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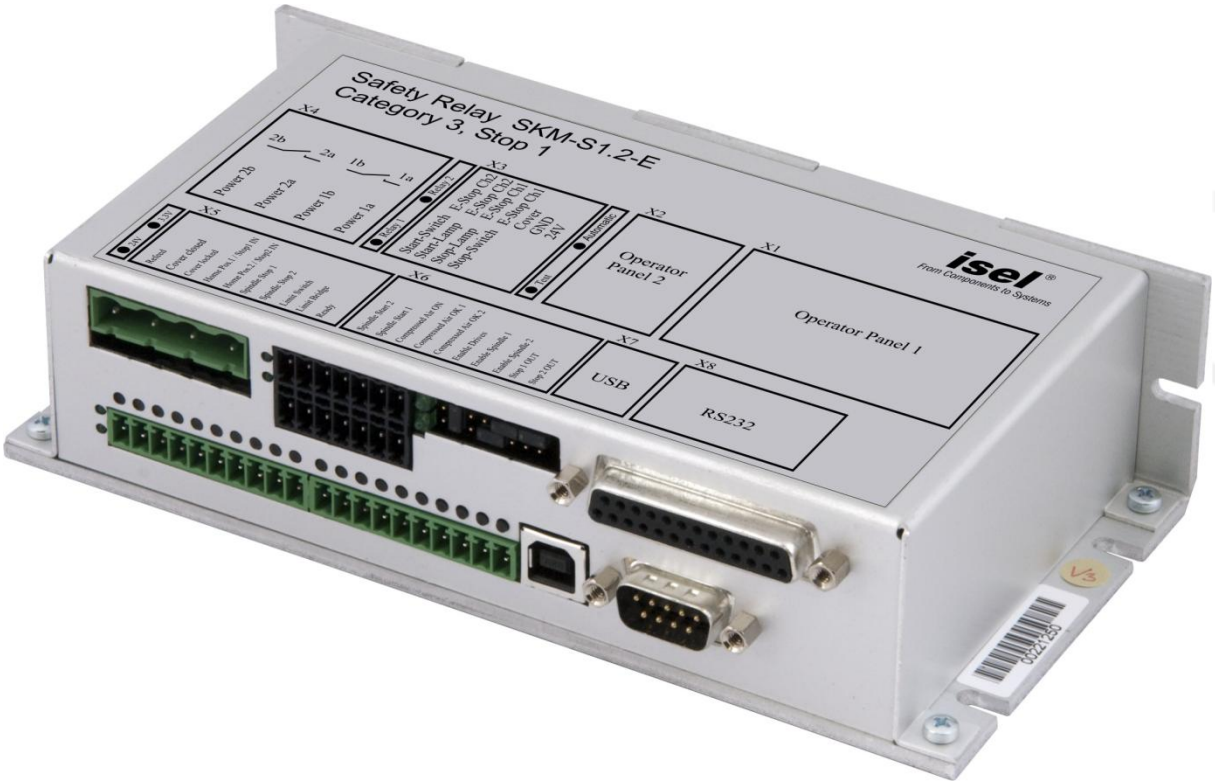

Safety Circuit Module SKM-S1.2-E

Operating Instruction

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About this manual

Used shortcuts

SCM **Safety Circuit Module**

Used symbols

You will find different symbols in this manual that signalizes important information/ facts and danger.

Warning!
This symbol indicates dangers that cause damages for person's health, physical injury or death.

Warning! Dangerous voltage!
Warning of danger from electricity. Ignoring can lead to serious injury or death.

Attention!
This Symbol indicates important notes. Ignoring this symbol leads to damages and malfunctions of the machinery

Information:

This symbol indicates important information and notes.

Observe the safety instructions

Before you make use of the module or integrate it into any CNC machine / CNC base machine or other equipment or make additions or changes to the module itself or the wiring of a machine / equipment make sure to read carefully the safety instructions in this manual (Chapter 1.3).

The information, technical data and dimensions contained in this print are up-to-date when published. Any possible misprints and mistakes cannot be excluded however. We are thankful for any suggestion for improvement and indication of mistakes.

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Item-no.: 970389 BE205
State: 07/2014

Technical specifications subject to change. Up to date Operating instructions and manuals for download you can find here:

www.isel-data.de/manuals

Table of contents

1. Introduction

1.1. Intended use

The **S**afety **C**ircuit **M**odule (in the following text named by the short cut **SCM**) SKM-S1.2-E is intended to be applicated for the safety related disconnection of power circuits in an ***isel*** CNC machine control. The SCM also controls the safety relevant components like motor power amplifier(s) and frequency converter(s) by monitoring sensor signals in an ***isel*** CNC machine control.

The SCM as a safety related device has to be used for operation:

- with EMERGENCY STOP devices corresponding EN ISO 13850:2008
- in safety control circuits corresponding EN 60204-1:2006

The SCM serves as a base module to control the whole safety circuit in an ***isel*** CNC machine control including the monitoring of interlocked doors, monitoring of (maximal 2) frequency converter(s) as well as monitoring the standstill of numerical axes (Standstill supervision).

Connecting a key switch to the SCM (the so called **Operating mode switch**) two modes (operating modes) can be selected: Automatic mode (**AUTO, chapter 3.4**) and Setup mode (**TEST, chapter 3.5**).

1.2. Safety symbols

Warning!
This symbol indicates dangers that cause damages for person's health, physical injury or death.

Warning! Dangerous voltage!
Warning of danger from electricity. Ignoring can lead to serious injury or death.

Attention!
This Symbol indicates important notes. Ignoring this symbol leads to damages and malfunctions of the machinery

Information:
This symbol indicates important information and notes.

1.3. Safety instructions

- The Safety Circuit Module SKM-S1.2-E is designed corresponding the current state of technics and the commonly accepted safety related regulations.
- Ambient temperature: +5°C to +40°C
- Storage temperature: –25°C to +70°C
- Do not expose the device (SCM) to high humidity or high vibrations.

- The device (SCM) may only be used if it is in correct condition. Any faults have to be eliminated immediately. Neither children nor non-authorized persons are allowed to put the device into operation.
- The device may only be used for the **intended use**.
- The **Safety category of SCM** can be warranted only with correct outside wiring / installation and by application of properly components, especially sensors and interface to / from inverters and motor power amplifiers.
- All work with the module (especially initial operation, putting into operation, installation, external wiring) must be executed from authorized personal regarding electrical industry rules and accident prevention regulations.
- Assembly and use of SCM has to be according to the standards of conformity declaration, as the **Machinery directive 2006/42/EU** as the **Low Voltage Directive 2006/95/EU**. In case of in proper use even the observation the respective rules and standards does not protect against physical damages and damage to property.
- Please take care of the instruction manual. Be sure that all users know the instructions.
- Ignoring the instruction manual can lead to damage, heavy physical damage or to death.

2. Technical data

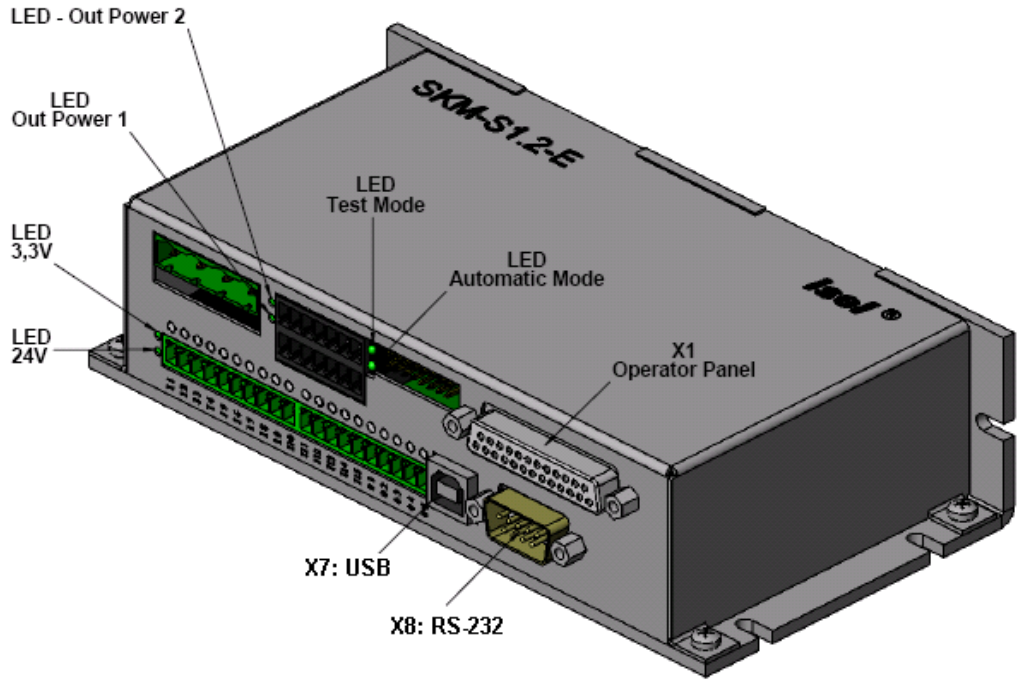
Size (**W**ide x **H**ight x **D**epth):	56mm (**W**) x 165mm (**H**) x 103mm (**D**)
Wight:	260 g
Safety class:	IP20
Power supply:	24VDC
Power consumption:	ca. 12 W (without periphery like e.g. door interlocking)
Ambient temperature:	5°C bis +40°C
Storage temperature:	-25°C bis +70°C
relative humidity:	max. 95%

