

## **Features and Benefits**

Universal programming utility  
 Fast development  
 Fast plug-in for software applications  
 Atmega128 Core  
 Firmware updatable via RS232 and USB  
 FPGA updatable via RS232 and USB  
 3 High Current Programmable Supplies  
 1 High Speed Fast  
 16 bit Level Settings  
 16 bit differential Measurements  
 4 analog comparators  
 Vector Generator  
 I2c to Daughter Board  
 Mountable in 19" Rack

## **Applications**

Experimental tool for Lab and Prototyping  
 Production Equipment for Serial Programming  
 Characterization tool by using mini-tester mode

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## **Ordering Information**

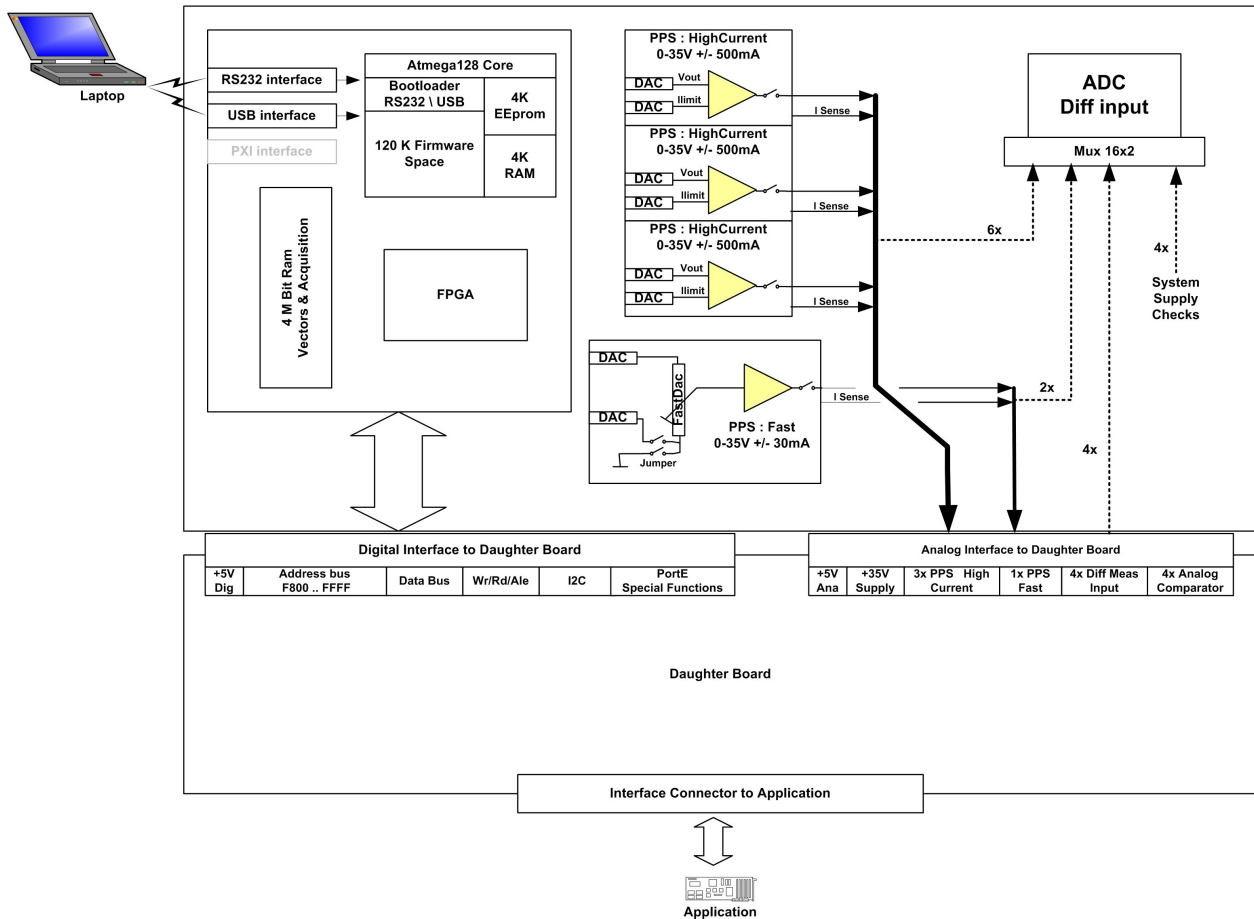
| <b>Part No.</b>                       | <b>Description</b>  |
|---------------------------------------|---|
| PTC04                                 | Programmer Unit<br>(Full Set : including adapter, cables, software, default DB) |
| PTC04-DB-Hall (included in PTC04)     | Default Daughter Board  |
| PTC04-DB-xxxxx                        | Other Daughter Boards for future products                                       |
| PTC04-19-x (with x equal to 1 till 4) | 19"Rack with build in x number of PTC04   |

