kitCON-164

Hardware-Manual

Edition June 1999

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Preface

This kitCON-164 User's Manual describes the board's design and functions. Precise specifications for the C164 microcontrollers can be found in the enclosed microcontroller Data-Sheet/User's Manual. If software is included please also refer to additional documentation for this software.

In this hardware manual and in the attached schematics, low active signals are denoted by a "/" in front of the signal name (i.e.: /RD). A "0" indicates a logic-zero or low-level signal, while a "1" represents a logic-one or high-level signal.

Declaration regarding EMV-Conformity of the PHYTEC kitCON-164

PHYTEC kitCON Single Board Computers (henceforth „products") are designed for installation in electrical appliances or as dedicated Evaluation Boards (i.e.: for use as a test and prototype platform for hardware/software development) in laboratory environments.

PHYTEC products must be operated within protective, grounded circuitry. Moreover, PHYTEC products should not be operated without protection circuitry if connections to the products' connectors are longer than 3 m.

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PHYTEC products do conform to the CE directives only in accordance to the descriptions and rules of usage indicated in this hardware manual (particularly in respect to the pin header row connectors, power connector and serial interface to a host-PC).

It is necessary that only appropriately trained personnel (such as electricians) handle and/or operate these products. PHYTEC products lacking protective enclosures are furthermore subject to damage by ESD and, hence, may only be unpacked, handled, operated in environments in which sufficient precautionary measures have been taken in respect to ESD-dangers.

The kitCON-164 is one of a series of PHYTEC kitCONs which can be fitted with different controllers and, hence, offers various functions and configurations. PHYTEC supports all common Infineons' 8- and 16-bit controllers in two ways:

(1)   as the basis for Starter Kits in which user-designed hardware can be implemented on a wrap-field around the controller and

(2)   as universal, insert-ready, fully functional micro- and mini-MODULS which can be embedded directly into the user's peripheral hardware design.

PHYTEC's microcontroller modules allow engineers to shorten development horizons, reduce design costs and speed project concepts from design to market. Please contact PHYTEC for additional information:

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1   Introduction to the kitCON-164

The kitCON-164 is a EURO-sized (160 x 100 mm) Evaluation Board for the Infineon C164x microcontroller of the C16x-microcontroller family in a MQFP-80 package. The kitCON-164 is pre-configured and equipped with all necessary connectors required for immediate start-up (*refer to Figure 2).*

The kitCON-164 offers the following features:

- Evaluation Board in EURO-card format 160 x 100 mm, including wrap-field (90x60 mm) for easy layout of user circuitry
- Improved interference safety through multi-layer technology
- Requires single unregulated 8 to 12 V/500 mA power source
- 256 kByte Flash on board (PLCC-package)(optionally expandable to up to 1 MB)[1]
- on-board Flash-programming
- No need for a dedicated programming voltage through use of 5 V-Flash devices
- 64 kByte SRAM on board (optionally expandable to up to 1 MB)
- On-chip Bootstrap Loader
- Programming Voltage for C164CI OTP-programming generated on-board
- All controller ports, as well as data and address lines, extend from the controller to the pins of the kitCON-Connector in the middle of the board
- RS-232 serial interface, available at DB9-socket P1
- If equipped with a C164Cx controller, an additional CAN-Interface is available at DB9-plug P2
- Two LED's to display the boards status, eight freely programmable LEDs at port P1
- Real-Time Clock[2]

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[1]:   For more information about additional configurations see the PHYTEC product catalog
[2]:   The Real-Time Clock is not available on boards included in Infineon Starter Kits

- Up to three free Chip-Select signals for easy connection of peripheral devices (controller-dependent)
- Provision for operating the board with an ICE/connect-16x for easy emulation of the controller
- Provision for operating the board with a Quad-Connector for easy emulation of the controller

1.1 Block Diagram
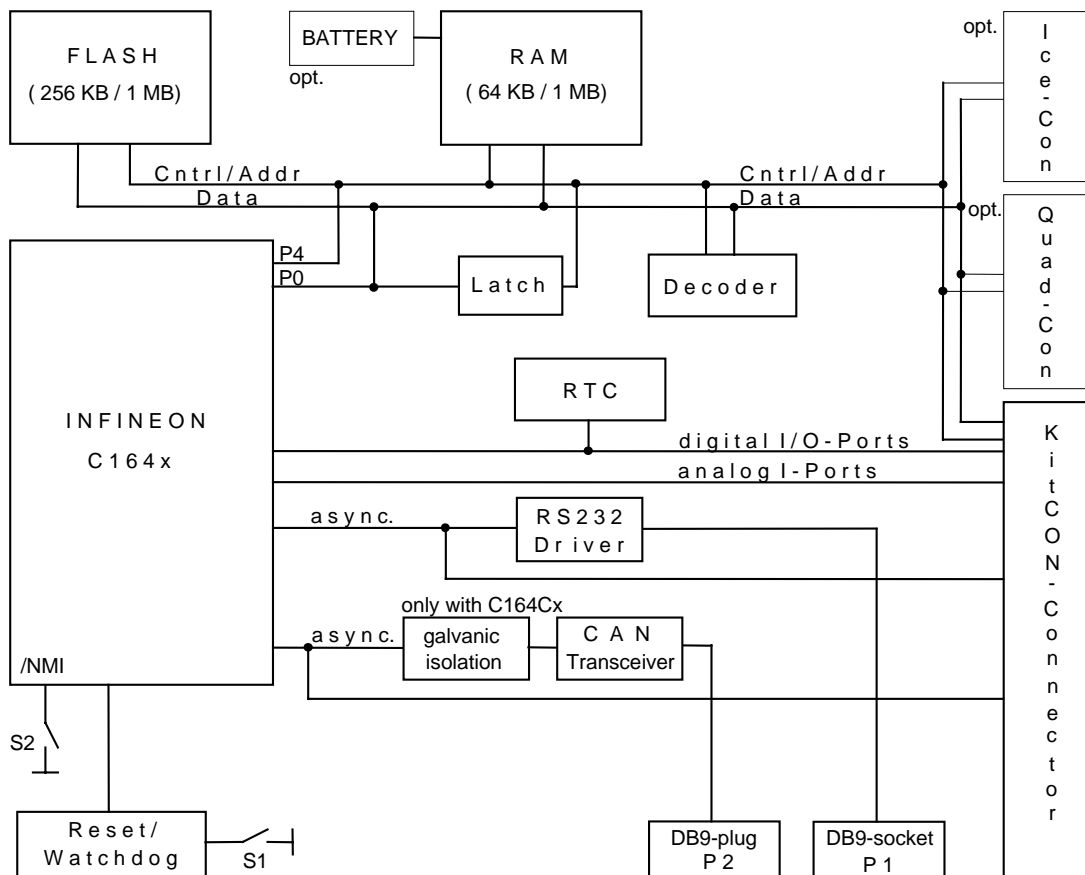
Figure 1:   Block Diagram

1.2 Overview of the kitCON-164
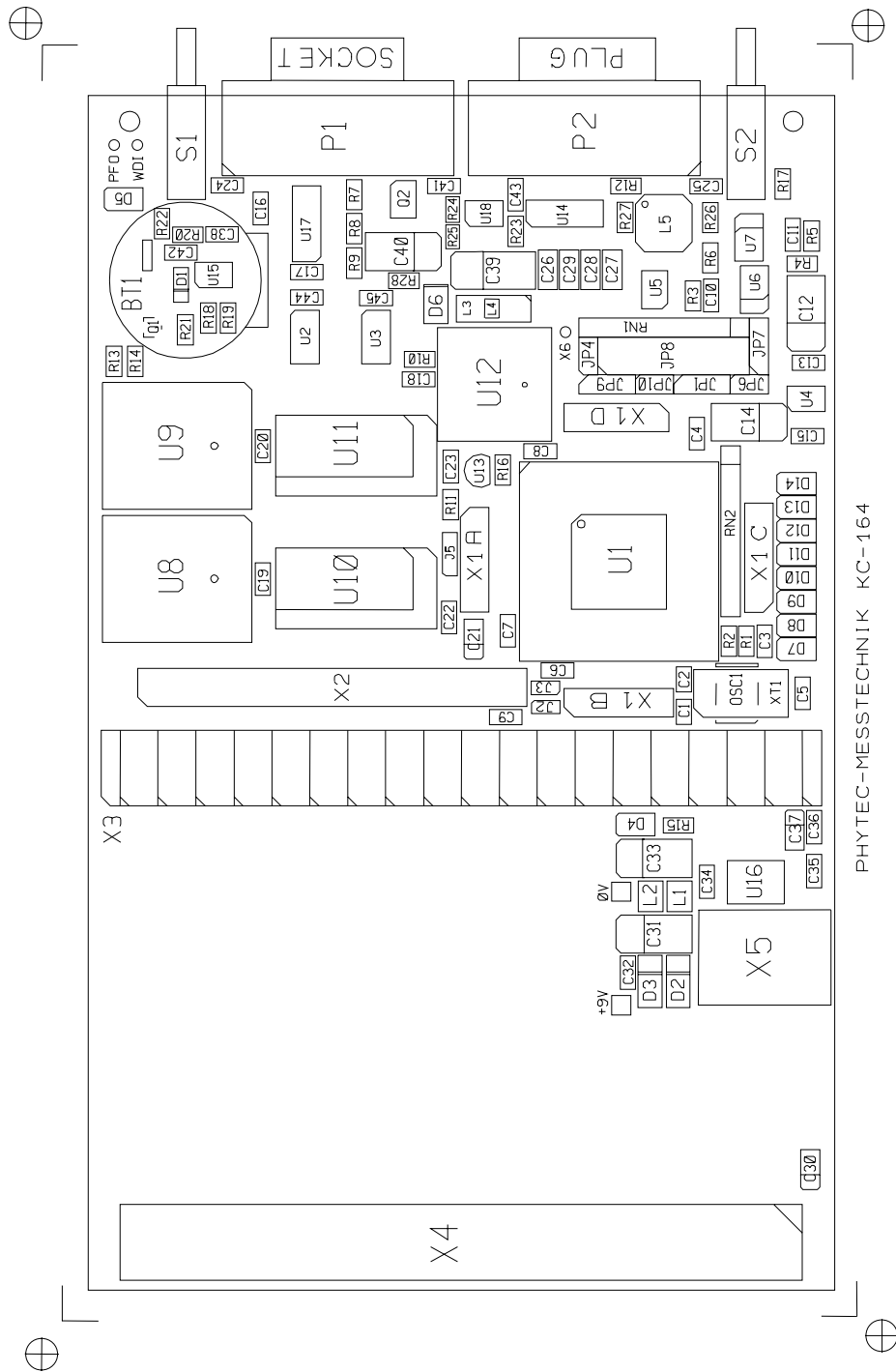
Figure 2:   Overview of the kitCON-164 (component side)

2   QuickStart Instructions

This chapter provides step-by-step instructions for putting the kitCON-164 into operation. Please note that the following instructions refer to the current versions of the FlashTools and the Monitor program from Keil Elektronik GmbH as of the pressing of this manual. To ensure putting the kitCON-164 quick and safe into operation, the use of the PC-software is described only for the DOS environment. Using it in conjunction with other operating systems or environments might result in improper operation, especially in regards to the serial communication.

