SYS TEC ELECTRONIC

Development Board ECUcore-5208

Hardware Manual

Edition August 2009

Status / Changes

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Ordering Information:	+49 (3661) 6279-0 info@systec-electronic.com	
Technical Support:	+49 (3661) 6279-0 support@systec-electronic.com	
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Web Site:	http://www.systec-electronic.com	

1st Edition August 2009

1 Introduction

The ECUcore-5208 Development Board provides a flexible development platform enabling quick and easy start-up and subsequent programming the Single Board Computer module. The Development Board design allows easy operation of the installed ECUcore in Communication Networks (LAN, RS422, CAN) and allow simple GPIO-Tests by keys and led's. Components for SPI and I²C allow easely testing of these bus-systems. A connection of additional expansion board features various functions that support fast and convenient prototyping and software evaluation.

For the SYSTEC IEC1131-PLC-firmware an additional RUN/STOP/MRES/CFG switch is provided on the Development Board as well as one RUN LED and one ERROR LED for indication of the operating mode of the IEC1131-PLC.

This manual describes the function of the development board. Precise specifications for the installed ECUcore or controller populating the ECUcore can be found in the applicable Hardware Manual and controller User's Manual or Data Sheet. No description of the module or microcontroller functions is included in this Hardware Manual, as such functions are not relevant for the basic functioning of the Development Board.
Please refer to the corresponding manuals and documentation for any other board-ic's you may use.

Low-active signals are denoted by a „/“ in front of the signal name (i.e. “/RD”). The representation “0” indicates a logical-zero or low-level signal. A “1” is the synonym for a logical one or high-level signal.

2 Ordering Information and Support

Part Number	Version
4002006	Development Board ECUcore-5208

Developmentboard features:

- Socket for ECUcore-5208 (Part.Number: 4001006)
- switching regulator 24VDC / 5VDC
- switching regulator 24VDC / 3,3VDC
- 4x4 keypad and 128x64 dot LCD display as HMI
- 6 keys and 5 led's free usable for development
- one 8position dip-switch
- two hexcode-switches
- one 4position slider switch and 2 led's for using with plc-firmware
- boot- and reset key's and led's
- battery for buffering real-time-clock on ECUcore
- potentiometer and ADC as analog input and SPI example
- DAC as SPI example
- SD-card socket
- I2C to SPI bridge
- Ethernet-connector for onboard PHY on ECUcore
- CAN-interface with connectors
- 2 RS232-Interfaces with connectors
- RS422-Interface with connector
- 26pin BDM/JTAG-interface for MCF5208
- all free usable pins of ECUcore are brought out to expansion connector, 2x 26pol pin contact stripes with user frindly 2,56mm contact spacing

3 Properties of the Development Board

3.1 Overview

The ECUcore-5208 belongs to the SYS TEC's ECUcore family. The ECUcore-5208 integrates all elements of a microcontroller system on a board. The module need's only an external power-supply (3,3V) to operate. The development board was build for accessing all interfaces of ECUcore and rapid development of softwaredrivers and applications. Some special drivers or external controllers are helpfull to interact with the environment (bus-systems, control elements). All interfaces are brought out on standard connectors (RJ45, DSUB).

