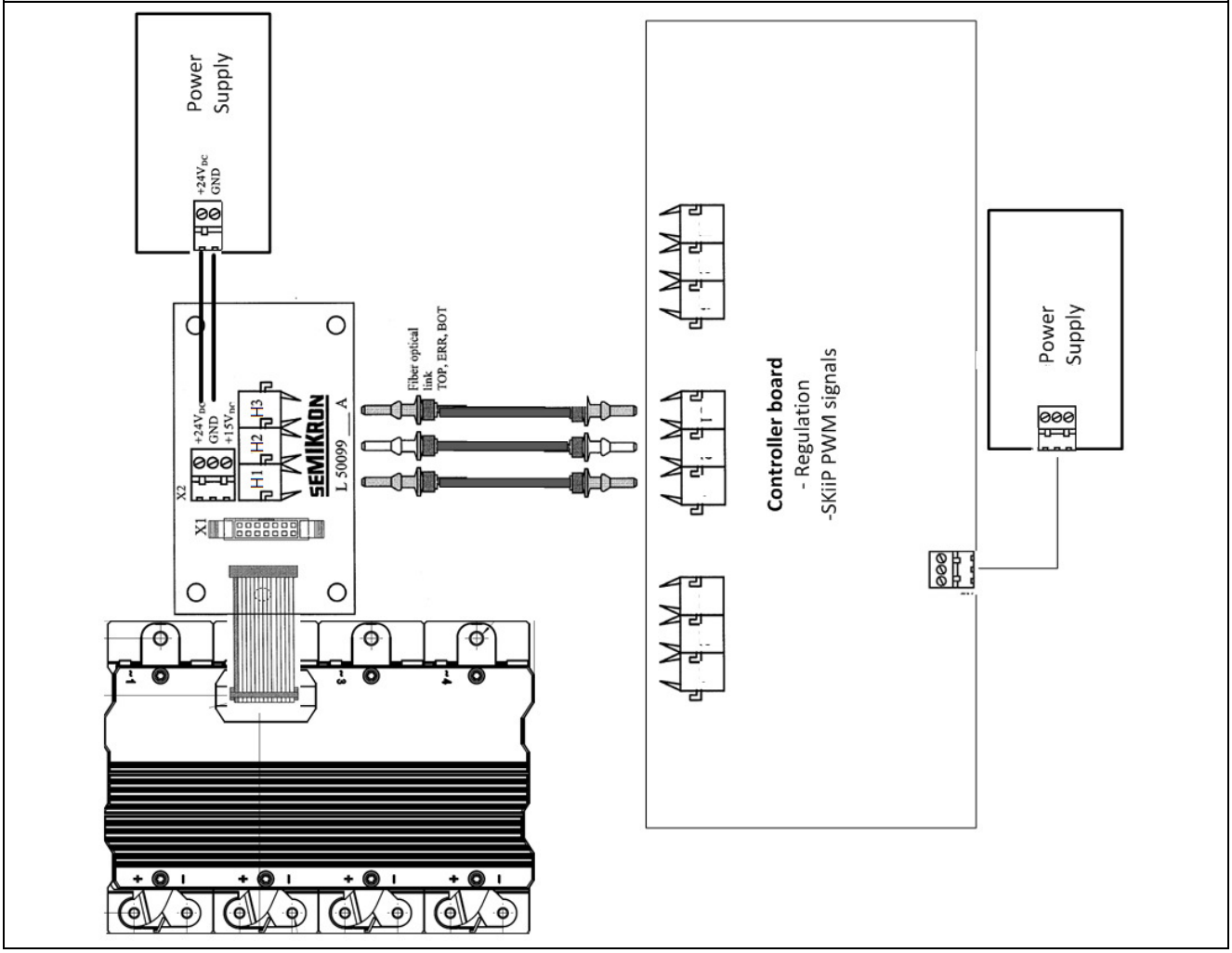
- one SKiiP®3 system GB type only (see Technical Explanation SKiiP®3, Rev. 2 for details)
- up to 4 SKiiP®3 systems (GB type only) in parallel over SKiiP®3 Parallel Board (see Technical Explanation SKiiP®3 Parallel Board for details)
- most of SEMIKRON IGBT and MOS drivers (see Technical Explanation SKYPER for details)

by means of fiber optics for optimal noise immunity.
The two switching signals (TOP/BOT) and the error signal are transferred via optical connection. In addition the analogue signals are available on the DIN41651 connector X1. The electrical connection between SKiiP®3 F-Option board and driver board is realized by 14-wired ribbon cable, which is already built-in into the SKiiP®3 F-Option board. On the other side it must be connected to the SEMIKRON DIN41651 connector interface of SKiiP®3 driver or IGBT/MOS Driver Board by a 14-pin DIN female connector.
By means of this the F-option SKiiP®3 can be used both for:

