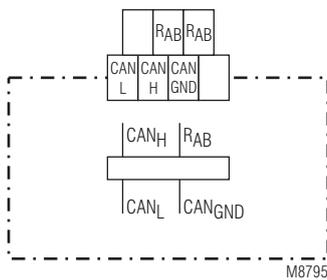




- For transmitting the status information from the control unit and the input modules, e.g. input and error states, start button and safety output assignments, to a control system or bus-capable display
- Galvanic separation
- Adjustment of transmission via rotary switch
- LED indicators for operating voltage and status
- Width 22,5 mm

Circuit Diagram



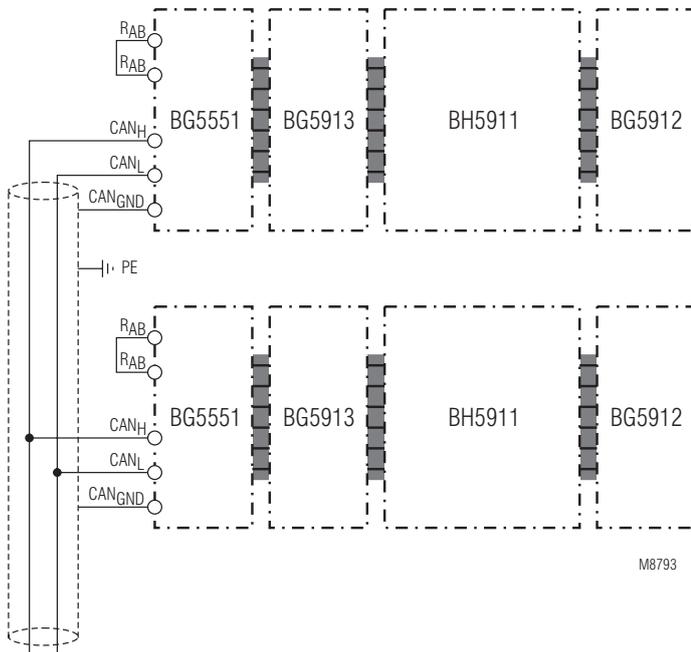
Approvals and Markings



Applications

For connection to a CANopen network for visualizing the status of the multi-function safety system SAFEMASTER M.

Connection Example



Indicators

- | | |
|------------------|--|
| Green LED „on“: | on when supply connected |
| Green LED „run“: | Continuously on, when the diagnostic module is accessed by the bus, flashing, when a bus failure is detected |

Device Connection

The diagnostic module is simply connected via flatcable instead of the left termination plug of the safety system. This connection is used for the power supply and for receiving the data to be evaluated. The CANopen-Bus is connected via terminals CAN_L and CAN_H. When the diagnostic module is physically installed at the end of the CAN Bus, the terminals R_{AB} have to be bridged.

Device Setting

The address (01 to 99) of the module in the CANopen system is set on the rotary switches 10¹ and 10⁰. The middle switch allows to set the data transmission rate. 20 Kbit, 125 Kbit, 500 Kbit or 1000 Kbit. All other configurations is done by software, e.g. Pro CANopen. A configuration file is necessary which can be obtained on CD-Rom PN 5501. It is located in the folder CANopen/EDS. Order reference: PN 5501, Article number: 0052860

Attention:



Work on the device must be carried out by specialist personnel when the device is in a deenergized state.

Technical Data

Input

Nominal voltage U_N : DC 24 V (power is supplied - by the SAFEMASTER M)

Voltage range:
at max. 5% residual ripple: 0.85 ... 1.15 U_N

Nominal consumption: max. 100 mA

CANopen interface

Transmission medium: Twisted, shielded two-wire line

Transmission optionally:
20 Kbit/s
125 Kbit/s
500 Kbit/s
1 Mbit/s

Maximum length:
2500 m at 20 Kbit/s
500 m at 125 Kbit/s
90 m at 500 Kbit/s
15 m at 1 Mbit/s

The screen of the bus cable has to be connected to the terminal CAN_{GND} of all diagnostic modules and at one point also to PE (see connection example).