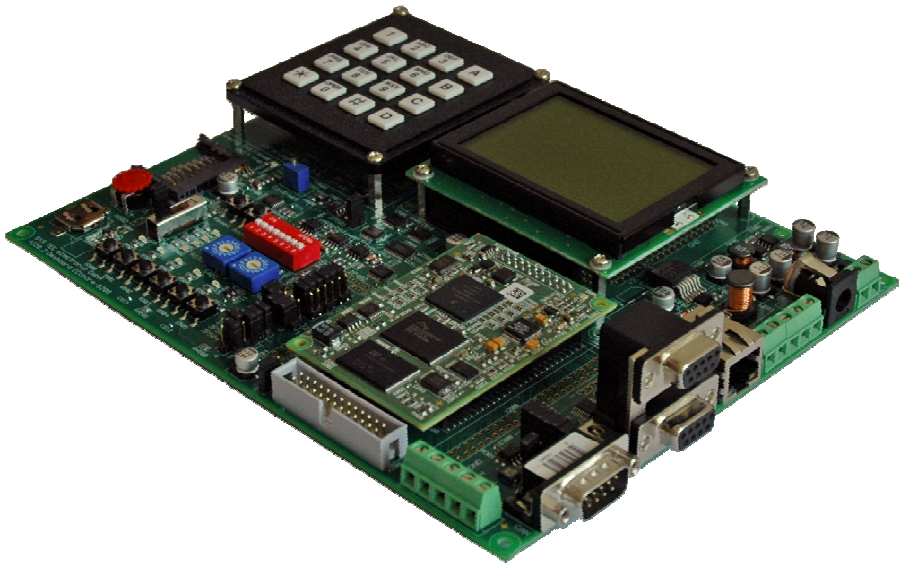

Figure 1: Development Board ECUcore-5208

The dimensions of the board are 200mm x 160mm.