- mounting SKiiP®3 F-Option directly on the SKiiP®3 top cover (can only be done by SEMIKRON)
- mounting SKiiP®3 F-Option on the SKiiP®3 Paralleling Board or Driver Board (can be done by customer).

The example of SKiiP®3 F-Option board application is shown in the Figure 3.1.

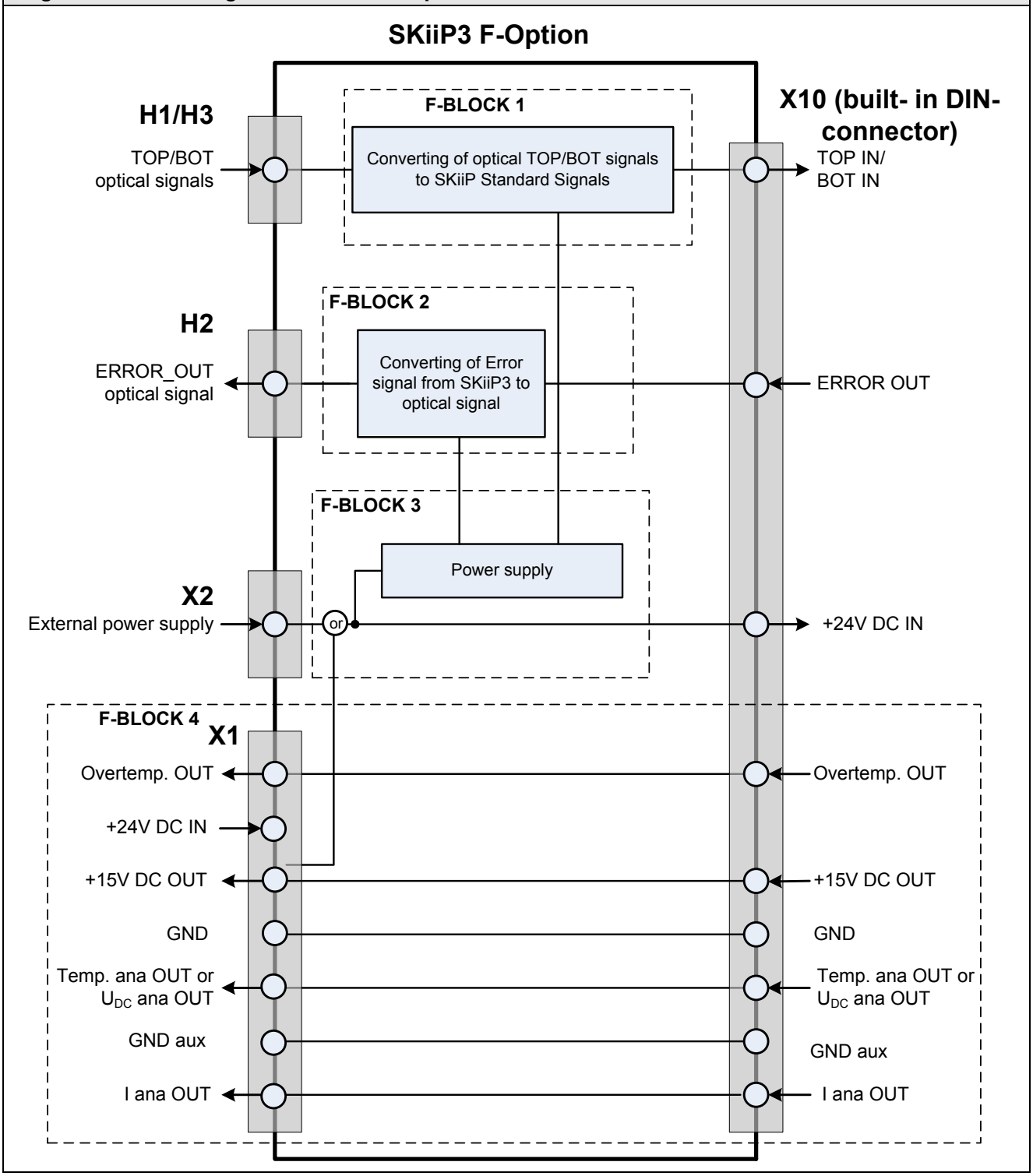
Figure 3.1: SKiiP®3 F-Option board application with connected SKiiP®3 system



