

 Micro Detectors	M.D. Micro Detectors Strada S. Caterina, 235 41122 Modena Italy Tel. +39 059 420411 Fax +39 059 253973 www.microdetectors.com info@microdetectors.com	<b>SB400</b> <b>Safety Modules</b>	<b>LANGUAGE</b>
		<b>Installation and Operation Manual</b>	<b>ENGLISH</b>



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**!** This symbol indicates an important personal safety warning. Failure to comply with the warning may result in very high risk for exposed personnel.

## 1.0 INTRODUCTION

The SB400 interface, connected to an IEC 61496 – ½ certified type 4 safety light curtain and equipped with two auto controlled PNP type solid-state outputs, is a type 4 ESPE (Electro sensitive Protective Equipment).

The other characteristics indicated above remaining constant, if the light curtain is type 2, the entire ESPE will be type 2.

### The SB400 main features are the following:

- Inputs for the connection of one safety barrier with fail safe outputs
- Restart manual or automatic selectable
- 2 N.O. outputs with guided contact safety relays
- 1 system monitor PNP output
- 1 external contactors feedback input

### The safety modules also guarantees that:

- the output lines are open if the barrier is intercepted;
- the output lines are enabled only with correct response times;
- in manual mode, maintenance of the RESTART contact closed is not interpreted as AUTO mode.

**!** For safe use of the device, it is essential to read and understand the contents of this handbook.  
**!** Failure to comply with the prescriptions indicated in this handbook may result in very high risks for the operating personnel of the machine protected.

## 2.0 SB400 MODULE

### 2.1 OPERATING MODES DESCRIPTION

OPERATING MODES SELECTION		
TERMINAL 5	TERMINAL 6	OPERATION
0 Vdc	+24 Vdc	Automatic
+24 Vdc	0 Vdc	Manual
0 Vdc	0 Vdc	Non-permissible conditions
+24 Vdc	+24 Vdc	

Table 1

#### 2.1.1 AUTOMATIC

In this operating mode, the outputs of the safety module follow the status of the photocell:

- with the protected area free (outputs of the barrier active), the relay outputs of the control unit are active.
- with the protected area occupied (outputs of the barrier de-activated), the relay outputs of the safety module are de-activated.