3.2 Block Diagram

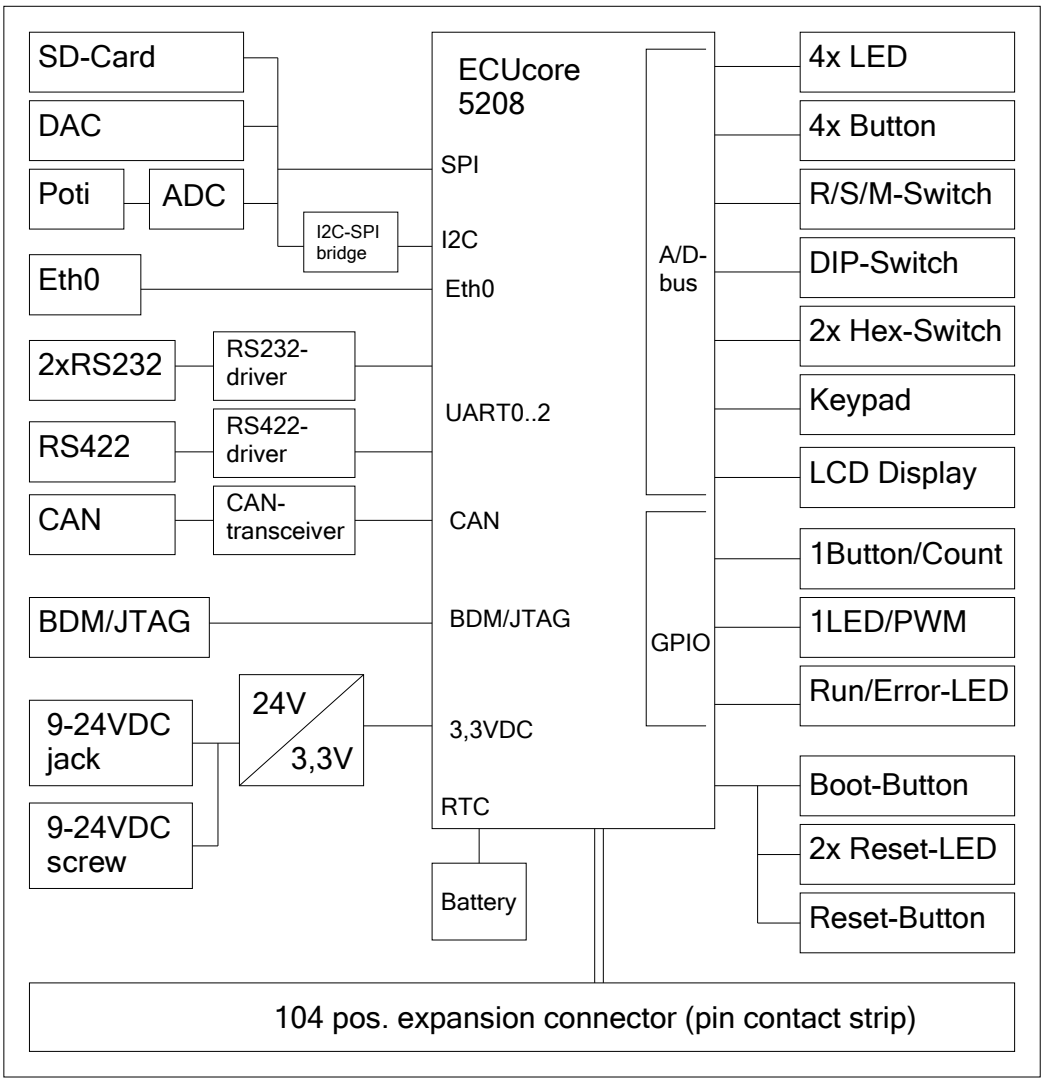

Figure 2: Block Diagram Development Board ECUcore-5208

3.3 Positions of elements

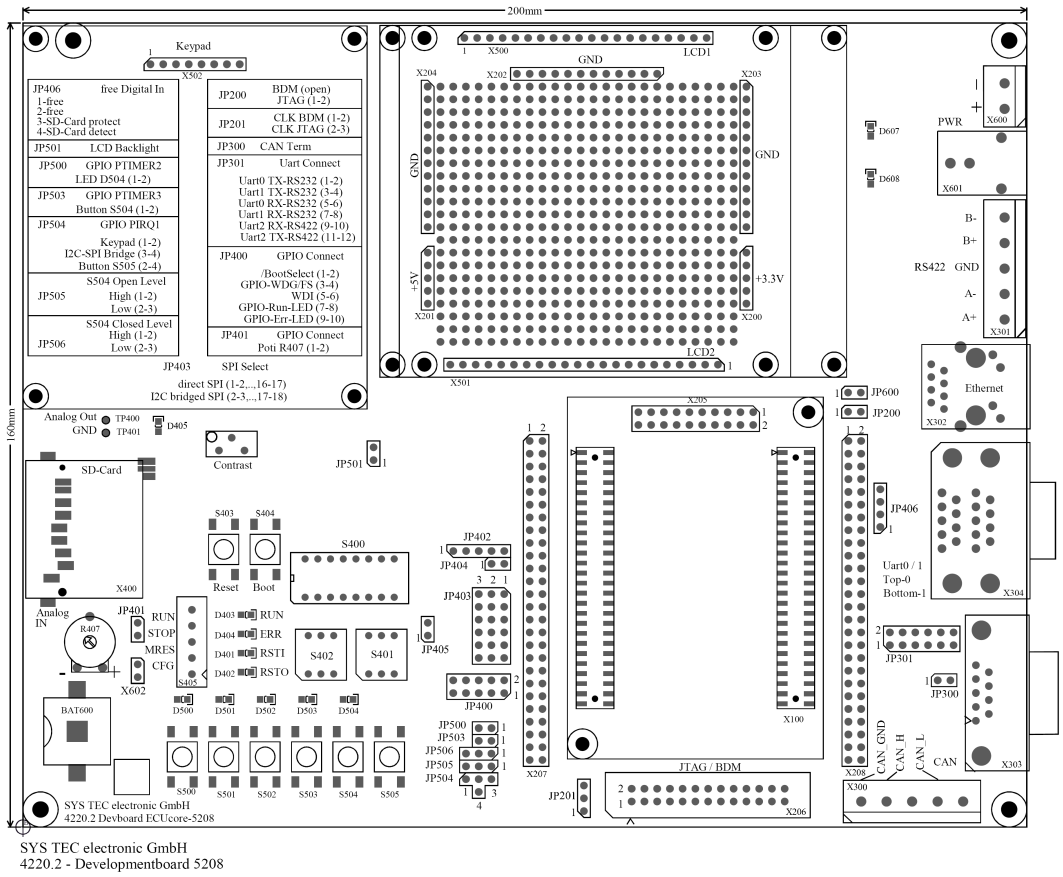

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Figure 3: Positions of components