STOP category:	1 (EN60204-1:2006)
Switch off delay:	app. 7 seconds

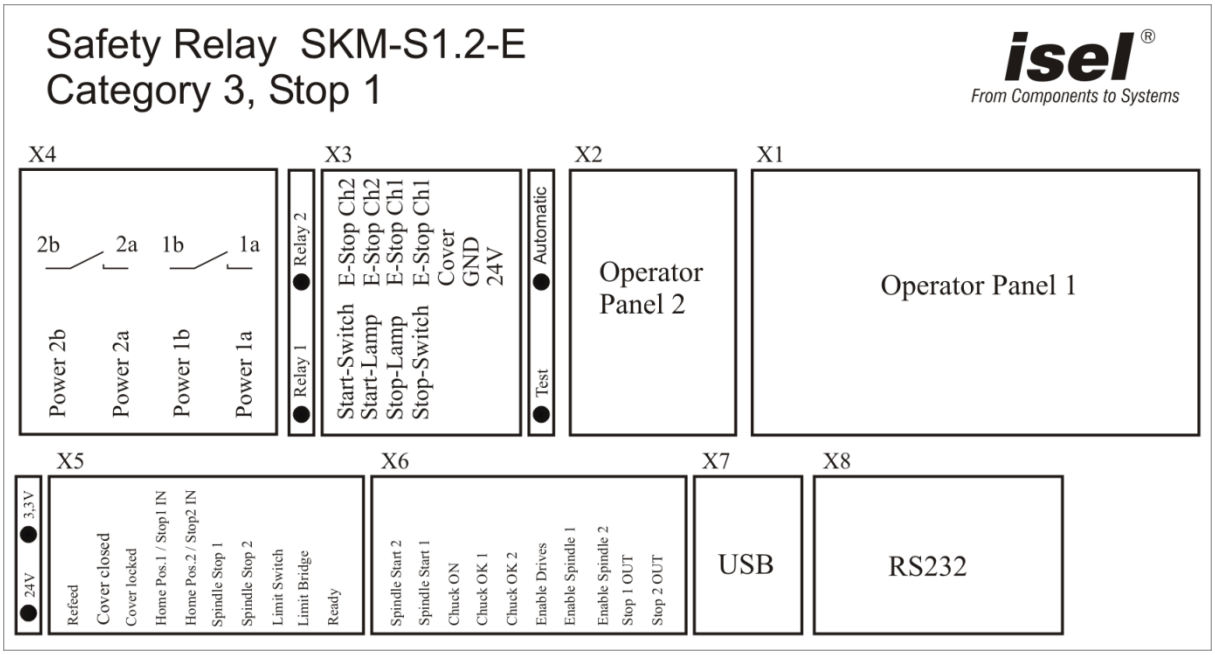
3. Functionality

3.1. Overview

3D view:



Marking:



3.2. Connectors, pin assignment

All signal inputs and outputs are 24VDC-compatible (except the RS232- and the USB-connection). A HIGH-level means +24VDC, a LOW-level means GND.

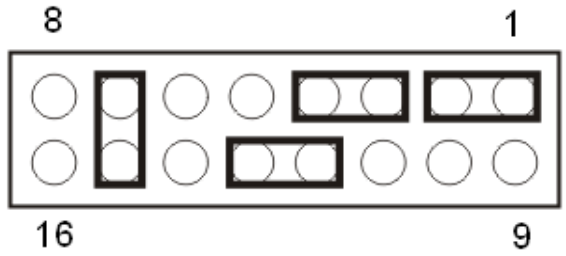
X1

SubD Female 25 pins
The female X1 can be used to connect the ***isel***-operator panel or the ***isel***-operator terminal.

Pin	Signal	Description
1	EMERGENCY STOP K1	EMERGENCY STOP Channel 1
2	E-Stop1	EMERGENCY STOP Channel 1
3	EMERGENCY STOP K2	EMERGENCY STOP Channel 2
4	E-Stop2	EMERGENCY STOP Channel 2
5	24V	24VDC
6	Power Switch	Power Schalter
7	Power Lamp	Power Lamp
8	24V	24VDC
9	Key Switch Test	Key switch TEST
10	Key Switch Auto	Key switch AUTO
11	24V	24VDC
12	Acceptance SW1	Acknowledge button Channel 1
13	24V	24VDC
14	Acceptance SW2	Acknowledge button Channel 2
15	Cover Open SW	Cover Button
16	Cover Open SW	Cover Button
17	GND	Groand
18	n.c.	Not connected
19	n.c.	Not connected
20	Fault Lamp	Fault Lamp
21	Start Switch	Start Button
22	Stop Switch	Stop Button
23	Start Lamp	Start Lamp
24	Stop Lamp	Stop Lamp
25	n.c.	Not connected

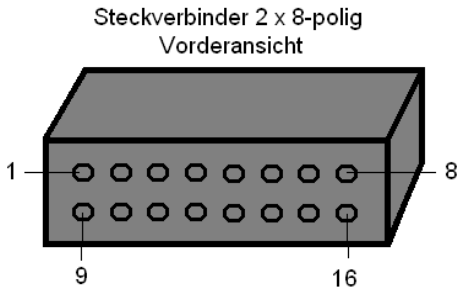
X2

2 x 8 pins Pin contact strip
The pin contact strip X2 can be used to connect an additional operating unit, e.g. an ***isel*** Joystick
Hints for using pin contact strip X2:
A: Using the SCM without additional operating unit
- Jumpers have to be mated if no additional operating unit is connected to X2

Front view	Pin	Signal
	1	EMERGENCY STOP Channel 1
	2	EMERGENCY STOP Channel 1
	3	EMERGENCY STOP Channel 2
	4	EMERGENCY STOP Channel 2
	5	Cover Lamp GND
	6	Key switch Test
	7	24VDC
	8	ACK 1
	9	24VDC
	10	ACK 2
	11	Cover
	12	Cover Open In
	13	Cover Open In 2
	14	not connected
	15	Operation mode
	16	not connected

