User Manual

Cbo, BRo, Ast, 2018-08-30
C867T0017, valid for C-867.10C885

C-867.10C885 Motion Controller Module for PILine®, for C-885 PIMotionMaster

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About this Document

This document describes the C-867.10C885 motion controller module for the C-885 PIMotionMaster (p. 7) from PI.

See "Product Description" (p. 7) for detailed information on the C-867.10C885.

Symbols and Typographic Conventions

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

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.

Symbol/Label	Meaning
1. 2.	Action consisting of several steps whose sequential order must be observed
➢	Action consisting of one or several steps whose sequential order is irrelevant
▪	List item
p. 5	Cross-reference to page 5
RS-232	Labeling of an operating element on the product (example: socket of the RS-232 interface)
	Warning signs on the product which refer to detailed information in this document

Other Applicable Documents

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

Description	Document
C-867.1U PILine® controller	MS223E user manual
C-885 PIMotionMaster (details see p. 7)	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).

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 C-867.10C885 is designed to be integrated in a device as defined by 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 C-867.10C885 is intended for driving capacitive loads, in the present case, PILine® piezomotor stages with piezoceramic actuators.

The C-867.10C885 is intended for closed-loop operation using incremental position sensors. Furthermore, the C-867.10C885 can read out and process the reference point and limit switch signals from the stage connected.

The C-867.10C885 may only be used in compliance with the technical specifications and instructions in this manual.

The C-867.10C885 has no case and is designed to be integrated in the C-885 PIMotionMaster (p. 7) 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 C-867.10C885 in the PIMotionMaster.

Safety Precautions

CAUTION

Risk of electric shock during operation without case!

If the C-867.10C885 is operated without a case, live parts will be accessible. Touching the live parts can result in minor injuries due to electric shock.

- Only operate the C-867.10C885 when it is installed in a suitable case (p. 7) that is connected to the protective earth conductor.

NOTICE

Electrostatic hazard!

The C-867.10C885 contains electrostatically sensitive equipment (ESD) and can be damaged if handled improperly.

- Avoid touching assemblies, pins and PCB traces.
- Before you touch the C-867.10C885, discharge yourself of any electric charges. For example, wear an antistatic wrist strap.
- Only handle and store the C-867.10C885 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

Unsuitable cables!

Unsuitable cables can cause damage to the controller module and can affect the performance of the stage.

- Only use original PI parts to connect the stage to the controller module.
- If you need longer cables, contact our customer service department (p. 9).

NOTICE

Incorrect parameter settings!

When using the software which is included in the scope of delivery of the C-867.10C885 controller module, the operating parameters of the stages can be loaded from a stage database. The *PIStages3* stage database contains the default parameter values of your stage for performing initial test motions during startup. Depending on the application, using the default parameter values (e. g. for P term, I term, D term, acceleration and velocity) can, however, cause damage to the stage, especially when operated with heavy loads.

- If possible: Perform the first startup without a load.
- Always install the latest version of the stage database on your PC.

For startup with a load:

- Before startup, make sure that the stages have been properly installed.
- For optimum performance of the moving axis, adjust the operating parameters of the C-867.10C885 (e. g. P term, I term, D term, acceleration, velocity; see the MS223E user manual for the C-867.1U controller).
- Save the new parameter values for future use in a stage database on the PC or in the nonvolatile memory of the controller (see the documentation of the C-885 PIMotionMaster (p. 3), the MS223E user manual for the C-867.1U controller and the PIMikroMove user manual).

INFORMATION

If the total cable length (between stage and controller) is ≥3 m, the parameter values for starting up your stage must be adapted to achieve an optimum motor power.

With a total cable length between 3 m and 6.5 m:

1. Load the default parameter values for your stage from the *PIStages3* stage database.
2. During the initial startup of the stage, change the ***Frequency Shift*** parameter (ID 0x64) as follows:
   - Test which of the following values is best to achieve the optimum motor power: 20, 15, 10, 5, 0, -5, -10, -15, -20.
   - Save the parameter value with which the optimum motor power was achieved.
3. If necessary, set the value of the ***Automatic frequency search*** parameter (ID 0x52) to 0.