The standard version of the kitCON-164 houses the C164Cx microcontroller, which includes an on-chip Bootstrap Loader.

Generally the Bootstrap Loader allows downloading and starting of any program suitable for the target controller. Depending on the terminal program used, different applications and tools will be loaded and executed. For instance when executing the PHYTEC terminal program ***FLASHT.EXE***, routines for programming the Flash (the so called FlashTools[1]) will automatically be loaded and started. This is in contrast to the terminal program ***MON166.EXE*** from Keil Elektronik GmbH, which downloads a Monitor program enabling simple debugging of user code.

The following sections provide a step-by-step description for starting the kitCON-164 using the FlashTools as well as for starting the kitCON using the Monitor program[2].

---

[1]:   Software tool for on-board Flash-programming, will be automatically loaded if the terminal program ***FLASHT.EXE*** is used

[2]:   The Monitor program is only available on boards included in Infineon Starter Kits

PHYTEC-MESSTECHNIK KC-164

■ ■   insertable jumper
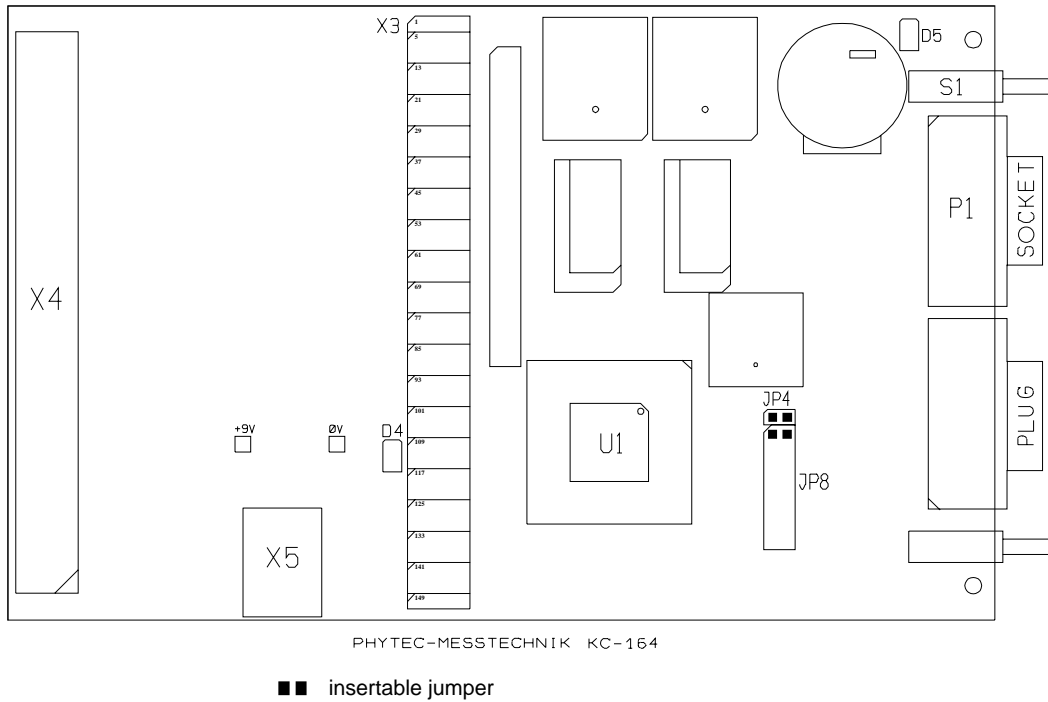
Figure 3:   *Important Jumpers and Connectors for Start-up*
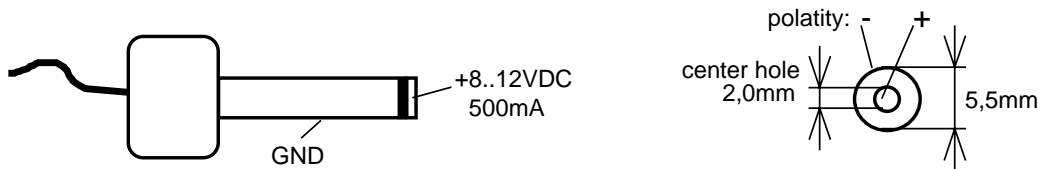
Figure 4:   *The Power-Plug*

2.1 Starting the kitCON using a Monitor program

- Use of the Monitor program requires a kitCON-164 and an IBM-PC or a compatible system, as well as an unregulated power supply for 8 V= - 12 V= /500 mA. Typically, all jumpers for configuring the kitCON-164 have been correctly set upon delivery of the board.

- Connect your Host-PC (COM1 or COM2) to the DB9-socket P1 on the kitCON-164 using a serial cable as shown below.

PC DB9-plug COM1,2		**kitCON-164 DB9-socket P1**
RxD PIN 2	to	TxD PIN 2
TxD PIN 3	to	RxD PIN 3
GND PIN 5	to	GND PIN 5

  No Hardware-Handshake-Line is required to invoke communication between the kitCON-164 and the Host-PC, as the firmware contains a transmission protocol to ensure fault-free data transmission between the PC and the kitCON-164.

- Ensure that the **blue** mode-jumper JP4 is closed.

- Ensure also that jumper JP9 is closed in position 2+3

- Also ensure that pins 1+2 of jumper JP8 (a bipolar pin row to the right of the controller) are closed with the **red** boot-jumper.

- Attach a power supply to the power connector X5. An unregulated 8 V to 12 V=/500 mA power source can be used to supply the board. Use only a fixed voltage power supply and no power supply with variable voltage. Double check the correct polarity of the plug as shown in *Figure 4*. If the power supply is attached correctly the red LED D4 will light up.

- Push switch <S1> to perform a Reset and to start the Bootstrap Loader on the kitCON-164.

- Invoke the terminal program ***MON166.EXE*** on your Host-PC by entering the following at the DOS prompt:

```
mon166 [BR(Baudrate)] [COM port number]
```

Other communication or terminal programs are not suitable for data transmission to and from the Monitor program on the kitCON-164, as a special transmission protocol is required. Ensure that only DOS is active at the time of the invocation.

Attention!
Ensure that the directory in which ***MON166.EXE*** is started contains the two files 'boot' and 'monitor' for the Controller C164.

- The Monitor program will automatically load after invoking ***MON166.EXE*** and the green LED D5 will light up. The loading procedure can be viewed on the monitor screen of the Host-PC.

- After successfully loading, the Monitor program will automatically start and its '#' prompt will appear on the screen of the Host-PC.

- Enter '*load* Pathname*hello164*' now in order to load the demo program.

- Once downloading has finished and the '#' prompt reappears, enter the command 'g' to execute the demo program. Successful execution results in the character string 'Hello World !...' appearing on the screen of the Host-PC.

- To leave the Monitor program press <F1>.

QuickStart Instructions for using a Monitor program - Summary

- Connect the kitCON-164 to an IBM-PC or a compatible system using a serial cable (P1 to COM1 or COM2)

- Close **blue** mode-jumper JP4

- Verify that jumper JP9 is closed in position 2+3

- Connect jumper JP8 at 1+2 with **red** boot-jumper

- Attach an unregulated power supply with 8 V to 12 V=/500 mA to X5 on the kitCON-164. **Double check the correct polarity.**

- Press switch S1 to perform a RESET

- Start *MON166.EXE* on your Host- PC (*mon166 [2* (for COM2)*]*) from the DOS environment

- After the '#' prompt appears, enter '*load* Pathname*hello164*''

- Press <ENTER>

- After the '#' prompt reappears enter 'g'

- Press <ENTER>

- ''Hello World !...'' appears on the screen of your Host-PC.

- To leave the Monitor program press <F1>

2.2 Starting the kitCON and programming the Flash

- Use of the FlashTools requires a kitCON-164 and an IBM-PC or a compatible system, as well as an unregulated power supply for 8 V= - 12 V= /500 mA. Typically, all jumpers for configuring the kitCON-164 have been correctly set upon delivery of the board.

- Connect your Host-PC (COM1 or COM2) to the DB9-socket P1 on the kitCON-164 using a serial cable as shown below.

PC DB9-plug COM1,2		kitCON-164 DB9-socket P1
RxD PIN 2	to	TxD PIN 2
TxD PIN 3	to	RxD PIN 3
GND PIN 5	to	GND PIN 5

- No Hardware-Handshake-Line is required to invoke communication between the kitCON-164 and the Host-PC, as the firmware contains a transmission protocol to ensure fault-free data transmission between the PC and the kitCON-164.

- Ensure that the **blue** mode-jumper JP4 is open.

- Ensure also that jumper JP9 is closed in position 2+3.

- Also ensure that pins 1+2 of jumper JP8 (a bipolar pin row to the right of the controller) are closed with the **red** boot-jumper.

- Attach a power supply to the power connector X5. An unregulated 8 V to 12 V=/500 mA power source can be used to supply the board. Use only a fixed voltage power supply and no power supply with variable voltage. Double check the correct polarity of the plug as shown in *Figure 4*. If the power supply is attached correctly the red LED D4 will light up.

- Push switch <S1> to perform a Reset and to start the Bootstrap Loader on the kitCON-164.

- Invoke the terminal program ***FLASHT.EXE*** on your Host-PC by entering the following at the DOS prompt:

```
flasht [BR(Baudrate)] [COM port number]
```

Other communication or terminal programs are not suitable for data transmission to and from the FlashTools on the kitCON-164, as a special transmission protocol is required. **Ensure that only DOS is active at the time of the invocation.**

Attention!
Ensure that the directory in which *FLASHT.EXE* is started contains the two files 'boot' and 'flash' for the Controller C164.

- The FlashTools will automatically be loaded after invoking *FLASHT.EXE*. The loading procedure can be viewed on the monitor screen of the Host-PC.