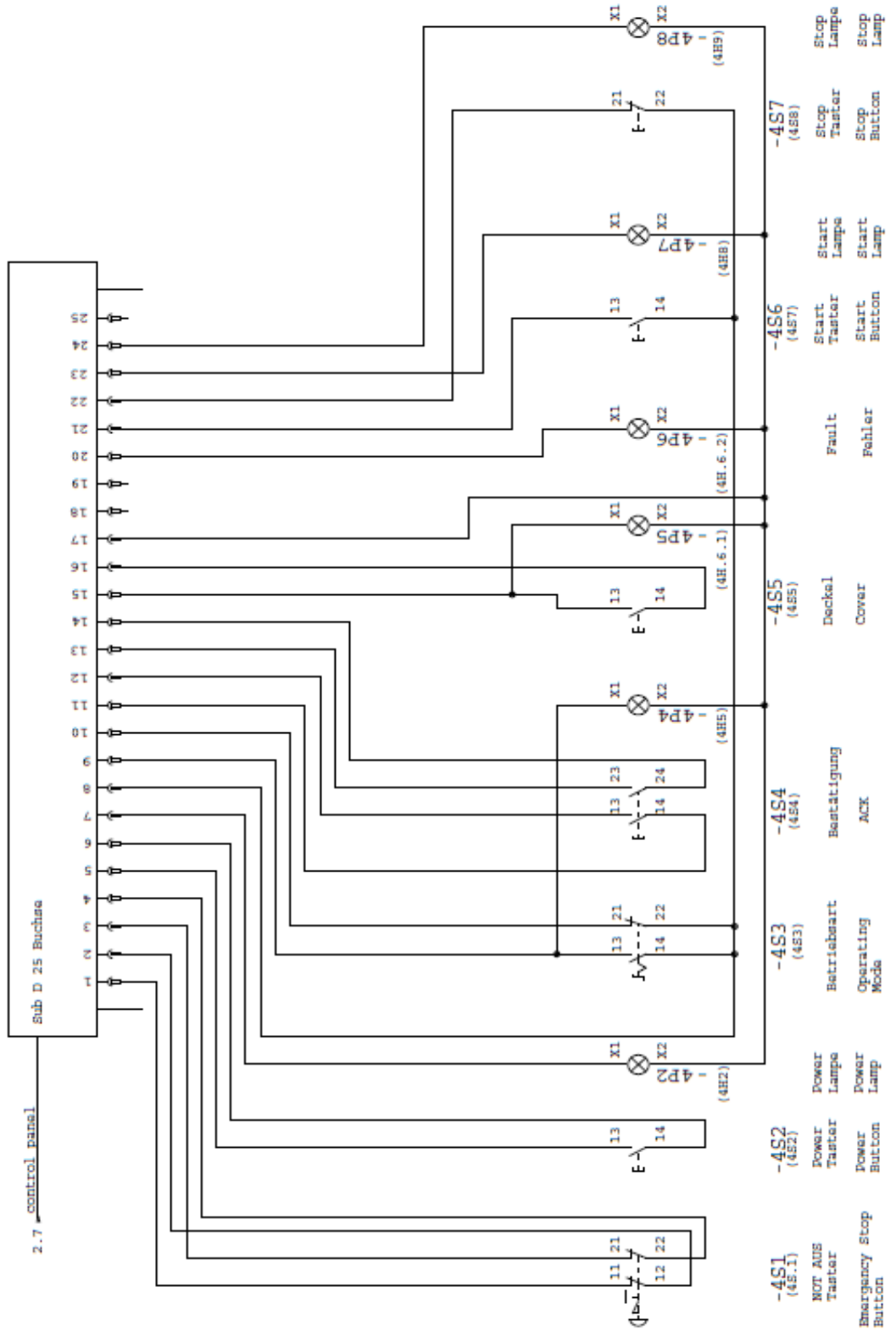
B : Using the SCM with additional operating unit (e.g. an ***isel*** Joystick)
- No Jumper hast to be mated
- The connection is done by an **adapter cable** from/to the round plug connector to the ***isel*** Joystick **(this** round plug connector is mounted in the left side of the control cabinet)

Pin assignment of **adapter cable**:

Front view	Pin	Signal	Color
	1	EMERGENCY STOP Channel 1	White
	2	EMERGENCY STOP Channel 1	Brown
	3	EMERGENCY STOP Channel 2	green
	4	EMERGENCY STOP Channel 2	yellow
	5	GND (Cover lamp)	gray
	6	n.c.	
	7	24VDC	blue
	8	ACK 1	red
	9	24VDC	black
	10	ACK 2	purple
	11	Cover Open Out (C)	gray/pink
	12	Cover Open In (NO)	red/blue
	13	n.c.	
	14	n.c.	
	15	n.c.	
	16	n.c.	

The resulting cable length when connecting external EMERGENCY STOP switch to the pins X2:1-2 or X3:6-7 (**channel 1**) resp. X2:3-4 or X3:4-5 (**channel 2**) is limited to **maximal 5 m** for each EMERGENCY STOP channel.

Basic pin assignment for Operator panel



X3

7x2 pins Phoenix Contact RM3,5

Pins	Signal	Description
1	24V	24VDC Voltage supply
2	GND	GND Voltage supply
3	Cover	Open Cover (unlock)
4	E-Stop Ch2	extern EMERGENCY STOP Channel 2
5	E-Stop Ch2	extern EMERGENCY STOP Channel 2
6	E-Stop Ch1	extern EMERGENCY STOP Channel 1
7	E-Stop Ch1	extern EMERGENCY STOP Channel 1
Pins		
8		
9		
10		
11	Stop Switch	Stop-Button
12	Stop Lamp	Lampe Stop-Button
13	Start Lamp	Lampe Start-Button
14	Start Switch	Start-Button

Pin (3) COVER can be used to connect the solenoid of a locking device. This output feeds HIGH-level (24VDC) when it is allowd to open the door.

Pins (4) to (7) can be used to connect an additional external EMERGENCY STOP-Switch. A two channel EMERGENCY STOP-Switch has to be used (2 x normally closed). If there is not needed any external EMERGENCY STOP switch so the pins have to be bridged.

Pins (11) and (14) support connecting of Start- and Stop-Button of an operator panel to an I/O module. The signals are 24V compatible.

Pin (11) - Stop Switch and Pin (14) Start Switch have to be connected with the corresponding inputs of such an I/O module.
Likewise the pins (12) Stop Lamp and (13) Start Lamp to signal specific states have to be connected with the corresponding outputs of such an I/O module.
Inside the Safety Circuit Module those signals are categorically directly connected from X1 to X2.

The resulting cable length when connecting external EMERGENCY STOP switch to the pins X2:1-2 or X3:6-7 (**channel 1**) resp. X2:3-4 or X3:4-5 (**channel 2**) is limited to **maximal 5 m** for each EMERGENCY STOP channel.

X4

4x1 pins Phoenix Contact RM7,62
2 potential free outputs 230VAC / 5A

Pin	Signal	Description
1	Power 1a	potential free Output 1a
2	Power 1b	potential free Output 1b
3	Power 2a	potential free Output 2a
4	Power 2b	potential free Output 2b

The potential free outputs

- **Power 1a - Power 1b**
- **Power 2a - Power 2b**

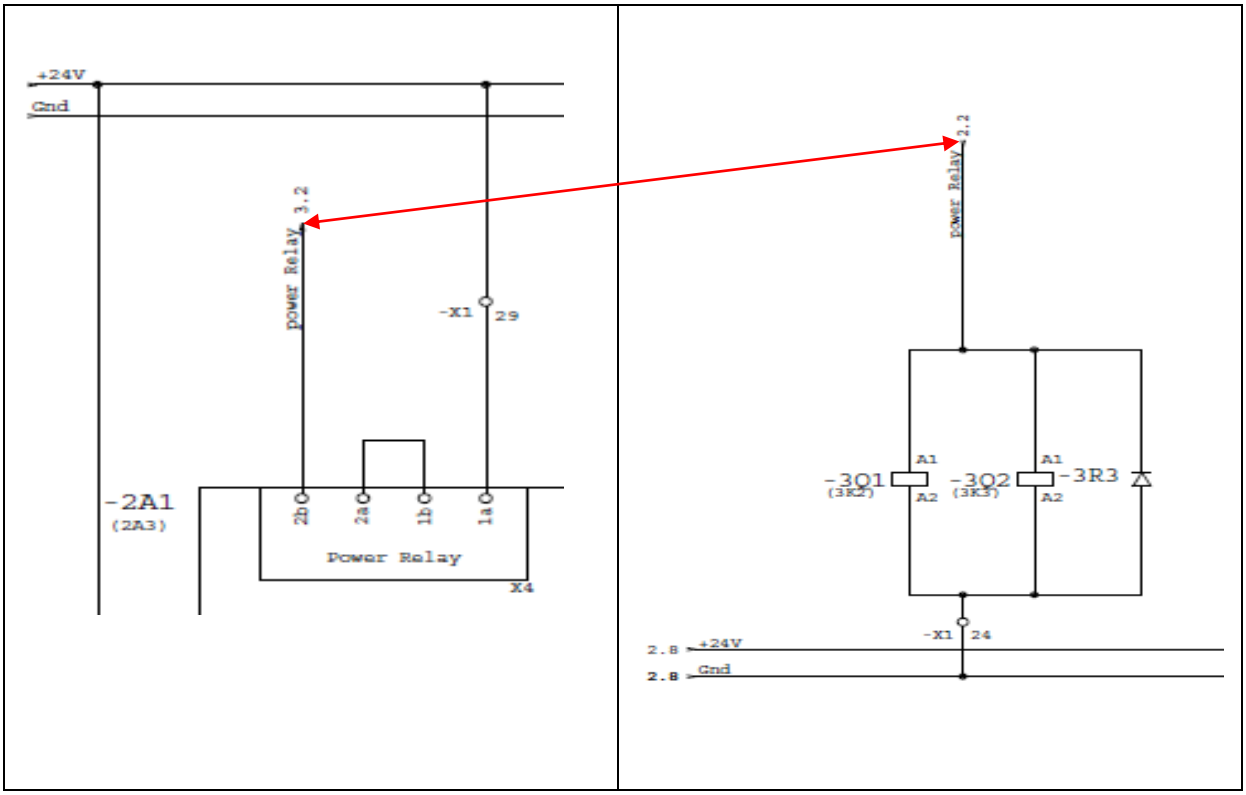
can switch a load (e.g. the primary AC net supply of a voltage supply device) directly if the power rating of contacts inside the SCM (**230VAC/5A**) is sufficient.

What to do if this power rating of contacts inside the SCM (**230VAC/5A**) is not sufficient ?
Increase the switchable load with the help of properly power relays.

