



Date : 30/08/2024  
Our offer : Offer D9999 Rev.B  
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### **3 Vaults equipped with S7-1500 PLC Siemens**



Version	Date	Observations
B	30/08/2024	Change PLC to Siemens
A	27/08/2024	Initial offer

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## SUMMARY OF REVISIONS

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Description of the modification	Link
Initial offer	Version A
Change the Schneider's PLC to Siemens's PLC	Version B

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**SUMMARY**

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# 1. COMPANY PROFILE AUTOMATIQUE INDUSTRIE

[www.aifrance.com](http://www.aifrance.com)

## 1.1 MAIN SERVICES

### Main Services



#### System Integrator

- Development/integration plans
- Functional design work
- Design/Modeling
- Studies/Development work
- Installation on site
- On-site implementation and start-up



#### Consulting

- Preliminary and feasibility studies
- Master plans
- Project specifications
- Technical directives
- Validation of technological scenarios
- Audit



#### Solution Development

- Technical Assistance
- Co-development
- Benchmark
- Functional analysis
- Project Management



#### Training

- Software training
- Operators training
- Skill transfer



#### Support

- Maintenance contract- support
- Outsourcing support
- Contracting support
- Technical assessments
- Project management assistance



AUTOMATIQUE ET INDUSTRIE is based on an experience of over 30 years in the field of automation, supervision and Computer Engineering. Based near Grenoble and Lyon, the company now is one of the French Leading Company.

The activity of the company focuses on three service offerings:

- The Consultancy,
- The Service
- The System Integration.

With the trust of our customers, our high-skilled team of engineers and technicians has growing fast and acquired huge and wide knowledge in the four following main areas of activity:

- Control of industrial processes,
- Energy & Building Management
- Energy Efficiency
- Airport.

Through Quality Processes / Strict Project Management, a research and development team, we wish respectively:

guarantee the satisfaction of our customers throughout our support for us up in the sustainability of long term partnership collaboration

Offer simple and efficient increasingly innovative and smart solutions to provide maximum value to your applications

Suggest new ways of development for our customers, partners and employees.

The size of our company allows us to adapt to all types of organization and provide responsiveness, flexibility and transparency. A network of partnerships in peripheral businesses enables us to offer comprehensive turnkey solutions through a single source.

Our French and international achievements allow AI to have a return of experience in many areas.

Resolutely turned towards supporting its customers, based on human relationships preferred, AI has developed a sense of listening and a mode of operation for the success of projects entrusted.

## **1.2 GROWTH AND FINANCIAL HEALTH**

For the year 2018/2019 the Bank of France has granted us note 3G++, indicating excellent financial health of AI.

AI is now one of the largest independent companies in terms of numbers of automation and Industrial IT engineers in France. This strike force is a guarantee of responsiveness, reservoir of skills and knowledge and reliable back office to our customers and our employees.

This force also highlights our ability to mobilize our team to be able to respond with speed to the expectations of our customers, but also to deal with any contingency.

AI profitable growth for many years is a guarantee of sustainability of our society and therefore the sustainability of the relationship with our customers, the follow-up of the developed applications, the constant improve of our solutions and a proper maintenance.

## **1.3 TECHNOLOGICAL WATCH, MANUFACTURER WATCH**

Many project managers are assigned the task of technological watch on the respective solutions of one or two main leading manufacturers in the field of automation and industrial IT. The goal is to keep in touch with frequent changes of scales, software features, solutions and hardware architectures to provide simple solutions, maintainable and sustainable.

And if you do need to remember one thing, we'd like whether our values that made a lot of new customers joined us and express confidence in the sustainability of our relations. This justifies the growth of AI for years.

These values are:

- Team spirit,
- Creativity is individual, the collective success.
- Anticipation,
- The organizational innovation.
- Reactivity,
- The respect of his liabilities
- The Exemplary,

- Trust, commitment.
- Transparency
- The Information.

## 1.4 MEMBERSHIP AND RESEARCH AND DEVELOPMENT

### 1.4.1 Tenerrdis

The Cluster Tenerrdis focuses on finding solutions to crucial challenges in the areas of energy production, storage, and management by supporting innovation in six new energy technology industries.

As a member of Tenerrdis, we are mainly focuses on:

[Solar energy](#)

[Energy-efficient buildings](#)

[Hydropower](#)

[Smart grids and storage](#)

### 1.4.2 Minalogic

The Cluster Minalogic has staked out a position as global leader in intelligent miniaturized solutions -a unique hybrid of micro- and nano-technologies and software- from fundamental research to technology transfer in infrastructure and industry.

AI is working in partnership with some of Minalogic members in the industry sector.

### 1.4.3 ADEME International

The ADEME International belongs to the French Environment and Energy Management Agency under the joint authority of the Ministry for Ecology, Sustainable Development and Energy and the Ministry for Higher Education and Research

We are involved in an environmental approach both internally and in the solutions we offer.

As a member of ADEME International we are focused on:

- [Solar energy](#)
- Renewable Energies
- [Energy-efficient buildings](#)
- Energy efficiency in the Industry
- Energy management



Years ago, the AI board of Directors decided to enhance the knowledge and the capability of the company in launching a Research and Development Department.

This Department is working in French and European Program in partnership with laboratories, universities and Expert companies.

We list here-after some of our partnership with well-known and expert authorities. Because of some clause of confidentiality, we cannot describe in details the subject of our Research.

#### 1.4.4 CEA

The CEA is the French Alternative Energies and Atomic Energy Commission

Within the CEA, our R&D team is working with the CEA Laboratory of Electronics and Information Technologies (LETI).



#### 1.4.5 CNRS

The CNRS (National Center of Scientific Research and Development) is the main public institute in France in terms of R&D

The AI team participates with them in a French program with the main purpose of optimization of the datas minimizing the number of captors on site.



#### 1.4.6 LIRIS

Main discipline Information Science and Technology (IST).

IST is concerned about information (data) processing. These information come from several sensors (cameras, scanners, networks sensors) or data digitized from different kinds of documents.



The AI team works with the LIRIS Lab, researchers in processing and modeling of the datas com from several type of sensors and captors with the aim to optimize the efficiency of the data in the Industries and Infrastructure such as "Business Object".



## 2. GENERALITIES

### 2.1 SUBJECT

This document defines the hardware and software architecture of the Airfield Ground Lighting Remote control and monitoring system as well as the basic functionality of the system for CHISINAU airport with Three vaults, with Siemens S7-1500 PLCs and with singlemode FO link between the sub-stations and the three control computers and one Runway.

This offer is available only with :

- 39x new communicating CCRs in Modbus TCP communication.
- 24x old CCRs in wire to wire

#### Important:

This technical offer can be subjected to modifications in terms of materials after the reception of complementary documents or/ and in the future modification and extension on site (such as a second runway, addressable system...).

This document defines:

- The configuration and functionality of the Airfield Ground Lighting control system;
- The functionality of the Fault Monitoring System;
- The physical links between different equipment.

We retain the right to adjust our technical specifications to face site existing situation.

### 2.2 TARGET OF THE CONTROL SYSTEM

The system is proposing the followings advantages for the Airport Operation and Maintenance Staff:

- Fast action, less than 1 second for command transmission.
- Industrial solution already well experienced.
- Open solution easy to upgrade or modify for future need
- All components “from the shelf”, available in spare-parts anywhere in the world, for at least 10 years after commissioning
- Standard solution for several airports
- Guarantee of no airfield lighting black-out caused by the remote control system.

### **2.3 COMPLIANT / NOT COMPLIANT**

- All documents will be submitted to the client engineer to receive agreement before manufacturing.

### **2.4 NOT INCLUDED IN OUR OFFER**

The following are not included in our offer:

- Cables ,
- Wiring all equipment on site
- Desks or Installation of PC in desks
- Any installation on site

### 3. GENERAL DESCRIPTION

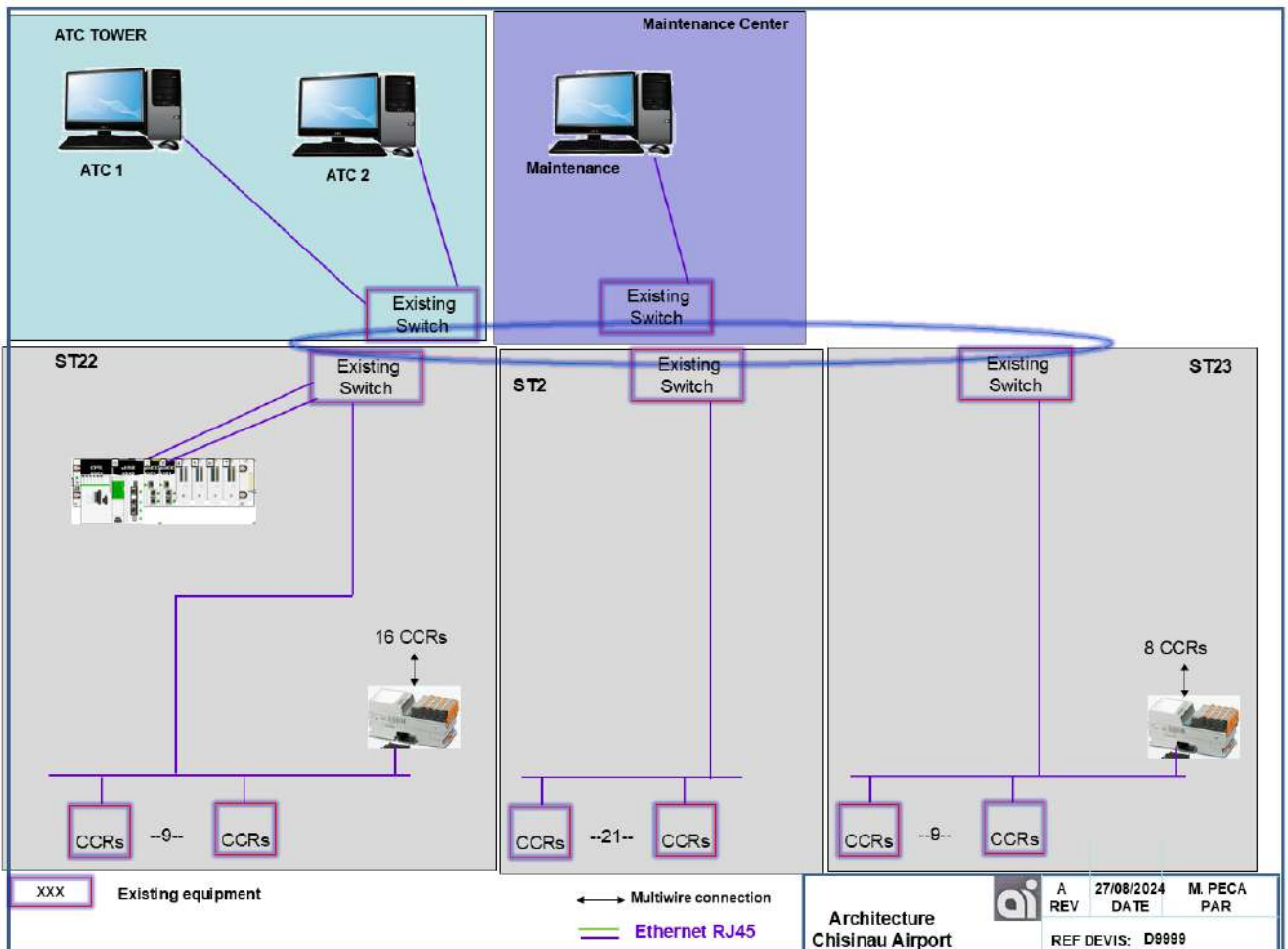
#### 3.1 PROJECT ARCHITECTURE

The control system is designed to control and monitor all equipment used for this project:

This version is based on Siemens PLC, and one (1) single mode FO loop architecture to monitor and/or monitor.

- 39xCCRs (**Modbus TCP IP ports**)
- 24 x old CCRs **with wire to wire**

##### 3.1.1 Architecture Description



The system is organised around the following locations:

- One ATC Tower

- 3 Sub-stations (CCR room)
- 1 maintenance center

The architecture of the AGL will be composed with:

- Two touch-screen PC in the ATC tower
- A screen PC maintenance in each the sub station

Security of the system.

The system is still operating in case of:

- Shut-down of the PC in the tower: The other PC ( Tower PC, Maintenance PC in each substation are equipped with the same application will take the hand).
- failure by broken loop : still operating
- Failure of PLC in a sub-station: CCR remains in same status as previously.

## **3.2 ATC TOWER**

### **3.2.1 Tower PC with touch-screen**

HP Prodesk– Micro-tour or similar

- Intel Core i3
- RAM 4 Go
- Hard Disk 1 x 250 Go SSD
- Windows 11



We provide 2 computers in the tower.

### 3.2.2 SCADA

The SCADA supervision software is:

- PCVUE last version © Software:
- The provided licences for the project is :
  - 1 run-time client license, 5000 variables
  - 1 server licence, 5000 variables
  - Modbus TCP protocol
- Application Software



### 3.2.3 Screen

The PC is equipped with a 22-inch touch-screen TFT extra-flat monitor type 2201 22" LCD Desktop Touch monitor or similar.

The touch-screen works with an acoustic surface wave system (according to last FAA specifications)



We provide 2 touch screen in the tower.

### 3.2.4 Switch

We used the existing switch.

## 3.3 MAINTENANCE CENTER

### 3.3.1 Maintenance PC with non touch-screen

HP Prodesk– Micro-tour or similar

- Intel Core i3
- RAM 4 Go
- Hard Disk 1 x 250 Go SSD
- Windows 11



We provide 1 computer in the maintenance center.

### 3.3.2 SCADA

The SCADA supervision software is:

- PCVUE last version © Software:
- The provided licences for the project is :
  - 1 server licence, 5000 variables
  - Modbus TCP protocol
- Application Software



### 3.3.3 Screen

The PC is equipped with a 22-inch non touch-screen TFT extra-flat monitor type 2201 22" LCD Desktop monitor or similar.

We provide 1 non touch screen in the maintenance center.



### 3.3.4 Switch

We used the existing switch.

## 3.4 SUB-STATION N°22

In the sub-station, the followings are located:

- 1 PLC in cabinet.

The equipment is sized to control:

- Up to 53 CCRs – communication Modbus TCP
- Miscellaneous: check inputs / outputs list

### 3.4.1 PLC Cabinet

The cabinet includes: **(PLC is include in our offer)**

- 1 PLC model type S7-1500 from Siemens
- One Ethernet coupler
- One remote I/O
  - One Ethernet card
  - 8x 16 outputs channel
  - 8x 16 inputs channel
- 1 power supply 220/24Vdc
- circuits breakers for circuits protection
- Accessories for installing, wiring, connecting, and laying

#### 3.4.1.1 Particularities

The PLC cabinet is to be power-supplied with 1 normal supply, provided by the site.

The PLC are equipped with 24VDC power-supplies:

A special communication cable is connected from the PLC, to each serial communicating CCR, Modbus -TCP, (cables not provided by A.I).

The free-standing cabinet is a 19" standard. It includes redundant power-supplies, protections, PLC, terminal boards. The dimension can be increase or decrease after the electrical studies.

Cables to CCR are not provided.

### 3.4.2 Switch

We used the existing switch.

### 3.4.3 Remote I/O module for old CCRs

This remote I/O modules will be provided to monitor and control some equipment.

We will provide a Remote I/O type WAGO or similar with

- One Ethernet card
- 8x 16 outputs channel
- 8x 16 inputs channel



This remote I/O will have an Ethernet port to be in connection with the FO Switch.

### 3.5 SUB-STATION 2

#### 3.5.1 Switch

We used the existing switch.

### 3.6 SUB-STATION N°23

In the sub-station, the followings are located:

- 1 Remote I/O in cabinet.

#### 3.6.1 Remote I/O Cabinet

The cabinet includes:

- One remote I/O
  - One Ethernet card
  - 8x 16 outputs channel
  - 8x 16 inputs channel
- 1 power supply 220/24Vdc
- circuits breakers for circuits protection
- Accessories for installing, wiring, connecting, and laying

#### 3.6.2 Switch

We used the existing switch.

#### 3.6.3 Remote I/O module for old CCRs

This remote I/O modules will be provided to monitor and control some equipment.

We will provide a Remote I/O type WAGO or similar with

- One Ethernet card
- 8x 16 outputs channel
- 8x 16 inputs channel

This remote I/O will have an Ethernet port to be in connection with the FO Switch.





## 4. DESCRIPTION OF THE AGL CONTROL SYSTEM

All the following are just a proposal associated with the supply of PC : the final system is adjusted according to the client's specifications or requirements.

### 4.1 SOFTWARE

#### 4.1.1 PLC Software

The PLC software are manufactured by A&I with the Siemens PLC Software tool .

The software tool is provided if the client want to make by himself some improvements, or a more accurate diagnostic on PLC.

#### 4.1.2 Supervision

The supervision software is PCVIEW 32.

#### 4.1.3 Speed and Security of the Software

The delay between operator action and operational result is less than 1 seconds.

PLCs are delivered with all necessary files ready for proper operation. The final version of the software ( sources and code ) will be delivered on a CDROM /Disk after site commissioning.

**The equipment is delivered Virus free and no additional files or software shall be installed by the customer in the PC.**

#### 4.1.4 Control of the Rights

Several PCs can control the system at the same time. The actions allowed are defined respectively depending on users' profiles (described hereafter).

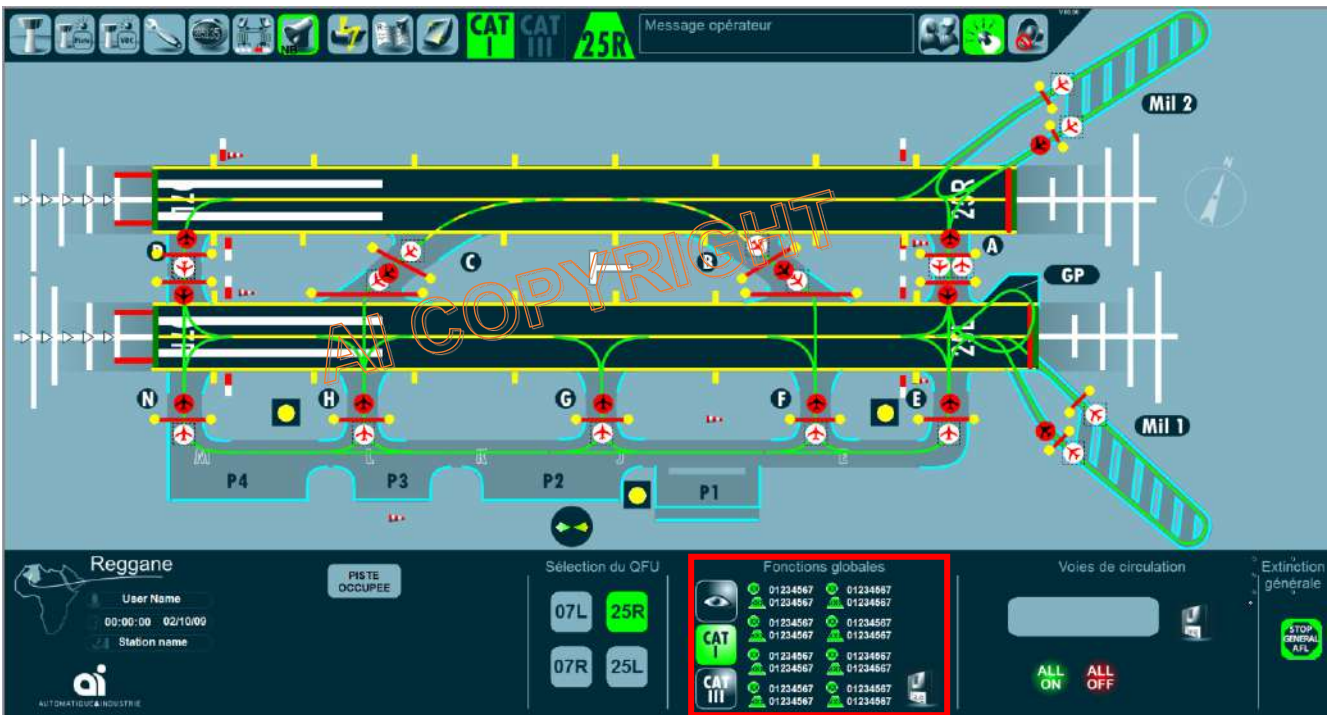
These views are not contractual.

4.1.4.1 Global view



To access this view, press “ ” button on the static view.

It allows the air-traffic controller to command the AGL according to the Airport configuration and to the meteorological conditions.



Global functions

**Global Functions**

The customized global functions permit an air-traffic controller, with just one button, to select a general configuration of airport ground lighting.

A controller can use a global function, but only the S-controller is allowed to customize and activate functions. The procedure is as follows (could be improved later):

Prepare a real lighting configuration in the manual view.

enter the login and the password reserved for supervising air-traffic-controller,

Then “memorize” button appear, press it

Window “Memorize Global Functions” appear

Enter a name for the function (12 characters maximum)

Check the activate button

Press “Save”

The global function is memorize and its name appear in the button



4.1.4.2 Manual view:



**Users and Passwords**


Each person authorized to use the system has a separate function with his own password. To access to software functions, each person has to key data, name and password.



**Messages**

On the Global view, there is a message box. The operator can use this box to leave a message to the next operator.

4.1.4.3 Maintenance view:

To  access this view, it is need to be logged as a maintenance people or super maintenance.  
Press “ ” button on the static view.

Access to this view is only given to the CM-technician and M-technicians.

They are allowed to control all the CCRs separately, to give information about the states of the equipment and to have access to detail view of each of them.

Specific information of each function is grouped in specific coloured screens on which all status are represented and can be easily observed



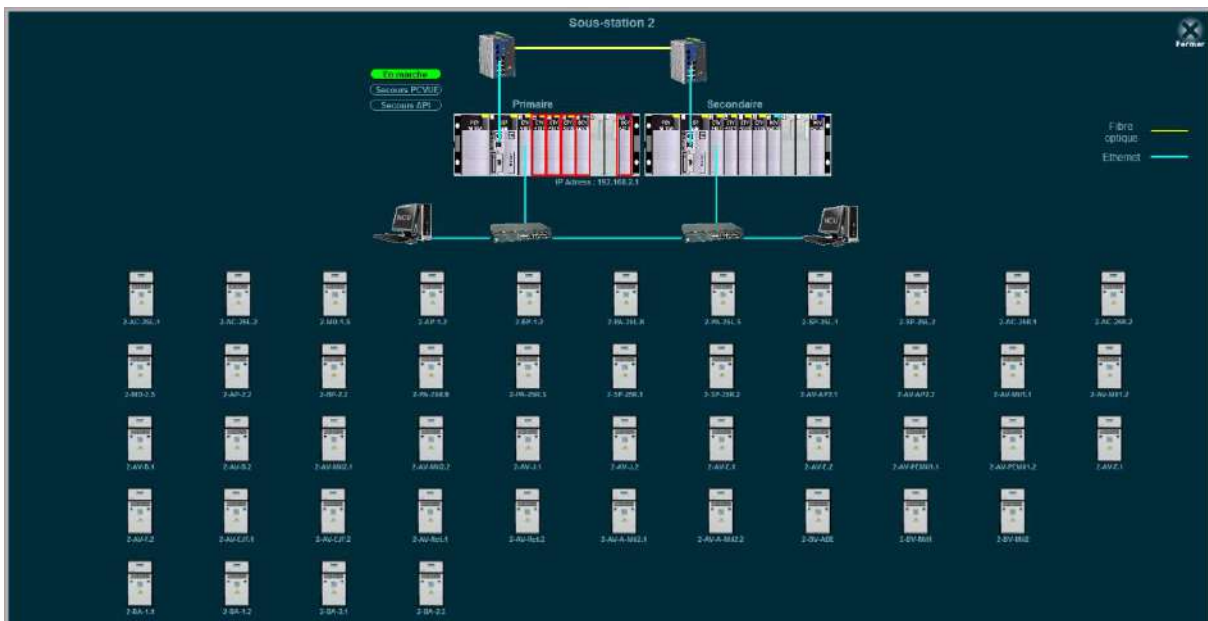
4.1.4.4 Detail CCRS View – AUGIER



4.1.4.5 Architecture view:

Access to this view is allowed only to the CM-technician and M-technicians.

This view gives the status of communications and PLCs on the installation.



4.1.4.6 Times View

Access to this view is allowed only to the CM-technician and M-technicians.

They are allowed to reset the functioning counters of all the CCRs

Reset all counters		Running time counters							Regulators Faults						
	NR ON	Time ON	Time B1	Time B2	Time B3	Time B4	Time B5	NB ON D	H ON D	NB BR D	H BR D	NB EL F	H EL F		
APPROACH 06 Loop 1	0	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	0	00:00:00	0	00:00:00	0	00:00:00		
APPROACH 06 Loop 2	1	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	0	00:00:00	0	00:00:00	0	00:00:00		
APPROACH 24 Loop 1	2	00:02:00	00:00:00	00:00:00	00:02:00	00:00:00	00:00:00	0	00:00:00	0	00:00:00	0	00:00:00		
APPROACH 24 Loop 2	2	00:02:00	00:00:00	00:00:00	00:02:00	00:00:00	00:00:00	0	00:00:00	0	00:00:00	0	00:00:00		
DIST.MARKER Loop 1	5	00:05:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	0	00:00:00	0	00:00:00	0	00:00:00		
DIST.MARKER Loop 2	5	00:10:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	0	00:00:00	0	00:00:00	0	00:00:00		
PAPI 06 Loop 1	3	00:03:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	0	00:00:00	0	00:00:00	0	00:00:00		
PAPI 06 Loop 2	3	00:03:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	0	00:00:00	0	00:00:00	0	00:00:00		
PAPI 24 Loop 1	2	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	0	00:00:00	0	00:00:00	0	00:00:00		
PAPI 24 Loop 2	2	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	0	00:00:00	0	00:00:00	0	00:00:00		
RUNWAY 06-24 Loop 1	8	01:06:00	00:22:00	00:00:00	02:42:00	00:00:00	00:00:00	0	00:00:00	0	00:00:00	0	00:00:00		
RUNWAY 06-24 Loop 2	8	01:06:00	00:22:00	00:00:00	02:42:00	00:00:00	00:00:00	0	00:00:00	0	00:00:00	0	00:00:00		
THRESHOLD 06 Loop 1	1	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	0	00:00:00	0	00:00:00	0	00:00:00		
THRESHOLD 06 Loop 2	1	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	00:00:00	0	00:00:00	0	00:00:00	0	00:00:00		
THRESHOLD 24 Loop 1	2	00:02:00	00:00:00	00:00:00	00:00:00	00:00:00	00:02:00	0	00:00:00	0	00:00:00	0	00:00:00		
THRESHOLD 24 Loop 2	2	00:02:00	00:00:00	00:00:00	00:00:00	00:00:00	00:02:00	0	00:00:00	0	00:00:00	0	00:00:00		
TAXIWAY Loop 1	4	00:04:00	00:00:00	00:00:00	00:00:00	00:00:00	00:04:00	0	00:00:00	0	00:00:00	0	00:00:00		
TAXIWAY Loop 2	15	01:39:00	01:02:00	00:00:00	01:25:00	00:00:00	02:43:00	6	01:57:00	6	01:57:00	85	00:14:00		
TXW Guidance Loop 1	4	00:04:00	00:00:00	00:00:00	00:00:00	00:00:00	00:04:00	0	00:00:00	0	00:00:00	0	00:00:00		
TXW Guidance Loop 2	4	00:04:00	00:00:00	00:00:00	00:00:00	00:00:00	00:04:00	0	00:00:00	0	00:00:00	0	00:00:00		
SFLS 06	3	00:03:00	00:01:00	00:00:00	00:01:00			0	00:00:00	0	00:00:00	0	00:00:00		
SFLS 24	2	00:02:00	00:00:00	00:00:00	00:02:00			0	00:00:00	0	00:00:00	0	00:00:00		

23/02/10 14:37:02 VR21R	RED L	+ FAULT	Discrepancy
23/02/10 14:37:02 VR21R	GREEN L	+ FAULT	Discrepancy
23/02/10 14:37:02 VR21R	SYSTEM	+ FAULT	Communication Switch HME623
23/02/10 14:37:02 VR21R	SYSTEM	+ FAULT	Communication Switch HME623

23/02/10

14:49:42

aet

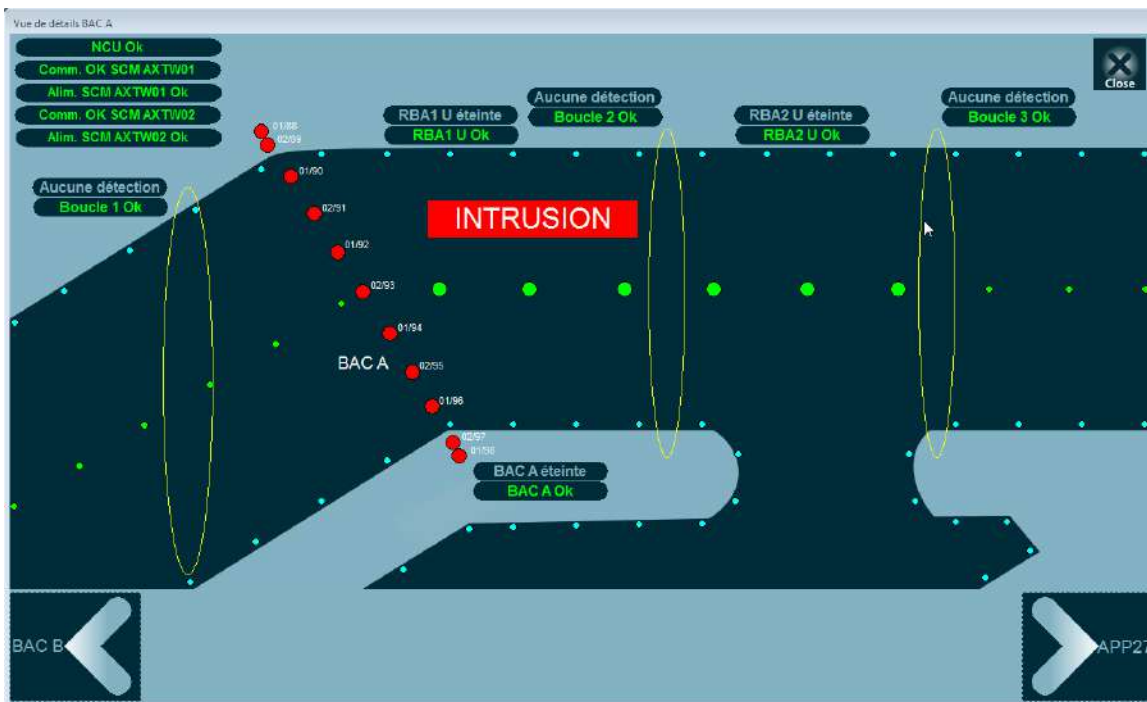
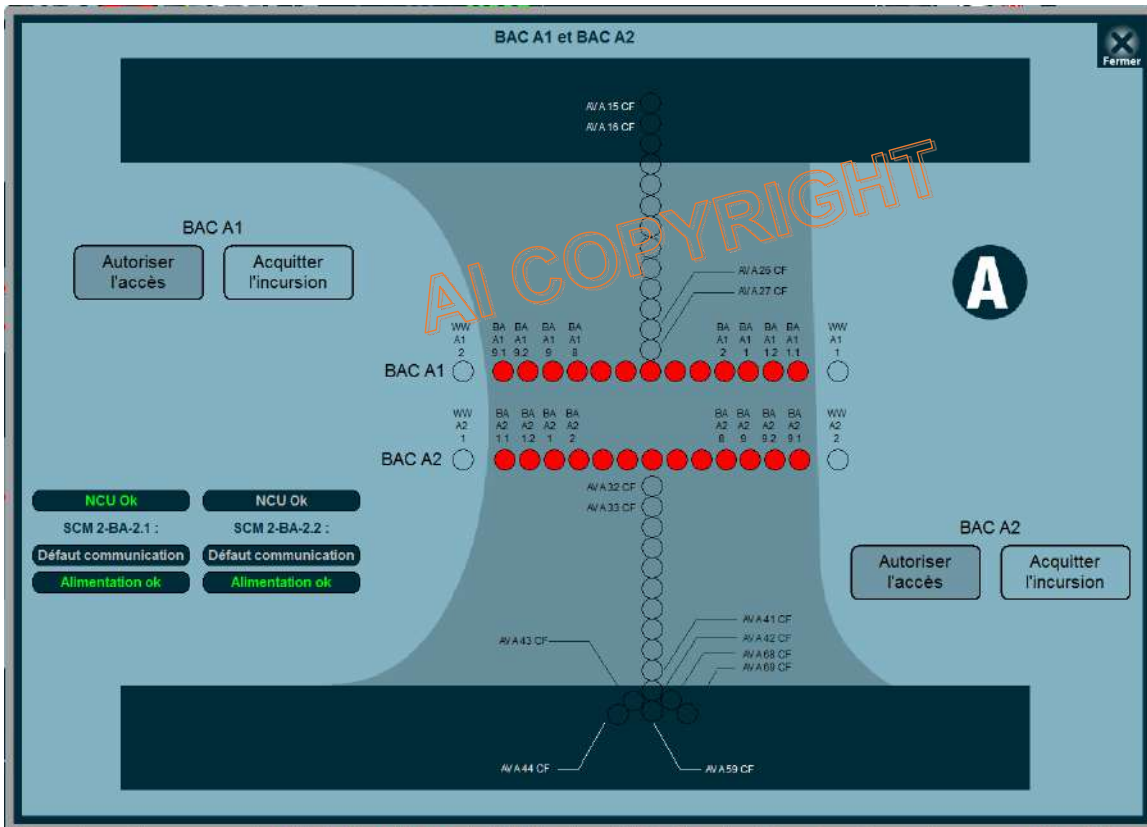


4.1.4.7 Stop-bar details view:

Access to this view is allowed only to the CM-technician and M-technicians.

This view gives the status of the lamps in the stop-bar.





## 5. PROJECT PROGRESS - STUDIES

### 5.1 ARRANGEMENT IN QUALITY INSURANCE

The progress of the project follows the development process which has been chosen to meet the requirements of the project. This may be a V cycle, but also RAD, AGILE or a particular organization established jointly with the different people involved.

The method chosen, the organization and resources are defined and validated at the launch of the project.

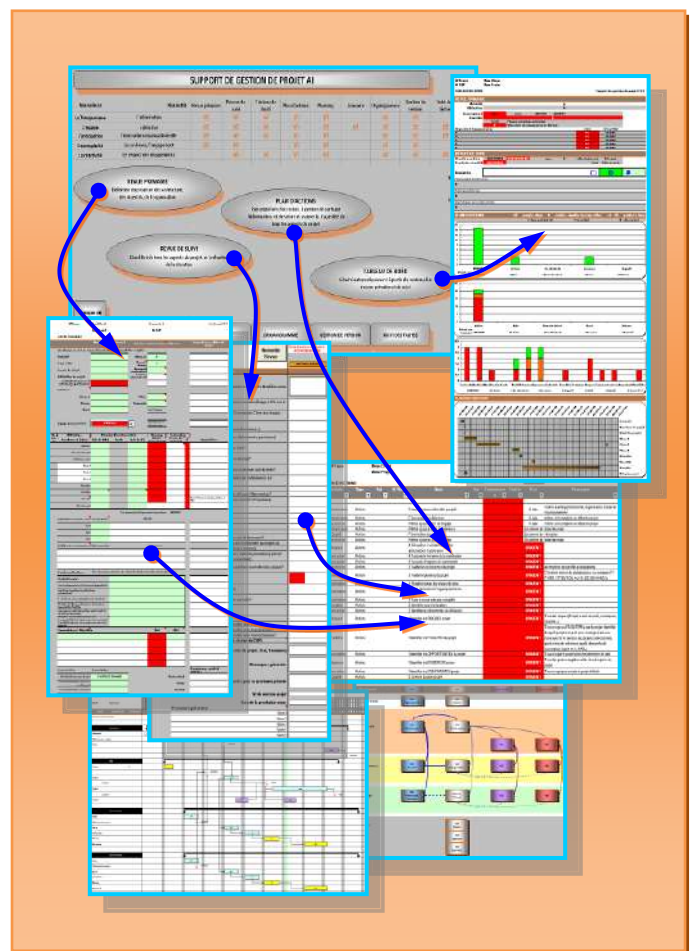
The internal weekly meetings will identify potential gaps in terms of time and quality and define an action plan to reduce them as soon as possible.

Because the quality and efficiency should not be synonymous with heavy, AI has developed a Quality System, which allows the project manager and managers of AI to have a complete view of the project to keep the objectives and to control the risks by playing on the anticipation and adaptation of the organization.

It comes in the form of a set of integrated and pragmatic tools to support the Project management

It is based on periodic reviews and a single action plan that ensure the consistency of all the people involved and a perfect traceability of the activities. A performance indicator table is automatically generated to give a complete picture of the situation and its evolution. The periodic reviews, as a complete checklist, allow the scan of all the aspects of the project and make decisions.

In addition, these tools include an organizational chart including the transverse flow of information and documents, a detailed schedule transverse, and a follow-up of the versions of documents, softwares and hardwares.



## 5.2 THE PARTICIPANTS A.I

This project is related to existing AI' experiences, this allows us to form a project team who can be quickly operational. So we set up a team of Automation engineer with a technical leader to ensure the full success of this project. The complete team will be supervised by a Project Manager.

The Business manager and the Quality manager are common to different projects.

We offer a perfect interchangeability of our team who can either perform the programming or commissioning, ensuring the quick availability of a person for commissioning, any urgent need on site or simple phone consultation.

### 5.2.1 Business Manager

In constant contact with COLAIR, he will provide:

- the correlation between the contract and the execution,
- the Quality supervision,
- The establishment of bi-weekly reports and spreading
- Coordination of suppliers and sub-contractors
- the deployment on site,
- the compliance with the schedule.

### 5.2.2 Project Manager

Its mission will be to:

- Define selection of suppliers and sub-contractors
- Organize teams of development, testing and commissioning
- Validate the technical works of the teams.
- Approve and spread the documents and project datas.
- Establish a methodology and a detailed action plan.
- Plan on-site commissioning.
- Analyze and manage technical risks and accidents.
- Define tailored solutions and further studies if necessary.
- Respect the contractual schedule.

### 5.2.3 Quality Manager

- Its mission is to:
  - Establish quality standards
  - Conduct internal audits
  - Measuring, control and monitor the implementation and effectiveness of quality systems in place (analysis, correction, improvement)
  - Establish and ensure the optimization of customer / supplier relationships
  - Train the team (technical guidance, safety regulations specific to certain sectors...)
- 
- It can be on site where it determines, in consultation with top management, the control of the works and ensure that they are in compliance with to customer requirements.

#### 5.2.4 Automation developers

The team of the developers will:

- Write PLC software
- Perform the platform tests
- Write the user manuals
- Perform commissioning
- Provide training

### 5.3 CAPACITY TO MOBILIZE ADDITIONAL RESOURCES

The organization of Automatique & Industrie as one of the biggest French high skilled specialized company allows to have a significant strike force and able to mobilize human and material resources in relation to the works to be done and to the schedules to meet. This while maintaining flexibility, responsiveness and rapid decision-making which are strong AI' strenghts.

For AI, the versatility of the staff continuously trained to the use of the up-dated supervision software (PCVUE, Citect, InTouch, Vijeo Designer, ...) and of the major PLC development platforms (Schneider, Omron, Wago, Ge Fanuc, Siemens, Rockwell, Phoenix Contact, ABB, Phoenix Contact...) allows us to mobilize if necessary, within a reasonable time additional resources to meet emergency requirements.

### 5.4 THE SAFETY

The axes of security will be:

- Safety of the customer's personal.
- Safety of the AI personal A.I
- Security and satefy of the delivered system.

Each member of AI staff is already aware of the specific case of operating into a working building and being complied with the procedures established locally.

AI has insurance for the works covered by the contract.

### 5.5 SEQUENCES OF THE PROJECT

#### 5.5.1 Starting point

After the order and a preparation phase between the various people involved, a launching meeting will be organized in **our office** at Saint Jean de Moirans during one (1) day with our Project Manager for the affair.

**Upon request we can quote a trip in your office.**

All the key people who are involved in this project will participate, including related services that may occur from time to time on the project (maintenance, services transverse, third parties involved in the interface with our system...).

During this meeting, will be defined and validated the following:

- The contacts

- The objectives of the project and the means to control them.
- The schedule and the key timing point.
- Deliverables
- The special constraints
- The means
- The frequency of reviews and contacts.
- The modalities to manage the deviations, client requests or suggestions for improvement from AI.

The people involved will provide all the information needed to start the project in the proper conditions and as soon as possible:

- The whole set of up-dated documents.
- The technical datas of the equipment from the different technical lots with links to the project.

### **5.5.2 Studies and Analysis**

This is the first phase of the project. It will take place in our office premises and will lead on the delivery of the functional analysis.

This folder will become the contract document listing and describing the functions to be performed by the system. It will be the basis for programming.

Electrical engineering studies for the PLC cabinet will be conducted on the basis of the list of inputs and outputs, information electrical information into the specifications, and the manufacturer's requirement.

### **5.5.3 Functional Analysis and Electrical Studies**

The Electrical studies for the cabinet and the functional analysis will be submitted to COLAIR for approval.

These documents are considered as reference documents and we will wait for their validation from COLAIR before starting the manufacture of cabinets and Automation studies and development.

### **5.5.4 Programming- Configuring**

This is the second phase of the project. It will take place at our office after you have validated the functional analysis. It will implement a structured, modular conception, and will be tested in our test platform.

### 5.5.5 DOCUMENTS PROVIDED

As the application software is customized to the airport authority requirement, the design of the various functions of the system shall be defined and validated during the design phase. The documentation provided includes the following manuals that shall be validated step by step by the airport authorities:

- Screen view
- Site Acceptance Test
- User's manual
- Software description
- Functional Analysis

All documents provided allows the final client to obtain extension, modification, and maintenance, by any other experimented company.

The full set of documentation will be provided in PDF files.

### 5.5.6 COMMISSIONING

A.I will delegate on site its Computer specialist for the commissioning of the Control & Monitoring System.

He will be delegated on site only when the equipment will be properly installed and ready to be powered.

During the commissioning period, he may need assistance from the Airport Authorities for the following:

- Security Pass and access authorization in the airport
- Transport on site from one station to another
- Electrical staff.
- Table and chair to install its documents

The duration of the commissioning is **10 working days, 6 days a week.**

When the system is put in to operation and hand-over to the Airport Authority, The Site Acceptance Certificate (SAC) shall be signed.

Should AI stay any longer than this 30 working days for commissioning on site for services out of the described scope responsible or special request that AI is not responsible, COLAIR will pay € 970.00 for the presence of Automatique & Industrie engineer during day shift, € 1100.00 during night shift + local accommodation for the additional duration and modification for the flight ticket majored of 15% for overhead.

### 5.5.7 TRAINING

A Site Training is provided to the Airport Staff for the Operation & Maintenance (level 1) of the system at the end of the commissioning:

**One (1) working days** for the Maintenance people – Level 1.

**One (1) working days** for the ATC controllers

The trainees shall be graduated in Electric/ Aeronautic/Automatism.

The content is strictly adjusted to the level of the trainees.

## **5.6 SPARE PARTS**

Upon request. Not quoted



## 6. LIST OF MAIN REFERENCES

\* Non-exhaustive list

### 6.1 FRANCE

REFERENCE	PAYS	ANNEE
Centres Régionaux de Navigation aérienne	France	2000
Vatry	Chalon en Champagne	1999
Ecole Air France	Saint Yan	2001
Mérignac	Bordeaux	2002
Nice	Nice	2002
Dôle	Dole	2002
Saint Exupery	Lyon	2003
Lesquin	Lille	2004
Auxerre	Auxerre	2004
Pau	Pau	2005
Pau Hélicoptère	Pau	2007
Vatry	Chalon en Champagne	2008
Cognac	Cognac	2008-2009
Bergerac	SNA SUD OUEST	2009
Quimper	DAC OUEST	2009
Base Aérienne de Nancy	Défense	2009
Poitiers	SNA SUD OUEST	2010
Biarriz	SNA SUD OUEST	2010
PAU	PAU	2010
Poitiers	CCI	2010
Dijon	CCI	2010
EVREUX	Ministère de la Défense	2010
VATRY	VATRY SVE	2010

C

PAU	PAU	2011
Saint Exupery	Lyon	2010/2011
Bordeaux	Aéroport de Bordeaux	2011
Cherbourg	Aéroport de Cherbourg	2011
BA de Villacoublay	Ministère de la Défense	2012-2015
Aéroport de Lille	Aéroport de Lille	2012
Aéroport de Brest	CCI de Brest	2014
Base Aérienne d'Orléans	Ministère de la Défense	2014
Aéroport de Clermont Ferrand	Aéroport de Clermont Ferrand	2014
Aéroport de Saint Yan	STERELA	2014
BA de La Horie	Ministère de la Défense	2014
BA de LANVEOC	Ministère de la Défense	2014
BA de Cognac	Ministère de la Défense	2014
BA de Villacoublay	Ministère de la Défense	2014
Aéroport de Grenoble Saint-Geoirs	Aéroport de Grenoble Saint-Geoirs	2015
Aéroport du Bourget (ADP)	Aéroport de Paris	2015-2017
Aéroport de Biarritz	SNA Sud Ouest	2015
Military Airbase - LANVEOC	Ministère de la Défense	2015
Aéroport de Vannes	Aéroport de Vannes	2016
Aéroport de Lyon	ADL	2016-2017
BA d'Istres	Ministère de la Défense	En cours
Aéroport de Lyon	ADL	2017
BA de la Horie	Ministère de la Défense	2017
BA de COGNAC	Ministère de la Défense	2018

BA d'Evreux	Ministère de la Défense	2017
Aéroport de PAU	PAU	2017
TARBES	TARBES	2017
LA ROCHELLE	LA ROCHELLE	2017
Aéroport de Nancy	NANCY	2017
BA de NANCY	Ministère de la défense	2017
Aéroport de Bordeaux	Aéroport de Bordeaux	2017
Aéroport Auxerre	Aéroport Auxerre	2017
Base aérienne de Villacoublay	Ministère de la Défense	2017
Aéroport du Bourget	Aéroport de Paris	2017
Base aérienne d'Istre	Ministère de la défense	2018
Base aérienne de Cognac	Ministère de la défense	2018_2019
Aéroport de Vatry	VATRY	2018
Aéroport de PAU	PAU	2018
Base aérienne de NANCY	Ministère de la Défense	2018
Base aérienne EVREUX	Ministère de la Défense	2018
Aéroport de Poitiers	CCI	2019
Aéroport de Biarritz	Biarritz	2019
Base Aérienne de Mont de Marsan	Ministère de la Défense	2018-2019
Aéroport de Rouen	Rouen	2019
Base aérienne Orléans	Ministère de la Défense	2019-2020
Base de Toulon Hyères	Toulon	2020
Base du Cannet des Maures	Le Cannet des Maures	2020
Aéroport de Vatry	VATRY	2020-2021

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Base aérienne de Pau	PAU	2021
Aéroport de Pau-Pyrénées	Pau	2022
Base aérienne d'Avord	AVORD	2023
Aéroport d'Aix-Les-Milles	Aix-Les-Milles	2024
Aéroport de Lille	Lille	En cours

**862 REFERENCE DOM-TOM**

Saint Pierre et Miquelon	DOM-TOM	1997-1998
Tahiti	Polynésie	1997-1998
Hao	Polynésie	2004
Fort de France	Martinique	2004
Saint Pierre et Miquelon	DOM-TOM	2004-2005
Tahiti	Polynésie	2004-2006
Saint Denis	Réunion	2007
Pierrefonds	Réunion	2006
Nouméa	Nouvelle-Calédonie	2007
Cayenne	Guyane	2009
Saint Denis	Réunion	2010
Pointe à Pitre	Guadeloupe	2010
Pointe à Pitre	Guadeloupe	2010
Pointe à Pitre	Guadeloupe	2010/2012
Cayenne	Guyane	2014-2015
Pointe à Pitre	Guadeloupe	2018-2019

Mayotte	Mayotte	2018
Saint Denis	Réunion	2020
Pierrefonds	Réunion	2020
Aéroport de La Réunion	La Réunion	En cours
Aéroport SAGPC	Guadeloupe	2021
Aéroport de Tahiti	Polynésie	2021
Aéroport SAGPC	Guadeloupe	2022
Aéroport SAGPC	Guadeloupe	En cours

### 6.3 REFERENCES INTERNATIONALES

Zadar	Croatie	1997
Larnaca	Chypre	2001
Sanaa	Yemen	2001
Téhéran	Iran	2002
Abidjan	Cote D'Ivoire	2002
Aleppo	Syrie	2002
Nino Aquino	Philippines - Manille	2003
Bezmer	Bulgarie	2003
Cebu	Philippines	2003
Fetesti	Roumanie	2003
Debrecen	Hongrie	2003
Montevideo	Uruguay	2003 – 2004
Djibouti	Djibouti	2004
Garoua	Cameroun	2004
Cotonou	Benin	2004
Phisanulok	Thaïlande	2005
M'Vengue	Gabon	2005
Palembang	Indonésie	2005
Libreville	Gabon	2005
Zadar	Croatie	2006
ILOILO	Philippine -	2007
Campia Turzi	Roumanie	2006
Bobocu	Roumanie	2006
Nadi	Iles Fidji	2006

Nausori	Iles Fidji	2006
Melbourne	Australie	2007
Bata	Guinée Equatoriale	2007
Djibouti	Djibouti	2007
Male	Maldives	2008
Azerbaïdjan	Base aérienne OTAN	2008
Tuzla	Roumanie	2008
Dubaï	Base militaire	2007
Butuan	Philippines	2008
Dumaguete	Philippines	2008
Sunshine	Australie	2008
Safran	Emirats Arabes Unis	2009
Maiden Saleh	Arabie Saoudite	2009
BéninParakou	Bénin	2009/2010
Akwa Ibom	Nigeria	2009/2011
Najran	Arabie Saoudite	2009/2010
Riyahd	Arabie Saoudite	2009/2010
Montevideo	Uruguay	2010
Bamako	Mali	2010
Taif	Arabie Saoudite	2010
Hail	Arabie Saoudite	2011
Reggane	Algérie	2011-2012
Bamako	Mali	2016-2017
Palembang	Indonésie	2014
Kaisal Airbase (Djeddah)	Arabie Saoudite	2015



Tabouk Airport	Arabie Saoudite	2015
Aéroport de Parakou	Bénin	2016
Djeddah International Airport	Arabie Saoudite	2017
Port Gentil	Gabon	2016-2017
Aéroport de Tananarive	Madagascar	2017
Aéroport de DEBRECEN	Hongrie	2018
Djeddah International Airport	Arabie Saoudite	2018
Aéroport de TABOUK	Arabie Saoudite	2018
Aéroport de Fetesti	Roumanie	2018-2019
Aéroport de TAIF	Arabie Saoudite	2019
Aéroport de DUBAI	Emirats	2019
Aéroport de DJIBOUTI	Djibouti	2018-2019
Aéroport de Mukah	Malaisie	2020
Aéroport de Fetesti	Roumanie	2021
Aéroport de Bacau	Roumanie	2020-2021
Aéroport de Campia	Roumanie	2021
Aéroport de Djibouti	Djibouti	2022
Aéroport de Djibouti	Djibouti	2023
Aéroport de Rabat	Maroc	2023
Héliport	Egypte	2023
Base militaire Nasonaya	Azerbaïdjan	En cours
Aéroport Labraq	Lybie	En cours
Aéroport Tobruk	Lybie	En cours
Aéroport Agadir	Maroc	2024



# Datasheet

## Taxiway CenterLine Straight (TCL) and Curved Light (TCC)

## General

TKH Airport Solutions inset lights are efficient and high-performing LED lights, providing at least 50,000 hours of service life at full 6.6A operation. The LED light fixtures have a simplified modular construction, consisting of five main components:

- Aluminum forging cover plate, with mechanical load capabilities exceeding FAA requirements
- Interchangeable LED light module
- Electronic driver board with housing
- Borosilicate glass prism with optional sapphire glass
- Secondary cable in accordance with FAA or ICAO requirements

This means easy maintenance of the lights because of the reduction of the amount of spare parts.

All of our inset lights are also available in CEDD technology. Please note that the specifications of CEDD lights are different from this datasheet. Contact our team for more details.

