

TSC 2003C

Modular Chassis

User Manual

Timing Solutions Corporation • 4775 Walnut St, Suite 1B, Boulder, CO 80301

(303) 939-8481

www.timing.com • sales@timing.com

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Timing Solutions Corporation provides information on its products and associated hazards, but it assumes no responsibility for the after-sale operation of the equipment or safety practices of the owner or user.

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Timing Solutions Corporation
4775 Walnut St, Suite 1B
Boulder, CO80301
(303) 939-8481
(303) 443-5152 fax

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I. HOW TO USE THIS MANUAL

FIRST READ THIS MANUAL THOROUGHLY!

This is especially true for the sections regarding SAFETY and OPERATION.

You should read the entire manual before attempting to operate the unit. If you are reading it as a paper version, you can locate information via the table of contents. If you are using a computer, there are additional ways to quickly locate information:

AS ACROBAT .PDF FILE on computer

If you are reading a .PDF version on a computer using Adobe Acrobat Reader[®], you may access information as follows:

- Click the “binoculars” icon at the top of the Acrobat Reader screen, or type CTRL+F, then enter a keyword in the dialogue box, and hit ENTER. You’ll jump to the page containing that word and the word will be highlighted.
- Type a page number in the white slot at the bottom left of the screen, or increment pages using the left/right arrow buttons near the slot, and hit ENTER. You’ll jump to that page.

Symbols (Icons)

These symbols appear throughout the manual as well as on the unit itself.



Caution, refer to manual. Read all instructions in Manual before using this product.



CE marking, attesting compliance to applicable European Directives



Caution – Risk of Electrical shock



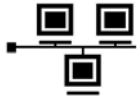
Fuse symbol



Mains Power is ON



Mains Power is OFF



LAN port, NETWORK, DO NOT CONNECT TO TELECOM CONNECTIONS THAT CARRY HAZARDOUS VOLTAGES.

101010

Serial port connection, DO NOT CONNECT TO TELECOM CONNECTIONS THAT CARRY HAZARDOUS VOLTAGES.



Earth terminal symbol: Used to indicate a circuit common connected to grounded chassis.

II. SPECIFICATIONS

ELECTRICAL

Protection Class	Class I (Grounded Type)
Power Input	AC: 100 – 240 V~, 2A (Maximum with full set of modules installed) DC: 19 – 30 V $\overline{\text{---}}$, 8A (Maximum with full set of modules installed) NOTE: Fluctuations not to exceed \pm 10% of nominal AC supply voltage.
Power Input Frequency	50/60 Hz
Power consumption	200 W maximum @ 100-240 V~
AC Power Inlet type	IEC 60320 sheet C14
Power Supply Cord Set	18 AWG (0.75 mm ² minimum)
Power Mains Fuses	(2) - 250V~ 3.15 A Time Lag, 5x20 mm
Battery back-up fuse	(1) – 250V~ 15A Fast Acting Mini Plug-in
Battery Back-up connector	AMP 1-350345-0

ENVIRONMENT



This unit is for INDOOR USE ONLY. It is not protected against a harmful ingress of moisture.