- After successfully loading the FlashTools will automatically start and the green LED D5 will light up. Now the FlashTools main menu will appear on the monitor screen of the Host-PC. (*refer to Figure 5*).

```
=====================================================================
                    FLASH-Utility for 80C16X V 2.5
=====================================================================
(c) 1994, PHYTEC Meßtechnik GmbH, D-55129 Mainz

Flash-Devices:              AMD 29F010
Flash-Area:                 000000H-03FFFFH
Software-Protected-Areas #1: none
                        #2: none
                        #3: none
No-Access-Areas         #1: 00EF00H-00FFFFH
                        #2: none
                        #3: none

(1) Flash status information
(2) Erase entire Flash-Area
(3) Erase partial Flash-Area
(4) Load INTEL-hexfile
(5) Software-Reset
(6) Run from address
(7) Erase, Load and Software-Reset

> Command:
```

Figure 5:   The main menu of the FlashTools

- All FlashTools menu options are intuitive. Select menu option 7, 'Erase, Load and software-reset' to download a demo program. Confirm that the unprotected sectors (i.e. the sectors available for user-applications) of the Flash can be erased by entering "Y".

- Following erasure of the unprotected Flash sectors, the next menu will automatically appear on the monitor screen of the Host-PC. Please press <F2> to indicate the name of the Hex-File to be downloaded into the Flash (specify the full pathname). To download the demo program enter 'Pathname*hello164.h86*'. Press <ENTER> to start the download.

- HELLO164.H86 will automatically start following download. Successful execution results in the character string 'Hello World !...' appearing on the screen of the Host-PC. The program can also be executed by pressing the RESET button on the kitCON-164 after removing the **red** boot-jumper from pins 1+2 of jumper JP8 (i.e.: toggling the kitCON-164 into execution mode).

- To leave ***FLASHT.EXE*** press <F1>

If any difficulties should occur during start-up, please contact the PHYTEC Technical Support hotline.

QuickStart Instructions for Flash-programming - Summary

- Connect the kitCON-164 to an IBM-PC or a compatible system using a serial cable (P1 to COM1 or COM2).
- Open **blue** mode-jumper JP4
- Verify that jumper JP9 is closed in position 2+3
- Connect jumper JP8 at 1+2 with **red** boot-jumper
- Attach an unregulated power supply with 8 V to 12 V=/500 mA to X5 on the kitCON-164. **Double check the correct polarity**
- Press switch S1 to perform a RESET
- Start ***FLASHT.EXE*** on your Host- PC (*flasht [2* (for COM2)*]*) from the DOS environment
- Select menu option '7'
- Press <Y> to confirm 'Erase'
- Press <F2>
- Enter 'Pathname*hello164.h86'*
- Press <ENTER>
- An automatic software-reset will execute the program following download.
- "Hello World!..." appears on the screen of your Host-PC.

- To leave the FlashTools press <F1>

To start the demo program again execute the following steps:

- Disconnect the power source
- Remove **red** boot-jumper from pins 1+2 of jumper JP8
- Reconnect the power source

3 Pinout

Please note that all module connections are not to exceed their expressed maximum voltage or current. Maximum input values are indicated in the corresponding controller manuals/data sheets. As damage from improper connections varies according to use and application, it is the user's responsibility to take appropriate safety measures to ensure that the module connections are protected from overloading through connected peripherals.

As shown in *Figure 6,* all relevant controller signals are brought out to the kitCON-Connector (X3) in the middle of the board *(refer to section 3.2).* The kitCON-164 is also prepared to accommodate an ICE/connect-16x (X2) *(refer to section 3.3).* This special connector enables easy emulation of the processor. The Quad-Connector-System (X6) provides an additional option for connecting an emulator to the board *(refer to section 3.4).* DB9-connectors P1 and P2 serve as RS-232 and CAN-interface. *Sections 3.5* and *3.6* describe the pinout. The following section describes the power connectors X4 and X5. Additional signal inputs and outputs are provided throught the connectors PFO, WDI and X6, which are described in *section 3.7.*
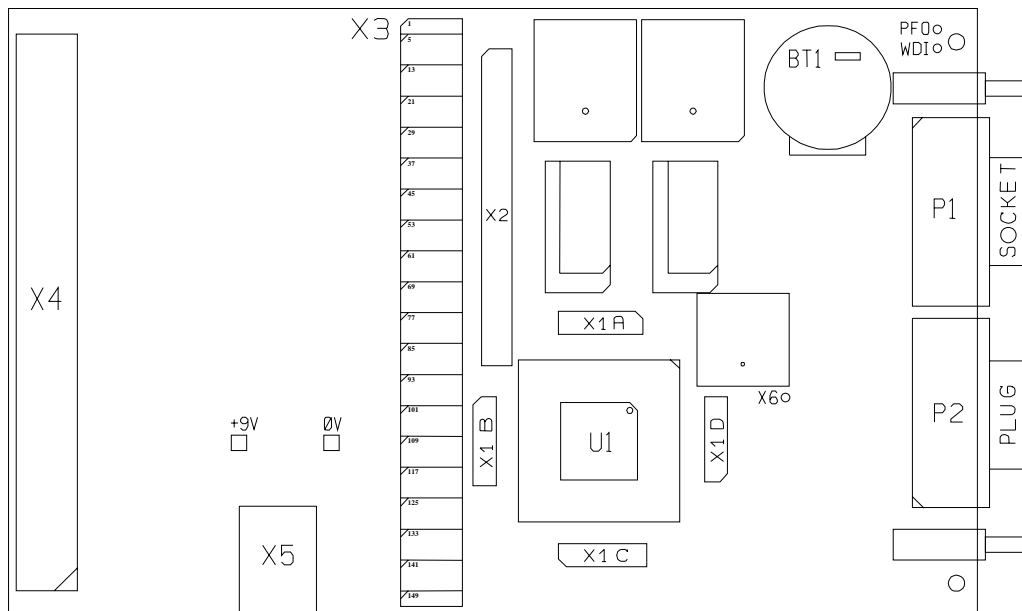
Figure 6:   Position of the connectors

3.1 Power Connectors X5, X4

There are two ways to provide power to the kitCON-164:

* connection via the VG96 connector at X4
* connection via the low voltage socket at X5

Attention!
Please do not use a laboratory or variable power supply, as power spikes during power-up could destroy the kitCON-164.
Please also avoid changing jumpers or connectors while the kitCON-164 is powered up.

3.1.1 Connecting via VG96-connector X4

A power supply via the VG96 connector X4 requires a constant voltage of + 5 V at the following pins:

Pin 1abc   + 5 V regulated
Pin 32abc   GND

Note that only pins 1abc and 32abc are preconnected at the VG96 connector. All other connector pins are freely available to the user.

Figure 7:   Numbering of the VG96-connector X4 (front view)

3.1.2 Connection via the Low Voltage Socket X5

An unregulated power supply in the range of +8 V=...12 V=/ 500 mA can be connected to the kitCON-164 at low voltage socket X5. Ensure the right polarity of the power supply as depicted in the Figure below.
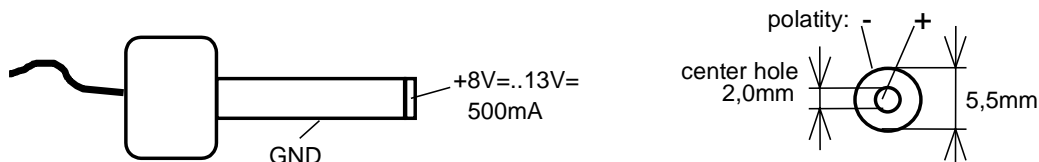
Figure 8:   Polarity of the Power Supply

3.2 The kitCON-Connector

Supply Voltage	PIN 1 VCC	2 VCC	3 GND	4 GND
Data-Bus	5 D0	6 D2	7 D4	8 D6
	9 D1	10 D3	11 D5	12 D7
	13 D8	14 D10	15 D12	16 D14
	17 D9	18 D11	19 D13	20 D15
Address-Bus	21 A0	22 A2	23 A4	24 A6
	25 A1	26 A3	27 A5	28 A7
	29 A8	30 A10	31 A12	32 A14
	33 A9	34 A11	35 A13	36 A15
	37 A16 / (CS3)	38 A18 / (CS1)	39 A20 / RXDC	40
	41 A17 / (CS2)	42 A19 / (CS0)	43 A21 / TXDC	44
Control-Signals	45 /RD-U	46 /RD-U	47 /RESO-U	48 /RES-U
	49 /WRL	50 ALE	51 VPP / /EA	52 /NMI-U
	53 /IO1	54 /IO3	55	56
	57 /IO2	58	59	60
Special Purose	61 VREF	62 VGND	63	64
	65 VREF	66 VGND	67 VPP / /EA	68
Analog Input	69 P5.0	70 P5.2	71 P5.4	72 P5.6
	73 P5.1	74 P5.3	75 P5.5	76 P5.7
	77	78	79	80
	81	82	83	84
Digitalport P8	85 P8.0	86 P8.2	87	88
	89 P8.1	90 P8.3	91	92
	93	94	95	96
	97	98	99	100
Digital-Port P3	101	102	103 P3.4	104 P3.6
	105	106	107	108
	109 P3.8	110 P3.10 / TXD0	111 /WRH	112
	113 P3.9	114 P3.11 / RXD0	115 P3.13	116 P3.15
Digital-Port P1	117 P1.0	118 P1.2	119 P1.4	120 P1.6
	121 P1.1	122 P1.3	123 P1.5	124 P1.7
	125 P1.8	126 P1.10	127 P1.12	128 P1.14
	129 P1.9	130 P1.11	131 P1.13	132 P1.15
	133	134	135	136
	137	138	139	140
	141	142	143	144
	145	146	147	148
Supply Voltage	149 VCC	150 VCC	151 GND	152 GND

Table 1:   Pinout of the kitCON-Connector (X3)

3.3 The ICE/connect-16x

The ICE/connect-16x provides an easy possibility for connecting a standard emulator, which uses the controller on board, to the kitCON-164. It can be mounted at position X2 *(refer to Figure 6).* It carries all data- and address signals. The control signals coming from the controller extend via pre-connections at the ICE/connect-16x to the peripheral devices. When using an emulator the control signals are generated by the emulator. In this case the pre-connections must be opened.

Table 2 shows the pinout of the ICE/connect-16x.

Attention!
Pins 41+42, 47+48, 49+50 and 53+54 are pre-connected on the soldering side. When using an ICE/connect-16x these pre-connections have to be opened.