## Key features

- 8" outer diameter
- 6.35 mm height above surface
- Depth below flange: 35 mm
- Light outlet size 40 mm x 6 mm
- Dust and water tightness: IP68, IP69
- Overall lifetime\* > 20 years
- Useful lamp life (LED) up to 50,000 h
- Chromaticity coordinates according to ICAO Annex 14, Vol. 1 or FAA AC 150/5345-46E
- Nominal current: 6.6 A (0 – 100 %)
- Nominal AC frequency: 40-70 Hz
- Power consumption (@6.6 A - fixture only, not including cable losses, transformer efficiency, etc): per side: 10W (green/yellow straight); 9W (green/yellow curved)
- Power factor > 95 % at nominal current
- Ambient temperature: -40 °C (-40 °F) / + 75 °C (+167 °F)
- Internal serial interface for diagnostics and parameterization
- Fail/open function (optional)
- De-icing kit/Heater (optional) - additional max. 13W per side while in operation
- Sapphire coated prism (optional)

\*) Apart from wear parts

## Standards

This fixture has been developed according to the following standards:

- ICAO Annex 14, Vol. 1 and Vol. 2
- FAA AC 150/5345-46E
- Engineering Brief No. 67D
- IEC TS 61827

## Variants

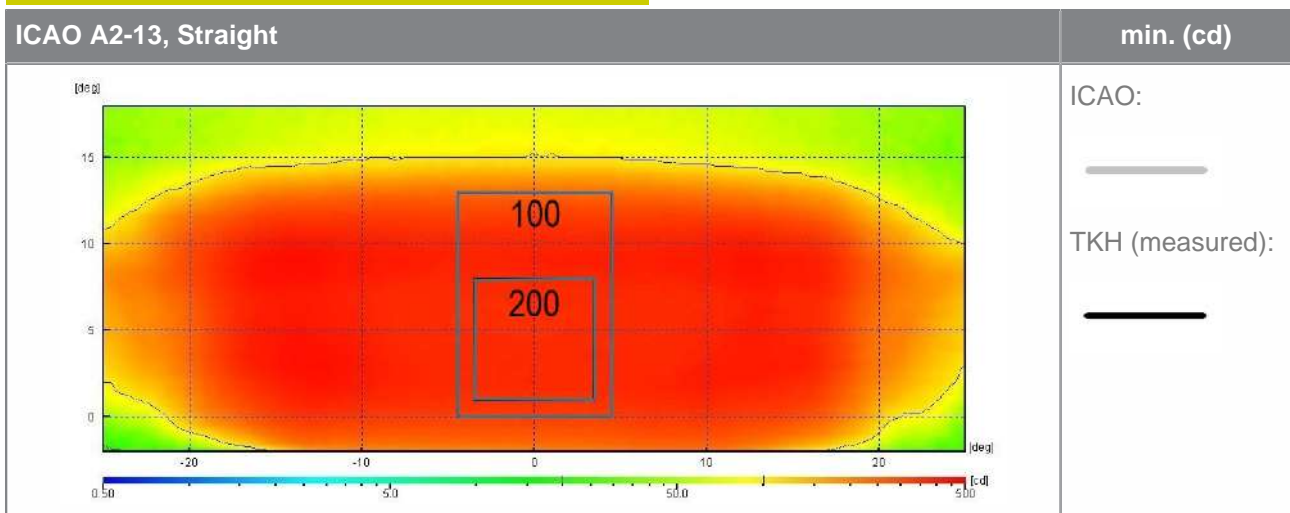
- Taxiway straight: Uni- and Bi-directional
- Taxiway straight configuration B: Uni- and Bi-directional
- Taxiway curve: Uni- and Bi-directional
- L-852C(L)
- L-852K(L)

## Colors

- Green
- Yellow
- Blue (non-ICAO/FAA)

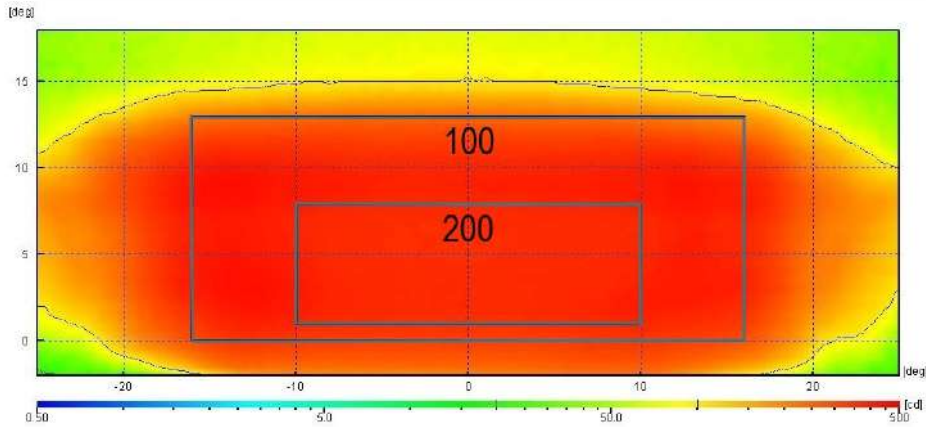
## Light distributions

### Green, Taxiway Centerline Light



**ICAO A2-12, Straight configuration B**

**min. (cd)**



ICAO:

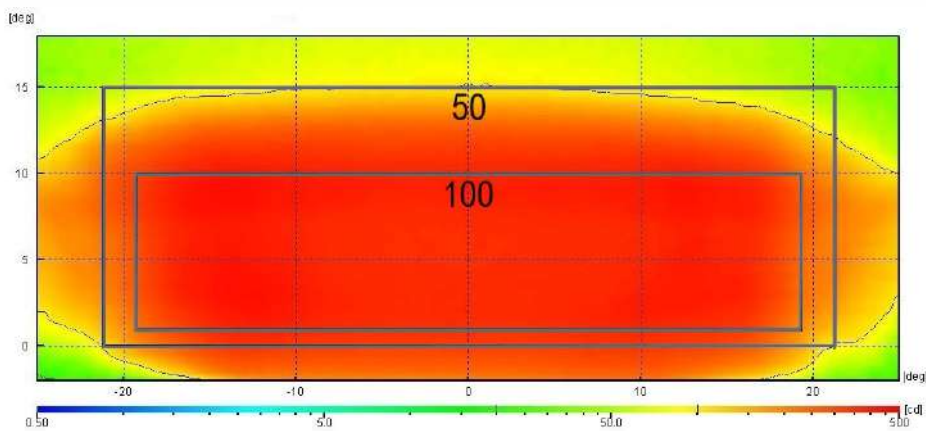


TKH (measured):



**ICAO A2-14, Curved**

**min. (cd)**



ICAO:



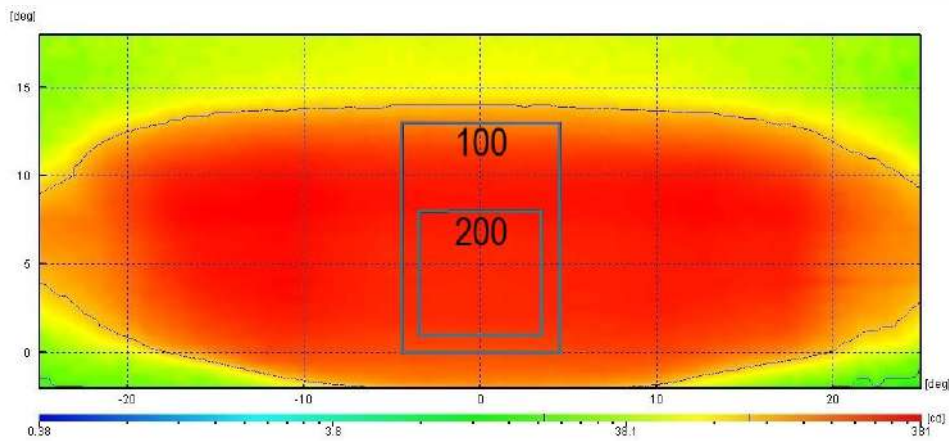
TKH (measured):



**Yellow, Taxiway Centerline Light**

**ICAO A2-13, Straight**

**min. (cd)**



ICAO:

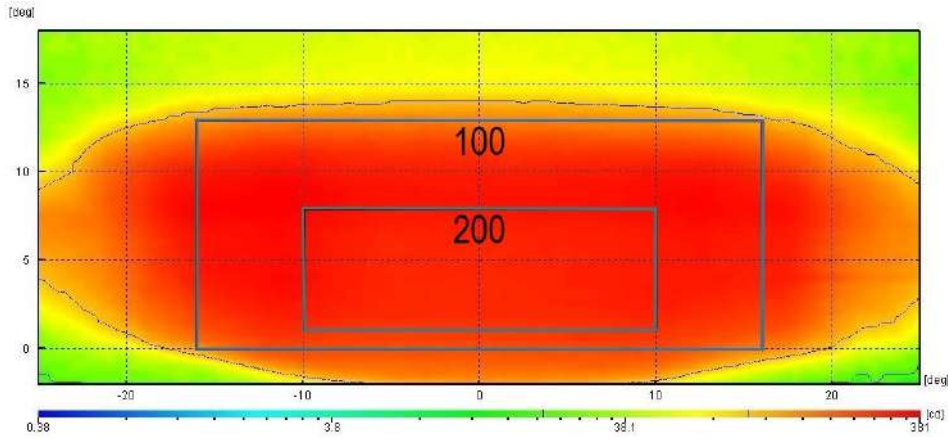


TKH (measured):



ICAO A2-12, Straight, configuration B

min. (cd)



ICAO:

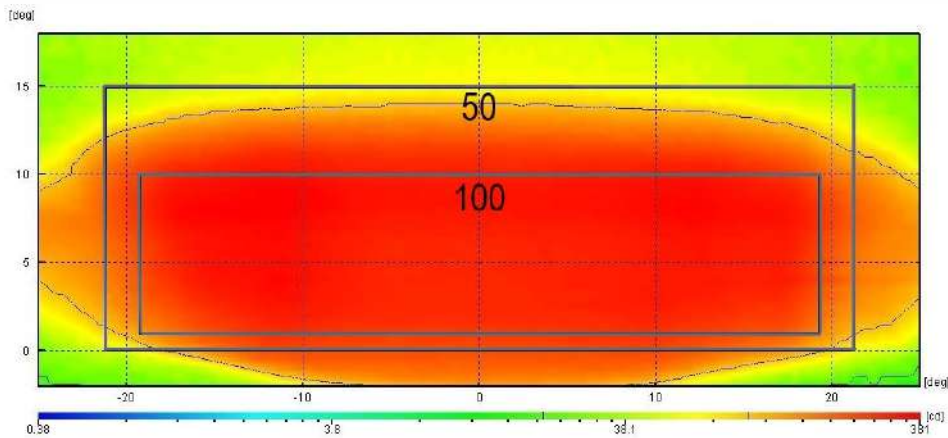


TKH (measured):



ICAO A2-14, Curved

min. (cd)



ICAO:

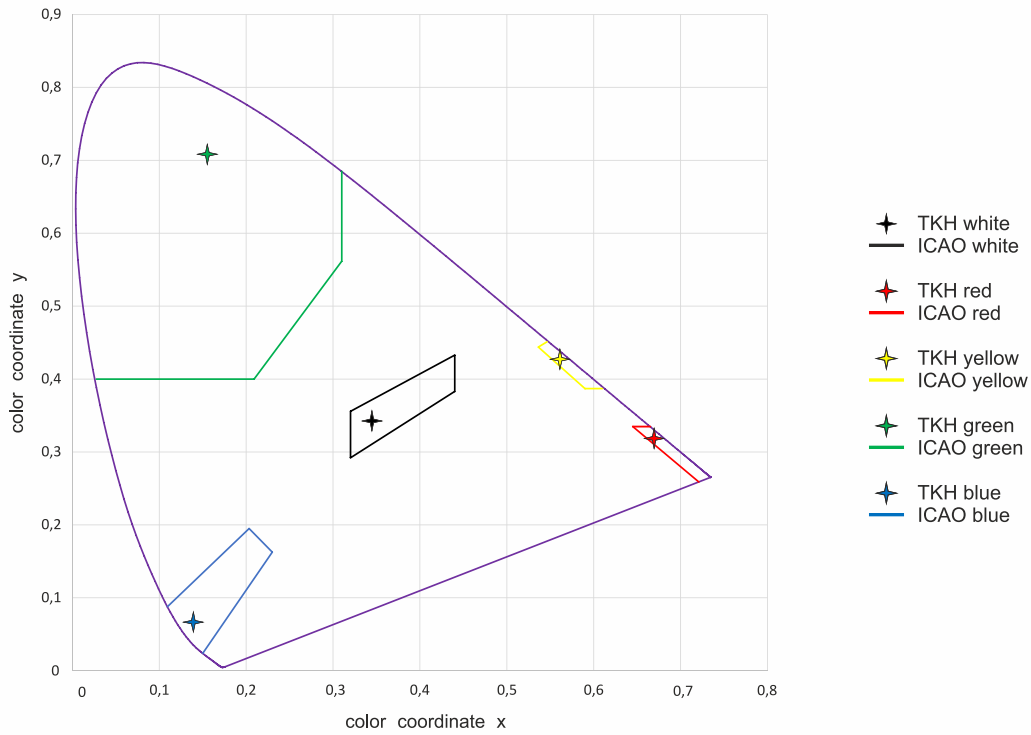


TKH (measured):

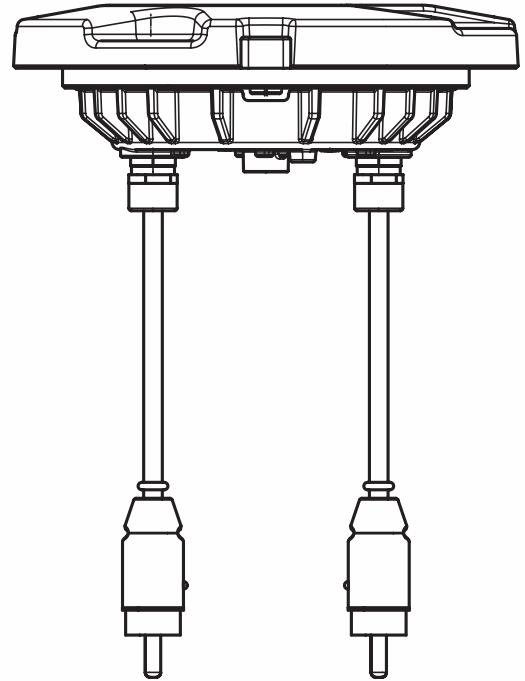
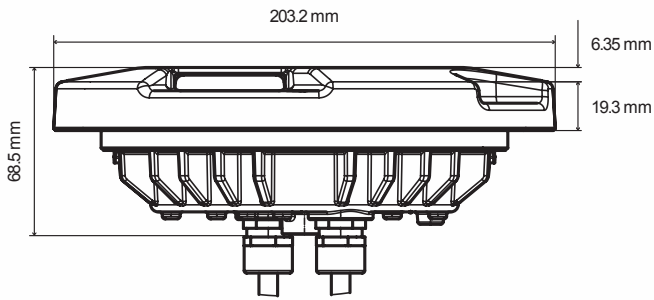


# Chromaticities

Areas description according to ICAO Annex 14, Volume I, Edition 8, July 2018



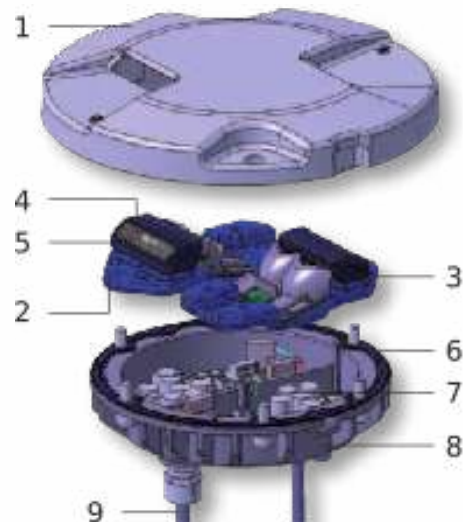
## Dimensions



## Components

### Straight configuration B

1. Cover (drop forged AL, anodised)
2. High power LED module 1
3. High power LED module 2
4. Prism (borosilicate glass)
5. Sealing aperture (Fluor silicate)
6. Sealing - housing ((Fluor silicate)
7. Electronics
8. Housing (Aluminum, die-cast)
9. FAA L-823 plug





## Accessories

- Transformer
- Shallow base
- Installation tools

Please contact [sales@tkh-airportsolutions.com](mailto:sales@tkh-airportsolutions.com) to discuss which accessories are required for your application.

## Packing data

Variant	Dimensions (L x W x H) in mm	Gross weight in kg	Net weight in kg
8" Fixture	250 x 250 x 105	2.8	2.5
8" Shallow Base	215 x 215 x 130	2.7	2.5

## Document Information

Name : 04\_LED\_Taxiway\_Centerline\_Straight\_Type\_TCL\_and\_Curved  
Light\_Type\_TCC\_03-71032

Version : V2.4

Language : English (Original manual)



For the latest version of this document see <https://www.tkh-airportsolutions.com/airfield-products/> or scan

# Ordering code

Option	Key	Description	TCL	-	S	-	I	-	3	1	-	G	00	0	00	-	1	-	10	-	1	0	0	0
<b>Function</b>	TCL	Taxiway Centerline																						
	TCC	Taxiway Centerline Curved																						
	852C	L-852C(L)																						
	852K	L-852K(L)																						
<b>Direction</b>	S	Straight																						
	L	Left																						
	R	Right																						
<b>Regulation</b>	F	FAA																						
	I	ICAO																						
<b>Light Intensity</b>	1	CAT I																						
	2	CAT II																						
	3	CAT III																						
	4	FAA																						
<b>Cover/Size</b>	1	8 Inch Cover																						
	3	8 Inch Flat Cover																						
<b>Color A</b>	G	Green																						
	Y	Yellow																						
	B	Blue (no ICAO/FAA function)																						
	0	Blank																						
<b>Toe-in A</b>	00	No Toe-In																						
<b>Color B</b>	G	Green																						
	Y	Yellow																						
	B	Blue (no ICAO/FAA function)																						
	0	Blank																						
<b>Toe-in B</b>	00	No Toe-In																						
<b>Prism</b>	1	Borosilicate Prism																						
	2	Sapphire Prism																						
<b>Cable</b>	10	250mm One Plug																						
	1T	250mm Two Plugs																						
	20	457mm One Plug																						
	2T	457mm Two Plugs																						
	30	300mm One Plug (combined with 3-pole plug)																						
	3T	300mm Two Plugs (combined with 3-pole plug)																						
<b>Plug type</b>	1	Standard FAA 2-Pole-Plug																						
	2	Special 3-Pole-Plug																						
<b>Fail-open</b>	0	Without Fail-Open																						
	1	With Fail-Open Hardware Relais																						
	2	With Fail-Open Signal Interface																						
<b>Heater</b>	0	No Heater																						
	1	With Heater																						
<b>Special options</b>	0	No Special Options																						
	1	Overheat Protection																						



### Company profile:

TKH Airport Solutions offers a complete range of LED-based airfield ground lighting products that are designed to be easy to install, operate, and maintain, and are compliant with international aviation standards. Our products meet the needs of our customers and contribute to a better future for the aviation industry. Being part of the TKH Group, our company can build on a history of more than 90 years in smart connectivity, energy distribution and AGL.

#### More information:

TKH Airport Solutions  
sales@tkh-airportsolutions.com  
www.tkh-airportsolutions.com  
+31 (0)53 57 414 56

#### Visiting address:

Elektrostraat 17  
7483 PG Haaksbergen  
The Netherlands



TKH  
AIRPORT  
SOLUTIONS



# Stopbar

## Datasheet

### LED AGL

Airfield Ground Lighting  
Power, Control and Monitor System

03-71030  
V1.2

## General

Our high-efficient LED inset lights meet the highest requirements in design and construction. The installation height of 6.3 mm reduces the attack surface for cleaning machines and snow ploughs. The use of shatter-proof and scratch-resistant glass as well as a high temperature resistance range guarantee a long lifetime. All our products have been certified with IP 68. The risk of damage is greatly reduced and therefore a significant reduction of maintenance costs and material consumption can be achieved. The light output is infinitely variable and moreover, there is a wide range of possible colours.

## Stopbar



## Benefits

- Reduced CO<sub>2</sub> emission by up to 85 %
- Up to 50,000 hrs LED service life
- Reduce maintenance and repair by up to 70 %

## Features

- 8" outer diameter (12" optional)
- 6.3 mm height above surface
- Depth below flange: 35 mm
- Light outlet size 40 mm x 6 mm
- Dust and Water tightness: IP 68
- Overall lifetime\* up to 20 years
- Useful Lamp life\*\* (LED) up to 50,000 h
- Chromaticity Coordinates according to ICAO Annex 14, Vol.1 Appendix 1 or FAA AC 150 / 5345-46D
- Nominal Current: 6.6 A (0 – 100 %)
- Power consumption (@6.6 A): 11 W per side
  - ICAO: 11 W per side
  - FAA: 23 W red, L852S, 13 W green, L852D
- $U_{max}$  (100 %): 3.5 V
- $U_{min}$  (0.1 %): 1.7 V
- Power factor > 95 %
- Fail /open functionality using a series transformer with a power rating of up to 100 W
- Temperature\*\*\*: -55°C (-67 F) / + 85°C (+185 F)
- Internal serial interface for diagnostics and parameterization
- Fail-Open Function (optional)
- De-icing kit (optional)
- Sapphire coated prism (optional)
- Integrated single lamp control (optional)

\*) Apart from wear parts

\*\*\*) Based on 24 h cycle: 8 h @55 °C Air temperature + 1kW/m<sup>2</sup> solar radiation /16 h@25 °C

\*\*\*\*) Measured on cover surface

## Standards

- ICAO Annex 14, Vol. 1
- FAA AC 150 / 5345-46D
- Engineering Brief No. 67D
- IEC TS 61827
- NATO: STANAG 3316

## Variants

- Unidirectional
- Bidirectional
- L-852 S

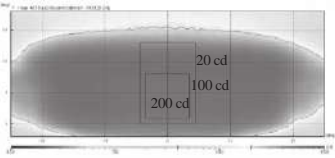
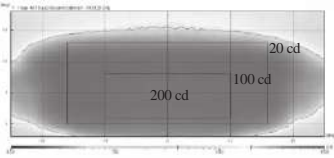
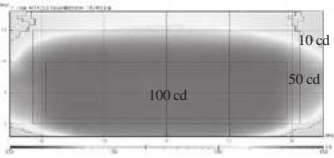
## Colours

- red
- red / red
- red / green

## Light distributions

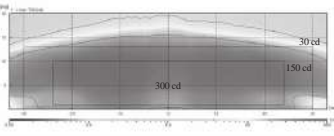
### ICAO Red

#### Stopbar Light

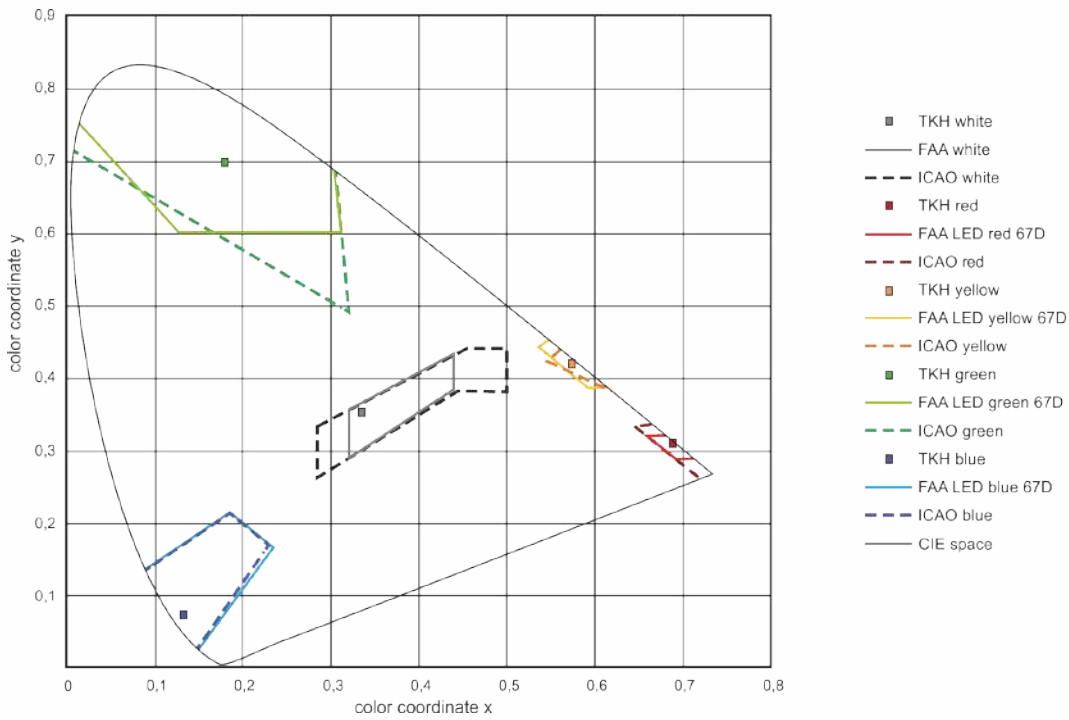
Straight		Straight Configuration B		Curve	
					
ICAO	Measured	ICAO	Measured	ICAO	Measured
min. average (cd)	min. average	min. average (cd)	min. average	min. average (cd)	min. average
200	366	200	376	100	386
min. (cd)	min.	min. (cd)	min.	min. (cd)	min.
100	325	100	325	50	181
20	206	20	150	10	50
max.	max.	max.	max.	max.	max.
3	1.25	3	1.37	3	2.52

### FAA Red

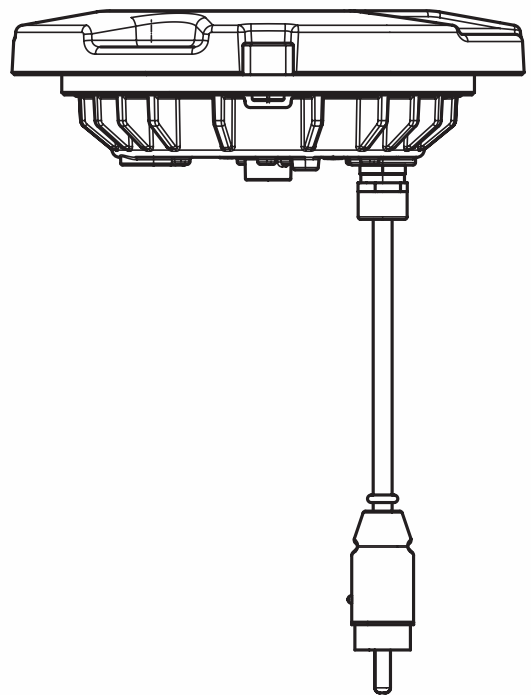
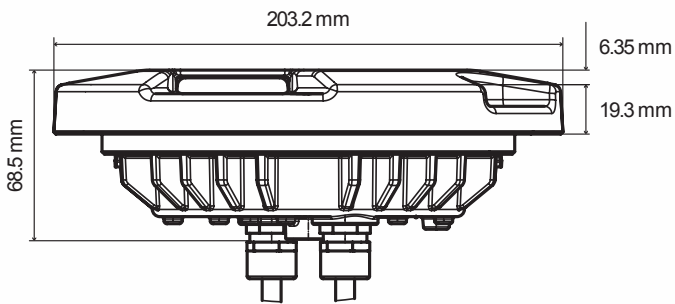
#### Stopbar Light – L 852 S

	
FAA min. average (cd)	Measured min. average (cd)
300	461
FAA min. (cd)	Measured min. (cd)
150	173
30	76

## Chromaticities



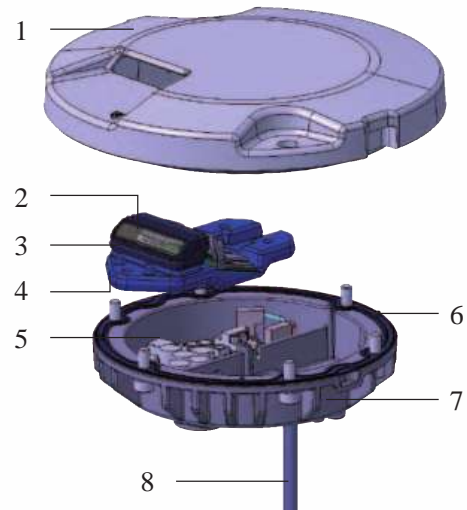
## Technical Drawings





## Components

1. Cover (drop forced AL, anodised)
2. Prism (borosilicate glass)
3. Sealing aperture (Fluor silicate)
4. High power LED module white
5. Electronics
6. Sealing - housing (Fluor silicate)
7. Housing (AlSi10Mg, die-cast, anodized)
8. FAA L-823 plug



## Accessories

- 8" Shallow Base
- 12" Shallow Base
- Installation Jig for 8"
- Installation Jig for 12"
- Transformer

## Packing data

Variant	Dimensions (L x W x H) in mm	Gross weight in kg	Net. weight in kg
8" Fixture	203.2 x 203.2 x 68.5	2.8	2.5
8" Shallow Base	215 x 215 x 130	5.2	5
12" Fixture	304.8 x 304.8 x 82.4	6.8	5.8
12" Shallow Base	320 x 320 x 150	7.5	7.1

## Ordering code

Please download our configuration tool at: <https://www.tkh-airportsolutions.com/airfield-products/> or scan:



## Document information

Name : o4\_Stopbar\_Type\_STB\_03-71030  
Version : V1.2  
Language : English (Original manual)

For the latest version of this document see <https://www.tkh-airportsolutions.com/airfield-products/> or scan:





### Company profile:

TKH Airport Solutions is a provider of a comprehensive range of Airfield Ground Lighting products. It includes powerful, highly reliable top of the range LED lighting products as well as future-proof technologies to better power and communicate with your LED lights. With our CEDD-AGL solution, we seamlessly integrate the needs of airports with new airfield network technology.

#### More information:

TKH Airport Solutions  
sales@tkh-airportsolutions.com  
www.tkh-airportsolutions.com  
+31 (0)53 57 414 57

#### Visiting address:

Elektrostraat 17  
7483 PG Haaksbergen  
The Netherlands



member of the TKH Group <

# DECLARAȚIE DE CONFORMITATE CE

Conform ghidului ISO 22 și EN 45014

**ICME ECAB SA**

42 Drumul între Tarlale Str., 032982 București, România  
Tel +4021 2090111, Fax +4021 2561476, e-mail info@icme.vionet.gr  
www.cablel.ro

Certifică pe propria răspundere că produsul:

**Cu/XLPE/CTS/PVC; Cu/ XLPE/ CWB/ PVC**

**Cablu de energie ecranat pentru instalații fixe, cu izolație din XLPE  
pentru utilizarea în circuitele de balizaj ale aeroporturilor,  
de tensiune nominală 5kV**

este conform cu cerințele următoarelor directive europene și specificații \*:

**2002/ 96/ EC** Directiva WEEE – Echipament electric și electronic scos din uz (deșeu)

**1999/ 44/ EC** Despre unele aspect ale vânzării de bunuri și garanțiile asociate

**Reglementări tehnice aplicabile\***: TS 3428: 2014; FAA Advisory Circular 150/5345-7F (în general)

\* Oricând un normativ de referință este citat fără a fi urmat de anul ediției, referirea la versiunea curentă este implicită

## Informații suplimentare:

- Produsul este conform cu cerințele directivelor și standardelor listate mai sus și în consecință poartă marcajul **CE** fie direct pe produs sau pe etichetă.
- Cablurile produse de ICME ECAB SA sunt identificate prin trademark-ul ● **CABLEL**
- OICPE – România a testat și a emis certificate de tip cu licență de marcă pentru produs (cert. nr. 527: 2014)
- Ultimele două cifre ale anului în care marcajul CE a fost aplicat: **11**

Prezenta DECLARAȚIE își pierde valabilitatea în cazul că produsul suferă schimbări fără autorizația producătorului.



**Andrei Papagheorghe**  
DIRECTOR DE CALITATE

București, 11 iulie 2014

## Cablul monoconductor din cupru, izolat cu XLPE, ecranat și manta de PVC, pentru circuitul de iluminat primar

SPECIFICATIE :	AC 150/5345-7E + cerinte client
TIPUL CABLULUI :	CU/XLPE/CTS/PVC (adaptat FAA L-824 TYPE C)
TENSIUNE NOMINALA, V :	5000
NR. CONDUCTOARE x SECTIUNE , [mm <sup>2</sup> ] :	1X6
FORMA CONDUCTORULUI :	CUPRU, ROTUND MULTIFILAR (7 x 1.02 mm), IEC 60228 CLASA 2
IZOLATIE :	XLPE TIP GP8 conf. BS 7655 SECTION 1.3, UNFILLED NATURAL
GROS. NOMINALA A IZOLATIEI [mm]:	3.0
TIP ECRAN METALIC	BANDA DE CUPRU DE 0,2 MM GROSIME APLICATA ELICOIDAL CU SUPRAPUNERE
<b>SECTIUNEA ECRANULUI METALIC [mm<sup>2</sup>] :</b>	<b>6</b>
REZISTENTA ELECTRICA A ECRANULUI LA 20°C MAX. [Ohm/Km] :	3.08
GROSIMEA BENZII PP, [mm]	0.13
MANTA :	PVC TIP TM1 conf. BS 7655 sectiunea 4.1, NEAGRA
GROS. NOMINALA A MANTALEI EXTERIOARE [mm] :	1.4
DIAMETRUL EXT. AL CABLULUI, APROX. [mm] :	13.5
LUNGIME DE LIVRARE ± 5% , [m] :	2500
REZISTENTA CONDUCTORULUI (C.C.) la 20°C, MAX. [Ohm/Km] :	3.08
REZISTENTA DE IZOLATIE MIN. [MOhm/Km] :	100
GREUTATA TOTALA A CABLULUI, APROX. [kg/km] :	260
RAZA DE CURBURA MINIMA :	12 x DIAMETRUL EXTERIOR
FORTA DE TRAGERE MAX. [N] :	300
DOMENIUL DE TEMPERATURA :	-15°C pana la +40°C
COD CABLU:	71732100737047
MARCARE:  <b>●CABLEL 1324FC ELECTRIC CABLE 1X6/6 MM<sup>2</sup> 5KV SCREEN CTS 2015</b>	

No.:	71732100737047	Cable Engineering Department	
Date - Revision:	6/11/2015 - 2	Detailed by:	N.Francesco
Client - Destination country:	RO	Approved by:	O. Avramescu

Registration no.: J 40 3748 1999 VAT no.: RO 11703669  
 IBAN: RO20 BUCU 0135 4514 2511 R001  
 Alpha Bank, Sucursala Unirii



# DECLARAȚIE DE PERFORMANȚĂ CE

Conform Regulamentului UE Nr. 305: 2011

Nr. 10002

## ICME ECAB SA

42 Drumul între Tarlale Str., 032982 București, România  
Tel +4021 2090111, Fax +4021 2561476, e-mail info@icme.vionet.gr  
www.cablel.ro

Certifică pe propria răspundere că produsul:

## H07RN-F

**Cablu de joasă tensiune flexibil, cu izolație și manta din cauciuc, pentru aplicații grele, de tensiune nominală până la 450/ 750V inclusiv**  
Cod unic de identificare : 713303\*

este proiectat și produs în conformitate cu cerințele următoarelor documente de reglementare\*\*:

**Regulamentul UE 305: 2011** (Regulament privind comercializarea produselor pentru construcții)

**Rectificări la Regulamentul UE 305: 2011 (actualizare la 19/04/13)**

**Regulamentul Delegat (UE) 574: 2014 al Comisiei de modificare a anexei III la Regulamentul (UE) 305: 2011**

**EN 50575: 2014** – Cabluri de energie, control și comunicații – Cabluri pentru aplicații generale în lucrări de construcții, cu cerințe de reacție la acțiunea focului

**IEC 60332-1-2** – Teste pe cabluri electrice și cu fibre optice sub acțiunea focului - Partea 1-2: Test pentru propagarea verticală a focului pe un singur conductor izolat sau cablu – Procedură pentru flacără pre-mixată de 1 kW

\* Codul unic de identificare reprezintă familia de produse la care se face referință. Fiecare construcție separată din cadrul familiei are coduri de identificare având aceeași rădăcină.

\*\* Oricând un normative de referință este citat fără a fi urmat de anul ediției, referirea la versiunea curentă este implicită

### Informații suplimentare:

● Produsul este conform cu cerințele directivelor și standardelor listate mai sus și în consecință poartă marcajul **CE**

fie direct pe produs sau pe etichetă. Ultimele două cifre ale anului în care marcajul CE a fost aplicat: **03**

● Conformitatea cu cerințele pentru cablurile anterior menționate, produse de ICME ECAB SA este în prezent evaluată conform Sistemului 4 în conformitate cu Regulamentul UE 305.

Prezenta DECLARAȚIE își pierde valabilitatea în cazul că produsul suferă schimbări fără autorizația producătorului.

  
**Andrei Papagheorghe**  
DIRECTOR DE CALITATE

București, 18 noiembrie 2015

## H07RN-F

### CABLURI FLEXIBILE CU IZOLATIE SI MANTA DE CAUCIUC



1. Conductor de cupru flexibil
2. Izolatie de EPR
3. Manta de cauciuc PCP

**TIP CABLU:**  
**TENSIUNE NOMINALA:**  
**STANDARD DE PRODUS:**

**H07RN-F**  
**450 / 750V**  
**HD 22.4 – BS 6007 – BS 6500**

#### UTILIZARE

In incaperi uscate sau in mediu umed; in aer liber; in ateliere cu mediu exploziv pentru solicitari mecanice medii. In aplicatii industriale sau pentru echipamente agricole, instalatii de incalzire, lampi de control, scule electrice precum masini de gaurit, ferastraie, aparatura electrocasnica si de asemenea pentru conectarea masinilor electrice mobile sau pentru utilizarea pe santiere de constructii si lucrari in agricultura. Pentru instalatii fixe, pentru alimentarea componentelor instalatiilor de ridicat si a diverselor utilaje.

#### COD DE CULORI

NUMAR DE CONDUCTOARE	CU CONDUCTOR GALBEN/VERDE	FARA CONDUCTOR GALBEN/VERDE
1	G/V	NEGRU
2	-	ALBASTRU – MARO
3	G/V – ALBASTRU – MARO	MARO – NEGRU – GRI
4	G/V – MARO – NEGRU – GRI	ALBASTRU – MARO – NEGRU – GRI
5	G/V – ALBASTRU – MARO – NEGRU – GRI	ALBASTRU – MARO – NEGRU – GRI – NEGRU
>5	G/V – NEGRE CU CIFRE ALBE	NEGRE CU CIFRE ALBE

NUMAR DE CONDUCTOARE x SECTIUNE NOMINALA	DIAMETRU EXTERIOR (APROX)	GREUTATE NETA (APROX)	REZISTENTA ELECTRICA MAXIMA LA 20°C	SARCINA ADMISIBILA	CADERE DE TENSIUNE	
					1 FAZA	3 FAZE
No x mm <sup>2</sup>	mm	Kg/Km	Ω/Km	A	mV/A/m	
1X1,5	7,2	55	13,7	22	31	27
1X2,5	8,0	75	8,21	31	19	17
1X4	9,0	100	5,09	41	12	10
1X6	11,0	135	3,39	53	7,8	6,7
1X10	12,5	200	1,95	73	4,6	4
1X16	14,5	275	1,24	98	2,9	2,5
1X25	16,5	390	0,795	129	1,85	1,55
1X35	18,5	515	0,565	158	1,37	1,15
1X50	21,0	720	0,393	198	1,02	0,84
1X70	23,5	950	0,277	245	0,71	0,58
1X95	26,0	1220	0,210	292	0,53	0,44
1X120	28,5	1550	0,164	344	0,44	0,36
1X150	31,5	1900	0,132	391	0,37	0,3
1X185	34,5	2430	0,108	448	0,33	0,26
1X240	38,0	2960	0,0817	528	0,26	0,21
1X300	51,5	3715	0,0654	608	0,24	0,19
1X400	46,5	4630	0,0495	715	0,19	0,15
1X500	51,5	5700	0,0391	820	0,15	0,12
2X1,0	10,5	120	20	15	48	-
2X1,5	11,5	130	13,7	18	31	-
2X2,5	13,5	185	8,21	26	19	-
2X4	15,0	255	5,09	34	12	-
2X6	18,5	355	3,39	44	7,8	-
2X10	24,0	665	1,95	61	4,6	-
2X16	27,5	855	1,24	82	2,9	-
2X25	31,5	1230	0,795	108	1,85	-
3X1,0	11,5	140	20	15	48	42
3X1,5	12,5	155	13,7	18	31	27
3X2,5	14,5	225	8,21	26	19	17
3X4	16,0	310	5,09	34	12	10
3X6	20,0	430	3,39	44	7,8	6,7
3X10	25,5	800	1,95	61	4,6	4
3X16	29,5	1050	1,24	82	2,9	2,5
3X25	34,0	1510	0,795	108	1,85	1,55
3X35	38,0	1940	0,565	135	1,37	1,15
3X50	44,0	2700	0,393	168	1,02	0,84
3X70	49,5	3535	0,277	207	0,71	0,58
3X95	54,0	4575	0,210	250	0,53	0,44
3X120	59,0	6120	0,164	292	0,44	0,36
3X150	66,5	6970	0,132	335	0,37	0,30
3X185	71,5	9130	0,108	382	0,33	0,26



NUMAR DE CONDUCTOARE x SECTIUNE NOMINALA	DIAMETRU EXTERIOR (APROX)	GREUTATE NETA (APROX)	REZISTENTA ELECTRICA MAXIMA LA 20°C	SARCINA ADMISIBILA	CADERE DE TENSIUNE	
					1 FAZA	3 FAZE
No x mm <sup>2</sup>	mm	Kg/Km	Ω/Km	A	mV/A/m	
4X1,0	12,5	170	20	15	-	42
4X1,5	13,5	190	13,7	18	-	27
4X2,5	15,5	270	8,21	26	-	17
4X4	18,0	300	5,09	34	-	10
4X6	22,0	535	3,39	44	-	6,7
4X10	26,0	965	1,95	61	-	4
4X16	32,0	1275	1,24	82	-	2,5
4X25	37,5	1875	0,795	108	-	1,55
4X35	42,0	2415	0,565	135	-	1,15
4X50	48,0	3580	0,393	168	-	0,84
4X70	54,5	4435	0,277	207	-	0,58
4X95	60,5	5720	0,210	250	-	0,44
4X120	65,5	7600	0,164	292	-	0,36
4X150	74,0	8960	0,132	335	-	0,30
4X185	79,5	11180	0,108	382	-	0,26
4X240	90,0	14260	0,0817	453	-	0,21
4X300	99,5	17845	0,0654	523	-	0,19
5X1,0	13,5	190	20	15	-	42
5X1,5	15,0	215	13,7	18	-	27
5X2,5	17,5	315	8,21	26	-	17
5X4	19,5	445	5,09	34	-	10
5X6	24,5	630	3,39	44	-	6,7
5X10	30,5	1115	1,95	61	-	4
5X16	35,5	1520	1,24	82	-	2,5
5X25	41,5	2235	0,795	108	-	1,55
7X1,5	17,5	330	13,7	-	-	27
7X2,5	20,0	475	8,21	-	-	17
12X1,5	23,0	535	13,7	-	-	27
12X2,5	26,5	770	8,21	-	-	17
18X1,5	26,5	900	13,7	-	-	27
18X2,5	31,5	1180	8,21	-	-	17
27X1,5	31,5	1110	13,7	-	-	27
27X2,5	37	1590	8,21	-	-	17
36X1,5	36,0	1320	13,7	-	-	27

Nota : Sarcinile admisibile sunt calculate pentru o temperatura a mediului ambiant de 30°C. Pentru alte temperaturi ale mediului ambiant factorul de corectie este :

Temperatura °C	15	20	25	35	40	45	50
Factor de corectie	1,22	1,15	1,08	0,91	0,82	0,71	0,58

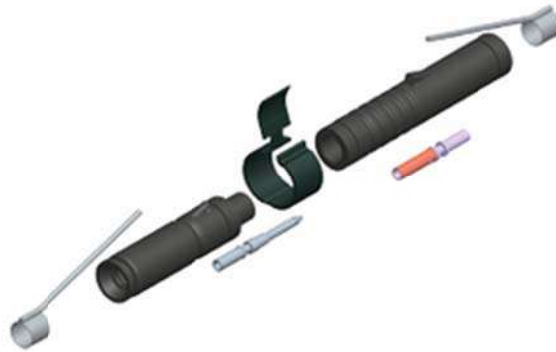
*[Signature]*

04.10.2005



## KD500/510 CONECTORI PRIMARI

Primary connectors  
**KD 500 / 510 series**



### Specificatii:

- FAA AC 150/5345 – 26c;

### Date tehnice:

- Curent nominal: 25A;
- Tensiune nominal: 5000V;
- Sectiune: - 6mm<sup>2</sup>(AWG8) sau 10mm<sup>2</sup>

### Constructie mecanica :

- Pini si mufe fabricate din alama sau cupru stanat. Mufa este prevazuta cu arc din cupru-beriliu pentru asigurarea presiuni de contact ;
- Corpul conectorului este fabricat din elastomer termoplastic (TPE) cu rezistanta excelenta la mediu si lichide. Conectorul rezista expunerilor la substante chimice gasite in mod normal pe aeroporturi, deasemenea este rezistent la UV.

### Continut kit:

- 1 pereche de corpuri conector (mama si tata) ;
- 1 pereche de pin si mufa ;
- 1 dispozitiv de blocare (polipropilena) ;
- Vaselina siliconica (in interiorul conectorului) ;

- Pin de ghidaj pentru mufa;
- Servetel de curatare ;
- Instructiuni de utilizare ;
- 2 conectori de impamantare (pentru seria 500) ;
- 1 conector impamantare cu 2 suruburi (seria 500).

### Tipuri si dimensiuni :

Idman type for screened cable	Idman type for unscreened cable	FAA L-823	Conductor size		Cable diameter	Diameter of cable insulation
			mm2	AWG		
KD 500	KD 510	Style 3, Style 10	6 mm2	AWG 8 (up to 19 strands)	10.0 - 14.5 mm	7.0 - 10.5 mm
KD 500.1	KD 510.1	Style 3, Style 10	6 mm2	AWG 8 (up to 19 strands)	14.0 - 18.5 mm	10.0 - 13.5 mm
KD 500.2	KD 510.2	Style 3, Style 10	10 mm2 (16 mm2 stranded)	AWG 6	14.0 - 18.5 mm	10.0 - 13.5 mm
KD 500.3	KD 510.3	Style 3, Style 10	6 mm2	AWG 8 (up to 19 strands)	18.0 - 22.0 mm	12.5 - 16.0 mm
KD 500.4	KD 510.4	Style 3, Style 10	10 mm2 (16 mm2 stranded)	AWG 6	18.0 - 22.0 mm	12.5 - 16.0 mm
KD 500.5	KD 510.5	Style 3, Style 10	10 mm2 (16 mm2 stranded)	AWG 6	10.0 - 14.5 mm	7.0 - 10.5 mm
KD 500.6	KD 510.6	Style 3, Style 10	6 mm2	AWG 8 (up to 19 strands)	8.5 - 11.5 mm	5.0 - 7.5 mm

## KD501/502/503 CONECTORI SECUNDARI

### Secondary connectors KD 501/502/503 series



KD 501 –series (Plug)

KD 502 –series (Receptacle)

### Specificatii:

- FAA AC 150/5345 – 26c;

### Date tehnice:

- Curent nominal: 20A;
- Tensiune nominal: 600V;

### Constructie mecanica :

- Pini si mufe fabricate din alama sau cupru stanat ;
- Corpul conectorului este fabricat din elastomer termoplastice (TPE) cu rezistenta excelenta la medii si lichide. Conectorul rezista expunerilor la substante chimice gasite in mod normal pe aeroporturi, deasemenea este rezistent la UV.

### Continut kit:

- 1 corp conector ;
- 1 corp interior conector ;
- 2 pini sau mufe ;
- Vaselina siliconica ;
- Piesa blocaj corp interior;
- Servetel de curatare ;
- Instructiuni de utilizare ;

## Tipuri si dimensiuni :

KD 501 and KD 502 series for two-core cables

Idman type	Type	FAA L-823	Conductor size	Cable diameter
KD 501	Plug	Style 5	1.5 - 2.5 mm <sup>2</sup>	8.5 - 13.5 mm
KD 501.1	Plug	Style 5	4.0 - 6.0 mm <sup>2</sup>	11.5 - 18.0 mm
KD 501.2	Plug	Style 5	4.0 - 6.0 mm <sup>2</sup>	8.5 - 13.5 mm
KD 502	Receptacle	Style 12	1.5 - 2.5 mm <sup>2</sup>	8.5 - 13.5 mm
KD 502.1	Receptacle	Style 12	4.0 - 6.0 mm <sup>2</sup>	11.5 - 18.0 mm
KD 502.2	Receptacle	Style 12	4.0 - 6.0 mm <sup>2</sup>	8.5 - 13.5 mm

KD 503 and KD 503/R series for two single wires

Idman type	Type	FAA L-823	Conductor size	Wire diameter
KD 503	Plug	Style 4	1.5 - 2.5 mm <sup>2</sup>	2.8 - 4.0 mm (x2)
KD 503.1	Plug	Style 4	4.0 - 6.0 mm <sup>2</sup>	3.8 - 5.5 mm (x2)
KD 503.2	Plug	Style 4	4.0 - 6.0 mm <sup>2</sup>	2.8 - 4.0 mm (x2)
KD 503.3	Plug	Style 4	4.0 - 6.0 mm <sup>2</sup>	5.0 - 8.0 mm (x2)
KD 503/R	Receptacle	Style 11	1.5 - 2.5 mm <sup>2</sup>	2.8 - 4.0 mm (x2)
KD 503.1/R	Receptacle	Style 11	4.0 - 6.0 mm <sup>2</sup>	3.8 - 5.5 mm (x2)
KD 503.2/R	Receptacle	Style 11	4.0 - 6.0 mm <sup>2</sup>	2.8 - 4.0 mm (x2)
KD 503.3/R	Receptacle	Style 11	4.0 - 6.0 mm <sup>2</sup>	5.0 - 8.0 mm (x2)



# Datasheet

## Constant Current Regulator (961)

## General

TKH Airport Solutions CCR 961 supplies precision output levels to power series lighting circuits on airport runways and taxiways containing both LED and conventional Halogen lighting fixtures. The CCRs are developed in a modular way and can be customized depending on project requirements.

## Key features

### General:

- Modular concept, enabling the CCR to be customized depending on project requirements
- Fixed size control unit (independent of the CCR specifications) which can easily be replaced
- High efficiency – low losses – high Mean Time Between Failure (MTBF)
- Full digital regulation circuit, with high output accuracy
- Built-in EMC filters
- Solid-state operation with no relays eliminating mechanical failures
- All CCR configurations stored on memory board, allowing transfer to other regulator modules for easy and fast maintenance
- Hour meters for 100 % intensity and total time
- Lamp fault detection with two alarm levels
- Earth fault detection with two alarm levels
- 7 individually adjustable intensity steps
- Soft start facility during normal switch-on, but output current re-established within 0.5 s for short breaks in power supply

### Environmental conditions:

- Designed for continuous indoor operation in an ambient temperature of 0 °C to +50 °C and maximum relative humidity of 95 %

### Digital display presenting extensive monitoring and diagnostic information:

- Output current (RMS value)
- Output voltage (RMS value)
- Input voltage
- Time / date through built-in watch
- Power output
- Impedance to earth
- Number of failed lamps
- Hours run counter
- Different languages available (English, Danish, German by default; custom languages to be added on request)

### Remote control through:

- Single or redundant Profibus
- RS-485 serial communication
- Parallel interface
- IP interface

## Standards

CCR961 has been developed according to the following standards:

- EN IEC 61822
- ICAO Aerodrome Design Manual, Part 5; § 3.2.1.4 to § 3.2.1.6

## Specifications

- Input voltage: 208 – 230 – 240 – 400 – 415 V, 50 or 60 Hz
- Nominal Series circuit current: 2.2 – 6.6 – 8.3 – 10 – 13.2 – 20 A
- Nominal Output power: 2.2 – 3.3 – 4 – 5 – 7.5 – 10 – 12.5 – 15 – 20 – 25 – 30 – 35 – 42 kVA

## Layouts

The CCR system can be customized in several ways:

- Stand-alone cubicles ('FAA layout') with one complete regulator in one cubicle
- Modular layout with electronics and output transformers in separate cubicles. In this form one cubicle can contain up to 16 regulator modules.



## Customized CCR Systems

### Module (standard)

The CCRs have a modular setup, enabling the CCR to be customized depending on project requirements.



#### Unit includes:

- Main board
- Trigger board
- Profibus board
- Memory board
- Thyristor block
- Connector
- Fuses
- Components comply with EMC requirements

### Variant 1: Standalone cubicles ('FAA layout')

The standalone version comprises one complete regulator in one cubicle.



#### Unit includes:

- One CCR Thyristor module for up to 75 A
- Output transformer
- Measuring transformers
- Isolation measuring equipment
- Lighting protection devices

#### Further specifications

- Built-in circuit breaker system for series circuit with grounding possibility (cut-off device)
- Efficiency:
  - when input voltage 230 V supply 94 – 97 %
  - when input voltage 400 V supply 95 – 98 %
  - Power factor better than 0.9 at full load (resistive load)

Mechanical specifications	Height	Depth	Width	Weight approx.
CCR for 230 V Power rating $\leq$ 10 kVA	1666 mm	600 mm	390 mm	175-240 kg
CCR for 400 V Power rating $\leq$ 10 kVA	1666 mm	600 mm	390 mm	175-275 kg
CCR for 230 V Power rating > 10 kVA	1666 mm	600 mm	772 mm	240-325 kg
CCR for 230 V Power rating > 20 kVA	1666 mm	600 mm	772 mm	275-325 kg

## Variant 2: Modular layout



### Available compositions: Further specifications:

- Electronics and output transformers in separate cubicles. In this form one cubicle can contain up to 16 regulator modules.
- Several complete regulators are built together.
- Common serial bus for all CCRs integrated in the CCR module cubicle, or divided in more groups.
- The CCR module cubicle can also contain modules for SFL systems and / or RIL systems.
- For cubicles with max. 16 CCR modules rated 40 / 60 A or max. 6 CCR modules rated 110 A, the fuses can be placed in the bottom of the cubicle. For cubicles with more CCRs, the fuses are placed behind each CCR.
- Efficiency:
  - when input voltage 230 V supply approx. 97 – 98 %
  - when input voltage 400 V supply 98 – 99 %
  - Power factor better than 0.96 at full load (resistive load).

