Power Distribution Controllers
CAN Box 8FR6

CAN Box 8FR6 is a programmable power distribution controller. It offers 8 fuse and relay channels and 6 high side channels and is intended to distribute the main power supply to several loads. All relays could be optionally fitted with current sense. The relays offer a digital feedback of each output, allowing a diagnosis of a defect fuse or monitoring relay's status. CAN Box 8FR6 is freely programmable according IEC61131-3 and fitted with two CAN interfaces. The product allows advanced gateway functionalities in addition to the standard PLC functions.

Applications

- Power distribution over eight fuses and relays and six high sides
- Analogue signals to CAN bus
- CAN to CAN gateway

Technical data

General information	
Housing	REDline Box Medium
Connector	1 x Powerelement M6
	1 x LeavySeal 39 pins
Dimensions	167 x 142 x 74
Weight	~470 g, unequipped
Operating temperature	-40 °C to 70 °C (no full load at 85 °C)
Storage temperature	-40 °C to 85 °C
Ingress protection	IP 64 (dust-proof / splashing protection)
Operating voltage	12 V or 24 V (relays) / 9 – 32 V HSD
Max self-protection voltage	Switch off over appr. 35 V
Pre-fusing (recommended)	80 A main supply
	1 A V_{CPU}
Max current (@ 70 °C)	55 A (max 6 relays constantly on)
Power consumption	Active (no output current) < 180 mA
	Sleep mode < 1 mA
Processor type	NXP K10 Cortex M4 32 bit
Clock frequency	120 MHz
Flash memory	512 kB
RAM	128 kB
FRAM	2 kB

Status LED	
Color	tri-color RGB LED
Function	Free programmable status LED
Visibility	Through transparent window

CAN bus	
acc. ISO 11898-5	High speed, wake-on-CAN
Baud rate	20 kBit/s to 1000 kBit/s (500 kBit/s default value)

Inputs / outputs overview		
4	Analogue inputs	0 – 30 V
4	Analogue inputs	0 – 10 V / 0 – 20 V mA
8	Fuses & relays	10/15 A micro relays with current sense
2	CAN interfaces	CAN high speed
1	Ignition inputs	Wake up feature
6	Digital outputs or PWM outputs	High side outputs max 2 A PWM outputs max 1 A
4	Frequency inputs	0 – 10 kHz
2	Temperature sensors	-40 °C to 125 °C (± 5 % at 125 °C)

Inputs / outputs details	
Analogue inputs	**4 x 0 – 30 V DC**
Input voltage range	0 – 32.4 V DC
Resolution	12 bits
Input resistance	130 kΩ
Analogue inputs	**4 x 0 – 10 V DC/ 0 – 20 mA**
Input voltage range	0 – 11.4 V DC
Resolution	12 bits
Input resistance	65 kΩ
Current input mode 0 – 20 mA	Switchable 380 Ω pull-down error < 1 % 4 – 20 mA (range 0 – 29 mA)
Frequency inputs	
Input resistance	42.5 kΩ
Input frequency	10 kHz
Duty cycle	0 to 100 % (1 % step)
Pull-up resistance	48.7 kΩ switchable to V_{CPU}
Digital inputs	**On each relay's output**
Input voltage range	0 V DC to Vsupply
Switch-on level	5 V
Switch-off level	3.3 V
Input resistance	49 kΩ at 32 V

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Inputs / outputs details	
Relays outputs	
Current output	10 A (NC) / 15 A (NO)
Current feedback	accuracy ~ 6 mA step error < 5 % from 1 A to 15 A range 0 to 22.5 A
ATO Fuse (intern)	20 A max / channel (15 A max current)
Digital outputs	**High side**
Load current	Max 2 A Diagnostic current sense, free wheel diode
Current feedback	accuracy ~ 1 mA step error < 5% from 0 to 2 A range 0 to 3.65 A
PWM outputs	
PWM frequency	Max 1 kHz
Duty cycle	effective 10 to 90 %
Resolution	0.1 %
Load current	Max 1 A at 1 KHz

Protections	
Overvoltage	CPU shutdown / transil diode
Relays	No specific voltage protection implemented (depends on coil specification)
Over current	Relays: depending on equipped fuses HSD: twice the nominal current allowed for 1 minute
Short to ground / battery	All inputs are referenced to ground. Relays are protected by fuses. High side outputs are protected by internal thermal protection.