Doing this be careful to use both channels
- 1st channel: **Power 1a - Power 1b**
- 2nd channel: **Power 2a - Power 2b**

in order to reach safety category (Redandancy).

Example:



X5

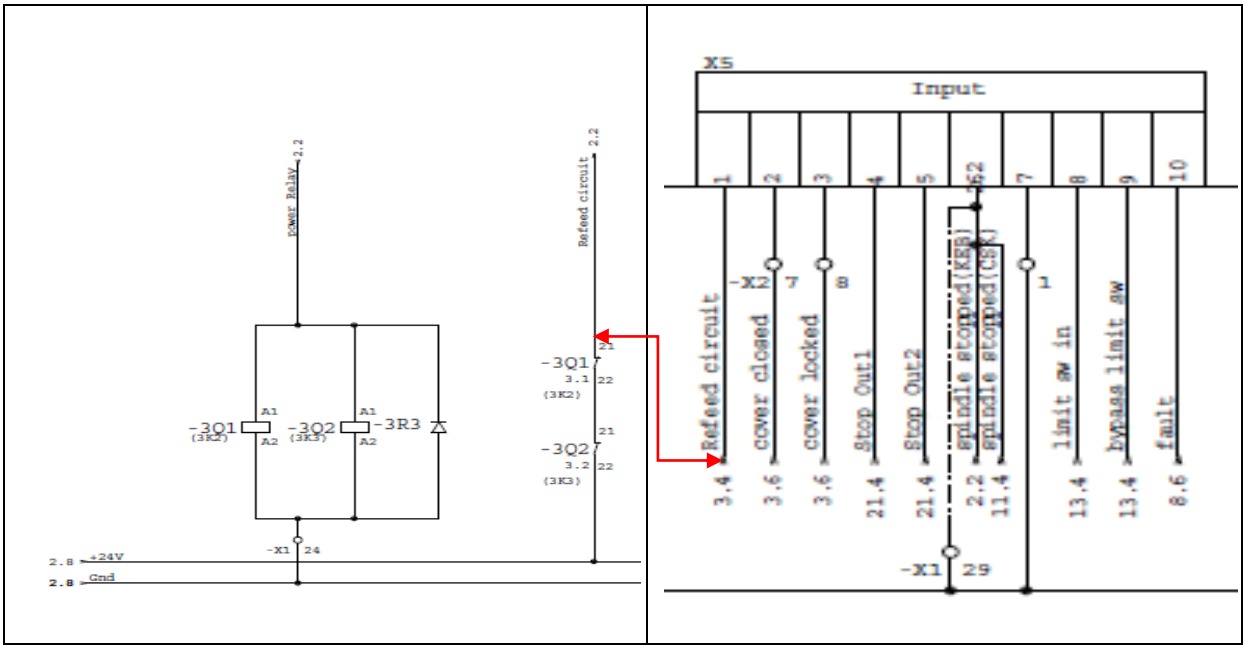
10x1 pins Phoenix Contact RM3,81

Inputs

Pin	Signal	Description
1	Refeed	IN Refeed circuit external power relay(s)
2	Cover closed	IN Hood / Cover closed
3	Cover locked	IN Hood / Cover locked
4	Home Pos.1 / Stop1 IN	IN clocked signal 1 Standstill monitoring Input
5	Home Pos.2 / Stop2 IN	IN clocked signal 2 Standstill monitoring Input
6	Spindle Stop 1	IN Spindle Standstill Signal 1
7	Spindle Stop 2	IN Spindle Standstill Signal 2
8	Limit Switch	IN Limit switch
9	Limit Bridge	IN Bridge Limit switches
10	Ready	IN no external fault (in components)

Pin (1) - **Refeed** – to be used as input for / from refeed circuit when external power relays are constituted.
In this case a +24VDC voltage is feeded over the forcibly actuated contacts of the power relay (normally closed) to this input of the SCM.

Example:



Pins (2) and (3) – **Cover Closed** and **Cover Locked** must both have a HIGH-Potential (24VDC) in order to signal a closed and locked door / hood / cover to the SCM.
That means: Two normally closed contacts are monitored here. Such normally closed contacts are included e.g. in the interlock device AZM 170 from Schmersal. This interlock device AZM 170 is a safety related part of control systems and used by ***isel Germany AG*** in CNC machinery.

Pin (4) **Home Pos.1 / Stop1 IN** and pin (5) **Home Pos.2 / Stop2 IN** – Standstill of all numerically controlled axes.
Signal 1 (4) and Signal 2 (5) are used for connecting the motor power amplifiers IMD10 (for BDC-Motors), IMD20 (for BLDC-Motores) resp. IMD 40 (for Synchronous motors) with standstill monitoring (2-channel, clocked).
Alternatively to those inputs (4) and (5) a 2-channel Home Position Sensor can be connected.

Pins (6) and (7) - **Spindle Stop1** and **Spindle Stop2** – are inputs to monitor the standstill of a working spindle. HIGH-Potential (24VDC) means here: Spindle stands still, does not rotate!

Pin (8) - **Limit Switch** – is used to monitor the state of hardware limit switches (in a hardware limit switch chain) over a sum signal. Here a HIGH-Potential is expected, reflecting the state „No limit switch activated“.
On the other side, a LOW-Potential is signaling that at least one of the connected limit switches (normally closed) of the numerically controlled axes is activated, also opened.

When a hardware limit switch is activated, this results in a shut off the main power supply (Stop-Category 1). So this main power supply can be switched on only if the limit switch error (Input=LOW) was redressed.

What to do if no hardware limit switch is used ?
Connect this input to HIGH-Potential (24VDC).

Pin (9) - **Limit Bridge** – is used to bridge the hardware limit switch chain.
If a HIGH-Potential is applied here any triggering of a hardware limit switchs will not result in power off the main voltage supply for motor power amplifiers.

This input can be used if numerically controlled axes with no explicit reference switch are applied.
Such axes have a so called **positive limit switch** and a **negative limit switch**. One of then must be used as a reference switch. Before starting homing (a reference run) this input is set to HIGH, so a power off during homing (and thus activating the limit switch) is prevented.

Pin (10) - **Ready** – This input monitors faults and / or malfunctions in components as e.g. frequency converters or motor power amplifiers.
A sum signal with HIGH-Potential means here that all components in the READY-chain are in Ready-State. LOW- Potential means fault or malfunction in at least one component.

If there is a fault or malfunction in any component so the Enable-Signals (outputs) for motor power amplifiers and frequency converters are reset until the malfunction is disposed.

X6

10x1 pins Phoenix Contact RM3,81: **5 Inputs**, **5 Outputs**

Pin	Signal	Description
1	Spindle Start 2	IN extern Start Spindle 2
2	Spindle Start 1	IN extern Start Spindle 1
3	Chuck ON	IN supervision work piece chuck on (activated)
4	Chuck OK 1	IN state signal 1 work piece chuck
5	Chuck OK 2	IN state signal 2 work piece chuck
6	Enable Drives	OUT Enable motor power amplifiers
7	Enable Spindle 1	OUT Enable Spindle 1 (Frequency converter 1)
8	Enable Spindle 2	OUT Enable Spindle 2 (Frequency converter 2)
9	Stop 1 OUT	OUT clocked signal 1 Standstill monitoring Output
10	Stop 2 OUT	OUT clocked signal 2 Standstill monitoring Output

Pin (1) – **Spindle 2 Start**: This input is used to connect an external control signal from an I/O-module or from a PLC in order to set the Output (8) Enable Spindle 2 (Frequency converter 2).
This input is combined with the module internal spindle enable by an AND-gate.
After an EMERGENCY STOP this Input must be switched to LOW-Level.

Pin (2) – **Spindle 1 Start**: This input is used to connect an external control signal from an I/O-module or from a PLC in order to set the Output (7) Enable Spindle 1 (Frequency converter 1).
This input is combined with the module internal spindle enable by an AND-gate.
After an EMERGENCY STOP this Input must be switched to LOW-Level.

Pin (3) – **Chuck ON**: This input must have HIGH-potential (24VDC) in order to activate the supervision of Work piece chuck (e.g. fixing the work piece on a vacuum chuck plate). Even if this input is not connected to HIGH-potential or LOW-potential (means the input is “open”) the supervision of Work piece chuck is active.

Pin (4) – **Chuck OK 1**: This input monitors the state of work piece chuck.
HIGH-Potential (24VDC) at this input signalizes the state „Work piece chuck OK“, e.g. „Vacuum available or pressure stable using a vacuum chuck plate“. If Pin (3) – **Chuck ON is not connected to HIGH-potential or LOW-potential**, this input has to feed LOW-potential (0VDC) that Pin (7) – **Enable Spindle 1** resp. Pin (8) – **Enable Spindle 2** can output / generate High-Signal to enable working spindle 1 resp. 2.