## Ordering Code

Ordering Code	Description	Output Current	Remote Control
CCR-962.221	CCR 961, 400 V - 50 Hz input, FAA layout	3.3 kVA - 6.6 A	RS485
CCR-962.241	CCR 961, 400 V - 50 Hz input, FAA layout	5 kVA - 6.6 A	RS485
CCR-962.251	CCR 961, 400 V - 50 Hz input, FAA layout	7.5 kVA - 6.6 A	RS485
CCR-962.261	CCR 961, 400 V - 50 Hz input, FAA layout	10 kVA - 6.6 A	RS485
CCR-962.271	CCR 961, 400 V - 50 Hz input, FAA layout	12.5 kVA - 6.6 A	RS485
CCR-962.281	CCR 961, 400 V - 50 Hz input, FAA layout	15 kVA - 6.6 A	RS485
CCR-962.291	CCR 961, 400 V - 50 Hz input, FAA layout	20 kVA - 6.6 A	RS485
CCR-962.301	CCR 961, 400 V - 50 Hz input, FAA layout	25 kVA - 6.6 A	RS485
CCR-962.121	CCR 961, 400 V - 50 Hz input, FAA layout	3.3 kVA - 6.6 A	Profibus
CCR-962.141	CCR 961, 400 V - 50 Hz input, FAA layout	5 kVA - 6.6 A	Profibus
CCR-962.151	CCR 961, 400 V - 50 Hz input, FAA layout	7.5 kVA - 6.6 A	Profibus
CCR-962.161	CCR 961, 400 V - 50 Hz input, FAA layout	10 kVA - 6.6 A	Profibus
CCR-962.171	CCR 961, 400 V - 50 Hz input, FAA layout	12.5 kVA - 6.6 A	Profibus
CCR-962.181	CCR 961, 400 V - 50 Hz input, FAA layout	15 kVA - 6.6 A	Profibus

Ordering Code	Description	Output Current	Remote Control
CCR-962.191	CCR 961, 400 V - 50 Hz input, FAA layout	20 kVA - 6.6 A	Profibus
CCR-962.201	CCR 961, 400 V - 50 Hz input, FAA layout	25 kVA - 6.6 A	Profibus
CCR-962.321	CCR 961, 400 V - 50 Hz input, FAA layout	3.3 kVA - 6.6 A	Parallel
CCR-962.341	CCR 961, 400 V - 50 Hz input, FAA layout	5 kVA - 6.6 A	Parallel
CCR-962.351	CCR 961, 400 V - 50 Hz input, FAA layout	7.5 kVA - 6.6 A	Parallel
CCR-962.361	CCR 961, 400 V - 50 Hz input, FAA layout	10 kVA - 6.6 A	Parallel
CCR-962.371	CCR 961, 400 V - 50 Hz input, FAA layout	12.5 kVA - 6.6 A	Parallel
CCR-962.381	CCR 961, 400 V - 50 Hz input, FAA layout	15 kVA - 6.6 A	Parallel
CCR-962.391	CCR 961, 400 V - 50 Hz input, FAA layout	20 kVA - 6.6 A	Parallel
CCR-962.401	CCR 961, 400 V - 50 Hz input, FAA layout	25 kVA - 6.6 A	Parallel

Other variants available on request:

- input voltage 230 V, 60 Hz
- Remote Control Bus: LAN / Ethernet
- (customized) modular layout
- supplied with wheels
- supplied with lifting lugs (for crane transport)

## Document Information

Name : 04\_Constant\_Current\_Regulator\_Type\_961\_03-71051  
Version : V1.7  
Language : English (Original manual)

For the latest version of this document see <https://www.tkh-airportsolutions.com/airfield-products/> or scan:





### Company profile:

TKH Airport Solutions is an innovator in airfield ground lighting, offering a complete range of LED AGL products. We build upon the know-how from a long and successful tradition of pioneering developments in the AGL and connectivity industry. Being part of the TKH Group, our company can build on a history of more than 90 years in smart connectivity, energy distribution and AGL.

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# Datasheet

## Sequential Flash Light System

## General

The LED-based Sequential Flash Light System (SFL 961) from TKH Airport Solutions is designed to meet the requirements of ICAO Annex 14 for flashing lights used in a center line approach system (AFL), as runway threshold identification light (TIL), or in a combination of both light systems.

The system offers control and monitoring of a system with up to 30 approach flashing lights (AFL) and 2 threshold identification lights (TIL), without the use of separate control cables. The very low power consumption in the LED flashing light fixture makes it possible to use installation cables of maximum 4 mm<sup>2</sup>, and the total installation only requires a 4-wire cable, as can be seen on the installation diagram.

A complete SFL system includes an SFL Flash Light controller system in the substation, and a system-dependent number of LED SFL light fixtures with their associated terminal boxes.

## Standards

The SFL 961 is designed to meet the requirements of ICAO Annex 14 for flashing lights used in an approach center line system (AFL) with associated runway threshold identification light (TIL).

- ICAO Annex 14, Volume 1
- International Standard IEC 61822
- European Aviation Safety Agency CS-ADR-DSN
- Nachrichten für Luftfahrer Teil i (nFL i 95/03)
- ENV 50234: 1997

## Controller Unit



H x W x D:

A. Stand-alone cubicle: 1252 x 392 x 605 mm

B. Wall mounted cabinet: 400 x 600 x 250 mm

Input power: 2 x 230 VAC + n + G, 50 Hz, 10 A, 60 Hz

Temperature range: 0 – 55 °C, non-condensing

Relative Humidity: 5-95%

TKH Airport Solutions' Sequential Flash Light controller system is based on a digital controller and monitoring system, in the same mechanical layout, and with the same easy-to-use menu as the TKH Airport Solutions constant current regulator type CCR 961. The controller supplies power for flashing, heating and communication via a 4 x 4 mm<sup>2</sup> standard installation cable connected in one loop to all fixtures. The power line communication includes the following information to each light fixture:

- Requested light intensity (3 steps)
- Time for one sequence (one or two sequences per second)
- Start signal for each new sequence

The controller unit can be supplied as a module in the same layout as the TKH Airport Solutions CCR type 961, and can be installed in a module cubicle for CCRs. Alternatively, the controller can be supplied as a wall-mounted unit.

SFL controller parts	Type No.
Module for RS 485	SFL 961 – RS 485
Module for profibus	SFL 961 – Profi
Stand-alone cubicle for max. of 2 SFL modules	SFL 961 – Cubicle
Wall-mounted cabinet for RS 485	SFL 961-Wm-RS 485
Wall-mounted cabinet for profibus	SFL 961-Wm- Profi
Circuit selector kit to be built into wall-mounted cabinet	SFL 961-B1/B2
Parallel interface for module or wall-mounted cabinet, RS 485	-

## Terminal Box



### Application

A terminal box is placed within a distance of 1 to 25 m from each flashing light fixture. The terminal box is for the connection of the cable from the controller unit to each flashing light fixture. An incoming and an outgoing cable, each typically  $4 \times 4 \text{ mm}^2$ , are used to supply power and communication signals to the flashing light fixture via two isolating transformers, each 230 VAC/24 VDC, both placed in the terminal box.

### Description

The terminal box is made of stainless steel, and can be mounted in many ways: on poles, on a wall, etc.

- Size: H x W x D: 360 x 200 x 120 mm
- Weight approx. 6.6 kg
- IP 68
- Standard type (in stainless steel): SFL TB1
- Lighting arrester block type No.: 40-6308
- Mounting kit for 60 mm pole type: mT 60 mm

### Cable connections from terminal box to flash light fixture:

Distance from box to fixture (m)	Cable dimension
1 - 8	$3 \times 1.5 \text{ mm}^2 + \text{ground}$
8 - 25	$3 \times 2.5 \text{ mm}^2 + \text{ground}$
> 25	$3 \times 4 \text{ mm}^2 + \text{ground}$



## High-Intensity LED Light Fixture

### Application

The high-intensity LED fixture is intended to be used instead of discharge-type flashing light in a barrette center line approach system and/or as runway threshold identification lighting. The required intensities are reached with LEDs as used in our standard LED approach light fixture. All communication and control via the power cables.

### Description

The fitting type is a high-intensity, unidirectional, lightweight, elevated light constructed to meet the demands for easy mounting, leveling and service, with capability to resist jet blast from today's aircrafts and last but not least to give sufficient light intensity, in the right angles with the use of a LED light source with low power consumption and a long lifetime.

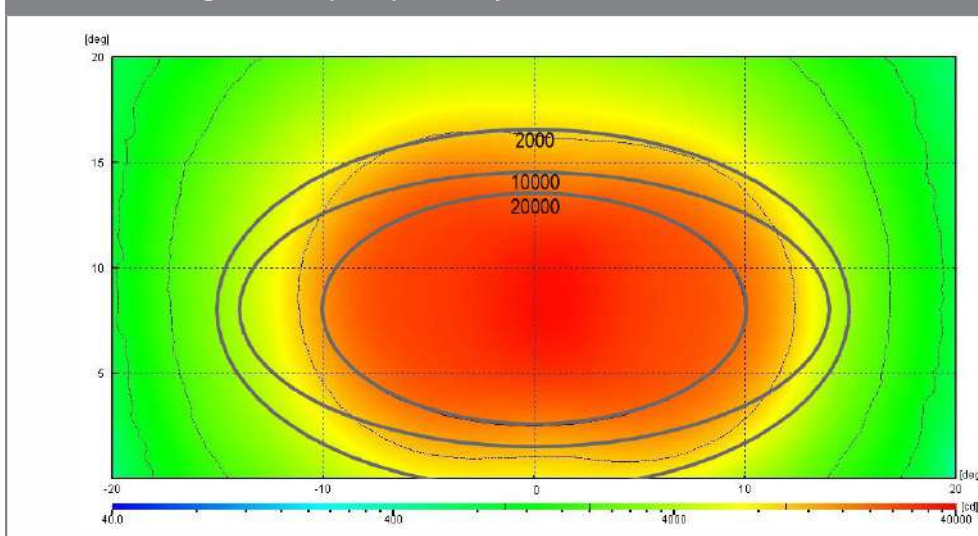
### Features



- The design conforms to the photometric requirement of ICAO Annex 14, Vol. 1, Fig. 2.1 with 40 W LED module
- Easy levelling and adjustment due to the patented ball joint
- The shape, small size and light weight (3 kg (6 lb)) are favorable features in respect to wind load and jet blast
- Flexible mast adaptation for various diameters of poles
- Mounting on tube, pole or base plates
- Fully corrosion-proof components are used
- Finished in aviation yellow
- Front glass according to FAA spec. CAA-1199a
- The outside surface of the glass is smooth and needs no cleaning.
- No adjustment necessary after relamping

## Light Distribution

### SFL 792 LED light white (A2-1) - steady function



min. (cd)

ICAO:

—————

TKH (measured):

—————

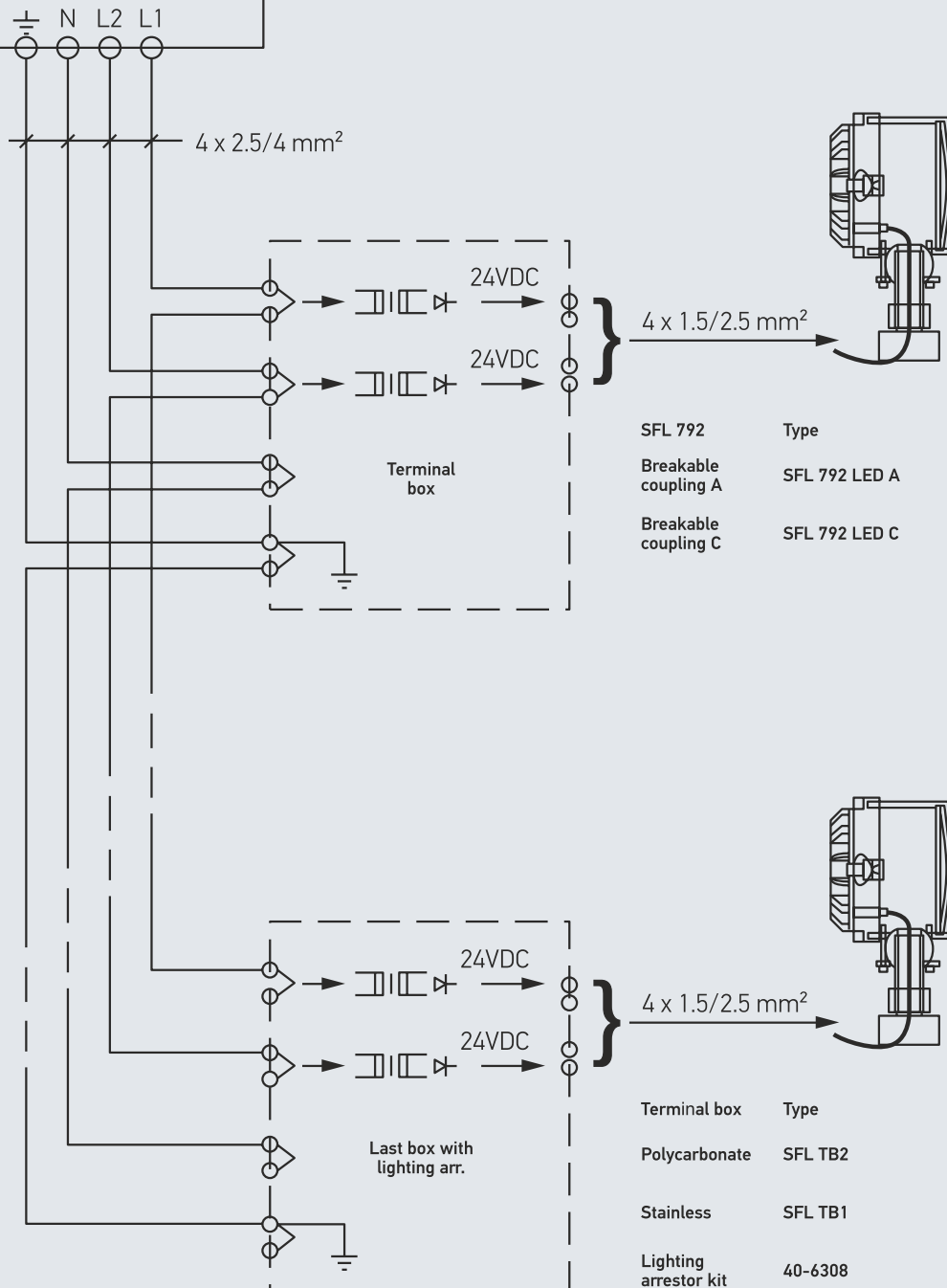
# Installation Principle

SFL 961 LED module or wall cabinet



### Controller types

- Module** SFL 961 module for RS 485 or profibus in cubicle.
- Wall cabinet** SFL 961 WM for RS 485 or profibus. Can be extended with circuit selector.



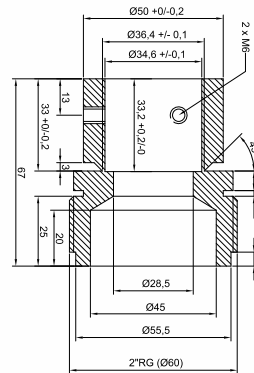
## Couplings

TKH elevated light fixtures can be delivered with different types of breakable coupling:

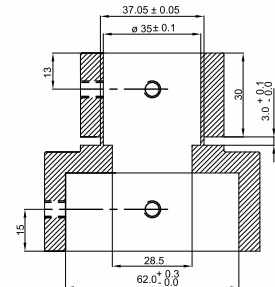
- **Type A:** With 2" thread (European standard thread or 11.5 NPT or NPS)
- **Type C:** For 2" pole mounting
- Customer designed couplings

TKH breakable coupling is calculated and tested to break at

45 kgm  $\pm$  4 kgm which is in accordance with FAA AC 150/5345-46E and ICAO Annex 14, Vol. 1.



Type A



Type C

## Operation

Brilliance control is by means of PWM regulation in the light fixture, based on step command received via power cable. The flash frequency can be one or two flashes per second. The first unit is located at the beginning of the approach, and the last unit is closest to the threshold. The units flash in sequences so that the pilot sees the light moving towards the runway. The threshold identification lights (TIL/RIL) flash simultaneously. The TIL are connected to the same supply cables as the approach sequential flash light system. Input line voltage is 230 V, and the supply cable is connected to the fixture via transformers in a terminal box. The supply includes flashing power, synchronization of the flashing sequence, as well as power for the heating element in the fixture. The address of each fixture is set by means of a built-in rotary switch. The sequential flash light system is controlled by TKH Airport Solutions' Sequential Flash Light controller system SFL 961-LED.

## Document Information

Name : 04\_Sequential\_Flash\_Light\_System\_Type\_SFL\_792\_03-71036  
Version : V1.6  
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### Company profile:

TKH Airport Solutions is an innovator in airfield ground lighting, offering a complete range of LED AGL products. We build upon the know-how from a long and successful tradition of pioneering developments in the AGL and connectivity industry. Being part of the TKH Group, our company can build on a history of more than 90 years in smart connectivity, energy distribution and AGL.

#### More information:

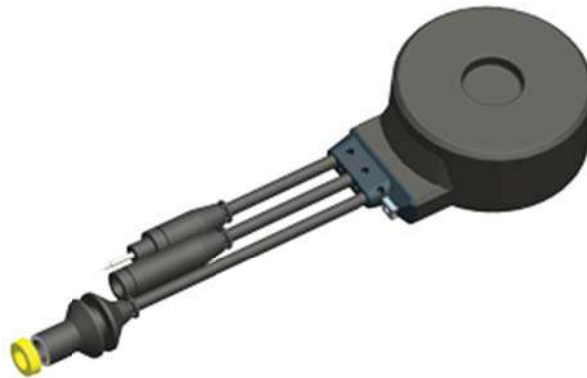
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## KR TRANSFORMATOARE DE SEPARATIE

### Isolating transformers KR



#### Specificatii:

- FAA AC 150/5345 – 47a;

#### Aplicatii:

- Transformatori de separatie pentru utilizarea in circuitele de balizaj ;

#### Instalare:

- In cuve sau camine pentru transformatori ;
- Direct in pamant ;

#### Constructie mecanica :

- Incapsulat in elastomer termoplastice (TPE);
- Rezistenta excelenta electrica si mecanica;
- Rezistenta excelenta la ulei, kerosene, acizi si alte substante prezente in mod normal pe aeroporturi;
- Doua infasurari din cupru, una primara si alta secundara, separate pe un miez toroidal si izolate cimples una de cealalta ;
- Doua cabluri primare (0,6m, AWG 8 – 8,3mm<sup>2</sup>, 6KV). Conectori FAA L823 stil 2 si stil 9 ;
- Un cablu secundar (1,2m, 2x2,5mm<sup>2</sup>, 1KV) cu conector FAA stil 7 ;
- Cu sau fara impamantare. Impamantarea este conectata la infasurarea secundara si este conectata la pinul mai mare al conectorului secundar.

## Dimensiuni:

Type	D, mm	L, mm	H, mm	Weight, kg
KR 531	100	125	55	1,7
KR 536	126	167	56	2,5
KR 541	147	193	54	3
KR 546	147	193	64	3,8
KR 551	147	193	64	3,8
KR 561	147	193	73	4,8

## Date tehnice :

Type with earthing	Type without earthing	Nominal power rating	Isolation voltage rating	Test voltage	Current rating	Frequency	Efficiency	Power factor	Max secondary cable length (4mm <sup>2</sup> )*	Max secondary cable length (2,5mm <sup>2</sup> )*
KR 531	KR 531.1	30 / 45 W	5000 V	10 kV	6,6/6,6 A	50/60 Hz	0,85	0,97	20 m	12 m
KR 536	KR 536.1	65 W	5000 V	10 kV	6,6/6,6 A	50/60 Hz	0,85	0,97	29 m	18 m
KR 541	KR 541.1	100 W	5000 V	10 kV	6,6/6,6 A	50/60 Hz	0,90	0,97	45 m	28 m
KR 546	KR 546.1	150 W	5000 V	10 kV	6,6/6,6 A	50/60 Hz	0,90	0,97	67 m	42 m
KR 551	KR 551.1	200 W	5000 V	10 kV	6,6/6,6 A	50/60 Hz	0,90	0,97	90 m	56 m
KR 561	KR 561.1	300 W	5000 V	10 kV	6,6/6,6 A	50/60 Hz	0,90	0,97		

Note! The length of secondary cable can be increased by selecting a bigger transformer or cable.

\* Maximum overload of the transformer 20%



# Installation and Maintenance Instructions

## Inset light 8"

## Preface

- Please read carefully and understand the contents of this manual.
- Failure to read the manual may result in serious injury, or serious damage to equipment.
- Make sure these instructions are always accessible for all users and ensure that you have read and understood the contents.

## Document Information

Name : **05\_LED\_AGL\_Installation\_instruction\_8-inch\_inset\_lights\_03-71083**

Version	Date	Description
V2.3	27-11-2023	Original
V2.4	09-07-2024	Added instructions to perform leakage test after opening and closing fixture

The English version of this document is the original version; this language version is verified by the manufacturer. All other language versions are translations of the original English language version. For the latest version of this document see <https://www.tkh-airportsolutions.com/airfield-products/> or scan:



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# 1. About this manual

This manual contains information about the installation and maintenance of the LED Inset light 8”.

## 1.1 Symbols used

The following marking conventions are used in this manual to draw attention to specific topics or actions:



**DANGER!** - This sign indicates a hazardous situation that, if not avoided, will result in death or serious injury.



**WARNING** - This sign indicates a hazardous situation that, if not avoided, could result in death or serious injury.





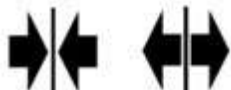



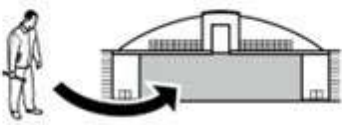


**CAUTION** - This sign indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.



**NOTICE** - is used in this manual to indicate a situation that could result in damage to property or equipment.

The following symbols are used in pictures for explanation or an action:

<p>Correct / Incorrect</p> 	<p>Look / See</p> 	<p>Location / position</p> 	<p>Movement</p> 
<p>Connect / Disconnect</p> 	<p>Photobiological safety</p> 	<p>ESD warning</p> 	
<p>Work carried out on runway</p> 		<p>Work carried out in workshop</p> 	

The following symbols are used on equipment and in this manual to warn of potential hazards:



**DANGER of electrical shock or arc flash.** Failure to observe this warning will result in serious injury or death.



**WARNING or CAUTION:** where this symbol is used on the equipment, it is mandatory to consult the manual to find out the nature of potential hazards and any actions which have to be taken to avoid them.

---

## 1.2 Storing the manual

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- This manual is a part of your product. Store the manual in a location that can be easily accessed by personnel working on the product.
- It is the responsibility of the company operating this equipment to ensure that its personnel is provided with a copy of this manual.

---

## 1.3 Limitations of the Document

---

TKH Airport Solutions reserves the right to revise this document without notification.

The data provided in this document is based on the most recent information at the time of publication. TKH Airport Solutions is continually seeking to ensure that its products are developed to the latest technological standards. As a result, it is possible that there may be some differences between the product and the information in this manual.

For further information regarding adjustment, maintenance or repair which is not described in this document, please contact the Customer Service department of TKH Airport Solutions.

The information in this document concentrates solely on use of the products as intended by the manufacturer.

---

## 1.4 Terms and Abbreviations

---

This document may include the terms and abbreviations as listed below.

AGL	Airfield Ground Lighting
EASA	European Aviation Safety Agency
ICAO	International Civil Aviation Organization
IEC	International Electrotechnical Committee
LED	Light Emitting Diode

---

## 1.5 Liability and Warranty

---

TKH Airport Solutions cannot be held responsible for injuries or damage resulting from non-standard, unintended use, faulty or improper installation of its equipment, or failure to follow the instructions and safety guidelines in this manual. The safety of any system incorporating the LED Inset light 8" is the responsibility of any site installation, commissioning, maintenance, and operational personnel using the system.

### NOTICE

Disregarding the safety instructions in this manual will result in the loss of warranty in case of damage.

Refer to the general TKH Airport Solutions Terms and Conditions document supplied with your sales order contract for a complete liability and warranty description.

---

## 1.6 Manufacturer Details

---

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For service requests, please contact the TKH Airport Solutions Customer Service department:

- Email: [service@tkh-airportsolutions.com](mailto:service@tkh-airportsolutions.com)

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## 2. Safety

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### 2.1 Safety

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This section contains general safety instructions for using your TKH Airport Solutions equipment. Some safety instructions may not apply to the equipment in this manual. Note all warnings and follow all instructions carefully. Failure to do so may result in personal injury, death, or property damage.

To use this equipment safely,

- Refer to the International Standard IEC 61820, Electrical installation for lighting and beaconing of aerodromes - Constant current series circuits for aeronautical ground lighting - System design and installation requirements, and to the International Standard IEC 61821, Electrical installations for lighting and beaconing of aerodromes - Maintenance of aeronautical ground lighting constant current series circuits for instructions on safety precautions.
- Observe all safety regulations. To avoid injuries, always remove power prior to making any wire connections and touching any live part. Refer to the International Standards IEC 61820 & IEC 61821.
- Read and become familiar with the general safety instructions provided in this section of the manual before installing, operating, maintaining, or repairing this equipment.
- Read and carefully follow the instructions given throughout this manual for performing specific tasks and working with specific equipment.
- Store this manual within easy reach of personnel installing, operating, maintaining, or repairing this equipment.
- Follow all applicable safety procedures required by your company, industry standards, and government or other regulatory agencies.

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### 2.2 Qualified Personnel

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The term "qualified personnel" is defined here as a person who thoroughly understands the equipment and its safe installation, operation, maintenance, and repair. Qualified personnel are physically capable of performing the required tasks, familiar with all relevant safety rules and regulations, and have been trained to safely install, operate, maintain, and repair the equipment. It is the responsibility of the company installing, operating or maintaining this equipment to ensure that its personnel meet these requirements.

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## 2.3 Intended use

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Use of this equipment in ways other than described in the datasheet and this manual may result in personal injury, death, or property damage. TKH Airport Solutions cannot be held responsible for injuries or damage resulting from non-standard, unintended application of its equipment. This equipment is designed and intended only for the purpose described in this manual. Uses not described in this manual are considered to be unintended use. Unintended use may result from taking the following actions:

- making changes to equipment that have not been recommended or described in this manual or using parts that are not genuine TKH Airport Solutions replacement parts or accessories
- using materials or auxiliary equipment that are inappropriate or incompatible with your TKH Airport Solutions equipment
- allowing unqualified personnel to perform any task

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## 2.4 Installation

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A thorough understanding of system components and their requirements will help you install the system safely and efficiently. Failure to follow these safety procedures can result in personal injury or death.



Read the safety and installation sections of all system component manuals before installing your equipment.

- Allow only qualified personnel to install TKH Airport Solutions equipment and auxiliary equipment. Use only approved equipment. Using unapproved equipment in an approved system may void agency approvals and will void the warranty.
- Make sure all equipment is rated and approved for the environment in which you are using it.
- Follow all instructions for installing components and accessories.
- Do not hold or carry the light assemblies by the cables.
- Install all electrical connections according to local codes and regulations, provided they are not in contradiction with the general rules.
- Use only electrical wire of sufficient gauge and insulation to handle the rated current and voltage demand. All wiring must meet local codes.
- Route electrical wiring along a protected path. Make sure the wires will not be damaged by moving equipment and animals (e.g. rodents).
- Protect components from damage, wear, and harsh environmental conditions.
- Allow sufficient room for maintenance, panel accessibility (power products), and cover removal (power products).
- Protect equipment with safety devices as specified by applicable safety regulations.
- If safety devices must be removed for maintenance, re-install them immediately after the work is completed and check them for proper functioning.

## 2.5 Operation



Only qualified personnel (see section Qualified Personnel) should operate this equipment. Read all system component manuals before operating this equipment. A thorough understanding of system components and their operation will help you operate the system safely and efficiently.

- Before starting this equipment, check all safety interlocks, fire-detection systems, and protective devices such as panels and covers. Make sure all devices are fully functional. Do not operate the system if these devices are not working properly. Do not deactivate or bypass automatic safety interlocks or locked-out electrical disconnects or pneumatic valves.
- Never operate equipment with a known malfunction.
- Do not attempt to operate or service electrical equipment if standing water is present.
- Use this equipment only in the environments for which it is rated. Do not operate this equipment in humid, flammable, or explosive environments unless it has been rated for safe operation in these environments.
- Never touch exposed electrical connections on equipment while the power is ON.
- Never look directly in the light source while the power is ON.
- For fixtures/spare parts marked with the photobiological safety symbol avoid prolonged staring in the switched ON fixture.

## 2.6 Action in the event of a system or component malfunction



Do not operate a system that contains malfunctioning components. If a component malfunctions, turn the system OFF immediately.

- Disconnect and lock out electrical power.
- Allow only qualified personnel to make repairs. Repair or replace the malfunctioning component according to instructions provided in its manual. Allow only qualified personnel to perform maintenance, troubleshooting, and repair tasks. Only persons who are properly trained and familiar with TKH Airport Solutions equipment are permitted to service this equipment.
- Follow the recommended maintenance procedures in your equipment manuals.
- Connect all disconnected equipment ground cables and wires after servicing equipment. Ground all conductive equipment.
- Use only approved TKH Airport Solutions replacement parts. Using unapproved parts or making unapproved modifications to equipment may void agency approvals, impair specified performance and create safety hazards.
- Check interlock systems periodically to ensure their effectiveness.
- Do not attempt to service electrical equipment if standing water is present. Use caution when servicing electrical equipment in a high-humidity environment.
- Use tools with insulated handles when working with electrical equipment.
- Make sure to perform a leakage test, as explained in chapter 6.9, everytime a fixture is opened and closed

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## 3. General Recommendations

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### 3.1 Receiving, Storage and Unpacking

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- 1 Upon receipt of goods at the site store, check all packaging for visible damage. Every damaged box should be opened and its contents inspected for damage. If equipment is damaged, a claim form shall be filled with the carrier immediately. It may then be necessary for the carrier to inspect the equipment.
- 2 Store the light assembly preferably in its original packaging in a protected area. When stored unpacked, please take care not to damage the cable insulation.
- 3 Unpack the light assembly at the installation site to avoid damage during transportation and handling.

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### 3.2 Electrical Connection

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The light assemblies covered by this manual are designed for connection to 6.6-A series circuits via one or two L-830 or L-831 series transformers. The current to the light should not exceed 6.6 A + 5%. The series transformers are to be ordered separately.

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### 3.3 Base Earthing

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Whatever the chosen installation method, it is strongly recommended to earth the base, especially in locations presenting a risk of lightning strikes. Failure to earth the base correctly will void the warranty for all damages occurring as a result of voltage surges.



## 4. About the Inset light 8”

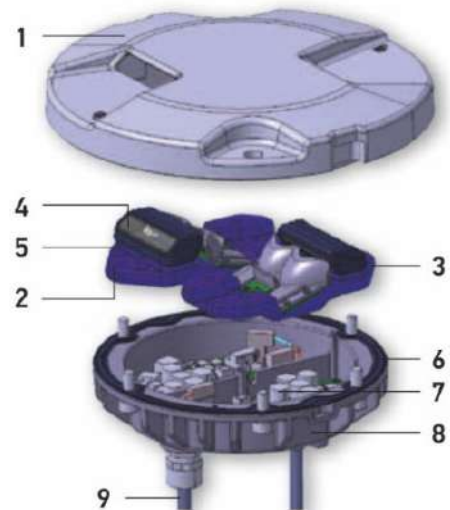
TKH Airport Solutions Inset lights 8” are constructed mainly by using standard components from TKH Airport Solutions standard program of inset lights. There are many variants available for runway and taxiway use.

### 4.1 Inset light 8” description

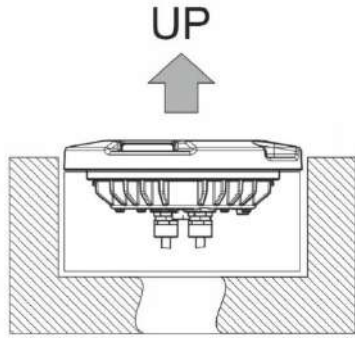
TKH Airport Solutions inset lights are efficient and high-performing LED lights, providing at least 50,000 hours of service life at full 6.6A operation. The LED light fixtures have a simplified modular construction, consisting of five main components:

- Aluminum forging cover plate, with mechanical load capabilities exceeding FAA requirements
- Interchangeable LED light module
- Electronic driver board with housing
- Borosilicate glass prism with optional sapphire glass
- Secondary cable in accordance with FAA or ICAO requirements

Pos.	Component
1.	Cover (drop forged AL, anodised)
2.	High power LED module 1
3.	High power LED module 2
4.	Prism (borosilicate glass)
5.	Sealing aperture (Fluor silicate)
6.	Sealing - housing ((Fluor silicate)
7.	Electronics
8.	Housing (Aluminium, die-cast)
9.	FAA L-823 plug



## 4.2 General specifications

Nominal AC frequency:	40-70 Hz
Operation on constant current source	max. 6.6 A
Ambient temperature:	-40°C (40°F) / +75°C (+167°F)
Weight: approx.	2.5 kg
Dust and water tightness:	IP68, IP69
Operation position must be according the drawing (note: drawing is indicative only):	

### 4.3 Operation Information

The Inset lights 8" are intended for outdoor use only for dedicated airfield installation. The power consumption and rated voltage are different for each function of the Inset lights 8". Optionally, the inset lights can be supplied with heating. Refer to the table below:

Power consumption of the Inset Lights 8 inch <sup>1</sup>					
Light	Function	Colour	Max. power consumption (W)	Max. power consumption with heating (W)	Max. rated voltage (VAC) normal/heating
TDZ	Touchdown Zone	White	19	32	3 / 5
REL	Runway Entrance	Red	11	24	2 / 4
RCL	Runway Center Line	White/white	38	64	6 / 10
		White/red	30	56	5 / 9
		Red	11	24	2 / 4
THL	Take-Off and Hold	Red	14	27	3 / 5
RWE	Runway End	Red	38	52	6 / 8
RETIL	Rapid Exit Taxiway Indicator Light	Yellow	17	31	3 / 5
RETL	Rapid Exit Taxiway 400 cd	Green/green	29	55	5 / 9
		Green/yellow	30	56	5 / 9
		Yellow/yellow	29	55	5 / 9
		Yellow	14	27	3 / 5
		Green	15	28	3 / 5
RETL800 RETL800	Rapid Exit Taxiway 800 cd	Yellow	21	35	4 / 6
		Green	22	36	4 / 6
RWG	Runway Guard	Yellow	25	39	4 / 6
TCL	Taxiway Center Line	Green	10	23	2 / 4
		Yellow	10	23	2 / 4
		Green/green	20	46	4 / 7
		Yellow/yellow	21	47	4 / 8
		Green/yellow	20	46	4 / 8
TCC	Taxiway Center Line curved	Green	9	22	2 / 4
		Yellow	9	22	2 / 4
		Green/green	17	43	3 / 7
		Yellow/yellow	17	43	3 / 7
		Green/yellow	17	43	3 / 7
IHP	Intermediate Holding Position	Yellow	11	24	2 / 4
STB	Stop Bar Light	Red	11	24	2 / 4
Omnidirectional Inset Lights 8 inch <sup>1</sup>					
REO	Runway Edge Omni	White	10	23	2 / 4
TXE	Taxiway Edge	Blue	8	21	2 / 4
TXO	Omnidirectional	Yellow	10	23	2 / 4
		Green	11	24	2 / 4
SMGL60	Stand Maneuvering Guidance	Yellow	11	24	2 / 4
HELI	Heliport	Green	10	23	2 / 4
		White	10	23	2 / 4

<sup>1</sup> = Power consumption is for the fixture only. Cable losses, transformer efficiency etc. are not included.

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### 4.3.1 More Information

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- For all technical data refer to the datasheet for your product at <https://www.tkh-airportsolutions.com/airfieldproducts/> or scan:



- If you have any questions about installation or maintenance, please contact TKH Airport Solutions Customer Service on [service@tkh-airportsolutions.com](mailto:service@tkh-airportsolutions.com).

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### 4.4 Accessories

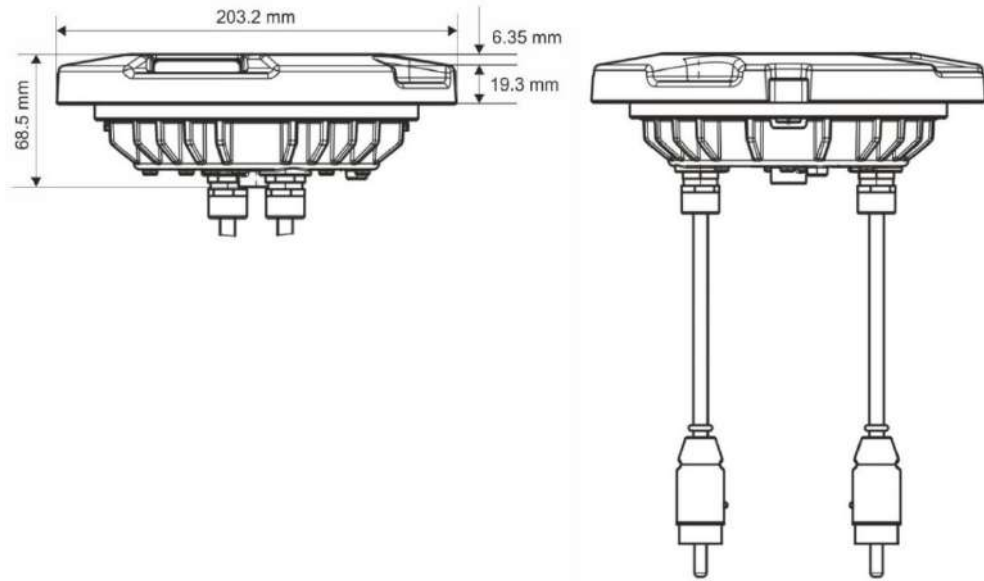
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Optional accessory:

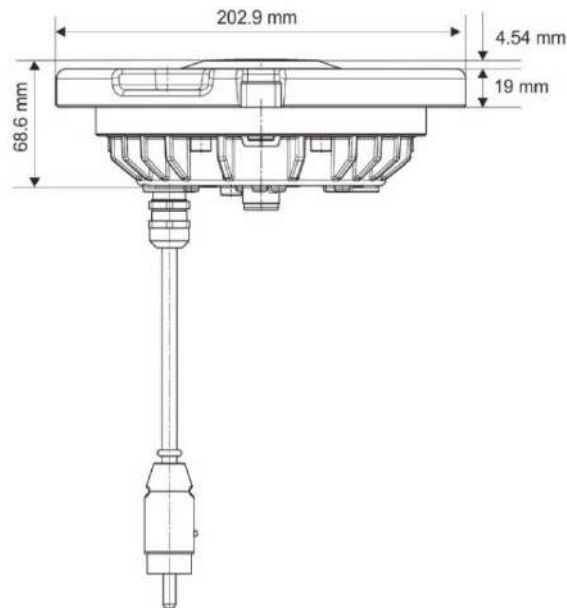
- Transformer
- Shallow base

## 4.5 Dimensions

### Uni/bi-directional inset lights 8"



### Omni directional inset lights 8":



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## **5. Maintenance Recommendations**

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### **5.1 Warranty Limitation**

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The light assemblies are delivered fully tested and sealed. In case of malfunctioning during the warranty period, the defective light shall be shipped back to TKH Airport Solutions without opening it. Any attempt to open the light during the warranty period will void the warranty.

The prisms are not included in the warranty.

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### **5.2 Maintenance in the Field**

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Field maintenance is limited to:

- Cleaning the surface of the front glass when necessary.
- Every 6 months, check the elevation and toe-in adjustment.

It is recommended to replace the light assembly if it malfunctions in the field or at end-of-life (after about 50000 operating hours).

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### **5.3 Preventive Maintenance**

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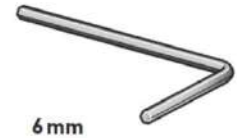
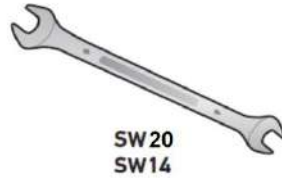
Besides cleaning the surface of the lens, no preventive maintenance is required.

## 6. Installation and maintenance instructions


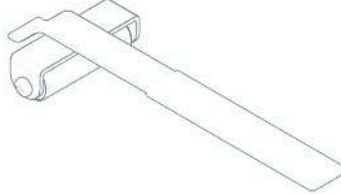

### 6.1 Tools Required



Non-caustic cleaning agent

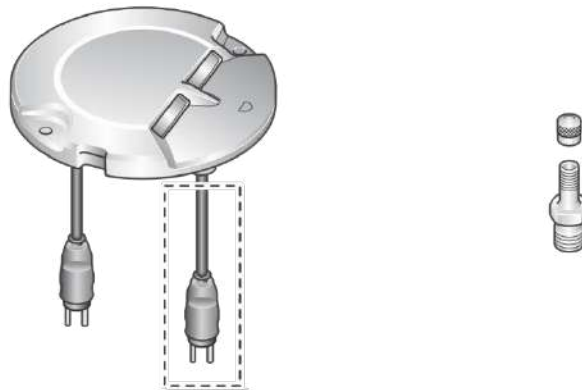
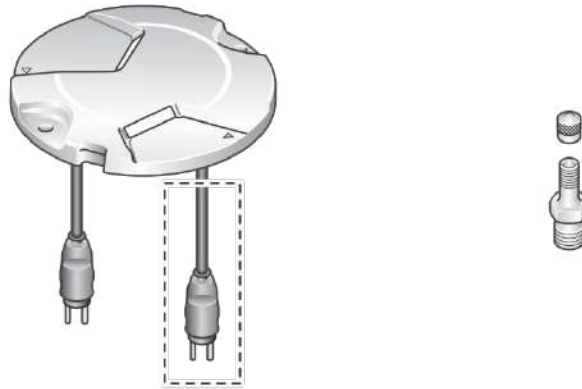
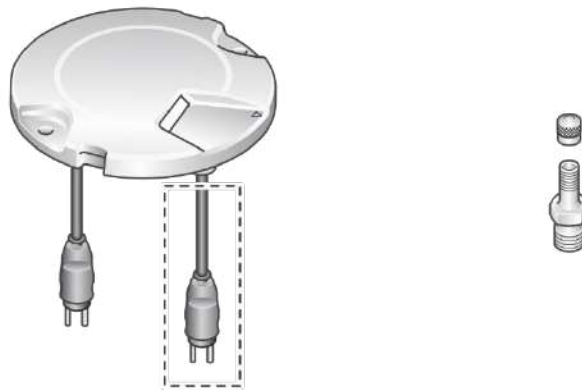
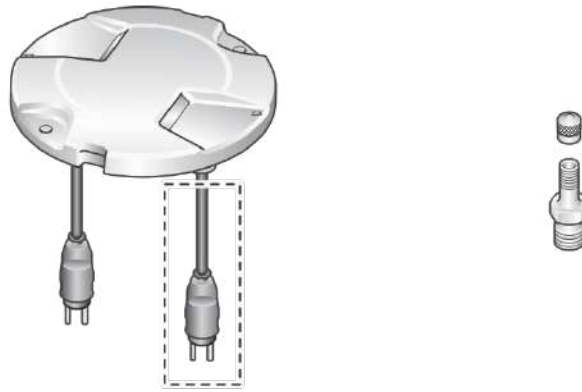


#### 6.1.1 Optional tools available to order

 <p>Torque wrench 20 - 40 Nm (302.331)</p>	 <p>Lifting tool (302.321) to extract inset lights from the shallow base</p>
	<p>Tool set (302.311) for repair and maintenance of inset lights containing:</p> <ul style="list-style-type: none"> <li>• Torque wrench 0-10 Nm</li> <li>• 13 adapters for torque wrench, covering sizes 4 mm - 14 mm</li> <li>• 6 Allen adapters for torque wrench, H3-H8</li> <li>• 7 TORX adapters for torque wrench, T10-T40</li> <li>• length adapters for torque wrench</li> <li>• 1 manual wrench 14 mm</li> <li>• 1 manual wrench 20 mm</li> </ul>

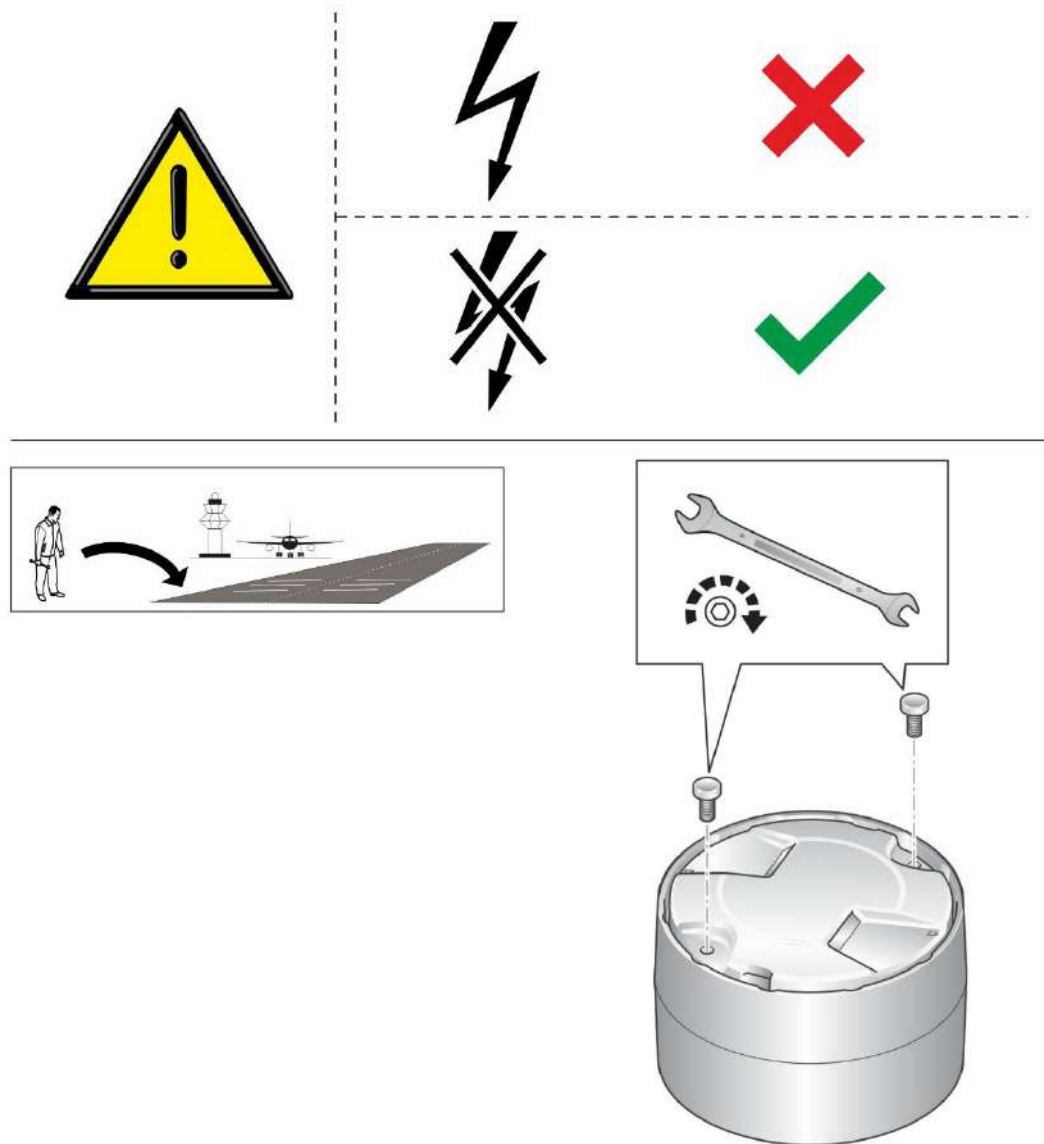
## 6.2 Kit includes

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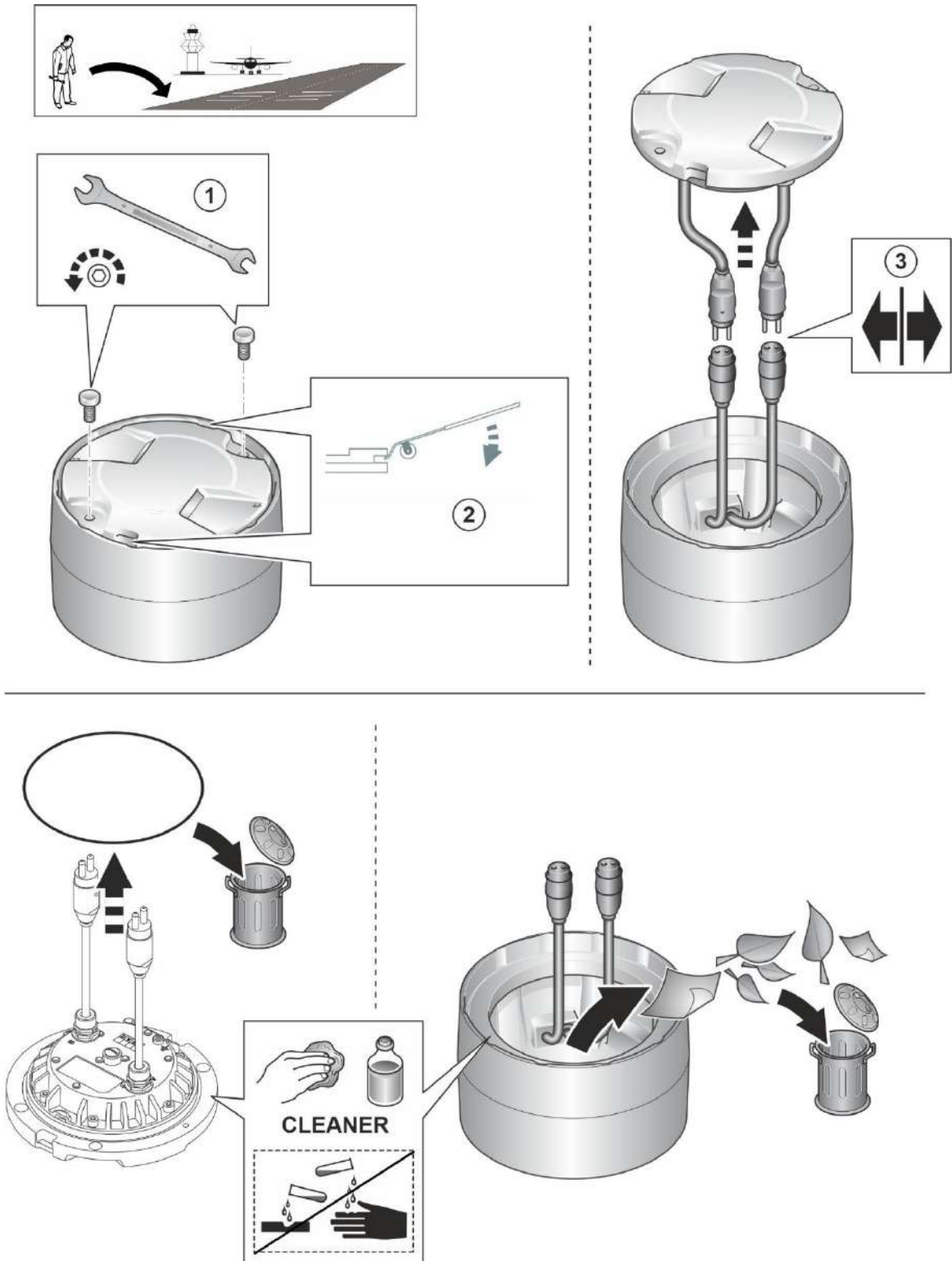
## 6.3 Installation

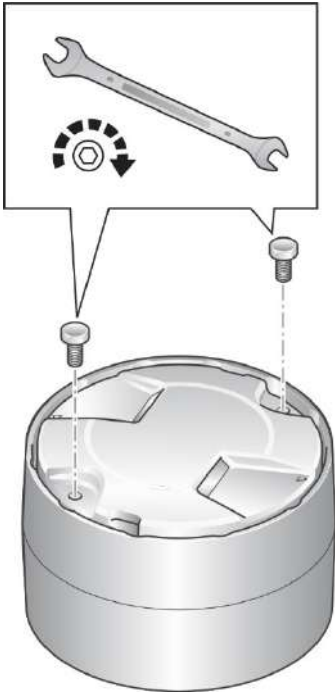
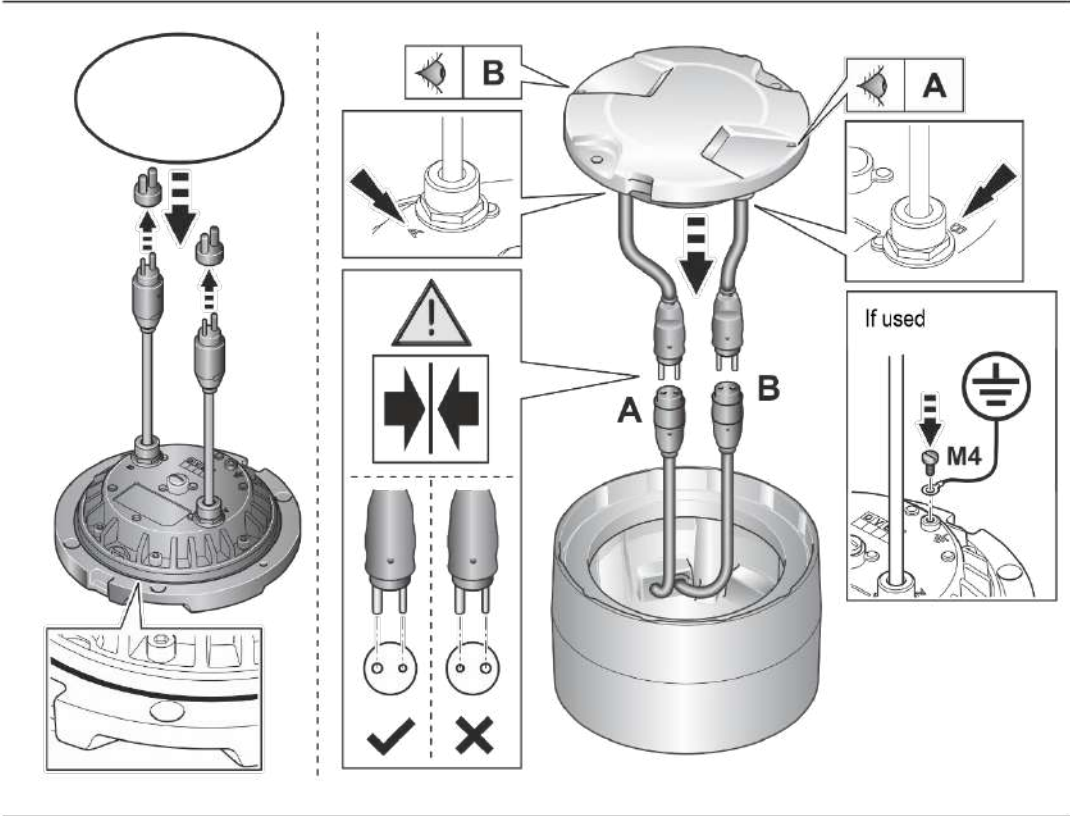


### NOTICE

Tighten the nuts with a torque wrench. See specification of the shallow base manufacturer.

