Mobile Control System

Master Module
Series ELMR 223

- electrical data and equipment is optimised for use in the mobile industry
- programming to IEC 61131-3
- detection of under- and over-voltages
- diagnostic functions for software and hardware
- outputs are protected against short-circuits and over-loads; can be examined by diagnostics
- RS232 serial interface
- CAN-Bus (master) with CANopen protocol
- automatic, and program-controlled, data storage in flash EPROM

1 Description

The ELMR223 master module is used as a controller in Bucher CAN bus systems. The module can have up to 24 power outputs, some of which are configurable. The features of the operating system, which was specially developed by Bucher Hydraulic, enable customer applications to be developed in significantly shorter timescales. The operating system represents the intelligence and functionality of the complete electronic system. It includes interface communications, parameterisation, configuration, I/O processing, recording/data logging and parameter-driven control algorithms (e.g. for con-trolling synchronous motion). The operating system is in use in numerous applications and is therefore robust, and proven to a high degree.

1.1 Designed for

- the extreme mechanical stresses that result from impacts and shock loadings
- low and high ambient temperatures while in operation
- the direct effects of dirt, water and dampness during field service
- the large voltage fluctuations that are found in battery/alternator systems
- severe interference effects, whether radiated or conductor-linked, on the entire electrical system

2 Technical Data

2.1 Controller as black box system for the implementation of a cental or decentralised system design

General characteristics	Description, value, unit
Housing	closed, screened metal housing with flange fastening
Dimensions (h x w x d)	153 x 225 x 43 mm
Mounting	by means of 4 M5 x L screws to DIN 7500 or DIN 7984 mounting position horizontal or vertical to thr mounting wall
Connection	55-pin connector, latched, protected against reverse polarity type AMP housing or Framatome AMP junior timer contacts, crimp connection 0,5 / 2,5 mm^2
Weight	1,2 kg
Operating/ storage temperature	-40°C ... +85°C
Protection	IP 67 (protection rating for plug deo. on cable preparation)

Input/output channels (total)		max. 40 (the total number which is available depends on the wiring and configuration of the controller)			
Inputs		max. 40 (corr. to 0 outputs)			
		Number	Signal	Version	
	possible configurations	8 or	digital analogue	for positive sensor signals with diagnostic capability 0...10/32 V DC, 0/4...20 mA or ratiometric	B_L A
		8	digital	for positive sensor signals	B_L
		4 or	digital frequency	for positive sensor signals, with diagnostic capability max. 50 kHz	B_L I_L
		4 or	digital frequency	for positive/negative sensor signals, with diagnostic capability max. 1 kHz	$B_{L/H}$ $I_{L/H}$
		8	digital	for positive/negative sensor signals, with diagnostic capability	$B_{L/H}$
		8	digital	for positive sensor signals, with diagnostic capability	B_L
Outputs				max. 24 (corr. to 16 inputs)	
		Number	Signal	Version	
	possible configurations	8 or or	digital PWM current-controlled	positive switching (High Side), with diagnostic capability PWM frequency 20...250 Hz 0,1...4 A	B_H PWM PWM_I
		8	digital	positive switching (High Side), with diagnostic capability	B_H
		4 or	digital PWM	positive switching (High Side), with diagnostic capability PWM frequency 20...250 kHz	B_H PWM
		4	digital	positive/negative switching (High/Low Side), with diagnostic capability can also be used as H bridge	$B_{H/L}$ H-Bridge

Operating states (Status-LED)	LED-colour	Status	Description
if both faults occur simultaneously, the LED appears orange.		off	no operating voltage
	orange	1 x on	initialisation or reset checks
	green	5 Hz	no operating system loaded
	green	0,5 Hz 2,0 Hz on	Run, CANopen: PREOPERATIONAL Run, CANopen: OPERATIONAL Stop, CANopen: PREPARED
	red	0,5 Hz 2,0 Hz on	Run with error (CANopen: PREOPERATIONAL) Run with error (CANopen: OPERATIONAL) fatal error or stop with error