3.4 Jumper

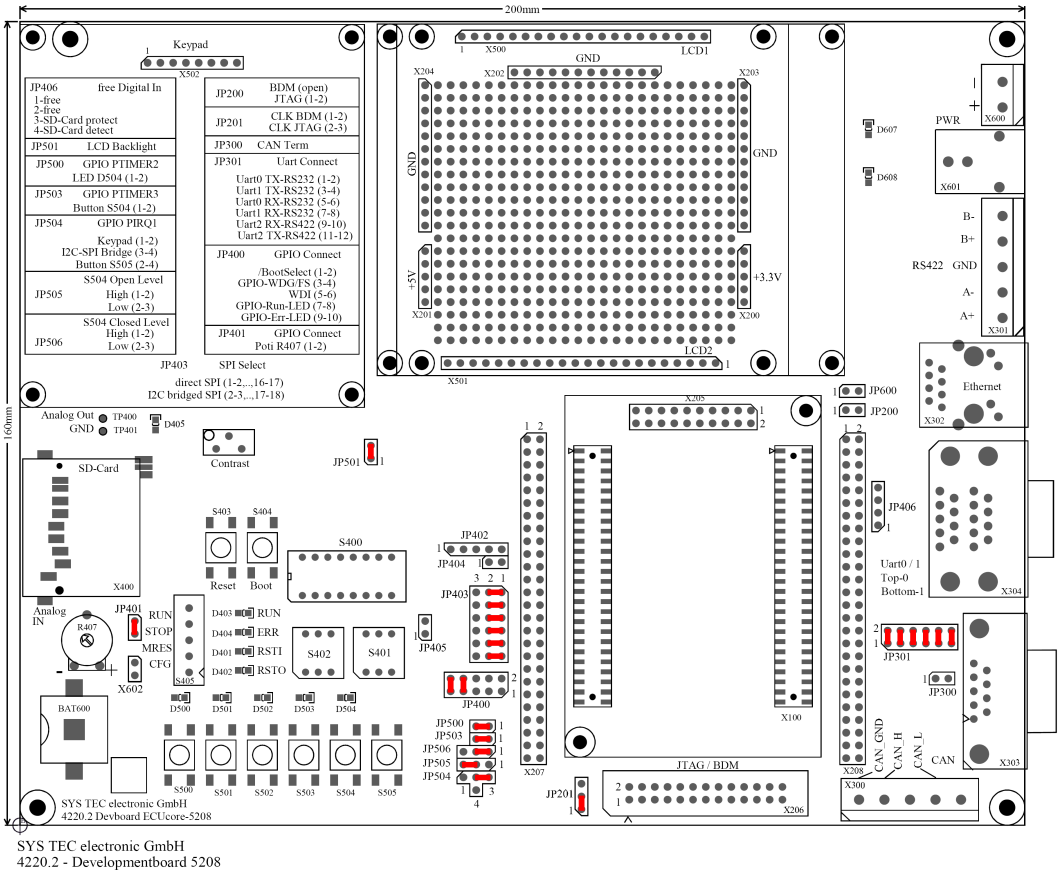

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Figure 4: Default Jumper configuration

Jumper	Signal	Jumper Setting	Function
JP200	JTAG_EN	open (default)	BDM for ECUcore-5208
		1-2	JTAG for ECUcore-5208
JP201	PSTCLK_TCLK	1-2 (default)	PSTCLK_TCLK used for BDM
		2-3	PSTCLK_TCLK used for JTAG
JP300	CAN Termination	open (default)	Termination 120R on CAN0 inactive
		1-2	Termination 120R on CAN0 active
JP301	UART-Signals	1-2 (default)	PUART_TXD0 on RS232 driver
		3-4 (default)	PUART_TXD1 on RS232 driver
		5-6 (default)	PUART_RXD0 on RS232 driver
		7-8 (default)	PUART_RXD1 on RS232 driver
		9-10 (default)	PUART_RXD2 on RS422 driver
		11-12 (default)	PUART_TXD2 on RS422 driver
		any open	UART signals are not connected to RS232/RS422 driver
JP400	various GPIO-Pins	1-2 (default open)	pull /BOOTSELECT to low, if closed
		3-4 (default open)	GPIO_PUART2 to WDG_FS for connection of GPIO_PUART2 to WDI (5-6 closed and R404 not assembled) or for connection of GPIO_PUART2 to FS of DAC (5-6 open and R404 assembled)
		5-6 (default open)	WDI to WDG_FS for loopback GPIO_PUART2 to WDI (3-4 closed and R404 not assembled)
		7-8 (default)	GPIO_PCS2 to RUN-LED
		9-10 (default)	GPIO_PCS3 to ERROR-LED
JP401	AIN	1-2 (default)	connect potentiometer R407 to AIN
		open	AIN is open
JP402 (not assembled)	free SPI-/CS		unused Signals of SPI-/CS decoder
JP403	SPI signals	1-2, 4-5, 7-8, 10-11, 13-14, 16-17	connect SD-card, ADC and DAC direct to SPI-Signals of ECUcore-5208 see detailed description for SPI
		2-3, 5-6, 8-9, 11-12, 14-15, 17-18	connect SD-card, ADC and DAC bridged to I2C-Signals of ECUcore-5208 see detailed description for SPI
JP404 (not assembled)	PSPI_/CSCAN	1-2	possible loopback of decoded SPI-CS to PSPI_/CSCAN
JP405 (not assembled)	optional clock for I2C-SPI-bridge	1-2	optional clock to /SS3 of I2C-SPI-bridge
		open	/SS3 of I2C-SPI-bridge can be used as GPIO
JP406 (not assembled)	free digital input	1	free
		2	free
		3	free / SDCARD_PROT
		4	free / SDCARD_DET
JP500	GPIO_PTIMER2	1-2	GPIO_PTIMER2 to LED D504
JP501	LCD backlight	1-2	5V to LCD backlight
JP503	GPIO_PTIMER3	1-2	GPIO_PTIMER3 to button S504
JP504	GPIO_PIRQ1	1-2	GPIO_PIRQ1 to INT Keypad
		2-3	GPIO_PIRQ1 to /INT I2C-SPI-bridge
		2-4	GPIO_PIRQ1 to button S505

