

## E-709.1CC885

### Digital Piezo Controller Module for C-885 PIMotionMaster



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## About this Document

This document describes the E-709.1CC885 digital piezo controller module for the C-885 PIMotionMaster (p. 6) from PI.

## Symbols and Typographic Conventions

The following symbols and typographic conventions are used in this document:

### WARNING



#### Possibly hazardous situation

If not avoided, the hazardous situation will result in serious injury.

- Actions to take to avoid the situation.

### CAUTION



#### Dangerous situation

If not avoided, the dangerous situation will result in minor injury or damage to the equipment.

- Actions to take to avoid the situation.

### NOTICE



#### Dangerous situation

If not avoided, the dangerous situation will result in damage to the equipment.

- Actions to take to avoid the situation.

The following symbols and markings are used in the user manuals of PI:

Symbol	Meaning
1.	Action consisting of several steps whose sequential order must be observed
2.	
➤	Action consisting of one or several steps whose sequential order is irrelevant
▪	List item
S. 5	Cross-reference to page 5
SVO?	Command line or command from PI's General Command Set (GCS) (example: command to get the servo mode)

<b>RS-232</b>	Operating element labeling on the product (example: socket of the RS-232 interface)
<b>Device S/N</b>	Parameter name (example: parameter where the serial number is stored)
<b>Start &gt; Settings</b>	Menu path in the PC software (example: to open the menu, the Start and Settings buttons must be clicked in succession)
<b>5</b>	Value that must be entered or selected via the PC software
	Warning signs on the product which refer to detailed information in this manual.

## Other Applicable Documents

The devices which are mentioned in this document are described in their own manuals.

Description	Document
E-709 Digital Piezo Controller	PZ222E user manual
C-885 PIMotionMaster (details see p. 6)	C885T0002 user manual
PIMikroMove	SM148E software manual

## Downloading Manuals

The latest versions of the user manuals are available for download on our website ([www.pi.ws](http://www.pi.ws)).

For products that are supplied with software (CD in the scope of delivery), access to the manuals is protected by a password. Protected manuals are only displayed on the website after entering the password. The password is included in the Release News on the CD of the product.

## Safety

### Intended Use

The E-709.1CC885 is a laboratory device according to DIN EN 61010-1. It is intended to be used in interior spaces and in an environment which is free of dirt, oil and lubricants.

In accordance with its design, the E-709.1CC885 is intended for driving capacitive loads (e.g. piezo ceramic actuators). The E-709.1CC885 can be used for static as well as dynamic applications. Capacitive position sensors must be used for closed-loop operation. PI stages intended for closed-loop operation already have the corresponding sensors. Other sensors can only be used with PI approval.

The E-709.1CC885 may only be used in compliance with the technical specifications and instructions in this manual. In particular, the E-709.1CC885 must not be used to drive ohmic or inductive loads.

The E-709.1CC885 has no case and is designed to be integrated in the C-885 PIMotionMaster (p. 6) from PI. The operator is responsible for electrical safety according to EN 61010 1:2010 and electromagnetic compatibility according to EN 61326-1:2013 when integrating the E-709.1CC885 in the PIMotionMaster.

## Safety Precautions

### WARNING



#### Risk of electric shock during operation without case!

If the E-709.1CC885 is operated without a case, live parts will be accessible. Touching the live parts can result in serious injuries due to electric shock.

- Only operate the E-709.1CC885 when it is installed in a suitable case (p. 6) that is connected to the protective earth conductor.

### NOTICE



#### Electrostatic hazard!

The E-709.1CC885 contains electrostatically sensitive equipment (ESD) and can be damaged if handled improperly.

- Avoid touching assemblies, pins and PCB traces.
- Before you touch the E-709.1CC885, discharge yourself of any electric charges. For example, wear an antistatic wrist strap.
- Only handle and store the E-709.1CC885 in environments that dissipate existing static charges to earth in a controlled way and prevent electrostatic charges (ESD workplace or electrostatically protected area, in short EPA).

### NOTICE



#### Oscillations of the stage!

If the piezo stage starts oscillating (humming noise):

- In closed-loop operation, switch off the servo immediately. Adjust the servo parameters (notch filter frequency, servo-loop P-term (loop gain), servo-loop I-term (time constant), servo-loop slew rate).
- In open-loop operation, stop the axis motion immediately. Do not operate the piezo stage at its resonant frequency because the notch filters are not active in open-loop operation.