## 6.4 Replacing the O-ring of the inset light 8"





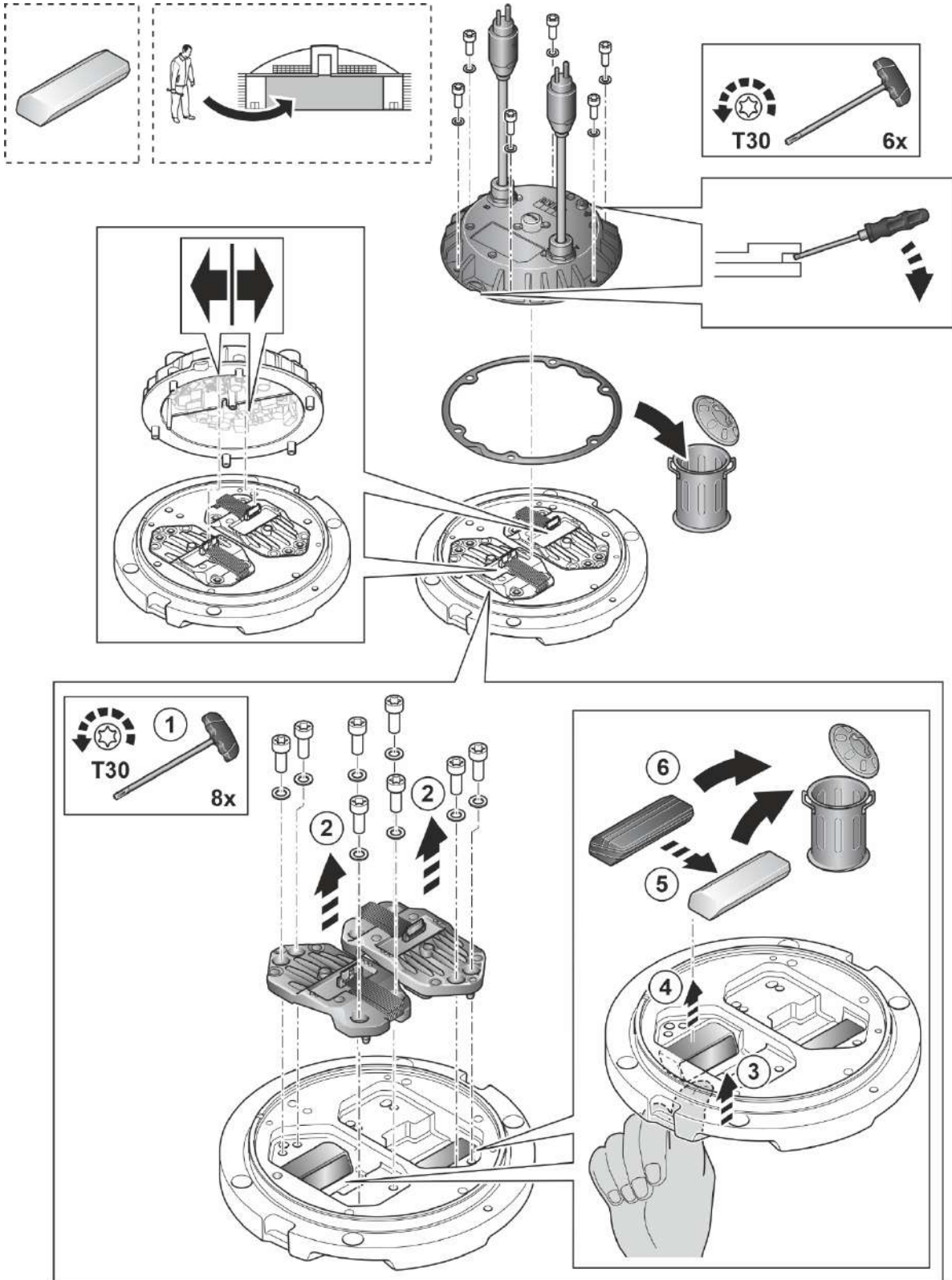
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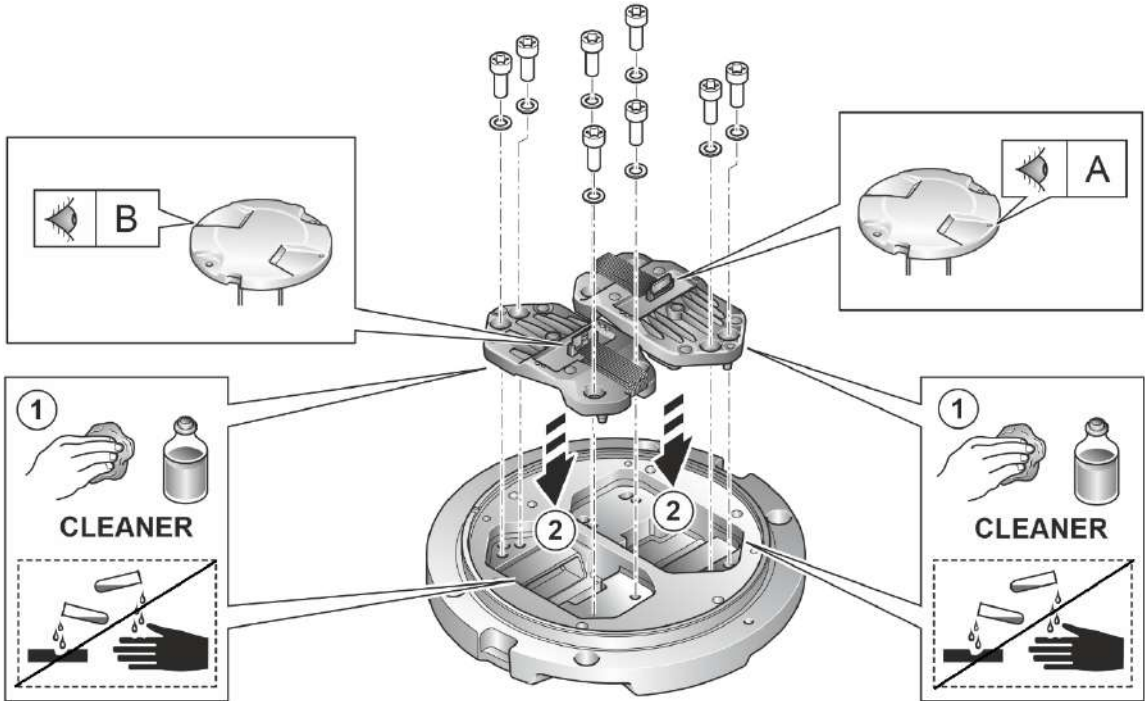
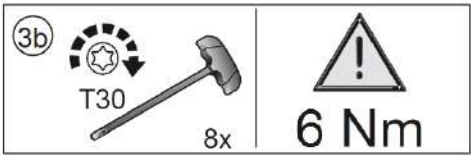
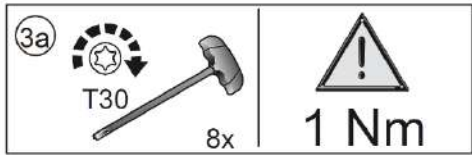
Tighten the nuts with a torque wrench. See specification of the shallow base manufacturer.

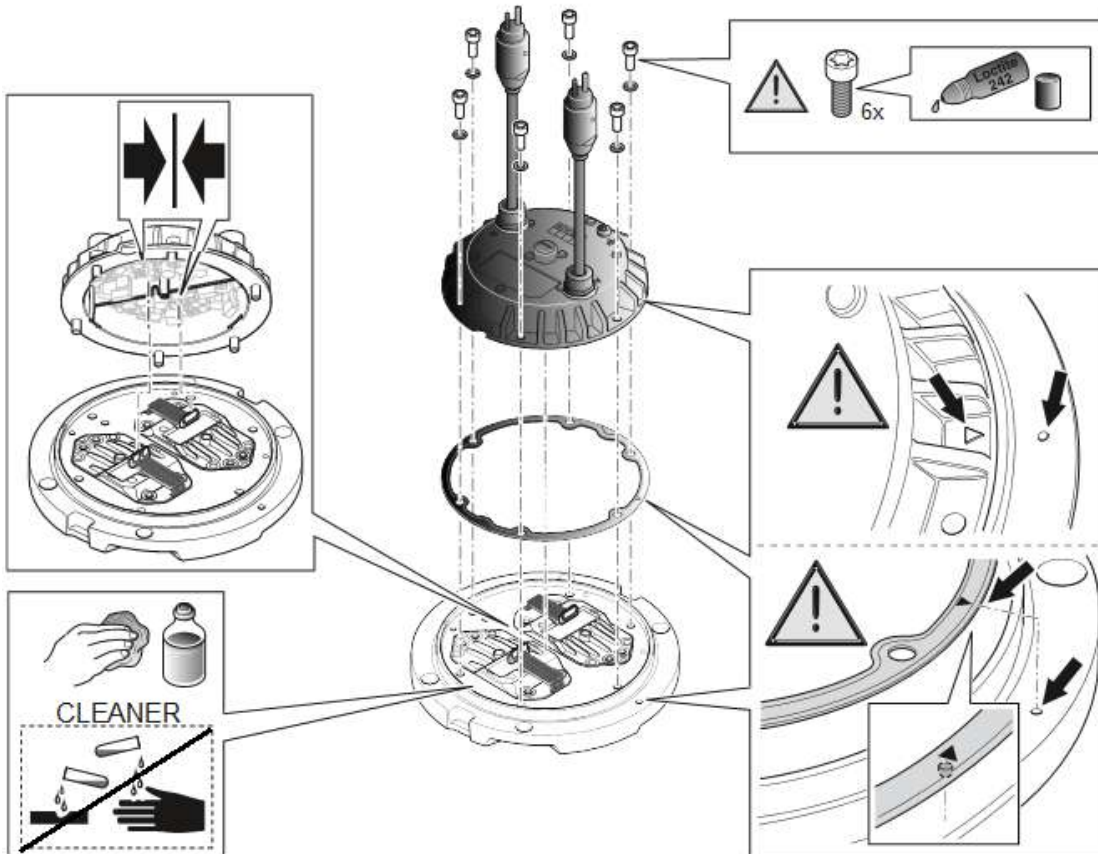
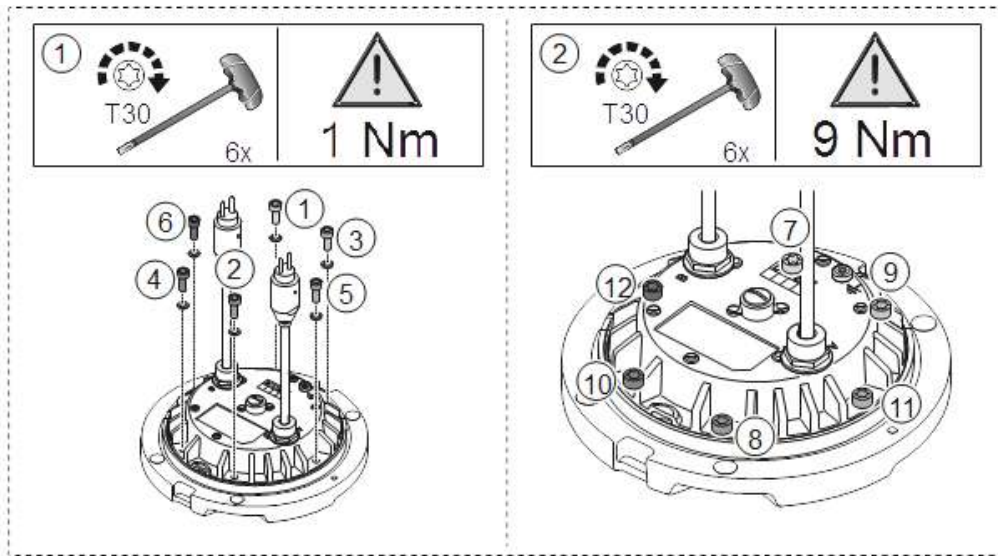
## 6.5 Replacing the prism

### NOTICE

Follow the instructions carefully and only disconnect the cables as shown in these pictures. Do not disconnect any other cables!







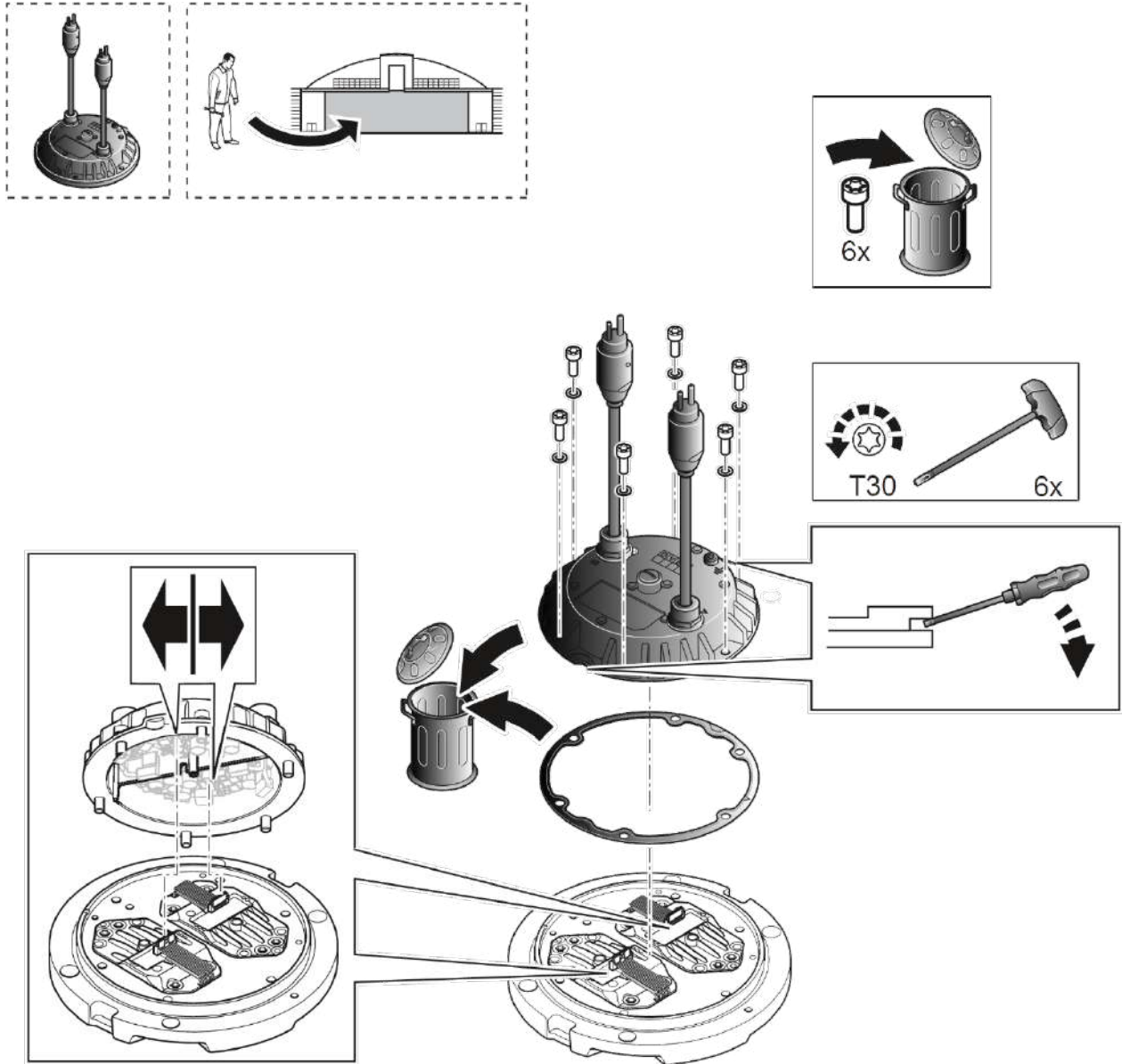
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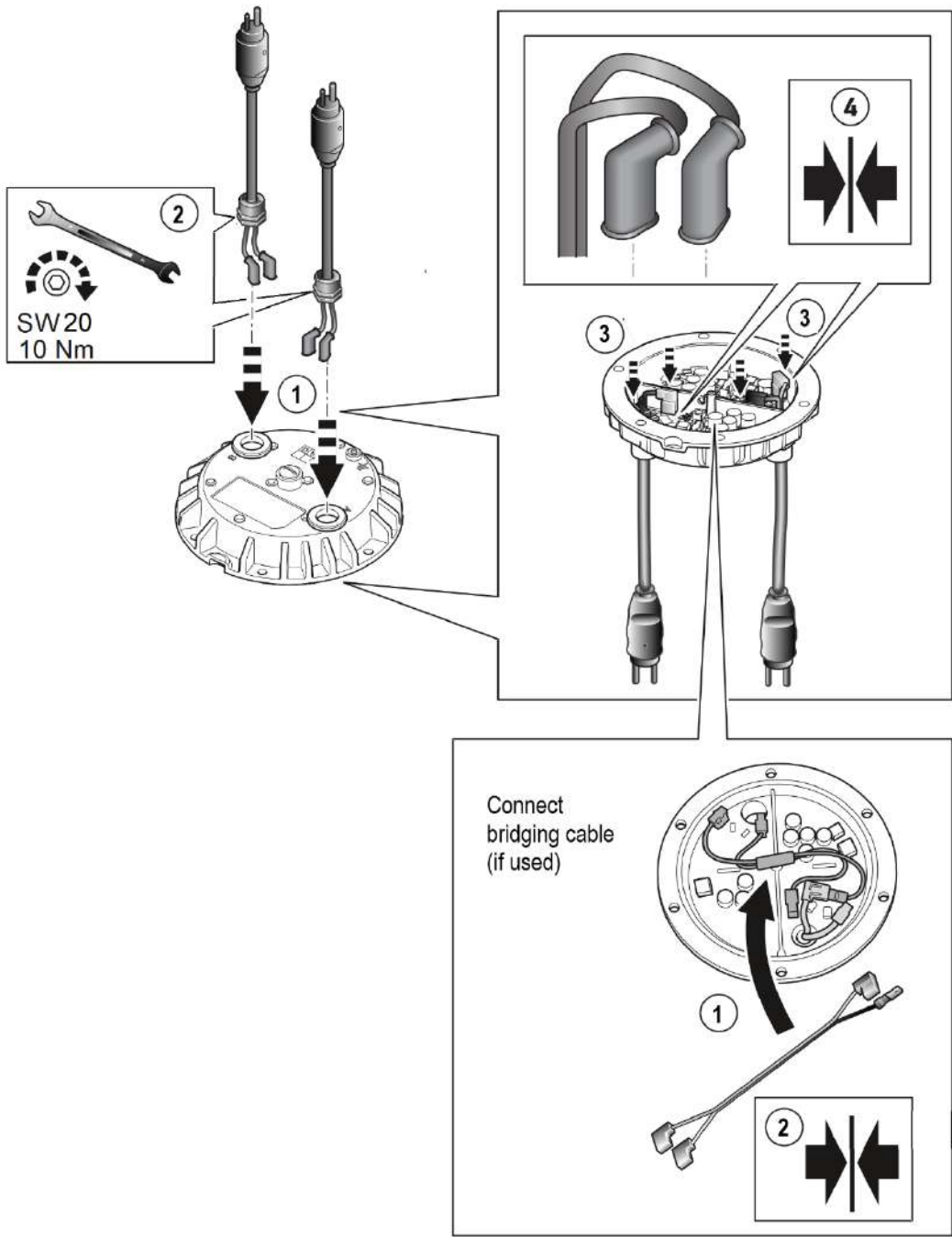
Make sure to perform a leakage test, as explained in chapter 6.9, everytime a fixture is opened and closed.

## 6.6 Replacing the housing group

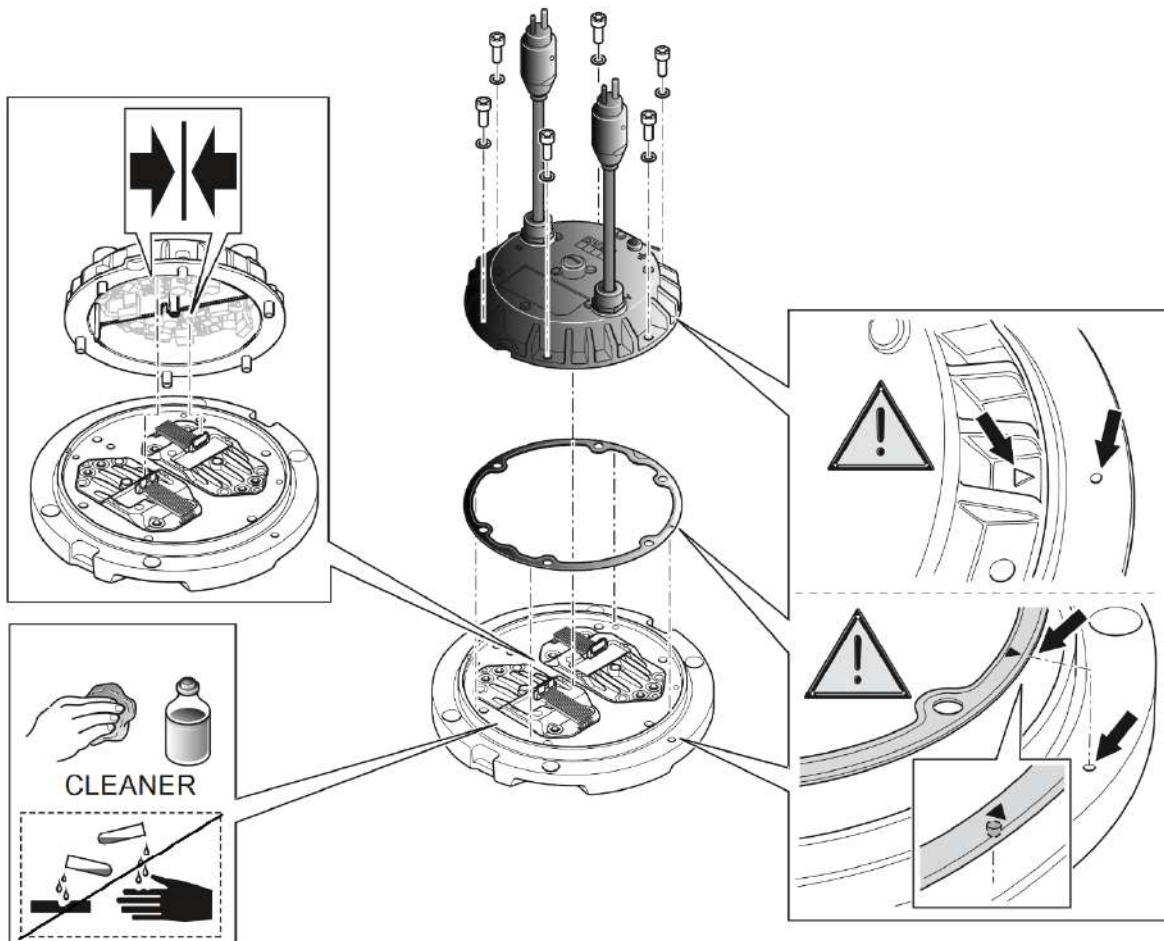
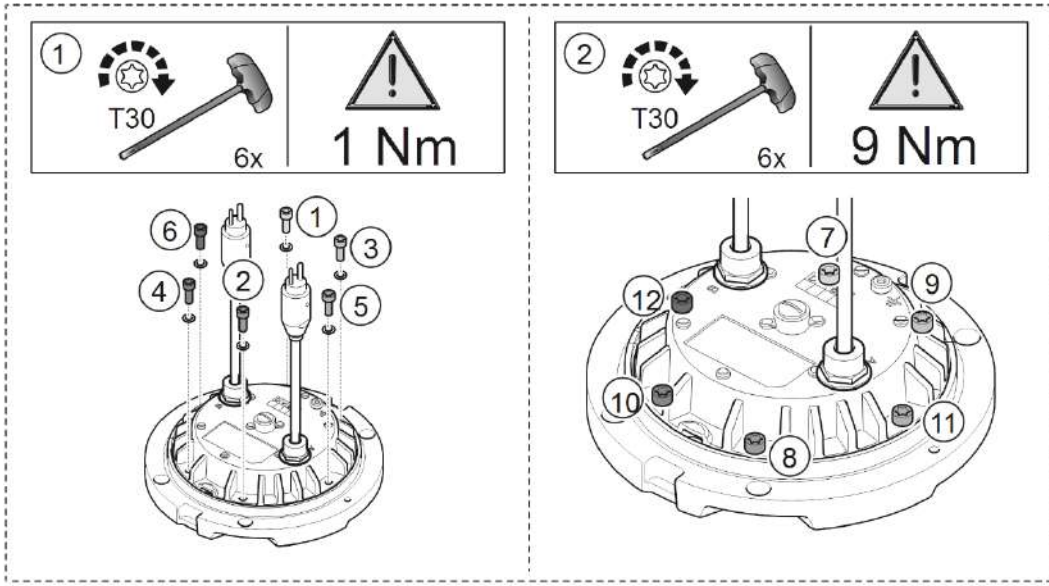
**NOTICE**

Follow the instructions carefully and only disconnect the cables as shown in these pictures. Do not disconnect any other cables!









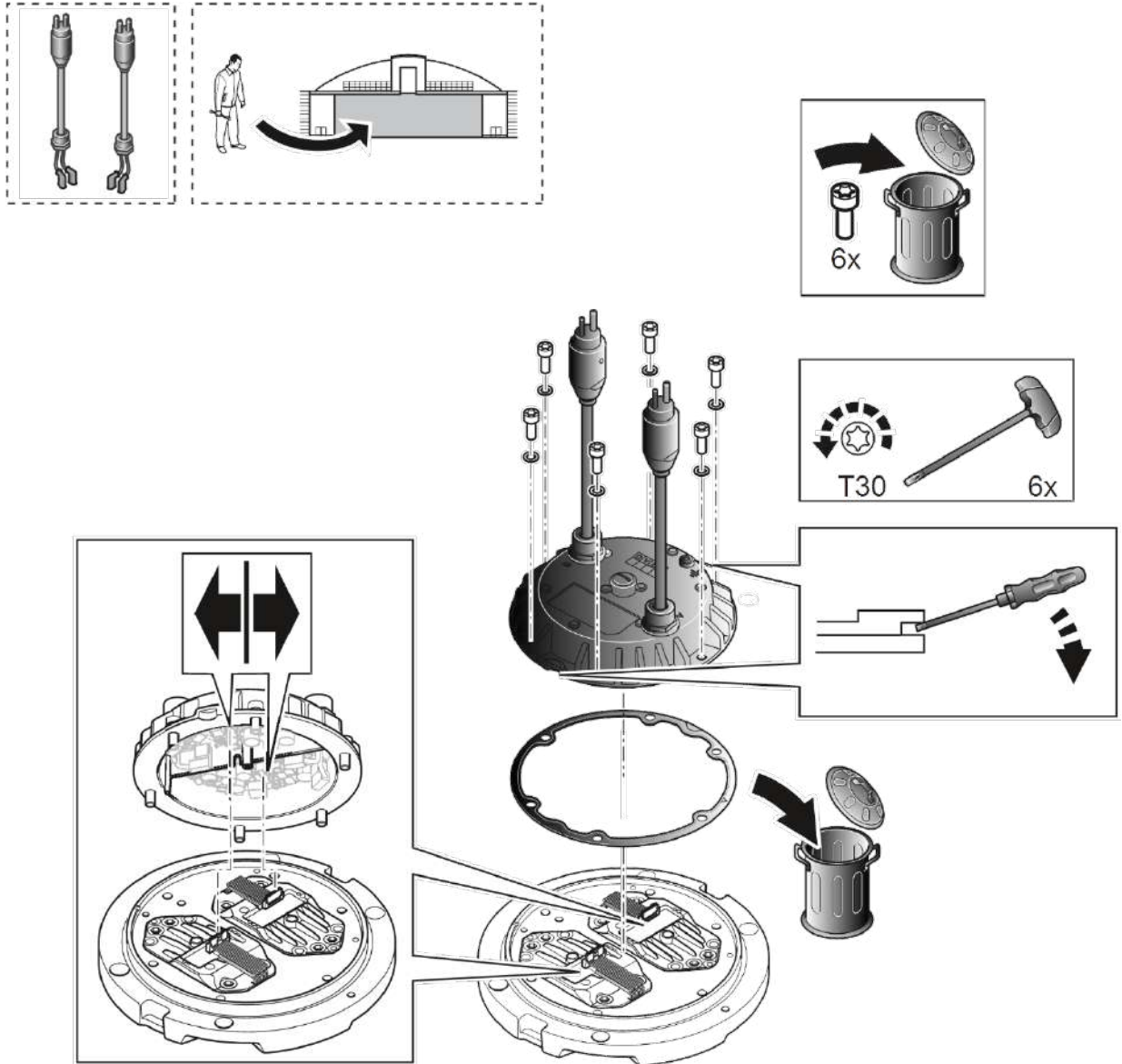
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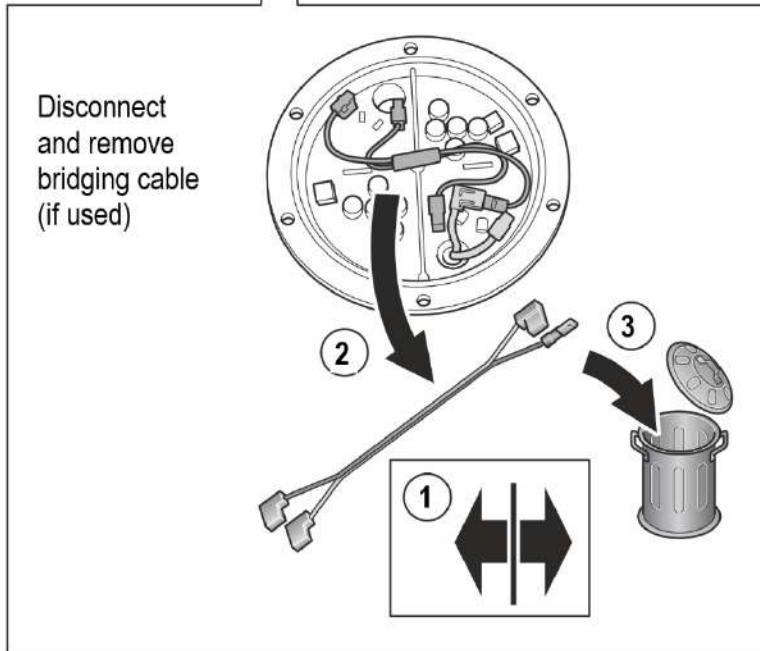
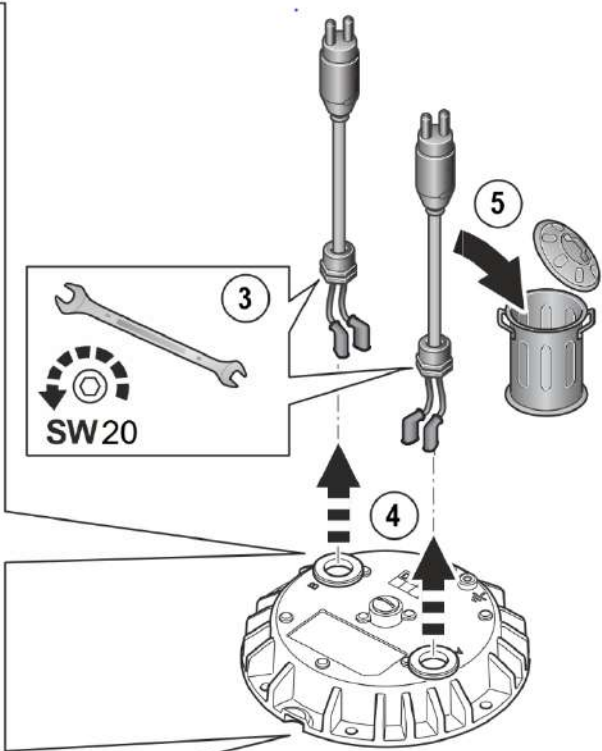
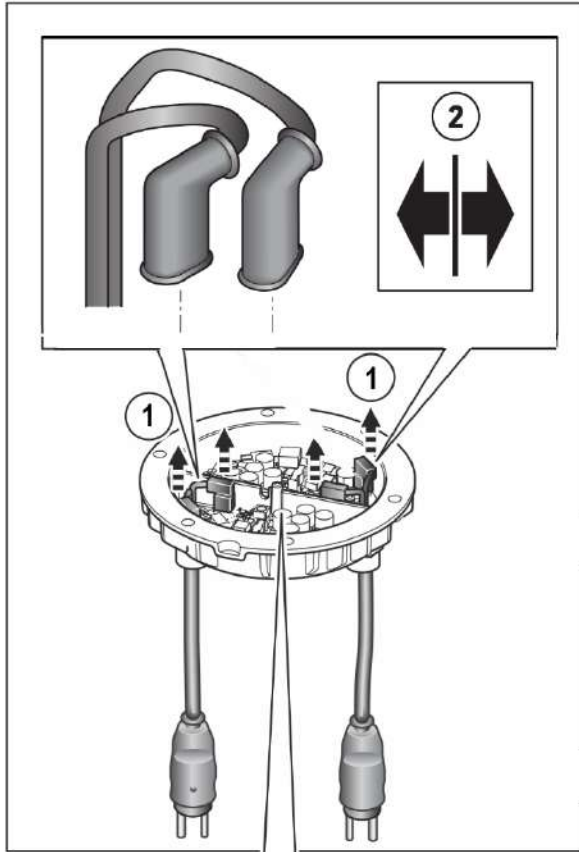
Make sure to perform a leakage test, as explained in chapter 6.9, everytime a fixture is opened and closed.

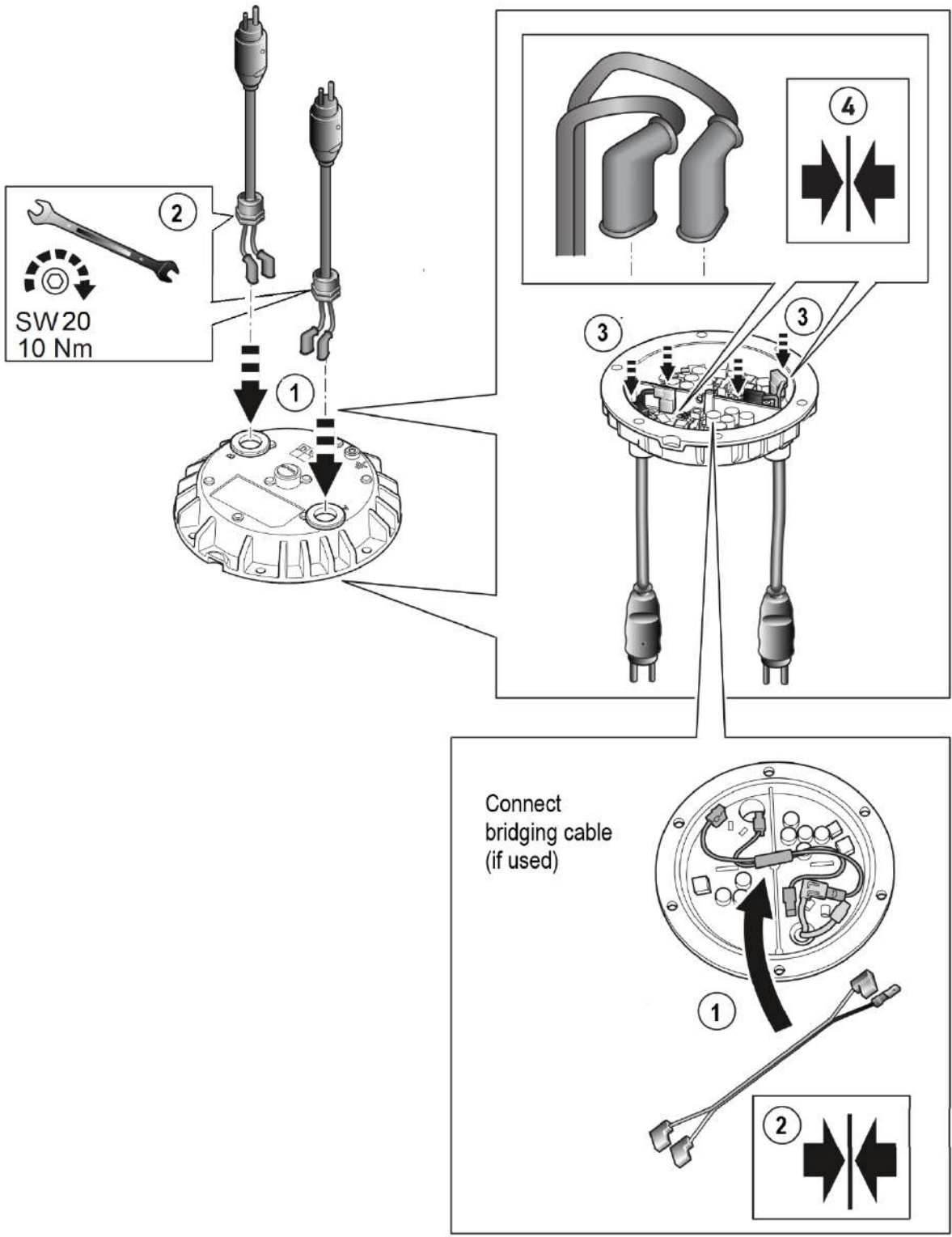
## 6.7 Replacing the external cable

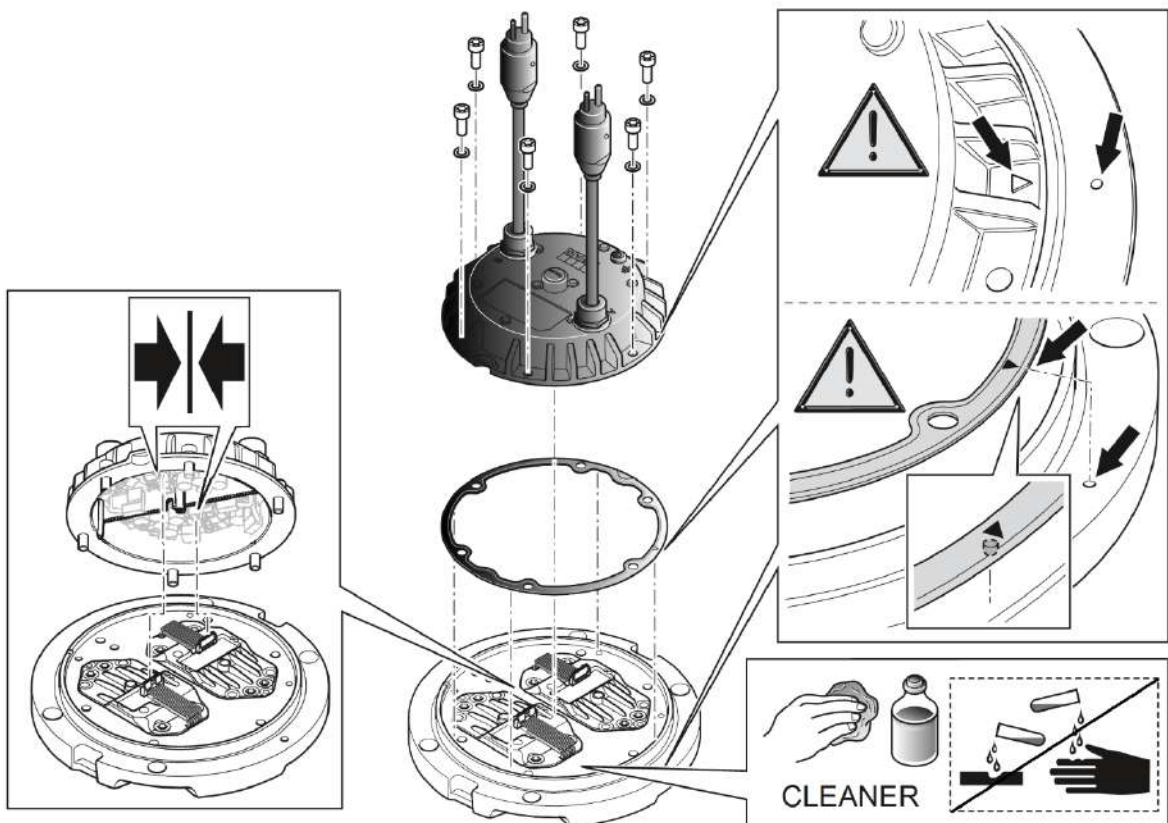
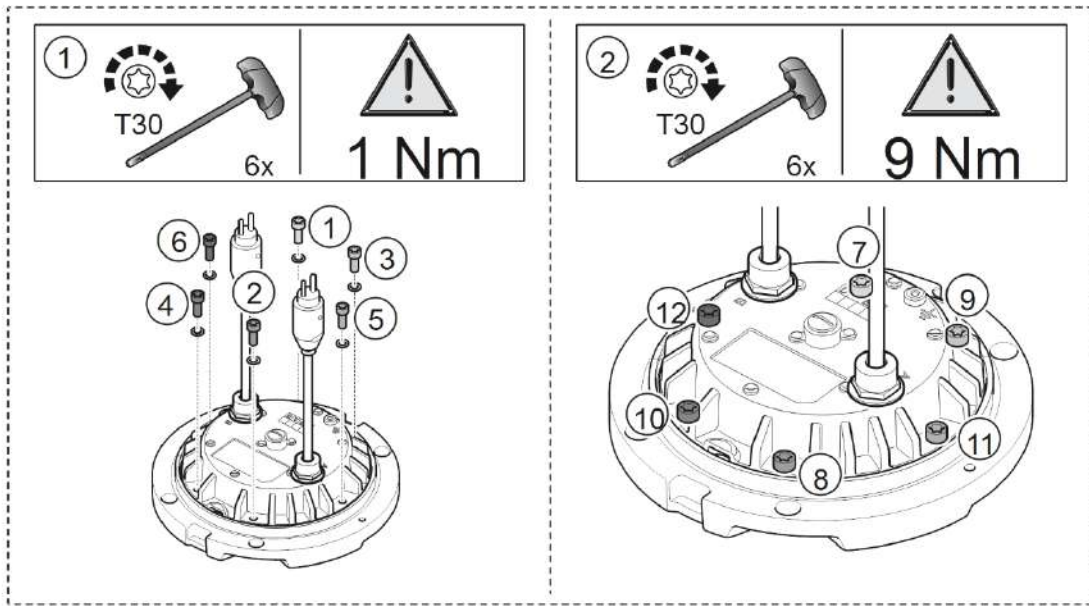
**NOTICE**

Follow the instructions carefully and only disconnect the cables as shown in these pictures. Do not disconnect any other cables!









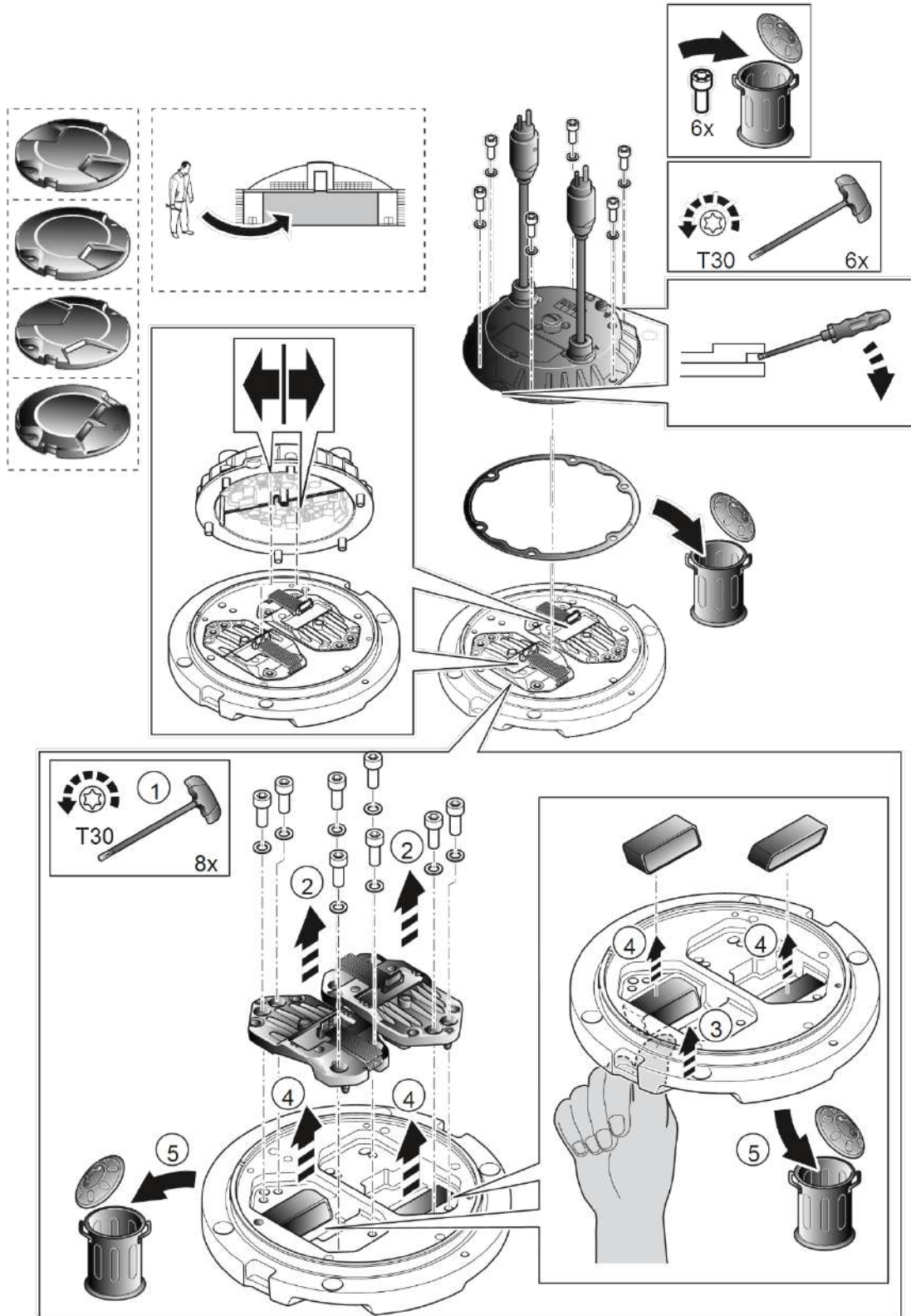
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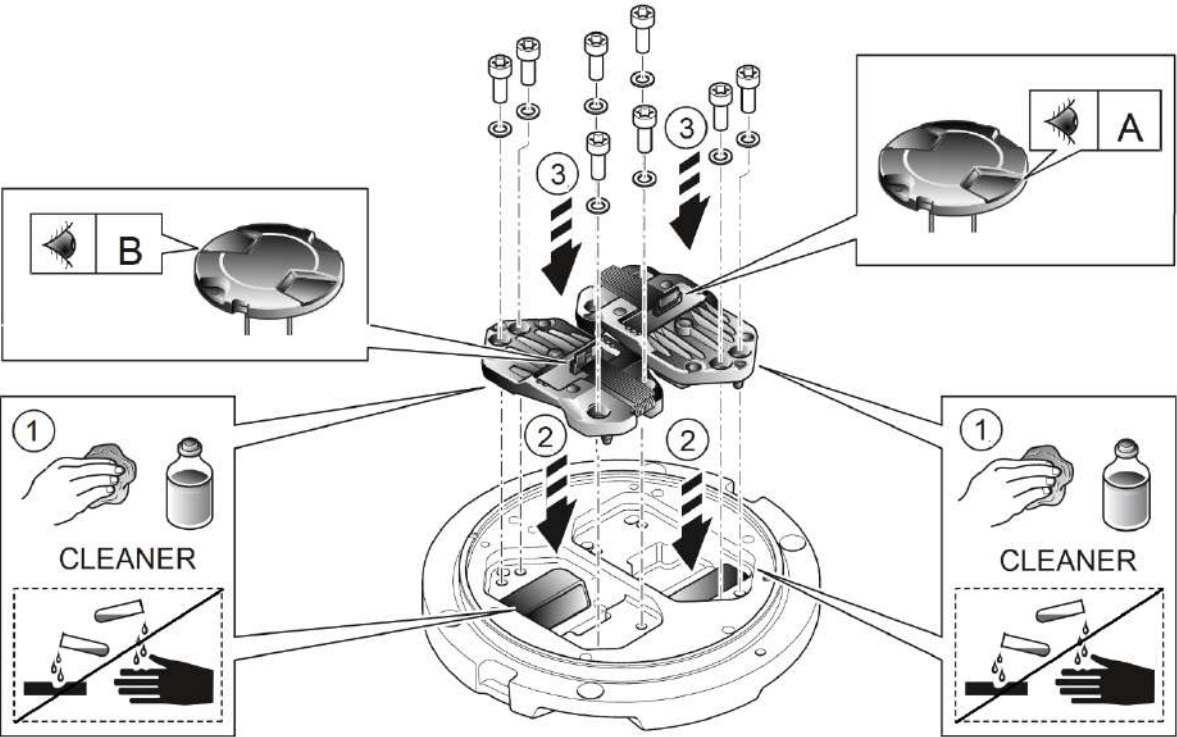
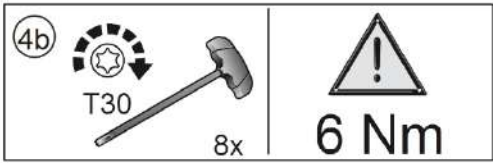
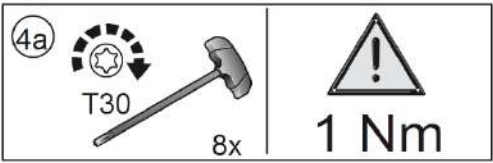
Make sure to perform a leakage test, as explained in chapter 6.9, everytime a fixture is opened and closed.

