



ACS-5175

User's Manual - Preliminary

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ABOUT THIS MANUAL

This manual is meant for engineers and system integrators to assist them in the development of systems based on the Eurotech ACS-5175 PC/104 isolated power supply module. This document contains a full technical specification, description of the connectors and main hardware sections. Included are instruction on installation, configuration and troubleshooting of your ACS-5175 module.



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Conventions

The following table lists the conventions that are used throughout this users manual.

Icon	Notice Type	Description
	Information note	Important features or instructions
	Warning	Information to alert you to potential damage to a program, system or device or potential personal injury

Environmental safety



When disposing the equipment, we suggest separating all of its components when possible, and disposing of them in accordance with local waste disposal legislations. Be sure to dispose of used batteries as required by local waste disposal legislation. Never throw batteries into a fire (risk of explosion) or household garbage can.

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Chapter 1 Product Overview

The Eurotech ACS-5175 75W isolated power supply is designed to meet the system design requirements of military vehicle, aircraft, machine or vessel installations. Resistance to high levels of shock and vibration are a result of the mechanical solutions of this power supply. These include the use of the PCB for heat dissipation, component selection and extensive use of SMD components. The power supply construction with the DC/DC converter module and heat dissipating protection devices mounted on the bottom side of the board easily supports the use of structural heat sinking in your system.

For a complete description of our standard products and systems please visit our web site: www.eurotech.fi and www.eurotech.it

In the following paragraphs you will find a brief description of the characteristics of the ACS-5175 module.

ACS-5175 Block diagram

The figure below shows the simplified functional block diagram of the ACS-5175 power supply module.

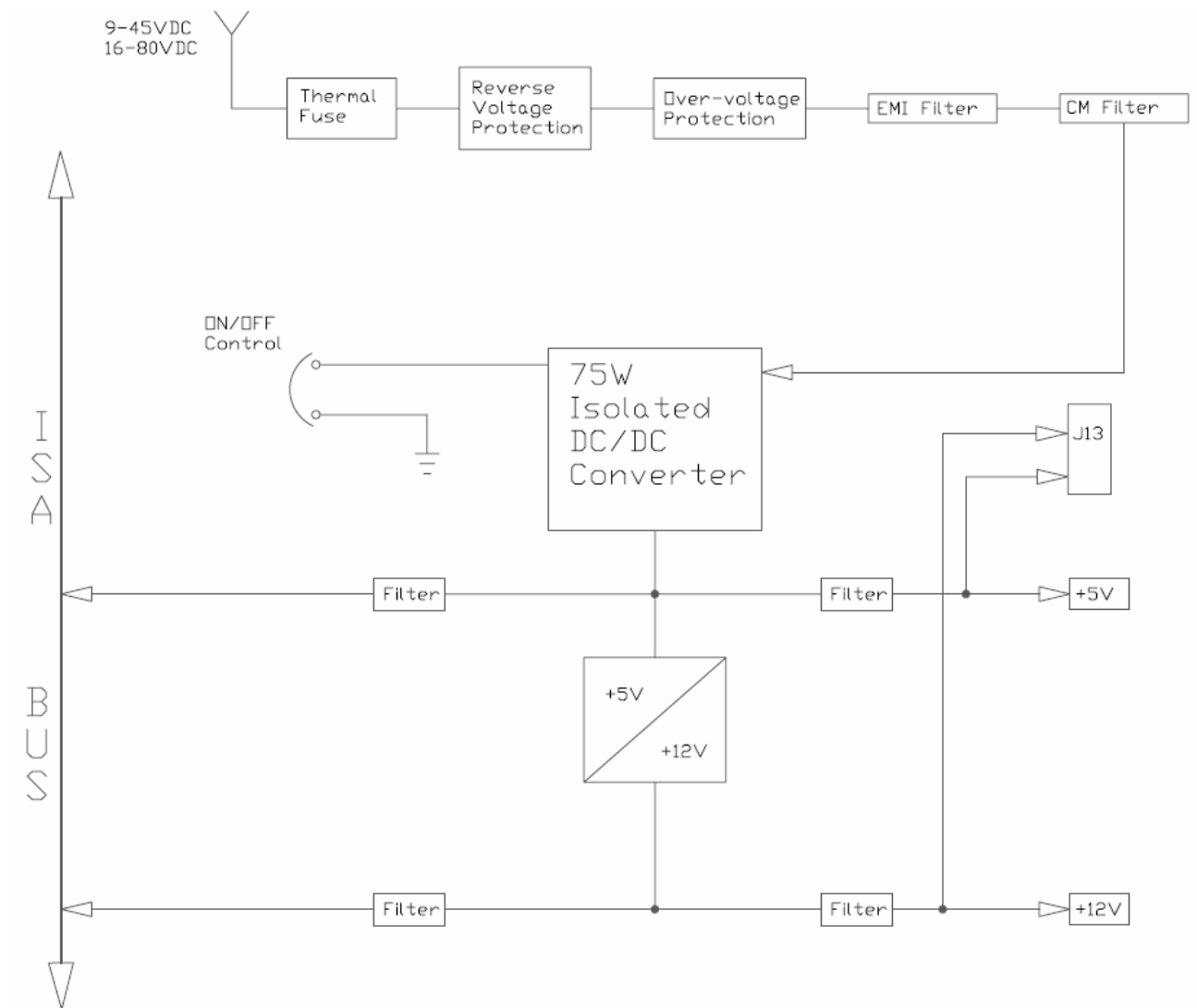


Figure 1. Functional blocks of the ACS-5175 isolated power supply

Product Description

ACS-5175 PC/104 isolated power supply

- PC/104 form factor: 90X96mm, height: 27mm, DC/DC converter mounts below the board
- Over temperature shutdown of board and system at 105°C
- Wide input range +9 to +45V DC or +16 to +80VDC
- High input voltage margin for transients and over voltages
- Reverse voltage protected up to –100VDC
- Input protected with multi-stage voltage suppressors and filters
- Outputs: +5V, and +12V, overload protected
- Power outputs without de-rating: +5V/15A, +12V/2A
- Peak output power +5V/15A, +12V/2.5A with limited operating temperature up to +70°C
- Meets requirements of EC low voltage directives for CE compliance
- -40 to +85°C operating temperature range, 100°C base plate temperature (max)
- MIL-STD-801, MIL-STD-461, MIL-STD-704 and MIL-STD-1275 compliant