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## **Accessories**

| <b>Part No.</b>                                      | <b>Description</b>  |
|--|---|
| PTC04-TestBench-Magnetic                             | Magnetic utility for evaluating samples on PTC04  |
| PTC-TestBench-4SIP-0x                                | PCB with VA socket  |
| PTC-TestBench-tssop-so8-0x                           | PCB with So Socket and Tssop Socket   |
| Magnet-T01   | Magnet for testing Vertical packaged devices (VA,VB,VC)   |
| Magnet-T02   | Magnet for testing Horizontal packaged devices with a perpendicular field (So8,tssop,....)        |
| Magnet-T03   | Magnet for testing Horizontal packaged devices with a rotating field (So8,tssop,....)             |
| Magnet-T04   | Magnetic coil for testing Horizontal packaged devices with a perpendicular field (So8,tssop,....) |
| Software Environment MPT (Windows)                   | Including Calibration Software and update tools   |
| DLL for Mini-Tester (Windows)                        |   |
| DLL's for all supported products (Windows)           |   |
| User Inter Faces for most support products (Windows) |   |

## 1. Functional Diagram



## 2. Description

The PTC-04 programmer was designed for efficient, precise calibration of the Melexis families of programmable ICs. The programmer is designed to be easily adapted to a standard PC and to an application module to allow calibration of programmable sensor ICs within the operating environment. The PTC-04 programmer contains its own programmable power supply and measurement circuitry. The programmer is similar to a standard EEPROM programmer, but adds many special features such as 16 bit voltage and current measurement capability, and a configuration options that will accommodate users from the prototyping phase directly into production. An IBM compatible PC is required (not included) to load software to the programmer and control the functions of the programmer. Communication is done through a standard RS-232 null modem cable to a COM port of the PC or via USB. The PC requires no custom configuration, allowing the programmer to be used with any PC with a COM port speed of 115.2kbs or a standard USB 1.1 or USB 2.0 interface.

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### 3. Glossary of Terms

PTC04: The programmer (including the applicable DB)

DB: Daughter board

### 4. Absolute Maximum Ratings

|   |             |
|---|-------------|
| Supply Voltage (External input)                       | 48V         |
| Reverse Voltage Protection                            | Yes         |
| Supply Current  | 1 A Fused   |
| PPS 1,2,3 Output                                      | 34 V        |
| PPS 1,2,3 Current (peak value)                        | 500mA       |
| PPS 4 : Output Current, I <sub>OUT</sub> (peak value) | 50 mA       |
| Operating Temperature Range, T <sub>A</sub>           | 25 °C       |
| Operating Temperature Range, T <sub>S</sub>           | 0°C – 55 °C |

Exceeding the absolute maximum ratings may cause permanent damage. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

### 5. PTC04 Electrical Specifications

#### 5.1. System Power Supply

DC Operating Parameters T<sub>A</sub> = 25-35°C, V<sub>ext</sub> = 48V (unless otherwise specified)

| Parameter                            | Symbol              | Test Conditions | Min | Typ | Max  | Unit |
|--------------------------------------|---------------------|-----------------|-----|-----|------|------|
| DC System Power Supply               | V <sub>ext_in</sub> |                 | 23  | 48  | 48.2 | V    |
| System Current Consumption           | I <sub>Ext_in</sub> |                 | 0.1 |     | 1.2  | A    |
| Daughter Board Analog Power Supply * |                     |                 |     |     | 36   | V    |
|                                      |                     |                 |     | 500 |      | mA   |
| Daughter Board Digital Power Supply  |                     |                 |     | 5   |      | V    |
|                                      |                     |                 |     | 500 |      | mA   |

