

Instruction Manual

# MTR 225 ACS - MTR 225 ACS DHHS

DIGITAL SYSTEM FOR AUTOMATIC COLLIMATION

Confidential Information



**Ralco**  
X-RAY COLLIMATORS



## SERIES R 225 ACS DHHS

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## **LEGAL WARNING**






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Model		Certifications
R 225 ACS	STANDARD VERSION	
R 225 ACS DHHS	FDA CERTIFIED VERSION AVAILABLE ON REQUEST	 

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<i>The English version of this manual is a translation of the Italian text which prevails in case of doubts.</i>		
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THIS INSTRUCTION MANUAL PROVIDES THE SPECIFICATIONS, DIMENSIONS, AND FUNCTIONS FOR A STANDARD COLLIMATOR. PERSONALIZATIONS ARE AVAILABLE UPON REQUEST. WITH PERSONALIZED COLLIMATORS, THE CUSTOMER MUST ENSURE THE FOLLOWING HAS BEEN PROVIDED:

- YOUR SPECIFIC CODE IS CLEARLY VISIBLE ON THE BACK LABEL AFTER "CUSTOMIZATION", ABOVE THE SERIAL NUMBER, TO ENSURE THE CORRECT PERSONALIZED COLLIMATOR HAS BEEN PROVIDED (SEE ABOVE).
- THE CHAPTER ENTITLED "PERSONALIZATIONS," WHICH INCLUDES RELEVANT INFORMATION REGARDING YOUR PERSONALIZATION.
- OTHER PROVIDED ATTACHMENTS WHICH REFER TO YOUR PERSONALIZATIONS.

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## INTRODUCTION

### General Safety Information

**Ralco products are designed and manufactured** to meet the international safety standards for medical equipment. However, all medical electrical equipment requires proper installation, operation and servicing, particularly with regard to human safety. Read, note, and strictly observe all safety tags on the equipment. Strictly observe all safety directions, all warnings and all cautions that are mentioned in this chapter and throughout this service documentation. In order to protect the personal health of service personnel, operators and patients, ensure the safe servicing and operation of the system.

### Intended Use of the Collimator

This collimator is designed to be used with a Radiological system producing ionizing radiation for medical or veterinary use. Whomever is authorized to operate or service the radiological equipment must be thoroughly familiar with the procedures related to radiation protection and equipment use and maintenance. Ralco is not responsible for any personal injuries or damage to property from misuse or unintended use of this collimator. This manual must be made available to the installer and operator.

### Installer and Operator Responsibility

The installer and operator must verify that ALL safety standards are followed immediately after installation of the collimator and before any subsequent use. All procedures regarding the installation and safe use of this collimator must be strictly followed.

### X-ray equipment manufacturer responsibility

If the X-ray equipment manufacturer does not use the READY signal, allowing X-ray exposures regardless of collimator state or status, all liability falls upon the X-ray equipment manufacturer. In the event of any emergency and the READY or ERROR signals are bypassed allowing X-ray exposures, all the liability falls upon the X-ray equipment manufacturer.

**The collimator** electronics supplies a signal defined as READY. The X-ray equipment manufacturer will manage this signal as the X-ray consent. In the event of a collimator failure, the liability for the correct bypass of this signal, in order to always ensure the X-ray consent, devolves upon the X-ray equipment manufacturer.

### Reporting

Information regarding accidents that have occurred while using this collimator must be reported immediately to Ralco, srl.

### Limitation of Liability

Ralco is not liable if the provided instructions are not complied with. Furthermore, Ralco is not liable if one or several of the following instances apply:  
If the unit is specifically designed per client specifications and the certification was the duty of the client;

The collimator was modified in any way by the OEM or operator;  
The collimator was installed without respecting the instructions, as provided in this manual;  
The collimator was used in a way outside its intended use;

The collimator was not installed by competent personnel;  
The collimator was not operated safely or in a way contrary to the instructions in this manual;  
The collimator was not subject to routine inspection and maintenance by competent personnel;  
The collimator was repaired with non-Ralco spare parts;

### The Collimator was Used in a Way Not Reasonably Foreseen by Ralco

Ralco is not liable for any direct or indirect damage caused if the procedures in this manual are not followed.

**The collimator complies with current standards** for static load, a non-wearing class. This statement is based on studies and tests performed on the collimator performance and its weight. If the final system, through tilting movements or other dynamic movements, increases the risk factor other than those studied and tested, it is the responsibility of the customer to ensure that there are no dangerous situations.

The collimator described here, is used on Radiological systems and is classified as a type IIB according to Attachment IX. The collimator has been designed and manufactured in compliance to Attachment II of Legislative Decree, 2 February 1997, N. 46, Implementation of Directive 93/42/CEE of 14 June 1993 and successive modifications applying Directive 2007/47/CE.

List Applicable Standards and to which Ralco adheres to:

IEC 60601-1:2005 + Am1:2012 (ed. 3.1), North American market deflections (US+CA)  
IEC 60601-1-2:2014 (ed 4)  
IEC 60601-1-3:2008 + Am1:2013 (ed. 2.1)  
IEC 60601-2-54:2009 + Am1:2015 (ed. 1.1)  
IEC 60601-2-45:2011 + Am1:2015 (ed. 3.1) Applicable in Mammography instead of IEC 60601-2-54:2009  
IEC 60601-1-6:2010 + Am1:2010 (ed. 3.1) (Usability)  
IEC 62304:2006 + Am1:2015 (ed. 1.1) (Software)  
IEC 60825-1:2014 (LASER - if applicable)  
IEC 62471:2006 (LED - if applicable)  
ISO 9001:2015  
ISO 13485:2016

21 CFR subchapter J (FDA)

8750 01 & 8750 81 (CSA)

CE

\*Ralco can provide documentation regarding its adherence to any of the above standards.

**EN 60601-1 par. 5**

Protection against electric hazards: "Class I" equipment.

Protection against direct and indirect contacts: Type B equipment with applied parts.

Protection against water see page: "Common equipment".

Safety of operation in the presence of inflammable anaesthetics with air or oxygen or nitrous oxide: Equipment not suited to application in the presence of inflammable anaesthetic mixtures containing air or oxygen or nitrous oxide.

- Operation conditions: Equipment for continuous operation at intermittent loads - See Chapter Operation Instructions.
- Should label data on the collimator not correspond to the specifications herein, inform Ralco of the non conformity.
- Verifications of the specifications are to be performed according to the indicated equipment standards.



**Inherent Danger of X-Rays**

The collimator has been constructed to current standards to meet the safety requisites of Directive 2007/47/CE and all other applicable standards. However, due to Radiology being an inherent dangerous activity which cannot be completely safe guarded against, it is crucial that all safety procedures are followed. The installer and operator must follow ALL established procedures (including those mentioned in this manual) to reduce the inherent danger of X-Rays.

The inherent risk of using collimators in Radiological systems is deemed reasonable as determined by applicable standards. The use of collimators for Radiological systems is strictly regulated. Ralco follows all applicable standards. It is up to the installer and operator to ensure that all possible steps are followed to ensure the health and safety of the patient and operator.

The contact with the moving parts can be considered impossible and may occur only during installation or maintenance (low hazard). The internal parts are protected by a mechanical safeguard in the form of a metal or plastic sheath which impedes access. Also motor units are not accessible as knobs are fixed using the Allen screws and can be removed only by using a tool, in accordance with paragraph 5.92.3 of EN 60601-1 and EN 60601-2-54 par. 201.9.2.2.5. In addition the collimator has been tested in accordance with EN 60601-1, paragraph 4.8.2



**Read all information in this chapter carefully.**

**You are responsible to take safety precautions and to follow the safety instructions. Thus, you can prevent harm form yourself and other persons.**

**TECHNICALLY QUALIFIED PERSONNEL ONLY!**

- Only technically qualified Field Service Engineers (FSEs) must do the service work. The FSEs must be appropriately and successfully trained and instructed.
- Perform all service tasks such as installation, maintenance, or repair in strict compliance with the provided safety instructions!
- Perform all action as for example unpacking, installation, setting to work, testing and replacement according to the sequence stated in this manual.
- Perform all service tasks in strict compliance with the local regulations concerning safety, health, accident prevention, and medical X-ray devices!
- Never change any system parameters or components that reduce the mechanical safety, electrical safety, radiation protection properties of the product!
- Do not modify this equipment without authorization of Ralco.  
Any unauthorized modification can cause malfunction or deterioration of performance and quality and can therefore lead to personal injury, clinical misdiagnosis or clinical mistreatment.
- Never leave problems unsolved that may affect the safety of the product!
- Order spare parts via Ralco distribution channel.
- Always perform all relevant safety checks before handing the product over to the customer!
- Keep in mind that certain details or procedures change since you previously installed or serviced a similar product!

**If you do not obey these instructions, there is a risk of death or serious injury.**



A temperature of the collimator cover, under normal operating conditions and at the maximum ambient operating temperature (40°C), could exceed 41°C. According to the Table 24 of the General IEC 60601-1 standard, contact with the collimator cover must be less than 1 minute, both for the operator and for the patient. During the diagnostic test the operator must pay attention that the patient does not come into contact with the collimator surface for more than 1 minute.

**If you do not obey these instructions, there is a risk of serious injury.**

## Precautions Against Mechanical Hazards

### SAFE HANDLING OR ROTATING MACHINERY

- Never service rotating machinery, bands or chains when rotational movements are activated.
- Make sure that the rotational movements are switched off.
- Make sure that nobody can switch on the movements accidentally.
- Block the movement, if necessary.

### Safe handling of tilting machinery

- Never service tilting machinery when tilting movements are activated or brakes are released.
- Make sure that the tilting movements are switched off.
- Make sure that nobody can switch on the movements accidentally.
- Block the movements, if necessary.

If you tilt the machinery during installation or during other service activities:

- Comply with the specific service instructions.
- Ask a second person to release the brake and to keep the tilting movement under control.
- Avoid uncontrolled tilting movement.
- Never release the brake longer than necessary.



### Hazard of physical injury caused by heavy loads

- Wear appropriate protective clothing, such as safety boots and gloves.
- Take care that heavy loads are correctly lifted or carried to avoid any physical injury.
- Ask other persons for help to handle very heavy or awkwardly shaped loads.
- Use mechanical devices whenever it is possible.
- Stick to the installation instructions regarding:
  - suitable tools
  - lifting devices
  - lifting/support points
  - particular safety measures

If you do not obey these instructions, there is a risk of property damage.

### Safe handling of light source

Light source and adjacent parts can be very hot. They can cause severe burns.

- Never touch the light source, light source socket, or light source bracket with your fingers immediately after use.
- Leave the light source and adjacent parts to cool down before handling them.

## Precautions Against Electrical Hazards



### Hazard of electrical shock during service tasks

During installation, maintenance, and other service tasks there is a risk of electrical hazards.

- Follow the general instructions provided in this chapter.

If you do not obey these instructions, there is a risk of property damage.

### General precautions against electrical hazards

- Switch off the mains supply.
- Make sure that nobody can switch on the system accidentally before you start.
- Make sure that all UPS-powered components are powerless.
- Use a voltmeter to verify that all line disconnects are opened.
- Remove all jewellery, such as bracelets, or rings to prevent short circuits.

### Precautions concerning installation and service

Electrical installations of medically used rooms must comply with the requirements of each country.

Follow the instructions provided on the installations sheets for the specific project.

- Always use a separate conductor for ground connection. The neutral conductor is not considered as ground connection.
- Do not use a three-to-two pins adapter to connect equipment provided with a power cord. Always connect the equipment to properly grounded, three-pin power outlets.
- Connect the system to the mains as late as possible during installation.
- Make sure that all protective earth conductors are installed and connected before first switching on the system.
- Always be sure that the power is switched off when installing any parts to the equipment.
- Make sure that the large internal capacitors are completely discharged. Discharging can take several minutes.
- Keep away water or other liquids from the inside of the equipment to avoid short-circuits or corrosion.
- After installation or service work on electrical components the following tests have to be performed to ensure the compliance with IEC 62353:
  - Touch voltage
  - Protective earth conductor resistance
  - Earth leakage measuring

### **Working when connected to voltages**

- Switch off the main power supply when working at the equipment. This rule does not apply for certain measuring and adjustment procedures that are only possible when the product is switched on.
- Never measure or adjust equipment with power-on unless another person is present.
- Be very careful when working close to live contacts.
- Never perform any work on live parts (> 50 V).
- Prevent unwanted or sudden movements of the system because they are dangerous. If the procedure involves mechanical movements, take every precaution especially when working with moving and rotating parts. Use the service switch or the EMERGENCY STOP button before working within the dangerous movement area of a product.
- Check the ground connections before touching conductive system parts.
- Use tools and measuring instruments, which are suitable for the respective procedure only.
- Make sure that test and adjustment points are accessible without any risk of injury. If safe access is not possible, switch off the system.
- Turn off the power supply immediately after finishing the test or adjustment procedure.

### **Safe handling of high-voltage cables**

- When the mains and auxiliary power supplies are disconnected: Wait at least two minutes before removing the flexible high-voltage cables from the X-ray tube housing or the generator.
- Discharge any residual charge before touching the contact pins (briefly connect them to ground).

### **Precaution Against Material Damage**

#### **ENVIRONMENTAL CONDITIONS FOR SAFE OPERATION**

- The oxygen content of the ambient air during operation must be lower than 25%!
- The X-ray equipment must not be operated along with combustible anaesthesia substances!
- Ensure that the indoor temperature is within +10 - +40°C.
- Ensure that the indoor relative humidity is within 10 - 75%.
- Ensure that the air pressure is within 700 - 1060 hPa

### **Cleaning and disinfection**

- Do not use aggressive cleaning agents to clean the product!
- When you use cleaning agents such as detergents and disinfectants, make sure that they do not contain explosive substances as they can create explosive gas mixtures!
- Obey the manufacturer's data of the cleaning agent and disinfectant!
- Obey the manufacturer's data of the cleaning clothes!



### **Malfunction through electromagnetic fields**

The equipment fulfils all requirements concerning electromagnetic compatibility (EMC). nevertheless, powerful high frequency transmitters used near the electronic components can cause malfunction of electronic components under unusual circumstances. This malfunction causes unwanted risks for patients, operators, and service personnel.

- Switch off your mobile phone in designated areas.

**If you do not obey these instructions, there is a risk of property damage.**



### **Processor overheating**

The processor can get damaged within a few seconds.

- Do not operate the processor without cooling.

**If you do not obey these instructions, there is a risk of property damage.**



### **Damage by electrostatic discharge (ESD)**

ESD can destroy or partially damage electrostatic sensitive devices such as printed circuit boards (PCB). The damage can lead to instant or later failures of the device.

- Read all the following instructions concerning ESD protection.
- Take all necessary precautions to protect electrostatic sensitive devices.

**If you do not obey these instructions, there is a risk of property damage.**

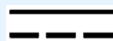


The rules concerning ESD protection apply to new devices and old devices and old devices. Old devices are replaced and sent back to the service depot.


### **Additional symbols on the collimator (if applicable)**



or **AC** Alternating Current No. 01-14 Ref. IEC 417-IEC 503



or **DC** Direct Current No. 01-18 Ref. IEC 417-IEC 5031

	or <b>AC/DC</b> Alternating and Direct Current No. 01-19 Ref. IEC 417-IEC 5033
	Protective Ground No. 01-20 Ref. IEC 417-IEC 5019
	Plus, Positive Polarity No. 01-27 Ref. IEC 417-IEC 5019
	Minus, Negative Polarity No. 01-28 Ref. IEC 417-IEC 5006
	Input No. 01-36 Ref. IEC 417-IEC 5006
	Output No. 01-37 Ref. IEC 417-IEC 5034
	Remote Control No. 01-38 Ref.
	Manual Control No. 01-45 ISO 7000-096
	Automatic Control (Closed Loop) No. 01-46 ISO 7000-0017
	Iris Diaphragm: Open No. 01-69 ISO 7000-0017
	Iris Diaphragm: Closed No. 01-70 Ref. 417-IEC 5324
	Radiation Filter or Filtration No. 04-51 Ref. 417-IEC 5381
	Light Indicator of Radiation Field No. 04-51 Ref. 417-IEC 5381
	Beam Limiting Device: Open No. 04-55 Ref. 417-IEC 5385
	Beam Limiting Device: Closed No. 04-56 Ref. 417-IEC 5386
	Beam Limiting Device: Closed with Separate Opening of the Shutters No. 04-57 Ref. 417-IEC 5387
	Beam Limiting Device with Separate Closing of the Shutters No. 04-58 Ref. 417-IEC 5388
	Cassette Size Sensing Device
	Device Requiring Proper Disposal, Attch. 4 Ref. 2002/95/CE



Type B Applied Part No. 02-02 Ref. 601-I-IEC (Not applicable for R 915, R 915 S and R 915 S DHHS)



Follow Instructions for Use Ref. ISO 7010-M002 (see the collimator label)



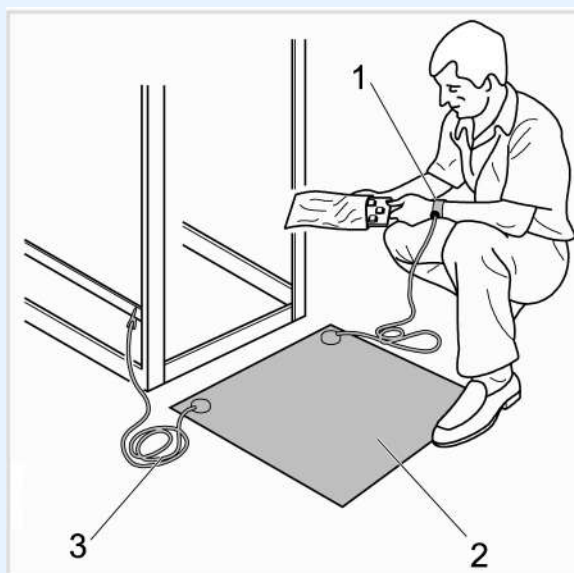
General Warning Sign No. 03-02 Ref. IEC 601-1



Caution: Laser Radiation Ref. 60825-1

This symbol identifies electrostatic sensitive devices.

- Always transport electrostatic sensitive devices (such as PCB) in their static shielding bags or boxes.
- Always use the ESD protection service kit when handling electrostatic sensitive devices.
  - Attach the wristband to your wrist (1) and connect the ground cable of the wristband to the conductive work surface (2).
  - Connect the second ground cable (3) to the conductive work surface (2).
  - Attach the crocodile clip to a reliable ground of the cabinet or console, where the PCB has to be installed.
- Place the PCB on the conductive work surface before installing them.
- Place the PCB on the conductive work surface for hardware settings or replacement of components.
- Never remove or disconnect the wristband before all electrostatic sensitive devices are installed.
- Never remove or disconnect the wristband before all removed electrostatic sensitive devices are safely packed in their static shielding bags or boxes.



**Fig. 1 ESD protection kit**

### **Safety Signs on the Product**

- Do not remove or change safety signs!
- Replace illegible safety signs by genuine spare parts!
- Clean soiled safety signs!

Refer to the labelling drawings of the components to see the positions of the labels.



### **Safety of Personal Protective Equipment**

- The collimator does not contain polluting materials or products with the exception of the lead that composes the shutters and an inner lining of the collimator cover, if properly disposed of at the end of its life cycle.
- Avoid direct contact with lead especially for prolonged periods.
- Gloves must be worn when handling the disassembled collimator, especially the parts mentioned above.
- Do not use for any other work.
- Disposable gloves may also be worn and can be disposed with normal trash.



### **Disposal**

- Dispose any material, batteries and X-ray equipment in accordance with the requirements of national legislation!
- Do not dispose X-ray equipment together with domestic waste!





- All Ralco's products conform to RoHS



- All Ralco's products conform to REACH

### ***Safety Messages Reported Into The Manual***



#### **WARNING**

This symbol combined with the signal word **WARNING** indicates a hazardous situation which, if not avoided, could result in death or serious injury.

**If you do not obey these instructions, there is a risk of death or serious injury.**



#### **CAUTION**

This symbol combined with the signal word **CAUTION** indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

**If you do not obey these instructions, there is a risk of minor or moderate injury.**

The shown symbols are sometimes replaced by other symbols which indicate the concrete risk:

### ***Material Damage***



#### **NOTICE**

This symbol combined with the signal word **NOTICE** indicates a hazardous situation which, if not avoided, could result in damages such as material damage. This damage is not related to personal injury.

**If you do not obey these instructions, there is a risk of property damage.**

### ***Other Messages***



#### **Important**

This symbol combined with the signal word **Important** indicates an important advice that points out that certain guidelines, parameters, conditions or restrictions must be observed.

### **For any inquires or notifications, please contact us at:**

Ralco, srl  
Via dei Tigli 13/G  
20853 Biassono, (MB) Italia  
Telephone: +39 039 2497925  
Fax: +39 039 2497799  
E-mail: [ralco@ralco.it](mailto:ralco@ralco.it)

## DESCRIPTION

**Multilayer, square field, automatic collimation system intended for installation on stationary X-ray equipment. This device has been designed and manufactured for skeletal, gastrointestinal, urographic and thoracic investigations.**

The square field is defined by 6 pairs of lead faced shutters contained in the collimator body. Two pairs of shutters are located near the X-ray focus to control the X-ray beam and eliminate off-focus radiation. Two pairs are located on the entrance window. The other two pairs of shutters are positioned near the exit window to provide a sharply defined X-ray field. A key-switch on the rear cover of the collimator allows to select between automatic and manual modes of operation. A set of rail guides inside the collimator allows the insertion of an ionization chamber.

A microprocessor circuit controls the stepper motors and provides the step-less adjustment of the square field dimensions at variable SID.

The field dimensions may be decreased and increased to the desired size by rotating the two knobs on the collimator front panel.

## CHARACTERISTICS

**Mounting Plane** at 80 mm (3.15") from the focus.

**Continuous Film Coverage** from Min: 00 x 00 cm to Max: 48 x 48 cm at 100 cm (40") SID.

**Maximum Radiation Leakage:** 150 kVp - 4 mA

High luminosity provided by a **White LED** which simulates the X-ray field.

**Minimum Inherent Filtration** 2 mm aluminium equivalent.

**Accessory Guides** are used for accessories and additional filtration.

**Retractable Tape** mounted on a radiological unit, measures the distance between the focus and the patient.

**Resin Rotating Mounting Flange** allows the collimator to rotate, 20mm thickness, 0° detent, 140mm diameter.

**Single Laser** for the alignment of the collimator to the receptor (Class 1).

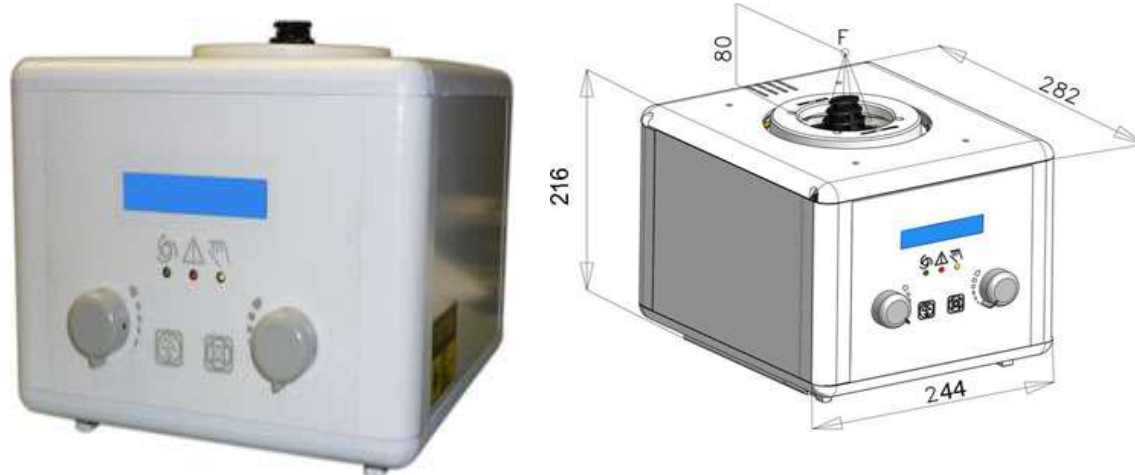
The collimator has been designed for **an Ionization Chamber** to be included. When the iris option is installed the device is assembled outside of the collimator.

**RSR008** electronic board which controls two motors for Cross/Long shutter movements.

**GC-LED-4A** timer board for light source supply and operation. The board is CanBus controlled.

**Connecting cable** 10m

**Fig. R 225 ACS - R 225 ACS DHHS Front Panel with Exterior Dimensions**





This collimator may have the following optional items; a detailed description is provided in the chapter **OPTIONAL ITEMS**.

RO	DESCRIPTION
RO 002	Iron mounting flange spacer: 1.5mm thickness
RO 063	Final quality test report documentation (Light field, luminosity, light to X-ray field correspondence, light field border contrast ratio, x-ray leakage, control of general functions)
RO 074	External housing in customized color
RO 082	Glass mirror with minimum internal inherent filtration: 1mm Al equivalent
RO 096	Wiring customization
RO 107	Knob color customization
RO 111	Front panel customization
RO 203	Self-centering top-cover bracket for Siemens X-ray tube only (mounting flange provided by Siemens only)
RO 210	Aluminum accessory guide rails painted in standard housing color (unless RO 074 selected)
RO 240	Focal-spot to skin spacer
RO 242/1	Single laser line to align collimator and detector center: Class 2
RO 242/2	Two lasers forming a crosshair to center the patient to the detector: Class 2 (not available with RO 436)
RO 278	Fixed near focal shutters (single layer collimation) for use with a mounting plane of 80mm from the X-ray focus
RO 305	Additional variable filtration - automatic selection. 4 position rotating wheel with selectable filters (clockwise): (1) empty or (2) 0.1mm Cu+1mm Al or (3) 0.2mm Cu+1mm Al or (4) 2mm Al
RO 305/1	Additional variable filtration - automatic selection. 4 position rotating wheel with selectable filters (clockwise): (1) empty or (2) 0.1mm Cu or (3) 0.2mm Cu or (4) 0.3mm Cu
RO 308	External analogic/digital interface in metal housing with 10 meter connecting cable

MTR 225 ACS - MTR 225 ACS DHHS - Description

RO	DESCRIPTION
RO 310	Round field collimation for image intensifier
RO 314	Camera assembled internally for patient monitoring: analogic interface
RO 320	Motorized rotation of collimator: 45° movement (not available with RO 492, RO 498 or RO 609)
RO 329	Internal proximity sensor
RO 330	Connecting cable extension
RO 332/A	Resin rotating mounting flange: 15mm thickness, +/-0° detent, 140mm diameter including fixing screws (not available with RO 492, RO 498 or RO 609)
RO 337	Camera support (camera not included)
RO 344	Accessory guide rail spacers with support painted in standard housing color (unless RO 074 selected)
RO 356	Shutter position verified by potentiometer: Output signal managed by customer
RO 409	Resin rotating mounting flange milled to form a square: 20mm thickness, +/-90° detent, 140mm diameter + three iron mounting flange spacers milled to form a square: 1.5mm thickness (not available with RO 492, RO 498 or RO 609)
RO 428	Mechanical modification for 7" touchscreen display (not available with RO 436)
RO 436	Reduction of housing height (from 204mm to 191mm- DAP may not be mounted internally)
RO 441	Resin rotating mounting flange: 20mm thickness, +/-50° detent, 140mm diameter (not available with RO 492, RO 498 or RO 609)
RO 442	Resin rotating mounting flange: 20mm thickness, +/-90° detent, 140mm diameter (not available with RO 492, RO 498 or RO 609)
RO 444	Collimator control protocol: CANopen (CIA 412-2)
RO 445	Metal rotating mounting flange, 20mm thickness, +/-90° mechanical stop, 140mm diameter (not available with RO 492, RO 498 or RO 609)
RO 452	Asymmetric longitudinal shutters ("stitching" application)
RO 456	Metal rotating mounting flange: 20mm thickness, +/-90° mechanical stop, 136mm diameter (only available with RO 492)

MTR 225 ACS - MTR 225 ACS DHHS - Description

RO	DESCRIPTION
RO 470	High precision ball bearing shutter movement
RO 481	Internal rotating square field (not available with RO 310 or RO 344)
RO 489	Resin rotating mounting flange: 20mm thickness, +/-45° detent, 140mm diameter (not available with RO 492, RO 498 or RO 609)
RO 490	Metal rotating mounting flange, 18mm thickness, +/-90° mechanical stop, 140mm diameter with countersunk mounts (only available with RO 492)
RO 492	Adjustable top-cover bracket for use with metal mounting flange (mounting flange not included)
RO 495	Camera assembled internally for patient monitoring: IP ethernet interface
RO 498	Self-centering top-cover bracket with zero position output signal using a microswitch (resin mounting flange not included)
RO 499	Resin rotating mounting flange: 20mm thickness, +/-90° detent, 140mm diameter, 0° position tolerance +/-3° (only available with RO 498)
RO 502	Camera assembled internally for patient monitoring: USB interface
RO 518	Additional variable filtration - automatic selection. 4 position rotating wheel with selectable filters (clockwise): (1) empty or (2) 0.1mm Cu+1mm Al or (3) 0.1mm Cu+0.5mm Al or (4) 0.5mm Cu+1mm Al
RO 530	Resin rotating mounting flange: 17mm thickness, +/-0° detent, 140mm diameter (not available with RO 492, RO 498 or RO 609)
RO 541	Metal rotating mounting flange, 15mm thickness, +/-90° mechanical stop, 140mm diameter (not available with RO 492, RO 498 or RO 609)
RO 544	7" touchscreen display (not available with RO 436)
RO 545	Front silkscreen with six double-safety touch buttons for collimator control and customer remote control movement (only available with RO 544)
RO 552	Metal rotating mounting flange, 20mm thickness, +/-90° mechanical stop, 140mm diameter, fixation plate 4mm, rotation force 1.6kg ± 0.4 / release force 3.5kg ± 0.5 (not available with RO 492, RO 498 or RO 609)
RO 570	Shutter position verified by encoders
RO 575	Iron mounting flange spacer: 1mm thickness

MTR 225 ACS - MTR 225 ACS DHHS - Description

RO	DESCRIPTION
RO 587/2	Two lasers forming a crosshair to center the patient to the detector: Class 1
RO 599	Resin rotating mounting flange: 17mm thickness, +/-90° detent, 140mm diameter, 0° position tolerance +/-3° (only available with RO 498)
RO 603	Shutter blocking screws with warning label for protection during shipment
RO 605	Resin rotating mounting flange: 20mm thickness, +/-0° detent, 140mm diameter, 0° position tolerance +/-3° (only available with RO 498)
RO 609	Self-centering top-cover bracket with zero position output signal using a microswitch (resin mounting flange not included)
RO 610	Resin rotating mounting flange: 17mm thickness, +/-90° detent, 140mm diameter, 0° position tolerance +/-3° (only available with RO 609)
RO 611	Metal rotating mounting flange: 18mm thickness, +/-90° mechanical stop, 140mm diameter, 0° position tolerance +/-3° (only available with RO 609)
RO 619	Resin rotating mounting flange: 15mm thickness, +/-90° detent, 140mm diameter, 0° position tolerance +/-3° with fixing screws (only available with RO 609)

## SPECIFICATIONS

### NOTE



SPECIFICATIONS OF THE BASIC VERSION OF THE COLLIMATOR ARE DESCRIBED HERE BELOW.

### POWER SUPPLY

Power Supply	24 V AC/DC - 3 A, 50/60 Hz
Fuse for power supply protection collimator. Not supplied by Ralco.	T 3.5 A
Motor Supplied by Collimator Board	RSR008
Fuse for Power Supply Protection Motor. Not supplied by Ralco	n.a.
Potentiometers/Encoders: Square Field Round Field	1 turn - 1 Kohm 1 turn - 1 Kohm

### ELECTRONIC SPECIFICATIONS

Software RSR008 Software GC-LED-4A	The software version of the collimator boards is documented by the Final Control and Testing Form attached to the collimator.
Power Supply, External PCB	n.a.
Fuse for External Board	n.a.

### RADIOLOGICAL SPECIFICATION

Inherent Filtration Al. Equivalent X-ray beam = 75 kV EN 60601-1-3 par. 7.3; 7.4	Min. Al Eq. 2 mm (1 mm on request)
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## RADIOLOGICAL SPECIFICATION

Filtration, Additional X-ray beam = 75 kV EN 60601-1-3 par. 7.5	n.a.
Limitation of Extra Focal Radiation Set Focus Distance, SID 100 cm (40") EN 60601-2-54	< 150 mm
Square X-ray Field Selection 100 cm (40") SID - ( $\pm$ 1% SID) EN 60601-2-54	Min: 00 x 00 cm Max: 48 x 48 cm
Round X-ray Field Selection 1 m SID - ( $\pm$ 1% SID) EN 60601-2-54	n.a.
Light Field Indicator Luminosity at 1 m from the focus, field size set at 35x35 cm. EN 60601-2-54	> 160 lx
Light Field Indicator - Contrast Edge Contrast Setting 35x35 cm at 1 m SID EN 60601-2-54	> 4:1
Light Field Indicator Precision Light Field/X-ray Field Correspondence EN 60601-2-54	< 1% SID
Accuracy of X-ray field as shown on the front display versus actual X-ray field dimension.	< 2 mm per side
X-ray Field Indication Precision Settings on an Index Scale EN 60601-2-54	Display: < 1% SID
SID: (optional) Precision of Measurement with Retractable Tape EN 60601-2-54	< 1% SID
Maximum Radiation Leakage Measured at 100 cm with X-ray Beam = 150 kVp - 4 mA EN 60601-1-3	< 40 mRh

MTR 225 ACS - MTR 225 ACS DHHS - Specifications

## GENERAL SPECIFICATIONS

Operation Environment  
Ambient Temperature  
Relative Humidity  
Atmospheric Pressure

10° - 40°C  
10% - 75%  
700 - 1060 hPa

Storage  
Temperature  
Humidity  
Atmospheric Pressure

-40° - +70°C  
10% - 95%  
500 - 1060 hPa

Weight\*

\* The weight may vary according to the optional items mounted to the collimator.

11 Kg

Dimensions

L: 282 mm  
W: 244 mm  
H: 216 mm

Maximum Load for Accessory Rails and Dimensions for Accessory

Static Load: 70 N (about 7.1 Kg)  
Dynamic load: 15 N (approx. 1.5 Kgm)

Distance between Rail Slots

177 mm (+/- 0.5 mm)\*\*

\*\*



### ATTENTION:

THE DISTANCE BETWEEN TWO RAILS VARIES AND DEPENDS ON THE COLLIMATOR MODEL.  
PRIOR TO INSERTING ACCESSORIES IN THE RAILS MAKE SURE THAT THE DIMENSIONS OF THE ACCESSORY MATCHES WITH THE DISTANCE BETWEEN TWO RAILS SLOTS (TOLERANCE MAX.  $\pm 0,5$  MM).  
THE INCORRECT DIMENSION CAN LEAD TO DANGEROUS SITUATIONS AND/OR TO THE ACCESSORY FALLING.  
SEE THE CHAPTER **OPTIONAL ITEMS** IF THE RAILS DIFFER FROM THE STANDARD ONES.

## INSTALLATION

### WARNINGS



THE COLLIMATOR MUST BE INSTALLED TO THE X-RAY TUBE THROUGH A MOUNTING FLANGE. RALCO PROVIDES VARIOUS FLANGE OPTIONS WHICH MAY NOT BE INTERCHANGEABLE. ONLY FLANGES PROVIDED WITH THE COLLIMATOR MAY BE UTILIZED. THE END-USER MAY INSTALL THEIR OWN FLANGE, HOWEVER RALCO CANNOT GUARANTEE COMPATIBILITY. ANY PREEXISTING FLANGE ON THE END-USER SYSTEM MUST NOT BE USED.



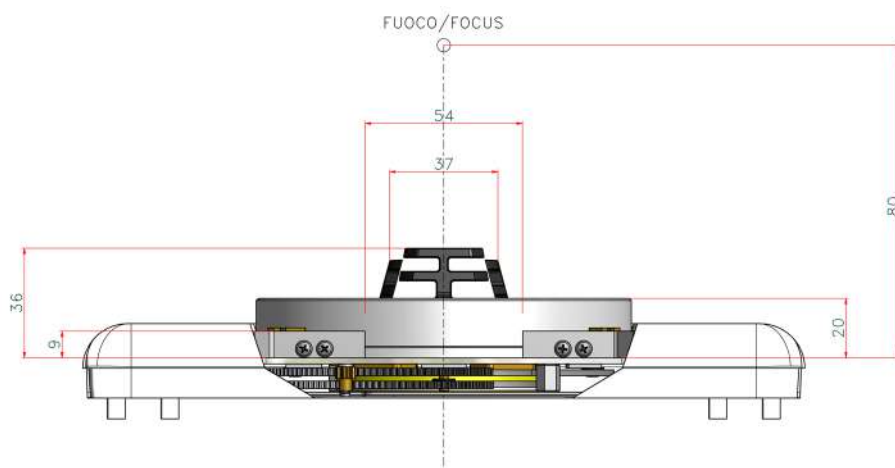
WHEN A FLANGE IS PROVIDED WITH THE COLLIMATOR BEARING A MATCHING SERIAL NUMBER, ENSURE THEY ALWAYS REMAIN COUPLED. IT IS MANDATORY THEY REMAIN TOGETHER AND THE CORRECT FLANGE PART NUMBER IS USED.



THE CONTENTS OF THE INSTRUCTIONS BELOW SHOULD BE STRICTLY ADHERED TO. RALCO IS NOT LIABLE FOR ANY PROPERTY DAMAGE OR RESULTING HARM IF NON-RALCO COMPONENTS OR NON-COMPATIBLE RALCO COMPONENTS ARE USED DURING THE INSTALLATION PROCESS.

### TUBE COMPATIBILITY

- Using the dimensions in **Fig. Tube Compatibility** below, ensure the near port shutters of the collimator are placed in the X-Ray tube port without interference.
  - Assembly values (X-Ray tube housing and collimator) must comply with a minimum value of inherent filtration and a maximum value of radiation leakage.
- The distance between the X-Ray tube focus and the flange mounting plane (collimator upper plate) must be: 80 mm (3.15"), tolerance +/- 1 mm (0.04 ").



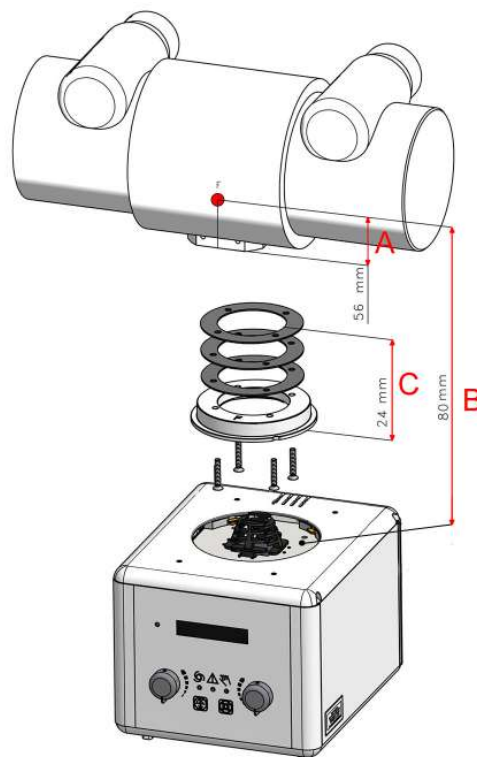
**Fig. Tube Compatibility**



3. Carefully remove the collimator and the mounting flange from their packaging.
4. Use the X-Ray tube housing datasheet to determine the distance (A) from the focal spot to the X-Ray tube port, see **Fig. Collimator Installation**.
5. Subtract the resulting distance from the source flange distance (B) and determine the number of spacers (1.5 mm) which, combined with the thickness of the mounting flange, will make up the difference (C). Allowable tolerance is 1 mm. (0.04"), see **Fig. Collimator Installation**.
6. Once the mounting plane distance has been confirmed, continue with the mounting flange installation to the X-Ray tube.

*\*The flange fixing screws and the spacers of the previous flange may be reused if the flange thickness is the same.\**

7.



**Fig. Collimator Installation**

## MOUNTING THE FLANGE TO THE X-RAY TUBE

### NOTE



THE FOLLOWING MOUNTING INSTRUCTIONS ARE ONLY APPLICABLE FOR COMPATIBLE FLANGES. IF YOU ARE UNSURE THE MOUNTING FLANGE YOUR COLLIMATOR IS EQUIPPED WITH IS COMPATIBLE, PLEASE CONSULT YOUR PERSONALIZATION PAGE PROVIDED WITH THIS MANUAL TO LOCATE THE FLANGE PART NUMBER (RO REFERENCE). FOLLOW THE MOUNTING INSTRUCTIONS SET FORTH UNDER THE SPECIFIC RO REFERENCE IN THIS MANUAL.

### WARNING



FLANGES MAY BE PROVIDED BY RALCO OR BY THE SYSTEM MANUFACTURER. FLANGES MAY NOT BE INTERCHANGEABLE. ONLY THE FLANGE PROVIDED WITH THE COLLIMATOR BEING INSTALLED WITH A SPECIFIC PART CODE MAY BE UTILIZED. ANY PRE-EXISTING FLANGES MAY NOT TO BE USED. IF THERE ARE ANY QUESTIONS REGARDING COMPATIBILITY, PLEASE CONTACT RALCO.

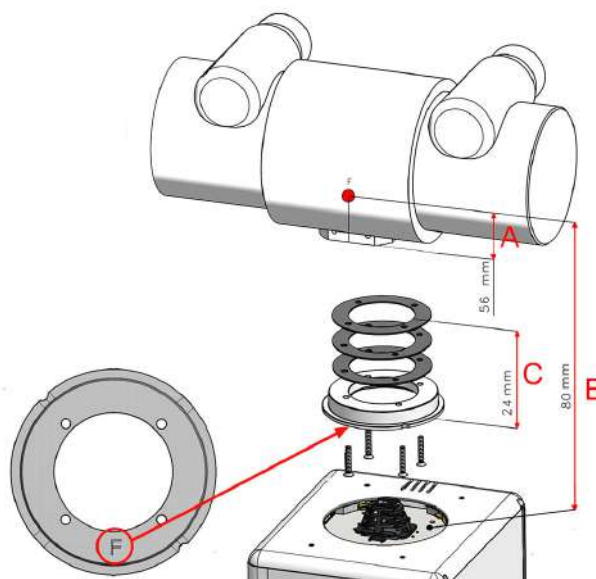
**CAUTION**



RALCO CANNOT GUARANTEE COMPLIANCE WITH RADIATION STANDARDS CONCERNING SAFETY IF THIS CONTROL HAS BEEN OMITTED.

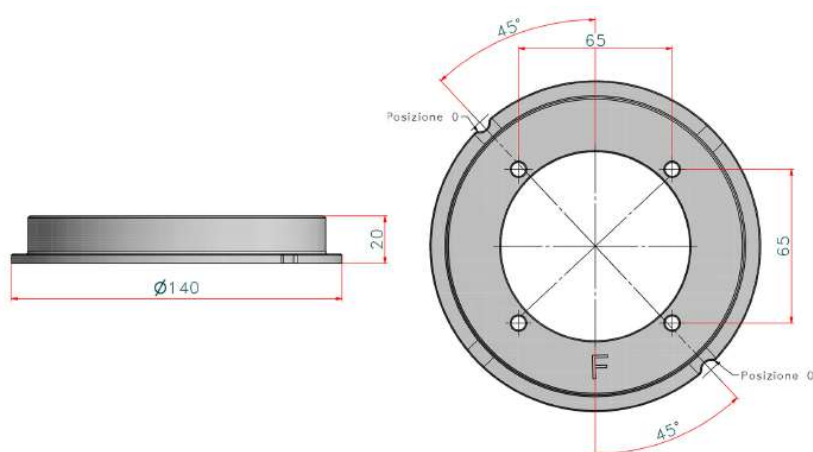
1. Place the flange on the X-Ray tube port, see **Fig. Flange Installation**.
2. Mount the mounting flange and spacers (optional) to the X-Ray tube port using 4 screws.\*\*

**\*\*Please ensure no conflicting information nor dangerous conditions exist due to adhering to these instructions or those provided by the X-Ray tube manufacturer. When in doubt please contact X-ray tube manufacturer and/or Ralco.**



**Fig. Flange Installation**

\*illustrative purpose only



**Fig. Mounting Flange**

**CAUTION**



THE FLANGE MUST BE PLACED WITH THE LETTER "F" FACING TOWARD THE X-RAY TUBE PORT. INCORRECT POSITION MAY CAUSE THE COLLIMATOR AND FLANGE TO MALFUNCTION.



ENSURE THE SCREW HEAD IS INDEED CORRECT FOR THE FLANGE SELECTED. IT IS THE RESPONSIBILITY OF THE END-USER TO ENSURE ALL SAFETY MEASURES ARE IMPLEMENTED TO ENSURE THE SCREWS ARE OPTIMALLY TIGHTENED INCLUDING THE USE OF APPROPRIATE LOCKTITE.



TIGHTEN THE 4 SCREWS TO THE X-RAY TUBE HEAD SECURELY, STRICTLY ACCORDING TO THE INSTRUCTIONS OF THE X-RAY TUBE MANUFACTURER. DO NOT EXCEED 0.45 NM OF FORCE.

### ALIGNMENT OF X-RAY TUBE FOCUS AND COLLIMATOR

Ralco guarantees the correct collimator functionality, format compliance and light/X-Ray field alignment only if the mounting flange and the collimator have been installed exactly in the centre of the X-Ray beam.

All Ralco collimators are aligned on our test bench utilizing specific references/values for our X-Ray tube focus, detector and Source to Image Detector Distance (SID). The customer must know and verify all known variables which may influence the X-Ray tube focus and collimator alignment. These may include, the X-Ray tube focus position tolerance, distance from X-Ray tube focus to collimator mounting plane, or the SID.

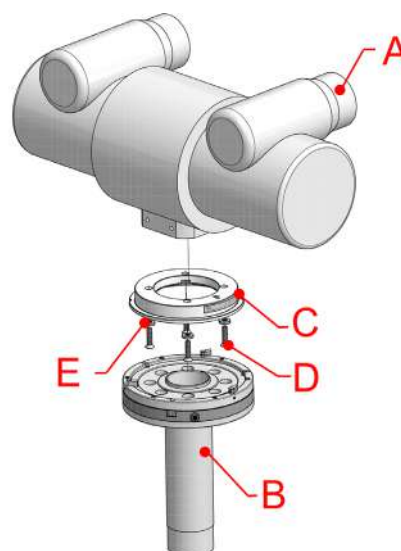
### Alignment Device

This device is used to ensure the collimator mounting flange is correctly aligned to the X-ray beam. The X-ray tube manufacturer provides a tolerance for the placement of X-ray tube focus.

Ralco recommends to use the Focal Alignment Device (jig) to ensure the correct flange alignment with the centre of the X-Ray beam, see **Fig. Focal Alignment Device**. By making an exposure, it is possible to verify the perpendicularity and concentricity using fixed references on the X-Ray image.

Once the mounting flange is aligned the collimator light/X-ray field should also be aligned (within specific tolerances).

Please consult the technical specifications of your X-Ray tube to find the maximum tolerance for the



A - X-Ray Tube, B - Focal Adjustment Device  
C - Mounting Flange, D - Screw, E - Washer

**Fig. Focal Alignment Device**

position of the focus. Should the use of an alignment device not be possible, Ralco collimators allow for the regulation of the light field.

## Mounting the Collimator to the Flange

### NOTE



THE MOUNTING FLANGE PROVIDED (IF PURCHASED) WITH THE COLLIMATOR IS SUBJECTED TO TESTING PURSUANT TO ALL APPLICABLE STANDARDS.



MOUNTING BRACKET TABS CONFORM TO EN60601.

### WARNINGS



PURSUANT TO APPLICABLE STANDARDS, RALCO HAS TESTED THE COLLIMATOR AND FLANGE APPLYING STATIC LOADS. RALCO IS NOT IN A POSITION TO KNOW THE DYNAMIC FORCES OF ALL END-USER SYSTEMS. IT IS THE RESPONSIBILITY OF THE END-USER TO ENSURE DYNAMIC FORCES OF THE SYSTEM DO NOT CREATE A DANGEROUS CONDITION.



IT IS THE RESPONSIBILITY OF THE SYSTEM MANUFACTURER TO ENSURE AND MITIGATE ANY DANGEROUS CONDITIONS WHICH MAY OCCUR DUE TO THE DYNAMIC FORCES CREATED BY THE SYSTEM. THE END-USER MUST PERFORM A SYSTEMATIC AND STRUCTURAL ANALYSIS DURING THE INSTALLATION AND USUAL MAINTENANCE.



SHOULD ANY DAMAGE TO THE COLLIMATOR OR FLANGE OCCUR A RISK ANALYSIS AND DAMAGE ASSESSMENT NEEDS TO BE CONDUCTED IMMEDIATELY. CONTACT RALCO IMMEDIATELY SHOULD THIS OCCUR. RALCO IS NOT LIABLE FOR RESULTING PROPERTY DAMAGE AND/OR HARM DUE TO AN UNREPORTED INCIDENT.



RALCO HAS DESIGNED AND TESTED THE COLLIMATOR FOR A LIFETIME OF 10 YEARS. AFTER THIS TIME PERIOD, IT IS THE RESPONSIBILITY OF THE END-USER TO ENSURE THE PROPER FUNCTIONING OF THE COLLIMATOR AND FLANGE. LIABILITY FOR ANY DANGEROUS CONDITIONS WHICH MAY BE PRESENT AFTER THE 10YEAR LIFETIME OF THE COLLIMATOR AND FLANGE RESTS WITH THE END-USER.



TO ENSURE THE SAFETY OF THE COLLIMATOR AND FLANGE AFTER 10 YEARS OF USE, RALCO HAS INSTITUTED A PROGRAM TO ASSESS THE SAFETY OF THE COLLIMATOR AND FLANGE. AFTER APPLYING A CHECK LIST OF QUALITY CONTROLS AND REFURBISHMENT ACTIVITIES (AT END-USER EXPENSE), RALCO MAY CERTIFY THE COLLIMATOR AND FLANGE FOR ADDITIONAL YEARS OF USE.

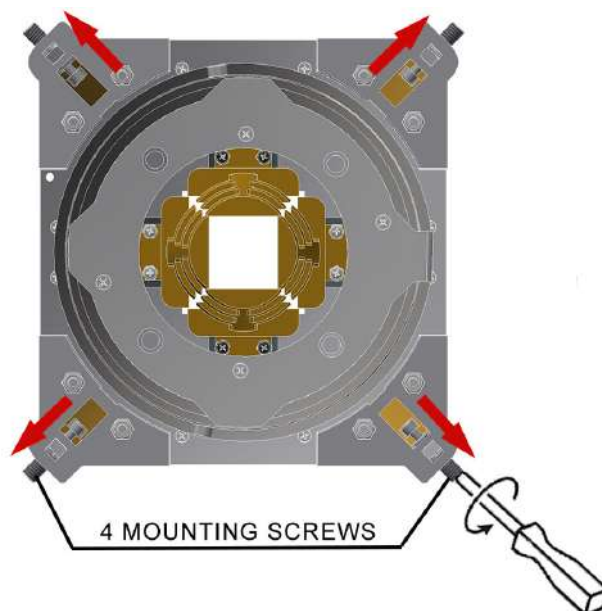
The mounting bracket has 2 tabs with springs in positions 2 and 4, while the 2 tabs in position 1 and 3 cover the surface of the outer ring of the flange, see **Fig. Mounting Bracket**.

1. Prepare the collimator to be installed by unscrewing the 4 hexagonal socket screws until the four tabs are completely withdrawn from the collimator top mounting plane, see **Fig. 4 Mounting Screws**.
2. If installing a manual collimator, adjust the collimator shutters to the fully open position using both knobs.

**CAUTION**



WHEN UNSCREWING THE HEXAGONAL SOCKET SCREW WHICH CONTROL THE TABS, DO NOT USE FORCE EXCEEDING 0,45 NM. UNSCREW WITH CARE SO AS NOT TO DAMAGE THE HEXAGONAL SCREW HEAD AND TABS.

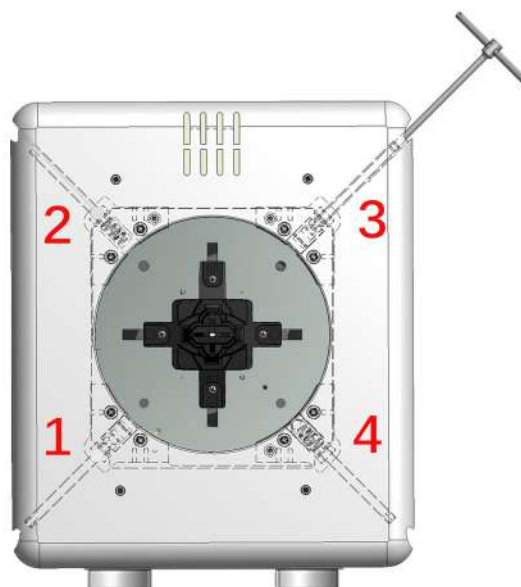


**Fig. Collimator Mounting Bracket**

3. With the tabs fully retracted, tabs in position 1 and 3 which overlap the outer ring must be tightening equally up to the end stroke with 0.45 Nm torque (at least 7 turns). See **Fig. Mounting Bracket**.
4. With the tabs fully retracted, the tabs in position 2 and 4 have an integrated adjustable spring and can be tightened in two different ways allowing the flange to be fixed or to rotate, see **Fig. Mounting Bracket**.

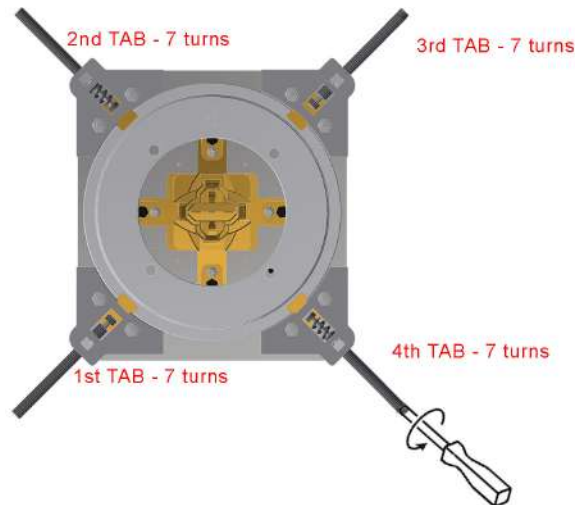
**FIXED (NO ROTATION)**

With the tabs fully retracted, tighten all tabs up to the end stroke with 0.45Nm torque at least 7 turns (if you are not able to respect the turns something is incorrect, repeat above instructions, if issues persist, please contact Ralco).



**Fig. Mounting Bracket**

*\*illustrative purpose only*

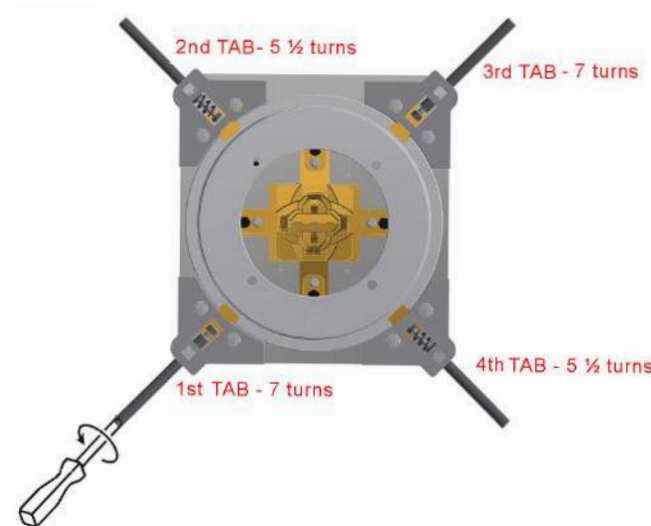


**Fig. Mounting Bracket (Fixed)**

**WITH ROTATION**

With the tabs fully retracted, tighten tabs in the following sequence (if you are not able to respect the turns something is incorrect, repeat above instructions, if issues persist, please contact Ralco):

- Tabs 1 and 3 - minimum of 7 turns
- Tabs 2 and 4 – exactly 5 ½ turns.



**Fig. Mounting Bracket (Rotating)**

The collimator tabs glide on the flange outer ring and the collimator rotates towards the X- Ray tube axis. If, however:

- The release force from the position 0° and the collimator rotation is too low, the two tabs of the tab 2 and 4 need to be tighten ½ turn.
- The release force from the position 0° and the collimator rotation is too high, the two tabs of the tab 2 and 4 need to be loosened ½ turn.



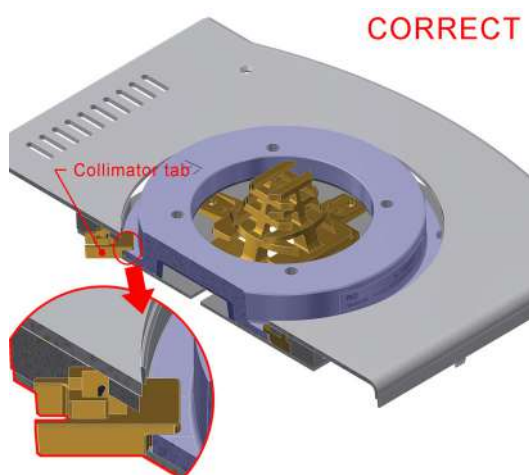
## VERIFICATION OF CORRECT INSTALLATION

### WARNING



IT IS THE DUTY OF THE INSTALLER TO ENSURE NO RISK OF THE COLLIMATOR FALLING EXISTS. ENS URE THE FOLLOWING, AS IN EACH SCENARIO BELOW SERIOUS RISK OF INJURY AND/OR PROPERTY DAMAGE MAY EXIST DUE TO NON-ADHERENCE.

1. The 4 tabs should overlap the flange outer ring, see **Fig. Correct Overlap**.
2. Ensure the mounting flange is flat against the collimator mounting plane, see **Fig. Correct Overlap**.
3. Ensure the 4 tabs are not in contact with only the mounting flange edge, see **Fig. Incorrect Overlap**.
4. Once the collimator is mounted, if not already, return the collimator/tube head to the intended use position. Rotate and/or gently pull the collimator to ensure correct coupling.
5. If the collimator is loose, something is incorrect. Repeat above mounting instructions, and if issues persist, please contact Ralco.



**Fig. Correct Overlap**



**Fig. Incorrect Overlap**

### Ionization Chamber Mounting

This collimator is designed for an ionization chamber with an inter axis of 177.5 mm.

- Remove the front panel, see Chapter - **COVER REMOVAL**.



- Disconnect the connector.



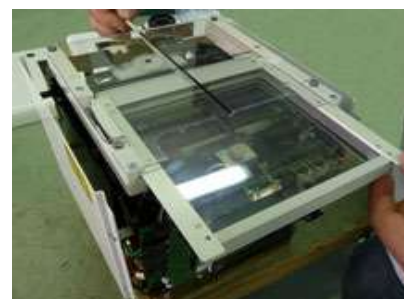
- Turn the collimator over and unscrew the four screws.



- Remove the tape stop by lifting it off with a screw driver. Gently ease the tape into its container within the collimator.



- Insert the ionization chamber between the two rails and mount lower part of the cover.

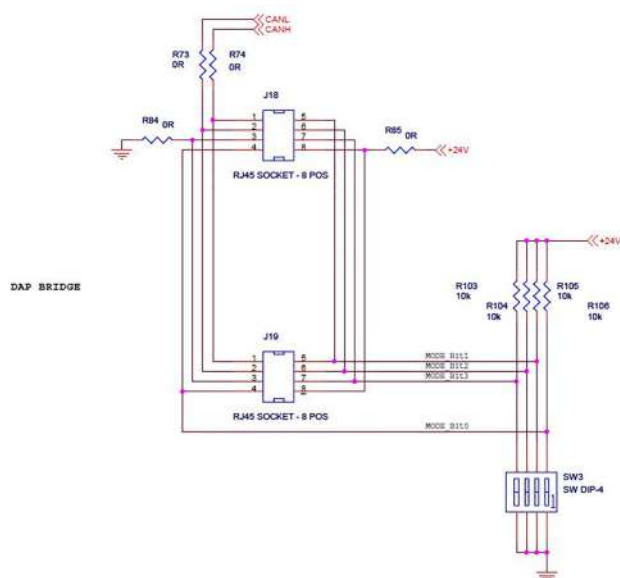


- Connect the DAP to board RSR008 and re-mount the cover in reverse order.
- Set up the SW3 dip-switch according to the DAP model.





- IBA 120-131 model: 1 and 3 dip-switch are ON (SW3)



## ELECTRICAL CONNECTION

### NOTE



THE WIRING DIAGRAM INCLUDED IN THIS DOCUMENT REFERS TO THE STANDARD PRODUCT. IT IS THE RESPONSIBILITY OF THE CUSTOMER WHO HAS REQUESTED AN ELECTRIC CUSTOMIZATION, TO ENSURE THAT AN ELECTRIC DIAGRAM RELATING TO THE CUSTOMIZATION HAS BEEN PROVIDED WITH THE DOCUMENTATION.



THE DEVICE IS PROJECTED TO OPERATE WITH A PERMANENT POWER SUPPLY PRESENT SO THE PROCEDURE OF SWITCHING OFF THE COLLIMATOR IS NOT FORESEEN. NO RISK OR DEVICE DAMAGE WILL OCCUR IF THE MACHINE IS ACCIDENTLY SWITCHED OFF.

### WARNING



THE DEVICE MUST BE EXCLUSIVELY CONNECTED TO POWER NETWORK, WITH EARTH PROTECTION, IN ORDER TO AVOID A RISK OF ELECTRICAL SHOCK.



SUPPLY AND SIGNALS TO THE COLLIMATOR MUST BE TO 2007/47/CE STANDARDS. DEVICES THAT SUPPLY THE COLLIMATOR MUST THEREFORE FEATURE DOUBLE OR REINFORCED INSULATION AS PROVIDED BY THE GENERAL STANDARD ON ELECTROMEDICAL EQUIPMENT CEI62-5 +A2 (EN 60601-1). THE DEVICE IS ELECTROSTATIC SENSITIVE, CONSEQUENTLY ALL THE RELATING SAFETY STANDARDS MUST BE COMPLIED WITH.



COLLIMATOR MUST BE SUPPLIED AS SPECIFIED, SEE CHAPTER **SPECIFICATIONS**. THE SUPPLY MUST COME FROM A SEPARATE SOURCE FROM THE POWER NETWORK THROUGH DOUBLE INSULATION OR REINFORCED INSULATION AND WITH LIMITED CURRENT. TRANSFORMER CHARACTERISTICS MUST CONFORM TO THE REQUIREMENTS OF STANDARD IEC 60601-1.




CABLES AND TERMINALS USED FOR THE INTERNAL CONNECTION OF THE COLLIMATOR MUST BE SUITABLE FOR OPERATION AT TEMPERATURES OF 80°C AND COLLIMATOR CURRENT ABSORPTION.



TO ENSURE THE SAFE USE OF THE COLLIMATOR, IT IS MANDATORY TO SECURELY AND FIRMLY INSERT THE POWER SUPPLY/DATA CABLE BETWEEN THE COLLIMATOR AND RADIOLOGICAL SYSTEM. IT IS ALSO MANDATORY THAT THE POWER SUPPLY/DATA CABLE IS CORRECTLY SECURED TO THE STRAIN RELIEF. IF THE STRAIN RELIEF IS MISSING IT IS MANDATORY ONE BE CORRECTLY AND SECURELY INSTALLED. RALCO IS NOT LIABLE FOR DAMAGES IN THE EVENT OF MISSING OR INCORRECT CABLE INSTALLATION.

### **Power Supply Connection**

- Remove the part of cover to access the terminal, see Chapter- **COVER REMOVAL**.
- Connect supply cables to the relative collimator terminals and earth on the screw marked with the relating symbol:  . Use the protective earth cable with green/yellow insulation.
- In collimators with a free cable stop, remove the cable stop, connect the supply cables, remount and then secure the cable stop.
- Remount the cover.

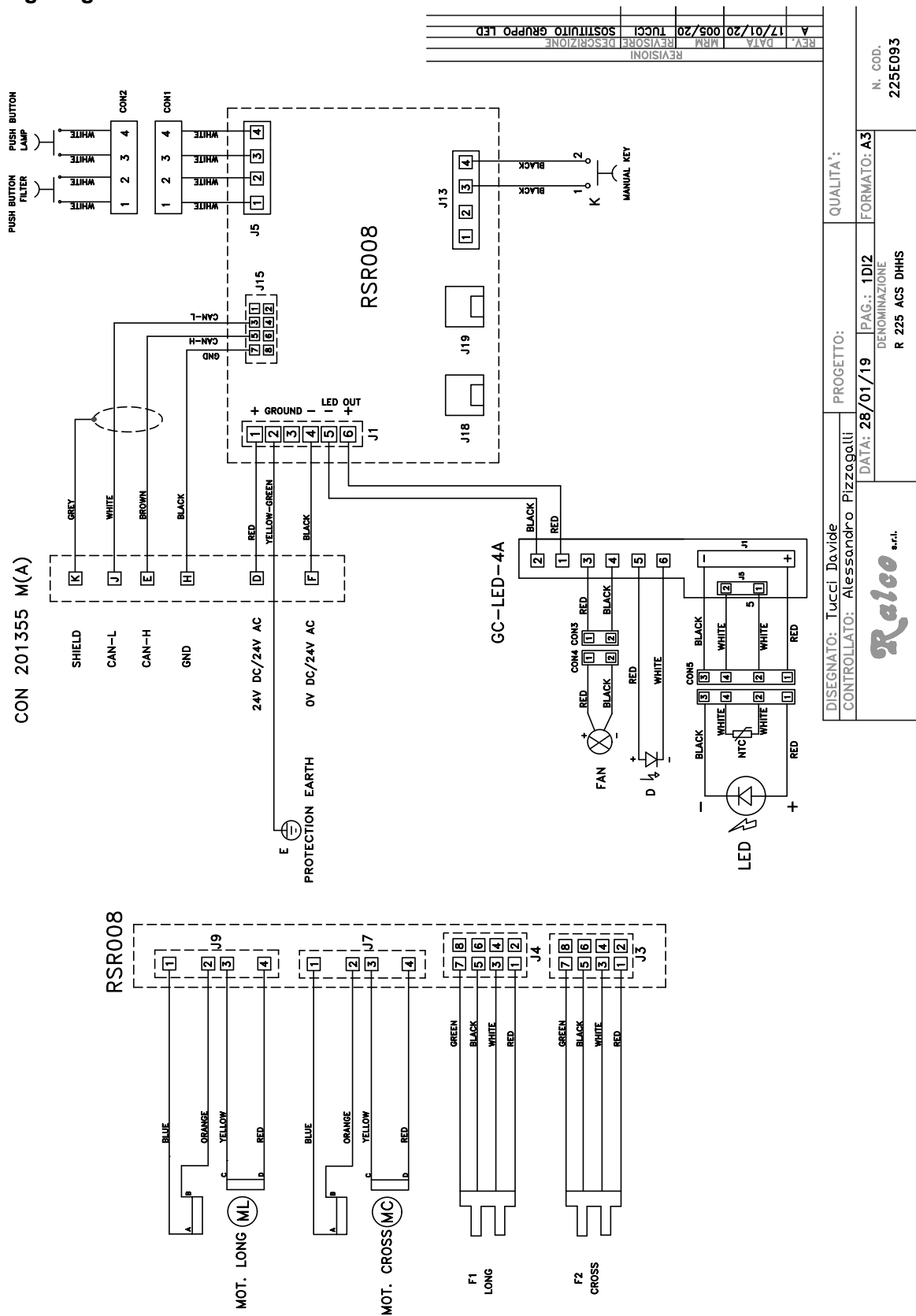
### **WARNINGS**



INCORRECT POWER SUPPLY COULD DAMAGE THE ELECTRONIC BOARDS AND/OR THE LIGHT SOURCE.  
SUPPLY MAY BE EITHER IN ALTERNATE OR DIRECT CURRENT.  
MAKE CERTAIN THAT POLARITY IS RESPECTED.

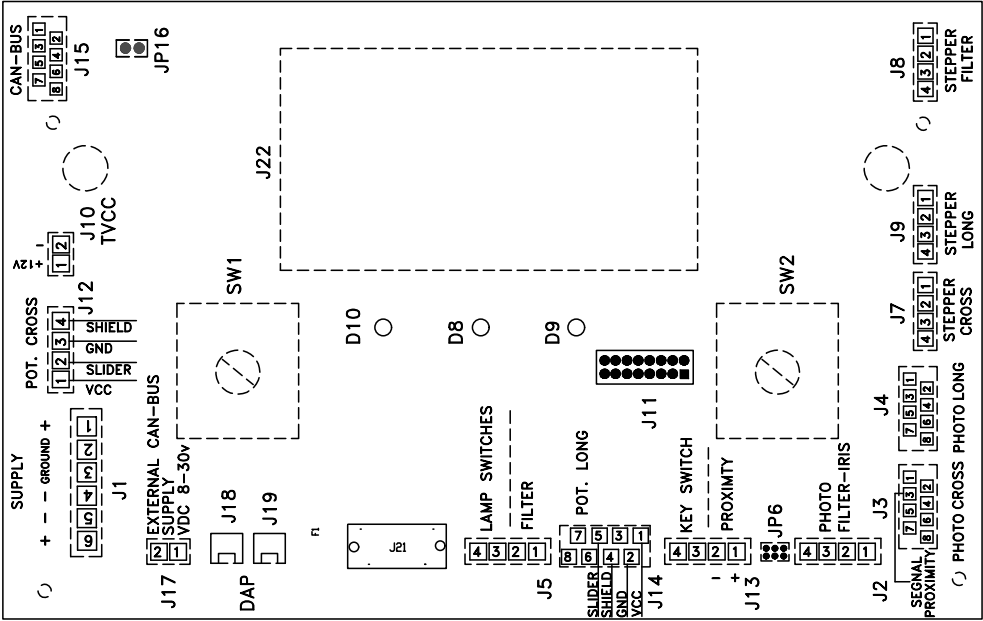
## Wiring Diagram

MTR 225 ACS - MTR 225 ACS DHHS - Installation

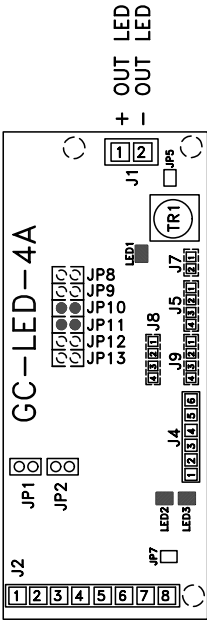


MTR 225 ACS - MTR 225 ACS DHHS - Installation

INSERT JUMPER JP16 FOR END LINE CAB-BUS

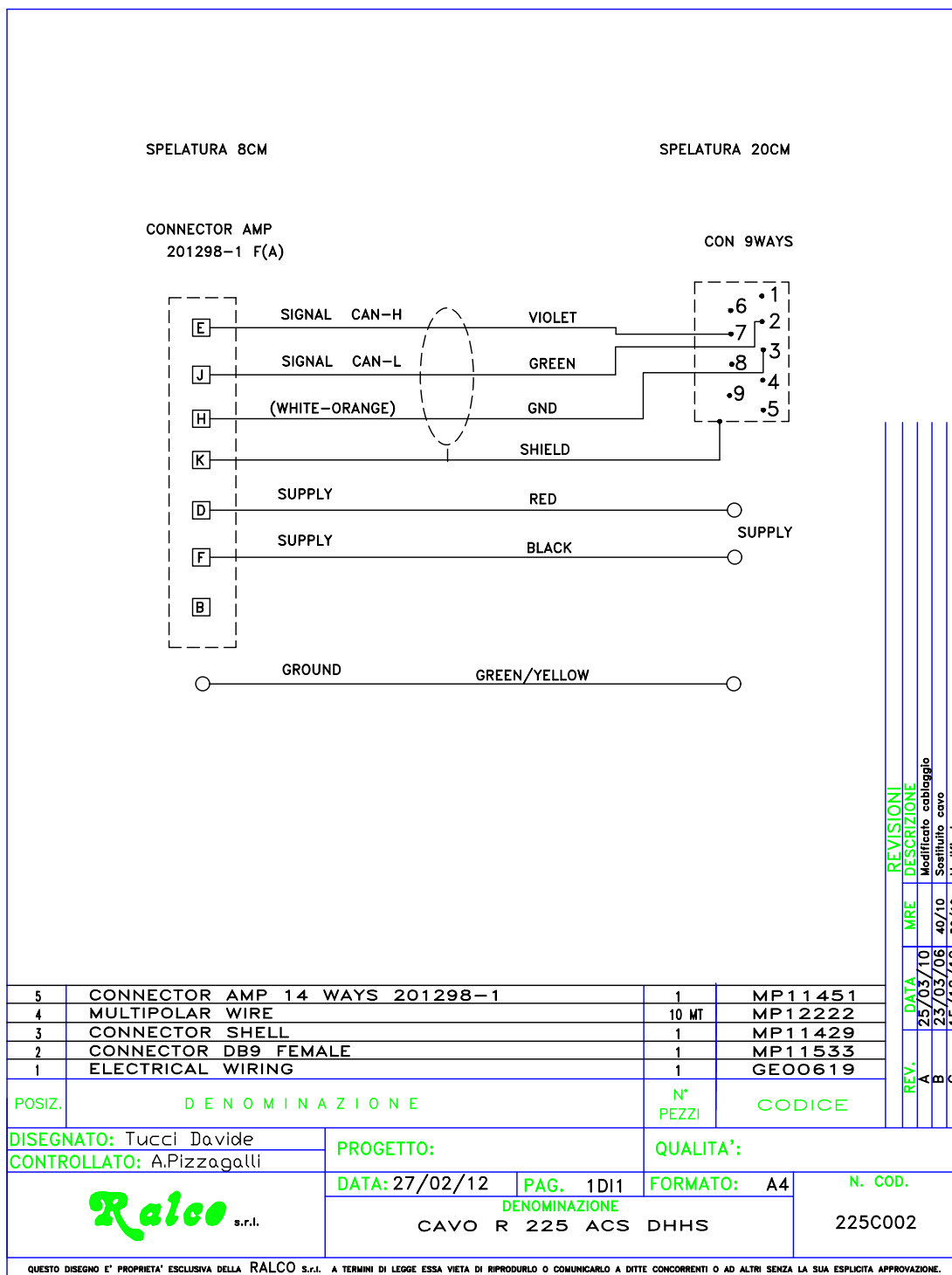


INSERT JUMPER JP10-JP11 FOR EXCLUDE TIMER



REV.	DATA	REVISIONE	DESCRIZIONE	REVISIONE	DESCRIZIONE
A	17/01/20	005/20	TUCCI	SOSTITUITO GRUPPO LED	
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## Cable



MTR 225 ACS - MTR 225 ACS DHHS - Installation

## OPERATION INSTRUCTIONS

This collimator is intended to be used for Radiography. It can be operated in automatic mode or manual mode. The following section describes generally how each mode works. This section also describes how to operate the light field.