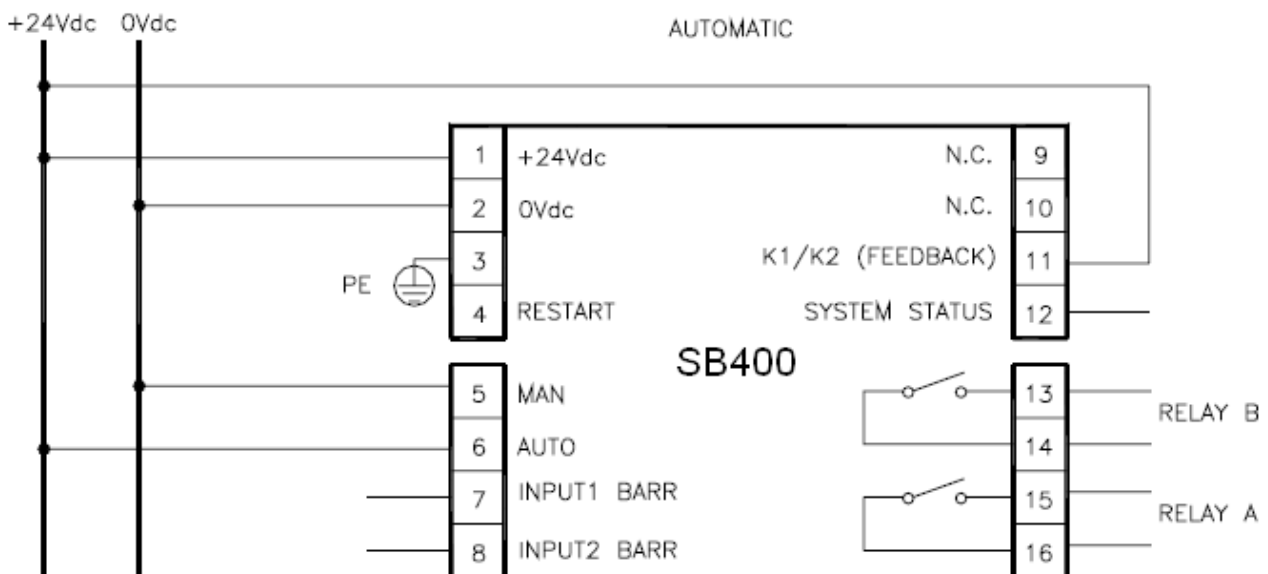


Figure 1

**!** Use in manual mode (start/restart interlock activated) is mandatory in the case in which the safety device controls an access protecting a danger zone and once a person has passed through the opening, he/she may remain in the danger zone without being detected (use as trip device according to IEC 61496). Failure to comply with this rule may result in very serious risks for the persons exposed.

**!** Check correct functioning of the entire safety system (control unit+barrier) following each re-installation. In particular, if the original operating mode was Manual, check that the unit has been reconfigured in this mode.

### 2.1.2 MANUAL

In this operating mode, the outputs of the control unit are activated only if the protected area is free and after sending the RESTART signal to the control unit using the push-button or by means of a specific command on the RESTART input (terminal 4).

Once the protected area has been occupied, the relay outputs are deactivated. The sequence described above must be repeated in order to re-activate them.

The RESTART command is active with a voltage of 24 Vdc.

The minimum duration of the command is 100 ms.

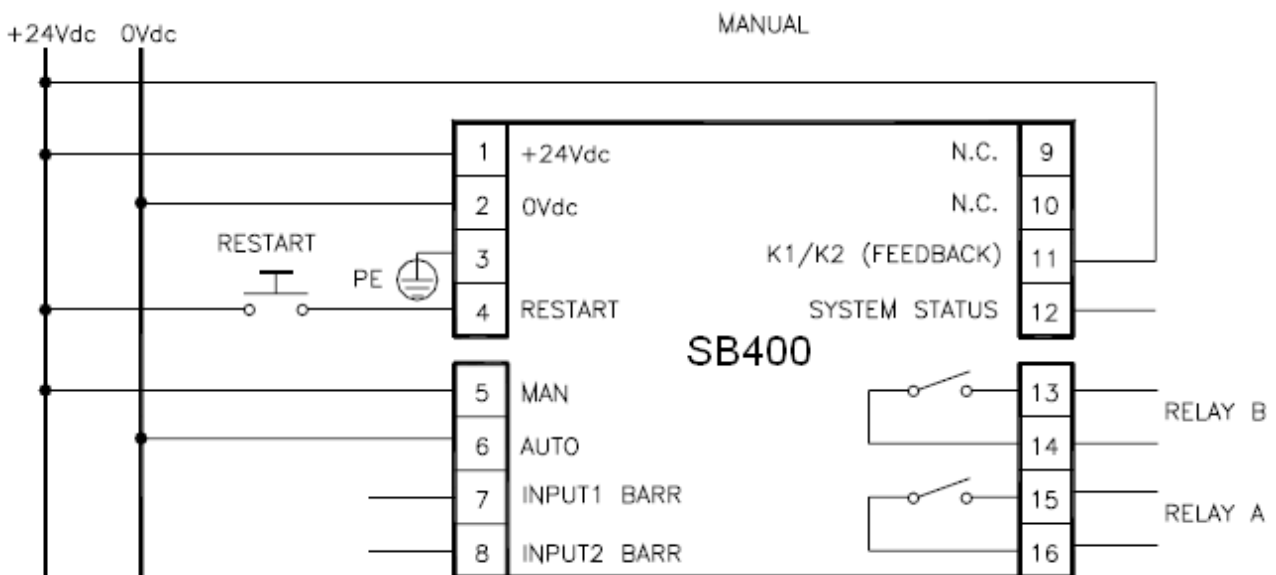


Figure 2

### 2.1.3 CONNECTION OF EXTERNAL CONTACTORS K1 and K2

Control of external contactors K1K2 can be activated in both operating modes. If this control must be used, the series of normally closed contacts of the external contactors must be connected to terminal 11 of the control unit (figures 3 and 4).