Pollution degree class 2 and IP00 shall be considered for the SKiiP®3 F-Option board.

4 Block diagram

Figure 4.1: Block diagram of SKiiP®3 F-Option board main functions



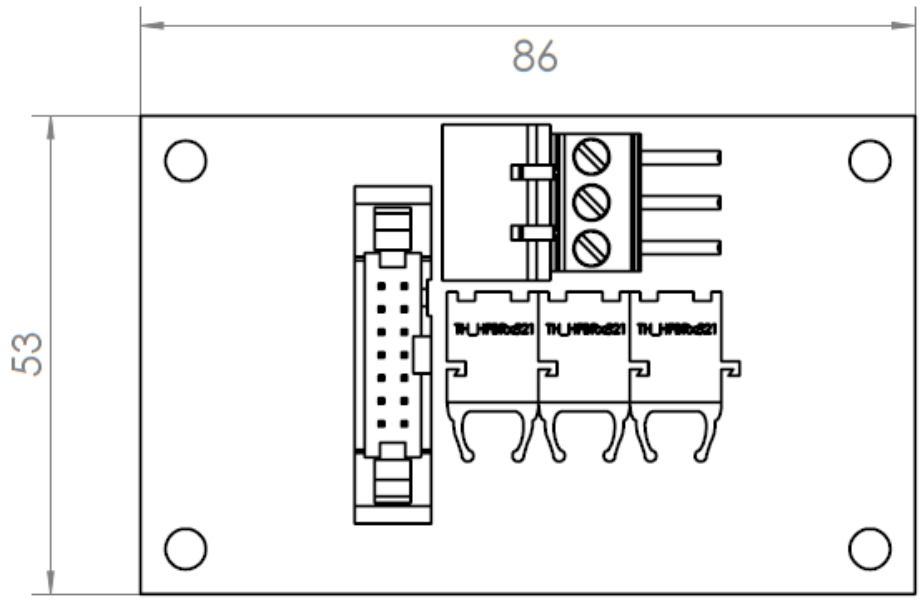
The main functions of the SKiiP®3 F-Option board are shown in the Figure 4.1. They are:

- F-Block 1: Converting the optical TOP/BOT switching signals from the connectors H1/H3 to the SKiiP®3 connector X10.
- F-Block 2: Converting the Error signal from SKiiP®3 connector X10 to optical error signal ERROR_OUT at connector H2
- F-Block 3: If the voltage drop over the ribbon cable will be too high due to the high supply current (Please see data sheet SKiiP®3 for supply current formula) and also in case of using the Parallel Board the external power supply connector X2 must be used. Otherwise the power supply can be routed from controller connector X1 to SKiiP®3 connector X10.
- F-Block 4: Forwarding of analogue signals from SKiiP®3 connector X10 to F-Option DIN-connector X1. Temp. ana OUT or U_{DC} ana OUT is available on X1 connector depending on SKiiP version.

5 Dimensions

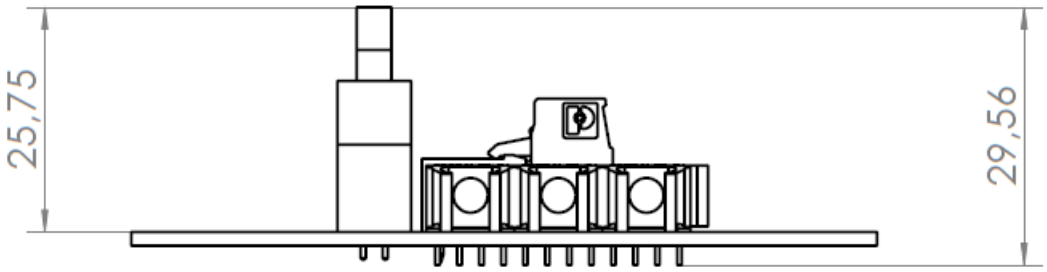
The mechanical dimensions of SKiiP®3 F-Option board, top view are shown in the Figure 5.1.