\* Depends on the DC System Power Supply

## 5.2. Programmable High Current Power Supply 1-3

DC Operating Parameters  $T_A = 25-35^\circ\text{C}$ ,  $V_{\text{ext}} = 48\text{V}$  (unless otherwise specified)

| Parameter                         | Symbol       | Test Conditions                  | Min    | Typ  | Max    | Unit             |
|-----------------------------------|--------------|----------------------------------|--------|------|--------|------------------|
| Output voltage range *            | VPPS 1-3     | Unloaded                         | 0.62   |      | 34.00  | V                |
| Output resolution                 |              |                                  |        | 0.52 |        | mV               |
| Output Current (peak value)       | IPPS 1-3     |                                  | -500   |      | 500    | mA               |
| Current Limit range               | I limPPS 1-3 |                                  | -500   |      | 500    | mA               |
| Settling time                     |              | Unloaded                         | 10     |      | 20     | $\mu\text{S}$    |
| Voltage Source Swing<br>PPS1-PPS3 | Vout         | I out = 10mA                     | 0.035  |      | 34     | V                |
|                                   |              | I out = 100mA                    | 0.2    |      | 32.5   | V                |
|                                   |              | I out = 500mA                    | 1.15   |      | 26     | V                |
|                                   |              | I out = -10mA                    | 1.14   |      | 34     | V                |
|                                   |              | I out = -100mA                   | 2.3    |      | 30     | V                |
|                                   |              | I out = -500mA                   | 9.46   |      | 30     | V                |
| Voltage Source Accuracy           |              | PPS1-3, I out = 10mA             | -0.033 |      | +0.033 | %                |
|                                   |              |                                  | -5     |      | +5     | mV               |
| Voltage Source Slew Rate          |              | PPS1-3, C load = 100nF           | 2.5    |      |        | V/ $\mu\text{S}$ |
|                                   |              | PPS1-3, C load = 1 $\mu\text{F}$ | 0.5    |      |        |                  |
|                                   |              | Between 20 & 80%                 |        |      |        |                  |

\* Depends on the DC System Power Supply

### 5.3. Programmable Fast Power Supply 4

DC Operating Parameters  $T_A = 25-35^\circ\text{C}$ ,  $V_{\text{ext}} = 48\text{V}$  (unless otherwise specified)

| Parameter  | Symbol | Remarks  | Min          | Typ | Max          | Unit    |
|--|--------|--|--------------|-----|--------------|---------|
| Output voltage range                             | VPPS 4 | When Fast DAC = 255  | 0.37         |     | 13           | V       |
| Output resolution                                |        |  |              | 0.2 |              | mV      |
| Output Current (peak value)                      | IPPS 4 |  | -50          |     | 50           | mA      |
| Fast DAC resolution                              |        | Divider between Pos and Neg voltage                            |              | 8   |              | bits    |
| Settling time                                    |        | This is taken by changing the Fast DAC only                    | 0.5          |     | 5            | us      |
| Voltage Source Swing<br>PPS4                     | Vout   | I out = 10mA<br>I out = 50mA                                   | 1<br>0.5     |     | 13<br>10     | V       |
| Voltage Source Accuracy                          |        | PPS4, I out = 10mA   | -0.033<br>-5 |     | +0.033<br>+5 | %<br>mV |
| Voltage Source Slew Rate<br>Using 8 bit Fast DAC |        | PPS4, C load = 100nF<br>PPS4, C load = 1uF<br>Between 20 & 80% | 0.25<br>0.08 |     |              | V/uS    |

## 5.4. Measurement system

DC Operating Parameters  $T_A = 25-35^\circ\text{C}$ ,  $V_{\text{ext}} = 48\text{V}$  (unless otherwise specified)

| Parameter                 | Symbol | Test Conditions | Min    | Typ  | Max    | Unit          |
|---------------------------|--------|-----------------|--------|------|--------|---------------|
| ADC Channels              |        |                 |        | 16   |        |               |
| Pin Potential             |        |                 | -0.5   |      | 35.5   | V             |
| Voltage range (full mode) |        |                 | -37.5  |      | 37.5   | V             |
| Resolution (full Mode)    |        |                 |        | 1.15 |        | mV            |
| Accuracy (full Mode)      |        |                 | -0.12  |      | +0.12  | %             |
|                           |        |                 | -5.77  |      | +5.77  | mV            |
| Voltage range (fine mode) |        |                 | -7.8   |      | 7.8    | V             |
| Resolution (fine Mode)    |        |                 |        | 0.24 |        | mV            |
| Accuracy (fine Mode)      |        |                 | -0.035 |      | +0.035 | %             |
|                           |        |                 | -1.2   |      | 1.2    | mV            |
| Current Meter Range       |        | PPS1-3          | -500   |      | 500    | mA            |
|                           |        | PPS4            | -50    |      | 50     |               |
| Resolution (full Mode)    |        | PPS1-3          |        | 77   |        | $\mu\text{A}$ |
|                           |        | PPS4            |        | 52   |        |               |
| Current Meter Accuracy    |        | PPS1-3          | -5     |      | +5     | %             |
|                           |        |                 | -0.5   |      | 0.5    | mA            |
|                           |        | PPS4            | -5     |      | +5     | %             |
|                           |        |                 | -0.5   |      | 0.5    | mA            |