The three different colored LEDs (red, green, and yellow) tell the user in what mode the collimator is functioning and whether any errors/dangerous operating conditions are present.

Red LED Exposure <b>HOLD</b>	<ul style="list-style-type: none"> <li>The SID in use is too short for the cassette in use; max. opening of shutters: 43x43 cm at 90 cm - i.e. the shutters are at end run but the motors are still running to attain a correct position.</li> <li>Motors are moving to their correct position.</li> </ul>
Increase <b>SID</b> Green LED <b>READY</b>	<ul style="list-style-type: none"> <li>The collimator will automatically adjust the field, etc.</li> <li>The system is ready.</li> <li>All pre-set functions are allowed.</li> <li>X-ray field not enabled.</li> <li>The system has no SID signal.</li> </ul>
Yellow LED <b>MANUAL</b>	<ul style="list-style-type: none"> <li>SID signal below or over the minimum and maximum set value.</li> <li>Collimator inclination exceeds <math>\pm 3^\circ</math>.</li> <li>Key switch (back of collimator) is turned to the Manual Mode.</li> <li>Manual Mode selected.</li> </ul>

Prior to operating the collimator, check the settings related to correct X-ray beam functions.

### NOTE



SHUTTERS CANNOT OPEN TO COVER A FIELD LARGER THAN THE SET FIELD. IF THE SYSTEM IS IN THE MANUAL MODE - LATERAL POSITION ( $\pm 90^\circ$ ), THE DISPLAY WITH READ THE LAST SID ENTERED AND THE LAST FIELD SIZE. IF THE SYSTEM IS IN A VERTICAL POSITION, THE DISPLAY WITH PROVIDE SHUTTER POSITION INDICATIONS.

## RADIOGRAPHY

### Automatic Square-Field Operation Mode (Long and Cross Shutters)

#### *Collimator in the Vertical Position*

- The collimator must be vertical,  $\pm 3^\circ$ .
- The collimator automatically sets to cassette dimension.
- The display indicates the SID selected, type of filter selected if the collimator assembles filters, Long and Cross (and iris dimensions, if the collimator assembles the round field feature).
- The green LED on the front panel serves to indicate that the unit is read.

#### **The operator can:**

- Turn the field light ON by activating the related push-button on the front panel or via the external control.
- Reduce the set field using the knobs or push-buttons on the front panel or via CanBus.
- The field may be resized within the limits of the field-size set automatically.

- If the shutters close completely, the output contact signalling "shutter closed" will be activated.
- If present, vary additional filtration by selecting the filters by activating the related push-button on the collimator front panel or via CanBus.
- Control from the collimator provides a sequential selection. CanBus control provides sequential or random filter selection.
- Vary SID selected keeping the field size automatically constant.

### **Collimator in the Lateral Position**

- The collimator must be turned left toward the lateral Bucky:  $-90^\circ$  left,  $+90^\circ$  right;  $\pm 3^\circ$ .
- One of the 5 SID lateral switch contacts must be closed.
- Left or right cassette inserted.  
The collimator automatically sets the cassette dimensions.
- The key in the vertical position.

### **The operator can:**

- Turn the light field light ON by activating the related push-button or via CanBus.
- Vary the set field size.
- Vary SID in use (selecting one of the 5 fixed SIDs) and keep the set field size automatically constant.

### **Manual Mode**

The collimator is in the manual mode if:

- The collimator is inclined at an angle exceeding  $3^\circ$  and less than  $87^\circ$ .
- Manual control is selected.
- The cassette-IN micro switch is open.
- The Bucky provides no information regarding cassette format.
- No SID signal is present.

When the system is in the Manual Mode, the yellow LED on the front panel is lit and the output contact is activated.

The x-ray contact is always closed.

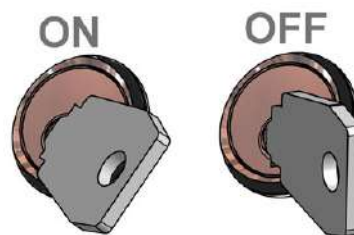
### **The operator can:**

- Turn the light field ON by pressing the related button on the front panel.
- Reduce field directly with the knobs or push-buttons related to shutter opening.
- Check on opening with the light field.
- Increase the set field with the knobs or the shutter-related knobs or push-buttons. The field may be opened to the maximum mechanical opening or, if CanBus controlled, to the setting fixed during the installation of the system.
- Check the opening with the light field or display reading.
- Vary the setting of the SID in use using push-buttons + and - on the front panel.

### **Manual Mode - Key Set**

The system is set to the Manual mode if the key switch on the rear of the collimator is turned to OFF.

- When the system is in the Manual Mode, the yellow LED on the front panel is lit and the output contact is activated.
- Display indicates the last cassette format memorised, SID and filter value.





- The X-ray contact is always closed.

**The operator can:**

- Turn the light field ON by pressing the related button on the front panel.
- Change filter position.
- Reduce the set field size directly with the knobs; the push-buttons are not enabled.

**Exposure Hold Mode (Red Light)**

The systems sets to EXPOSURE HOLD:

- In cases of incorrect operation conditions.
- When the system is in the automatic mode and the shutter motors are operating to reach the selected position.
- If the system fails to reach the selected position.
- The LED is lit and the output contact is activated.
- The exposure contact is open.

**Inclinometer HOLD Mode**

- The control to exclude the inclinometer deactivates the signals from the device for angulation detection. Consequently, the system could remain in the automatic mode even though it might not be in a vertical position. This forces the collimator to operate in a vertical position.
- The deactivation of this control causes the system not to calculate the signal from the angulation device on the PCB located within the collimator.

**Light Field Operation**

**WARNING**



PROLONGED LIGHTING WITHOUT ALLOWING THE LAMP TO COOL CAUSES THE COLLIMATOR TO OVERHEAT IN THE AREA NEAR THE LAMP.  
FOR EMERGENCIES: MAXIMUM LIMIT ADVISED IS 5 SUCCESSIVE LAMP OPERATIONS. ALLOW THE COLLIMATOR TO COOL (ABOUT 10 MIN.). THE OPERATOR MUST AVOID OVERHEATING THE COLLIMATOR AND CARE MUST BE TAKEN NOT TO SCORCH HIMSELF OR THE PATIENT.

The collimator is normally operated by activating the push-button on the front panel to switch the light field ON.

The collimator has been designed to operate as follows:

- Supply constantly connected during operation of the equipment.
- Lamp ON time: ON time is pre-set in factory to 30s (tol. 20%).
- A normal lamp ON / OFF cycle is established at 2 sequences followed by 4 minutes to allow for cooling (i.e. 1 minute ON / 4 minutes OFF).
- The field is set automatically by external electronics. For field reduction use the knobs on the front panel and check the dimension on the display or using the light field.
- The ability to make an exposure is controlled by the electronics that control the collimator. This acts as a fail safe to block any exposure if there is any problem with the collimator.

## CALIBRATION

### WARNINGS



THE FOLLOWING PROCEDURES REQUIRE THAT X-RADIATION BE PRODUCED. TAKE ADEQUATE PRECAUTIONS TO MAKE CERTAIN THAT NO PART OF THE HUMAN BODY IS EXPOSED TO X-RADIATION, DIRECT OR INDIRECT.

### CENTERING X-RAY BEAM WITH COLLIMATOR LIGHT

- Select large focus, 60 kV and 5 mAs or equivalent for digital receptor.
- Place a loaded cassette 24 x 30 cm (9.5"x 12") on the table top and prepare exposure.
- Set SID = 100 cm (40") by using a ruler.

### NOTE



IF THE DISTANCE OF 100 CM (40") SID CANNOT BE DETERMINED, USE THE SID VALUE CLOSEST TO 100 CM (40") AND CALCULATE THE MEASUREMENT TOLERANCES AS THE APPROPRIATE PERCENTAGES OF THE DISTANCE.



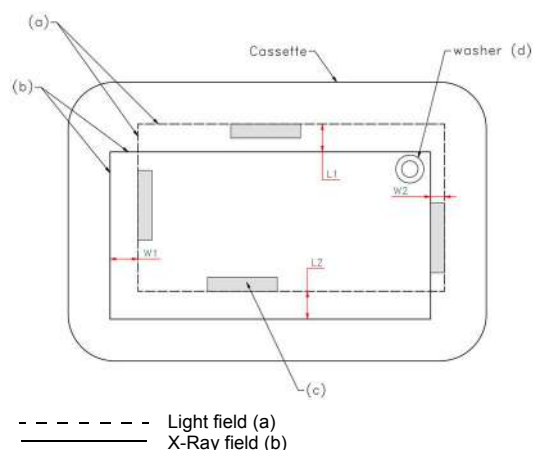
IF THE X-RAY BEAM CANNOT BE POSITIONED VERTICALLY USE CLAMPS, MASKING TAPE, OR OTHER MATERIAL AS REQUIRED TO POSITION THE X-RAY TUBE AND IMAGE RECEPTOR. THE X-RAY TUBE AND THE IMAGE RECEPTOR MUST BE SET OUT AT THE SPECIFIED SID DISTANCE PERPENDICULARLY TO THE X-RAY TUBE AS DESCRIBED IN THE FOLLOWING PROCEDURE.

### NOTE



FIGURE **CHECK LIGHT FIELD/X-RAY FIELD** SHOWS AN EXAMPLE WITH FILM CASSETTE. THE SAME PRINCIPLE CAN BE USED FOR A DIGITAL SYSTEM.

- Set field to 24 x 30 cm.
- Centre the X-ray tube on the cassette.
- Switch ON the light and place four metal strips (c) on the light field edges (a).
- Place a washer (d) on the right hand-top of the light field.
- Make an exposure.
- Develop the film or print exposure scale 1:1.
- Measure the differences L1, L2, W1 and W2 between the outer edge of each copper strips image and the corresponding edge of the X-ray Field (b).



**Fig: Check Light Field/X-ray Field**

- For required values is referred to the System Reference Manual. However, the values L1 + L2 and W1 + W2 shall NEVER exceed 2 cm (representing 2% of the SID).
- Note the measured values in Chart below.
- Repeat preceding steps with small focus selected.

SID = 100 cm (40") 2.0% x 100 cm (40") =			
LARGE FOCUS	L1+L2 W1+W2	= ..... + ..... = ..... = ..... + ..... = .....	= ≤ 2.0% SID = ≤ 2.0% SID
SMALL FOCUS	L1+L2 W1+W2	= ..... + ..... = ..... = ..... + ..... = .....	= ≤ 2.0% SID = ≤ 2.0% SID

#### CAUTION



THE HEEL EFFECT WILL CAUSE THE FIELD TOWARD THE CATHODE TO BE SLIGHTLY LESS SHARP THAN ON THE OTHER THREE SIDES. THIS IS NORMAL AND CANNOT BE CORRECTED BY ADJUSTMENT. IN ADDITION, AN X-RAY TUBE OF 12° OR LESS TARGET ANGLE WILL PRODUCE AN ASYMMETRICALLY SHAPED FIELD WHEN A LARGE FIELD SIZE IS USED AT SHORT SID, BECAUSE OF ANODE CUT-OFF EFFECT. THIS IS NORMAL AND MAY NOT BE CORRECTED BY ADJUSTMENT.

### LIGHT FIELD TO X-RAY FIELD ALIGNMENT

Misalignment of the light field/ X-ray field in either the X (cross table) or Y (long table) direction must not exceed 2% of the SID. In this case, it would be less than 20 mm (0.80"). If the test film shows that the light field (shadows of the copper strips) matches the X-ray field (shadow of the collimator shutters) to within the diameter of one strips and, if the diameter is less than 20 mm (0.80"), then alignment complies with the regulations.

Greater precision than this is possible. Recommended maximum deviation is one fourth. It is important the greatest degree of congruency possible is achieved.

If misalignment is detected in both X and Y directions, check the spacing from the focal spot to the collimator mounting surface is 80 mm (3.15") +/- 1 mm. If spacing needs to be adjusted, repeat the test film exposure after the adjustment.

If the source flange distance (**SFD**) is correct, but adjustment is still necessary proceed as follows:

- Place the test film on the face of the cassette over the white paper or repeat exposure on the flat panel.
- Place the cassette in the position originally marked.
- Check the correct position of the film or the X-ray field on the flat panel by the shadows cast by the copper strips.
- Using the images of the collimator shutters as the references for the shape and size of the X-ray field, adjust the light field to match.
- If adjustment is necessary, adjust the travel of the light source. All procedures can be found in **LIGHT FIELD ADJUSTMENTS** in this chapter.

## VERTICAL ALIGNMENT

- Remove the part of the cover necessary to access the screws, see Chapter - **COVER REMOVAL**.
- If adjustment is required loosen the two screws **C** holding the light support.
- If the light-field is smaller than the X-ray field, move away the light source by adjusting screw **D**.
- If the light-field is bigger than the X-ray field, move the light source closer by adjusting screws **D**.
- Tighten the two screws **C**. See *Fig. Light Field Adjustment*

## Longitudinal Alignment (Long)

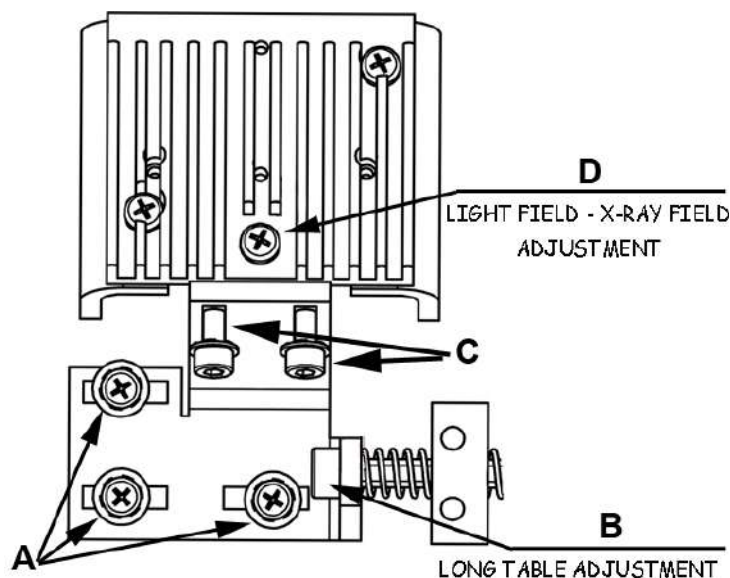
### WARNING



DO NOT TOUCH THE DISSIPATER WITH YOUR HANDS; IT COULD BE HOT AND CAUSE SEVERE BURNS.

- Remove part of the cover, see Chapter - **COVER REMOVAL**.
- If the light-field needs to be moved laterally, loosen (not remove) the fixing screws **A**.
- Use screw **B** to adjust transversely.
- When calibration is terminated, lock the screws **A**. See *Fig. Light Field Adjustment*

*Fig. Light Field Adjustment*

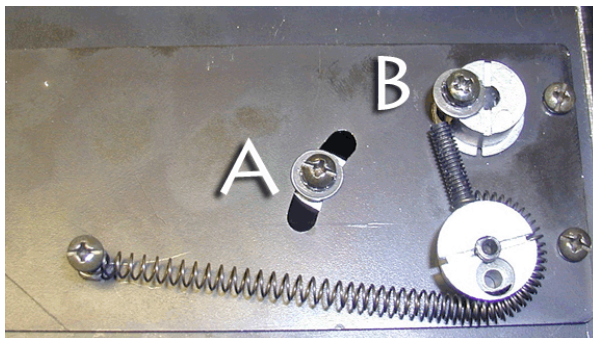


## Transversal Calibration (CROSS)

If the light-field needs calibration, the mirror needs to be adjusted as follows:

- Remove the part of the cover necessary to access the screws, see Chapter - **COVER REMOVAL**.
- Loosen the mirror fixing screw **A** (not remove) and rotate the cam **B** to adjust the position of the mirror, see *Fig. Transversal Calibration (CROSS)*.
- Once you have regulated the mirror tighten the screw **A** and remount the cover, see Chapter - **COVER REMOVAL**.

***Fig. Transversal Calibration (CROSS)***

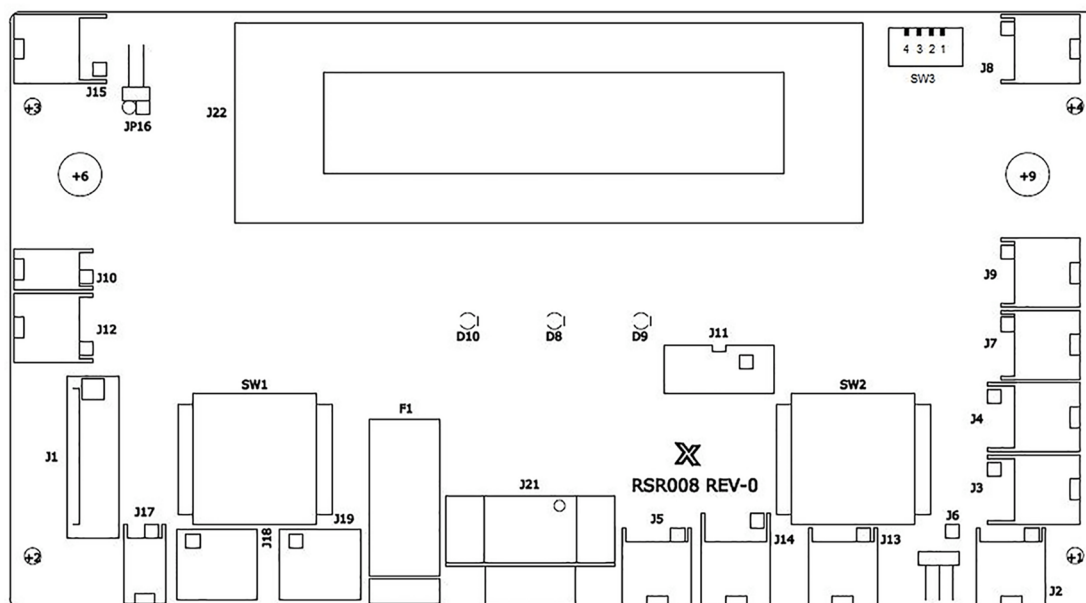


## ELECTRONIC SYSTEM

This section describes the collimator control system which includes:

- **RSR008** - Electronic board which controls two motors for Cross/Long shutter movements and one motor for filter positioning.
- **GC-LED-4A** - Timer board for light source supply and operation. The board is CanBus controlled.

### RSR008 BOARD



### Characteristics

- CanBus Interface 500 Kbit/s 11 bit.
- White LED output.
- Ionization chamber output 24 V DC.
- Cooling fan output 24 V DC.
- Supply 24 V AC/DC.
- Temperature sensor input.
- Manual control input.
- Selection of fixed times (4 light times, 4 ramp times).
- Customizable board via serial interface (TTL).
- CanBus Connector.
- Hardware streamlining to improve measurement of mains frequencies.
- Compatible with 50/60 Hz frequencies with frequency detection.

#### J1 - Supply

1. 24 V AC/DC
2. Earth
3. Earth
4. 24 V AC/DC
5. Lamp
6. Lamp

**J2 - Filter Photocell**

1. +LED Emitter
2. In Photosensor Filter
3. -LED Emitter
4. Gnd Photosensor

**J3 - Cross & Proximity Photocell**

1. +LED Emitter Cross
2. n.u. (+LED)
3. In Photosensor Cross
4. In Proximity Signal
5. -LED Emitter
6. n.u. (Gnd)
7. Gnd Photosensor Cross
8. n.u. (Gnd)

**J4 - Long Photocell**

1. +LED Emitter Long
2. n.u. (+LED)
3. In Photosensor Long
4. n.u. (In sensor)
5. -LED Emitter
6. n.u. (Gnd)
7. Gnd Photosensor Long
8. n.u. (Gnd)

**J5 - Filter and Lamp Switch**

1. In Filter Switch
2. Gnd Filter Switch
3. In Lamp Switch
4. Gnd Filter Switch

**J6 - Electronic Measuring Device**

1. Gnd
2. +5 V
4. RX
6. TX

**J7 - Cross Motor**

1. OUTB-
2. OUTB+
3. OUTA-
4. OUTA+

**J8 - Filter Motor**

1. OUTB-
2. OUTB+
3. OUTA-
4. OUTA+

**J9 - Long Motor**

1. OUTB-
2. OUTB+
3. OUTA-
4. OUTA+

**J10 - Camera Supply**

1. +12 V DC
2. Gnd

**J11 - Programming Connector**

1. +5 V DC
2. Busy
3. SCLK
4. RXD
5. CE
6. EPM
7. Gnd
8. Reset
9. CNVSS
10. TXD

**J12 - Cross Potentiometer**

1. +5 V DC (white)
2. Cursor (red)
3. Gnd (blue)
4. Gnd

**J13 - Proximity Supply & Key Input**

1. +24 V DC Proximity
2. Gnd Proximity
3. Key Input
4. Gnd Key

**J14 - Long Potentiometer**

1. +5 V DC (white)
2. Gnd (blue)
3. n.u. Laser Out +5 V
4. Gnd
5. Cursor (red)
6. Gnd
7. Out Fan +24 V
8. Gnd



**J15 - CanBus Connector**

1. +5 V DC
2. +5 V DC
3. CANL
4. CANL
5. CANH
6. CANH
7. Gnd
8. Gnd

**J17 - External CanBus Supply**

1. +8/30 V DC Can
2. Gnd Can

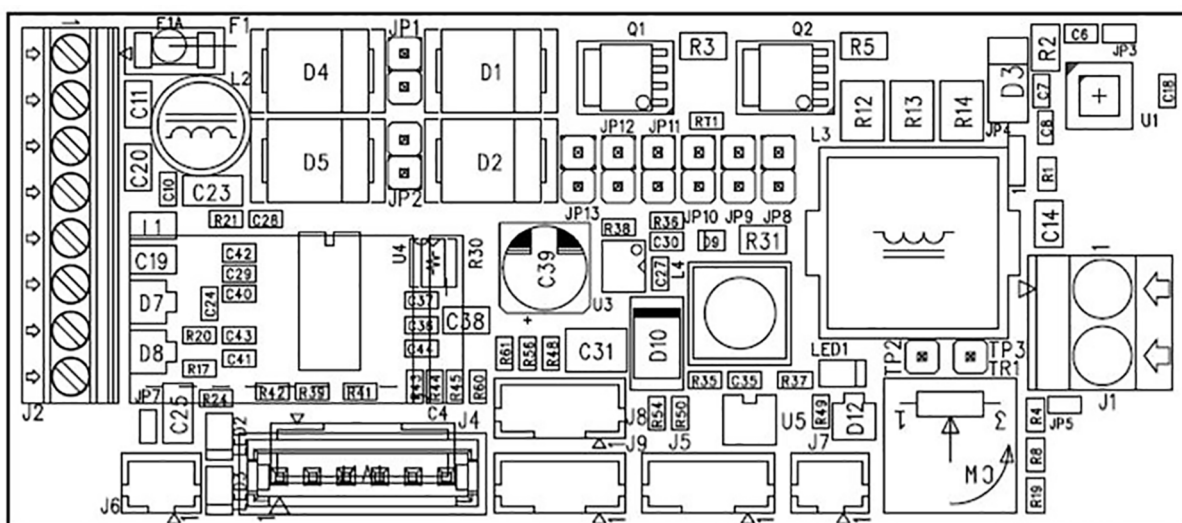
**J18,J19 - RJ45 Connectors for DAP**

1. CANH
2. CANL
3. Gnd
4. Dip-Switch 1
5. Dip-Switch 2
6. Dip-Switch 3
7. Dip-Switch 4
8. +24 V DC

**Jumper**

JP16 - CanBus termination  
OFF: CanBus not terminated  
ON: CanBus terminated with resistor 120 Ohm

**GC-LED-4A**



**Fig. Timer Board Layout**

**CONNECTORS**

<b>J2 - SUPPLY AND OUTPUTS</b>	<ol style="list-style-type: none"> <li>1. 24 V AC/DC or 12 V DC</li> <li>2. 24 V AC/DC or 12 V DC</li> <li>3. +5 V Fan</li> <li>4. GND Fan</li> <li>5. +5 V Laser</li> <li>6. GND Laser</li> <li>7. + external light push-button</li> <li>8. GND external light push-button</li> </ol>
<b>J1 - LED OUTPUT</b>	<ol style="list-style-type: none"> <li>1. + GC-LED-4A positive output</li> <li>2. - GND GC-LED-4A</li> </ol>
<b>J3 - PROGRAMMING CONNECTORS</b>	<ol style="list-style-type: none"> <li>1. Vpp</li> <li>2. +5 V</li> <li>3. GND</li> <li>4. PGD</li> <li>5. PGC</li> <li>6. NC</li> </ol>
<b>J4 - HOME SENSOR INPUT + EXTERNAL LED</b>	<ol style="list-style-type: none"> <li>1. + External LED</li> <li>2. - External LED</li> <li>3. - Photosensor LED Cathode</li> <li>4. + Photosensor LED Anode</li> <li>5. Input signal (Photosensor output collector)</li> <li>6. GND (Photosensor output emitter)</li> </ol>
<b>J5 - PUSH BUTTON INPUT + NTC EXTERNAL LED</b>	<ol style="list-style-type: none"> <li>1. NTC LED input</li> <li>2. NTC LED input</li> <li>3. Laser input, pin 1</li> <li>4. Laser input, pin 2</li> </ol>
<b>J6 - OPEN-COLLECTOR OUTPUT</b>	<ol style="list-style-type: none"> <li>1. +5 V</li> <li>1. GND</li> </ol>
<b>J7 - OPEN-COLLECTOR (ABNORMAL OPERATION MANAGEMENT)</b>	<ol style="list-style-type: none"> <li>1. +</li> <li>2. -</li> </ol>
<b>J8 - J9 - ENCODER</b> (By connecting an opto-switch it is possible to switch ON the light when the shutter move) **The encoder reading is available for s.w. 2.00 and 5.00	<ol style="list-style-type: none"> <li>1. +LED</li> <li>2. IN</li> <li>3. GND</li> <li>4. GND</li> </ol>
<b>Jumpers</b>	OFF: without jumper ON: with jumper
<b>JP1, JP2 - ALTERNATE/DIRECT POWER SUPPLY</b>	OFF: alternate power supply ON: direct power supply (pay attention to polarity)
<b>JP5 - LED POWER SUPPLY UP TO 6.2 A (STANDARD SETTING 4 A)</b>	OFF: LED power supply is adjustable through trimmer to max. 4.8 A ON: LED power supply is adjustable through trimmer to max. 6.2 A

<b>JP14 - ADDITIONAL RESISTANCE</b>	<p>OFF: standard input</p> <p>ON: used to power a retro-reflective photocell</p>
<b>JP8, JP9, JP10, JP11, JP12, JP13 - Operation mode selection</b>	
<b>JP8 - TIME RENEW MODE</b>	<p>OFF: Standard</p> <p>ON: the timer operates in the time renew mode. When the button is pressed the time is renewed without the LED OFF (if the LED is already ON, continues to stay ON but with renewed time). The same is applicable for the laser if is independent.</p>
<b>JP9 - LASER CONTROLLED INDEPENDENTLY</b>	<p>OFF: Standard</p> <p>ON: When the button, placed on J5, is pressed the laser switches ON independently from the light.</p>
<b>JP11, JP10* - TIME MANAGEMENT</b> * Only in mode 4.00 JP10 takes the function of exclusion of auto-turning off LED (designed for temperature) <b>JP10 - AUTO-SHUTDOWN EXCLUSION</b>	<p>OFF, OFF: 30 seconds</p> <p>ON, OFF: 45 seconds</p> <p>OFF, ON: 60 seconds</p> <p>ON, ON: power supply (maximum light ON time is 15 min. for safety reasons).</p> <p>JP10 - LED auto shutdown exclusion, available in s.w. 4.00 only</p>
<b>JP12, JP13 - SOFTWARE CONFIGURATION</b>	<p>OFF, OFF: s.w.2.00 (standard) - it is possible to use the encoder management to switch ON/OFF the laser and LED</p> <p>ON, OFF: s.w.3.01 - power supply without any safety and shutdown time.</p> <p>OFF, ON: s.w.5.00 with the LED off, pressing the button only turns on the LED and the fan.</p> <p>If the button is pressed again within 5 seconds, the laser also lights up. Pushing the button after the first 5 seconds, everything will switch off. The LED and eventually the laser switch off anyway when the time set with the trimmer has set</p> <p>(in this mode it is possible to use the encoder management to switch on light / laser).</p> <p>ON, ON: s.w.4.00 (following the button, the switching on of the board is controlled by closing the contact)</p> <p>If the board is configured as JP8 standard:</p> <p>OFF:( pushing the button the status will change) (if on will switch off and the other way around)</p> <p>ON: The board works in renewal time mode. In this mode, each time the button is pressed, the ignition time is renewed without switching off the light.</p> <p>If the light is already on, it continues to stay on but with renewed time. Also applies to the laser if independent</p>
<b>FAN</b>	<p>The fan switches ON together with the LED, and operates 15 seconds longer after the LED OFF.</p>
<b>Trimmers</b>	
<b>TR1- CURRENT CONTROL</b>	<p>Adjust the output current intensity to the LED.</p> <p>Step-less current adjustment from 0 to 4.8 A.</p> <p>-&gt; Luxeon V LED - adjust current to ~ 2.2 A.</p>
<b>LEDs</b>	

<b>GREEN LED 1</b>	Power supply + 5 V
<b>YELLOW LED 2</b>	Indicates software version: 1 blink = standard sw 2 blinks = 3.01 sw 3 blinks = 5.00 sw 4 blinks = 4.00 LED 2 will stop blinking if LED 3 is ON.
<b>LED 3 - ALARMS</b>	Indicates an alarm type Switch OFF - OK 1 blink = LED disconnected or faulty driver 2 blinks = LED short-circuited 3 blinks = Fan failure or disconnected 4 blinks = Laser failure or disconnected 5 blinks = Push button pressed longer than 5 seconds or short-circuited 6 blinks = Timer temperature >105° 7 blinks = LED temperature >110°
<b>ALARM DIAGNOSTIC</b>	

The timer identifies anomalies/errors/malfunctions. The outgoing messages from J7 are managed and interpreted by "intelligent board"

**bit** = 10 ms

**byte:**

1 bit sync (1)

8 bit data - transmission bit L....H

1 bit stop (0)

Output status:

0 = output disabled

1 = output enabled

BYTE 1: firmware version

BYTE 2: firmware mode + jumper status

bit7: firmware mode bit 1

bit6: firmware mode bit 0

bit5: JP13

bit4: JP12

bit3: JP11

bit2: JP10

bit1: JP9

bit0: JP8

BYTE 3: input/output status

bit7: 1 = LED push button pressed

bit6: 1 = Laser push button pressed

bit5: 1 = ENC1 input activated

bit4: 1 = ENC2 input activated

bit3: 1 = O.C. output activated

bit2: 1 = Laser ON

bit1: 1 = Fan ON

bit0: 1 = LED ON

BYTE 4: alarms:

bit7:

bit6: High LED temperature

bit5: High timer temperature

bit4: Push button pressed more than 5 seconds

bit3: Laser error

bit2: Fan error

bit1: LED short-circuited

bit0: LED disconnected or faulty driver

## SYSTEM START-UP

On system power-up, board RSR008 software performs a series of internal self-tests aimed at self-assessment. Depending on the position of the key at the back of the collimator, the automatic or manual control phase will initiate on receipt of CanBus controls.

The display will then read the following information:

**R 2 2 5 A C S C o l l i m a t o r**

Serial Number 12345

Where 12345 stands for the serial number (see programming of serial number)

In the normal mode, HW and SW versions of the board RSR008 will be displayed:

**RSR008**  
**H w 0 . 0 0 S w 0 . 0 0**

The display will then provide current collimator functional parameters:

 **C R O S S 0 L O N G 0**  
**S I D 0**

Current filtering level will be shown if a four-position radiological filter (0 Al) is in place:

 **C R O S S 0 L O N G 0**  
**S I D 0 0 A L**

### NOTE



THE SYSTEM MAY BE PROGRAMMED TO DISPLAY THE KEY STATUS.  
IN THIS CASE, THE SECOND LINE WILL DISPLAY A "CLOSED PADLOCK" IF THE  
KEY IS IN THE "AUTOMATIC" MODE AND AN "OPEN PADLOCK" IF THE KEY IS  
IN THE MANUAL MODE.

If the operator wishes to configure the system to different requirements, the "configuration" mode must be initiated by keeping pressed "filter" and "lamp" push button while turning the system ON.



Current CanBus communication speed is displayed; this value may be changed.

**BOARD CONFIGURATION**  
**Can Speed 500 kBits/s**

followed by:

**W a i t C o m m a n d.....**

The operator may send the CanBus strings to perform collimator configuration. Configuration parameters and relative strings are described in the following paragraph.

## DESCRIPTION OF CONFIGURATION CONTROLS

The collimator configuration is performed by sending CAN Bus messages to ID 0x600, DLC=8.

### Data Writing

Send the message using ID=0x600 as shown in the below chart "CanBus Messages".

### Data Reading

Send the message using ID=0x601 and D0 with a number as shown in the below chart. The collimator will reply through ID=0x602 message using formatted data according to the below chart.

Note: Byte D1 and D2 must be specified if the subcontrol 0x38 is required.

For each sent control the operator will get feedback on the display, therefore, it will be possible to check the correctness of the configuration.

A Warning will be displayed in the event of an error message.

### NOTE



TO SET THE MAXIMUM CROSS AND LONG OPENING, SEND THE VALUE IN MM EXPRESSED IN A 16 BIT NUMBER, EG:

430 MM CORRESPOND TO: 0x01 0xAE

250 MM CORRESPOND TO: 0x00 0xFA

## UPDATING OF FIRMWARE

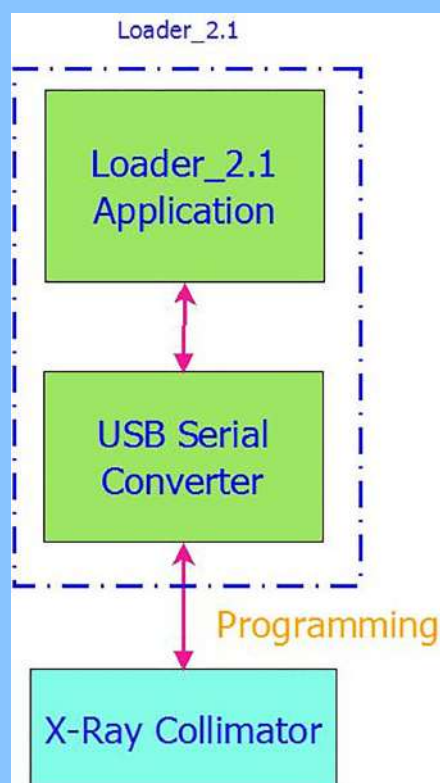
### NOTE



FIRMWARE VERSIONS ARE UPDATED WITH LOADER.EXE PROGRAM SUPPLIED BY RALCO SRL.

### Functional Overview

The Loader\_2.1 is a Hardware + Software tool used to directly connect the USB Serial Converter to the X-Ray collimator and to configure X-Ray Collimator parameters according to RALCO CAN communication protocol.



### Bill of Material

The Loader\_2.1 tool requires the following items:

- Loader\_2.1 Application Program.
- USB Serial Converter.





## Installation

### USB Serial Converter

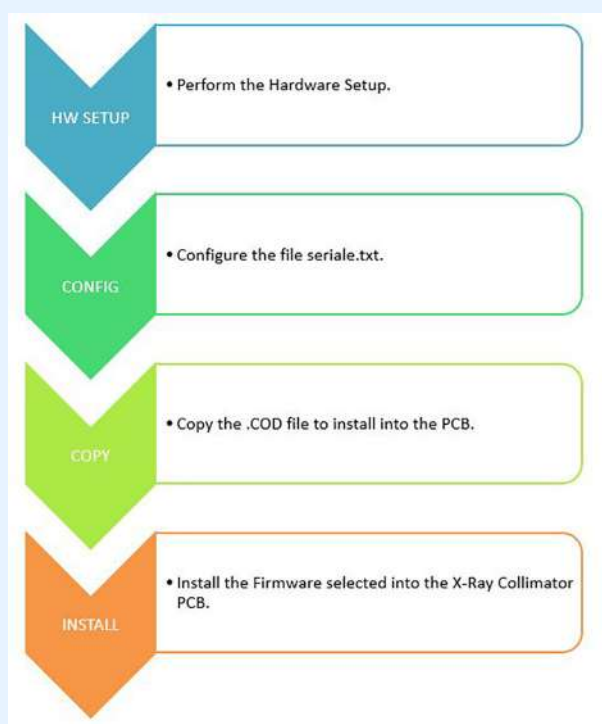
In order to install the USB Serial Converter, it's enough to connect it to the PC, and it will be automatically recognized as a serial port.

### Loader\_2.1 Application Program

In order to install the Loader\_2.1 Application Program, simply unzip the .rar archive provided by RALCO into the selected folder.

## Workflow

Following the detailed workflow.



## HW Setup

connect the USB Serial Converter adapter to the PC and to the Serial Port placed into the RSR008 PCB (visible by unmounting the XRay Collimator front panel).

Connect the X-Ray Collimator to the power supply but keep it still powered OFF.

## Config

Into the main folder of the Loader\_2.1 Application program there is the file `seriale.txt`.

Such file is used by the program to set the following configurations:

1. COM Port Number : it's the number of the COM port to use. Such number shall match exactly the number of the COM port



2. detected by the Operating System.

For instance, if Windows configures the USB Serial converter as COM5 (see image below).

The file `seriale.txt` shall be modified as follows:

COM = 5

BAUD\_RATE = 115200

3. COM Baud Rate : it's the baud rate used for the file transferring procedure. (that is equal to 115200kHz for the X-Ray Collimators).

## Copy

Copy the .COD file into the same folder where are stored both `Loader_2.1.exe` and `seriale.txt` files.

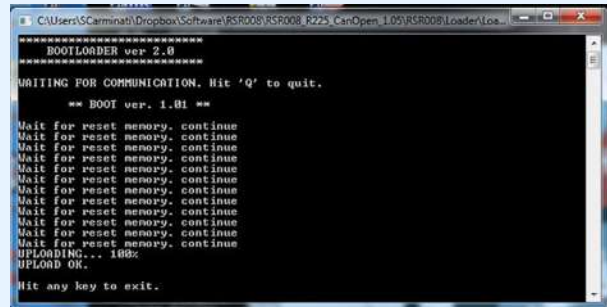
Such file contains the Firmware to upgrade into the X-Ray Collimator.

Important note:

Use only .COD firmware files provided and approved by RALCO S.r.l. Any other file different from these ones can be responsible of a malfunctioning of the collimator.

## Firmware Upload Complete

When the X-Ray Collimator upload is completed, the tool retrieves the proper status message.



## Issues List

1. Fail to open COM port.



- the serial.txt file has not been properly configured.
- the USB Serial Converter is not correctly connected both to the PC and / or to the X-Ray Collimator Serial Port.

## 2. Firmware Upload does not start.



Possible Root Causes of the problem:

- The Bootloader is not installed on the RSR008 PCB.
- The X-Ray Collimator is not powered on.
- The RSR008 PCB is defective or broken.
- There are more than one COM devices active on the PC, and the Loader\_2.1 application program is trying to upload the firmware on the wrong one.

#### Configuration via Serial Interface

Configuration of the collimator via serial interface is performed in Ralco with updated software; the customer will be required to load the software as described in the preceding paragraph.

#### POTENTIOMETER POSITIONING ALARMS

The alarm may be enabled in message 0x100 (0x7 D0) through 0x600 entering control 0x33 in the configuration phase.

This message includes the control bytes for potentiometer positioning alarms.

When the collimator activates a movement alarm, the system will read the collimator alarm state through message 0x100 and the number of alarms activated from start-up.

The red LED, Exposure Hold, on the collimator front panel flashes to indicate an alarm state.

#### **Alarm State Reset**

Turn the collimator key from automatic to manual. This will reset the shutters and Iris if assembled.

# CANSYSTEM RALCO R 225 ACS

Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Config	0x600	8	0	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	Requires to the Collimator to visualize on the LCD display the string "RS232COMM".	1.00
Tx_Config	0x600	8	0	0x01	MSB_SerialNr	CSB_SerialNr	CSB_SerialNr	CSB_SerialNr	LSB_SerialNr	0x00	0x00	Store into the RSR008 Flash Memory the X-Ray Collimator serial number with the provided value.	1.00
Tx_Config	0x600	8	0	0x02	Coll_Language	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator language displayed on the LCD screen with the provided setting value. Coll_Language : 0x01 = Italian. Coll_Language : 0x02 = English. (default)	1.00
Tx_Config	0x600	8	0	0x03	Meas_Unit	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator measurement unit displayed on the LCD screen with the provided setting value. Meas_Unit : 0x01 = Metric System. (default) Meas_Unit : 0x02 = Imperial System.	1.00
Tx_Config	0x600	8	0	0x04	Show_SID	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator SID visualization displayed on the LCD screen with the provided setting value. Show_SID : 0x00 = The LCD screen does not displays the SID value. Show_SID : 0x01 = The LCD screen displays the SID value. (default)	1.00
Tx_Config	0x600	8	0	0x05	SFW_Installed	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator spectral filter wheel with the provided setting value. SFW_Installed : 0x00 = The X-Ray Collimator does not have the spectral filter wheel installed. (default) SFW_Installed : 0x01 = The X-Ray Collimator includes the spectral filter wheel.	1.00
Tx_Config	0x600	8	0	0x06	SFW_TickType	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator spectral filter wheel thickness with the provided setting value. SFW_TickType : 0x01 = The X-Ray Collimator spectral filter wheel thickness is 1mm Al. SFW_TickType : 0x02 = The X-Ray Collimator spectral filter wheel thickness is 2mm Al. (default) SFW_TickType : 0x03 = The X-Ray Collimator spectral filter wheel thickness is 0.3mm Cu. SFW_TickType : 0x04 = The X-Ray Collimator spectral filter wheel thickness is custom.	1.00

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Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Config	0x600	8	0	0x07	AutoLight	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator light automatic ignition with the provided setting value. AutoLight : 0x00 = The X-Ray Collimator light is not automatically ignited while moving knobs. AutoLight : 0x01 = The X-Ray Collimator light is automatically ignited while moving knobs.	1.00
Tx_Config	0x600	8	0	0x08	Incl_Installed	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator inclinometer with the provided setting value. Incl_Installed : 0x00 = The X-Ray Collimator does not have the inclinometer installed. (default) Incl_Installed : 0x01 = The X-Ray Collimator includes the inclinometer.	1.00
Tx_Config	0x600	8	0	0x09	SquaredAutoLimits	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator automatic limits of the squared field with the provided setting value. SquaredAutoLimits : 0x00 = The X-Ray Collimator does not have the automatic limits of the squared field configured. (default) SquaredAutoLimits : 0x01 = The X-Ray Collimator has the automatic limits of the squared field configured. (default)	1.00
Tx_Config	0x600	8	0	0x0A	LeftSIDType	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator such that the left side SID value is set according to the provided setting value. LeftSIDType : 0x01 = The X-Ray Collimator left side SID set with CAN messages. (default) LeftSIDType : 0x02 = The X-Ray Collimator left side SID set with discreet input values. LeftSIDType : 0x03 = The X-Ray Collimator left side SID set with values retrieved by the potentiometer.	2.08
Tx_Config	0x600	8	0	0x0B	LeftReceptorType	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator such that the left receptor is set according to the provided setting value. LeftReceptorType : 0x00 = The X-Ray Collimator left receptor is not installed. LeftReceptorType : 0x01 = The X-Ray Collimator left receptor is set with CAN messages (default). LeftReceptorType : 0x02 = The X-Ray Collimator left receptor is set with values retrieved by the bucky.	1.00

Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Config	0x600	8	0	0x0C	RightReceptorType	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator such that the right receptor is set according to the provided setting value. RightReceptorType : 0x00 = The X-Ray Collimator right receptor is not installed. RightReceptorType : 0x01 = The X-Ray Collimator right receptor is set with CAN messages (default). RightReceptorType : 0x02 = The X-Ray Collimator right receptor is set with values retrieved by the bucky.	1.00
Tx_Config	0x600	8	0	0x0D	VertSIDType	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator such that the vertical SID value is set according to the provided setting value. VertSIDType : 0x01 = The X-Ray Collimator left side SID set with CAN messages. (default) VertSIDType : 0x02 = The X-Ray Collimator left side SID set with a constant value. VertSIDType : 0x03 = The X-Ray Collimator left side SID set with a single input value. VertSIDType : 0x04 = The X-Ray Collimator left side SID set with a differential input value.	1.00
Tx_Config	0x600	8	0	0x0E	VertReceptorType	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator such that the vertical receptor is set according to the provided setting value. VertReceptorType : 0x00 = The X-Ray Collimator right receptor is not installed. VertReceptorType : 0x01 = The X-Ray Collimator right receptor is set with CAN messages (default). VertReceptorType : 0x02 = The X-Ray Collimator right receptor is set according to ATS specifications. VertReceptorType : 0x03 = The X-Ray Collimator right receptor is set with values retrieved by the bucky. VertReceptorType : 0x04 = The X-Ray Collimator right receptor is set with fixed formats values retrieved by the firmware.	2.08
Tx_Config	0x600	8	0	0x0F	LSB_FixedSIDValue	MSB_FixedSIDValue	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator fixed SID (Source Image Distance) with the provided setting value defined with bytes [MSB_FixedSIDValue; LSB_FixedSIDValue]. FixedSIDValue : 100 cm (default) FixedSIDValue eligible range of values : [50;300]cm	2.06

Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Config	0x600	8	0	0x10	LSB_MaxFixedSIDValue	MSB_MaxFixedSIDValue	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator maximum fixed SID (Source Image Distance) with the provided setting value defined with bytes [MSB_MaxFixedSIDValue; LSB_MaxFixedSIDValue]. MaxFixedSIDValue : 180 cm (default) MaxFixedSIDValue eligible range of values : [50;300]cm	2.06
Tx_Config	0x600	8	0	0x11	LSB_MinFixedSIDValue	MSB_MinFixedSIDValue	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator minimum fixed SID (Source Image Distance) with the provided setting value defined with bytes [MSB_MinFixedSIDValue; LSB_MinFixedSIDValue]. MinFixedSIDValue : 80 cm (default) MinFixedSIDValue eligible range of values : [50;300]cm	2.06
Tx_Config	0x600	8	0	0x12	VertSTD	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator vertical STD (Source Table Distance) with the provided setting value. VertSTD : 0 cm (default) VertSTD eligible range of values : [0;15]cm	2.08
Tx_Config	0x600	8	0	0x13	InclAlarmThreshold	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator inclinometer alarm threshold with the provided setting value. InclAlarmThreshold : 3° (default) InclAlarmThreshold eligible range of values : [0;15]°	1.00
Tx_Config	0x600	8	0	0x14	SFW_RetToZero	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator return to zero configuration of the spectral filter wheel with the provided setting value. SFW_RetToZero : 0x00 = The spectral filter wheel does not return to the zero position before reaching the target position. (default) SFW_RetToZero : 0x01 = The spectral filter wheel returns to the zero position before reaching the target position.	1.00
Tx_Config	0x600	8	0	0x15	Show_KeyLock	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator key lock icon visualization displayed on the LCD screen with the provided setting value. Show_KeyLock : 0x00 = The LCD screen does not displays the key lock icon. Show_KeyLock : 0x01 = The LCD screen displays the key lock icon. (default)	1.00



Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Config	0x600	8	0	0x16	Show_InclAngle	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator incline angle visualization displayed on the LCD screen with the provided setting value. Show_KeyLock : 0x00 = The LCD screen does not displays the incline angle value. Show_KeyLock : 0x01 = The LCD screen displays the key incline angle value. (default)	1.00
Tx_Config	0x600	8	0	0x17	SqrdField_RetToZero	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator return to zero configuration of the squared field with the provided setting value. SqrdField_RetToZero : 0x00 = Shutters do not return to the 0x0 position before reaching the target position. (default) SqrdField_RetToZero : 0x01 = Shutters return to the 0x0 position before reaching the target position..	1.00
Tx_Config	0x600	8	0	0x18	0x01	Side	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator such that it will automatically retrieve offset inclinometer data values for the selected side. (the side is the same as the lexan one) Side : 0x00 = offset inclinometer data values retrieved for the vertical side. Side : 0x01 = offset inclinometer data values retrieved for the right side. Side : 0x02 = offset inclinometer data values retrieved for the left side.	2.18
Tx_Config	0x600	8	0	0x18	0x02	Side	MSB_InclValue	CSB_InclValue	CSB_InclValue	LSB_InclValue	0x00	Configure the X-Ray Collimator offset inclinometer for the selected side with provided setting values. Side : 0x00 = offset inclinometer data values retrieved for the vertical side. Side : 0x01 = offset inclinometer data values retrieved for the right side. Side : 0x02 = offset inclinometer data values retrieved for the left side.	2.18
Tx_Config	0x600	8	0	0x19	CrossSteps	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator Cross shutter manual regulation steps with the provided setting value. CrossSteps : 0x0A. (default) CrossSteps eligible range of values : [1;20]mm	1.00
Tx_Config	0x600	8	0	0x1A	LongSteps	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator Long shutter manual regulation steps with the provided setting value. LongSteps : 0x0A. (default) LongSteps eligible range of values : [1;20]mm	1.00

Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Config	0x600	8	0	0x1B	CrossCorrection	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator Cross shutter opening adjustment with the provided setting value. Such configuration depends on the 0x42 Configuration setting: If 0x42 config. Setting = 0x01 : Cross opening adjustment eligible range : [-25;25]cm on SID value. If 0x42 config. Setting = 0x02 : Cross opening adjustment eligible range : [-10.0;+10.0]% on Cross shutters actual opening value.	1.15
Tx_Config	0x600	8	0	0x1C	LongCorrection	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator Long shutter opening adjustment with the provided setting value. Such configuration depends on the 0x42 Configuration setting: If 0x42 config. Setting = 0x01 : Long opening adjustment eligible range : [-25;25]cm on SID value. If 0x42 config. Setting = 0x02 : Long opening adjustment eligible range : [-10.0;+10.0]% on Long shutters actual opening value.	1.15
Tx_Config	0x600	8	0	0x1D	DisplayVisualType	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator data organization displayed on the LCD screen with the provided setting value. DisplayVisualType : 0x01 = Data displayed on the LCD according to Standard configuration. (default) DisplayVisualType : 0x02 = Data displayed on the LCD according to Sedecal configuration. DisplayVisualType : 0x03 = Data displayed on the LCD according to Open configuration.	1.00
Tx_Config	0x600	8	0	0x1E	MSB_MaxCrossOpeningValue	LSB_MaxCrossOpeningValue	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator maximum opening value for Cross shutters with the provided setting value. MaxCrossOpeningValue : 430mm. (default) MaxCrossOpeningValue eligible range of values : [0;500]mm	1.00
Tx_Config	0x600	8	0	0x1F	MSB_MaxLongOpeningValue	LSB_MaxLongOpeningValue	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator maximum opening value for Long shutters with the provided setting value. MaxLongOpeningValue : 430mm. (default) MaxLongOpeningValue eligible range of values : [0;500]mm	1.00

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Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Config	0x600	8	0	0x20	EncodersSensitivity	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator encoders sensitivity with the provided setting value. EncodersSensitivity : 25ms. (default) EncodersSensitivity eligible range of values : [0;250]ms	1.00
Tx_Config	0x600	8	0	0x21	EncodersInversionSensitivity	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator encoders inversion sensitivity with the provided setting value. EncodersInversionSensitivity : 25ms. (default) EncodersInversionSensitivity eligible range of values : [0;250]ms	1.00
Tx_Config	0x600	8	0	0x22	ShuttersConfiguration	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator shutters configuration with the provided setting value. ShuttersConfiguration = 0x00 : Cross and Long shutters are configured according to technical drawing. (default) ShuttersConfiguration= 0x01 : Cross and Long shutters are configured swapped compared to technical drawing.	1.00
Tx_Config	0x600	8	0	0x23	CollCommProtocol	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator communication protocol with the provided setting value. CollCommProtocol= 0x01 : the X-Ray Collimator operates with the Standard Communication Protocol. (default) CollCommProtocol= 0x02 : the X-Ray Collimator operates with the Sedecal Communication Protocol. CollCommProtocol= 0x03 : the X-Ray Collimator operates with the GMM Communication Protocol.	1.00
Tx_Config	0x600	8	0	0x24	BaudRate	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator Baud Rate with the provided setting value. BaudRate= 0x01 : the X-Ray Collimator operates with a Baud Rate of 1Mbit/s. BaudRate= 0x02 : the X-Ray Collimator operates with a Baud Rate of 500kbit/s. BaudRate= 0x03 : the X-Ray Collimator operates with a Baud Rate of 250kbit/s. BaudRate= 0x04 : the X-Ray Collimator operates with a Baud Rate of 125kbit/s. BaudRate= 0x05 : the X-Ray Collimator operates with a Baud Rate of 100kbit/s. BaudRate= 0x06 : the X-Ray Collimator operates with a Baud Rate of 50kbit/s. BaudRate= 0x07 : the X-Ray Collimator operates with a Baud Rate of 20kbit/s. BaudRate= 0x08 : the X-Ray Collimator operates with a Baud Rate of 10kbit/s.	1.00

Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Config	0x600	8	0	0x28	MSB_SFW_StepsPosition	LSB_SFW_StepsPosition	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator number of steps that the spectral filter wheel needs to perform in order to reach each position with the provided setting value. StepsPosition : 4262. (default) StepsPosition eligible range of values : [0;12000]	1.00
Tx_Config	0x600	8	0	0x29	AnalogInputUsage	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator analog input with the provided setting value. AnalogInputUsage = 0x01 : the RSR008 Analog Input is used for the proximity sensor. (default) AnalogInputUsage = 0x02 : the RSR008 Analog Input is not used.	1.00
Tx_Config	0x600	8	0	0x2A	MSB_CommandID	LSB_CommandID	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator command message ID with the provided setting value. CommandID : 0x7A0. (default) CommandID eligible range of values : [0x000;0x7F0]	1.00
Tx_Config	0x600	8	0	0x2B	MSB_FAST_ShutMaxFreq	LSB_FAST_ShutMaxFreq	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator maximum frequency of shutters (when they operate in FAST mode) with the provided setting value. ShutMaxFreq : 6000 (Hz) ShutMaxFreq eligible range of values : [500;7000]Hz	1.02
Tx_Config	0x600	8	0	0x2C	MSB_MaxSteps	LSB_MaxSteps	MSB_RefSize	LSB_RefSize	MSB_RefSteps	LSB_RefSteps	0x00	Configure the X-Ray Collimator calibration values (Maximum number of steps, Reference Size, Reference Steps number ) for the Cross shutter with the provided setting values. MaxSteps : 7050. RefSize : 495. RefStep : 7050.	1.05
Tx_Config	0x600	8	0	0x2D	MSB_MaxSteps	LSB_MaxSteps	MSB_RefSize	LSB_RefSize	MSB_RefSteps	LSB_RefSteps	0x00	Configure the X-Ray Collimator calibration values (Maximum number of steps, Reference Size, Reference Steps number ) for the Long shutter with the provided setting values. MaxSteps : 5540. RefSize : 495. RefStep : 5540.	1.05
Tx_Config	0x600	8	0	0x2E	MSB_RotCommandID	LSB_RotCommandID	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator rotative board ID with the provided setting value. RotCommandID : 0x740. (default) CommandID eligible range of values : [0x000;0x7F0]	1.00

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Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Config	0x600	8	0	0x2F	SpectralFilterType	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator spectral filter wheel type with the provided setting value. SpectralFilterType = 0x01 : on the collimator is installed the 1-HOLE spectral filter wheel. SpectralFilterType = 0x02 : on the collimator is installed the 5-HOLES spectral filter wheel.(default)	1.10
Tx_Config	0x600	8	0	0x30	PotInstalled	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator potentiometers with the provided setting value. PotInstalled = 0x00 : potentiometers not installed.(default) PotInstalled = 0x01 : potentiometers installed.	1.11
Tx_Config	0x600	8	0	0x31	SettingsPotOpened	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator potentiometers with shutters totally opened. SettingsPotOpened = 0x01 : start potentiometers configuration with totally opened shutters.	1.11
Tx_Config	0x600	8	0	0x32	SettingsPotClosed	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator potentiometers with shutters totally closed. SettingsPotOpened = 0x01 : start potentiometers configuration with totally closed shutters.	1.11
Tx_Config	0x600	8	0	0x33	EnableAlarmMsg	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator 0x100 alarm message with the provided setting value. EnableAlarmMsg = 0x00 : the X-Ray Collimator does not retrieve the 0x100 Alarm Message.(default) EnableAlarmMsg = 0x01 : the X-Ray Collimator retrieves the 0x100 Alarm Message.	1.11
Tx_Config	0x600	8	0	0x34	EnableCollRot	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator rotation with the provided setting value. EnableCollRot = 0x00 : the X-Ray Collimator rotation is disabled.(default) EnableCollRot = 0x01 : the X-Ray Collimator rotation is enabled.	1.11
Tx_Config	0x600	8	0	0x35	IRIS_Installed	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator iris with the provided setting value. IRIS_Installed : 0x00 = The X-Ray Collimator does not have the iris installed. (default) IRIS_Installed : 0x01 = The X-Ray Collimator includes the iris.	1.11

Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Config	0x600	8	0	0x36	MSB_IrisCommandID	LSB_IrisCommandID	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator iris command ID with the provided setting value. IrisCommandID : 0x750. (default) IrisCommandID eligible range of values : [0x000;0x7F0]	1.11
Tx_Config	0x600	8	0	0x37	ProxSensorType	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator proximity sensor type with the provided setting value. ProxSensorType : 0x00 = The X-Ray Collimator includes the old PNP proximity sensor type. ProxSensorType : 0x01 = The X-Ray Collimator includes the new NPP proximity sensor type. (default)	1.12
Tx_Config	0x600	8	0	0x38	0x01	FormatsNumber	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator number of fixed formats for both Cross and Long shutters with the provided setting value. FormatsNumber : 0x00. (default) FormatsNumber eligible range of values : [0x00;0x05]	1.12
Tx_Config	0x600	8	0	0x38	0x02	FormatNumber	CrossFixedFormatAperture	LongFixedFormatAperture	0x00	0x00	0x00	Configure the aperture value (in cm) for the selected fixed format for both Cross and Long shutters with the provided setting values. CrossFixedFormatAperture = opening value for Cross shutters for the fixed format selected. LongFixedFormatAperture = opening value for Long shutters for the fixed format selected. CrossFixedFormatAperture, LongFixedFormatAperture eligible range of values : [0x00;0x2B] <b>cm</b>	1.12
Tx_Config	0x600	8	0	0x38	0x03	FormatNumber	CrossFixedFormatAperture	LongFixedFormatAperture	0x00	0x00	0x00	Configure the aperture value (in inches) for the selected fixed format for both Cross and Long shutters with the provided setting values. CrossFixedFormatAperture = opening value for Cross shutters for the fixed format selected. LongFixedFormatAperture = opening value for Long shutters for the fixed format selected. CrossFixedFormatAperture, LongFixedFormatAperture eligible range of values : [0x00;0x11] <b>inch</b>	1.12

Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Config	0x600	8	0	0x38	0x04	FormatsNumber	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator number of fixed formats for the iris with the provided setting value. FormatsNumber : 0x00. (default) FormatsNumber eligible range of values : [0x00;0x05]	2.08
Tx_Config	0x600	8	0	0x38	0x05	FormatNumber	IrisFixedFormatAperture	0x00	0x00	0x00	0x00	Configure the aperture value (in cm) for the selected fixed format for the iris with the provided setting values. IrisFixedFormatAperture = opening value for the iris for the fixed format selected. IrisFixedFormatAperture eligible range of values : [0x00;0x2B]cm	2.08
Tx_Config	0x600	8	0	0x38	0x06	FormatNumber	IrisFixedFormatAperture	0x00	0x00	0x00	0x00	Configure the aperture value (in inches) for the selected fixed format for the iris with the provided setting values. IrisFixedFormatAperture = opening value for the iris for the fixed format selected. IrisFixedFormatAperture eligible range of values : [0x00;0x11]inch	2.08
Tx_Config	0x600	8	0	0x39	Filter1	Filter2	Filter3	Filter4	0x00	0x00	0x00	Configure the X-Ray Collimator spectral filter wheel filter sequence with the provided setting values. Default Filter Sequence = 0,1,2,3. Filter1,Filter2,Filter3,Filter4 eligible range of values : [0x00;0x03]	1.13
Tx_Config	0x600	8	0	0x3A	SetFirmNameOnLCD	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator message that appears on the LCD at the power on. SetFirmNameOnLCD = 0x00 : At the power on, the LCD screen retrieves the string "RALCO" SetFirmNameOnLCD = 0x01 : At the power on, the LCD screen retrieves the string set with the 0x3B Configuration message.	1.13
Tx_Config	0x600	8	0	0x3B	Char1	Char2	Char3	Char4	Char5	Char6	Char7	Configure the X-Ray Collimator message that appears on the LCD at the power on with the provided characters. Note : such string appears only if the SetFirmNameOnLCD parameter of the 0x3A configuration message is set to 0x01.	1.13
Tx_Config	0x600	8	0	0x3C	MSB_ShutterFreqMovement	LSB_ShutterFreqMovement	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator shutters stepper motor frequency when moved by using proper CAN messages. ShutterFreqMovement: 1500 Hz. (default) ShutterFreqMovement eligible range of values : [0x1F4;0x1B58]Hz	1.15

Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Config	0x600	8	0	0x3D	EnableIrisMovements	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator iris movements with the provided setting value. EnableIrisMovements = 0x00 : Iris movements disabled. (the iris opening value is set to its maximum value) EnableIrisMovements = 0x01 : Iris movements enabled. Note : the iris shall be configured as present, with the configuration command 0x35.	2.00
Tx_Config	0x600	8	0	0x3E	ShuttersOffset	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator shutters offset respect to the iris opening with the provided setting value. ShuttersOffset: 8mm. (default) ShuttersOffset eligible range of values : [0x00;0x14]mm	2.00
Tx_Config	0x600	8	0	0x3F	EnableUltrasonicRuler	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator ultrasonic ruler with the provided setting value. EnableUltrasonicRuler = 0x00 : the X-Ray Collimator does not include the ultrasonic ruler.(default) EnableUltrasonicRuler = 0x01 : the X-Ray Collimator includes the ultrasonic ruler.	2.01
Tx_Config	0x600	8	0	0x40	MSB_OffsetUltrasonicRuler	LSB_OffsetUltrasonicRuler	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator ultrasonic ruler offset with the provided setting value. ShutterFreqMovement: 270mm. (default)	2.01
Tx_Config	0x600	8	0	0x41	SFW_StepperMotorType	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator stepper motor type with the provided setting value. SFW_StepperMotorType = 0x01 : the X-Ray Collimator stepper motor type is the old model (round shape).(default) SFW_StepperMotorType = 0x02 : the X-Ray Collimator stepper motor type is the new model (squared shape).	2.04
Tx_Config	0x600	8	0	0x42	FormatCorrectionType	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator format correction type with the provided setting value. FormatCorrectionType = 0x01 : the X-Ray Collimator shutters opening correction type is in cm respect to the actual SFD value. FormatCorrectionType = 0x02 : the X-Ray Collimator shutters opening correction type is in percentage respect to the shutters opening value. (default) NOTE : the changing of correction type selected sets the correction data to 0.	2.04



Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Config	0x600	8	0	0x43	MSB_FMaxKnobs	LSB_FMaxKnobs	SpeedLimit	Acceleration	0x00	0x00	0x00	Configure the X-Ray Collimator knobs movement parameters(maximum frequency sent to the stepper motor during movements, knob rotation speed that corresponds to FMax and knobs acceleration) with the provided setting value. FMaxKnobs = 7000Hz. SpeedLimit = 4 Acceleration = 3	2.05
Tx_Config	0x600	8	0	0x44	ManMovSpeedType	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator manual movement speed type with the provided setting value. ManMovSpeedType = 0x01 : Shutters are manually moved at a constant frequency value (default). ManMovSpeedType = 0x02 : Shutters are manually moved at a frequency value defined with the 0x45 configuration command message.	2.06
Tx_Config	0x600	8	0	0x45	MSB_ManMovFreqSpeed	LSB_ManMovFreqSpeed	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator manual movement speed frequency with the provided setting value. ManMovFreqSpeed : frequency value defined for shutters manual movement. ManMovFreqSpeed = 100 mm/s (default). ManMovFreqSpeed eligible range of values : [10;500] mm/s	2.06
Tx_Config	0x600	8	0	0x46	PotInputType	0x00	0x00	0x00	0x00	0x00	0x00	Configure the RSR008 potentiometer input with the provided setting value. PotInputType = 0x01 : the RSR008 potentiometer input PIN is connected to the SINGLE STATIVE (Default). PotInputType = 0x02 : the RSR008 potentiometer input PIN is connected to the Table.	1.00
Tx_Config	0x600	8	0	0x47	RightSIDType	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator such that the right side SID value is set according to the provided setting value. RightSIDType : 0x01 = The X-Ray Collimator right side SID set with CAN messages. (default) RightSIDType : 0x02 = The X-Ray Collimator right side SID set with discreet input values. RightSIDType : 0x03 = The X-Ray Collimator right side SID set with values retrieved by the potentiometer.	2.08

Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Config	0x600	8	0	0x48	LeftSTD	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator left STD (Source Table Distance) with the provided setting value. LeftSTD : 0 cm (default) LeftSTD eligible range of values : [0;15]cm	2.08
Tx_Config	0x600	8	0	0x49	RightSTD	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator right STD (Source Table Distance) with the provided setting value. RightSTD : 0 cm (default) RightSTD eligible range of values : [0;15]cm	2.08
Tx_Config	0x600	8	0	0x4A	EnableMinFormats	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator minimum formats with the provided setting value. EnableMinFormats = 0x00 : the X-Ray Collimator minimum formats are disabled (Default). EnableMinFormats = 0x01 : the X-Ray Collimator minimum formats are enabled.	1.00
Tx_Config	0x600	8	0	0x4B	EnableManCollimation	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator manual collimation with the provided setting value. EnableManCollimation = 0x00 : the X-Ray Collimator manual collimation disabled. EnableManCollimation = 0x01 : the X-Ray Collimator manual collimation is enabled. (default)	2.11
Tx_Config	0x600	8	0	0x4C	EnableIrisVisualValue	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator iris opening values visualization when the collimator operates in radiology mode with the provided setting value. EnableIrisVisualValue = 0x00 : the X-Ray Collimator LCD does not retrieve the iris actual opening value when the collimator operates in radiology mode (it displays only the string '---'). EnableIrisVisualValue = 0x01 : the X-Ray Collimator LCD retrieve the iris actual opening value (in <b>cm</b> ) when the collimator operates in radiology mode.	2.12
Tx_Config	0x600	8	0	0x4D	MSB_0x7F5FreqOutput	LSB_0x7F5FreqOutput	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator 0x7F5 frequency output with the provided setting value. 0x7F5FreqOutput = 0x00 : the 0x7F5 output message is not retrieved (default). 0x7F5FreqOutput eligible range of values : [50;1000]ms, emitted when the potentiometer value changes.	2.15

Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Config	0x600	8	0	0x4E	filterNr	CH1	CH2	CH3	CH4	CH5	CH6	Configure the name of the X-Ray Collimator spectral filter selected with the provided setting value. filterNr = number of the spectral filter for which to set the LCD display name. filterNr eligible range of values : [1;4] CH1...CH6 : first bundle of ASCII Characters that indicates the spectral filter name. 0x00 represent the end of line character. If [CH1;CH6] does NOT contain 0x00, the spectral filter name will also contains CH7...CH12.	2.15
Tx_Config	0x600	8	0	0x4F	filterNr	CH7	CH8	CH9	CH10	CH11	CH12	Configure the name of the X-Ray Collimator spectral filter selected with the provided setting value. filterNr = number of the spectral filter for which to set the LCD display name. filterNr eligible range of values : [1;4] CH7...CH12 : second bundle of ASCII Characters that follows CH1...CH6 for describing the spectral filter name. 0x00 represent the end of line character.	2.15
Tx_Config	0x600	8	0	0x50	IrisCorrection	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator Iris opening adjustment with the provided setting value. Such configuration depends on the 0x42 Configuration setting: If 0x42 config. Setting = 0x01 : Iris opening adjustment eligible range : [-25;25]cm on SID value. If 0x42 config. Setting = 0x02 : Iris opening adjustment eligible range : [-10.0;+10.0]% on Long shutters actual opening value.	2.16
Tx_Config	0x600	8	0	0x51	EnableInclFiltering	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator inclinometer filtering with the provided setting value. EnableInclFiltering = 0x00 : the inclinometer filtering function is disabled (The collimator retrieves the actual inclinometer value). EnableInclFiltering = 0x01 : the inclinometer filtering function is enabled (The collimator does not retrieve the minimum and the maximum inclinometer values in order to avoid data fluctuations).	2.17

