



DAQ Modules

UDAQ-1408A/E/CA/CE/DA/DE

UDAQ-1416CA/CE

User Guide

My DAQ Module Details:

type of module: (e.g. UDAQ-1408A)

serial number: (e.g. 10300001)

purchase date:

module owner:

Manufacturing, sales office, service center, technical support and headquarters:

address: TEDIA® spol. s r. o.
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CE Declaration of Conformity

All TEDIA® products described in this user guide comply with the essential requirements of the following applicable European Directives:

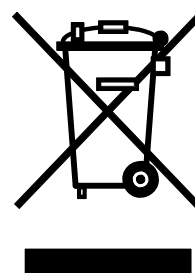
- Electromagnetic Compatibility (EMC) Directive 2014/30/EU
- RoHS Directive (EU) 2015/863 amending Annex II to Directive 2011/65/EU

The CE Declaration of Conformity original document is stored at the manufacturer and its copy may be provided on request.



Waste Electrical and Electronic Equipment (WEEE)

This symbol indicates that waste products should be disposed of separately from municipal household waste according to WEEE Directive 2012/19/EU of the European Parliament and the Council on waste electrical and electronic equipment (WEEE). All products at the end of their life cycle must be sent to a WEEE collection and recycling center. Proper WEEE disposal reduces environmental impact and the risk to human health due to potentially hazardous substances used in such equipment. Your cooperation in proper WEEE disposal will contribute to the effective usage of natural resources.



1. Introduction

1.1 Description

The modules UDAQ-1408A/E/CA/CE/DA/DE a UDAQ-1416CA/CE are products of a modern concept intended especially for laboratory and mobile measuring systems.

The advantages include simple installation and programmable configurability of all parameters; no hardware configuration need to be set during installation or use.

General view of the modules is shown in the Figures 1 and 2 in the Appendix.

1.2 Available versions

module type	number of analog inputs	type of analog inputs connector	analog inputs isolation	other inputs and outputs
UDAQ-1408A	8x S.E.	screw terminals	no	1 digital output 2 digital inputs 2 counters (all digital I/O on screw terminals)
UDAQ-1408E	8x S.E.	screw terminals	yes	
UDAQ-1408CA	8x S.E.	D-Sub 25	no	
UDAQ-1408CE	8x S.E.	D-Sub 25	yes	
UDAQ-1408DA	8x DIF.	D-Sub 25	no	
UDAQ-1408DE	8x DIF.	D-Sub 25	yes	
UDAQ-1416CA	16x S.E.	D-Sub 25	no	
UDAQ-1416CE	16x S.E.	D-Sub 25	yes	

1.3 General instructions for use

The modules are compatible with USB 1.1 / 2.0 computers in office, industrial or portable environments and are designed for signal processing.

All measured signals (analogue as well as digital) can be connected with a suitable shielded cable with a maximum length of 2 m.

Caution:

The modules are designed for data transmission and may be used only according to the manufacturer's recommendations and precautions given in this manual and other general standards and terms and may be used only such a way, that its failure caused by any reason will not be dangerous to any person or property.

1.4 Note on the contents of the manual

This manual contains all information related to module features, I/O connectors etc., but does not include a description of installing and using drivers.

For information about drivers see the dedicated documentation attached to the installation files.

2. Specifications

2.1 Analog inputs

Number and type of inputs:	8x S.E. 8x DIF. 16x S.E.	(UDAQ-1408A/E/CA/CE) (UDAQ-1408DA/DE) (UDAQ-1416CA/CE)
ADC resolution:	14-bit	
General input range:	±10 V	
General input range gain:	±0.1% of range max.	(after calibration)
General input range offset:	±0.2% of range max.	(±0.1% typ., cannot be adjusted)
Programmable gain:	1x, 2x, 5x, 10x, 20x, 50x (ie. ranges ±10 V, ±5 V, ±2 V, ... , ±0.2 V)	
Gain error 2x ÷ 50x:	±0.15% of range max.	(±0.05% typ.)
Input impedance:	>10 MOhm	
Maximum input voltage:	±24 V ±50 V	(permanently; max. 5 inputs) (10 ms max.)
Isolation voltage:	1 kV _{DC}	(types E, CE and DE only)

Note: Although the analog inputs have high impedance characteristics, it should be taken into account that the output impedance of the source of the measured signal fundamentally affects the function of the input signal multiplexer (ie. it increases the time needed to stabilize the measured signal after switching the analog input). When using a signal source with output impedance greater than 1 kOhm, it is necessary to set a longer delay to stabilize the amplifier; the module allows to set up to 255 µs separately for each input range and thus adjust the properties to a signal source with an impedance of tens of kOhms. Insufficient settling time results in an unstable measured value usually affected by signals from other inputs.