Pin (5) – **Chuck OK 2**: This input monitors the state of work piece chuck.
LOW-Potential (0VDC) at this input signalizes the state „Work piece chuck OK“, e.g. „Vacuum available or pressure stable using a vacuum chuck plate“. If Pin (3) – **Chuck ON is not connected to HIGH-potential or LOW-potential**, this input has to feed HIGH-potential (24VDC) that Pin (7) – **Enable Spindle 1** resp. Pin (8) – **Enable Spindle 2** can output / generate High-Signal to enable working spindle 1 resp. 2.

Pin (6) – **Enable Drives**: This output has a HIGH-potential (24VDC) to enable motor power amplifiers, if switching contacts Power 2b – Power 2a **and** switching contacts Power 1b – Power 1a (**X4** Pin1 to 4) are closed. This state is optically signaled through lighting of both green LEDs Relay 1 and Relay 2 between the Female X3 and X4.

Pin (7) – **Enable Spindle 1**: This output generates a High-Signal to enable working spindle 1 (Frequency converter 1).
Pin (8) – **Enable Spindle 2**: This output generates a High-Signal to enable working spindle 2 (Frequency converter 2).

Pin (9) – **Stop 1 OUT**: This output drives the clocked signal 1 for standstill monitoring of all numerically controlled axes.
Pin (10) – **Stop 2 OUT**: This output drives the clocked signal 1 for standstill monitoring of all numerically controlled axes.

The inputs at **X5**

- Pin (1) – **Refeed**
- Pin (6) – **Spindle Stop1**
- Pin (7) – **Spindle Stop2**
- Pin (8) – **Limit Switch**
- Pin (10) – **Ready**

and the inputs at **X6**

- Pin (1) – **Spindle 2 Start**
- Pin (2) – **Spindle 1 Start**

influence the Enable (**Enable Drives**) for motor power amplifiers.

The following equation is valid: (**AND**: AND-combination, **NOT**: negation):

Enable Drives = Refeed AND Spindle Stop1 AND Spindle Stop2
AND Limit Switch AND Ready
AND [NOT Spindle 1 Start]
AND [NOT Spindle 2 Start]

The inputs at **X6**

- Pin (3) – **Chuck ON**
- Pin (4) – **Chuck OK 1**
- Pin (5) – **Chuck OK 2**

influence the Enable (**Enable Spindle 1/2**) for working spindle 1 (Frequency converter 1) resp. for working spindle 2 (Frequency converter 2) and Enable Drives.
If both module internal safety relays have switched on **and** supervision of work piece chuck is activated, means if:

Pin (3) – **Chuck ON**: this input has HIGH-Potential (24VDC)

For this the following equation is valid: (**AND**: AND-combination, **NOT**: negation)

Enable Spindle 1 = Limit Switch AND Ready AND Spindle 1 Start
AND Chuck OK 1 AND [NOT Chuck OK 2]

Enable Spindle 2 = Limit Switch AND Ready AND Spindle 2 Start
AND Chuck OK 1 AND [NOT Chuck OK 2]

X7

USB B Female
USB

Important hint:
Those with (optional *) marked signals in the following table are reserved for future extensions of functionality of the Safety Circuit Module. They are not supported in the current version of SCM device.
.

Pin	Signal	Description
1	VCC USB	(optional *)
2	USB D-	USB Data- (optional *)
3	USB D+	USB Data+ (optional *)
4	GND	(optional *)

X8

SubD Female 9 pins
RS-232

Pin	Signal	Description
1	Not used	
2	RXD	RS232 RXD
3	TXD	RS232 TXD
4	Not used	
5	GND	RS232 GND
6	ICSP VPP	Programming voltage Flash Controller
7	ICSP CLK	Programming (Clock) Flash Controller
8	ICSP Data	Programming (Data) Flash Controller
9	3,3V	

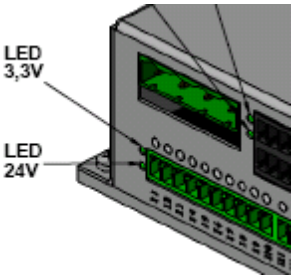
This serial connection is used as diagnosis interface.
For this purpose a cable should be used which only needs three signal lines (RXD, TXD, GND) for serial data communication. Be careful: The signal lines for RXD and TXD have to be crossed.

No standard “Zero modem cable” may be used, because this will produce problems with the pins for Flash programming (Pins 6, 7, 8 and 9).

3.3. Indications for monitoring

The Safety Circuit Module SKM-S1.2-E has several service LEDs (see chapter 3.1).

There are:
- LEDs for Signaling active Outputs = HIGH (yellow)
- LEDs for Signaling active Inputs = HIGH (green)
- LEDs for Signaling the voltage supply (3,3VDC for controller/logic, 24VDC for external power supply)
- LEDs for signaling operation mode: one LED for TEST, one LED for AUTO
- LEDs for signaling the state of the module internal power relays (Relay 1, Relay 2) switched on/off



A blinking LED for 3,3VDC signalizes as the correct voltage supply as the correct communication with the Host-PC via RS-232

3.4. Operating mode Automatic (AUTO)

The operating mode Automatic (AUTO) represents the standard / normal operating mode of a CNC machinery or CNC system. In this mode the application program is running on the CNC controller, the work piece is processed.

At run time of the application program the door / cover of the machine has to be closed and is locked. In this state an access into the working space is prevented.

In case of
- opening the door forcibly when the machinery axes are moving
- the home position is left and the door / cover is open
- at least one numerically controlled axis is moving and the door / cover is open

the power supply for motor power amplifiers is switched off and the Enable signals
- Enable Drives
- Enable Spindle 1
- Enable Spindle 2

to the components change to LOW-Level.

In operating mode Automatic (AUTO) the door / cover can be opened if:
- the axes of the machine are in Home-Position **or** all numerical axes do not move (axes standstill) **and**
- the working spindle(s) is (are) switched off (spindle standstill).

3.5. Operating mode Setup (TEST)

In operating mode Setup (TEST) the monitoring of the door / cover is deactivated. So you can open the door / cover also when the numerically controlled axes of the machinery / system are moving.

In operating mode Setup (TEST) the frequency converter driving the working spindle is always disabled,
so the spindle can't be switched on !

The functionality of the machine / system is kept in a way that the axes are moving with the programmed velocity (as normal motion as fast motion), but the working spindle will never rotate.

But opening the door / cover is combined with triggering the **Acknowledge-button (ACK-Button) on the operator panel or the operator terminal or the front side** of the CNC controller.

This **Acknowledge-button (ACK-Button)** has to be pushed permanently when the door / cover is open.

Releasing the **Acknowledge-button (ACK-Button)** when the door / cover is open causes an EMERGENCY STOP and therewith a switch off the power voltage supply for the motor power amplifiers and for the frequency converter(s) driving the working spindle(s).

In **operating mode Setup (TEST)** safety relevant sensors / inputs (the **Cover Closed** and **Cover Locked** signals) are not monitored as long as the ACK button is pushed by the operator!

As user you are obligated to instruct your operator staff about possible hazards.

The operating mode **Setup (TEST)** can only be activated when the key switch **on the operator panel or the operator terminal or the front side** of the CNC controller is turned from position AUTO to position TEST.

Save the key switch carefully and do never pass it to unauthorized person!

In order to achieve a maximal protection for the operator especially the instructions in the **Machinery directive 2006/42/EU** have to be respected (e.g. reducing velocity for axes motions, tipp mode).