Otherwise the piezo stage could be irreparably damaged.

## Product Description

The E-709.1CC885 is a single-axis controller module for the C-885 PIMotionMaster (p. 6) from PI. It is based on the standard E-709.CR single-axis controller (OEM module). In comparison to the E-709.CR controller, the E-709.1CC885 controller module only features a Sub-D special 7W2 socket and a HD Sub-D 26 (f) socket.

## Product View



Figure 1: E-709.1CC885 controller module (front view)

## Scope of Delivery

Item ID	Description
E-709.1CC885	Digital piezo controller module for C-885 PIMotionMaster
E709T0007	User manual for E-709.1CC885 (this document)

## Overview of C-885 PIMotionMaster

The E-709.1CC885 is designed to be integrated in a C-885 PIMotionMaster from PI.

The C-885 PIMotionMaster is a customizable, modular multi-axis controller with card slots. In order to be functional, the C-885 PIMotionMaster requires a chassis (C-885.Rx ) with one digital processor and interface module (C-885.Mx) and at least one controller module. See the table below for the C-885 system components. For the supported controller modules see the documentation of the C-885 PIMotionMaster (p. 4).

Product Number	Item	Remarks
C-885.Mx	Digital processor and interface module for PIMotionMaster with Ethernet interface, USB	One C-885.Mx module required per PIMotionMaster. The C-885.Mx controls up to 20 controller modules with the largest chassis.

Product Number	Item	Remarks
C-885.Rx	Chassis for PIMotionMaster	One C-885.Rx chassis required per PIMotionMaster. There are chassis in two sizes: <ul style="list-style-type: none"><li>▪ 9.5": provides card slots for up to 4 controller modules</li><li>▪ 19": provides card slots for up to 20 controller modules</li></ul>

## Installation

The E-709.1CC885 must be installed in the C-885 PIMotionMaster (p. 6) from PI. See the documentation of the C-885 PIMotionMaster (p. 4) for more information.

## Power Source

The maximum power consumption of the E-709.1CC885 is 24 W.

- Use a sufficiently dimensioned power supply for the C-885 PIMotionMaster in which the E-709.1CC885 is to be installed.

## Start-Up and Operation

### Start-up of the E-709.1CC885 and Normal Operation of the C-885 PIMotionMaster

#### NOTICE



#### Risk of losing preset data!

Your system will be fully calibrated before being shipped. If you have informed PI about your application, calibration is done with the corresponding setup, otherwise with a default setup. It is usually not necessary for you to do anything more than adjust the zero point(s) before operating the system.

- Do not interchange piezo control electronics or piezo stages of a calibrated system. Respect the assignment of piezo stages to the electronics channels. The assignment is shown by the serial numbers on the device labels. With multi-axis stages also respect the channel / axis assignment given by the cable labeling.
- Re-calibration should only be done by adequate trained personnel and after consultation with PI. Otherwise preset data will be lost.

As the E-709.1CC885 is already configured for the connected stage, the adjustment that may be necessary on start-up is running the Auto Zero procedure (see the E-709 Digital Piezo Controller user manual, p. 4). The Auto Zero procedure of the controller module requires direct communication with the controller module.

In normal operation, the C-885 PIMotionMaster behaves like a "conventional" multi-axis controller, and the parameter settings for the axes cannot be changed.

### Command Set of E 709.1CC885

The E-709.1CC885 is fully GCS 2.0 compatible.

The commands of the E-709.1CC885 are accessible via direct communication with the controller module. See the documentation of the C-885 PIMotionMaster (p. 4) for details.

The range of commands and parameters available on the E-709.1CC885 may be different from that of the E-709.CR controller.

- To get a list of available GCS commands, send HLP? to the E-709.1CC885.
- To get a list of available parameters, send HPA? to the E-709.1CC885.

See the PZ222E user manual for the E-709 controller for more information on GCS commands and parameters.



## Updating the Firmware

If a firmware update is necessary for the E-709.1CC885:

- For information on how to perform firmware updates, contact our customer service department.

## Customer Service

For inquiries and orders, contact your PI sales engineer or send us an email ([service@pi.de](mailto:service@pi.de)).

If you have questions concerning your system, have the following information ready:

- Product codes and serial numbers of all products in the system
- Firmware version of the controller (if present)
- Version of the driver or the software (if present)
- Operating system on the PC (if present)

The latest versions of the user manuals are available for download on our website ([www.pi.ws](http://www.pi.ws)).