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Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Config	0x600	8	0	0x52	MSB_CommandBaseID	LSB_CommandBaseID	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator Base ID for command messages with the provided setting value. CommandBaseID : 0x700. (default) CommandBaseID eligible range of values : [0x000;0x7F0]	2.18
Tx_Config	0x600	8	0	0x53	Enable0x7F8Ack	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator 0x7F8 acknowledge message with the provided setting value. Enable0x7F8Ack = 0x00 : the X-Ray Collimator does not reply with a 0x7F8 event message after receiving a 0x7A3 command message. (default) Enable0x7F8Ack = 0x01 : the X-Ray Collimator replies with a 0x7F8 event message after receiving a 0x7A3 command message.	2.18
Tx_Config	0x600	8	0	0x54	EnableTableKeyVILLA	IDStatusOffset	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator in order to simulate messages retrieved VILLA's tables while pressing membrane buttons on the X-Ray Collimator with the provided setting value. EnableTableKeyVILLA = 0x00 : the X-Ray Collimator does not simulate VILLA TABLE messages. (default) Enable0x7F8Ack = 0x01 : the X-Ray Collimator simulates VILLA TABLE status messages retrieved while pressing membrane buttons installed on the collimator front panel. Such status messages are retrieved on the ID_STATUS + IDStatusOffset id. IDStatusOffset = 0x04 (default) : VILLA TABLE status messages are retrieved on 0x7F4 ID. IDStatusOffset eligible range of values : [0x00;0x0F]	2.18
Tx_Config	0x600	8	0	0x55	EnableMexRecASR003	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator ASR003 Status Message reception with the provided setting value. EnableMexRecASR003 = 0x00 : ASR003 message reception disabled. (default) EnableMexRecASR003 = 0x01 : ASR003 message reception enabled. Messages are retrieved on IIDs 0x7AA, 0x7AB, 0x7AC and 0x7AE.	2.18

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Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Config	0x600	8	0	0x56	EnableCANTubeAngle	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator Tube Angle value with the provided setting value. EnableCANTubeAngle = 0x00 : tube angle value can be set with CAN messages disabled. (default) EnableCANTubeAngle = 0x01 : tube angle value cannot be set with CAN messages enabled.	2.18
Tx_Config	0x600	8	0	0x57	EnableKnobsJitter	JitValue	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator knobs jitter value with the provided setting value. EnableKnobsJitter = 0x00 : knobs jittering disabled. (default) EnableKnobsJitter = 0x01 : knobs jittering enabled. JitValue represents the number of impulses that shall be completed by knobs after changing their rotation movement in order to allow the Collimator to move shutters.	2.20
Tx_Config	0x600	8	0	0x58	MSB_ConfTime	LSB_ConfTime	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator time necessary for entering into Configuration mode while pressing buttons installed on the front panel with the provided setting value. MSB_ConfTime, LSB_ConfTime : time for which is necessary to keep pressed buttons installed on the front panel of the collimator in order to enter in configuration mode. Default : 0xFA (25s)	2.20
Tx_Config	0x600	8	0	0x59	MSB_InclRetTime	LSB_InclRetTime	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator inclinometer message timespan with the provided setting value. MSB_InclRetTime, LSB_InclRetTime : Timespan for the inclinometer status message. InclRetTime Default value : 0 (message not retrieved) InclRetTime eligible range of values : [0; 2000] ms.	2.20
Tx_Config	0x600	8	0	0x5A	EnRoundZero	0x00	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator rounding function for shutters closing apertures with the provided setting value. EnRoundZero = 0x00 : shutters actual values rounded to zero while opening value is equal to 3 mm or less. (default) EnRoundZero = 0x01 : shutters actual values not rounded to zero.	2.20

Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Config	0x600	8	0	0x5B	MSB_ClosureValue	LSB_ClosureValue	0x00	0x00	0x00	0x00	0x00	Configure the X-Ray Collimator totally closed shutters indication threshold with the provided setting value. MSB_ClosureValue, LSB_ClosureValue : closure value that at least one shutter has to reach such that the collimator retrieves on its status messages that at least one shutter is totally closed.	2.22
Tx_Config	0x600	8	0	0x64	SaveConfig	0x00	0x00	0x00	0x00	0x00	0x00	Save the X-ray Collimator configuration parameters with values set. SaveConfig = 0x00 : discard modifications. SaveConfig = 0x01 : save modifications.	1.00
Tx_Config	0x600	8	0	0xFD	0x55	0xAA	0x00	0x00	0x00	0x00	0x00	Restore the X-Ray Collimator configuration parameters to their default values.	2.15
Tx_Config	0x600	8	0	0xFE	0x55	0x00	0x00	0x00	0x00	0x00	0x00	Reboot the X-Ray Collimator.	2.00
Tx_Config	0x600	8	0	0xFF	EnStepperMotorModif	0x00	0x00	0x00	0x00	0x00	0x00	Enable or disable the X-Ray Collimator stepper motor configuration parameter. EnStepperMotorModif = 0x00 : Disable the stepper motor configuration parameter. EnStepperMotorModif = 0x01 : Enable the stepper motor configuration parameter.	2.00
Tx_Config	0x601	8	0	Mux	0x00	0x00	0x00	0x00	0x00	0x00	0x00	Read the X-Ray Collimator Configuration Value for the parameter specified by Mux.	1.00
Rx_Config	0x602	8	0	Mux	Data	Data	Data	Data	Data	Data	Data	Message retrieved from the collimator as response to the 0x601 Configuration Message with the actual Value for the configuration parameter specified by Mux.	1.00

Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Command	0x7A0	8	0	<p>b7 : 1 = The X-Ray Collimator operates in Manual Mode (for STANDARD and GMM Communication protocol only)</p> <p>b6 : 1 = The X-Ray Collimator operates in Automatic Mode (for STANDARD and GMM Communication protocol only)</p> <p>b5 : 1 = Totally Close Cross shutter.</p> <p>b4 : 1 = Totally Open Cross shutter.</p> <p>b3 : 1 = Totally Close Long shutter.</p> <p>b2 : 1 = Totally Open Long shutter.y.</p> <p>b1 : 1 = Totally Close Iris Diaphragm (if present).</p> <p>b0 : 1 = Totally Open Iris Diaphragm (if present).</p>	<p>b7 : 1 <b>NON-GMM Communication Protocol</b> disable format limits (configuration not saved in Flash Memory) <b>GMM Communication Protocol</b></p> <p>Set the spectral filter wheel to position defined by bits b7 and b5)</p> <p>b6 : not used.</p> <p>b5: 1 (for GMM Communication Protocol only)</p> <p>Set the spectral filter wheel to position defined by bits b7 and b5)</p> <p>b4: 0 = if the collimator operates in Radiology mode, totally open the iris diaphragm</p> <p>b4 : 1 = move the iris diaphragm to the opening value set with the command 0x7A3 sub 0x0A.</p> <p>b3 : 1 = while sending the 0x7A0 command, ignore data written in bytes D3,D4,D5,D6,D7.</p> <p>b2: 0 = the collimator operates in Radiology mode.</p> <p>b2 : 1 = the collimator operates in Fluoroscopy mode.</p> <p>b1 : 1 = move the spectral filter wheel to the adjacent position (for STANDARD and SEDECAL communication protocol only).</p> <p><b>Standard Communication Protocol</b></p> <p>b0 : 1 = revert the actual light status.</p> <p>b0 : 0 = don't change the actual light status.</p> <p><b>Sedecal Communication Protocol</b></p> <p>b0 : 1 = switch the light ON.</p> <p>b0 : 0 = don't change the actual light status.</p> <p><b>GMM Communication Protocol</b></p> <p>b0 : 1 = switch the light ON.</p> <p>b0 : 0 = switch the light OFF.</p>	<p>b7 : not used.</p> <p>b6 : 1 = MSB_SIDValue.</p> <p>b5: not used.</p> <p>b4: not used.</p> <p>b3 : not used.</p> <p>b2 : not used.</p> <p>b1 : not used.</p> <p>b0 : not used.</p>	LSB_SIDValue	MSB_CrossValue MSB_IrisValue (if the collimator operates in fluoroscopy mode)	LSB_CrossValue LSB_IrisValue (if the collimator operates in fluoroscopy mode)	MSB_LongValue	LSB_LongValue	Command Message.	1.00
Tx_Command	0x7A0	6	0	0x01	MSB_IrisValue	LSB_IrisValue	0x00	0x00	0x00			Command Message.	1.00
Tx_Command	0x7A0	2	0	Cross Shutter Incline Value [0;70°]	Long Shutter Incline Value [0;70°]							Command Message.	1.00

Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Co mmand	0x7A1	8	0	MSB_LeftCrossValu e	LSB_LeftCrossValue	MSB_LeftLon gValue	LSB_LeftLo ngValue	MSB_Rig htCrossV alue	LSB_Rig htCrossV alue	MSB_Rig htLongVa lue	LSB_Rig htLongVa lue	Command message used in order to set lateral side formats for both Cross and Long shutters.	1.00
Tx_Co mmand	0x7A2	8	0	MSB_LateralSIDVal ue	LSB_LateralSIDValue	0x00	0x00	0x00	0x00	0x00	0x00	Command message used in order to set the lateral SID value.	1.00
Tx_Co mmand	0x7A3	8	0	0x01	Filter_position	0x00	0x00	0x00	0x00	0x00	0x00	Command message used to moves the spectral filter wheel to the provided position. Filter_position = [0x00; 0x03].	1.00
Tx_Co mmand	0x7A3	8	0	0x02	0x00	0x00	0x00	0x00	0x00	0x00	0x00	Command message used for requiring the PCB serial number.	1.00
Tx_Co mmand	0x7A3	8	0	0x03	0x00	0x00	0x00	0x00	0x00	0x00	0x00	Command message used to change the actual LIGHT status. If light ON, after sending this command it is switched OFF. If light is OFF, after sending this command it is switched ON.	1.00
Tx_Co mmand	0x7A3	8	0	0x04	0x00	0x00	0x00	0x00	0x00	0x00	0x00	Command message used to switch ON the D21 led installed on the RSR008 PCB.	1.00
Tx_Co mmand	0x7A3	8	0	0x05	0x00	0x00	0x00	0x00	0x00	0x00	0x00	Command message used to switch OFF the D21 led installed on the RSR008 PCB.	1.00
Tx_Co mmand	0x7A3	8	0	0x06	MSB_StepperMotorFreq	LSB_Stepper MotorFreq	0x00	0x00	0x00	0x00	0x00	Command message used to change the actual speed of shutters while moving in automatic mode with the provided value. MSB_StepperMotorFreq, LSB_StepperMotorFreq = [500;6000] Hz	1.15
Tx_Co mmand	0x7A3	8	0	0x07	MSB_StepperMotorFreq	LSB_Stepper MotorFreq	0x00	0x00	0x00	0x00	0x00	Command message used to change the actual speed of shutters while moving in manual mode with the provided value. MSB_StepperMotorFreq, LSB_StepperMotorFreq = [500;6000] Hz	1.15
Tx_Co mmand	0x7A3	8	0	0x08	LightStatus	0x00	0x00	0x00	0x00	0x00	0x00	Command message used to change the actual LIGHT status. LightStatus = 0x00 : the LIGHT is switched OFF. LightStatus = 0x01 : the LIGHT is switched ON.	1.15
Tx_Co mmand	0x7A3	8	0	0x09	InclStatus	0x00	0x00	0x00	0x00	0x00	0x00	Command message used to change the actual Inclinometer status. InclStatus = 0x00 : the INCLINOMETER is disabled. (collimator always considered as vertical) InclStatus = 0x01 : the INCLINOMETER is enabled. Note : this is a temporary setting : at the power on, the inclinometer status is the same as per defined in configuration. Note 2 : this command works only if the inclinometer is enabled in configuration.	1.15



Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Command	0x7A3	8	0	0x0A	MSB_IrisOpening	LSB_IrisOpening	0x00	0x00	0x00	0x00	0x00	Command message used to set the maximum opening value of the Iris diaphragm. MSB_IrisOpening, LSB_IrisOpening : maximum opening value of the Iris diaphragm [mm]	2.00
Tx_Command	0x7A3	8	0	0x0B	ShuttersMovingType	0x00	0x00	0x00	0x00	0x00	0x00	Command message used to set the shutters moving type when movements are performed with message 0x7A0 sub D1. ShuttersMovingType = 0x01 : shutters are moved with constant frequency (as per defined with the 0x7A3 sub. 0x07 command) ShuttersMovingType = 0x02 : shutters are moved with constant speed, even if SID is changed.	2.06
Tx_Command	0x7A3	8	0	0x0C	Shutter	MSB_ShutterSpeed	LSB_ShutterSpeed	0x00	0x00	0x00	0x00	Command message used to set the shutters speed when movements are performed with message 0x7A0 sub D1. Shutter = 0x00 : Cross Shutter Selected. Shutter = 0x01 : Long Shutter Selected. MSB_ShutterSpeed, LSB_ShutterSpeed : shutter speed set [10; 500] mm/s. Default : 100mm/s	2.06
Tx_Command	0x7A3	8	0	0x0D	KnobsStatus	0x00	0x00	0x00	0x00	0x00	0x00	Command message used to set the actual KNOBS status. KnobsStatus = 0x00 : knobs are DISABLED. KnobsStatus = 0x01 : knobs are ENABLED.	2.06
Tx_Command	0x7A3	8	0	0x0E	FilterButtonStatus	0x00	0x00	0x00	0x00	0x00	0x00	Command message used to set the actual FILTER BUTTON status. FilterButtonStatus = 0x00 : Filter Button is DISABLED. FilterButtonStatus = 0x01 : Filter Button is ENABLED.	2.06
Tx_Command	0x7A3	8	0	0x0F	LightButtonStatus	0x00	0x00	0x00	0x00	0x00	0x00	Command message used to set the actual LIGHT BUTTON status. LightButtonStatus = 0x00 : Light Button is DISABLED. LightButtonStatus = 0x01 : Light Button is ENABLED.	2.06

Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Command	0x7A3	8	0	0x10	IrisStatus	CmdType	0x00	0x00	0x00	0x00	0x00	Command message used to set the actual IRIS status. IrisStatus = 0x00 : Iris Diaphragm is DISABLED. IrisStatus = 0x01 : Iris Diaphragm is ENABLED. CmdType = 0x00 : Temporary Setting. CmdType = 0x01 : Prmanent Setting. (setting value is saved in flash memory)	2.08
Tx_Command	0x7A3	8	0	0x11	IrisMovementType	CmdType	0x00	0x00	0x00	0x00	0x00	Command message used to set the actual IRIS movement type. IrisMovementType = 0x00 : Iris Diaphragm Movements follow the shutters ones. IrisMovementType = 0x01 : Iris Diaphragm Movements are independent from the shutters ones. CmdType = 0x00 : Temporary Setting. CmdType = 0x01 : Prmanent Setting. (setting value is saved in flash memory)	2.08
Tx_Command	0x7A3	8	0	0x12	IrisButtonStatus	0x00	0x00	0x00	0x00	0x00	0x00	Command message used to set the actual IRIS DIAPHRAGM BUTTON status. IrisButtonStatus = 0x00 : Iris Diaphragm Button is DISABLED. IrisButtonStatus = 0x01 : Iris Diaphragm Button is ENABLED.	2.08
Tx_Command	0x7A3	8	0	0x13	LightTriggerTime	CmdType	0x00	0x00	0x00	0x00	0x00	Command message used to set the actual LIGHT trigger time. LightTriggerTime = [5;60]s. Default : 5s. CmdType = 0x00 : Temporary Setting. CmdType = 0x01 : Prmanent Setting. (setting value is saved in flash memory)	2.13
Tx_Command	0x7A3	8	0	0x14	LightStatus	0x00	0x00	0x00	0x00	0x00	0x00	Command message used to ignite the LIGHT for the trigger time set with the 0x7A3 sub 0x13. LightStatus = 0x00 : the LIGHT is switched OFF. LightStatus = 0x01 : the LIGHT is switched ON for the trigger time set, then OFF.	2.13

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Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Command	0x7A3	8	0	0x15	TFTVisuallcon	IconStatus	0x00	0x00	0x00	0x00	0x00	Command message used to set the actual icon status showed on the TFT display. TFTVisuallcon = 0x01 : X-Ray Icon. IconStatus = 0x00 : X-Ray Icon OFF IconStatus = 0x01 : X-Ray Icon ON TFTVisuallcon = 0x02 : SID Icon. IconStatus = 0x00 : Under Table SID Icon ON IconStatus = 0x01 : Over Table SID Icon ON IconStatus = 0x02 : Free Exp SID Icon ON TFTVisuallcon = 0x03 : Column Icon. IconStatus = actual Column angle Value [-99;+99]°	2.18
Tx_Command	0x7A3	8	0	0xF0	EventStatus	0x00	0x00	0x00	0x00	0x00	0x00	Command message used to set the actual 0x7F4 event generation status. EventStatus = 0x00 : 0x7F4 event messages not retrieved by the collimator. EventStatus = 0x01 : 0x7F4 event messages retrieved by the collimator.	2.15
Tx_Command	0x7A3	8	0	0xF1	OptForkStepTest	0x00	0x00	0x00	0x00	0x00	0x00	Command message used to set the actual optical fork step test status. OptForkStepTest = 0x00 : optical fork test step disabled. OptForkStepTest = 0x01 : optical fork test step enabled.	2.15
Tx_Command	0x7A3	8	0	0xFD	InclSimStatus	InclValue	0x00	0x00	0x00	0x00	0x00	Command message used to set the actual inclinometer simulation status. InclSimStatus = 0x00 : the inclinometer simulation is disabled. InclSimStatus = 0x01 : the inclinometer simulation is enabled. InclValue = 0x00 : Error simulation. InclValue = 0x01 : Vertical Inclination simulation. InclValue = 0x02 : Left Inclination simulation. InclValue = 0x03 : Right Inclination simulation.	2.08
Tx_Command	0x7A3	8	0	0xFE	RebootType	0x00	0x00	0x00	0x00	0x00	0x00	Command message used to perform the X-Ray Collimator Reboot. RebootType = 0x55 : physical reboot the collimator. RebootType = 0x56 : at the next reboot, the collimator enters in Configuration mode.	2.15

Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Command	0x7A4	8	0	CollOperMode	0x00	0x00	0x00	0x00	0x00	0x00	0x00	Command message used to set the X-Ray Collimator Actual Operating Mode. CollOperMode = 0x80 : the collimator is in Manual Mode. CollOperMode = 0x40 : the collimator is in Automatic Mode.	1.00
Tx_Command	0x7A5	8	0	LSB_SID	MSB_SID	0x00	0x00	0x00	0x00	0x00	0x00	Command message used to set the X-Ray Collimator Actual SID value. MSB_SID, LSB_SID : actual SID value, whose eligible range of values is the one set with Configuration Message.	1.00
Tx_Command	0x7A6	8	1	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	Command message used to get the X-Ray Collimator RSR008 PCB Actual HW/ FW Version.	2.00
Rx_Command	0x7A6	8	1	MSB_HW	CSB_HW	CSB_HW	LSB_HW	0x53	MSB_FW	CSB_FW	LSB_FW	Command message used to get the X-Ray Collimator RSR008 PCB Actual HW/ FW Version.	2.00
Tx_Command	0x7A7	8	0	MSB_0x7F0	LSB_0x7F0	MSB_0x7F1	LSB_0x7F1	MSB_0x7F9	LSB_0x7F9	LSB_0x7FC	LSB_0x7FC	Command message used to set the output frequency status messages (in msec). (default value : 0ms) MSB_0x7F0, LSB_0x7F0 : output frequency for the 0x7F0 status message. MSB_0x7F1, LSB_0x7F1 : output frequency for the 0x7F1 status message. MSB_0x7F9, LSB_0x7F9 : output frequency for the 0x7F9 status message. MSB_0x7FC, LSB_0x7FC : output frequency for the 0x7FC status message. Note : if the frequency output message set is lower than 100ms, the output message is retrieved only once.	1.00
Tx_Command	0x7A8	8	0	MSB_MaxCross	LSB_MaxCross	MSB_MaxLong	LSB_MaxLong	MSB_MinCross	LSB_MinCross	MSB_MinLong	LSB_MinLong	Command message used to set the output frequency status messages (in msec). (default value : 0ms) MSB_MaxCross, LSB_MaxCross : Maximum Cross Opening Value. (default : 430mm) MSB_MaxLong, LSB_MaxLong : Minimum Long Opening Value. (default : 430mm) MSB_MinCross, LSB_MinCross : Maximum Cross Opening Value. (default : 0mm) MSB_MinLong, LSB_MinLong : Minimum Long Opening Value. (default : 0mm) Note : it's possible to set Minimum Cross and Long opening values only if they are enabled in configuration.	2.05

Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Command	0x7A9	8	0	LightTriggerTime	0x00	0x00	0x00	0x00	0x00	0x00	0x00	Command message used to set the actual LIGHT trigger time. LightTriggerTime = [5;60]s. Default : 5s.	1.00
Tx_Command	0x7AA	8	0	b0 : 1 = left side panoramic enabled. b1 : 1 = right side bucky enabled. b2 : 1 = right side panoramic enabled. b3 : 1 = open Long Shutter. b4 : 1 = close Long Shutter. b5 : 1 = open Cross Shutter. b6 : 1 = close Cross Shutter. b7 : 1 = open Iris Diaphragm.	b0 : = not used. b1 : = not used. b2 : = not used. b3 : = not used. b4 : = not used. b5 : = not used. b6 : = not used. b7 : 1 = left side bucky enabled.	b0 : = not used. b1 : = not used. b2 : 1 = Set Fixed Format #5. b3 : 1 = Set Fixed Format #4. b4 : 1 = Set Fixed Format #3. b5 : 1 = Set Fixed Format #2. b6 : 1 = Set Fixed Format #1. b7 : 1 = The collimator operates in Fluoroscopy Mode. b7 : 0 = The collimator operates in Radiology Mode.	b0 : 1 = close Iris Diaphragm. b1 : 1 = Set Spectral Filter Wheel in position 1. b2 : = not used. b3 : 1 = Set Lateral SID to position 1. b4 : 1 = Set Spectral Filter Wheel in position 2. b5 : 1 = Set Spectral Filter Wheel in position 3. b6 : 1 = Set Lateral SID to position 5. b7 : 1 = Set Lateral SID to position 4.	b0 : 1 = b1 : 1 = Set Lateral SID to position 2. b2 : 1 = Set Lateral SID to position 3. b3 : 1 = Set Lateral Panoramic SID to position 1. b4 : 1 = Set Spectral Filter Wheel in position 1. b5 : 1 = Set Lateral Panoramic SID to position 2. b6 : 1 = Set Lateral Panoramic SID to position 2. b7 : = not used.	b0 : = not used. b1 : = not used. b2 : = not used. b3 : 1 = Set Spectral Filter Wheel in position 4. b4 : 1 = Switch the Light ON. b5 : = not used. b6 : 0 = Switch the Light OFF. b7 : = not used.	b0 : = not used. b1 : = not used. b2 : = not used. b3 : = not used. b4 : 1 = Read Calibration. b5 : = not used. b6 : = not used. b7 : = not used.	b0 : = not used. b1 : = not used. b2 : = not used. b3 : 1 = Set Tomography Mode. b4 : 1 = Set Manual Operation Mode. b5 : = not used. b6 : = not used. b7 : 1 =	Command message used from the ASR003 External Board in order to set the actual external board digital input status.	1.00

Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Command	0x7AB	8	0	MSB_VPotStat	LSB_VPotStat	MSB_VPotTable	LSB_VPotTable	MSB_VPotBuckyCrossTable	LSB_VPotBuckyCrossTable	MSB_VPotBuckyLongTable	LSB_VPotBuckyLongTable	Command message used from the ASR003 External Board in order to set the actual potentiometers voltage value. MSB_VPotStat,LSB_VPotStat = actual stative potentiometer voltage value. MSB_VPotTable,LSB_VPotTable = actual table potentiometer voltage value. MSB_VPotBuckyCrossTable,LSB_VPotBuckyCrossTable = actual Cross Bucky Table potentiometer voltage value. MSB_VPotBuckyLongTable,LSB_VPotBuckyLongTable = actual Long Bucky Table potentiometer voltage value.	1.00
Tx_Command	0x7AC	8	0	MSB_VPotBuckyCrossLeft	LSB_VPotBuckyCrossLeft	MSB_VPotBuckyLongLeft	LSB_VPotBuckyLongLeft	MSB_VPotBuckyCrossRight	LSB_VPotBuckyCrossRight	MSB_VPotBuckyLongRight	LSB_VPotBuckyLongRight	Command message used from the ASR003 External Board in order to set the actual potentiometers voltage value. MSB_VPotBuckyCrossLeft,LSB_VPotBuckyCrossLeft = actual Cross Bucky Left potentiometer voltage value. MSB_VPotBuckyLongLeft,LSB_VPotBuckyLongLeft = actual Long Bucky Left potentiometer voltage value. MSB_VPotBuckyCrossRight,LSB_VPotBuckyCrossRight = actual Cross Bucky Right potentiometer voltage value. MSB_VPotBuckyLongRight,LSB_VPotBuckyLongRight = actual Long Bucky Right potentiometer voltage value.	1.00

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Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_Command	0x7AD	8	0	b0 : 1 = Set English Language. b1 : 1 = Set Italian Language. b2 : 1 = Set Metric Measurement Unit. b3 : 1 = Set Imperial Measurement Unit. b4 : 1 = Cross SID correction as per defined in D2. b5 : 1 = Long SID correction as per defined in D3. b6 : = not used. b7 : 1 = Sub D1 Used.	If D0 b7 = 1 D1 = 0x01 = Set Iris Diaphragm Status.	If D0 b7 = 0 If Format Correction Type (0x600 sub 0x42) set is in cm respect to the actual SFD value. D2 = Cross Correction Value [-25;+25]cm If Format Correction Type (0x600 sub 0x42) set in percentage respect to the shutters opening value. D2 = Cross Correction Value [-10;+10]% If D0 b7 = 1 D2 = 0x00 : Disable Iris Diaphragm. D2 = 0x01 : Enable Iris Diaphragm.	If D0 b7 = 0 If Format Correction Type (0x600 sub 0x42) set is in cm respect to the actual SFD value. D2 = Long Correction Value [-25;+25]cm If Format Correction Type (0x600 sub 0x42) set in percentage respect to the shutters opening value. D2 = Long Correction Value [-10;+10]% If D0 b7 = 1 D3 = 0x00 : Save Settings Temporarily. D3 = 0x01 : Save Settings Permanently	Not Used	Not Used	Not Used	Not Used	Command message used to set some configuration parameters without entering in Configuration Mode.	2.00
Tx_Command	0x7AE	8	0	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	Command message used to get the actual ARS003 External Board FW Version.	1.00
Tx_Command	0x7AF	8	0	Data	Data	Data	Data	Data	Data	Data	Data	Command message used exactly as the 0x600 Configuration message in order to set X-Ray Collimator Configuration Parameters without entering in Configuration mode. Note : in order to make changes effective, it's mandatory to save configuration values and to reboot the collimator by using the following messages: 0x7AF 8 0x64 0x01 0x7AF 8 0xFE 0x55	2.00

Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Rx_Stat us	0x7F0	8	0	b0 : 1 = the collimator is rebooting. b1 : = not used. b2 : = not used. b3 : = not used. b4 : = not used. b5 : = not used. b6 : 1 = LIGHT switched ON. b7 : = not used.	b0 : = not used. b1 : = not used. b2 : = not used. b3 : = not used. b4 : = not used. b5 : 1 = the collimator is at 0°. b6 : 0 = the collimator operates in manual mode. b6 : 1 = the collimator operates in automatic or in ExpHold mode. b7 : 1 = proximity sensor is enabled.	b0 : 1 = spectral filter wheel actual position = 1. b1 : 1 = spectral filter wheel actual position = 2. b2 : = MSB for SID > 255cm. b3 : = not used. b4 : 1 =iris diaphragm stepper motor is moving. b5 : 1 =spectral filter wheel stepper motor is moving. b6 : 1 = cross shutter stepper motor is moving. b7 : 1 = long shutter stepper motor is moving. Note : if both b0 and b1 = 1, the spectral filter wheel actual position is 3.	LSB SID Value	MSB Actual Vertical Cross Value	LSB Actual Vertical Cross Value	MSB Actual Vertical Long Value	LSB Actual Vertical Long Value	Status Message that retrieves information as per described in detail.	2.06
Rx_Stat us	0x7F1	8	0	Actual Inclination Value [-128;+127°]	Not Used	Not Used	Actual Spectral Filter Wheel Position [0;3]	LSB _Lateral SID Value	MSB _Lateral SID Value	Not Used	Not Used	Status Message that retrieves information as per described in detail.	2.05
Rx_Stat us	0x7F2	8	0	0x53	0x2F	0x4E	MSB_SN	CSB_SN	CSB_SN	CSB_SN	LSB_SN	Status Message that retrieves the actual X-Ray Collimator Serial Number Set. Note : the first 3 digits are constant (0x53 0x2F 0x43 = S/N)	1.00



Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Rx_Stat us	0x7F4	1	0	b0 : 1 = left button pressed. b1 : 1 = right button pressed. b2 : 1 = down button pressed. b3 : 1 = up button pressed. b4 : 1 = left rotation button pressed. b5 : 1 = right rotation button pressed. b6 : = not used. b7 : = not used.								If enabled, this status Message retrieves the actual status of buttons installed on the X-Ray Collimator Front Panel. If button not pressed : Message retrieved each 1s. If button pressed : Message retrieved each 80ms.	2.15
Rx_Eve nt	0x7F4	8	0	0x01	0x00	0x00	0x00	0x00	0x00	0x00	0x00	EV_POWER_ON : Event message retrieved from the collimator at the power on.	2.15
Rx_Eve nt	0x7F4	8	0	0x02	StepperMotorNr	0x00	0x00	0x00	0x00	0x00	0x00	EV_MOT_STARTED : Event message retrieved from the collimator when the selected motor starts its movement.	2.15
Rx_Eve nt	0x7F4	8	0	0x03	StepperMotorNr	0x00	0x00	0x00	0x00	0x00	0x00	EV_MOT_STOPPED : Event message retrieved from the collimator when the selected motor stops its movement.	2.15
Rx_Eve nt	0x7F4	8	0	0x04	StepperMotorNr	0x00	0x00	0x00	0x00	0x00	0x00	EV_DSC_STARTED : Event message retrieved from the collimator when both the selected motor and the corresponding knob start their movement.	2.15
Rx_Eve nt	0x7F4	8	0	0x05	StepperMotorNr	0x00	0x00	0x00	0x00	0x00	0x00	EV_DSC_STOPPED : Event message retrieved from the collimator when both the selected motor and the corresponding knob stop their movement.	2.15
Rx_Eve nt	0x7F4	8	0	0x06	StepperMotorNr	0x00	0x00	0x00	0x00	0x00	0x00	EV_DONE : Event message retrieved from the collimator when the selected motor complete its movement.	2.15
Rx_Eve nt	0x7F4	8	0	0x07	0x00	AlarmTemp	0x00	MSB_Temp	CSB_Temp	CSB_Temp	LSB_Temp	EV_INFO : Event message retrieved from the collimator when its temperature value is again in eligible range of values. MSB_Temp,LSB_Temp = Actual X-Ray Collimator Temperature Value.	2.15
Rx_Eve nt	0x7F4	8	0	0x07	0x00	AlarmLedPCB	0x00	0x00	0x00	0x00	0x00	EV_INFO : Event message retrieved from the collimator when the LED board is restored after a fault.	2.15
Rx_Eve nt	0x7F4	8	0	0x08	0x00	0x00	0x00	MSB_LightStatus	CSB_LightStatus	CSB_LightStatus	LSB_LightStatus	EV_LIGHT : Event message retrieved from the collimator when its light status changes. MSB_LightStatus,LSB_LightStatus = Actual X-Ray Collimator Light Status: 0x00 = Light OFF 0x01 : Light ON	2.15

Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Rx_Event	0x7F4	8	0	0x09	ChNumber	CanBusStatus	0x00	0x00	0x00	0x00	0x00	EV_CANBUS : Event message retrieved from the collimator when the CAN Bus status changes on the selected channel. ChNumber = Channel Number related to the EV_CANBUS CanBusStatus = 0x01 = BusOff CanBusStatus = 0x01 = BusOff Recovery CanBusStatus = 0x01 = Can Bus Passive	2.15
Rx_Event	0x7F4	8	0	0x0A	0x00	0x00	0x00	0x00	0x00	0x00	0x00	EV_INIT_START : Event message retrieved from the collimator when it starts its initialization.	2.15
Rx_Event	0x7F4	8	0	0x0B	0x00	0x00	0x00	0x00	0x00	0x00	0x00	EV_MASTER_READY : Event message retrieved from the collimator when it finishes its initialization and it is in ready status.	2.15
Rx_Event	0x7F4	8	0	0x0C	0x00	0x00	0x00	MSB_KeyStatus	CSB_KeyStatus	CSB_KeyStatus	LSB_KeyStatus	EV_CHIAVE : Event message retrieved from the collimator when its key status changes. MSB_KeyStatus,LSB_KeyStatus = Actual X-Ray Collimator Key Status: 0x00 = Automatic 0x01 : Manual	2.15
Rx_Event	0x7F4	8	0	0x0D	StepperMotorNr	0x00	0x00	MSB_FilterPos	CSB_FilterPos	CSB_FilterPos	LSB_FilterPos	EV_FILTER_READY : Event message retrieved from the collimator when its spectral filter wheel changes its position. StepperMotorNr = number of the stepper motor connected to the spectral filter wheel. MSB_FilterPos,LSB_FilterPos = Actual X-Ray Collimator Spectral Filter Wheel Position [0;3]	2.15
Rx_Event	0x7F4	8	0	0x0E	StepperMotorNr	0x00	0x00	MSB_StepsNr	CSB_StepsNr	CSB_StepsNr	LSB_StepsNr	EV_FILTER_READY : Event message retrieved from the collimator when the selected shutter complete its opening movement in order to indicate the number of steps missed for obscuring the optical fork. StepperMotorNr = number of the stepper motor that has completed its opening motion. MSB_StepsNr,LSB_StepsNr = number of missing steps for obscuring the optical fork.	2.15

Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Rx_Event	0x7F4	8	0	0x0F	StepperMotorNr	0x00	0x00	MSB_AnalogicPotValue	CSB_AnalogicPotValue	CSB_AnalogicPotValue	LSB_AnalogicPotValue	EV_POTENZIOMETRO : Event message retrieved from the collimator that contains the actual analogic value of the potentiometer connected to the indicated stepper motor. StepperMotorNr = number of the stepper motor. MSB_AnalogicPotValue, LSB_AnalogicPotValue = analogic value of the potentiometer connected to StepperMotorNr.	2.15
Rx_Event	0x7F4	8	0	0x10	FrontButtonNr	0x00	0x00	MSB_ButtonStatusValue	CSB_ButtonStatusValue	CSB_ButtonStatusValue	LSB_ButtonStatusValue	EV_TASTO_FRONTALE : Event message retrieved from the collimator that contains the actual status value of the indicated front panel button. FrontButtonNr = number of the front panel button pressed. FrontButtonNr = 0x01 : LIGHT front panel button. FrontButtonNr = 0x01 : SPECTRAL FILTER WHEEL front panel button. MSB_ButtonStatusValue, LSB_ButtonStatusValue = STATUS value of the front panel button pressed. MSB_ButtonStatusValue, LSB_ButtonStatusValue = 0x00 : Front Panel Button Released. MSB_ButtonStatusValue, LSB_ButtonStatusValue = 0x01 : Front Panel Button Pressed.	2.15
Rx_Event	0x7F4	8	0	0x40	StepperMotorNr	0x01	0x00	MSB_WrongPosValue	CSB_WrongPosValue	CSB_WrongPosValue	LSB_WrongPosValue	EV_ERROR : Error message retrieved from the collimator when it receives a movement value for the stepper motor indicated out of its eligible range of values. StepperMotorNr = stepper motor number for which the collimator has received a value out of the eligible range. MSB_WrongPosValue, LSB_WrongPosValue = wrong position value received by the collimator for the selected stepper motor.	2.15
Rx_Event	0x7F4	8	0	0x40	StepperMotorNr	0x02	0x00	MSB_AttemptsFilterPositioning	CSB_AttemptsFilterPositioning	CSB_AttemptsFilterPositioning	LSB_AttemptsFilterPositioning	EV_ERROR : Error message retrieved from the collimator that contains the number of attempts performed by the spectral filter wheel in order to reach the requested position. StepperMotorNr = stepper motor number related to the spectral filter wheel. MSB_AttemptsFilterPositioning, LSB_AttemptsFilterPositioning = number of attempts performed by the spectral filter wheel in order to reach the requested position.	2.15

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Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Rx_Event	0x7F4	8	0	0x40	0x00	0x03	0x00	MSB_ActualTemp Value	CSB_ActualTemp Value	CSB_ActualTemp Value	LSB_ActualTemp Value	EV_ERROR : Error message retrieved from the collimator when its actual temperature is higher than the maximum threshold value. MSB_ActualTempValue,LSB_ActualTemp Value = actual X-Ray Collimator temperature value.	2.15
Rx_Event	0x7F4	8	0	0x40	0x00	0x04	0x00	MSB_ActualTemp Value	CSB_ActualTemp Value	CSB_ActualTemp Value	LSB_ActualTemp Value	EV_ERROR : Error message retrieved from the collimator when its actual temperature is lower than the maximum threshold value. MSB_ActualTempValue,LSB_ActualTemp Value = actual X-Ray Collimator temperature value.	2.15
Rx_Event	0x7F4	8	0	0x40	StepperMotorNr	0x05	0x00	0x00	0x00	0x00	0x00	EV_ERROR : Error message retrieved from the collimator when the external board received a message from the indicated stepper motor later than the timeout set. StepperMotorNr = stepper motor number that sends messages to the external board later than the timeout set.	2.15
Rx_Event	0x7F4	8	0	0x40	StepperMotorNr	0x06	0x00	MSB_DeltaPotValue	CSB_DeltaPotValue	CSB_DeltaPotValue	LSB_DeltaPotValue	EV_ERROR : Error message retrieved from the collimator that contains the difference between the actual value retrieved by the potentiometer connected to the selected stepper motor and its theoretical value. StepperMotorNr = stepper motor number connected to the potentiometer. MSB_DeltaPotValue,LSB_DeltaPotValue = difference between the actual value retrieved by the potentiometer connected to the selected stepper motor and its theoretical value.	2.15
Rx_Event	0x7F4	8	0	0x40	StepperMotorNr	0x07	0x00	0x00	0x00	0x00	0x00	EV_ERROR : Error message retrieved from the collimator if the indicated stepper motor generates a timeout error during the X-Ray Collimator boot-up procedure. StepperMotorNr = number of the first stepper motor that generates a timeout error at the boot up.	2.15
Rx_Event	0x7F4	8	0	0x40	0x00	0x08	0x00	0x00	0x00	0x00	0x00	EV_ERROR : Error message retrieved from the collimator that indicated that a general failure error occurred.	2.15

Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Rx_Event	0x7F4	8	0	0x40	StepperMotorNr	0x09	0x00	MSB_DeltaPotValue	CSB_DeltaPotValue	CSB_DeltaPotValue	LSB_DeltaPotValue	EV_ERROR : Error message retrieved from the collimator that contains the difference between the actual value retrieved by the potentiometer connected to the selected stepper motor and its theoretical value while performing its calibration. StepperMotorNr = stepper motor number connected to the potentiometer. MSB_DeltaPotValue, LSB_DeltaPotValue = difference between the actual value retrieved by the potentiometer connected to the selected stepper motor and its theoretical value while performing its calibration.	2.15
Rx_Event	0x7F4	8	0	0x40	0x00	0x0A	0x00	MSB_LEDPCBErrorCode	CSB_LEDPCBErrorCode	CSB_LEDPCBErrorCode	LSB_LEDPCBErrorCode	EV_ERROR : Error message retrieved from the collimator that contains the error code generated by the LED PCB. LEDPCBErrorCode = Error Code generated by the LED PCB. LEDPCBErrorCode = 0x00 : LAMP_ALARM_NONE LEDPCBErrorCode = 0x01 : LAMP_ALARM_OUT_ZERO LEDPCBErrorCode = 0x02 : LAMP_ALARM_LED_SCROLL LEDPCBErrorCode = 0x03 : LAMP_ALARM_KEY_PRESSED LEDPCBErrorCode = 0x04 : LAMP_ALARM_INT_TEMP LEDPCBErrorCode = 0x05 : LAMP_ALARM_EXT_TEMP LEDPCBErrorCode = 0x06 : LAMP_ALARM_SHUT_OFF_INT LEDPCBErrorCode = 0x07 : LAMP_ALARM_SHUT_OFF_EXT LEDPCBErrorCode = 0x0A : LAMP_ALARM_ERROR LEDPCBErrorCode = 0x64 : LAMP_ALARM_ERROR_DIAG_0 LEDPCBErrorCode = 0x65 : LAMP_ALARM_ERROR_DIAG_1	2.15

Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Rx_Event	0x7F4	8	0	0x40	0x00	0x0B	0x00	MSB_MemoryError	CSB_MemoryError	CSB_MemoryError	LSB_MemoryError	EV_ERROR : Error message retrieved from the collimator that contains the error code generated by the PCB Data Flash Memory. MemoryErrorCode = Error Code generated by the PCB Data Flash Memory. MemoryErrorCode = 0x00 : MEM_ERR_CALIBR MemoryErrorCode = 0x01 : MEM_ERR_SN MemoryErrorCode = 0x02 : MEM_ERR_CONFIG	2.15
Rx_Event	0x7F4	8	0	0x40	0x00	0x0C	0x00	MSB_CANFiFoOverRun	CSB_CANFiFoOverRun	CSB_CANFiFoOverRun	LSB_CANFiFoOverRun	EV_ERROR : Error message retrieved from the collimator that contains the error code generated by the indicated CAN FiFo while it is in OverRun status. CANFiFoOverRunNr = CAN FiFo that generates the OverRun error. CANFiFoOverRunNr = 0x00 : Command Message CAN FiFo CANFiFoOverRunNr = 0x01 : Configuration Message CAN FiFo CANFiFoOverRunNr = 0x02 : Remote Message CAN FiFo	2.15
Rx_Status	0x7F5	8	0	MSB_CrossPotValue	LSB_CrossPotValue	MSB_LongPotValue	LSB_LongPotValue	Not Used	Not Used	Not Used	Not Used	Status Message that retrieves Cross and Long actual potentiometer value at the output frequency set in configuration.	2.15
Rx_Status	0x7F7	8	0	D0 = 0x01 - Actual Inclinator Axes Values	If D0 = 0x01 MSB_X axis value	If D0 = 0x01 LSB_X axis value	If D0 = 0x01 MSB_Y axis value	If D0 = 0x01 LSB_Y axis value	Not Used	Not Used	Not Used	Status Message that retrieves information as per described in detail at the output frequency set in configuration.	2.20
Rx_Acknowledge	0x7F8	8	0	Data	Data	Data	Data	Data	Data	Data	Data	Acknowledge Message that contains the same data as per sent by means 0x7A3 Command Message. Note : such message is retrieved only if enabled with the 0x600 sub 0x53 configuration message.	1.00

Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Rx_Stat us	0x7F9	8	0	b0 : 1 = LIGHT switched ON. b1 : = not used. b2 : = not used. b3 : = not used. b4 : = not used. b5 : 1 = The collimator operated in Automatic or in Manual mode (front panel red LED switched OFF). b6 : = not used. b7 : 1 = at lease one shutter (Cross or Long) is totally closed.	b0 : 1 = The collimator operated in Manual mode. (Yellow Front Panel LED switched ON) b1 : 1 = The collimator is NOT operational. (Red Front Panel LED switched ON) b2 : 1 = The collimator operated in Automatic mode. (Green Front Panel LED switched ON) b3 : 1 = The key is turned such that the collimator operates in Manual mode. (Yellow Front Panel LED switched ON) b4 : = not used. b5 : = not used. b6 : = not used. b7 : = not used.	b0 : 1 = Cross Shutter Configured. b1 : 1 = Long Shutter Configured. b2 : 1 = Iris Diaphragm Configured. b3 : 1 = Spectral Filter Wheel Configured. b4 : 1 = Vertical Fixed SID Selected. b5 : 1 = English Language active. b6 : = not used. b7 : 1 = Imperial Measurement Unit active.	b0 : 1 = Differential Vertical SID active. b1 : 1 = Vertical Receptor Bucky active. b2 : 1 = Right Side Receptor Bucky active. b3 : 1 = Left Side CAN or ATS receptor enabled. b4 : = not used. b5 : = not used. b6 : = not used. b7 : = not used.	b0 : 1 = 2mm Filter Width Selected. b1 : 1 = Vertical CAN or ATS receptor enabled. b2 : 1 = Right Side CAN or ATS receptor enabled. b3 : 1 = Left Side CAN or ATS receptor enabled. b4 : 1 = Left Side CAN SID enabled. b5 : 1 = Right Side CAN SID enabled. b6 : 1 = SID value visualize d on LCD. b7 : = not used.	MSB Iris Diaphragm Opening Value	b0 : 1 = Error while updating the Flash Memory with Configura tion Values. b1 : 1 = Flash Memory restored to its default configura tion values. b2 : 1 = Flash Memory updated with the new configura tion values. b3 : = not used. b4 : = not used. b5 : = not used. b6 : = not used. b7 : = not used.	LSB Iris Diaphragm Opening Value	Status Message that retrieves information as per described in detail at the output frequency set.	1.15

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Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Rx_Stat us	0x7FC	8	0	MSB Actual Cross Opening Value (measurement unit : number of steps)	LSB Actual Cross Opening Value (measurement unit : number of steps)	MSB Actual Long Opening Value (measureme nt unit : number of steps)	LSB Actual Long Opening Value (measureme nt unit : number of steps)	MSB Actual Spectral Filter Wheel Position Value (measure ment unit : number of steps)	LSB Actual Spectral Filter Wheel Position Value (measure ment unit : number of steps)	b0 : 1 = Optical Fork Obscured while Cross Shutter is totally closed. b1 : 1 = Optical Fork Obscured while Long Shutter is totally closed. b2 : 1 = Spectral Filter Wheel Optical Fork Obscured . b3 : 1 = Optical Fork Obscured while Cross Shutter is totally opened. b4 : 1 = Optical Fork Obscured while Long Shutter is totally opened. b5 : = not used. b6 : = not used. b7 : = not used.	Not Used	Status Message that retrieves information as per described in detail at the output frequency set.	1.00



Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Tx_DisplayConfig	0x7C0	8	0	D0 = 0x01 - LCD Display Visualization Type Standard D0 = 0x01 - LCD Display Visualization Type Sedecal D0 = 0x01 - LCD Display Visualization Type Free	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Configuration Message to set-up the LCD Display Visualization Type.	1.00
Tx_DisplayConfig	0x7C1	8	0	Data	Data	Data	Data	Data	Data	Data	Data	Configuration Message to set-up the LCD Display Message. Note : such configuration is possible only if the LCD Visualization Type is configured as Free by means the 0x7C0 subD1 message. See Quick Start Guide for an example of LCD Configuration esample.	1.00
Rx_Status	0x7D0	2	0	b0 : 1 = Ready relay Output activation required b1 : 1 = ExpHold relay Output activation required b2 : 1 = Manual relay Output activation required. b3 : 1 = Closed Shutters relay Output activation required. b4 : 1 = X-Ray relay Output activation required. b5 : 1 = internal use. b6 : 1 = internal use. b7 : 1 = The Collimator is Booting Up.	Not Used							Status Message that retrieves information as per described in detail at the output frequency set.	1.00

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Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Rx_Stat us	0x7D0	8	0	b0 : 1 = Ready relay Output activation required b1 : 1 = ExpHold relay Output activation required b2 : 1 = Manual relay Output activation required. b3 : 1 = Closed Shutters relay Output activation required. b4 : 1 = X-Ray relay Output activation required. b5 : 1 = internal use. b6 : 1 = internal use. b7 : 1 = The Collimator is Booting Up.	Not Used	b0 : 1 = Isb_Number of Consecutive Spectral Filter Positioning Attempts. b1 : 1 = msb_Number of Consecutive Spectral Filter Positioning Attempts. b2 : = not used. b3 : 1 = Cross or Long Shutter Reset Alarm. b4 : 1 = Iris Diaphragm Alarm. (Wrong Positioning) b5 : 1 = Long Shutter Alarm. (Wrong Positioning) b6 : 1 = Cross Shutter Alarm. (Wrong Positioning) b7 : 1 = Spectral Filter Wheel Alarm. (Wrong Positioning)	Total Number of Alarms generate d for the Spectral Filter Wheel from the X- Ray Collimator Power ON.	Total Number of Alarms generate d for the Cross Shutter from the X-Ray Collimato r Power ON.	Total Number of Alarms generate d for the Long Shutter from the X-Ray Collimato r Power ON.	Total Number of Alarms generate d for the Iris Diaphrag m from the X- Ray Collimato r Power ON.	Not Used	Status Message that retrieves information as per described in detail at the output frequency set. Note : such message is retrieved only if configured with the 0x600 sub 0x33 Configuration Message.	1.00

Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Rx_Stat us	0x100	2	0	b0 : 1 = Ready relay Output activation required b1 : 1 = ExpHold relay Output activation required b2 : 1 = Manual relay Output activation required. b3 : 1 = Closed Shutters relay Output activation required. b4 : 1 = X-Ray relay Output activation required. b5 : 1 = internal use. b6 : 1 = internal use. b7 : 1 = The Collimator is Booting Up.	Not Used							Status Message that retrieves information as per described in detail at the output frequency set.	1.00

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Type	ID	DLC	RTR	D0	D1	D2	D3	D4	D5	D6	D7	Description	FW Ver.
Rx_Status	0x100	8	0	b0 : 1 = Ready relay Output activation required b1 : 1 = ExpHold relay Output activation required b2 : 1 = Manual relay Output activation required. b3 : 1 = Closed Shutters relay Output activation required. b4 : 1 = X-Ray relay Output activation required. b5 : 1 = internal use. b6 : 1 = internal use. b7 : 1 = The Collimator is Booting Up.	Not Used	b0 : 1 = Isb_Number of Consecutive Spectral Filter Positioning Attempts. b1 : 1 = msb_Number of Consecutive Spectral Filter Positioning Attempts. b2 : = not used. b3 : 1 = Cross or Long Shutter Reset Alarm. b4 : 1 = Iris Diaphragm Alarm. (Wrong Positioning) b5 : 1 = Long Shutter Alarm. (Wrong Positioning) b6 : 1 = Cross Shutter Alarm. (Wrong Positioning) b7 : 1 = Spectral Filter Wheel Alarm. (Wrong Positioning)	Total Number of Alarms generated for the Spectral Filter Wheel from the X-Ray Collimator Power ON.	Total Number of Alarms generated for the Cross Shutter from the X-Ray Collimator Power ON.	Total Number of Alarms generated for the Long Shutter from the X-Ray Collimator Power ON.	Total Number of Alarms generated for the Iris Diaphragm from the X-Ray Collimator Power ON.	Not Used	Status Message that retrieves information as per described in detail at the output frequency set. Note : such message is retrieved only if configured with the 0x600 sub 0x33 Configuration Message.	2.04

## CAN BUS MESSAGES - COLLIMATOR COMMUNICATION

### Description

This collimator features an open communication CanBus connected to board RSR008.

CanBus messages used by the collimator are described in this Chapter **CAN BUS MESSAGES - COLLIMATOR CONFIGURATION**; the addresses not taken by the following messages may be used by other communications nodes without interfering with normal collimator operation.

### NOTE

COLLIMATOR CANBUS COMMUNICATION SPEED IS SET AT 500 KBIT/S



### QUICK START

#### SID, Cross, Long Values

SID, Cross and Long values are set by sending message **7A0** via CanBus.

Regulate:

- SID at 100 cm
- Cross at 430 mm
- Long at 130 mm

A message of the following type must be sent via CanBus:

ID	DLC	D0	D1	D2	D3	D4	D5	D6	D7
7A0	8	40	00	00	64	01	AE	00	82
	length	automatic mode		SID values set at 100 cm		Cross value set at 430 mm		Long value set at 130 mm	

#### Setting of Automatic/Manual Mode

To set the collimator operating mode, message 7A0 must be sent via CanBus. A Cross/Long/SID value must be entered:

- SID at 100 cm
- Cross at 430 mm
- Long at 130 mm

A message of the following type must be sent via CanBus to enable the automatic mode:

ID	DLC	D0	D1	D2	D3	D4	D5	D6	D7
7A0	8	40	00	00	64	01	AE	00	82
	length	automatic mode		SID values set at 100 cm		Cross value set at 430 mm		Long value set at 130 mm	

A message of the following type must be sent via CanBus to enable the manual mode:

ID	DLC	D0	D1	D2	D3	D4	D5	D6	D7
7A0	8	80	00	00	64	01	AE	00	82
	length	manual mode		SID values set at 100 cm		Cross value set at 430 mm		Long value set at 130 mm	

## Status Messages

The status messages feature must be activated to received collimator status data. To do this, set the time value in milliseconds of the message return frequency.

Status messages are activated with two messages:

- 7A7 - enables message transmission; 7F0 (SID, Cross, Long status and position); 7F1 (Filter and Flag)

To enable status messages 7F0 and 7F1 with a frequency of 100 ms.

ID	DLC	D0	D1	D2	D3	D4	D5	D6	D7
7A7	8	00	64	00	00	00	00	00	00
	length	Time in milliseconds							

## Cross/Long

Once a movement message is sent, the status messages provide data related to collimator movement, current position and possible movement errors.

Status message 7F0 give the current Cross/Long value.

ID	D0	D1	D2	D3	D4	D5	D6	D7
7F0	FLAGS	xx	yy	zz	CrossH	CrossL	LongH	LongL
					Byte Cross position		Byte Long position	

Cross = (CrossH<<8) + CrossL

Long = (LongH<<8) + LongL

When the device is moving, bit0 (with a value of D0) is set at 1. To detect errors during movement, the D1 value of status message 7F9 must be analysed.

Messages are detailed with specific descriptions in this Chapter.

## CONTROL MESSAGES

“Control” messages are sent to RSR008 by the external board ASR003 and may be used by the outside control system via CanBus when ASR003 board is lacking.

### 0x7A0

This is a particular message, in fact it may takes on two different meanings, DLC equal to 8 or 2, 6.

ID	TYPE	DLC	D0	D1	D2	D3	D4	D5	D6	D7
0x7A0	Input for RSR008	8								
0x7A0	Input for RSR008	2								

This message is programmable in configuration phase or may be positioned in address differ from the standard.

### DLC=8

<b>D0</b>	
<b>b7</b>	If 1: Collimator manual control (applicable to R225 ACS and R225/006/ACS protocol)
<b>b6</b>	If 1: Collimator automatic control (applicable to R225/006/ACS protocol)
<b>b5</b>	If 1: Cross closed
<b>b4</b>	If 1: Cross open
<b>b3</b>	If 1: Long closed
<b>b2</b>	If 1: Long open
<b>b1</b>	if 1: Iris closed (if assembled)
<b>b0</b>	If 0: Iris open (if assembled)

<b>D1</b>	
<b>b7</b>	If 1: Disable temporarily the format limits (the value not Flash stored), applicable to R 225 ACS protocol If 1: Filter position 2 (if bit 5 used inserts filter position 3), applicable to R 225/006/ACS protocol
<b>b6</b>	Not used
<b>b5</b>	If 1: Filter position 1 (if bit 7 used inserts filter position 3)
<b>b4</b>	If 0: In square field moves Iris to maximum aperture (62cm) If 1: In square field moves Iris to indicated aperture by 7A3 sub-control. 0x0A
<b>b3</b>	If 1: Ignores formats (SID and dimensions)
<b>b2</b>	If 0: Radiology (square-field) If 1: Fluoroscopy (round-field, if assembled)
<b>b1</b>	If 1: Filter change applicable to R 225 ACS and R 225/170/ACS protocol)
<b>b0</b>	R 225 ACS: 1: Inverts the light status 0: Light status unchanged R 225/170/ACS: 1: Light ON 0: Light status unchanged GMM: 1: Light ON 0: Light OFF

## D2 ...D7

Are not bit defined but byte defined

<b>0x7A0</b>	
<b>D2</b>	bit 7: not used bit 6: MSbit for SID > 255 bit 5: bit1 not used
<b>D3</b>	Vertical SID in cm

<b>D4</b>	MSB vertical Cross format in mm or Iris if in Fluoroscopy
<b>D5</b>	LSB vertical Cross format in mm or Iris if in Fluoroscopy
<b>D6</b>	MSB vertical Long format in mm
<b>D7</b>	LSB vertical Long format in mm

## DLC=2

The message is used to send values of Cross and Long inclination.

<b>0x7A0</b>	
<b>D0</b>	Cross inclination (0-70°)
<b>D1</b>	Long inclination (0-70°)

## DLC=6

The message is used to send various controls.

<b>0x7A0</b>	IRIS movement
<b>D0</b>	0x01 control: runs IRIS
<b>D1</b>	MSB IRIS format
<b>D2</b>	LSB IRIS format
<b>D3</b>	not used
<b>D4</b>	not used
<b>D5</b>	not used

## 0x7A1

This message transmits the data related to lateral left and right formats externally from the collimator to board RSR008.

ID	Type	DLC	D0	D1	D2	D3	D4	D5	D6	D7
0x7A1	Input for RSR008	8								

<b>0x7A1</b>	
<b>D0</b>	MSB left Cross format in mm
<b>D1</b>	LSB left Cross format in mm
<b>D2</b>	MSB left Long format in mm
<b>D3</b>	LSB left Long format in mm
<b>D4</b>	MSB right Cross format in mm
<b>D5</b>	LSB right Cross format in mm



<b>D6</b>	MSB right Long format in mm
<b>D7</b>	LSB right Long format in mm

## 0x7A2

This message transmits the data related to lateral SID externally from the collimator to board RSR008.

ID	Type	DLC	D0	D1	D2	D3	D4	D5	D6	D7
0x7A2	Input for RSR008	8								

<b>0x7A2</b>	
<b>D0</b>	LSB lateral SID in cm
<b>D1</b>	MSB lateral SID in cm
<b>D2..D7</b>	Not used

## 0x7A3

This message allows different operations to be performed

ID	Type	DLC	D0	D1	D2	D3	D4	D5	D6	D7
0x7A3	Input for RSR008	8								

Each sent message has a reply on 0x7F8 (if configured). This message contains the same transmitted data as 0x7A3.

NOTE: Se D1 is not recognized, D1= 0xFF is transmitted in the message 0x7F8. If the values are not recognized in D2, this byte takes on the current value in the message 0x7F8.

Byte D0 may assume the following values:

- 01h: Filter change, in this case byte D1 transmits filter position information (00h...03h)
- 02h: Requires the serial number to be transmitted via CanBus (see 0x7F2 message)
- 03h: Shows a request of change to lamp status: If Lamp is ON it will be switched OFF; If it is OFF it will be switched ON
- 04h: Shows a request to switch ON LED on RSR008 board
- 05h: Shows a request to switch OFF the LED on RSR008 board
- 06h: Modifies speed during automatic movement for format values:  
D1: MSB motor frequency (min. 500, max. 6000)  
D2: LSB motor frequency
- 07h: Modifies manual movement speed for shutters  
D1: MSB motor frequency (min. 500, max. 6000)  
D2: LSB motor frequency
- 08h: Light ON/OFF control  
D1= 1 - ON  
D1= 0 - OFF

- 09h: Inclinometer temporary disabled  
D1= 1 - Inclinometer disabled (collimator always in vertical)  
D1= 0 - Inclinometer enabled (Only if Inclinometer has been previously enabled in configuration)
- 0Ah: Maximum Iris Field  
D1, D2 = H,L - Maximum size in mm
- 0Bh: Type of shutter displacement with open/closed bit, msg 0x7A0  
D1= 1: Shutter displacement with fixed frequency (sub message 0x7A0)  
D1= 2: Fixed shutter displacement in mm/sec. Shutter speed is fixed although SID varies.
- 0Ch: Shutter speed with open/closed bit, msg 0x7A0  
D1 = 0: STEPPER\_CROSS - 1: STEPPER\_LONG  
D2, D3 = H, L - speed in mm/sec (100 mm/sec default), min. = 10 mm/sec, max. = 500 mm/sec. Speed of projected movement is constant although SID changed.
- 0Dh: Enable/Disable Knobs on front panel  
D1 = 0: Knobs disabled  
D1 = 1: Knobs enabled
- 0Eh: Enable/Disable Filter push button on front panel  
D1 = 0: Push button disabled  
D1 = 1: Push button enabled
- 0Fh: Enable/Disable Light push button on front panel  
D1 = 0: Push button disabled  
D1 = 1: Push button enabled
- 10h: Enable/Disable Iris  
D1 = 0: Iris disabled  
D1 = 1: Iris enabled  
D2 = 0: Temporary setting  
D2 = 1: Flash stored
- 11h: Independent Iris setting  
D1 = 0: Iris varies depending on shutters  
D1 = 1: Independent Iris control  
D2 = 0: Temporary setting  
D2 = 1: Flash stored
- 12h: Enable/Disable Iris push-buttons on front panel  
D1 = 0: Push button disabled  
D1 = 1: Push button enabled
- 13h: Light ON Time for buttons and CAN bus controls  
D1 = Light ON Time (from 5 to 60 sec.)  
D2 = 0: Temporary setting,  
D2 = 1: Flash stored
- 14h: Light ON for defined time  
D1 = Light ON time (from 1 to 60 sec.), if 0 Light OFF

- **FDh:** Collimator simulation of inclination  
D1 = 0: Simulation disabled  
D1 = 1: Simulation enabled  
D2 = 0: ERROR  
D2 = 1: VERTICAL  
D2 = 2: LEFT  
D2 = 3: RIGHT
- **FEh:** COLLIMATOR RESET. D1=0x55 - Collimator Reset (complete restart)
- **15h:** Configuration of TFR Visualisation  
D1 = Sub-command  
    0x01: X-Ray icon  
        D2= 0x00 - OFF  
        D2=0x01 - ON  
    0x2: SID icon  
        D2= 0x00 - Under table  
        D2= 0x01 - Above table  
        D2= 0x02 - Outside of table (no angles and FREE Exposure is blinking)
- 0x03: Angle Column  
        D2= Angle Column - values -99 to +99, SINT8 format

Note: If D1 is not recognized, D1 = 0xFF is transmitted in the message 0x7F8.  
If the values are not recognized in D2, this byte takes on the current value in the message 0x7F8.

### 0x7A4

The message is used to send automatic/manual control to RSR008 board

ID	Type	DLC	D0	D1	D2	D3	D4	D5	D6	D7
0x7A4	Input for RSR008	8								

<b>0x7A4</b>	
<b>D0</b>	Bit defined
<b>b7</b>	If 1: collimator request of manual control
<b>b6</b>	If 1: collimator request of automatic control
<b>b5..b0</b>	bit non utilizzati
<b>D1...D7</b>	Byte non utilizzati

### 0x7A5

Message used to send SID value to the collimator, without changing the square field size.

ID	Type	DLC	D0	D1	D2	D3	D4	D5	D6	D7
0x7A5	Input for RSR008	8	LSB	MSB						

D0, D1 (LSB, MSB): Shows the present SID value in cm. The value must be between the min. and max. values selected in the collimator configuration phase.

### 0x7A6

This message serves to know the hardware/software version of board RSR008.

ID	Type	DLC	D0	D1	D2	D3	D4	D5	D6	D7
0x7A6	Remote	8								

Board RSR008 responds with string

"R225S200"

Which stands for:

Collimator 225 firmware 2.00

### 0x7A7

This message serves to program the transmission time of "Status" type messages with address 0x7F0, 0x7F1, 0x7F9 and 0x7FC by board RSR008 board.

ID	Type	DLC	D0	D1	D2	D3	D4	D5	D6	D7
0x7A7	Input for RSR008	8								

0x7A7	
D0	MSB transmission time 0x7F0 messages in msec (default = 0)
D1	LSB transmission time 0x7F0 messages in msec
D2	MSB transmission time 0x7F1 messages in msec (default = 0)
D3	LSB transmission time 0x7F1 messages in msec
D4	MSB transmission time 0x7F9 messages in msec (default = 0)
D5	LSB transmission time 0x7F9 messages in msec
D6	MSB transmission time 0x7FC messages in msec(default = 0)
D7	LSB transmission time 0x7FC messages in msec

If the set time is less than 100 msec, the messages will be sent once only. If the value is the same or greater, the messages will be repeated at a value equal to the set time value.

### 0x7A8

The message is used to send to control the maximum Cross and Long apertures.

ID	Type	DLC	D0	D1	D2	D3	D4	D5	D6	D7
0x7A8	Input for RSR008	8								

0x7A8	
D0..D1	Set value in mm, maximum Cross opening (MSB, LSB) (default = 430)
D2..D3	Set value in mm, maximum Long opening (MSB, LSB) (default = 430)
D4..D5	Set value in mm, minimum Cross opening (MSB, LSB) (default = 0)(*)

**D6..D7** Set value in mm, minimum Cros opening (MSB, LSB)(default = 0)(\*)

These values indicate maximum and minimum available opening of the square field.

The message does not modify values stored in Flash memory during a configuration phase; the values are lost on the collimator power down and must be re-sent at subsequent power-up.

(\*) Min. formats are considered only if previously enabled in configuration.

## 0x7A9

This message allows to program light source ON.

ID	Type	DLC	D0	D1	D2	D3	D4	D5	D6	D7
0x7A9	Input for RSR008	8								

<b>0x7A9</b>	
<b>D0</b>	Lamp Timer setting in seconds (5 to 60 seconds)(default = 30)
<b>D1..D7</b>	Not used

## 0x7AA

This message is used by the external board ASR003 to send, to board RSR008, status messages related to digital inputs present on the external board.

<b>0x7AA</b>	
<b>D0</b>	Bit defined
	b0: Presence of full size lateral left
	b1: Right lateral cassette
	b2: Full size lateral right
	b3: Open Long
	b4: Close Long
	b5: Open Cross
	b6: Close Cross
	b7: Open Iris
<b>D1</b>	Bit defined
	b0-b6: Not used
	b7: Presence of lateral left cassette

<b>D2</b>	Bit defined
	b0:
	b1:
	b2: Fixed format #5
	b3: Fixed format #4
	b4: Fixed format #3
	b5: Fixed format #2
	b6: Fixed format #1
	b7: 0 = Radiography, 1 = Fluoroscopy
<b>D3</b>	Bit defined
	b0: Close iris
	b1: Filter position 1
	b2: Not used
	b3: SID lateral position 1
	b4: Filter position 2
	b5: Filter position 3
	b6: SID lateral position 5
	b7: SID lateral position 4
<b>D4</b>	Bit defined
	b0: Not used
	b1: SID lateral position 2
	b2: SID lateral position 3
	b3: SID lateral full size 1
	b4: SID lateral full size 2
	b5: Not used
	b6: Temporary exclusion inclinometer
	b7: Not used
<b>D5</b>	Bit defined
	b0: Not used
	b1: Not used
	b2: Not used
	b3: Filter position 4
	b4: ON/OFF light source switch
	b5- b7: Not used

<b>D6</b>	Bit defined
	b0 - b3: Not used
	b4: Calibration request
	b5 - b7: Not used
<b>D7</b>	Bit defined
	b0 - b2: Not used
	b3: Tomography
	b4: Request Manual mode
	b5-b6: Not used
	b7: Table cassette in

## 0x7AB

This message is used by the external board ASR003 to send, to board RSR008, the voltage value of potentiometer measurement related to SID and vertical cassettes.

ID	Type	DLC	D0	D1	D2	D3	D4	D5	D6	D7
0x7AB	Input for RSR008	8								

<b>0x7AB</b>	
<b>D0</b>	MSB voltage value of stand potentiometer
<b>D1</b>	LSB voltage value of stand potentiometer
<b>D2</b>	MSB voltage value of table potentiometer
<b>D3</b>	LSB voltage value of table potentiometer
<b>D4</b>	MSB voltage value of table bucky Cross potentiometer
<b>D5</b>	LSB voltage value of table bucky Cross potentiometer
<b>D6</b>	MSB voltage value of table bucky Long potentiometer
<b>D7</b>	LSB voltage value of table bucky Long potentiometer

## 0x7AC

Message is used by the external board ASR003 to send, to board RSR008, the voltage value of potentiometer measurement related to lateral left and right cassettes.

ID	Type	DLC	D0	D1	D2	D3	D4	D5	D6	D7
0x7AC	Input for RSR008	8								

<b>0x7AC</b>	
<b>D0</b>	MSB voltage value of the left bucky Cross potentiometer
<b>D1</b>	LSB voltage value of the left bucky Cross potentiometer
<b>D2</b>	MSB voltage value of the left bucky Long potentiometer
<b>D3</b>	LSB voltage value of the left bucky Long potentiometer

<b>D4</b>	MSB voltage value of the right bucky Cross potentiometer
<b>D5</b>	LSB voltage value of the right bucky Cross potentiometer
<b>D6</b>	MSB voltage value of the right bucky Long potentiometer
<b>D7</b>	LSB voltage value of the right bucky Long potentiometer

### 0x7AD

Message to configure some operation variable without having to resort to configure.

ID	Type	DLC	D0	D1	D2	D3	D4	D5	D6	D7
0x7AD	Input for RSR008	8								

<b>0x7AD</b>	
<b>D0</b>	Bit defined b7: If 1, sub-control on D1 is used b6: Not used b5: If 1 indicates Long side SID correction (value in byte D3) b4: If 1 indicates Cross side SID correction (value in byte D2) b3: If 1 sets inches as unit of measurement b2: If 1 indicates cm as unit of measurement b1: If 1 indicates the use of Italian b0: If 1 indicates the use of English
<b>D1</b>	Sub-control if D0b7 = 1
<b>D2</b>	Correction for Cross: If correction is set in cm for SID: correction from -25 to +25 cm If correction is set in % for format: Percentage correction for Cross: -10.0%, +10,0% eg.:40= 4,0%, -15%= -1.5%
<b>D3</b>	Correction for Long: If correction is set in cm for SID: correction in cm from -25 cm to +25 cm If correction is set in % for format: Percentage correction for Long: -10.0%, +10,0% eg.:40= 4,0%, -15%= -1.5%
<b>D4</b>	Not used
<b>D5</b>	Not used
<b>D6</b>	Not used
<b>D7</b>	Not used

D1: 0x01 - Enable/Disable Iris  
 D2: 0x00=Disable Iris - 0x01 Enable Iris  
 D3: 0x00=Temporary - 0x01=Flahs stored

### 0x7AE



Message used to transmit information, related to the software version of the external board to RSR008 for display viewing.

## 0x7AF

Used exactly the same way as 0x600 in configuration. It serves to change different parameters during normal collimator operation.

Note:

Remember to save data through control 7Af 8 0x64 0x01.

After saving data, the collimator must be switched OFF and ON again or re-set through control 0x7Af 8 0xFE 0x55.

## STATUS MESSAGES

“Status” type messages are the messages generated by board RSR008 to relay information related to collimator status.

## 0x7F0

This message may be sent by board RSR008 after having programmed the transmission time.

R225/006/ACS protocol: The message is sent automatically every 1000 ms without having to enter the activation control (0x7A7).