General Data

Nominal mode of operation: Continuous operation
Temperature range: $\pm 0 \dots + 50^\circ \text{C}$
At an operating temperature of 50°C the modules must be mounted with a distance of 3 - 5 mm.

EMC

HF irradiation: 10 V / m IEC 61 000-4-3
Fast transients on supply line A1-A2: 2 kV IEC 61 000-4-4
on signal and control lines: 2 kV IEC 61 000-4-4

Technical Data

Surge voltage between supply lines: 1 kV IEC 61 000-4-5
between supply line and ground: 2 kV IEC 61 000-4-5
HF wire guided: 10 V IEC 61 000-4-6
Interference suppression: Grenzwert Klasse B EN 55 011

Degree of protection

Housing: IP 20 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Housing: Thermoplastic with V0 behaviour according to UL subject 94

Vibration resistance:

Amplitude 0.35 mm frequency 10 ... 55 Hz IEC/EN 60068-2-6

Resistance to shock

Acceleration: 10 g
Impulse length: 16 ms
Number of shocks: 1000 per axis on 3 axes

Climate resistance: 0 / 050 / 04 IEC/EN 60 068-1

Terminal designation: EN 50 005

Wire connection:

1 x 2.5 mm² stranded wire with sleeve or 1 x 4 mm² solid or 2 x 1.5 mm² stranded wire with sleeve
DIN 46 228-1/-2/-3/-4
Terminal screws M3,5, box terminals with wire protection

Mounting: on DIN rail IEC/EN 60 715

Weight: 135 g

Dimensions

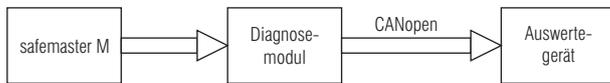
Breite x Höhe x Tiefe 22.5 x 84 x 121 mm

Standard Type

BG 5551 DC 24 V 50 / 60 Hz

Article number: 0056708

Information on System Diagnostics



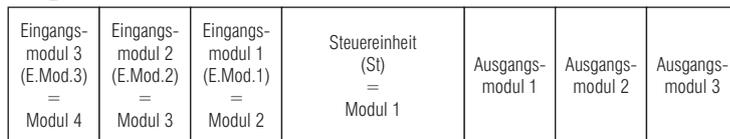
Flow of information to evaluate data

M8807

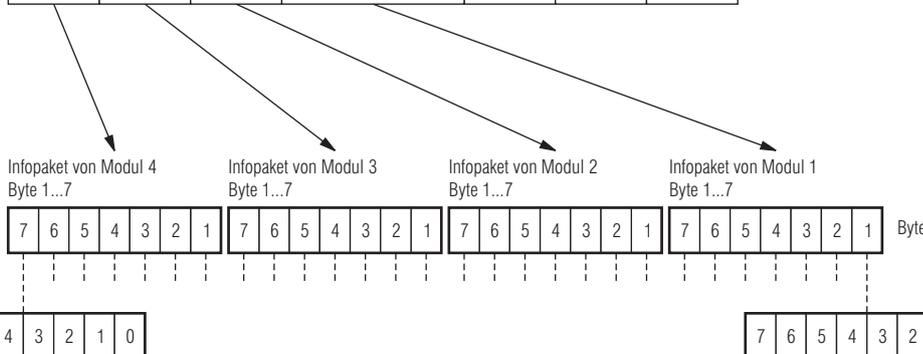
Information Structure

The diagnostic module delivers depending on the configuration a package of max. 28 information bytes. These are 7 Bytes for the control unit, and 7 Bytes each for the 3 possible input modules. Each byte has 8 information bits (Bit 0 ... Bit 7). The tables below „Structure of Diagnostic Information“ show the assignment of each byte.