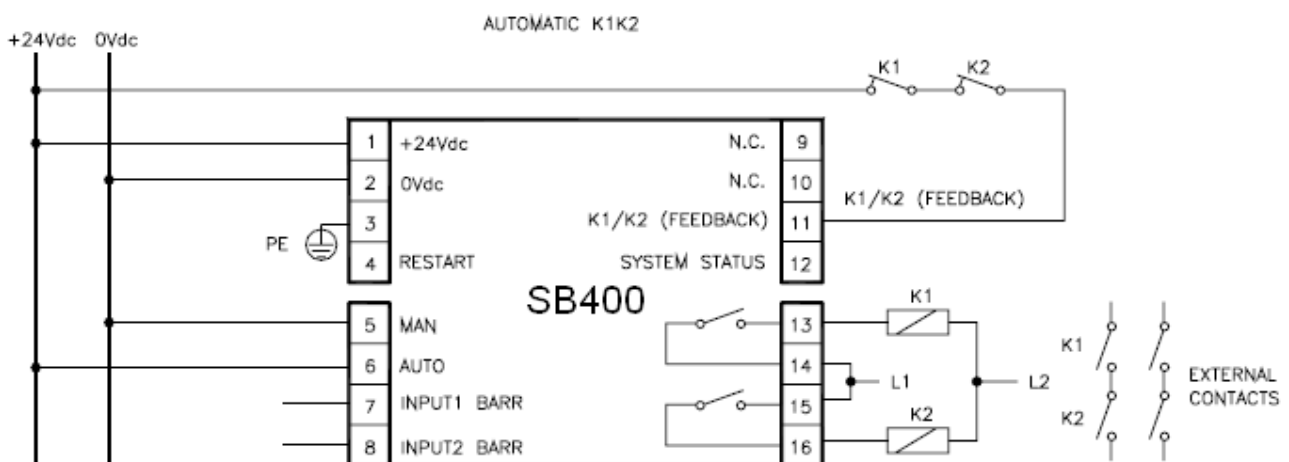
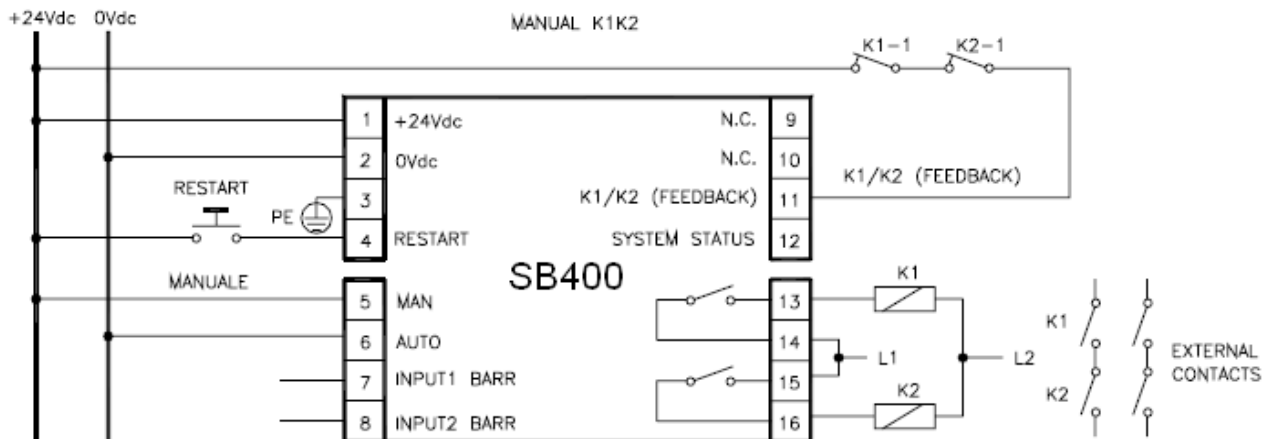


Figure 3

Automatic functioning with K1K2 relays



**Figure 4**  
Manual operation with K1/K2 relays

## 2.2 SIGNAL DESCRIPTION


TERMINAL NUMBER	SIGNAL NAME	TYPE OF SIGNAL	DESCRIPTION
1	24 Vdc		Power supply 24 Vdc
2	0 Vdc		Power supply 0 Vdc
3	PE		Ground connection
4	RESTART	Input	Restart command
5	MAN	Input	Manual / Automatic Configuration
6	AUTO	Input	
7	INPUT1 BARR	Input	Safety barrier input 1 status
8	INPUT2 BARR	Input	Safety barrier input 2 status
9	n.c.	-	-
10	n.c.	-	-
11	K1k2 (Feedback)	Input	Feedback external contactors K1K2
12	SYSTEM STATUS	Output	Output status
13	Relay B NO 1	Output	Safety relay B, contact 1 (N.O.)
14	Relay B NO 2	Output	Safety relay B, contact 2 (N.O.)
15	Relay A NO 1	Output	Safety relay A, contact 1 (N.O.)
16	Relay A NO 2	Output	Safety relay A, contact 2 (N.O.)