ID	Type	DLC	D0	D1	D2	D3	D4	D5	D6	D7
0x7F0	Output for RSR008	8								

D0 and D1 byte are bit defined

D0	
b7	Not used
b6	If 1: Light source is ON
b5	Not used
b4	Not used
b3	Not used
b2	Not used
b1	Not used
b0	If 1: Collimator is in the initial reset mode
D1	
b7	If 1: Photosensor is activated if 0: Photosensor is de-activated or disabled during configuration

<b>b6</b>	If 1: Collimator in the manual mode If 0: Collimator in the automatic mode or in the ExpHold
<b>b5</b>	If 1: Switch is activated if the collimator position is 0°
<b>b4</b>	Not used
<b>b3</b>	Not used
<b>b2</b>	Not used
<b>b1</b>	Not used
<b>b0</b>	Not used

<b>D2</b>	
<b>b7</b>	If 1: The Long field motor is moving
<b>b6</b>	If 1: The Cross field motor is moving
<b>b5</b>	If 1: The Filter motor is running
<b>b4</b>	If 1: Iris field motor is running
<b>b3</b>	Not used
<b>b2</b>	Msbite for SID > 255
<b>b1</b>	Filter in position 2
<b>b0</b>	Filter in position 1

(perfiltrposizione3inseritoavremob1eb0attivia1)

The following data are byte programmed:

<b>0x7F0</b>	
<b>D3</b>	Vertical SID in cm
<b>D4</b>	MSB vertical Cross format in mm
<b>D5</b>	LSB vertical Cross format in mm
<b>D6</b>	MSB vertical Long format in mm
<b>D7</b>	LSB vertical Long format in mm

## 0x7F1

This message may be sent by board RSR008 after having programmed transmission time.

ID	Type	DLC	D0	D1	D2	D3	D4	D5	D6	D7
0x7F1	Output for RSR008	8								

<b>0x7F1</b>	
<b>D0</b>	Inclination (from -128 to +127)
<b>D1</b>	Not used
<b>D2</b>	Not used

D3	Present filter selection (0...3)
D4	SID lateral in cm (LSB)
D5	SID lateral in cm (MSB)
D6	Not used
D7	Not used

## 0x7F2

Message sent by board RSR008.

It contains the serial number over 8 bytes and is generated with control 7A3.

ID	Type	DLC	D0	D1	D2	D3	D4	D5	D6	D7
0x7F2	Input for RSR008	8								

0x7F2	
D0	'S'
D1	'/'
D2	'N'
D3	First digit of serial number
D4	Second digit of serial number
D5	Third digit of serial number
D6	Fourth digit of serial number
D7	Fifth digit of serial number

## 0x7F4

Message sent by board RSR008.

It contains the status of the front panel keypads relating to the table movements. This message is transmitted at each second when any push button is pressed or at 80 ms when at least one push button is pressed.

ID	Type	DLC	D0	D1	D2	D3	D4	D5	D6	D7
0x7F4	Outputs from RSR008	8								

D0	
b7	Not used
b6	Not used
b5	If 1: Right rotation
b4	If 1: Left rotation
b3	If 1: Upward
b2	If 1: Downward
b1	If 1: Right

**b0** If 1: Left

**0x7F4: Event**

This message (disabled) is created as a result of an event only if transmission has been enabled in configuration or temporarily by message 0x7A3 sub control.

Bytes:

0x7F4	dic=8							
D0	D1	D2	D3	D4	D5	D6	D7	NOTES
Event	Motor	Par1	Par2	dato.HH	dato.HL	dato.LH	dato.LL	

**Description of events**

Event	Code	Motor	Par1	Par2	Data
EV_POWER_ON	0x01	-		*	
EV_MOT_STARTED	0x02	1-n		*	Current position (SINT32)
EV_MOT_STOPPED	0x03	1-n		*	Current position (SINT32)
EV_DSC_STARTED	0x04	1-n		*	Current position (SINT32)
EV_DSC_STOPPED	0x05	1-n		*	Current position (SINT32)
EV_DONE	0x06	1-n		*	Current position (SINT32)
EV_INFO	0x07	-	0x01: Temperature returns in range	*	Current Temperature (SINT32)
EV_INFO	0x07	-	0x02: LED board alarm	*	
EV_LIGHT	0x08	-		*	Light Status: 0x00 = OFF 0x01 = ON
EV_CANBUS	0x09	0,1 CAN Bus CH	CAN Bus Status: 0x01 = BusOff 0x02 = BusOff recovery 0x03 = Passive		
EV_INIT_START	0x0A	-			
EV_MASTER_READY	0x0B	-		*	
EV_KEY	0x0C	-		*	Key status 0 = automatic 1 = manual
EV_FILTER_READY	0x0D	1-n		*	Number of filter
EV_STEPS_PHOTO	0x0E	1-n		*	Number of current steps when the photocell is cut If 1: photocell is not cut
EV_POTENTIOMETER	0x0F	1-n		*	Analog value of potentiometer
EV_PUSHBUTTON_FRONT	0x010	1=filter 2=light		*	Front pushbutton: TURE= pressed FALSE= released
EV_ERROR	0x40	1-n	0x01: Format not possible	*	Incorrect position (SINT32)
EV_ERROR	0x40	1-n	0x02: Filter	*	Number of potentiometer attempts
EV_ERROR	0x40	-	0x03: High Temperature NTC	*	Current temperature (SINT32)
EV_ERROR	0x40	-	0x04: Low Temperature NTC	*	Current temperature (SINT32)
EV_ERROR	0x40	1-n	0x05: Timeout received by motor on the external board	*	

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EV_ERROR	0x40	1-n	0x06: Format error from potentiometer feedback	*	Differences related to theoretical value
EV_ERROR	0x40	1-n	0x07: HOME timeout (generated motor number)	*	
EV_ERROR	0x40	-	0x08: General Failure	*	
EV_ERROR	0x40	1-n	0x09: Wrong format from feedback of potentiometer during the calibration.	*	Differences related to theoretical value
<p>Codes of LED board error:</p> <p>0 = LAMP_ALARM_NONE  1 = LAMP_ALARM_OUT_ZERO  2 = LAMP_ALARM_LED_SCROLL  3 = LAMP_ALARM_KEY_PRESSED  4 = LAMP_ALARM_INT_TEMP  5 = LAMP_ALARM_EXT_TEMP  6 = LAMP_ALARM_SHUT_OFF_INT  7 = LAMP_ALARM_SHUT_OFF_EXT  10 = LAMP_ALARM_ERROR  100=LAMP_ALARM_ERROR_DIAG_0  101=LAMP_ALARM_ERROR_DIAG_1</p>					
EV_ERROR	0x40	-	0x0A: LED board error		
<p>Codes of memory error:</p> <p>1 = MEM_ERR_CALIBR  2 = MEM_ERR_SN  3 = MEM_ERR_CONFIG</p>					
EV_ERROR	0x40	-	0x0B: Memory data error		
<p>Error Codes</p> <p>1 = FIFO Comandi  2 = FIFO Configuration  3 = FIFO Remote</p>					
EV_ERROR	0x40	-	0x0C: CAN FIFO OverRun		
<p>Error Codes:</p> <p>1 = "+" Cable disconnected  2 = "-" Cable disconnected</p>					
EV_ERROR	0x40	1-n	0x0D: Connection error of potentiometer (feedback)		

## 0x7F5

This message may be transmitted by board RSR008 after having programmed transmission time.

ID	Type	DLC	D0	D1	D2	D3	D4	D5	D6	D7
0x7F5	Output RSR008	8								

D0	
D0	MSB Cross Potentiometer Value
D1	LSB Cross Potentiometer Value
D2	MSB Long Potentiometer Value
D3	LSB Long Potentiometer Value
D4	Not used
D5	Not used
D6	Not used
D7	Not used

## 0x7F8

This message is transmitted by the RSR008 board, it contains the same data sent with the message 0x7A3 in response to the same (see above).

ID	Type	DLC	D0	D1	D2	D3	D4	D5	D6	D7
0x7F8	Output	8								

D0-D7 = the same data received with the message 0x7A3.

## 0x7F3, 0x7F4, 0x7F6, 0x7F7

Messages that are not used.

## 0x7F9

Message that may be transmitted by board RSR008 after having programmed transmission time.

## 0x7F9

ID	Type	DLC	D0	D1	D2	D3	D4	D5	D6	D7
0x7F9	Output for RSR008	8								

D0	
b7	If 1: Indicates at least one shutter (Cross or Long) is completely closed
b6	Not used
b5	If 1: Indicates collimator is in the automatic or manual mode (red LED off)
b4	Not used
b3	Not used
b2	Not used
b1	Not used
b0	If 1: Light ON

D1	
b7	Not used
b6	Not used
b5	Not used
b4	Not used
b3	If 1: Indicates Key in manual mode
b2	If 1: Indicates collimator in the automatic mode (green LED)
b1	If 1: Indicates collimator not operational (red LED)
b0	If 1: Indicates collimator manual operation (yellow LED)

D2	
b7	If 1: Unit of measurement inches (0=centimetres)

<b>b6</b>	Not used
<b>b5</b>	If 1: Language - English (0=Italian)
<b>b4</b>	If 1: Fixed Vertical SID selection
<b>b3</b>	If 1: Filter present
<b>b2</b>	If 1: Iris present
<b>b1</b>	If 1: Long present
<b>b0</b>	If 1: Cross present

<b>D3</b>	
<b>b7</b>	Not used
<b>b6</b>	Not used
<b>b5</b>	Not used
<b>b4</b>	Not used
<b>b3</b>	If 1: Lateral left Bucky
<b>b2</b>	If 1: Lateral right Bucky
<b>b1</b>	If 1: Vertical Bucky
<b>b0</b>	If 1: Differential vertical SID selection

<b>D4</b>	
<b>b7</b>	Not used
<b>b6</b>	If 1: SID display enabled
<b>b5</b>	If 1: Right lateral CAN SID selection
<b>b4</b>	If 1: Left Lateral CAN SID selection
<b>b3</b>	If 1: CAN or ATS left lateral receptor
<b>b2</b>	If 1: CAN or ATS right lateral receptor
<b>b1</b>	If 1: Vertical CAN or ATS receptor
<b>b0</b>	If 1: Vertical filtering selection 2 mm (0=1 mm)

<b>D5</b>	MSB Iris aperture (in mm)
<b>D6</b>	
<b>b7</b>	Not used
<b>b6</b>	Not used
<b>b5</b>	Not used
<b>b4</b>	Not used
<b>b3</b>	Not used
<b>b2</b>	If 1: Flash has been updated with a new configuration value

MTR 225 ACS - MTR 225 ACS DHHS - Can Bus Messages - Collimator Communication

<b>b1</b>	If 1: Flash has been re-loaded with default values
<b>b0</b>	If 1: Error in data load from Flash

<b>D7</b>	LSB Iris aperture (in mm)
-----------	---------------------------

### **0x7FA, 0x7FB**

These messages are not used

### **0x7FC**

This message may be transmitted by board RSR008 after having programmed transmission time.

ID	Type	DLC	D0	D1	D2	D3	D4	D5	D6	D7
0x7FC	Output RSR008	8								

<b>D0</b>	
<b>D0</b>	MSB Cross present position indicated as the step number
<b>D1</b>	LSB Cross present position indicated as the step number
<b>D2</b>	MSB Long present position indicated as the step number
<b>D3</b>	LSB Long present position indicated as the step number
<b>D4</b>	MSB Filter present position indicated as the step number
<b>D5</b>	LSB Filter present position indicated as the step number
<b>D6</b>	Bit use according to the following meaning: b0: If 1 opto-Switch of Cross closed is in the blackout mode, if 0 illuminated b1: If 1 opto-Switch of Long closed is in the blackout mode, if 0 illuminated b2: If 1 opto-Switch of Filter is in the blackout mode, if 0 illuminated b3: If 1 opto-Switch of Cross open is in the blackout mode, if 0 illuminated b4: If 1 opto-Switch of Long open is in the blackout mode, if 0 illuminated b5, b6, b7: Not used
<b>D7</b>	Not used

### **0x7FD, 0x7FE, 0x7FF**

These messages are not used

## **DISPLAY MESSAGES**

### **0x7CO**

This message allows to change the display during collimator operation: switching between R225/ACS, R225/170/ACS and free display modes with a single control.

The control is not stored in the microprocessor Flash; on system power-up the collimator loads the last value stored during configuration.

ID	Type	DLC	D0	D1	D2	D3	D4	D5	D6	D7
0x7CO	Input for RSR008	8								



<b>DO</b>	New display type: 0x01 R225/ACS, 0x02 R225/170/ACS, 0x03 available
<b>D1 - D7</b>	Not used

## 0x7C1

The message is available in the "free" mode only. It allows to write data in a specific position on the display.

Display is composed of two lines of 20 characters each.

Character position is identified singly as follows:

0x00 0x01 0x02 0x03 0x04 0x05 0x06 0x07 0x08 0x09 0x0A 0x0B 0x0C 0x0D 0x0E 0x0F 0x10 0x11 0x12 0x13  
0x20 0x21 0x22 0x23 0x24 0x25 0x26 0x27 0x28 0x29 0x2A 0x2B 0x2C 0x2D 0x2E 0x2F 0x30 0x31 0x32 0x33

Control 0x7C1 allows to write a string of 7 ASCII characters (max) starting from one of the positions described above.

If the string exceeds the selected line, the invalid part is ignored.

The ASCII characters available in the display map have hexadecimal codes between 0x20 and 0x7F.

The following codes are also available:

0x01: Padlock closed

0x02: Padlock open

0x03: Mark °

Should the number of characters be fewer than 7, code 0 x 00 will be added at the end of the string.

With this message it is possible to delete one or both lines.

Message structure:

ID	Type	DLC	D0	D1	D2	D3	D4	D5	D6	D7
0x7C1	Input RSR008	8								

<b>D0</b>	Controls: 0x00...0x13: Writes from the mark specified in the first line 0x00...0x33: Writes from the mark specified in the second line 0xF1: Deletes the first line 0xF2: Deletes the second line 0xF3: Deletes both lines
<b>D1 - D7</b>	Characters to be entered (the value 0 indicates the string end)

Example:

H e l l o      W o r l d !  
W e l c o m e      t o      R a l c o !

The following sequence must be sent:

ID	DLC	D0	D1	D2	D3	D4	D5	D6	D7	Meaning
0x7C0	8	0x03								Switch the collimator in the mode: "Open display"

0x7C1	8	0xF3								Delete the display
0x7C1	8	0x03	0x48	0x65	0x6C	0x6C	0x6F	0x20	0x57	Writes “ <b>Hello W</b> ” starting from the position 03 hex
0x7C1	8	0x0A	0x6F	0x72	0x6C	0x64	0x21	0x00	0x00	Writes “ <b>orld</b> ” starting from the position 0A hex
0x7C1	8	0x21	0x57	0x65	0x6C	0x63	0x6F	0x6D	0x65	Writes “ <b>Welcome</b> ” starting from the position 21 hex
0x7C1	8	0x29	0x74	0x6F	0x20	0x52	0x61	0x6C	0x63	Writes “ <b>to Ralc</b> ” starting from the position 29 hex
0x7C1	8	0x30	0x6F	0x21	0x00	0x00	0x00	0x00	0x00	Writes “ <b>O!</b> ” starting from the position 30 hex

## STATUS 0x100

This special message is sent by board RSR008 to any net node to transmit data related to collimator operation.

ID	Type	DLC	D0	D1	D2	D3	D4	D5	D6	D7
0x100	Output RSR008	2/8								

<b>D0</b>	
<b>b7</b>	If 1: Collimator is in initial reset phase
<b>b6</b>	Used internally for relay switch lateral SID
<b>b5</b>	Used internally for relay switch lateral SID
<b>b4</b>	If 1: Indicates “x-ray” relay output to be activated
<b>b3</b>	If 1: Indicates “closed shutters” relay output to be activated
<b>b2</b>	If 1: Indicates “manual” relay output to be activated
<b>b1</b>	If 1: Indicates “hold” relay output to be activated
<b>b0</b>	If 1: Indicates “ready” relay output to be activated

<b>D1</b>	
<b>b7</b>	Not used
<b>b6</b>	Not used
<b>b5</b>	Not used
<b>b4</b>	Not used
<b>b3</b>	Not used
<b>b2</b>	Not used
<b>b1</b>	Not used
<b>b0</b>	Not used

**If 0x100 control has been set up to inform about possible alarms (dlc=8):**

<b>D2</b>	
<b>b7</b>	If 1: Filter alarm (position not correct)
<b>b6</b>	If 1: Cross alarm (position not correct)
<b>b5</b>	If 1: Long alarm (position not correct)
<b>b4</b>	If 1: Iris alarm (position not correct)

<b>b3</b>	If 1: Cross or Long reset alarm
<b>b2</b>	Not used
<b>b1-b0</b>	Number of successive trials of filter positioning (0-3)
<b>D3</b>	Total filter alarms from start-up
<b>D4</b>	Total Cross alarms from start-up
<b>D5</b>	Total Long alarms from start-up
<b>D6</b>	Total Iris alarms from start-up
<b>D7</b>	Not used

In the event of R225/006/ACS the control is sent to 0x7D0 address, in other cases to 0x100 address.

## COMPLIANCE VERIFICATION

### MINIMUM FILTRATION REQUIREMENT

To indicate compliance with 21 CFR, sub-chapter J, part 1020 of Performance Standard it is necessary for the assembler to perform a series of tests.

Description of test methods are illustrated in this chapter but factors, such as experience, availability of equipment and tolerance on compliance are referred directly to the Safety Standards covering Electro-medical equipment.

#### WARNINGS



THE FOLLOWING PROCEDURES REQUIRE THAT X-RADIATION BE PRODUCED. TAKE ADEQUATE PRECAUTIONS THAT NO PART OF HUMAN BEING IS EXPOSED TO X-RADIATION, DIRECT OR INDIRECT.

The above HVL requirements can be met if it is demonstrated that the aluminium equivalent in the primary beam is not less than that shown in the following table:

Minimum Filtration Requirement - Beam Quality (HVL)				
X-Ray Tube Voltage (kilovolt peak)		Minimum HVL (mm of aluminum)		
Designed Operating Range (kVp)	Measured Operating Potential (kVp)	Specified Dental System <sup>1</sup>	I-Other X-Ray Systems <sup>2</sup>	II-Other X-Ray Systems <sup>3</sup>
Below 51	30	1.5	0.3	0.3
	40	1.5	0.4	0.4
	50	1.5	0.5	0.5
From 51 a70	51	1.5	1.2	1.3
	60	1.5	1.3	1.5
	70	1.5	1.5	1.8
Above 70	71	2.1	2.1	2.5
	80	2.3	2.3	2.9
	90	2.5	2.5	3.2
	100	2.7	2.7	3.6
	110	3.0	3.0	3.9
	120	3.2	3.2	4.3
	130	3.5	3.5	4.7
	140	3.8	3.8	5.0
	150	4.1	4.1	5.4

<sup>1</sup> Dental X-ray Systems designed for use with intraoral image receptors and manufactured after December 1, 1980.

<sup>2</sup> Dental X-ray Systems designed for use with intraoral image receptors and manufactured before or on December 1, 1980, and all other X-ray systems subjected to this section and manufactured before June 10, 2006.

<sup>3</sup> All X-ray systems, except dental X-ray systems designed for use with intraoral image receptors subjected to this section and manufactured on or after June 10, 2006.

The information contained in the above table was extracted from the Code of Federal Regulations FDA 21 1020.30 (m).

Type 100 Aluminium Alloy (as given in "ALUMINUM STANDARDS AND DATA" verification of compliance).

### Visual Determination of Half-Value Layer (HVL)

The above HVL requirements can be met if it is demonstrated that the aluminium equivalent in the primary beam is not less than that shown in the following Total Filtration table:

Total Filtration Of Primary Beam In Aluminium Equivalence	
Operating Voltage (kVp)	Total Filtration (mm Al Equivalent)
Below 50	0.5
From 51 to 70	1.5
Over 70	2.2

The Aluminium equivalence of each component in the primary beam (X-ray tube and housing, beam limiting device and any additional filtration in the system) is specified on the component, in the technical data attached to the component or can be measured. Determine the total aluminium equivalence in the primary beam and make sure that it is equal or greater than those specified in the above **Table Total Filtration of Primary Beam in Aluminium Equivalence**.

### Quick-Check of Minimum Filtration Requirement at a Particular kVp

If the total inherent filtration cannot be seen, then the HVL must be obtained with the following procedures:

The HVL in millimetres of aluminium in the system under test must be compared with those specified in **Table Minimum Filtration Requirement - Beam Quality (HVL)** and must be greater than or equal to the values shown in the table.

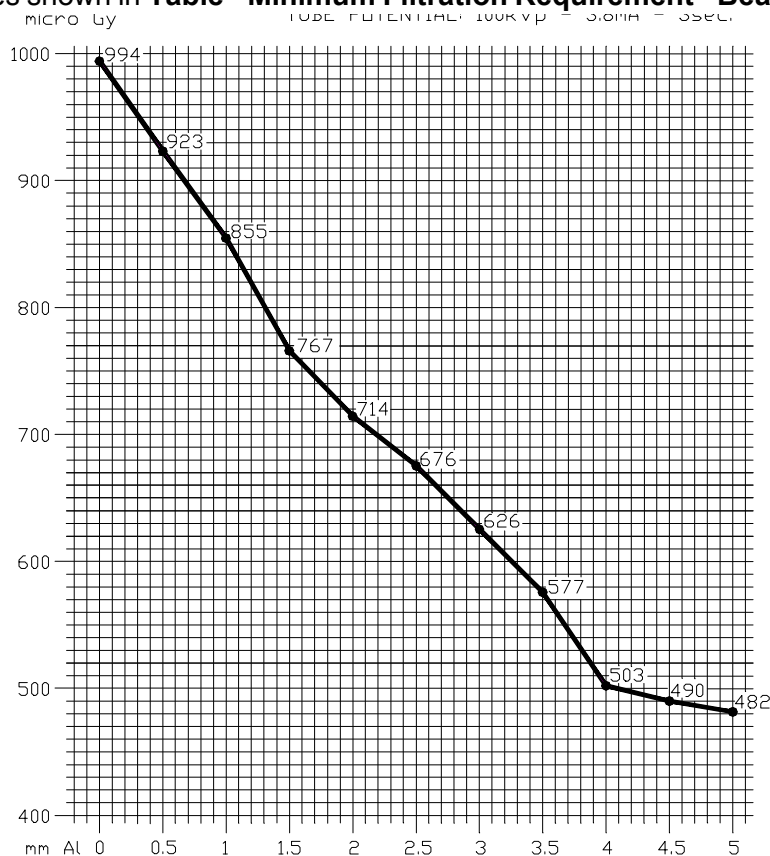
- Direct the central X-ray beam perpendicular and in the center of a RAD-Check instrument. Determine the exact distance from the X-ray tube focal spot to the window of the collimator (273 mm - 10.75"). Place the input area of the RAD-CHECK at an equal distance from the collimator window. Collimate the beam to an area slightly larger than the detector.
- Make an exposure at a pre-selected technique factor of 90 kVp and appropriate mA and time values with no added filtration in the beam; record the reading.  
Using the type 1100 Aluminium Alloy, tape a total of 2.5 mm of Aluminium to the window of the collimator. Make an exposure using the same technique factors; record the reading.
- Verify that the radiation read with the 2.5 mm Al in the beam is greater or equal to 50% of the radiation read with no filtration in the beam.

### Standard Absorber Method

The HVL determination obtained from the following procedures are to be compared with those illustrated in the **Table - Minimum Filtration Requirement - Beam Quality (HVL)**. The HVL

in millimetres of aluminium obtained during the test must be greater or equal than the values listed in the above mentioned table.

- Direct the central X-ray beam perpendicular and in the center of a RAD-Check instrument. Determine the exact distance from the X-ray tube focal spot to the window of the collimator (273 mm - 10.75"). Place the input area of the RAD-CHECK at an equal distance from the collimator window. Collimate the beam to an area slightly larger than the detector.
- Select a tube potential of 100 kVp and appropriate mA and seconds, with no added filtration in the beam make an exposure and record the reading. Using a set of several sheets of 1100 Aluminium Alloy, each having a thickness of 0.5 or 1.0 mm, tape the filtration to the window of the collimator. Make an exposure for each increments of filtration and record the reading.
- Plot the exposure readings (log scale) versus the total added filtration thickness on semi-log paper; see the sample hereunder.
- Verify that HVL values in the useful beam for the above specific tube potential is not less than the values shown in **Table - Minimum Filtration Requirement - Beam Quality (HVL)**.



## **VISUAL DEFINITION OF X-RAY VERSUS LIGHT FIELD**

Chapter - **COLLIMATOR CALIBRATION** - paragraph - **Light-Field to X-ray Field Alignment**.

## **FIELD SIZE INDICATION**

Chapter- **ADJUSTMENTS**, paragraph **Field Size Indication**.

## **CROSSHAIR ALIGNMENT**

### **CHAPTER- ADJUSTMENTS, PARAGRAPH CROSSHAIR ALIGNMENT.**

#### **LIGHT FIELD ILLUMINATION INTENSITY**

- a) When a light field simulating the X-Ray field is used the illumination provided at 100 cm. cannot be less than: 160 lux [(21 CFR 1020.31 (d) (2) (ii)].
- b) Place the Focus of the X-Ray tube at 100 cm. from the table top were the light field as been projected. Open the collimator's shutters to assure that each quadrant of the light field is larger than the measuring area of the photometer.
- c) Check that the voltage specified by the manufacturer is applied to the lamp, make certain that all surfaces in the light beam are clean and unobstructed.
- d) Place a photometer capable of reading up to 160 lux in the centre of each of the four quadrants of the light field.
- e) Turn on the light beam and read the light intensity, subtract to it the ambient lighting, previously determined.
- f) Verify that the average illumination is higher than 160 lux.
- g) Verify that the contrast ratio is performed between two points:
  - The first point at 3 mm outside the edge of the light field.
  - The second point at 3 mm inside the edge of the light field.
 These measurements are to be performed with the probe of the lux metre set at 1 mm aperture.
- h) Record the measured values including all data regarding the instrument and voltage employed.

#### **EMC COMPLIANCE**

The ME Equipment is intended to be used in the PROFESSIONAL EM ENVIRONMENTS.

#### **WARNING**



TO ASSURE THAT ACCESSORIES, TRANSDUCERS AND CABLES THAT CAN AFFECT THE EMISSIONS OR IMMUNITY OF THE ME EQUIPMENT, ACCESSORIES, TRANSDUCERS AND CABLES ARE CHOSEN THAT WILL ALLOW THE ME EQUIPMENT TO CONTINUE TO MEET THE EMISSIONS AND IMMUNITY REQUIREMENTS OF THIS COLLATERAL STANDARD.

## Electromagnetic Emissions

The R 225 ACS - R 225 ACS DHHS collimator is suitable for use in the specified electromagnetic environment. The purchaser or user of the R 225 ACS - R 225 ACS DHHS should assure that it is used in an electromagnetic environment as described below:

Emissions Test	Compliance	Electromagnetic Environment- Guidance
RF emissions CISPR 11	Group 1	The Collimator R 225 ACS - R 225 ACS DHHS needs special precautions regarding EMC and needs to be installed and put into service according to the EMC report. Portable and mobile RF communications equipment can affect the collimator R 225 ACS - R 225 ACS DHHS.
RF emissions CISPR 11	Class [A]	This R 225 ACS - R 225 ACS DHHS is suitable for use in all establishments other than domestic and those directly connected to the low voltage power supply network which supplies buildings used for domestic purposes.  The EMISSIONS characteristics of this equipment make it suitable for use in industrial areas and hospitals (CISPR 11 class A). If it is used in a residential environment (for which CISPR 11 class B is normally required) this equipment might not offer adequate protection to radio-frequency communication services. The user might need to take mitigation measures, such as relocating or re-orienting the equipment
Harmonic emissions IEC 61000-3-2	[Not applicable]	
Voltage fluctuations/flicker emissions IEC 61000-3-3	[Not applicable]	



### Electromagnetic Immunity for All Equipment and Systems

Collimator R 225 ACS - R 225 ACS DHHS is intended for use in the electromagnetic environment specified below. The customer or the user should assure that it is used in such an environment.

Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment
Electrostatic discharge (ESD) IEC 61000-4-2	8 kV contact 2/4/8/15 kV air	EN 60601-1-2 test level	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Radiated electromagnetic field IEC 61000-4-3	3 V/m 80 MHz to 2.7 GHz	IEC 60601-1-2 Test level	Portable and mobile RF communications equipment should be used no closer to any part of the collimator R 225 ACS - R 225 ACS DHHS, including cables. Minimum distance 30 cm
Electrical fast transient/burst IEC 61000-4-4	2 kV for power supply lines 1 kV for input/output lines >3m	EN 60601-1-2 test level	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	0.5/1 kV differential mode 0.5/1/2 kV common mode	EN 60601-1-2 test level	Mains power quality should be that of a typical commercial or hospital environment.
Conducted disturbances induced by RF fields IEC 61000-4-6	3 V 150 kHz to 80 MHz 6V ISM frequencies	IEC 60601-1-2 Test level	Portable and mobile RF communications equipment should be used no closer to any part of the collimator R 225 ACS - R 225 ACS DHHS, including cables. Minimum distance 30 cm
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	10 ms – 0% a 0°, 45°, 90°, 135°, 180°, 225°, 270°, 315° 20 ms – 0% a 0° 500 ms – 70% a 0° 5 s – 0%	EN 60601-1-2 test level	Mains power quality should be that of a typical commercial or hospital environment. If the user of the collimator R 225 ACS - R 225 ACS DHHS requires continued operation during power mains interruptions, it is recommended that the collimator R 225 ACS - R 225 ACS DHHS be powered from an uninterruptible power supply or a battery.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	30 A/m	EN 60601-1-2 test level	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.

### Frequency Range and Level: RF wireless communication EQUIPMENT

Collimator R 225 ACS - R 225 ACS DHHS is intended for use in the electromagnetic environment specified below. The customer or the user should assure that it is used in such an environment.

Test Frequency (MHz)	Modulation	Minimum IMMUNITY Level (V/m)	IMMUNITY Level Applied (V/M)
385	**Pulse Modulation: 18 Hz	27	27
450	*FM $\pm$ 5 Hz deviation: 1 kHz sine **Pulse Modulation: 18 Hz	28	28

**Frequency Range and Level: RF wireless communication EQUIPMENT**

710 745 780	**Pulse Modulation: 217 Hz	9	9
810 870 930	**Pulse Modulation: 18 Hz	28	28
1720 1845 1970	**Pulse Modulation: 217 Hz	28	28
2450	**Pulse Modulation: 217 Hz	28	28
5240 5500 5785	**Pulse Modulation: 217 Hz	9	9

## COVER REMOVAL

(1).

REMOVE THE TWO KNOBS BY UNSCREWING THE DOWEL.



(2).

REMOVE CAREFULLY THE SNAP-ON FRONT PANEL.



(3).

DISCONNECT THE CONNECTOR.



(4).

REMOVE THE TAPE STOP BY LIFTING IT OFF WITH A SCREW DRIVER. GENTLY EASE THE TAPE INTO ITS CONTAINER WITHIN THE COLLIMATOR.



(5).

TURN THE COLLIMATOR OVER  
AND UNSCREW THE FOUR  
SCREWS PLACED ON THE  
RAILS.



(6).

REMOVE THE REAR COVER BY  
UNSCREWING THE FOUR  
SCREWS.



(7).

REMOVE THE LATERAL COVER  
BY LIFTING IT OFF FROM THE  
TWO SPACERS.



## ADJUSTMENTS

### WARNINGS



THIS IS PROVIDED AS AN AID TO THE END USER. RALCO IS NOT LIABLE FOR ANY DAMAGES RESULTING FROM THE ALTERING OF PRESET FACTORY CONFIGURATIONS.

ADJUSTMENTS HAVE BEEN PRESET AT THE FACTORY PRIOR TO SHIPMENT OF THE COLLIMATOR. SHOULD ANY PROBLEM ARISE REQUIRING THE NEED TO RECALIBRATE, PLEASE CONTACT RALCO FOR ASSISTANCE BEFORE PROCEEDING WITH THE ADJUSTMENT.

### EXTRA-FOCAL SHUTTERS

The instructions that follow are provided by way of information. The customer is advised to contact Ralco prior to proceeding with the adjustment.

Close the Long and Cross shutters completely either manually or via electronic control.

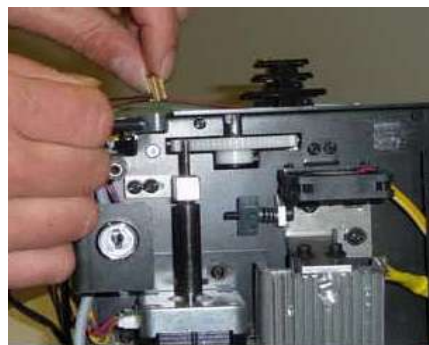
Remove the covers, see Chapter- **COVER REMOVAL**.



Loosen the Long transmission fixing screw.



Remove the shaft screw.

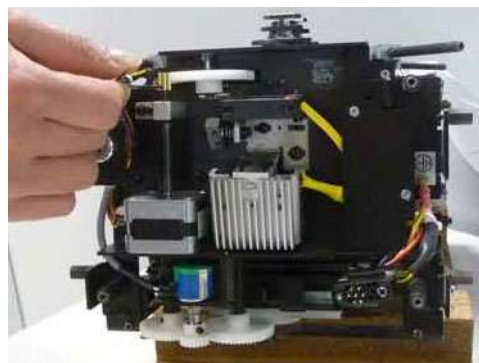


Keeping the Long shutters perfectly closed, manually adjust the movement transmission gear and position the aperture of the long extra-focals to 8.0 mm  $\pm$  0.5.

This value refers to the inside of the upper shutters.

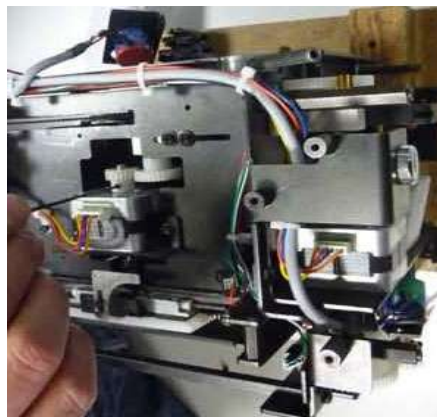


Position the shutters; remount the screw on the transmission shaft.

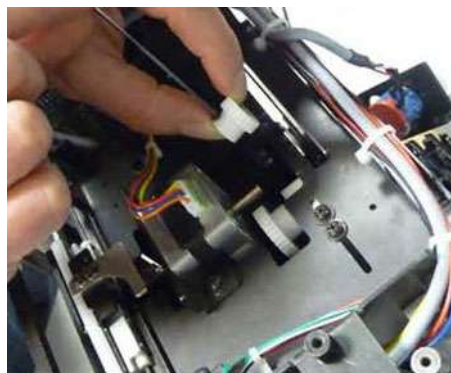




Loosen the Cross transmission fixing screw.



Remove the shaft screw.



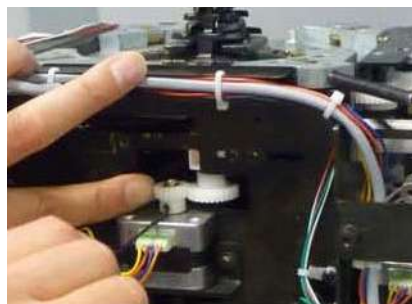
Keeping the Cross shutters perfectly closed, manually adjust the movement transmission gear and position the aperture of the Cross extra-focals to 3.0 mm  $\pm$  0.5.

This value refers to the inside of the upper shutters.



Position the shutters; remount the screw on the transmission shaft.

Remount the collimator covers.



### CROSSHAIR ADJUSTMENT

- Activate the light field.
- Adjust the light field to a narrow line for each pair of shutters by turning the two knobs alternately.
- Check that the project cross line is exact halfway between the edges of the shutters, see **Fig. Cross Line**.
- If adjustment is required, remove the cover from the sides and bottom of the collimator, see Chapter - **COVER REMOVAL**.
- Loosen the four screws securing the plastic panel and adjust the cross lines to coincide with the light lines, see Chapter - **COVER REMOVAL**.
- Tighten the screws.



**Fig. Cross Line**



## LASER LIGHT ADJUSTMENT

The collimator laser is classified as Class 1 (1 m W - wavelength = 645 nm, +/- 10 nm); used for collimator/image receptor center alignment, see **Fig. Laser Line**.

### WARNINGS



CAUTION: CLASS 1 LASER SYSTEM DO NOT STARE INTO THE BEAM.

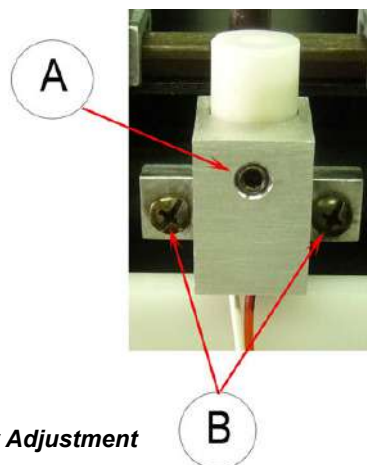
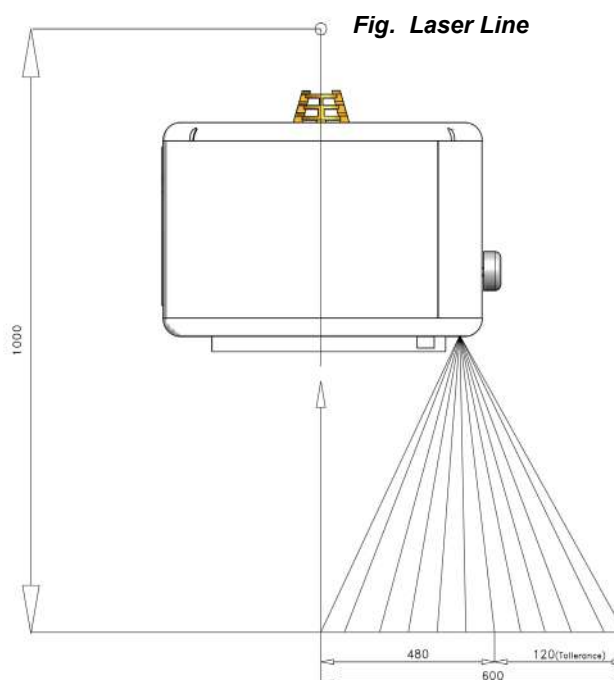
### Laser Adjustment

- Remove part of the cover to access the point of adjustment, see Chapter- **COVER REMOVAL**.
- The line is to fall on a perpendicular cross-line on the plastic anti-dust panel near the collimator controls, see **Fig. Laser Line**.
- Adjust the position of the line by rotating or moving the base of the laser system.
  - To rotate the laser system, loosen the Allen screw **A**, see **Fig. Laser Adjustment**.
  - Tighten the Allen screw when the laser beam falls on or is parallel to the bisector line drawn on the anti-dust panel.
- Shift the laser system by loosening the two **B** screws holding the laser system base to the beam limiting device front plate.
  - Move the base until the laser beam falls over the perpendicular bisector line on the anti-dust panel, see **Fig. Laser Alignment**.
  - Tighten the two **B** screws.

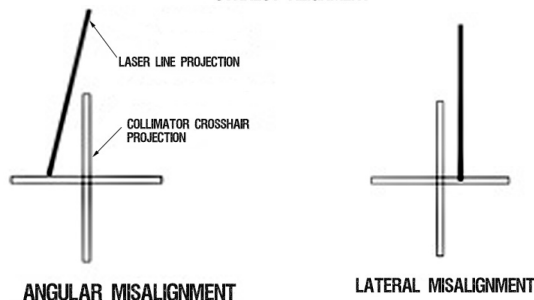
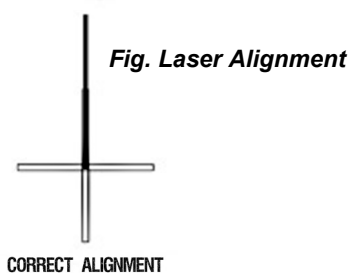
### WARNINGS



DO NOT APPLY EXCESSIVE FORCE TO THE SCREW. THE LASER SHELL IS IN PLASTIC AND EXCESSIVE PRESSURE COULD CRACK THE PLASTIC AND POSSIBLY SHORT-CIRCUIT THE LASER.

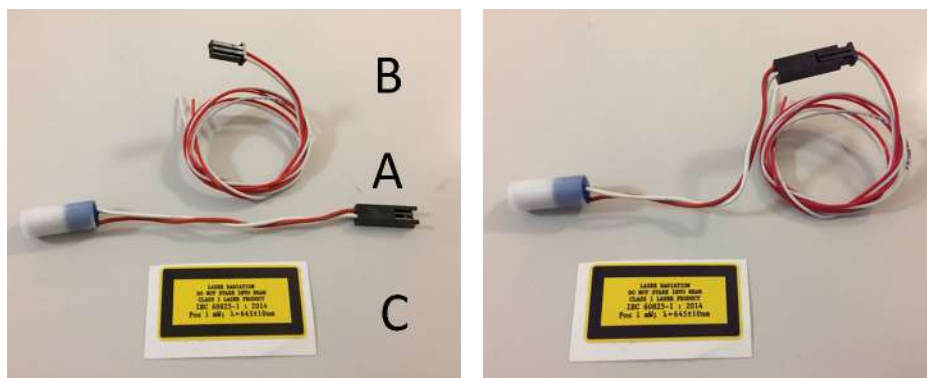


**Fig. Laser Adjustment**



### Substitution

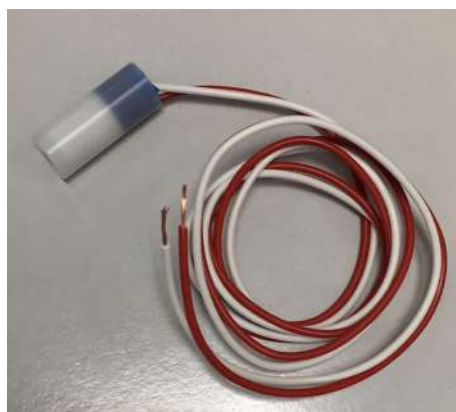
The Laser Substitution Kit is composed of the following components: the laser (A), the extension cable (B) and the laser label (C) pictured below in **Fig. Laser Substitution Kit**. This Kit is designed to substitute any laser Ralco provides.



**Fig. Laser Substitution Kit**

Prior to replacing the laser, confirm which version of laser is installed on your collimator which will ensure the substitution is performed correctly.

- The previous laser version is connected to the board via 2 cables (red and white), see **Fig. Previous Laser Version** below.



**Fig. Previous Laser Version**

- The new laser is connected to the board via the connector, see **Fig. New Laser Version** below..



**Fig. New Laser Version**

### Replacing the Previous Laser Version

To replace the previous version of laser, all components of the Laser Substitution Kit (A, B and C) must be used.

To substitute the laser, proceed as follows:

1. Disconnect the collimator supply.
2. Remove the cover, see Chapter **COVER REMOVAL** in the Instruction Manual for your specific model.
3. Prior to disconnecting the laser cables from the board, identify the cables and their position on the terminal board, see Chapter **INSTALLATION**, paragraph **Wiring Diagram** in the Instruction Manual for your specific model.
4. Carefully remove the laser, the extension cable and the label from their packaging.
5. Ensure the extension cable (**B**) is firmly connected to the laser (**A**), see **Fig. Laser Substitution Kit** above.
6. Substitute the laser with the identical item using component (**A**) of the Laser Substitution Kit, see **Fig. Laser Substitution Kit** above.
7. Adjust the length of the extension (**B**) cable by cutting the 2 cables (red/white).
8. Connect both cables to the board.
9. Apply the new laser label (**C**) to the collimator cover, see Chapter **SPARE PARTS** in the Instruction Manual for your specific mode.
10. Verify the Laser alignment, see Chapter **ADJUSTMENT** or **OPTIONAL ITEMS** in the Instruction Manual for your specific model.

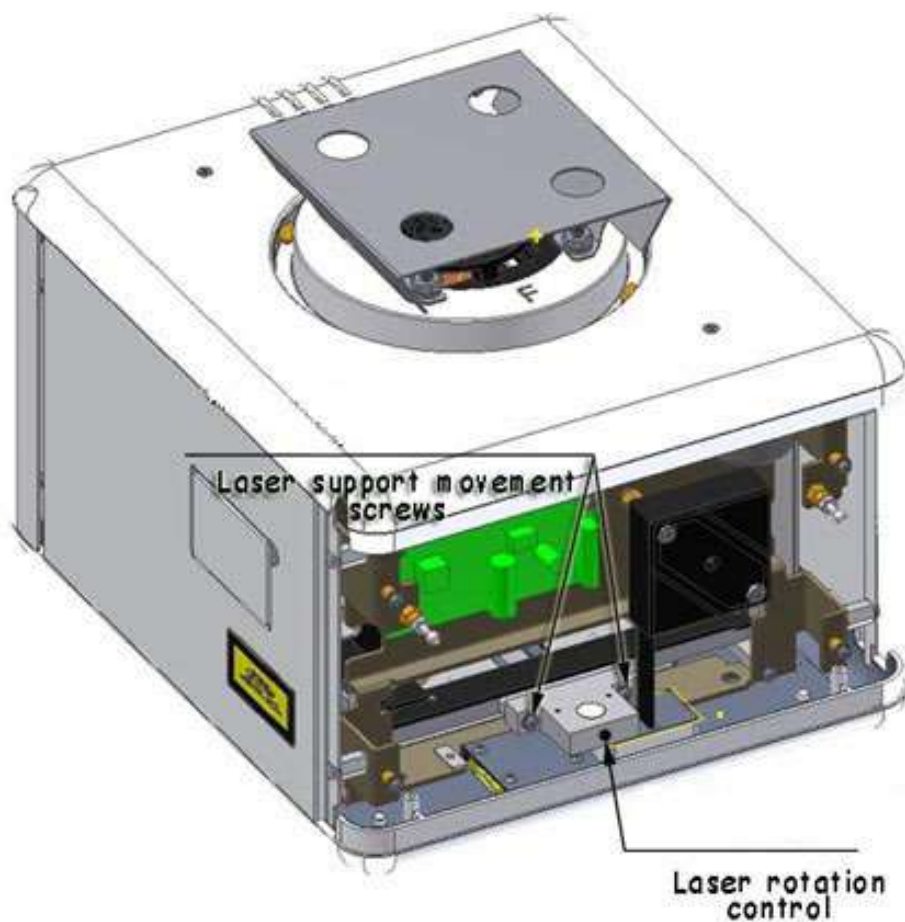
## Replacing the New Laser Version

To replace the new laser version, only part **A** and **C** of the Kit must be used.

To substitute the laser, proceed as follows:

- Disconnect the collimator supply.
- Remove the cover, see Chapter **COVER REMOVAL** in the Instruction Manual for your specific model.
- Detach the connector of the faulty laser from the collimator wiring.
- Carefully remove the laser, the extension cable and the label from their packaging.
- Substitute the laser with the identical item using component (**A**) of the Laser Substitution Kit, see **Fig. Laser Substitution Kit** above.
- Connect the new laser to the collimator wiring.
- Apply the new laser label (**C**) to the collimator cover, see Chapter **SPARE PARTS** in the Instruction Manual for your specific mode.
- Verify the Laser alignment, see Chapter **ADJUSTMENT** or **OPTIONAL ITEM** in the Instruction Manual for your specific model.

**Fig. Laser Control**



## TROUBLESHOOTING

A faulty Collimator must not be used until it is repaired and checked.

The use of a faulty collimator might impair the safety of the operator and patient.

Before returning the collimator to Ralco for repair, please make sure that the fault is not caused by one of the problems listed below. If the indications provided fail to solve your fault, **please make sure that you obtain a Return number (RMA) from Ralco for the collimator**, see Chapter - **GENERAL**, paragraph **Repairs**.

### GENERAL FAULT FINDING

Function	Fault Description	Fault finding and solutions
Light	Faulty light source	<ul style="list-style-type: none"> <li>Check if power supply is OK (see chapter <b>SPECIFICATION</b>)</li> <li>Check if LED power supply is + 3 V</li> <li>If still NOK, replace LED (see chapter <b>SUBSTITUTIONS</b>)</li> </ul>
	Faulty timer	<ul style="list-style-type: none"> <li>Check if power supply is OK (see chapter <b>SPECIFICATION</b>)</li> <li>Check if timer board is supplied</li> <li>Check if fan operates when pressing the push button on the front panel</li> <li>Check if green diode place on the timer is ON when pressing the push button on the front panel.</li> <li>If NOK, replace the timer board (see chapter <b>SUBSTITUTIONS</b>)</li> </ul>
	Area defined by Light Field not (completely) on film	<ul style="list-style-type: none"> <li>Check if source flange distance is correct (see chapter <b>INSTALLATION</b>)</li> <li>Check if mirror or light source are positioned correctly (see chapter <b>CALIBRATION</b>)</li> <li>If still NOK, exchange the collimator.</li> </ul>
	Faulty ON/OFF push-button	<ul style="list-style-type: none"> <li>Check contact</li> <li>If NOK, replace the front panel</li> </ul>

Function	Fault Description	Fault finding and solutions
Shutters	Shutters do not hold position.	<ul style="list-style-type: none"> <li>Check if potentiometer are correctly calibrated (see chapter <b>REPLACEMENTS</b>)</li> <li>If still NOK, replace.</li> </ul>
	Shutters fail to move	<ul style="list-style-type: none"> <li>Check motor cabling</li> <li>If still NOK, replace motor</li> </ul>
	Shutter close	<ul style="list-style-type: none"> <li>Check motor cabling</li> <li>If still NOK, replace motor</li> </ul>

### INDICATORS GC-LED-4A

Number	Color	Description	Fault finding and solutions
LED1	Green	+12 V DC or +24 V DC	<p>In case LED1 is OFF:</p> <ul style="list-style-type: none"> <li>check if +12/+24 V is present; LED1 should be ON</li> <li>if still NOK, check if system cables are connected correctly to <b>GC-LED-4A</b></li> <li>if still NOK, replace GC-LED-4A (see chapter <b>SUBSTITUTIONS</b>)</li> <li>if still NOK, replace collimator.</li> </ul>
LED2	Yellow	Software version	<ul style="list-style-type: none"> <li>check if LED2 blinks 4 times</li> <li>if NOT, wrong software version, replace collimator (see chapter <b>SUBSTITUTIONS</b>)</li> </ul>

LED3	Red	Alarms	<p>1 blink: Disconnected LED or Driver failure</p> <ul style="list-style-type: none"> <li>• check if LED is connected correctly</li> <li>• if still NOK, replace LED</li> <li>• if still NOK, replace GC-LED-4A (see chapter <b>SUBSTITUTIONS</b>)</li> <li>• if still NOK, replace collimator.</li> </ul> <p>2 blinks: LED short circuit</p> <ul style="list-style-type: none"> <li>• remove the short circuit</li> <li>• if still NOK, replace LED</li> <li>• if still NOK, replace GC-LED-4A (see chapter <b>SUBSTITUTIONS</b>)</li> <li>• if still NOK, replace collimator.</li> </ul> <p>3 blinks: Fan failure or disconnected</p> <ul style="list-style-type: none"> <li>• check if fan is connected correctly</li> <li>• if still NOK, replace fan (see chapter <b>SUBSTITUTIONS</b>)</li> <li>• if still NOK, replace GC-LED-4A (see chapter <b>SUBSTITUTIONS</b>)</li> <li>• if still NOK, replace collimator.</li> </ul> <p>4 blinks: Laser failure or disconnected</p> <ul style="list-style-type: none"> <li>• check if laser is connected correctly</li> <li>• if still NOK, replace laser (see chapter <b>SUBSTITUTIONS</b>)</li> <li>• if still NOK, replace GC-LED-4A (see chapter <b>SUBSTITUTIONS</b>)</li> <li>• if still NOK, replace collimator.</li> </ul> <p>5 blinks: push button pressed longer than 5 seconds or short-circuited</p> <ul style="list-style-type: none"> <li>• check if push button works properly</li> <li>• remove short circuit if present</li> <li>• if still NOK, replace GC-LED-4A (see chapter <b>SUBSTITUTIONS</b>)</li> <li>• if still NOK, replace collimator.</li> </ul> <p>6 blinks: PCB temperature &gt; 105°</p> <ul style="list-style-type: none"> <li>• switch OFF the collimator for 10 minutes</li> </ul>
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## SUBSTITUTIONS

### LED SUBSTITUTION

#### WARNING



NOT IMMEDIATELY TOUCH THE DISSIPATER WITH YOUR FINGERS IT COULD BE HOT AND CAUSE SEVERE BURNS.

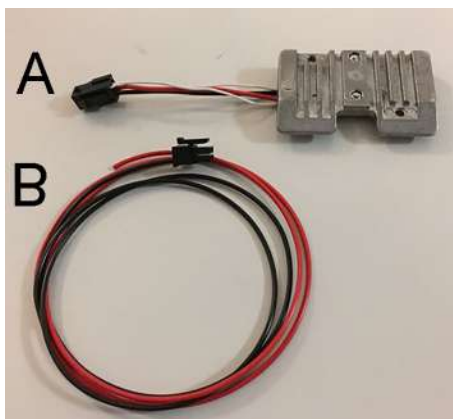


DO NOT TOUCH THE LIGHT SOURCE, THE SOCKET, OR THE LIGHT BRACKET WITH YOUR FINGER. THEY CAN BE VERY HOT AND CAUSE SEVERE BURNS.



DO NOT TOUCH THE LED LENS WITH YOUR FINGERS DIRECTLY, EVEN WHEN IT IS COLD. OIL FROM YOUR SKIN WILL LOWER THE LED PERFORMANCE. IF YOU HAVE TOUCHED THE LED, WIPE THE LED SURFACE WITH A SOFT CLOTH IN CASE OF CONTACT.

The LED Substitution Kit is composed of the following components: the LED (**A**), and an extension cable (**B**), pictured in **Fig. LED Substitution Kit**. This Kit is designed to substitute any LED Ralco provides.



**Fig. LED kit**

Prior to replacing the LED, confirm which version of LED is installed on your collimator which will ensure the substitution is performed correctly.



- The previous version LED is connected to the board via 2 cables (red and black), see **Fig. Previous Version LED** below.



**Fig. Previous Version LED**

- The new LED is connected to the board via the connector, see **Fig. New Version LED** below.



**Fig. New Version LED**

### Replacing the Previous Version LED

To replace the previous version of LED, both components of the LED Substitution Kit (A and B) must be used.

To substitute the LED, proceed as follows:

- Disconnect the collimator supply.
- Remove the cover, see Chapter - **COVER REMOVAL** in the Instruction Manual for your specific model.
- Remove the LED heat sink protection by unscrewing the 2 screws **C**, see **Fig. LED Substitution** below.
- Prior to disconnecting the LED cables from the board, identify the cables and their position on the terminal board, see Chapter **INSTALLATION**, paragraph **Wiring Diagram** in the Instruction Manual for your specific model.
- Carefully remove the LED and the extension cable from their packaging.
- Make sure that the extension cable (**B**) is firmly connected to the LED (**A**), see **Fig. LED kit**.
- Adjust the length of the extension (**B**) cable by cutting the 2 cables (red/black).
- Connect both cables to the board.
- Remount the heat sink protection by tightening the two fixing screws (**C**), see **Fig. LED Substitution** below.
- Remount the covers in reverse order, see Chapter **COVER REMOVAL**.
- Verify the Light Field/X-Ray field correspondence, see Chapter **CALIBRATION**.

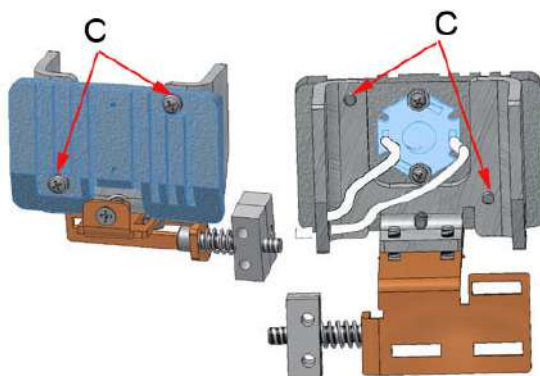


## Replacing the New Version LED

To replace the new version LED, only part A of the Kit must be used.

To substitute the LED, proceed as follows:

- Disconnect supply.
- Remove the cover, see Chapter **COVER REMOVAL**.
- Remove the LED heat sink protection by unscrewing the 2 screws **C**, see **Fig. LED Substitution** below.
- Detach the connector of the faulty LED from the collimator wiring.
- Substitute the LED with an identical item by using the part **A** of the LED Substitution Kit.
- Remount the heat sink protection by tightening the 2 fixing screws **C**, see **Fig. LED Substitution** below.
- Remount the covers in reverse order, see Chapter **COVER REMOVAL**.
- Verify the Light Field/X-Ray field correspondence, see Chapter **CALIBRATION**.



**Fig. LED Substitution**

## SUBSTITUTION OF THE ELECTRONIC BOARD RSR008

- Disconnect the collimator supply.
- Remove the cover to access the component, see Chapter- **COVER REMOVAL**.
- Identify the cables and their position on the board, see Chapter **INSTALLATION**.
- Disconnect the cables from the electronic board RSR008.
- Remove the RSR008 boards by unscrewing the fixing screws.
- Substitute the board and remount in reversed order; pay particular attention to the connection of the cables.
- Power up the collimator and make sure that the collimator operates correctly.

### SUBSTITUTION OF THE ELECTRONIC BOARD FOR LED

The PCB Substitution Kit is composed of the following components: the board (A), an extension cable (B)\* and 8 jumpers (C), pictured in opposite **Fig. PCB Substitution Kit**. This Kit is designed to substitute the previous version of the timer board for LED.

**(B)\* - The extension cable is added only if the collimator model is equipped with the additional filtration and with the indicator diode place on the front panel. In other cases, is useless and it will not be added to the PCB Substitution Kit.**

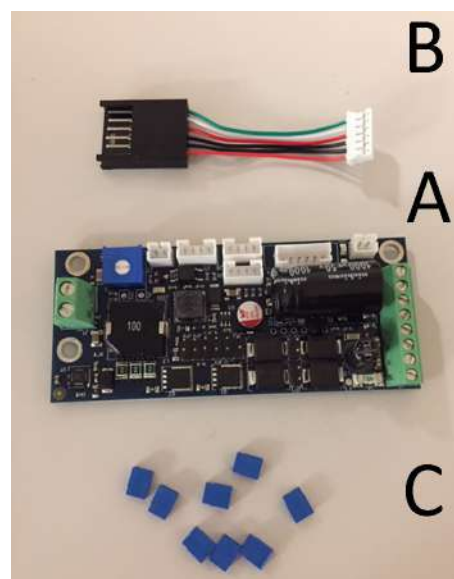
**To substitute the timer board, proceed as follows:**

1. Disconnect the collimator supply.
2. Remove the cover, see Chapter **COVER REMOVAL** in the Instruction Manual for your specific model.
3. Prior to disconnecting the cables from the board, identify the cables and their position on the terminal board, see Chapter **INSTALLATION**, paragraph Wiring Diagram in the Instruction Manual for your specific model
4. Carefully remove the timer board, the extension cable and the jumpers from their packaging.

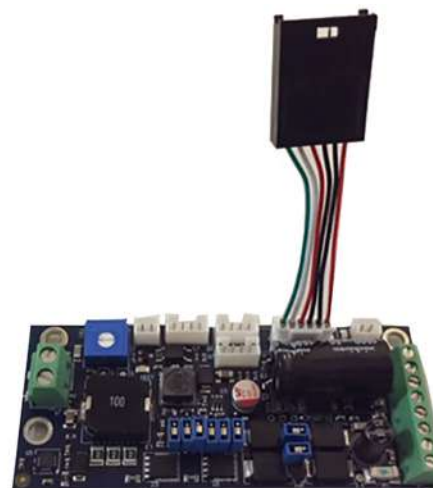
The next 3 steps are applicable only to the collimator equipped with the additional filtration and the indicator diode placed on the front panel.

- Insert the extension cable (B) in the J4 connector, placed on the new timer board, see **Fig. Extension Cable**.
- Detach the connector from the faulty timer board, see **Fig. Connector Removal** below.
- Connect the unplugged connector to the extension cable (B), see **Fig. Extension Cable Connection** below.

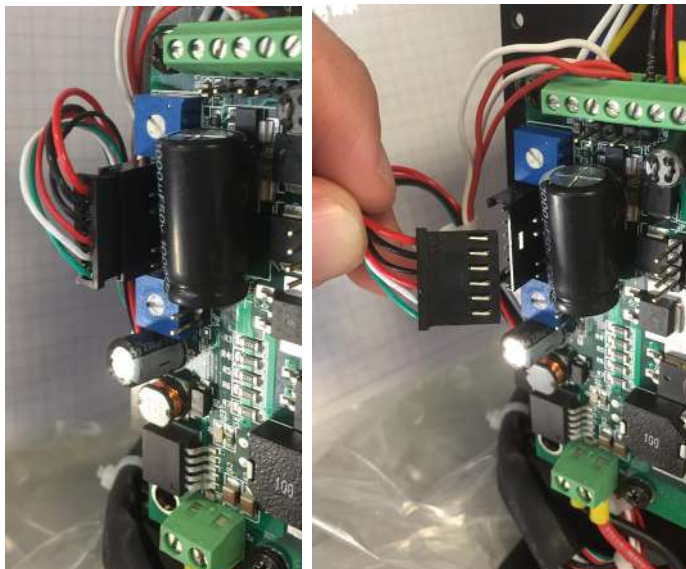
5. Remove the 2 screws holding the timer board.
6. Install the new timer board by proceeding in a reverse order; pay particular attention to the connection of the cables on the 2 or 8-way electric terminal.
7. Correctly set up the board by using the 8 jumpers (C) according to the Wiring Diagram. See Chapter **INSTALLATION**, paragraph Wiring Diagram and **GC-LED-4A** in the Instruction Manual for your specific model for further information.
8. Remount the covers in reverse order, see Chapter **COVER REMOVAL**.
9. Verify the Light Field/X-Ray field correspondence, see Chapter **CALIBRATION**.



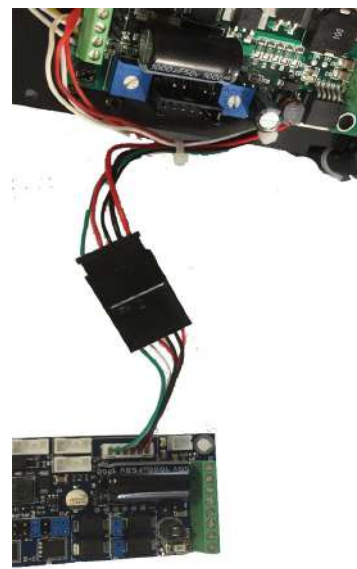
**Fig. PCB Substitution Kit**



**Fig. Extension Cable**



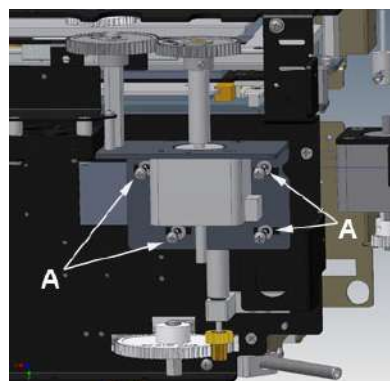
**Fig. Connector Removal**



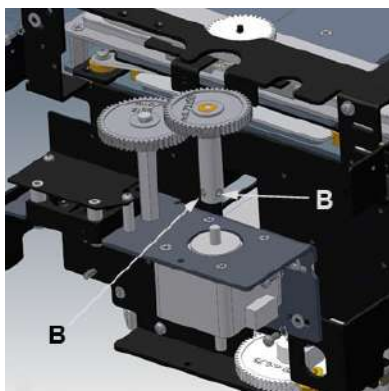
**Fig. Extension Cable Connection**

### SUBSTITUTION OF SQUARE FIELD MOTORS

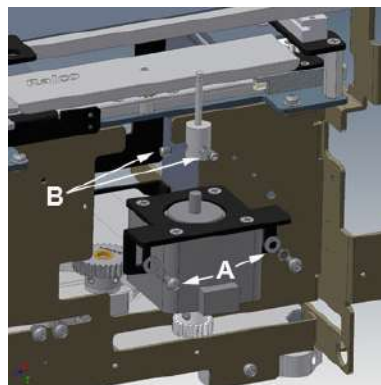
- Disconnect supply.
- Remove the cover, see Chapter - **COVER REMOVAL**.
- Disconnect the motor connector.
- Unscrew the motor support screws **A**, see **Fig. 1** and/or **Fig. 3**.
- Unscrew the Allen screws **B**, see **Fig. 2**.
- Substitute the support with an identical part.
- Remount the support with a new motor.
- Reconnect the connector.
- Mount the front panel.



**Fig. 1**



**Fig. 2**



**Fig. 3**

WARNING



PLASTIC GEARS ARE NOT ALWAYS UNIFORM. POSSIBLE DEFORMATION COULD HARDEN OR BLOCK MOVEMENTS.  
CHECK THAT MOVEMENTS ARE FREE FROM OBSTRUCTIONS ALLOWING THE LEAST PLAY POSSIBLE BETWEEN GEARS.

## SUBSTITUTION OF THE MIRROR

- Remove the collimator cover, see Chapter - **COVER REMOVAL**.
- Remove the four screws on the upper left partition, see **Fig.1**.
- Lift off the upper part of the right-hand partition, see **Fig. 2**.
- Substitute the mirror and remount in reversed order, see **Figure 3**.

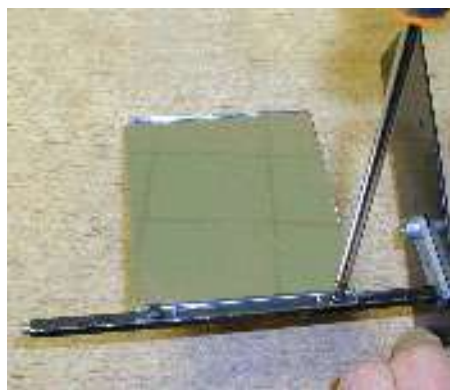
**Fig. 1 Substitution of the Mirror**



**Fig. 2 Substitution of the Mirror**



**Fig. 3 Substitution of the Mirror**





## SPARE PARTS

### NOTE



WHEN ORDERING SPARE PARTS, THE CUSTOMER IS REQUESTED TO SPECIFY THE COLLIMATOR MODEL AND SERIAL NUMBER.



THE SPARE PARTS LISTED BELOW REFER TO THE STANDARD MODEL ONLY.