M8808_a



Modulnumerierung von safemaster M



Bit 0...7 von Byte 7 / Modul 4

Bit 0...7 von Byte 1 / Modul 1

Structure of Diagnostic Information

Byte No.	CANopen designation	Module	Informations bytes							
			Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	Modul1 ModulNr	St*	0	0	0	0 = OK 1 = Systemfehler	Module number, if module available	0001 = Modul 1 0010 = Modul 2 0011 = Modul 3 0100 = Modul 4	1 = input S12 inactive	1 = input S14 inactive
	Modul2 ModulNr	E.Mod.1*								
2	Modul3 ModulNr	E.Mod.2*	1 = T4	1 = T3	1 = T2	1 = T1	Which start button effects this module? 0000 0000: Module not available or another module reports errors. In this case, all 7 bytes have the value 0000 0000. Which output module does this module have an effect on?	1 = output module 1 1 = output module 2	1 = input S12 inactive	1 = input S14 inactive
	Modul4 ModulNr	E.Mod.3*								
3	Modul1 assignments	St*	1 = T4 activated	1 = T3 activated	1 = T2 activated	1 = T1 activated	If bit 4 is set in the module number: system error code	1 = output module 3	0	1 = input S12 inactive
	Modul2 assignments	E.Mod.1*								
4	Modul3 assignments	E.Mod.2*	1 = output module 3 activated	1 = output module 2 activated	1 = output module 1 activated	1 = safety outputs of control unit activated	Only if the button concerned is assigned to the control unit	1 = input S42 inactive	1 = input S44 inactive	1 = input S24 inactive
	Modul4 assignments	E.Mod.3*								
5	Modul1 status	St*	0	0	0	1 = short circuit on the inputs	Position of function switch (0000 bis 1001 for function 0 to 9)	1 = input S42 inactive	1 = input S44 inactive	1 = input S12 inactive
	Modul2 status	E.Mod.1*								
6	Modul3 status	E.Mod.2*	1 = error on a safety output	1 = release of assigned safety outputs enabled	1 = waiting for activation of assigned start button (error has been eliminated)	1 = safety outputs of control unit activated	These bits show the activation signal, which is transmitted to the modules. In the case of delayed outputs, the progress of the delay time is not visible.	1 = input S42 inactive	1 = input S44 inactive	1 = input S12 inactive
	Modul4 status	E.Mod.3*								
7	Modul1 status and security outputs	St*	1 = control unit reports errors (bit 4 or 7 of module status byte 1 set)	1 = assigned safety outputs enabled	1 = activation of assigned start button (error has been eliminated)	1 = start button T1 activated	The assignment of this byte depends on the function of the control unit or the respective input module (see the following pages)	1 = input S42 inactive	1 = input S44 inactive	1 = input S12 inactive
	Modul2 status and security outputs	E.Mod.1*								
8	Modul3 status and security outputs	E.Mod.2*	see comments below	1 = assigned safety outputs enabled	1 = activation of assigned start button (error has been eliminated)	1 = start button T2 activated	The assignment of this byte depends on the function of the control unit or the respective input module (see the following pages)	1 = input S42 inactive	1 = input S44 inactive	1 = input S12 inactive
	Modul4 status and security outputs	E.Mod.3*								

Comment: Bit 7 and bit 4 of the **Modul x status byte 1** (Byte 5) are saved from the time when the error appears until when the module is restarted. DThe fact that the fault was corrected is indicated by bit 5 in the case of a manual start; and by bit 6 in the case of an automatic start. If these errors are detected in the control unit, the entire **SAFEMASTER M** system is locked. f the input modules are error-free in the „automatic start“ mode, their bits 7 and 6 flash in the **status byte 1** (byte 12, 19 or 26) as well as their green LEDs until the error has been corrected in the control unit or in the safety outputs.

Structure of Diagnostic Information

Assignment of bytes 6 in the different modules of SAFEMASTER M

Control unit BH 5911:

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Modul1 status byte 2	1 = start button activated for too long (>3s)	1 = one of the assigned start buttons has been activated	1 = emergency stop S14 activated	1 = emergency stop S12 activated	1 = error on output module 3	1 = error on output module 2	1 = error on output module 1	1 = error on the safety outputs of the Ct*

Comment 1: All signals are saved from the time when the error is detected until the safety outputs are released for activation again. The fact that the error was corrected is indicated in **status byte 1** (byte 5), bits 5 and 6.

Comment 2: In the case of a 2-channel emergency stop, bits 5 and 4 change together. For more precise diagnostics of the input signals, byte 3 (status of the inputs) must be evaluated.