## 5.5. Function Timings

DC Operating Parameters  $T_A = 25-35^\circ\text{C}$ ,  $V_{\text{ext}} = 48\text{V}$  (unless otherwise specified)

| Parameter                       | Symbol | Remarks                                       | Min | Typ | Max | Unit          |
|---------------------------------|--------|---|-----|-----|-----|---------------|
| Voltage Source Program Rate     |        | PPS1-4, Using PC Software and RS232 interface |     | 20  |     | mS            |
|                                 |        | Using vector functions                        | 10  |     |     | $\mu\text{S}$ |
| Voltage Source Noise            |        | PPS1-4, Peak-to-peak                          |     | 2   | 5   | mV            |
| Current Measurement Sample Time |        | Firmware Only                                 |     | 0.5 |     | mS            |
|                                 |        | PC software and RS232                         |     | 20  |     |               |

## **6. Unique Features**

### **6.1. Mini Tester**

Due to the architecture of the Hardware in combination with the Software, the PTC04 can be used as a mixed mode tester. (With limited performance)

There are library routines (DLL) available in order to interface with any software language. (C, C++, Visual Basic, Lab view, Excel...)

### **6.2. Analogue Vector Generator**

A vector space of 512Kbyte allows you to store a huge amount of actions. These actions consists of setting a level on a channel, waiting a time x, setting the Fast DAC and making samples on an analogue input (measurement) or a digital comparator. For details, refer to the instruction set of the PTC04 chapter Pattern generator

### **6.3. Acquisition memory**

An advance library on the Analogue vector generators, allows use of the vector area in combination with Measurement and setting levels. Through this method one may use the PTC04 as a slow Data acquisition card.

### **6.4. Port E Atmega128**

The port E of the Atmega128 core is connected fully to the Daughter board.

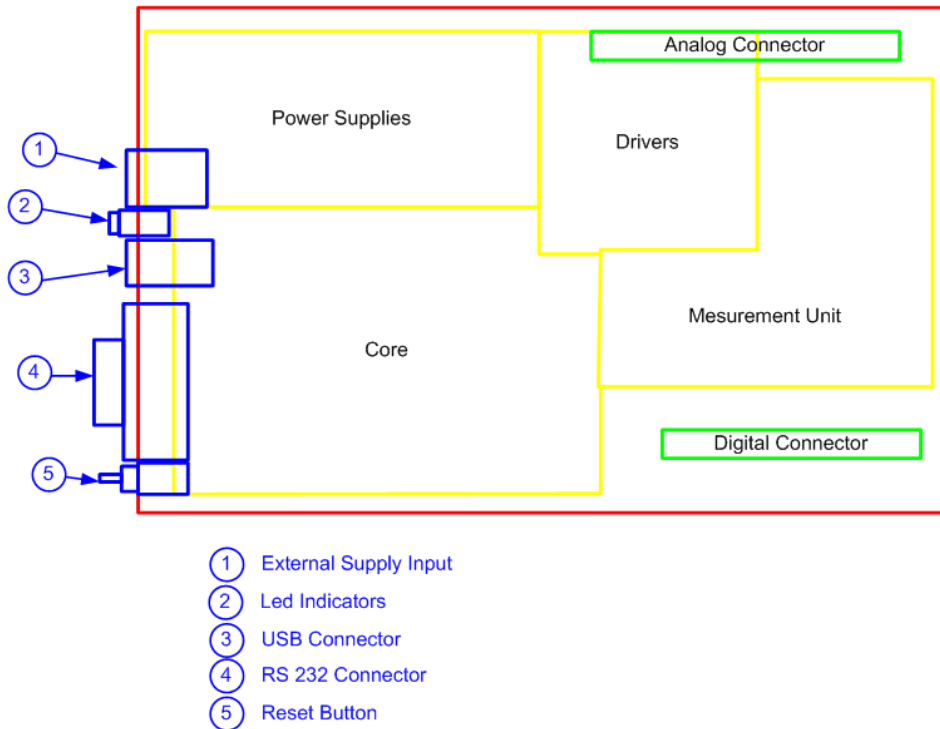
With this port, items like critical timing generation measurements can be performed. Also, all types of UARTS can be configured. Other capabilities are possible with the PTC04.