PLEASE CONSULT YOUR PERSONALIZATION PAGE TO VERIFY WHICH SPARE PARTS MAKE UP YOUR CUSTOMIZED MODEL

## Labels

LABEL 1A



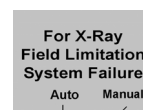
LABEL 1B



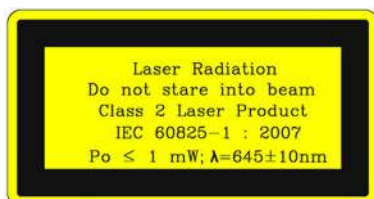
LABEL 2



LABEL 1C



LABEL 3A



LABEL 3B



LABEL 4



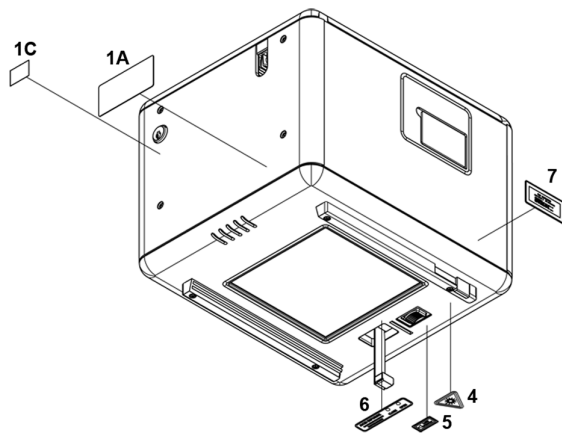
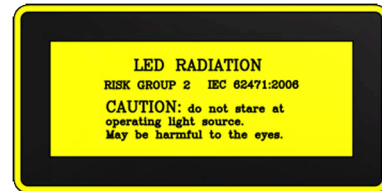
**LABEL 5**



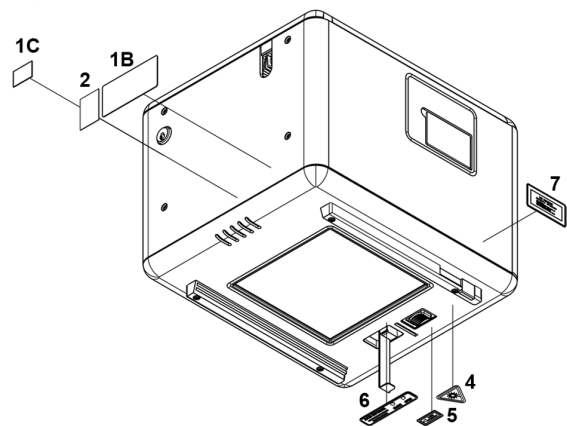
**LABEL 6**



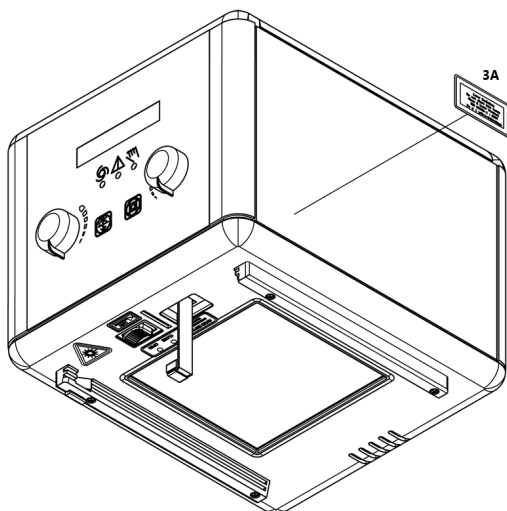
**LABEL 7**



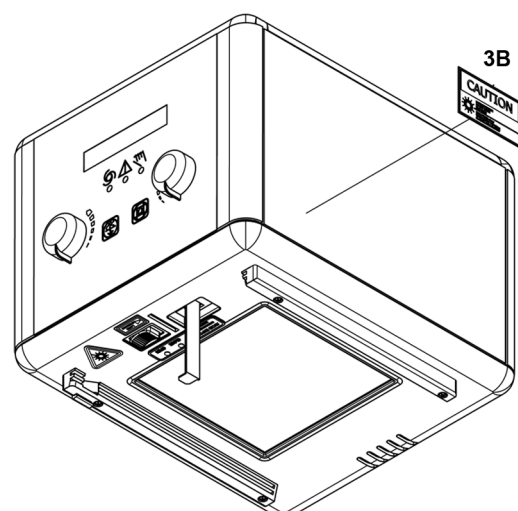
*Fig. Standard Labels - LED and Laser ( Red Laser Line).*



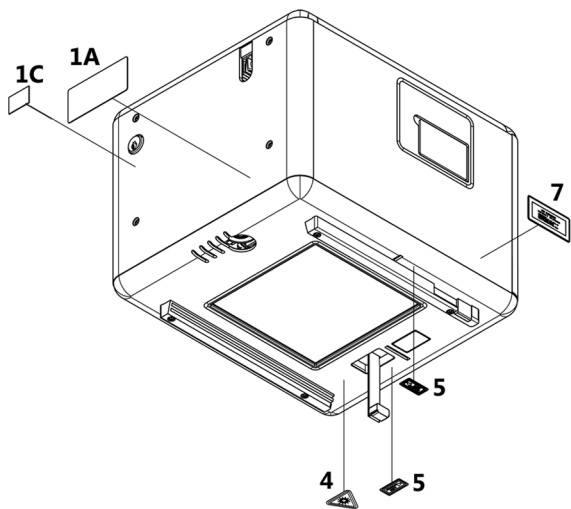
*Fig. DHHS Labels - LED and Laser ( Red Laser Line).*



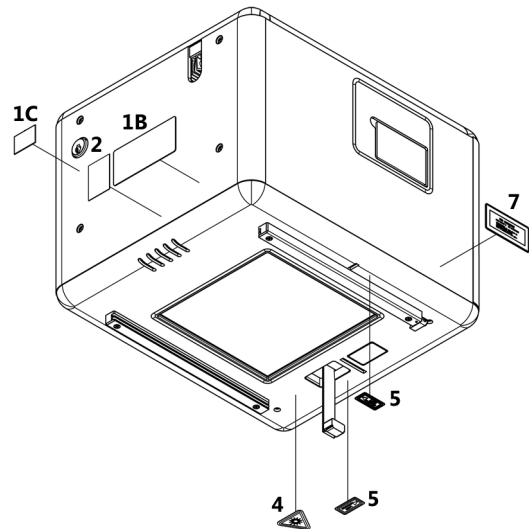
*Fig. Standard Laser Label (Red Laser Line)*



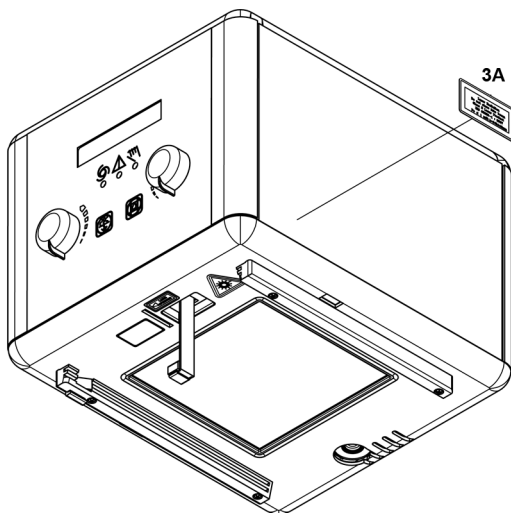
*Fig. DHHS Laser Label (Red Laser Line)*



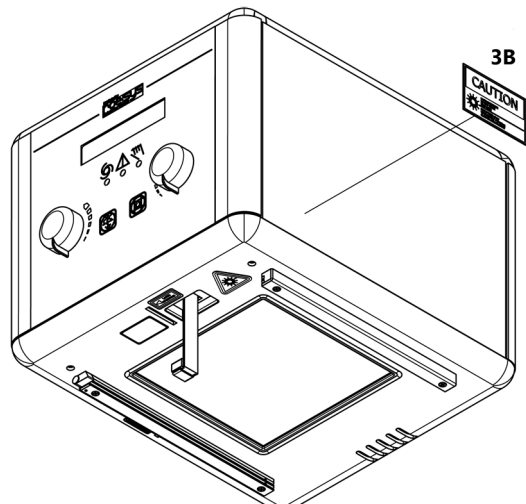
**Fig. Standard Laser Labels (2 Red Laser Lines)**  
- Optional Item RO 242/2



**Fig. DHHS Laser Labels (2 Red Laser Lines)**  
- Optional Item RO 242/2



**Fig. Standard Labels - LED and Laser (2 Red Laser Lines, Optional Item RO 242/2)**



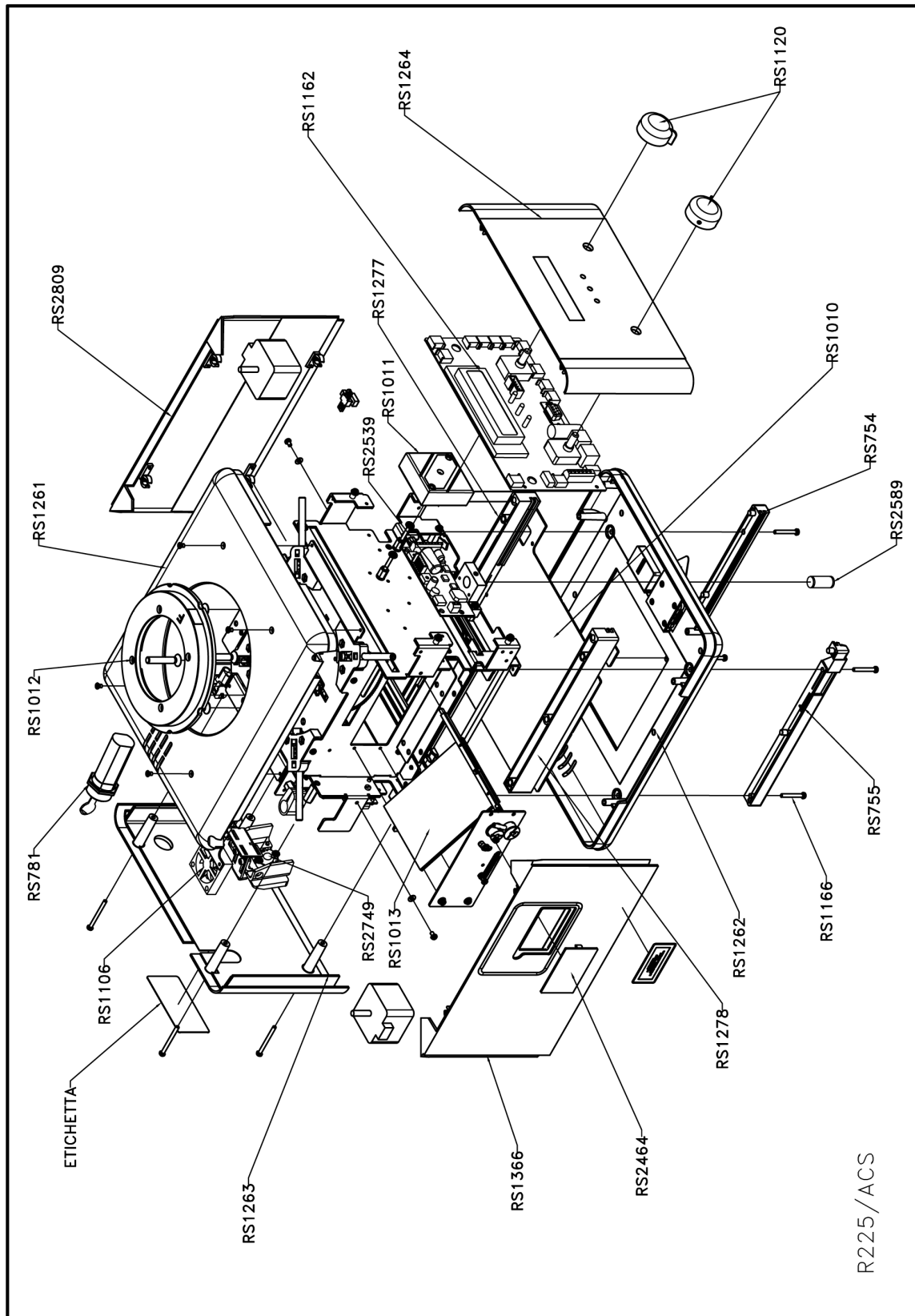
**Fig. DHHS Labels - LED and Laser (2 Red Laser Lines, Optional Item RO 242/2)**

**R225 ACS - R225 ACS DHHS STANDARD**

PN	DESCRIPTION
RS 754	Right accessory guide
RS 755	Left accessory guide
RS 781	Switch
RS 1004	Upper cover, up to SN 716
RS 1010	Antidust panel
RS 1011	Retractable tape measure
RS 1012	Mounting flange
RS 1013	Mirror
RS 1106	Fan
RS 1120	Knob
RS 1124	Front panel, up to SN 716
RS 1125	Lower cover, up to SN 716
RS 1126	Left lateral cover, up to SN 716
RS 1127	Rear cover, up to SN 716
RS 1129	Right lateral cover, up to SN 716
RS 1162	RSR008 board
RS 1166	Screw, TC M3x20mm
RS 1261	Upper cover, from SN 717
RS 1262	Lower cover, from SN 717
RS 1263	Rear cover, from SN 717
RS 1264	Front cover, from SN 717
RS 1277	Right accessory guide spacer
RS 1278	Left accessory guide spacer
RS 1365	Right lateral cover, from SN 717
RS 1366	Left lateral cover, from SN 717
RS 2464	Lateral access panel
RS 2539	LED board
RS 2589	Laser
RS 2749	LED
RS 2809	Right lateral cover



## PARTS BREAKDOWN



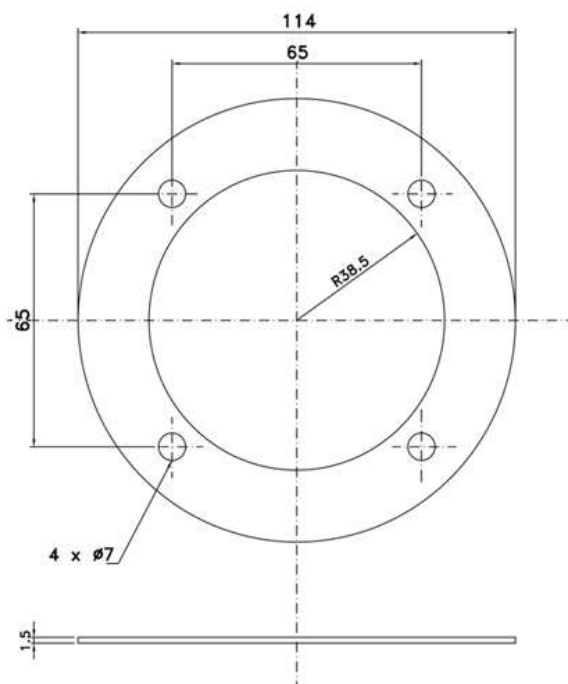
MTR 225 ACS - MTR 225 ACS DHHS - Spare Parts

## OPTIONAL ITEMS

This collimator may have the following optional items; a detailed description is provided in this chapter.

### RO 002 Iron Mounting Flange Spacer

This accessory is used for the mounting flange; 1.5 mm thickness.



### RO 063 Final Quality Test Report Documentation

This test provides higher control to check 100% of the production lot to verify product quality from beginning to end of the production cycle.

Final tests include:

- Light field illumination intensity (if applicable),
- Light field to X-ray field alignment (if applicable),
- X-ray leakage test,
- Edge contrast (if applicable),
- Operation and electronic check up.

### RO 074 External housing and guide rails in customized color

The customer can specify a collimator cover color. Ralco's standard color is RAL9003.

### RO 082 Glass Mirror

Glass mirror, 0.8 mm thickness, inherent filtration 1 mm Al equivalent. With this mirror, the collimator equivalent filtration value of 2 mm Al is reduced to 1 mm Al.

### RO 096 Wiring Customization

Customized electrical wiring. If ordered please refer to the **PERSONALIZATIONS**, annex included with this Instruction Manual, Chapter – Installation, paragraph **Wiring Diagram**.

### RO 107 Knob Color Customization

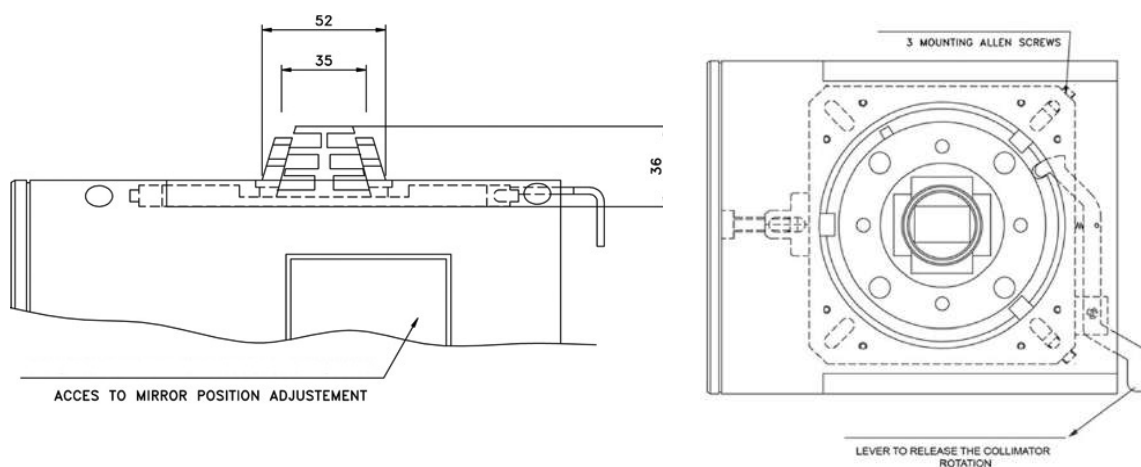
The customer can specify the required knob color.

### RO 111 Front panel customization

The customer can customize the front panel adding, for example, the Company Logo and/or the Company colors.

### RO 203 Self-centering top-cover bracket for Siemens X-Ray tube

This bracket is designed for Siemens X-Ray tube only (flange provided by Siemens only).



MTR 225 ACS - MTR 225 ACS DHHS - Optional Items



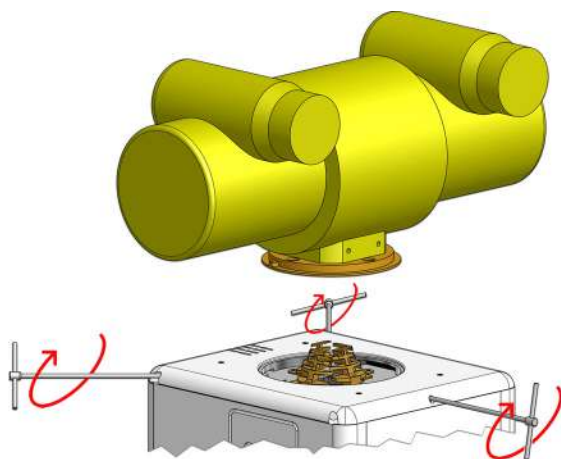
**NOTE**

RALCO RECOMMENDS FOLLOWING THE BELOW PROCEDURE, DURING THE INSTALLATION OF THE COLLIMATOR EQUIPPED WITH THE SIEMENS TOP COVER TO THE X-RAY TUBE. THE CORRECTLY PERFORMED PROCEDURE ALLOWS THE COLLIMATOR TO ROTATE FREELY.

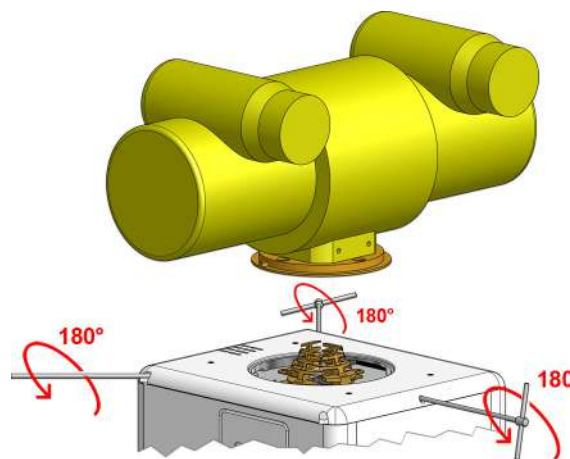
**PROCEDURE:**

1. REMOVE THE COLLIMATOR FROM ITS PACKAGING AND PLACE IT ON A FLAT SURFACE,
2. UNSCREW ALL 3 FIXING SCREWS OF THE COLLIMATOR, SEE **FIG. 1**,
3. INSTALL THE COLLIMATOR ONTO THE FLANGE PREVIOUSLY MOUNTED TO THE X-RAY TUBE.
4. TIGHTEN ALL 3 SCREWS COMPLETELY, SO THAT THE TABS WILL TOUCH THE FLANGE SLIGHTLY,
5. ONCE THE SCREWS ARE COMPLETELY TIGHTENED LOOSEN ONE BY ONE ABOUT 1/2 TURN (180°) TO ALLOW THE COLLIMATOR TO ROTATE FREELY. SEE **FIG. 2**.

**Fig. 1**



**Fig. 2**



**RO 210 Aluminium Accessory Guides**

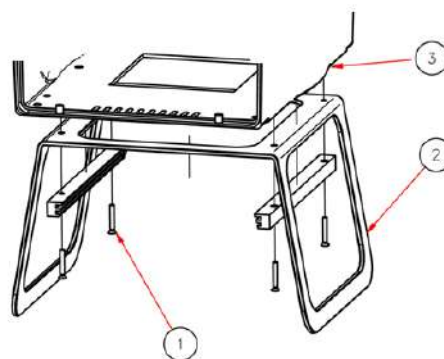
Aluminium accessory guides in RAL 9003 used to input filters or ionization chamber.

**RO 240 Focal-spot to skin spacer**

This accessory ensures a minimum safety distance (309.5 mm) between the X-ray focus and the patient.



THIS ACCESSORY DEALS WITH PREVENTING THE USE OF INAPPROPRIATE SMALL FOCUS/ SKIN DISTANCES IN ORDER THAT THE DOSE EQUIVALENT TO THE PATIENT BE KEPT AS LOW AS REASONABLY POSSIBLE.



1 - Countersunk Screws, 2 - Focus-Skin Distance Spacers, 3 - Collimator Cover.

## RO 242/1 Single Laser Line to align collimator and detector center: Class 2

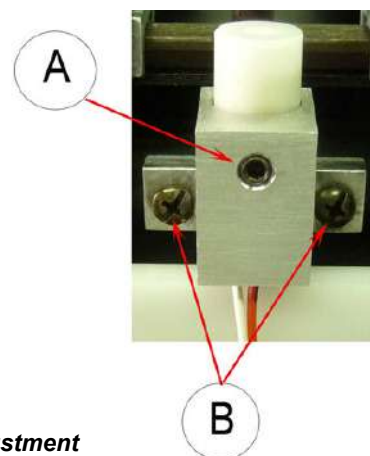
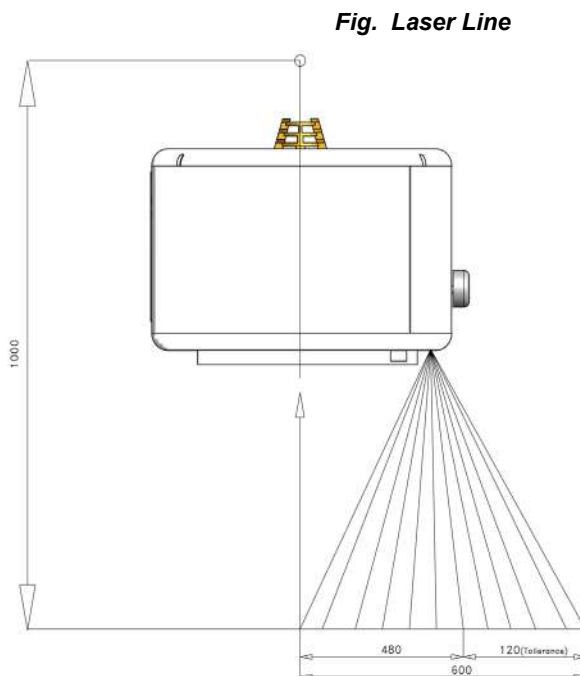
The collimator laser is classified as Class 2 (1 m W - wavelength = 645 nm  $\pm$  10 nm); used for collimator/image receptor center alignment, see **Fig. Laser Line**.



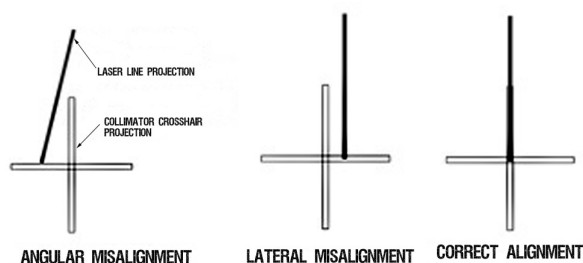
CAUTION: CLASS 2 LASER SYSTEM DO NOT STARE INTO THE BEAM.

### Laser Adjustment

- Remove part of the cover to access the point of adjustment, see Chapter- **COVER REMOVAL**.
- The line is to fall on a perpendicular cross-line on the plastic anti-dust panel near the collimator controls, see **Fig. Laser Line**.
- Adjust the position of the line by rotating or moving the base of the laser system.
  - To rotate the laser system, loosen the Allen screw **A**, see **Fig. Laser Adjustment**.
  - Tighten the Allen screw when the laser beam falls on or is parallel to the bisector line drawn on the anti-dust panel.
  - To tilt the laser system, loosen the 2 screws **C** placed on the laser support and shift it upwards or downwards. See **Fig. Laser Adjustment**.
  - Once the position of the laser line has been adjusted, tighten the 2 screws **C**.
- Shift the laser system by loosening the two **B** screws holding the laser system base to the beam limiting device front plate.
  - Move the base until the laser beam falls over the perpendicular bisector line on the anti-dust panel, see **Fig. Laser Alignment**.



**Fig. Laser Adjustment**



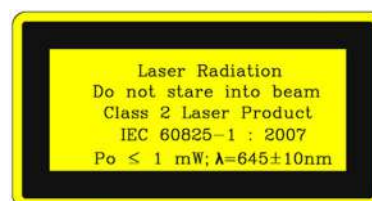
**Fig. Laser Alignment**

- Tighten the two **B** screws.



DO NOT APPLY EXCESSIVE FORCE TO THE SCREW. THE LASER SHELL IS IN PLASTIC AND EXCESSIVE PRESSURE COULD CRACK THE PLASTIC AND POSSIBLY SHORT-CIRCUIT THE LASER.

**Classification EN 60825-1 par. 1 -5:** Class 2 laser product => Red laser line.



**RO 242/2 Two lasers (one mounted externally) forming a crosshair to center the patient to the collimator: Class 2**

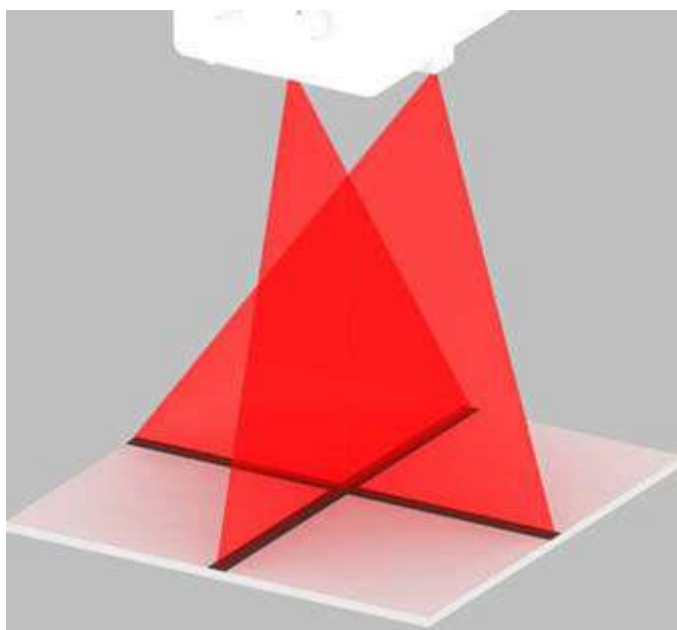
Second laser which serves to center the patient using the cross projection.

The collimator lasers are classified as Class 2 (1 m W - wavelength = 645 nm, +/- 10 nm) and are used for collimator/image receptor center alignment.

**WARNING**



CAUTION: CLASS 2 LASER SYSTEM DO NOT STARE INTO THE BEAM





#### CALIBRATION CONTROL

- Draw a cross (two lines at 90°) on a sheet of paper and use this as reference.
- Switch the light ON and set the sheet of paper at 1 m from the focus.
- Make sure the cross on the paper coincides exactly with the two lines silk-screened on the plastic window.
- Examine the laser projections on the paper: the laser is correctly calibrated when the projections coincide with the lines drawn on the paper, otherwise an adjustment will be necessary.

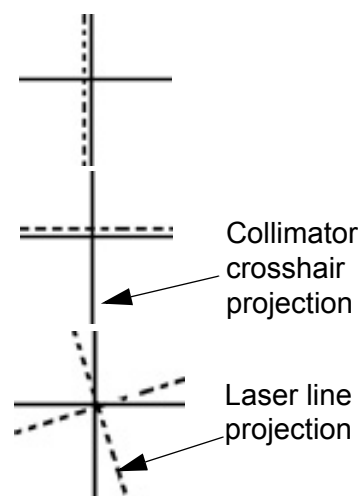


Fig. Laser projections

#### ADJUSTMENT

##### Horizontal

- Disconnect power supply.
- Remove the laser cover located on the rail by unscrewing the two screws **A**, see **Fig. Horizontal Laser**.
- To correct horizontal misalignment, loosen the screws **B**, see **Fig. Horizontal Laser** and move the laser support until the projected laser line coincides with the cross on the sheet of paper. Tighten screws **B**.

##### Vertical

- Disconnect power supply.
- Remove the knobs and front panel, see Chapter- **COVER REMOVAL**.
- To correct vertical misalignment, loosen the Allen screw **A**, see **Fig. Vertical Laser** on the laser support; rotate the laser and align the laser line over the cross on the sheet of paper. Tighten **B** screw s.

#### WARNING



DO NOT APPLY EXCESSIVE FORCE TO THE SCREW. THE LASER SHELL IS IN PLASTIC AND EXCESSIVE PRESSURE COULD CRACK THE PLASTIC AND POSSIBLY SHORT-CIRCUIT THE LASER.

#### SUBSTITUTION

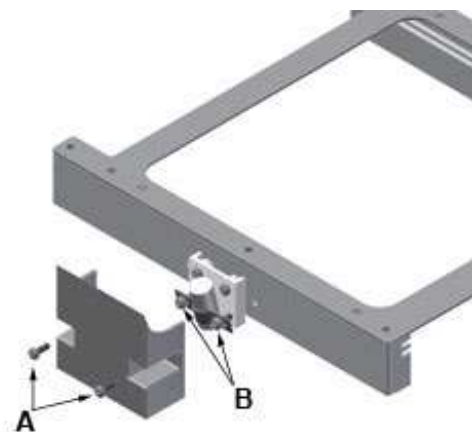
##### Horizontal

- Disconnect supply.
- Remove the laser cover located on the rail by unscrewing the two screws **A**, see **Fig. Horizontal Laser**.
- Disconnect the timer cables from the terminal board - white 0 V, red 5 V.
- Remove the laser and substitute with an identical item.
- Tighten the screws.
- Check the laser alignment, see paragraph **ADJUSTMENT**.
- Remount the laser cover.

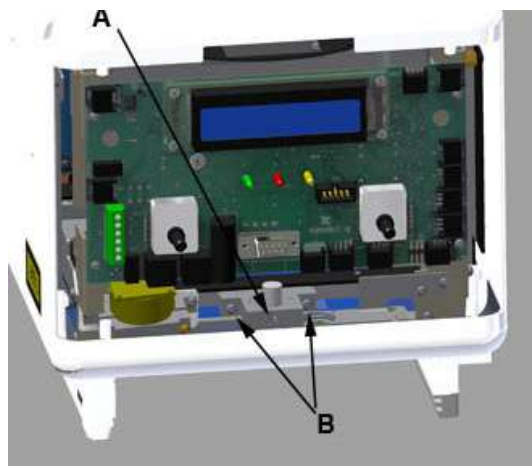
##### Vertical

- Disconnect supply.
- Remove the knobs and front panel, see Chapter- **COVER REMOVAL**.
- Loosen the Allen screw **A**, see **Fig. Vertical Laser** on the laser support.
- Disconnect the timer cables from the terminal board - white 0 V, red 5 V.
- Remove the laser and substitute with an identical item.

- Tighten the Allen screw.
- Check the laser alignment, see paragraph **ADJUSTMENT**.
- Remount the laser cover.



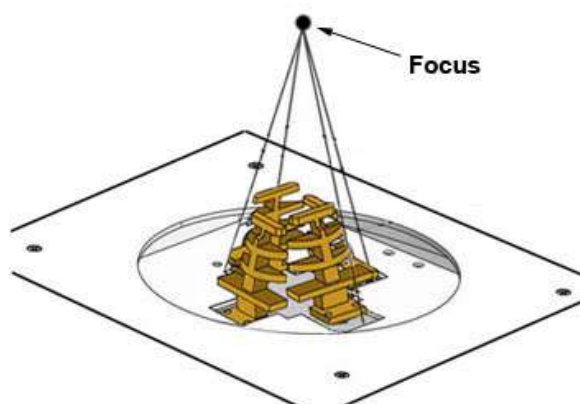
**Fig. Horizontal Laser**



**Fig. Vertical Laser**

## RO 278 Fixed Near Focal Shutters

Upper cover with extra-focal shutters to allow the use of the collimator with rotating anode X-ray tubes; brass extra-focal.





## RO 305 Additional Variable Filtration - Automatic Selection

Additional variable filtration may be added to the minimum collimator filtration in the form of an aluminium disk, 1 mm thickness, with automatic control via the electronic PCB.

The disk features a hole allowing the passage of X-rays and includes three filters with the following filtration values:

- 0: no filtration
- 0,1 mm Cu + 1 mm Al. (Al eq. 3.5 mm)
- 0,2 mm Cu + 1 mm Al (Al eq. 6.0 mm)
- 1 mm Al + 1 mm Al support (Al eq. 2.0 mm).

### Adjustments

#### PHOTOCELL ADJUSTMENT

- Remove the front panel - See Chapter- **COVER REMOVAL**.
- Disconnect the connector from the RSR008 PCB.
- Unscrew the 4 screws "D" holding the RSR008 PCB on the front plate, see **fig. 1**
- Unscrew the 2 screws "C" holding the filter system on the front plate, see **fig. 2**
- Remove the support together with the filter from the collimator.
- Adjust the photocell by using the 2 screws "B" located on the support, see **fig. 3**
- When adjusted is terminated, tighten the "B" screws, see **fig. 3**
- Remount the support and the front plate.

### Substitutions

#### SUBSTITUTION OF THE FILTER MOTOR

- Disconnect supply.
- Remove the front panel.
- Remove the cover - See Chapter - **COVER REMOVAL**.
- Disconnect motor connector J8 on board **RSR008**.
- Unscrew the 2 screws "A" from the front wall, see **fig. 4**
- Substitute with an identical item.
- Remount the support with the new motor.
- Connect the connector removed previously.
- Remount the cover and front panel.

Fig. 1

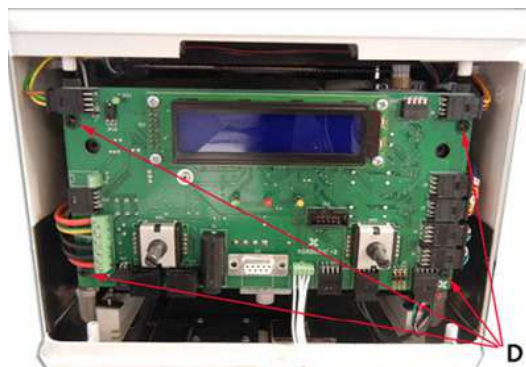


Fig. 2

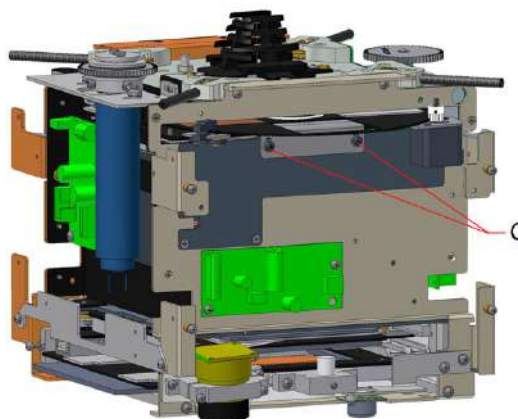
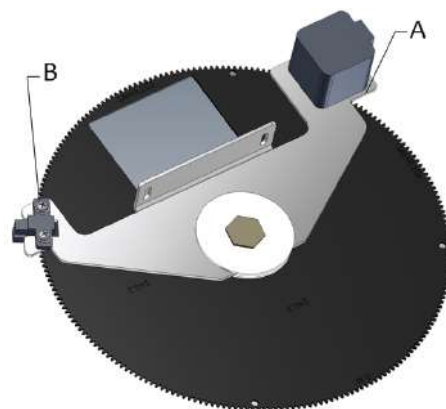


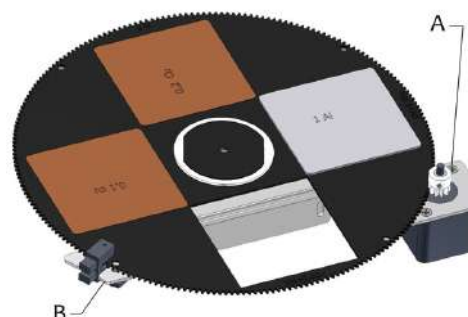
Fig. 3



#### SUBSTITUTION OF FILTER MOVEMENT PHOTOCELL

- Disconnect supply.
- Remove the front panel.
- Remove the cover- See Chapter - **COVER REMOVAL**.
- Disconnect the four photocell cables on terminal J2 on the board **RSR008**.
- Unscrew the 2 screws "B" from the front wall, see **fig. 3**
- Substitute with an identical item.
- Remount the support with the photocell.
- Connect the four photocell cables on terminal J2.
- Remount the cover and front panel.

Fig. 4



#### RO 305/1 Additional Variable Filtration

Additional variable filtration may be added to the minimum collimator filtration in the form of an aluminium disk, 1 mm thickness, with automatic control via the electronic PCB.

The disk features a hole allowing the passage of X-rays and includes three filters with the following filtration values:

- 0: no filtration.
- 0,1 mm Cu (Al eq. 2.5 mm)
- 0,2 mm Cu (Al eq. 5.0 mm)
- 0,3 mm Cu (Al eq. 7.5 mm)

To adjust and/or to change the filter see **RO 305 Additional Variable Filtration** description in this Chapter.

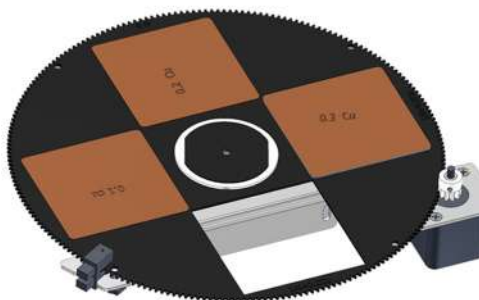


Fig. RO 305/1

#### RO 308 External Board ASR003

##### ASR003 Board

##### Characteristics

- Analogical/ Digital interface.
- Vertical SID interface with potentiometers for table and stand, Potter Bucky, (vertical, right, left) inputs.
- Interface for 5 fixed lateral distances.
- Interface for general controls; e.g., open/close for shutters, tomography.
- CanBus interface.

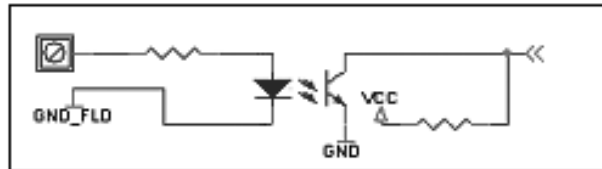
##### Description

- Board ASR003 is an extension of the radiological system, providing an interface for the collimator to other system devices with analogical signals.
- It operates via CAN BUS with a Ralco proprietary protocol.
- The user end features 32 digital inputs, 8 analogue inputs and 10 relay outputs.
- Digital inputs are optoisolated to allow connection to devices that supply output control voltages (typical range 12-32 V DC).

- Supply: 24 V AC 50/60 Hz 3.5 A.
- Fuse: n.a. (not supplied by Ralco).

### **Digital and Analogue Inputs**

#### **Digital Input**

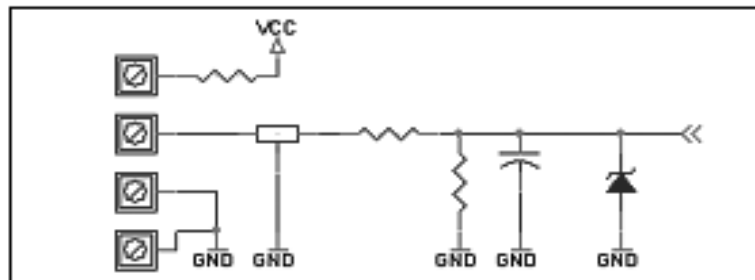


Since the input signal sometimes comes from a voltage-free contact, the board features a number of pins to which an external supply may be connected. As an alternative, these pins may be connect to a voltage incoming from board ASR003 itself by simply connecting pin M79 to pin M80 and, pin M81 to pin M82.

The available voltage is not taken upstream of the voltage regulator but downstream of the fuse and rectifier bridge.

The type of software applied determines the function of each input.

#### **Analogue Input**



In this case the input range will be reduced with respect to the digitalization capacity of the microprocessor digital/analogue convertor. However, the board will have better protection against wrong Potentiometer connections.

The analogue inputs are designed primarily for connection to 1 Kohm potentiometers.

Additional safeguards have been added because the user could supply an analogue signal directly without using potentiometers.

The main purpose of these inputs is to furnish the collimator with the cassette size data and information related to focus-film/focus-floor distances (depending on the configuration).

In general, non linearity introduced by the safeguards is contained. However, should a greater degree of precision be required (such as in the case of focus-film/focus-floor signals) we suggest that a voltage between 0 and 6 V DC be supplied so as to make the most of the convertor range.

Higher voltages up to 12 V, which could be caused by incorrect connections, will not damage the input.

The 10 output relays each have an NO/NC contact and may consequently be adapted to a number of different configurations. Their use depends on the software applied.

This board also supplies the go-ahead to program some of the system parameters.

## Mechanical Installation of the External Interface Unit

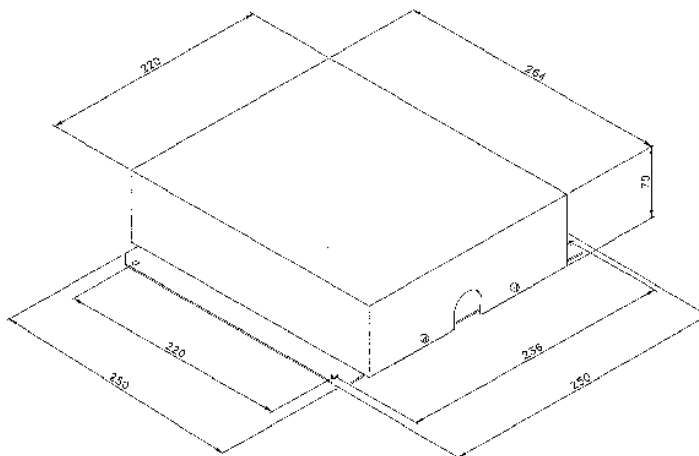
The external box is to be installed in such a way as to ensure connection of all the electric devices present in the radiological system.

We suggest that the box be installed at a safe distance from electromagnetic sources such as high voltage transformers.

Use the holes on the sides of the box to perform the installation.

Should it be necessary to install the board within a rack of the general system, remove the electronic board from the box prior to proceeding with the installation of the box itself.

Make sure that each portion of the rack that is to accommodate the box is adequately earthed.



### External Unit Labels



### ***Electrical Connection***

### NOTE

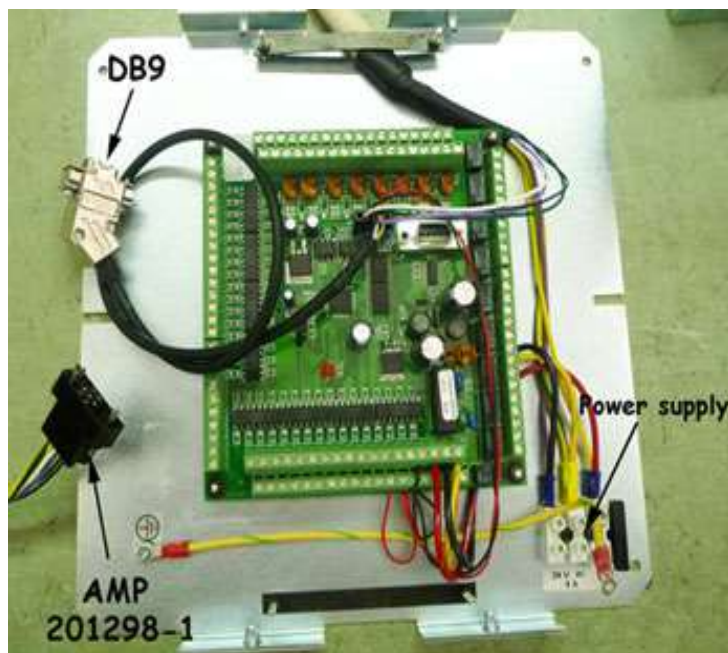


POWER MUST BE SUPPLIED BY A SAFETY TRANSFORMER COMPLIANT WITH CURRENT  
NORMS AND PROTECTED BY AN FUSE 4 A.

- Connect the collimator using the connection cable. The cable end with the AMP 201298-1 connector is to be inserted into the connector at the back of the collimator.

- The other end of the cable, with the DB9 connector and 3 wires, must be connected to the CanBus interface and power supply, see **Fig. 1**.
- Consult the electric drawing to perform a correct connection of inputs.

**Fig. 1**



#### WARNINGS



COLLIMATOR SUPPLY IS NOT PROTECTED BY A FUSE. PRIOR TO CONNECTING THE COLLIMATOR, CHECK THAT SUPPLY IS PROTECTED BY AN EXTERNAL FUSE 4A, NOT SUPPLIED BY RALCO, SEE CHAPTER- **SPECIFICATIONS**.



SUPPLY CABLES (24 V AC 50/60 Hz 3.5 A) USED FOR COLLIMATOR CONNECTION MUST BE SUITABLE FOR THE PURPOSE AND COLLIMATOR CURRENT ABSORPTION.(MIN. SECTION 1.5 MM<sup>2</sup>).



THE SYSTEM REQUIRES SCREENED CABLES WITH THE ADDITION OF FERRITE CORES (NOT SUPPLIED) TO AVOID ELECTROMAGNETIC INTERFERENCE WITH THE SERVER ELECTRONICS.

CABLES FROM THE SYSTEM TO THE EXTERNAL BOARD MUST BE SCREENED. THE FERRITE CORES ARE TO BE MOUNTED ON THE CABLES INSIDE THE BOX AS SHOWN IN THE DRAWING BELOW. FERRITE CORES ARE USED TO ATTENUATE INDUCTION AND IRRADIATION OF ELECTROMAGNETIC INTERFERENCE. WE SUGGEST A 279 FERRITE, ATTENUATION RANGE 100 MHZ TO 200 MHZ, SUITED TO YOUR CABLES; IE: MSFC-10 FERRITE BY RICHCO.



**NOTE**



THE WIRING DIAGRAM INCLUDED IN THIS DOCUMENT REFERS TO THE STANDARD PRODUCT. IT IS THE RESPONSIBILITY OF THE CUSTOMER WHO HAS REQUESTED AN ELECTRIC CUSTOMIZATION, TO ENSURE THAT AN ELECTRIC DIAGRAM RELATING TO THE CUSTOMIZATION HAS BEEN PROVIDED WITH THE DOCUMENTATION.



THE DEVICE IS PROJECTED TO OPERATE WITH A PERMANENT POWER SUPPLY PRESENT SO THE PROCEDURE OF SWITCHING OFF THE COLLIMATOR IS NOT FORESEEN. NO RISK OR DEVICE DAMAGE WILL OCCUR IF THE MACHINE IS ACCIDENTLY SWITCHED OFF.

**WARNING**



THE DEVICE MUST BE EXCLUSIVELY CONNECTED TO POWER NETWORK, WITH EARTH PROTECTION, IN ORDER TO AVOID A RISK OF ELECTRICAL SHOCK.



SUPPLY AND SIGNALS TO THE COLLIMATOR MUST BE TO 2007/47/CE STANDARDS. DEVICES THAT SUPPLY THE COLLIMATOR MUST THEREFORE FEATURE DOUBLE OR REINFORCED INSULATION AS PROVIDED BY THE GENERAL STANDARD ON ELECTROMEDICAL EQUIPMENT CEI62-5 +A2 (EN 60601-1). THE DEVICE IS ELECTROSTATIC SENSITIVE, CONSEQUENTLY ALL THE RELATING SAFETY STANDARDS MUST BE COMPLIED WITH.



COLLIMATOR MUST BE SUPPLIED AS SPECIFIED, SEE CHAPTER **SPECIFICATIONS**. THE SUPPLY MUST COME FROM A SEPARATE SOURCE FROM THE POWER NETWORK THROUGH DOUBLE INSULATION OR REINFORCED INSULATION AND WITH LIMITED CURRENT. TRANSFORMER CHARACTERISTICS MUST CONFORM TO THE REQUIREMENTS OF STANDARD IEC 60601-1.



CABLES AND TERMINALS USED FOR THE INTERNAL CONNECTION OF THE COLLIMATOR MUST BE SUITABLE FOR OPERATION AT TEMPERATURES OF 80°C AND COLLIMATOR CURRENT ABSORPTION.



TO ENSURE THE SAFE USE OF THE COLLIMATOR, IT IS MANDATORY TO SECURELY AND FIRMLY INSERT THE POWER SUPPLY/DATA CABLE BETWEEN THE COLLIMATOR AND RADIOLOGICAL SYSTEM. IT IS ALSO MANDATORY THAT THE POWER SUPPLY/DATA CABLE IS CORRECTLY SECURED TO THE STRAIN RELIEF. IF THE STRAIN RELIEF IS MISSING IT IS MANDATORY ONE BE CORRECTLY AND SECURELY INSTALLED. RALCO IS NOT LIABLE FOR DAMAGES IN THE EVENT OF MISSING OR INCORRECT CABLE INSTALLATION.

**Connection of System to ASR003 Board**

All the system devices listed in the following tables (variable SID table, variable SID stand,

fixed lateral SID, vertical Bucky, lateral Bucky, etc.) are to be connected to the connectors of the external board. **Correct operation of the system is guaranteed if the return signals from the Bucky (if mounted) and SID Potentiometers are clean and devoid of electrical disturbances. Use tri-polar screened cables with the addition of ferrite cores near the connections to the PC board (external unit).**

The SID variation control signal must be analogue DC, 5 V DC max.

#### WARNINGS



TAKE CARE THAT ELECTRICAL RESIDUES HOWEVER SMALL (BITS OF COPPER LEADS FROM WIRES, ETC.) ARE NOT LEFT TO CLUTTER THE CIRCUIT - THESE COULD CAUSE BOARD MALFUNCTION OR ANOMALIES.

Earthing of the collimator circuit is used to disperse noise or extra voltage coming from the collimator supply system.

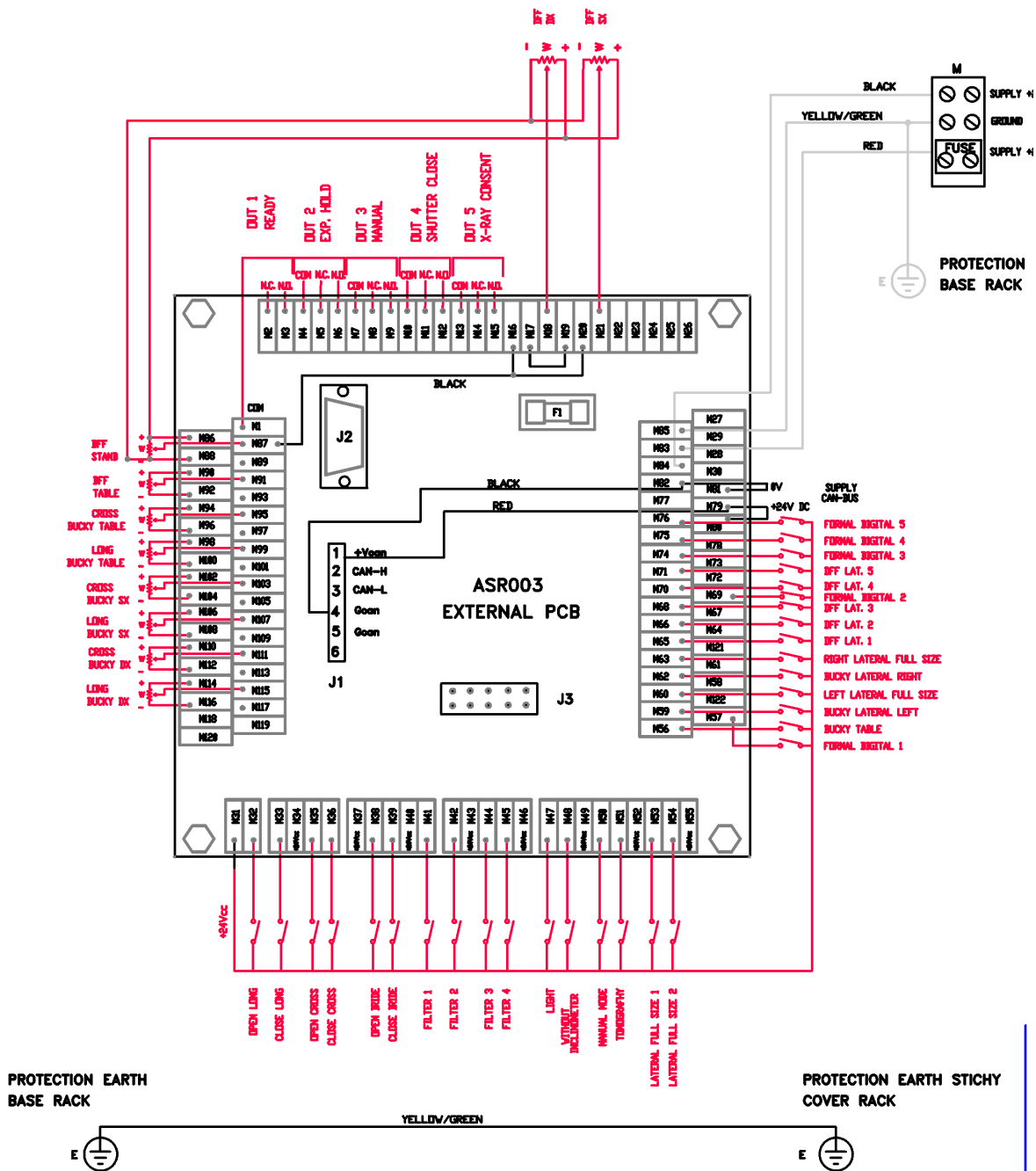
The device that disperses noise is reversible, consequently noise instead of being eliminated is fed into the system power supply circuit. Therefore, it is essential that the earth outlet to which the system is connect be effectively the unipotential protection point of the system or the room.

#### POWER SUPPLY

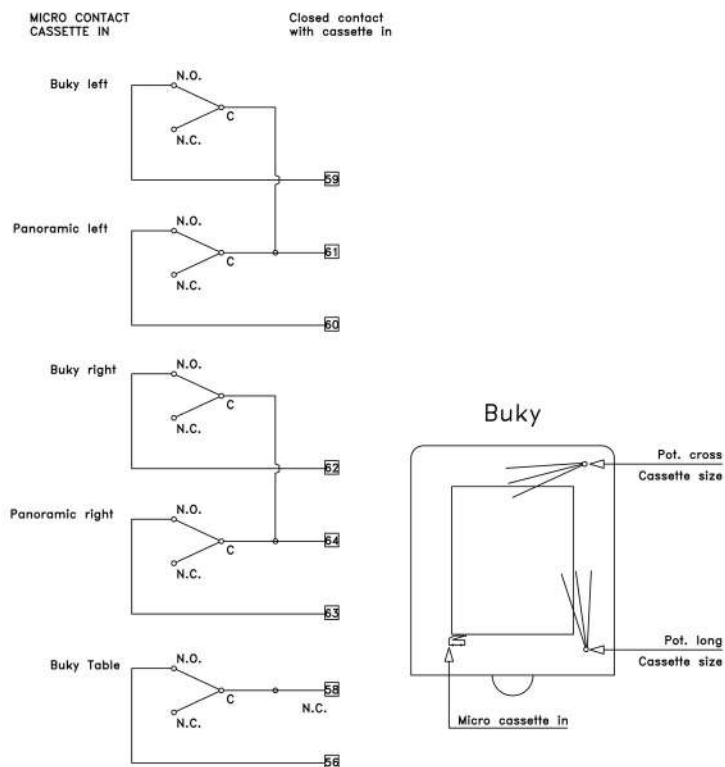
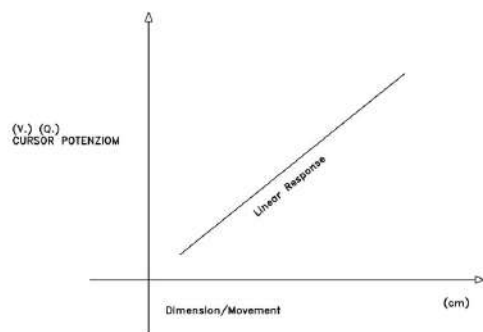
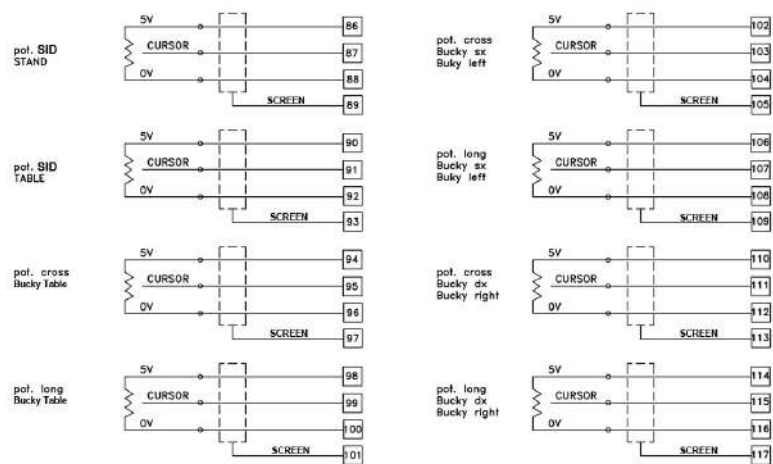
<b>IN-AN</b>	Supply 24 V AC 50/60 Hz 3.5 A	<b>M83</b>
<b>IN-AN</b>	Supply 24 V AC 50/60 Hz 3.5 A	<b>M84</b>
<b>IN/OUT</b>	Mains Ground Contact	<b>M85</b>

<b>IN =</b>	Digital Input Signal
<b>IN-AN =</b>	Analogical Input Signal
<b>OUT=</b>	Output Signal

**Fig. ASR003 Board**







MTR 225 ACS - MTR 225 ACS DHHS - Optional Items

## OUTPUTS



All outputs are simple relay contacts (1 A 24 V DC) configured as normally open. Output relays can switch 1 A to 110 V AC or 30 V DC; do not exceed these values and provide fuses on load supply circuits.

If relays are used to switch inductive loads (coils of other relays), provide these loads with appropriate snubber R-C circuits.

Should an electric signal be produced by a multi-contact relay, ground the contacts surrounding the signal or set them at minimum potential (max. 24 V) by using a snubber circuit for the relating load.

Signal	Description	Contacts	
<b>OUT1</b>	With closed contact the system is in "Ready " mode	<b>COM</b>	<b>M1</b>
		<b>N.C.</b>	<b>M2</b>
		<b>N.O.</b>	<b>M3</b>
<b>OUT2</b>	With closed contact the system is in "Exp.Hold" mode	<b>COM</b>	<b>M4</b>
		<b>N.C.</b>	<b>M5</b>
		<b>N.O.</b>	<b>M6</b>
<b>OUT3</b>	With closed contact system is in "Manual"	<b>COM</b>	<b>M7</b>
		<b>N.C.</b>	<b>M8</b>
		<b>N.O.</b>	<b>M9</b>
<b>OUT4</b>	Closed contact: "Closed Shutters"	<b>COM</b>	<b>M10</b>
		<b>N.C.</b>	<b>M11</b>
		<b>N.O.</b>	<b>M12</b>
<b>OUT5</b>	With closed contact the system allows the X-ray "Exposure"	<b>COM</b>	<b>M13</b>
		<b>N.C.</b>	<b>M14</b>
		<b>N.O.</b>	<b>M15</b>

Signal	Contact	Description
<b>IN</b>	<b>M31</b>	Common +V DC
<b>IN</b>	<b>M32</b>	Long shutters open
<b>IN</b>	<b>M33</b>	Long shutters closed
<b>IN</b>	<b>M34</b>	Common +V DC
<b>IN</b>	<b>M35</b>	Cross shutters open
<b>IN</b>	<b>M36</b>	Cross shutters closed
<b>IN</b>	<b>M37</b>	Common +V DC
<b>IN</b>	<b>M38</b>	Iris shutters open
<b>IN</b>	<b>M39</b>	Iris shutters closed
<b>IN</b>	<b>M40</b>	Common +V DC
<b>IN</b>	<b>M41</b>	Filter selection 1
<b>IN</b>	<b>M42</b>	Filter selection 2

Signal	Contact	Description
IN	M43	Common +V DC
IN	M44	Filter selection 3
IN	M45	Filter selection 4
IN	M46	Common +V DC
IN	M47	Collimator Light ON
IN	M48	Exclusion of collimator tilt device
IN	M49	Common +V DC
IN	M50	Manual Mode selection
IN	M51	Tomography Mode selection
IN	M52	Common contacts selection (+V DC)
IN	M53	Contact for the fixed lateral full size SID - 1
IN	M54	Contact for the fixed lateral full size SID - 2
IN	M55	Common contacts selection (+V DC)
IN	M56	Cassette IN contact, table Bucky
IN	M57	Fluoro 1
IN	M58	Common contact table Bucky (+V DC)
IN	M59	Cassette IN contact, left lateral Bucky
IN	M60	Cassette IN contact, full size left lateral
IN	M61	Common contact and full size left lateral (24 V DC)
IN	M62	Cassette IN contact, right lateral Bucky
IN	M63	Cassette IN contact, full size right lateral
IN	M64	Common contacts Bucky and full size right lateral (+V DC)
IN	M65	Contact for the fixed lateral SID -1
IN	M66	Contact for the fixed lateral SID - 2
IN	M67	Common contacts Bucky and full size right lateral (+V DC)
IN	M68	Contact for the fixed lateral SID - 3
IN	M69	Fluoro 2
IN	M70	Contact for the fixed lateral SID - 4
IN	M71	Contact for the fixed lateral SID - 5
IN	M72	Common contacts of fixed lateral SIDs (+V DC)
IN	M73	Common contacts of fixed lateral SIDs (+V DC)
IN	M74	Fluoro 3
IN	M75	Fluoro 4
IN	M76	Fluoro 5
IN	M78	Common contacts of fixed lateral SIDs (+V DC)
Signal	Contact	Description
IN-AN	M86	Potentiometer SID/tube-stand terminal (high-level 5 V DC)
IN-AN	M87	Potentiometer SID/ tube-stand slider
IN-AN	M88	Potentiometer SID/ tube-stand terminal (low-level 0 V DC)

MTR 225 ACS - MTR 225 ACS DHHS - Optional Items

Signal	Contact	Description
IN-AN	M89	Cable shielding of potentiometer SID/ table
IN-AN	M90	Potentiometer SID/Table terminal (high-level 5 V DC)
IN-AN	M91	Potentiometer SID/Table slider
IN-AN	M92	Potentiometer SID/Table terminal (low-level 0 V DC)
IN-AN	M93	Cable shielding of potentiometer SID/Table
IN-AN	M94	Cross potentiometer/table Bucky terminal (high-level 5 V DC)
IN-AN	M95	Cross potentiometer/table Bucky slider
IN-AN	M96	Cross potentiometer/table Bucky terminal (low-level 0 V DC)
IN-AN	M97	Cable Shielding of Cross potentiometer/table Bucky
IN-AN	M98	Long pot./table Bucky terminal (high-level 5 V DC)
IN-AN	M99	Long potentiometer/table Bucky slider
IN-AN	M100	Long potentiometer/table Bucky terminal (low-level 0 V DC)
IN-AN	M101	Cable Shielding of Long potentiometer/table
IN-AN	M102	Cross potentiometer/left lateral Bucky terminal (high-level 5 V DC)
IN-AN	M103	Cross potentiometer/ left lateral Bucky slider
IN-AN	M104	Cross potentiometer/ left lateral Bucky terminal (low-level 0 V DC)
IN-AN	M105	Cable Shielding of Cross potentiometer/ left lateral Bucky
IN-AN	M106	Long potentiometer/left lateral Bucky terminal (high-level 5 V DC)
IN-AN	M107	Long potentiometer/left lateral Bucky slider
IN-AN	M108	Long potentiometer/left lateral Bucky terminal (low-level 0 V DC)
IN-AN	M109	Cable Shielding of Long potentiometer/ left lateral Bucky
IN-AN	M110	Cross pot./right lateral Bucky terminal (high-level 5 V DC)
IN-AN	M111	Cross potentiometer/right lateral Bucky slider
IN-AN	M112	Cross potentiometer/ right lateral Bucky terminal (low-level 0 V DC)
IN-AN	M113	Cable Shielding of Cross potentiometer/right lateral Bucky
IN-AN	M114	Long pot./right lateral Bucky terminal (high-level 5V DC)
IN-AN	M115	Long potentiometer/ right lateral Bucky slider
IN-AN	M116	Long potentiometer/right lateral Bucky terminal (low-level 0VDC)
IN-AN	M117	Cable Shielding of Long potentiometer/right lateral Bucky

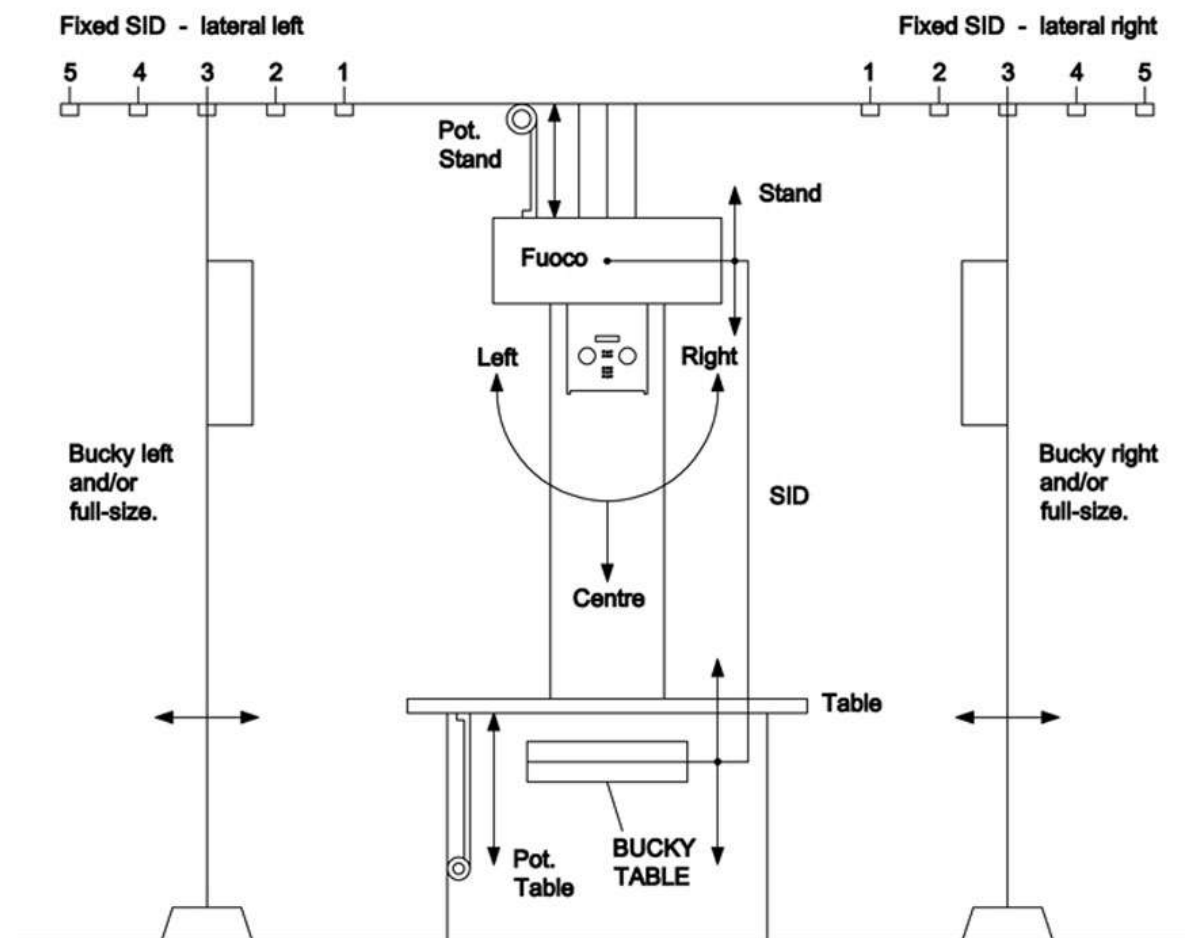
**Check the Following Whenever the Potentiometer Operates Irregularly:**

- The analogue signal (V DC) from the table Bucky potentiometer sliders must increase with the increase of cassette format. Use a voltmeter to check this condition between contacts M99 (+) and M100 (-) for the Long function and, between M95 (+) and M96 (-) for the Cross function.
- The analogue signal (V DC) from the right lateral Bucky potentiometer sliders must increase with the increase of cassette format. Use a voltmeter to check this condition between contacts M115 (+) and M116 (-) for the Long function and between M111 (+) and, M112 (-) for the Cross function.
- The analogue signal (V DC) from the left lateral Bucky potentiometer sliders must increase with the increase of cassette format. Use a voltmeter to check this condition between contacts M107 (+) and M108 (-) for the Long function and between M103 (+) and M104 (-) for the Cross function.

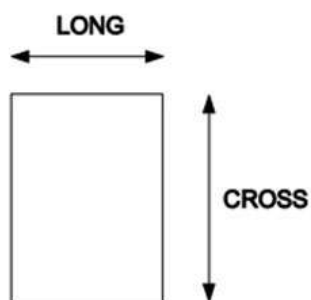
- The analogue signal (V DC) from the table translator potentiometer slider must increase with the decrease of the SID (as the table rises). Use a voltmeter to check this condition between contacts M91 (+) and M92 (-).
- The analogue signal (V DC) from the stand potentiometer slider must increase with the increase of the SID (as the stand rises). Use a voltmeter to check this condition between contacts M87(+) and M88 (-) as the stand rises.

Using the ASR003 board, the operator is able to calibrate the collimator to the components, see **Fig. Radiology System**.

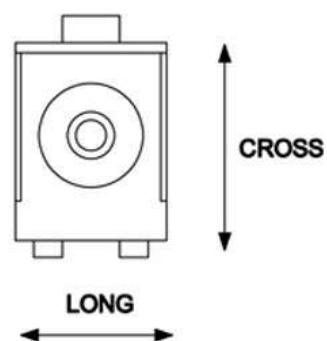
**Fig. Radiology System.**



**X RAY CASSETTE**



**RADIOLOGY SYSTEM**



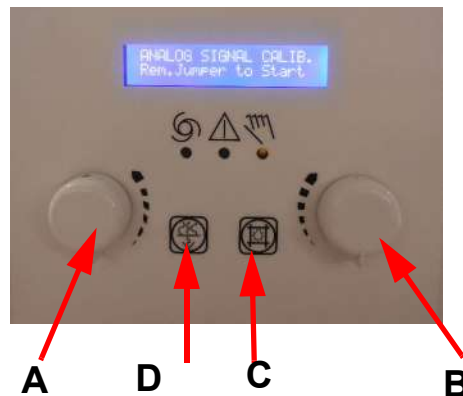
### Calibration Start-Up

It is possible to start calibration in two manners:

- Press the LIGHT (C) push button and keep pressed while switching the collimator ON, see **Fig. 1**.
- jumper J4 on the external board, see **Fig. 1**. The systems sees the insertion and displays the following:

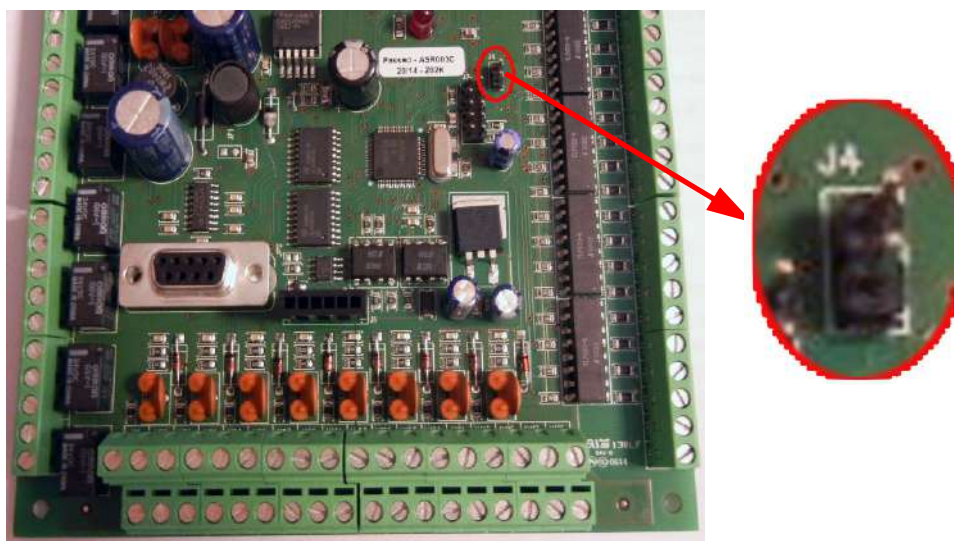
**Remove Jumper to start**

**Fig. 1**



- A - Encoder Cross changes option and set up the Cross cassette size.  
B - Encoder Long sets up Long cassette size.  
C - to confirm  
D - to skip without saving

**Fig. 2**



By removing the jumper, the procedure starts with the calibration of the SID potentiometers.

## Calibration Procedure

### 1. Language Selection

The display will read one of the two following messages, depending on the current language setting.

*Language  
English*

### 2. Measuring Unit - Centimetres

The Encoder Cross (A) will allow to switch from CENTIMETRES to INCHES.

*Measuring Units  
centimetres*

Press LIGHT to confirm the setting; the next selection will be displayed:

### 3. Inclinomater Present

*Inclinom. Present?  
YES/NO*

Please Note: When wall Bucky is present Inclinomater must be enabled.

The Encoder Cross (A) switches from Yes to NO.

Press LIGHT (C) to confirm the setting.

If Inclinomater is disabled go to **Vertical SID Measure section 4.**

If Inclinomater is enabled, the inclinometer offset may be calibrated:

#### 3.1. Offset Inclinomater - Sets 0° position



**WARNING**

MAKE SURE THAT THE COLLIMATOR IS IN A VERTICAL POSITION (0°) WHILE ACQUIRING DATA, OTHERWISE THE CALIBRATION WILL NOT BE VALID.

*Inclinometer Offset 0°  
X: xx Y: xx*

xx: value read by inclinometer

yy: value read by inclinometer

Press LIGHT (C) to confirm the setting.



### 3.2. Offset Inclinometer - 90° CCW



**WARNING**

MAKE SURE THAT THE COLLIMATOR IS ROTATED 90° TOWARD RIGHT (CCW) WHILE ACQUIRING DATA, OTHERWISE THE CALIBRATION WILL NOT BE VALID.

*Inclinometer Offset 90 R*  
X: xx Y: xx

xx: value read by inclinometer

yy: value read by inclinometer

Press LIGHT (C) to confirm the setting.

### 3.3. Offset Inclinometer - 90° CW



**WARNING**

MAKE SURE THAT THE COLLIMATOR IS ROTATED 90° TOWARD LEFT (CW) WHILE ACQUIRING DATA, OTHERWISE THE CALIBRATION WILL NOT BE VALID.

*Inclinometer Offset 90 L*  
X: xx Y: xx

xx: value read by inclinometer

yy: value read by inclinometer

Press LIGHT (C) to confirm the setting.

### 3.4. Degrees Tolerance

*Degrees Tolerance*  
XX degrees

The encoder Cross (A) will allow to enter values from 1 to 15 degrees.

Press LIGHT (C) to confirm the setting.

### 3.5. Collimator Angle Visualization

*Angle Visualization*  
Yes

The Encoder Cross (A) activates or deactivates the display of the collimator tilt angle in degrees.

Press LIGHT (C) to confirm the setting.

## 4. Vertical SID Measure

The Encoder Cross (A) will allow to switch between SID: SINGLE, DIFFERENTIAL, FIXED and CAN.

- **SINGLE:** only one potentiometer is calibrated for SID calculation:
  - Table (go to the section 4.1 and 4.1.1)
  - Stand (go to the section 4.1 and 4.1.2)
- **FIXED:** the fixed value is set during calibration (go to the section 4.2).
- **CAN:** SID value is transmitted to the collimator via CANBus (go to **Right Lateral Measure section 5**)
- **DIFFERENTIAL:** both potentiometers are calibrated, one for the table and one for the stand (go to the section 4.1.1 and 4.1.2).

*Vertical SID  
Meas.*

### 4.1. Potentiometer Input

*Potentiometer Input  
Stand Pot/Table Pot*

Indicate the potentiometer to be calibrated (table or stand)

Press LIGHT (C) to confirm the setting.