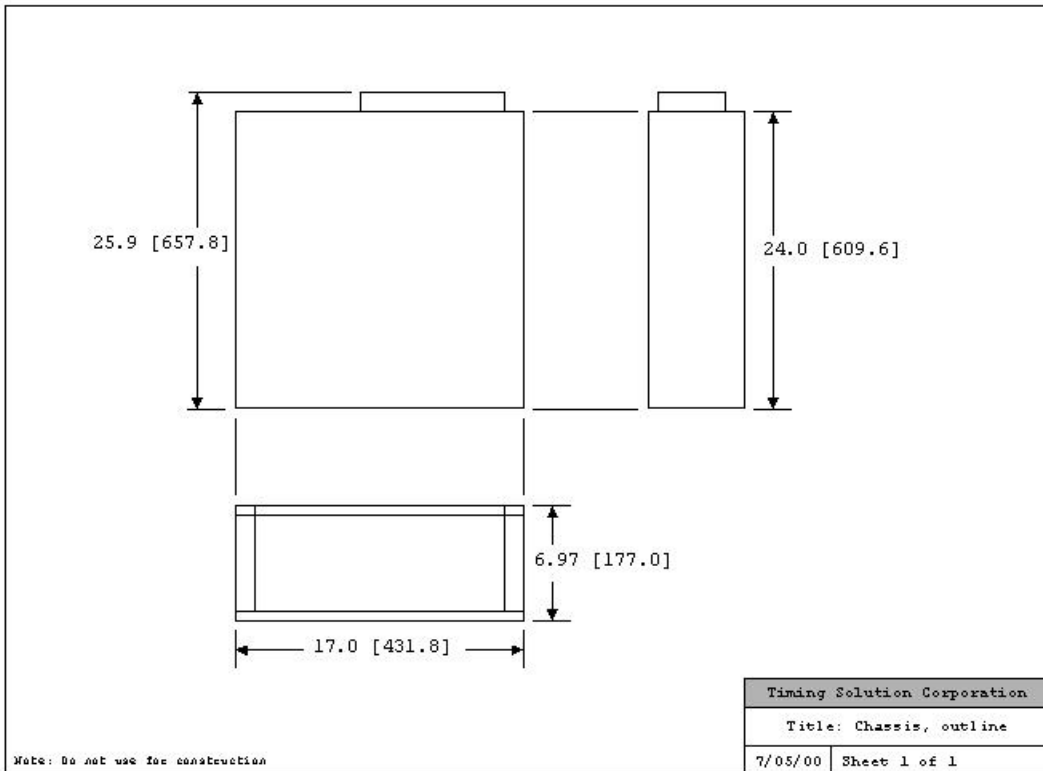
- Pollution Degree II per EN61010-1
- Installation (Over-Voltage) Category II for transient over-voltages per EN 61010-1
- Equipment suitable for continuous operation
- Equipment intended to be installed in an Enclosed/Open type equipment rack

	Temperature	Relative Humidity	Altitude
In use	0°C to 50°C	0% to 90% (non-condensing)	3,000 meters (9,843 feet)
Storage	-40°C to 70°C	0% to 90% (non-condensing)	

Transportation	-40°C to 70°C	0% to 90% (non-condensing)	
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PHYSICAL

Size	43.2 cm x 17.7 cm x 65.8 cm (17.0" x 7.0" x 25.9")
Weight	31.8 kg (70 lbs.)



III. INSTALLATION

SAFETY FIRST!



Do not attempt to install or operate this equipment if you have not first acquired proper training.



Ensure that all cables are properly connected.



Verify that input line voltage and current capacity are within specifications before turning on the unit.



Use proper ESD precautions.



BE CAREFUL AROUND THIS EQUIPMENT!



WARNING: RISK OF DEATH OR BODILY INJURY

- **Disconnect all sources of input power before troubleshooting this unit or anything connected to it.**
- **Operating and maintenance personnel must receive proper training before installing or maintaining electrical equipment.**
- **Potentially lethal voltages could cause death, serious injury, or damage to the equipment. Ensure that all appropriate safety precautions are taken.**

UNPACKING

Open the shipping box and carefully inspect the unit. Check for physical damage to the box and the unit. If none is apparent, then proceed with unpacking. If physical damage is observed, then immediately contact Timing Solutions and the carrier. Save the shipping box for submitting any necessary claims to the carrier.

Remove the TSC 2003C Chassis Installation kit from the shipping box along with any other separately supplied components before attempting to remove the chassis.

WARNING: 2 person lift required. A fully populated TSC-2003C chassis weighs approximately 70 pounds when modules are installed. Care must be taken when taking the chassis out of the shipping box.

***INSTALL IN A PROTECTED ENVIRONMENT,
NOT SUITABLE FOR OUTDOOR USE!***

CLEANING

Use a soft cloth dampened with a mild soap and water solution to clean the main chassis and front panels.



Do not spray or use too much liquid when cleaning the unit. Liquid can enter the unit and damage sensitive electronic components.