Electrical characteristics		Description, value, unit
Operating voltage U_B		10 ... 32 V DC
	Overvoltage	36 V for t ≤ 10 s
	undervoltage detection	for U_B ≤ 9,5 V
	Auto save	for U_B ≤ 9,0 V
Current consumption		≤ 160 mA (without external load at 24 V DC)
CAN interface 1		CAN interface 2.0 B, ISO 11898
	Baud rate	20 Kbits/s ... 1 Mbit/s (default setting 125 Kbits/s)
	Communication profile	CANopen, CiA DS 301 version 4, CiA DS 401 version 1.4
Node-ID (CANopen)		hex 20 (= dez 32)
CAN interface 2		CAN interface 2.0 A/B, ISO 11898
	Baud rate	20 Kbits/s ... 1 Mbit/s (default setting 125 Kbits/s)
	Communication profile	SAE J 1939 or free protocol
Serial interface		RS 232 C
	Baud rate	9,6 kBit/s, 19,2 kBit/s, 28,8 kBit/s
	Topology	point-to-point (max. 2 participants); master-slave connect.
	Protocol	predefined ifm protocol (INTELHEX)
Processor		CMOS microcontroller 16 Bit C167CS; cycle frequency 20/40 MHz
Device monitoring		undervoltage monitoring watchdog function check sum test for program and system excess temperature monitoring
Process monitoring concept		two relays according to EN 954 monitor two groups of 12 outputs each
Program memory		1 MByte Flash, can be used by the user
Data memory		128 Kbytes SRAM, 32 Kbytes Flash, 3 Kbytes FRAM
Data memory (protected in case of power failure)		256 Byte (auto-save memory)
Status indication		three couler LED (red/green/blue)

2.2 Test standards and regulations

Characteristics	Description, value, unit
Climatic tes	Damp heat to EN 60068-2-30, test Db (≤ 95% rel. humidity, non-condensing) Salt mist test to EN 60068-2-52, test Kb, severity level 3 Degree of protection to EN 60529
Mechanical resistance	vibration to IEC 68-2-6, Test Fc shock to IEC 68-2-27, Test Ea bump to EN 60068-2-29, Test Eb
Immunity to conducted interference	to ISO 7637-2, pulses 2, 3a, 3b, severity level 4, function state A
	to ISO 7637-2, pulses 5, severity level 1, function state A
	tp ISO 7637-2, pulses 1, severity level 4, function state C
Immunity to interfering fields	directive 95/54/EG (at 100 V/m) and DIN EN 61326 (e1 type approval)
Interference emission	directive 95/54/EG and DIN EN 61326 (e1 type approval)

2.3 Characteristics of the inputs

Characteristics	Description, value, unit
Digital/analogue inputs (B_L, A) %IW00...07 %IX0.00...07 can be configured as	Voltage inputs input voltage 0...10/32 V resolution 10 bit_s input resistance 50/30 kΩ input frequency 50 Hz
	Current inputs input current 0/4...20 mA resolution 10 bit input resistance 400 kΩ input frequency 50 Hz
	Digital inputs for positive sensor signals, with diagnostic capability *) switch-on level 0,7 U_B switch-off level 0,4 U_B input resistance 30 kΩ input frequency 50 Hz
Digital inputs (B_L) %IX0.08...11 %IX0.16...19 can be configured as	Digital inputs for posit ive sensor signals switch-on level 0,4...0,7 U_B switch-off level 0,29 U_B input resistance 3,21 kΩ input frequency 50 Hz

Characteristics	Description, value, unit
Digital inputs (B_L, I_L) %IX0.12...15 can be configured as	Digital inputs for positive sensor signals, with diagnostic capability *) switch-on level 0,7 U_B switch-off level 0,4 U_B input resistance 2,86 kΩ input frequency 50 Hz
	Frequency inputs for positive sensor signals with diagnostic capability, evaluation with integrated comparator switch-on level 0,43...0,73 U_B switch-off level 0,29 U_B input resistance 2,86 kΩ input frequency max. 50 Hz
Digital inputs ($B_{L/H}$, $I_{L/H}$) %IX0.20...23 can be configured as	Digital inputs fpr positive/negative sensor signals, with diagnostic capability *) switch-on level 0,7 U_B switch-off level 0,4 U_B input resistance 3,21 kΩ input frequency 50 Hz
	Frequency inputs for positive/negative sensor signals with diagnostic capability, evaluation with integrated comparator switch-on level 0,43...0,73 U_B switch-off level 0,29 U_B input resistance 3,21 kΩ input frequency max. 1 kHz
Digital inputs ($B_{L/H}$) %IX0.24...31 can be configured as	Digital inputs for positive/negative sensor signals, with diagnostic capability *) switch-on level 0,7 U_B switch-off level 0,4 U_B input resistance 3,21 kΩ input frequency 50 Hz
Digital inputs (B_L) %IX0.32...39 can be configured as	Digital inputs for positive sensor signals, with diagnostic capability *) switch-on level 0,4...0,7 U_B switch-off level 0,2..0,24 U_B input resistance 3,21 kΩ input frequency 50 Hz
Test input	During thr test mode (e.g. programming) the ”TEST” connection must be con-nected to U_B. For the ”RUN” mode the input must not be connected. input resistance 3,21 kΩ
*) NAMUR inputs	Digital inputs with diagnostic capability can be used as NAMUR inputs when used with an external resistor connection. supply voltage 5...25 V; e.g. ifm NAMUR sensoren NT5001...NN5002