Pin	Description	Description	Pin
1	GND	D0	2
3	D1	D2	4
5	D3	D4	6
7	D5	D6	8
9	D7	GND	10
11	D9	D8	12
13	D11	D10	14
15	D13	D12	16
17	D15	D14	18
19	GND	A0	20
21	A1	A2	22
23	A3	A4	24
25	A5	A6	26
27	A7	GND	28
29	A9	A8	30
31	A11	A10	32
33	A13	A12	34
35	A15	A14	36
37	GND	ALE	38
39	GND	XT1	40
41	/RES_P	/RES_U	42
43	NC	NC	44
45	NC	NC	46
47	RESO_P	RESO_U	48
49	/NMI-P	/NMI-U	50
51	GND	GND	52
53	/RD_P	/RD_U	54
55	/WRL	/WRH	56
57	NC	VCC	58
59	A16 / /CS3	A17 / /CS2	60
61	GND	GND	62
63	A18 / /CS1	A19 / CS0	64
65	A20 / RXDC	A21 / TXDC	66
67	GND	GND	68
69	GND	GND	70
71	NC	NC	72
73	NC	NC	74
75	NC	NC	76
77	NC	NC	78
79	GND	GND	80

Table 2:   Pinout of the ICE/connect-16x (X2)

3.4 The Quad-Connector

The kitCON-164 is also prepared to house a Quad-Connector at X1. In contrast to the ICE/connect-16x this connector system can be used to adapt bondout based emulators or measuring systems.

Table 3 shows the pinout of the Quad-Connector.

Quad-Connector X1 A

Pin	Description	Description	Pin
1	VREF	P5.4	2
3	P5.5	P5.6	4
5	P5.7	GND	6
7	VCC	P3.4	8
9	P3.6	P3.8	10
11	P3.9	P3.10	12
13	P3.11	/WRH	14
15	P3.13	P3.15	16
17	P4.0, A16	P4.1, A17	18
19	P4.2, A18	GND	20

Quad-Connector X1 B

Pin	Description	Description	Pin
21	VCC	P4.3, A19	22
23	A20, RXDC	A21, TXDC	24
25	/RD-P	/WRL	26
27	ALE	VPP / /EA	28
29	P0.0, D0	P0.1, D1	30
31	P0.2, D2	P0.3, D3	32
33	P0.4, D4	P0.5, D5	34
35	P0.6, D6	P0.7, D7	36
37	P0.8, D8	P0.9, D9	38
39	P0.10, D10	VCC	40

Quad-Connector X1 C

Pin	Description	Description	Pin
41	GND	P0.11, D11	42
43	P0.12, D12	P0.13, D13	44
45	P0.14, D14	P0.15, D15	46
47	P1.0	P1.1	48
49	P1.2	P1.3	50
51	P1.4	P1.5	52
53	VCC	XTO	54
55	XTI	GND	56
57	P1.6	P1.7	58
59	P1.8	GND	60

Quad-ConnectorX1 D

Pin	Description	Description	Pin
61	VCC	P1.9	62
63	P1.10	P1.11	64
65	P1.12	P1.13	66
67	P1.14	P1.15	68
69	/RES-P	/RESO-P	70
71	/NMI-P	P8.0	72
73	P8.1	P8.2	74
75	P8.3	P5.0	76
77	P5.1	P5.2	78
79	P5.3	VGND	80

Table 3:   Pinout of the Quad-Connector X1

3.5 The DB9-socket P1

The DB9-socket P1 serves as RS-232-interface. The pinout is shown below.

DB9-socket P1:   RS-232 interface

          Pin 2:   TXD0 (RS-232)
Pin 3:   RXD0 (RS-232)
Pin 5:   GND
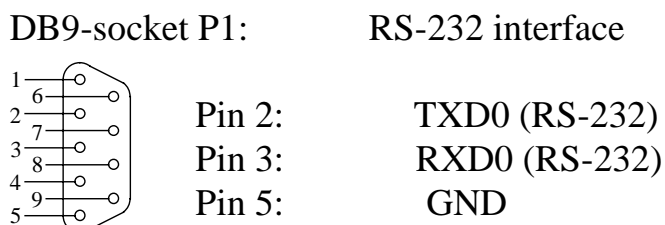
Figure 9:   Pinout of the DB9-socket P1 (front view)

3.6 The DB9-plug P2

The DB9-plug P2 carries the CAN-signals if the kitCON-164 houses a C164Cx-Controller. The pinout of the DB9-plug P2 is shown in the following.

DB9-plug P2:   CAN interface

          Pin 2:   CAN_L
Pin 7:   CAN_H
Pin 3,6:   CAN_GND
Pin 9:   CAN_VCC (12 V)
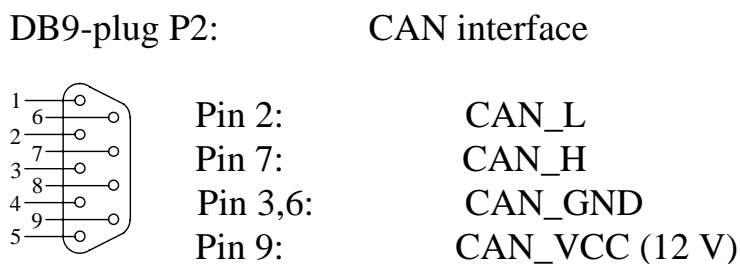
Figure 10:   Pinout of the DB9-plug P2 (CAN-Interface)(front view)

3.7 The connectors X6, WDI and PFO

The connectors X6, WDI and PFO provide three additional signal inputs/outputs. They are carried out as soldering holes in order to enable the mounting of test pins.

The WDI connector extends directly to the watchdog input of the watchdog device 694. The watchdog input controls the Watchdog Timer. As long as this connector is left open (i.e. the WDI pin is floating) the Watchdog Timer is disabled. If WDI is driven to either high or low level the Watchdog Timer is started. Reset is executed, if there is no further transition for the watchdog time-out period (see the LTC694 data sheet for further information on the exact timing of the Watchdog Timer).

The PFO connector extends directly to the power failure output of the watchdog device 694. PFO can be used to monitor the condition of the supporting battery or to indicate a power failure at VCC (i.e. VCC is below the battery voltage) (see the LTC694 data sheet for further information on the exact functioning of PFO and the trigger-levels).

X6 extends to pin 12 of the address decoder. It is reserved for future or customer-specific use.

4 Jumper

To configure the module, the kitCON-164 has 10 insertable and solderable jumpers. In order to ensure immediate use of the board the jumpers have been configured prior to delivery. *Figure 11* illustrates the numbering of the solderable jumper-pads, while *Figure 12* indicates the location of the jumpers on the board.
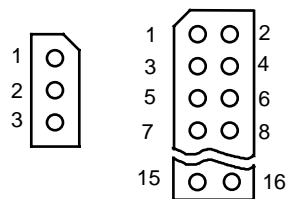

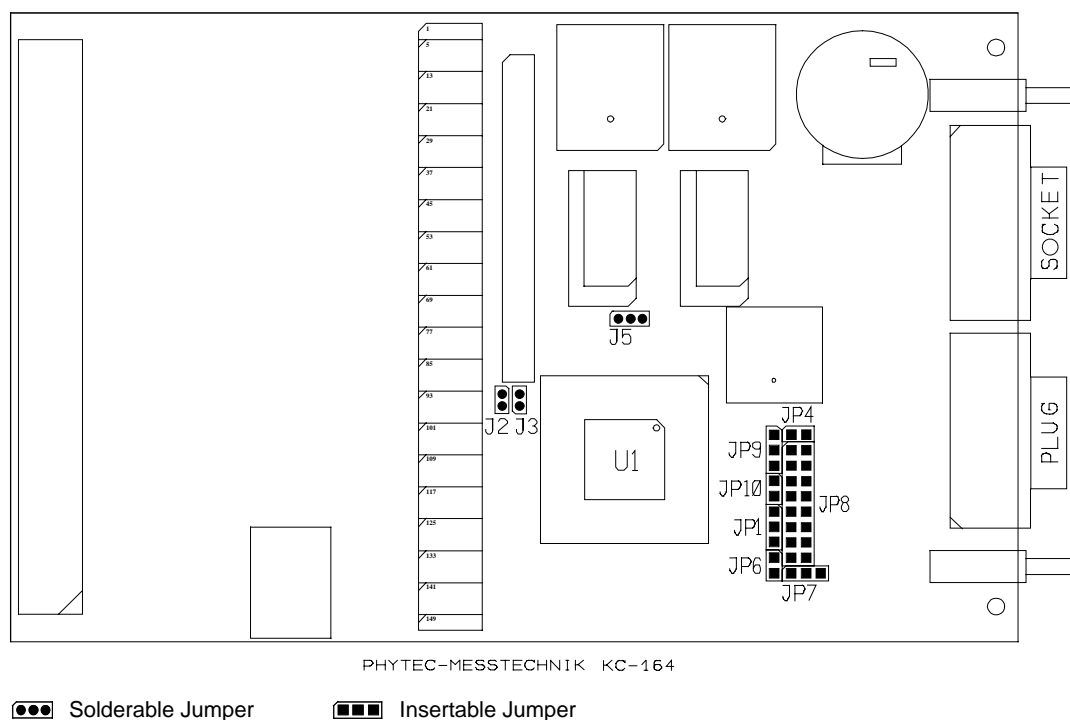*Figure 11:   Numbering of the Jumper Pads*

Figure 12:   Position of the Jumper (component side)

The jumpers (JP = insertable jumper, J = solderable jumper) have the following functions:

	Default Setting		Alternate Setting	
JP1	(1+2)	external ROM/ Flash active	(2+3) (open)	internal ROM/ Flash active Pin 28 connected to Pin 51 and 67 of the kitCON-Connector (for OTP programming)
J2	(closed)	V_{AREF} derived from supply voltage VCC	(open)	V_{AREF} from external voltage source via kitCON-Connector X3 pins 61/65
J3	(closed)	V_{AGND} derived from digital ground GND	(open)	V_{AGND} from external ground via kitCON-Connector X3 pins 62/66
JP4	(closed)	Mode 0	(open)	Mode 1 (JP9 at 2+3); Chip-Select signals of the C164 active (JP9 at 1+2)
J5	(2+3)	128 or 32 kByte RAM	(1+2)	512 kByte RAM
JP6, JP7	(closed) (2+3)	CAN-VCC derived from supply voltage	(open) (1+2)	CAN-VCC derived from CAN-network via DB9-plug P2
JP8 pins 1+2	(closed)	Boostrap mode	(open)	normal Program Execution Mode
JP8 pins 3+4	(open)	no CPU host mode	(closed)	CPU host mode (for OTP programming)
JP8 pins 5+6	(open)	no Emulation mode	(closed)	Emulation mode
JP8 pins 7+8 pins 9+10	(closed) (closed)	four Segment Address Lines (A16, A19) at port P4 available		Number of Segment Address Lines at port P4 (0, 2 or 6)
JP8 pins 11+12 13+14 15+16	(open) (open) (open)	System Clock Speed = XT1 * 4		Prescaler to generat the System Clock Speed from XT1 (*1, *2, *3, *5, *1.5, *2.5 or 0,5)
JP9	(2+3)	Address decoding done with the on-board GAL-device	(1+2)	Address decoding done with the Chip-Select signals of the C164

Table 4:   Jumper Settings

4.1 Program Storage JP1

At the time of delivery, jumper JP1 is pre-connected between pads 1 + 2. This default configuration means that the program stored in the external program memory is executed after Reset. In order to allow the execution of a specific controller's internal program memory, jumper JP1 must be closed at 2 + 3. When Programming the internal OTP jumper JP1 functions as connection of VPP to the EA pin.