2.2 Trigger logic

Trigger sources:	internal timer (pacer), software start	
Scanning logic sources:	all physical inputs (AIN, CNT, DIO)	
Pacer trigger mode range:	30.5 Hz ÷ 40 kHz	
Software trigger mode range:	single measurement up to dozens of Hz	
Conversion time of ADC:	12 µs	(independent of selected gain)
Settling time range:	0÷255 µs 3÷255 µs 8÷255 µs	(gain 1x÷10x) (gain 20x) (gain 50x)
Minimum sampling period:	(number of measured AIN+CNT+DIO) * 25 µs + sum of the configured settling time for all AINs	

Note: The maximum sampling rate for is equal to the reciprocal value of the minimum sampling period.

2.3 Counters

Number and resolution:	2x 16-bit
Operating frequency:	2 MHz max. (duty cycle signal 1:1)
Type of inputs and levels:	see section 2.4 Digital ports
Data transfer mode:	asynchronously and synchronously with AIN data

Note: Counter inputs are shared with digital inputs.

2.4 Digital ports

Number of inputs:	2	(see Figures 1 and 2)
Operating levels:	TTL/HC	
Maximum input voltage:	-10 V / +15 V	(permanently)
	-15 V / +24 V	(10 ms max.)
Number of outputs:	1	
Type of outputs:	C type relay	(see Figures 1 and 2)
Operating levels:	30 V _{DC} / 0.5 A, resp. 100 V _{RMS} / 0.5 A	
Isolation voltage of outputs:	200 V _{DC}	
Data transfer mode:	asynchronously and synchronously with AIN data	

2.5 General data

USB bus standard:	USB 1.1/2.0	
Power voltage:	+5 V	(from the USB bus)
Current consumption:	240 mA max.	(A, CA and DA types)
	300 mA max.	(E, CE and DE types)
Dimensions:	cca 140 x 110 x 35 mm	
Connectors - analog inputs:	plug-in screw terminals	(A and E types)
	D-Sub 25 male	(CA, CE, DA and DE types)
Connectors - digital ports:	plug-in screw terminals	
Connectors - USB:	USB-B type	
Operating temperature:	0° ÷ 55° C	
Storage temperature:	-10° ÷ 60° C	
Relative humidity:	10% ÷ 90%, noncondensing	
Recommended cable length:	shielded cables, 2 m max.	

Note: The current consumption is suitable for connecting the module directly to the USB port of the computer or to a powered USB hub (so-called active hub), but it exceeds the allowed value for connection to a passive USB hub, ie. hubs without their own power supply.

3. Installation

3.1 Introduction

Attention has been focused on achieving a high quality and reliability during the manufacturing process and attention was also paid to an inspection of the module before being shipped to you. Detailed reading of this guide and following the instructions precisely are highly recommended for achieving full quality and to prevent any damage during installation. For further information see manufacturer's website <http://www.tedia.eu>.

3.2 Hardware configuration

Modules do not contain any configuration elements except of the calibration potentiometer located on the back of the module. Calibration process is described in Chapter 5.

3.3 Installation

Connect the module with included USB cable to your computer with a functional USB interface (it does not matter whether it is on or off).

The system driver is installed differently depending on your version of Windows, see the installation manual (included in this driver's installation package).

The TEDIA_DAQ01 application driver is installed by a separate setup program; for more information about installation and use, refer to its documentation.

*Note: The Windows 8, Windows 7, Windows Vista, Windows XP (Windows 2000 and Windows 98/Me supported without warranty) are supported at the time of document release. You can find the current status and detailed information in the documentation attached to the installation files.
Server operating systems are only supported by the system driver.*

3.4 Connectors location and pin assignment

The connector pin and plug-in screw terminals assignments and location are shown in Figure 1, Figure 2, Table 1 and Table 2 in Appendix of this manual.

4. Basic features of the module

4.1 Analog inputs

The UDAQ-1408A/E/CA/CE/DA/DE modules contain 8 high-impedance analog inputs; all inputs are available on plug-in screw terminals, resp. on the D-Sub 25 connector located on the front of the module.