2.4 Characteristics of the outputs

Characteristics	Description, value, unit
Outputs (B_H, PWM, PWM_I) %QX0.00...07 can be configured as	Semiconductor outputs, with diagnostic capability posit. switching (high side), short-circuit an overload protected switching voltage 10...32 V DC switching current max. 4 A
%QX0.00...05 can be configured as	PWM outputs; with diagnostic capability PWM frequency max. 250 Hz PWM pulse ratio 1...99 % resolution depending on the PWM freque. load current max. 4 A integr. pull-down resistor (4,7 kΩ) to trigger Danfoss valves
	Current-controlled outputs; with diagnistic capability switching current 0,1...4 A total current max. 16 A setting resolution 1 mA control resolution 5 mA accuracy ± 2% FS
Outputs (B_H) %QX0.08...15 can be configured as	Semiconductor outputs, with diagnostic capability positive switching (high side), short-circuit an overload protected switching voltage 10...32 V DC switching current max. 2 A output frequency max. 100 Hz (depending on the load)
Outputs (B_H, PWM) %QX0.16, 19, 20, 23 can be configured as	Semiconductor outputs, with diagnostic capability positive switching (high side), short-circuit an overload protected switching voltage 10...32 V DC switching current max. 4 A output frequency max. 100 Hz (depending on the load)
	PWM outputs PWM frequency max. 250 Hz PWM pulse ratio 1...99 % resolution depending on the PWM frequency load current max. 4 A
Outputs ($B_{L/H}$) %QX0.17, 18, 21, 22 can be configured as	Semiconductor outputs, with diagnostic capability positive/negative switching (high/low side), short-circuit an overload protected switching voltage 10...32 V DC switching current max. 4 A output frequency max. 100 Hz (depend. on load)
Internal relay outputs for electrically isolated deactivation of the outputs	Normally open contacts in series to 2 groups of 12 semiconductor outputs. Sustained forcing by means of hardware and additional controlling by means of user program.
	The relays must always be switched without load!
	total current max. 12 A je Gruppe switching current 0,1...15 A overload current 20 A number of operating cycles ≤ 10^6 (without load) switching-time constant ≤ 3 ms

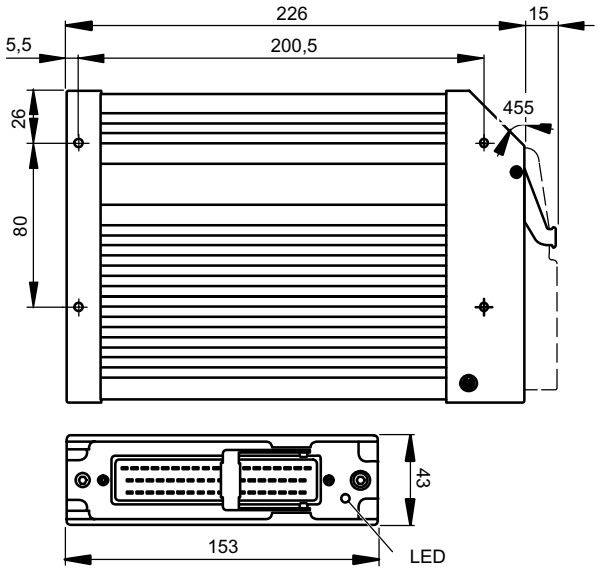
Explanation

A	=	analogue
B_H	=	binary High Side
B_L	=	binary Low Side
I_H	=	pulse High Side
I_L	=	pulse Low Side
PWM	=	pulse width modulation
PWM_I	=	current-controlled output
%IWx	=	IEC-address for analogue input
%IX0.xx	=	IEC-address for binary input
%QX0.xx	=	IEC-address for binary output

3 Ordering code

ELMR223 - 00***	without software
Order-no:	100026514
ELMR223 - 01***	with specific software
Order-no:	100.....