With a total cable length of more than 6.5 m:

➢ During the initial startup of the stage, import suitable parameter values into *PIStages3* from a custom stage database which you can obtain from our customer service department (p. 9).

Product Description

The C-867.10C885 is a controller module for the C-885 PIMotionMaster (p. 7) from PI. It is based on the standard C-867.1U controller. In comparison to the C-867.1U controller, the C-867.10C885 controller module is not installed in a case and has a reduced number of features. The C-867.10C885 only features a Sub-D 15 (f) motor socket, an ERR LED and a STA LED.

Product View

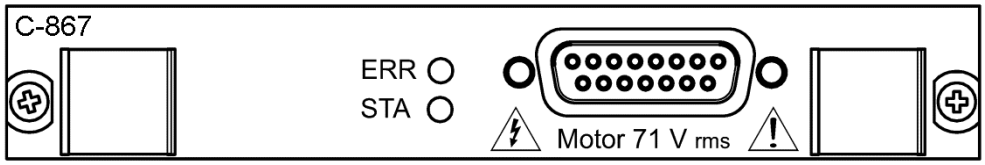

Figure 1: C-867.10C885 controller module (front view)

Scope of Delivery

Item ID	Description
C-867.10C885	Motion controller module for PILine® piezomotor systems with Sub-D connector, 1 channel, for PIMotionMaster
C867T0017	User manual for C-867.10C885 (this document)

Accessories

Order Number	Description
C-885.iD	Digital interface module, gives access to the four input lines (digital/analog) and four output lines (digital) of the C-867.10C885. For pinout, see p. 13. Further details see the C885T0002 user manual of the C-885 PIMotionMaster.

Overview of C-885 PIMotionMaster

The C-867.10C885 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 with one C-885.M1 digital processor and interface module and at least one controller module. See the table below for the available system components. For the supported controller modules see the documentation of the C-885 PIMotionMaster (p. 3).

Order 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.

Order Number	Item	Remarks
C-885.Rx	Chassis for PIMotionMaster	One C-885.Rx chassis required per PIMotionMaster. There are chassis in two sizes: ▪ 9.5": provides card slots for up to 4 controller modules ▪ 19": provides card slots for up to 20 controller modules

Installation

The C-867.10C885 must be installed in the C-885 PIMotionMaster (p. 7) from PI. See the documentation of the C-885 PIMotionMaster (p. 3) for more information.

Power Source

The maximum power consumption of the C-867.10C885 is 24 W.

- ➢ Use a sufficiently dimensioned power supply for the C-885 PIMotionMaster in which the C-867.10C885 is to be installed.

Start-Up and Operation

Configuration of the C-867.10C885 and Normal Operation of the C-885 PIMotionMaster

At the first start-up of the C-885 PIMotionMaster, the C-867.10C885 controller module has to be configured for the connected stage. Configuration 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.

See the documentation of the C-885 PIMotionMaster (p. 3) for details and instructions.

Command Set of C-867.10C885

The C-867.10C885 is fully GCS 2.0 compatible.

The commands of the C-867.10C885 are accessible via direct communication with the controller module. See the documentation of the C-885 PIMotionMaster (p. 3) for details.

The range of commands and parameters available on the C-867.10C885 may be different from that of the C-867.1U controller.

- ➢ To get a list of available GCS commands, send `HLP?` to the C-867.10C885.
- ➢ To get a list of available parameters, send `HPA?` to the C-867.10C885.

See the MS223E user manual of the C-867.1U controller for more information on GCS commands and parameters.

Updating the Firmware

If a firmware update is necessary for the C-867.10C885:

- ➢ For information on firmware updates, contact our customer service department (p. 9).

Customer Service

For inquiries and orders, contact your PI sales engineer or send us an email (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).