Jumper	Signal	Jumper Setting	Function
JP505	level of not pressed button S504	1-2	pulled up to high
		2-3	pulled down to low
JP506	level of pressed button S504	1-2	pulled up to high
		2-3	pulled down to low
JP600	PowerFail	open	PFI of ECUcore not connected to power supply
		1-2	PFI of ECUcore connected to power supply

Table 1: Jumpers on development board

3.5 Board connectors

Connector	Function
X100	main connector of ECUcore-5208
X200	3V3 near wrap field
X201	5V near wrap field
X202	GND near wrap field
X203	GND near wrap field
X204	GND near wrap field
X205	simplified BDM/JTAG interface of ECUcore-5208
X206	recommended BDM/JTAG interface
X207	expansion connector of ECUcore-5208
X208	expansion connector of ECUcore-5208
X300	CAN
X301	RS422 (UART2)
X302	Ethernet
X303	CAN
X304	RS232 (UART0, 1)
X400	SD-card
X500	LCD
X501	LCD
X502	Keypad
X600	Power Supply
X601	Power Supply
X602	Battery Supply for RTC on ECUcore-5208

Table 2: Connectors on development board

The following table defines the pinout of the ECUcore-5208 main connector X100. The expansion connectors have the same pinout (X207 is X100 A+B; X208 is X100 C+D).

Signal	Pin	Pin	Signal		Signal	Pin	Pin	Signal
GND	A01	B01	/MR		2V5_EPHY	C01	D01	ETH_TX-
/RSTO	A02	B02	/RSTI		GND	C02	D02	ETH_TX+
PFI	A03	B03	PI2C_DATA		ETH_RX+	C03	D03	ETH_LINK/ACT
WDI	A04	B04	GND		ETH_RX-	C04	D04	GND
TP_0	A05	B05	PI2C_CLK		ETH_SPEED	C05	D05	GPIO_PUART2
A0	A06	B06	A10		D16	C06	D06	D24
GND	A07	B07	A11		GND	C07	D07	D25
A1	A08	B08	A12		D17	C08	D08	D26
A2	A09	B09	A13		D18	C09	D09	D27
A3	A10	B10	GND		D19	C10	D10	GND
A4	A11	B11	A14		D20	C11	D11	D28
A5	A12	B12	A15		D21	C12	D12	D29
GND	A13	B13	A16		GND	C13	D13	D30
A6	A14	B14	A17		D22	C14	D14	D31
A7	A15	B15	A18		D23	C15	D15	PSPI_/CS2
A8	A16	B16	GND		PSPI_/CS0	C16	D16	GND
A9	A17	B17	A19		PSPI_/CS1	C17	D17	PSPI_/CSCAN
/CS1	A18	B18	/CS4		PSPI_CLK	C18	D18	PSPI_MRST
GND	A19	B19	/CS5		GND	C19	D19	GPIO_PIRQ1
R/W	A20	B20	/OE		PSPI_MTSR	C20	D20	GPIO_PIRQ7
/BWE0	A21	B21	GPIO_BWE1		GPIO_PTIMER 2	C21	D21	GPIO_PCS2
GPIO_PBUSCTL0	A22	B22	GND		GPIO_PTIMER 3	C22	D22	GND
GPIO_PBUSCTL2	A23	B23	/BOOTSELEC T		PUART_RXD0	C23	D23	GPIO_PCS3
VBAT	A24	B24	PCAN_RX0		PUART_RXD1	C24	D24	PUART_TXD0
GND	A25	B25	PCAN_TX0		GND	C25	D25	PUART_TXD1
3V3	A26	B26	3V3		PUART_RXD2	C26	D26	PUART_TXD2