4 Dimensions



5 Wiring

Pin	Potential	Description	note
23	VBB_S (10...32 V DC)	supply sensors and module	
05	VBB_O (10...32 V DC)	supply outputs	
34	VBB_R (10...32 V DC)	supply via relay	relay awitched (1)
01	GND_S	ground sensors and module	relay awitched (2)
15	GND_O	ground outputs	
12	GND_A	ground analogue outputs	

5.1 CAN, RS232, ERROR, TEST

Pin	Potential	Description	note
14	$CAN1_H$	CAN-Interface 1 (High)	
32	$CAN1_L$	CAN-Interface 1 (Low)	
26	$CAN2_H$	CAN-Interface 2 (High)	SAE J 1939
25	$CAN2_L$	CAN-Interface 2 (Low)	SAE J 1939
33	GND	ground	
06	RxD	RS 232-Interface (programming)	Pin 03, PC D-Sub (9 pin)
07	TxD	RS 232-Interface (programming)	Pin 02, PC D-Sub (9 pin)
13	ERROR	Error outout B_H	
24	TEST	test input	

5.2 Inputs/ Outputs

Pin	inputs	configuration	outputs	configuration	diagnostic capability input / output	relay switched
08	%IX0.00 / %IW00	B_L A	-	-	• / -	
27	%IX0.01 / %IW01	B_L A	-	-	• / -	
09	%IX0.02 / %IW02	B_L A	-	-	• / -	
28	%IX0.03 / %IW03	B_L A	-	-	• / -	
10	%IX0.04 / %IW04	B_L A	-	-	• / -	
29	%IX0.05 / %IW05	B_L A	-	-	• / -	
11	%IX0.06 / %IW06	B_L A	-	-	• / -	
30	%IX0.07 / %IW07	B_L A	-	-	• / -	
44	%IX0.08	B_L	%QX0.00	B_H PWM PWM_I	- / •	VBB_O (1)
45	%IX0.09	B_L	%QX0.01	B_H PWM PWM_I	- / •	VBB_O (1)
46	%IX0.10	B_L	%QX0.02	B_H PWM PWM_I	- / •	VBB_O (1)
47	%IX0.11	B_L	%QX0.03	B_H PWM PWM_I	- / •	VBB_O (1)
20	%IX0.12	B_L I_L	-	-	• / -	
02	%IX0.13	B_L I_L	-	-	• / -	
21	%IX0.14	B_L I_L	-	-	• / -	
38	%IX0.15	B_L I_L	-	-	• / -	
36	%IX0.16	B_L	%QX0.04	B_H PWM PWM_I	- / •	VBB_R (2)

Pin	inputs	configuration	outputs	configuration	diagnostic capability input / output	relay switched
54	%IX0.17	B_L	%QX0.05	B_H PWM PWM$_I$	- / •	VBB_R (2)
17	%IX0.18	B_L	%QX0.06	B_H	- / •	VBB_R (2)
53	%IX0.19	B_L	%QX0.07	B_H	- / •	VBB_R (2)
19	%IX0.20	$B_{L/}$ $I_{L/H}$	-	-	• / -	
55	%IX0.21	$B_{L/}$ $I_{L/H}$	-	-	• / -	
18	%IX0.22	$B_{L/}$ $I_{L/H}$	-	-	• / -	
37	%IX0.23	$B_{L/}$ $I_{L/H}$	-	-	• / -	VBB_O (1)
39	%IX0.24	$B_{L/H}$	%QX0.08	B_H	•▯•	VBB_O (1)
03	%IX0.25	$B_{L/H}$	%QX0.09	B_H	•▯•	VBB_O (1)
40	%IX0.26	$B_{L/H}$	%QX0.10	B_H	•▯•	VBB_O (1)
22	%IX0.27	$B_{L/H}$	%QX0.11	B_H	•▯•	VBB_O (1)
41	%IX0.28	$B_{L/H}$	%QX0.12	B_H	•▯•	VBB_O (1)
42	%IX0.29	$B_{L/H}$	%QX0.13	B_H	•▯•	VBB_O (1)
43	%IX0.30	$B_{L/H}$	%QX0.14	B_H	•▯•	VBB_O (1)
04	%IX0.31	$B_{L/H}$	%QX0.15	B_H	•▯•	VBB_O (1)
48	%IX0.32	B_L	%QX0.16	B_H PWM	•▯•	VBB_R (2)
49	%IX0.33	B_L	%QX0.17	$B_{H/L}$ H-Bridge	•▯•	VBB_R (2)
31	%IX0.34	B_L	%QX0.18	$B_{H/L}$ H-Bridge	•▯•	VBB_R (2)
50	%IX0.35	B_L	%QX0.19	B_H PWM	•▯•	VBB_R (2)
51	%IX0.36	B_L	%QX0.20	B_H PWM	•▯•	VBB_R (2)
52	%IX0.37	B_L	%QX0.21	$B_{H/L}$ H-Bridge	•▯•	VBB_R (2)
16	%IX0.38	B_L	%QX0.22	$B_{H/L}$ H-Bridge	•▯•	VBB_R (2)
35	%IX0.39	B_L	%QX0.23	B_H PWM	•▯•	VBB_R (2)

Note the double pin connection of inputs/outputs.

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Classification: 470.710.740