Input module BG 5913.08/ 0 _ _ _

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Modul2 status byte 2 Modul3 status byte 2 Modul4 status byte 2	1 = time error ²⁾	1 = one of the assigned start buttons has been activated	1 = one of the assigned simulation buttons has been activated	0 (unused)	1 = function group 4 of module does not grant release ¹⁾	1 = function group 3 of module does not grant release ¹⁾	1 = function group 2 of module does not grant release ¹⁾	1 = function group 1 of module does not grant release ¹⁾

BComments: Except for bit 6 and 5, all signals are saved from the time when the error is detected until the assigned safety outputs are released for activation again. The fact that the error was corrected is indicated in **status byte 1** (no. 19, 20 or 26), bits 5 and 6.

1) The numbers of the different function groups match the numbering of the safety functions in the application examples of the data sheet of input module BG 5913.08/ 0 _ _ . If less than 4 functions are possible as a result of the input module setting (e.g. max. 2 with two-hand control type IIC), the surplus bits are set to 0.

2) Time error is detected if the start or simulation buttons (>3s) are activated for too long. A time error message is also generated if two sensors of a function are not activated in the required time window (e.g. in the case of gates or two-hand controls).

Input module BG 5913.08/ 1 _ _ _ , BG 5913.08/ 2 _ _ _ and BG 5913.08/ 3 _ _ _

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Modul2 status byte 2 Modul3 status byte 2 Modul4 status byte 2	1 = time error ²⁾	1 = one of the assigned start buttons or simulation buttons has been activated	0 (unused)	0 (unused)	1 = function group 4 of module does not grant release ¹⁾	1 = function group 3 of module does not grant release ¹⁾	1 = function group 2 of module does not grant release ¹⁾	1 = function group 1 of module does not grant release ¹⁾

Comments: Except for bit 6, all signals are saved from the time when the error is detected until the assigned safety outputs are released for activation again. The fact that the error was corrected is indicated in **status byte 1** (no. 19, 20 or 26), bits 5 and 6.

1) The numbers of the different function groups match the numbering of the safety functions in the applications examples of the data sheet from input module. If a function combination with two-hand type IIC is set on the input module, only 3 function groups are available and bit 3 is then always 0.

2) Time error is detected if the start or simulation buttons (>3s) are activated for too long. A time error message is also generated if two sensors of a function are not activated in the required time window (e.g. in the case of gates or two-hand controls).

Structure of Diagnostic Information

Input module BG 5914.08/_0_ _ _ _ , BH 5914.08/_1_ _ _ _ and BH 5914.08/_2_ _ _ _

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Modul2 status byte 2 Modul3 status byte 2 Modul4 status byte 2	1 = start button activated for too long (>3s)	1 = one of the assigned start buttons has been activated	1 = emergency stop on S14, S24, S34 or S44 does not grant release ¹⁾	Double contact error on S42 - S44 ²⁾	1 = emergency stop on S42 or S44 does not grant release ¹⁾	1 = emergency stop on S32 or S34 does not grant release ¹⁾	1 = emergency stop on S22 or S24 does not grant release ¹⁾	1 = emergency stop on S12 or S14 does not grant release ¹⁾

Comments: Except for bit 6, all signals are saved from the time when the error is detected until the assigned safety outputs are released for activation again. The fact that the error was corrected is indicated in **status byte 1** (no. 12, 19 or 26), bits 5 and 6.

- 1) The emergency stop function which actually prevented the release can only be recognized from the combination of bit 5 with the bits 0 to 3. The current status of the inputs is always visible in byte 10, 17 or 24 (status of the inputs).
- 2) Bit 4 is only set if S42 and S44 are set for 2-channels for the emergency stop function, and both signals do not match.

Interpretation Example for Diagnostic Information

We have a safemaster M system with the following components:

- 1 control unit BH 5911.03/00MF0
- 1 output module BG 5912.04
- 1 diagnostic module BH 5552 for Profibus DP

The transmitted information from diagnostic module BH 5552 is to be used in order to observe how and why the outputs of output module 1 change.