Test standards and regulations		
E1	UN/ECE-R10 10R06 9300	ESD Immunity Radiated Immunity Conducted Immunity Magnetic Immunity Conducted Emissions Radiated Emissions
Electrical tests	ISO 7637-2	Pulse 1, 24 V System, Pulse 2a, 24 V System, Test Level III, 5000 Events, FSC B Pulse 2b, 24 V System, Test Level I-IV, FSC C Pulse 3a, 24 V System, Test Level III, FSC A* Pulse 3b, 24 V System, Test Level III, FSC A* (*pulse not suppressed at output voltage)
	ISO 16750-2	Starting Profile, 12 V System, Pulse A, 24 V System, Us= 123 V, Ri= 2 Ω, td= 350 ms, 100 Events, FSC C Pulse B, 24 V System, Us = 123 V, Up = 30 V, Ri= 2 Ω, td = 300 ms, 100 Events, FSC C
	ISO-11452-2 ISO-11452-4 ISO-10605 EN 55025 (CISPR 25)	
Environmental tests	EN 60068-2-30 EN 60068-2-78 EN 60068-2-52	
Mechanical tests	ISO 16750-3 EN 60068-2-6 ISO 16750-3	

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Intend of use and disclaimer	
Relays K1 – K8	The design will allow a voltage to be present on the normally closed contact even if the V_{CPU} is not present, as long as the main supply will be powered. In that stage, there is no possibility to activate the relays or to take any action through the CPU.
HSD 0 – 5	Whereas protected against reverse polarity the outputs are not intended to be supplied by another voltage while the Vmain is not present. This may lead to reverse supply of CPU.
LED usage	The LED will illuminate while booting the CPU. Once the CPU has started the LED behavior has to be defined in the main application.
Temperature sensors	The temperature sensors are only an indication and are here to give a rough idea about the temperature status of the product. No specific behavior has been designed in. The final application is free to define some actions based on those temperature sensors (NTC resistor type). When either temperature measurement rises above 100 °C, countermeasures should be taken to reduce the heat generation within the box (e.g. number of active relays).
Vmain / V_{CPU}	The main supply voltage is connected to all the outputs and should be protected outside of the box. The V_{CPU} is only supplying the logic and CAN drivers. It has to be present to allow the electronic to start (wake-on-CAN or wake through ignition pin).
CAN 0 port	CAN 0 port is used for UDS programming and WEcontrol Designer debugging interface. Following IDs are by default reserved for our purpose: 0x100 / 0x7E0 / 0x7DF / 0x7E8

Diagnostic possibilities (Example)	
Relays K1 – K8 & fuses	The NO and NC contacts are connected to digital inputs allowing a feedback on their status (switched / not switched). **Warning:** the logic for analysis has to be programmed in the main application. NO '0' & NC '0' → fuse blown Relay trigger + no modification → relay defective Relay switch off + no modification → relay defective Both'1' → external voltage injection, prevent relay to be switched on
HSD 0 – 5	On the high side, the current feedback information can be used to detect short circuit or overload. Actions may then be programmed in the main application.