The UDAQ-1416CA/CE modules contain 16 high-impedance analog inputs; all inputs are available on the D-Sub 25 connector located on the front of the module.

Details on connecting analog inputs and screw/connector pin assignments can be found in Figure 1, Figure 2, Table 1 and Table 2 in Appendix of this manual.

All types of modules allow selection of working range independently for each input.

4.2 Digital inputs

All types of modules include two digital inputs for TTL/HC signals. For details refer to the Figure 1 in Appendix of this manual.

4.3 Digital outputs

All types of modules include one digital output (C type relay). For details refer to the Figure 1 in Appendix of this manual.

4.4 Counters

All types of modules include two 16-bit counters connected to the digital input signals.

4.5 Operating modes

All types of modules supported two operating modes - software trigger mode and pacer timer mode.

Software trigger mode is only suitable for the lowest sampling rates; all measurement requirements are controlled by the application program and the module transmits all currently measured values (ie. the status of analog inputs, digital inputs and counters) at one batch. In this mode can be also controlled the digital output, preset the working ranges of the individual analog inputs, and set the counter value.

Pacer timer mode is suitable for measuring the sampling frequencies defined by the module's internal timer; the application program only starts the measurement and then processes the data transmitted by the module to the computer. In this mode it is no longer possible to modify the setting of analog input ranges or counter contents, but digital output can be still controlled.

4.6 Creating your own program

All types of modules are supported by a comfortable high-level driver TEDIA_DAQ01, which allows to control all functions of the module without knowledge of low-level protocol. For more information about installation and use, refer to its documentation.

5. Calibration of A/D converter

5.1 Introduction

For accurate measurement, all types of modules allow the calibration of A/D converter range with a potentiometer accessible through the rear panel.

To compensate the voltage offset of the input amplifier (ie. the same value for different ranges with zero input voltage) is intended the second potentiometer located inside of the module (it is reserved for calibration at the manufacturer's service workplace only).

5.2 Calibration procedure

Calibration can be performed by any suitable program (such as a test program available from the TEDIA_DAO01 administrative tool) while maintaining the following:

- 1) Connect signal with voltage 0 V to the selected input (the easiest way to connect the input to AGND) and to check the measured value at a maximum of ± 20 mV (typically less than ± 10 mV); the zero voltage deviation is not compensable.
- 2) Connect signal with voltage 9.0÷9.9 V to the selected input at gain 1x (ie. ± 10 V range), change repeatedly signal polarity and set the values closest to the applied voltage for both polarities by the calibration potentiometer. This step should be repeated several times to be set compromise value for both polarities.
- 3) Subsequently, the accuracy can be verified on all inputs and ranges, ie. apply suitable voltages to the selected input at the selected operating range and compare the measured values with the voltage of input signal.

Note: During manufacturing the module is carefully calibrated and the measurement accuracy is validated on all ranges and inputs.