**Table 2**

### 2.2.1 The RESTART command

- The RESTART command must be sent to the control unit connecting terminal 4 to the +24 Vdc.
- The contact used for the RESTART command must be able to switch a voltage of 24 Vdc and a current of 20 mA (guaranteeing a closing time > 100 ms). This data is particularly important in the case of automatic management of the RESTART command sending, for example using a PLC.
- The SYSTEM RESET TIME is obtained adding the reset time of any external contactors K1K2 to the reset time of the SB400 control unit (100 ms).
- In the case of manual activation, a normally open external button can be used, temporary closing of which generates the RESTART command.



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! The Restart command must be installed outside the danger area in a position where the danger area and the entire work area concerned are clearly visible.

! It must not be possible to reach the control from inside the danger area.

### 2.2.2 K1K2 FEEDBACK input

Using the K1 and K2 auxiliary safety contactors with guided contact safety type, it is necessary to connect the +24 Vdc to the K1K2 FEEDBACK through the series of the K1-1 e K2-1 N.C. control contacts. The control of the correct switching of K1 and K2 is performed with a delay of 300 ms after the real command. When the K1-1 e K2-1 N.C. control contacts are not used (or no control is provided) it is mandatory to connect the terminal 11 (K1K2 FEEDBACK) to the +24 Vdc.

### 2.2.3 SYSTEM STATUS output

The SYSTEM STATUS output reports exactly the output safety relays status :

- When the output relays are opened, the SYSTEM STATUS reports 0 Vdc.
- When the output relays are closed, the SYSTEM STATUS reports +24 Vdc.

## 2.3 INSTALLATION AND ELECTRICAL CONNECTIONS

! Install the SB400 control unit in an environment with a protection rating of at least IP54.

! If more modules SB400 must be installed in the same board panel, in order to avoid overheating, maintain between them one minimal distance of 2 cm.

! The SB400 control unit must be supplied with a 24 Vdc  $\pm$ 20%.

! The external power supply must comply with the standard EN 60204-1.


! During the installation of the SB400 control unit be sure to avoid short circuits between the contacts 7 and 8.

### 2.3.1 Characteristics of the output circuit.

For the output circuit, the control unit uses two guided contact safety relays.

These relays are rated by the manufacturer for voltage and current values above those indicated in the technical data; however, to assure correct insulation and to avoid damage or premature aging, protect each output line with a 4 A slow-blow fuse and check that load characteristics comply with the indications given in the table below.

Minimum switching voltage	18 Vdc
Minimum switching current	20 mA
Maximum switching voltage	250 Vac
Maximum switching current	2 A

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### 2.3.2 Use of K1 and K2 auxiliary contact elements

For loads with higher voltage and current characteristics than those indicated in the table above, use of auxiliary external relays or contactors suitable for the load to be controlled is recommended.

- The K1 and K2 auxiliary contactors or relays must be of the guided contact safety type.
- Referring to the table below, pay particular attention to the configuration of the control contacts on terminal 11 and that of the contacts of use.

	<b>Relay K1</b>	<b>Relay K2</b>
Control contacts	K1-1 normally closed	K2-1 normally closed
Use contacts	K1-2 normally open	K2-2 normally open

- Control contacts K1-1 and K2-1 (terminal 11) must be able to switch a current of 20 mA and a voltage of 24 Vdc.
- To increase the electrical life of internal relays A and B, it is advisable to use anti-disturbance devices which must be connected across the coils of K1 and K2.

### 2.3.3 Warnings regarding the connection cables

- For light curtain/control unit connections of more than 50 m, cables with a cross-section of at least 1 mm<sup>2</sup> must be used.
- It is good practice to separate the power supply of the control unit from that of other electrical appliances (electrical motors, inverters, frequency variators) or other sources of disturbance.
- The path of the connection cables between the control unit and the sensors, the connection referring to the test command and feedback contacts connected to terminal 11 must be different from that of other power cables.