Code-Access	JP1
external Program Storage	1+2[*]
internal Program Storage	2+3
Programming internal OTP	2+3

* = Default-Setting

4.2 Reference Voltage of the A/D Converter J2, J3

The A/D converter of the controller requires a reference voltage (V_{AREF}, V_{AGND}) applied at pins 1 and 80 of the controller. This reference voltage can be derived either from an external source connected to the kitCON-Connector pins 61/65 and 62/66 or from the internal supply voltage of the kitCON-164. The source of the reference voltage can be chosen with jumpers J2 and J3.

Reference Voltage of the A/D Converter	J3 (V_{AGND})	J2 (V_{AREF})
external reference voltage connected to kitCON-Connector X3 pins 61/65 and 62/66	open	open
derived from the internal supply voltage of the kitCON-164	closed[*]	closed[*]

* = Default-Setting

4.3 Memory Models JP4

The **blue** mode-jumper JP4 configures the memory model in conjunction with jumper JP9. If jumper JP9 is set to 2+3 Mode 1 sets the memory model for normal programming/downloading of user code, while Mode 0 enables use of a monitor program *(refer to chapter 5: "Memory Models")*. If jumper JP9 is in position 1+2 address decoding is done by means of the on-chip Chip-Select signals of the C164 (hence according to the configuration of the BUSCONx and ADDRESELx registers).

Memory Model	JP4	JP9
Mode 0	closed*	2+3*
Mode 1	open	2+3
on-chip Chip-Select signals are active	open	1+2

* = Default-Setting

Attention!
When utilizing the on-chip Chip-Select signals the address space and the number of Chip-Selects depends on the configuration of jumper JP8. With jumper JP8 open at 7 + 8 and closed at 9 + 10 all four Chip-Selects are available, the address space for each Chip-Select is limited to 64 kByte. If jumper JP8 is open at 7 + 8 and open at 9 + 10 two Chip-Selects (/CS0 and /CS1 for the on-board memory) are available, the address space for each Chip-Select is limited to 256 kByte. In order to meet the timing specifications the Chip Select Signals must be independent of the /RD and /WR signals (bits CSREN and CSWEN = 0).

4.4 Memory Size J5

Jumper J5 configures the memory size, which is dependent upon the specific memory devices mounted at U10/U11 on the board. The standard memory of the kitCON-164 offers 64 kByte RAM[1] mounted at U10 and U11.

Memory Size of U10/U11	J5
1 MB RAM	1+2
256 or 64 kByte	2+3*

    * = Default-Setting

4.5 Supply voltage of the CAN-Interface JP6, JP7

The CAN-driver on the kitCON-164 can be optically isolated electrically using the optocouplers at U6 and U7. In order to achieve a complete isolation of the CAN-bus, the CAN-circuitry should be supplied through the CAN-interface - DB9-plug P2 (12 V on pin 9, GND on pin 3 and 6). This requires jumper JP6 be opened and jumper JP7 be connected between pads 1+2. If jumper JP6 is closed and JP7 is connected between 2+3 the supply voltage of the CAN-circuitry is derived from the kitCON-164's supply voltage.

Supply Voltage of the CAN-circuitry	JP6	JP7
derived from CAN-network via DB9-plug P2	open	1+2
derived from the supply voltage of the kitCON-164	closed*	2+3*

* = Default-Setting

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[1]:   More information about additional configurations can be found in the PHYTEC product catalog

4.6 Configuration during System Reset JP8

Most of the programmable features of the C164 are either selected during the initialization phase or repeatedly during program execution. However, there are some features that must be selected earlier, because they are used for the first access of the program execution. These selections are made during reset via the pins of Port P0, which are read at the end of the internal reset sequence. During reset, internal pullup devices are active at Port P0 meaning that high input levels are the default configuration on Port P0. To change the configuration external pulldown devices have to be connected to the respective port pins. This can be done with the help of jumper JP8, as jumper JP8 allows the configuration of the board during system reset (for more information about the configuration during system reset refer also to the C164 User's manual, chapter "System Reset"). Some configurations which are usually made only once can be changed by installing optional resistors.

Some of the configurations are fixed and cannot be changed with jumper JP8. The following Figure shows Port P0, the function of the pins during reset and how they can be changed (either with jumper JP8 or with optional resistors). The shaded pins are fixed and must not be changed.

Function of Port P0 during System Reset (High-Byte)			
Bit H7 H6 H5	H4 H3	H2 H1	Bit H0
CLKCFG *JP8 15+16, 13+14, 11+12*	SALSEL *JP8 9+10, 7+8*	CSSEL	WRC *0*

Function of Port P0 during System Reset (Low-Byte)						
Bit L7 L6	L5	L4	L3	L2	L1	Bit L0
BUSTYP *1 1*	**R**	BSL *JP8 1+2*	**R**	HOST *JP8 3+4*	ADP *R14*	EMU *JP8 5+6*

Reserved pins must remain high in order to ensure proper operation.
The configuration of these pins must not be changed.

The following sections contain a more detailed description of the configuration done with Jumper JP8.

4.6.1 Boot-Jumper JP8 (Pins 1+2)

The C164 houses an on-chip Bootstrap Loader which can be activated with **red** boot-jumper JP8. The Bootstrap Loader is started if pin 4 of port P0 is low during reset. This is accomplished by closing **red** boot-jumper JP8 at pins 1 + 2.

Boot-Jumper	JP8 (1+2)
Bootstrap mode	closed*
normal Program Execution	open

  * = Default-Setting

4.6.2 CPU Host Mode JP8 (Pin 3+4)

The CPU Host Mode can be used for programming the internal OTP. In CPU Host Mode the C164 Controller itself controls the programming cycles via the OTP programming interface. The programming routine must be fetched from outside the OTP memory. CPU Host Mode can be enabled with jumper JP8 (pins 3 + 4).

CPU Host Mode	JP8 (3+4)
enabled	closed
disabled	open*

  * = Default-Setting

4.6.3 Emulation Mode JP8 (Pin 5+6)

This mode allows switching the C164 Controller virtually off, so an emulator may control the kitCON-164, even though the Controller remains on the board. In this state the pins of the C164 float to tristate or are deactivated via internal pullup/pulldown devices. Besides /RSTOUT floats to tristate and the on-chip oscillator is switched off. Adapt Mode can be enabled with jumper JP8 (pins 5 + 6).

CPU Host Mode	JP8 (5+6)
enabled	closed
disabled	open*

* = Default-Setting

4.6.4 Segment Address Lines JP8 (Pin 7+8 and 9+10)

The C164 controller family allows user configuration of the number of address-lines available for segment addressing at port P4. The configuration of port P0.11 and P0.12 during system reset specifies the number of active address lines. This configuration can be done with jumper JP8 (pins 7 + 8 and 9 + 10).

Segment Adress Lines	JP8 Pin 7 + 8	JP8 Pin 9 + 10
only A16 and A17 are active	open	open
four A16 - A19 are active	closed*	closed*
all A16 - A21 are active	closed	open
none are active	open	closed

* = Default-Setting

Attention:

When utilizing the on-chip Chip-Select signals the address space and the number of Chip-Select depends on the configuration of jumper JP8. Having jumper JP8 open at 7 + 8 and closed at 9 + 10 all four Chip-Selects are available, the address space for each Chip-Select is limited to 64 kByte. If jumper JP8 is open at 7 + 8 and open at 9 + 10 two Chip-Selects (/CS0 and /CS1 for the on-board memory) are available, the address space for each Chip-Select is limited to 256 kByte. In order to meet the timing specifications the Chip Select Signals must be independent of the /RD and /WR signals (bits CSREN and CSWEN = 0).

4.6.5 Clock Mode JP8 (Pin 11+12,13+14 and 15+16)

The CPU-clock can be derived either directly from the oscillator clock or from the on-chip PLL which allows definition of a prescaler. To determine the clock source and the prescaler port P0.13 -P0.15 must be configured with jumper JP8 (pins 11 + 12, 13 + 14 and 15 + 16) during system reset.The standard version of the kitCON-164 is equipped with a 5 MHz quartz meaning that the frequency of the CPU clock is 20 MHz with the default jumper setting.

Clock - Mode	JP8 Pin 11+12	JP8 Pin 13+14	JP8 Pin 15+16
XT1 x 4(2,5-6,25 MHz)	open[*]	open[*]	open[*]
XT1 x 3 (3,3-8,3 MHz)	closed	open	open
XT1 x 2 (5-12,5 MHz)	open	closed	open
XT1 x5 (2-5MHz)	closed	closed	open
OSC1 x 1(1-25MHz) direct drive	closed / open	closed / open	closed

* = Default-Setting

4.7 OTP programming voltage control JP10

When programming the internal OTP the programming voltage must be controlled by the programming routine. In order to control VPP with port P8.3. The connection between programming voltage control and port P8.3 is permanent with a diode on position JP10. Before a read/verify cycle the CPU Host Mode must be switched off (JP8 open at position 3 + 4) , whereas it must be switched on during the programming cycle. When switching the CPU Mode the board must be reconnected.

Attention:
Port P8.3 must not be used for any other I/O or switching function.

VPP control with port P8.3	JP10
enabled	closed
disabled	open*

* = Default-Setting

4.8 Jumper Settings for the most important modes

1.   Monitor Mode

In Monitor Mode applications are downloaded and debugged in external RAM.

JP8 (1 + 2)	**red** Boot-Jumper
closed	Bootstrap mode

JP4	**blue** Mode-Jumper
closed	Mode 0

All other jumpers in default mode.[1]

2.   External Flash Programming Mode

In external Flash programming mode applications are downloaded into Flash.

JP8 (1 + 2)	**red** Boot-Jumper
closed	Bootstrap mode

JP4	**blue** Mode-Jumper
open	Mode 1

All other jumpers in default mode.[1]

3.   Normal Program Execution out of external Flash

In this mode the code/ application programmed into external Flash (under Point 2) will be executed.