For more details, refer to the Atmega128 datasheet



## 7. Main Board description

### 7.1. Board Layout



**Figure 7-1**

As shown in Figure 7-1, The Main board can be divided in 4 major areas.

- The Supplies where all required voltage and current levels are created
- The digital Core that processes all requests from the host computer.
- A Driver Area where the Programmable Power supplies are located
- A Measurement area where the ADC and the input MUX are located

Beside these four areas, there are the input connector on the main board and the two connectors to the daughter board.

### 7.2. Power Supplies

The Power Supply input connector is a single input to supply the whole PTC. The Input supply requires a minimum of 24 volts and can tolerate a maximum of 48 volts. It is not recommended to use a higher voltage than needed for the application. There's an internal fuse (on the main board) of 1 A in order to avoid damage when improperly used. The connected supply should provide a minimum current of 1.5 A with peak capacity to source 10A.

The external Supply is the source to create all the internal requirements. Internal voltages are created on the main board by using the input voltage from the external supply.

- +35V for drivers (for the drivers or Programmable Power Supplies)
- +5V Digital (Digital core as interface between PTC and Host application)
- +5V Analog (measurement circuit with MUX and ADC)
- +3.3 V Digital (Supply for the FPGA and USB)

### **7.3. Power Supply system check**

When something goes wrong it's useful to check the status of all the above mentioned supplies. The main board has the capability to measure all internal supplies. The only requirement is that the +5V Digital supply is available. This is indicated by the red led on the rear panel of the programmer. All the other supply could be checked by the Measurement system itself. Channels 8 till 11 are reserved for this. The channel 8 is connected to the driver supply and is very useful to check the voltages of the connected external supply. This can be useful to check when applications are launched where extra High voltage is needed. Refer to the chapter "Measurement system" for more details about measuring these channels. There are DLL functions available that will do these checks for you.

A typical diagnostic check will start with checking if the external supply is available. Then it will check if the red led is lit. If these steps are ok, the diagnostics via software can be executed.

### **7.4. Supply Connector**

This connector provides the PTC with power. Any power source that generates a voltage between 24 and 48 V DC with a minimum current of 1.5 A are allowed.



**Figure 7-2**

### **7.5. LED Indicators**



Two Led indicators will help the user to check the status of the PTC  
The red led shows that the core inside has power  
The green led will show a busy status. If the Programmer is executing a job, the led will be on.

**Figure 7-3**

### **7.6. USB Connector**

One of the communication possibilities with the host PC is the USB link. See chapter "USB communication with host" for more details

### **7.7. RS 232 Connector**

One of the communication possibilities with the host PC is the serial Communication. See chapter "RS communication with host" for more details