Figure 5.1: Mechanical dimensions of SKiiP®3 F-option board, top view



The mechanical dimensions of SKiiP®3 F-Option board, side view are shown in the Figure 5.2.

Figure 5.2: Mechanical dimensions of SKiiP®3 F-option board, side view



6 Mounting Instruction

Please note: For mounting of SKiiP®3 F-Option board on the top cover of SKiiP®3 the special plastic frame is necessary. The mounting or replacement of this frame can only be done by SEMIKRON!

Please refer to the Technical Explanation SKiiP®3 Parallel Board for information about mounting of F-Option on the SKiiP®3 Parallel Board.

7 Pin Description of DIN41651 connector X1 and X10

Please see Technical Explanation SKiiP®3 V3 Rev.02 Table 5-1: Pin description for further information. The pins which are not shown in the Figure 4.1 are not connected.

8 Pin Description of optical connectors H1, H2, H3

Table 1: Description of optical connectors H1, H2, H3

Connector	Type	Signal description
H1	Optical Receiver • Type: HFBR-2521, horizontal	Receives the PWM control signal for TOP-IGBT from the controller
H2	Optical Transmitter • Type: HFBR-1521, horizontal	Transmits the Error_OUT signal from SKiiP®3 driver to controller
H3	Optical Receiver • Type: HFBR-2521, horizontal	Receives the PWM control signal for BOT-IGBT from the controller

The following fiber optical cable type was used for the qualification: Leoni KHPS-HPS11005m. This fiber optic cable consists of:

- 2 optical connectors SXHP-SSO-19-0040 (incl. crimp barrel)
- 5m long optical fiber cable V2Y 1P980/1000.

9 Power Supply

Please note: The supply voltage for SKiiP®3 F-Option Board and connected device (SKiiP®3 system/Driver Board) can be provided over connector X1 if the voltage drop over the ribbon cable will not be too high due to the high supply current (please see corresponding data sheets for supply current formula). Otherwise the power supply connector X2 must be used.

The pin assignment of power supply connector X2 is shown in the Table 2.

Table 2: Power supply connector X2 pin assignment

Pin	Signal name	Function
01	+15V_{DC} IN	Supply voltage input for F-Option Board and connected device
02	GND	Ground
03	+24V_{DC} IN	Supply voltage input for F-Option Board and connected device

Table 3: Connection example of power supply connector X2

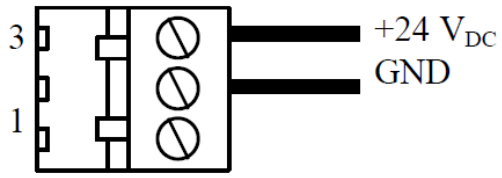
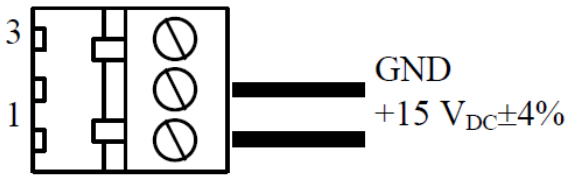
For 24V_{DC} supply	For 15V_{DC} supply
	

Table 4 shows the required features of an appropriate power supply for a SKiiP®3 system.

Table 4: Requirements of the power supply

Power supply	Supply voltage should be 13-30V. The supply is defined at the F-Option Board input.
Maximum rise time of 24V	< 2s
Rated current	1.5 times of the maximum SKiiP driver input current
Minimum peak	2 times of the maximum SKiiP driver input current (at least 1,5A)

For further information please refer to the Technical Explanation SKiiP®3.