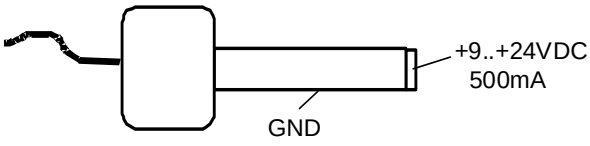
Table 3: Pinout ECUcore-5208 connector

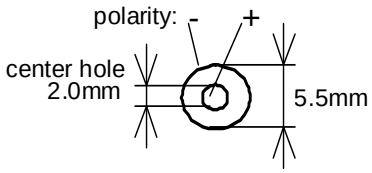
4 Component Descriptions

4.1 Power Supply

The Developmentboard needs a supply of 9VDC to 24VDC unregulated. Power should be min. 12W to supply module and any peripheral circuits.

External power supply can be connected by Low Voltage Socket X601 or Terminal Block X600.





Please ensure that the correct polarity is applied to the terminal block. This is shown on the silkscreen on the PCB next to the terminal block.

From this voltage two switching regulators produce the onboard voltages (5VDC and 3,3VDC).
5VDC only used for LCD display. 3,3VDC supplies the ECUcore and all other peripheral elements.

4.2 BDM-Interface

The BDM-Interface is for programming and debugging the Coldfire-CPU. It's a pin contact stripes with standard contact spacing 2,54mm.

The Connector-Layout is adjusted for using BDM-Adapter from pemicro (www.pemicro.com) with usb- or parallel interface.
The following table shows the BDM/JTAG layout with pin names.

Signal	Pin	Pin	Signal
not connected	1	2	/BKPT – TMS
GND	3	4	DSCLK – /TRST
GND	5	6	TCLK
/RSTI	7	8	DSI – TDI
3,3V	9	10	DSO – TDO
GND	11	12	PST3
PST2	13	14	PST1
PST0	15	16	DDATA3
DDATA2	17	18	DDATA1
DDATA0	19	20	GND
not connected	21	22	not connected
GND	23	24	PSTCLK
COREvoltage	25	26	/TA

Table 4: BDM/JTAG connector X206

With closed Jumper JP200 the JTAG_EN-Signal will pulled high and the JTAG-Mode of Coldfire is active, e.g. for BoundaryScan. Otherwise programming and debugging in BDM-mode is possible.

The Coldfire 5208 uses one common clock signal for BDM and JTAG. To select the right clock-pinon the connector for the different modes, the jumper JP201 is used.

1-2 closed: common clock PSTCLK_TCLK is connected to PSTCLK on BDM connector (pin 24)

2-3 closed: common clock PSTCLK_TCLK is connected to TCLK on BDM connector (pin 6)

4.3 I/O-Elements

The developmentboard provides a lot of I/O-elements for rapid development of software and for configuration and using of supplied software. Additional LED's directly connected to onboard periphery, like Power Supply and LAN.

The next table shows the connection of each element at the µC.

element	connect to	IO on ECUcore	Function
S400	3,3V	A/D bus	8x DIP switch
S401	3,3V	A/D bus	HexCode switch
S402	3,3V	A/D bus	HexCode switch
S403 "RESET"	GND	/MR	Reset button
S404 "BOOT"	GND	/BOOTSELECT	Bootselect botton
S405	3,3V / GND	A/D bus	R/S/M switch
S500	3,3V	A/D bus	Digital input
S501	3,3V	A/D bus	Digital input
S502	3,3V	A/D bus	Digital input
S503	3,3V	A/D bus	Digital input
S504	3,3V / GND	GPIO_PTIMER3	Digital input / Counter
S505	GND	GPIO_PIRQ1	Digital input / Interrupt
D401 "RSTI"	3,3V	/RSTI	Reset in
D402 "RSTO"	3,3V	/RSTO	Reset out
D403 "RUN"	3,3V	GPIO_PCS2	Run-LED
D404 "ERROR"	3,3V	GPIO_PCS3	Error-LED
D405	GND	SPI	Analog output
D500	3,3V	A/D bus	Digital output
D501	3,3V	A/D bus	Digital output
D502	3,3V	A/D bus	Digital output
D503	3,3V	A/D bus	Digital output
D504	GND	GPIO_PTIMER2	Digital output / PWM
LCD display X500, X501		A/D bus	LCD display
Keypad X502		A/D bus	Keypad