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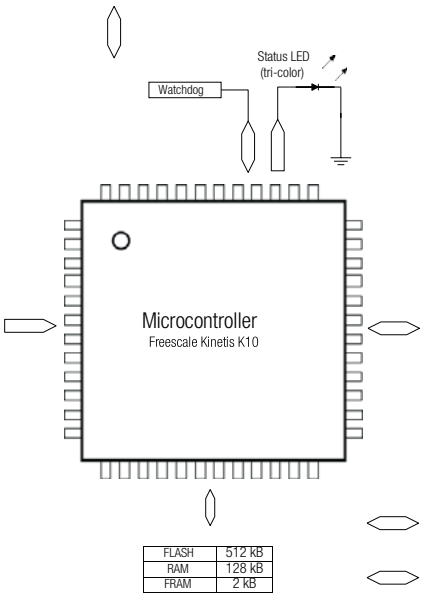
Hardware map

PE		AI_30V_MAIN_PWR	**Power Supply** for Outputs	**1x**
X1	32	N/A	**Power Supply** for CPU and CAN (Vcpu)	**1x**
X1	27	GND	Ground	**3x**
X1	30			
X1	33			

X1	24	AI_30V_00	**Analogue Input** 0-33.6 V DC, 12 Bit	**8x**
	21	AI_30V_01		
	18	AI_30V_02		
	15	AI_30V_03		
	12	AI_10V_20MA_04	**Analogue Input** 0-11 V DC 0-20 mA, 12 Bit	
	9	AI_10V_20MA_05		
	6	AI_10V_20MA_06		
	3	AI_10V_20MA_07		
	28	DI_REL_K1_NO	**Digital Input** Relay's outputs feedback	**16x**
	25	DI_REL_K1_NC		
	22	DI_REL_K2_NO		
	19	DI_REL_K2_NC		
	16	DI_REL_K3_NO		
	13	DI_REL_K3_NC		
	10	DI_REL_K4_NO		
	7	DI_REL_K4_NC		
	17	DI_REL_K5_NO		
	-	DI_REL_K5_NC		
	14	DI_REL_K5_NO		
	-	DI_REL_K5_NC		
	11	DI_REL_K7_NO		
	-	DI_REL_K7_NC		
	8	DI_REL_K8_NO		
	-	DI_REL_K8_NC		
	31	DI_KL15_IGN	**Ignition** – wake up	**1x**
	29	DI_FREQ_00	**Frequency Input** With switchable pull up to Vcpu	**4x**
	26	DI_FREQ_01		
	23	DI_FREQ_02		
	20	DI_FREQ_03		

TEMP_HSD	**Temperature Sensor** -40 °C to 125 °C (±5 % @125 °C)	**2x**
TEMP_REL		

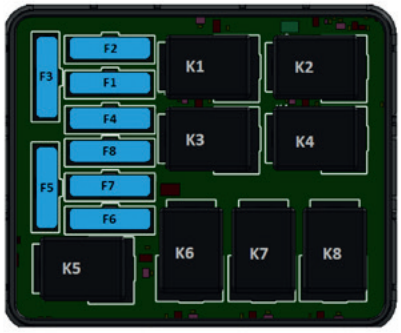


2x	**Analogue Input** 12 Bit	AI_30V_MAIN_PWR	V_MAIN
		AI_3V3	3.3V DC

6x	**Digital Output or PWM Output** 2 A/Output 1 A/PWM Current sense measurement	HSD block1	HSD0	34	X1
			HSD1	37	
		HSD block2	HSD2	35	
			HSD3	38	
		HSD block3	HSD4	36	
			HSD5	39	
4x	**Change-over Relay Output** 10/15 A Current sense measurement Fuse protected (15 A)	K1 NO		28	
		K1 NC		25	
		K2 NO		22	
		K2 NC		19	
		K3 NO		16	
		K3 NC		13	
		K4 NO		10	
		K4 NC		7	
4x	**Relay Output** 15 A max Current sense measurement Fuse protec:on (20 A max)	K5 NO		17	
		K6 NO		14	
		K7 NO		11	
		K8 NO		8	