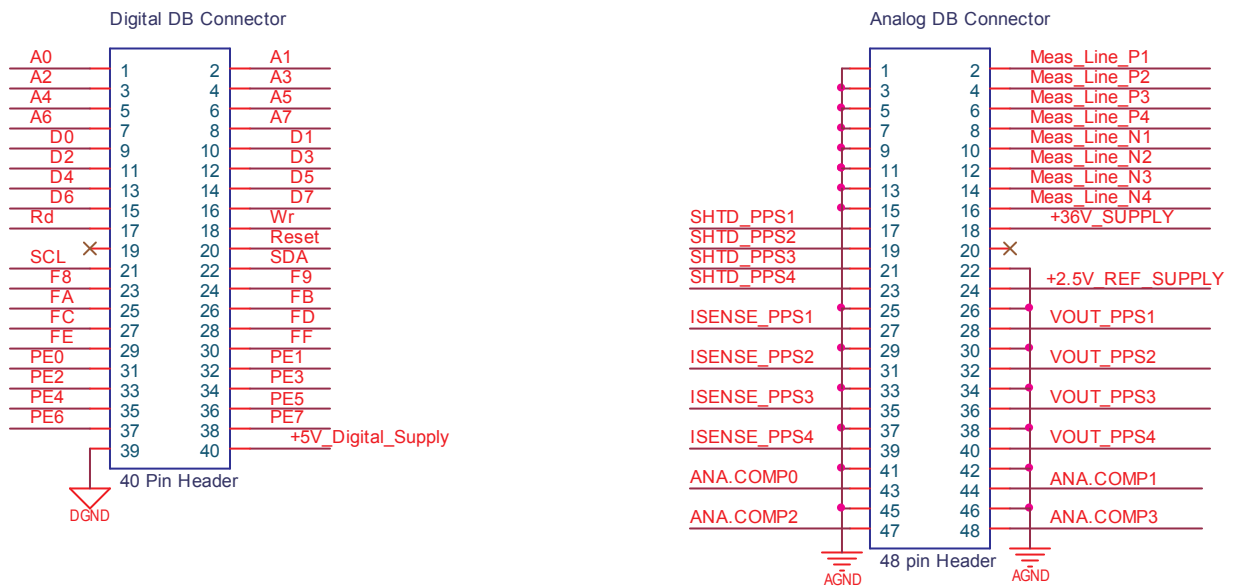
### **7.8. Reset button**

This button is connected to all reset lines in to the main board as well on the daughterboard. This button allows the user to reset the whole programmer after crashing software and when connected also to the application device under test.

### 7.9. Daughter board Connectors

The main board has two connectors to the interface with the application. The PTC allows the addition of a full PCB in between the main board and the interface. This daughter board can be mounted on the two connectors. In some exceptional cases, a daughter board contains only a few wires from the Analog connector to the application connector.

The connectors are described below.



### 7.9.1. Digital DB Connector (40 Pins)

Mainly, the digital connector is meant to expand the programmer for extra needs. Address lines A0-A7 together with the Map Select Lines F8-FF allows the user direct access to an area of 2 K. Example would be adding a simple addressed I/O register by using the selection lines. If more complexity is needed, a full FPGA can be mounted on the DB board

| Pins   | Names        | Description  |
|--------|--------------|--|
| 1 – 8  | A0 – A7      | Address lines  |
| 9 – 16 | D0 – D7      | Data Lines active during Rd or Wr signals  |
| 17     | Rd           | Read : A negative pulse will indicate a sampling of the data on the Data Bus   |
| 18     | Wr           | Write : A Negative pulse will indicate when data is available on the Data Bus  |
| 20     | Reset        | This signal goes low by powering the PTC or by pressing the reset button.<br>This line can be pulled low by application.<br>Check firmware documentation for resetting by software.  |
| 21-22  | SCL / SDA    | I2c Bus  |
| 23-30  | F8,F9,...,FF | CS lines when the address areas are accessed   |
| 31-38  | Port E       | Note: These pins are limited to 5 Volt input/output!!!!<br>The full Port E of the Atmega core is mounted to these pins. This allows us to use advanced features like PWM, UARTS, Time Measurements, etc....<br>By using firmware that supports these, functions, really nice application specific requirements can be fulfilled. |
| 39     | Dgnd         | Digital Ground   |
| 40     | +5V Digital  | 5 Volt Digital Supply. Maximum current to get out of this supply : ....mA  |

Note: All the pins are limited to 5 Volt input/output!!!! However, there are Protections, please take precautions in order to avoid damage of the main board.

### 7.9.2. Analog DB Connector (48 Pins)

Mainly, the analog connector provides all the analog signals and measure possibilities.

| Pins        | Names         | Description  |
|-------------|---------------|--|
| 28,32,36    | PPS 1-3       | Output of the Programmable Supplies  |
| 40          | PPS 4         | Output of the Fast DAC Programmable Power Supply   |
| 27,31,35,39 | Isense_PP1-4  | Outputs (Driver outputs before Rsens) for current evaluations.<br>These outputs could be used to connect to the analog comparators in order to create fast digital signals based on current. |
| 2,4,6,8     | ExtMeas1-4Pos | There are 4 differential inputs for making measurements  |
| 10,12,14,16 | ExtMeas1_4Neg | The negative inputs of ExtMeas1-4Pos   |
| 17,19,21,23 | Shtd_PPS1-4   | Outputs that shows the status of the Drivers.<br>Signals are meant to connect LED's for the front panel  |
| 43,44,47,48 | AnaComp0-3    | See *Note.<br>Input (limited to 5V)<br>Fast Level comparators in order to remove time consuming measurement  |
| 18          | +35V_Supply   | Supply to extend the daughter board with some extra drivers  |
| 20          | NC            | Not Connected  |
| 24          | +2.5V Ref     | Output of internal reference   |
| All other   | AGND          | Analog Ground  |

Note: All the pins are limited to 35 Volt input/output!!!! However, there are Protections, please take precautions in order to avoid damage of the main board.