JP8 (1 + 2)	**red** Boot-Jumper
open	Programm Execution Mode

JP4	**blue** Mode-Jumper
open	Mode 1

All other jumpers in default mode. [1]

---

[1]:   For information on the default setting see table 4 and figure 8

4. Programming Mode for internal OTP

In Programming Mode for internal OTP, applications are downloaded into the internal OTP memory.

JP8 (1 + 2)	**red** Boot-Jumper
closed	Bootstrap mode

JP8 (3 + 4)	CPU Host Mode
closed	enabled

JP4	**blue** Mode-Jumper
open	Mode 1

JP1	OTP Programming Voltage
2 + 3	VPP applied to EA

All other jumpers in default mode. [1]

CAUTION OTP Progamming can be done only once !

5. Normal Program Execution Mode out of internal OTP

In this mode the application which was programmed into internal OTP (see point 4) will be executed.

JP8 (1 + 2)	**red** Boot-Jumper
open	Program Execution Mode

JP8 (3 + 4)	CPU Host Mode
open	disabled

JP4	**blue** Mode-Jumper
open	Mode 1

JP1	Execution from internal OTP
2 + 3	enabled

All other jumpers in default mode. [1]

5 Memory Models

Address decoding on the kitCON-164 is done with the help of one GAL device at U12 or with the help of the Chip-Select signals of the C164 microcontroller.

5.1 Address decoding with the GAL device (JP9 at 2+3)

If jumper JP9 is in position 2 + 3 configuring the **blue** mode-jumper JP4 allows selection of one of two memory models (Mode 1: JP4 open; Mode 0: JP4 closed) (*refer to Figure 13 and Figure 15*).

Mode 1 (JP4 open) represents the mode for normal program execution out of the ROM-memory, as well as for programming/download of user code into the Flash. If the **red** boot-jumper JP8 is open at 1 + 2, the user application in the Flash will be executed beginning at address 00:0000h.
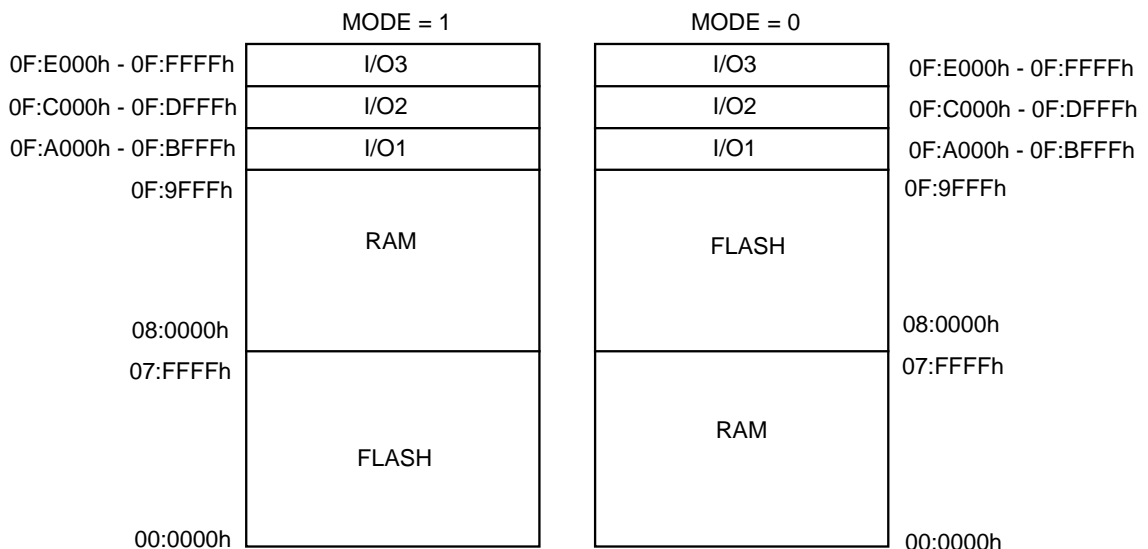

Figure 13:   Memory Model at Maximum Memory (512 kByte Flash, 512 kByte SRAM)

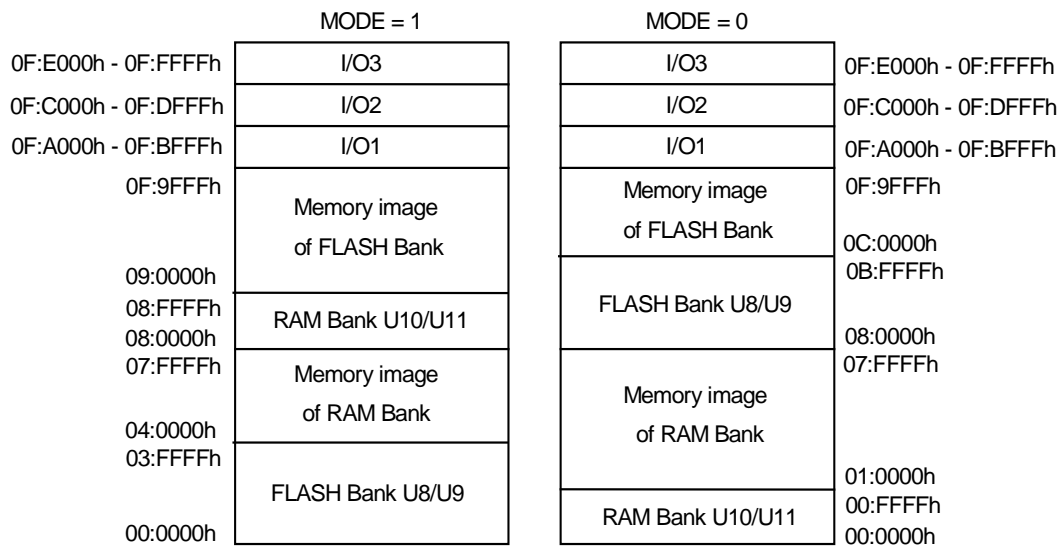|	MODE = 1		MODE = 0	
0F:E000h - 0F:FFFFh	I/O3		I/O3	0F:E000h - 0F:FFFFh
0F:C000h - 0F:DFFFh	I/O2		I/O2	0F:C000h - 0F:DFFFh
0F:A000h - 0F:BFFFh	I/O1		I/O1	0F:A000h - 0F:BFFFh
0F:9FFFh	Memory image of FLASH Bank		Memory image of FLASH Bank	0F:9FFFh
09:0000h				0C:0000h
08:FFFFh				0B:FFFFh
08:0000h	RAM Bank U10/U11		FLASH Bank U8/U9	
07:FFFFh	Memory image of RAM Bank			08:0000h
				07:FFFFh
04:0000h			Memory image of RAM Bank	
03:FFFFh				01:0000h
	FLASH Bank U8/U9		RAM Bank U10/U11	00:FFFFh
00:0000h				00:0000h

Figure 14:   Memory Model at Standard Memory (64kByte SRAM, 256kByte Flash)

If the **red** boot-jumper JP8 is closed at 1 + 2, the Bootstrap Loader will start. It will load and, subsequently, execute any application in the external RAM. The application can be user code, or any other program or utility of choice. When using the terminal program FLASHT.EXE, the FlashTools (a proprietary software from PHYTEC) will be loaded for purposes of downloading user code into the Flash *(refer to section 13: "FlashTools")*.

Mode 0 (JP4 closed) represents the mode for starting a program out of external memory. This is required, for example, when a monitor program is used. If the **red** boot-jumper JP8 is open at 1 + 2, the user application in the external RAM will be executed beginning at address 00:0000h.

If the **red** boot-jumper JP8 is closed at 1 + 2, the Bootstrap Loader is started. It loads and, subsequently, executes any application in the external RAM. The application can be user code, or any other program or utility of choice. If the terminal program MON166.EXE is utilized, a monitor program from Keil Elektronik GmbH will load and execute.

In both modes three 8 kByte I/O areas are available in addition to RAM and ROM.

Note that a total of 256 kByte Flash memory is mirrored twice in the ROM memory area.

As the address lines A20 and A21 are used for the CAN-interface, the address decoder supports only memory up to 512 kByte. This means that, even if the kitCON-164 is equipped with Flash devices of type 29F040, only 512 kByte are available. The same restrictions are valid for external memory.

5.2 Address decoding with Chip-Select signals (JP9 at 1+2) (JP4 open)

The C164 Controller provides up to four Chip-Select signals at port P4 for easy selection of external peripherals or memory banks. Two Chip-Select signals are used internally. /CS0 (P4.3) selects the Flash memory installed at U8/U9 (Flash bank) with a total memory of 64 kByte. /CS1 (P4.2) selects the RAM bank at U10/U11 with a total memory of 64 kByte. /CS2 (P4.1) and /CS3 (P4.0) are used as general purpose Chip-Select signals (I/O1 and I/O2).

The assignment of the Chip-Select signals to specific address areas is done with the corresponding ADDRESELx and BUSCONx register. Note that ADDRESELx has to be configured prior activating of the Chip-Select signal with BUSCONx. Take care that the memory areas do not conflict.

Prior definition of the ADDRESELx and the BUSCONx register only /CS0 is active in the entire address space and remains active for all areas not assigned to an other Chip-Select signal.

By configuring the memory cycle wait state (Tc = 50 ns) and the R/W-Delay it is possible to use memory devices with access times up to 100 ns at a bus cycle time of 150 ns. To run the controller without wait state memory devices with 55 ns access time have to be installed. The bus cycle time then is 100 ns. The R/W-Delay should be always active (refer to the C164-User's manual for more information).

Below you will find two examples for configuring the memory area. These examples match the needs of most standard applications.