## Technical Data

### Specifications

	E-709.1CC885
Function	Controller module for piezo nanopositioning systems, for C-885 PIMotionMaster modular multi-axis controller system
Axes	1
Supported functions	Wave generator. Data recorder. Autozero. Trigger I/O.
Processor	DSP 32-bit floating point, 150 MHz
Controller type	P-I, 2 notch filters
Sampling rate, servo control	10 kHz
Sampling rate, sensor	10 kHz

Sensor	E-709.1CC885
Sensor type	Capacitive
Linearization	5th order polynomials
Sensor bandwidth	5 kHz
Sensor resolution	16 bit
External synchronization	For C-885 PIMotionMaster not supported

# User Manual

E709T0007, valid for E-709.1CC885

Ast, BRo, 8/30/2018



<b>Amplifier</b>	<b>E-709.1CC885</b>
Output voltage	-30 V to 130 V
Peak output power (<5 ms)	10 W
Average output power (>5 ms)	5 W
Peak current (<5 ms)	100 mA
Average output current (>5 ms)	50 mA
Current limitation	Short-circuit proof
Resolution DAC	17 bit

<b>Interfaces and operation</b>	<b>E-709.1CC885</b>
Communication interfaces	USB or Ethernet, via C-885.M1 / C-885.M2 Digital Processor and Interface Module
Piezo / sensor connection	Sub-D special connector
I/O connector	HD Sub-D 26 (f) 1 analog input 0 to 10 V 1 sensor monitor 0 to 10 V 1 digital input (LVTTTL, programmable) 1 analog output 5 digital outputs (LVTTTL, 3x predefined, 2x programmable)
Command set	PI General Command Set (GCS)
User software	PIMikroMove
Application programming interfaces	API for C / C++ / C# / VB.NET / MATLAB / python, drivers for LabVIEW, compatible with MetaMorph, µManager, Andor iQ

<b>Electrical properties and environment</b>	<b>E-709.1CC885</b>
Operating voltage	24 V DC, supply via C-885 PIMotionMaster
Max. power consumption	24 W
Operating temperature range	5 to 50°C (above 40°C, power derated)
Dimensions	186.42 mm × 128.4 mm (3 RU) × 19.98 mm (4 HP)
Mass	280 g

## Maximum Ratings

The E-709.1CC885 is designed for the following maximum ratings:

Input on:	Maximum Operating Voltage	Operating Frequency	Maximum Power Consumption
	⚠	⚠	⚠
Backplane connector (supply via C-885 PIMotionMaster)	24 V	— — —	24 W

## Ambient Conditions and Classifications

See the documentation for the C-885 PIMotionMaster (p. 4) for details.

## Dimensions

Dimensions in mm. Note that the decimal places are separated by commas in the drawings.