## 2.4 STATUS INDICATORS

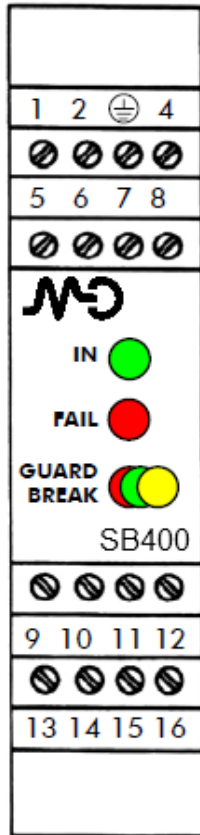


Figure 5

LED	COLOR	STATUS	CONDITION
IN	Green	ON	Barrier free
		OFF	Barrier intercepted
FAIL	Red	ON	Fault detected *
		OFF	Correct operation
GUARD BREAK	Green / Red / Yellow	RED	Output relays opened
		RED blinking	The number of blinking shows the kind of FAIL (only with FAIL is ON) *
		GREEN	Output relays closed
		YELLOW	Barrier free – Output relays opened (only in manual mode)

Table 3

\* M.D. MICRO DETECTORS TO THE "FAULT DIAGNOSI" SECTION TO HAVE A DETAILED EXPLANATION OF THE POSSIBLE FAULT

## 2.5 DIMENSIONS

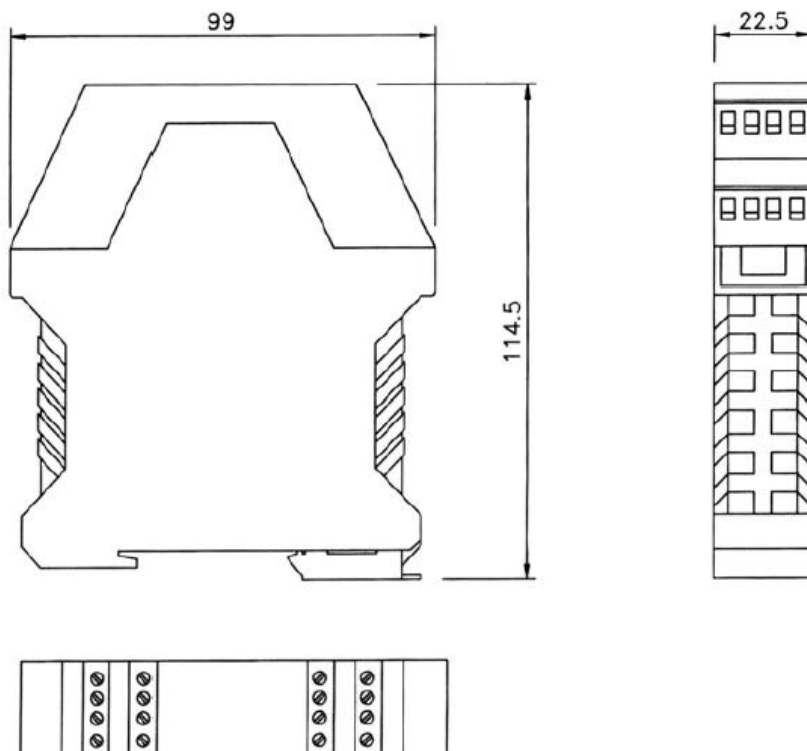



Figure 6

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## 2.6 TECHNICAL DATA SB400

<b>Safety category</b>		4
<b>Power supply</b>	Vdc	24 ± 20%
<b>Power requirement</b>	W	5 max
<b>Output</b>	Relay	2 N.O. contacts (2 A; 250 Vac)
<b>System Status Output</b>		100 mA; 24 Vdc
<b>Response time</b>	ms	20 max
<b>Operating modes</b>		Manual or Automatic, selectable from terminal block
<b>External Relay control</b>		2 N.C. contacts (20 mA; 24 Vdc)
<b>Number of connectable barriers</b>		1 (with 2 PNP safety static outputs)
<b>Connections</b>		Terminal block with protection against reversal of polarity
<b>Status indicator</b>	LED	Power On – Barrier status – Fail
<b>Max. length of connections</b>	m	100
<b>Operating temperature</b>	°C	0 ÷ 55
<b>Enclosure protection rating</b>		IP 20
<b>Terminal block protection rating</b>		IP 2X
<b>Fastening</b>		Fast attachment to rail according to EN 50022-35
<b>Dimensions (h x w x d)</b>	mm	99 x 22,5 x 114,5
<b>Weight</b>	g	150
<b>B10d</b>		800.000
<b>Device lifetime</b>		20 years
<b>Safety level</b>	Type 4	IEC 61496-1:2004 IEC 61496-2:2006
	SIL 4	IEC 61508:1998
	SILCL 4	IEC 62061:2005
	Cat. 4	ISO 13849-1 : 2006