The **operator panel and the operator terminal** provided by ***isel*** Germany AG have as a **2-channel EMERGENCY STOP-button** as an **Acknowledge-button (ACK-Button).**

4. Software

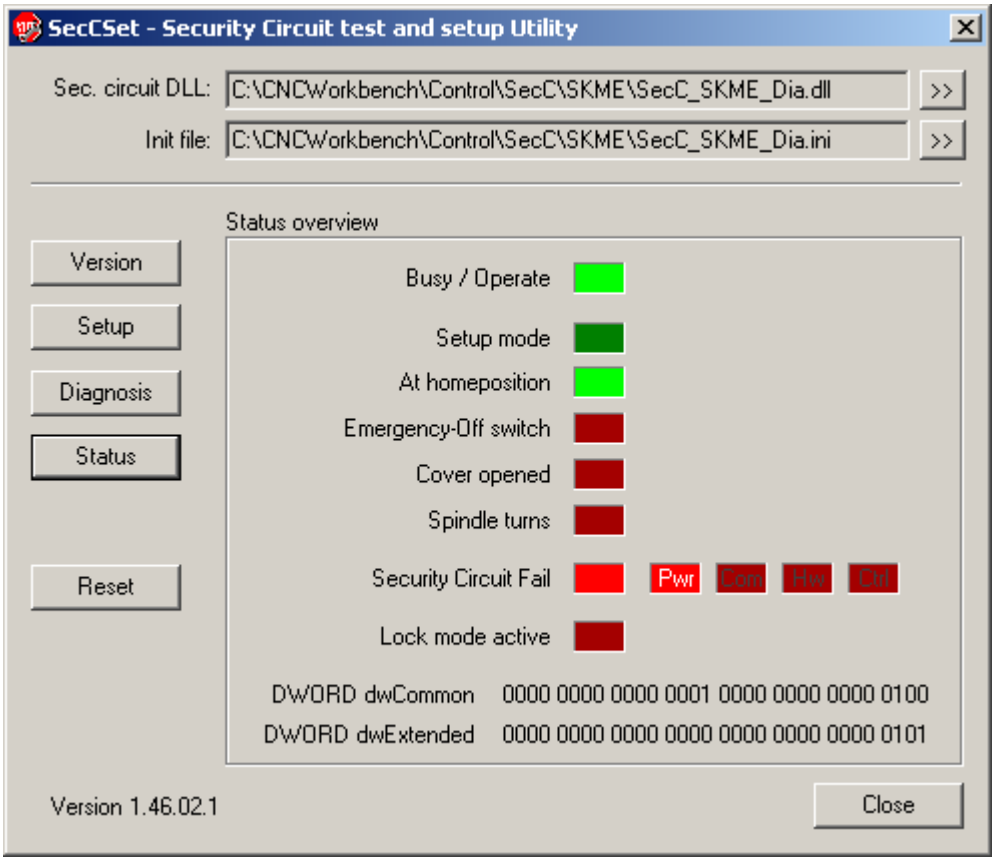
Having installed the software Remote or ProNC the folder

***drive*:\CNCWorkbench\Bin**

contains the executable file **SecCSet.exe** (executable program).

When you start this program you can change different settings of the Safety Circuit Module SKM-S1.2-E or you can request important status information from the module via serial connection to the Host-PC (RS-232). So the user is able to recognize most of the problems and to do efficient diagnosis to find the causes of those problems.

Having started the program **SecCSet.exe** you should see the following dialog:



In case the upper two edit fields (Sec.circuit DLL: / Init file:) contain no drive, path and name of the DLL for the Safety Circuit Module SKM-S1.2-E you should click on the buttons with double arrow “>>” and select the corresponding files (DLL and the Init file) using the file select box.

In the dialog shown above you can see four buttons (on the left upper side: Version, Setup, Diagnose, Status). A mouse click on those buttons will open further dialog windows providing more functions (the description of the functionality will follow in this chapter). Use the button „Close“ to end the program.

Status indication:

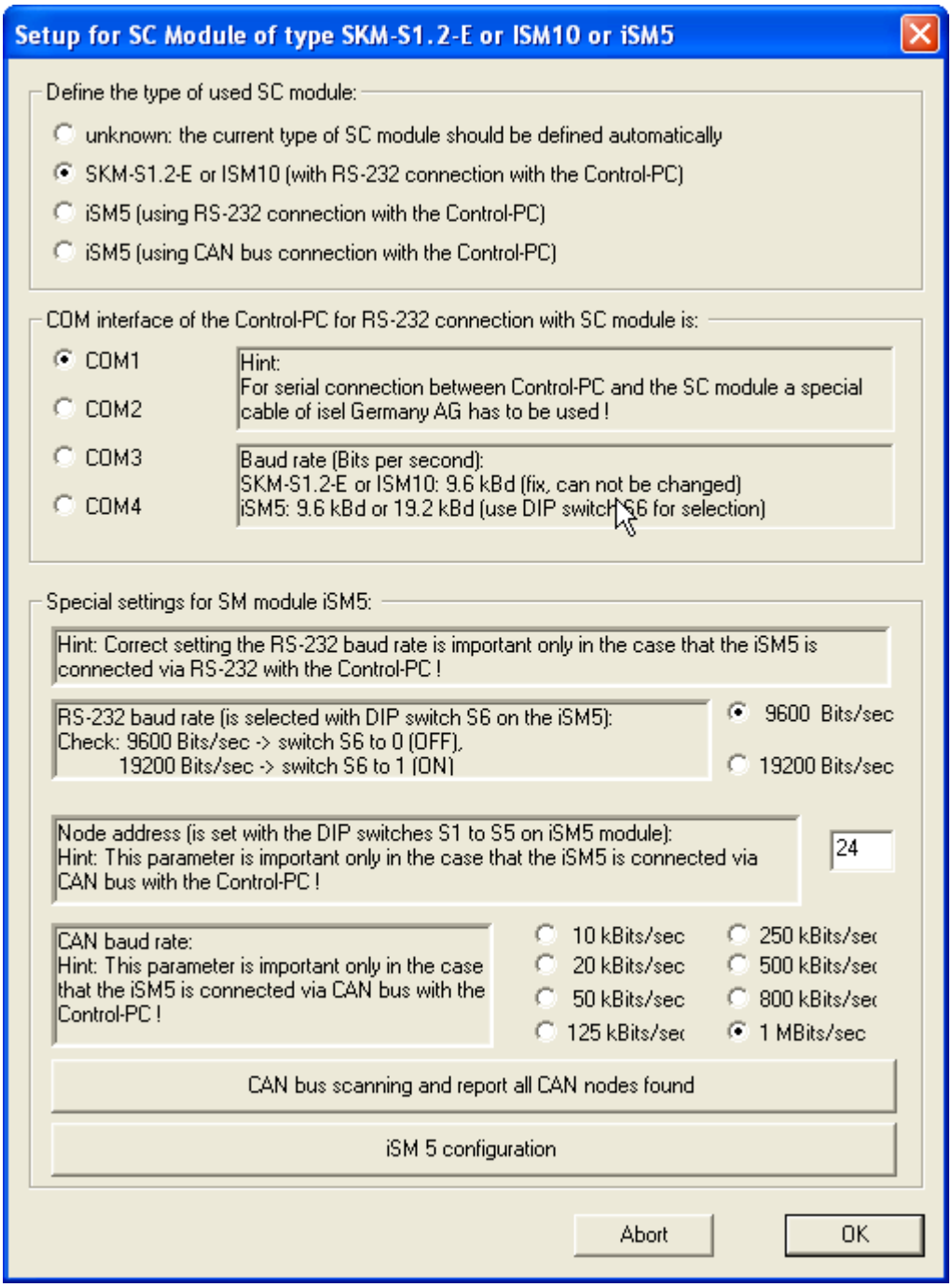
Busy / Operate	- Safety Module in operation
Setup mode	- Mode of operation „Setup mode“ was activated by key switch
At Homeposition	- Axes of the machine are in Homeposition
Emergency-Off switch	- Emergency-Off switch applied
Cover opened	- Cover or sliding door oft he machine is open
Spindle turns	- Hauptspindleantrieb dreht sich (kein Spindlestillstand)
Security Circuit Fail	- Hardware fault in Safety Circuit Module or Security Circuit
Lock mode active	- Currently not used

4.1. Dialog to request Version information

This dialog shows as the current version of the Software DLL as the hardware and software version from the Safety Circuit Module. This information is helpful if you have questions according the functionality of the module or problems in using the module.