#### 4.1.1. Calibration of Vertical SID - Table Down

Indications displayed for the calibration of the table analogue signal require the table to be lowered:

*Move Table Down  
xxx pts*

The second line of the display shows the digitized voltage value generated by the table potentiometer. The operator will lower the table. When reading is stabilized, press LIGHT (C) to complete the setting. Should the operator wish to keep the value previously stored and maintain the last calibration, this setting may be avoided by pressing FILTER (D).

Both instances will lead to the next measurement.

#### Calibration of Vertical SID - Raise Table 25 cm

*Set Table at + 25 cm  
xxx pts*

The operator is required to place the table at the stated height. When the setting is stabilized, press LIGHT (C) to confirm the setting.

Should the operator wish to keep the value previously stored and maintain the last calibration, this setting may be avoided by pressing FILTER (D).

**Calibration of Vertical SID - Focus Table Distance**
*Focus Table Distance*  
*xxx pts*

The operator is required to place the table at the stated height. When the setting is stabilized, press LIGHT (C) to confirm the setting.

Should the operator wish to keep the value previously stored and maintain the last calibration, this setting may be avoided by pressing FILTER (D).

**4.1.2. Calibration of Vertical SID - Stand All Up**
*Move Stand Full Up*  
*xxx pts*

The display will provide calibration indications for the stand analogue signal, requiring the stand be raised to a higher position.

The second line of the display shows the digitized voltage value generated by the stand potentiometer.

The operator is required to raise the stand. When the value is stabilized, press LIGHT (C) to confirm the setting.

Should the operator wish to keep the value previously stored and maintain the last calibration, this setting may be avoided by pressing FILTER (D).

**Calibration of Vertical SID - Lower Stand 50 cm**
*Lower 50 cm*  
*xxx pts*

The operator is required to place the table at the assigned height. When the value is stabilized, press LIGHT (C) to complete the setting.

Should the operator wish to keep the value previously stored and maintain the last calibration, this setting may be avoided by pressing FILTER (D).

**Calibration of Vertical SID - SID at 100 cm**
*Set stand to 100cm*  
*xxx pts*

The operator is required to set the stand at 1 m (100 cm) from the table top.

When the value is stabilized press LIGHT (C) to complete the setting

Should the operator wish to keep the value previously stored and maintain the last calibration, this setting may be avoided by pressing FILTER (D).

#### 4.2. Fixed Vertical SID Value

The Encoder Cross (A) will allow to increase or decrease the SID value from 50 cm min to 300 cm max.

*Vertical Fixed SID*  
*xxx cm*

Press LIGHT to confirm the setting; the next selection will be displayed (go to section 5):

#### 5. Right Lateral SID Measure

The Encoder Cross (A) will allow to switch between DISCRETE SID, CAN or POTENTIOMETER.

Press LIGHT (C) to confirm the setting; the next selection will be displayed:

*Right Lateral SID*  
*DISCRETE/CAN/POTENTIOMETER*

- **DISCRETE:** lateral SID is selected via contacts on terminals M65, M66, M68, M70, M71.
- **CAN:** Lateral SID is transmitted to the collimator via CANBus.
- **POTENTIOMETER:** if SID is measured through potentiometer, the operator tilts the collimator first and then calibrates the potentiometer.

- **MIN RIGHT POT. SID**

Minimum distance from a surface of image receptor to the film is to be set up.

*Min Right Pot. SID: nnn*  
*... cm*

*nnn* - (value read by potentiometer).

- **MAX. RIGHT POT. SID**

Maximum distance from a surface of image receptor to the film is to be set up.

*Max.Right Pot. SID: nnn*  
*... cm*

*nnn* - (value read by potentiometer).

## 6. Left Lateral SID Measure

The Encoder Cross will allow to switch between DISCRETE SID, CAN or POTENTIOMETER.

Press LIGHT (C) to confirm the setting; the next selection will be displayed:

*Left Lateral SID*  
*DISCRETE/CAN/POTENTIOMETER*

- **DISCRETE:** lateral SID is selected via contacts on terminals M65, M66, M68, M70, M71.
- **CAN:** Lateral SID is transmitted to the collimator via CANBus.
- **POTENTIOMETER:** if SID is measured using potentiometer, the operator tilts the collimator first and then calibrates the potentiometer.

- **MIN LEFT POT. SID**

Minimum distance from a surface of image receptor to the film is to be set up.

*Min. Left Pot. SID: nnn*  
*... cm*

*nnn* - (value read by potentiometer).

- **MAX LEFT POT. SID**

Maximum distance from a surface of image receptor to the film is to be set up.

*Max. Left Pot. SID: nnn*  
*... cm*

*nnn* - (value read by potentiometer).

## 7. Vertical Receptor

The Encoder Cross (A) will allow to switch between NO, BUCKY, CAN, ATS or FIXED FORMATS.

*Vertical Receptor*  
*NO/BUCKY/CAN/ATS/FIXED FORMATS*

- **NO:** no receptor is connected.
- **BUCKY:** The receptor is a classical Bucky.
  - **Film Table Distance**  
This requests the distance from the table top to the image receptor.  
The display will read the following information:

*Film Table Distance*  
*xxx cm*

The Encoder Cross (A) will allow to enter values from 0 min. to 15 cm max.  
Press LIGHT (C) to confirm the setting.

- **CAN:** formats are CanBus related to the collimator.
- **ATS:** formats are CanBus related to the collimator (ATS detector mode)
- **FIXED FORMATS:** 5 fixed formats are selected.
  - **DIGITAL FORMAT # n**  
The display will read indications to enter the fixed measures of lateral SID. It is possible to connect, to the external board ASR003, the inputs (max 5) that allow to enter the fixed formats in the automatic mode.

*Formato Digitale # n*  
*AA x BB cm*

AA - Cross format. The Encoder Cross (A) will allow to increase or decrease the SID value.

BB - Long format. The Encoder Long (B) will allow to increase or decrease the SID value.

Values will be given in inches if this was the initial setting.

Press LIGHT (C) to confirm the setting; the next selection will be displayed.

## 8. Right Lateral Receptor

The type of lateral (right) receptor installed with the system must be selected.  
The Encoder Cross (A) will allow to switch between BUCKY, CAN, or NO.

*Right Lateral Receptor  
NO/BUCKY/CAN*

- **NO:** no receptor is connected.
- **BUCKY:** classical Bucky receptor.
  - **Right Film-Plane Distance**  
This requests distance from the receptor top to the image receptor.  
The display will read the following information

*Right FilmPlane Distance  
xxx cm*

The Encoder Cross (A) will allow to enter values from 0 min to 15 cm max.  
Press LIGHT (C) to confirm the setting; the next selection will be displayed.

- **CAN:** formats are transmitted to the collimator via CanBus.  
Press LIGHT (C) to confirm the setting; the next selection will be displayed:

## 9. Left Lateral Receptor

The type of lateral receptor (left) installed with the system must be selected. The Encoder Cross (A) will allow to switch between BUCKY, CAN, NO.

*Left Lateral Receptor  
NO/BUCKY/CAN*

- **NO:** no receptor is connected.
- **BUCKY:** classical Bucky receptor.
  - **Left Film-Plane Distance**  
This requests the distance from the receptor top to the image receptor.  
The display will read the following information

*Left FilmPlane Distance  
xxx cm*

The Encoder Cross (A) will allow to enter values from 0 min to 15 cm max.  
Press LIGHT (C) to confirm the setting; the next selection will be displayed.

- **CAN:** formats are transmitted to the collimator via CanBus.  
Press LIGHT(C) to confirm the setting; depending on the vertical SID value entered.

### 10. Setting of SID Horizontal # 1

The display will require the fixed values for the lateral SID to be entered.

*Horiz. SID Meas. #1*  
*xxx cm*

The Encoder Cross (A) will allow to enter the measurements from 25 min to 300 cm max. Values will be given in inches if this was the initial setting.

Press LIGHT (C) to confirm the setting and move forward to the next Lateral SID value.

### 11. Setting of SID Horizontal # 2

*Horiz. SID Meas. #2*  
*xxx cm*

The Encoder Cross (A) will allow to enter the measurements from 25 min to 300 cm max. Press LIGHT (C) to confirm the setting.

### 12. Setting of SID Horizontal # 3

*Horiz. SID Meas. #3*  
*xxx cm*

The Encoder Cross (A) will allow to enter the measurements from 25 min to 300 cm max. Press LIGHT (C) to confirm the setting.

### 13. Setting of SID Horizontal # 4

*Horiz. SID Meas. # 4*  
*xxx cm*

The Encoder Cross (A) will allow to enter the measurements from 25 min to 300 cm max. Press LIGHT (C) to confirm the setting.

### 14. Setting of SID Horizontal # 5

*Horiz. SID Meas. # 5*  
*xxx cm*

The Encoder Cross (A) will allow to enter the measurements from 25 min to 300 cm max. Press LIGHT (C) to confirm the setting.

### 15. Setting of FULL-SIZE SID # 1

*Panoramic SID #1*  
*xxx cm*

The Encoder Cross (A) will allow to enter the measurements from 25 min to 300 cm max. LIGHT (C) confirms the selection and passes to the next SID Panoramic value.



## 16. Setting of FULL-SIZE SID # 2

*Panoramic SID #2*  
*xxx cm*

The Encoder Cross (A) will allow to enter the measurements from 25 min to 300 cm max. LIGHT (C) confirms the selection and passes to the next SID Panoramic value.

## 17. Calibration of Vertical SID Limits - minimum

The display will show indications of the minimum Vertical SID value accepted by the collimator.

*Vertical SID Min.*  
*xxx cm*

The Encoder Cross (A) will allow to enter the measurements from 50 cm min to 300 cm max. Press LIGHT (C) to confirm the setting.

## 18. Calibration of Vertical SID Limits - maximum

The display will show indications of the maximum Vertical SID value accepted by the collimator.

*Vertical SID Max.*  
*xxx cm*

The Encoder Cross (A) will allow to enter the measurements from 50 cm min to 300 cm max. Press LIGHT (C) to confirm the setting; maximum Vertical SID data will be displayed.

## 19. SID Visualisation

*SID Visualization*  
*Yes*

The Encoder Cross (A) activates or deactivates the display of the SID value on the main window.  
Press LIGHT (C) to confirm the setting.

## 20. Key Status Visualization

*Key Status Visual.*  
*Yes*

The Encoder Cross (A) activates or deactivates the display of the key status on the main window (open or closed padlock).  
Press LIGHT(C) to confirm the setting.

Calibrate the vertical Bucky cassettes.

The system will, otherwise, analyze the settings related to the two lateral receptors: if at least one of the two has been programmed as analogue Bucky, the lateral left and/or right cassettes will be calibrated.

If no Bucky was selected, the system will display the end of calibration. Cassette Calibration Information:

The first thing the system requires is to select a quick calibration procedure or a full calibration procedure for all types of cassettes (vertical, lateral left and lateral right).

The differences between the two calibrations are:

- **Quick Cassette Calibration:** the system requires to enter two cassette sizes only (one small and one large).
- **Full Cassette Calibration:** the system requires to enter all possible cassette values (max. 10 Buckys).  
IE: If 3 cassette sizes are stored as 13x18, 24x30 and 30x40 cassettes, the system will also be able to identify cassette sizes such as 13x30, 13x40, 24x18, 24x40, 30x18, 30x30.

## 21. Vertical Bucky Cassettes, Calibration

<p><i>Table Bucky Cal. Quick</i></p>
--

The system starts with the calibration type.

The Encoder Cross (A) will allow to switch from Quick to Full calibration.

Press LIGHT (C) to confirm the setting.

To cancel the procedure press FILTER (D). This keeps the last calibration values and moves forward to the next calibration phase. The number of cassette sizes to be processed must be entered in the event of a Full Calibration.

This step is skipped for the Quick Calibration procedure and 2 cassette values will be processed.

## Full Calibration

*Set Number of  
Table Buckies: xxx*

xx - cassette number from 0 to 10.

Once the number is selected the cassettes need to be calibrated one by one.

*Cross 1 T cm 13: XXX  
Long 1 T cm 13: XXX*

*Cross 2 T cm 43: XXX  
Long 2 T cm 43: XXX*

At this point the operator may:

- Set the Cross cassette from 13 cm (") min to 43 cm (17") max with the Encoder Cross (A).
- Set the Long cassette from 13 cm (") min to 43 cm (17") max with the Encoder Cross (A).

When values are stabilized, confirm the setting by pressing LIGHT (C).

## 22. Calibration of Left Lateral Bucky Cassette

*Left Bucky Cal.  
Quick*

The system starts with the calibration type.

The Encoder Cross (A) will allow to switch from Quick to Full calibration.

Press LIGHT (C) to confirm the setting.

To cancel the procedure press FILTER (D). This keeps the last calibration values and moves forward to the next calibration phase. The number of cassette sizes to be processed must be entered in the event of a Full Calibration.

This step is skipped for the Quick Calibration procedure and 2 cassette values will be processed.

## Full Calibration

*Set Number of  
Left Side Buckie xxx*

xx - cassette number from 0 to 10.

Once the number is selected the cassettes need to be calibrated one by one.

*Cross 1 S cm 13: XXX  
Long 1 S cm 13: XXX*

*Cross 2 S cm 43: XXX  
Long 2 S cm 43: XXX*

At this point the operator may:

- Set the Cross cassette from 13 cm (") min to 43 cm (17") max with the Encoder Cross (A).
- Set the Long cassette from 13 cm (") min to 43 cm (17") max with the Encoder Cross (A).

When values are stabilized, confirm the setting by pressing LIGHT (C).

## 23. Calibration of Right Lateral Bucky Cassette

*Right Bucky Cal.  
Quick*

The system starts with the calibration type.

The Encoder Cross (A) will allow to switch from Quick to Full calibration.

Press LIGHT to confirm the setting.

To cancel the procedure press FILTER (D). This keeps the last calibration values and moves forward to the next calibration phase. The number of cassette sizes to be processed must be entered in the event of a Full Calibration.

This step is skipped for the Quick Calibration procedure and 2 cassette values will be processed.

## Full Calibration

*Set Number of  
Right Side Buckies xxx*

xx - cassette number from 0 to 10.

Once the number is selected the cassettes need to be calibrated one by one.

*Cross 1 D cm 13: XXX  
Long 1 D cm 13: XXX*

*Cross 2 D cm 43: XXX  
Long 2 D cm 43: XXX*

At this point the operator may:

- Set the Cross cassette from 13 cm (") min to 43 cm (17") max with the Encoder Cross (A).
- Set the Long cassette from 13 cm (") min to 43 cm (17") max with the Encoder Cross (A).

When values are stabilized, confirm the setting by pressing LIGHT (C).

## 24. Saving Calibration Data

The system informs the operator that calibration has terminated.

*End of Calibration  
LIGHT per RESET*

Save the setting by restarting up the collimator or pressing the push-button LIGHT (C)

## RO 310 Round field collimation for image intensifier

Iris device providing round field collimation with automatic setting of the selected field. This device is positioned roughly mid-way within the collimator housing. The field is defined by lead iris-type shutters and is externally tangent to the maximum square field size.

Shutter movements are motorized with stepper motors; shutter positioning is potentiometer controlled.

The round-field size may be set via CanBus (Can STEP4 board) or by analogue control via the external board ASR003 (RO 308); its size may be reduced remotely via the two push-buttons on the collimator front panel.



Round-field values vary from 10 cm (4") to 60 cm (24").

## CanBus Controls

ID	Type	d l c	1	2	3	4	5	6	7	8	Note
xx0h	Remote	8	xx	xx	xx	xx	xx	xx	xx	xx	Read Release
xx3h	Remote	8	xx	xx	xx	xx	xx	xx	xx	xx	Read S/N
xxBh	Remote	7	xx	Fmin.H	Fmin.L	Fmax.H	Fmax.L	Ramp.H	Ramp.L		Read Dati Speed
xx1h	Out	8	Pos.HH	Pos.HL	Pos.LH	Pos.LL	Stato	A/D.H	A/D.L	01h	Status
xx1h	Out	8	Num	Adc.H	Adc.L	Step.H	Step.L			02h	Value calibration send
xx2h	In	3	00h	Pot.H	Pot.L						Home
xx2h	In	7	01h	Ass.HH	Ass.HL	Ass.LH	Ass.LL	Max.H	Max.L		Absolute
xx2h	In	7	02h	Rel.HH	Rel.HL	Rel.LH	Rel.LL	Max.H	Max.L		Relativo
xx2h	In	1	03h								Motor Release
xx2h	In	2	04h	Close	Open						Remote Button
xx2h	In	5	FEh	Pos.HH	Pos.HL	Pos.LH	Pos.LL				Set Position
xx2h	In	1	FFh								Stop
xx4h	In	5	M	K	T	D	L				Drive Mode
xx5h	In	8	M	Fmin.H	Fmin.L	Fmax.H	Fmax.L	Ramp.H	Ramp.L	Save	Drive Speed
xx6h	In	2	Opz	Save							Options
xxCh	In	8	xx	xx	xx	xx	xx	xx	xx	xx	Set S/N
xxDh	In	8	00h			Curr.H	Curr.L	CW	IDLE	PCurr	Set Motore
xxDh	In	3	01h	Time.H	Time.L						Set Time Tx Status
xxDh	In	4	02h	PM.H	PM.L	Flag					Set Max. Steps
xxDh	In	2	03h	Tar							Sets Calibration
xxDh	In	8	04h	Fmin.H	Fmin.L	Fmax.H	Fmax.L	Ramp.H	Ramp.L	Save	Drive Speed for Buttons
xxDh	In	8	05h	Num	Adc.H	Adc.L	Step.H	Step.L			Set Calibration Values
xxDh	In	8	06h	Num	Time.L						Reads Calibration values

## MESSAGGES

### STATUS

xx1h	Out	8	Pos.HH	Pos.HL	Pos.LH	Pos.LL	Stato	A/D.H	A/D.L	01h	Status
------	-----	---	--------	--------	--------	--------	-------	-------	-------	-----	--------

Controls Status Current position is transmitted every 250 ms.

Pos: Current position.

A/D: Potentiometer value

Status (bit defined)

## Status:

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Home	Por	-	-	Mov. Man	Protection	Degree 0	Motor in motion

## HOME

xx2h    In    3    00h    Pot.H    Pot.L    Home

Rotates mechanism to Home, motor is moving until potentiometer does not read a value indicated by Pot.HL.

## ABSOLUTE

Moves motor to specific position.

Ass.H/L: position to be reached.

Max.H/L: max. position not to be exceeded using buttons

## RELATIVE

Moves motor by number of given steps (also negative).

## RELEASE

Turns motor driver OFF. A new Homing control will be required to re-synch the steps.

## SET POSITION

Forces microprocessor to specified position. Useful for driver without home sensor to provide board with current motor position. Motor driver is activated.

## STOP

Stops the motor.

## REMOTE BUTTON

Specifies motor operation parameters.

Button: if 1 moves the motor

## SET MAX STEPS

If Flag: 1 stores data in eeprom

## DRIVE MODE

Specifies motor operation parameters.

M – settings mask; if bit at 1 field used is valid

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
-	-	-	-	Status	Decay	Torque	Step type

K - Step Type:

03 – Full Step

04 – 1/2 Step low torque

05 – 1/2 Step high torque

06 – 1/4 Step

07 – 1/8 Step

08 – 1/16 Step

T – Torque – not used

D – Decay – defines damping to be used:

00 = 12,5%

01 = 37,5% (default)

02 = 75%

03 = 100%

L – Signal status in Home position

1 = if fork is not cut-off (=0 for ATS only)

0 = fork cut-off (=1 for ATS only)

#### **DRIVE SPEED**

Specifies motor operation speed.

M – Settings mask; if bit at 1 field used is valid

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
		-	-	-	Ramp	Fmax	Fmin

Fmin: Step frequency for motor in acceleration and braking (max 20000 Hz).

Fmax: max. Step frequency during movement (max 20000 Hz).

Ramp: time from Fmin to Fmax in ms and vice versa during acceleration and deceleration. (max 1000ms).

#### **OPTIONS**

Sets operation of LED and offset:

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
		-	-	Offset	LED1	LED0	-

Offset – if at 1 output messages are shifted by 0x80.

LED1,0 – Defines Led function

00 – Home sensor status

Off with flash per second - NOT Home

ON with flash per second - Home

01 – Constant flash 1 Hz

10 - ON motor movement – OFF motor idle

11 – Incoming message via CanBus

Dis\_switch - 0= enables local buttons - 1= disables local buttons

Save: = 1 stores data in Flash - =0 only temporary data

#### **SET S/N**

Sets board Serial number.

#### **MOTOR SET**

Sets mechanical parameters of the board:

PM: Max. Number of steps from home that can be used.

Curr: Motor drive current (in mA).

IDLE: Motor IDLE time (in seconds, if =0 not used). Serves to keep the motor driver using the current specified by byte Pcurr.

PCurr:(20-100) is the percentage to be used on the work current Curr to obtain the value to be used in IDLE. The minimum current is never set by the board at less than 200 mA.

#### **TX STATUS SET TIME**

Sets Tx Stato transmission time.

Time: in ms – Status re-transmission time with motor position.



## WARNINGS



THIS IS PROVIDED AS AN AID TO THE END USER. RALCO IS NOT LIABLE FOR ANY DAMAGES RESULTING FROM THE ALTERING OF PRESET FACTORY CONFIGURATIONS.

ADJUSTMENTS HAVE BEEN PRESET AT THE FACTORY PRIOR TO SHIPMENT OF THE COLLIMATOR. SHOULD ANY PROBLEM ARISE REQUIRING THE NEED TO RECALIBRATE, PLEASE CONTACT RALCO FOR ASSISTANCE BEFORE PROCEEDING WITH THE ADJUSTMENT.

## RO 310 Adjustments

### MOTOR

- Disconnect supply
- Remove the cover, see Chapter- **COVER REMOVAL**
- Remove the Can STEP4 board by unscrewing the 4 screws **D**, see **Fig.1**
- Remove the lateral partitions, see **Fig. 2**
- Unscrew the 4 screws **F** from the front partition and remove the filter group, see **Fig.3**
- Unscrew the 4 screws **G** on the iris support plate, see **Fig. 4**
- Remove the iris support plate, see **Fig. 5**
- Loosen the 2 screws **A** on the motor support and adjust play between the gear and the iris, see **Fig.6**
- Tighten the 2 screws **A** and remount in reverse order

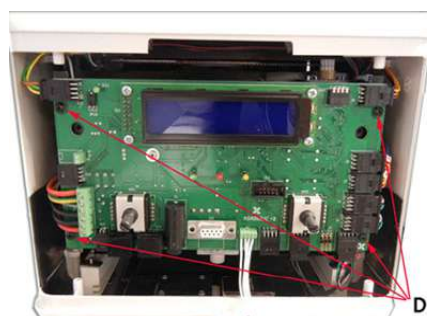


Fig. 1

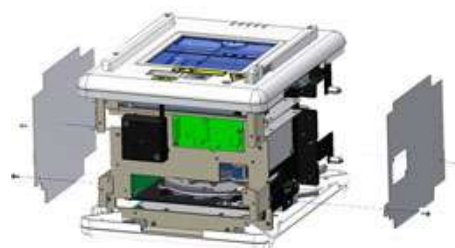


Fig. 2

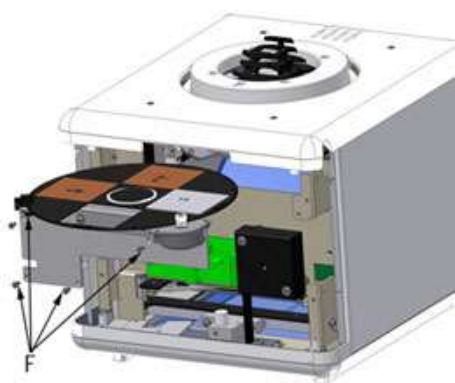


Fig. 3

### POTENTIOMETER

- Disconnect supply
- Remove the cover, see Chapter- **COVER REMOVAL**
- Remove the RSR008 board by unscrewing the 4 screws **D**, see **Fig.1**
- Remove the lateral partitions, see **Fig. 2**
- Unscrew the 4 screws **F** from the front partition and remove the filter group, see **Fig.3**
- Unscrew the 4 screws **G** on the iris support plate, see **Fig.4**
- Remove the iris support plate, see **Fig.5**
- Loosen the 2 screws **B** on the motor support and adjust play between the gear and the iris, see **Fig.6**
- Tighten the 2 screws **B** and remount in reverse order

### SQUARE-FIELD/ROUND-FIELD ALIGNMENT

Alignment of the round/square fields is necessary, if one of the square-field shutters is noticeable in the round field.

- Disconnect supply
- Remove the cover, see Chapter- **COVER REMOVAL**
- Remove the RSR008 board by unscrewing the 4 screws **D**, see **Fig.1**
- Remove the lateral partitions, see **Fig. 2**
- Unscrew the 4 screws **F** from the front partition and remove the filter group, see **Fig.3**

- Loosen the 4 screws **G** on the iris support plate, see **Fig.4**
- Using the light-field, open the iris to 9"
- Set the square field shutters to touch the edge of the round field
- If one of the shutters extends into the round-field, move the iris until it is aligned with the edges of the square-field shutters
- Tighten the 4 screws **G** at the base of the iris
- Remount the cover, see Chapter- **COVER REMOVAL**

### Substitutions

#### MOTOR

- Disconnect supply
- Remove the cover, see Chapter- **COVER REMOVAL**
- Remove the RSR008 board by unscrewing the 4 screws **D**, see **Fig.1**
- Remove the lateral partitions, see **Fig. 2**
- Unscrew the 4 screws **F** from the front partition and remove the filter group, see **Fig.3**
- Unscrew the 4 screws **G** on the iris support plate, see **Fig. 4**
- Remove the iris support plate, see **Fig. 5**
- Unscrew the 2 screws **A** on the motor support
- Substitute the motor for an identical part and remount in reverse order

#### POTENTIOMETER

- Disconnect supply
- Remove the cover, see Chapter- **COVER REMOVAL**
- Remove the RSR008 board by unscrewing the 4 screws **D**, see **Fig.1**
- Disconnect the connector from the DC STEP4 board
- Remove the lateral partitions, see **Fig. 2**
- Unscrew the 4 screws **F** from the front partition and remove the filter group, see **Fig.3**
- Unscrew the 4 screws **G** on the iris support plate, see **Fig. 4**
- Remove the iris support plate, see **Fig. 5**
- Unscrew the 2 screws **B** on the motor support
- Substitute the motor for an identical part and remount in reverse order.

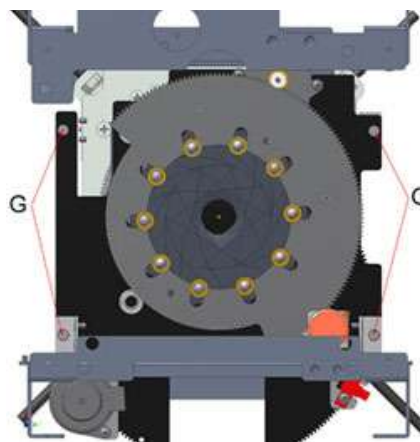


Fig. 4

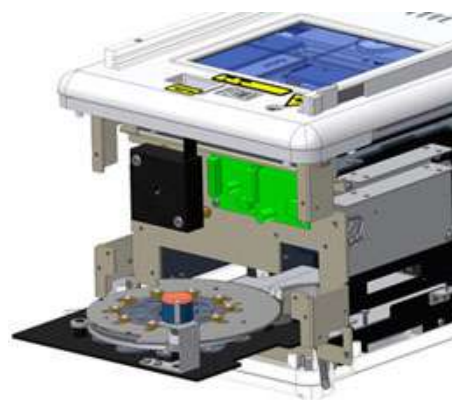


Fig. 5

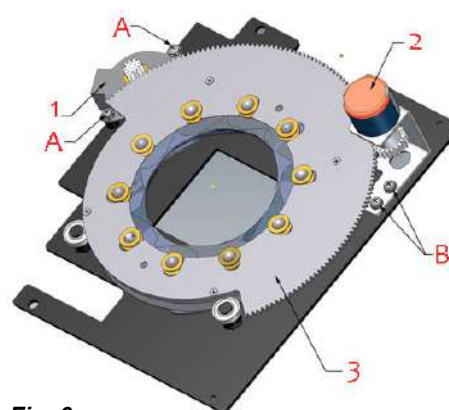
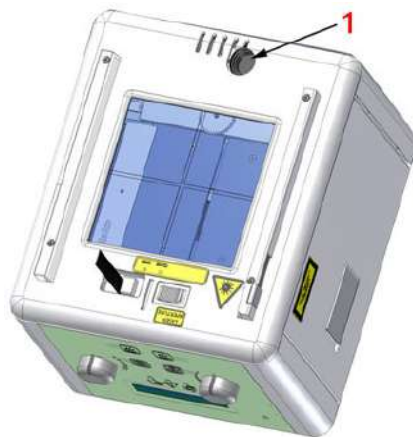


Fig. 6

1- Step Motor, 2 - Potentiometer, 3 - Iris,  
A - Step Motor Adjustment, B - Potentiometer Adjustment

**RO 314 Camera assembled internally**

Analogue, color, video camera mounted on the lower part of the collimator for remote patient monitoring.



***Substitution of the Video Camera***

- Remove the knobs by unscrewing the 2 screws per knob.



- Unscrew the 4 screws placed on the rails.



- Remove carefully the snap-on front panel and detach the connectors:  
**A** for the push button  
**B** for the front panel LED.

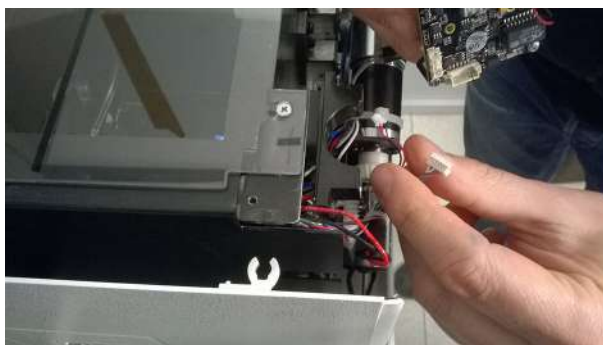




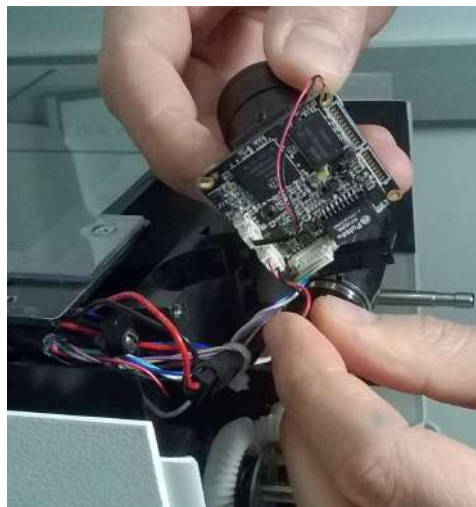
- Remove the lower cover.
- Remove the 2 lateral covers, if necessary.
- Remove the video camera with its support by unscrewing the fixing screws (C).



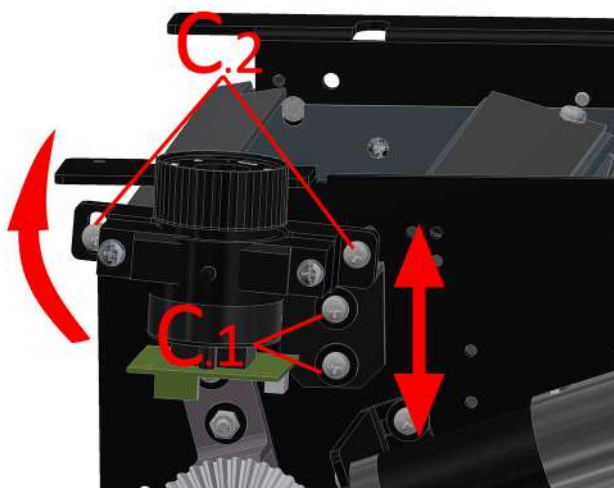
- Detach the 2 connectors from the video camera.



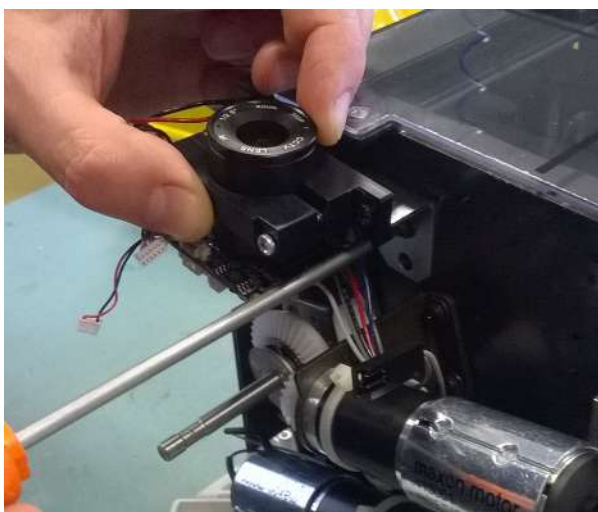
- Remount the video camera with its support by connecting the 2 connectors and then fixing the support to the collimator housing.



- The video camera can be adjusted vertically (C.1) or be tilted (C.2) whenever it is necessary.



- Power up the collimator and check if the video camera is calibrated.



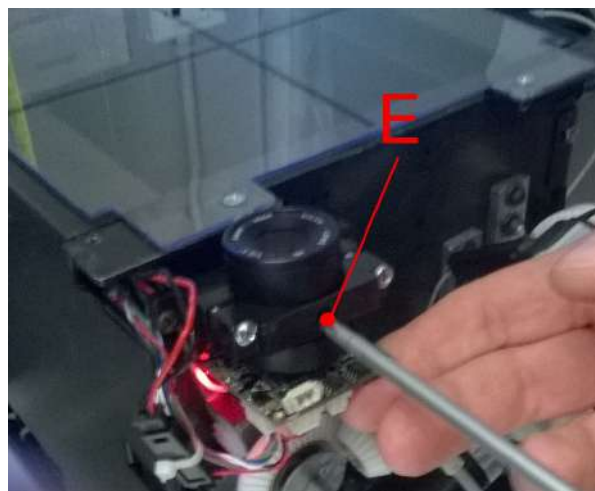


THE VIDEO CAMERA IS ALREADY WELL-FOCUSED IN THE FACTORY. PLEASE FOLLOW THE BELOW PROCEDURE TO READJUST THE FOCUS.

- If necessary, loosen the 2 screws (**D**) and rotate the whole video camera to calibrate it.

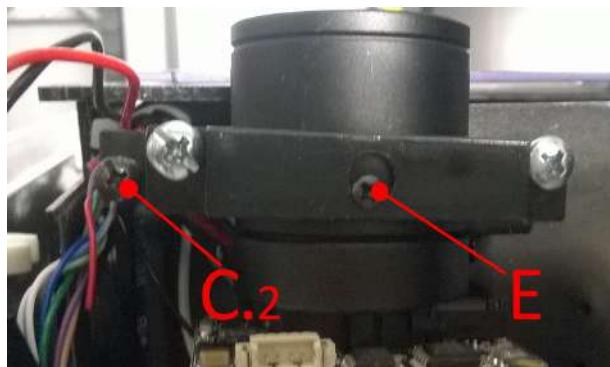


- Loosen the screw **E** placed on the video camera support.
- Adjust the focus by rotating the lens.





- Loosen the screw **F** and adjust the video camera inclination, if necessary.
- Tighten the screws **E** and **F**.
- Remount the collimator cover in reverse order.



### RO 320 Motorized rotation of collimator

Collimator rotation,  $\pm 45^\circ$ , with potentiometer to control collimator movement.



### Rotation Adjustment

#### MOTOR

The motor for the collimator rotation is assembled inside the collimator body and is calibrated inhouse. If the gear with the cogwheel on the mounting flange is not perfect, proceed as follows:

- Remove the plate to access the adjustment point, see Chapter- **COVER REMOVAL**.
- Loosen the two screws **A**, move the motor toward the collimator and check that play between two gears is minimum.
- Tighten the two screws **A**, see **Fig. 1**.
- Tighten the 2 screws **C** on the gear if the motor is running while the collimator does not move or loosen the 2 screws **C** if the gear does not run at the end of stroke.

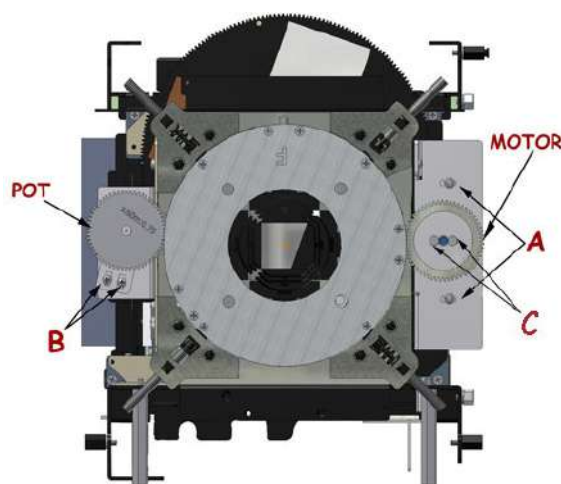


Fig. 1

### POTENTIOMETERS

The potentiometer that controls collimator position is assembled inside the collimator body and is calibrated inhouse. If the gear with the cogwheel on the mounting flange is not perfect, proceed as follows:

- Loosen the two screws **B** move the potentiometer toward the collimator and check that play between the two gears is minimum.
- Tighten the two screws **B**, see **Fig. 2**.

### Motorized Rotation Substitution

#### MOTOR

- Disconnect supply to the collimator.
- Remove the plate to access the adjustment point, see Chapter - **COVER REMOVAL**.
- Loosen the two screws **D** and remove the part. The friction support is glued to the motor shaft; this means that the motor, friction and support need to be substituted.
- Substitute with an identical item.
- Tighten the screws **D** and adjust play between gears, see Chapter - **ADJUSTMENTS**.
- Fasten the two screws **D**, see **Fig. 3**.

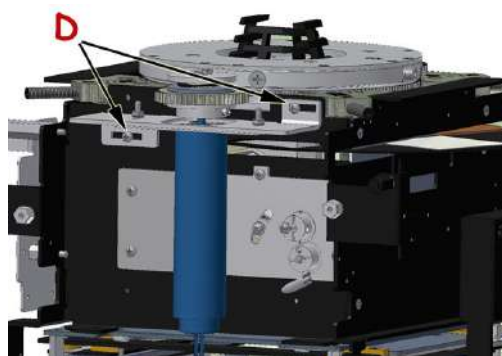


Fig. 2

#### POTENTIOMETER

- Disconnect supply.
- Remove the plate to access the adjustment point, see Chapter - **COVER REMOVAL**.
- Unsolder electrical wires and mark polarity.
- Unscrew the two screws **E**.
- Remove the gear from **F**.
- Substitute with an identical item.
- Remount the gear.
- Remount the support and adjust play between gears, see Chapter - **ADJUSTMENTS**.
- Fasten screws **E**, see **Fig. 3**.

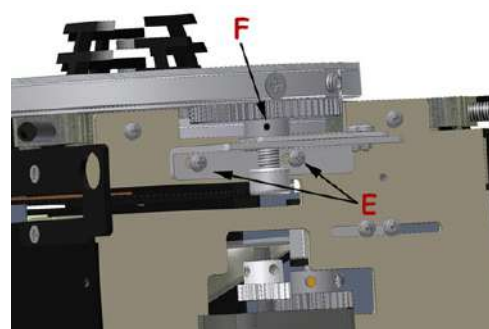


Fig. 3



FOR THE CORRECT CONNECTION OF THE CAN-STEP4 BOARD REFERS TO THE COLLIMATOR WIRING.

### CanBus Controls

xx0h	Remote	8	xx	xx	xx	xx	xx	xx	xx	xx	Read Release
xx3h	Remote	8	xx	xx	xx	xx	xx	xx	xx	xx	Read S/N
xxBh	Remote	7	xx	Pmin.H	Pmin.L	Pmax.H	Pmax.L	Ramp.H	Ramp.L		Read Dati Speed
xx1h	Out	7	Pos.HH	Pos.HL	Pos.LH	Pos.LL	Stato	A/D.H	A/D.L		Status

xx2h	In	5	01h	Ass.HH	Ass.HL	Ass.LH	Ass.LL				Absolute
xx2h	In	5	02h	Rel.HH	Rel.HL	Rel.LH	Rel.LL				Relative
xx2h	In	4	05h	Pwm	Time.H	Timer.L					Muove_vs_Min (debug)
xx2h	In	4	06h	Pwm	Time.H	Timer.L					Muove_vs_Max (debug)
xx2h	In	1	FFh								Stop
xx4h	In	3	01h	SwMin	SwMax						Switch_Remote
xx5h	In	8	M	Pmin.H	Pmin.L	Pmax.H	Pmax.L	Ramp.H	Ramp.L	CW	Drive_Speed
xx6h	In	1	Opz								Options
xxAh	In	5	01h	Pos.HH	Pos.HL	Pos.LH	Pos.LL				Set_Pos_Min
xxAh	In	5	02h	Pos.HH	Pos.HL	Pos.LH	Pos.LL				Set_Pos_Media
xxAh	In	5	03h	Pos.HH	Pos.HL	Pos.LH	Pos.LL				Set_Pos_Max
xxAh	In	5	04h	Vel.H	Vel.L	Brk.H	Brk.L				Set_Vel_& Brake
xxAh	In	1	05h								Set_Pot_Min
xxAh	In	1	06h								Set_Pot_Max
xxCh		8	xx	xx	xx	xx	xx	xx	xx	xx	Set_S/N
xxDh	In	3	01h	Time.H	Time.L						Set_Time_Tx_Stato
xxFh	In	5	01h	Id.H	Id.L	Sp.H	Sp.L				Set ID e speed
xxFh	In	2	FFh	Sys							Set system

## Status

Status message is sent repeatedly in two ways:

If the motor is running, the message is transmitted every few ms defined by message **Set Time Tx**.

If the motor is idle, the message is sent every one second.

Pos: position in degrees \*10 (degrees are expressed in decimal system).

## Status

bit defined

bit 7	bit 6	bit 5	bit 4	bit 3	bit2	bit 1	bit 0
Home	-	-	-	Alarm	Protection		Triggered

Home: = 1 if the collimator is in min. position.

Alarm: Alarm is ON if the movement control was performed but the potentiometer does not move. The alarm is ON also if position has not been reached within the set time. The alarm is not enabled in manual movements: Move forward and Move backward.

A/D: A/D converter value read by the potentiometer.

## Absolute

Moves motor to specified position.

## Relative

Moves motor by number of given steps (also negative).

**Muove\_vs\_Min** control moves the collimator toward min. position (es.  $-45^\circ$ ).

**Muove\_vs\_Max** control moves the collimator toward max. position (es.  $+45^\circ$ ).

Pwm: power applied to motor 0 = idle 255 = max

Time: motor working time (in ms)

### Stop

Stops the motor.

### Switch\_Remote

Repeats the switch remote status.

SwMin: rotates the collimator toward min. position (0=not pressed, 0xFF= pressed).

SwMax: rotates the collimator toward max. position (0=not pressed, 0xFF=pressed).

### Drive\_Speed

Specifies motor working speed.

M- settings, if bit at 1 the inserted field is valid.

bit 7	bit 6	bit 5	bit 4	bit 3	bit2	bit 1	bit 0
-	-	-	-	CW	Rampa	Pmax	Pmin

Pmin: PWM min. to use at motor start-up (0-255).

Pmax. max. PWM applicable (0-255).

Ramp: in ms, time used to switch Pmin to Pmax and vice versa during acceleration and deceleration. (max 1000 ms).

CW: (0/1) inverts direction clockwise and counterclockwise.

### Options

Sets operation of LED and offset:

### Options

:

bit 7	bit 6	bit 5	bit 4	bit 3	bit2	bit 1	bit 0
-	-	-	-	Offset	LED1	LED0	Dis_switch

Offset – if at 1 output messages are shifted by 0x80.

LED1,0 – Defines LED function.

00 – Home sensor status.

Off with flash per second - NOT Home.

ON with flash per second - Home.

01 – Constant flash 1 Hz.

10 - ON motor movement – OFF motor idle.

11 – Incoming message via CanBus.

Dis\_switch 0= enables local keys 1- disables local keys.

### Set\_Pos\_Minima

### Set\_Pos\_Media

### Set\_Pos\_Massima

These controls are used to set both potentiometer in correct position and relative degrees.

When control is sent the cpu reads the potentiometer value and stores into parameters together with received degrees by the same control.

Pos: the sent degrees correspond to current position. Degrees to be sent are multiplied by 10, considering tenths of a degree.

ie. to send +45°, +450 is dispatched, in Hex 0x000001C2

ie. to send -45°, -450 is dispatched, in Hex 0xFFFFFE3E

### Set\_Vel\_&\_Brake

Set the rotation speed in degrees (always multiplied by 10) on the highest motor power.

Set also the motor braking time.

To stop motor invert the rotation for specified time.

Spe: Speed in °/sec. x 10.

Brk: braking time in ms.

### Set\_Pot\_Max

Set max potentiometer excursion (stores the converter A/D value read at the message sending).

### S/N setting

Set the board S/N.

### Status Time Tx Stato

Set transmission time Tx Status.

Time: in ms - time of Status re-transmission with motor position.

### CANBUS AND ID CONFIGURATION

*Boards have default values which are loaded at first power-up. These values need to be varied to provide correct system operation.*

*The first thing to be set is the CanBus ID address and velocity of each board. Jumper JP4 is used for the purpose.*

*By inserting the Jumper, CanBus speed is momentarily set at 500 Kbits/sec.*

### Set ID and Speed

ID	Type	dlc	1	2	3	4	5	6	7	8	Note
xxFh	In	5	01h	Id.H	Id.L	Sp.H	Sp.L				Set ID e Speed

*Id: assigned CanBus ID§*

*Note: ID 7F0h not used.*

*Sp: CanBus Speed in Kbit/sec (10, 20, 50, 100, 125, 150, 250, 500, 800, 1000)*

### System Type

ID	Type	dlc	1	2	3	4	5	6	7	8	Note
xxFh	In	2	FFh	Sys							Set sistema

*Sys: to be defined*

### Calibration of Rotation Position

To calibrate the rotation position it is necessary to proceed as follows:

- Loosen the fixing screws of the potentiometer.
- Position the collimator at 0° (central position).
- Rotate the potentiometer shaft by hand from minimum to maximum to check the value on the display at position A/D:yyy.

- Rotate the potentiometer until the maximum value divided by 2 is read.
- Tighten the potentiometer screws.
- Switch on the collimator by keeping the filter and rotation (+45°) push buttons pressed.
- Release the push buttons when the collimator starts a configuration.
- Wait for the message "Wait command" that appears on the display.
- Press the filter push button; a readout similar to the following string will appear on the screen:  
-45 Gr: xxxx A/D:yyyy  
where:  
xxxx = collimator position in degrees.  
yyyy = potentiometer reading.
- Rotate the collimator to position "-45°" by using the rotation push buttons.
- Press the lamp push button to confirm. The display reads the number -450 at position Gr.: xxxx.
- Rotate the collimator to position "0°" by using the rotation push buttons.
- Press the filter push button to position "0°" in the menu.
- Press the lamp push button to confirm. The display reads "0" at position Gr.:xxxx.
- Rotate the collimator to position "+45°" by using the rotation push buttons.
- Press the filter push button to "+ 45°" in the menu.
- Press the Lamp push button to confirm. The display reads "+450" at position Gr.:xxxx..

At this point the rotation is calibrated



RE-POSITION THE POTENTIOMETER ONLY IF STRICTLY NECESSARY.

### **Self - positioning**

At start-up the collimator does not position itself. A self-repositioning function is enabled internally by sending the message via Canbus or pressing the push button of the rotation.

In practice, if for some external problem the board should detect the different position from the last one, the motor will automatically restore a correct position.

### **RO 329 Internal Proximity Sensor**

A proximity sensor is a sensor able to detect the minimum distance to a patient without any physical contact, thereby avoiding the risk of collision.

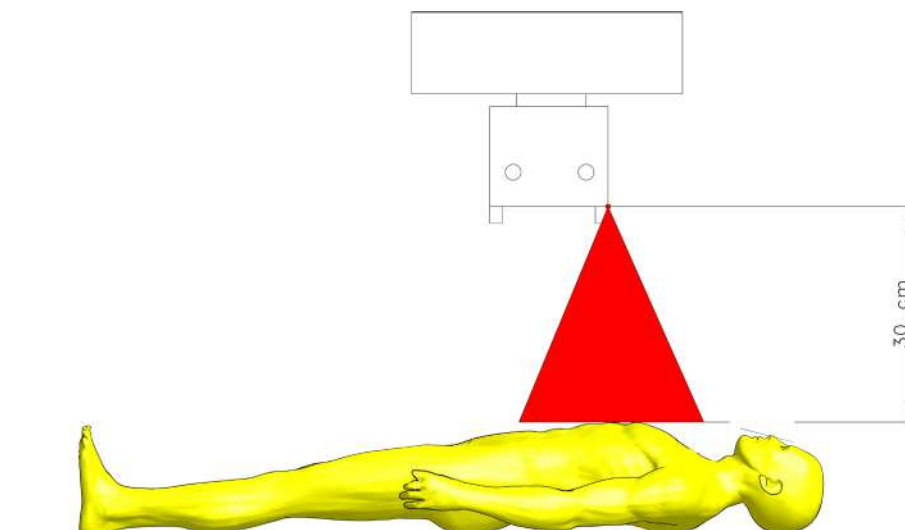
The proximity sensor emits an inferred beam and register a return signal if utilized correctly.

The minimum distance that this sensor detects is 30 cm. A shorter distance will generate alarms to be managed by the X-ray system and end user.

WARNING



THE LIABILITY FOR THE CORRECT SENSOR FUNCTIONING DEVOLVES  
UPON THE END USER AND/OR THE X-RAY EQUIPMENT  
MANUFACTURER.



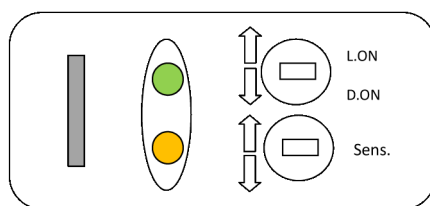
**Fig. Minimum distance patient/X-ray focus**

### Connection

The 12 V supply is to be drawn from connector J10; the output signal is to be connected to pin 2 of connector J12. A resistor, 10 Kohm 1/4 W, is to be mounted between pins 2 and 3 on connector J12. See Fig. 1 for the wiring diagram of the sensor.

### Calibration

The two switches on the sensor front serve as reference



### Sensor Calibration

- Rotate the Light/Dark switch to LIGHT ON to activate the sensor when the object is in measuring range.
- Set the object at the required detection distance and adjustment the sensitivity switch by increasing the potentiometer until the orange LED light is lit.
- Remove the object and set sensitivity half-way between the detected point and maximum potentiometer value.



**WARNING**

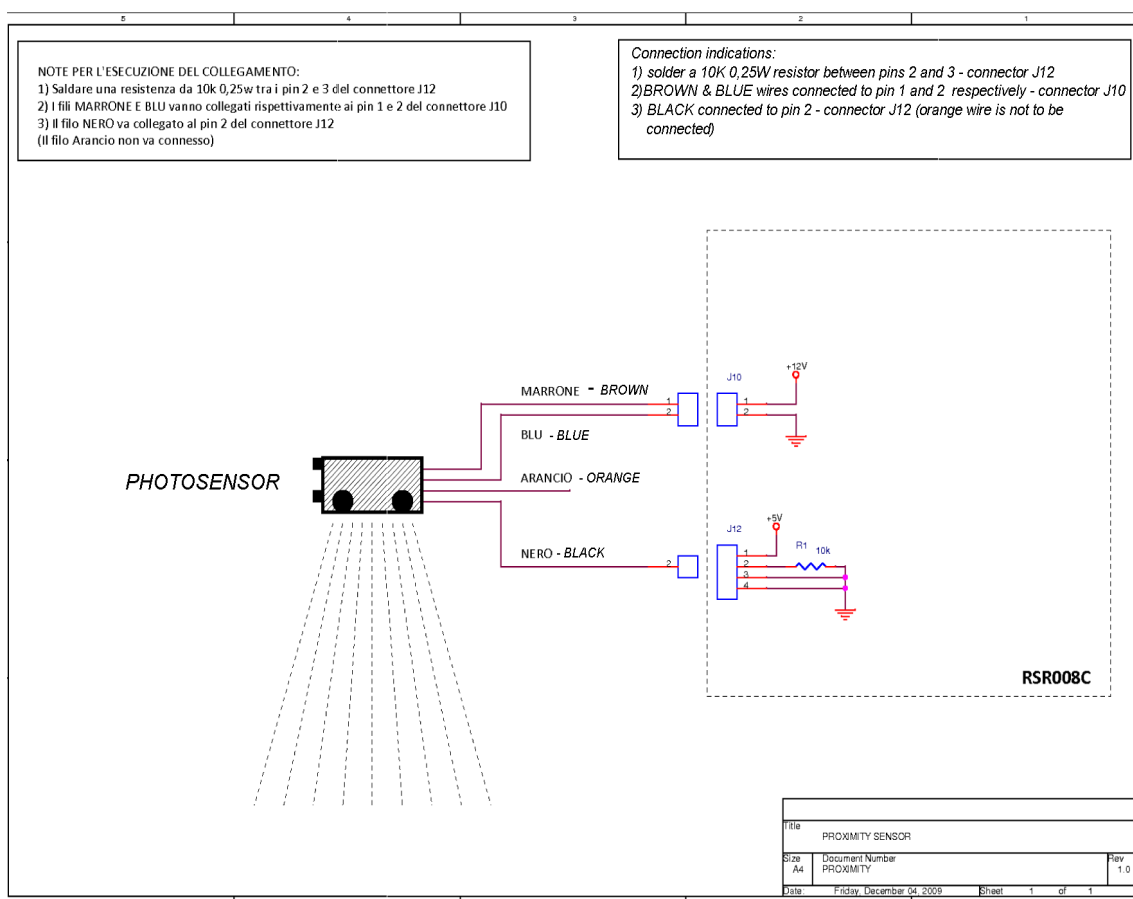


MAKE SURE THAT THE PROXIMITY SENSOR IS WORKING PROPERLY.  
AN IMPROPER USE OF THE PROXIMITY SENSOR MIGHT CAUSE  
HARM TO THE PATIENT.

**WARNING**



RALCO REFUSES TO ACCEPT ANY LIABILITY FOR DAMAGES IN  
THE EVENT OF FAILED OR IMPROPER OPERATION OF THE DEVICE.



**RO 330 Connecting cable extension**



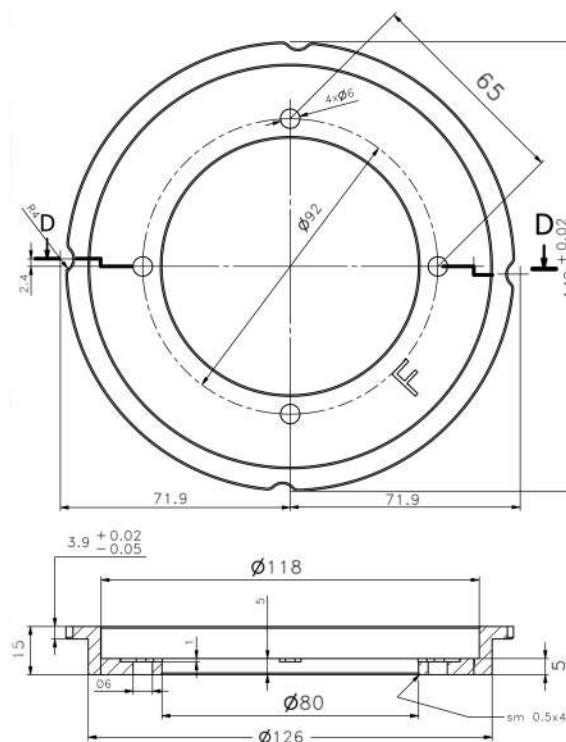
Connecting cable extension; Longer cable is provided for your system.

### RO 332/A Resin Rotating Mounting Flange

Resin rotating mounting flange with fixing screws:

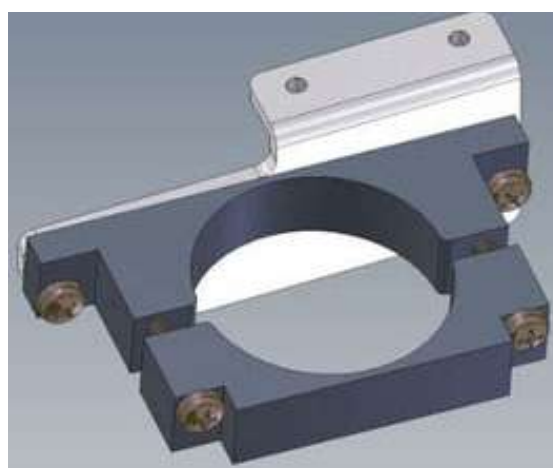
- 15 mm thickness
- +/- 90° detent
- 140 mm diameter

Please refer to the chapter **INSTALLATION** in this Instruction Manual for the correct flange/collimator mounting instructions.



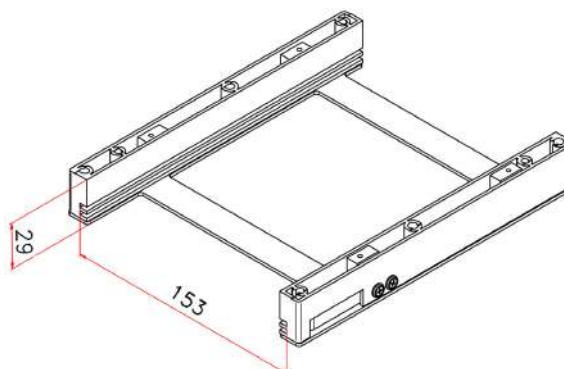
### RO 337 Mechanical arrangement for digital camera assembling

Mechanical adaptation for the accommodation of a patient monitoring video camera (camera not supplied).



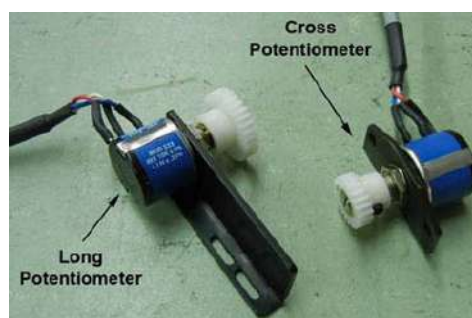
### RO 344 Accessory guide rail spacers with reinforced support

Pair of plastic rail guides (RAL 9003) on metal support designed to accommodate the ionization chamber and allow the insertion of relative filter (153 mm  $\pm$  0.5).



### RO 356 Shutter position verified by potentiometer

Supplementary safety device to ensure correct positioning of shutters. It consists of two potentiometers mounted on the collimator: One is mounted on the back of the collimator to control the Long shutters and the other potentiometer is mounted on the side to control the Cross shutters. The output signal is managed by a customer.



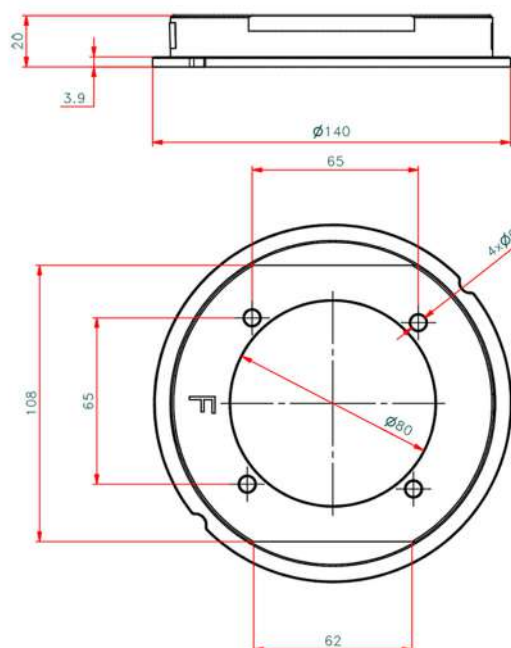
### RO 409 Resin Rotating Mounting Flange

Resin rotating mounting flange milled to form a square:

- 20 mm thickness
- $\pm$  0° detent
- 140 mm diameter

Option includes three (3) iron mounting flange spacers also milled to form a square: 1.5 mm thickness.

Please refer to the chapter **INSTALLATION** in this Instruction Manual for the correct flange/collimator mounting instructions.



## RO 428 Touchscreen Display

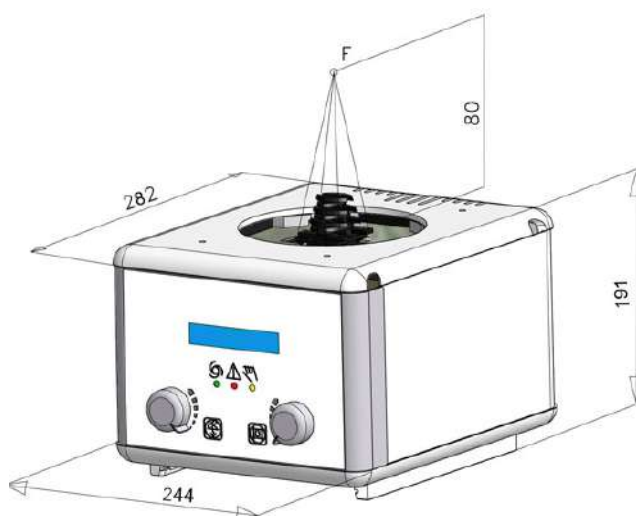
The collimator front panel is without knobs and a touchscreen panel is added, allowing to control filter, light and shutter position. DFF/SID is also displayed.



## RO 436 Reduction of housing height

Modified housing providing a lower collimator (DAP may not be mounted internally).

Collimator cover dimensions: 191 x 244 x 282 cm

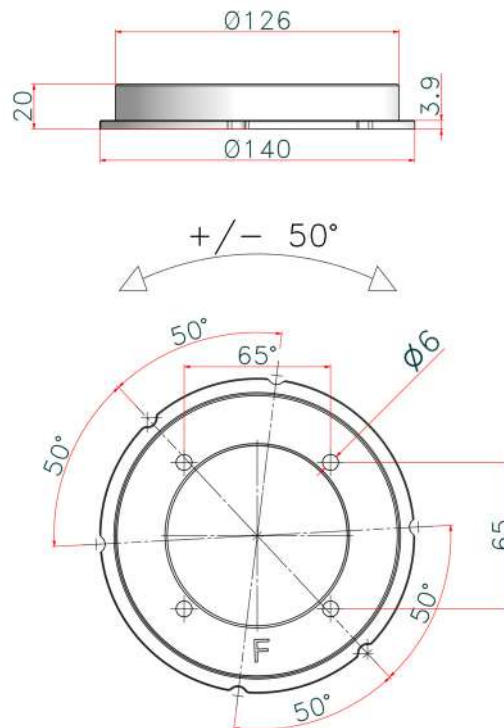


## RO 441 Resin Rotating Mounting Flange

Resin rotating mounting flange:

- 20 mm thickness
- $\pm 50^\circ$  detent
- 140 mm diameter

Please refer to the chapter **INSTALLATION** in this Instruction Manual for the correct flange/collimator mounting instructions.

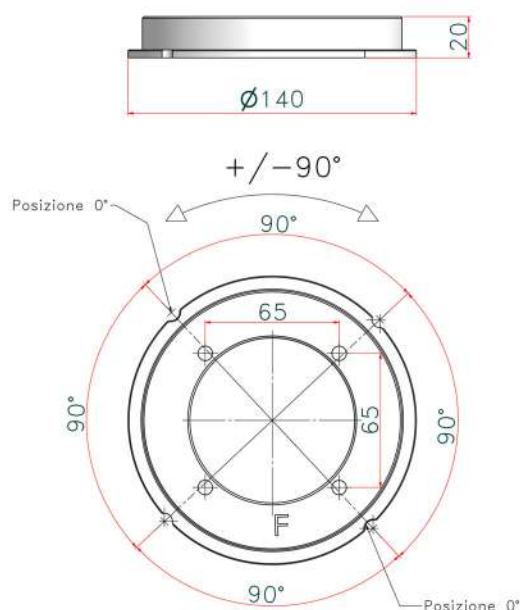


## RO 442 Resin Rotating Mounting Flange

Resin rotating mounting flange:

- 20 mm thickness
- $\pm 90^\circ$  detent
- 140 mm diameter

Please refer to the chapter **INSTALLATION** in this Instruction Manual for the correct flange/collimator mounting instructions.



## RO 444 Can Open Protocol

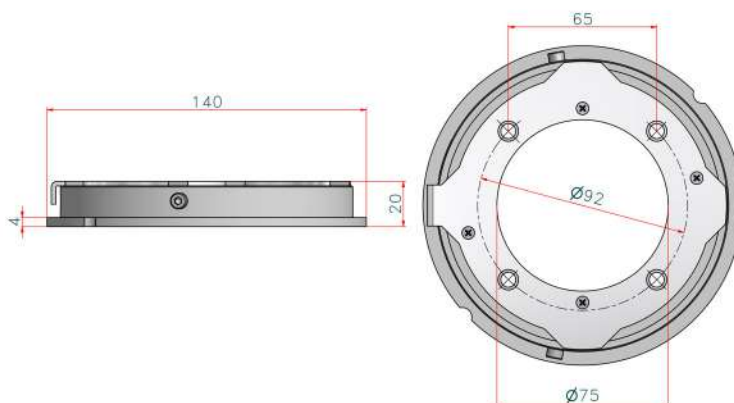
Software that controls the collimator functions via CanOpen protocol.

## RO 445 Metal Rotating Mounting Flange

Metal rotating mounting flange:

- 20 mm thickness
- +/- 90° mechanical stop
- 140 mm diameter

Please refer to the chapter **INSTALLATION** in this Instruction Manual for the correct flange/ collimator mounting instructions.



### When the collimator is assembled check the collimator to Focal Spot Alignment (Primary Shutter Cut-Off).

Inspect the four images of the four collimator shutters which form the edges of the X-ray field. A definitely indistinct edge indicates that the primary shutter, close to the focal spot, is the one forming the line, rather than the outermost shutter.

To correct the condition, use the four mounting/centering adjustment screws to shift the collimator in the direction of the indistinct line. Repeat the test film exposure after making the adjustment.

**NOTE**



THE HEEL EFFECT WILL CAUSE THE FIELD TOWARD THE CATHODE TO BE SLIGHTLY LESS SHARP THAN ON THE OTHER THREE SIDES. THIS IS NORMAL AND CANNOT BE CORRECTED BY ADJUSTMENT. IN ADDITION, AN X-RAY TUBE OF 12° OR LESS TARGET ANGLE WILL PRODUCE AN ASYMMETRICALLY SHAPED FIELD WHEN A LARGE FIELD SIZE IS USED AT SHORT SID, BECAUSE OF ANODE CUT-OFF EFFECT. THIS IS NORMAL AND MAY NOT BE CORRECTED BY ADJUSTMENT.

### RO 452 Manual-Image Stitching on LONG Shutters

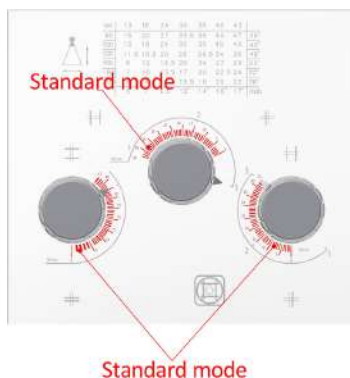
Each single Long shutter is moving through a knob on the front panel. This specialized system allows the user to manually adjust and fine-tune the stitch position. During the manual-stitching process, alignment of the Potter Bucky with the X-ray beam is manually performed for each exposure.

The X-ray tube remains stationary throughout the entire process. The acquired number of exposures is 3 at 100 cm SID.

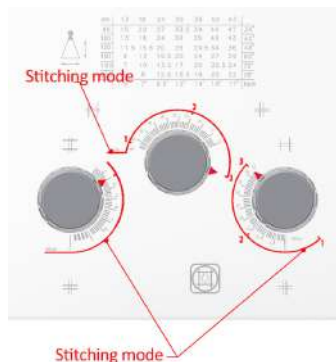
#### NOTE



THE FRONT PANEL SHOWS THE 2 INDEX SCALES THAT ALLOWS THE COLLIMATOR TO OPERATE EITHER IN THE STANDARD OR STITCHING MODE. SEE **FIG. INDEX SCALE - STANDARD MODE** AND **FIG. INDEX SCALE - STITCHING MODE**. THE MAXIMUM COLLIMATOR APERTURE IN THE STITCHING MODE IS 43 X 43 CM AT 100 CM SID.



**Fig. Index Scale - Standard Mode**



**Fig. Index Scale - Stitching Mode**

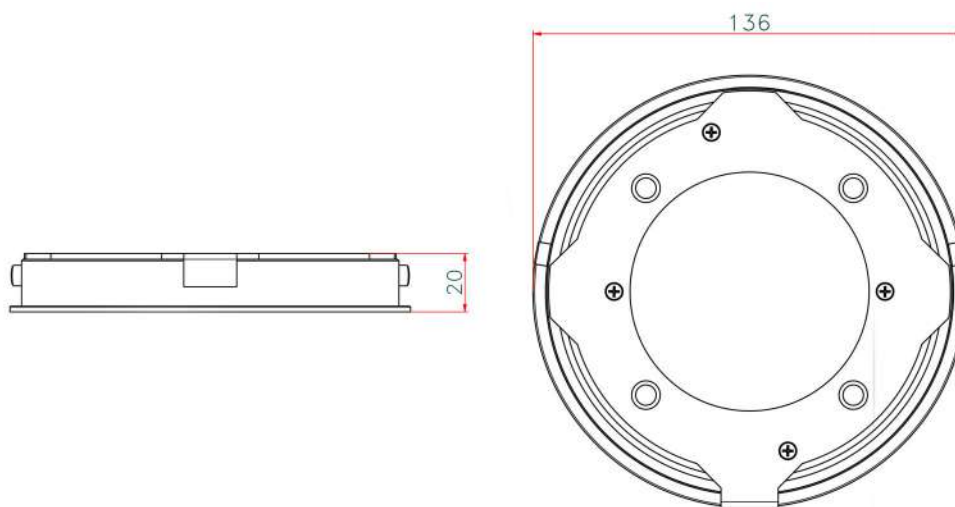


## RO 456 Metal Rotating Mounting Flange

Metal rotating mounting flange:

- 20 mm thickness
- +/- 90° with mechanical stop
- 136 mm diameter

Please refer to section **RO 492 Adjustable Top-Cover Bracket** in this chapter of the Instruction Manual for the correct flange/collimator mounting instructions..

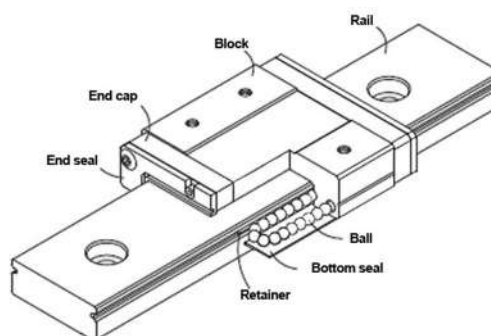


## RO 470 High precision ball bearing shutter movement

A linear guideway permits linear movement with the aid of rolling elements. By using balls or rollers between the rail and block, a linear guideway can attain an extremely precise linear movement. Compared with a standard sliding guide, the friction coefficient here is just one fiftieth.

### PROPERTIES AND ADVANTAGES:

- High positioning accuracy
- Long lifetime and highly precise movement
- High speed and low driving force
- Same high load capacity in all directions



**Fig. Linear guideway**



SUBSTITUTION OF LINEAR GUIDEWAYS MUST BE EXCLUSIVELY PERFORMED IN RALCO.

### RO 481 Internal Rotating Square Field

Two pairs of rectangular lead shutters (Long and Cross), moving jointly, both rotating  $\pm 360^\circ$  by means of three stepper motors. The motorized movement of its shutters permits adjustment of the X-Ray field to the area under investigation.