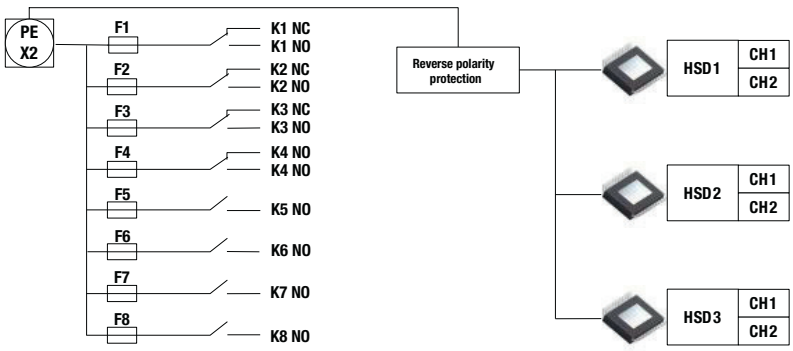
1x	**CAN BUS 0** High Speed (11898-5), wake-on CAN	CAN 0H	1	X1
		CAN 0L	2	
1x	**CAN BUS 1** High Speed (11898-5), wake-on CAN	CAN 1H	4	
		CAN 1L	5	

Fuses & relays location



Design has an internal parallel diode on each coil. We recommend using relays with diode or no protection at all. Relays with resistor are generating more heat within the enclosed environment.

Power supply distribution



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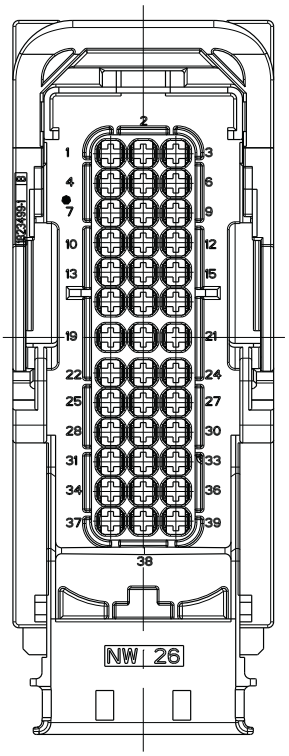
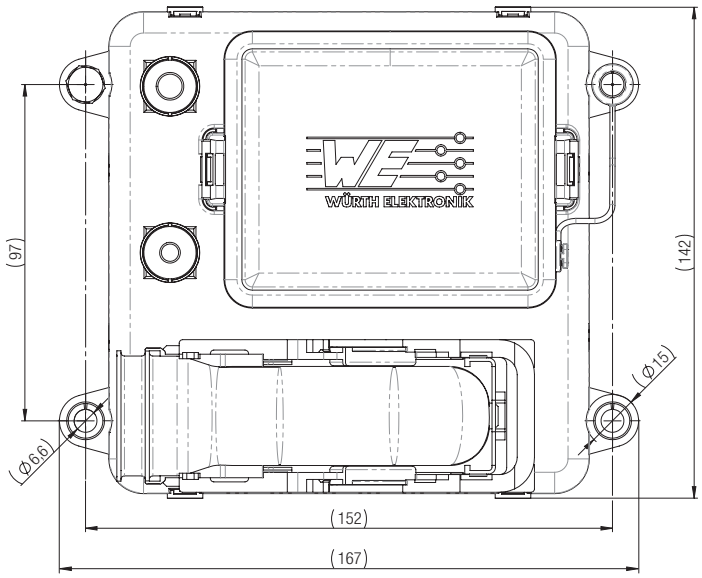
Pin assignment