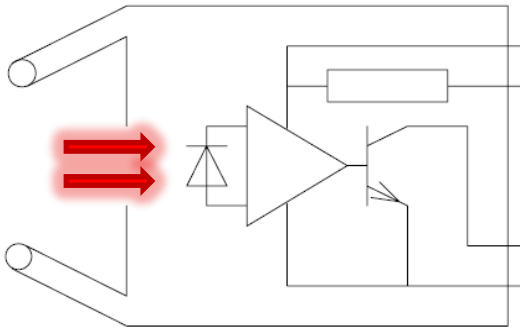
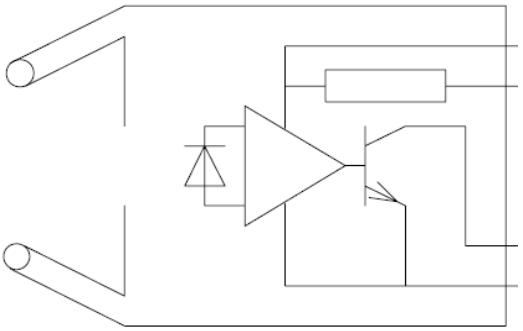
Please note: Power supply cable should be twisted or shielded to enhance the EMI robustness.

10 Optical Input/Output Signals

10.1 PWM TOP/BOT Signals

The PWM TOP/BOT optical signals could be described as follow: by recognised incoming light the IGBT will be switched on, by no light the IGBTwill be switched off. Please see Table 5.

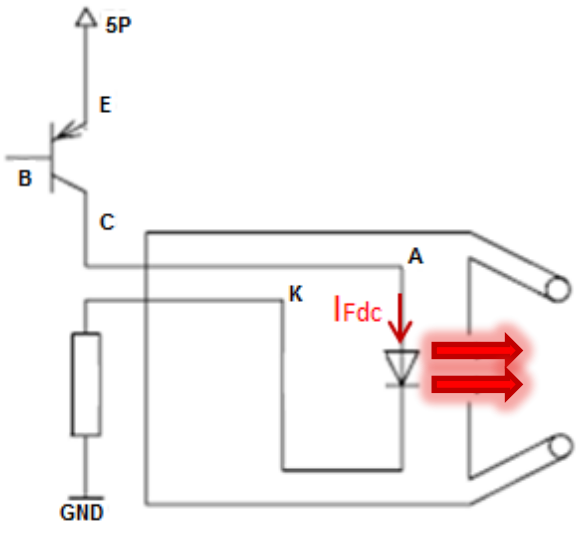
Table 5: PWM TOP/BOT optical signals on connectors H1/H3

Optical Receiver receives light	Optical Receiver receives no light
	
IGBT ON	IGBT OFF

Please note: A non-connected optical link will be considered as LOW signal (IGBT

If the light intensity is not sufficient the ERROR_OUT signal might be set. To avoid this the minimal transmitter current I_{Fdc} at the controller side should be at least 50 mA. Please see Figure 10.1 for example of the circuit for transmitter LED at the controller side.

Figure 10.1:Transmitter current controller side

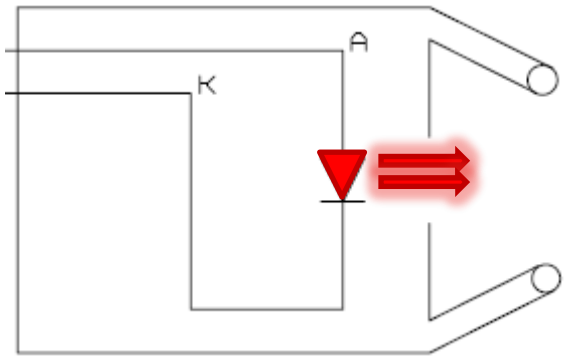
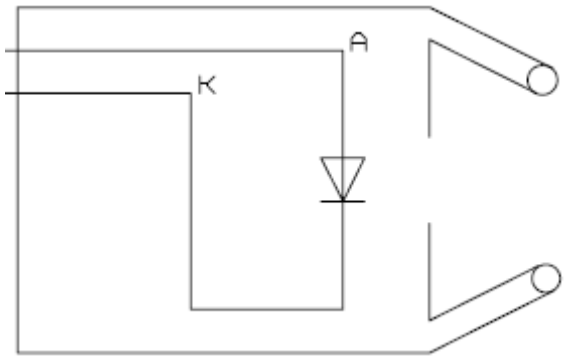


10.2 ERROR_OUT Signal

Characteristics and functionality:

- Shows the status of the IGBT driver
- For ERROR_OUT logic please see Table 6.