75W DC/DC converter specifications

- Wide input range +9 to +45V DC or +16 to +80VDC
- “Quarter Brick” form factor
- High efficiency, 86% typical
- Start-up time 30ms into full load
- 420kHz Fixed frequency operation forward converter
- 100°C baseplate temperature
- Continuous short-circuit protection
- Remote shutdown (SHDN-jumper on the board)
- Isolation input-to output and input to base-plate 1500V
- Isolation output to base-plate 500V
- Operating temperature (case) –40 to +100°C, storage –55 to 125°C
- Shutdown temperature +105°C
- Thermal impedance 15°C/W to ambient free air

Application Areas

- High reliability systems
- Vehicle and mobile computers
- Industrial controllers
- Vessel and airborne systems
- Space applications

Chapter 2 Jumper Description

This chapter shows the jumpers layouts and explains how to set up the board correctly.

Jumper Layout and Configuration

Described in the figure below, is the general jumper layout of the ACS-5175 power supply.

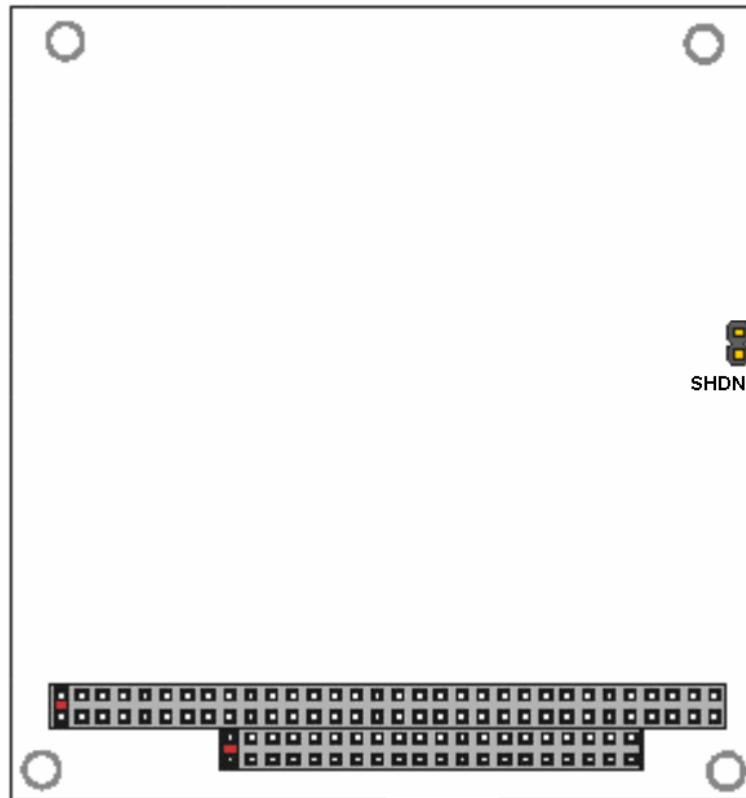


Figure 2. Jumper on the ACS-5175 board

The following jumper is located on the module

Two 2-pin jumper SHDN for board shutdown control, located next to the input terminal block:

- connecting jumper -> Turns off the complete power supply
- removing jumper -> Power supply board fully operational, this is the factory default setting.

The following table provides a quick cross-reference for the ACS-5175 module's jumpers.

Table 1. Jumper Settings (factory configured)

LABEL	Type	Function	Default
SHDN	2 pin jumper	ON-OFF control of the ACS-5175 Closed : Board is standby - OFF Open : Normal operation	Open

Chapter 3 Connector Description

This chapter provides an overall description of the ACS-5175 input and output connectors, describing their locations on the board and their functionality.

Connector Layout

The figure below highlights the connector positions. Each individual connector is described later in this manual.