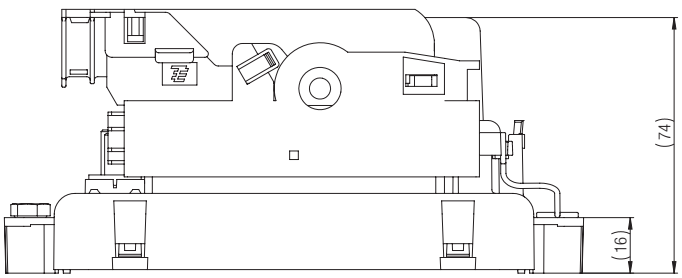
X1 Connector		
Pin	**Description**	**Function**
1	CAN0_H	CAN-bus 0 High
2	CAN0_L	CAN-bus 0 Low
3	AI_10V_20MA_07	Analogue input 0 – 10 V 0 – 20 mA
4	CAN1_H	CAN-bus 1 High
5	CAN1_L	CAN-bus 1 Low
6	AI-10V_20MA_06	Analogue input 0 – 10 V 0 – 20 mA
7	DI_REL_K4_NC	Normally closed contact 4 (87 A)
8	DI_REL_K8_NO	Normally open contact 8 (87)
9	AI_10V_20MA_05	Analogue input 0 – 10 V 0 – 20 mA
10	DI_REL_K4_NO	Normally open contact 4 (87)
11	DI_REL_K7_NO	Normally open contact 7 (87)
12	AI_10V_20MA_04	Analogue input 0 – 10 V 0 – 20 mA
13	DI_REL_K3_NC	Normally closed contact 3 (87 A)
14	DI_REL_K6_NO	Normally open contact 6 (87)
15	AI_30V_03	Analogue input 0 – 30 V
16	DI_REL_K3_NO	Normally open contact 3 (87)
17	DI_REL_K5_NO	Normally open contact 5 (87)
18	AI_30V_03	Analogue input 0 – 30 V
19	AI_30V_02	Analogue input 0 – 30 V
20	DI_FREQ_03	Frequency input 4
21	AI_30V_01	Analogue input 0 – 30 V
22	DI_REL_K2_NO	Normally open contact 2 (87)
23	DI_FREQ_02	Frequency input 3
24	AI_30V_00	Analogue input 0 – 30 V
25	DI_REL_K1_NC	Normally closed contact 1 (87 A)
26	DI_FREQ_01	Frequency input 2
27	GND	Ground
28	DI_REL_K1_NO	Normally open contact 1 (87)
29	DI_FREQ_00	Frequency input 1

X1 Connector		
30	GND	Ground
31	DI_KL15_IGN	Ignition
32	Logic / CPU supply	Power supply for CPU and CAN
33	GND	Ground
34	DO_HS_00	High side with current sense max 2 A (PWM max 1 A)
35	DO_HS_02	
36	DO_HS_04	
37	DO_HS_01	
38	DO_HS_03	
39	DO_HS_05	



Dimensions





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Programming

CAN Box 8FR6 is supported by the new programming environment and by the complementary WE Flasher tool from Würth Elektronik ICS.
This advanced development environment is a set of powerful text and graphic editors for IEC-61131-3 languages.

Supported programming types are:

- Sequential Flow Chart (SFC)
- Function Block Diagram (FBD)
- Ladder Diagram (LD)
- Structured Text (ST)

Further features:

- Optimised application creation
- Simulation and on-line data access / modification over CAN bus
- Automated conversion from one language to another
- Graphical I/O mapping and configuration
- User Defined Function Blocks (UDFB) for specific / repetitive functions
- Automated HTML documentation of project
- Easy graphical debug interface creation (based on application)
- CAN communication database import from Vector and Peak systems

We will also be happy to create your application, based on your requirements.

Order information

Available references	Part number WE ICS
CAN Box 8FR6 (no fuses, no relays) with current measurement on relays, not programmed	ICS-103794
CAN Box 8FR6 (10 A fuses, 12 V relays) without current measurement on relays, not programmed	ICS-103792
CAN Box 8FR6 (10 A fuses, 24 V relays) without current measurement on relays, not programmed	ICS-103793
CAN Box 8FR6 (customer specific equipment and programming)	on request

Mating connector	TE Connectivity Part Number
AMP MCP2.8 RECEPTACLE HSG., 39POS.	5-2208684-3
Cover	1418882-1
MCP 2.8 contacts 1.5-2.5 mm²	1-968857-1
MCP 2.8 contacts 0.5-1.0 mm²	1-968855-1
Single wire seal	828905-1

For more information visit us at www.we-online.com/ics or call +49 7940 9810-0.

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