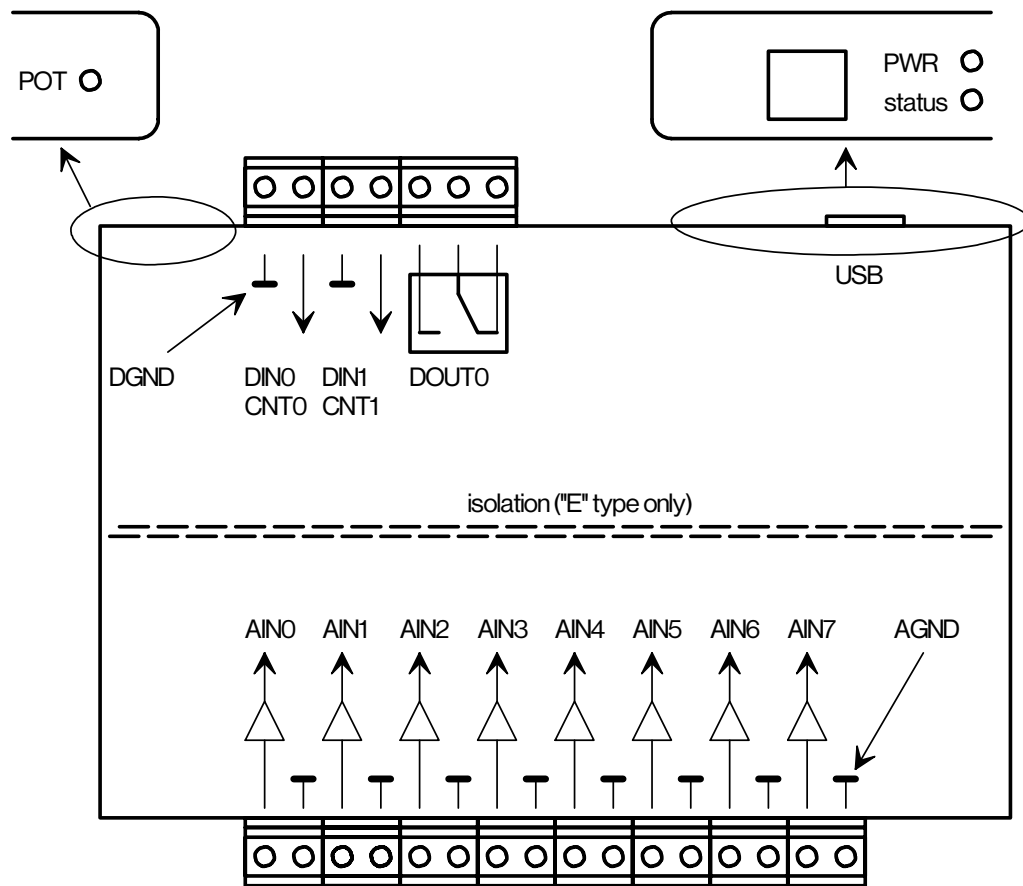


Figure 1. Location of important points on UDAQ-1408A/1408E module (top view).

AIN0	plug-in screw terminal of analog input AIN0 the meaning of both signals is shown in the figure
AIN1÷AIN7	plug-in screw terminals of another analog inputs
DINO	plug-in screw terminal of digital input DIN0 (TTL/HC signals, inputs contain a 10 kOhm pull-up resistor to the +5 V voltage)
DIN1	plug-in screw terminal of digital input DIN1
DOUT0	plug-in screw terminal of digital output DOUT0 the meaning of all signals is shown in the figure
USB	USB interface connector (also for powering the module)
POT	potentiometer to calibrate the A/D converter range
PWR	LED indicating the presence of supply voltage
status	signaling data transfer from module to PC

Note: The UDAQ-1408E modules contain analog inputs isolated and the AGND signal is floating; the inputs are not isolated from each other.
The UDAQ-1408A modules do not have isolated inputs and the AGND signal is directly connected to the GND USB interface, resp. to the computer case.
The digital inputs are always connected to the GND USB interface, resp. to the computer case.