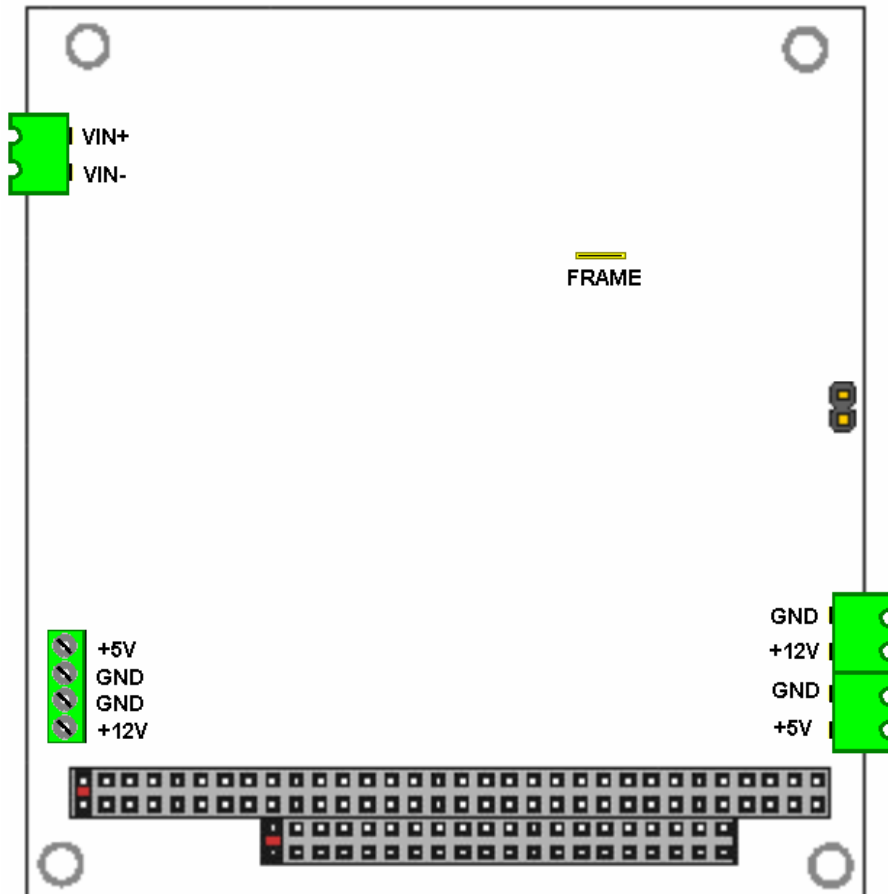


Figure 3. Connector locations

Table below lists the name of the connectors with their function and the reference page.

Table 2. Connector functions

Connector	Function	Page
J1-J2	ISA BUS (PC/XT)	13
VIN	DC input	14
+12V	+12V scew terminal plug	15
+5V	+5V scew terminal plug	16
EXT	+5V and +12V output	16
FRAME	Chassis connection	17

J1 and J2 for the ISA Bus

The ISA BUS

Connectors J1 and J2 contain the signals for the PC/AT ISA-bus. These signals match definitions of the IEEE P996 standard. Below is shown a picture of the PC/104 ISA-bus connector

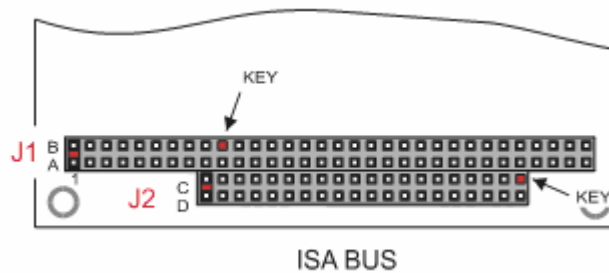


Figure 4. PC/104 BUS layout and definitions

According to PC/104 specifications, two KEYS on the connector are closed on the upper side and the equivalent pin is removed on the bottom side of the bus connector. Keying of the connectors avoids board failure due to wrong insertion in/of another module on the bus.



For further information about the ISA-bus please visit the Eurotech website at (www.eurotech.it), section Industry Standards.

How to connect to the CPU other PC/104 & PC/104 devices: the stack assembly

The ISA Bus connectors of the module are designed to allow the connection onto a stack of other PC/104 and/or PC/104Plus devices. We recommend you to follow the procedure below to ensure that stacking of the modules does not damage any connectors or electronics parts. Failure to follow these instructions may result in irreparable board damage or failure.

1. Turn off all power to the PC/104 computer and its peripheral devices.
2. Touch a grounded metal part of the rack to discharge any accumulation of static electricity.
3. Select and install standoffs to properly position the module on the PC/104 stack.
4. Remove the module from its anti-static bag.
5. Check that keying pins in the bus connector are properly positioned.
6. Check the stacking order; make sure an XT bus card will not be placed between two AT bus cards or it will interrupt the AT bus signals.
7. Hold the module by its edges and orient it so that the bus connector pins line up with the matching connector on the stack.
8. Press evenly the module onto the PC/104 stack.

The picture below shows a typical module stack with 2 PC/104 modules, 1 PC/104 16-BIT module, and 1 PC/104 8-BIT module. The maximum configuration for the PCI bus of PC/104 modules is 4 plus the Host Board. If standard PC/104 modules are used in the stack, they must be the top module(s) because they will normally not include the PCI bus.

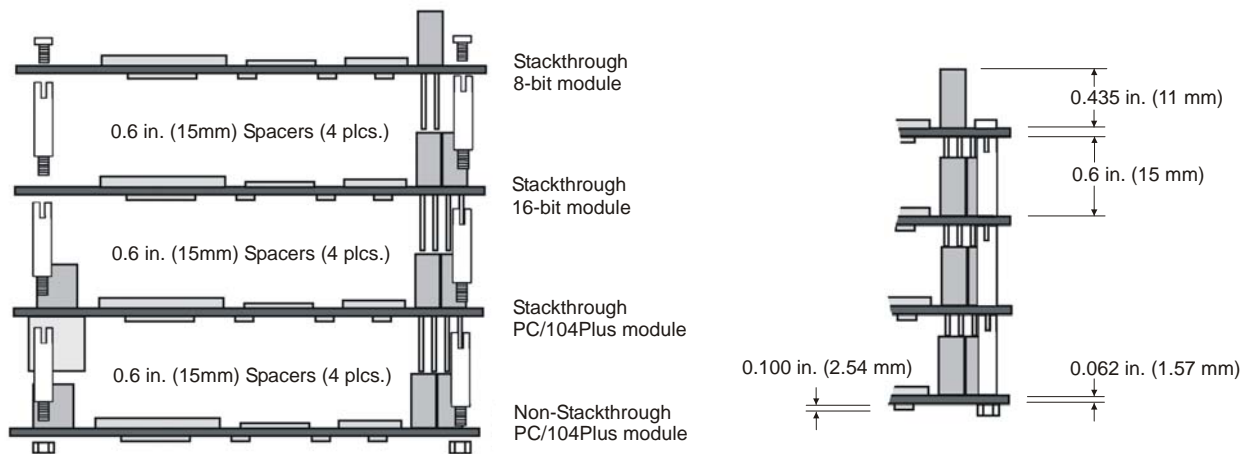


Figure 5. The PC/104 module stack



Do not force any module onto the stack! Wiggling the module or applying too much pressure may damage it. If the module does not readily press into place, remove it, check for bent pins or out-of-place keying pins, and try again.