Load	Number of Commutations	PFHd *	DCavg #	MTTFd #	PL #	CCF #
2A@230Vac	1 every 30s	2,64E-08	98,92%	26,06	d	80%
	1 every min	1,55E-08	98,85%	50,29	e	80%
	1 every hour	4,93E-09	97,24%	100,00	e	80%
	1 every day	4,77E-09	96,89%	100,00	e	80%
0,5A@24Vdc	1 every 30s	4,86E-08	98,96%	13,28	d	80%
	1 every min	2,64E-08	98,92%	26,06	d	80%
	1 every hour	5,11E-09	97,51%	100,00	e	80%
	1 every day	4,78E-09	96,91%	100,00	e	80%

**Table 4**

\* IEC 61508

# ISO 13849-1

## 2.7 STATUS INDICATORS / FAULT DIAGNOSIS

### 2.7.1 Status indicators

LED			MEANING
IN GREEN	FAIL RED	GUARD/BREAK RED / GREEN	
ON	ON	Red	Power on TEST
OFF	OFF	Red	Barrier INTERCEPTED, outputs in OFF
ON	OFF	Yellow	Barrier FREE, output in OFF (Module waiting for RESTART)
ON	OFF	Green	Barrier FREE, outputs in ON

Table 5

### 2.7.2 FAULT DIAGNOSIS







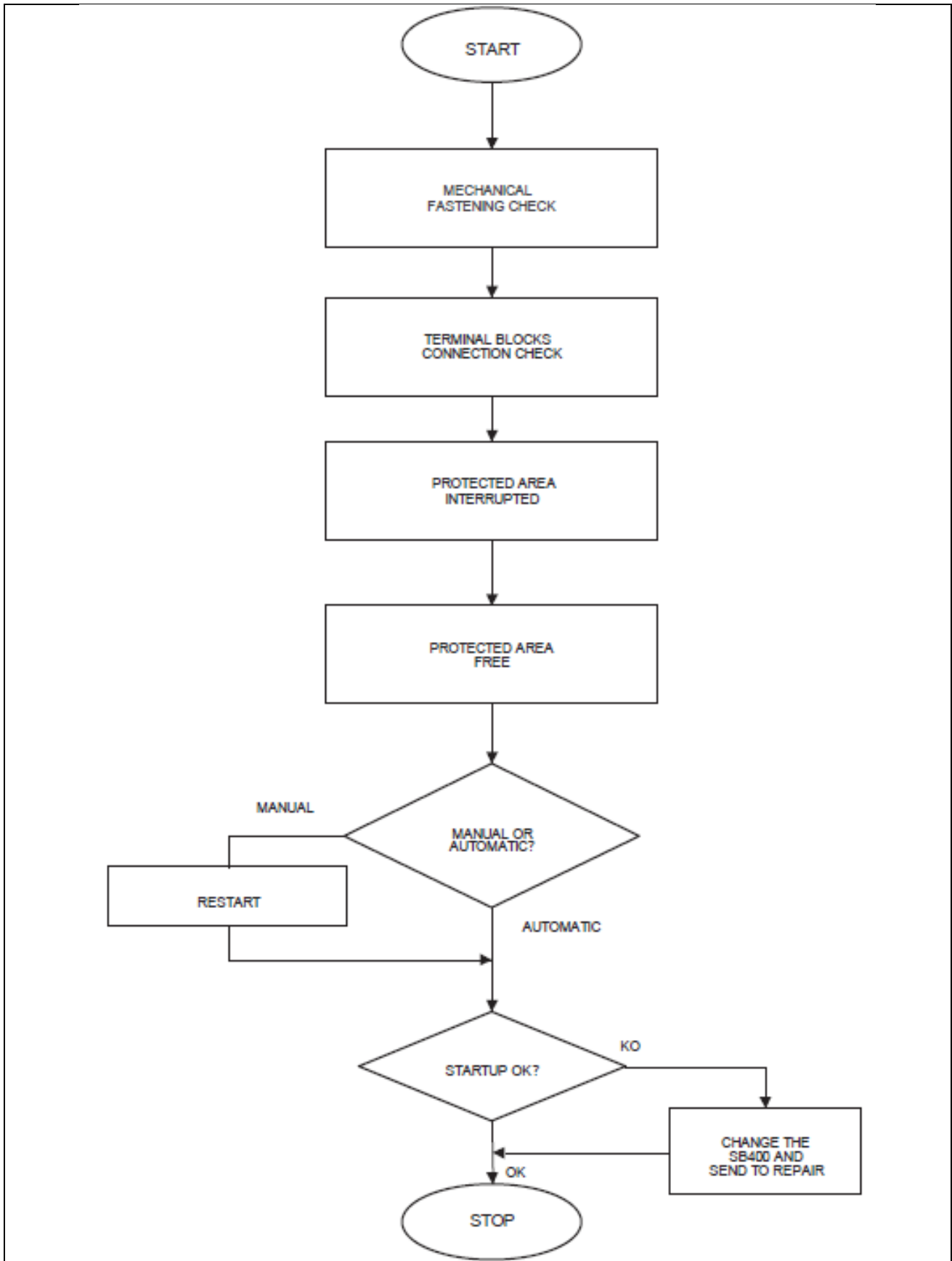

		LED		MEANING
IN GREEN	FAIL RED	GUARD/BREAK RED/GREEN (pulses led Red)		
OFF	ON			(2 pulses) Internal fault
OFF	ON			(3 pulses) Internal relays fault
OFF	ON			(4 pulses) K1K2 external relays fault
OFF	ON			(5 pulses) User configuration failure
OFF	ON			(6 pulses) User configuration changed without system restart: Switch off and restart the module to solve the problem. At the switch on verify the new user configuration.
OFF	ON			(7 pulses) Possible overload or SYSTEM STATUS connection error


Table 6

**!** If it is not possible to clearly identify the malfunction and to remedy it, stop the machine and contact the M.D. MICRO DETECTORS's Assistance Service.

## 2.8 PERIODIC TESTS TO DO EVERY YEAR



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## 2.9 GUARANTEE

M.D. Micro Detectors warrants that each SB400 unit in new ex-factory condition, in conditions of normal use, is free of defects in the materials and of manufacturing defects for a period of 24 months.

In this period, M.D. Micro Detectors undertakes to eliminate any faults in the product through repair or replacement of the faulty parts, completely free of charge as regards material and labor. However, M.D. Micro Detectors reserves the right to replace the entire faulty appliance with another equivalent appliance or with the same characteristics instead of repairing this.