Table 5: I/O-elements connected to ECUcore

LED	connect to	Function
D607	5V	5V-Supply
D608	3,3V	3,3V-Supply

Table 6: LED's connected to onboard IC's

The I/O elements are located in address-space:

/CS4	A2	A1	R/W	I/O element
0	0	0	0	Write LEDs D500…D503 on D24…D27
0	0	1	0	---
0	1	0	0	Write Keypad rows on D24…D27
0	1	1	0	---
0	0	0	1	Read HexCode switch S401 on D16…D19 Read HexCode switch S402 on D20…D23 Read DIP switch S400 on D24…D31
0	0	1	1	Read R/S/M switch S405 on D24…D27 Read SD card detect (and pin 3 on jumper JP406) on D28 Read SD card protect (and pin 4 on jumper JP406) on D29 Read free pins 1+2 on jumper JP406 on D30+D31
0	1	0	1	Read Keypad columns on D24…D27
0	1	1	1	

Table 7: I/O elements in address space

For LCD display the /CS5 is used.

4.4 Ethernet

The Coldfire-CPU has a build-in Ethernet-MAC. A Ethernet-PHY (KS8721BL) is on ECUcore. The Delevopmentboard provide a RJ45-ModularJack X302 for connecting LAN..

Pin	Function
1	TX+
2	TX-
3	RX+
4	TDCT
5	RDCT
6	RX-
7	not connected
8	GND

Table 8: pinout of RJ45-connectors

PHY provides autonegotiation, so standart patch cable can be used, cross-link is not necessary.

4.5 SPI

The SPI peripheries on development board can be used direct by SPI interface of ECUcore or by I2C interface of ECUcore over a I2C-SPI bridge. Which interface is used, can be selected by jumper JP403.
If JP403 1-2, 4-5, 7-8, 10-11, 13-14 and 16-17 is closed, than direct SPI is used.
If JP403 2-3, 5-6, 8-9, 11-12, 14-15 and 17-18 is closed, than bridged SPI is used.

No other jumper configuration is allowed!

For direct SPI interface the /CS signals of the SPI peripheries are generated by an address decoder:

PSPI_CS2	PSPI_CS1	PSPI_CS0	Active periphery
0	0	0	JP402 – 5
0	0	1	SD card
0	1	0	ADC
0	1	1	DAC
1	0	0	JP402 – 4
1	0	1	JP402 – 3
1	1	0	JP402 – 2
1	1	1	JP402 – 1

Table 9: SPI /CS decoding direct SPI interface

4.5.1 I2C-SPI bridge

The I2C-SPI bridge (NXP SC18IS602B) is used, to get access to the SPI periphery over the I2C interface of the ECUcore. This can be necessary, if the SPI-CAN-Controller on ECUcore is used, because this produces a high datarate on SPI. To prevent message lost on CAN, use only this on SPI.
Here the /CS signals of the SPI peripheries are generated by the bridge:

Signal	Active periphery
/SS0	SD card
/SS1	ADC
/SS2	DAC

Table 10: SPI /CS decoding bridged SPI interface

4.5.2 SD-Card

SD-Card-socket X400 provides Standard-SD-Cards and MMC-Cards. It is connected to the ECUcore by SPI-Bus.

Pin	ECUcore
/CS	See /CS configuration in tables above
DI	PSPI_MTSR or I2C-SPI bridge MTSR
DO	PSPI_MRST or I2C-SPI bridge MRST
SCLK	PSPI_CLK or I2C-SPI bridge CLK
DETECT	A/D bus see 4.3
PROTECT	A/D bus see 4.3
COM	3,3V

Table 11: SD-Card connection

4.5.3 ADC

The Analog Digital Converter (TI ADS7822) will be used to getting an analog feature to the plc. Some analog values can be adjusted by Potentiometer R407 and interpreted by software. If jumper JP401 is open, on pin 1 of JP401 an external voltage (0…3,3V) can be measured.
Because in this IC only the analog values must be read, it's not necessary to write parameters (no SI Pin present).