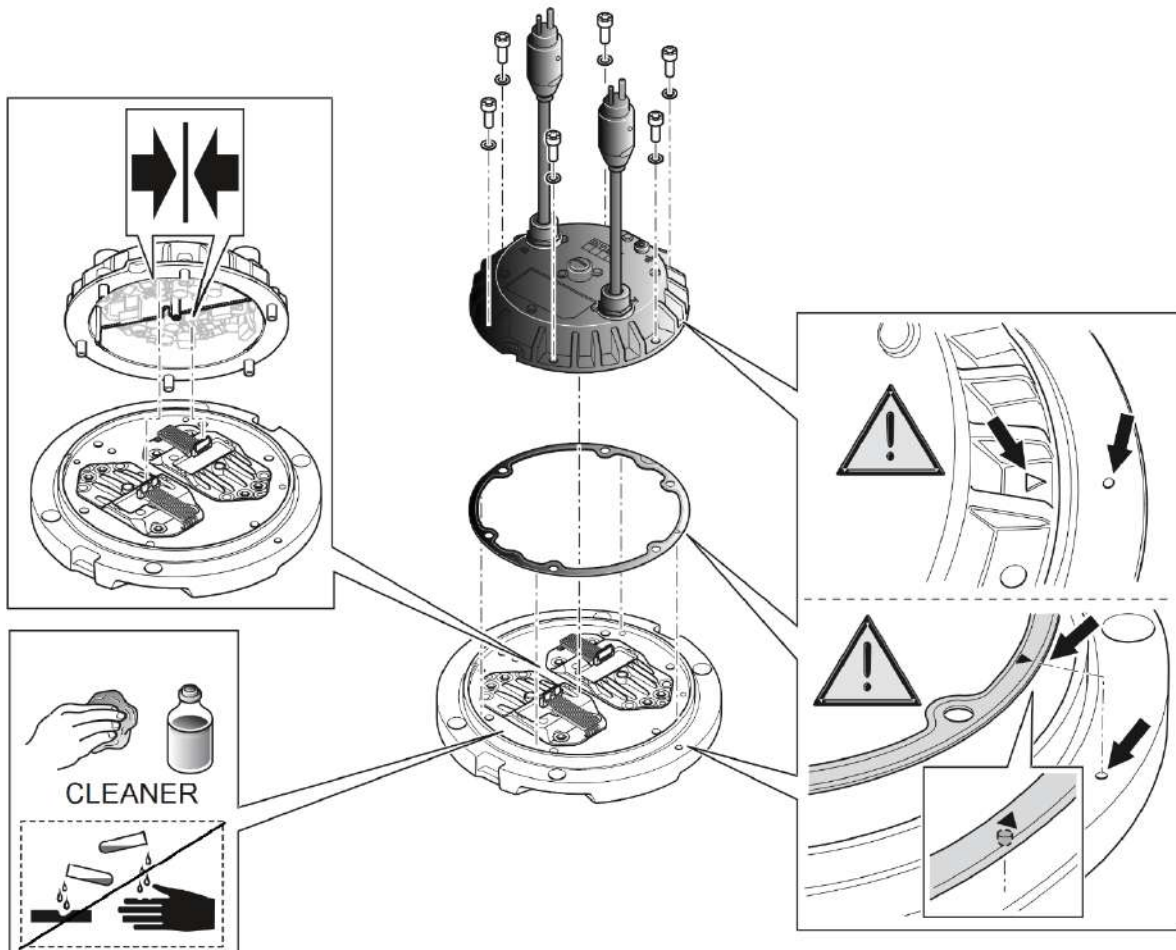
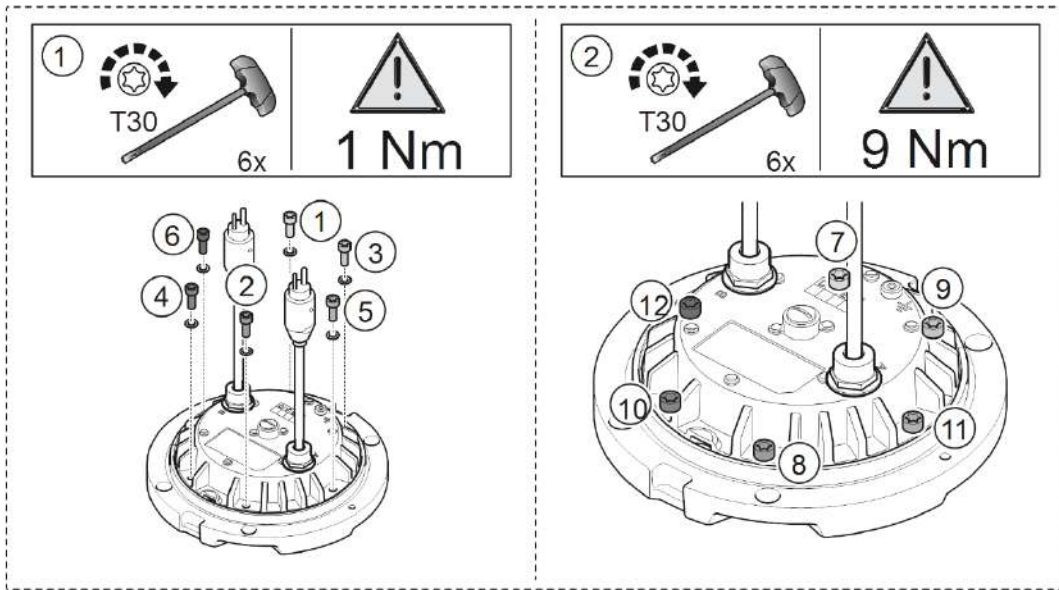
## 6.8 Replacing the module holder group

### NOTICE

Follow the instructions carefully and only disconnect the cables as shown in these pictures. Do not disconnect any other cables!





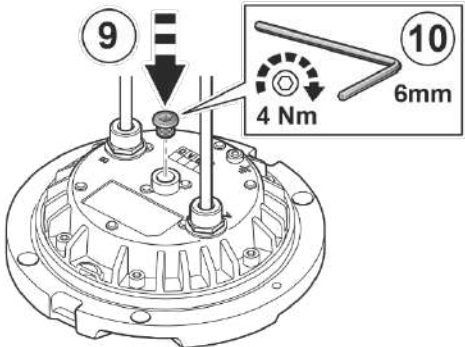
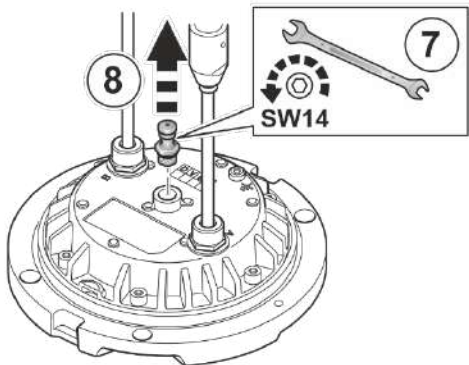
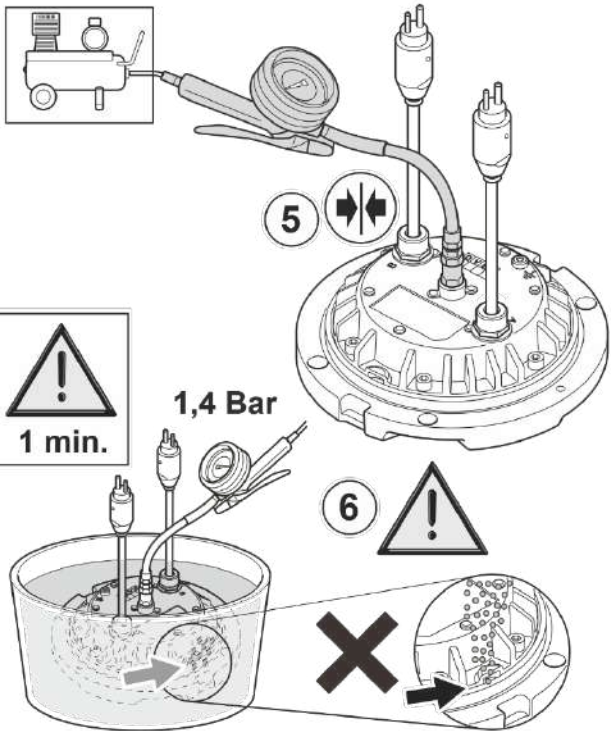
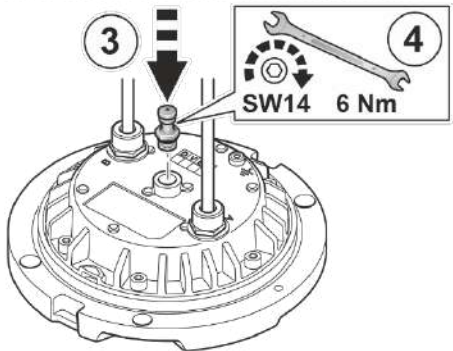
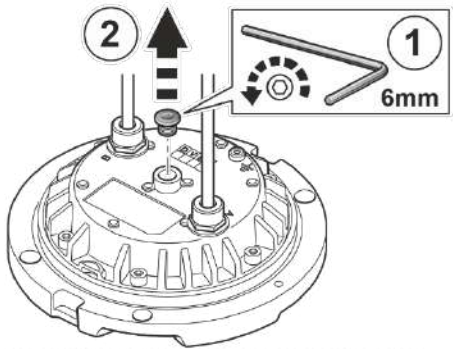


**NOTICE**

Make sure to perform a leakage test, as explained in chapter 6.9, everytime a fixture is opened and closed.



**6.9 Leakage test**





### Company profile:

TKH Airport Solutions is an innovator in airfield ground lighting, offering a complete range of LED AGL products. We build upon the know-how from a long and successful tradition of pioneering developments in the AGL and connectivity industry. Being part of the TKH Group, our company can build on a history of more than 90 years in smart connectivity, energy distribution and AGL.

#### More information:

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sales@tkh-airportsolutions.com  
www.tkh-airportsolutions.com  
+31 (0)53 57 414 56

#### Visiting address

**TKH Airport Solutions**  
Elektrostraat 17  
7483 PG Haaksbergen  
The Netherlands



# Installation and Operation Manual

## Sequential Flash Light System – SFL 971

---

## Preface

---

- Please read carefully and understand the contents of this manual.
- Failure to read the manual may result in serious injury, or serious damage to equipment.
- Make sure these instructions are always accessible for all users and ensure that you have read and understood the contents

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## Document Information

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Name : *05\_LED\_AGL\_User\_manual\_Sequential\_Flash\_Light\_System\_SFL971\_03-71098\_EN\_V0\_02.pdf*

Version	Date	Description
1.0	17-09-2024	First Release

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# 1. About this manual

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This manual includes technical information about the TKH Airport Solutions Sequential Flash Light System SFL 971 for Approach (AFL) and Threshold Identification Light (TIL).

The manual is intended to be used for installation, operation, maintenance of an SFL system, as well as for purchase of spare parts.

---

## 1.1 Symbols used

---

The following marking conventions are used in this manual to draw attention to specific topics or actions:



**DANGER!** - This sign indicates a hazardous situation that, if not avoided, will result in death or serious injury.



**WARNING** - This sign indicates a hazardous situation that, if not avoided, could result in death or serious injury.





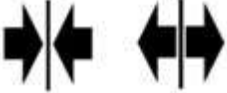



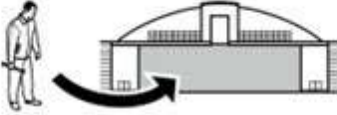


**CAUTION** - This sign indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.



**NOTICE** - is used in this manual to indicate a situation that could result in damage to property or equipment.

The following symbols are used in pictures for explanation or an action:

<p>Correct / Incorrect</p> 	<p>Look / See</p> 	<p>Location / position</p> 	<p>Movement</p> 
<p>Connect / Disconnect</p> 	<p>Photobiological safety</p> 	<p>ESD warning</p> 	
<p>Work carried out on runway</p> 		<p>Work carried out in workshop</p> 	

The following symbols are used on equipment and in this manual to warn of potential hazards:



**DANGER of electrical shock or arc flash.** Failure to observe this warning will result in serious injury or death.



**WARNING or CAUTION:** where this symbol is used on the equipment, it is mandatory to consult the manual to find out the nature of potential hazards and any actions which have to be taken to avoid them.

## 1.2 Storing the manual

- This manual is a part of your product. Store the manual in a location that can be easily accessed by personnel working on the product.
- It is the responsibility of the company operating this equipment to ensure that its personnel is provided with a copy of this manual.



---

## 1.3 Limitations of the Document

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TKH Airport Solutions reserves the right to revise this document without notification.

The data provided in this document is based on the most recent information at the time of publication. TKH Airport Solutions is continually seeking to ensure that its products are developed to the latest technological standards. As a result, it is possible that there may be some differences between the product and the information in this manual.

For further information regarding adjustment, maintenance or repair which is not described in this document, please contact the Customer Service department of TKH Airport Solutions on [service@tkh-airportsolutions.com](mailto:service@tkh-airportsolutions.com).

The information in this document concentrates solely on use of the products as intended by the manufacturer.

---

## 1.4 Terms and Abbreviations

---

This document may include the terms and abbreviations as listed below.

AGL	Airfield Ground Lighting
EASA	European Aviation Safety Agency
ICAO	International Civil Aviation Organization
IEC	International Electrotechnical Committee
LED	Light Emitting Diode
SFL	Sequential Flash Light

---

## 1.5 Liability and Warranty

---

TKH Airport Solutions cannot be held responsible for injuries or damage resulting from non-standard, unintended use, faulty or improper installation of its equipment, or failure to follow the instructions and safety guidelines in this manual. The safety of any system incorporating the Sequential Flash Light System - SFL 971 is the responsibility of any site installation, commissioning, maintenance, and operational personnel using the system.

### NOTICE

Disregarding the safety instructions in this manual will result in the loss of warranty in case of damage.

Refer to the general TKH Airport Solutions Terms and Conditions document supplied with your sales order contract for a complete liability and warranty description.

---

## 1.6 Manufacturer Details

---

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## 2. Safety

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### 2.1 Safety

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This section contains general safety instructions for using your TKH Airport Solutions equipment. Some safety instructions may not apply to the equipment in this manual. Note all warnings and follow all instructions carefully. Failure to do so may result in personal injury, death, or property damage.

To use this equipment safely,

- Refer to the International Standard IEC 61820, Electrical installation for lighting and beaconing of aerodromes - Constant current series circuits for aeronautical ground lighting - System design and installation requirements, and to the International Standard IEC 61821, Electrical installations for lighting and beaconing of aerodromes - Maintenance of aeronautical ground lighting constant current series circuits for instructions on safety precautions.
- Observe all safety regulations. To avoid injuries, always remove power prior to making any wire connections and touching any live part. Refer to the International Standards IEC 61820 & IEC 61821.
- Read and become familiar with the general safety instructions provided in this section of the manual before installing, operating, maintaining, or repairing this equipment.
- Read and carefully follow the instructions given throughout this manual for performing specific tasks and working with specific equipment.
- Store this manual within easy reach of personnel installing, operating, maintaining, or repairing this equipment.
- Follow all applicable safety procedures required by your company, industry standards, and government or other regulatory agencies.

---

### 2.2 Qualified Personnel

---

The term "qualified personnel" is defined here as a person who thoroughly understands the equipment and its safe installation, operation, maintenance, and repair. Qualified personnel are physically capable of performing the required tasks, familiar with all relevant safety rules and regulations, and have been trained to safely install, operate, maintain, and repair the equipment. It is the responsibility of the company installing, operating, or maintaining this equipment to ensure that its personnel meet these requirements.

---

## 2.3 Intended use

---



**DANGER!**

Use of this equipment in ways other than described in the datasheet and this manual may result in personal injury, death, or property damage. TKH Airport Solutions cannot be held responsible for injuries or damage resulting from non-standard, unintended application of its equipment. This equipment is designed and intended only for the purpose described in this manual. Uses not described in this manual are considered to be unintended use. Unintended use may result from taking the following actions:

- making changes to equipment that have not been recommended or described in this manual or using parts that are not genuine TKH Airport Solutions replacement parts or accessories
- using materials or auxiliary equipment that are inappropriate or incompatible with your TKH Airport Solutions equipment
- allowing unqualified personnel to perform any task

---

## 2.4 Installation

---



**WARNING**

A thorough understanding of system components and their requirements will help you install the system safely and efficiently. Failure to follow these safety procedures can result in personal injury or death.

**NOTICE**

Read the safety and installation sections of all system component manuals before installing your equipment.

- Allow only qualified personnel to install TKH Airport Solutions equipment and auxiliary equipment. Use only approved equipment. Using unapproved equipment in an approved system may void agency approvals and will void the warranty.
- Make sure all equipment is rated and approved for the environment in which you are using it.
- Follow all instructions for installing components and accessories.
- Do not hold or carry the light assemblies by the cables.
- Install all electrical connections according to local codes and regulations, provided they are not in contradiction with the general rules.
- Use only electrical wire of sufficient gauge and insulation to handle the rated current and voltage demand. All wiring must meet local codes.
- Route electrical wiring along a protected path. Make sure the wires will not be damaged by moving equipment and animals (e.g. rodents).
- Protect components from damage, wear, and harsh environmental conditions.
- Allow sufficient room for maintenance, panel accessibility (power products), and cover removal (power products).
- Protect equipment with safety devices as specified by applicable safety regulations.
- If safety devices must be removed for maintenance, re-install them immediately after the work is completed and check them for proper functioning.

---

## 2.5 Operation

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Only qualified personnel (see section Qualified Personnel) should operate this equipment. Read all system component manuals before operating this equipment. A thorough understanding of system components and their operation will help you operate the system safely and efficiently.

- Before starting this equipment, check all safety interlocks, fire-detection systems, and protective devices such as panels and covers. Make sure all devices are fully functional. Do not operate the system if these devices are not working properly. Do not deactivate or bypass automatic safety interlocks or locked-out electrical disconnects or pneumatic valves.
- Never operate equipment with a known malfunction.
- Do not attempt to operate or service electrical equipment if standing water is present.
- Use this equipment only in the environments for which it is rated. Do not operate this equipment in humid, flammable, or explosive environments unless it has been rated for safe operation in these environments.
- Never touch exposed electrical connections on equipment while the power is ON.
- Never look directly in the light source while the power is ON.

---

## 2.6 Action in the event of a system or component malfunction

---



### **WARNING**

Do not operate a system that contains malfunctioning components. If a component malfunctions, turn the system OFF immediately.

- Disconnect and lock out electrical power.
- Allow only qualified personnel to make repairs. Repair or replace the malfunctioning component according to instructions provided in its manual. Allow only qualified personnel to perform maintenance, troubleshooting, and repair tasks. Only persons who are properly trained and familiar with TKH Airport Solutions equipment are permitted to service this equipment.
- Follow the recommended maintenance procedures in your equipment manuals.
- Connect all disconnected equipment ground cables and wires after servicing equipment. Ground all conductive equipment.
- Use only approved TKH Airport Solutions replacement parts. Using unapproved parts or making unapproved modifications to equipment may void agency approvals, impair specified performance, and create safety hazards.
- Check interlock systems periodically to ensure their effectiveness.
- Do not attempt to service electrical equipment if standing water is present. Use caution when servicing electrical equipment in a high-humidity environment.
- Use tools with insulated handles when working with electrical equipment.

---

## 3. About the SFL 971

---

The LED based SFL system from TKH Airport Solutions is designed to meet the requirements in ICAO Annex 14 for flashlights used in a center line approach system (AFL), as runway threshold identification light (TIL), or in a combination of both light systems.

The system offers control and monitoring of up to 64 approach flash lights (AFL) and threshold/runway identification lights (TIL/RIL).

---

### 3.1 The System

---

A system will include:

- An SFL 971 Flash controller unit to be placed in the power station. The controller unit is supplied in a wall mount cabinet.
- Between 1 and 32 Approach flashlights and Threshold/Runway identification lights
- A Terminal Box for each light fixture
- 2 Lightning arrestors
- Primary SFL cables from the controller to the lights
- Secondary SFL cables between the lights and the terminal boxes

The connection between the components is shown on the following pages.

Standard input voltages are 1 x 220V-240V - 50Hz/60Hz ( $\pm 2$  Hz), max. 6A.

#### Controller unit

The controller supplies power for flashing, heating, and communication via a 5x4mm<sup>2</sup> standard installation cable connected in one loop to all fixtures. The power line communication includes the following information to each light fixture:

- Requested light intensity (7 steps)
- Flash speed (one or two flashes per second)
- Heater active
- Start signal for each new sequence.

The Controller unit is supplied as a wall mounted unit. More information can be found in the Controller details.

To power off the system please remove the plug from wall outlet, or by other means disconnect the power lines Infront of the system.



The protective earthing is done via the wall outlet, by connecting the yellow/green terminal inside the Controller near the power switch.

### Flashlight fixture SFL 793

The elevated Flashlight fixtures are based on the 792-LED approach light fixtures, but with new electronic including features for:

- LED protection
- LED temperature measure

Besides elevated fixtures, inset fixtures are available as well (depending on airfield category and project requirements).

More information in the SFL fixture details.



The protective earthing is done via the cable to the terminal box.

### Terminal box

The cable from Controller (1 phase, 1 communication, neutral and ground) is connected in a terminal box near each fixture. The terminal box includes terminals for connection to the next terminal box, as well as the connection to the light fixture via a safety transformer (230 V / 24 V), which means that no voltage above 24 VDC will be present in the light fixtures and secures safe service and adjustments.

- Power line communication with Controller unit
- Intensity regulation according to received command from Controller.
- Each light fixture is assigned with an address, set in the terminal box.

More information in the Terminal box details.



The protective earthing is done, via the cable to the connector.

---

## 3.2 Standards

---

The SFL 971 system is constructed, manufactured, and tested to meet the relevant ICAO and FAA standards. The performance of the light fixtures SFL 793 has been verified in tests by independent laboratory for use as a steady burning Approach light fixture.

---

## 3.3 Key Features

---

Key features of the SFL 971:

- Fully digital control and monitoring
- 7 intensity steps in low and high speed
- Lamp supervision
- Hour meters for 100% intensity and for total time
- All control and monitoring performed over the power cable
- Heater can be switched on independent of the flashing system
- Individual monitoring of the RIL fixtures, and automatic shutdown in case of lamp failure
- Wall mount cabinet
- Remote control through:
  - Single Profibus/Profinet
  - RS-485 serial communication
  - Parallel interface
- Digital display showing:
  - Selected intensity step
  - Selected configuration
  - “The running” lights
  - Input voltage
  - Time/date through built-in watch
  - Number of faulty lamps
- Built-in lightning protection

---

## 3.4 Specifications

---

Temperature range:

- Controller: Within substation: 0°C - 40 °C
- Terminal box and lamp: -40°C - +55°C

Humidity, max: 95% (not condensing)

Efficiency: 94 - 97%

Power factor better than 0.9 at full load (resistive load)

Cubicle is electro-plated and coated in light grey RAL 7035.



---

## 4. Installation

---

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### 4.1 Unpacking the SFL shipment

---

Unpack carefully and check that all parts are included.  
After unpacking, the controller must be stored indoor.

---

### 4.2 Before the installation

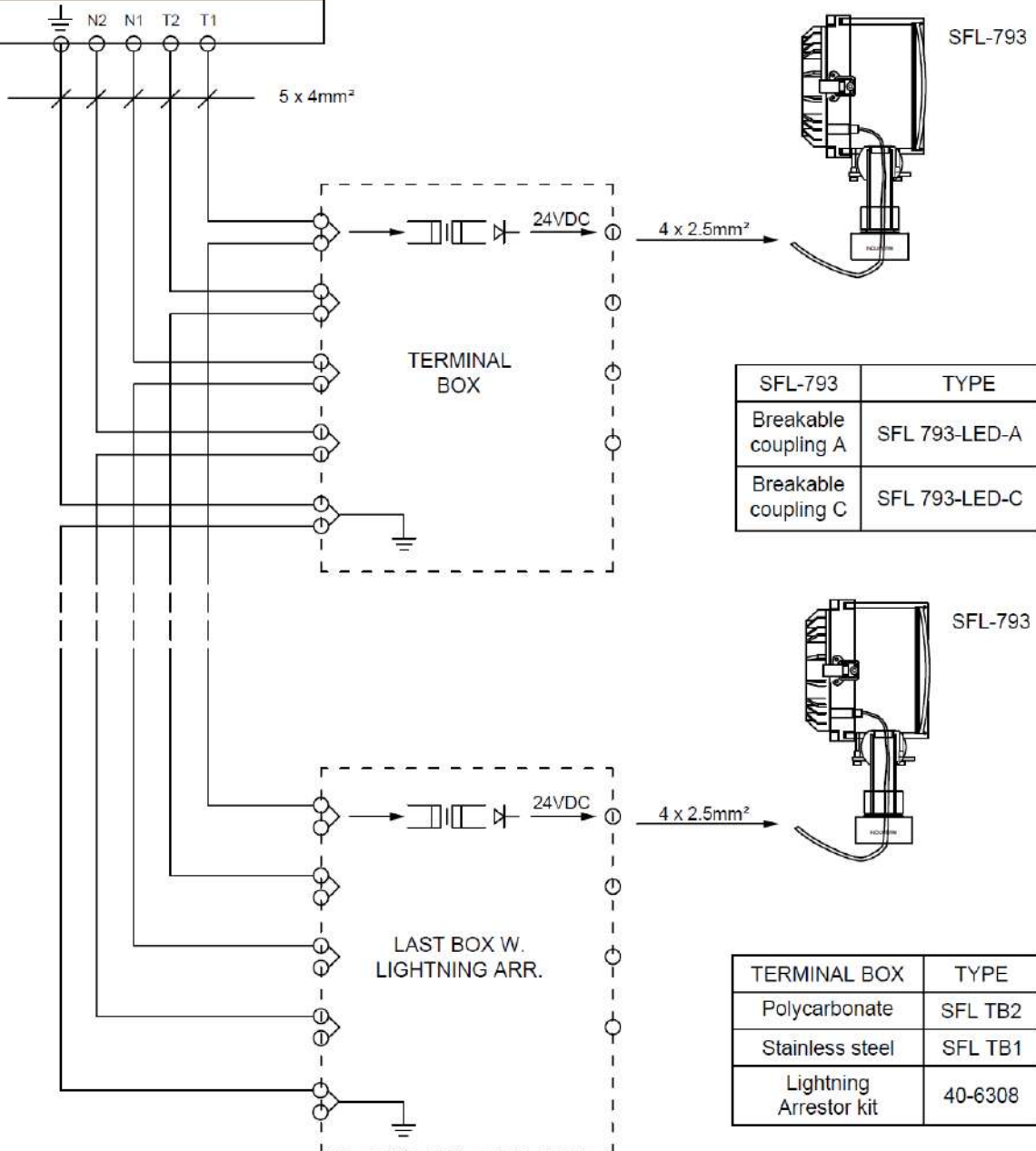
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Check the planned installation location. The room must be ventilated and free air circulation around the controller must be secured

## 4.3 Installation Principle



CONTROLLER TYPES See SFL 971 controller datasheet	
Module	SFL 971 Module for RS 485 or Profibus in cubicle
Wall cabinet	SFL 971 WM for RS 485 or Profibus. Can be extended with circuit selector



SFL-793	TYPE
Breakable coupling A	SFL 793-LED-A
Breakable coupling C	SFL 793-LED-C

TERMINAL BOX	TYPE
Polycarbonate	SFL TB2
Stainless steel	SFL TB1
Lightning Arrester kit	40-6308

---

## 5. Operation

---

The AFL light fixtures will start flashing at the beginning of the approach line towards the threshold. If the TIL/RIL lights are programmed, they will flash simultaneously in one sequence.

The flash frequency can be selected as 1 or 2 flashes / second. The system can be set to 1 to 7 intensity steps in low and high speed. 64 lamps can be connected, max 32 in operation at any time, selected with 1 of 4 programmable configurations. Any nos. of TIL/RIL of the 64.

The controller output is two lines, T1, T2 (and N), where T1 (230V) is only for power supply, while T2 (24V) line is for communication. The controller makes a start pattern on the communication line, which are seen by the terminal box as a start signal for a new sequence, and the terminal box starts a timer, with a time accordingly to the setup from the controller - when the timer expires the light flash.

The communication includes information of the required light intensity and length, as there is back information to the controller about the state of each light fixture.

As no voltage above 24VDC is present in the light fixtures, the safety is increased drastically compared to service on traditional discharge flash types. There is no safety problem in working with the flashlight fixtures when these are in operation, but to avoid the high intensity flashes when working with a fixture, the address 00 in the terminal box turns off the flash. As all supply to the light fixtures is low voltage via transformers in the terminal box, lightning arrestors are only needed in each end of the supply cable that is in the power station and in the last terminal box in the approach.

The Power line, T1, is 230V - but in the Controller is mounted an Isolation transformer to improve safety. The terminal box measures the flash power when a flashlight fixture is activated, and the back communication to the controller reports a fault to the controller, the controller indicates locally and remotely the faulty light fixtures.

The light fixtures are supplied with a small heater to keep the internal free from dew. The heating can be on and is powered from the same cable as the flashing, even without the flashing being activated.

Each terminal box is given an address and this address is used by the controller to identify eventual lamp failure(s) and setup of flash parameters.

The controller display has an overview of each terminal box, with status. From the controller, the setup of each terminal box can be set:

- When to flash
- Length of flash
- Is the lamp a TIL/RIL?

In each Terminal box there is a label of information on how to set the actual address by means of two 10-position rotary switches, one for tens and one for ones.

Special attention to:

Address 65 – Calibration: with power on (key in manual, lights off) set the terminal box to address 65 and

the box will cycle all the intensities, so lamp supervision is working correct. Must be done at installation and if Lamps/cable is repaired/changed. Please check, that also the heater is switched ON.

Address 98: Turns on lamp - for test at the field.

Address 99: Turns on heater, for test.

Address 66-97: Tests lamp in different intensities. (For manufacturing)

The label also tells the functions of the LED signal lamps in the terminal box.

The label is as follows:

## SFL971 TB1 SETTINGS

Address:				Test: (some combinations used as address)			
Address	SW "10"	SW "1"	Note	SW "10"	Intensity	SW "1"	Duration [ms]
0	0	0	Light off	6	1	0	4
1	0	1	Address 1	7	2	1	8
...	...	...	...	8	3	2	12
64	6	4	Address 64	9	4	3	16
65	6	5	Lamp supervision reset			4	20
..	...	...	...			5	24
98	9	8	Test			6	28
99	9	9	Heater test			7	32
						8	36
						9	40

Leds:			Error Morse codes:		
Zero X	Blue 1 sec blink	Zero X ok	No error	On - short blink	
Run	Yellow fast blink	Running ok	No power (T1a)	P	.-.-.
Run	Yellow Morse alphabet	Error (see error codes)	Heater	H	....
Temp	Green	Temperature error	Flash	L	.-..
Flash	Red	Light Flash	Temp. CPU	T U	- ..-
Heat	Blue	Heater on	Temp. LEDs	T L	- .-..
Data	Green	Data input uP	Zero X	Z	--..
Data	Green	Data input (T2) ok	Setup	S	...
Power	Green	Power (T1a) ok			
3v3	Green	Supply ok			

---

## 6. Controller Unit

---

The TKH Sequential Flash Light Controller System is based on a digital controller and monitoring system. The SFL 971 is designed to meet the requirements in ICAO Annex 14 for flashlights used in an Approach Centre line system (AFL) with belonging runway Threshold Identification Light (TIL).

---

### 6.1 Application

---

The system offers control and monitoring of a system with up to 64 approach flashlights (AFL) and threshold/runway identification lights (TIL/RIL), without the use of separate control cables.

The AFL light fixtures start flashing at the beginning of the approach line towards the threshold. If TIL/RIL lights are installed, they will flash simultaneously in one sequence. The flash frequency can be selected as one or two flashes per second. The system is supplied for 7 intensity steps, and the intensity regulation is digital controlled in the SFL terminal boxes.

---

### 6.2 Mechanical Layout

---

The controller can be built as a wall mounted cabinet.



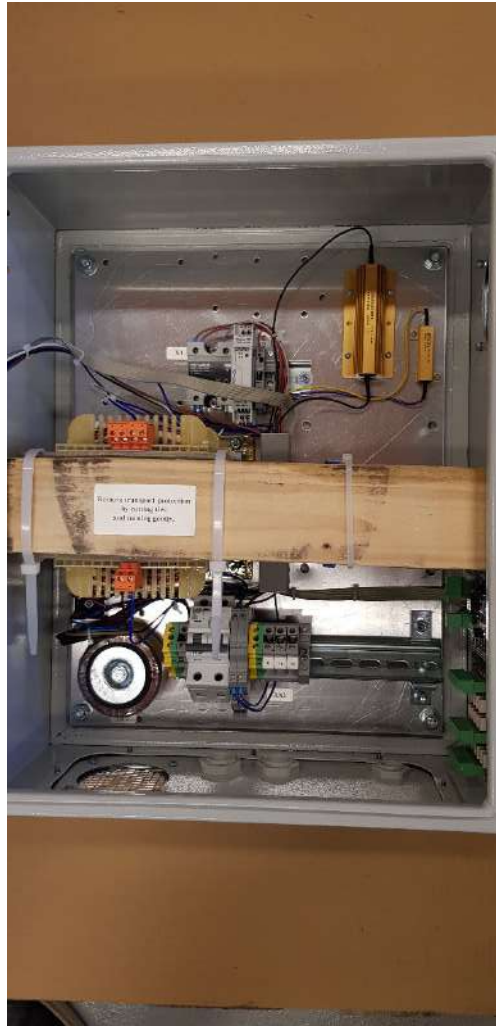
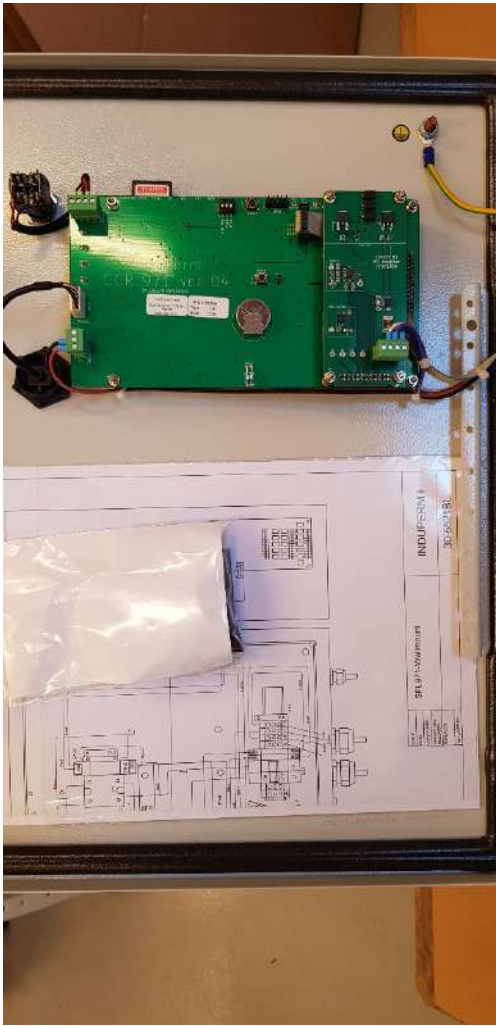
SFL Controller Parts	Type No.
Wall mount Cabinet for RS 485	SFL971-WM-RS485
Wall mount Cabinet for Profibus	SFL971-WM-PROFIBUS
Wall mount Cabinet for Parallel	SFL971-WM-PARALLEL

Wall mount cabinet: 400 x 600 x 250 mm

Input power: 1 x 230VAC + N + G, 50/60 HZ, 6A

Temperature range: 0 - 40°C, non-condensing.

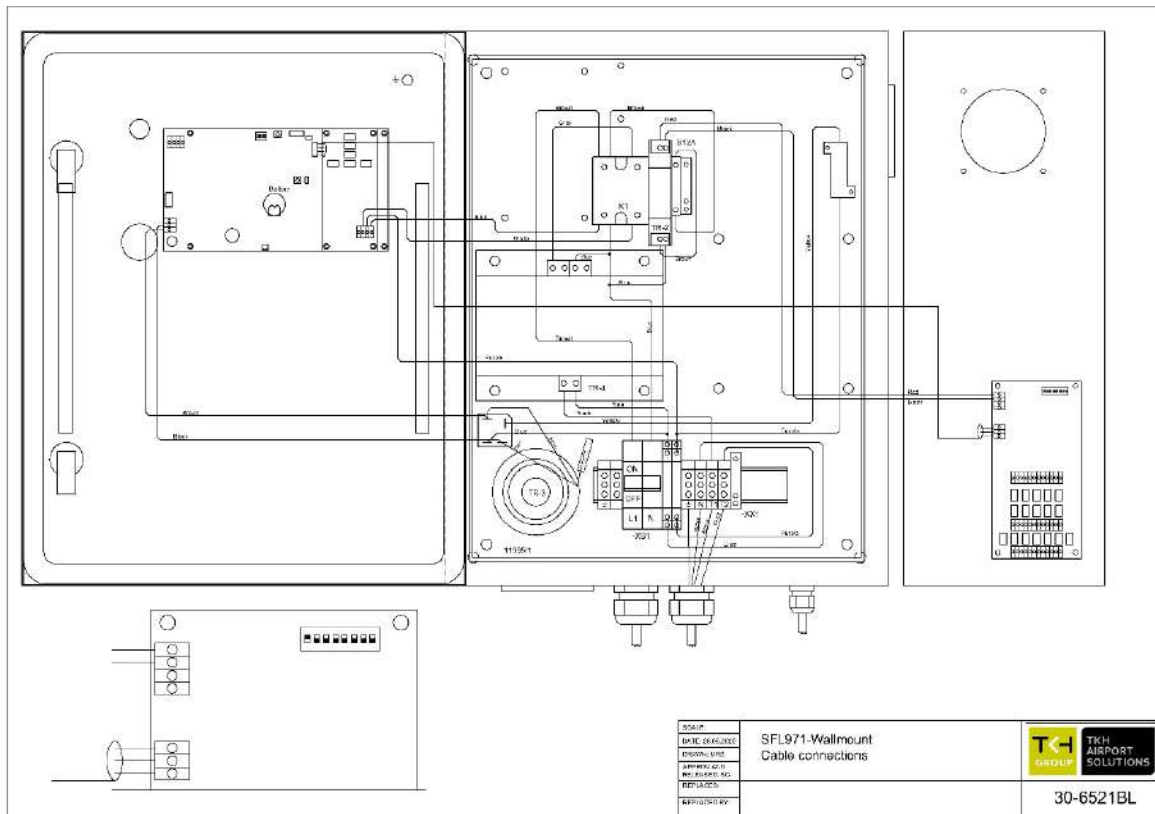
## Controller Wall Mount:



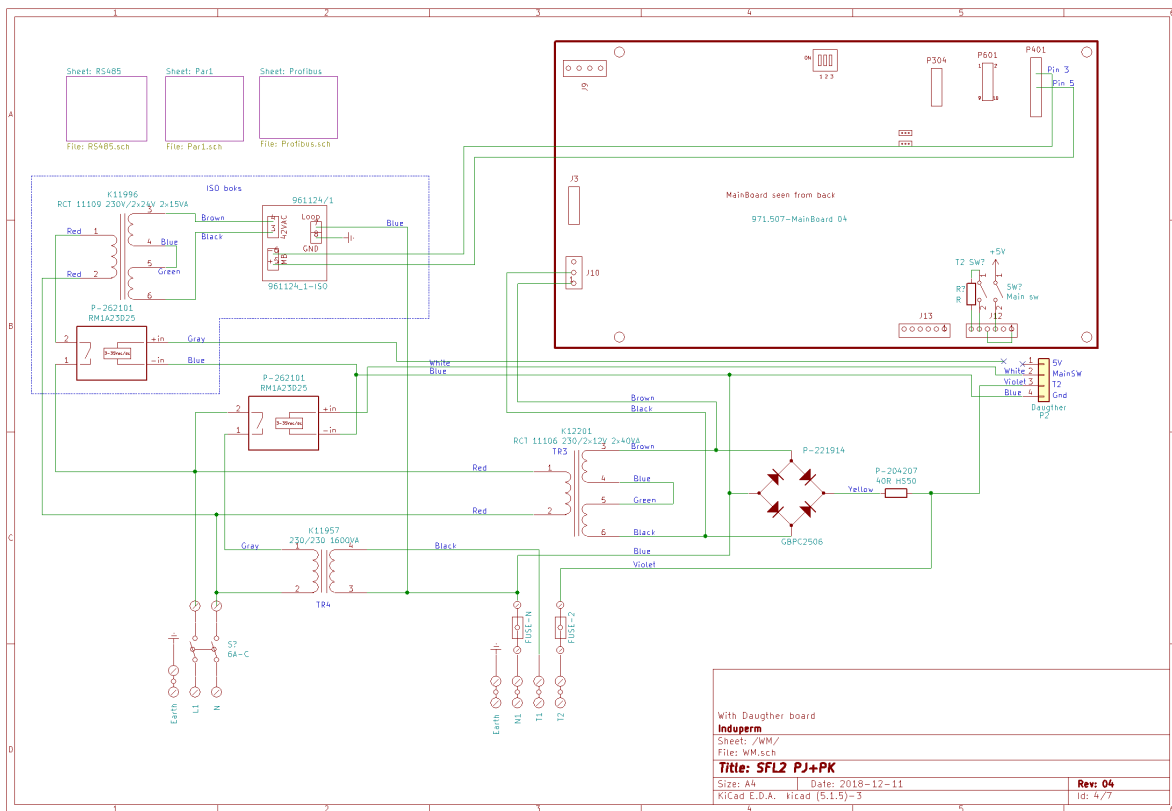
## Outer measures:

H x W x D = 500 x 400 x 200 mm

Weight: 15 Kg



File: SFL971-Wallmount\_Cable\_connections.kicad\_sch



---

## 7. SFL Fixture

---

The high-intensity LED fixture, available as elevated or inset light, is intended to be used instead of discharge-type flashlight in barrette centre line approach system and/or as threshold/runway identification lights.

The required intensities are reached with LEDs as used in our standard LED Approach light fixture. All communication and control via the power cables.

---

### 7.1 Operation

---

Brilliance control by means of PWM regulation in terminal box, based on step command received via Power cable. The flashing frequency can be one or two flashes / second.

The first unit is located at the beginning of the approach, and the last unit is closest to the threshold. The units are flashing in sequences, and the pilot sees the light moving towards the runway. The threshold/runway identification lights (TIL/RIL) are flashing simultaneously.

The TILs are connected to same supply cable as the approach sequential flashlight system. Any number of insert lights can be mounted, to extend the SFL into the overrun area.

Input power is 2 x 24VDC, via 4 x 2.5mm<sup>2</sup>.

4-pole connector mounted in light fixture, connector part for cable is included.

---

### 7.2 Features Elevated Lights

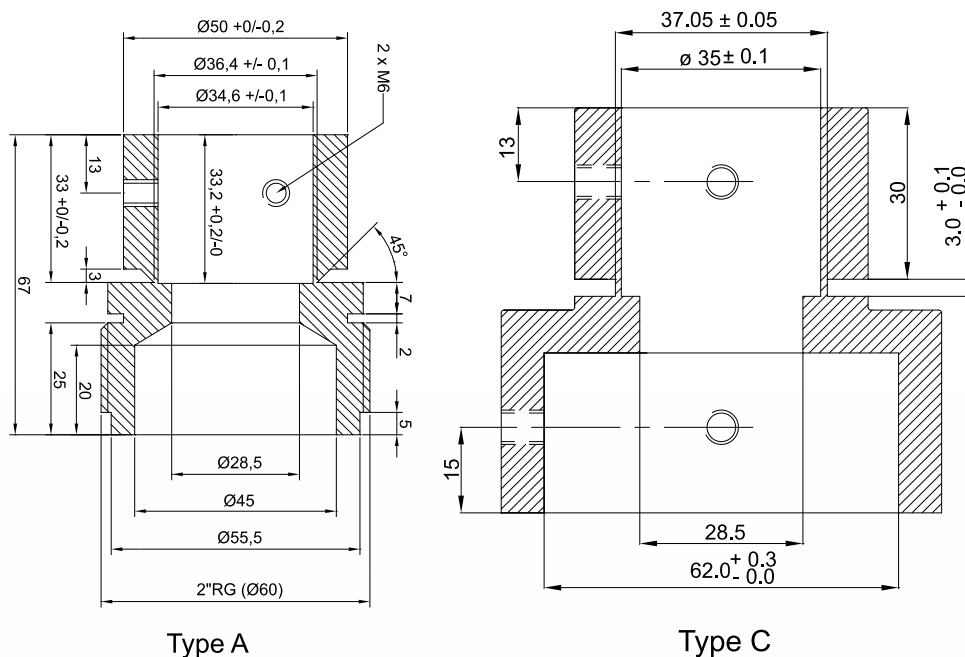
---

- The design conforms to the photometric requirement of ICAO, Annex 14, Vol. 1 Fig. 2-1 with 40 W LED module in steady state.
- Front glass according to FAA spec. CAA-1199a.
- Easy levelling and adjustment due to patented ball joint.
- The shape, the small size and weight (3 kg. – 6lb.) are favorable features in respect to wind load and mast construction.
- The outside surface of the glass is smooth and needs no cleaning.
- No adjustment after re-lamping.
- Mounting on tube, pole, or base plates.
- Fully corrosion proof components are used.
- Finished in aviation yellow.
- Lamp power, heating supply and synchronization signals via only low voltage power supply.





## 7.3 Breakable Coupling



TKH elevated light fixtures can be delivered with different types of breakable coupling:

- Type A: With 2" thread (European standard thread or 11,5 NPT or NPS)
- Type C: for 2" pole mounting.

TKH breakable coupling is calculated and tested to break at 45 Kgm  $\pm$  4 Kgm which is in accordance with FAA AC 150/5345-46E and ICAO Annex 14, Vol. 1.

## 7.4 Features Inset Lights

- 12" outer diameter
- 12.5 mm height above surface
- Depth below flange: 50 mm
- Light outlet size 49 mm x 10 mm
- Dust and water tightness: IP68, IP69
- Overall lifetime\* > 20 years
- Useful lamp life (LED) up to 50,000 h
- Ambient temperature: -40 °C (-40 °F) / + 75 °C (+167 °F)
- Internal serial interface for diagnostics and parameterization
- Fail-open function (optional)
- De-icing kit (optional). Additional min. 14 W while in operation
- Sapphire coated prism (optional)



\* ) *Apart from wear parts*

---

## 7.5 Fixture Installation

---

For installation and maintenance instructions of the SFL 793 fixtures, please refer to the below manuals which can be found on our website <https://www.tkh-airportsolutions.com/service/mounting-instructions>

- **LED Inset Lights 12"**
- **792 Elevated LED Lights**

## 8. SFL Terminal Box

A Terminal box is placed within a distance of 1 to 30 m from each Flashlight fixture. The Terminal box is for the connection of the cable from the Controller unit to each Flashlight fixture. An incoming and an outgoing cable, each 5 x 4mm<sup>2</sup>, is used to supply power and communication signals to the Flash Light fixture via one isolating transformer 230VAC / 24VDC, placed in the Terminal box.



---

## 8.1 Description

---

The Terminal box is made of stainless steel, and can be mounted in many ways, on poles, on a wall etc.

Size:	H x W x D: 360x200x120mm
Weight:	approximately 6.6Kg
Standard Type (in stainless steel):	SFL TB1
Ingress Protection:	IP 66
Lightning arrestor block Type nr:	40-6308
Mounting kit for 60mm pole type:	MT 60mm

Lamps calibration is advised at any new/altered installation, by selecting address 65 and switched on Heater. This compensates for any cable resistance, in the lamp Supervision.

Selecting address 65, will turn on the yellow led on the PCB in the terminal box- the program will then cycle through all intensities and measure the power consumption, when done the yellow led will go off, and the values measure is store internally.

---

## 8.2 Installation

---

The power cables are connected to the two groups of terminals marked Ground – Neutral1 – T1 – Neutral2 and T2 (one set of terminals for incoming cable and one set for outgoing cable to the next Terminal box).

On the farthest away Terminal box, the terminals for the outgoing cable are used for the connection of a lightning arrestor module.

Cable dimensions from Controller to Terminal box:

The system is very tolerant to voltages, so as a guide calculate - max 6 ohms to last box from controller.

Distance from Controller to last Box (m) Standard copper	Cable dimension
Less than 2500	5 x 4mm <sup>2</sup> (including earth)

Do not intermix T1 and T2, as it will destroy the electronics, triple check before first power on.

N, neutral on controller power input is DIFFERENT from N on controller lamps output, due to internal safety transformer. Neither is N the same as E Earth.

The cable for the light fixture is to be connected to:

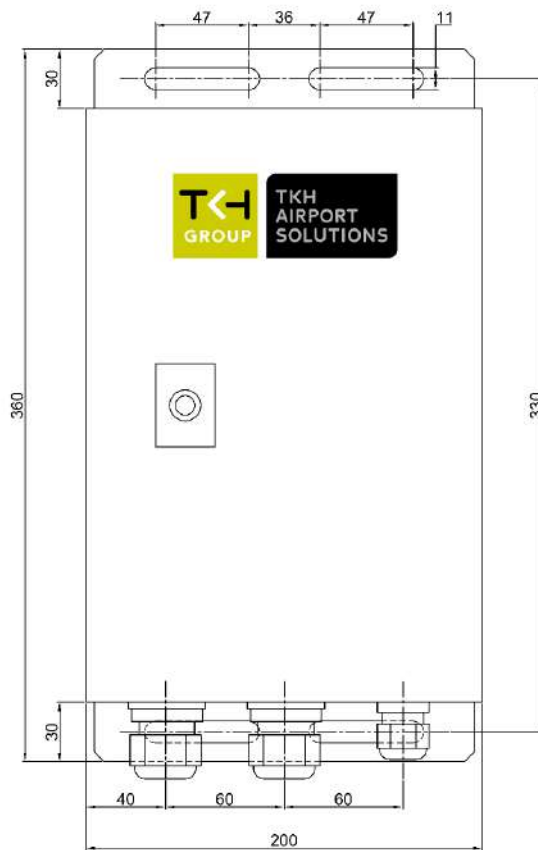
In terminal box	Blue connector on lamp
Earth	4 Earth
1	1
2	2
3	3 0V

Input line voltage is 220V-240V, and the supply cable is connected to the fixture via Transformer in a Terminal box (see separate chapter).

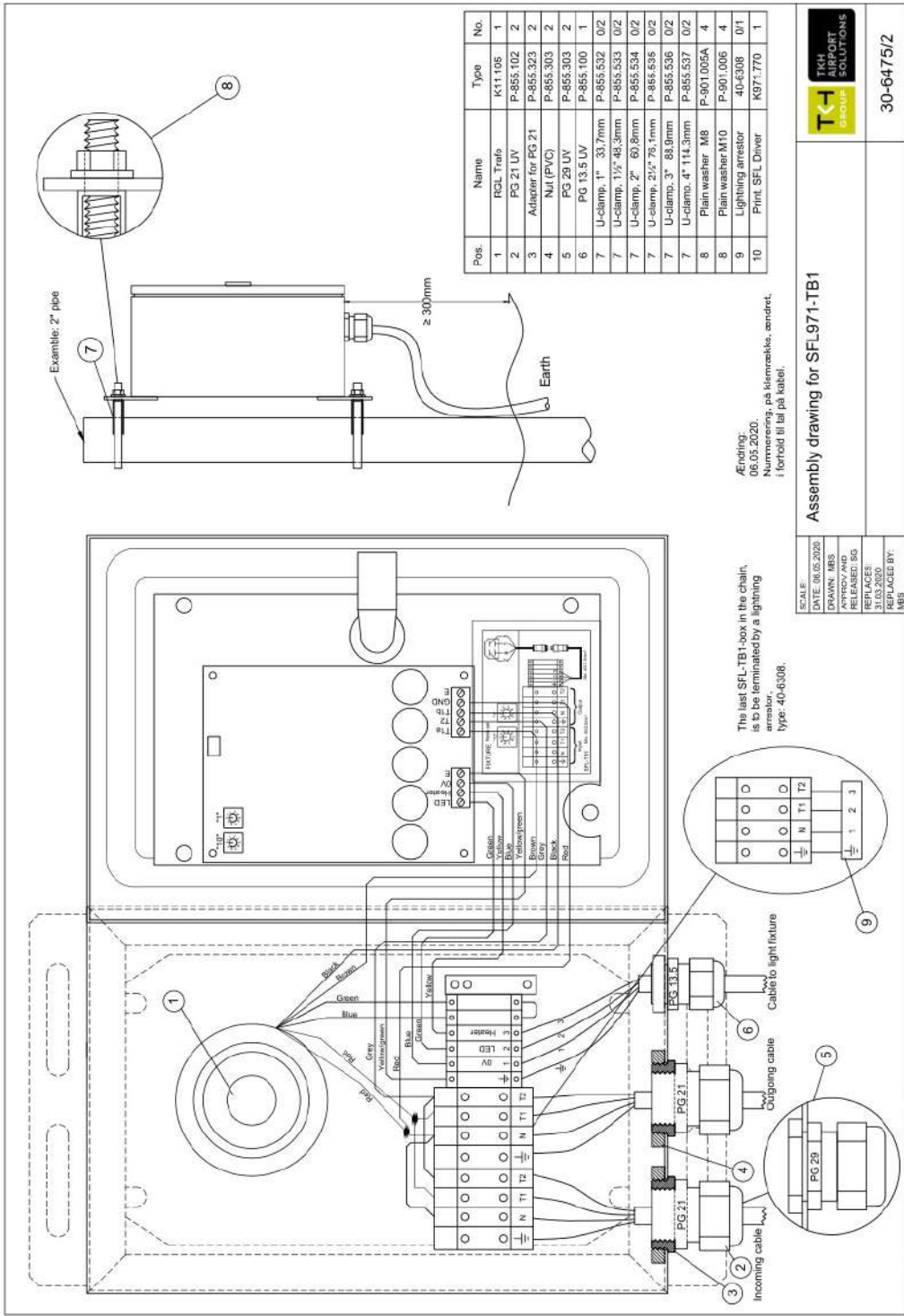
The supply includes flashing power, synchronization of the flashing sequence as well as power for heating element in the fixture.

The address of each fixture is set by means of a built-in rotary switch.

### SFL-TB1/1 (Stainless)



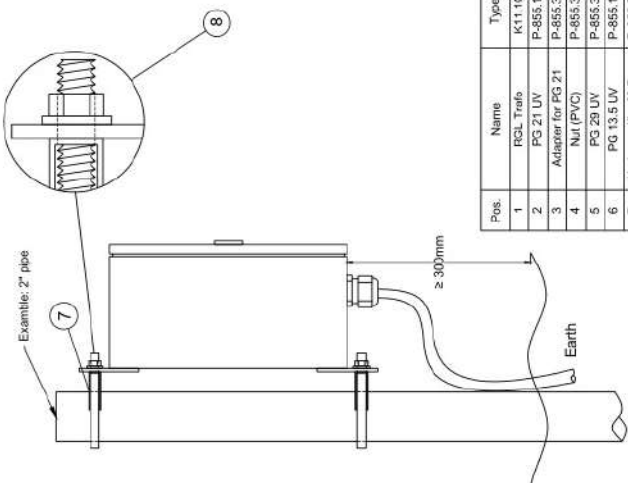
Height: 120 mm.  
Total weight: 6.6 kg.



The last SFL-TB1-box in the chain, is to be terminated by a lightning arrester, type: 40-6308.

A'ending: 08.05.2020. Nummerering, på kiemrækkie, ændret, i forhold til til på kabeli.