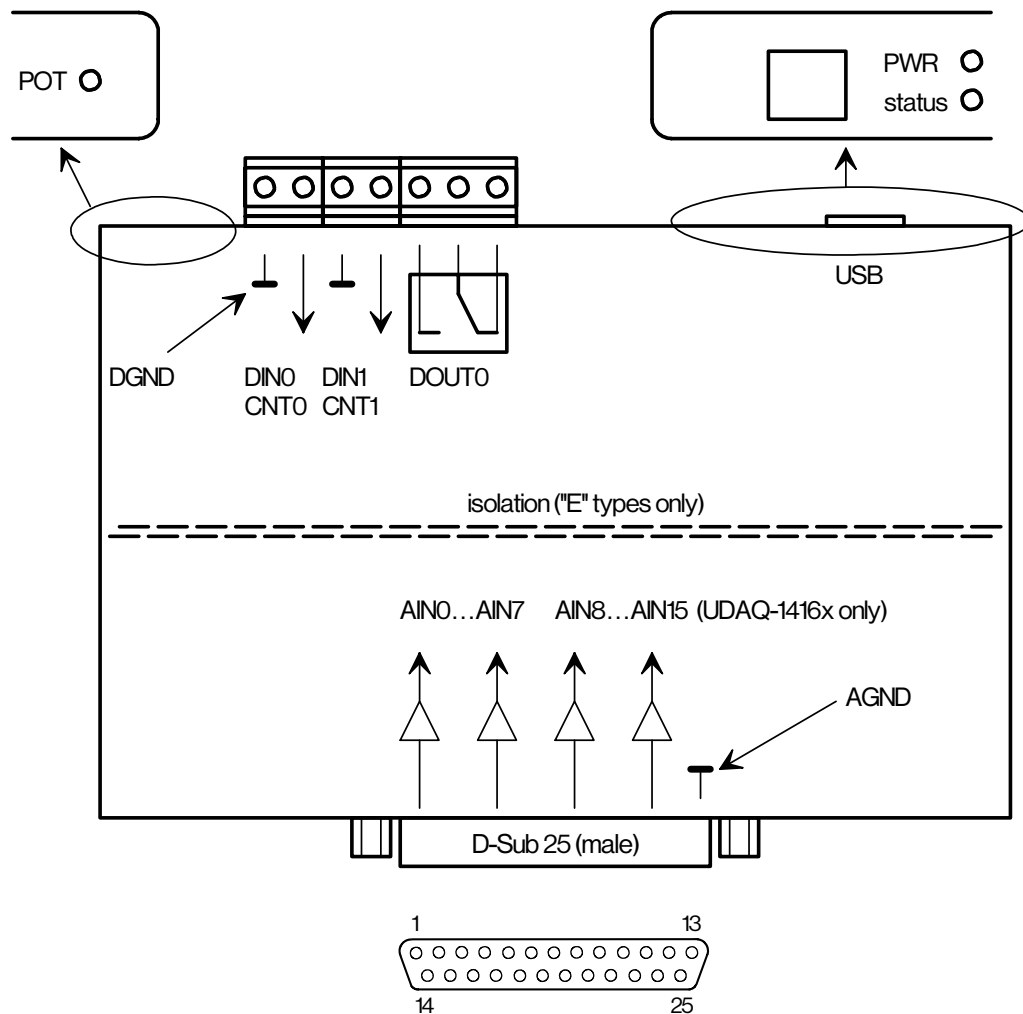


Figure 2. Location of important points on UDAQ-1408CA/CE/DA/DE and UDAQ-1416CA/CE module (top view).

D-Sub 25	connector for analog input signals AIN0÷AIN7 signals are available on all types of modules AIN8÷AIN15 signals are available on UDAQ-1416CA/CE modules only
all other	all elements on the rear panel are identical with UDAQ-1408A/E (see previous page)

Note: The UDAQ-1408CE/DE and UDAQ-1416CE modules contain analog inputs isolated and the AGND signal is floating; the inputs are not isolated from each other. The UDAQ-1408CA/DA and UDAQ-1416CA modules do not have isolated inputs and the AGND signal is directly connected to the GND USB interface, resp. to the computer case. The digital inputs are always connected to the GND USB interface, resp. to the computer case.

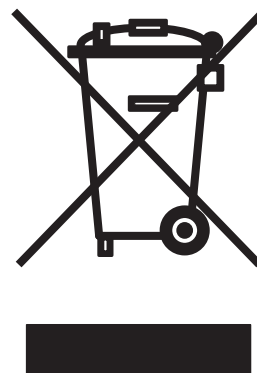
signal	pin	pin	signal
---	C1	C14	---
AGND	C2	C15	AGND
---	C3	C16	---
---	C4	C17	---
AGND	C5	C18	AIN 7
AGND	C6	C19	AIN 6
AGND	C7	C20	AIN 5
AGND	C8	C21	AIN 4
AGND	C9	C22	AIN 3
AGND	C10	C23	AIN 2
AGND	C11	C24	AIN 1
AGND	C12	C25	AIN 0
AGND	C13		

Table 1. D-Sub 25 (male) connector pin assignment of UDAQ-1408CA/CE modules.

signal	pin	pin	signal
---	C1	C14	---
AGND / AGND	C2	C15	AGND / AGND
---	C3	C16	---
---	C4	C17	---
AIN 7- / AIN 15	C5	C18	AIN 7+ / AIN 7
AIN 6- / AIN 14	C6	C19	AIN 6+ / AIN 6
AIN 5- / AIN 13	C7	C20	AIN 5+ / AIN 5
AIN 4- / AIN 12	C8	C21	AIN 4+ / AIN 4
AIN 3- / AIN 11	C9	C22	AIN 3+ / AIN 3
AIN 2- / AIN 10	C10	C23	AIN 2+ / AIN 2
AIN 1- / AIN 9	C11	C24	AIN 1+ / AIN 1
AIN 0- / AIN 8	C12	C25	AIN 0+ / AIN 0
AGND / AGND	C13		

Table 2. D-Sub 25 (male) connector pin assignment of UDAQ-1408DA/DE modules (label before the slash) and UDAQ-1416CA/CE (label behind slash).

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