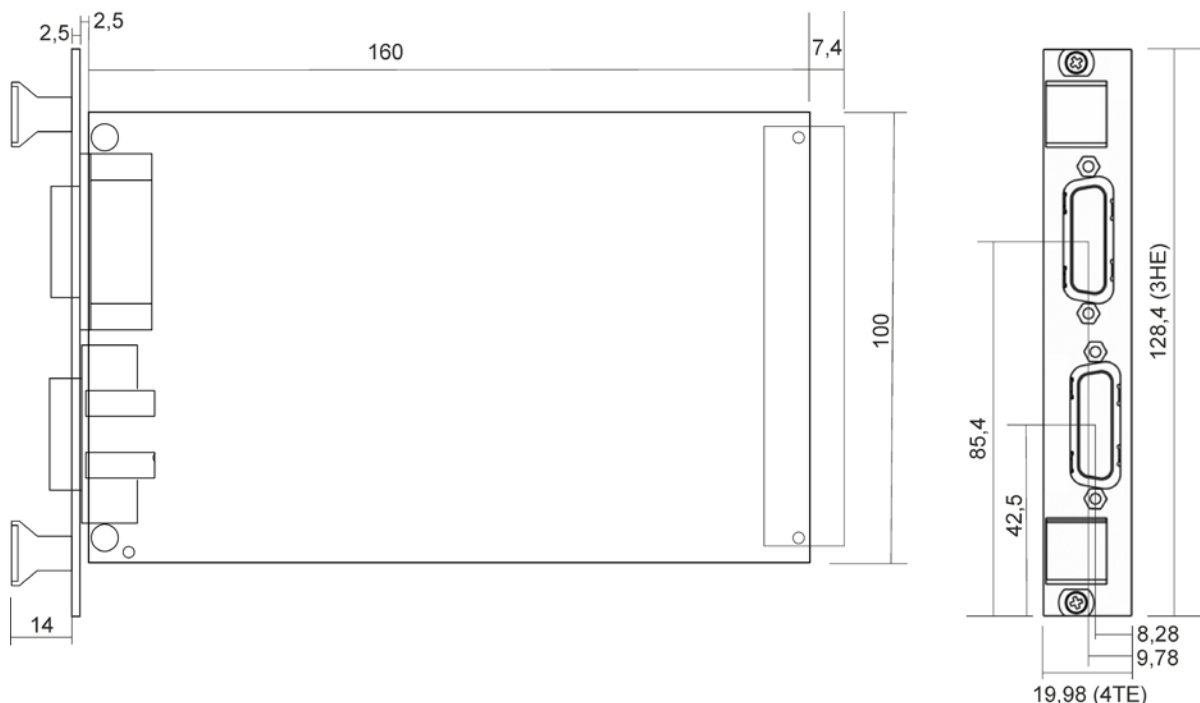


Figure 2: Dimensions of the E-709.1CC885

## Pin Assignment

### Pin Assignment I/O

#### HD Sub-D 26 (f)

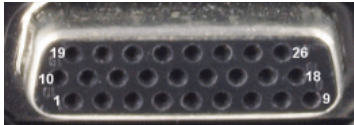


Figure 3: Front view of the I/O socket

Pin	Signal	Function
1	Servo On/Off	Servo monitor (LVTTTL; on = low, off = high)
2	ONT	On target state (LVTTTL; on target = low, otherwise high)
3	OVL	Overflow state (LVTTTL; overflow = low; otherwise high)
4	Internal use	Do not connect
5	Internal use	Do not connect
6	Internal use	Do not connect
7	Internal use	Do not connect
8	Internal use	Do not connect
9	Internal use	Do not connect
10	Digital_IN_1	Digital input 1, can be configured for triggering tasks (LVTTTL, active high)
11	Digital_OUT_1	Digital output 1, can be configured for triggering tasks (LVTTTL, active high)
12	Digital_OUT_2	Digital output 2, can be configured for triggering tasks (LVTTTL, active high; shares the TWS trigger table with Digital_OUT_1)
13	Internal use	Do not connect
14	DGND	GND
15	DGND	GND
16	Internal use	Reserved for future applications
17	Internal use	Do not connect
18	Internal use	Do not connect
19	Analog_Input	0 to 10 V Can be used to connect a control-signal source or an external sensor (handled by E-709 as input signal channel 2)

Pin	Signal	Function
20	Analog_Output	0 to 10 V Can be used to monitor the axis position or for controlling an external driver (handled by E-709 as output signal channel 2)
21	Amplifier_Out_Monitor	Monitor output of the piezo output voltage present on the "PZT & Sensor" socket, 0.3 to 1.3 V (piezo output voltage divided by 100; the piezo output voltage itself is handled by E-709 as output signal channel 1)
22	AGND	GND
23	Internal use	Reserved for future applications
24	Internal use	Reserved for future applications
25	Internal use	Do not connect
26	Internal use	Do not connect

## Pin Assignment PZT & Sensor

Sub-D special 7W2 for 2 coax lines and 5 single pins (f)



Figure 4: Front view of the PZT & Sensor socket

Pin	Signal	Function
Coax inner lines:		
A1	output	PZTOUT
A2	input	Sensor Probe
Standard pins:		
1	bidirectional	ID chip
2	GND	AGND
3	GND	AGND
4	GND	AGND
5	output	Sensor target

Note:

Probe and Target are the connections of the capacitive sensor in the mechanics.

The PZTOUT line carries the piezo voltage for the actuator in the mechanics, up to 130 V.

## Old Equipment Disposal

In accordance with the applicable EU law, electrical and electronic equipment may not be disposed of with unsorted municipal wastes in the member states of the EU.

When disposing of your old equipment, observe the international, national and local rules and regulations.

To meet the manufacturer's product responsibility with regard to this product, Physik Instrumente (PI) GmbH & Co. KG ensures environmentally correct disposal of old PI equipment that was first put into circulation after 13 August 2005, free of charge.

If you have old PI equipment, you can send it postage-free to the following address:

Physik Instrumente (PI) GmbH & Co. KG

Auf der Roemerstr. 1

D-76228 Karlsruhe, Germany