Power Input connection

The ACS-5175 accepts a wide input voltage range from +9V to +45V DC or alternatively +16 to +80V DC. This makes this power supply ideal for nominal +24V military vehicle or +28V aircraft installations. The input is reverse voltage protected up to 100V. A multi-stage protection scheme as well as a thermal fuse is used to protect the input of the power supply. Low radiated and conducted emissions are achieved by a purpose built multi-stage common mode and differential mode input filter and high frequency RF filter. Inputs and outputs of the converter are bypassed and filtered to the chassis/frame of the system. As the input power of the module can reach 130W it is important to ensure that suitable input cables are used.

VIN – Isolated power supply input connector

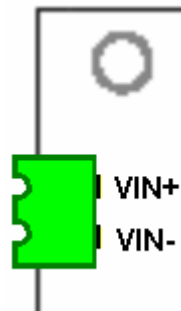


Figure 6. Input power connector

This power input connector implements the following functions:

- + 9 to 45V DC or +16 to +80V DC Isolated Input
 - Connects raw input power to the ACS-5175 power supply and system, note that the VIN- of this input power source is not connected to the computer ground or the chassis ground.

+5V Output connector

A high reliability 75W output +5V isolated switching D/DC converter is used to power your complete 5V system. This converter feeds power into the PC/104 bus pins and is available for peripheral device connection on the locking screw terminal block as shown in the picture below. The +5V is filtered to reduce radiate noise on the output. The maximum output current of the +5V converter is 15A. The power consumption of the cascaded +12V converters must be taken into consideration while performing power calculations.

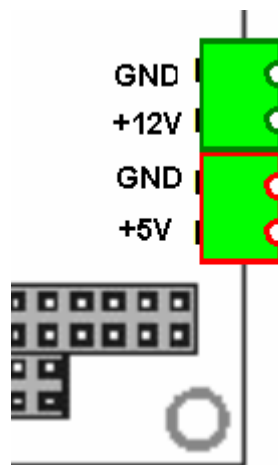


Figure 7. +5V output connector

+12V Output connector

A nominal 25W output +12V high efficiency switching D/DC converter is used to create +12V from +5V. This converter feeds power into the PC/104 bus pins and is available for peripheral device connection on the locking screw terminal block as shown in the picture below. The +12V is filtered to reduce radiate noise on the output. The maximum output current of the +12V output is 2.5A. The output is over current protected and will withstand a permanent short circuit condition. The maximum peak transient current is 3A.

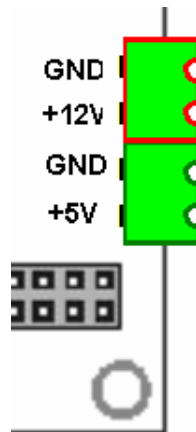


Figure 8. +12V output connector

External power connector

The external power output connector shown in the picture below has two ground pins in the middle and additionally +5V and +12V. Use this screw terminal block to connect to your standard peripheral devices such as HDD and CD-ROM drives.

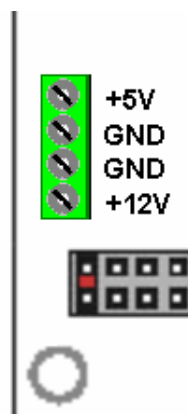


Figure 9. External power connector



Note: These power terminals are connected in parallel with the equivalent outputs described before.

Frame

A flat frame lug is supplied on the board for a connection from the board Chassis ground to the body of your chassis. This connection may be used if your DC-DC converter hetsink frame is not in galvanical contact with the chassis of your enclosure. The Chassis is connected to the bottom-left PC/104 mounting hole shown in figure 3.



Figure 10. Frame connection lug



Note: The chassis or Frame of your system is capacitively coupled to the system ground as well as the input V-. Isolation voltage is 500VDC. The input filter as well as input-output connections of the DC-DC converter is capacitively coupled to the frame of your system. Frame grounding must be carefully verified in the final installation for compliance with emissions requirements.

Chapter 4 Power Supply Description

This chapter provides a brief description of the ACS-5175 input protection circuitry, power supply converters, onboard filters and indicators.

Input protection and filtering

Reverse voltage protection

Input power reversal is a common error condition in power supply connection or installation in hostile electrical environments. The ACS-5175 power supply will withstand reverse voltages up to 100V indefinitely. A series schottky diode on the positive supply input line also protects the transient absorber diodes from forward conducting in a reverse voltage condition. The reverse voltage protection diode is rated for a 9.0A input current.

Over voltage protection

The ACS-5175 input protection is based on using different types of protection technologies. Firstly the complete board is protected by a thermal fuse that will disconnect the positive input of the board if excessive current is drawn through the board, secondly input filters create an impedance mismatch to reflect part of the transient or surge energy back to its source and assist in dissipating the energy into onboard protection devices.

Multiple protection device technologies are used in multiple stages. The first stage consists of a power MOV absorber for bipolar voltage surges and a high-speed transient absorber diode stage will clamp the input to 100V maximum under all conditions. After the dual filter stage a dual device automotive input clamp will keep the voltage below the maximum rated level (45V or 80Vdc) under all conditions.

Even though the input voltage ranges specified for the ACS-5175 are rated up to 45VDC and 80VDC due to the input protection devices the maximum steady state input voltage range is lower as the protection devices will start to conduct at a lower voltage level. The maximum clamping voltage is tuned to the maximum input voltage levels of the DC-DC converter. The table below shows the maximum recommended nominal input voltages in continuous operation. The voltages listed below are the breakdown voltage of the protection devices.