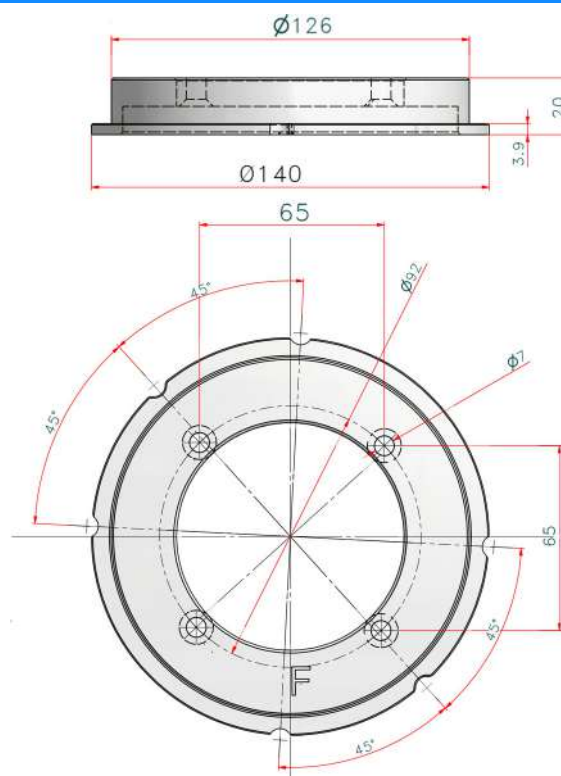
This option is not available with RO 310 or RO 344.

### RO 489 Resin Rotating Mounting Flange

Resin rotating mounting flange:

- 20 mm thickness
- $\pm 45^\circ$  detent
- 140 mm diameter

Please refer to the chapter **INSTALLATION** in this Instruction Manual for the correct flange/collimator mounting instructions.



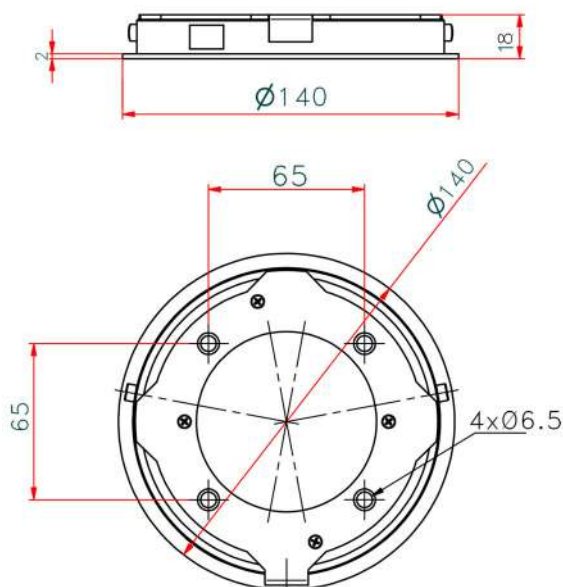


## RO 490 Metal Rotating Mounting Flange

Metal rotating mounting flange with countersunk mounts:

- 18 mm thickness
- +/- 90° with mechanical stop
- 140 mm diameter

Please refer to section **RO 492 Adjustable Top-Cover Bracket** in this chapter of the Instruction Manual for the correct flange/ collimator mounting instructions.  
This flange is **ONLY** available with **RO 492**.



## RO 492 Adjustable Top-Cover Bracket

This accessory has been designed to precisely install the collimator with a 136mm diameter metal flange (not included) to the X-ray tube.

### WARNINGS



THE COLLIMATOR MUST BE INSTALLED TO THE X-RAY TUBE THROUGH A MOUNTING FLANGE. RALCO PROVIDES VARIOUS FLANGE OPTIONS WHICH MAY NOT BE INTER-CHANGEABLE. ONLY FLANGES PROVIDED WITH THE COLLIMATOR MAY BE UTILIZED. THE END-USER MAY INSTALL THEIR OWN FLANGE, HOWEVER RALCO CANNOT GUARANTEE COMPATIBILITY. ANY PREEXISTING FLANGE ON THE END-USER SYSTEM MUST NOT BE USED.



WHEN A FLANGE IS PROVIDED WITH THE COLLIMATOR BEARING A MATCHING SERIAL NUMBER, ENSURE THEY ALWAYS REMAIN COUPLED. IT IS MANDATORY THEY REMAIN TOGETHER AND THE CORRECT FLANGE PART NUMBER IS USED.

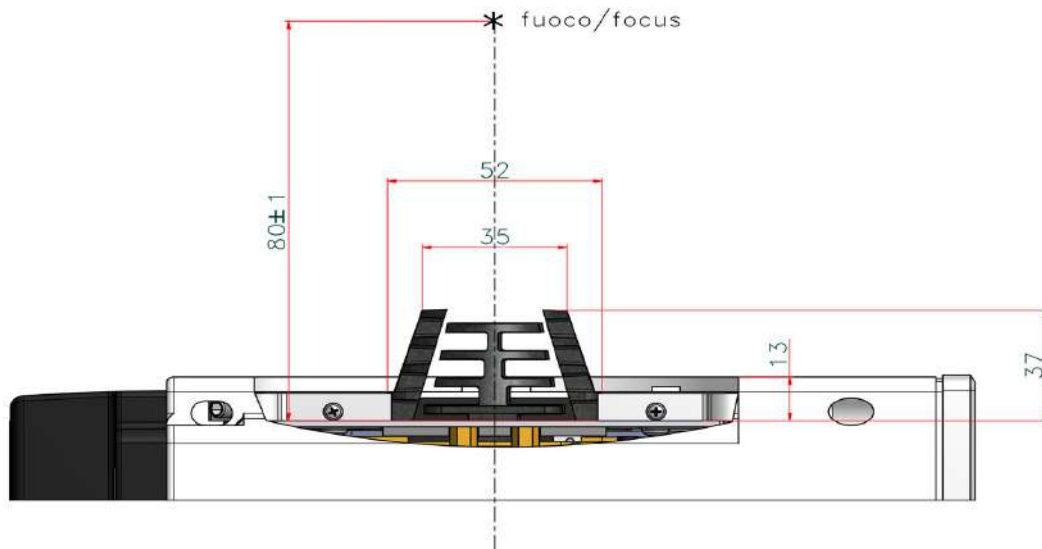


THE CONTENTS OF THE INSTRUCTIONS BELOW SHOULD BE STRICTLY ADHERED TO. RALCO IS NOT LIABLE FOR ANY PROPERTY DAMAGE OR RESULTING HARM IF NON-RALCO COMPONENTS OR NON-COMPATIBLE RALCO COMPONENTS ARE USED DURING THE INSTALLATION PROCESS.

## Installation

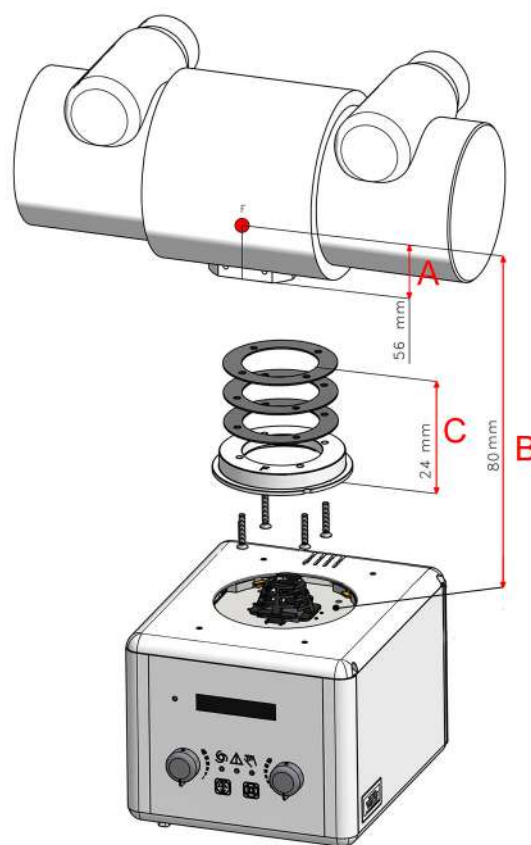
### TUBE COMPATIBILITY

1. Using the dimensions in **Fig. Tube Compatibility** below, ensure the near port shutters of the collimator are placed in the X-Ray tube port without interference.
2. The distance between the X-Ray tube focus and the flange mounting plane (collimator upper plate) must be: 80 mm (3.15"), tolerance  $\pm 1$  mm (0.04 ").



**Fig. Tube Compatibility**

3. Carefully remove the collimator and the mounting flange (if purchased) from their packaging.
4. Use the X-Ray tube housing datasheet to determine the distance (**A**) from the focal spot to the X-Ray tube port, see **Fig. Collimator Installation**.
5. Subtract the resulting distance from the source flange distance (**B**) and determine the number of spacers (1.5 mm) which, combined with the thickness of the mounting flange, will make up the difference (**C**). Allowable tolerance is 1 mm. (0.04"), see **Fig. Collimator Installation**.
6. Once the mounting plane distance has been confirmed, continue with the mounting flange installation to the X-Ray tube.



**Fig. Collimator Installation**  
\*illustrative purpose only

*\*The flange fixing screws and the spacers of the previous flange may be reused if the flange thickness is the same.*

### Mounting the Flange to the X-ray Tube

#### NOTE



THE FOLLOWING MOUNTING INSTRUCTIONS ARE ONLY APPLICABLE FOR COMPATIBLE FLANGES WITH THIS OPTIONAL ITEM. IF YOU ARE UNSURE THE MOUNTING FLANGE YOUR COLLIMATOR IS EQUIPPED WITH IS COMPATIBLE, PLEASE CONSULT YOUR PERSONALIZATION PAGE PROVIDED WITH THIS MANUAL TO LOCATE THE FLANGE PART NUMBER (RO REFERENCE). FOLLOW THE MOUNTING INSTRUCTIONS SET FORTH UNDER THE SPECIFIC RO REFERENCE IN THIS MANUAL.

#### WARNING



FLANGES MAY BE PROVIDED BY RALCO OR BY THE SYSTEM MANUFACTURER. FLANGES MAY NOT BE INTERCHANGEABLE. ONLY THE FLANGE PROVIDED WITH THE COLLIMATOR BEING INSTALLED WITH A SPECIFIC PART CODE MAY BE UTILIZED. ANY PRE-EXISTING FLANGES MAY NOT TO BE USED. IF THERE ARE ANY QUESTIONS REGARDING COMPATIBILITY, PLEASE CONTACT RALCO.

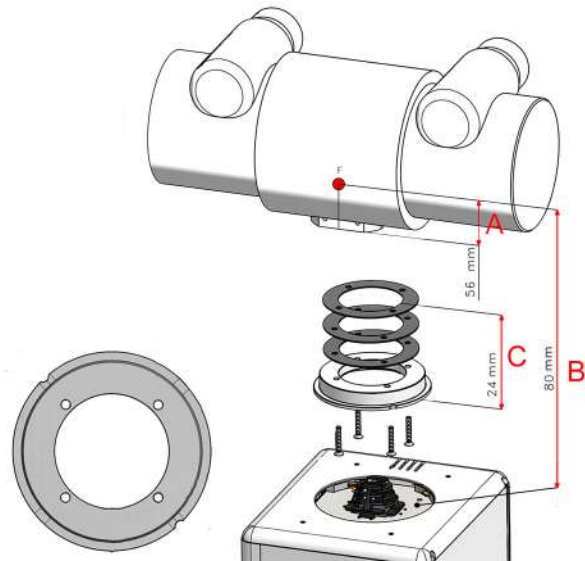
**CAUTION**



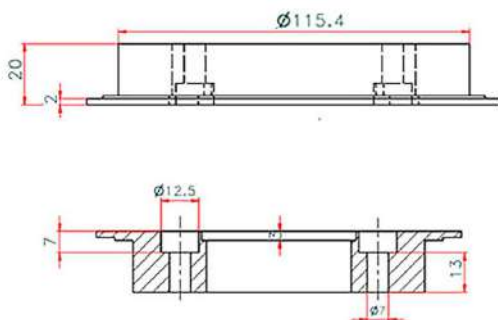
RALCO CANNOT GUARANTEE COMPLIANCE WITH RADIATION STANDARDS CONCERNING SAFETY IF THIS CONTROL HAS BEEN OMITTED.

1. Place the flange on the X-Ray tube port, see **Fig. Flange Installation**.
2. Mount the mounting flange and spacers (optional) to the X-Ray tube port using 4 screws.\*\*

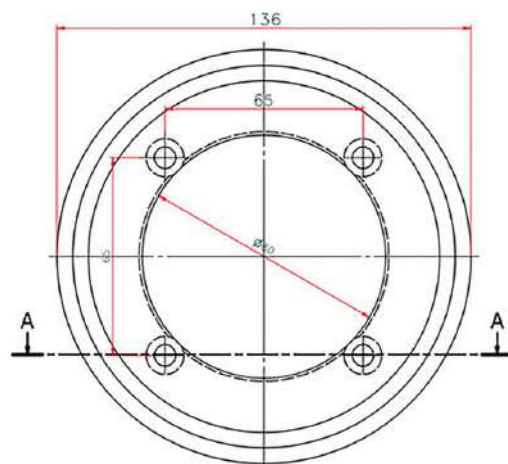
**\*\*Please ensure no conflicting information nor dangerous conditions exist due to adhering to these instructions or those provided by the X-Ray tube manufacturer. When in doubt please contact X-ray tube manufacturer and/or Ralco.**



**Fig. Flange Installation**  
\*illustrative purpose only



**Fig. Mounting Flange**  
\*illustrative purpose only



**CAUTION**



ENSURE THE SCREW HEAD IS INDEED CORRECT FOR THE FLANGE SELECTED. IT IS THE RESPONSIBILITY OF THE END-USER TO ENSURE ALL SAFETY MEASURES ARE IMPLEMENTED TO ENSURE THE SCREWS ARE OPTIMALLY TIGHTENED INCLUDING THE USE OF APPROPRIATE LOCKTITE.



TIGHTEN THE 4 SCREWS TO THE X-RAY TUBE HEAD SECURELY, STRICTLY ACCORDING TO THE INSTRUCTIONS OF THE X-RAY TUBE MANUFACTURER. DO NOT EXCEED 0.45 NM OF FORCE.

### **Alignment of X-Ray Tube Focus and Collimator**

Ralco guarantees the correct collimator functionality, format compliance and light/X-Ray field alignment only if the mounting flange and the collimator have been installed exactly in the centre of the X-Ray beam.

All Ralco collimators are aligned on our test bench utilizing specific references/values for our X-Ray tube focus, detector and Source to Image Detector Distance (SID). The customer must know and verify all known variables which may influence the X-Ray tube focus and collimator alignment. These may include, the X-Ray tube focus position tolerance, distance from X-Ray tube focus to collimator mounting plane, or the SID.

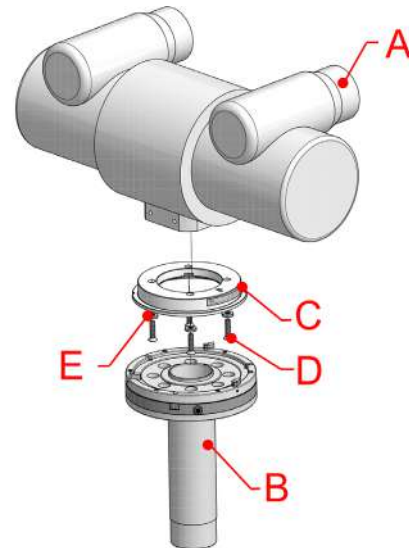
### **Alignment Device**

This device is used to ensure the collimator mounting flange is correctly aligned to the X-ray beam. The X-ray tube manufacturer provides a tolerance for the placement of X-ray tube focus.

Ralco recommends to use the Focal Alignment Device (jig) to ensure the correct flange alignment with the centre of the X-Ray beam, see **Fig. Focal Alignment Device**. By making an exposure, it is possible to verify the perpendicularity and concentricity using fixed references on the X-Ray image.

Once the mounting flange is aligned the collimator light/X-ray field should also be aligned (within specific tolerances).

Please consult the technical specifications of your X-Ray tube to find the maximum tolerance for the position of the focus. Should the use of an alignment device not be possible, Ralco collimators allow for the regulation of the light field.



A - X-Ray Tube, B - Focal Adjustment Device  
C - Mounting Flange, D - Screw, E - Washer

**Fig. Focal Alignment Device**

## Mounting the Collimator to the Flange

### NOTE



THE MOUNTING FLANGE PROVIDED (IF PURCHASED) WITH THE COLLIMATOR IS SUBJECTED TO TESTING PURSUANT TO ALL APPLICABLE STANDARDS.



MOUNTING BRACKET TABS CONFORM TO EN60601.

### WARNINGS



PURSUANT TO APPLICABLE STANDARDS, RALCO HAS TESTED THE COLLIMATOR AND FLANGE APPLYING STATIC LOADS. RALCO IS NOT IN A POSITION TO KNOW THE DYNAMIC FORCES OF ALL END-USER SYSTEMS. IT IS THE RESPONSIBILITY OF THE END-USER TO ENSURE DYNAMIC FORCES OF THE SYSTEM DO NOT CREATE A DANGEROUS CONDITION.



IT IS THE RESPONSIBILITY OF THE SYSTEM MANUFACTURER TO ENSURE AND MITIGATE ANY DANGEROUS CONDITIONS WHICH MAY OCCUR DUE TO THE DYNAMIC FORCES CREATED BY THE SYSTEM. THE END-USER MUST PERFORM A SYSTEMATIC AND STRUCTURAL ANALYSIS DURING THE INSTALLATION AND USUAL MAINTENANCE.



SHOULD ANY DAMAGE TO THE COLLIMATOR OR FLANGE OCCUR A RISK ANALYSIS AND DAMAGE ASSESSMENT NEEDS TO BE CONDUCTED IMMEDIATELY. CONTACT RALCO IMMEDIATELY SHOULD THIS OCCUR. RALCO IS NOT LIABLE FOR RESULTING PROPERTY DAMAGE AND/OR HARM DUE TO AN UNREPORTED INCIDENT.



RALCO HAS DESIGNED AND TESTED THE COLLIMATOR FOR A LIFETIME OF 10 YEARS. AFTER THIS TIME PERIOD, IT IS THE RESPONSIBILITY OF THE END-USER TO ENSURE THE PROPER FUNCTIONING OF THE COLLIMATOR AND FLANGE. LIABILITY FOR ANY DANGEROUS CONDITIONS WHICH MAY BE PRESENT AFTER THE 10YEAR LIFETIME OF THE COLLIMATOR AND FLANGE RESTS WITH THE END-USER.



TO ENSURE THE SAFETY OF THE COLLIMATOR AND FLANGE AFTER 10 YEARS OF USE, RALCO HAS INSTITUTED A PROGRAM TO ASSESS THE SAFETY OF THE COLLIMATOR AND FLANGE. AFTER APPLYING A CHECK LIST OF QUALITY CONTROLS AND REFURBISHMENT ACTIVITIES (AT END-USER EXPENSE), RALCO MAY CERTIFY THE COLLIMATOR AND FLANGE FOR ADDITIONAL YEARS OF USE.

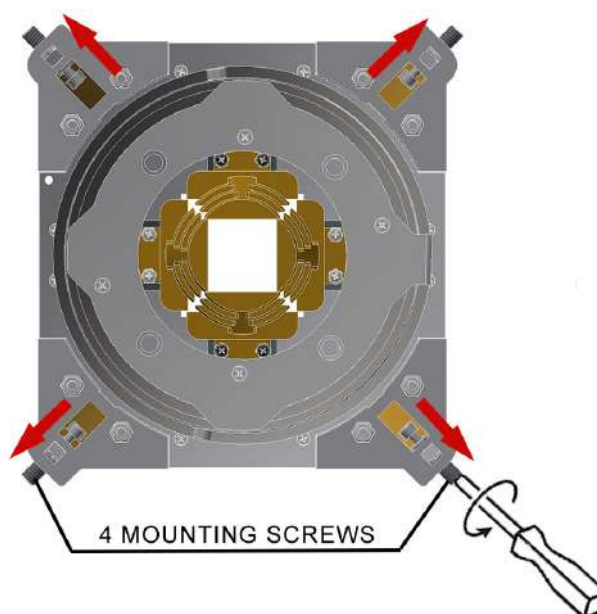


1. Prepare the collimator to be installed by unscrewing the 4 hexagonal socket screws until the four tabs are completely withdrawn from the collimator top mounting plane, see **Fig. 4 Mounting Screws**.
2. If installing a manual collimator, adjust the collimator shutters to the fully open position using both knobs.

**CAUTION**

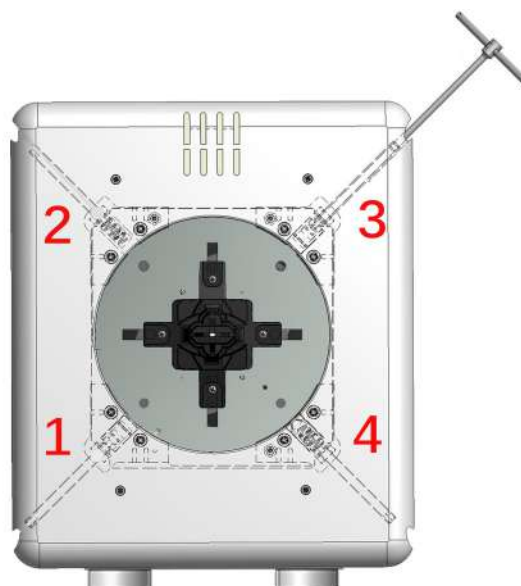


WHEN UNSCREWING THE HEXAGONAL SOCKET SCREW WHICH CONTROL THE TABS, DO NOT USE FORCE EXCEEDING 0,45 NM. UNSCREW WITH CARE SO AS NOT TO DAMAGE THE HEXAGONAL SCREW HEAD AND TABS.



**Fig. 4 Mounting Screws**

3. With the tabs fully retracted, the hexagonal socket screws of the mounting bracket must be tightening equally up to the end stroke with 0.45 Nm torque (at least 7 turns), see **Fig. Mounting Bracket**.
4. The 4 tabs of the hexagonal socket screws overlap on the flange outer ring in the same manner.
5. The collimator tabs adhere to the flange outer ring. Depending on the optional flange purchased, the collimator may rotate or be fixed (no rotation).
6. Once the collimator is coupled to the flange in the method described above, verify the distance between the collimator housing and the mounting flange is equal in all directions and the collimator face is parallel to the axis of the table. Loosen the screws and adjust as necessary.
7. The collimator should be coupled to the flange firmly. If the collimator is loose, please repeat the above mounting instructions, and if issues persist, please contact Ralco.



**Fig. Mounting Bracket**  
\*illustrative purpose only

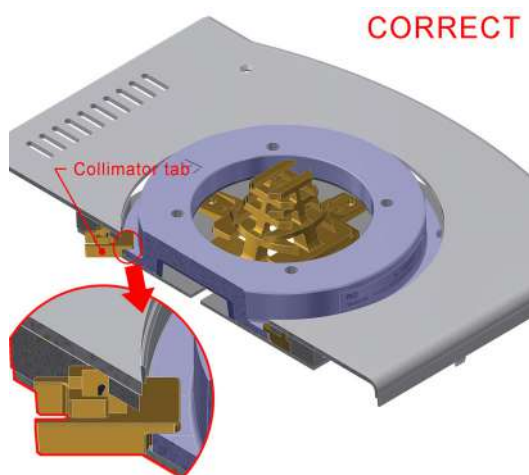
## Verification of Correct Installation

### WARNING



IT IS THE DUTY OF THE INSTALLER TO ENSURE NO RISK OF THE COLLIMATOR FALLING EXISTS. ENSURE THE FOLLOWING, AS IN EACH SCENARIO BELOW SERIOUS RISK OF INJURY AND/OR PROPERTY DAMAGE MAY EXIST DUE TO NON-ADHERENCE.

1. The 4 tabs should overlap the flange outer ring, see **Fig. Correct Overlap**.
2. Ensure the mounting flange is flat against the collimator mounting plane, see **Fig. Correct Overlap**.
3. Ensure the 4 tabs are not in contact with only the mounting flange edge, see **Fig. Incorrect Overlap**.
4. Once the collimator is mounted, if not already, return the collimator/tube head to the intended use position. Rotate and/or gently pull the collimator to ensure correct coupling.
5. If the collimator is loose, something is incorrect. Repeat above mounting instructions, and if issues persist, please contact Ralco.



**Fig. Correct Overlap**



**Fig. Incorrect Overlap**

## RO 495 Camera assembled internally for patient monitoring

An IP ethernet interface is a type of digital camera commonly employed for surveillance, and which, unlike analog closed circuit television (CCTV) cameras, can send and receive data via a computer network and the Internet.



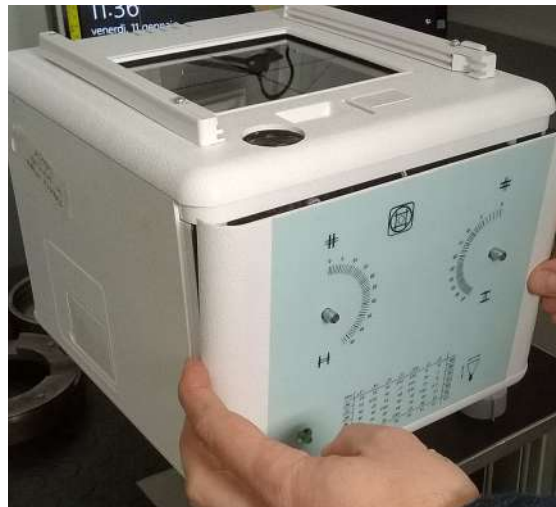
### ***Substitution of the Video Camera***

- Remove the knobs by unscrewing the 2 screws per knob.



- Unscrew the 4 screws placed on the rails.





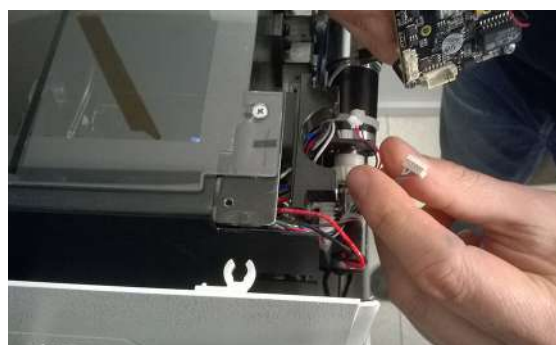
- Remove carefully the snap-on front panel and detach the connectors:  
**A** for the push button  
**B** for the front panel LED (if present).



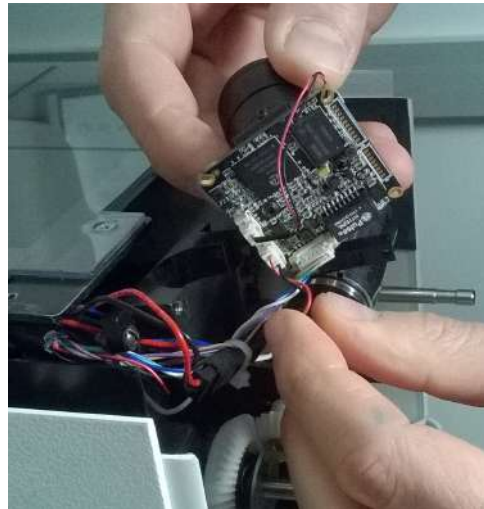
- Remove the lower cover.
- Remove the 2 lateral covers, if necessary.
- Remove the video camera with its support by unscrewing the fixing screws (C).



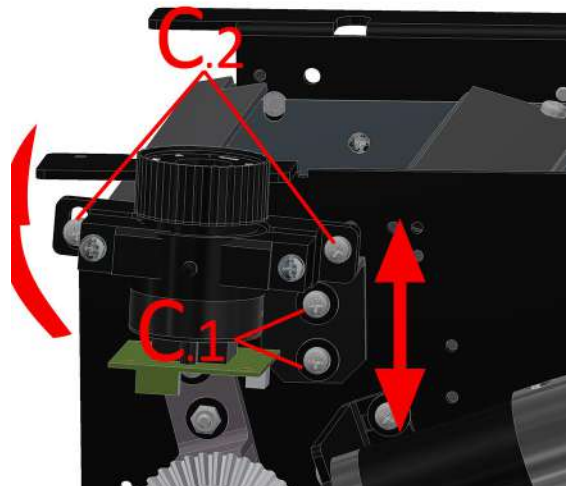
- Detach the connectors from the video camera, as shown in the photos.



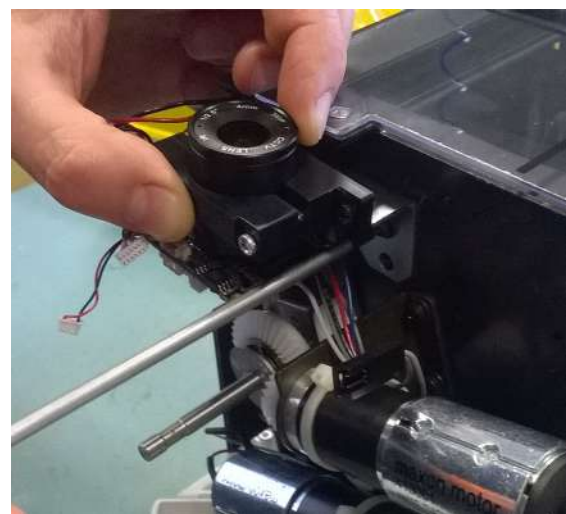
- Remount the video camera with its support by connecting the connectors and then fixing the support to the collimator housing.



- The video camera can be adjusted vertically (C.1) or be tilted (C.2) whenever it is necessary.



- Power up the collimator and check if the video camera is calibrated.



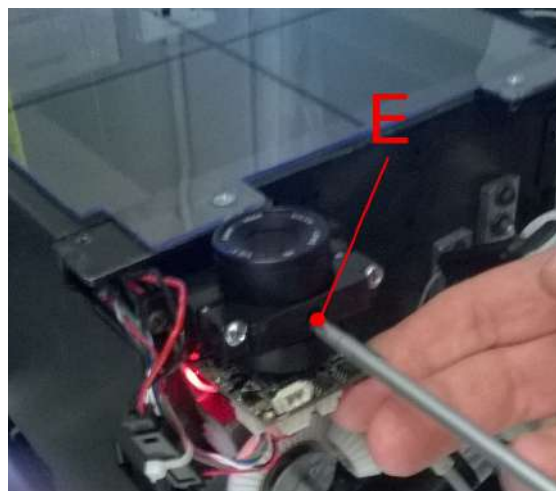


THE VIDEO CAMERA IS ALREADY WELL-FOCUSED IN THE FACTORY. PLEASE FOLLOW THE BELOW PROCEDURE TO READJUST THE FOCUS.

- If necessary, loosen the 2 screws (**D**) and rotate the whole video camera to calibrate it.

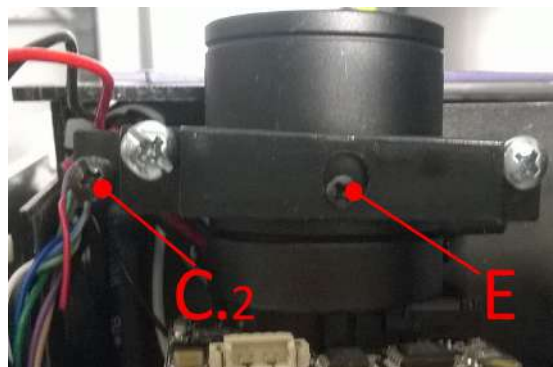


- Loosen the screw **E** placed on the video camera support.
- Adjust the focus by rotating the lens.





- Loosen the screw **F** and adjust the video camera inclination, if necessary.
- Tighten the screws **E** and **F**.
- Remount the collimator cover in reverse order.



### RO 498 Self-Centering Top-Cover Bracket with Zero Position Output Signal

Zero position ( $\pm 3^\circ$ ) output signal is provided by a microswitch with signal being managed by the customer.

#### Installation

#### WARNINGS



THE COLLIMATOR MUST BE INSTALLED TO THE X-RAY TUBE THROUGH A MOUNTING FLANGE. RALCO PROVIDES VARIOUS FLANGE OPTIONS WHICH MAY NOT BE INTERCHANGEABLE. ONLY FLANGES PROVIDED WITH THE COLLIMATOR MAY BE UTILIZED. THE END-USER MAY INSTALL THEIR OWN FLANGE, HOWEVER RALCO CANNOT GUARANTEE COMPATIBILITY. ANY PREEXISTING FLANGE ON THE END-USER SYSTEM MUST NOT BE USED.



WHEN A FLANGE IS PROVIDED WITH THE COLLIMATOR BEARING A MATCHING SERIAL NUMBER, ENSURE THEY ALWAYS REMAIN COUPLED. IT IS MANDATORY THEY REMAIN TOGETHER AND THE CORRECT FLANGE PART NUMBER IS USED.

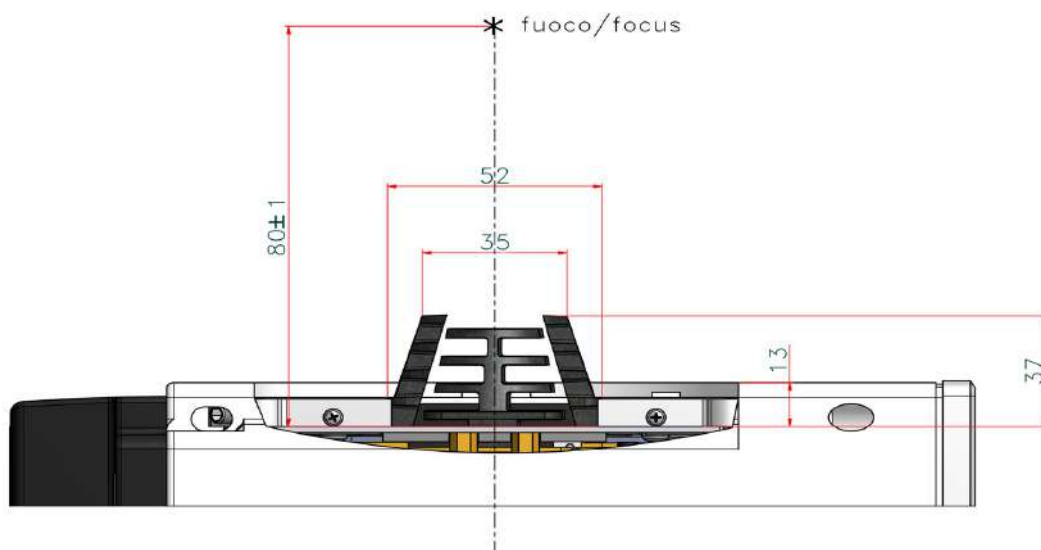


THE CONTENTS OF THE INSTRUCTIONS BELOW SHOULD BE STRICTLY ADHERED TO. RALCO IS NOT LIABLE FOR ANY PROPERTY DAMAGE OR RESULTING HARM IF NON-RALCO COMPONENTS OR NON-COMPATIBLE RALCO COMPONENTS ARE USED DURING THE INSTALLATION PROCESS.

#### TUBE COMPATIBILITY

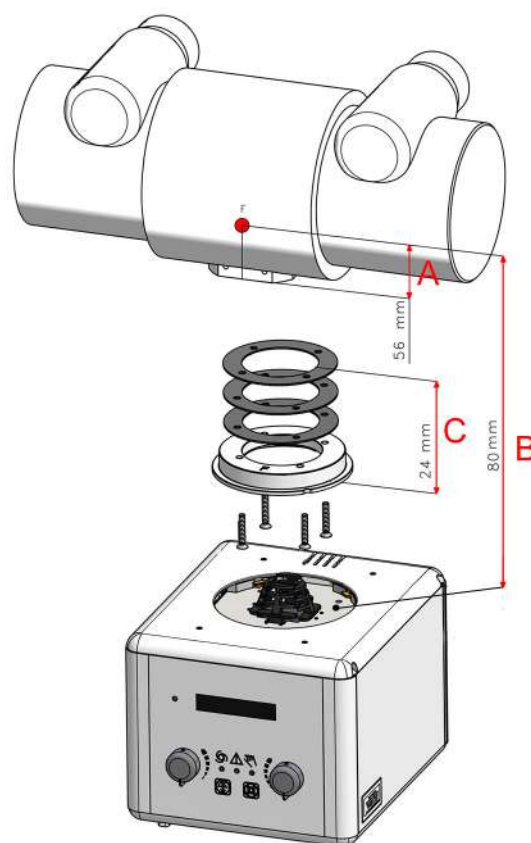
1. Using the dimensions in **Fig. Tube Compatibility** below, ensure the near port shutters of the collimator are placed in the X-Ray tube port without interference.

- The distance between the X-Ray tube focus and the flange mounting plane (collimator upper plate) must be: 80 mm (3.15"), tolerance +/- 1 mm (0.04 ").



**Fig. Tube Compatibility**

- Carefully remove the collimator and the mounting flange from their packaging.
- Use the X-Ray tube housing datasheet to determine the distance (**A**) from the focal spot to the X-Ray tube port, see **Fig. Collimator Installation**.
- Subtract the resulting distance from the source flange distance (**B**) and determine the number of spacers (1.5 mm) which, combined with the thickness of the mounting flange, will make up the difference (**C**). Allowable tolerance is 1 mm. (0.04"), see **Fig. Collimator Installation**.
- Once the mounting plane distance has been confirmed, continue with the mounting flange installation to the X-Ray tube.



**Fig. Collimator Installation**  
\*illustrative purpose only

*\*The flange fixing screws and the spacers of the previous flange may be reused if the flange thickness is the same.*

## ***Mounting the Flange to the X-ray Tube***

### **NOTE**



THE FOLLOWING MOUNTING INSTRUCTIONS ARE ONLY APPLICABLE FOR COMPATIBLE FLANGES WITH THIS OPTIONAL ITEM. IF YOU ARE UNSURE THE MOUNTING FLANGE YOUR COLLIMATOR IS EQUIPPED WITH IS COMPATIBLE, PLEASE CONSULT YOUR PERSONALIZATION PAGE PROVIDED WITH THIS MANUAL TO LOCATE THE FLANGE PART NUMBER (RO REFERENCE). FOLLOW THE MOUNTING INSTRUCTIONS SET FORTH UNDER THE SPECIFIC RO REFERENCE IN THIS MANUAL.

### **WARNING**



FLANGES MAY BE PROVIDED BY RALCO OR BY THE SYSTEM MANUFACTURER. FLANGES MAY NOT BE INTERCHANGEABLE. ONLY THE FLANGE PROVIDED WITH THE COLLIMATOR BEING INSTALLED WITH A SPECIFIC PART CODE MAY BE UTILIZED. ANY PRE-EXISTING FLANGES MAY NOT TO BE USED. IF THERE ARE ANY QUESTIONS REGARDING COMPATIBILITY, PLEASE CONTACT RALCO.

### **CAUTION**

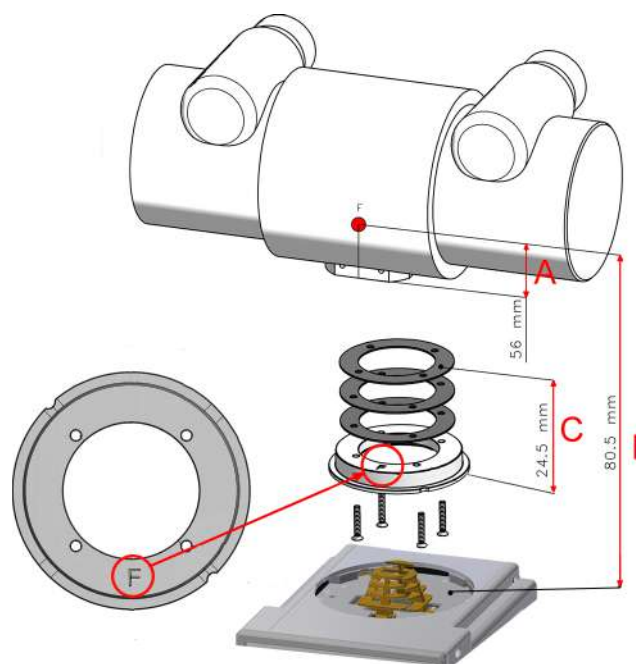


RALCO CANNOT GUARANTEE COMPLIANCE WITH RADIATION STANDARDS CONCERNING SAFETY IF THIS CONTROL HAS BEEN OMITTED.



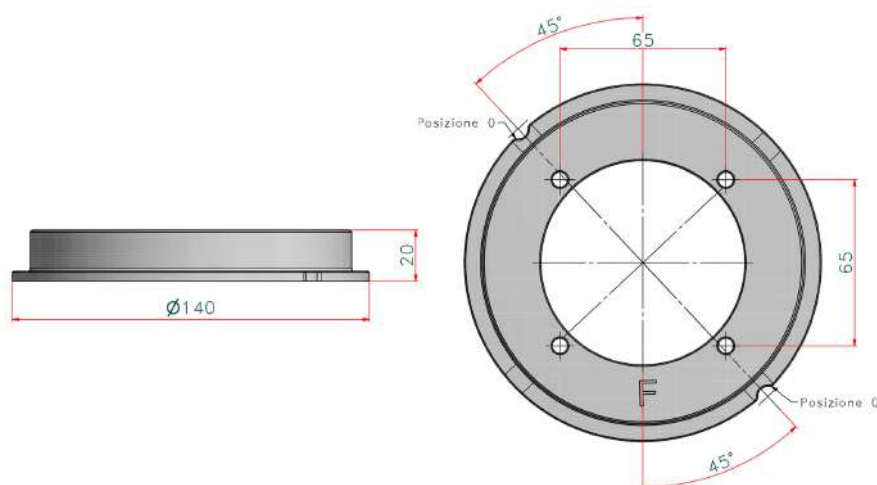
1. Place the flange on the X-Ray tube port, see **Fig. Flange Installation**.
2. Mount the mounting flange and spacers (optional) to the X-Ray tube port using 4 screws.\*\*

**\*\*Please ensure no conflicting information nor dangerous conditions exist due to adhering to these instructions or those provided by the X-Ray tube manufacturer. When in doubt please contact X-Ray tube manufacturer and/or Ralco.**



**Fig. Flange Installation**

*\*illustrative purpose only*



**Fig. Mounting Flange**

*\*illustrative purpose only*

**CAUTION**



THE FLANGE MUST BE PLACED WITH THE LETTER "F" FACING TOWARD THE X-RAY TUBE PORT. INCORRECT POSITION MAY CAUSE THE COLLIMATOR AND FLANGE TO MALFUNCTION.

**CAUTION**



ENSURE THE SCREW HEAD IS INDEED CORRECT FOR THE FLANGE SELECTED. IT IS THE RESPONSIBILITY OF THE END-USER TO ENSURE ALL SAFETY MEASURES ARE IMPLEMENTED TO ENSURE THE SCREWS ARE OPTIMALLY TIGHTENED INCLUDING THE USE OF APPROPRIATE LOCKTITE.



TIGHTEN THE 4 SCREWS TO THE X-RAY TUBE HEAD SECURELY, STRICTLY ACCORDING TO THE INSTRUCTIONS OF THE X-RAY TUBE MANUFACTURER. DO NOT EXCEED 0.45 NM OF FORCE.

**Alignment of X-Ray Tube Focus and Collimator**

Ralco guarantees the correct collimator functionality, format compliance and light/X-Ray field alignment only if the mounting flange and the collimator have been installed exactly in the centre of the X-Ray beam.

All Ralco collimators are aligned on our test bench utilizing specific references/values for our X-Ray tube focus, detector and Source to Image Detector Distance (SID). The customer must know and verify all known variables which may influence the X-Ray tube focus and collimator alignment. These may include, the X-Ray tube focus position tolerance, distance from X-Ray tube focus to collimator mounting plane, or the SID.

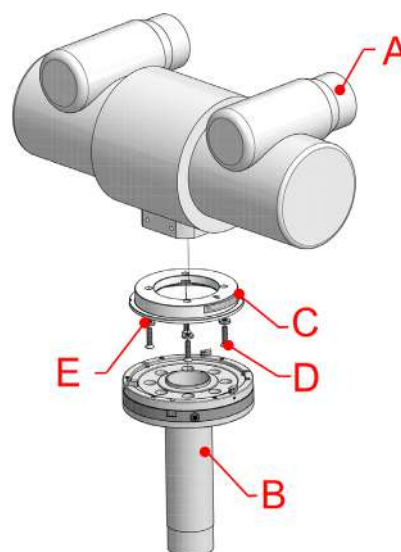
**ALIGNMENT DEVICE**

This device is used to ensure the collimator mounting flange is correctly aligned to the X-ray beam. The X-ray tube manufacturer provides a tolerance for the placement of X-ray tube focus.

Ralco recommends to use the Focal Alignment Device (jig) to ensure the correct flange alignment with the centre of the X-Ray beam, see **Fig. Focal Alignment Device**. By making an exposure, it is possible to verify the perpendicularity and concentricity using fixed references on the X-Ray image.

Once the mounting flange is aligned the collimator light/X-ray field should also be aligned (within specific tolerances).

Please consult the technical specifications of your X-Ray tube to find the maximum tolerance for the position of the focus. Should the use of an alignment device not be possible, Ralco collimators allow for the regulation of the light field.



A - X-Ray Tube, B - Focal Adjustment Device  
C - Mounting Flange, D - Screw, E - Washer

**Fig. Focal Alignment Device**

## Mounting the Collimator to the Flange

### NOTE



THE MOUNTING FLANGE PROVIDED (IF PURCHASED) WITH THE COLLIMATOR IS SUBJECTED TO TESTING PURSUANT TO ALL APPLICABLE STANDARDS.



MOUNTING BRACKET TABS CONFORM TO EN60601.

### WARNINGS



PURSUANT TO APPLICABLE STANDARDS, RALCO HAS TESTED THE COLLIMATOR AND FLANGE APPLYING STATIC LOADS. RALCO IS NOT IN A POSITION TO KNOW THE DYNAMIC FORCES OF ALL END-USER SYSTEMS. IT IS THE RESPONSIBILITY OF THE END-USER TO ENSURE DYNAMIC FORCES OF THE SYSTEM DO NOT CREATE A DANGEROUS CONDITION.



IT IS THE RESPONSIBILITY OF THE SYSTEM MANUFACTURER TO ENSURE AND MITIGATE ANY DANGEROUS CONDITIONS WHICH MAY OCCUR DUE TO THE DYNAMIC FORCES CREATED BY THE SYSTEM. THE END-USER MUST PERFORM A SYSTEMATIC AND STRUCTURAL ANALYSIS DURING THE INSTALLATION AND USUAL MAINTENANCE.



SHOULD ANY DAMAGE TO THE COLLIMATOR OR FLANGE OCCUR A RISK ANALYSIS AND DAMAGE ASSESSMENT NEEDS TO BE CONDUCTED IMMEDIATELY. CONTACT RALCO IMMEDIATELY SHOULD THIS OCCUR. RALCO IS NOT LIABLE FOR RESULTING PROPERTY DAMAGE AND/OR HARM DUE TO AN UNREPORTED INCIDENT.



RALCO HAS DESIGNED AND TESTED THE COLLIMATOR FOR A LIFETIME OF 10 YEARS. AFTER THIS TIME PERIOD, IT IS THE RESPONSIBILITY OF THE END-USER TO ENSURE THE PROPER FUNCTIONING OF THE COLLIMATOR AND FLANGE. LIABILITY FOR ANY DANGEROUS CONDITIONS WHICH MAY BE PRESENT AFTER THE 10YEAR LIFETIME OF THE COLLIMATOR AND FLANGE RESTS WITH THE END-USER.



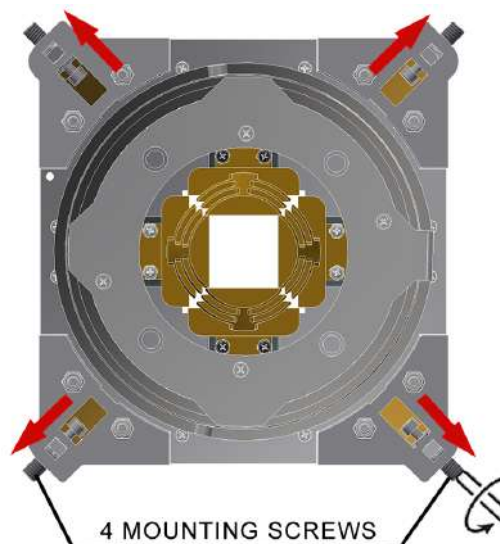
TO ENSURE THE SAFETY OF THE COLLIMATOR AND FLANGE AFTER 10 YEARS OF USE, RALCO HAS INSTITUTED A PROGRAM TO ASSESS THE SAFETY OF THE COLLIMATOR AND FLANGE. AFTER APPLYING A CHECK LIST OF QUALITY CONTROLS AND REFURBISHMENT ACTIVITIES (AT END-USER EXPENSE), RALCO MAY CERTIFY THE COLLIMATOR AND FLANGE FOR ADDITIONAL YEARS OF USE.

The mounting bracket has 2 tabs with springs in positions 2 and 4, while the 2 tabs in position 1 and 3 cover the surface of the outer ring of the flange, see **Fig. Mounting Bracket**.

1. Prepare the collimator to be installed by unscrewing the 4 hexagonal socket screws until the four tabs are completely withdrawn from the collimator top mounting plane, see **Fig. 4 Mounting Screws**.
2. Ensure the microswitch is completely retracted, see **Fig. Microswitch**.



**Fig. Microswitch**



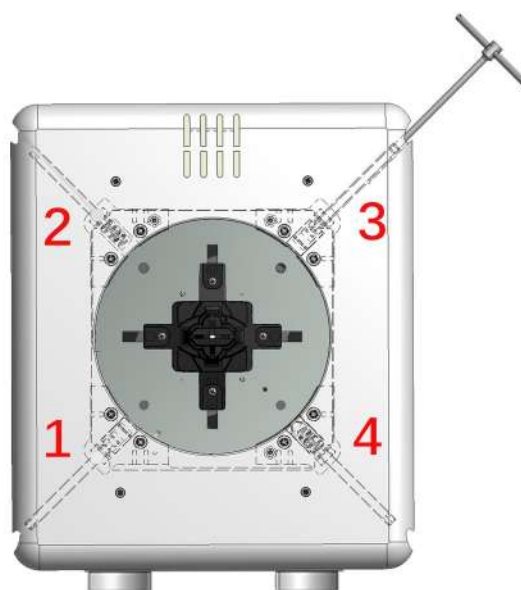
**Fig. 4 Mounting Screws**

**CAUTION**



WHEN UNSCREWING THE HEXAGONAL SOCKET SCREW WHICH CONTROL THE TABS, DO NOT USE FORCE EXCEEDING 0,45 NM.  
UNSCREW WITH CARE SO AS NOT TO DAMAGE THE HEXAGONAL SCREW HEAD AND TABS.

3. With the tabs fully retracted, tabs in position 1 and 3 which overlap the outer ring must be tightened completely up to the end stroke with 0.45Nm of torque (at least 7 turns), see **Fig. Mounting Bracket**.
4. With the tabs fully retracted, tabs in position 2 and 4 which overlap the outer ring must be tightened exactly 5 ½ turns, see **Fig. Mounting Bracket**.
5. If you are not able to respect the turns something is incorrect, repeat above instructions, if issues persist, please contact Ralco.
6. Ensure the microswitch is completely engaged by tightening the set screw, see **Fig. Microswitch**.
7. The collimator tabs glide on the flange outer ring and the collimator rotates towards the X-ray tube axis. If, however:
  - The release force from the position 0° and the collimator rotation is too low, the two tabs of the tab 2 and 4 need to be tightened ½ turn.
  - The release force from the position 0° and the collimator rotation is too high, the two tabs of the tab 2 and 4 need to be loosened ½ turn.



**Fig. Mounting Bracket**  
\*illustrative purpose only

### Verification of Correct Installation

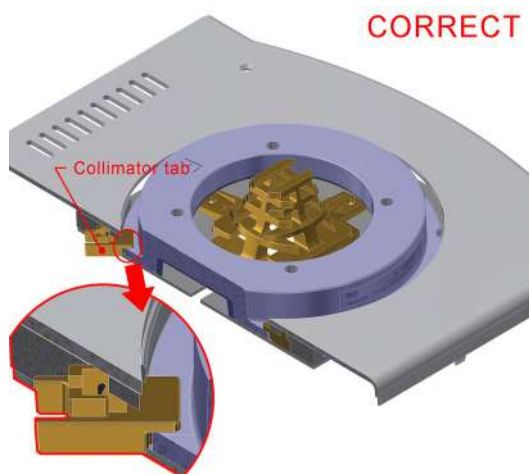
#### WARNING



IT IS THE DUTY OF THE INSTALLER TO ENSURE NO RISK OF THE COLLIMATOR FALLING EXISTS. ENS URE THE FOLLOWING, AS IN EACH SCENARIO BELOW SERIOUS RISK OF INJURY AND/OR PROPERTY DAMAGE MAY EXIST DUE TO NON-ADHERENCE.

1. The 4 tabs should overlap the flange outer ring, see **Fig. Correct Overlap**.
2. Ensure the mounting flange is flat against the collimator mounting plane, see **Fig. Correct Overlap**.
3. Ensure the 4 tabs are not in contact with only the mounting flange edge, see **Fig. Incorrect Overlap**.
4. Once the collimator is mounted, if not already, return the collimator/tube head to the intended use position. Rotate and/or gently pull the collimator to ensure correct coupling.
5. If the collimator is loose, something is incorrect. Repeat above mounting instructions, and if issues persist, please contact Ralco.





*Fig. Correct Overlap*



*Fig. Incorrect Overlap*

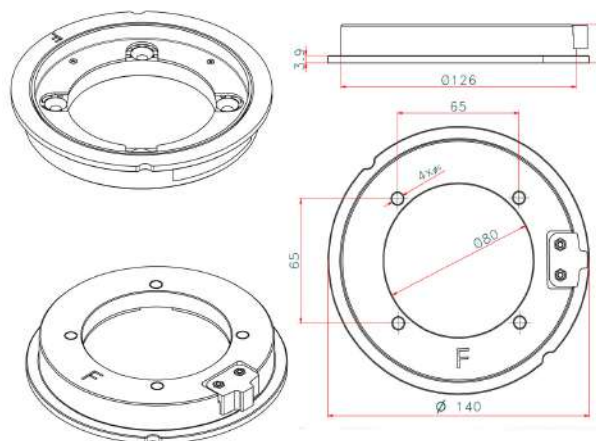
### RO 499 Resin Rotating Mounting Flange with Position Indicator

This accessory is a part of the position control system designed to indicate the collimator 0° position ( $\pm 3^\circ$ ) through a microswitch.

Resin rotating mounting flange:

- 20 mm thickness
- $\pm 90^\circ$  detent
- 140 mm diameter

Please refer to section **RO 498 Auto-Centering Top-Cover Bracket** in this chapter of the Instruction Manual for the correct flange/collimator mounting instructions.



### RO 502 Camera assembled internally for patient monitoring

The USB camera with CMOS image sensor delivers excellent image quality and accuracy in color reproduction, even in the harshest ambient light conditions. The camera is completely integrated with the collimator thanks to its lightweight, compact design, 15 fps at full resolution (2592 x 1944 px) and embedded power supply.

## RO 518 Additional Variable Filtration

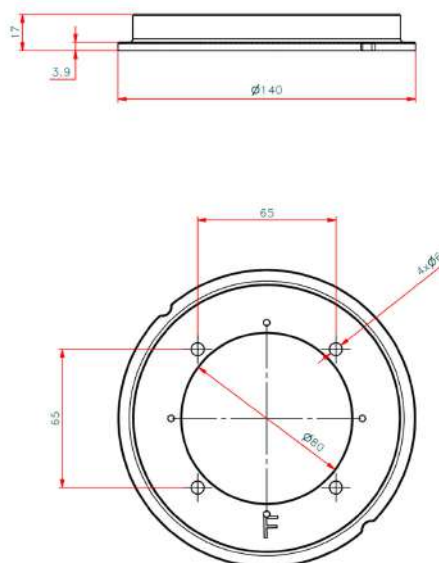
Additional variable filtration may be added to the minimum collimator filtration in the form of the 4 position rotating wheel with selectable filters (clockwise): (1) empty or (2) 0.1mm Cu+1mm Al or (3) 0.1mm Cu+0.5mm Al or (4) 0.5mm Cu+1mm Al.

## RO 530 Resin Rotating Mounting Flange

Resin rotating mounting flange:

- 17 mm thickness
- 0° detent
- 140 mm diameter

Please refer to the chapter **INSTALLATION** in this Instruction Manual for the correct flange/collimator mounting instructions.

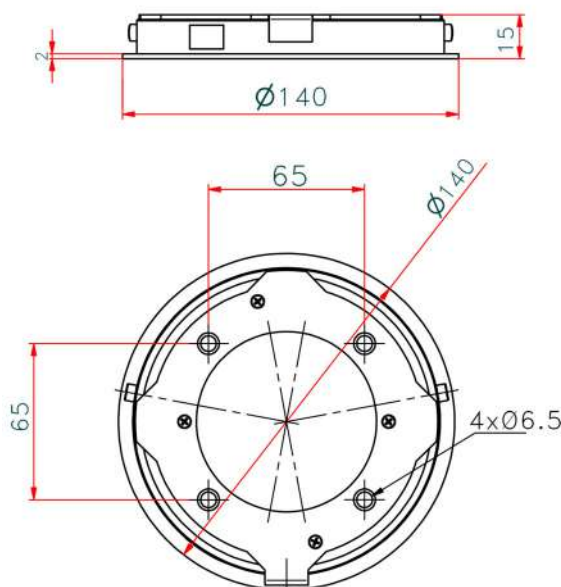


## RO 541 Metal Rotating Mounting Flange

Metal rotating mounting flange:

- 15 mm thickness
- +/- 90° with mechanical stop
- 140 mm diameter

Please refer to the chapter **INSTALLATION** in this Instruction Manual for the correct flange/collimator mounting instructions.



## RO 544 7" Touchscreen Display

A full colour display which allows an operator to configure the collimator parameters, control the X-ray system and preview an examination via Ethernet in real time (not available with RO 436)

### **Characteristics:**

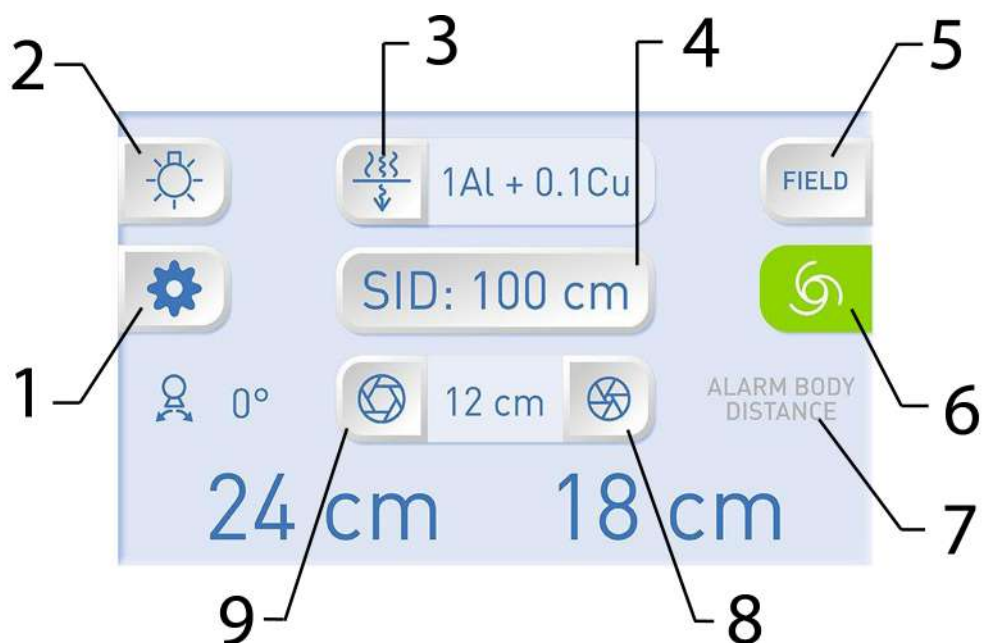
- Full colour display
- Diagonal Screen Size 7" or 4.3"
- Format 16:9
- Resolution 800x480 pixel
- Custom graphic and colours to meet all needs.

### **Functionality**

All touch screen applications for a normal use are included in a single page. The display, however, has been designed to add additional pages for future requests. The icon view on the display adapts accordingly to the collimator inclination (vertical/lateral). This change occurs when the collimator rotates by 45 degrees and is measured by a built-in tilt sensor.

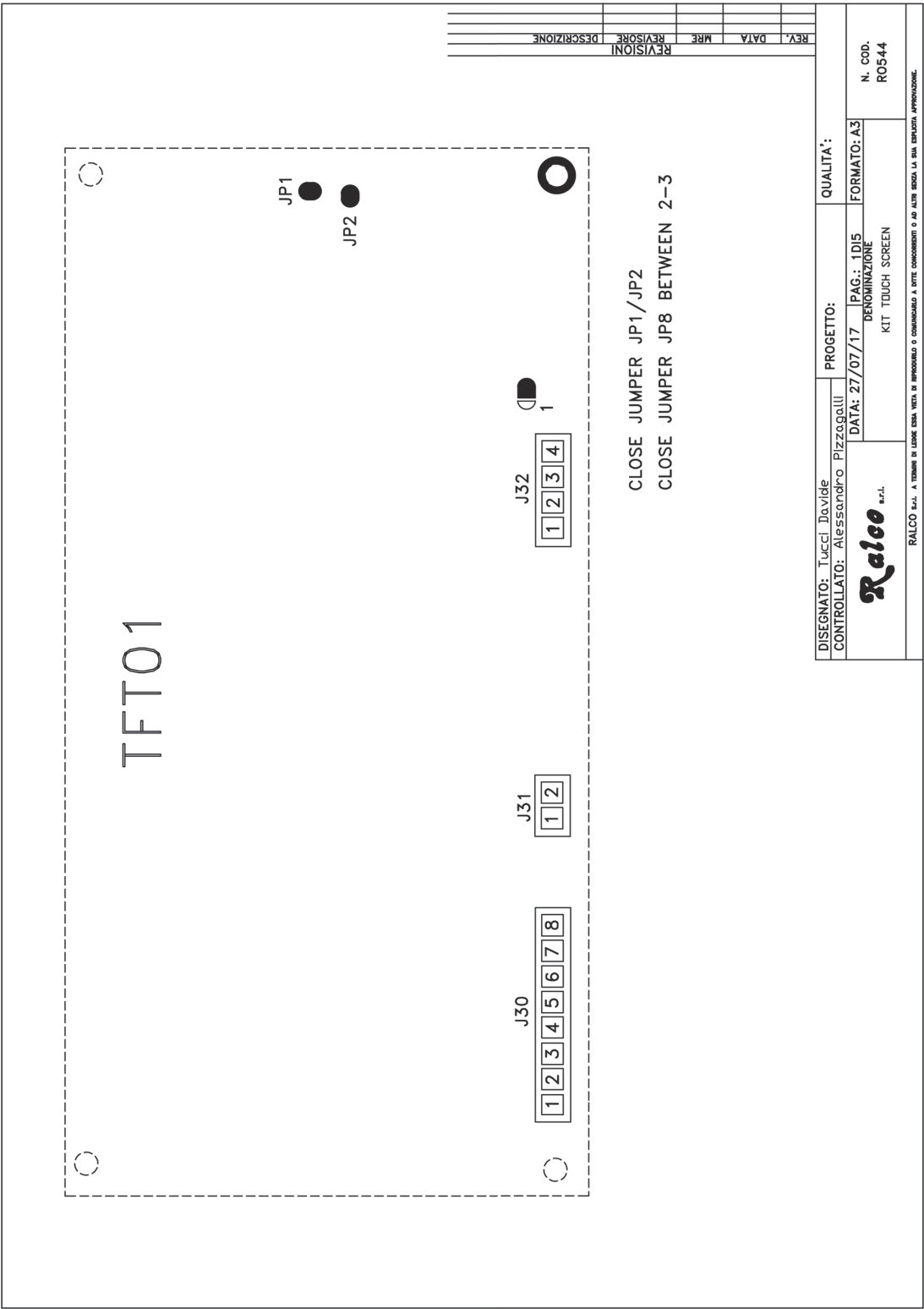
The touch screen menu:





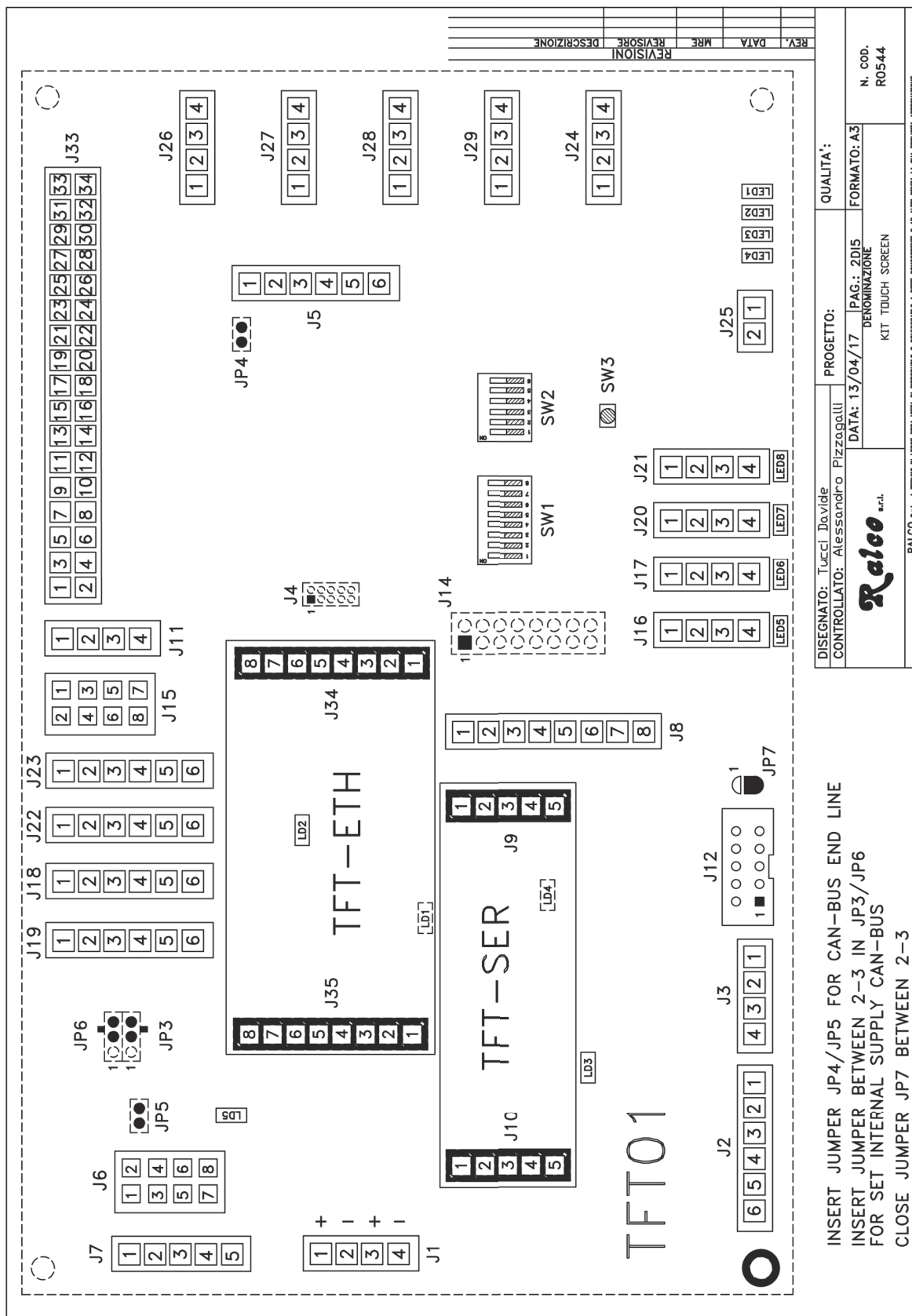
- 1 - System configuration
- 2 - ON/OFF
- 3 - Filter change
- 4 - SID
- 5 - Pre-set Format
- 6 - Collimator Status
- 7 - Proximity Sensor
- 8 - Iris closed
- 9 - Iris opened

Electrical connection

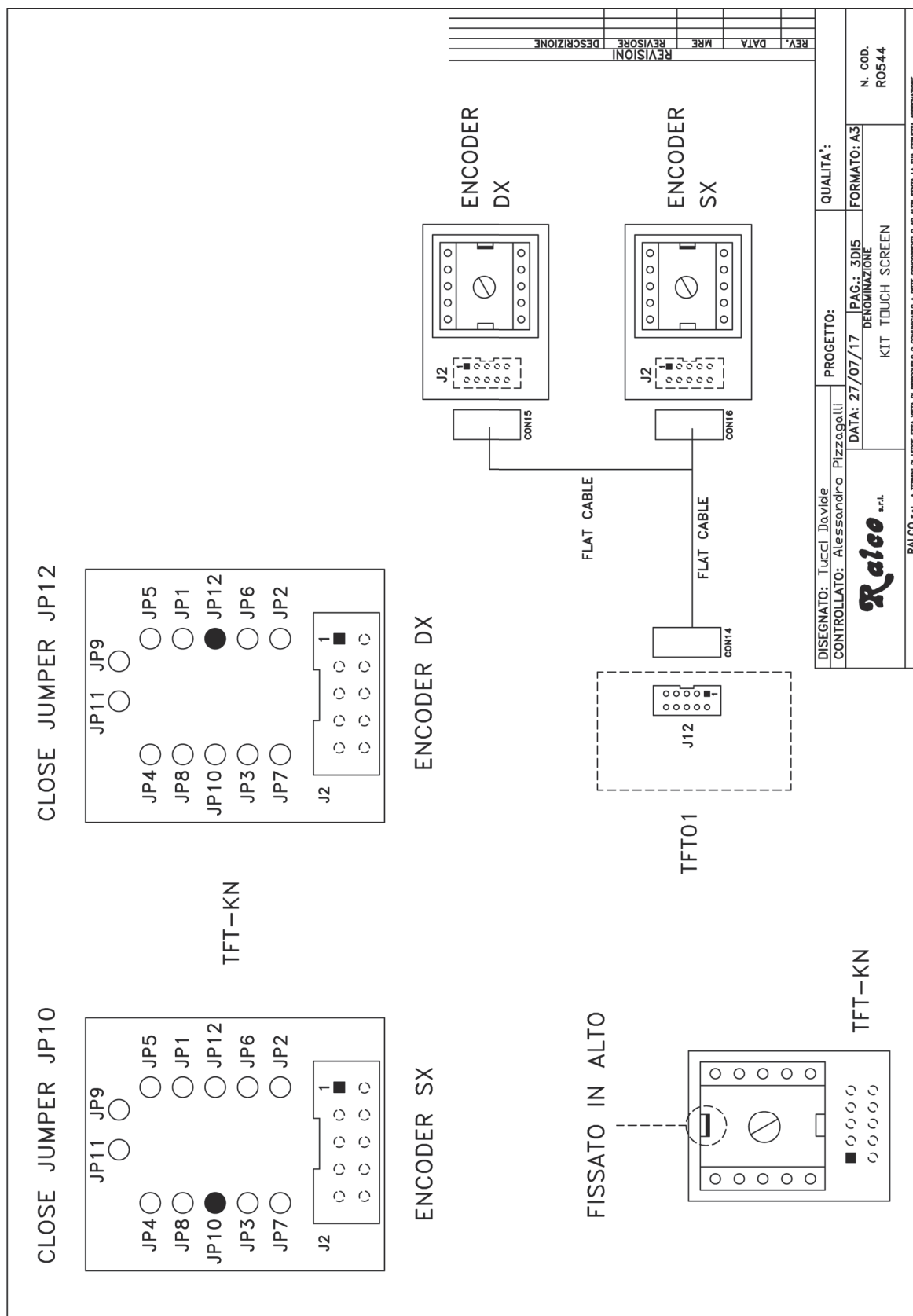


MTR 225 ACS - MTR 225 ACS DHHS - Optional Items

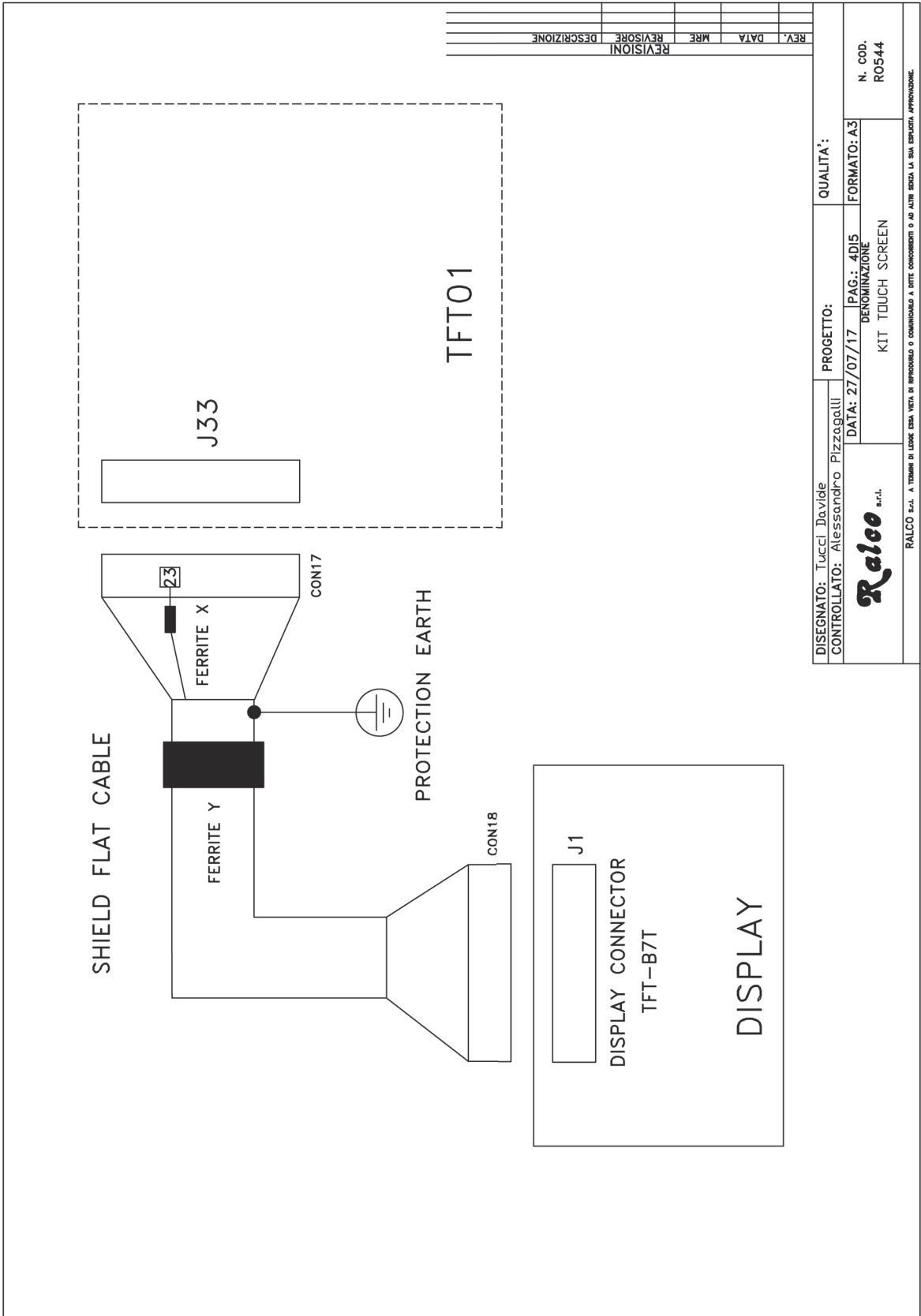
MTR 225 ACS - MTR 225 ACS DHHS - Optional Items



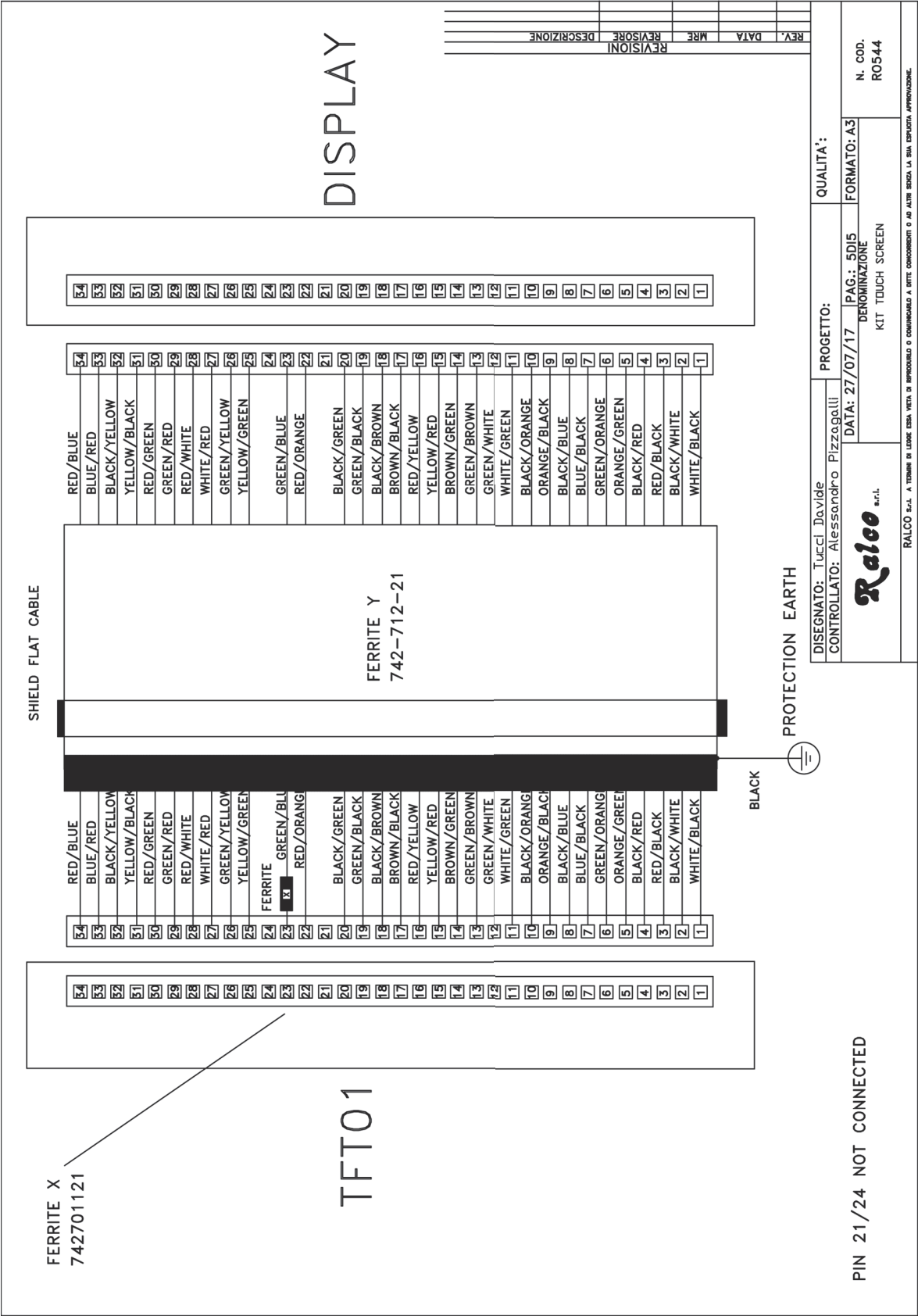
MTR 225 ACS - MTR 225 ACS DHHS - Optional Items



MTR 225 ACS - MTR 225 ACS DHHS - Optional Items



MTR 225 ACS - MTR 225 ACS DHHS - Optional Items



## EMC COMPLIANCE

### Electromagnetic Emissions

The R 225 ACS - R 225 ACS DHHS collimator is suitable for use in the specified electromagnetic environment. The purchaser or user of the R 225 ACS - R 225 ACS DHHS should assure that it is used in an electromagnetic environment as described below:

Emissions Test	Compliance	Electromagnetic Environment- Guidance
RF emissions CISPR 11	Group 1	The Collimator R 225 ACS - R 225 ACS DHHS needs special precautions regarding EMC and needs to be installed and put into service according to the EMC report. Portable and mobile RF communications equipment can affect the collimator R 225 ACS - R 225 ACS DHHS.
RF emissions CISPR 11	Class [A]	This R 225 ACS - R 225 ACS DHHS is suitable for use in all establishments other than domestic and those directly connected to the low voltage power supply network which supplies buildings used for domestic purposes.
Harmonic distortion IEC 61000-3-2	[Not applicable]	
Limitation of Voltage Fluctuation and Flicker IEC 61000-3-3	[Not applicable]	This R 225 ACS - R 225 ACS DHHS is not suitable to be connected to other equipments.