Table 6: ERROR_OUT optical signal on connector H2

Optical Transmitterr emits light	Optical Transmitter emits no light
	
No error	Error

The connected SKiiP®3 system sets the ERROR_OUT signal (Optical transmitter emits no light) if following happens:

- the unit is not ready to operate
- error happened

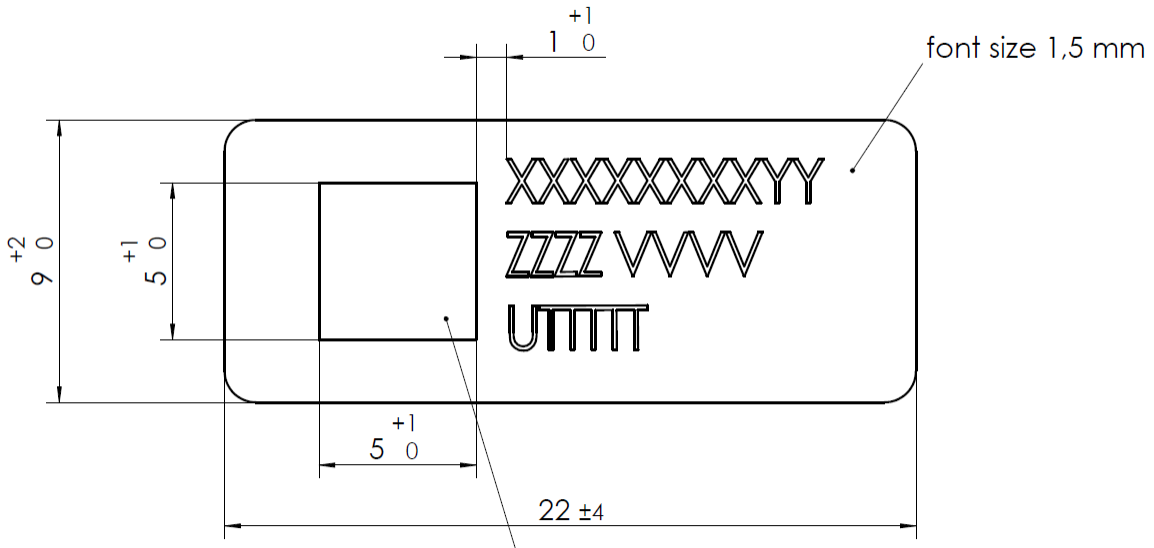
Please refer to the SKiiP®3 V3 Technical Explanation Rev.02 Chapter 5.2.6 for further information.

11 Analogue signals on connector X1

F-Option Board SKiiP®3 forwards analogue signals to connector X1 without any changes. For signal characteristics and further information please see Technical Explanation SKiiP®3 Rev.02 Chapter 5.3.8.

12 Logistics

Figure 12.1: Part Marking Information



Data-Matrix area:
max. 34 signs
cell dimension 0,254 - 0,3 mm
scan distance: 60-100mm
scan angle max 30 degrees of perpendicular angle

lettering Data-Matrix area:

XXXXXXXXYYZZZZVVVVUTTTTT
(L5022001NF04400001054229 for instance)

- accounts payable number (5-digit)
- country code (1-digit)
- continuous Lot-Nr. referenced to date code (4-digit)
- date code for instance 0440 year/week (4-digit)
- release of the Ident Nr. (2-digit)
- Ident Nr. (8-digit)

Label:
PE - foil (white sheeny) z.B. 0500XE-TT from manufacturer Förster-Etikettendruck
Operating temperature: min -40°C / max +100°C
Overprint waterproof and varnish resist

13 Provisions and handling after use

Components which are obsolete or defective must be disposed according to local regulations

List of figures:

List of tables:

References

[1] www.SEMIKRON.com
[2] A. Wintrich, U. Nicolai, W. Tursky, T. Reimann, “Application Manual Power Semiconductors”, ISLE Verlag 2011, ISBN 978-3-938843-666

HISTORY

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SEMIKRON INTERNATIONAL GmbH
P.O. Box 820251 • 90253 Nuremberg • Germany
Tel: +49 911-65 59-234 • Fax: +49 911-65 59-262
sales.skd@semikron.com • www.semikron.com