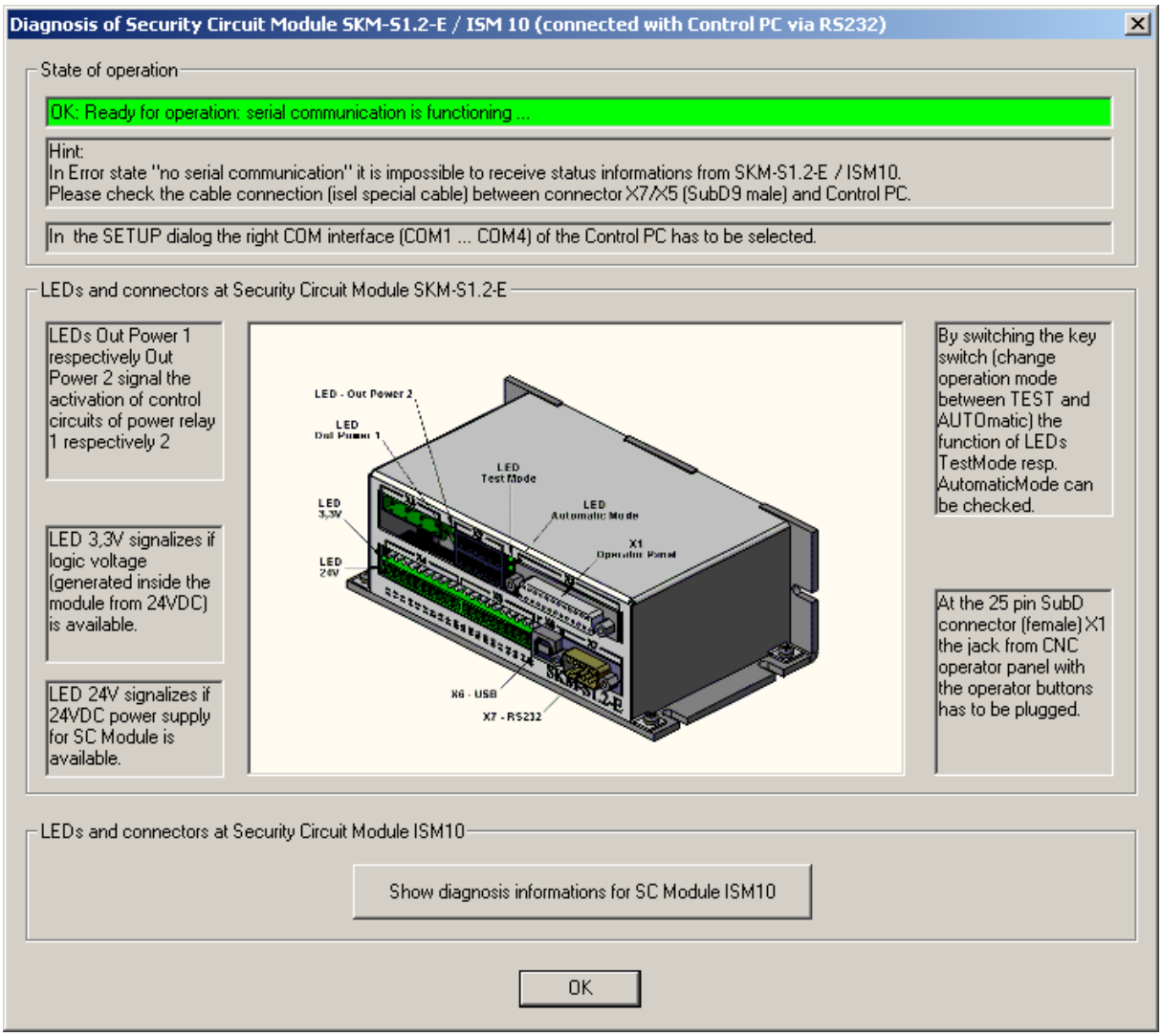
Please keep this data in mind if you have questions to our service staff.

4.2. Dialog for Setup



This dialog can be used to define the basic parameters of the Safety control. In the upper area the used COM interface of the Control PC (where the control software ProNC or Remote is running) must be selected with the help of radio button COM 1 to COM4. If you choose a wrong COM interface any communication between Safety Circuit Module and the Control PC is impossible.

4.3. Dialog for Diagnosis



The upper area „State of operation“ is used to show current status messages (colored green in case of OK or colored red in case of fault). In case of problems / fault please care about the hint given in this area of dialog.

The lower area of the dialog shows information according the LEDs and the connector to the operator panel with the key switch. Use the key switch to change operation mode between AUTO and TEST.

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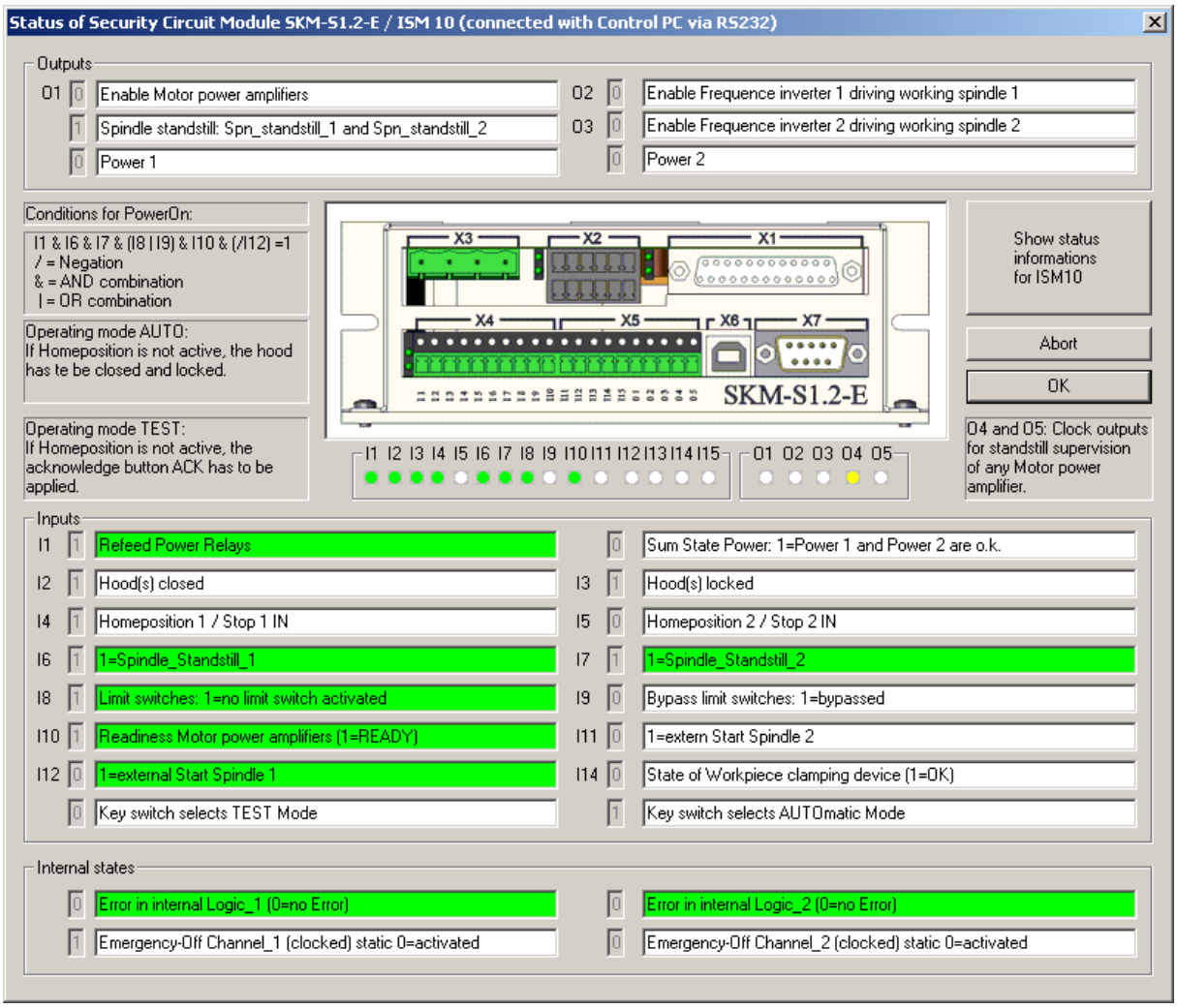
4.4. Dialog for Status Request



The current state of inputs (I1 to I15) and outputs (O1 to O5) of the Safety Circuit Module is requested cyclically by the Control PC via RS232 (the selected COM interface) from the Safety Circuit Module. This current state is shown in the Status dialog with a refresh interval of about 200 msec.

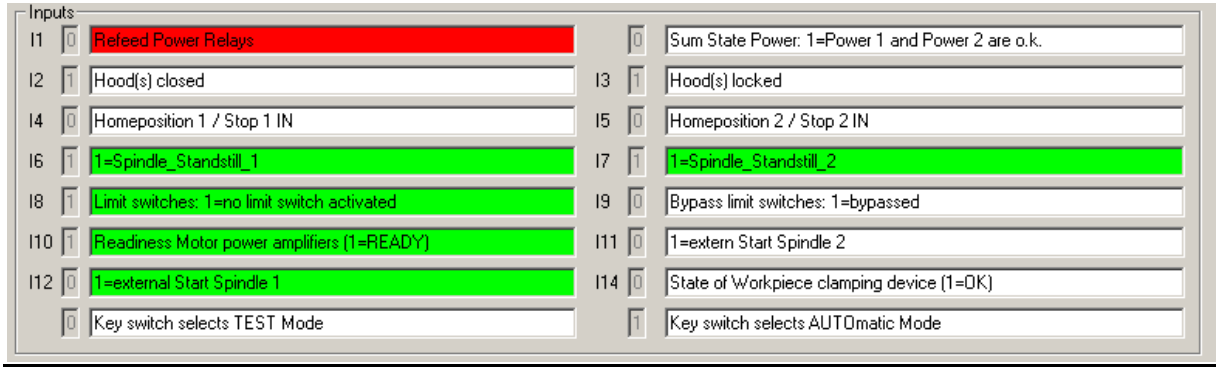
The area ahead in the dialog (left from the frontal view of Safety Circuit Module) shows the Conditions for PowerOn the Operation Voltage supply for the Servo motor amplifiers.