CHASSIS PREPARATION

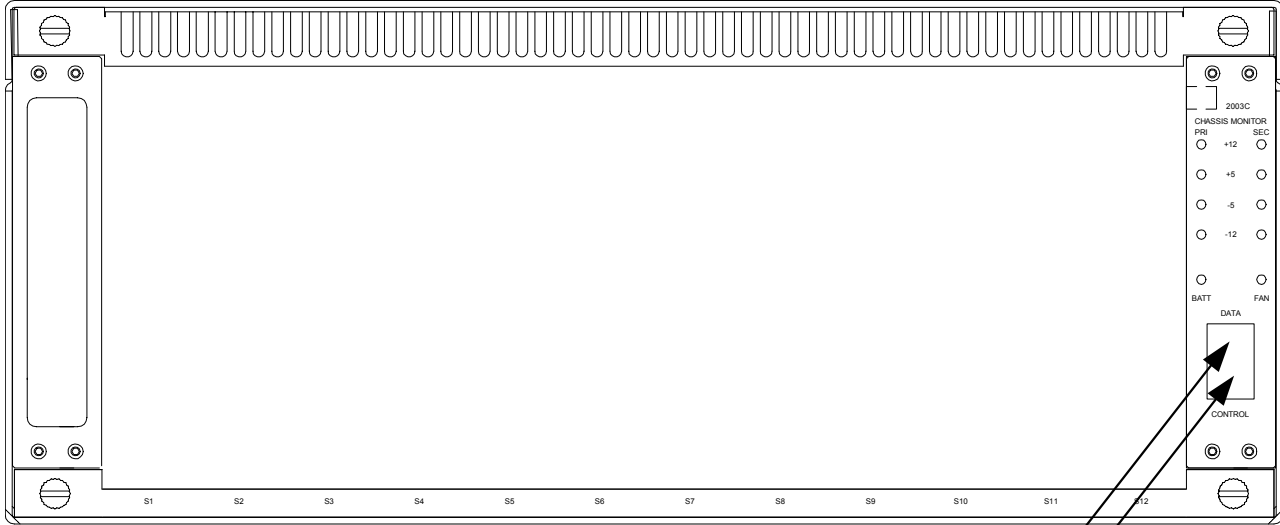
Perform the following steps before mounting the chassis in a 19" hardware rack.

1. Install the chassis rack mounting brackets using the hardware provided in the TSC 2003C Chassis Installation kit. Use a 1/8" Allen wrench to tighten the 10-32 flat head screws. Do not use Loc-tite.

CABLES REQUIRED

- North American or European IEC power cord. One or other will be supplied with the unit.
- Battery back-up power cable – A connector is provided on the rear panel to utilize the DC back-up capability of this product. The external wiring to this connector must be at least 1.5mm² (14 AWG), including a fuse or circuit breaker of not more than 15A. A 20A circuit breaker may be used if the external wiring is jacketed 14 AWG, with maximum length of 20 feet.