Table 1. Maximum normal condition input voltage range

Board Type	Voltage Range MAX	Clamped Voltage Range
ACS-5175-A0	28,8V	+9 to 45Vdc
ACS-5175-A1	53,4V	+16 to 80Vdc

Input filtering

Low radiated and conducted emissions are important when selecting power supplies for critical embedded systems. All the power outputs from the onboard DC/DC converter subsystems are filtered using power ferrites reducing emissions in the frequency range of 30 to 150MHz. The ACS-5175 will exceed the requirements of the EC low voltage directives for CE compliance. An input filter specially dimensioned for the ACS-5175 power supply ensures compatibility with EN-55022 class B or MIL-STD-461 requirements for conducted and radiated emissions.

The frame of the converter (as well as the chassis if it is conductive) may be connected to the ground of the power supply output.

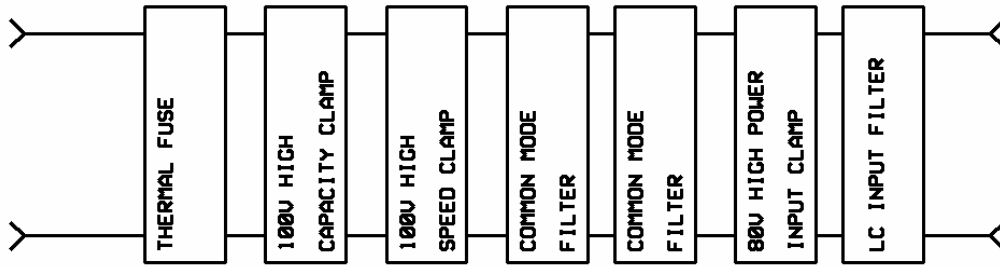


Figure 11. General scheme of the input filters of the ACS-5175

Table 2. Compliance with MIL-STD 461 C emissions and immunity

	MIL-STD-461 C	ACS-5175 Module
Conducted emission Low frequency 30Hz - 15KHz Narrowband 15KHz - 50 MHz Broadband 15KHz - 50 MHz	CE 01 CE 03 CE 03	CE 01 CE 03 CE 03
Conducted susceptibility Band 1.5 Hz - 50 KHz Band 50 KHz - 400 MHz	CS 01 CS 02	CS 01 CS 02
Radiated emission Band 30Hz - 15Hz Narrowband 14KHz - 1GHz Broadband 14KHz - 1GHz	RE 01 RE 02 RE 02	RE 01 RE 02 RE 02
Radiated susceptibility Band 30 Hz - 50 KHz Band 14 KHz - 10GHz	RS 01 RS 03	RS 01 RS 03

Isolated +5V DC/DC converter module

The main +5V output is designed based on a monolithic High Rel extended temperature range galvanically isolated 75W DC-DC converter module. The converter output current is internally limited to 15A. This Eurotech converter design is unique offering an easy solution for structural heat sinking of the power supply. The filtering and shielding of the DC/DC converter ensures low input ripple current and low radiated noise under all load conditions. Use of optimal PCB layout and use of low high quality capacitors ensure un-degraded performance over the complete operating temperature range of -40 to +85C. Mounting the ACS-5175 on a heat conducting baseplate for structural heatsinking is easy as the DC/DC converter module is mounted on the bottom side of the power supply. The power supply is intended to be the bottom-most board in your PC/104 stack.

The main +5V converter supplies the PC/104 +5V bus with power. This power is available for external devices from an external terminal block. (See previous section for the location of terminal block.)

Table 3. +5V DC/DC converter environmental specifications

Characteristics	Conditions	Severity	Test Procedure
Altitude	Altitude level C Climb up	40.000 ft, unit fonctionning 1.000 ft/min to 70.000 ft, unit fonctionning	MIL - STD - 810D Method 500.2
Humidity	Damp heat Duration	88 % H.R Cycle I : 240 Hrs	MIL - STD - 810D Method 507.2
Salt atmosphere	Duration	48 Hrs	MIL - STD - 810E Method 509.1
Temperature cycling	Number of cycles Temperature change Transfert time / Steady state time	200 -40°C / +85°C 40 min. / 20 min.	MIL - STD - 883C Method 1010
Vibration (Sinusoidal)	Number of cycles Frequency Amplitude/acceleration	10 cycles in each axis 10 to 60 Hz/60 to 2000 Hz 0.7 mm/10 g	MIL - STD - 810D Method 514.3
Shock (Half sinus)	Number of shocks Peak acceleration Duration	3 shocks in each axis 100 g 6 ms	MIL - STD - 810D Method 516.3
Bump (Half sinus)	Number of bumps Peak acceleration Duration	2000 Bumps in each axis 40 g 6 ms	MIL - STD - 810D Method 516.3
Conducted Emission		CE01 CE03 CE07	MIL - STD - 461C
Conducted susceptibility		CS01, CS02 CS06 spike #2	MIL - STD - 461C
Radiated emission		RE01 RE02	MIL - STD - 461C
Radiated susceptibility		RS01, RS03	MIL - STD - 461C

Current Limit

To protect the ACS-5175 against fault or error conditions the +5V DC/DC converter circuit is equipped with current limiting to provide continuous overload protection. After reaching the current limit point (typically 110% exceeding the rated maximum current), the output voltage will fall along the vertical line shown in the following figure. Once the short circuit condition is removed, the output will return to the nominal value without restarting the power supply or switching power off.

