THORN
Airfield Lighting

Airfield Lighting
Manual
SAGA

System of Azimuth Guidance for Approach (SAGA)

SAFEGATE GROUP

***Note**: This page is blank for convenient double-sided printing.*

SYSTEM OF AZIMUTH GUIDANCE FOR APPROACH (SAGA)

CONTENTS

Documentation

This document includes Airfield Lighting information with a focus on safety, installation and maintenance procedures.

***Note**: It is very important to read this document before any work is started.*

Original documentation is created in English (U.K.).

Images and texts used in this document are reference examples only and may not exactly depict a customer product.

For more information, see www.safegate.com.

Copyright

History

Version	Date	Description
1.0	May 2011	First Release

***Note**: This page is to be updated with every authorised change to the document.*

Abbreviations and Terms

This document may include abbreviations and terms.

Abbreviation	Term
CAA	Civil Aviation Authority
FAA	Federal Aviation Administration
ICAO	International Civil Aviation Organization
IEC	International Electrotechnical Committee
NATO	North Atlantic Treaty Organization
SAGA	System of Azimuth Guidance for Approach
STAC	Service Technique de l'Aviation Civile (France)
STANAG	Standardization Agreement (NATO)

1. INTRODUCTION

The documentation includes general Information about use of the system and different steps to follow to successfully install and maintain a SAGA System.

1.1 SAFETY INSTRUCTIONS

WARNING! *PRIOR TO THE COMMENCEMENT OF WORK ALL ELECTRICAL SERVICES MUST BE ISOLATED FROM THE SUPPLY AND CONNECTED TO EARTH. FULL DETAILS OF THE WORK INVOLVED MUST BE GIVEN TO THE AUTHORISED PERSON RESPONSIBLE FOR THE ELECTRICAL ENGINEERING SERVICES AT THE AIRPORT WITH REGARD TO THE DURATION OF THE WORK AND SO ON... IT IS RECOMMENDED THAT PRIOR TO STARTING ANY CUTTING WORK THE NATURE AND LOCATION OF SERVICES SUCH AS CABLE DUCTS AND SO ON. SHOULD BE IDENTIFIED ANY INSTALLATION OR MAINTENANCE WORK SHOULD ONLY BE CARRIED OUT BY TRAINED AND EXPERIENCED PERSONNEL.*

1.2 DELIVERY OF THE FITTINGS

The system units are supplied completely assembled, tested and ready for installation. A SAGA system is delivered in a single packing box.

Note*: Power supply and control cables are not supplied.*

The packing box contains:

- One complete “Master” unit (pre- mounted and wired).
    - One “Master” power supply box.
    - One optical head.
    - One support.
        - One frangible leg.
        - Two power supply box fixation bars.
        - Two complete clamps for leg fixation.
        - Four M18 –400 mm sealing rods.
- One complete “Slave” unit (pre- mounted and wired).
    - One “Slave” power supply box.
    - One optical head.
    - One support.
        - One frangible leg.
        - Two power supply box fixation bars.
        - Two complete clamps for leg fixation.
        - Four M18 –400 mm sealing rods.
- One tool for alignment and horizontal adjustment.

Product documentation is available at www.safegate.com or on request one set of documents is delivered with fittings.

1.3 SYSTEM DESCRIPTION

System of Azimuth Guidance for Approach (SAGA) is a system designed to provide aircraft pilots with visual azimuth guidance during aircraft approach towards the landing area (airport or heliport).

The SAGA system includes two light units (one Master and one Slave) placed symmetrically on both sides of the Runway (or TLOF) threshold supplying unidirectional rotating beams, which give a flashing effect.

The pilot receives, each second illumination of two “Flashes” provided in sequence by the two light units.

- When the aircraft flies inside a 9° width angular sector, centred on the approach axis, the pilot sees the two lights “flashing” simultaneously.
- When the aircraft flies inside a 30° width angular sector, centred on the approach axis and outside the previous one, the pilot sees the two lights “flashing” with a variable delay (60 to 330 ms), according to the position of the aircraft in the sector. The further the aircraft is from the axis, the greater the delay. The delay between the two “flashes” produces a sequence effect which shows the direction of the axis.
- The visual signal is not visible when the aircraft flies outside the 30° angular sector.

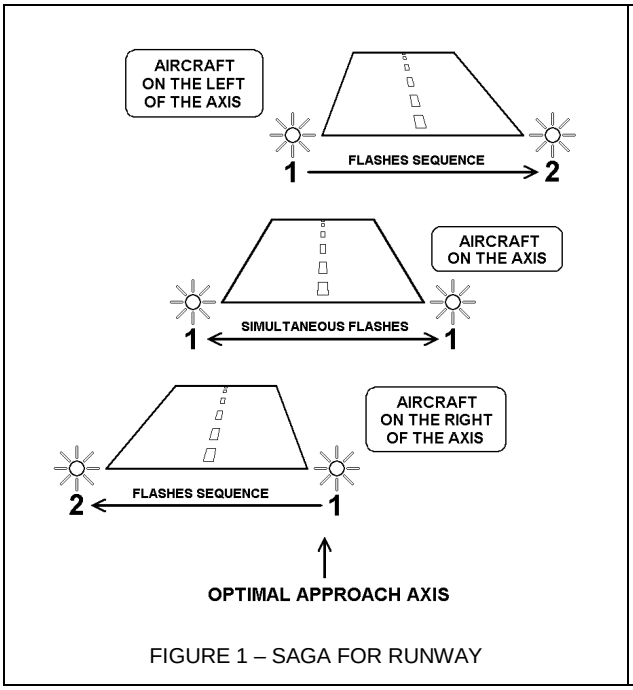


FIGURE 1 – SAGA FOR RUNWAY

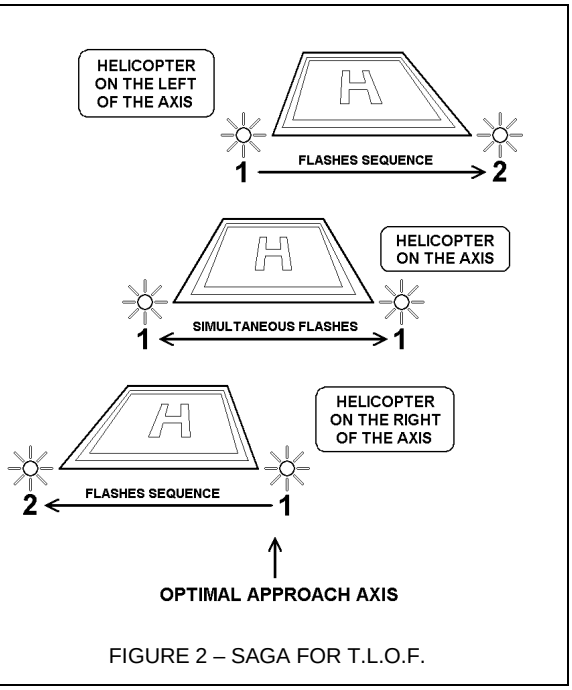


FIGURE 2 – SAGA FOR T.L.O.F.

1.4 AIRFIELD POSITION

The two light units of a SAGA system must be installed 10 metres from the runway Edge symmetrically on both sides of the threshold of the Runway (for TLOF the two units must be installed as close as possible of the threshold edges).

The Master unit must be installed on the right of the Threshold and the Slave unit on the left.

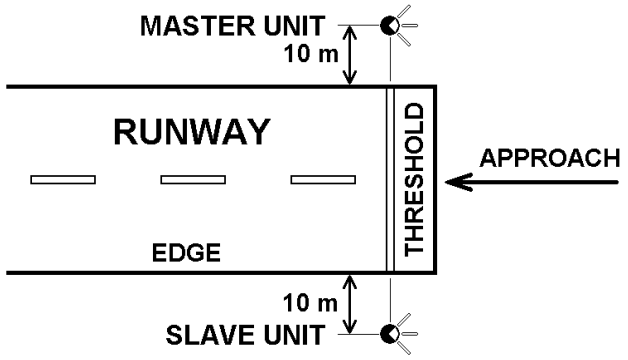


FIGURE 3 – SAGA POSITION FOR RUNWAY

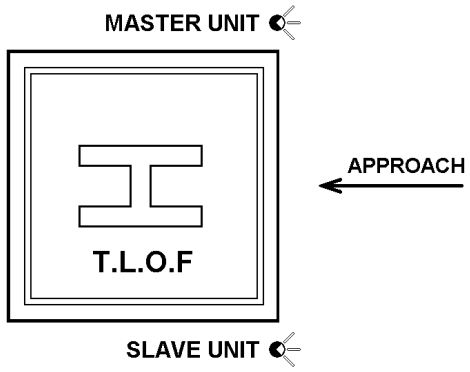


FIGURE 4 – SAGA POSITION FOR T.L.O.F.

1.5 SYSTEM DESIGN AND EXPLODED VIEW

The design and exploded view shows the sub-assemblies for each of the SAGA system units.

SAGA system design and exploded view

1. Optical head
2. Power supply box
3. Frangible leg
4. Power supply box fixation bars (x 2)
5. Power supply box fixing screws (x 4)
6. Clamps for leg fixation (x 2) with nuts and washers (2 set by clamp)
7. M18 –400 mm sealing rods (x 4) with nuts and washers for fixation of the leg (delivered with the leg).

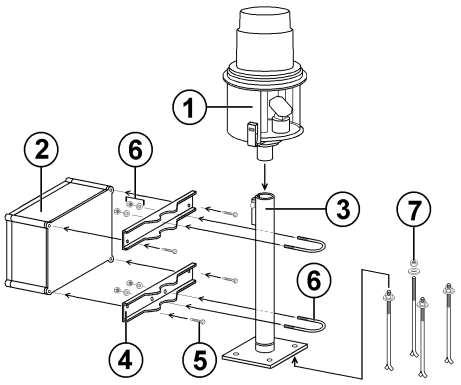


FIGURE 5 – SAGA EXPLODED VIEW

2. INSTALLATION

2.1 TOOLS REQUIRED

Standard tools are used for installation including:

- Two 22 mm open ended spanner.
- One 22 mm box spanner / socket.
- Two 17 mm open ended spanner.
- One 8 mm box spanner / socket.
- One small screw driver.
- One large screw-driver.
- Brush and cloth.
- Spirit level.

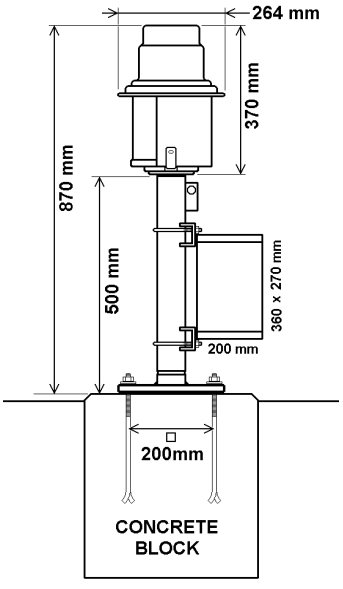
Other special tools are used for installation including:

- One set of adjustment tools.

  Note: *Standard surveyor equipment shall be also required to determine the location of the foundation blocks and so on.*
- One multi-meter (for Electrical Installation).
- Cable stripping tool.

2.2 CIVIL WORKS

The M18 –400 mm sealing rods delivered with the SAGA system must be sealed vertically in the surface (soil, concrete, pavement or other) in respect to the position on the airfield. The surface on which each of the SAGA units is to be installed must be flat and horizontal.

Mechanical installation and dimensions	
If a concrete block is to be used, it must be at least to the characteristics as shown in the figure. • Seal the fixing devices vertically in the flat and horizontal surface in respect to the position in the airfield. ***Note****: Fixing devices which differ from the sealing rods delivered with the system may be used if M18 and placed with a distance of 200 mm between them.*	 FIGURE 6 – SAGA CONCRETE BLOCK

2.3 MECHANICAL INSTALLATION

1. Place the unit leg on the previously installed surface fixing devices.
   ***Note**: Make sure the unit window is in the direction of the approach*.
2. Mount the fixing washers on the fixing devices.
3. Loosely fasten (but do not lock) the M18 fixing screws on the fixing devices.