The logic equation (**&** is a logical AND connection, | is a logical OR connection, ***/*** means a negation) must be true to be able to switch on Operation Voltage supply for the Servo motor amplifiers.

This situation is shown in the dialog screen shot above:
All relevant Inputs (I1, I6, I7, I8, I10 and I12) are marked green and no Errors in internal Logic (see: Internal states) of the Safety Circuit Module are active.

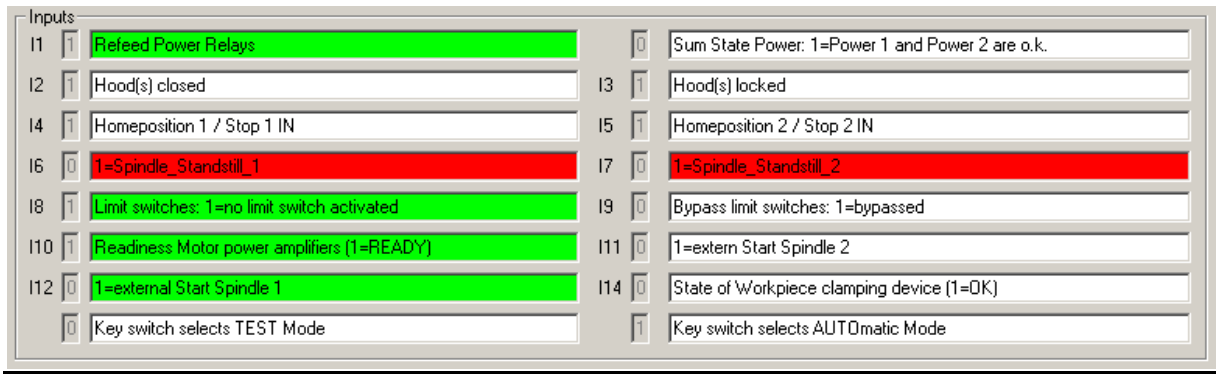
The following fault states (red marked) impede Power On the Operating voltage supply for motor amplifiers by pushing the PowerOn button on the operator panel / operator terminal:

Input I1=0 -> „Reefed Power Relays“ signalizes a fault:



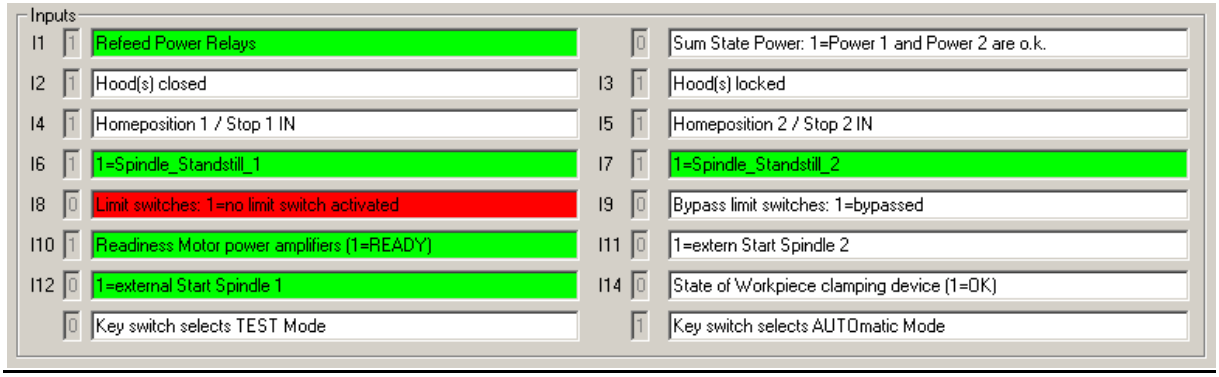
Fault reason: The / at least one main relay inside the control cabinet (Load circuit) did not open when EMERGENCY STOP was activated.

Input I6=0 / Input I7=0 -> „Spindle_Standstill_1“ or „Spindle_Standstill_2“ or both (redandant) inputs signalize that the working spindle is still rotating, e.g. there is no spindle standstill.



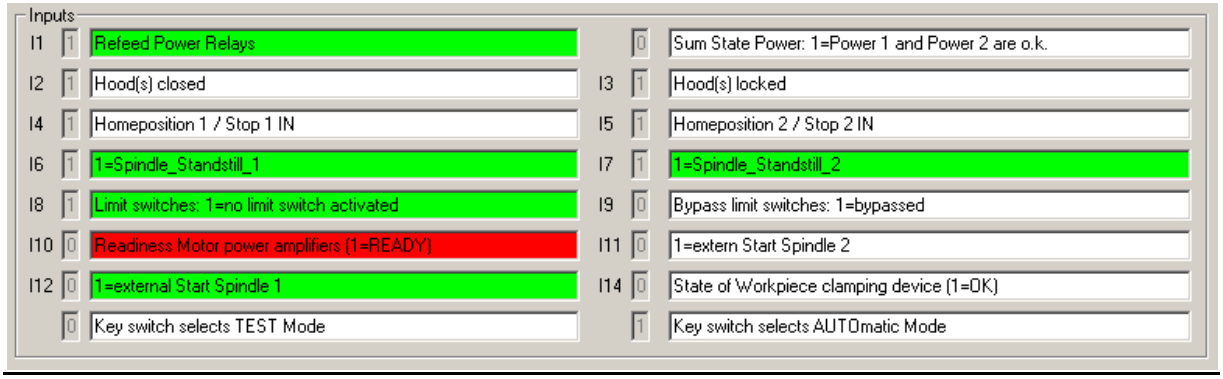
Fault reason: Working spindle is still rotating or faulty output „Spindle standstill“ of the frequency converter or faulty cabling of output „Spindle standstill“ from the frequency converter to the SC module

Input I8=0 -> „Limit switches …“ signalizes a fault:



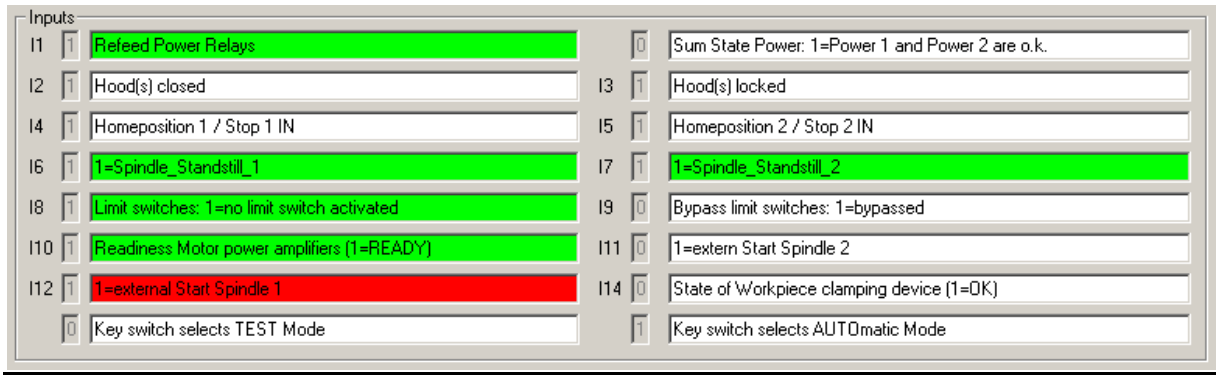
Fault reason: In (at least) one axis of the CNC machine a (hardware) limit switch was / is activated.

Input I10=0 -> „Readiness Motor power amplifiers …“ signalizes a fault:



Fault reason: Sum fault signal -> (at least) one motor power amplifier inside the control cabinet signalizes an error, e.g. encoder fault, temperature fault or CAN Bus communication error.

Input I12=1 -> „external Start Spindle 1“ signalizes a fault state:



Fault reason: An active Input I12 („external Start Spindle 1“) impedes switch on the operating voltage supply for motor power amplifiers / frequency converter for working spindle in order to scotch a restart of working spindle. .

Internal faults inside the logic arrays (PLAs) of the Safety Circuit Module are signalized as follows:

Fault reasons can be:

1. Key switch inputs to the SCM are not anticoincidencely
2. Faulty connection or contact fault inside the two-channel EMERGENCY STOP device (e.g. cross short cut between channel 1 and channel 2 of EMERGENCY STOP device)
3. Active sum fault signal I10 -> missing Readiness Motor power amplifiers
4. Faulty logic inputs (Redandancy inside the internal Logic arrays)

The internal faults 1, 2 and 4 in the SCM can be cleared only by PowerOn Reset, that means switch off -> wait one second -> switch on the 24VDC power supply to the SCM.