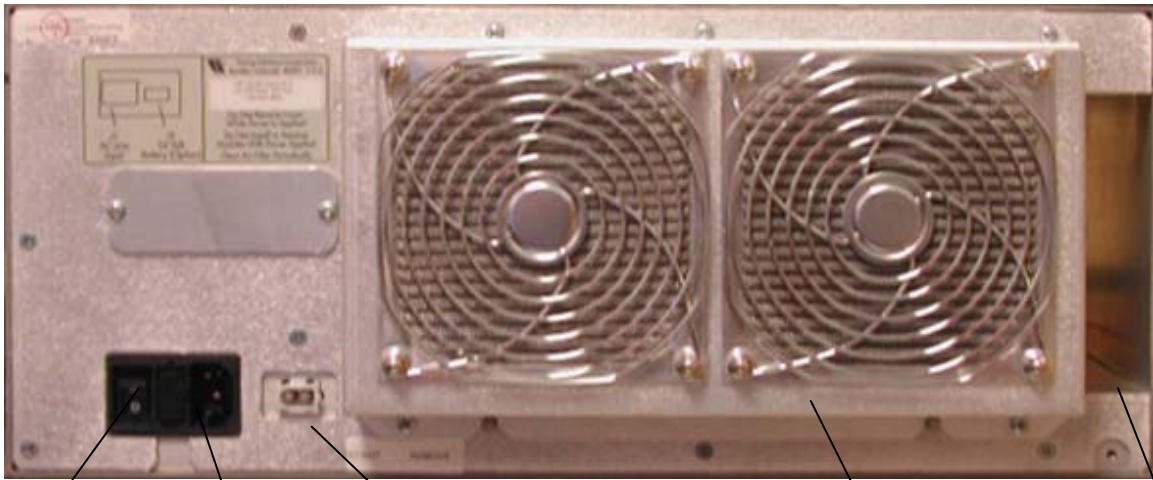
LAYOUT - FRONT PANEL



101010

101010

LAYOUT - REAR PANEL



ON/OFF POWER SWITCH and FUSE LOCATION

CONNECTOR FOR BATTERY BACK-UP

CABLE PASSAGEWAY

INPUT POWER:
100-240 V,
50/60 Hz

DUAL COOLING FAN ASSEMBLY

MAKING CONNECTIONS

- **AC INPUT POWER** - The input power to the unit is supplied through a detachable 3-prong power cable. First plug the female end into the male IEC-320 plug on the rear of the unit, then plug the male end of the cable into a 100V~ to 240V~, 50/60 Hz power source. Ensure that this power supply cord is connected to a properly grounded mains receptacle to ensure safety.
- **Battery back-up power** – A connector is provided on the rear panel to utilize the DC back-up capability of this product. This connector is intended for use with a battery back-up system in the event of AC power failure, and is not intended for use longer than one day. An internal fuse mounted on the power supply carrier board is included to protect this input. The external wiring to this connector must be at a minimum 1.5 mm² (14 AWG) with a 15A fuse or circuit breaker. A 20A circuit breaker may be used if the external wiring is jacketed 14 AWG, with maximum length of 20 feet.
- The user is responsible for the provision of an external AC Disconnect Means for the equipment if the Disconnect Switch at the Power Entry Module or the power supply cord set is not accessible when the unit is mounted inside an enclosed rack.

IV. OPERATION

The TSC 2003C chassis must be fully populated with Timing Solutions Corporation 2000 series modules. Every slot must be occupied by a module to ensure proper airflow for cooling of the modules and chassis power supplies.

STARTUP

Plug in the AC power cord and press the "POWER ON" switch on the back of the unit.

Next, if desired, plug in the battery backup cord on the back of the unit.

Note: the battery backup input is intended for use when AC is not present. The unit may operate for 24 hours using the TSC 4004 battery backup unit.

1. Boot the PC that will be used to communicate with the unit via the Ethernet port on the TSC controller, if this has not been done so already. Make sure that a LAN "cross-over" cable is used when directly connecting the two. A standard LAN cable must be used if this connection is made through a network hub.
2. Plug in the power cord and press the "POWER ON" switch on the back of the unit. This action automatically initiates the boot process for the TSC controller.

V. MAINTENANCE PROCEDURES

The 2003C hardware chassis and 2000 series modules require little maintenance, however the chassis cooling fans and filters should be checked every 6 months.

CHASSIS COOLING FAN MAINTENANCE

The TSC 2003C chassis powers a redundant dual fan assembly to provide cooling. This fan assembly is located on the rear of the chassis and is monitored by the TSC 2024. Both fans are mounted inside of a shroud that is held in place by five screws. The fans do not need to be periodically lubricated.

Note: If the "FAN" LED on the TSC 2024 is "green", then the fan assembly is operating properly. However, a "red" LED indicates that one of the two fans has failed. The chassis automatically shuts down if both fans fail.

FAN FILTER MAINTENANCE PROCEDURE

The dust that accumulates on the fan filter should be cleaned every six months. It is recommended that this maintenance be performed during scheduled downtime when chassis power can be turned off, however the filters can be vacuumed without shutting off the power.

FAN FILTER REMOVAL AND CLEANING



If attempting to clean the filters without shutting off the power to the chassis, then use a vacuum to clean the filter. In this case, do not remove the filters. Do not use any liquid cleaner

- A) Turn off the AC and DC power to the chassis.
- B) Remove the four (5/16") nuts that hold the protective grill and filter in place.
- C) Remove the grill, then the filter.
- D) Clean the filter with compressed air, vacuum or a soft bristle brush.
- E) Install the filter and grill along with the four nuts in reverse order.
- F) Repeat the procedure for the other filter.

VI. REPLACEMENT PROCEDURES

This section describes the installation and removal procedures for the redundant dual fan assembly, any module and power supply(s).

REDUNDANT DUAL FAN ASSEMBLY REMOVAL AND INSTALLATION

If a cooling fan needs to be replaced, then replace the entire dual fan assembly by following this procedure.

- A) Pull the TSC 2003C chassis forward on its slide support assembly so that it is entirely clear of the rack.
- B) Turn off AC and DC power and disconnect the power cables from the chassis.

WARNING: Lethal voltages are exposed in the chassis where you will be working. These voltages are not marked and you MUST power down the chassis during this procedure.

- C) Remove the five screws that hold the fan shroud in place. Hold the fan shroud so that it does not fall.
- D) Gently move the fan assembly away from the rear of the chassis so that you can see where the cable assembly from the fan attaches to the power supply carrier board.
- E) Gently pull on the connector body on the power supply carrier board and remove the fan assembly from the chassis.
- F) Install the new dual fan assembly in reverse order.