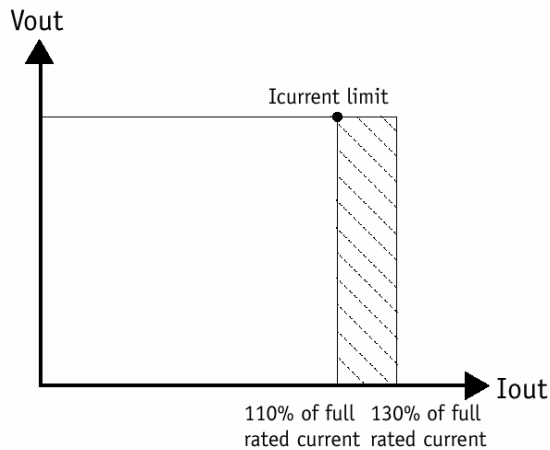


Figure 12. Over current protection operation of DC-DC converter

Over temperature protection

A thermal over temperature device adjusted at +105°C (+-5%) internal temperature with 10°C hysteresis cycle will inhibit the module as long as the overheat is present and restores normal operation automatically when the overheat condition is removed.

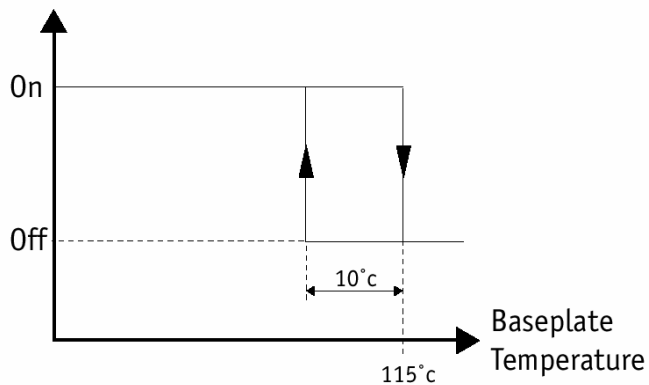


Figure 13. Module temperature protection characteristics

Input under voltage lock-out

An under voltage protection circuit will inhibit the module when the input voltage drops below the lockout turn-off threshold (Turn-on 10,5V or 16Vdc) and restores back to normal operation automatically when the input voltage rises above the lockout turn-on threshold. Note that if your source power supply is incapable of supplying the required start-up power to your system your power supply may detect an under voltage during start-up.

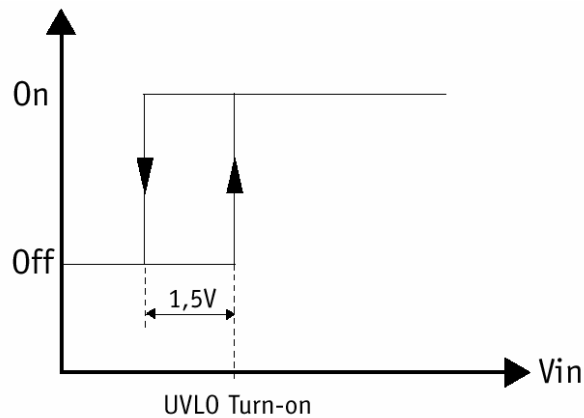


Figure 14. UVLO characteristics of the module

Remote On/Off control

The header connector labeled SHDN near the edge of the board is the remote ON/OFF control. Closing this contact will disengage the ACS-5175 and place the converter in a low power standby condition. In this condition the ACS-5175 will still consume some power. This control signal could be connected to the ignition key of an automobile, vehicle or machine.

+12V step up converter

A step-up DC/DC converters with high efficiency generates the +12V volts for peripheral devices such as EL- or TFT- panels, hard drives, motors etc. The +12V output can supply up to 3.0A peak current (2.0A continuous –40 to +85°C). The high level peak current will ensure that the converter can respond to short term currents. +12V supply is available from terminal block and the 4-position screw terminal block near the bus connector. The +12V supply also powers the PC/104 bus power pins. The +12V power outputs are filtered with ferrites to reduce the radiated emitted from the board.

Status indicator LEDs

Two green status LEDs near the PC/104 bus connector indicate the state of the power outputs. The LED indicators are connected to the +5V and +12V outputs.

Technical/Sales Assistance

If you have a technical question, please call Eurotech Customer Support Service at one of the numbers below, or e-mail our technical support team at:

- Email: info@eurotech.fi
- Phone: +358 477 888 0
- Fax: +358 477 888 99

If you have a sales question, please contact your local Eurotech Sales Representative or the Regional Sales Office for your area.

Additional and latest information is available at Eurotech website, located at:

<http://www.eurotech.fi> and <http://www.eurotech.it>

Other information can be found at:

<ftp://ftp.eurotech.it/>

Returning For Service

Before returning any of Eurotech's products, you must phone Eurotech at **+39-0433-485411** and **obtain a Returned Material Authorization (RMA) number.**



Note. You must have the RMA number in order to return any product for any reason!

The following information is needed to expedite the shipment of a replacement to you:

- Your company name and address for invoice
- Shipping address and phone number
- Product I.D. number
- The name of a technically qualified individual at your company familiar with the mode of failure on the board
- A detailed description of the problem and of the current configuration including OS and software loaded.

If the unit is out of warranty, service is available at a pre-designated service charge. Contact Eurotech for pricing and please supply a purchase order number for invoicing the repair. Pack the board in anti-static material and ship in a sturdy cardboard box with enough packing material to adequately cushion it.



Warning! Any product returned to Eurotech improperly packed will immediately void the warranty for that particular product!

Appendix



A.1 Electrical and Environmental Specifications

The following section provides tables and illustrations showing the electrical, mechanical and environmental specifications for the ACS-5175 module.

In the following tables you will find:

- Operating Characteristics
 - Electrical operating characteristics
 - Operating temperature Range
- Absolute maximum ratings
- MTBF
- Power Consumption

Operating Characteristics

Electrical Operating Characteristics

Table 3. DC Operating Characteristics

ACS-5175-A0	VIN = 9V to 45V
ACS-5175-A1	VIN = 16V to 80V

Table 4. Maximum normal condition input voltage range

Board Type	Voltage Range MAX	Clamped Voltage Range
ACS-5175-A0	28,8V	+9 to 45Vdc
ACS-5175-A1	53,4V	+16 to 80Vdc



Note. This module is not warranted against damage caused by overheating at temperatures in the excess of +85C

For proper operation of the ACS-5175 module, the base plate temperature must remain inside this range: -40°C to +105°C and the ambient air temperature within -40°C to +85°C.