The available diagnostic information of the control unit and its changes are shown here:

1. Normal state: Safety outputs are activated, all EMERGENCY STOP buttons are released

		Bit no.	76543210
Byte 1: Module number:	Hex: 01	Bin:	00000001
Byte 2: Assignments:	Hex: 13	Bin:	00010011
Byte 3: Status of inputs:	Hex: 00	Bin:	00000000
Byte 4: Status of outputs:	Hex: 00	Bin:	00000000
Byte 5: Status byte 1:	Hex: 45	Bin:	01000101
Byte 6: Status byte 2:	Hex: 00	Bin:	00000000
Byte 7: Start button and safety outputs:	Hex: 0B	Bin:	00000011

Module number 01 with deleted bit 4 shows that the entire safemaster M system is working properly.

The set bits 0 to 3 of status byte 1 show that the function switch of the control unit (module1) is set to position "5". That means that the following mode of operation is set:

2 x 1 channel emergency stop, manual start, 4 start buttons

The set assignments in byte 2 shows you that the control unit is started by the start button 1 (bit 4), and it has an effect on its own outputs (bit 0) and the outputs of output module 1 (bit 1). Since no input module is available, the outputs of both modules must always have the same status.

The set bit 6 in status byte 1 means the control unit grants the release for setting the safety outputs which are assigned to it. The fact that the outputs are actually set can be seen in byte 4.

2. Emergency stop button on S12 activated

		Bit no.	76543210
Byte 1: Module number:	Hex: 01	Bin:	00000001
Byte 2: Assignments:	Hex: 13	Bin:	00010011
Byte 3: Status of inputs:	Hex: 01	Bin:	00000001
Byte 4: Status of outputs:	Hex: 0x	Bin:	0000x0xx = flash
Byte 5: Status byte 1:	Hex: 05	Bin:	00000101
Byte 6: Status byte 2:	Hex: 10	Bin:	00010000
Byte 7: Start button and safety outputs:	Hex: 00	Bin:	00000000

Bit 6 in status byte 1 shows that the control unit does not release the safety outputs which are assigned to it.

The reason for this is indicated by bit 0 in byte 3 (input S12 inactive) and by bit 4 in status byte 2 (emergency stop activated). The set bit 4 in byte 6 is saved until the release is granted again.

Byte 4 signals that the outputs have actually dropped out (bit 4 and 5) and the output 48 (bit 2) as well as the LED run 1 (bit 0) flash.

3. Emergency stop button is unlocked again

		Bit no.	76543210
Byte 1: Module number:	Hex: 01	Bin:	00000001
Byte 2: Assignments:	Hex: 13	Bin:	00010011
Byte 3: Status of inputs:	Hex: 00	Bin:	00000000
Byte 4: Status of outputs:	Hex: 0x	Bin:	0000x0x
Byte 5: Status byte 1:	Hex: 25	Bin:	00100101
Byte 6: Status byte 2:	Hex: 10	Bin:	00010000
Byte 7: Start button and safety outputs:	Hex: 00	Bin:	00000000

Since all inputs are in quiescent state again, only the status bytes 1 and 2 as well as byte 4 (status of outputs) still indicate that safemaster M was switched off. However, the saved bit 4 in status byte 2 still shows the reason for switch-off.

4. Start button T1 is activated

		Bit no.	76543210
Byte 1: Module number:	Hex: 01	Bin:	00000001
Byte 2: Assignments:	Hex: 13	Bin:	00010011
Byte 3: Status of inputs:	Hex: 01	Bin:	00010000
Byte 4: Status of outputs:	Hex: 00	Bin:	00000000
Byte 5: Status byte 1:	Hex: 05	Bin:	00100101
Byte 6: Status byte 2:	Hex: 00	Bin:	00000000
Byte 7: Start button and safety outputs:	Hex: 00	Bin:	00000000

If the start button was activated properly (< 3 s), the system returns to the normal state described under section 1. If the start button is activated for too long (> 3 s), bit 7 would signal in byte 6.

Comment:

If a system was already put into operation, it is often sufficient just to evaluate status bytes 1 and 2.

Depending on the depth and degree of detail of the diagnostics, e.g. in the case of troubleshooting when placing the system into operation, the other bytes can also be included if required.