POWER SUPPLY REMOVAL AND INSTALLATION

WARNING: Performance of this procedure is restricted to trained or Authorized personnel knowledgeable of the electrical risks involved. Lethal voltages are exposed in the chassis where you will be working. These voltages are not marked and you MUST disconnect AC and battery back-up during this procedure.

The chassis power supply consists of the redundant power supplies mounted on a carrier board. There are two fuses in the power entry module. If it has been determined that these fuses failed due to an external cause, they may be replaced. If it is not clear what caused the fuse to fail, further troubleshooting of the power supplies and carrier board will be required. If the fuse on the carrier board has failed, do not replace until the cause for failure has been determined.

- A) To remove a power supply from the chassis, turn off the chassis voltages to gain access to the rear of the chassis.
- B) Remove the five screws from the chassis fan shroud cover. Disconnect the fan cable and remove the shroud cover assembly from the chassis.
- C) Remove the eight screws that hold the rear chassis cover and remove the cover.
- D) Remove the power supply by pulling the center of the white levers mounted on the top of the power supply.

If the carrier board needs to be replaced, perform the following additional steps:

- A) Remove the cable that attaches to the bottom of the carrier board. Note the orientation of this cable.
- B) Disconnect the 4-pin connector (black and green wires) located at the left end of the carrier board. Note the connector that corresponds to the 4-pin connector.
- C) Disconnect the two wire (red and black) cable near the middle of the carrier board.
- D) Disconnect the 26-pin IDC connector from the middle of the carrier board.
- E) Carefully pull the carrier board assembly out of the rear of the chassis, taking care to not snag the carrier board on any of the cables in the area.

Replace the power supply or carrier board by following these steps in reverse order.

TSC MODULE REMOVAL AND INSERTION

The TSC 2003C chassis is capable of holding twelve TSC single-width modules. The insertion procedure for all modules (except power supplies and the TSC 2024) is the same.

Note: Most modules have base address and possibly IRQ jumpers that must be set prior to installation in the chassis. These settings depend on the slot that the module is installed. **DO NOT ASSUME THAT A MODULE CAN BE MOVED BETWEEN LOCATIONS IN A CHASSIS WITHOUT CHANGING JUMPER SETTINGS.**

REMOVAL PROCEDURE

- A) Disconnect AC and DC power from the chassis.
- B) Remove the TSC 2003C chassis upper trim strip.
- C) Remove the TSC 2003C chassis lower trim strip.
- D) Lift up the front of the module with one or two fingers from the bottom. A small amount of force is necessary to disengage the connector from the motherboard.
- E) Slide the module straightforward, it will come out at a slight incline.

INSTALLATION PROCEDURE

- A) Check that both the upper and lower trim strip have been removed.
- B) Verify that the module's slide support is in the upright position. (The module's slide support is the formed metal assembly that is located beneath the perforated metal assembly that holds the module.) Gently lift up on the slide to allow the slide support to snap to its upright position if necessary. Verify that the slide is centered on the slide support.
- C) Set the module onto the front edge of the slide so that the rib on the bottom right side of the module is located along the right side of the slide. Engage the rib on the top right side of the module into the mating slot in the black guide plate located in the top of the chassis.
- D) Slide the module into the chassis.

NOTE: If the progress of the module is impeded when the module has been inserted approximately half way into the chassis, stop pushing. Lift the module tight against the guide plate and gently attempt to push the module past the obstruction. Alternately, press downward slightly on the front of the module while pushing the module into the chassis. In an extreme case, it is acceptable to press down slightly on the slide at a position just to the rear of the module while sliding the module into the chassis.

- E) When the module is pushed most of the way into the chassis, additional resistance will be felt while the module retaining screw is engaged. Push the module so that its top edge is aligned with the front edge of the chassis. Then, depress the slide support located underneath the module and allow the module to drop into position in the chassis. For double width modules, both slide supports below the module must be depressed to allow the module to be seated properly.
- F) Press down on the top edge of the module to seat the module into the chassis motherboard connector. If excessive force is required to seat the module into the motherboard connector, the module's connector may not be properly located in the motherboard connector. Remove the module from the chassis and examine the chassis slot for debris. Note that the module drops down slightly when the module's card edge connector drops into the chassis motherboard connector. The position of the module may need to be adjusted slightly either into or out of the chassis to get the connectors to mate.

Install the upper and lower trim strips only after the chassis has a module in every slot.



The cooling system in the TSC 2003C Chassis requires that modules be installed in all slots and the chassis lower trim strip be in place. Do not operate the chassis without making sure that the chassis is full and the lower trim strip is in place. Use TSC 2002 Slot Covers if required to fill the chassis.