Pin	ECUcore
/CS	See /CS configuration in tables above
SO	PSPI_MRST or I2C-SPI bridge MRST
SCK	PSPI_CLK or I2C-SPI bridge CLK

Table 12: ADC connection

4.5.4 DAC

The Digital Analog Converter (TI TLV5606) will be used to setting an analog feature by the plc.
The output of the DAC is buffered by an operational amplifier with a gain of 2. The output value (0…3,3V) can be measured on testpoint TP400 or can be visualized on LED D405.
Because in this IC only the analog values must be written, it's not necessary to read parameters (no SO Pin present).

Pin	ECUcore
/CS	See /CS configuration in tables above
SI	PSPI_MTSR or I2C-SPI bridge MTSR
SCK	PSPI_CLK or I2C-SPI bridge CLK

Table 13: DAC connection

4.6 CAN

For the CAN-interface of ECUcore-5208 the board provides CAN-transceiver (TI SN65HVD231), a male DSUB9-Connectors (X303) and a terminal block (X300).
Connector pinnout is compatible to CANopen-Standard.

Pin X300	Pin X303	function
2, 5	1, 4, 5, 8, 9	not connected
4	2	CANL
1	3,6	GND
2	7	CANH
	Shield	not connected

Table 14: CAN connector pinout

CAN-Bus can be terminated by 120R with Jumper JP300.

4.7 RS232 / RS422

The ECUcore-5208 provides 3 UART's. 2 UART's can be used as RS232-interface by DSUB-connectors (X304 A+B) on development board. One UART can be used as RS422-interface by a terminal block (X301).

ECUcore-UART	Signal	connector	gender	communication signals
UART0	RS232	X304B	female	RxD0 (3), TxD0 (2), GND (5)
UART1	RS232	X304A	female	RxD1 (3), TxD1 (2), GND (5)
UART2	RS422	X301	terminal block	A+ (1), A- (2), B+ (4) B- (5) GND (3)

Table 15: RS232 connector pinout

4.8 Wrap field

The development board provides the user with a wrap field for building own circuitries. The wrap field provides an array of 24x21 through-hole pads in 2.54mm pitch and X200 for 3,3V-, X201 for 5V- and X202, X203, X204 for GND-connection.

4.9 Keypad

The development board can connect a 4x4 matrix keypad on X502. The column keypad lines are interrupt-capable (configurable via jumper JP504) triggering an interrupt with every key press.
The reference keypad delivered with the Starter Kit is the Grayhill 96BB2-006-F.

If no keypad is used, the I/Os for keypad can be used as normal digital I/Os. So there are 4 additional inputs and 4 additional outputs.

Pin X502	Function
1	Row 1 (output)
2	Row 2 (output)
3	Row 3 (output)
4	Row 4 (output)
5	Column 1 (input)
6	Column 2 (input)
7	Column 3 (input)
8	Column 4 (input)

Table 16: Keypad connection

4.10 LCD display

The development board features a LCD interface circuitry suitable for connecting a 20-pin or 22-pin dot-matrix LCD with Samsung KS0107 or KS0108 graphic controller. All signals are brought out via 2.54mm pitch pin-header rows.
The LCD is memory mapped via /CS5 and the LCD pages are selected by address line A2. The LCD module is reset automatically whenever a hardware reset occurs (/RSTI asserts).

X500 is suitable for connecting LCD with an compatible 20-pin interface. The reference type is WINSTAR WG12864C.

Pin X500	Signal
1	LCD_/CS1
2	LCD_/CS2
3	GND
4	5V
5	LCD_Contrast
6	LCD_D/I
7	LCD_R/W
8	LCD_EN
9	LCD_DB0
10	LCD_DB1
11	LCD_DB2
12	LCD_DB3
13	LCD_DB4
14	LCD_DB5
15	LCD_DB6
16	LCD_DB7
17	LCD_/RSTI
18	NC
19	Backlight
20	GND

Table 17: LCD 20pin connection

X501 is suitable for connecting LCD with a compatible 22-pin interface. The reference type is RICH12864C-09.

Pin X501	Signal
1	LCD_/CS1
2	LCD_/CS2
3	GND
4	5V
5	LCD_Contrast
6	LCD_D/I
7	LCD_R/W
8	LCD_EN
9	LCD_DB0
10	LCD_DB1
11	LCD_DB2
12	LCD_DB3
13	LCD_DB4
14	LCD_DB5
15	LCD_DB6
16	LCD_DB7
17	LCD_CS1_H
18	LCD_CS2_H
19	LCD_/RSTI
20	NC
21	Backlight
22	GND

Table 18: LCD 22pin connection

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