Technical Data

Specifications

	C-867.10C885
Function	Controller for single-axis positioning or scanning stages, for C-885 PIMotionMaster modular multi-axis controller system
Drive type	PILine® motors (class 2)
Channels	1
Motion and control	
Servo characteristics	Programmable PID control, parameter changes on the fly
Trajectory profile modes	Trapezoid
Encoder input	Sin/cos or A/B (quadrature, differential, 50 MHz) or BiSS interface
Stall detection	Servo off, triggered by programmable position error
Limit switches	2 × TTL (polarity programmable)
Reference point switch	1 × TTL
Electrical properties	
Max. output power	21 W
Max. output voltage	200 V_{pp}

	C-867.10C885
Interface and operation	
Communication interfaces	USB or Ethernet, via C-885.M1 digital processor and interface module
Motor connector	Sub-D 15-pin (f)
I/O ports	Optional with C-885.iD digital interface module: 4 analog/digital in (0 to 5 V/TTL), 4 digital out (TTL)
Command set	PI General Command Set (GCS)
User software	PIMikroMove
Software drivers	Driver for NI LabVIEW, dynamic libraries for Windows and Linux
Supported functionality	Start-up macro, data recorder for recording parameters as motor input voltage, velocity, position or position error
Miscellaneous	
Operating voltage	24 V DC via C-885 PIMotionMaster
Max. power consumption	24 W
Operating temperature range	10 to 40 °C
Mass	172 g
Dimensions	186.42 × 128.4 (3 RU) × 19.98 (4 HP)

Maximum Ratings

The C-867.10C885 is designed for the following maximum ratings:

Output on:	**Maximum Output Voltage**	**Maximum Output Current**	**Maximum Output Frequency**
Sub-D 15 (f) (pins 3 and 11)	200 V_{pp} or 71 V_{eff}	300 mA_{eff}	500 kHz

Ambient Conditions and Classifications

See the documentation for the C-885 PIMotionMaster (p. 3) for details.