Example a)

ADDRESEL1: 0104h = Memory area 01:0000h - 01:FFFFh (64 kByte RAM Bank 1 at U10/11)

ADDRESEL2: 0803h = Memory area 08:0000h - 08:8000h (64 kByte free I/O area)

ADDRESEL3: 1000h = Memory area 10:0000h - 10:0FFFh (4 kByte free I/O area)

BUSCON0: 04EFh : Bus active for /CS0 (Flash bank 1 U8/9)

BUSCON1: 04EFh : Bus active for /CS1 (RAM bank 1 U10/11)

BUSCON2: 06CCh : Bus active for /CS2 (free I/O)

BUSCON3: 06CCh : Bus active for /CS3 (free I/O)

BUSCON0 - 1: for all 55 ns memory devices (0 Waitstate, R/W-Delay, no Tri-state, short ALE, 16-bit Multiplexed)

BUSCON2 - 3: for free I/O area (3 Waitstate, RW-Delay, Tri-state Wait 300 ns, long ALE, 16-bit Multiplexed)

Example b)

ADDRESEL1: 0004h = Memory area 00:0000h - 00:FFFFh (64 kByte RAM Bank1 at U10/11)

ADDRESEL2: 0204h = Memory area 02:0000h - 02:FFFFh (64 kByte free I/O)

ADDRESEL3: 0304h = Memory area 03:0000h - 03:FFFFh (64 kByte free I/O)

BUSCON0: 04EFh : Bus active for /CS0 (Flash bank1 U8/9)

BUSCON1: 04EFh : Bus active for /CS1 (RAM bank1 U10/11)

BUSCON2: 06CCh : Bus active for /CS4 (free I/O)

BUSCON3: 06CCh : Bus active for /CS4 (free I/O)

BUSCON0-1: for all 55 ns memory devices active (0 Waitstate, RW-Delay, no Tri-state, short ALE, 16-Bit Multiplexed)

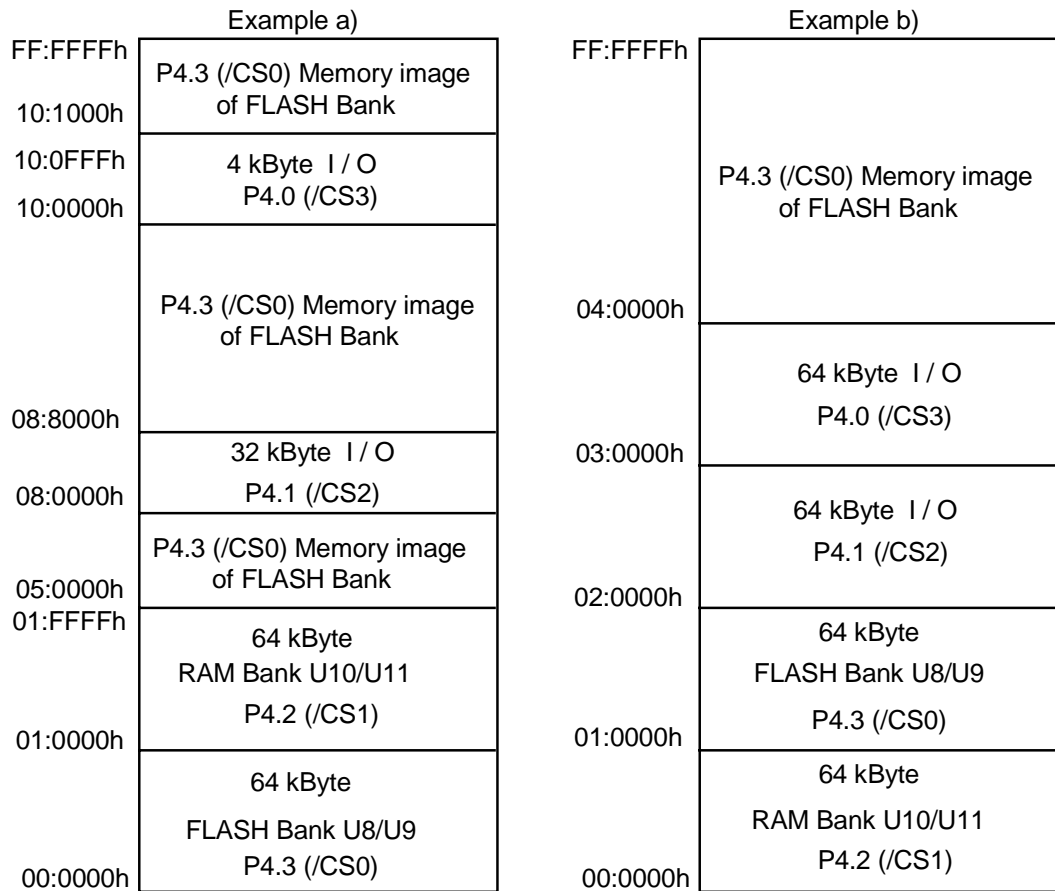BUSCON2-3: for free I/O area (3 Waitstate, RW-Delay, Tri-state, long ALE, 16-Bit Multiplexed)

Example a)

FF:FFFFh	
	P4.3 (/CS0) Memory image of FLASH Bank
10:1000h	
10:0FFFh	4 kByte I / O
10:0000h	P4.0 (/CS3)
	P4.3 (/CS0) Memory image of FLASH Bank
08:8000h	
	32 kByte I / O
08:0000h	P4.1 (/CS2)
05:0000h	P4.3 (/CS0) Memory image of FLASH Bank
01:FFFFh	64 kByte RAM Bank U10/U11
01:0000h	P4.2 (/CS1)
	64 kByte FLASH Bank U8/U9
00:0000h	P4.3 (/CS0)

Example b)

FF:FFFFh	
	P4.3 (/CS0) Memory image of FLASH Bank
04:0000h	
	64 kByte I / O
03:0000h	P4.0 (/CS3)
	64 kByte I / O
02:0000h	P4.1 (/CS2)
	64 kByte FLASH Bank U8/U9
01:0000h	P4.3 (/CS0)
	64 kByte RAM Bank U10/U11
00:0000h	P4.2 (/CS1)

Figure 15:   Memory Model Examples

6 Flash memory

Flash is a highly functional means of storing non-volatile data. The kitCON-164 can be fitted with two Flash devices of either type 29F010 (128 kByte each) or of type 29F040 (512 kByte each). This gives a minimum memory of 256 kByte (two 29F010) and a maximum of 1 MB (two 29F040). Use of 5 V Flash devices means that no dedicated programming voltage is required on board.

On-board programming is done with a utility program developed by PHYTEC, so called "FlashTools" (*refer to section 13: "FlashTools"*). FlashTools must be loaded with the Bootstrap Loader prior to use.

Use of a Flash device as the only means of code storage results in no or limited usability of the Flash memory as non-volatile memory for data. This is due to the internal structure of the Flash device, as during the Flash-internal programming process the reading of data from Flash is not possible. Hence, for Flash-programming, program execution must be transferred out of Flash (such as into von-Neumann RAM). This usually equals the interruption of a "normal" program execution cycle.

As of the printing of this manual, Flash devices generally have a life expectancy of at least 100,000 Erase-/Program-cycles.
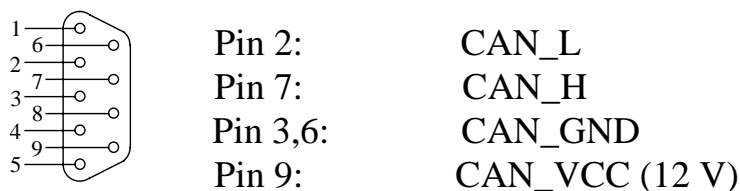
7   The CAN-Interface

The kitCON-164 can be equipped with a C164Cx controller. One of the special features of this controller is the on-chip Full-CAN-Controller which enables the kitCON-164 to be run within a CAN-network. Running the C164 controller at 20 MHz CPU clock, a bit rate of up to 1 MBaud can be achieved.

When utilising the CAN-interface the portpins P4.5 (RXDC) and P4.6 (TXDC) should not be connected to any other circuitry. The CAN-bus can be connected directly to DB9-plug P2. The pinout of the DB9-plug P2 is shown in *Figure 17*. The CAN-signals from the controller are also present at pin 39 and pin 43 of the kitCON-connector.

The programming of the CAN-controller is done by means of control-registers, which are mapped into segment 0 of the normal memory area of the controller at the addresses 00:EF00h through 00:EFFFh.

A detailed description of the registers and how to program the controller can be read in the corresponding controller manual of the C164Cx.

DB9-plug P2

Pin 2:	CAN_L
Pin 7:	CAN_H
Pin 3,6:	CAN_GND
Pin 9:	CAN_VCC (12 V)

Figure 16:   Pinout of the DB9-plug P2 (CAN-interface)(front view)

8   The LEDs

8.1   The Status LEDs D4 and D5

The kitCON-164 is fitted with two LEDs, D4 and D5, that indicate the status of the board.

The red LED D4 simply indicates proper connection to the power source.

The green LED D5 gives the status of the initialization of the controller done by software. At the end of the basic initialization in any program a 'EINIT' command should be executed. Following execution of this command the SYSCON-register is protected and can not not be changed accidentally. The green LED D5 lights up after this command is executed to indicate the end of the basic initialization (see the 'Instruction Set Manual' for further information about 'EINIT').

These LEDs are automatically controlled by hardware.

8.2   General Purpose LEDs D7 - D14 at Port P1

In addition to the status LEDs the kitCON-164 is equipped with 8 red LEDs at D7 - D14. These are connected to Port P1.0 to P1.7 and can be controlled by software. Writing a low-level to one of the ports will activate the corresponding LED.

The general purpose LEDs D7-D14 can only be activated by a user-application.

D7	D8	D9	D10	D11	D12	D13	D14
P1.0	P1.1	P1.2	P1.3	P1.4	P1.5	P1.6	P1.7

9   The Battery Buffer

To prevent loss of data in case of sudden power failure the kitCON-164 can be equipped with a battery. This battery buffers the memory devices on U10 and U11, as well as the Real-Time Clock. However, this battery buffer is not otherwise essential to the functioning of the kitCON-164.

Position BT1 on the component side of the module is provided for mounting a battery type CR2032. As of the pressing of this manual, a lithium battery is recommended as it offers relatively high capacity at low self-discharge. In the event of a power failure at VCC, the RAM memory blocks and the real-time clock will be buffered by a connected battery via VBAT.

The current consumption depends on the components populating the board and memory size. For the standard devices used on the board the draw is typically 1 µA (max. 100 µA) per RAM-device. The power consumption of the Real-Time Clock is 50µA.

Regarding data and code integrity, please be advised that despite the battery buffer, changes in the data content within the RAM can occur given disturbances. The battery-buffer does not completely remove the danger of data destruction.

Please note that utilizing the battery buffer for the RAMs and the real-time clock the storage temperature is only 0°C to +70°C.

10 The Real-Time Clock RTC-8583[1]

For real-time applications the kitCON-164 the board houses a Real-Time Clock of type RTC_8583. This Real-Time Clock device provides the following features:

- Serial input/output bus (I^2C)
- operating current (f = 0Hz) max. 50µA (important for battery buffer)
- Clock function with four year calendar
- Universal timer with alarm and overflow indication
- 24- and 12-hour format
- automatic word address incrementing
- Programmable alarm, timer and interrupt functions

If the kitCON-164 is equipped with a battery the Real-Time Clock runs independently of the board.

Programming the Real-Time Clock is done via the I^2C-bus which is connected to port P8.1 (SCL) and port P8.2 (SDA). The Real-Time Clock also provides an interrupt output which is connected to port P1.8. An interrupt occurs in case of a clock alarm, timer alarm timer overflow and event counter alarm. The interrupt has to be cleared by software. With the interrupt function the Real-Time Clock can be utilized in various applications. The software shipped with the kitCON-164 includes a library with functions to program the Real-Time Clock via the I^2C-bus as well as example programs (for more information about the registers of the Real-Time Clock refer to the data-sheet).