Validity of this warranty is regulated by the following conditions:

- The user must inform M.D. Micro Detectors of the fault within 24 months from the date of delivery of the product.
- The appliance and its components must be in the conditions in which they were delivered by M.D. Micro Detectors.
- The serial numbers must be clearly legible.
- The fault or defect has not been caused directly or indirectly by:
  - Improper use;
  - Non-compliance with instructions for use;
  - Carelessness, inexperience, incorrect maintenance;
  - Repairs, modifications, adaptations not carried out by M.D. Micro Detectors personnel, tampering, etc.;
  - Accidents or impacts (also due to transportation or causes of force majeure);
  - Other causes not to be ascribed to M.D. Micro Detectors.

Repairs will be carried out at the M.D. Micro Detectors laboratories to which the material must be delivered or dispatched: transport risks and the risks of any damage or loss of the material during shipment are the responsibility of the user.

All products and components replaced become the property of M.D. Micro Detectors.

M.D. Micro Detectors does not recognize any other warranties or rights except for those specifically described above; therefore, no claims for damages may be submitted for expenses, interruption of business or other factors or circumstances in any way related to failure of the product or of one of its parts.

Precise, complete compliance with all the rules, instructions and prohibitions indicated in this handbook is an essential requirement for correct functioning of the safety interface. M.D. Micro Detectors therefore declines any responsibility for all and anything resulting from failure to comply, even partially, with such indications.

Characteristics subject to change without notice.

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