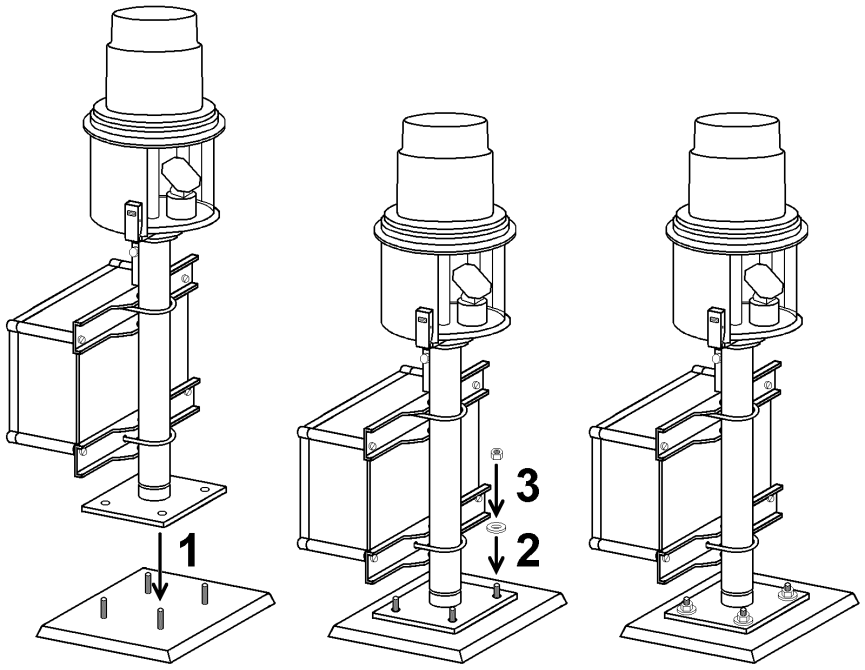


FIGURE 7 – SAGA MECHANICAL INSTALLATION

2.4 ELECTRICAL WIRING

As the SAGA units are delivered completely mounted, some electrical connections are required during installation as follows:

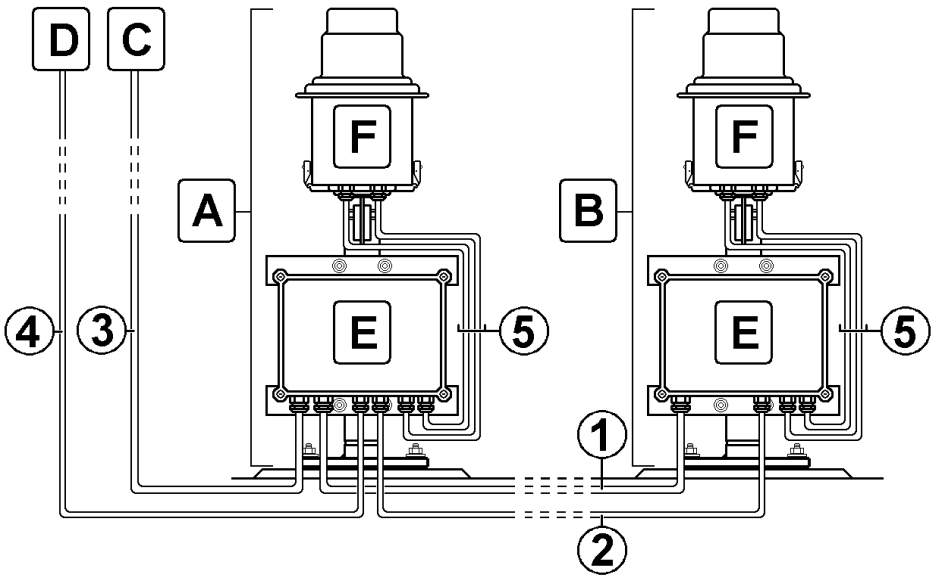


FIGURE 8 – SAGA ELECTRICAL WIRING

2.4.1 Power supply of the system

- Connect the 'Master Box' (see **A**) to the main supply distribution panel (**C**).
- Connect the 'Slave Box' (**C**) to the 'Master Box' (**A**) (Bridge of the main supply).

2.4.2 Transmission of Control/Monitoring signals

- Connect the 'Master Box' (see **A**) to the Control and Monitoring Desk (**C**).
- Connect the 'Slave Box' (**B**) to the 'Master Box' (**A**). Transmission of the different signals necessary for synchronisation between the two units or management of alarm status.

Note: *For each unit, the two cables (see **5**) which link between the Power Supply Box (**E**) and Optical Head (**F**) are connected in the factory.*

2.4.3 Power supply cabling

All SAGA power supply cables in the system must have 4 wires:
Ground, Neutral, P1/SAGA and P2/Heating Resistors.

The total diameter of all power supply cables in the system must be between 12.5 mm and 18 mm.

Wiring between Master and Slave light units (see **1**) includes:

- 4 x 4 mm² LV Cable HO7RNF type.

Wiring between Master light units and main supply distribution panel (**3**) includes:

- 4 x 4 mm² LV Cable HO7RNF type for distance less than 1,000 m.
- 4 x 6 mm² LV Cable HO7RNF type for distance greater than 1,000 m.

Note*: Swishing of power supplies for SAGA and Heating Resistors must be separated on the Main Supply Distribution Panel.*

In areas particularly vulnerable to lighting strikes, the ground wired is to be doubled by an embedded copper cable buried over the power cable. This cable is to be connected firstly to each supply box using the dedicated cross terminal (screw and bolt) and secondly, to the legs of the two units using the sealing rods.

2.4.4 Control cable between Master and Slave lights units

Control Cable between Master and Slave lights units (see **2**): This cable must have 7 individual screened pairs (minimum wire cross section = 0.22 mm²).

The 7 pairs are used as follows:

- 2 pairs for brilliancy level control.
- 3 pairs for synchronisation between light units.
- 2 pairs for feedback signals.

The total diameter of the control cable must be between 7.5 mm and 13 mm.

***Note**: The control cable shields must only be connected to the earth of the "Master" power supply box.*

2.4.5 Control cable between Master unit and Control/Monitoring Desk

Control cable between Master unit and Control and Monitoring Desk (**4**): This cable is a shielded cable and must have 4 pairs (minimum wires cross section = 1.5 mm²).

The 4 pairs are used as follows:

- 2 pairs for Brilliancy Level Control.
- 1 pair for Master default feedback signal.
- 1 pair for Slave default feedback signal.

The total diameter of the control cable must be between 7.5 mm and 13 mm.

***Note**: Brilliancy levels of the SAGA system are driven using 48 Vdc. The lower brilliancy level is set by default and does not need to be driven. This brilliancy is selected as soon as the system is powered on.*

Master and Slave 'Default' feedback information is available on connection of dry contacts normally 'Open' located in the power supply boxes.

The control cable shields must only be connected to the earth of the control and monitoring desk.

2.5 ELECTRICAL CONNECTIONS

2.5.1 Master and slave box compression packer/cable location

The two types of power supply boxes are: Master (with 6 compression packers for cables) and Slave (with 4 compression packers for cables).

Cabling must be fed into the power supply boxes through compression packers.

Each compression packer location is dedicated to a specific cable as follows:

Master box

(a) Entry for the power supply cable from the main supply distribution panel (see **A**).

(b) Exit for the power supply cable to the Slave unit (**B**).

(c) Entry of the control/monitoring cable from the Control and Monitoring Desk (**C**).

(d) Exit for the control/monitoring cable to the Salve unit (**D**).

(e) Exit for the cables to the optical head of the Master unit (pre-cabled) (**E**).

(f) Exit for the cables to the optical head of the Master unit (pre-cabled) (**F**).

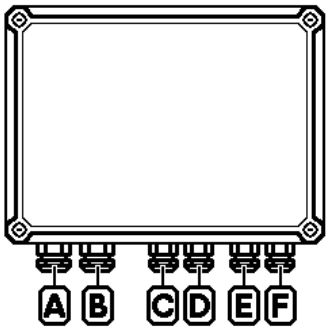


FIGURE 9 – SAGA MASTER BOX COMPRESSION PACKERS

Slave box

(g) Entry of the power supply cable from the Master unit (see **G**).

(h) Entry of the control/monitoring cable from the Master unit (**H**).

(i) Exit of the cables to the optical head of the Salve unit (pre-cabled) (**I**).

(j) Exit of the cables to the optical head of the Salve unit (pre-cabled) (**J**).

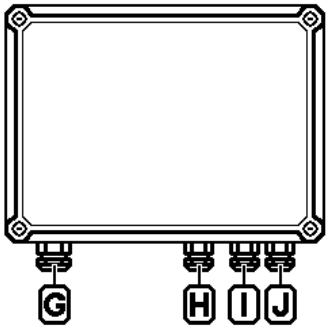


FIGURE 10 – SAGA SLAVE BOX COMPRESSION PACKERS

2.5.2 Disassemble the power supply boxes

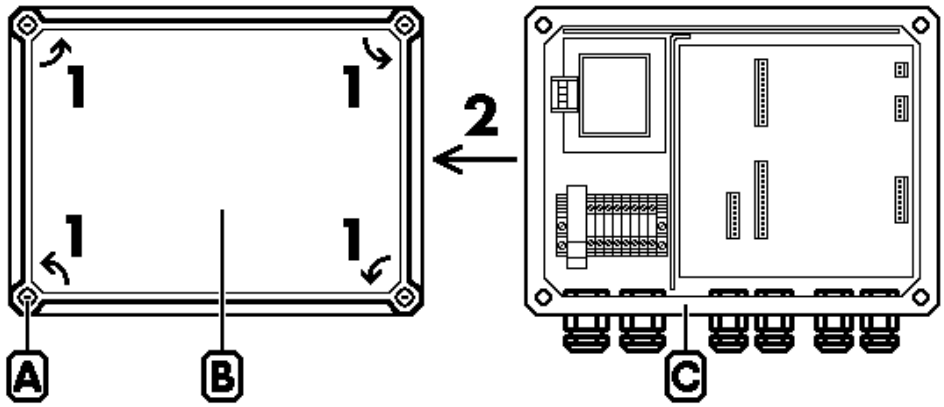


FIGURE 11 – OPEN A SAGA POWER SUPPLY BOX

Open the power supply boxes in each of the two SAGA units as follows:

(a) Using a large flat screwdriver unscrew (see **1**) the four closing screws (**A**).

(b) Remove the front cover (**B**) of the power supply box (**C**).

2.5.3 Power supply box terminal location

Inside the power supply boxes (Master and Slave) are terminals for electrical connection in the system.

Master box

(a) See (**A**) terminal for connection of power supply cables, input and output.

(b) See (**B**) terminal (**J5**) for connection of Control /Monitoring cable to the Slave unit.

(c) See (**C**) terminal (**J6**) for connection of Control /Monitoring cable from the Control and Monitoring Desk.

Note: *The location of pin **n°1** of Terminals (**B**) and (**C**) are also shown for reference in the figure.*

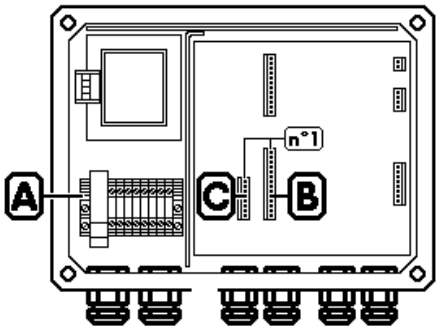


FIGURE 12 – MASTER BOX TERMINALS

Slave box

(a) See (**A**) terminal for connection of power supply cables (input).

(b) See (**B**) terminal (**J5**) for connection of Control /Monitoring cable from the Master unit.

Note*: The location of pin **n°1** of Terminal (**B**) is also shown for reference in the figure.*

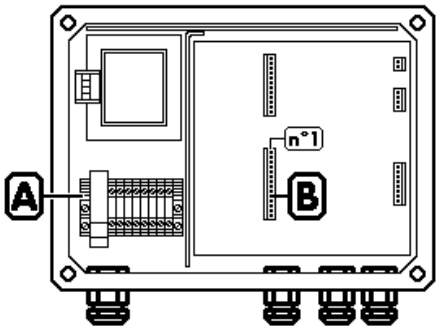


FIGURE 13 – SLAVE BOX TERMINALS

2.5.4 Prepare power supply box compression packers

This section describes the preparation and cable installation for all compression packers, locations: A, B, C, D, G, H.

(a) Unfasten and remove the lower bolt (**A**) of the compression packer.
(b) Remove the cap (**B**) of the lower bolt (**A**) of the compression packer.
(c) Remove/pull the internal Gasket (**C**) away from the compression packer.

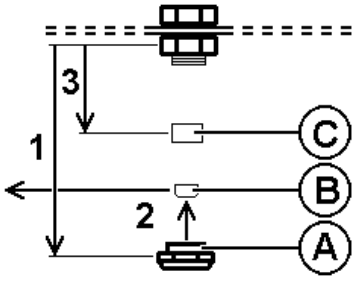


FIGURE 14 – COMPRESSION PACKER PREPARATION

2.5.5 Cabling a compression packer

(a) Feed the cable through the external screw and the gasket of the compression packer (see **1**).
(b) Feed the cable through the fixing part of the compression packer (**2**).
***Note**: Pull 50 cm of the cable inside the power supply box.*

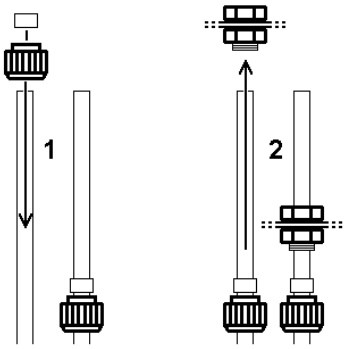


FIGURE 15 – COMPRESSION PACKER CABLING

2.5.6 Prepare power supply cables

(a) Strip 5 cm from the cable sleeve (see **3**).
***Note**: It is recommended to use a specific cable stripping tool to remove cable sleeves and avoid damage to the wires.*
(b) Strip the 3 (or 4) wires to 1 cm (**4**).