Pos.	Name	Type	No.
1	RGL Trafo	K11.105	1
2	PG 21 UV	P-855.102	2
3	Adaptor for PG 21	P-855.323	2
4	Nut (PVC)	P-855.303	2
5	PG 29 UV	P-855.303	2
6	PG 13.5 UV	P-855.100	1
7	U-clamp, 1" - 33,7mm	P-855.532	0/2
7	U-clamp, 1 1/2" - 48,3mm	P-855.533	0/2
7	U-clamp, 2" - 60,8mm	P-855.534	0/2
7	U-clamp, 2 1/2" - 75,1mm	P-855.535	0/2
7	U-clamp, 3" - 88,9mm	P-855.536	0/2
7	U-clamp, 4" - 114,3mm	P-855.537	0/2
8	Plain washer M8	P-901.005A	4
9	Plain washer M10	P-901.006	4
9	Lighting arrester	40-6308	0/1
10	Print, SFL Driver	K971.770	1



**Assembly drawing for SFL971-TB1**

SCALE: DATE: 08.05.2020  
 DRAWN: MBS  
 APPROVED: MBS  
 RELEASED: SG  
 31.03.2020  
 REPLACES BY: MBS

**TKH AIRPORT SOLUTIONS**

**30-6475/2**

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## 9. Cables

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Required cables supplied with the system:

SFL Primary cable: **P-242400** YMK Dca 0,6/1 kV, 5 G 4 rm

SFL Secondary cable: **P-242401** MarineLine + YZp 0,6/1 kV, 4 G 2,5 mm<sup>2</sup>

### NOTICE

SFL 971 has only been released using the above mentioned cables. For using SFL 971 with other cable types, please contact TKH Airport Solutions for advice and technical approval.

---

## 10. SFL 971 Module

---

(Seen from the front)



TKH SFL 971

- LEDs
- Communications port
- LCD display
- Key Switch

**LEDs: Light sensor (Top) - RED (top1) - YELLOW (middle) - GREEN (lower)**

**RED:** Flashing: Key on "Manual" or off  
Steady Light: Alarm.

**YELLOW:** Earth measure, if is equipped.

**GREEN:** Flashing with synchronization speed

**LCD display:**

Several several parameters are shown, such as Menu, Key position, Runway name, Alarms.

---

### 10.1 General information

---

**The Key Switch has 3 positions: Remote – Off – Manual**

- REMOTE  
In this position the SFL system can be controlled only via the Remote-Control System.
- OFF  
The SFL Controller is off.
- MANUAL  
In this position the SFL system can only be controlled locally. Back-indications and Alarms are still transmitted to the Remote-Control System.



Changing the Key position between Remote and Local must be done in a swift manner to prevent the SFL from being turned off.

When changing from Remote to Manual, the SFL will maintain the from Remote selected intensity step. In manual and off-Key position, the arrow keys can be used to go through the menus.

The buttons 1-7 can be used to switch-on the SFL in one of the intensity steps.

Off is used to switch-off the SFL.

L/H toggles between low/High speed.

Heat turns on heating.

If the system is used with configuration selection the buttons Cfg1 – Cfg4 are used for this.

The Module have a light sensor on the front. That turns off the display when the light in the room is off. In case of lamps fail the LCD is always on.

### Communication port:

Can be used to download new SW to the controller, with a special program.

## 10.2 The SFL Menus

In all menus:

The topline:

menu, here "Main,"

key position, here "Manual,"

runway name

Menu buttons. Left & Right

Line 2:

Lamp alarms – how many lamps defect

RIL alarms – how many RIL lamps defect

Right:

Buttons for selecting of active configuration

Bottom:

Buttons for selecting Off, 1..7, L/H, Heater



**Menu Main:**

The box shows all lamps, left and top is the addresses of the lamps i.e., 9-16 (9+top row).

The number in the cells is the sequence number, i.e., when to turn on the lamp.

Distinct colours and letters give information about the state of the lamp (not all shown on picture)



**Menu setup:**

Address: Address of lamp to setup

Sequence: Sequence number of lamp. 0=disable

RIL: Is RIL active on this lamp.

Dur.: Duration of flash, (all lamps in this configuration).

Password: key in password. (Default 0751) resetting when key is in Remote.

New password: key in a new password.



**Menu Time:**

Year, Month, Day: Press to key in date.

Hour, Min, Sec: Press to key in time.

Default: Press to load default values (key must be in off and correct password).

Rwy. Name: Press to key in Runway name.

Uln: Calibration of Uln.



**Menu Display:**

Contrast, Situation, Brightness: LCD params.

Language: Press to change language (need SD card mounted.)

Calibration: Calibrate LCD touch area.

“Back door”: in main menu,

Key to manual.

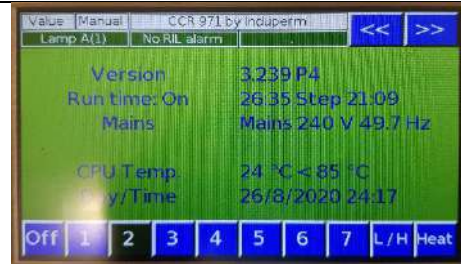
Press display.

key to off



Menu Values:

Show various information.



## 10.3 Main menu, Cells/Lamps

On the main menu the cells display information about the state of the lamps.

# SFL971 WM LEGENDS

TB: Terminal box at lamp  
 WM: Wall mount controller  
 SEQ: Sequence number in SFL

Text	Colour text on back	State	Explanation
[SEQ]	White on Green	Ok	☺
[SEQ]	White on Greenery	OK RIL	☺
[SEQ] N	White on Green	Ok	New setup to TB
[SEQ] N	White on Greenery	OK RIL	New setup to TB
---	Red on Grey	Not enabled	[SEQ] = 0
---	Red on White	Not enabled RIL	[SEQ] = 0
[SEQ]	Black on Yellow	Status check	WM need to ask TB for state
U	White on Red	Error	TB needs update
L	White on Red	Error	Lamp fail
H	White on Red	Error	Temperature lamp to high
T	White on Red	Error	Temperature TB to high
N	White on Red	Error	New setup to TB
U	White on Pink	Error RIL	TB needs update
L	White on Pink	Error RIL	Lamp fail
H	White on Pink	Error RIL	Temperature lamp to high
T	White on Pink	Error RIL	Temperature TB to high
N	White on Pink	Error RIL	New setup to TB
[SEQ]	Black on White	Enabled not exist	Enabled but no TB answer
---	Black on White	Not enabled not exist	Not enabled no TB answer

---

## 11. How it works

---

The SFL system can manage up to 64 lamps, but no more than 32 can be on at any time. Any of the lamps can be TIL/RIL (threshold/runway indication lights). The address is set in the terminal boxes, each address must be unique.

The sequence of the flashlights is set up in the controller, the flash sequence does NOT depend on the address. Any address can be set to a sequence number 1 – 32; 0 is disabled.

In case of RIL - give the different addresses, the same sequence number and mark them as RIL. There can be “holes” in the sequence, i.e. a lamp is not possible to mount (maybe there is a road where the lamp should be). The sequence will then run smoothly through the missing “lamps” without jumps.

It is possible to set up 4 different Configurations, Cfg. 1- 4. Each configuration can flash up to 32 lamps. This way it is possible to have one controller to both landing directions, and/or have short - long APH, also with “holes.”

In case of lamp fail, the lamps will report it back to the controller and this will result in a Lamp fail on the display and an Alarm on the remote system. If the failing lamp are marked as RIL all RIL lamps will stop flashing.

The communication is made on the 50/60Hz frequency (100 bit/sec), so it can take some time for new setup to reach the lamps. And it can take up to approx. 5 Sec (if all setup is done) for a fail to be reported. Speed and Intensity can be changed fast, 1 Sec.

The length of a lamps flash can be set between 10 – 50 mSec, all lamps in a configuration will have the same flash length.

The controller will calculate the flashing times so a “run” always takes 1 sec (low speed) from lowest sequence number to highest number, including “holes” - i.e. 10 lamps will have a flash space of 100mSec, 21 lamps will have 48mSec, 32 lamps have 31mSec. There is one flash delay between last lamp and the start over again.

---

### 11.1 Possible error conditions and clearance

---

The error system is designed to report all possible errors, that can interfere with the correct function of the SFL system. Errors can come from 3 sources.

- Lamp not flashing
- Heater not heating
- No lamp communication

The lamp alarm is a combination of these 3 error types. A lamp alarm is “active” until all error conditions is not there anymore. One bit, lamp alarm, is send on the remote communication, but on the local display a letter combination shows the alarm in more detail. See 9.3

A lamp error, or lamp ok, can only be measured while the lamp is energized, so a previous lamp error detected can only be cleared if the System is flashing and normal flash is detected. If flashing is turned off, with a lamp error it will be “active” until a normal flash is again measured.

A heater error/ok can also only be detected while energized. Heater cannot be active when the System is flashing - Flash is prioritized, so heater is only active if heater on and no flashing, but a previous heater error is there until heater is energized (heater on, not flashing) and no error is detected. (SW >= 5.06 clears heater error when heater is activated from controller).

There can be several reasons for lamp communication errors, defect cables, defect electronic in terminal box or signal noise/weak/distorted.

There is also communication going on in flash off mode, so communication errors can appear even if the flash is turned off, due to bad communication signal. In the worst case it can come and go in a random pattern if the communication is partial.

Combinations where internal errors can come or go. (Lamp Alarm is the combination)

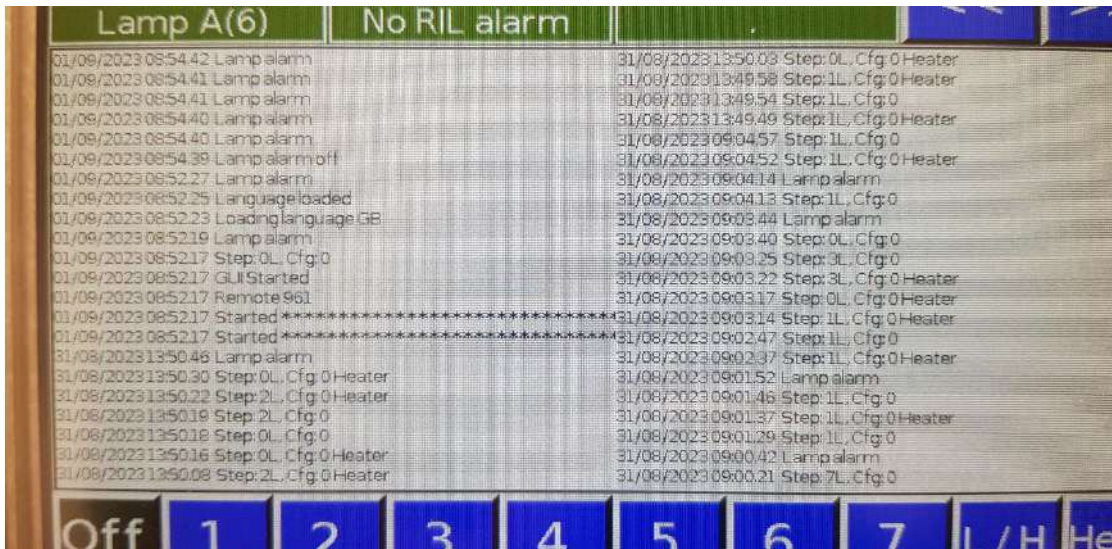
	Flash off Heater off	Flash on Heater off	Flash off Heater on	Flash on Heater on
Lamp error		On/off possible		On/off possible
Heater error			On/off possible	On/off possible
Com. Error	On/off possible	On/off possible	On/off possible	On/off possible
Lamp Alarm	On/off possible	On/off possible	On/off possible	On/off possible

### System diagnostics. (SW 1342 and above)

There is a test switch on the back of the mainboard (printed circuit). Moving this to “on”, activates several things. (Activation can degrade normal operation, use only for diagnostic!)



- The key indicator in main menu turns violet.
- All menus accessible when key in remote.
- An extra menu is enabled, Logs, with a list of events.



The log shows the startup sequence, alarms, and what is activated.

- Started\*\*\*\*\*, System start from power on.
- Start sequence, GUI, Language, etc.
- Lamp alarm, on/off
- Step x, Cfg x, (heater)

---

## 12. Setup examples

---

Set the addresses starting from 1 - the box far from the runway - ending with the box near the runway.

### **Simple: 21 lamps, no RIL.**

Set the sequence number in the controller setup, starting from 1 at address 1 to 21 at address 21. All other addresses to 0 (disabled).

Adr. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 ...  
Seq. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 0 0 ...

### **Simple: 21 lamps, RIL.**

Set the sequence number, in the controller setup, starting from 1 at address 1 to 19 at address 19. Address 20 and address 21 is set to sequence 20 and marked as RIL. All other addresses to 0 (disabled).

Adr. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 ...  
Seq. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20R 20R 0 0 ...

### **Holes: 21 lamps RIL.**

Same as 21 lamps RIL, but we make a hole between address 17 and 18

Adr. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 H 18 19 20 21 22 23 ...  
Seq. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 19 20 21R 21R 0 0 ...

### **Short/Long: 21/26 lamps RIL.**

Here we have 21 lamps for short APH and 26 for long APH. We use 2 Cfg's. Cfg1 for short and Cfg2 for long.

CFG1:

Adr. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 ..  
Seq. 0 0 0 0 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25R 25R 0..

Or CFG1:

Adr. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 ..  
Seq. 0 0 0 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21R 21R 0..

CFG2:

Adr. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 ..  
Seq. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25R 25R 0..

### **2 landing directions.**

Same as above but use Cfg3 and Cfg4 for the other end, use addresses 33 to 64 for the lamps, and sequence numbers is still 1 to xx. i.e., address 33 is sequence 1 etc.

---

## 13. Commissioning

---

Commissioning and adjustment normally must be certified in a protocol.

### **A. Conditions for a correct adjustment:**

- The SFL is wired for correct supply voltage (1 x 230VAC)
- Remote control address is set to correct value.
- The power lines are controlled for acceptable isolation value and continuity.
- The remote-control cable is connected.

### **B. Assembling:**

- The Key switch is set in position “OFF.”
- Power is switched on.
- No blinking must occur in the display.
- The Key - switch is turned to position “Manual” (local operation)



# 14. Remote Control

## 14.1 Standard RS485

The Mainboard includes all hardware and software for direct communication with a remote-control system via RS485. The connection in the cubicle is as standard a set of terminals (-XX1) or a set of RJ45 connectors.

### Description of the RS485 communication protocol

#### General information:

19200 Baud, 8bit, no parity, 1 stop bit.

SFL971 will only transmit after receiving a command or status inquiry.

#### Commands to SFL971

1	2	3	4	5	6	7	8	9	10	11
Start	ID-High	ID-Low	CMD	Step	Cfg	Heater	spare	CRC high	CRC low	End
@	0..9	0..9	S, W	0..6	0..3	0..1	1.. F	0.. F	0.. F	*

- Byte 1: Start character @
- Byte 2 and 3: Node number, decimal figure 0-32.
- Byte 4: Command = W. Status request = S
- Byte 5: Step command, decimal figure 0-3 low speed, 4-6 high speed
- Byte 6: Configuration selector 0-3
- Byte 7: Heater 0 not active, 1 active
- Byte 8: not used.
- Byte 9 and 10: CRC hexadecimal figure between 00 and FF
- Byte 11: Stop character \*

#### Back indications from SFL971:

1	2	3	4	5	6	7	8	9	10	11	12
Start	ID-High	ID-Low	CMD	Step	Cfg	Err1	Heater	Key	Spare	Spare	Spare
#	0	0	S, W	0..6	0..3	0.. F	0.. F	0..2	0.. F	0.. F	0.. F

13	14	15	16	17	18	19	20	21	22	23	24
Spare	Spare	Spare	Spare	Spare	Spare	Spare	Spare	Spare	CRC High	CRC low	End
0.. F	0.. F	0..F	0..F	0..F	0..F	0..F	0..F	0..F	0..F	0..F	*

- Byte 1: Start character #
- Byte 2 and 3: SFL node number, decimal figure 0 - 32.

Byte 4: Answer to command = R. Answer to status request = S  
 Byte 5: Step indication, decimal figure 0-3 low speed, 4-6 high speed  
 Byte 6: Configuration selector 0-3  
 Byte 7: Error status 1: sum (0-F) of Lamp = 1, RIL = 2, Emin1 = 4, Emin2 = 8  
 Byte 8: Heater 0 not active, 1 active  
 Byte 9: Key switch position: Remote = 2, Off or local = 0  
 Byte 10-12: Spare  
 Byte 13-15: Spare  
 Byte 16-18: Spare  
 Byte 19-21: Spare  
 Byte 22-23: CRC hexadecimal figure between 00 and FF  
 Byte 24: Stop character \*

**Command to CCR971 CRC calculation:**

^ = Xor

crc = data,1(start character)

crc = crc ^ data,2

crc = crc ^ data,3

etc. (until all bytes are included)

crc value, in Hex, is converted to 2 bytes Ascii.

**Example:**

	Ascii:	Decimal:	Xor crc:
Start	@	64	64
ID high	0	48	64 ^ 48 = 112
ID low	9	57	112 ^ 57 = 73
Command	W	87	73 ^ 87 = 30
Step	3	51	30 ^ 51 = 45
Cfg.	1	49	45 ^ 49 = 28
Heater	0	48	28 ^ 48 = 44
Time	0	48	44 ^ 48 = 28

28 decimals = 1C Hex

1	2	3	4	5	6	7	8	9	10	11
Start	ID-High	ID-Low	CMD	Step	Cfg	Heater	Time	CRC high	CRC low	End
@	0	9	W	3	1	0	0	1	C	*

### Back indication examples:

Byte 7:

No failures = ascii 0 = decimal 48

Lamp failure 1 = ascii 1 = decimal 49

Lamp failure 2 = ascii 2 = decimal 50

ISO failure 1 = ascii 4 = decimal 52

ISO failure 2 = ascii 8 = decimal 56

Lamp failure 1 and ISO failure 2 = 1+8 = decimal 57

Lamp failure 2 and ISO failure 2 = 2+8 =ascii a = decimal 65

Byte 8:

No failures = ascii 0 = decimal 48

I min failure = ascii 1 = decimal 49

I max failure = ascii 2 = decimal 50

Byte 9(Key switch position)

Remote = ascii 2 = decimal 50

Off or Local = ascii 0 = decimal 48

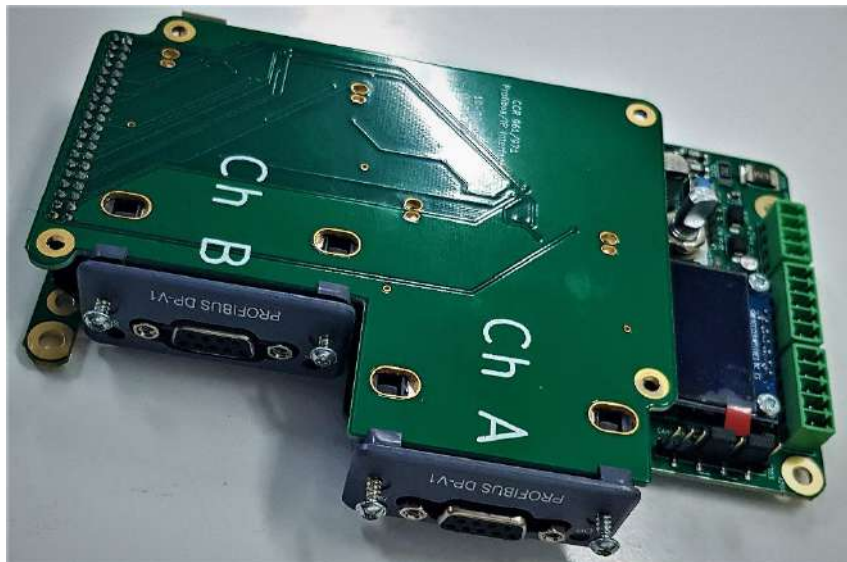
Connections on terminals –XX1 for RS485 based remote control communication with the above-described protocol.

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## 14.2 Dual Profibus

---

(Need the mounting of 971751/Profibus in cabinet)



When a Profibus communication interface to the remote-control system is required, the SFL Module will have a dual Profibus Board added internally, and this will then communicate with the SFL Main board via CAN bus.

The connections in the SFL cubicle are done with standard Profibus connectors.

## Adjustments



- Setup(dial) To alter the Profibus address. Press is to select the address field and turn to change address. The value will be saved, and interface on that channel is rebooted.
- Reset(button) Resets the hole interface.
- Erase(button) Only for factory use.

## Description

The Profibus module can be used as a single or dual interface to the Main Board via Can bus. The module is mounted with one or two Anybus modules.

Module Ch. A is always overruling Ch. B. If No communication on Ch. A for 3 Sec. trying on Ch. B

Data from controller to remote system is always on both channels.

## Profibus interface description

The screenshot shows the 'Communicator' software interface for HMS Industrial Networks. The main window displays configuration options for a Profibus interface. The 'Current Slave Address' is set to 22. The 'Edit' buttons allow for address modification. The 'Communication Active' status is shown as 'Connected'. The 'Parameter' field is empty, and the 'Config' field shows the address range '80 01 40 00 40 40 45 40 4'. The 'Output Data', 'Input Data', and 'User Diagnosis' sections show communication logs for slave address 76543210.

Output Data	Input Data	User Diagnosis
1: 22 00100010 " 34	1: 22 00100010 " 34	
2: 00 00000000 . 0	2: 01 00000001 . 1	
	3: 0C 00011100 . 12	
	4: 00 00000000 . 0	
	5: 00 00000000 . 0	
	6: 00 00000000 . 0	
	7: 00 00000000 . 0	
	8: 01 00000001 . 1	
	9: 00 00000000 . 0	
	10: 00 00000000 . 0	
	11: 00 00000000 . 0	
	12: 00 00000000 . 0	
	13: 00 00000000 . 0	
	14: 10 00011101 . 28	
	15: 01 00000001 . 1	
	16: 02 00000010 . 2	
	17: 00 00000000 . 0	
	18: 00 00000000 . 0	
	19: 00 00000000 . 0	
	20: 00 00000000 . 0	
	21: 00 00000000 . 0	
	22: 00 00000000 . 0	
	23: 00 00000000 . 0	

Example from test SW

The Profibus configuration is 80 01 40 00 40 40 40 45 40 43

Output: 2 bytes

Input: 1 byte, 1 word, 6 words, 4 words

Output from master (input to controller)	Description	Remarks
Byte 0, bits 0..2	Step/Intensity	0 = off, 1..7 step/intensity
Byte 0, bit 3	Spare	
Byte 0, bits 4..7	Configuration	0=Cfg1, ... 3=Cfg4
Byte 1, bits 0..4	Spare	
Byte 1, bit 5	Speed	Low or high speed
Byte 1, bit 6	Heater	1=on
Byte 1, bit 7	Spare	

Input to master (output from controller)	Description	Remarks
Byte 0, 0..2	Step	
Byte 0, bit 3	Spare	
Byte 0, 4..7	Configuration	
Byte 1+2 = Word	Status	
bit 0	Lamp alarm	One or more lamps not working
bit 1	RIL alarm	RIL Disabled
bit 2	Earth Warning	If Earth box is mounted
bit 3	Earth Alarm	If mounted
bits 4..9	Spare	
bit 10	Key in remote	
bit 11	Flashing is on	
Bit 12	Speed	
bit 13	Heater is on	
bits 14..15	Spare	
Byte 3+4 = word	Spare	3 = high part 4 = low part
Byte 5+6 = Word	Spare	
Byte 7+8 = word	Num. faulty lamps	
Byte 9+10 = word	Earth impedance (kOhm)	If mounted
Byte 11+12 = word	Spare	
Byte 13+14 = word	Load	Load in %*10(promille)
Byte 15..22 = 64 bits	Faulty lamps	Lamps adr. 1..64 (one bit each) 15 = low part .. 22 = high part

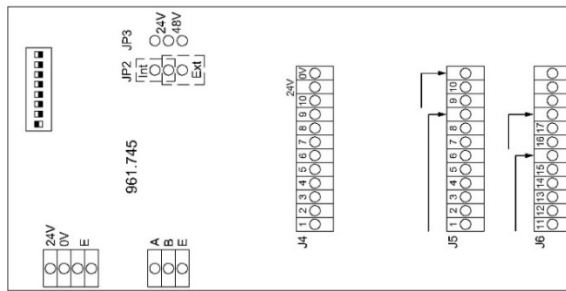
# 14.3 Parallel control

(961 HW or Interface board 971751/Parallel)

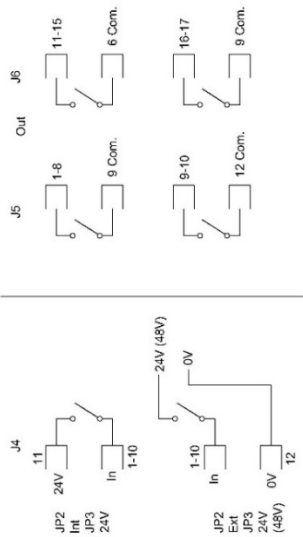
When a parallel interface is required, a separate parallel interface board is placed in the SFL cubicle, and 961 HW board will communicate with the SFL mainboard via the RS485 serial bus. And 971751/Parallel will use CAN bus to mainboard.

Preliminary Wiring:

IO no.	Function	Comment
I1	Step 1 low speed	
I2	Step 2 low speed	
I3	Step 3 low speed	
I4	Heater active	
I5	Step 1 high speed	
I6	Step 2 high speed	
I7	Step 3 high speed	
I8	Bit 0 of dfg	00=cfg1 01=cfg2
I9	Bit 0 of dfg	10=cfg3 11=cfg4
I10		
O1	Step 1 low speed	
O2	Step 2 low speed	
O3	Step 3 low speed	
O4	Bit 0 of dfg	00=cfg1 01=cfg2
O5	Bit 1 of dfg	10=cfg3 11=cfg4
O6	Remote	
O7	Lamp alarm	
O8	RLL alarm	
O9	Step 1 high speed	
O10	Step 2 high speed	
O11	Step 3 high speed	
O12	Heater active	
O13	Earth warning	
O14	Earth Error	
O15		
O16		
O17		



In	Pin	Out	Pin	Common
1	1	11	1	6
2	2	12	2	6
3	3	13	3	6
4	4	14	4	6
5	5	15	5	6
6	6	16	6	9
7	7	17	7	9
8	8		8	
9	9		9	
10	10		10	12
11	11		11	12
12	12		12	



---

## 15. Maintenance and Trouble shooting

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### 15.1 Regular Control

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There is no direct demand for certain maintenance to be done on the SFL, but this chapter states a few recommendations which could improve both MTBF, lifetime of the equipment as well as safety for maintenance personnel.

Every other year:

- The power lines are disconnected from the SFL, and the isolation level is measured (Megger).

Every 5 years:

- The SFL is cleaned inside with a vacuum cleaner (SFL CUBICLE IS POWERED OFF!), and all components are visually controlled for changes in colour etc.
- All power connections are controlled by means of a Thermo camera.

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### 15.2 Safety instructions

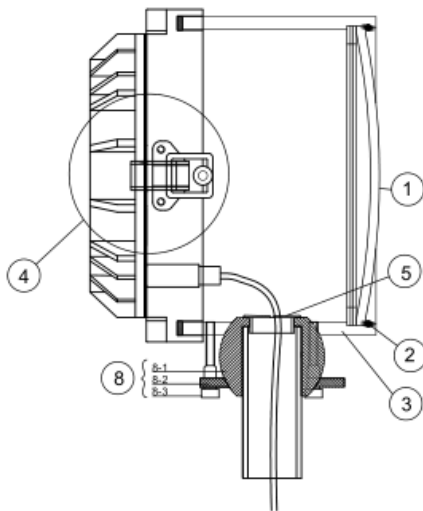
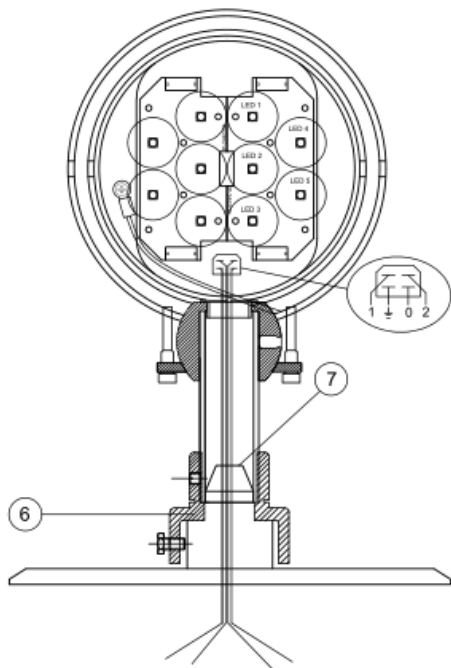
---

Before any service work is done in the SFL cubicle, the power supply must be switched off.

Before any work is done on the series circuit:

- The key selector on the SFL is set to "OFF", there will still be 24V to circuit.
- The SFL front door is clearly marked with a sign "Work is done on the circuit."

## 15.3 List of spares



Pos.	Name	Product Number
1	Frontglass, clear	P-382300
2	Spring for frontglass	792006/1
	Sealing for front glass	792854
3	Alu housing	792011
4	Cover with Electronic	793892/4
5	PVC-roundel	P-855001
6a	Breakable coupling Type C	790901/2
6b	Breakable coupling Type A (with 2" thread)	790518/2
7	Rubber grommet	P-850059
8	Adjustment fixing assembly	790021 + 790022 + P-902841





### Company profile:

TKH Airport Solutions is an innovator in airfield ground lighting, offering a complete range of LED AGL products. We build upon the know-how from a long and successful tradition of pioneering developments in the AGL and connectivity industry. Being part of the TKH Group, our company can build on a history of more than 90 years in smart connectivity, energy distribution and AGL.

#### More information:

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**TKH Airport Solutions**  
Elektrostraat 17  
7483 PG Haaksbergen  
The Netherlands





**INDUPERM<sup>AS</sup>**

## Regulator type CCR 961-SW4.00

**USER MANUAL  
GB**



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## 1. General information

### 1.1 The layout of this manual

This manual includes technical information about the TKH Airport Solutions range of Constant Current Regulators, CCR 961 with improved firmware, SW4.0xx.

The range of CCR's are constructed and manufactured of standard parts, mostly produced in-house. As the possible settings in the CCR's are numerous, it is advised to study the manual carefully before any settings are changed.

All standards settings and operations are detailed described in the Step-by-Step instruction in section 5.5.

### 1.2 The use of the manual

The manual is intended to be used for installation, operation, maintenance of the CCR, as well as for purchase of spare parts.

### 1.3 Manufacturer information

The CCR 961 are developed and manufactured by:

**TKH Airport Solutions A/S**  
**Københavnsvej 1**  
**DK-4800 Nykøbing Falster**  
**DENMARK**

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### 1.4 Document information

Version	Date	Author	Approved
A –First release	2015.3.28	Ole Lund-Hermansen	OLH

Version	Date	Author	Approved	Comments
B	2015.5.12	OLH	OLH	SW Version 4.00c included
B1	2015.5.26	OLH	OLH	Optional remote terminals added
B2	2015.9.10	OLH	OLH	New drwg. for Remote control terminals
B3	2018.12.13	PE	PE	Company name, webpage and logo updated
B4	2019.07.09	PE	PE	Menu items and step-by-step guide updated
C	2020.10.6	OLH	OLH	TKH version, Menu corrected



This manual includes a number of safety instructions, but national instructions as well as IEC 61820, Annex C, must be observed.



TKH Airport Solutions A/S reserves the right to changes without notice. It is not allowed to copy this manual without permission.

## 2 Overall CCR 961 information

### 2.1 Relevant standards

The range CCR 961 is constructed, manufactured and tested to meet the latest EN IEC 61822 standard. The performance of the CCR 961 has been verified in tests performed by TÜV SÜD in Germany. The range of CCR961 meets the requirements in ICAO Annex 14, as well as ICAO Design Manual

### 2.2 Main data

The CCR 961 in FAA layout is a complete unit including CCR Thyristor module for 40A, 60A or 110A, built together with output transformer and all belonging hardware such as measuring transformers, Isolation Measuring equipment and lightning protection devices.

Standard power ratings from 2,2 KVA to 35 KVA.

Standard 100% series circuit current can be selected in the SW between 2,2A / 6,6A and 13,2A (However, measuring transformer must be changed as well), but we can supply 8,3A – 10A – and 20A versions as well.

Standard input voltages are 230V / 400V (± 10%) - 50Hz or 60Hz (± 2 Hz)

#### Features

- Seven individual adjustable intensity steps.
- Earth fault supervision with two alarm levels.
- Lamp supervision with two alarm levels.
- Hour meters for 100% intensity and total time.
- All CCR adjustment stored on changeable Memory board for easy and fast maintenance
- Digital display showing:
  - Output current (RMS value).
  - Output voltage (RMS value).
  - Input voltage.
  - Time/date through build-in watch.
  - Power output.
  - Impedance to earth.
  - Number of faulty lamps

#### Mechanical specifications:

	Height (mm)	Depth (mm)	Width (mm)	App. Weight (KG)
CCR for 230V, Power rating ≤ 10 KVA	1666	600	390	175 – 240
CCR for 400V, Power rating ≤ 20 KVA	1666	600	390	175 – 275
CCR for 230V, Power rating > 10 KVA	1666	600	772	240 – 325
CCR for 400V, Power rating > 20 KVA	1666	600	772	275 – 325

#### Other specifications:

- Max room temperature: 50 °C  
 Humidity, max: 95% (not condensing)  
 Efficiency:
- 230V supply 94 - 97%
  - 400V supply 95 – 98%
- Power factor better than 0,9 at full load (ohmish)

Cubicle is electro-plated and coated in light grey RAL 7035).

## CCR961 MANUAL-GB

### 2.3 CCR 961 variants

#### a. Input voltage

CCR 961 can be supplied for almost all values of input voltages. However, our standards are 230VAC and 400VAC, 50Hz. The 400VAC version are preferred due to higher efficiency, and will be supplied if no specific requirement are stated.

The CCR modules can be supplied in three different max. current ratings, 40A - 60A and 110A. All three types can be set up for 230VAC use or 400VAC, simply by changing a terminal connection in the modules.

The 40A and 60A module are mechanical identical, which means that the 60A module can be used as spare for the 40A type. The 110A module is 2 times wider as the other modules.

#### b. Firmware

The CCR modules with the last Firmware (program), SW4.0xx covers:

- ISO measuring version 1 (standard offered type):  
ISO measuring in intervals (0-2,5K $\Omega$ , ..., 1-2M $\Omega$ , > 2M $\Omega$ )
- ISO measuring version 2 (requires special measuring box):  
Measuring of ISO value from 5K $\Omega$  to >50M $\Omega$ , with high accuracy and two significant digits.
- Series circuit current nominal 6,6A (current measuring transformer 6,6/0,25A)
- Series circuit current nominal 2,2A (current measuring transformer 2,2/0,25A)
- Series circuit current nominal 13,2A (current measuring transformer 13,2/0,25A)

All SW version can be supplied for a number of different languages. The Danish, English and German languages are included as standard:

Last digit	1	2	3	4	5	6	7
Language (Country code)	D	F	N	S	P	I	

#### c. ISO measuring

As mentioned under Firmware, the CCR can be with the standard ISO measuring in intervals or the more expensive explicit measurement where the isolation value can be displayed from zero to more than 50M $\Omega$  with two significant digits, fx. 37M $\Omega$ . Besides the different setting in the SW, the explicit measurement system requires a more complicated Earth Measuring Box.

#### d. Cut-out device.

As standard, the CCR961 regulators are with Cut-out device based on FAA plugs as shown on drawing XXX: This Cut-out device is placed behind the front door. The construction is simple and reliable, and gives easy access to measurements on the circuit while disconnected from the CCR.

Alternatively, the CCR can be supplied with a key operated Cut-off device, which can be operated without opening the front door on the CCR cubicle. This solution is specially designed in cases where the CCR must be operated and maintained by people without any technical education.

Both solutions are described in section 7.

# CCR961 MANUAL-GB

## e. Tapping on output transformer.

Dependent on date of construction and power rating, the TKH Airport Solutions range of output transformers can be with tappings in steps of 7% or 10%.

All transformers are with two secondary coils, and for 7% tapping each coil have four terminals, while for 10% tappings the coils have only three terminals.

Most wiring diagrams shows both alternatives and the tapping must be based on the actual output transformer type. Tapping procedure is described in section 5.3.13.

## 2.4 Warranty limitations

The manufacturer or his representative cannot be held responsible for failures and malfunctions, if the instructions in this manual are not followed.

The CCR 961 will meet all specifications when installed and operated as specified.

TKH Airport Solutions A/S only has responsibility to replace faulty parts if construction, production or component failure is proven.

## 3 CCR DESCRIPTION

### 3.1 General Information

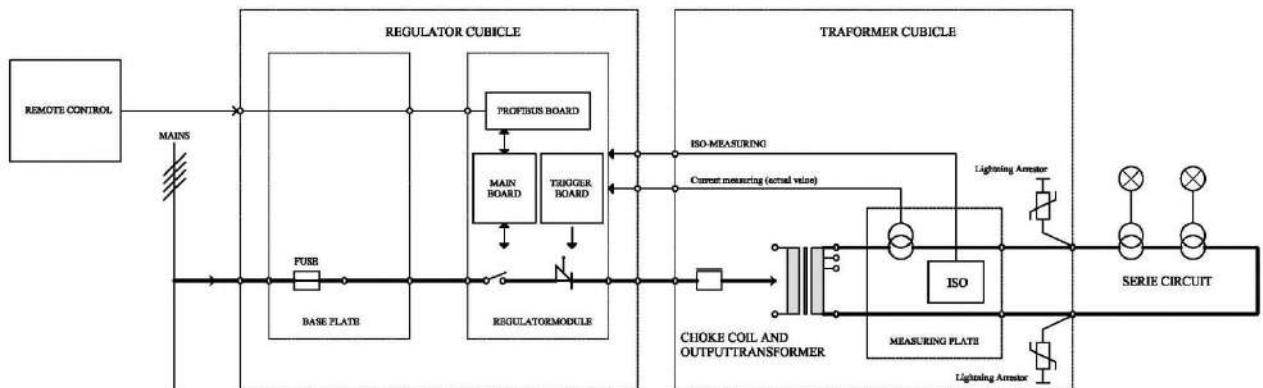
TKH Airport Solutions Constant Current Regulator type CCR 961 is developed specially for the supply of power to lighting systems in airports with their special demands for safety, reliability, accuracy and easy maintenance.

CCR 961 is designed for lighting systems built up as series circuits.

TKH Airport Solutions CCR type 961 is constructed based on the latest experience and expertise within the field of power electronics, just as a number of  $\mu$ -processors are used in each CCR.

This results in a very compact construction, large number of facilities and easy adaptation to any special requirement.

The Block Diagram 961.010 shows the principles in the CCR layout.

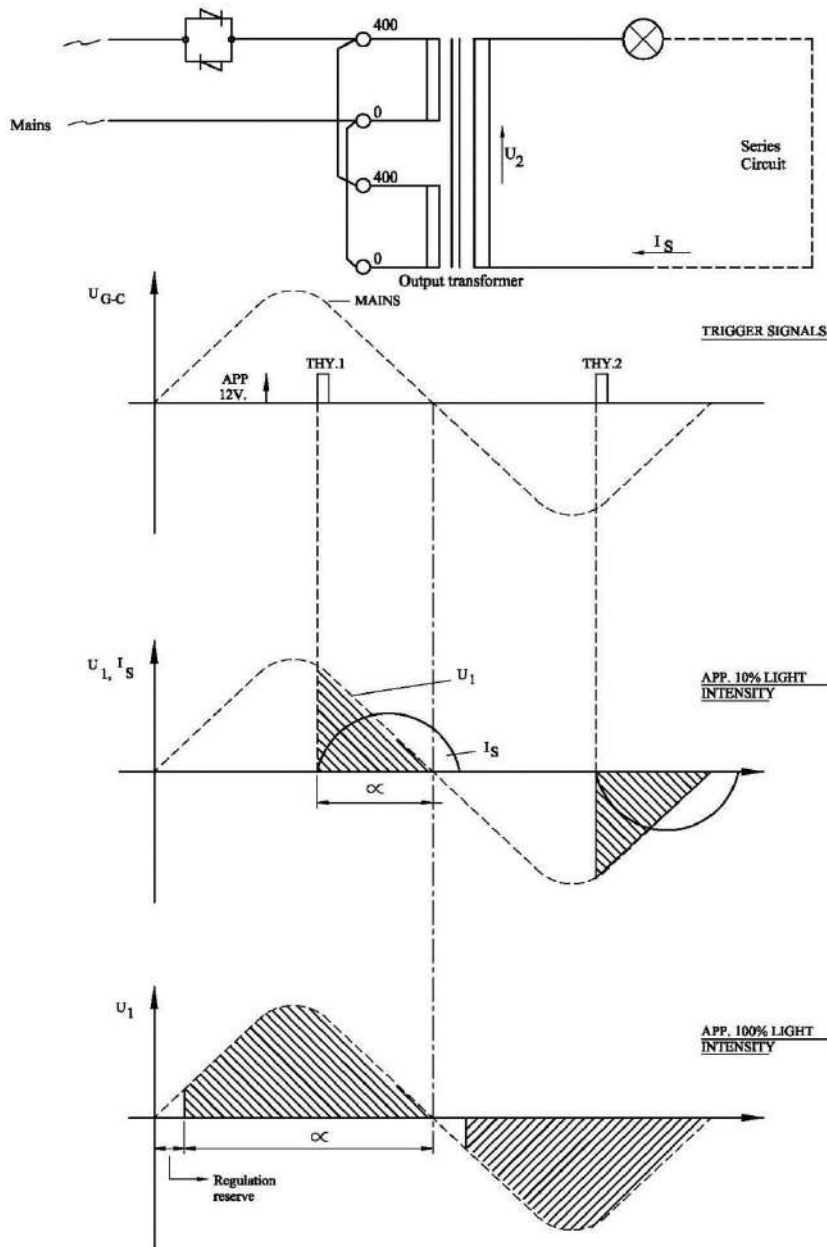


Block Diagram 961.010

The basic working principles can be described as follows:

Mains (one or two phases) are supplied to the CCR Module via MCB's (fuses) in the CCR cubicle. Through the contactor the Mains is connected to the thyristors. Each thyristor will lead a variable part of each half wave through to the Power Transformer (Thyristor working principle, see drawing 951.015).

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Thyristor Working Principle  
951.015

The resulting input voltage on the primary side of the Power Transformer generates a certain output voltage (given by the voltage ration for the Power Transformer) to the series circuit. This output voltage generates a current in the series circuit corresponding to the impedance in the series circuit.

The current transformer measures the value of the current in the series circuit and the measuring signal is send back to the CCR Module. In the CCR Module, the RMS value of the current is calculated, and a control is performed to see whether the current have a value corresponding to the requested value (our Reference Value). If that is not the case, the electronics will chance the time for triggering the thyristors in each half wave until the current have the correct value.



## CCR961 MANUAL-GB

### 3.2 CCR Module (Standard)

The modules are manufactured in three sizes, 40A, 60A and 110A.

The CCR Modules are constructed as plug-in units with connectors for easy maintenance.

The CCR Modules includes up to three printed circuit boards (Mainboard, Trigger board and Profibus board), thyristor block, contactor, EMC components and fuses.

These elements are the main components in the CCR Modules.

On the front of the CCR Module, you will find:

- Key switch (Remote – Off – Local)
- Folia push bottoms
- Display
- LED indications
- Data connection

Each CCR Modules includes a Memory board. This Memory board includes a set of standard values for the adjustment of the CCR (Default Values). The Memory board do also include all individual adjustment for the CCR Module, as well as specific data for the connected series circuit.

If this Memory board is removed from one CCR Module to another, all data are moved accordingly. The Memory board is placed in a socket on the Mainboard printed circuit.

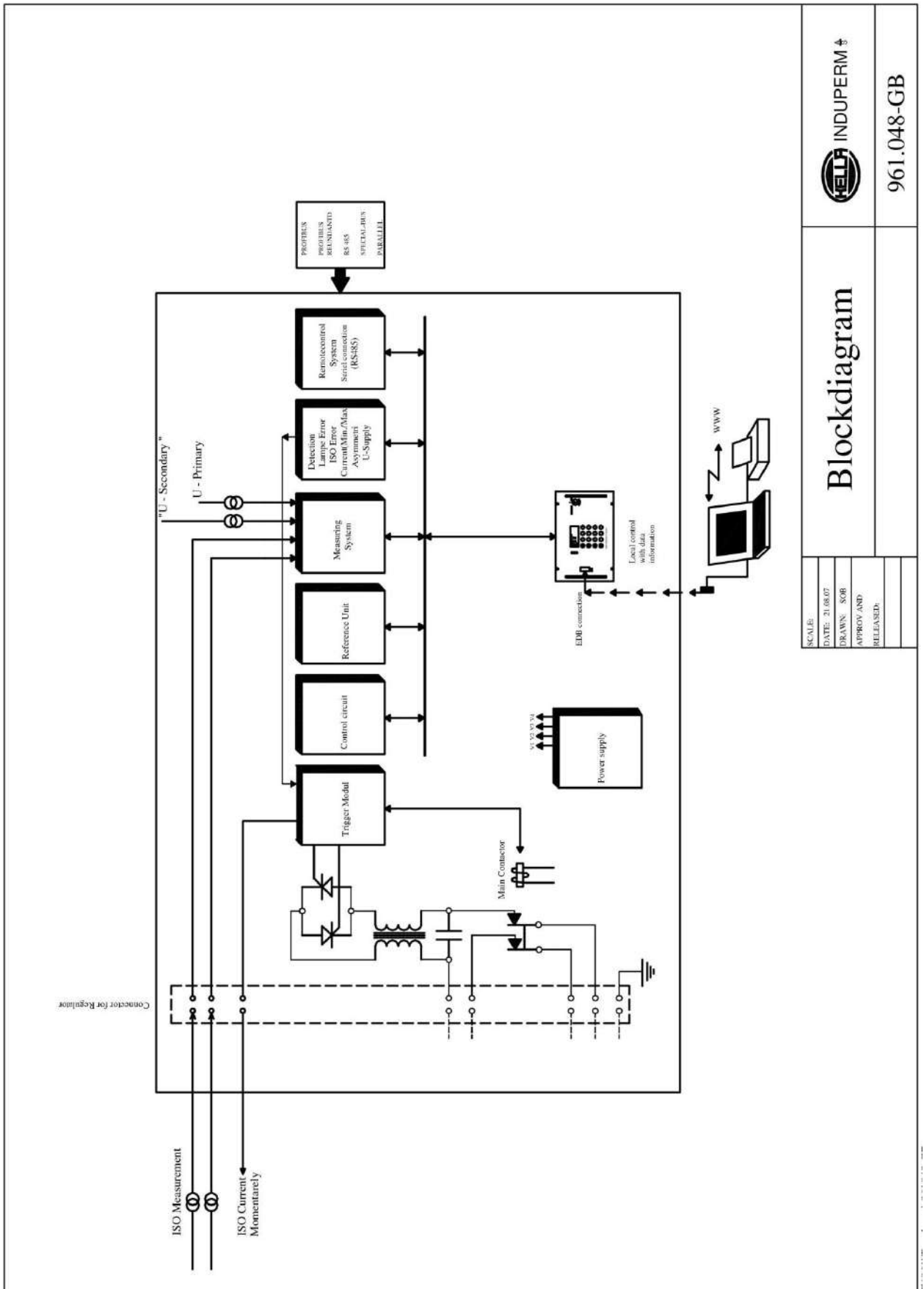
This facility means that a spare CCR can be taken in operation, fully adjusted, in a few minutes.

Drawing 961.048 shows a block diagram of the CCR Module.

All communication internally are done via an I2C data buss. On the Mainboard is placed two  $\mu$ -processors. These processors are handling the current regulation, supervision as well as communication with the front panel (Local operation) or with the Remote Control. The Main Board includes facilities for directly remote control in our RS485 serial protocol. If Profibus is required, an additional Profibus board is included in the Module.

The following information can be added to the each single part (block) on drawing 961.048:

- The Current Reference system.  
As standard, the CCR has seven “normal” light intensity steps. These steps can all be adjusted to any current value between 2,2A and 6,6A.  
Besides, the CCR has a special step 8 (SW version 2.14y or later), designed for special purposes, such as
  - Heating of lamps / fixtures without any light output
  - Interlock current step, or a “safe” current value. The step can be used in connection with for instance large load changes.
  - Particular critical circuits can be permanent supervised for lamp- or isolation failures without lighting the circuit.
  - For Stopbarre circuits frequently switched on and off, to reduce number of contactor operations.
- The Analogue measuring system:  
The following analogue values are converted to digital data:
  - The current in the series circuit (0 – 6,6A via current transformer 7,5A/0,25A)
  - Mains (230V or 400V via voltage transformer 400V/10V)
  - Output voltage (0 – 5000V, measured on the primary side of the Power transformer via voltage transformer 400/10V, multiplied with the voltage ration of the Power transformer)
  - The isolation level of the series circuit to ground, measured from 0  $\Omega$  to more than 2M $\Omega$  via ISO measuring box with 500VDC measuring voltage.



SCALE:	INDUPERM
DATE: 21.08.07	
DRAWN: SOB	
APPROV AND RELEASED:	
Blockdiagram	
961.048-GB	

# CCR961 MANUAL-GB

- The Supervision system

A number of vital parameters are constantly supervised, and one or two alarms can be generated for each of the following parameters.

- Current in the series circuit:

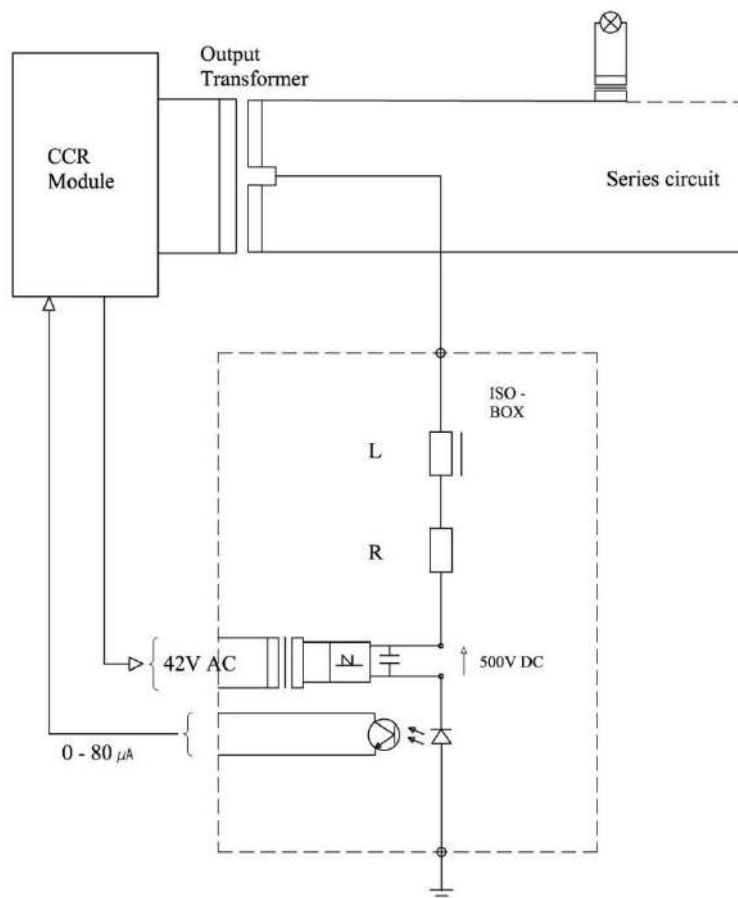
If the current drops below a certain (adjustable) limit, the series circuit must be open. This is dangerous for the maintenance people, and therefore the CCR are switched-off and an I-min alarm is displayed in the menu and send to the remote control system.

If the current exceeds a certain (adjustable) limit, a CCR failure is properly at hand. This is dangerous for the lamps, and therefore the CCR is switched-off and an I-max is displayed in the menu and send to the remote control system.

- Isolation failure:

The CCR can be programmed to continuously ISO measurement or to interval measurements. By interval measurements, the interval between the measurements can be adjusted between 1 to 99 hours.

A measuring voltage (500VDC) is connected between the series circuit and ground through a special measuring box. The resulting DC current can be used to calculate the isolation level. Isolation values between  $0\Omega$  and  $2M\Omega$  are displayed in 11 bands (fx.  $50K\Omega$  -  $100K\Omega$ ). Two alarm levels can be set.



ISO Measuring principle

## CCR961 MANUAL-GB

- Lamp failure:

The principle behind the TKH Airport Solutions LAME (Lampen Ausfall MEldung) system is based on the physical phenomenon, that when a lamp in the series circuit is faulty, the belonging isolating transformer will go in and out of saturation. Just after the activation of the thyristors in each half wave, or just before the current goes to zero again, the isolation transformer impedance will be very large. In the rest of each half wave, the isolation transformer impedance will be almost zero.

By measuring the  $di/dt$  of the current around zero, the number of faulty lamps in the series circuit can be calculated.

The CCR have a built-in Learn Mode for the adjustment of the LAME system.

The number of faulty lamps can be detected up to 20 lamps with a very high accuracy. Two alarm levels can be set.