\* Note: Some pins are protected and limited to 5 Volt!!!! However, there are Protections, please take precautions in order to avoid damage of the main board.

## 8. Daughter board concept

### 8.1. Background

The future of our products is not known and building a universal programmer will not be possible to survive more than a few years. For this reason, a flexibility is build in by having a Daughter board (abbreviation : DB) as interface between PTC04 and the application connector. On this way, special needs can be fulfilled.

The most simple DB are just wires form the DB connectors to the application connector.

The idea is to support with one single DB as many as possible products.

### 8.2. Requirements

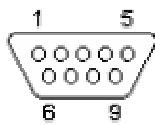
See specific daughter board documentation.

## 9. RS 232 Communication with host

This page describes all items concerning the hardware of the RS232C communication link. Information about the protocol is explained in the software documentation.

### 9.1. Connector

| DB9-Male | Description |
|----------|-------------|
| 2        | RxD         |
| 3        | TxD         |
| 5        | GND         |



(at the Computer and at the PTC04)

9 PIN D-SUB MALE at the Computer.

### 9.2. Cable

The cable between PTC and Host PC is a standard null-modem cable for RS232C  
Cable Description:

| DB9-FEM | DB9-FEM | Description |
|---------|---------|-------------|
| 2       | 3       | RxD / TxD   |
| 3       | 2       | TxD / RxD   |
| 5       | 5       | GND         |

### 9.3. Settings

The microprocessor core has a fixed setting to communicate with the host.  
Used settings are as follows

|              |             |
|--------------|-------------|
| Baud rate    | 115, 2 kBps |
| Bits         | 8           |
| Parity       | No          |
| Flow Control | None        |
| Sop bits     | 1           |

## 10. USB Communication with host

Universal Serial Bus (USB) is used (V1.0)

Developed by Compaq, Hewlett-Packard, Intel, Lucent, Microsoft, NEC and Phillips.

### 10.1. Connectors

| Pin | Name | Description |
|-----|------|-------------|
| 1   | VBUS | +5 VDC      |
| 2   | D-   | Data -      |
| 3   | D+   | Data +      |
| 4   | GND  | Ground      |

### 10.2. Cable

Default



USB A (at the Connector) to plug into a PC



USB B (at the Connector) to plug into the PTC04

Series "A" plugs are used towards the host system and series "B" plugs are used towards the USB device.

### 10.3. Settings

2 drivers have to be installed and are available on the Software CD

## 11. Measurement system

The measurement system on the main board contains mainly a high accurate 16 bit ADC and two 16 to 1 channels MUX. Basically, the ADC always measures differential between inputs.

For the internal voltage channels, the negative input is the internal analog ground.

For the current measurements that uses a sense resistor (PPS1-4) are clearly measuring over the sense resistor.

There are also 4 full differential lines going to the daughter board allowing the user to make high quality measurements by selecting the reference by the application itself. This way of working easily supports the use of force and sense lines.

### 11.1. Channels

| Nr | Pos input             | Neg input          | Description                   |
|----|-----------------------|--------------------|-------------------------------|
| 0  | Vout PPS1             | Internal AGND      | Output Voltage PPS1           |
| 1  | V driver PPS1         | Vout PPS1          | Output Current PPS1           |
| 2  | Vout PPS2             | Internal AGND      | Output Voltage PPS2           |
| 3  | V driver PPS2         | Vout PPS2          | Output Current PPS2           |
| 4  | Vout PPS3             | Internal AGND      | Output Voltage PPS3           |
| 5  | V driver PPS3         | Vout PPS3          | Output Current PPS3           |
| 6  | Vout PPS4             | Internal AGND      | Output Voltage PPS4           |
| 7  | V driver PPS4         | Vout PPS4          | Output Current PPS4           |
| 8  | Supply Driver: +35/2  | Internal AGND      | Driver Supply divide by 2     |
| 9  | Supply Analog : +5 V  | Internal AGND      | Analog 5V Supply              |
| 10 | Supply Digital : +5 V | Internal AGND      | Digital 5V Supply             |
| 11 | Reference : +2.5V     | Internal AGND      | Reference Voltage for DAC/ADC |
| 12 | DB_Ana_conn Pin 2     | DB_Ana_conn Pin 10 | Daughterboard Meas. Channel 1 |
| 13 | DB_Ana_conn Pin 4     | DB_Ana_conn Pin 12 | Daughterboard Meas. Channel 2 |
| 14 | DB_Ana_conn Pin 6     | DB_Ana_conn Pin 14 | Daughterboard Meas. Channel 3 |
| 15 | DB_Ana_conn Pin 8     | DB_Ana_conn Pin 16 | Daughterboard Meas. Channel 4 |