Absolute Maximum Ratings

Table 4. Absolute Maximum Ratings

Supply Voltage:	See above
Storage Temperature Range:	-45°C to +85°C
Non-Condensing Relative Humidity:	<95% at 40°C (+104°F)
Operating Temperature Range:	-40°C to +85°C
Output +5V	15A
Output +12V	2.5A



Warning! Stressing the device beyond the “Absolute Maximum Ratings” may cause permanent damage. These are stress ratings only. Operation beyond the “Operating Conditions” is not recommended. Extended exposure beyond the “Operating Conditions” may affect device reliability.

MTBF

Hours: 750.000 **Standard:** MIL-HDBK-217F ground fixed (Gf) **Temperature:** 25.0 °C, baseplate at +40°C

A.2 Mechanical Dimensions

Board Dimensions

The ACS-5175 module’s mechanical dimensions are shown in the following pictures:

- PC-board outside dimensions: 90 X 96 mm, height: 27 mm with DC/DC converter included

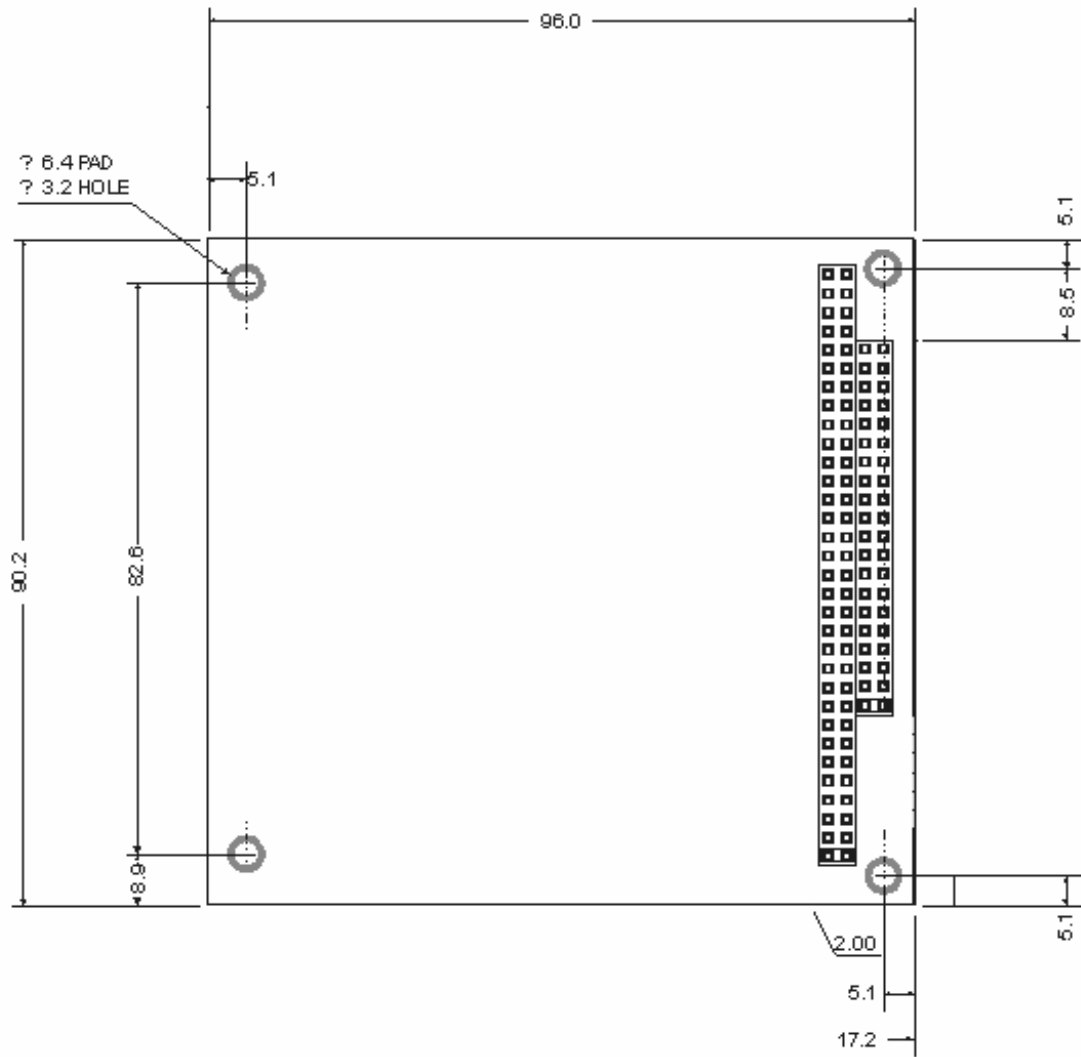


Figure 15. ACS-5175 Board dimensions

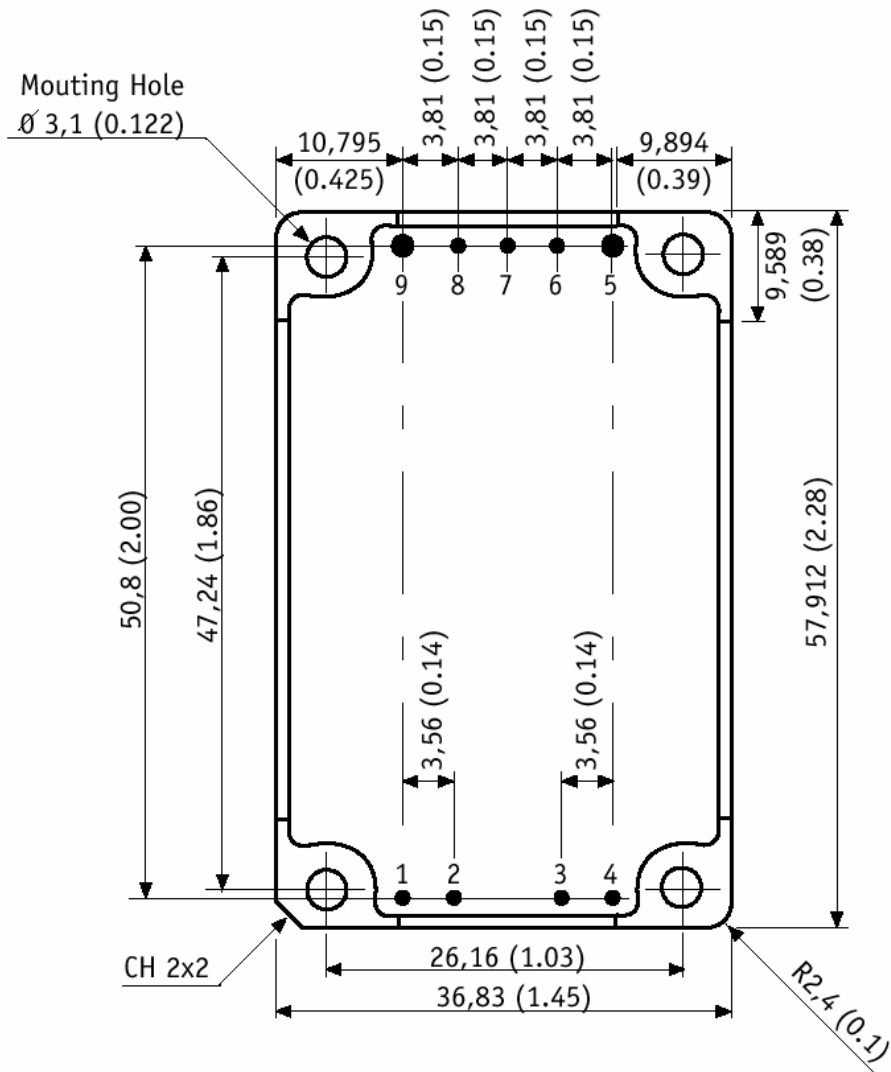


Figure 16. DC/DC converter measurements as seen from module bottom side, top side of the ACS-5175 board



Note: For further information about the mechanical dimensions of ISA buses please refer to the [pc/104 consortium site \(www.pc104.org\)](http://www.pc104.org)

A.3 Safety Summary

The following general safety precautions must be observed during all phases of operation, service, and repair of this equipment. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the equipment. Eurotech SpA assumes no liability for the customer's failure to comply with these requirements.

The safety precautions listed below represent warnings of certain dangers of which Eurotech is aware. You, as the user of the product, should follow these warnings and all other safety precautions necessary for the safe operation of the equipment in your operating environment.

Ground the Instrument

To minimize shock hazard, the equipment chassis and enclosure must be connected to an electrical ground. The equipment is supplied with a three-conductor ac power cable; the power cable must be plugged into an approved three-contact electrical outlet, with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and mating plug of the power cable meet International Electro technical Commission (IEC) safety standards.

Do Not Operate in an Explosive Atmosphere

Do not operate the equipment in the presence of flammable gases or fumes. Operation of any electrical equipment in such an environment constitutes a definite safety hazard.

Keep Away From Live Circuits

Operating personnel must not remove equipment covers. Only Factory Authorized Service Personnel or other qualified maintenance personnel may remove equipment covers for internal subassembly or component replacement or any internal adjustment. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