MODULE BOARD IO ADDRESSES

Some of the TSC modules require a Base IO and an IRQ jumper to be set. This section describes the details of this procedure. Each IO Address corresponds to a slot number or position. For example, a module in Slot 2 has a dip switch setting of 0x108.

IO ADDRESS DIP SWITCH SETTINGS

This address is set using the Dip Switch that can be seen from the bottom of the module on the computer board. It is usually blue or red, and has a bank of 7 or 8 white switches.

The chassis cards (in module) are addressed according to the slot they occupy. The first slot is addressed at 0x100. Each subsequent slot (i.e. card in module) is addressed 0x08 higher than the previous slot. The one exception to this rule is the TSC 2172 Comm Port board, which is addressed at 0x200.

SLOT	1	2	3	4	5	6
Address	0x100	0x108	0x110	0x118	0x120	0x129
SLOT	7	8	9	10	11	12
Address	0x130	0x138	0x140	0x148	0x150	0x158

Table: Slot and Address Map

TSC 2077E Battery REMOVAL AND DISPOSITION

The user shall dispose of the Lithium Ion button cell type battery located in the 2077E in accordance with local regulations.

VII THEORY OF OPERATION

INTRODUCTION

The 2003C chassis provides the capability to install, power and communicate with TSC 2000 series modules. Every combination of modules operates in a different manner, and are described in the appropriate manual.

VIII. WARRANTY AND SHIPPING INFORMATION

This chapter provides information on how to contact Timing Solutions Corporation for warranty service, as well as shipping guidelines for the chassis.

WARRANTY INFORMATION

This system is warranted by Timing Solutions Corporation for a period of one year from date of shipment. Repair should be obtained by contacting Timing Solutions Corporation at (303) 939-8481, fax (303) 443-5152. Written correspondence may be addressed to:

Timing Solutions Corporation
4775 Walnut St, Suite 1B
Boulder, CO; 80301

www.timing.com

SHIPPING INFORMATION

If you need to ship this chassis for any reason including returning it to Timing Solutions for warranty service, follow these shipping instructions. Failure to follow these instructions may damage your system.

PACKING PROCEDURES

The chassis should always be shipped in its original carton. It must be shipped with all modules in place. No cables or connectors may be attached to the front or rear of the chassis. The chassis should be wrapped in plastic to protect against moisture. The molded plastic piece should be placed over the front of the unit. A foam piece should be placed over the rear of the unit. Two persons should lower the chassis into the TSC shipping carton. The plywood stiffener fits between the front foam insert and the cardboard carton.

CONFIGURING THE TSC 2003C CHASSIS FOR SHIPMENT



The TSC 2003C chassis must be properly prepared for shipment or damage will occur. Modules may be shipped within the chassis if all 12 slots are filled.

Remove the rack mount brackets using an 1/8 inch hex wrench.

Verify that all chassis slides are in the down position and are locked in place by the lower trim strip.

Verify that the upper trim strip is in place.

Chassis Support Assembly (If applicable)

Remove the 10/32 x 1 inch rack screws that secure the chassis support assembly.

Pull the chassis support assembly straight out of the rack by pulling on the "towel bar". If the chassis support assembly is equipped with slide locks, depress these locks while sliding the chassis support assembly back into the rack.

Package the chassis in a box with sufficient packaging material to protect the chassis during shipment. It is highly recommended to use the same packaging that was used by TSC to originally ship the 2003C.

IX. Declaration of Conformity

Declaration of Conformity according to ISO/IEC Guide 22 and EN 45014 Tested as part of 12030-120, and without modules installed

Manufacturer's Name: Timing Solutions Corporation
Manufacturer's Address: 4775 Walnut Drive Suite 1B
Boulder CO 80301

declares that the product:
Product Name: Modular Chassis
Model Number: 2003C
Product Options: All

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC and carries the CE-marking accordingly.

This product was tested in a typical configuration

Conforms to the following Product Specifications:

Safety:

EN61010-1:2001	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, Part 1: General Requirements
IEC 61010-1:2001	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, Part 1: General Requirements

EMC

EN55011 Class A	Emissions
EN61326:2000	General Requirements for Immunity
EN61000-3-2:	AC Power Line Harmonics
EN61000-3-3	AC Power Line Flicker

Supplementary Information:

European Contact: Contact the Manufacturer directly at the address above