### 11.2. Conversion time

In general the conversion time depends of the loaded firmware version. Theoretically, a full conversion to a floating real value takes about 4ms if the filter is put at 100 samples. For more detailed timings, we have to refer to the firmware description. Every function includes its own timing.

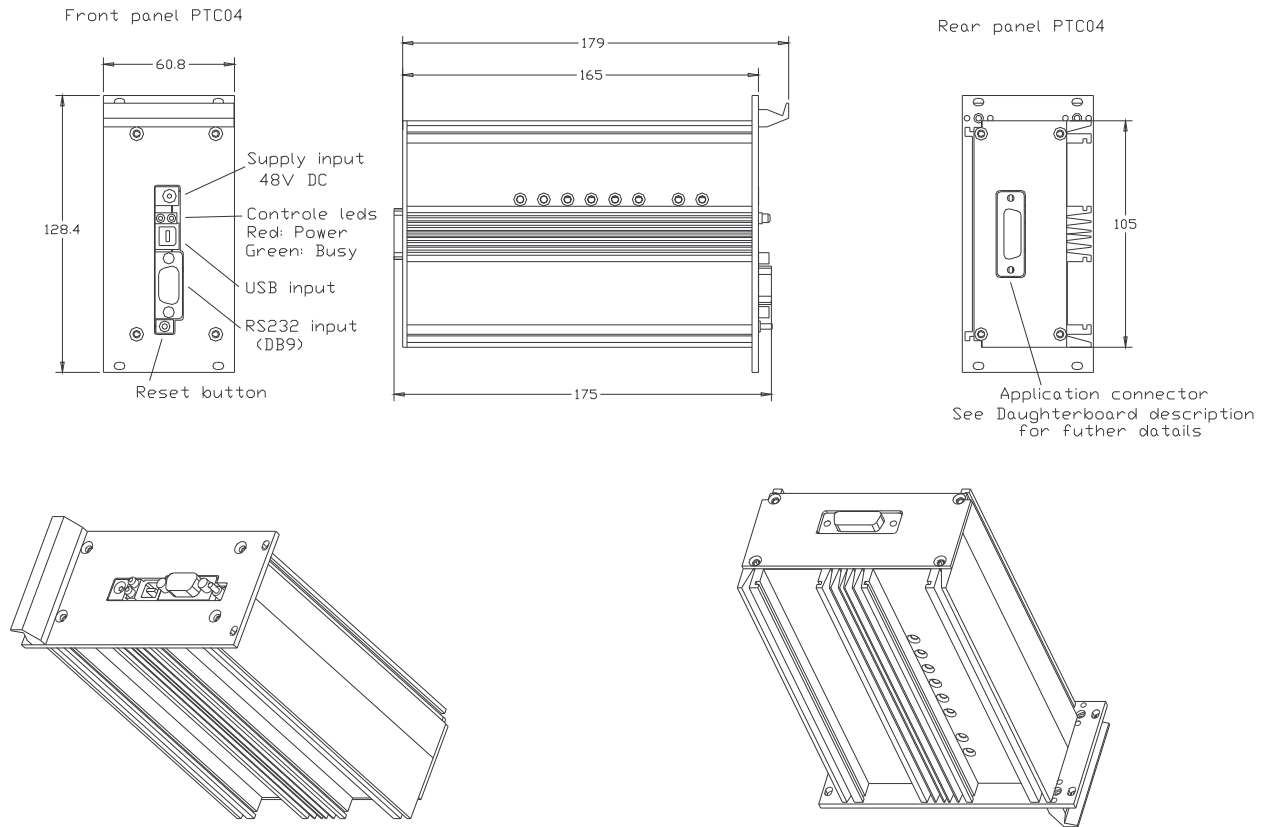
## 12. ESD Precautions

Electronic semiconductor products are sensitive to Electro Static Discharge (ESD).

Always observe Electro Static Discharge control procedures whenever handling semiconductor products.



## 13. Mechanical Outlines



## **14. Disclaimer**

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