Do Not Substitute Parts or Modify Equipment

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification of the equipment. Contact Eurotech technical staff or your local representative for service and repair to ensure that safety features are maintained.

Observe Dangerous Procedure Warnings

Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed. You should also employ all other safety precautions, which you deem necessary for the operation of the equipment in your operating environment.

Flammability

All Eurotech PCBs (printed circuit boards) are supplied by UL-certified manufacturers. Boards have a flammability rating of UL-V0.

EMI Caution

This equipment generates, uses and can radiate electromagnetic energy. It may cause or be susceptible to electromagnetic interference (EMI) if not installed and used in a cabinet with adequate EMI protection.

CE Notice

This product complies with the EMC Directive (89/336/EEC). Compliance with this directive implies conformity to the following European Norms:

- EN55022 (CISPR 22) Radio Frequency Interference
- EN50082-1 (IEC801-2, IEC801-3, IEC801-4) Electromagnetic Immunity

The product also fulfills EN60950 (product safety), which is essentially the requirement for the Low Voltage Directive (73/23/EEC). This product was tested in a representative system to show compliance with the above-mentioned requirements. A proper installation in a CE-marked system will maintain the required EMC/safety performance.

Disclaimer of Warranty

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Reliability

Eurotech has taken extra care of product design in order to ensure reliability. The two major ways in which reliability is achieved are:

- The product is designed in top-down fashion, utilizing the latest in hardware and software techniques, so unwanted side effects and unclear interactions between parts of the system are eliminated.
- Eurotech tests each board by exercising its functions, burns it in under power, and retests it to ensure that the infant mortality phase is passed before the product is shipped.

Life Support Policy

Eurotech products are not authorized for use as critical components in life support devices or systems without the express written approval of the president of Eurotech.

Technical & Sales Assistance

If you have a technical question, please contact the Eurotech Customer Support Service

support@eurotech.fi

Other information can be found at:

www.eurotech.fi
www.eurotech.com.cn

If you have a sales question, please contact your local Eurotech Sales Representative or the Regional Sales Office for your area.

Additional and latest information is available at Eurotech website, located at:

<http://www.eurotech.fi>