Dimensions

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

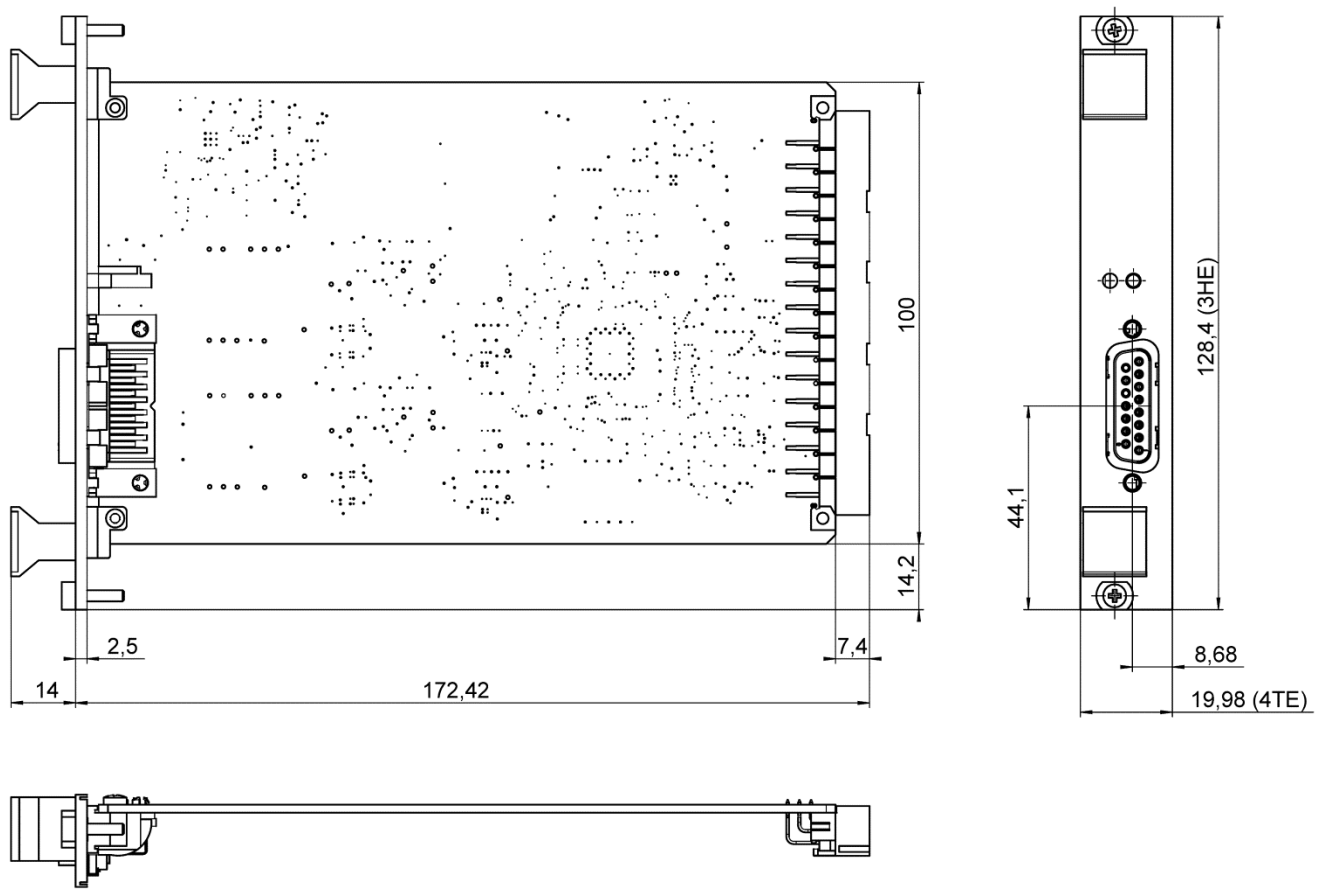

Figure 2: Dimensions of the C-867.10C885
HE = rack unit (RU)
TE = horizontal pitch (HP)

Pin Assignment Motor

Connector: Sub-D 15 (f)

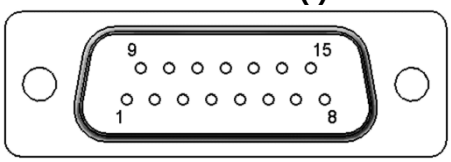

Figure 3: Front view of the Sub-D 15 (f) connector

Pin	Signal	Signal Direction	Function
1	NC	-	Not connected
2	MOTOR_COM	Output	Piezomotor ground
3	MOTOR_PHS1	Output	Piezomotor 200 V_{pp} or 71 V_{eff}
4	VCC_ENC	Output	+5 V
5	PLIMIT	Input	Positive limit switch, TTL
6	ID-CHIP	Bidirectional	Data line for ID chip
7	SENS_A-	Input	Encoder channel A (inverted), RS-422
8	SENS_B-	Input	Encoder channel B (inverted), RS-422
9	MOTOR_COM	Output	Piezomotor ground
10	GND	-	0 V
11	MOTOR_PHS2	Output	Piezomotor 200 V_{pp} or 71 V_{eff}
12	NLIMIT	Input	Negative limit switch, TTL
13	REF	Input	Reference point switch, TTL
14	SENS_A+	Input	Encoder channel A, RS-422
15	SENS_B+	Input	Encoder channel B, RS-422

Pin Assignment C-885.iD Digital Interface Module

The C-885.iD digital interface module is connected to the C-867.10C885 controller module via a ribbon cable and a 10-pin connector strip of the C-867.10C885. See the C885T0002 user manual of the C-885 PIMotionMaster for installation details.

Connector: Sub-D 9 (f)

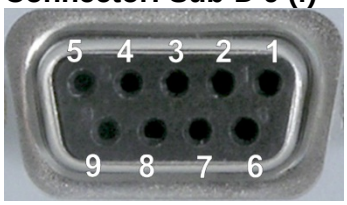

Figure 4: Front view of the Sub-D 9 (f) connector

Connector Strip	Sub-D 9 Socket		Function
1	1		Input 0 (analog: 0 to 5V / digital: TTL)
2		9	Input 1 (analog: 0 to 5V / digital: TTL)
3	2		Input 2 (analog: 0 to 5V / digital: TTL)
4		8	Input 3 (analog: 0 to 5V / digital: TTL)
5	3		Digital output 0 (TTL)
6		7	Digital output 1 (TTL)
7	4		Digital output 2 (TTL)
8		6	Digital output 3 (TTL)
9	5		GND
10			n. a.