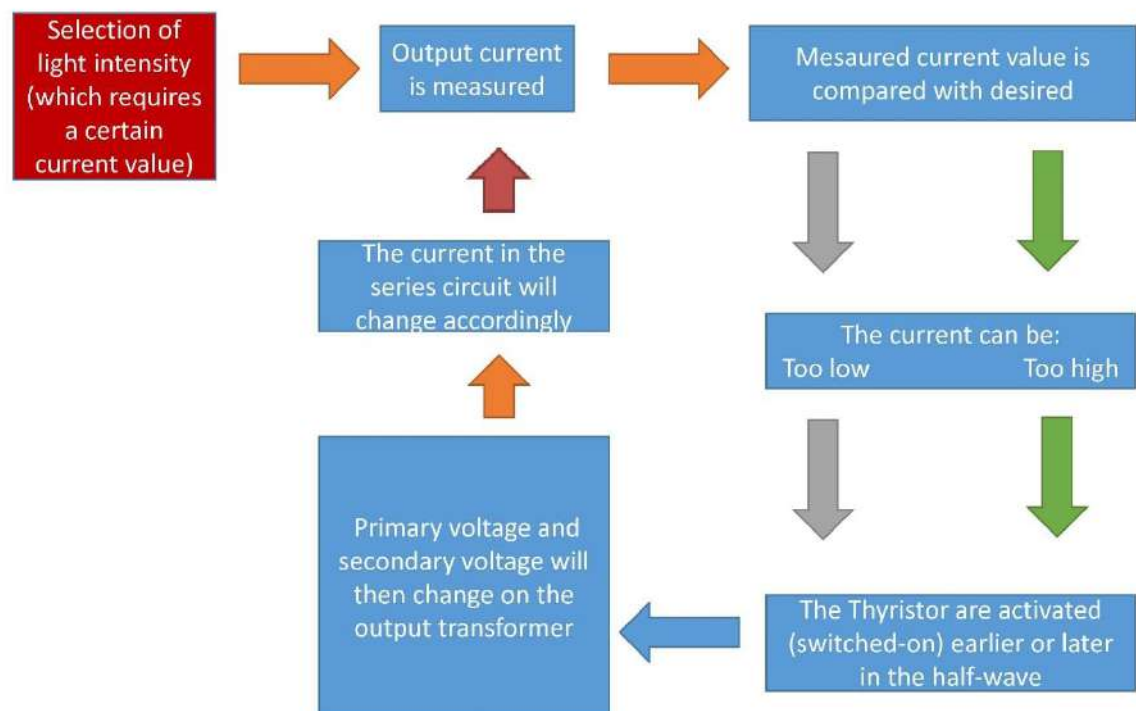
- The regulation circuit.

In the regulation circuit, the actual current value is constantly compared with the requested current value (the Reference value). Based on the comparison it is determined when the thyristor can be activated in each half wave.

When using a larger part of the half wave a larger part of the Mains will be activated, and a larger current in the series circuit can be expected.

The regulation is controlled by a  $\mu$ -processor. The processor has divided each half wave in 500 steps. When turned on, the  $\mu$ -processor will start in step 0, and by means of the built-in soft start facility, the current will slowly be regulated to the selected reference value.

When the current is within  $\pm 0,5A$  from the reference value, the current is slowly regulated to match the reference value.



Principle for the regulation circuit.

## CCR961 MANUAL-GB

- **Trigger Module**  
 This module converts the control signal from the  $\mu$ -processor to galvanic separated power signals to the thyristors.  
 To be able to guarantee triggering (activation) of the thyristors under difficult circumstances (such as reactor load) the trigger signal is not only a single pulse, but a large number of trigger pulses.  
 The Trigger module does also include a galvanic separation (Solid State Relay) between the on signals from the Main Board to the main contactor.  
 In the same manner the cyclic control of the ISO measurements are performed. When a measurement is requested, 42VAC is connected to the ISO box via a Solid State Relay.
- **Remote Control System**  
 The Main Board Module includes a standard RS485 communications port. This can be connected directly to the remote control system.  
 For more sophisticated protocols, an additional printed board can be built into the CCR module. As standard, TKH Airport Solutions can offer Profibus or redundant Profibus plug-in boards.  
 If IP addresses are requested, an IP module is placed in the CCR cubicle and communicates with the module through our RS485 serial communication.  
 If parallel interface to a remote control system is requested, a Parallel interface module is placed in the CCR cubicle and communicates with the module through the RS485 serial communication.
- **Information Display**  
 The CCR Module is equipped with a large LCD display.  
 The following information can be seen in the display:
  - Output Current
  - Output voltage
  - Output power
  - Time and date
  - Hour meters
  - Selected step
  - Actual regulation reserve
  - Alarms
  - Number of faulty lamps
  - Isolation level

From the front of the CCR Module, it is possible to change all settings.

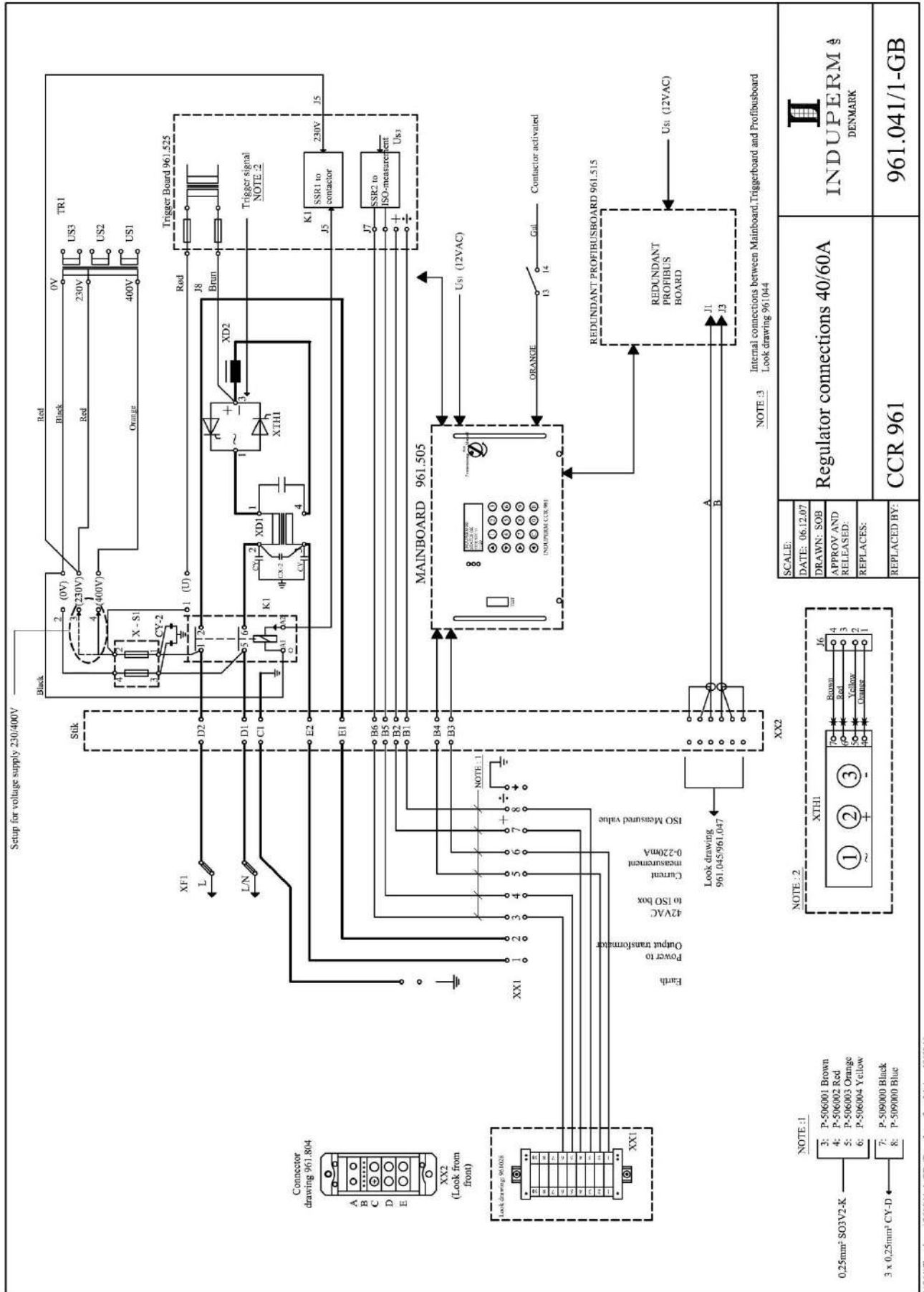
As mentioned, the CCR module is a plug-in unit.

The electrical connections:

- Power input (N+PH or PH+PH, +Ground)
- Power output to power transformer (output transformer)
- Current feed-back measurement
- ISO measuring
- Serial communication (RS485 or Profibus)

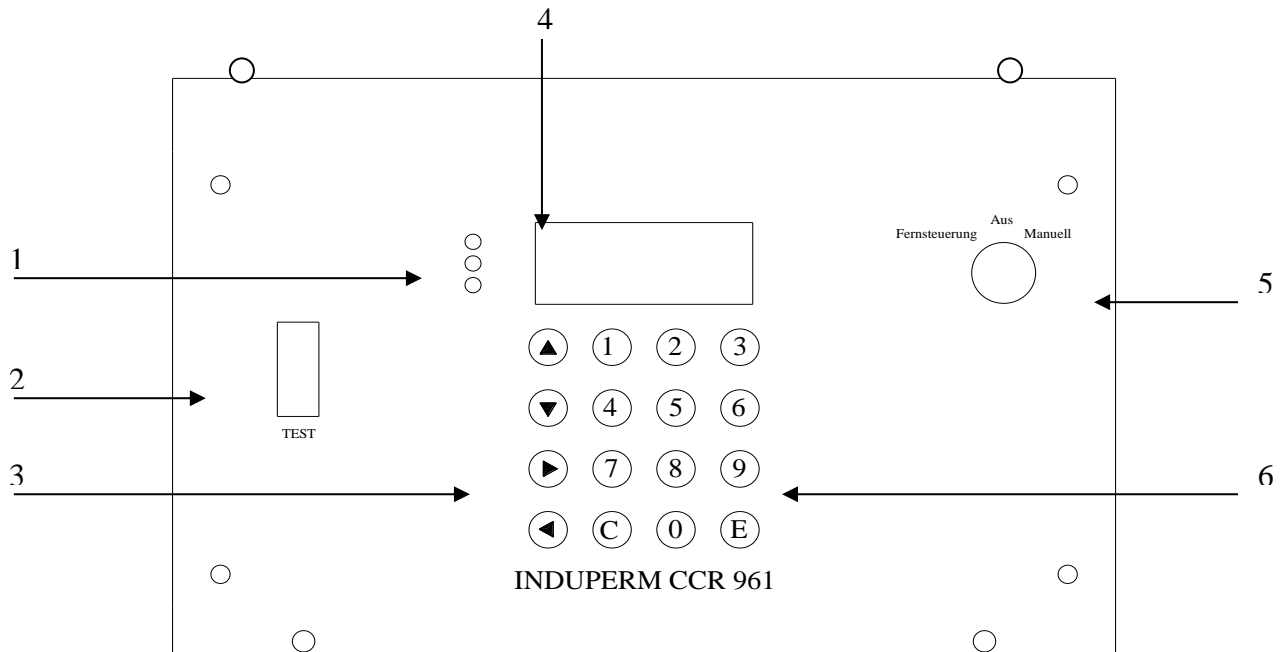
are all done via our special high performance connector. The connector is mounted on screws with springs, which will secure full contact in the connector. That's the reason, why it is important that the module after plug-in is fastened with the screws in the front.

The wiring of the module and connections to Output transformer and measuring signals, is shown on the diagram on the following page.



## CCR961 MANUAL-GB

### 3.3 Operating Description



2. Communication port
3. Arrow keys
4. LCD display
5. Key switch
6. The keys 0-9 + E & C

1. LED: RED (top) – YELLOW (in the middle) – GREEN (bottom)

#### **RED:**

A flashing red LED indicates that the regulator is in either ‘manual’ or ‘turned off’. Constant light in the red diode indicates that there is some kind of an alarm.

#### **YELLOW:**

Constant light in the yellow diode indicates that the earth error measuring is active. A flash every two. seconds indicates that the earth error measuring is disconnected permanently.

#### **GREEN:**

The light in the green diode means, that the actual current in the serial circuit is equal to the “Should-Be” value  $\pm 0.4A$ .

This means that the green light will turn off shortly when switching and changing the level of the current.

The green diode will for instance be turned off if there are so many defect lights in the circuit that the regulator reserves are not sufficient to give the required current value at the relevant level (most often the 100% level).

## CCR961 MANUAL-GB

If the green light is off for more than 1-5 seconds (adjustable), the step back-indication to the remote control will disappear.

2. On the communication port the oscilloscope or the PC can be connected to read out values from the regulator.

3. The arrow keys are used to navigate the menus on the regulator. The arrow keys have other functions as well in the individual menus.

4. LCD display:

Here you see a number of parameters such as:

- Analogue values
- General information
- And directions for potential activities

5. The key switch has three positions: Remote control – Turned off – Manual control.

- REMOTE CONTROL (FERN)

When the key switch is in Remote control mode, the regulator can be switched-on and off, and light intensity step can be selected from the Remote Control System.

- TURNED OFF (AUS)

When the key switch is turned off, it means that the regulator can be controlled neither from the keyboard nor from the remote control.

- MANUAL CONTROL (MANUAL)

When the key switch is in Manual control mode, the regulator can be controlled by way of the keyboard on the regulator.

Back-indications, alarms and analogue values will, however, still be send to the remote control system.

When you switch from Remote control mode to Manual control mode, you have to pass the Turned off position. To prevent the regulator from switching-off, the key switch must be turned quickly past turned off. The regulator will stay at the level to which it has been connected from the remote control.

When you switch from Manual control mode to Remote control mode, you have to pass the Turned off position. To prevent the regulator from switching-off, the key switch must be turned quickly past turned off. The regulator will switch to the intensity level selected from the remote control.

You change between the ordinary menus by using the arrow keys (→←), irrespective of the position of the key switch without affecting the setting of the light.

You can for instance browse forward to Menu 3 (ISO Mess. circuit) and activate a measurement.

6. The keys 0-9 + E & C:

The keys 0-7 can be used to switch-on or off in light intensity levels 1-7 where 0 is used for switching-off.

When pressing a key between 0-7 above the max number of steps to which the regulator is set, the regulator will connect to the 100% level.

The keys 0-9 are also used for indicating new values, e.g. in the adjusting mode.



## CCR961 MANUAL-GB

Press the E key to get into the adjusting mode. The key is moreover used for acknowledging. The 0 key is used to resetting any alarms. The key switch must be in the OFF position.

The most frequent adjustments are described in the Step-by-Step instruction.

### 3.4 The menu's

There are more menu areas:

Normal menu (no access code needed) with the menu's N1 – N12

User menu (user code) with the menu's U1 – U 21

Factory menu (factory code) with the menu's F1 – F19

Normal menu is only for display of data, while User and Factory menu are for setting and adjustment of the CCR.

Below is given information about what can be read and done by means of the Normal menu, while information about settings and possibilities in User and factory menus are given in section 5.2.

Normal menu:

Menu no.	Menu information	Eventual special function
N1	Series circuit name Actual output current Actual selected intensity step Remote – Off – local operation selected	Press > ← <: Lower text line shows: 10/(500-XXX), where XXX is the actual trigger firing position (called “pyk”). The CCR always returns to this menu (after 2 min.). Press > ↓ <: Lower text line shows current mode, ISO mode and RS485 address Press > E <: Brings you directly to menu N7
N2	Actual output current Actual output voltage Actual input voltage Actual output power	Press > E <: When the CCR is set to “Learn” for lamp supervision (see 5.3.11) it will automatically note and store the Z-value for each step ( $Z = U_{out} / I_{out}$ )
N3	Lamp Alarm No. of faulty lamps	Press > E <:
N4	Circuit Isolation Last found value (can be 3 hours old) Measuring active or off	Press > ↑ <: Activates a new isolation measurement (also with CCR in Remote Control).
N5	Hour count Total in 100% step Total for all steps System Temperature in °C	
N6	CCR961 SW version Time Date RS485 address (node)	
N7	Adjustment? Enter Code	If you want to go to user or factory menu, enter the code and press > E <

## CCR961 MANUAL-GB

### 3.5 Power Transformer

Standard sizes are as follows: 2,2 - 3 - 5 - 7,5 - 10 - 12,5 - 15 - 20 - 25 - 30 - 35kVA.

The Transformers are, as standard, available for 230V or 400V. For all types larger than 20 kVA, the standard is 400V. Other primary voltages upon request.

As our standard is preferred the 400V series, as the total losses for the CCR are less than for the 230V series.

The transformers are constructed with two coils, each with a primary and a secondary side.

The two primary windings are, as standard connected in parallel, so each winding only have to be calculated for 50% of the nominal primary current.

It is possible to change the primary windings from parallel to series, if the following conditions are observed:

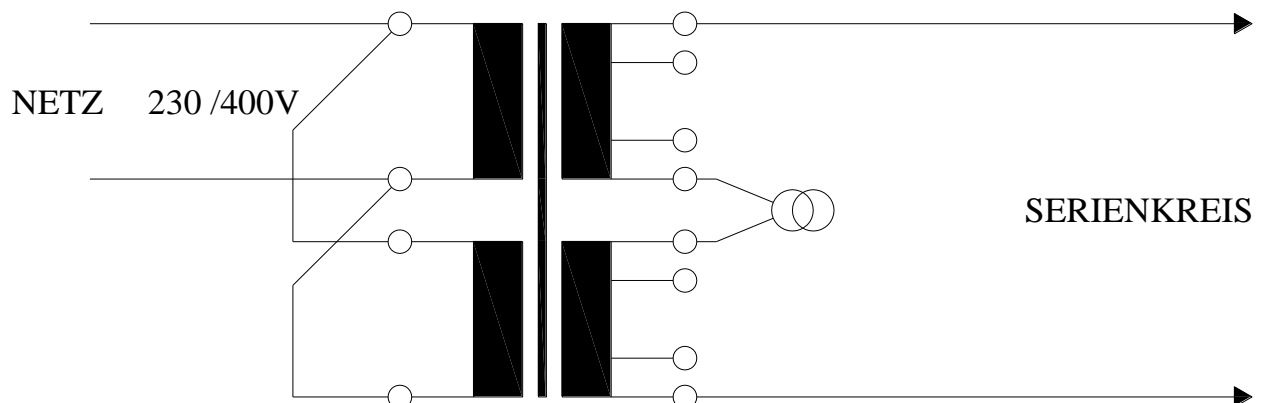
- A transformer for 230V can be used for 400V primary voltage with the two primary windings in series.
- For a transformer with a rating more than twice the actual needed load, it is an advantage to connect the two windings in series for better adjustment to the load. Max. Load is only 50 % of nominal load.

The secondary winding is with several tapings for adjustment to actual load.

The two secondary windings are always connected in series.

The transformers are air-cooled.

### POWER TRANSFORMER



## CCR961 MANUAL-GB

### 4 CCR installation

#### 4.1 Unpacking the CCR shipment

The CCR's are supplied on a pallet, and covered in a plywood box.

Remove the screws in the top and bottom of the plywood box, and the box can be lifted off the CCR pallet, and folded.

The CCR cubicle are bolted to the pallet. Remove the bolts and eventual additional transport support for the output transformer and the CCR cubicle can be removed from the pallet.

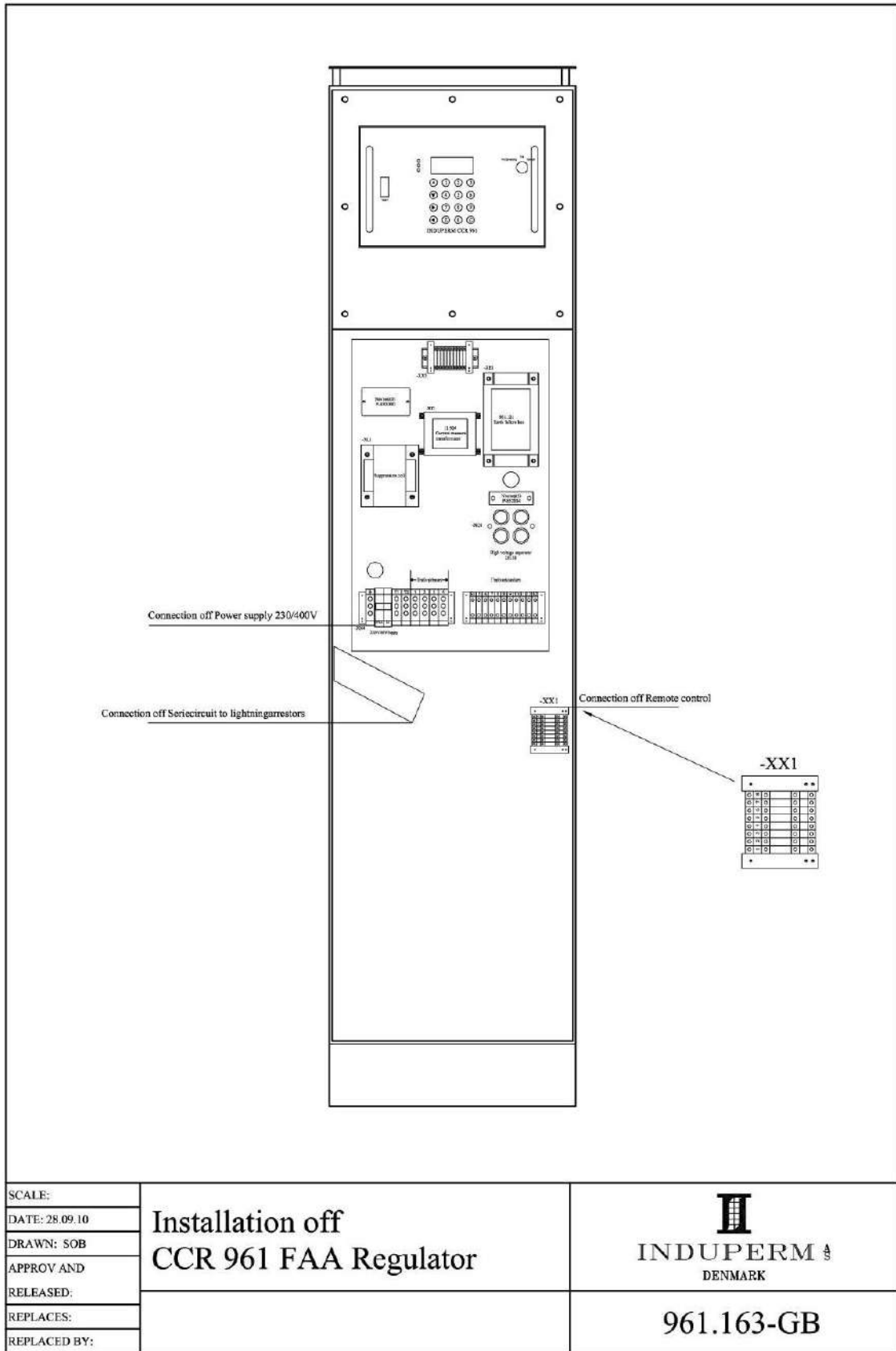
#### 4.2 Before the installation

Check the planned installation location. The floor must be stable, and the CCR cubicle must be fastened to the floor. The room must be ventilated and free air circulation from under the cubicle must be secured. If this cannot be guaranteed, a special front door with air-inlets must be ordered.

The CCR cubicles can be placed directly next to another, and as all services can be performed from the front the CCR cubicle can be placed with the backside directly to a wall.

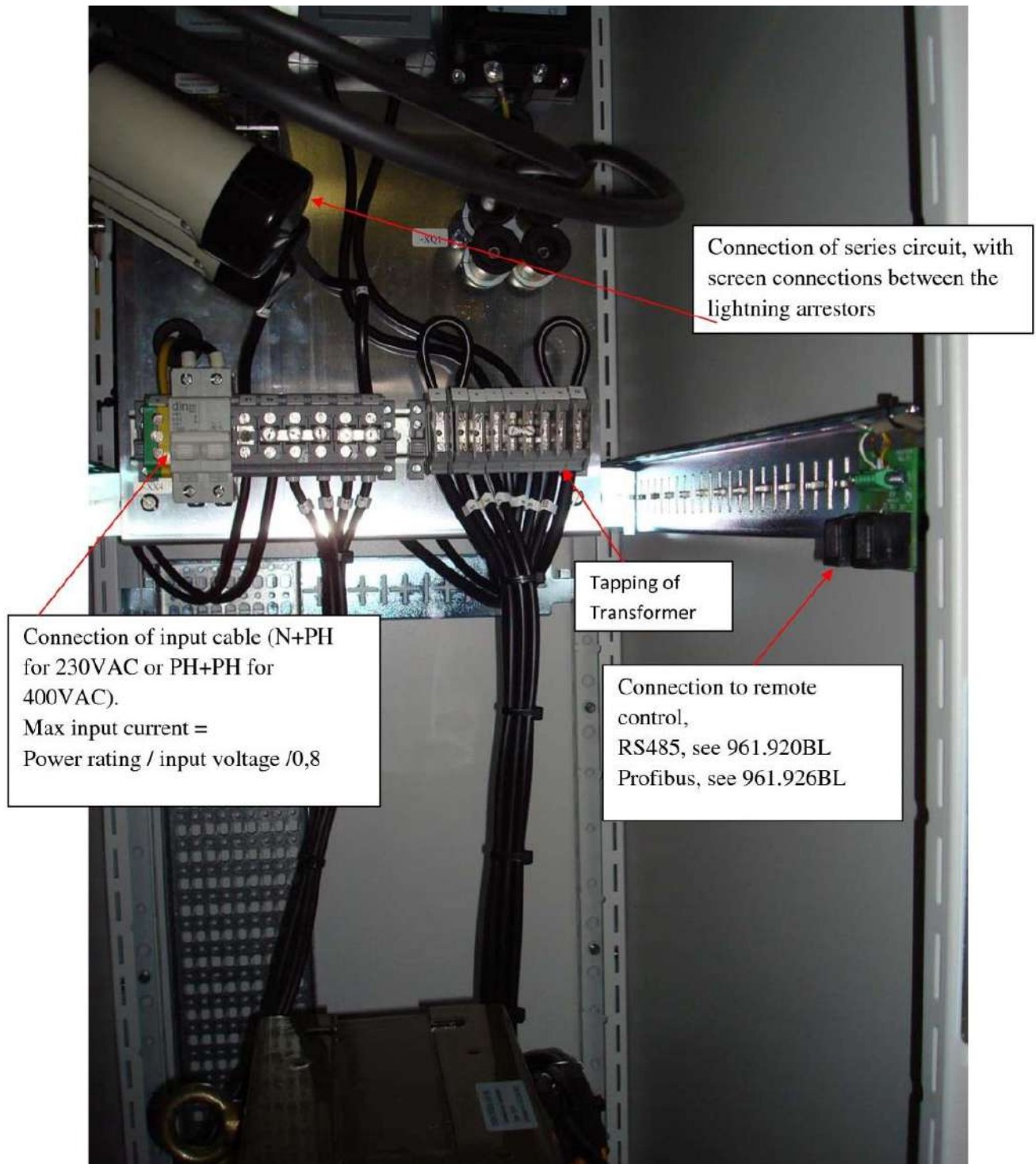
#### 4.3 CCR installation





CCR front view

## CCR961 MANUAL-GB



## Comments:

- Remote connection for RS485 can be by means of terminals or RJ45 plugs
- Input power cable dimension must be according to calculated max. input current
- Series circuit cables must be connected by means of cable shoes, and these are normally included in the delivery (mounted on lightning arrestors)

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### 5 Commissioning

#### 5.1 Preparation

Commissioning and adjustment normally have to be certified in a protocol. This protocol can be made by means of the serial interface on front of the CCR together with a Monitor Program, or it can be done by hand on, by reading values in the display.

#### A. Conditions for a correct adjustment:

- The CCR is wired for correct supply voltage (230V or 400V, factory setting is 400V)
- Remote control address is set to correct value
- The series circuit is controlled for acceptable isolation value and continuity
- The remote control cable is connected

#### B. Assembling:

- The Key switch is set in position "OFF" (= AUS).
- Power is switched on
- No blinking must occur in the display
- The Key - switch is turned to position "Manual" (local operation)

#### C. Setting and adjustments:

There are more menu areas:

Normal menu (no access code needed) with the menu's N1 – N12

User menu (user code) with the menu's U1 – U 21

Factory menu (factory code) with the menu's F1 – F19

Normal menu is only for display of data, User and Factory menu are for setting and adjustment of the CCR.

The following adjustment procedure is valid for CCR's supplied directly from work, where Default data are activated and the CCR is calibrated for Iout.

The CCR will work without additional settings, but for full function of lamp supervision etc., the following control / adjustments in the relevant menu can be performed.

The User- and Factory menus can only be accessed by the use of a code. The codes will be listed in the enclosed Factory Test protocol.

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### 5.2 Control of settings in each menu.

1. The CCR is entered into **User Mode** (from Normal menu 1), by pressing:

- >E<
- Enter Code for User Mode

With > → < (arrow right) the menus are controlled/corrected as follows:

Menu No.	Menu Name	Default Value	Comments
U1	Lamp alarm		Only for LAME adjustments (Point F)
U2	Std. L (Delta)	250	Only used in LAME minimum procedure
U3	Max lamps	40	Number of lamps in circuit
U4	Normal / %	50 %	No of faulty lamps as numbers or in %
U5	Lamp alarm	2 / 5	Alarm limit 1 and 2 to be set
U6	ISO Meas.	3 Hours	Time between ISO measurements
U7	ISO alarm 1	500K – 1M	Set ISO alarm level 1
U8	ISO alarm 2	25K – 50K	Set ISO alarm level 2
U9	On-ref band	0,5A	Accepted current deviation
U10	Imin	1,5A	
U11	Step/ I out	1: 2,8A 2: 3,3A 3: 4,0A 4: 5,1A 5: 6,5A 6: 5,2A 7: 6,5A 8: 1,0A	Current values to controlled / adjusted Step 8 is a special “black-current” step developed for Stopbarre operation. Imin in step 8 reduced to 0,3A
U12	Interlock time	0 s	If interlock time is set > 0s, the CCR will automatically go back to originally step after the set time in step 8. If time set = 0s, no automatic return will take place from step 8.
U13	No. of Steps	5	No. of active steps to be set
U14	Uout calibration		Uout calibration Must be performed after change of tapping on output transformer
U15	Uin		Uin calibration
U16	Uin min. alarm	0V	Alarm limit for Uin. The alarm level for Uin-alarm can be set between 304 and 380V. If limit set to 0, the alarm is deactivated. The alarm is delayed 2½ minute. In case of alarm, the CCR will be switched-off, and the alarm must be reset before the CCR can be switched-on again. A special setting is activated by setting the limit to 300, and means: CCR will be switched off (2½ min. delayed) if input voltage gets below 305V and will AUTOMATICALLY switch on again (10 s delayed) when input voltage get over 323V.
U17	Display Contr.	5	
U18	Display light	7	Brightness adjustment
U19	Language	English	Select display-language
U20	Circuit name		Name of series circuit is set
U21	User password	0725	
U22	Tapping contr.		Only valid for 400V input
U23	Z-alarm	Inactive	Recommended activated for circuits > 12,5KVA
U24	Ipeak start	Inactive	Default is soft start
U25	Watch calibr.		Factory setting is UTC
U26	Store data		New data stored by pressing >E< Select default values by pressing >5<

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The CCR is entered into **Factory Mode**:

- >E<
- Enter code for Factory Mode

With > → < (arrow right) the menus are controlled/corrected as follows:

Menu Nr.	Menu Name	Default Value	Settings for circuits with Uout-max < 1500V	Settings for other circuits	Comments
F1	Ucurve-zero	6 = automatic setting of value	Default,		In cases where high accuracy for lamp supervision is required, please manually set value as described under high accuracy in 3.11 LAME.
F2	Iout				This calibration is done in the factory
F3	Hour count				Hour counter for 100 % step can be reset by pressing >0<
F4	Imin delay	0,5s	Default	Default	Delay by Normal Imin switch-off (I < 1,5A)
F5	I <sub>max</sub> alarm	6,75A	Default	Default	
F6	On-ref off delay	4s	Default	Default	
F7	I <sub>peak</sub> tid	0,40s	Default	Default	
F8	I <sub>peak</sub> max	10,0A	Default	Default	I <sub>peak</sub> value during Soft Start
F9	I <sub>peak</sub> -limit	4100 (OFF)	4100 (Off)	4000	Max. Value 4100
F10	Z engage delay	0,6s	Default	Default	Z delay during switch-on. Note: F12 must be adjusted first.
F11	Z alarm delay	0,5s	Default	Default	Z delay in normal use
F12	Z Factor	2,6	4,0	2,6	
F13	User Password	0725	Default	Default	Password for User Mode can be changed
F14	Reg. max	35	Default	Default	Reg. "max": Max "pyks's" in each regulation step
F15	Up regulation	0,4	Default	Default	Factor for calculated reg. step, up
F16	down regulation	0,2	Default	Default	Factor for calculated reg. step, down
F17	Reg. delay	3	Default	Default	Factor (x10mS) delay between regulations
F18	LED init value	250	Default	Default	Pyk-Limit during softstart
F19	Reg. up interlock				
F20	Down reg. interlock				
F21	Thy. max range	80			Lowest TG. angle
F22	Imin-M Off	Inactive	Default	Default	Imin-M deactivated (only possible in Local operation mode)
F23	Imin-N Off	Inactive	Default	Default	Imin-N deactivated (only possible in Local operation mode)
F24	ISO type	1			1: Analog (in ranges) 2: Digital, direct value in KΩ
F25	Inorm type	1			100% output current: 0: 2,2A 1: 6,6A 2: 13,2A
F26	Store Data				Store new values by pressing >E<



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### 5.3 Step by Step adjustments

Operation and adjustments can be performed in different menus, please consult 961.002 for more details:

Normal Menu (no code) with the menus N1 – N7: Normal CCR operation and data read-out

User Menu (User code) with the menus U1 – U26: Standard user adjustments

Factory Menu (Factory code) with the menus F1 – F26: Special adjustments

To get access to the User or Factory menu, the CCR must be in menu N1 (where the Output Current is shown), then press "E", followed by the relevant code, ending by pressing "E" again. Now you can change between the different menus by means of the push button right → or left ←. When all values are as wanted, go to the final menu to store the new values by pressing "E". In the final menu, you could also select to eliminate the new adjustments by pressing "C" or you can select the factory default values by pressing "5".

An easy way to get to the final menu where the data are stored is to press arrow right → for some seconds.

**Remember, always save data changes when leaving the User menu (>E< in menu U26) or leaving the Factory Menu (>E< in menu F26).**

#### Simple adjustments and operation instructions, "Step by step"

- 3.1. Alarm acknowledge
- 3.2. Manuel selection of intensity step
- 3.3. Adjustment of number of intensity steps
- 3.4. Adjustment of current in each step
- 3.5. Reading of actual isolation value for the series circuit
- 3.6. Adjustment of alarm limits for isolation level
- 3.7. Adjustment of alarm limits for lamp failure
- 3.8. Adjustment of time / date
- 3.9. How to change the language in the display
- 3.10. How to set up the name of the series circuit (f.i. RCL L1)
- 3.11. Procedure for the change of a CCR module

## CCR961 MANUAL-GB

### 3.1 Alarm acknowledge

A current alarm can be a minimum (Imin) or a maximum (Imax) alarm, and each of these alarms will always switch-off the CCR.

The CCR can only be switched-on again, when the actual alarm have been acknowledged.

Other types of alarms, LAME or ISO, needs no acknowledgement as the CCR is not switched-off, and the alarms will automatically disappear when the alarm condition disappear.

Before a current alarm is acknowledged, it is important to record the exact type of alarm shown in the CCR display. The possibilities are as follows:

- Imax alarm
- Imin-N, which is the normal Imin alarm telling that the current in the series circuit have been below the adjusted value for Imin (normal value is 1,5A)
- Imin-M, telling that the signal is missing from the current measuring transformer (the feedback signal)
- Imin-Z, telling that the impedance in the series circuit is several times bigger as the normal value. This is used for supervising open circuit conditions in long circuits with large capacitive currents.

#### Alarms acknowledge:

- The Key switch is turned to the position "OFF"
- Press "0" and see the alarm description disappear in the CCR display
- The Key switch is turned to the position "Manual"
- Switch-on the CCR in step 1 by pressing "1", while observing the current value in the display
- If the CCR is not working properly, Trouble Shooting must be performed. This could f.i. be repair of fault in series circuit or mounting a spare CCR module.
- If the CCR is working properly, check all relevant steps and then the Key switch is turned to "Remote"

### 3.2 Manuel selection of intensity step

- The Key switch is turned to position "Manual"
- Switch-on the CCR in step 1 by pressing "1". Other intensity steps may be selected in the same manner. The CCR can be adjusted for up to 7 active intensity steps. If you try to select a higher step than selected as active steps, the CCR will go to the 100% light intensity step.

### 3.3 Adjustment of current in each step

- The Key switch is turned to position "Manual"
- Press "E"
- Enter the code for User Menu
- Press "E"
- Press → 10 times to the display shows "Intensity steps / Iout"
- Use the push-buttons 0 – 9 to enter the desired output current value for step 1
- Press "E"
- Press ↑ (arrow up) to select the next step. Repeat the two previous steps
- Repeat this for all relevant light intensity steps
- Press → some seconds to get to the menu for "Store data"
- Press "E"

Standard current values (Default Values):

Step	1	2	3	4	5	6	7
Current (A)	2,80	3,40	4,10	5,20	6,50	5,20	6,50

## CCR961 MANUAL-GB

### 3.4 Adjustment of number of intensity steps

- The Key switch is turned to position "Manual"
- Press "E"
- Enter the code for User Menu
- Press "E"
- Press → 12 times to the display shows "Max no. of steps"
- Use the push-buttons 1 – 7 to select the number of active steps
- Press → some seconds to get to the menu for "Store data"
- Press "E"

### 3.5 Reading of actual isolation value for the series circuit

- Press → 3 times to get to the menu "Circuit Isolation". The value shown in the display may be several hours old as the Isolation Value is only measured in certain intervals.
- Pressing ↑ will start a new measurement
- After app. 10s, the new ISO value can be read in the display

### 3.6 Adjustment of alarm limits for isolation level

- The Key switch is turned to position "Manual"
- Press "E"
- Enter the code for User Menu
- Press "E"
- Press → 6 times to see "Circuit Isolation – Alarm 1" in the display
- Use ↑↓ to select the isolation value for the "Alarm 1" limit
- Press → once to see "Circuit Isolation – Alarm 2" in the display
- Use ↑↓ to select the isolation value for the "Alarm 2" limit
- Press → some seconds to get to the menu for "Store data"
- Press "E"

### 3.7 Adjustment of alarm limits for lamp failure

- The Key switch is turned to position "Manual"
- Press "E"
- Enter the code for User Menu
- Press "E"
- Press → 4 times to see "Lamp alarms" in the display
- Press ↑ and the value for "Alarm 1" limit will start flashing
- Use the push-buttons 0 – 9 to enter the desired value for alarm limit 1
- Press "E"
- Press ↑ and the value for "Alarm 2" limit will start flashing
- Use the push-buttons 0 – 9 to enter the desired value for alarm limit 2
- Press "E"
- Press → some seconds to get to the menu for "Store data"
- Press "E"

### 3.8 Adjustment of time / date

- The Key switch is turned to position "Manual"
- Press "E"
- Enter the code for User Menu
- Press "E"

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- Press → 24 times to see "Calibration of watch" in the display
- Press ↑ and the value for "Hours" will start flashing
- Use the push-buttons 0 – 9 to enter the desired value for hour
- Press "E"
- Press ↑ and the value for "Minutes" will start flashing
- Use the push-buttons 0 – 9 to enter the desired value for minutes
- Press "E"
- Press ↑ and the value for "Day" will start flashing
- Use the push-buttons 0 – 9 to enter the desired value for day
- Press "E"
- Press ↑ and the value for "Month" will start flashing
- Use the push-buttons 0 – 9 to enter the desired value for month
- Press "E"
- Press ↑ and the value for "Year" will start flashing
- Use the push-buttons 0 – 9 to enter the desired value for year (2 last digits)
- Press "E"
- Press → some seconds to get to the menu for "Store data"
- Press "E"

### 3.9 How to change the language in the display

- The Key switch is turned to position "Manual"
- Press "E"
- Enter the code for User Menu
- Press "E"
- Press → 18 times to see "Language" or "Sprache" in the display
- Press ↑↓-push buttons to select the desired language
- Press → some seconds to get to the menu for "Store data"
- Press "E"

### 3.10 I How to set up the name of the series circuit (f.i. RCL L1)

- The Key switch is turned to position "Manual"
- Press "E"
- Enter the code for User Menu
- Press "E"
- Press → 19 times to see "CCR Name" in the display

The CCR Name (or more correctly the name of the series circuit) is constructed as follows:  
 XXXX Z1 Z2 Z3 Z4, where:

XXXX can be selected among the following terms:

APH-APL-RSR-THR-PAPI-REH-REL-RWE-RCL-TDZ-TXC-TXE-STB-RGL-TXS-SPEC!

Each of the digits Z1, Z2, Z3 and Z4 can be selected between the following:  
 0-9, L, -, space,

If the option SPEC! is selected for XXXX each digit (all together) can be given an ASCII value.

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- Press >E< 4 times until ”^^^” is shown in the display.
- Press ↑↓-push buttons to choose the XXXX term
- Press >E<
- Press ↑↓-push buttons to select the Z1 value
- Press >E<
- Press ↑↓-push buttons to select the Z2 value
- Press >E<
- Press ↑↓-push buttons to select the Z3 value
- Press >E<
- Press ↑↓-push buttons to select the Z4 value
- Press ”E”
- Press → some seconds to get to the menu for ”Store data”
- Press ”E”

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### ASCII Code:

&#040;	(	ASCII: opening parenthesis
&#041;	)	ASCII: closing parenthesis
&#042;	*	ASCII: asterisk
&#043;	+	ASCII: plus sign
&#045;	-	ASCII: hyphen-minus
&#046;	.	ASCII: period
&#048;	0	ASCII: digit zero
&#049;	1	ASCII: digit one
&#050;	2	ASCII: digit two
&#051;	3	ASCII: digit three
&#052;	4	ASCII: digit four
&#053;	5	ASCII: digit five
&#054;	6	ASCII: digit six
&#055;	7	ASCII: digit seven
&#056;	8	ASCII: digit eight
&#057;	9	ASCII: digit nine
&#058;	:	ASCII: colon
&#061;	=	ASCII: equals sign
&#065;	A	ASCII: Latin Capital Letter A
&#066;	B	ASCII: Latin Capital Letter B
&#067;	C	ASCII: Latin Capital Letter C
&#068;	D	ASCII: Latin Capital Letter D
&#069;	E	ASCII: Latin Capital Letter E
&#070;	F	ASCII: Latin Capital Letter F
&#071;	G	ASCII: Latin Capital Letter G
&#072;	H	ASCII: Latin Capital Letter H
&#073;	I	ASCII: Latin Capital Letter I
&#074;	J	ASCII: Latin Capital Letter J
&#075;	K	ASCII: Latin Capital Letter K
&#076;	L	ASCII: Latin Capital Letter L
&#077;	M	ASCII: Latin Capital Letter M
&#078;	N	ASCII: Latin Capital Letter N
&#079;	O	ASCII: Latin Capital Letter O
&#080;	P	ASCII: Latin Capital Letter P
&#081;	Q	ASCII: Latin Capital Letter Q
&#082;	R	ASCII: Latin Capital Letter R
&#083;	S	ASCII: Latin Capital Letter S
&#084;	T	ASCII: Latin Capital Letter T
&#085;	U	ASCII: Latin Capital Letter U
&#086;	V	ASCII: Latin Capital Letter V
&#087;	W	ASCII: Latin Capital Letter W

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&#088;	X	ASCII: Latin Capital Letter X
&#089;	Y	ASCII: Latin Capital Letter Y
&#090;	Z	ASCII: Latin Capital Letter Z
&#096;	`	ASCII: spacing grave
&#097;	a	ASCII: Latin Small Letter A
&#098;	b	ASCII: Latin Small Letter B
&#099;	c	ASCII: Latin Small Letter C
&#100;	d	ASCII: Latin Small Letter D
&#101;	e	ASCII: Latin Small Letter E
&#102;	f	ASCII: Latin Small Letter F
&#103;	g	ASCII: Latin Small Letter G
&#104;	h	ASCII: Latin Small Letter H
&#105;	i	ASCII: Latin Small Letter I
&#106;	j	ASCII: Latin Small Letter J
&#107;	k	ASCII: Latin Small Letter K
&#108;	l	ASCII: Latin Small Letter L
&#109;	m	ASCII: Latin Small Letter M
&#110;	n	ASCII: Latin Small Letter N
&#111;	o	ASCII: Latin Small Letter O
&#112;	p	ASCII: Latin Small Letter P
&#113;	q	ASCII: Latin Small Letter Q
&#114;	r	ASCII: Latin Small Letter R
&#115;	s	ASCII: Latin Small Letter S
&#116;	t	ASCII: Latin Small Letter T
&#117;	u	ASCII: Latin Small Letter U
&#118;	v	ASCII: Latin Small Letter V
&#119;	w	ASCII: Latin Small Letter W
&#120;	x	ASCII: Latin Small Letter X
&#121;	y	ASCII: Latin Small Letter Y
&#122;	z	ASCII: Latin Small Letter Z

### 3.11 Procedure for the change of a CCR module

- The Key switch is turned to position "Manual"
- The CCR module is removed from the cubicle
- The Memory-stick from the "old" module is mounted in the "new" module
- In the "new" module the remote control address is set by means of the belonging DIP-switch. See instruction on the side of the module or simply copy the setting on the "old" module.
- The module is set for the correct operating voltage (230V / 400V). This is done by means of a lead in the terminal block above the automatic fuses in the module. The lead must be mounted in the terminal block marked 230V alternatively 400V.  
If adjusted for 230V, the module should be clearly marked "OBS: 230V"
- The Log-schema on the side of the module should be filled-in with the name of the actual serial circuit.
- The Key switch on the "new" module is set in position "AUS" (OFF)
- The "new" module is mounted in the cubicle

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- See, that the display seems to be working normally (no flashing)
- The CCR module is switched-on in step 1, while observing the current in display. If the module seems to be working, the other steps are tested.
- In step 1, press the push button → 2 times to get to the menu for lamp failure. Allow the CCR a little time for calculations, then control that the number of faulty lamps is as expected.
- The Key switch can now be turned to the position "Fern" (remote)

### Adjustments and operation instructions, "Step by step" for super-users

#### 3.11 LAME

#### 3.12 Calibration of the Uout measurement

#### 3.13 Control of the transformer tapping

#### 3.11 LAME

##### Conditions for correct adjustment:

- All light intensity steps have been adjusted
- All lamps, connectors and isolating transformers in the circuit are OK
- All isolating transformers are identical. If not, the smaller one should be used for the adjustments.

##### OBS:

If for any reason, a LAME adjustment is not necessary on a circuit, a Learn procedure for Z, see section c, must be performed.

### Principle

The idea behind the built-in adjustment procedure is, that the CCR as a start learns the electrical parameters in the circuit with all lamps OK, and after that the same with a number of faulty lamps. The procedure must be performed as a minimum with all lamps OK, but the accuracy will increase with a learn procedure with more faulty lamps.

If there is a demand for a high degree of accuracy with a high number of faulty lamps, a learn procedure with 2, 3 or 5 faulty lamps can be performed, eventual followed by a correction with one or more "Break-points", f.i. 8 and/or 12 faulty lamps.

Normally a Learn procedure with 2 or 3 faulty lamps will be sufficient, as the CCR from the learned data will calculate a higher number of faulty lamps.

We normally recommend a procedure as follows:

	<b>Learn procedure with number of faulty lamps</b>			
<b>Number faulty lamps</b>	0	1	2	5 (+ evt. 8,12) = "Break" Point
<b>Minimal Procedure</b>	X			
<b>Normal Procedure</b>	X	X		X (3)
<b>Procedure for high accuracy</b>	X	X	X	X



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### Adjustments:

#### Minimal procedure

1. The Key switch is set in position Manual
2. >E<
3. Enter code for user menu
4. >E<
5. Press >5< to start of learn procedure
6. Confirm "All lamps OK?" by pressing >E<
7. The CCR will automatically run through all active steps
8. When the question "-1 lamp?" pops up, press >C< shortly to end the Learn procedure
9. Then press >→< for some sec. until the "Store Data menu" is shown
10. Store the learned data by pressing >E<
11. "Minimal procedure" for LAME is finalized

If only the Minimal procedure is performed, the CCR will not be able to "recognize" the circuit with faulty lamps. It is therefore necessary to let the CCR use data from a "standard transformer". In User menu, U2 can be adjusted a desired L (delta) value. This procedure is useful to secure normal operation, without LAME alarms, but the accuracy is low.

#### Normal procedure

1. The Key switch is set in position Manual
2. >E<
3. Enter code for User Menu
4. >E<
5. Press >5< to start the learn procedure
6. Confirm "All lamps OK?" by pressing >E<
7. The CCR will automatically run through all active steps
8. When the question "-1 lamp?" pops up, remove one lamp in the circuit and press >E<
9. When the question "-2 lamp?" pops up, press >C< shortly
10. Press >8< for "Break-point"
11. Upon request for Break-point, enter 3
12. When the question "-3 lamps?" pops up, remove 2 more lamps from isolating transformers in the circuit and press >E<
13. The CCR runs automatically through the active steps
14. When finished, press >C< shortly to end the Learn procedure
15. Then press >→< for some sec. until the "Store data menu" is shown
16. Store the learned data by pressing >E<
17. "Normal procedure" for LAME is finalized

#### Procedure for high accuracy

The accuracy from the Normal procedure can be improved by

- manual setting of U-curve-zero in menu F1:
  - Switch-on CCR in highest intensity step
  - In Factory Menu 1, read actual value
  - Enter this value manual instead of the default value 6
  - Press enter and leave factory menu
- adding one or more "break-points":
  - Remove the number of lamps belonging to the actual "Break-point"
  - In User Menu 1 press >8< for "Break-point"

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- Upon request enter the number of faulty lamps, meaning ”- XX lamps?”, where XX is number of faulty lamps in the ”Break-point”, then press >E<
- The CCR runs automatically through the active steps
- When CCR is switched-off again, a new ”Break-point” can be entered or
- Press >C< shortly to end the ”Break-point” procedure
- Press >→< some sec. until the ”Store data menu” is shown
- Press >E< to store learned data

### Manuel correction in table with values for L / Ua.

If the CCR is not able to perform a satisfying Learn procedure, or if you want to modify one or more values, the following procedure must be followed:

Typical failures could be three horizontal lines in the display when a high percentage of lamps in a circuit are faulty, or the display of 1 faulty lamp, when you know that all lamps are Ok.

The values for L /Ua found during the Learn procedure are stored in tables.

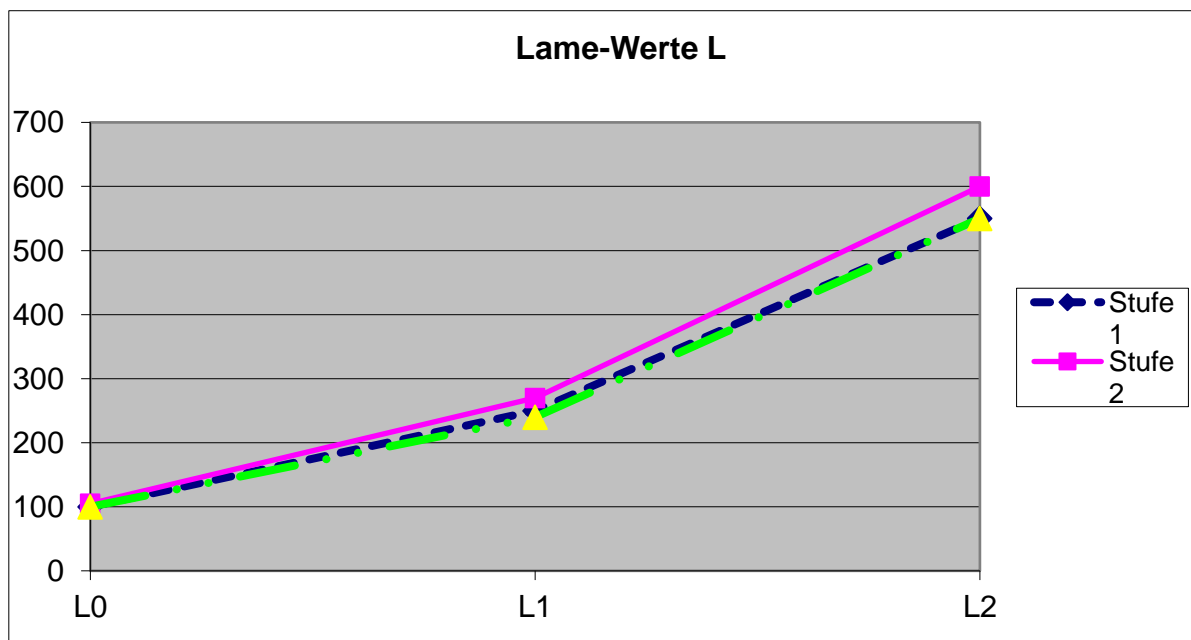
Table 0 includes data for each light intensity step with all lamps OK, while table 1 is for all steps when 1 lamp is faulty, (table values are called L-values, while actual values are called Ua-values).

The actual value for Ua is in the LAME system constantly compared to the stored values in the tables. The Ua value will increase when lamps gets faulty.

Table values can be seen in the User menu U2:

- >E<
- Enter code for User Mode
- >E<
- Press >2<

	Step 1	Step 2	Step 3
Table 0	100	105	100
Table 1	250	270	240
Table 2	550	600	550



The values can also be seen in the Normal menu N3, where number of faulty lamps is normally shown.