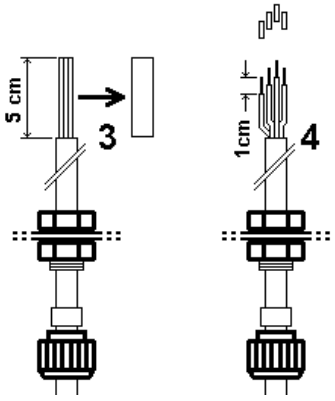


FIGURE 16 – POWER SUPPLY CABLE PREPARATION

2.5.7 Connect power supply cables

(a) Connect the cable wires (see **5**) to the dedicated terminal connectors.
For the “Input” cable (see **A**) (Master Box and Slave Box).
For the “Output” (**B**) (Master Box only).
For each of the two power cable connections: **GND**, **N**, **P1**, (**P2**).
Note: *The second Phase **P2** is a reserve for the power supply of the heating resistor (option).*

(b) Pull the cable from outside the power supply box for a minimum length inside the box (**6**).

(c) Place the locking ring and the gasket inside the fixing part of the compression packer (**7**).

(d) Fasten and lock the external bolt on the fixing part of the compression packer.

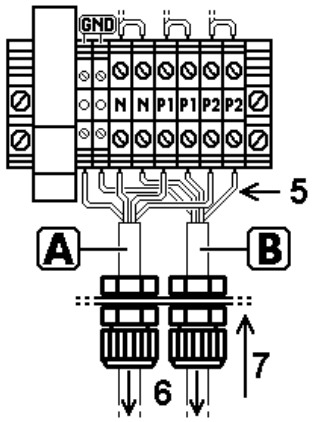


FIGURE 17 – POWER SUPPLY CABLE CONNECTION

2.5.8 Prepare control/monitoring cables

(a) Strip 10 cm from the cable (see **3**). **Note**: It is recommended to use a specific cable stripping tool to remove cable sleeves and avoid damage to the wires.
(b) Strip the wires for use to 1 cm (**4**).

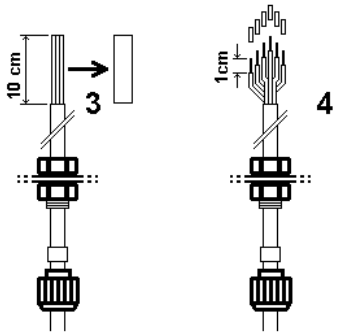


FIGURE 18 – CONTROL/MONITORING CABLE PREPARATION

2.5.9 Connect control/monitoring cable wires to terminals

- Connect the cable wires (see Figure 19 – Control/monitoring cable connection) to be used to the dedicated removable male terminal connector according to the charts in the following table.

Chart 1: J5 Terminal (large) of both (master and slave) boxes

Master Pin n°	Wire to be used	Slave Pin n°
Pin 1 (first from top)	Pair 1 wire A	Pin 1 (first from top)
Pin 2	Pair 1 wire B	Pin 2
Pin 3	Pair 2 wire A	Pin 3
Pin 4	Pair 2 wire B	Pin 4
Pin 5	Pair 3 wire A	Pin 5
Pin 6	Pair 3 wire B	Pin 6
Pin 7	Pair 4 wire A	Pin 7
Pin 8	Pair 4 wire B	Pin 8
Pin 9	Pair 5 wire A	Pin 9
Pin 10	Pair 5 wire B	Pin 10
Pin 11	Not Used	Pin 11
Pin 12	Pair 6 wire A and Pair 7 wire A	Pin 12
Pin 13	Pair 7 wire B	Pin 13
Pin 14	Pair 7 wire B	Pin 14

Chart 2: J6 Terminal (large) of the master box

Master Pin n°	Function
Pin 1 (first from the top)	Slave Default
Pin n°2	Slave Default
Pin n°3	Master Default
Pin n°4	Master Default
Pin n°5	Not Used
Pin n°6	Common Brilliancy
Pin n°7	Medium Brilliancy
Pin n°8	High Brilliancy

2.5.10 Connect control/monitoring terminals to boxes

(a) Connect the terminal dedicated to link the Master box to the Slave box (see **A**) (Master and Slave boxes).

(b) Connect the terminal dedicated to link the Master box to Control and Monitoring Desk (**B**) (Master box only). For the “Output” (**B**) (Master Box only).

Note: *The removable male connector corresponding to the two types of terminal are delivered mounted on the mother board.*

(c) Pull the cable outside the power supply box to the minimum length inside the box (**6**).

(d) Place the locking ring and the Gasket inside the fixing part of the compression packer (**7**).

(e) Fasten and lock the external bolt on the fixing part of the compression packer.

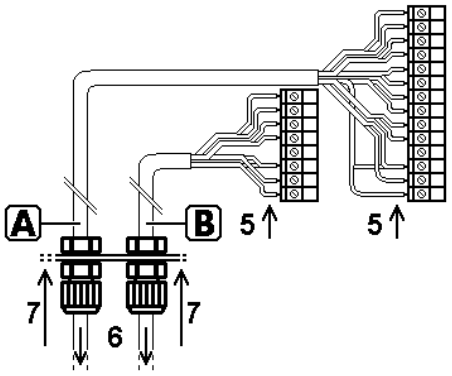


FIGURE 19 – CONTROL/MONITORING CABLE CONNECTION

2.5.10.1 Control principles

Remote control of Brilliancy = Brilliancy levels of SAGA are driven using 48 Vdc. The lower brilliancy level is set by default brilliancy and does not need to be driven. This brilliancy is selected as the system is powered on. The medium and high brilliancy level are driven by placing a 48 Vdc between the common (0 Vdc on U4/pin 6) and the pin corresponding to the requested brilliancy level, + 48 Vdc on pin 7 (Medium Brilliancy) or U4/pin 8 (High Brilliancy).

2.5.10.2 Monitoring principles

Default Master = Connections of a dry contact normally ‘Open’.
Contact ‘Opened’ => No default.
Contact ‘Closed’ => Alarm ‘Master’ default.

Default Slave = Connections of a dry contact normally ‘Open’.
Contact ‘Opened’ => No default.
Contact ‘Closed’ => Alarm ‘Slave’ default.

2.5.11 Assemble the power supply boxes

1. Place the front cover (see **B**) on the power supply box (**C**).
2. Fasten the four closing screws (**A**) using a large flat screwdriver.

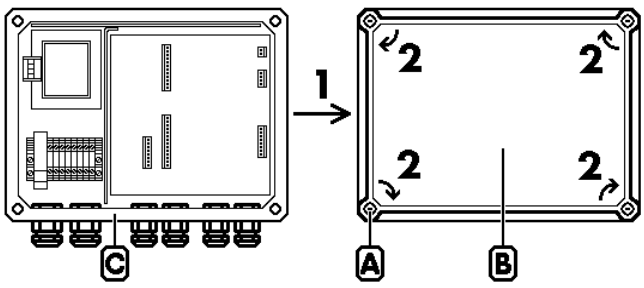


FIGURE 20 – MONITORING PRINCIPLES

2.6 ADJUSTMENTS

2.6.1 Requirements

The SAGA system units must be installed symmetrically on both sides of the threshold for all landing area types such as airport runway or heliport T.L.O.F.

The optical head of each unit must be adjusted to horizontal and also with its optical axis parallel to the approach axis.

During system installation it is necessary to adjust, using a special setting tool, the two optical heads to obtain horizontality and alignment.

SAGA setting tools are for example, one spirit level for horizontal adjustment and one sight telescope for alignment adjustment.

The use of a sight stick is also recommended during alignment adjustment (see Figure 21 – Alignment of units). For example, the sight stick must be held at a distance **D min** (> 30 m for a heliport and > 50 m for an airport runway) on two previously prepared marks (**A** and **B**).

***Note**: The two marks must take into account placement of the units and direction of the approach.*

The line passing through the centre of the SAGA units and the marks A (or B) must be strictly parallel to the approach axis.

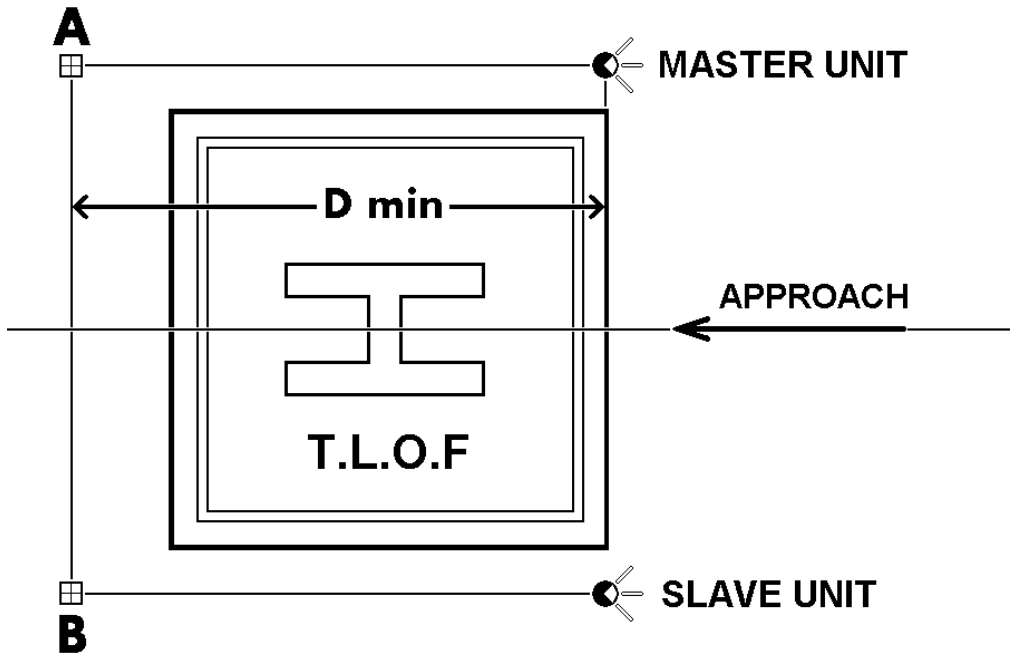


FIGURE 21 – ALIGNMENT OF UNITS

2.6.2 Prepare the sighting telescope setting tool

1. Mount the sighting telescope (see **A**) on the adaptor (**B**).

   ***Note**: Carefully mount the sighting telescope to aim in the required direction (in front or rear of unit).*

   *The adaptor (**B**) is equipped with a spirit level for horizontal adjustment of the unit.*
2. Fasten and lock the two sighting telescope fixing screws (**D**).

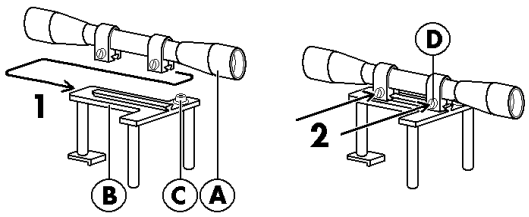


FIGURE 22 – SIGHTING TELESCOPE PREPARATION

2.6.3 Open catches

- Open the two locking catches (**A**) on the unit cover, push (**B**) and on top of the catch to open/release it.

  ***Note**: The locking part of the catch is to secure closure. When closing a catch, do not forget to push on it as this allows for re-opening without difficulty. Forcing a catch may cause damage.*

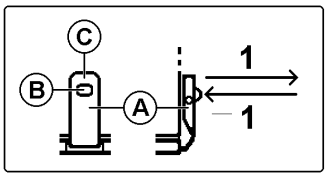


FIGURE 23 – OPEN CATCHES

2.6.4 Mount the sighting telescope setting tool

1. Remove the unit cover.
2. Remove the lamp from its holder.
3. Install the setting tool on the unit. Put the two front leg studs of the tools in the dedicated holes, located on top of the unit.
4. Verify that the three legs of the Setting Tool are in positioned correctly on the top of the unit.

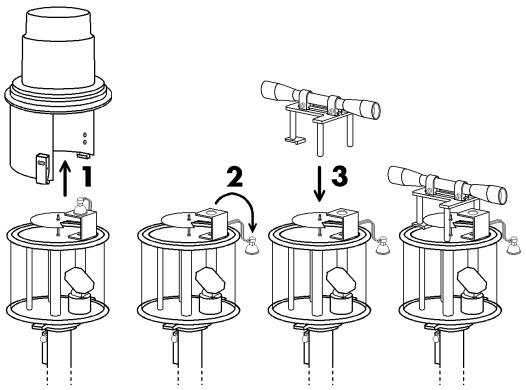


FIGURE 24 – SETTING TOOLS MOUNTING

2.6.5 Adjust the unit

Horizontal adjustment

- Adjust the leg fixing screws (see **2**) until the Spirit Level (**1**) bubble is centred.

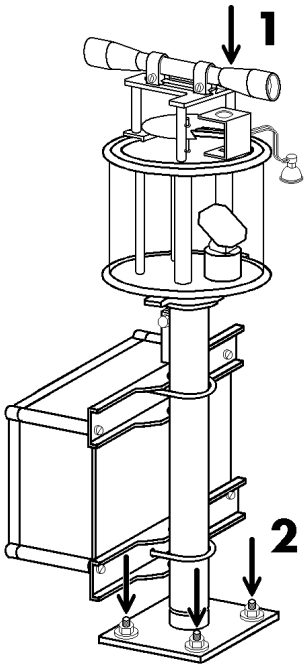


FIGURE 25 – HORIZONTAL ADJUSTMENT

Vertical Alignment

1. Unscrew the optical head locking screw (**C**), located on the rear of the leg.
2. Manually twist the optical head into the leg, until obtaining a view of the vertical bar in the sighting telescope, (**D**) using the aiming stick, located in the front or back of unit.
3. Fasten and lock the optical head locking screw (**C**).

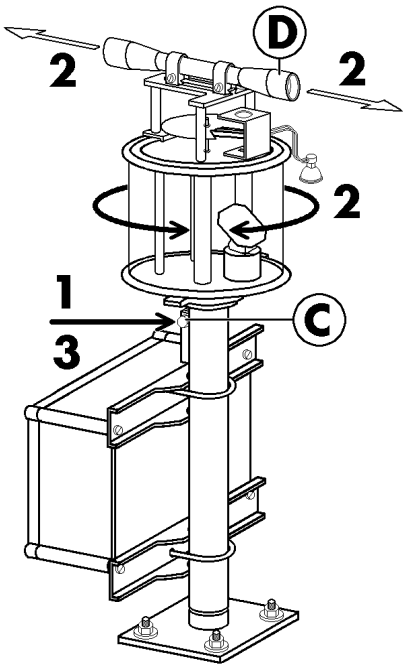
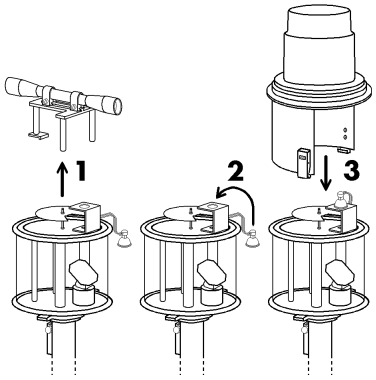


FIGURE 26 – VERTICAL ALIGNMENT

2.6.6 Remove the setting tool and assemble the unit

1. Lift the setting tool from the SAGA unit. 2. Place the lamp on the lamp holder. 3. Place the cover on the unit and close the two catches.	 FIGURE 27 – SETTING TOOL REMOVAL AND UNIT ASSEMBLY

When the two units of the SGA system are adjusted and re-assembled, they can be commissioned.

2.7 SYSTEM COMMISSIONING

2.7.1 Master unit (right of threshold)

If the master unit is installed, as standard, to the right of the threshold, see 2.7.3 Commissioning on page 22.

2.7.2 Master unit (left of threshold)

It may be required to install the Master unit on the left of the threshold (=> Slave unit on the right). If this is the case, then the rotating directions of the reflecting mirrors (located in the optical head) must be inverted.

2.7.2.1 Invert reflecting mirrors rotating directions

1. Open the power supply boxes using a large flat screwdriver to unscrew the four closing screws (see **A**) of the power supply box.
2. Remove the front cover (**B**) of the power supply box (**C**).

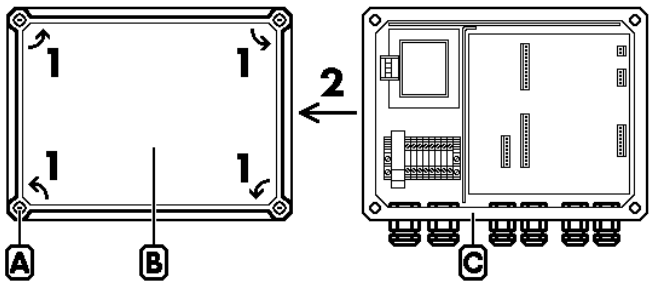


FIGURE 28 – OPEN POWER SUPPLY BOXES

3. Change location of the micro switch **S2** on the PCBs as follows:

- **Position A** = Clockwise rotation of the mirror (standard Master).
- **Position B** = Anti-clockwise rotation of the mirror (standard Slave).

MASTER BOX SLAVE BOX

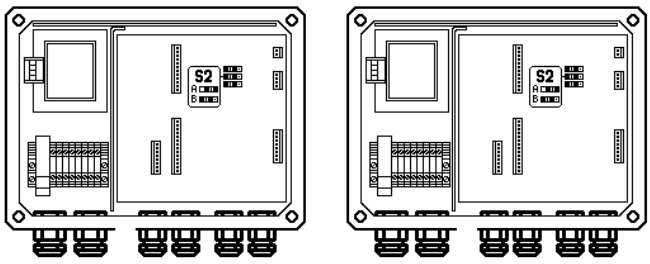


FIGURE 29 – MICRO SWITCH S2 LOCATION

4. Place the front cover (**B**) on the power supply box (**C**) and using a large flat screwdriver fasten the four closing screws (**A**) to close the power supply box.

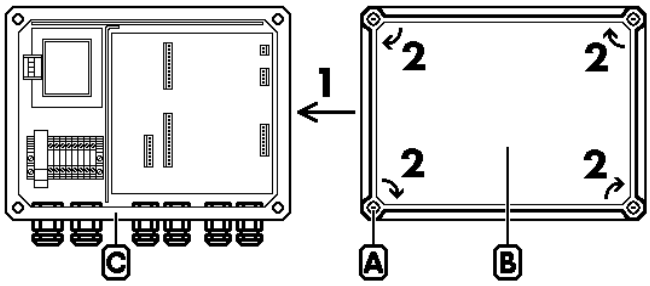


FIGURE 30 – CLOSE POWER SUPPLY BOXES

2.7.3 Commissioning

2.7.3.1 System initialisation

Set the system power supply to on:

1. Turn the Master unit mirror (if necessary) and stop on its reference position, the mirror reference metal bar is located immediately above the magnetic sensor.
2. Turn the Slave unit mirror (if necessary) and stop on its reference position, the mirror reference metal bar is located immediately above the magnetic sensor.
3. If no problem occurs during this initialisation sequence, the two unit lamps are lit, “light on”, and the mirrors start to turn.
4. If any problems occur during this initialisation sequence, the system does not start.

For more information, see the Maintenance section.

2.7.3.2 Brilliancy

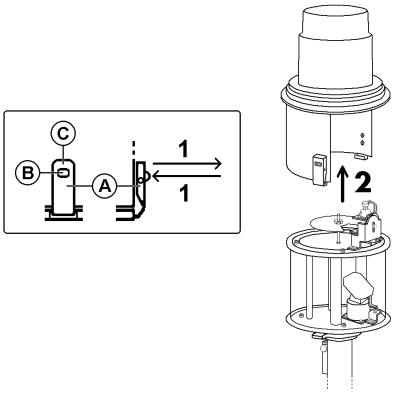
Check the remote control of the brilliancy:

1. Using the control desk, set the command for medium brilliancy.
2. Verify the change of brilliancy is effective on the two units.
3. Using the control desk, set the command for high brilliancy.
4. Verify the change of brilliancy is effective on the two units.

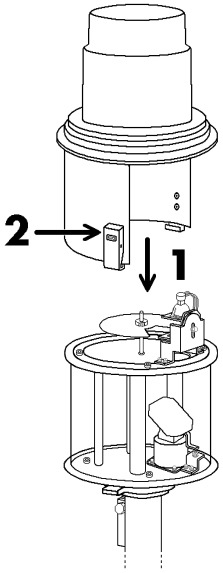
3. MAINTENANCE

3.1 OPTICAL HEAD

3.1.1 Disassemble an optical head cover

1. Open the two locking catches (**A**) on the unit cover, press (**B**) and on top of the catch to open/release it. ***Note**: The locking part of the catch is to secure closure. When closing a catch, do not forget to push on it as this allows for re-opening without difficulty. Forcing a catch may cause damage.* 2. Remove the cover of the unit.	 FIGURE 31 – OPTICAL HEAD DISASSEMBLY

3.1.2 Replace an optical head cover

1. Place the cover on the unit. 2. Close the two catches.	 FIGURE 32 – OPTICAL HEAD REPLACEMENT

3.1.3 Change a lamp

- Disassemble the optical head, see 3.1.1 on page 23.

1. Disconnect the lamp terminal from the lamp.
2. Remove the lamp from its support by sliding it out of the fixing springs sideways.

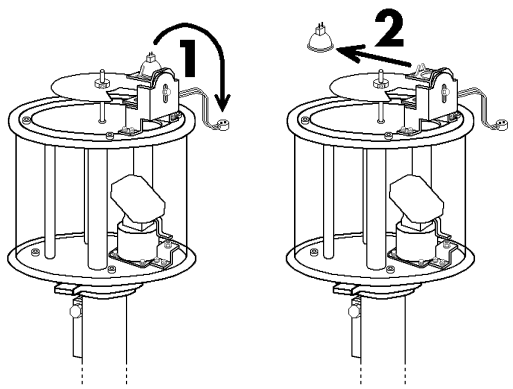


FIGURE 33 – LAMP REMOVAL

3. Install the lamp on its support by sliding it into the fixing springs from the side.
4. Connect the lamp terminal on the lamp.

- Replace the cover of the unit, see 3.1.2 on page 23.

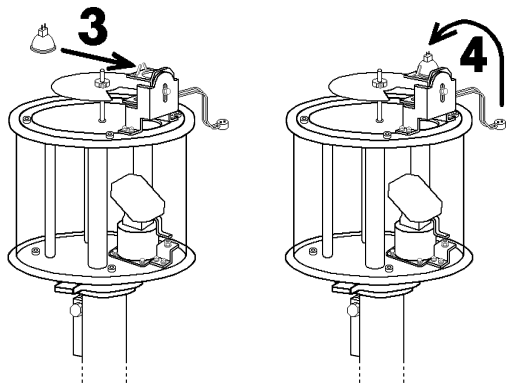


FIGURE 34 – LAMP REPLACEMENT

3.1.4 Changing the protection glass

- Disassemble the optical head, see 3.1.1 on page 23.

1. Unscrew and remove the four fixing screws (**A**) on the ring to block the protection glass.
2. Remove the ring (**B**).
3. Remove the protection glass (**C**).

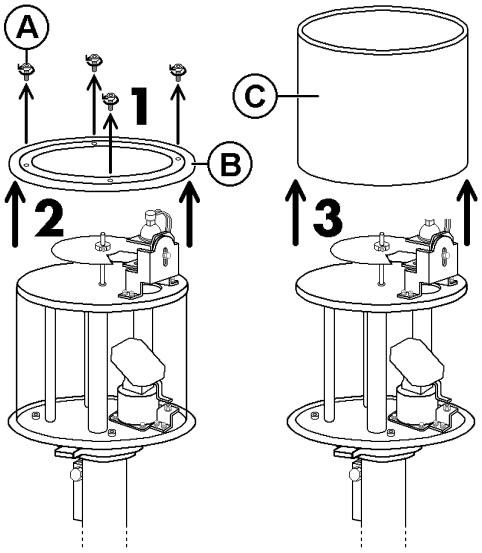


FIGURE 35 – PROTECTION GLASS REMOVAL

4. Place the protection glass on the unit.
5. Place the ring on the unit to block the protection glass.
6. Mount, screw and lock the four fixing screws of the ring to block the protection glass.

- Replace the cover of the unit, see 3.1.2 on page 23.

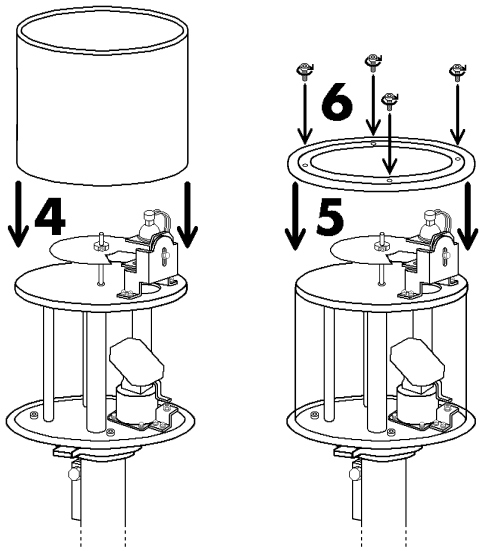


FIGURE 36 – PROTECTION GLASS REPLACEMENT

3.1.5 Changing the optical head and connections

1. Disassemble the optical head, see 3.1.1 on page 23.
2. Unfasten the optical head locking screw located on the leg.
3. Disconnect all the wires of the two optical head power supply box link cables.

   ***Note**: Each SAGA unit includes two separate cables for the electrical links between the optical head power supply boxes:*

   ***-** The first cable is dedicated to supply power to the lamp (10 V) and the heating resistor (230 V).*

   ***-** The second cable is dedicated to drive the step motor and to return the detection signal made by the sensor.*
4. Open the two compression packers of the optical head.
5. Pull the two link cables to outside the optical head.
6. Pull up and remove the optical head from the leg.
7. Install a new optical head on the leg.
8. Pass the two link cables through the two compression packers to inside the optical head.
9. Reconnect all the wires of the optical head power supply box link cable on the dedicated terminal (see Figure 37 – Terminal motor sensor) and make connections as follows, see **Chart 1**.

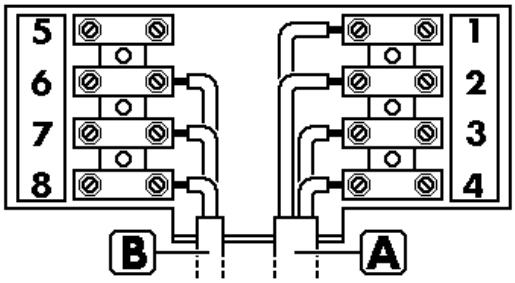


FIGURE 37 – TERMINAL MOTOR SENSOR

***Note**: **A =** step motor cable and **B =** position sensor cable*

Chart 1: Link with the Motor and the Sensor (optical head connections)

Supply box Terminal U22	Link cable wires	Optical head Terminal	Motor cable *	Sensor cable
Pin 1 (First from the bottom)	Red	Pin 1	Red	
Pin 2	White	Pin 2	Red/White	
Pin 3	Orange	Pin 3	Green/White	
Pin 4	Green	Pin 4	Green	
Pin 5	Not Use	Pin 5		
Pin 6	Brown	Pin 6		Brown
Pin 7	Black	Pin 7		Black
Pin 8	Blue	Pin 8		Blue

Note**: An asterisk ** denotes the black and the white wires of the motor are not used.*

10. Reconnect all the lamp heating resistor link cable wires on the dedicated terminal (see Figure 37 – Terminal motor sensor) and make the connections as follows, see chart 2.

Chart 2: Link with the lamp and the heating resistor (optical head connections)		
Supply Box Terminal U21	**Link cable wires**	**Optical head terminal**
Pin 1 (First from the bottom)	White	Heating Resistor
Pin 2	Brown	Heating Resistor
Pin 3	Green	Lamp
Pin 4	Yellow	Lamp

Note: *Be careful not to mix the two power supplies (Resistor= 230 V and lamp= 10 V)*

11. Adjust the length of the links cables (same external length as the protection flexible tubes).
12. Mount the two compression packers of the optical head.
13. Re-align the SAGA optical head, see 2.6 on page 17.
14. Replace the cover of the unit, see 3.1.2 on page 23.
15. Re-commission the SAGA system, see 2.7 on page 21.

3.2 POWER SUPPLY BOXES

3.2.1 Open a power supply box

1. Open the power supply boxes using a large flat screwdriver to unscrew the four closing screws (see **A**) of the power supply box.
2. Remove the front cover (**B**) of the power supply box (**C**).

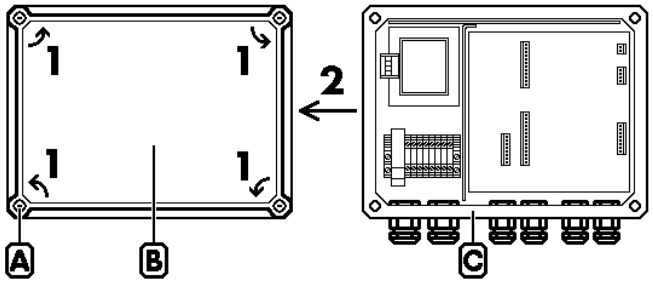


FIGURE 38 – OPEN POWER SUPPLY BOXES

3.2.2 Close a power supply box

3. Place the front cover (**B**) on the power supply box (**C**) and using a large flat screwdriver fasten the four closing screws (**A**) to close the power supply box.

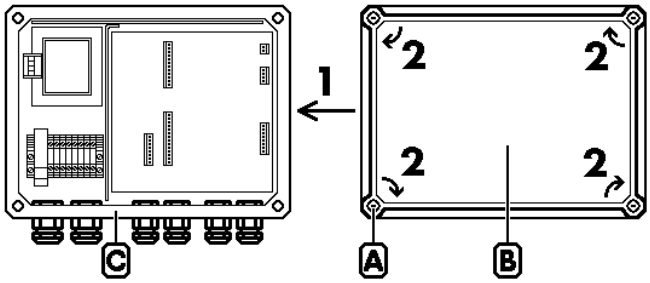


FIGURE 39 – CLOSE POWER SUPPLY BOXES

3.2.3 Description

Each power supply box includes the following sub-assemblies:

A - One power supply block

B - One PCB

C - One fixing plate

D - One heating resistor

Note: *The differences between Master and Slave boxes are: the number of compression packers on the external box and the type of PCB installed. All other components are similar.*

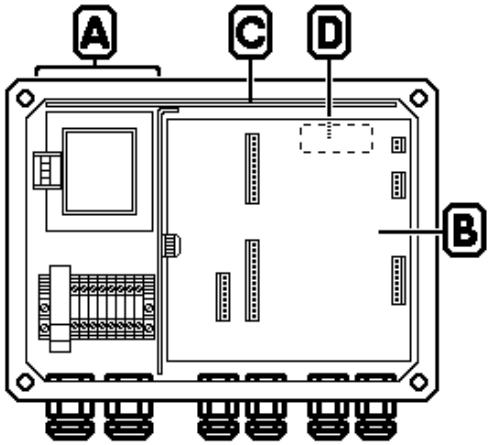


FIGURE 40 – POWER SUPPLY BOX SUB ASSEMBLY LOCATION

3.2.4 Power supply block and fuses

The power supply block includes the following functions:

1. Filtering, protection of the input power supply (N, P1 and P2).
2. Using a special transformer make the power supplies internally used by the SAGA unit.

The power supply box is equipped with three fuses for protection. The fuses are named and mounted as follows:

A - **FUSE** = lamp.

This fuse is mounted in the large holder located of the main terminal. It is a standard fuse of 20 A: Diameter = 10.3 mm and length = 38 mm.

B - **FUS 1** = electronic PCB.

This fuse is mounted in the holder located on the side of the block in the middle (the second holder from the cover). It is a standard fuse of 250 V / 6 A: Diameter = 3.3 mm and length = 32 mm

C - **FUS 2** = heating resistor.

This fuse is mounted in the holder located on the side of the block in the middle (the first holder from the cover). It is a standard fuse of 250 V / 6 A: Diameter = 3.3 mm and length = 32 mm

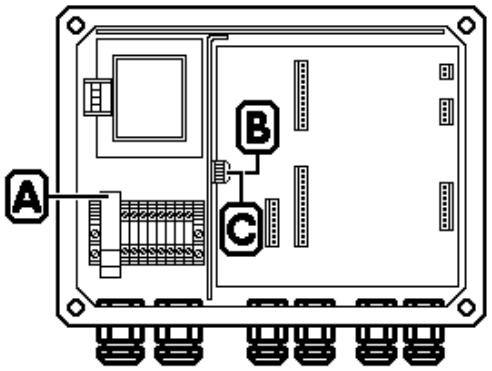


FIGURE 41 – POWER SUPPLY BLOCK AND FUSES

3.2.5 Electronic PCB

There are two types of PCB:

1. PCB for Master units
2. PCB for the Slave units.

3.2.6 Master electronic PCB

The Master electronic PCB performs the following functions:

1. Management of the movements of the mirror located in the optical head of the Master unit.
2. Management of the brilliance levels of the lamp of the Master unit.
3. Synchronisation of the Slave unit.
4. Management of the default status of the SAGA system.

3.2.6.1 Master electronic PCB fuse

The Master electronic PCB is equipped with only one fuse (see **F1**) to protect the + 5 V power supply of the electronic PCB.

- The fuse is a standard fuse of 2 A: Diameter = 2 mm and length = 20 mm

  The fuse is mounted in the holder located to the lower right of the PCB.

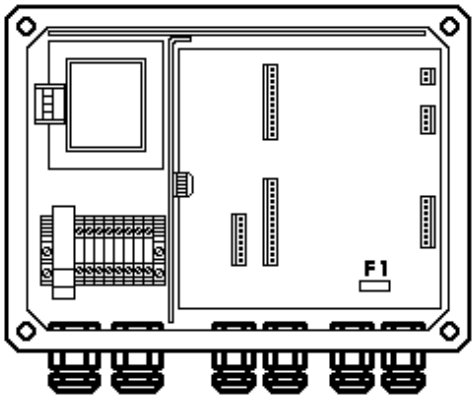


FIGURE 42 – MASTER ELECTRONIC PCB FUSE

3.2.6.2 Master electronic PCB LEDs

The Master electronic PCB is equipped with eleven LEDs with respective functions. LEDs are named and located as follows:

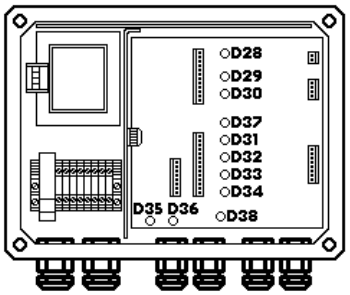


FIGURE 43 – MASTER ELECTRONIC PCB LEDS

D35 = Display of the status of the feedback information relay «Slave Default» and is mounted in the lower left of the PCB.

D36 = Display of the status of the feedback information relay «Master Default» and is mounted in the lower left of the PCB.

D28 = Detection made by the Master position sensor. Position « 0 » of the rotating subassembly and is mounted in the upper centre of the PCB.

D29 = Indicate the «Home» of the step motor. The home position (LED light off) corresponds to motor position when all its wiring is powered in the same way and is mounted in the upper centre of the PCB.

D30 = Status of the Slave lamp. Lamp light on = LED light on and is mounted in the upper centre of the PCB.

D37 = Detection made by the Slave position sensor. Position « 0 » of the Slave rotating subassembly is mounted in the centre of the PCB.

D31 = Detection made by the Slave position sensor. Position « 0 » of the Slave rotating subassembly and is mounted in the lower centre of the PCB.

D32 = Status of the command send to the relay which drive the power of the lamp of the Slave and is mounted in the lower centre of the PCB.

D33 = Display of the clock send to the step motor of the Slave and is mounted in the lower centre of the PCB.

Note: *The LED blinks in normal mode.*

D34 = Display of the reset signal send to the step motor of the Slave and is mounted in the lower centre of the PCB.

Note: *The LED continuously alternates between light on and short light off.*

D35 = Display of the status of the feedback information relay «Slave Default» and is mounted in the lower left of the PCB.

D36 = Display of the status of the feedback information relay «Master Default» and is mounted in the lower left of the PCB.

D38 = + 5 Vdc of the electronic PCB.is mounted lower centre of the PCB.

3.2.7 Slave electronic PCB

The Slave electronic PCB performs the following functions:

1. Management of the movements of the mirror located in the optical head of the Slave unit.
2. Management of the brilliance levels of the lamp of the Slave unit.
3. Synchronisation of the Slave unit.
4. Management of the default status of the SAGA system.

3.2.7.1 Slave electronic PCB fuses

The Slave electronic PCB is equipped with six fuses for protection. The fuses are named and mounted as follows:

F1 = Protection of the + 5 V Power supply of the electronic PCB.

This fuse is mounted in the fuse holder located lower right of the PCB.

This is a standard **2 A** fuse: **Diameter = 5 mm and length = 20 mm**.

F2 = Protection of the line Master / Slave dedicated to return the Slave lamp status.

This fuse is mounted in the fuse holder mounted vertically by the J5 connector.

This is a standard **2 A** fuse: **Diameter = 5 mm and length = 20 mm**.

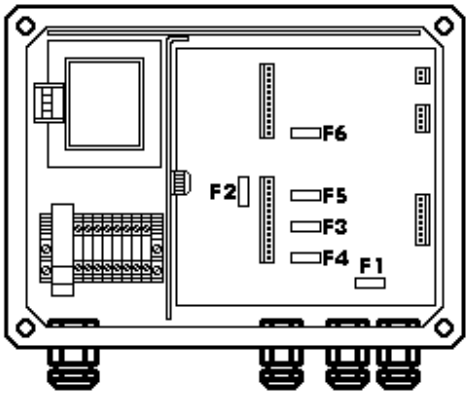


FIGURE 44 – SLAVE ELECTRONIC PCB FUSES

F3 = Protection of the line Master / Slave dedicated to send to the Slave the synchronisation clock.

This fuse is mounted in the third (from the top) of the four fuse holders mounted horizontally in the centre of the PCB.

This is a standard **2 A** fuse: **Diameter = 5 mm and length = 20 mm**.

F4 = Protection of the line Master / Slave dedicated to send to the Slave the signal «Motor Initialisation».

This fuse is mounted in the fourth (from the top) of the four fuse holders mounted horizontally in the centre of the PCB.

This is a standard **2 A** fuse: **Diameter = 5 mm and length = 20 mm**.

F5 = Protection of the line Master / Slave dedicated to send to the Slave the command of the relay which drive the lamp.

This fuse is mounted in the second (from the top) of the four fuse holders mounted horizontally in the centre of the PCB.

This is a standard **2 A** fuse: **Diameter = 5 mm and length = 20 mm**.

F6 = Protection of the line Master / Slave dedicated to return the Slave position sensor status.

This fuse is mounted in the first (from the top) of the four fuse holders mounted horizontally in the centre of the PCB.

This is a standard **2 A** fuse: **Diameter = 5 mm and length = 20 mm**.

3.2.7.2 Slave electronic PCB LEDs

The Slave electronic PCB is equipped with four LEDs. The LEDs include names and functions as follows:

D40 = Detection made by the position sensor. Position « 0 » of the Slave rotating subassembly. This LED is mounted in the centre of the PCB.

D29 = Indicates the «Home» of the step by step motor. The home position (LED light off) corresponds to motor position when all wiring is powered in the same way.

This LED is mounted in the upper centre of the PCB.

***Note**: This status exists 50 times per turn => the LED blinks quickly.*

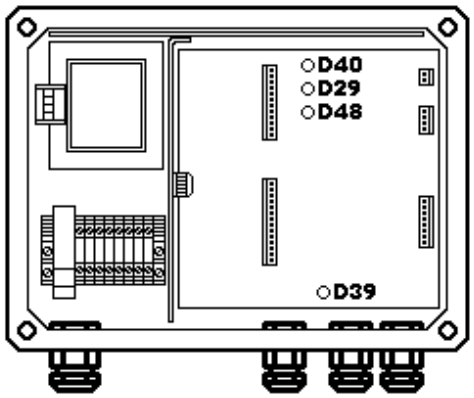


FIGURE 45 – SLAVE ELECTRONIC PCB LEDS

D48 = + 12 Vdc of the electronic PCB.

This LED is mounted in the upper centre of the PCB.

D39 = + 5 Vdc of the electronic PCB.

This LED is mounted in the lower centre of the PCB.

3.3 STANDARD OPERATION OF THE SAGA SYSTEM

When the system power supply is switched on, the system starts an initialisation cycle which includes the following steps:

1. Microprocessor initialisation.
2. Test of the «Default» Signalling Relays.
3. Set the reference position to «0» of the rotating subassembly for the Slave unit optical head.
4. Turn the light on and test the two SAGA unit lamps.

If this initialisation cycle is completed successfully (= no default is detected during the cycle), the SAGA system is considered as operational and immediately starts to work. The rotating subassemblies of the two optical heads are synchronised to turn in opposite directions.

To stop the system, switch off the power supply.

The brilliancy level can be set using the control signal sent to the Master.

3.4 SAGA SYSTEM DEFAULT STATUS

3.4.1 Detection of defaults on SAGA system

In "Normal" working mode the system continuously tests if received information is coherent. If the system detects information which indicates that the guidance indication given to the aircraft is in error (not perfect), the system stops immediately. Using information from two relays and the associated LEDs (D35/Slave default and D36/Master default) located on the Master PCB, the operator receives coded information about the type of fault detected.

System information is in three main types as follows:

1. The default LED light is on continuously.

(a) Meaning = Detection of a lamp default confirm on three turns.

(b) Behaviour of the SAGA system = The two lamps are light off and the two rotating subassemblies are stopped (with the mirror position marker at 180 ° of the sensor.

(c) Analysis of the problem and possible corrective operations =

The lamp of the corresponding unit has been detected as defective => Replace the lamp.

2. The default LED blinks 10 times (frequency = 1 Hz).

(a) Meaning = Detection of a rotating subassembly default.

(b) Behaviour of the SAGA system = The two lamps are light off and the two rotating subassemblies are stopped then the system restarts its initialisation cycle (= try to restart the system).

(c) Analysis of the problem and possible corrective operations =
Movement of the rotating subassembly has been detected as defective => one of the parts of the rotating subassembly (step motor, transmission mechanisms or sensor) are at fault. Open the optical heads and the two power supply boxes and check the following:

- During the initialisation cycle, observe the behaviour of the rotating subassembly. The subassembly should turn easily without problems.
- Verify the rotating subassembly is not obstructed on its movement area.
- For system power off, verify the rotating subassembly does not have any mechanical resistance or hard points.
- Re-check the connections of the Motor / Sensor link cable in the optical head and in the power supply box.

- Increase the torque of the step motor turning the potentiometer **R39** slowly clockwise (see Figure 46 – PCB potentiometers locations) until a satisfactory result is obtained.
  ***Note**: Do not turn the potentiometer too far*.
- During the initialisation cycle, verify that the sensor detects the mirror location marker. The LED lights **D40** (Slave PCB) and **D28** / **D37** (Master PCB) are set on. If the lights are not on:
- Re-check the connections of the Motor / Sensor link cable in the optical head and in the power supply box.
- Control the distance between the mirror position marker and the top of the sensor. The distance must be greater than 0.1 mm and lower than 0.3 mm. If this distance is too great, re-adjust the height of the sensor using its fixing screws.
- Verify the alignment of the maker and the sensor using the previously described process.

3. The default LED is blinks 10 times (frequency = 2 Hz).

(a) Meaning = Position sensor always activated.

(b) Behaviour of the SAGA system = The two lamps are light off and the two rotating subassemblies are stopped then the system restarts its initialisation cycle (= try to restart the system).

(c) Analyse of the problem and possible corrective operations =

***** One of the «position sensor» signal received by the Master PCB is always activated => One of the elements of the sensor detection signal acquisition chain is defective (sensor, cabling or electronic PCB).

Open the optical heads and the two power supply boxes and check the following:

- During the initialisation cycle, observe the behaviour of the rotating subassembly. The subassembly should turn easily without problems. If not:
- Verify that the rotating subassembly is not obstructed on its movement area.
- Re-check the connections of the Motor / Sensor link cable in the optical head and in the power supply box.
- Verify and compare information from LED **D40** (Slave PCB) and **D28** and **D37** (Master PCB).
- Verify fuse **F6** of the Slave PCB.

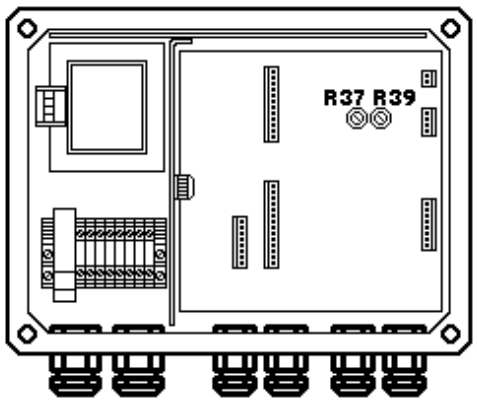


FIGURE 46 – PCB POTENTIOMETERS LOCATIONS

3.5 REMOVE/INSTALL POWER SUPPLY BOX SUBASSEMBLIES

3.5.1 Remove/install an Electronic PCB

Remove

1. Open the power supply box.
2. Disconnect all the cable from the connectors of the PCB (**J1**, **J2**, **J3**, **J4**, **J5**, **J6**).
3. Remove the 2 fuses **FUS 1** and **FUS 2** from the power supply block (for easy extraction of the PCB).
4. Unscrew and remove the 6 PCB fixing screws.
5. Remove the PCB.

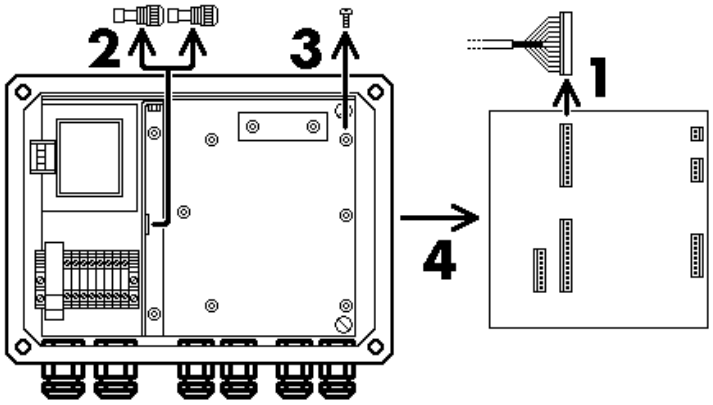


FIGURE 47 – ELECTRONIC PCB

Install

1. Place a PCB in the power supply box.
2. Place and fasten the 6 PCB fixing screws.
3. Place the 2 fuses **FUS 1** and **FUS 2** in the power supply block.
4. Connect all the cable on the connectors of the PCB (**J1**, **J2**, **J3**, **J4**, **J5**, **J6**).
   When installing a new PCB, re-adjust the torque of the step motor.
   a. Switch on the power supply of the SAGA system.
   b. Increase the torque of step motor turning the potentiometer R39 slowly clockwise until a good result is obtained.
      ***Note**: Do not turn the potentiometer too far*.
   c. Switch off the power supply of the SAGA system.
5. Close the power supply box.

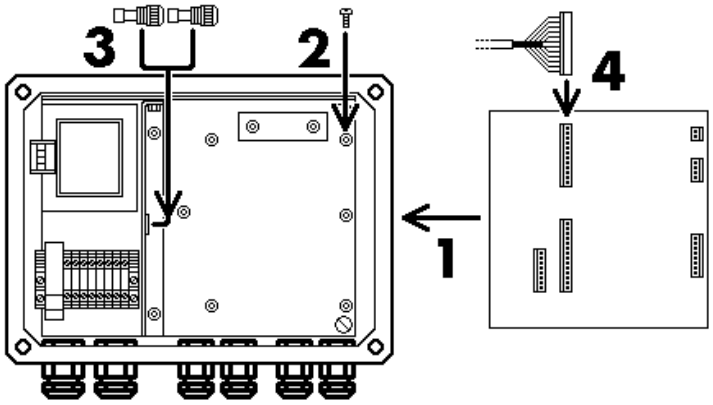


FIGURE 48 – ELECTRONIC PCB INSTALLATION

3.5.2 Remove/install a power supply block

Remove

1. Remove the electronic PCB**,** see 3.4.2.1 on page 36.
2. Disconnect all wires connected on the main terminal of the power supply block.
3. Unfasten and remove the three power supply fixing screws.
4. Remove the power supply block from the power supply box.

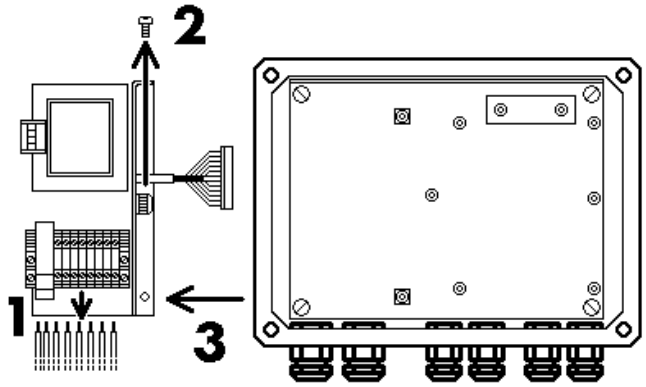


FIGURE 49 – POWER SUPPLY BLOCK REMOVAL

Install

1. Place the power supply block in the power supply box.
2. Place and fasten the 3 power supply block fixing screws.
3. Install the electronic PCB in the power supply box.
4. Reconnect all the wires on the main terminal of the power supply block using the Installation instructions.

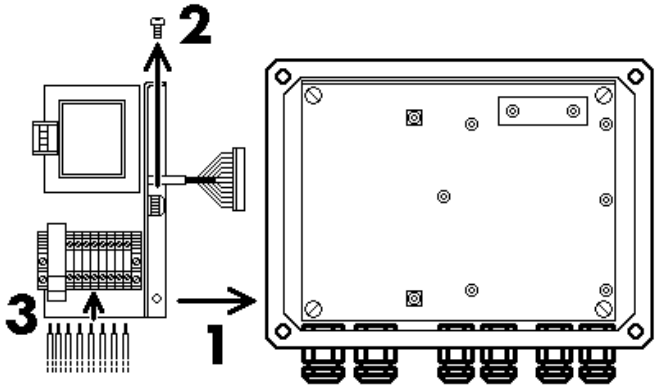


FIGURE 50 – POWER SUPPLY BLOCK INSTALLATION

3.5.3 Remove/install a mounting plate

Remove

1. Remove the electronic PCB.
2. Remove the power supply block.
3. Unfasten and remove the 4 mounting plate fixing screws.
4. Remove the mounting plate from the power supply box.

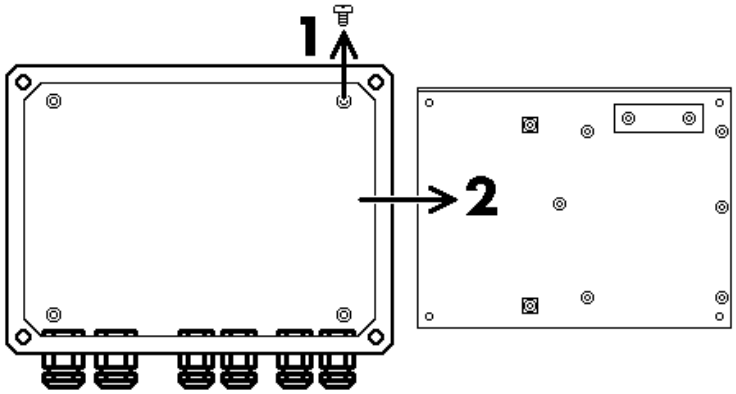


FIGURE 51 – MOUNTING PLATE REMOVAL

Install

1. Place the mounting plate on the power supply box.
2. Place and fasten the 4 mounting plate fixing screws.
3. Install the power supply block in the power supply box.
4. Install the electronic PCB in the power supply box.

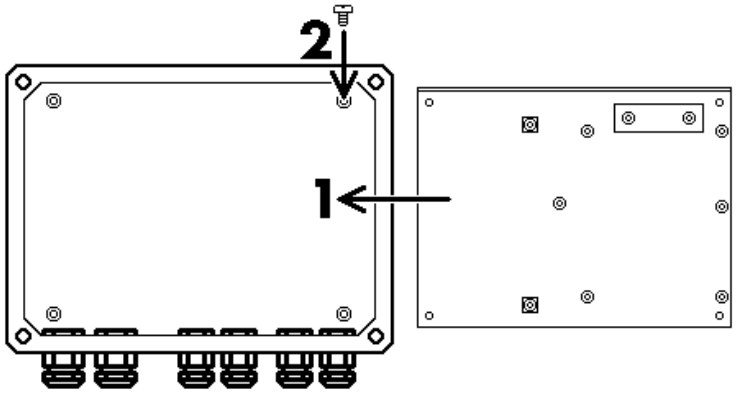


FIGURE 52 – MOUNTING PLATE INSTALLATION

3.5.4 Remove/install a heating resistor

Remove

1. Remove the electronic PCB.
2. Remove the power supply block.
3. Remove the power mounting plate.
4. Unfasten and remove the 2 heating resistor fixing screws.
5. Remove the heating resistor protection plate.
6. Remove the heating resistor.

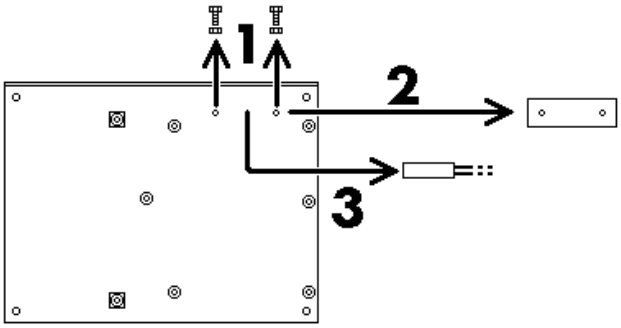


FIGURE 53 – HEATING RESISTOR REMOVAL

Install

1. Place the heating resistor in position.
2. Place the protection plate on the heating resistor.
3. Place and fasten the 2 heating resistor fixing screws.
4. Install the mounting plate in the power supply box.
5. Install the power supply block in the power supply box.
6. Install the electronic PCB in the power supply box.

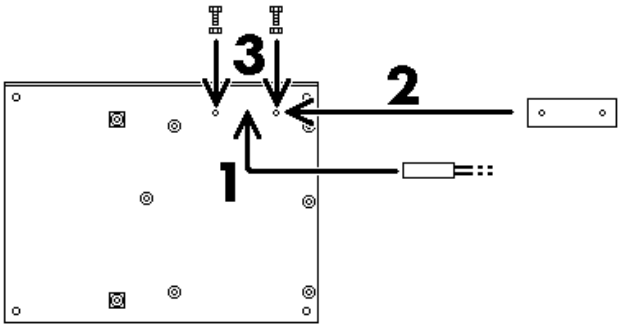


FIGURE 54 – HEATING RESISTOR INSTALLATION

3.6 REMOVE/INSTALL OPTICAL HEAD SUBASSEMBLIES

3.6.1 Remove/install a position sensor

Remove

1. Open the optical head.
2. Open the power supply box.
3. Configure the Master power supply box in mode «Setting on reference position 0».
4. Switch on the power supply of the SAGA system.

   ***Note**: Successively, the mirrors of the two optical heads turn to and find their reference position 0 (marker of the mirror just over the position sensor) and remain on it.*
5. Switch off the power supply of the SAGA system.
6. Disconnect the three wire of the sensor from the main terminal of the optical head.
7. Remove the sensor from its support using an open end wrench, 7 mm.

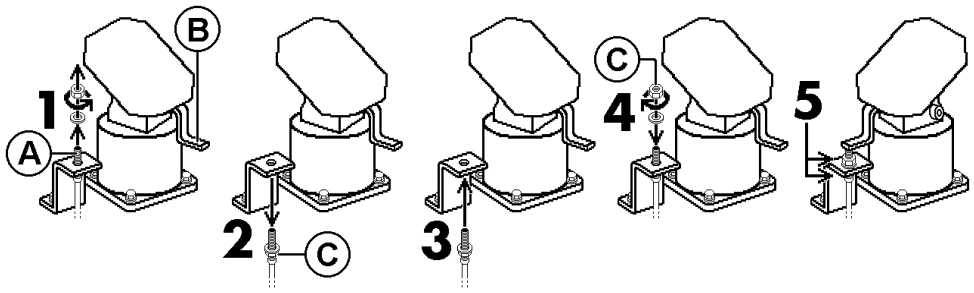


FIGURE 55 – POSITION SENSOR REMOVAL/INSTALLATION

Install

1. Place a new sensor on the support. Adjust the height of the sensor for the top of the sensor (**A**) to be as near as possible from the position maker of the mirror (**B**) adjusting the two screws of sensor (**C**). Use an open end wrench of 7 mm.
2. ***Note**: The distance between the mirror position maker and the top of the position sensor must be bigger than 0.1 mm and lower than 0.3 mm.*
3. Connect the three wires of the sensor on the main terminal of optical head.
   - Connect the brown wire on connector no. 6.
   - Connect the black wire on connector no. 7.
   - Connect the Blue wire on connector no. 8.
4. Re-adjust the alignment of the rotating subassemblies of the optical head, see 3.5 Mechanical adjustment on the optical head on page 44.
5. Close the optical head.
6. Close the power supply box.

3.6.2 Remove/install a mirror block

Remove

1. Open the optical head.
2. Open the power supply box.
3. Configure the Master power supply box in mode «Setting on reference position 0».
4. Switch on the power supply of the SAGA system.
   ***Note**: Successively, the mirrors of the two optical head turn to and find their reference position 0 (= Marker of the mirror just over the position sensor) and remain on it.*
5. Switch off the power supply of the SAGA system.
6. Unfasten (but do not remove) the fixing screw of the mirror block (**B**) (use a 5 mm Allen key).
7. Remove the mirror block.

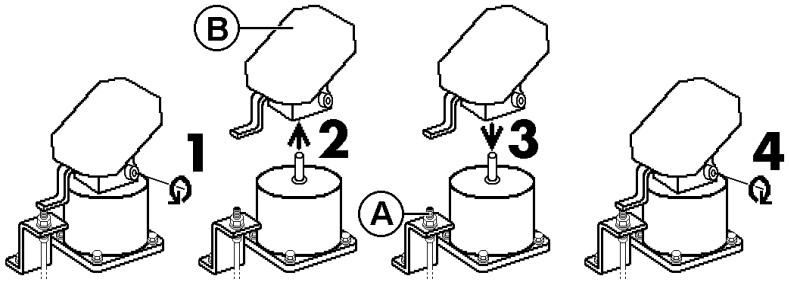


FIGURE 56 – MIRROR BLOCK REMOVAL/INSTALLATION

Install

1. Place a new mirror block of the motor axis. Adjust the height of the mirror block for the top of the sensor (**A**) to be as near as possible from the position maker of the mirror. Use a 7 mm open end wrench.
   ***Note**: The distance between the mirror position maker and the top of the position sensor must be greater than 0.1 mm and less than 0.3 mm.*
2. Fasten the mirror on the motor axis = Fasten the fixing screw.
3. Re-adjust the alignment of the rotating subassemblies of the optical head.
4. Close the optical head.
5. Close the power supply box.

3.6.3 Remove/install a step motor

Remove

1. Open the optical head.
2. Disconnect the wires of the step motor from the main terminal of the optical head.
3. Unfasten and remove the four fixing screws (**C**) of the motor / sensor fixing plate (**A**).
4. Remove the motor/sensor fixing plate from its leg adaptor (**B**).
5. Unfasten the gear fixing screw using a 3 mm Allen key.
6. Remove the gear from motor axis.

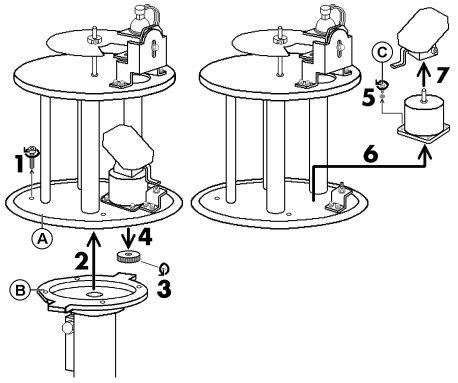


FIGURE 57 – STEP MOTOR REMOVAL

7. Unfasten and remove the four motor fixing screws using a 7 mm angled socket wrench.
8. Remove the motor from its fixing plate.
9. Remove the mirror block from the motor.

Install

1. Install the mirror block on the axis of the new motor.
2. Replace the new motor on its support plate.
3. Place and fasten the four motor fixing screws.
4. Replace the gear on the motor axis. Put the flat part of the axis in front of the gear fixing screw.
5. Fasten the gear fixing screw.
6. Place and fasten the four motor fixing screws.

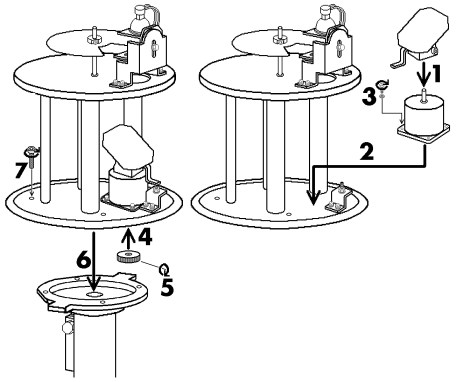


FIGURE 58 – STEP MOTOR INSTALLATION

***Note**: Be careful not to have a hard point on the rotating subassembly rotation.*

7. Install the motor/sensor fixing plate on its leg adaptor.
8. Place and fasten the four the four fixing screws of the motor/sensor fixing plate.
9. Adjust the height of the sensor for the top of the sensor (**A**) to be as near as possible from the position maker of the mirror. Use an open end wrench of 7 mm. Adjust using the two screws of the sensor.
10. Reconnect the wire of the motor on the optical head main terminal as follows:
    - Connect the Red wire on the connector no. 1.
    - Connect the Red/ White wire on the connector no. 2.
    - Connect the Green/ White wire on the connector no. 3.
    - Connect the Green wire on the connector no. 4.

    ***Note**: The white and the black wires of the motor are not in use*.
11. Readjust the alignment of the rotating subassembly of the optical head.
12. Close the optical head.
13. Close the power supply box.

3.6.4 Remove/install a shutter

Remove

1. Open the optical head.
2. Disconnect the lamp terminal from the lamp.
3. Unfasten and remove the four fixing screws (**B**) of the lamp support (**A**) (use a large flat screwdriver).
4. Remove the lamp support.
5. Loosen but do not remove the fixing screws of the shutter (**C**). Use a 3 mm Allen key.
6. Remove the shutter from its axis.

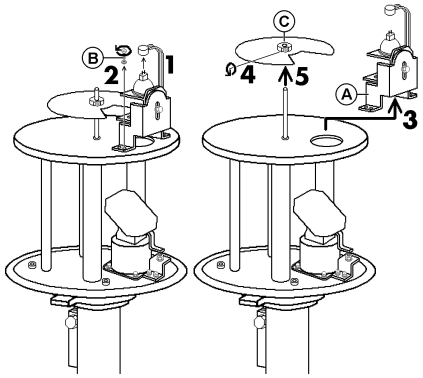


FIGURE 59 – SHUTTER REMOVAL/INSTALLATION

Install

1. Install a new shutter on the axis.
2. Install the lamp support.
3. Place and fasten the four fixing screws of the lamp support.
4. Set the shutter at mid distance between the lamp and the diaphragm.
5. Readjust the alignment of the rotating subassembly of the optical head.
6. Lock the shutter on its axis. Fasten the shutter fixing screw.
7. Close the optical head.
8. Close the power supply box.

3.7 MECHANICAL ADJUSTMENT ON THE OPTICAL HEAD

The precision of the system depends on the quality of the mechanical adjustments of the optical part of the optical head. This alignment is a factory operation at the end of the production process of a SAGA system.

***Note**: It is recommended for a skilled operator only to make adjustments on site, if one of the optical components of the rotating subassembly has been moved or removed.*

3.7.1 Alignment of the rotating subassembly of the optical head

This operation consists of aligning the optical components of the optical head (mirror and shutter) with the mechanical components (motor and sensor). This adjustment is very important to obtain good synchronisation between the light beams of the two units.
As previously stated this alignment is a factory operation at the end of the production of a SAGA system. However, if required, it can also be done on site by a skilled operator, if one of the optical components of the rotating subassembly has been moved or removed, using the following process:

Align the rotating assembly of the optical head

1. Open the optical head.
2. Open the power supply box.
3. Set the micro-switch **S1** of the Master PCB to position **A** (setting the motor to reference position **0**).
4. Power on the SAGA system.
   ***Note:** Successively, the mirrors of the two optical heads turn to reach the motor reference position 0 (= mirror reference marker over the position sensor) and remain on it.*

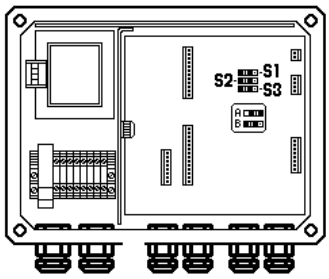


FIGURE 60 – MICRO SWITCHES

5. Adjust the position of the mirror in order to have the mirror reference marker just over the position sensor (see 2.7.3 Commissioning on page 22). The distance between the mirror reference marker and the top of the sensor must be greater than 0.1 mm and less than 0.3 mm.
   ***Note:** When the adjustment is sufficient, LEDs **D28** and **D37** of the Master PCB and **D40** of the Slave PCB must be on.*

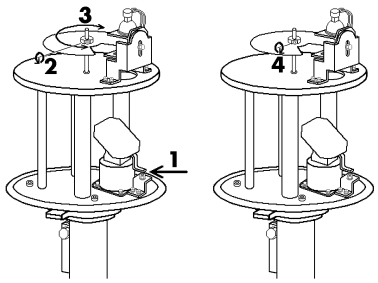


FIGURE 61 – MIRROR POSITION

6. Unfasten but do not remove the shutter fixing screws (**C**) using a 3 mm Allen key.
   ***Note**: Perform steps 1 to 6 again for the second optical head.*
7. Turn the shutter until its window is centred over the lens.
8. Fasten the shutter fixing screw.
9. Switch off the power supply to the SAGA system.
10. Set the micro-switch **S1** of the Master PCB to **position B** (= Normal).
11. Switch on the power supply of the SAGA system.
    ***Note:** If no default is detected, the system starts and works normally.*
12. Switch off the power supply of the SAGA system.
13. Close the optical head.
14. Close the power supply box.

3.7.2 Adjustment of the optical components

This operation consists of setting the long distance «Focus» of the optical subassembly of the optical head: The lamp, the diaphragm and the lens. This operation must be done if one of these three components are moved or removed.

This adjustment made in the factory at the end of the production process of a SAGA system.

***Note**: It is recommended for a skilled operator only to set the long distance focus on site, if one of the optical components of the rotating subassembly has been moved or removed.*

1. Install the SAGA system in a large dark room at 10 m from a wall.
2. Open the optical head.
3. Open the power supply box.
4. Set the micro-switch **S1** (see Figure 60 – Micro switches) of the Master PCB to **position A** (= Setting on the motor reference position 0).
5. Power on the SAGA system.
   ***Note:** Successively, the mirrors of the two optical heads turn to reach the motor reference position 0 (= mirror reference marker over the position sensor) and remain on it.*
6. Check that the alignment, of the components of the rotating subassembly, is effective. If not, re-alignment is required.
7. Align the two optical heads to the two beams projected at 10 m on the wall.

3.7.3 Focus of the optical subassembly

1. Loosen slightly, do not remove, the fixing screw (**C**) of the mobile part (**B**) of the lamp support (**A**).
2. Move the focus vertically up or down on the mobile part of the lamp support.
   ***Note**: The rectangular window seen on the wall must have clear and sharp edges.*
3. Fasten the fixing screw of the mobile part of the lamp support.

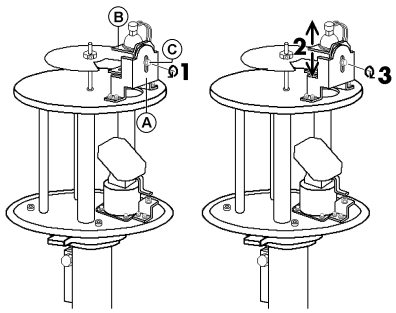


FIGURE 62 – FOCUS

3.7.4 Alignment of the diaphragm

1. Install the SAGA setting tool on the optical head (see the Installation instructions).
2. Loosen slightly, do not remove, the two fixing screws (**E**) of the diaphragm (**D**) slightly.
3. Move the diaphragm on its support until:

- a window appears on the wall as vertical as possible.
- the middle of the window is aligned with the vertical bar of the sight telescope of the SAGA setting tool.

4. Fasten the two fixing screws of the diaphragm.

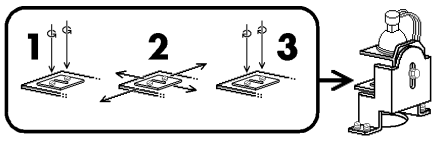


FIGURE 63 – DIAPHRAGM

3.7.5 Verification of the SAGA system

1. Align on the wall the window of the two SAGA units.
2. Switch off the power supply of the SAGA system.
3. Set the micro-switch **S1** of the Master PCB to **position B** (= Normal).
4. Power on the SAGA system.

Note: *If no default is detected the SAGA system starts to work normally.*

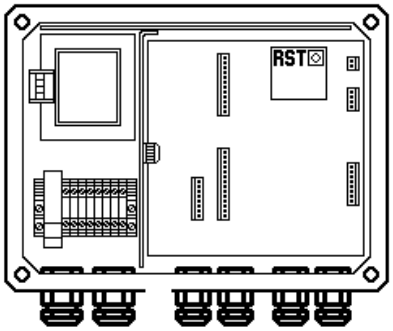
5. From the wall where the light window is shown, move, with back to the wall, to verify if the light coding SAGA system is correct.
6. Close the optical head.
7. Close the power supply box.

3.8 RESET THE SAGA SYSTEM

A SAGA system, stopped on default detection, is restarted by resetting from its microprocessor.

Resetting a SAGA system is possible as follows:

- Power off and then power on of the SAGA system or
- Press the **RST** key on the microprocessor PCB mounted on the Master PCB.

Reset using the RST key	
1. Open the master power supply box. 2. Press on the **RST** key. 3. Close the master power supply box. ***Note****: A local reset using the RST key simplifies operations when working directly with SAGA system units.*	 FIGURE 64 – RST KEY

3.9 NORMAL MAINTENANCE OPERATIONS ON A SAGA SYSTEM

The optical quality of the system is closely linked to the cleanliness of system sub-assemblies.

It is recommended to clean SAGA equipment:

- periodically (a fixed period as required by operations) or
- after abnormal weather conditions (storm, sand wind and so on)

Cleaning is recommended as follows:

1. Clean external parts with a wet sponge and a dry cotton duster (glass, optical head, command box).
2. Clean the internal parts of the optical head:
    a. Open the optical head.
    b. Clean the dust inside the optical head with a dry duster, especially the mirror and the lens.
    c. If necessary, oil the metal axel of the motor and the shutter.
    d. Check the shape of the glass gasket and clean, if necessary.
    e. Check the equipment adjustment.
    f. Close the optical head.
3. Verify the horizontal alignment of the two units of the SAGA system (see Installation instructions).

4. SUPPORT

4.1 SAFEGATE GROUP WEBSITE

The Safegate Group Website, www.safegate.com, offers information regarding our airport solutions, products, company, news, links, downloads, references, contacts and more.
***Note**: There is also a **Client/Partner login** area for the latest information and updates, if available.*

4.2 RE-CYCLING

4.2.1 Local Authority Re-cycling

The disposal of Safegate Group products is to be made at an applicable collection point for the recycling of electrical and electronic equipment. The correct disposal of equipment prevents any potential negative consequences for the environment and human health, which could otherwise be caused by inappropriate waste handling. The recycling of materials helps to conserve natural resources. For more detailed information about recycling of products, contact your local authority city office.

4.2.2 Safegate Group Re-cycling

Safegate Group is fully committed to environmentally-conscious manufacturing with strict monitoring of our own processes as well as supplier components and sub-contractor operations. Safegate Group offers a re-cycling program for our products to all customers worldwide, whether or not the products were sold within the EU.

Safegate Group products and/or specific electrical and electronic component parts which are fully removed/separated from any customer equipment and returned will be accepted for our recycling program.

All items returned must be clearly labelled as follows:

- For ROHS/WEEE Re-cycling
- Sender contact information (Name, Business Address, Phone number).
- Main Unit Serial Number.

Safegate Group will continue to monitor and update according for any future requirements for EU directives as and when EU member states implement new regulations and or amendments. It is our aim to maintain our compliance plan and assist our customers.
***Note**: For more information, see www.safegate.com, or contact Safegate Group Support via email at support@safegate.com or phone +46 40 699 1740.*

4.3 SPARE PARTS

Spare parts are available for Airfield Lighting. For more information see the Spare Parts List document.

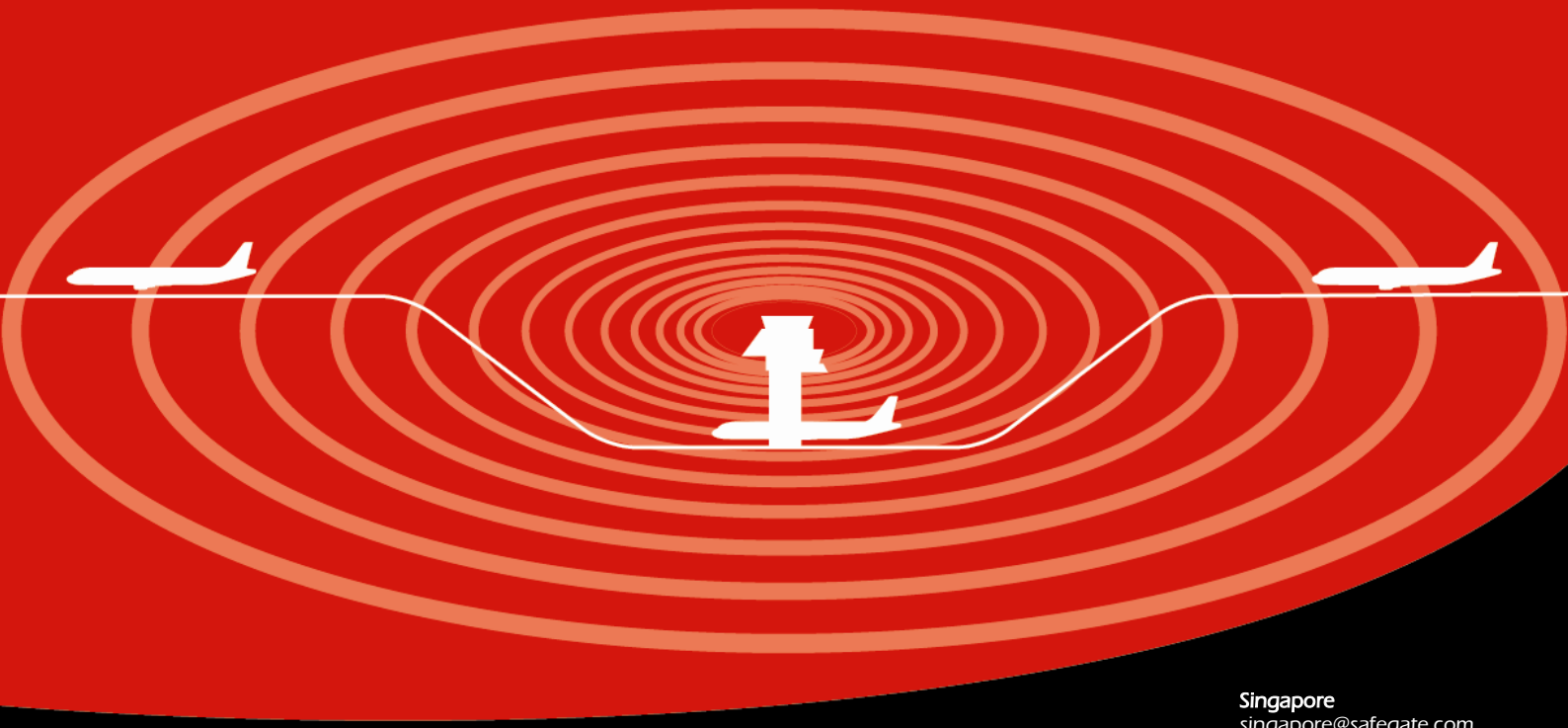
***Note**: Contact Safegate Group for assistance with ordering spare parts.*

***Note**: This page is blank for convenient double-sided printing.*

Check in to the future

How many aircraft can your airport handle today?
Can this number be increased without adverse effects on the airport's safety level?
It is a known fact that traffic volume will rise in the foreseeable future. More movements will demand monitoring of the entire airport. Requirements will be sharpened and the development of an integrated system controlling not only ground movements but also air traffic close to the airport is of the highest interest.
The International Civil Aviation Organization (ICAO) already describes A-SMGCS, Advanced Surface Movement Guidance and Control System, as the answer to the future modern airport need to control the entire airport space in one superior system.

To a larger extent than today's systems, A-SMGCS will rely on automated processes to give both pilots and traffic controllers exact information about positions and directions. Safegate Group delivers complete A-SMGCS solutions already, as well as all vital parts relating to it.
Safegate Group can check your airport into the future – today!



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THORN Airfield Lighting IDMAN

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Safegate Group offers solutions for increased safety, efficiency and environmental benefits to airports around the world. The company was founded in 1973 and has its headquarters in Malmö, Sweden. Safegate Group has over 70 partners around the globe in order to be close to its customers. The latest members of Safegate Group, Thorn AFL and Idman, have both over 40 years of experience in airfield lighting solutions for airports and heliports worldwide. Safegate Group´s complete range of products and services, a "one-stop shop", provides solutions to customers and airborne travellers around the globe.

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