---

[1]: The Real-Time Clock is not available on boards included in an Infineon Starter Kit

11 Technical Specifications

The physical dimensions of the kitCON-164 are represented in *Figure 17*. The board's profile is about 17 mm. thick, including the DB9 sockets. The components on the soldering side have a maximum height of 3.5 mm and approximately 12 mm on the component side. The board itself is approximately 1.5 mm thick.
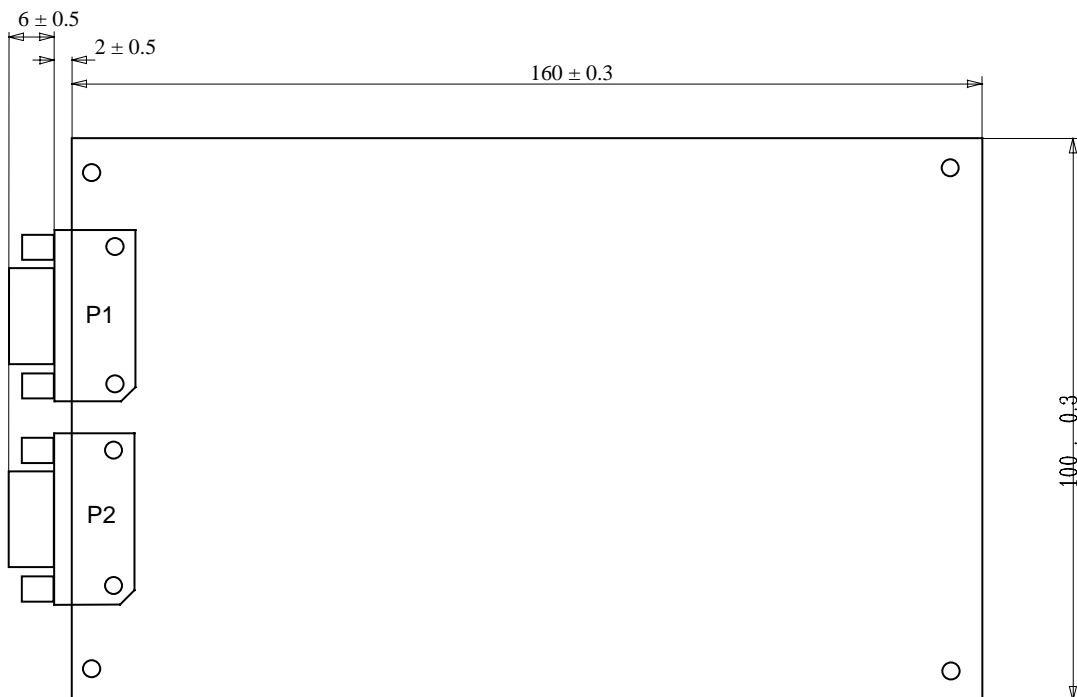

Figure 17:   Physical Dimensions

Additional specifications:

- Dimensions: 160 x 100 mm ± 0.03 mm.
- Weight: approximately 125 g., if fitted with 1 MB Flash and 1MB RAM
- Storage temperature: -40°C to + 90°C, using the battery buffer 0°C to + 70°C
- Operating temperature:0°C to + 70°C, extended -40°C to + 85°C
- ambient humidity: 90% r.F. not condensed
- Operating voltage: 5 V ± 10 %
- Supply voltage: 8 V = to 12 V =/500 mA, VBAT 3 V ± 20%
- Power consumption: 300 mA. at 20 MHz CPU-clock.

These specifications describe the standard configuration of the kitCON-164 as of the pressing of this manual.

Typically the current consumption is less than 150 mA with 64 kByte SRAM memory and 256 kByte Flash memory at 20°C.

Please note that utilizing the battery buffer for the RAMs and the real-time clock the storage temperature is only 0°C to +70°C.

12 Hints for Handling the kitCON-164

Removal or exchange of components on the kitCON-164 (controller, memory, quartz etc.) is not advisable given the compact nature of the kitCON-164. Should this nonetheless be necessary, please ensure that the board, as well as surrounding components and sockets, remain un-damaged during removal. Overheating the board can cause the solder pads to loosen, rendering the module inoperable. Carefully heat neighbouring connections in pairs. After a few alternations, compo-nents can be removed with the solder-iron tip. Alternatively, a hot air gun can be used to heat and loosen the bonds.

When changing the controller ensure that the controller to be used is pin-compatible to the C164 Controller and that special hardware features are compatible with the layout of the board.

13 FlashTools

Flash is a highly functional means of storing non-volatile data. One of the main advantages of using Flash devices is the on-board programming capability. On-board programming can be easily done with a special utility program, the 'FlashTools', described in this chapter.

The FlashTools do not resist permanently on the board. They have to be loaded with the Bootstrap Loader prior programming of the Flash.

The following section describes the use of the Bootstrap Loader as well as the FlashTools. These description are valid only for the use of the enclosed FlashTools and is not intended as guidelines for use with any other Flash programming software.

13.1 Starting FlashTools

To load the FlashTools the Bootstrap Loader has to be started first after reset. Once activated, the Bootstrap Loader awaits the start of a terminal program on the Host-PC connected to the kitCON-164. Depending on the terminal-program started, a specific program will be downloaded into the external RAM and executed. To use the Flash-Tools the terminal program FLASHT.EXE must be invoked.

Programming the Flash devices with the help of the FlashTools can be done as described below.

Connect the **red** boot-jumper JP8 Pin 1 + 2

Open **blue** mode-jumper JP4, as Flash-programming can be done only in Mode 1.

Ensure also that jumper JP9 is closed in position 2 + 3

Connect the kitCON-164 to a Host- PC (using either the COM1 or COM2 serial communication port) with a serial cable as shown below:

Host-PC (COM1 or 2)		**kitCON-164 DB9 socket P1**
RxD Pin 2	to	TxD Pin 2
TxD Pin 3	to	RxD Pin 3
GND Pin 5	to	GND Pin 5

Attach a power supply to the power-connector X5. An unregulated 8 V to 12 V=/500 mA power source can be used to supply the board. Use only a fixed voltage power supply and no power supply with variable voltage. Double check the correct polarity of the plug as shown in Figure 4. If the power supply is attached correctly the red LED D4 will light up.

Push switch <S1> to perform a reset. and to start the Bootstrap Loader on the kitCON-164.

Invoke the Terminal program FLASHT.EXE on your Host-PC by entering the following at the DOS prompt:

```
flasht [BR(Baudrate)] [COM port number]
```

Ensure that the directory in which FLASHT.EXE is started contains the two files 'boot' and 'flash'.

The Bootstrap Loader determines the baud rate automatically. Hence, only after starting the Bootstrap Loader on the kitCON-164, the terminal program can be started with a baud rate of your choice. Thereafter, the Bootstrap Loader will automatically configure the serial port for this baud rate.
Please note that some controllers are only able to generate specific baud rates. Hence, it is possible that a baud rate specified by the invocation of the terminal program can not be generated by the controller and transmission fails. In this case the terminal program should be invoked again specifying a lower baud rate.

Once FLASHT.EXE has been successfully invoked, loading of the FlashTools starts and the green LED D5 lights up. The downloading can be viewed on the Host-PC monitor screen. FlashTools start immediately following loading and the main menu appears on the screen. You can leave the FlashTools at any time except during a download by pressing <F1>.

13.2 Downloading into Flash

The main menu gives access to the different functions of the Flash-Tools (*refer to Figure 5*). The tools enable the partial or total erasure of the Flash device, as well as programming of the device. They also allow device status information to be read from the Flash. All menu options are intuitive. Only Intel hexfiles can be used for programming purposes.

After user code has been downloaded into the Flash, it can be executed following a software-reset. Alternatively, **red** jumper JP8 can be opend at pins 1 + 2 in order to switch the kitCON-164 into execution mode following a hardware reset.

FLASHT.EXE can always be exited, except during downloading of user code, with the special-function key <F1>.

A   Appendices

GAL-Listing U12

```
*IDENTIFICATION
 P475.ppl              File:  P475.DCB
 Adressdecoderpal für KitCON - 164 Version 1.1 GAL 16V8
 Power Down über Mode 1
 PHYTEC , 10.07.97 ms

*PAL
TYPE = GAL16V8_C8

*DECLARATIONS
 X-VARIABLES = 12;
 Y-VARIABLES = 6 ;

*X-NAMES
 RES, MODE, MODE1, A[13..21];

*Y-NAMES
 IO1, IO2, IO3, Frei, CS1, CS2;

*RUN-CONTROL
 PROGFORMAT = JEDEC;
 LISTING = EQUATIONS, PINOUT;

*BOOLEAN-EQUATIONS
 Frei = 0;

* FUNCTION-TABLE
  $  (A[19..13]) , RES , MODE , MODE1 :  CS1  ; CS FLASH
     40H..7CH , 1 ,   0   ,    1    :   0   ; U8/U9  80000H..F9FFFH, MODE0
     00H..3FH , 1 ,   1   ,    1    :   0   ; U8/U9  00000H..7FFFFH, MODE1
  REST: 1;
  $  (A[19..13]) , RES , MODE , MODE1 :  CS2  ; CS RAM
     00H..3FH , 1 ,   0   ,    1    :   0   ; U10/U11  00000H..7FFFFH, MODE0
     40H..7CH , 1 ,   1   ,    1    :   0   ; U10/U11  80000H..F9FFFH, MODE1
  REST: 1;
  $  (A[19..13]) , RES , MODE , MODE1 :  IO1  ;
      7DH     , 1 ,   -   ,    1    :   0   ; IO1 von XF:A000H..XF:BFFFH,
  REST: 1;                                  ; IO - Signal
  $  (A[19..13]) , RES , MODE , MODE1 :  IO2  ;
      7EH     , 1 ,   -   ,    1    :   0   ; IO2 von XF:C000H..XF:DFFFH,
  REST: 1;                                  ; IO - Signal
  $  (A[19..13]) , RES , MODE , MODE1 :  IO3  ;
      7FH     , 1 ,   -   ,    1    :   0   ; IO3 von XF:E000H..XF:FFFFH,
  REST: 1;                                  ; IO - Signal
  *PINS
```

```
A[13..21]      = [1..9],
Frei           = 12,
MODE1          = 11,
CS1            = 14,
CS2            = 15,
IO1            = 16,
IO2            = 17,
IO3            = 13,
MODE           = 18,
RES            = 19;

*END
```

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Did you find any mistakes in this manual?   page

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