## CCR961 MANUAL-GB

Pressing >E< will change to display of step and actual Ua value (=Ua) together with Uo (=table 0 value for the actual step) etc. If all lamps are OK, the Ua value must be close to the Uo value, and with 1 faulty lamp the Ua must be close to U1 etc.

For the above shown table values, the CCR will in step 1 show 0 faulty lamps for Ua values up to 175 (average between 100 and 250), and show 1 faulty lamp for Ua values between 176 and 400.

If the Ua value in step 1 by 0 faulty lamp is a bit unstable, reaching a value above 175, the LAME will by mistake show 1 faulty lamp.

If we increase the value 100 in table 0 for step 1, the limit for showing 1 faulty lamp will be increased. If the value is changed from 100 to 120, the limit for 1 faulty lamp will be changed from 176 to 186.

- a. The CCR is brought into User Mode
  - >E<
  - Press code for User menu
  - >E<
- b. Press >2< for table
- c. Change table by means of >→< or >←<
- d. By means of up/down switches >↑<, >↓< we can select the value we want to change (flashing)
- e. Enter the new value
- f. Press >↓< to control that the value have been changed
- g. >E<
  - Press >→< some sec. until the "Store data menu" is shown
  - Press >E< to store learned data
  -

### 3.12 Calibration of the Uout measurement

The Uout measurement is done on the primary side of the Output Transformer, and multiplied with the voltage ratio for this transformer. This means that we have to calibrate Uout when the transformer tapping has been changed. The factory setting is for the output transformer in 100% tapping.

- The Key switch is turned to position "Manual"
- Press "E"
- Enter the code for User Menu
- Press "E"
- Press → 13 times to see "Uout Calibration" in the display
- Press ↑ to get to the desired step for calibration (normally the 100% step)
- The true output voltage value (see Note below) is entered by means of the 0 – 9 push-buttons
- Press "E"
- Press → some seconds to get to the menu for "Store data"
- Press "E"

Note:

The true output voltage for calibration in the 100% step can be found in many ways:

- a. The voltage can be measured by means of a high voltage measuring transformer and a true RMS voltmeter

## CCR961 MANUAL-GB

- b. The voltage on the primary side of the output transformer is measured with a true RMS voltmeter, and the value multiplied with the actual voltage ratio of the output transformer
- c. The Uout is calibrated in the factory for 100% tapping. The output voltage is noted before any tapping is done.

### 3.13 Control of transformer tapping

Selection of the correct tapping on the output transformer can be based on a number of different criteria's, such as expected variations on the mains supply etc. See the special document for more details.

Below is given some simple guidelines for the control of the tapping or in connection with the change of tapping.

With the CCR in "Normal Menu 1, N1", where current and step are given, you can press the push-button ← and see the following figures: 10/(500 – XXX).

The figure XXX is an expression for the time delay in each half wave before the thyristors are activated, and in this way an expression for the regulation reserve when the CCR is in the 100% step.

We can recommend the following values for the figure XXX:

CCR size (KVA)	Isolating transformer nominal power (VA)	
	≤100	>100
0 – 2,2	230 – 250	250- 280
2,2 – 5	160 – 200	180 – 220
7,5 – 12,5	150 – 190	160 – 200
≥ 15	140 - 180	150 – 190

If the figure XXXX is too high, a lower tapping must be selected, if possible.

For very small CCR ratings, it might be necessary to increase the XXXX value, as a faulty lamp could cause an Imin alarm.

#### Tapping:

Tapping means changing the maximum output power of the CCR, by connecting the series circuit to a lower secondary output tapping than the maximum.

From factory, the CCR's will always be shipped connected to full output rating.

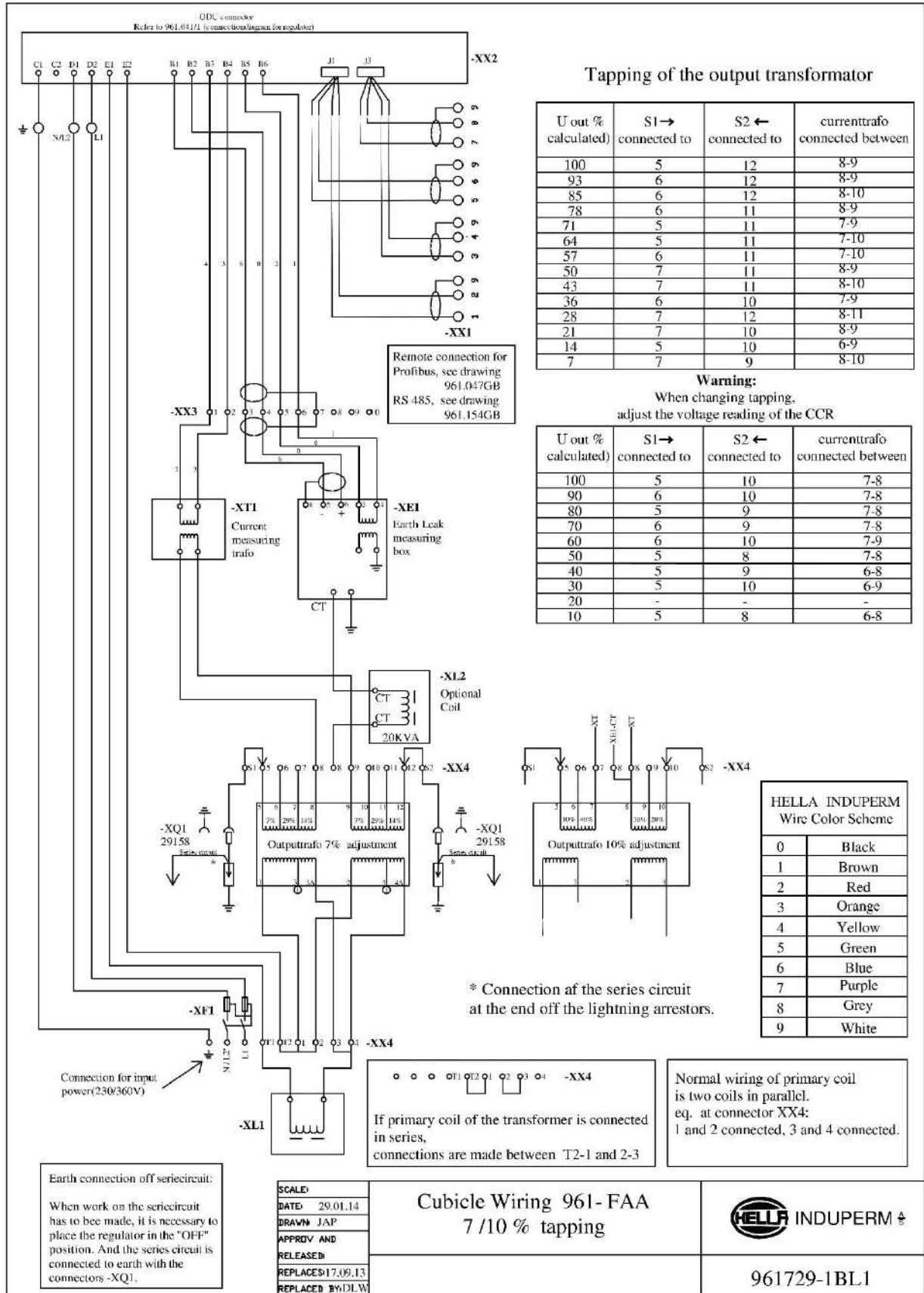
Dependent of type and power rating, the output transformers are supplied with tapping possibility in steps of 10% (three output terminals / coil) or with tapping possibility in steps of 7,5% (four output terminals / coil).

On the following page are diagram 961.906BL, showing the wiring in the CCR cubicle.

- In the top of the drawing is shown box simulating the CCR module.
- Top, right shows the Remote control terminals (-XX1).
- In the middle the current measuring transformer (-XT1) and the ISO box (-XE1)
- Below the output transformer, with the secondary terminals to –XX4, where the tapping is done.
- To the right you will find two tables.
  - The top one valid for transformers with 7,5% tapping steps
  - The lower one valid for transformers with 10% tapping steps

## CCR961 MANUAL-GB

- On –XX4 the series circuit is connected to the output transformer via S1 and S2, in this case to 5 and 12.
- The two secondary windings (one / coil) is connected in series by means of the current measuring transformer –XT1, in this case between 8 and 9.
- If we look at the top table, it can be seen that the use of shown connections will give 100% output voltage.
- In the table, it can be seen how to connect to get lower tapings.



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## 6 Remote Control

### 6.1 Standard RS485

The Mainboard includes all hardware and software for direct communication with a remote control system via RS485. The connection in the cubicle is as standard a set of terminals (-XX1) or a set of RJ45 connectors.

Description of the RS485 communication protocol:

#### General information:

19200 Baud, 8bit, no parity, 1 stop bit

CCR961 will only transmit after receiving a command or status inquiry.

#### Commands to CCR961.

1	2	3	4	5	6	7	8	9	10	11
Start	ID-High	ID-Low	CMD	Step	RWY	Mode	Time	CRC high	CRC low	End
@	0..9	0..9	S,W	0..7	1..9	1..F	1..F	0..F	0..F	*

Byte 1: Start character @

Byte 2 and 3: CCR node number, decimal figure 0 - 32.

Byte 4: Command = W. Status request = S

Byte 5: Step command, decimal figure 0 - 7

Byte 6: Circuit selector 1-4, not in use!

Byte 7: Normal mode = 0. Service mode = 1, Not in use!

Byte 8: Normal = 0. Set internal watch to 12.00 = 1

Byte 9 and 10 CRC hexadecimal figure between 00 and FF

Byte 11: Stop character \*

#### Back indications from CCR961:

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Start	ID-High	ID-Low	CMD	Step	RWY	Err1	Err2	Sta	Ana1	Ana2	Ana3	Ana1	Ana2
#	0	0	S,W	0..7	1..9	0..F	0..F	0..F	0..F	0..F	0..F	0..F	0..F

15	16	17	18	19	20	21	22	23	24
Ana3	Ana1	Ana2	Ana3	Ana1	Ana2	Ana3	CRC High	CRC low	End
0..F	0..F	0..F	0..F	0..F	0..F	0..F	0..F	0..F	*

Byte 1 : Start character #

Byte 2 and 3: CCR node number, decimal figure 0 - 32.

Byte 4: Answer to command = R. Answer to status request = S

Byte 5: Step indication, decimal figure 0 - 7

Byte 6: Circuit selector 1-4, not in use!

Byte 7: Error status 1: sum (0-F) of Lamp1 = 1, Lamp2 = 2, Emin1 = 4, Emin2 = 8

Byte 8: Error status 2: sum (0-3) of Imin = 1, Imax = 2

Byte 9: Key switch position: Remote = 2, Off or local = 0

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Byte 10-12: Iout analog decimal value 0 - 999  
 Byte 13-15: Lamp analog decimal value 0 - 999  
 Byte 16-18: Uout analog decimal value 0 - 999  
 Byte 19-21: ISO analog decimal value 0 - 999  
 Byte 22-23: CRC hexadecimal figure between 00 and FF  
 Byte 24: Stop character \*

### Command to CCR961 CRC calculation:

$\wedge = \text{Xor}$

crc = data,1(start character)

crc = crc  $\wedge$  data,2

crc = crc  $\wedge$  data,3

etc. (until all bytes are included)

crc value, in Hex, is converted to 2 bytes Ascii

### Example:

	Ascii:	Decimal:	Xor crc:
Start	@	64	64
ID high	0	48	64 $\wedge$ 48 = 112
ID low	9	57	112 $\wedge$ 57 = 73
Command	W	87	73 $\wedge$ 87 = 30
Step	3	51	30 $\wedge$ 51 = 45
RWY	1	49	45 $\wedge$ 49 = 28
Mode	0	48	28 $\wedge$ 48 = 44
Time	0	48	44 $\wedge$ 48 = 28

28 decimals = 1C Hex

1	2	3	4	5	6	7	8	9	10	11
Start	ID-High	ID-Low	CMD	Step	RWY	Mode	Time	CRC high	CRC low	End
@	0	9	W	3	1	0	0	1	C	*

### Back indication examples:

Byte 7:

No failures = ascii 0 = decimal 48

Lamp failure 1 = ascii 1 = decimal 49

Lamp failure 2 = ascii 2 = decimal 50

ISO failure 1 = ascii 4 = decimal 52

ISO failure 2 = ascii 8 = decimal 56

Lamp failure 1 and ISO failure 2 = 1+8 = decimal 57

Lamp failure 2 and ISO failure 2 = 2+8 =ascii a = decimal 65

Byte 8:

No failures = ascii 0 = decimal 48

I min failure = ascii 1 = decimal 49

I max failure = ascii 2 = decimal 50

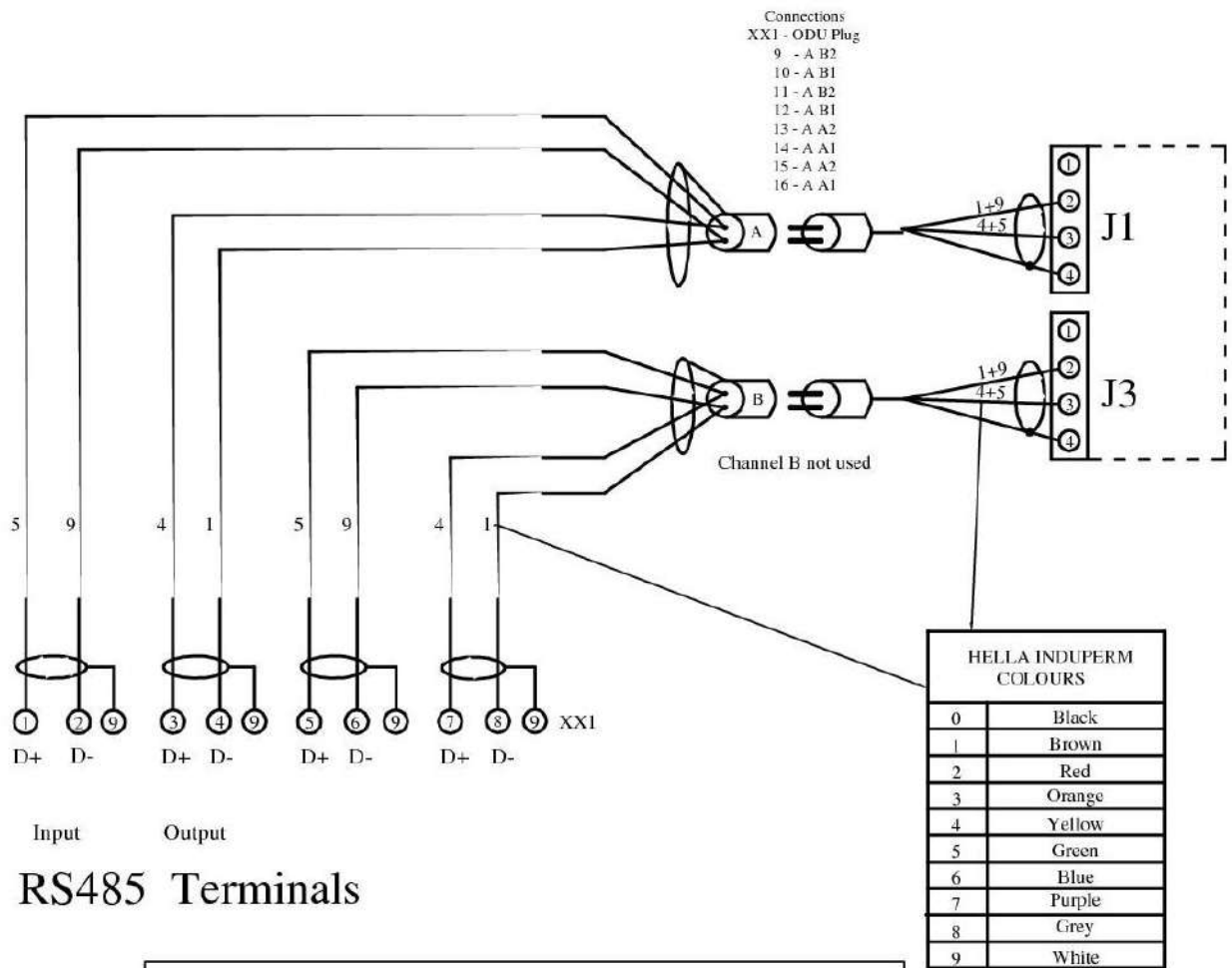
Byte 9(Key switch position)

Remote = ascii 2 = decimal 50

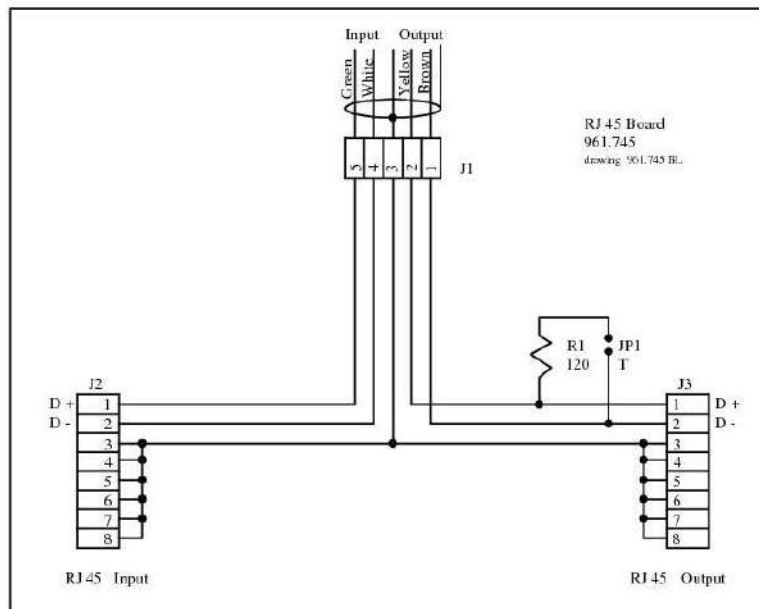
Off or Local = ascii 0 = decimal 48



# CCR961 MANUAL-GB



## RS485 Terminals



Connections on terminals –XX1 for RS485 based remote control communication with the above described protocol.

In the lower part of the picture is shown that, upon request, the terminals –XX1 can be exchanged to two nos. RJ45 connector houses, mounted on the board 961.745

# CCR961 MANUAL-GB

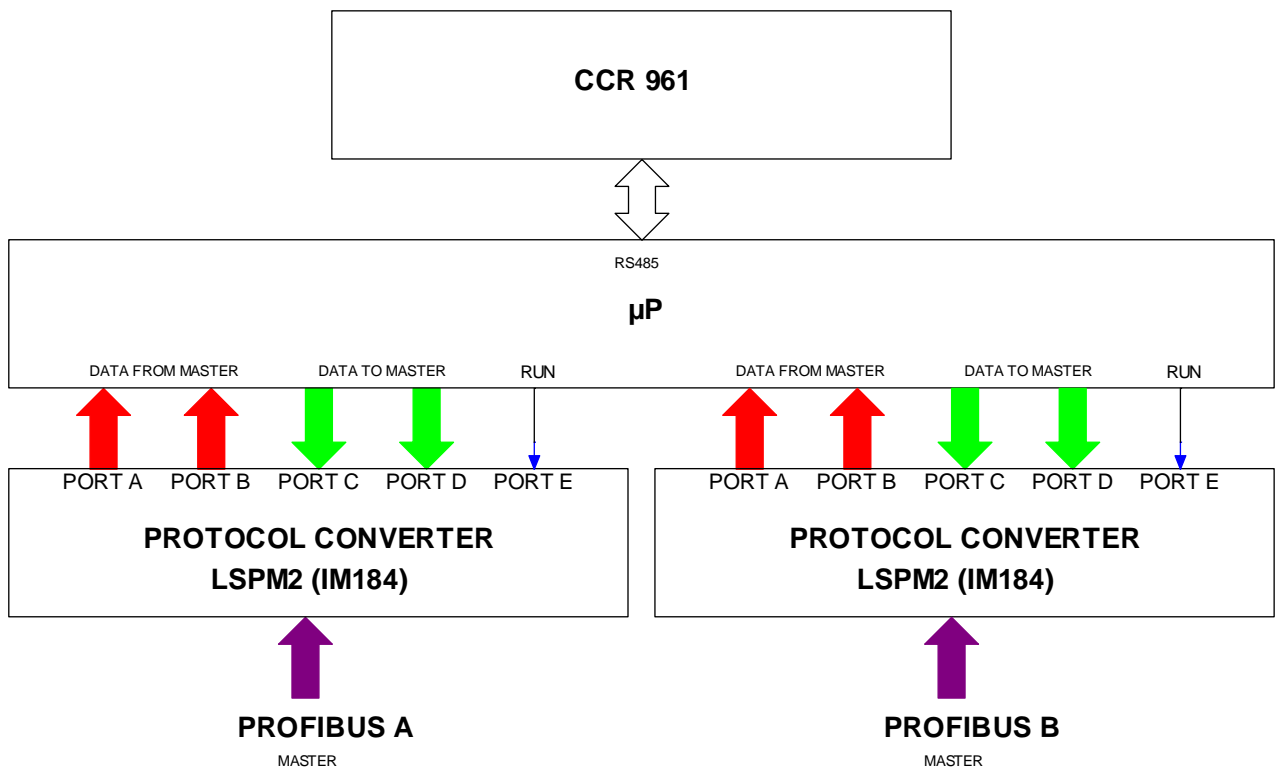
## 6.2 Redundant Profibus

When a Profibus communication interface to the remote control system is required, the CCR Module will have a Redundant Profibus Board added internally, and this will then communicate with the CCR Main board in a RS485 protocol.

The connections in the CCR cubicle is a set of terminals (-XX1).

### Description of PROFIBUS

The Profibus module can be used as a single or redundant interface to the Main Board via RS485. The Module is constructed and based on two nos. Siemens ASIC circuit LSPM2, which fulfils the Profibus format according to IEC 61158.



### Redundant use:

Port PB.0 **Master Bit** determinates which channel (A or B) is controlling the CCR.

The detection of the Master bit is edge triggered (edge sensitive).

The channel with the latest change from 0 to 1 is the controlling channel. This is also the case if the Master bit is 1 from both channels.

*If the Master bit in both channels is permanently set to 1, and there is a failure on one Chanel, there is a risk that the communication will fail, as no shift is detected in the master bit.*

### Response time:

The data communication between Profibus board and main board is stroke controlled. The Profibus module will send data to the main board with fixed intervals of 200mS and the main board will send data to the Profibus module with fixed intervals of 300mS.

The total time from data received from the Profibus until a response is placed in the buffer on the Profibus module, which can be read via the Profibus, will vary from app. 10mS to app. 510mS. (200mS + 300mS + 2 x 5mS (µP program cycle)).

**The individual functions are described in the following table and examples.**

# CCR961 MANUAL-GB

<b>FROM master</b>			
<b>IM184</b>	<b>Bit</b>		
<b>Port</b>			
PA	0	Step bit 0	
	1	Step bit 1	
	2	Step bit 2	
	3		
	4		
	5		
	6		
	7	Status req.	if = 1 cancel step info and set "tx status"
PB	0	Master bit	positive edge trig !!
	1		
	2		
	3	Set time = 12.00	if = 1 set ccr time to 12.00 (noon)
	4	0=tx status 1=tx analog	
	5	analog pointer 0	(Iout=11H, Lamp=31H, Uout=51, E=71H)
	6	analog pointer 1	
	7	analog pointer 2	
<b>TO master</b>			
<b>IM184</b>	<b>Bit</b>		
<b>Port</b>			
PC	0	Step bit 0	
	1	Step bit 1	
	2	Step bit 2	
	3		
	4		
	5		
	6		
	7	Lamp error 1	
PD	0	Lamp error 2	
	1	E min1	
	2	E min2	
	3	I min	
	4	I max	
	5	Remote	
	6		
	7	0=status	
PC	0	12 bit analog lsb	
	1	12 bit analog	
	2	12 bit analog	
	3	12 bit analog	
	4	12 bit analog	
	5	12 bit analog	
	6	12 bit analog	
	7	12 bit analog	
PD	0	12 bit analog	
	1	12 bit analog	
	2	12 bit analog	
	3	12 bit analog msb	
	4	analog pointer 0	(Iout=8xH, Lamp=9xH, Uout=ax, E=bxH)
	5	analog pointer 1	(analog pointer + bit7)
	6	analog pointer 2	
	7	1=analog	

# CCR961 MANUAL-GB

## Explanations to the Profibus protocol.

- Port PA and PB is receiving the information from MASTER, while port PC and PD delivers the signals to MASTER.
- Bit PA-7, Status req. can be set to 1, to enable a request of tx status or tx analog without sending a step command at the same time.
- If Bit PB-4 is set to 1, the request is for analog values. Which analog value requested is set by means of the Bits PB 5-6-7.
- Port PC and PD are shown on the previous page, both for tx status and for tx analog. In case of tx status step indications, Warnings and Alarms are send. In case of tx analog values for Iout, Lamp Failure, Uout or Isolation resistance can be send. The actual analog value in question can be determined by means of the Bits PD 4-5-6.
- The analog value is given as follows:

### 1. Iout, Lamp failure and Uout

Value is given only in PC:

Bit	7	6	5	4	3	2	1	0
Binary value	128	64	32	16	8	4	2	1

Iout: Binary value / 10 = Iout (A)

Uout: Binary value / 100 = Uout (KV)

Lamp failure: Binary value = number of faulty lamps

### 2. ISO value (Resistance to ground).

Profibus master is sending the following data bit to CCR:

PA: 00000010                      Step 2

PB: 01110001                      master, tx analog value type 3 ~ ISO value

The analog value is given in KΩ by means of 3 digits: 2 significant digits + number of zero's

	Port D								Port C							
Bit no:	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Value:	Analog pointer				2048	1024	512	256	128	64	32	16	8	4	2	1

Example:

250K ~ 251:

260K ~ 261:

56K ~ 560:

1,7M ~ 173:

PD: xxxx0000 PC: 11111011

PD: xxxx0001 PC: 00000101

PD: xxxx0010 PC: 00110000

PD: xxxx0000 PC: 10101101

## Profibus data examples:

### Step = 2 (normal)

Profibus master will send flg. data bit to CCR:

PA: 00000010                      step 2

PB: 00000001                      master, Status req.

Profibus module will send flg. data bit to master:

PC: 00000010                      step 2

## CCR961 MANUAL-GB

PD: 00100000                    remote

### **Step = 2 (Emin1 alarm, Emin2 alarm (Emin = ISO))**

Profibus master will send flg. data bit to CCR:

PA: 00000010                    step 2  
 PB: 00000001                    master, Status req.

Profibus module will send flg. data bit to master:

PC: 00000010                    step 2  
 PD: 00100110                    remote, Emin1 alarm, Emin2 alarm

### **Step = 2 (Imin alarm)**

Profibus master will send flg. data bit to CCR:

PA: 00000010                    step 2  
 PB: 00000001                    master, Status req.

Profibus module will send flg. data bit to master:

PC: 00000000  
 PD: 00101000                    remote, Imin alarm

### **Step = 2 (Imax alarm)**

Profibus master will send flg. data bit to CCR:

PA: 00000010                    step 2  
 PB: 00000001                    master, Status req.

Profibus module will send flg. data bit to master:

PC: 00000000  
 PD: 00110000                    remote, Imax alarm

### **Analog values:**

#### **I-out:**

Step = 2

Profibus master will send flg. data bit to CCR:

PA: 00000010                    step 2  
 PB: 00010001                    master, tx analog value type 0 (Iout)

Profibus module will send flg. data bit to master:

PC: 00011001                    25 ~ Iout 2.5A  
 PD: 10000000                    analog value type 0 ~ Iout

#### **Lamp failure:**

Step = 2

Profibus master will send flg. data bit to CCR:

PA: 00000010                    step 2  
 PB: 00110001                    master, tx analog value type 1 ~ lamp failure

Profibus module will send flg. data bit to master:

PC: 00000001                    1 ~ lamp failure, one faulty lamp  
 PD: 10010000                    analog value type 1 ~ lamp failure

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## U-out:

Step = 2

Profibus master will send flg. data bit to CCR:

PA: 00000010

step 2

PB: 01010001

master, tx analog value type 2 ~ Uout

Profibus module will send flg. data bit to master:

PC: 00110000

48 ~ Uout = 0.48KV

PD: 10100000

analog value type 2 ~ Uout

## ISO value (E):

Step = 2

Profibus master will send flg. data bit to CCR:

PA: 00000010

step 2

PB: 01110001

master, tx analog value type 3 ~ ISO

The isolation value is given in KΩ by means of 3 digits: 2 significant digits + number of zero's (factor 10)

The value is displayed as a binary value on port C + the first 4 bits in port D.

Example 15KΩ: 1 5 0 = 0000 1001 1001

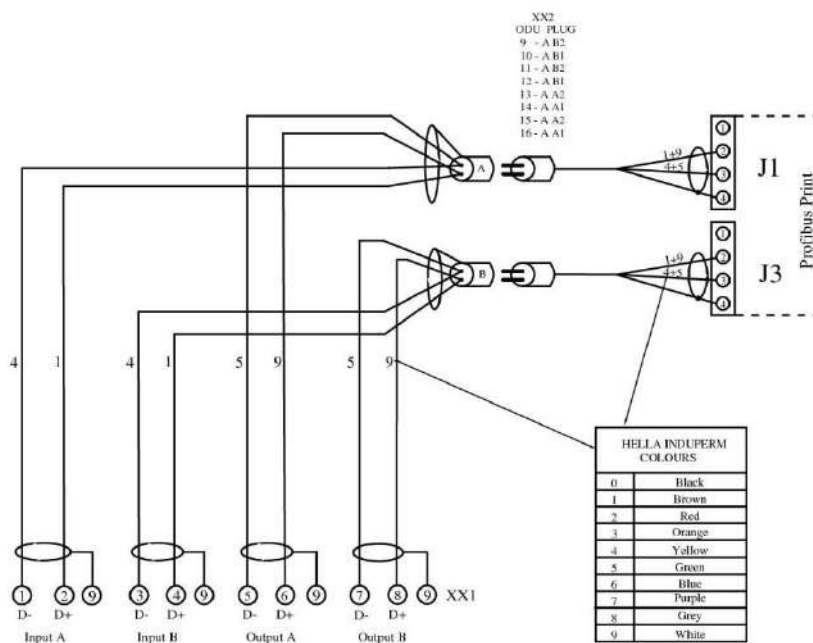
Profibus module will send flg. data bit to master:

PC: 10010110

150

PD: 10110000

analog value type 3 ~ ISO



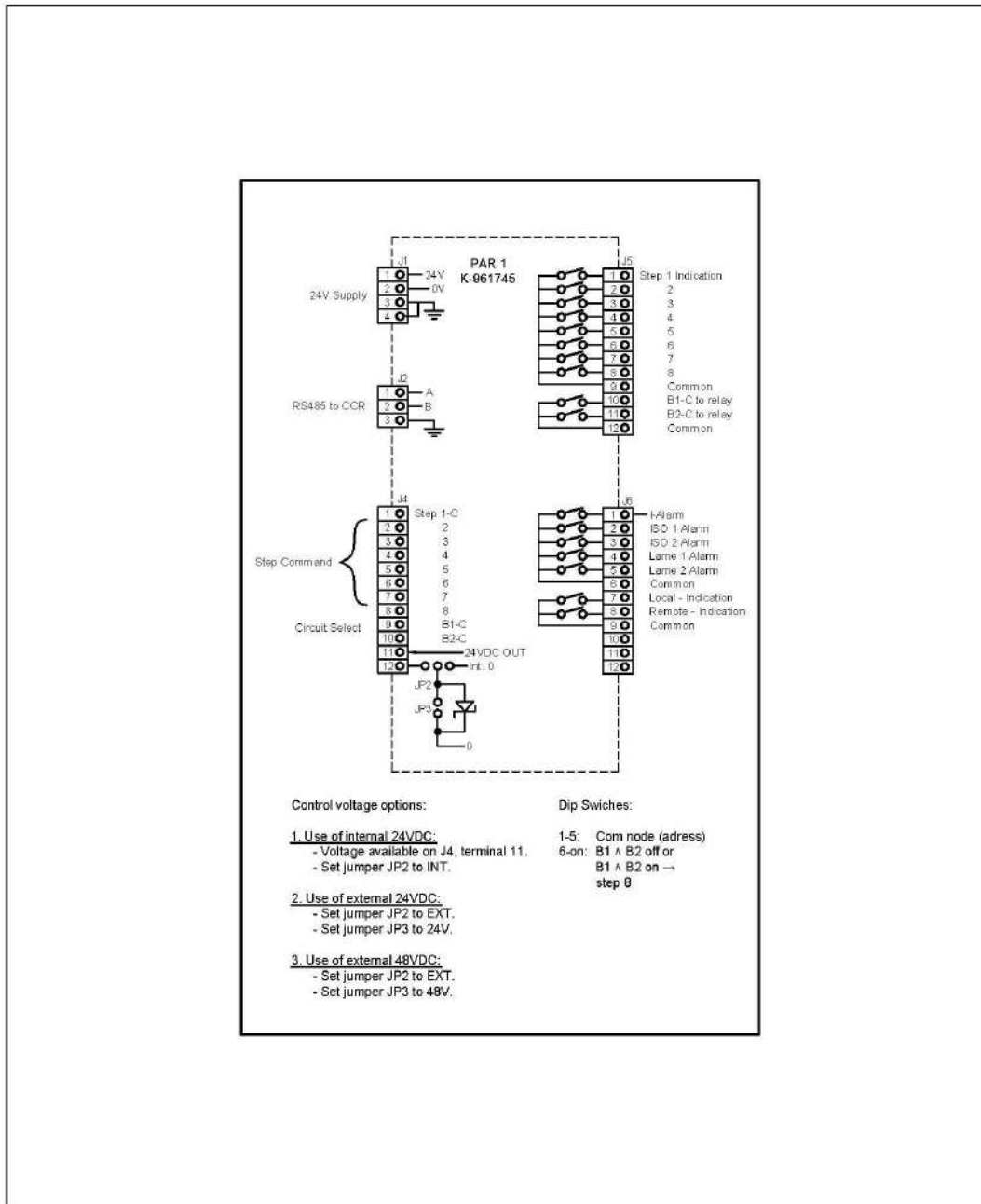
Profibus Terminals

Connection diagram for Profibus to the terminals –XX1.

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## 6.3 Parallel control

When a parallel interface is required, a separate parallel interface board is placed in the CCR cubicle, and this board will communicate with the CCR module via the RS485 serial bus. The latest parallel version is shown below:



SCALE:	<b>Parallel Interface</b>	
DATE: 11.05.2015		
DRAWN: MBS		
APPROV AND RELEASED:		
REPLACES:		
REPLACED BY:	<b>CCR 961</b>	<b>961.745BL-GB</b>

F:\961\Tegninger\961745BL-GB skilt til dæklade

## CCR961 MANUAL-GB

The connections to the Parallel Interface board is done via the connectors J4, J5 and J6. These connectors are designed for max. 1mm<sup>2</sup> flexible wire.

If heavier wire is used we can offer a solution with 25 nos. terminals for 2,5mm<sup>2</sup> cable. This row of terminals is mounted in the front of the CCR for easy access and is shown below. The terminals with pre-mounted cable connections to the connectors J4, J5 and J6 can be ordered separately as type 961.629.

### Optional Remote control terminals for CCR 961 Parallel interface

Terminal set incl. connectors for parallel interface board Hella Induperm A/S type 961.629

Terminal no.	Function	Wire color	Wire connected to:	
1	Step 1 command (24V or 48VDC possible)	white	PAR1-J4-1	
2	Step 2 command	brown	PAR1-J4-2	
3	Step 3 command	green	PAR1-J4-3	
4	Step 4 command	yellow	PAR1-J4-4	
5	Step 5 command	grey	PAR1-J4-5	
6	Circuit selector B1 on command	pink	PAR1-J4-9	
7	Circuit selector B2 on command	blue	PAR1-J4-10	
8	Step / CS command common (0V)	red	PAR1-J4-12	
9	Step 1 indication	black	PAR1-J5-1	
10	Step 2 indication	violet	PAR1-J5-2	
11	Step 3 indication	grey/pink	PAR1-J5-3	
12	Step 4 indication	red/blue	PAR1-J5-4	
13	Step 5 indication	white/green	PAR1-J5-5	
14	Step indication common	brown/green	PAR1-J5-9	
15	Current alarm	white/yellow	PAR1-J6-1	
16	ISO alarm 1	yellow/brown	PAR1-J6-2	
17	ISO alarm 2	white/grey	PAR1-J6-3	
18	Lamp failure 1	grey/brown	PAR1-J6-4	
19	Lamp failure 2	white/pink	PAR1-J6-5	
20	Local indication	pink/brown	PAR1-J6-7	
21	Remote indication	white/blue	PAR1-J6-8	
22	Alarm Indication common	brown/blue white/red	PAR1-J6-6 PAR1-J6-9	
23	Circuit selector B1 on indication	yellow	CS-board-4	B1 / B2 indications only in use for CCR's with Circuit Selector
24	Circuit selector B2 on indication	grey	CS-board-5	
25	Circuit selector indication common	pink	CS-board-6	

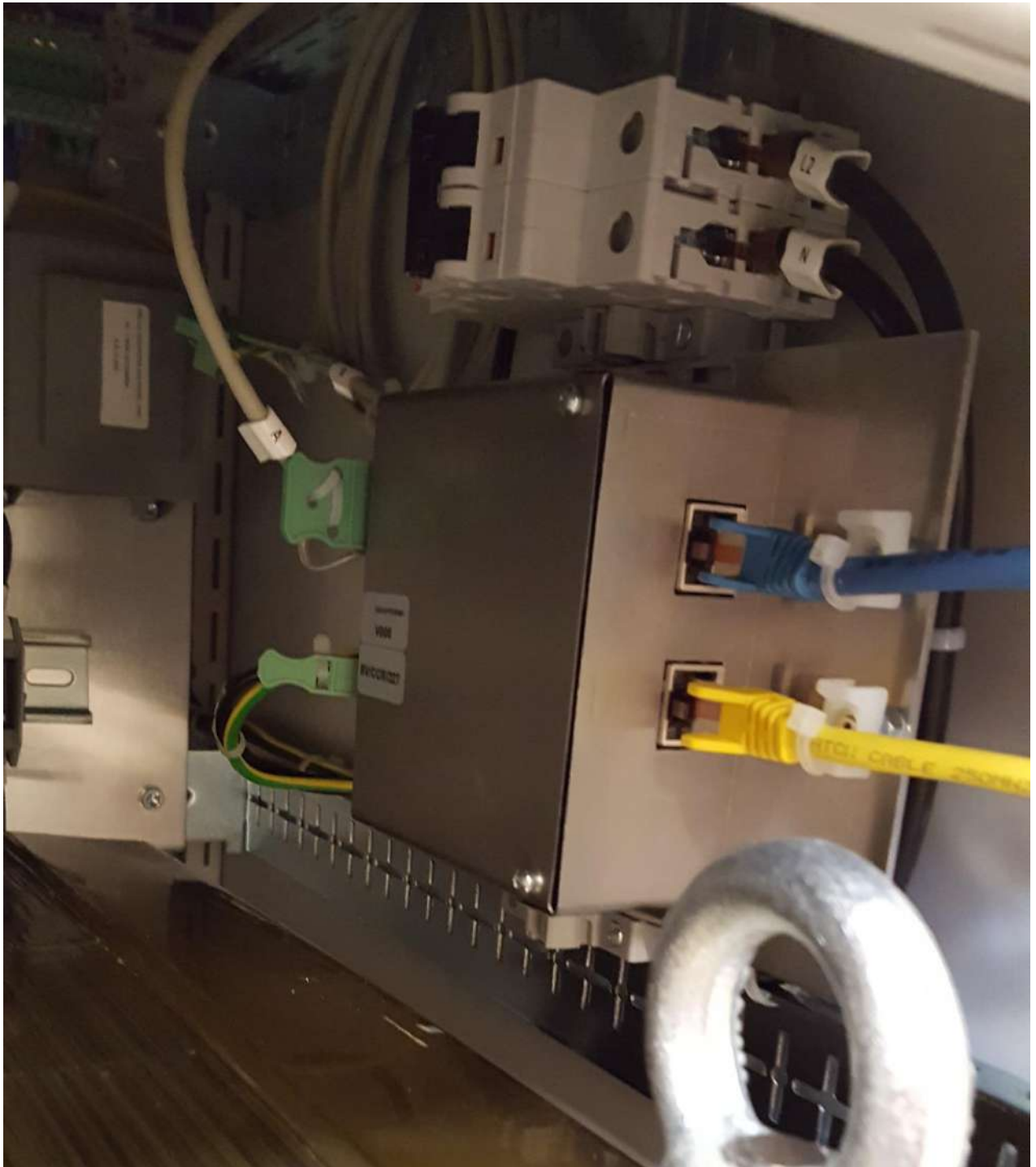


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### 6.4 Ethernet IP addressable

The IP solution is similar to the solution for Parallel control, by mounting a special box in the CCR cubicle that will convert the IP communication to RS485 towards the CCR.

The Protocol and set-up for this solution can be obtained in a separate document.



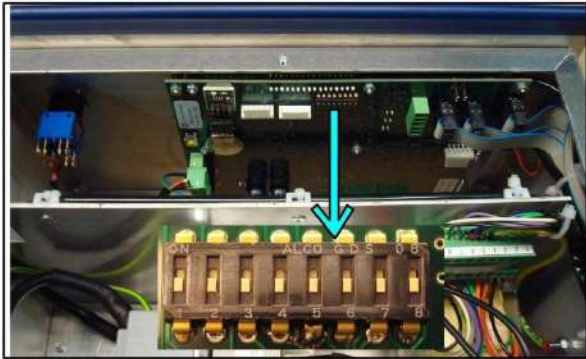
Ethernet IP addressable Lan-com interface.

# CCR961 MANUAL-GB

## 6.5 Dip-switch settings

There are dip switches on the Main Board and on the Profibus Board (only for Profibus solutions). The drawing below shows the setting of the dip-switches, both on the Main Board and on the Profibus Board.

In solutions with a parallel remote control interface, the address on both Main Board and on the Parallel Board is normally set to 1.



MainBoard seen from inside Module

Switch	RS485-951	RS485-961	Profibus
1	RS 485 Adress	RS 485 Adress	Not in use set on Profibus Board
2			
3			
4			
5			
6	OFF	ON	OFF
7	ON	OFF	OFF
8	OFF	OFF	OFF

RS 485 node address -Binary-

VALUE: 1 2 4 8 16

ON	●	●	●	●	●	●	●
OFF	○	○	○	○	○	○	○
	1	2	3	4	5	6	8

RS485-961

RS485-951


DIP switch located on the Mainboard  
Example: node address set to 9

Profibus Adressing (BCD) on ProfibusBoard

	8	4	2	1	8	4	2	1
OFF	●	●	○	○	●	●	●	○
ON	○	○	○	○	○	○	○	○

← Tens 2
|
← Ones 7

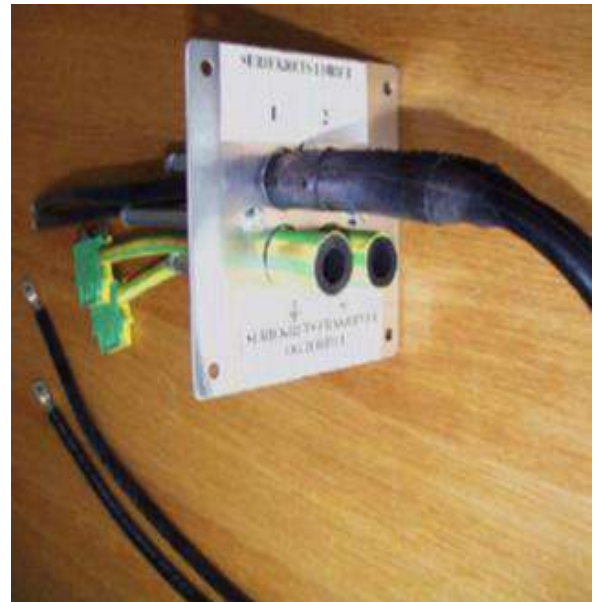
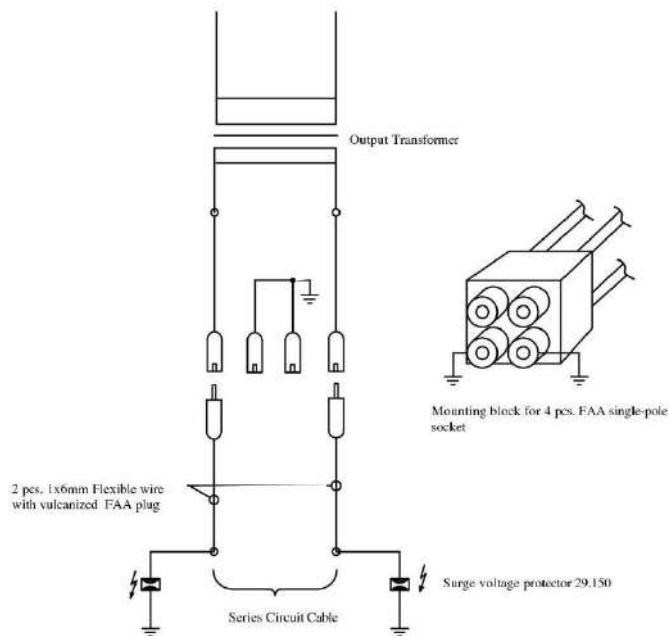
● (Eksample: Adress 27)

SCALE:	<b>CCR 961</b>	
DATE: 10-02-2014		
DRAWN: DLW	<b>DIP-switch, MainBoard</b>	<b>961.508BL</b>
APPROV AND		
RELEASED:		
REPLACES:		
REPLACED BY:		

## CCR961 MANUAL-GB

### 7 Cut-Out devices

#### 7.1 Standard FAA connector type



The Cut-out device includes the following parts:

- The Aluminum device with four nos. female FAA high Voltage connectors. Two of the plugs are connected to each end of the output transformer (S1 and S2 on terminals –XX4), and two are connected to ground.
- Two nos. flexible high voltage cable, length app. 0,8 m, with vulcanized FAA high voltage male connector in one end. The other end is connected to the series circuit on the lightning arrestors.

Function:

In normal operation are the two male plugs mounted in the upper female FAA connectors, and in this way connected to the output transformer. For service, or during work on the series circuit, the two male plugs are mounted in the grounded female plugs.

Now the CCR is disconnected from the series circuit, and the series circuit is grounded.

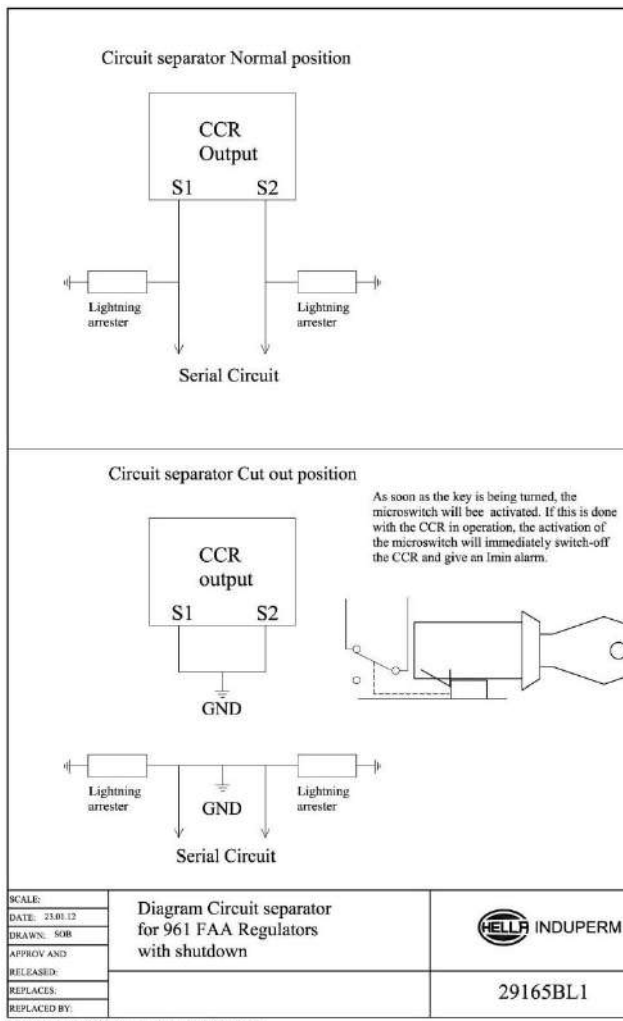
Cables and plugs are designed for 20A and max 5KV.

#### **IMPORTANT:**

**The plugs are only to be moved with the CCR key switch in position OFF (=AUS).**

# CCR961 MANUAL-GB

## 7.2 Key operated safety type



When the key is turned the front of the Cut-out device (with its high voltage connector) can be pulled out and turned 180° to change the function.

**THE CUT-OUT DEVICE MUST ONLY BE OPERATED WHEN THE CCR IS SWITCHED OFF!**

## CCR961 MANUAL-GB

### 8 Maintenance and Trouble shooting

#### 8.1 Regularly Control

There is no direct demand for certain maintenance to be done on the CCR, but in the following is given a few recommendations, which could improve both MTBF, lifetime of the equipment as well as safety for maintenance personnel.

Every 2. Year:

- The series circuit is disconnected from the CCR and the series circuit isolation is measured (Megger). The value is compared with the latest measured value in the CCR.
- The CCR includes supervision of the series circuit current, Imin (open circuit) and Imax (most likely thyristor failure). These function is not often in use and can be tested as follows:
  - The current in the lowest intensity step is adjusted to 1,0 A, Switch on in step three, wait some seconds and then switch to step one. The CCR must switch-off with Imin alarm within 1 sec.
  - The Imax alarm is adjusted to 5,1A. The CCR is switched on in the lowest step, wait some seconds and the switch to the highest step. The CCR must switch-off with Imax alarm within app. 4 sec.

Every 5 years:

- The CCR is cleaned inside with a vacuum cleaner (CCR CUBICLE IS POWERED OFF!), and all components are visually controlled for changes in color etc.
- All power connections are controlled by means of a Thermo camera.

#### 8.2 Safety instructions

Before any service work is done in the CCR cubicle, the power supply must be switched off.

If measurement have to be done with power on, the measurement must be via a measuring transformer.

Remember, that ISO measurement on the series circuit is performed with 500VDC, and a good circuit is like a capacitor, and can keep the voltage long after power is removed, therefor always ground the series circuit.

Before any work is done on the series circuit:

- The key selector on the CCR is set to “OFF”
- The cut-out is activated (FAA plugs to ground or Cut-out selector to “Cut-Out”)
- The CCR front door is clearly marked with a sign “Work is done on the series circuit”

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### 8.3 List of possible failures

No.	Failure	Cause	Correction
1	Imin	Open circuit	Repair circuit
2		Many faulty lamps (open secondary sides on SIT)	Change lamps
3		Cut-out device activated	Set to normal position
4		CCR module failure	Change module
5			
6	Imax	Thyristor unit shorted	Change module or Thyristor
7		Too much load change in series circuit due to selector switch or single lamp control	Adapt
8		Flash-over on Lightning Arrestors	Change Lightning Arrestors
9	Display saying "Default values"	Memory Board missing in CCR Module	
10		Memory Board from old Software, set default data (5)	
11		Faulty Memory Board	Change Memory Board
12			
13	No step back - indication	Too many fault lamps in circuit	Change lamps
14		The series circuit have been expanded	Change tapping
15	No indications in Display	Power to the cubicle is missing	Repair the supply
16		Fuse in Module faulty	Change fuse or change module
17			
18			
19			
20			
21			
22			
23			

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### List of spares

Pos.	Description	No.	
1	40A CCR Module 230/400V Profibus	961060	
2	110A CCR Module 230/400V Profibus	961070	
3	60A CCR Module 230/400V Profibus	961080	
4	60A CCR Module 230/400V RS-485	961085	
5	40A CCR Module 230/400V RS 485	961090	
6	110A CCR Module 230/400V RS 485	961100	
7	Additional coil for ISO box 961121 (Uout > 2KV)	961105	
8	ISO box for 961, 42V (ISO-Interval)	961121	
9	ISO box for 961,42V, Ver.2 (ISO-continuosly)	961124	
10	Mainboard 961 V4:120707	961505	
11	Profibus Board 961	961515	
12	Memoryboard til 961	961535	
13	Trigger Board 961 V4	961555	
14	Tool set CCR 961 (incl. 961360)	961361	
15	Cable 961 current measurement	961400	
16	Monitor Kit, Diagram + cable + Dongle	961-MON	
17	Lightning arresstor 1,2KV 30gr.	29.150.211	
18	Lightning arrestor 2,4KV 30gr.	29.150.221	
19	Lightning arrestor 3,6KV 30gr.	29.150.231	
20	Lightning arrestor 5KV 30gr.	29.150.241	
21	Coil 1,4mH 60A	11920	
22	Coil 2mH 28A	11921	
23	Coil 60A - 2mH	11936	
24	Coil 40A (for Module)	11941	
25	Coil 110A (for Module)	11942	
26	Coil 60A (for Module)	11943	
27	Current transformer 6,6A/0,22A 1m PLT	11923	
28	Output Trafo 5KVA360V 7,5% tap	P-950100	
29	Output Trafo.7,5KVA360V 7,5% tap	P-951101	
30	Output Trafo.10KVA360V 7,5% tap	P-950102	
31	Output Trafo.12,5KVA360V 7,5% tap	P-950103	
32	Output Trafo.15KVA360V 7,5% tap	P-950104	
33	Output Trafo.20KVA360V 7,5% tap	P-950105	
34			
35			