### Electromagnetic Immunity for All Equipment and Systems

Collimator R 225 ACS - R 225 ACS DHHS is intended for use in the electromagnetic environment specified below. The customer or the user should assure that it is used in such an environment.

Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment
Electrostatic discharge (ESD) IEC 61000-4-2	8 kV contact 15 kV air	EN 60601-1-2 test level	Hospital



## Electromagnetic Immunity

The R 225 ACS - R 225 ACS DHHS collimator is intended for use in the electromagnetic environment specified below. The customer or the user of the collimator should assure that it is used in such an environment.

Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment
			Portable and mobile RF communications equipment should be used no closer to any part of the R 225 ACS - R 225 ACS DHHS, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended Separation Distance
Radiated RF IEC 61000-4-3	3 V 80 MHz to 2,5 GHz	3 V/m	$d=1.2 \sqrt{P}$ 80 MHz to 800MHz $d=2.3 \sqrt{P}$ 800 MHz to 2.5GHz
			Where $P$ is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and $d$ is the recommended separation distance in metres (m).
			Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, should be less than the compliance level in each frequency range. Interference may occur in the vicinity of equipment marked with the following symbol:



## Recommended Separation Distances for Non-Life Supporting Equipment

Collimator R 225 ACS - R 225 ACS DHHS is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the collimator can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the collimator as recommended below, according to the maximum output power of the communications equipment.

Rated Maximum Output Power of Transmitter <b>W</b>	Separation Distance According to Frequency of Transmitter (m)		
	150 kHz to 80 MHz $d = 1.2 \times \sqrt{P}$	80 MHz to 800 MHz $d = 1.2 \times \sqrt{P}$	800 MHz to 2,5 GHz $d = 2.3 \times \sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

For transmitters rated at a maximum output power not listed above, the recommended separation distance  $d$  in metres (m) can be estimated using the equation applicable to the frequency of the transmitter, where  $P$  is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

## RO 545 Front silkscreen with six double-safety touch buttons

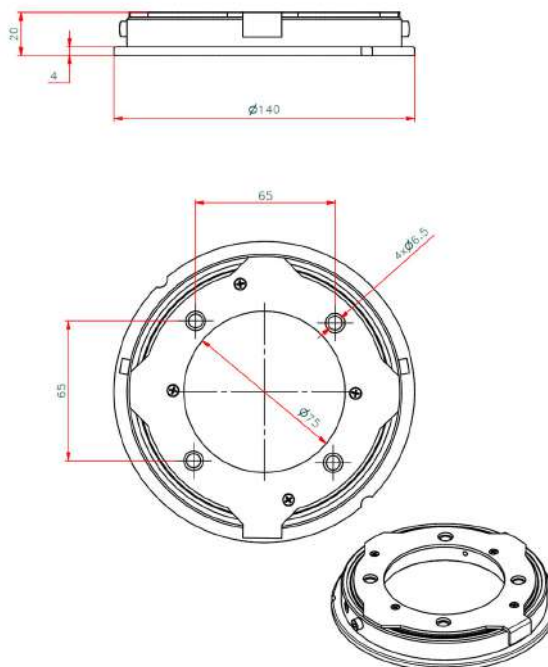
This accessory has been designed for collimator control and customer remote control movement (only available with RO 544)

## RO 552 Metal Rotating Mounting Flange

Metal rotating mounting flange:

- 20 mm thickness
- +/- 90° with mechanical stop
- 140 mm diameter
- Fixation plate 4 mm
- Rotation force 1.6kg +/- 0.4 /  
release force 3.5kg +/- 0.5

Please refer to the chapter **INSTALLATION** in this Instruction Manual for the correct flange/collimator mounting instructions.

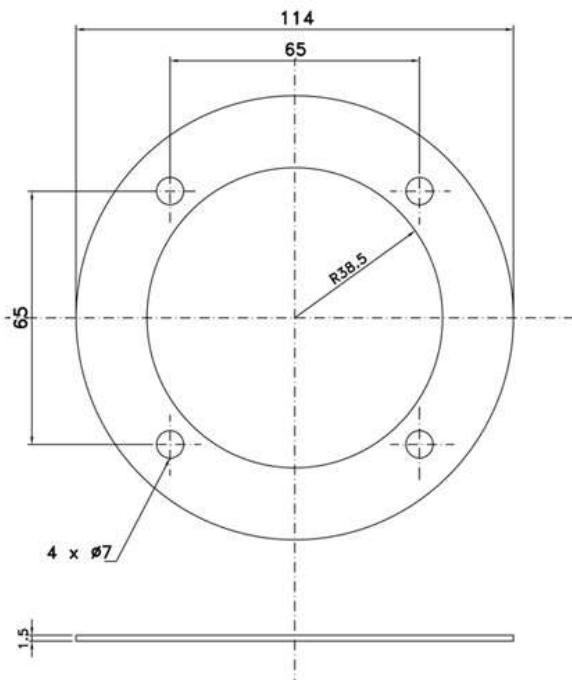


## RO 570 Shutter position verified by encoders

Supplementary safety device to ensure correct positioning of shutters. It consists of two encoders mounted on the collimator.

## RO 575 Iron Mounting Flange Spacer

This accessory is used for the mounting flange; 1 mm thickness.



## RO 587/2 Two lasers (one mounted externally) forming a crosshair to center the patient to the collimator: Class 1

Second laser which serves to center the patient using the cross projection.

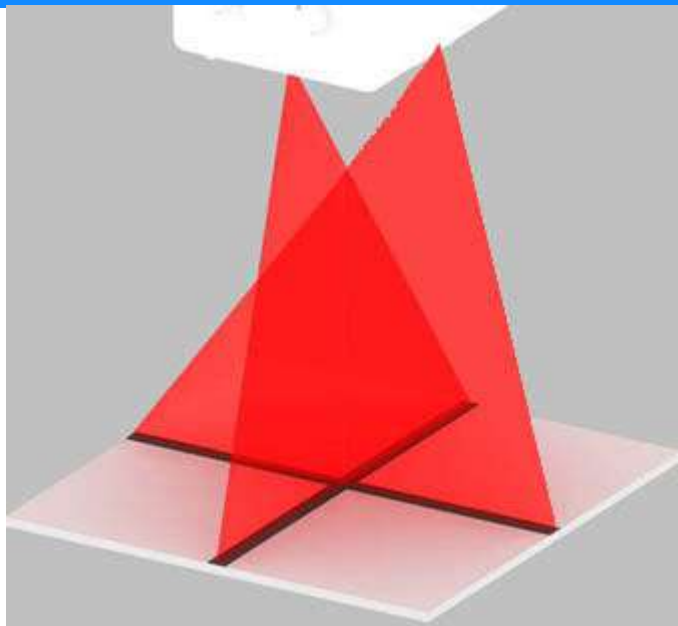
The collimator lasers are classified as Class 1 (1 m W - wavelength = 645 nm, +/- 10 nm) and are used for collimator/image receptor center alignment.



CAUTION: CLASS 1 LASER SYSTEM DO NOT STARE INTO THE BEAM.

### CALIBRATION CONTROL

- Draw a cross (two lines at 90°) on a sheet of paper and use this as reference.
- Switch the light ON and set the sheet of paper at 1 m from the focus.

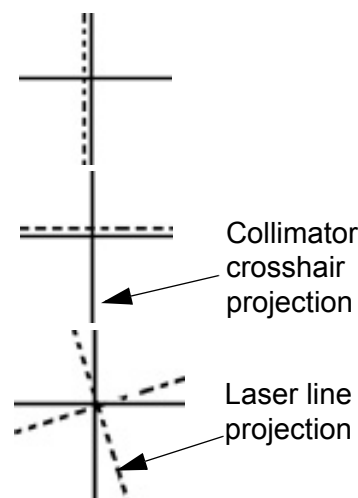


- Make sure the cross on the paper coincides exactly with the two lines silk-screened on the plastic window.
- Examine the laser projections on the paper: the laser is correctly calibrated when the projections coincide with the lines drawn on the paper, otherwise an adjustment will be necessary.

#### ADJUSTMENT

##### Horizontal

- Disconnect the collimator supply.
- Remove the laser cover located on the collimator cover by unscrewing the two screws **A**, see **Fig. Horizontal Laser**.
- To correct horizontal misalignment, loosen the screws **B**, see **Fig. Horizontal Laser** and move the laser support until the projected laser line coincides with the cross on the sheet of paper. Tighten screws **B**.



**Fig. Laser Projections**

##### Vertical

- Disconnect power supply.
- Remove the knobs and front panel, see Chapter- **COVER REMOVAL**.
- To correct vertical misalignment, loosen the Allen screw **A**, see **Fig. Vertical Laser** on the laser support; rotate the laser and align the laser line over the cross on the sheet of paper.
- To move laterally the laser loosen the screws **B** and shift the laser support until the projected laser line coincides with the cross on the sheet of paper.
- Tighten **B** screw s.

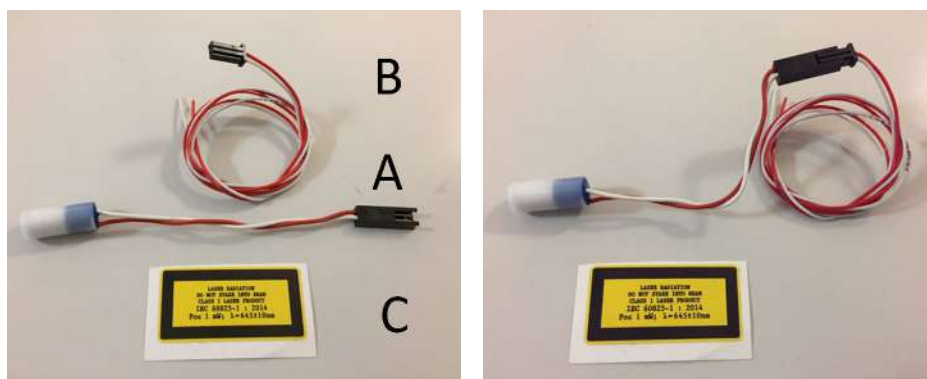
#### WARNINGS



DO NOT APPLY EXCESSIVE FORCE TO THE SCREW. THE LASER SHELL IS IN PLASTIC AND EXCESSIVE PRESSURE COULD CRACK THE PLASTIC AND POSSIBLY SHORT-CIRCUIT THE LASER.

#### SUBSTITUTION

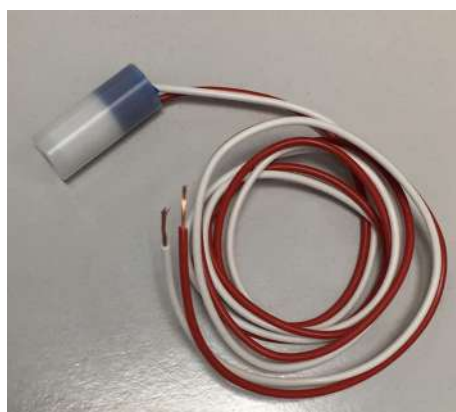
The Laser Substitution Kit is composed of the following components: the laser (**A**), the extension cable (**B**) and the laser label (**C**) pictured below in **Fig. Laser Substitution Kit**. This Kit is designed to substitute any laser Ralco provides.



**Fig. Laser Substitution Kit**

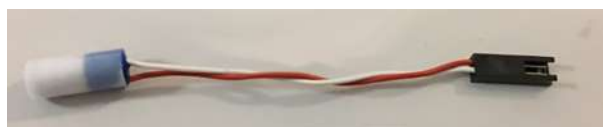
Prior to replacing the laser, confirm which version of laser is installed on your collimator which will ensure the substitution is performed correctly.

- The previous laser version is connected to the board via 2 cables (red and white), see **Fig. Previous Laser Version** below.



**Fig. Previous Laser Version**

- The new laser is connected to the board via the connector, see **Fig. New Laser Version** below.



**Fig. New Laser Version**

### **Replacing the Previous Laser Version**

To replace the previous version of laser, all components of the Laser Substitution Kit (RS 2589) (A, B and C) must be used.

To substitute the laser, proceed as follows:

- Disconnect the collimator supply.
- Remove the cover, see Chapter **COVER REMOVAL** in the Instruction Manual for your specific model.

- Prior to disconnecting the laser cables from the board, identify the cables and their position on the terminal board, see Chapter **INSTALLATION**, paragraph **Wiring Diagram** in the Instruction Manual for your specific model.
- Carefully remove the laser, the extension cable and the label from their packaging.
- Ensure the extension cable (**B**) is firmly connected to the laser (**A**), see **Fig. Laser Substitution Kit** above.
- Substitute the laser with the identical item using component (**A**) of the Laser Substitution Kit, see **Fig. Laser Substitution Kit** above.
- Adjust the length of the extension (**B**) cable by cutting the 2 cables (red/white).
- Connect both cables to the board.
- Apply the new laser label (**C**) to the collimator cover, see Chapter **SPARE PARTS** in the Instruction Manual for your specific mode.
- Verify the Laser alignment, see Chapter **ADJUSTMENT** or **OPTIONAL ITEMS** in the Instruction Manual for your specific model.

## Replacing the New Laser Version

To replace the new laser version, only part **A** and **C** of the Kit must be used.

To substitute the laser, proceed as follows:

- Disconnect the collimator supply.
- Remove the cover, see Chapter **COVER REMOVAL** in the Instruction Manual for your specific model.
- Detach the connector of the faulty laser from the collimator wiring.
- Carefully remove the laser, the extension cable and the label from their packaging.
- Substitute the laser with the identical item using component (**A**) of the Laser Substitution Kit, see **Fig. Laser Substitution Kit** above.
- Connect the new laser to the collimator wiring.
- Apply the new laser label (**C**) to the collimator cover, see Chapter **SPARE PARTS** in the Instruction Manual for your specific mode.
- Verify the Laser alignment, see Chapter **ADJUSTMENT** or **OPTIONAL ITEM** in the Instruction Manual for your specific model.

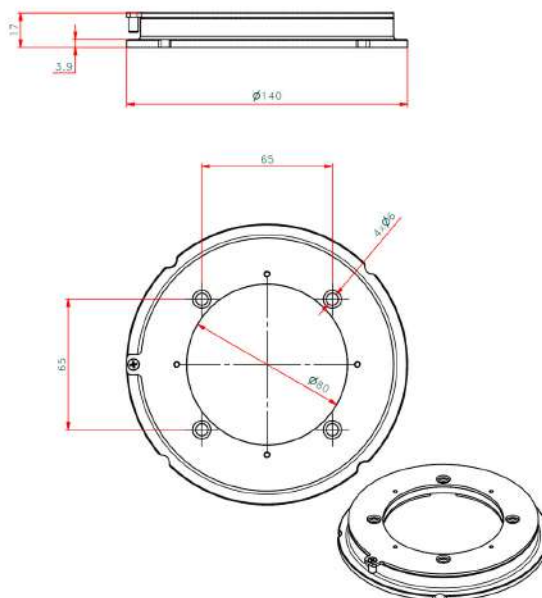
## RO 599 Resin Rotating Mounting Flange with Position Indicator

This accessory is a part of the position control system designed to indicate the collimator 0° position ( $\pm 3^\circ$ ) through a microswitch.

Resin rotating mounting flange:

- 17 mm thickness
- $\pm 90^\circ$  detent
- 140 mm diameter

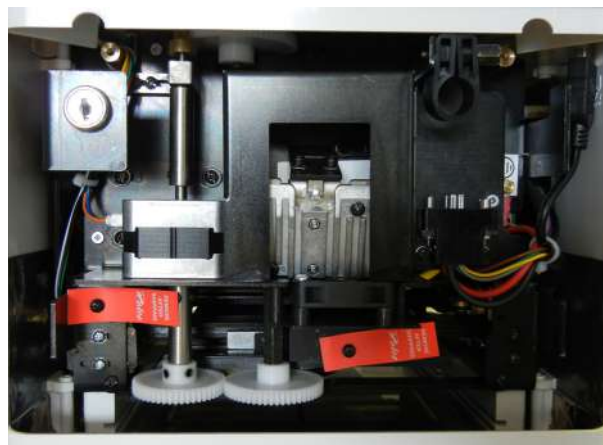
Please refer to section **RO 498 Auto-Centering Top-Cover Bracket** in this chapter of the Instruction Manual for the correct flange/collimator mounting instructions.





### RO 603 Shutter blocking screws

The 2 shutter locking screws with warning labels for protection during shipment.



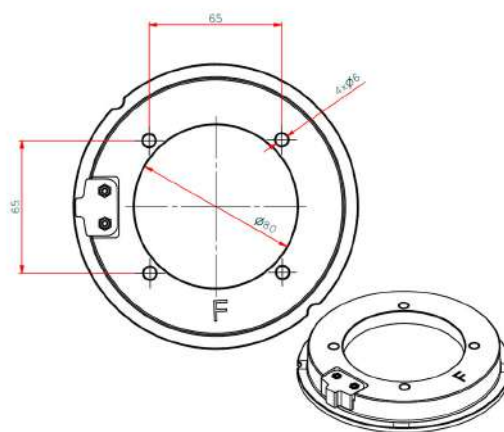
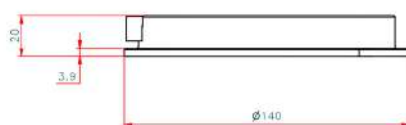
### RO 605 Resin Rotating Mounting Flange with Position Indicator

This accessory is a part of the position control system designed to indicate the collimator 0° position ( $\pm 3^\circ$ ) through a microswitch.

Resin rotating mounting flange:

- 20 mm thickness
- 0° detent
- 140 mm diameter

Please refer to section **RO 498 Auto-Centering Top-Cover Bracket** in this chapter of the Instruction Manual for the correct flange/collimator mounting instructions.



### RO 609 Self-Centering Top-Cover Bracket with Zero Position Output Signal

Zero position ( $\pm 3^\circ$ ) output signal is provided by a microswitch with signal being managed by the customer.

## Installation

### WARNINGS



THE COLLIMATOR MUST BE INSTALLED TO THE X-RAY TUBE THROUGH A MOUNTING FLANGE. RALCO PROVIDES VARIOUS FLANGE OPTIONS WHICH MAY NOT BE INTERCHANGEABLE. ONLY FLANGES PROVIDED WITH THE COLLIMATOR MAY BE UTILIZED. THE END-USER MAY INSTALL THEIR OWN FLANGE, HOWEVER RALCO CANNOT GUARANTEE COMPATIBILITY. ANY PREEXISTING FLANGE ON THE END-USER SYSTEM MUST NOT BE USED.



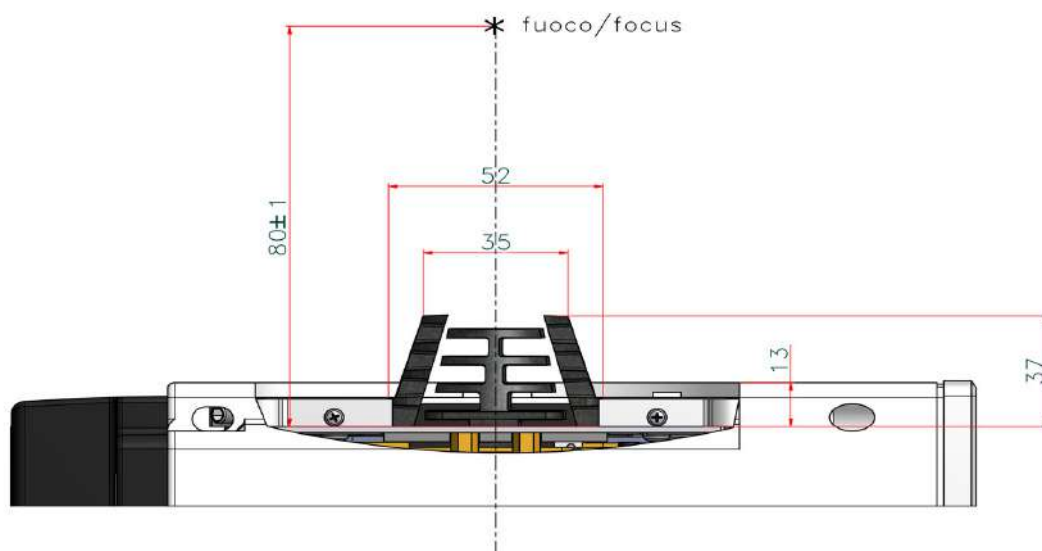
WHEN A FLANGE IS PROVIDED WITH THE COLLIMATOR BEARING A MATCHING SERIAL NUMBER, ENSURE THEY ALWAYS REMAIN COUPLED. IT IS MANDATORY THEY REMAIN TOGETHER AND THE CORRECT FLANGE PART NUMBER IS USED.



THE CONTENTS OF THE INSTRUCTIONS BELOW SHOULD BE STRICTLY ADHERED TO. RALCO IS NOT LIABLE FOR ANY PROPERTY DAMAGE OR RESULTING HARM IF NON-RALCO COMPONENTS OR NON-COMPATIBLE RALCO COMPONENTS ARE USED DURING THE INSTALLATION PROCESS.

### TUBE COMPATIBILITY

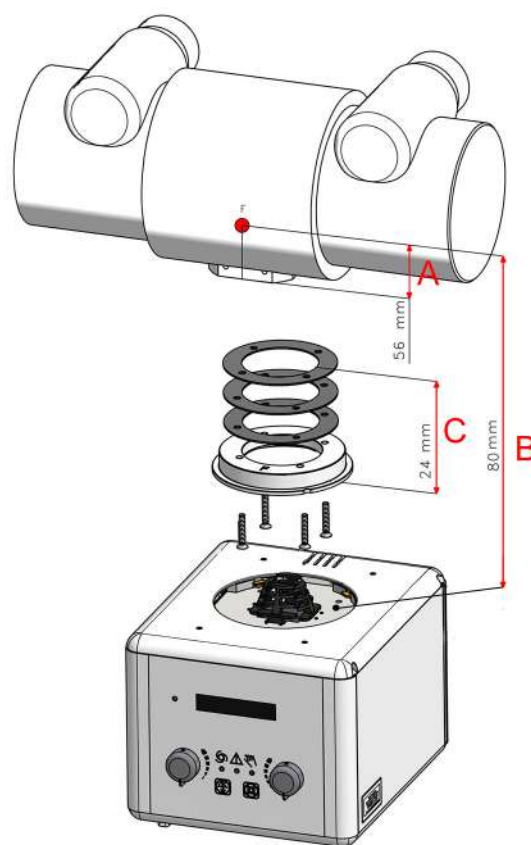
1. Using the dimensions in **Fig. Tube Compatibility** below, ensure the near port shutters of the collimator are placed in the X-Ray tube port without interference.
2. The distance between the X-Ray tube focus and the flange mounting plane (collimator upper plate) must be: 80 mm (3.15"), tolerance  $\pm 1$  mm (0.04 ").



**Fig. Tube Compatibility**

3. Carefully remove the collimator and the mounting flange from their packaging.
4. Use the X-Ray tube housing datasheet to determine the distance (**A**) from the focal spot to the X-Ray tube port, see **Fig. Collimator Installation**.
5. Subtract the resulting distance from the source flange distance (**B**) and determine the number of spacers (1.5 mm) which, combined with the thickness of the mounting flange, will make up the difference (**C**). Allowable tolerance is 1 mm. (0.04"), see **Fig. Collimator Installation**.
6. Once the mounting plane distance has been confirmed, continue with the mounting flange installation to the X-Ray tube.

*\*The flange fixing screws and the spacers of the previous flange may be reused if the flange thickness is the same.*



**Fig. Collimator Installation**  
\*illustrative purpose only

### Mounting the Flange to the X-ray Tube

#### NOTE



THE FOLLOWING MOUNTING INSTRUCTIONS ARE ONLY APPLICABLE FOR COMPATIBLE FLANGES WITH THIS OPTIONAL ITEM. IF YOU ARE UNSURE THE MOUNTING FLANGE YOUR COLLIMATOR IS EQUIPPED WITH IS COMPATIBLE, PLEASE CONSULT YOUR PERSONALIZATION PAGE PROVIDED WITH THIS MANUAL TO LOCATE THE FLANGE PART NUMBER (RO REFERENCE). FOLLOW THE MOUNTING INSTRUCTIONS SET FORTH UNDER THE SPECIFIC RO REFERENCE IN THIS MANUAL.

#### WARNING



FLANGES MAY BE PROVIDED BY RALCO OR BY THE SYSTEM MANUFACTURER. FLANGES MAY NOT BE INTERCHANGEABLE. ONLY THE FLANGE PROVIDED WITH THE COLLIMATOR BEING INSTALLED WITH A SPECIFIC PART CODE MAY BE UTILIZED. ANY PRE-EXISTING FLANGES MAY NOT TO BE USED. IF THERE ARE ANY QUESTIONS REGARDING COMPATIBILITY, PLEASE CONTACT RALCO.

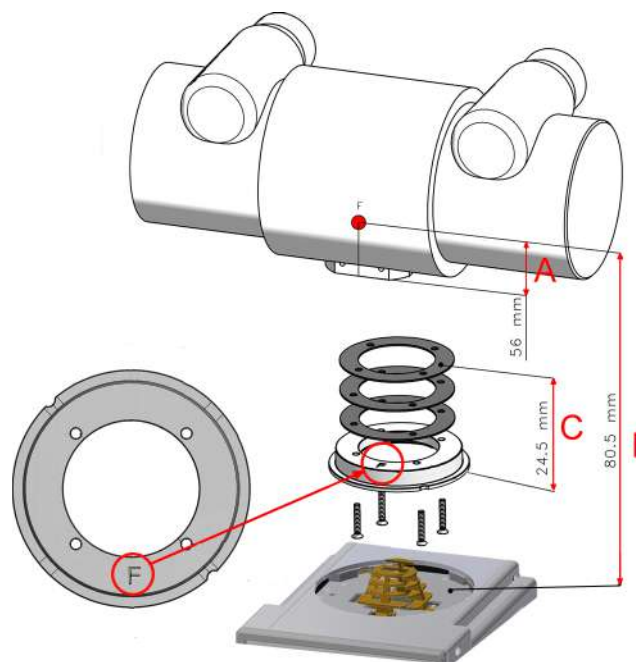
**CAUTION**



RALCO CANNOT GUARANTEE COMPLIANCE WITH RADIATION STANDARDS CONCERNING SAFETY IF THIS CONTROL HAS BEEN OMITTED.

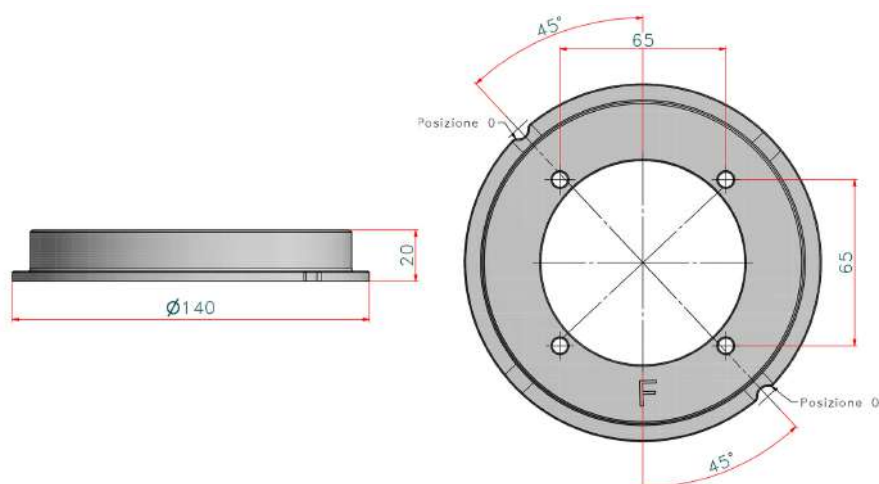
1. Place the flange on the X-Ray tube port, see **Fig. Flange Installation**.
2. Mount the mounting flange and spacers (optional) to the X-Ray tube port using 4 screws.\*\*

**\*\*Please ensure no conflicting information nor dangerous conditions exist due to adhering to these instructions or those provided by the X-Ray tube manufacturer. When in doubt please contact X-Ray tube manufacturer and/or Ralco.**



**Fig. Flange Installation**

*\*illustrative purpose only*



**Fig. Mounting Flange**

*\*illustrative purpose only*

**CAUTION**



THE FLANGE MUST BE PLACED WITH THE LETTER "F" FACING TOWARD THE X-RAY TUBE PORT. INCORRECT POSITION MAY CAUSE THE COLLIMATOR AND FLANGE TO MALFUNCTION.



ENSURE THE SCREW HEAD IS INDEED CORRECT FOR THE FLANGE SELECTED. IT IS THE RESPONSIBILITY OF THE END-USER TO ENSURE ALL SAFETY MEASURES ARE IMPLEMENTED TO ENSURE THE SCREWS ARE OPTIMALLY TIGHTENED INCLUDING THE USE OF APPROPRIATE LOCKTITE.



TIGHTEN THE 4 SCREWS TO THE X-RAY TUBE HEAD SECURELY, STRICTLY ACCORDING TO THE INSTRUCTIONS OF THE X-RAY TUBE MANUFACTURER. DO NOT EXCEED 0.45 NM OF FORCE.

### **Alignment of X-Ray Tube Focus and Collimator**

Ralco guarantees the correct collimator functionality, format compliance and light/X-Ray field alignment only if the mounting flange and the collimator have been installed exactly in the centre of the X-Ray beam.

All Ralco collimators are aligned on our test bench utilizing specific references/values for our X-Ray tube focus, detector and Source to Image Detector Distance (SID). The customer must know and verify all known variables which may influence the X-Ray tube focus and collimator alignment. These may include, the X-Ray tube focus position tolerance, distance from X-Ray tube focus to collimator mounting plane, or the SID.

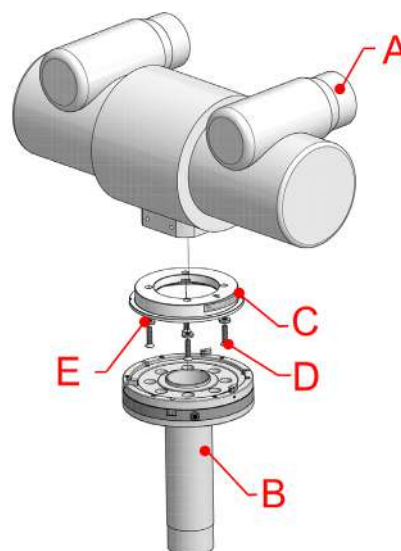
#### **ALIGNMENT DEVICE**

This device is used to ensure the collimator mounting flange is correctly aligned to the X-ray beam. The X-ray tube manufacturer provides a tolerance for the placement of X-ray tube focus.

Ralco recommends to use the Focal Alignment Device (jig) to ensure the correct flange alignment with the centre of the X-Ray beam, see **Fig. Focal Alignment Device**. By making an exposure, it is possible to verify the perpendicularity and concentricity using fixed references on the X-Ray image.

Once the mounting flange is aligned the collimator light/X-ray field should also be aligned (within specific tolerances).

Please consult the technical specifications of your X-Ray tube to find the maximum tolerance for the position of the focus. Should the use of an alignment device not be possible, Ralco collimators allow for the regulation of the light field.



A - X-Ray Tube, B - Focal Adjustment Device  
C - Mounting Flange, D - Screw, E - Washer

**Fig. Focal Alignment Device**

## Mounting the Collimator to the Resin Flange (RO 610 or RO 619)

### NOTE



THE MOUNTING FLANGE PROVIDED (IF PURCHASED) WITH THE COLLIMATOR IS SUBJECTED TO TESTING PURSUANT TO ALL APPLICABLE STANDARDS.



MOUNTING BRACKET TABS CONFORM TO EN60601.

### WARNINGS



PURSUANT TO APPLICABLE STANDARDS, RALCO HAS TESTED THE COLLIMATOR AND FLANGE APPLYING STATIC LOADS. RALCO IS NOT IN A POSITION TO KNOW THE DYNAMIC FORCES OF ALL END-USER SYSTEMS. IT IS THE RESPONSIBILITY OF THE END-USER TO ENSURE DYNAMIC FORCES OF THE SYSTEM DO NOT CREATE A DANGEROUS CONDITION.



IT IS THE RESPONSIBILITY OF THE SYSTEM MANUFACTURER TO ENSURE AND MITIGATE ANY DANGEROUS CONDITIONS WHICH MAY OCCUR DUE TO THE DYNAMIC FORCES CREATED BY THE SYSTEM. THE END-USER MUST PERFORM A SYSTEMATIC AND STRUCTURAL ANALYSIS DURING THE INSTALLATION AND USUAL MAINTENANCE.



SHOULD ANY DAMAGE TO THE COLLIMATOR OR FLANGE OCCUR A RISK ANALYSIS AND DAMAGE ASSESSMENT NEEDS TO BE CONDUCTED IMMEDIATELY. CONTACT RALCO IMMEDIATELY SHOULD THIS OCCUR. RALCO IS NOT LIABLE FOR RESULTING PROPERTY DAMAGE AND/OR HARM DUE TO AN UNREPORTED INCIDENT.



RALCO HAS DESIGNED AND TESTED THE COLLIMATOR FOR A LIFETIME OF 10 YEARS. AFTER THIS TIME PERIOD, IT IS THE RESPONSIBILITY OF THE END-USER TO ENSURE THE PROPER FUNCTIONING OF THE COLLIMATOR AND FLANGE. LIABILITY FOR ANY DANGEROUS CONDITIONS WHICH MAY BE PRESENT AFTER THE 10YEAR LIFETIME OF THE COLLIMATOR AND FLANGE RESTS WITH THE END-USER.



TO ENSURE THE SAFETY OF THE COLLIMATOR AND FLANGE AFTER 10 YEARS OF USE, RALCO HAS INSTITUTED A PROGRAM TO ASSESS THE SAFETY OF THE COLLIMATOR AND FLANGE. AFTER APPLYING A CHECK LIST OF QUALITY CONTROLS AND REFURBISHMENT ACTIVITIES (AT END-USER EXPENSE), RALCO MAY CERTIFY THE COLLIMATOR AND FLANGE FOR ADDITIONAL YEARS OF USE.

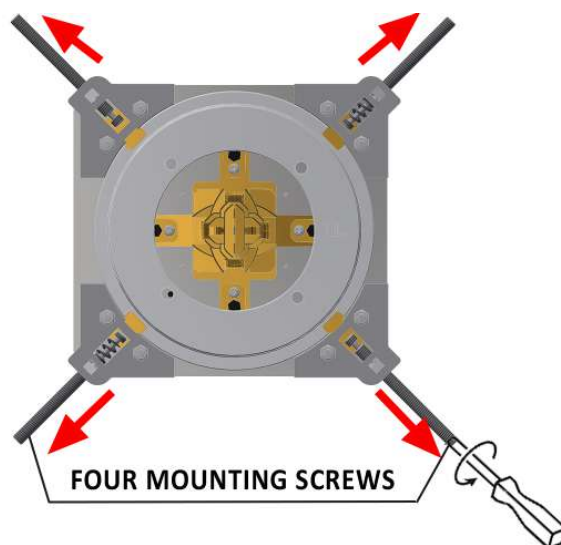
The mounting bracket has 2 tabs with springs in positions 2 and 4, while the 2 tabs in position 1 and 3 cover the surface of the outer ring of the flange, see **Fig. Mounting Bracket**.



1. Prepare the collimator to be installed by unscrewing the 4 hexagonal socket screws until the four tabs are completely withdrawn from the collimator top mounting plane, see **Fig. 4 Mounting Screws**.
2. Ensure the microswitch is completely retracted, see **Fig. Microswitch**.



**Fig. Microswitch**



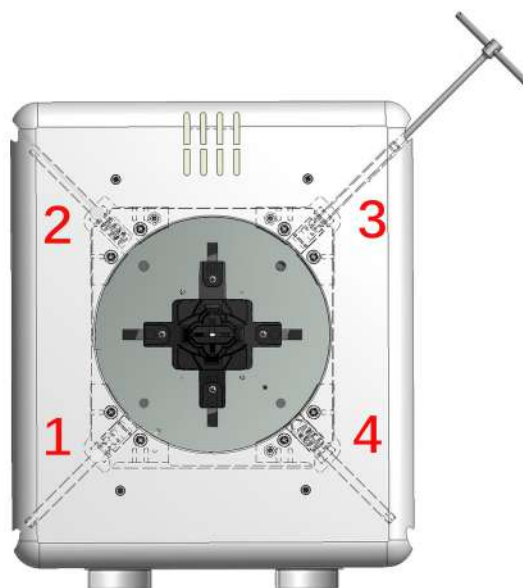
**Fig. 4 Mounting Screws**

**CAUTION**



WHEN UNSCREWING THE HEXAGONAL SOCKET SCREW WHICH CONTROL THE TABS, DO NOT USE FORCE EXCEEDING 0,45 NM.  
UNSCREW WITH CARE SO AS NOT TO DAMAGE THE HEXAGONAL SCREW HEAD AND TABS.

3. With the tabs fully retracted, tabs in position 1 and 3 which overlap the outer ring must be tightened completely up to the end stroke with 0.45Nm of torque (at least 7 turns), see **Fig. Mounting Bracket**.
4. With the tabs fully retracted, tabs in position 2 and 4 which overlap the outer ring must be tightened exactly 5 ½ turns, see **Fig. Mounting Bracket**.
5. If you are not able to respect the turns something is incorrect, repeat above instructions, if issues persist, please contact Ralco.
6. Ensure the microswitch is completely engaged by tightening the set screw, see **Fig. Microswitch**.
7. The collimator tabs glide on the flange outer ring and the collimator rotates towards the X-ray tube axis. If, however:
  - The release force from the position 0° and the collimator rotation is too low, the two tabs of the tab 2 and 4 need to be tightened ½ turn.
  - The release force from the position 0° and the collimator rotation is too high, the two tabs of the tab 2 and 4 need to be loosened ½ turn.



**Fig. Mounting Bracket**  
\*illustrative purpose only

### Mounting the Collimator to the Metal Flange (RO 611)

#### NOTE



THE MOUNTING FLANGE PROVIDED (IF PURCHASED) WITH THE COLLIMATOR IS SUBJECTED TO TESTING PURSUANT TO ALL APPLICABLE STANDARDS.



MOUNTING BRACKET TABS CONFORM TO EN60601.

#### WARNINGS



PURSUANT TO APPLICABLE STANDARDS, RALCO HAS TESTED THE COLLIMATOR AND FLANGE APPLYING STATIC LOADS. RALCO IS NOT IN A POSITION TO KNOW THE DYNAMIC FORCES OF ALL END-USER SYSTEMS. IT IS THE RESPONSIBILITY OF THE END-USER TO ENSURE DYNAMIC FORCES OF THE SYSTEM DO NOT CREATE A DANGEROUS CONDITION.



**WARNINGS**



IT IS THE RESPONSIBILITY OF THE SYSTEM MANUFACTURER TO ENSURE AND MITIGATE ANY DANGEROUS CONDITIONS WHICH MAY OCCUR DUE TO THE DYNAMIC FORCES CREATED BY THE SYSTEM. THE END-USER MUST PERFORM A SYSTEMATIC AND STRUCTURAL ANALYSIS DURING THE INSTALLATION AND USUAL MAINTENANCE.



SHOULD ANY DAMAGE TO THE COLLIMATOR OR FLANGE OCCUR A RISK ANALYSIS AND DAMAGE ASSESSMENT NEEDS TO BE CONDUCTED IMMEDIATELY. CONTACT RALCO IMMEDIATELY SHOULD THIS OCCUR. RALCO IS NOT LIABLE FOR RESULTING PROPERTY DAMAGE AND/OR HARM DUE TO AN UNREPORTED INCIDENT.

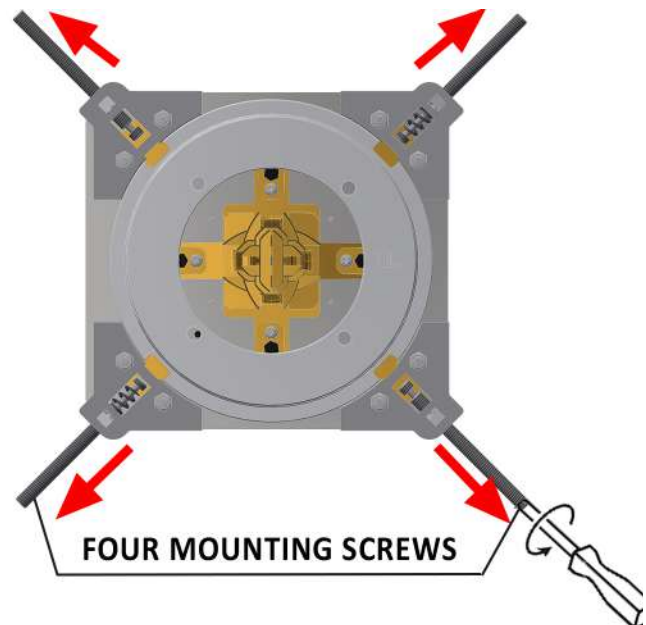


RALCO HAS DESIGNED AND TESTED THE COLLIMATOR FOR A LIFETIME OF 10 YEARS. AFTER THIS TIME PERIOD, IT IS THE RESPONSIBILITY OF THE END-USER TO ENSURE THE PROPER FUNCTIONING OF THE COLLIMATOR AND FLANGE. LIABILITY FOR ANY DANGEROUS CONDITIONS WHICH MAY BE PRESENT AFTER THE 10YEAR LIFETIME OF THE COLLIMATOR AND FLANGE RESTS WITH THE END-USER.



TO ENSURE THE SAFETY OF THE COLLIMATOR AND FLANGE AFTER 10 YEARS OF USE, RALCO HAS INSTITUTED A PROGRAM TO ASSESS THE SAFETY OF THE COLLIMATOR AND FLANGE. AFTER APPLYING A CHECK LIST OF QUALITY CONTROLS AND REFURBISHMENT ACTIVITIES (AT END-USER EXPENSE), RALCO MAY CERTIFY THE COLLIMATOR AND FLANGE FOR ADDITIONAL YEARS OF USE.

1. Prepare the collimator to be installed by unscrewing the 4 hexagonal socket screws until the four tabs are completely withdrawn from the collimator top mounting plane, see **Fig. 4 Mounting Screws**.
2. If installing a manual collimator, adjust the collimator shutters to the fully open position using both knobs.



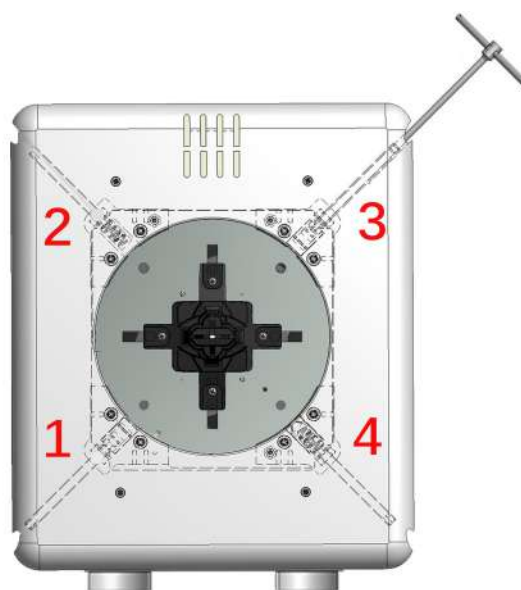
**Fig. 4 Mounting Screws**

**CAUTION**



WHEN UNSCREWING THE HEXAGONAL SOCKET SCREW WHICH CONTROL THE TABS, DO NOT USE FORCE EXCEEDING 0,45 NM. UNSCREW WITH CARE SO AS NOT TO DAMAGE THE HEXAGONAL SCREW HEAD AND TABS.

3. With the tabs fully retracted, the hexagonal socket screws of the mounting bracket must be tightening equally up to the end stroke with 0.45 Nm torque (at least 7 turns), see **Fig. Mounting Bracket**.
4. The 4 tabs of the hexagonal socket screws overlap on the flange outer ring in the same manner.
5. The collimator tabs adhere to the flange outer ring. Depending on the optional flange purchased, the collimator may rotate or be fixed (no rotation).
6. Once the collimator is coupled to the flange in the method described above, verify the distance between the collimator housing and the mounting flange is equal in all directions and the collimator face is parallel to the axis of the table. Loosen the screws and adjust as necessary.
7. The collimator should be coupled to the flange firmly. If the collimator is loose, please repeat the above mounting instructions, and if issues persist, please contact Ralco.



**Fig. Mounting Bracket**  
\*illustrative purpose only

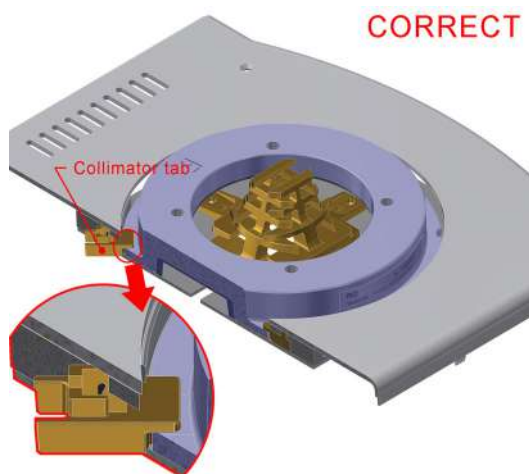
### Verification of Correct Installation

#### WARNING

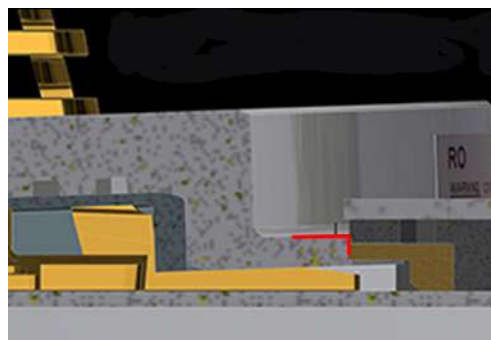


IT IS THE DUTY OF THE INSTALLER TO ENSURE NO RISK OF THE COLLIMATOR FALLING EXISTS. ENS URE THE FOLLOWING, AS IN EACH SCENARIO BELOW SERIOUS RISK OF INJURY AND/OR PROPERTY DAMAGE MAY EXIST DUE TO NON-ADHERENCE.

1. The 4 tabs should overlap the flange outer ring, see **Fig. Correct Overlap**.
2. Ensure the mounting flange is flat against the collimator mounting plane, see **Fig. Correct Overlap**.
3. Ensure the 4 tabs are not in contact with only the mounting flange edge, see **Fig. Incorrect Overlap**.
4. Once the collimator is mounted, if not already, return the collimator/tube head to the intended use position. Rotate and/or gently pull the collimator to ensure correct coupling.
5. If the collimator is loose, something is incorrect. Repeat above mounting instructions, and if issues persist, please contact Ralco.



*Fig. Correct Overlap*



*Fig. Incorrect Overlap*

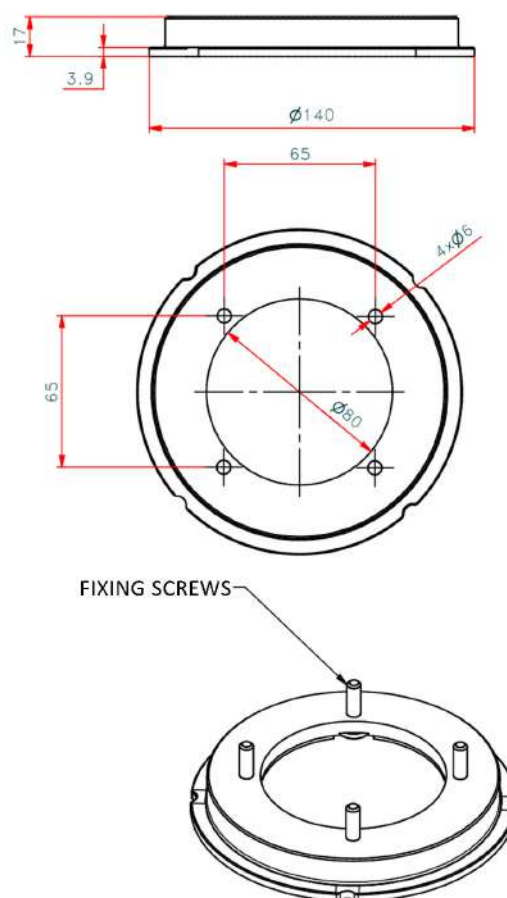
### RO 610 Resin Rotating Mounting Flange with Position Indicator

This accessory is a part of the position control system designed to indicate the collimator 0° position ( $\pm 3^\circ$ ) through a microswitch.

Resin rotating mounting flange:

- 17 mm thickness
- $\pm 90^\circ$  detent
- 140 mm diameter

Please refer to section **RO 609 Self-Centering Top-Cover Bracket** in this chapter of the Instruction Manual for the correct flange/collimator mounting instructions.



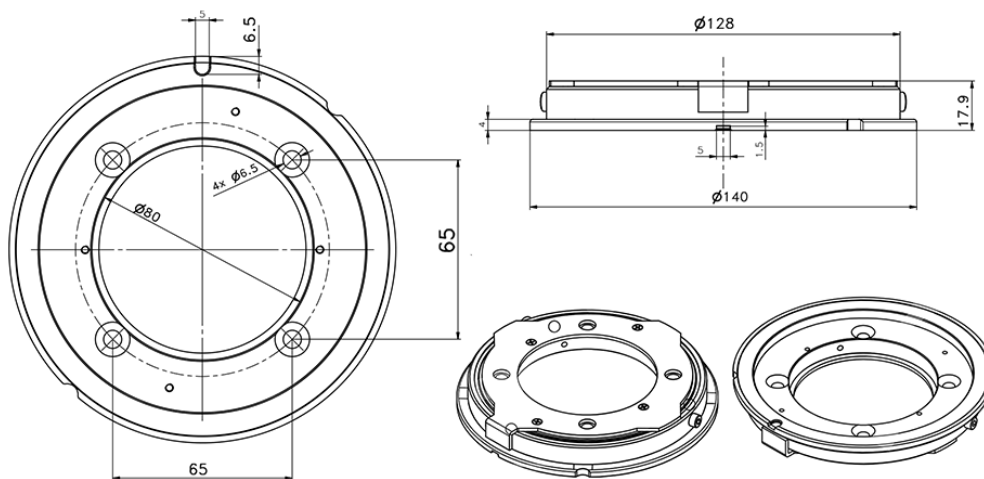
### RO 611 Metal Rotating Mounting Flange with Position Indicator

This accessory is a part of the position control system designed to indicate the collimator 0° position ( $\pm 3^\circ$ ) through a microswitch.

Metal rotating mounting flange:

- 18 mm thickness
- $\pm 90^\circ$  detent
- 140 mm diameter

Please refer to section **RO 609 Self-Centering Top-Cover Bracket** in this chapter of the Instruction Manual for the correct flange/collimator mounting instructions.



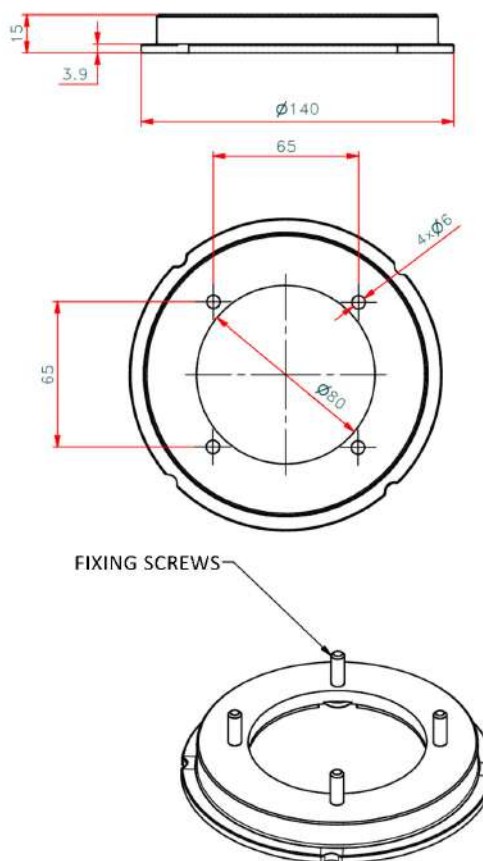
## RO 619 Resin Rotating Mounting Flange with Position Indicator

This accessory is a part of the position control system designed to indicate the collimator 0° position (+/- 3°) through a microswitch.

Resin rotating mounting flange:

- 15 mm thickness
- +/- 90° detent
- 140 mm diameter

Please refer to section **RO 609 Self-Centering Top-Cover Bracket** in this chapter of the Instruction Manual for the correct flange/collimator mounting instructions.



## MAINTENANCE

To ensure constantly safe performance of the collimator and its compliance with applicable regulations, a maintenance program is indispensable.

It is the Owner's responsibility to supply or arrange for this service.

### CLEANING RECOMMENDATIONS

- The collimator housing must be cleaned as prescribed by the sanitary regulations followed by the operator.
- Disconnect supply.
- Use non abrasive cleaning products.  
Care must be taken to prevent liquid from entering the collimator. **Please Note: The collimator cover is not watertight.**
- **Do not** reapply power if inflammable liquids have leaked into the collimator.  
See the following Maintenance Instructions.
- Clean the varnished and aluminium surfaces with a damp cloth only, using a neutral cleansing agent then dry the surfaces with a soft cloth.
- Clean chrome surfaces with a dry soft cloth.

#### CAUTION



DO NOT SPRAY WATER OR DETERGENT DIRECTLY OVER THE COLLIMATOR. THE UNIT'S LIQUID PROTECTION LEVEL IS IPx0.

### DISINFECTION

The disinfection method use must conform with the currently applicable norms and directives covering disinfection and protection against explosion hazards.

#### CAUTION



NEVER USE CAUSTIC SUBSTANCES, SOLVENTS OR ABRASIVE DETERGENTS. IF PRODUCTS THAT COULD FORM EXPLOSIVE GAS MIXTURES ARE USED, ALLOW THE GAS TO EVAPORATE BEFORE STARTING THE SYSTEM.

- Disconnect supply.
- Disinfect the unit including accessories and cables with a dampened cloth.
- Do not spray the unit with the disinfectant because it could leak into the collimator.

### RECOMMENDED MAINTENANCE PROGRAM

Ralco suggests a yearly servicing program, however shorter intervals are advisable when the collimator is subject to heavy workloads.

- Re-calibration of the collimator will be necessary whenever the X-ray tube is changed or at each substitution of the source light (lamp or LED, if assembled) used to simulate the light field.

- Calibration procedures (if provided) must be performed as described in this manual.
- Check once a week that the screws and tabs which serve to secure the collimator to the flange/tube adapter are correctly tightened.
- Remove the covers and panels from collimator. Inspect the moving parts for signs of wear or damage.
- Check the electric system and substitute parts that show wear.
- Check the plastic anti-dust window and substitute it if necessary.
- Clean the collimator with a soft cloth paying particular attention to the plastic anti-dust window. Do not use abrasive or inflammable cleaning products.
- Wipe away all excess oil and remount the cover.

**CAUTION**



MAKE SURE TO TIGHTEN THE ALLEN SCREWS SECURING THE COLLIMATOR OR THE CONTROL TABS.  
APPROPRIATE TIGHTENING OF THE 4 ALLEN SCREWS ENSURES SECURE MOUNTING OF THE COLLIMATOR. TIGHTENING FORCE USED MUST NOT EXCEED 0.50 NM.

**NOTE**



IF THE COLLIMATOR IS TO BE MOUNTED ON A ROTATING FLANGE, USE A TIGHTENING FORCE BETWEEN MIN. 0,50 NM AND MAX. 0.75 NM.



## GENERAL

### WARRANTY

This product has been manufactured and tested to the highest quality standards by Ralco, srl. Ralco undertakes to replace and repair any collimator during a period of 24 months for mechanical and 12 months for electrical parts (motors, potentiometers, electrical boards, lasers) from the date of invoice (shipment date from Ralco).

The warranty applies provided the product has been handled properly in accordance with its operating instructions and its intended use.

Warranty covers cost of all components and labor involved, **unless**:

- Product documents have been altered in any way or made illegible;
- The model or production number on the product has been altered, deleted, removed or made illegible;
- Repairs or product modifications and alterations have been performed by unauthorized and unqualified persons;
- Unauthorized repairs and/or modifications have been performed;
- Damage caused by misuse or neglect, incorrect installation or accidental damage;
- Damage occurred during transit due to shipping company, or incorrect packing by customer;
- Unoriginal spare parts and accessories have been used.

In-warranty spares will be available only upon return to Ralco, at the customer's expense, of the parts considered to be faulty to allow Ralco to assess the cause of the fault.

Components Not Covered by this Warranty:

- Consumable items such as lamp bulbs, lexan panels and mirrors (if applicable);
- Cosmetic damage such as scratches;
- Any missing components when product arrives for repair.

### REPAIRS

In the event the customer finds any Non Conformity in the product, please contact Ralco via e-mail at the address: [repairs@ralco.it](mailto:repairs@ralco.it) (Ralco Repair Assistance).

To successfully resolve any Non Conformity, the following information must be provided:

- The model and serial number of the collimator found on the label;
- A detailed description of the problem (in Italian or English);
- Whether you want a repair, refurbishment, or model upgrade of the product.

Ralco and the customer will work together to resolve the problem by either providing instructions, and/or field service or by sending replacement parts.

In the event the collimator needs to be repaired at Ralco, you will be provided with a RMA (Return Merchandise Authorization) number as your consent to the return. If a product is returned to Ralco without a RMA or without a description of the problem, the customer will incur a €100 processing fee.

If the product is returned under warranty and no defect is found, the customer incurs the cost of evaluation, testing and shipping.

The shipping of the unit is at the customer's expense if the unit is out of warranty.

The warranty period resets only on replaced parts once repairs are completed (shipment date from Ralco back to customer), see paragraph, **WARRANTY**.

Ralco reserves the right to decide if the product is to be repaired or substituted.

Please send defective material to the following address:

RALCO SRL  
VIA DEI TIGLI 13/G  
20853 BIASSONO (MB) - ITALIA  
FAX: ++39-039-2497.799  
EMAIL: RALCO@RALCO.IT

### END OF LIFE DISPOSAL

Your collimator contains materials which can be recycled and reused. Specialised companies can recycle your product to increase the amount of reusable materials and to minimize the amount of materials to be disposed of.

The product contains lead which can be highly contaminating if dispersed incorrectly. The following symbol signifies that the product conforms to the environmental requirements of directives 202/95/EC, 2002/96/EC, 2003/108/EC; it must be disposed of correctly at the end of its life-cycle.



The collimator does not contain polluting materials or products with the exception of the lead that composes the shutters - avoid direct contact with lead especially for prolonged periods.

It is required that you observe Local Laws regulating the disposal of the collimator using certified environmental management entities. Should this prove impossible, return the collimator to Ralco at the purchaser's expense and Ralco will undertake its correct disposal.

If you are replacing the unit with new equipment, you may return the old collimator to Ralco. Please contact us if you require further information.

### DISASSEMBLY

#### WARNINGS



CARE MUST BE TAKEN NOT TO LET THE COLLIMATOR FALL.

- Disconnect supply to the collimator.
- Remove the cover and disconnect the supply cables.
- Loosen the fixing Allen screws on the upper part of the collimator connected to the flange mounted to the X-ray tube.

### TRANSPORT AND STORAGE

#### ATTENZIONE



ANY DAMAGE TO THE COLLIMATOR DUE TO INCORRECT OR UNSUITABLE PACKAGING IS THE RESPONSIBILITY OF THE CUSTOMER. IF POSSIBLE, THE USE OF ORIGINAL RALCO PACKAGING IS RECOMMENDED. IF THIS IS NOT POSSIBLE, PLEASE FOLLOW THE INSTRUCTIONS PROVIDED WITHIN THE INSTRUCTION MANUAL. IF THE COLLIMATOR IS NOT PACKAGED CORRECTLY, ALL WARRANTIES WILL BE VOIDED.

***In order to properly package the collimator for shipping the following materials are needed:***

- Plastic bag;
- Sturdy cardboard box properly sized for the collimator;
- Protective packaging (bubble wrap, bubble bags, air pillows, polyfoam etc.) -
- Packaging tape;
- Strapping.

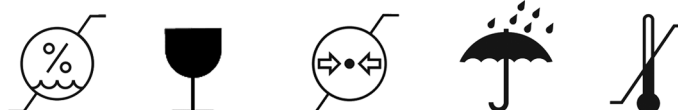
***Procedure:***

1. Ensure all covers are remounted properly on the collimator if previously removed.
2. Place the collimator in the plastic bag to avoid packing material from entering the collimator.
3. Place the collimator inside the cardboard box.
4. Use protective packaging to fill any empty spaces inside the cardboard box so that the collimator is stable during shipment.
5. Seal the cardboard box firmly so it will not open during shipping using high-quality packaging tape.
6. Use strapping to ensure proper closure.
7. It is strongly recommended to pallet the packaging (especially when single collimators are shipped) to ensure proper handling.
8. Ensure of the correct storage conditions:
  - Ambient Temperature = from -40°C to +70°C
  - Relative Humidity = from 10% to 95%
  - Atm. Pressure = from 500 a 1060 hPa.

**FRAGILE**

**X-RAY EQUIPMENT**

**DISPOSITIVO RADIOLOGICO - X射线设备**



**SAFETY/RESPONSIBILITY**

Ralco adheres to the directives governing manufacturers of electro-medical equipment:

Directive 2007/47/CE para.10 -Legislative Decree n° 46 para.10

Ralco shall not be held responsible when instructions provided in the present manual are not complied with. Ralco shall not be held responsible if the collimator relates to one or several of the following instances:

- The unit is of Ralco construction, built to client specifications with no CE marking.
- The unit has been modified by the OEM or end user.
- The unit has been installed without respecting the instructions provided in this manual.
- The unit is used without respecting the instructions provided in this manual.
- The unit has not been subject to routine functional inspection.
- The unit has not been subject to routine maintenance.
- The unit has been repaired with unoriginal spare parts.
- Ralco shall decline all responsibility for any damage, direct or indirect, caused to persons or things by inappropriate accessories.

**WARNINGS**



INFORMATION REGARDING ACCIDENTS THAT HAVE OCCURRED WHILE USING THE RADIOLOGICAL COLLIMATOR MUST BE REPORTED IMMEDIATELY TO RALCO SRL.

**RESIDUAL RISKS**

The collimator has been constructed to current standards to meet the safety requisites of directive 2007/47/CE. However, due to the presence of x-rays, the type of application implies a residual risk derived from possible faults that could occur during operation of the unit.

The Instructions contained in the this Manual will ensure the correct use of the device and reduce the causes of possible hazards.

The residual risks of the device are reasonable; they have been assessed and approved in the related Risk Management Plan contained the Technical Report.

**Information For The Manufacturer**

*The following form is provided for your comments and suggestions with regards to the collimator so that we may ensure and improve the quality of our production.*

*Please e-mail comments and/or suggestions to: [repairs@ralco.it](mailto:repairs@ralco.it)*

Date:

Customer:

*Information regarding possible accidents that may have occurred while using the collimator.*

*Directive 2007/47/CE states that accidents (such as death or grievous injury to a patient) that involve the collimator described herein, must be reported to the Ministry of Health and to the Manufacturer.*

*The present form is provided to report to Ralco srl post-free.*

Date:

Customer:

