



RELIANCE Intelligent Lighting

# User Manual

UM-0600, Rev. 2.2, 2023/08/03





## A.0 Disclaimer / Standard Warranty

### CE certification

The equipment listed as CE certified means that the product complies with the essential requirements concerning safety and hygiene. The European directives that have been taken into consideration in the design are available on written request to ADB SAFEGATE.

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The equipment listed as ETL certified means that the product complies with the essential requirements concerning safety and FAA Airfield regulations. The FAA directives that have been taken into consideration in the design are available on written request to ADB SAFEGATE.

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### Note

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## Note

See your sales order contract for a complete warranty description.

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## Liability

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### WARNING

Use of the equipment in ways other than described in the catalog leaflet and the manual may result in personal injury, death, or property and equipment damage. Use this equipment only as described in the manual.

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ADB SAFEGATE cannot be held responsible for injuries or damages resulting from non-standard, unintended uses of its equipment. The equipment is designed and intended only for the purpose described in the manual. Uses not described in the manual are considered unintended uses and may result in serious personal injury, death or property damage.

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- Making changes to equipment that have not been recommended or described in this manual or using parts that are not genuine ADB SAFEGATE replacement parts or accessories.
- Failing to make sure that auxiliary equipment complies with approval agency requirements, local codes, and all applicable safety standards if not in contradiction with the general rules.
- Using materials or auxiliary equipment that are inappropriate or incompatible with your ADB SAFEGATE equipment.
- Allowing unskilled personnel to perform any task on or with the equipment.

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# TABLE OF CONTENTS

<b>1.0 Safety .....</b>	<b>1</b>
1.1 Safety Messages .....	1
1.1.1 Introduction to Safety .....	2
1.1.2 Intended Use .....	2
1.1.3 Operation Safety .....	3
1.1.4 Maintenance Safety .....	3
1.1.5 Material Handling Precautions, ESD .....	4
1.1.6 Arc Flash and Electric Shock Hazard .....	4
<b>2.0 RELIANCE Intelligent Lighting Product Introduction .....</b>	<b>5</b>
2.1 RELIANCE Intelligent Lighting Safety notes .....	5
2.2 Abbreviations used in RELIANCE Intelligent Lighting products .....	5
<b>3.0 RELIANCE Intelligent Lighting System User Guide .....</b>	<b>7</b>
3.1 Individual Light Control and Monitoring System .....	7
3.2 Vault equipment .....	11
3.2.1 Installation .....	11
3.3 System response times .....	11
3.3.1 Single command response time .....	12
3.3.2 Sensor response time .....	12
3.3.3 Failed lamp response time .....	12
3.3.4 Multi-segment response time .....	12
<b>4.0 AMT User Guide .....</b>	<b>13</b>
4.1 Application .....	13
4.2 References .....	13
4.3 Requirements .....	13
4.4 Different variants of AMT .....	13
4.4.1 AMT Basic .....	13
4.4.2 AMT Pro .....	13
4.5 The user interface .....	13
4.5.1 Login .....	14
4.5.2 Main window .....	14
4.6 Communication settings .....	16
4.6.1 Monitoring .....	16
4.6.2 Control and Monitoring .....	16
4.7 System configuration .....	17
4.7.1 The configuration tree .....	17
4.7.2 Search in the configuration .....	17
4.8 Log window .....	18
4.9 Tools window .....	18
4.9.1 LPU Manager .....	18
4.9.2 FCU Inspector .....	19
4.9.3 SCM Inspector .....	20
4.9.4 LPC I/O .....	20
4.10 Circuit Monitor .....	21
4.10.1 Advanced logging .....	22
4.10.2 Review Logged data .....	23
4.11 Circuit Tuning .....	24
4.12 Self Hosted SCM .....	24
4.13 To use AMT .....	24
4.13.1 Maintain LMS/SIU/RELIANCE IQ .....	24
4.13.2 Programming and test procedure .....	25
4.14 Testing functions .....	29
4.14.1 LMS function test .....	30
4.14.2 SIU function test .....	30

4.14.3 Remote control mode .....	31
4.14.4 Manual mode .....	31
4.15 SCM Maintenance .....	31
4.15.1 Activating SCM Maintenance .....	32
4.15.2 SCM Maintenance sequence .....	33
4.15.3 Troubleshooting SCM Maintenance .....	33
4.16 Loading SCM Firmware .....	33
4.17 Advanced Maintenance .....	34
4.17.1 Loading SCM Configuration .....	34
4.17.2 Loading SCM Parameters .....	35
4.18 Circuit Maintenance .....	36
4.19 Circuit Monitor .....	36
4.19.1 Monitoring Circuit Communication .....	37
4.19.2 Evaluation of monitored communication .....	39
4.20 Sending Commands .....	40
4.21 FCU Version Query .....	40
4.22 Menu Command Reference .....	40
4.23 Other Commands .....	41
4.24 Advanced functions .....	41
4.24.1 FCU Maintenance .....	41
4.25 Circuit Tuning .....	44
4.25.1 Why circuit tuning? .....	44
4.26 Frequency tuning by AMT .....	45
4.26.1 Hardware set-up .....	46
4.26.2 AMT frequency tuning principles .....	46
4.26.3 Before starting AMT frequency tuning sequence .....	46
4.26.4 AMT frequency tuning sequence .....	47
4.27 Self Hosted SCM .....	53
4.27.1 Configuration functionality .....	53
4.27.2 Monitoring functionality .....	53
4.28 User handling .....	54
4.28.1 User groups .....	54
4.29 Appendix .....	54
4.29.1 LPU .....	54
4.29.2 Hardware setup for Manual Mode .....	55
4.29.3 Hardware setup for Remote Control Mode .....	55
4.29.4 AMT Appendix A - SCM and LPC front panels .....	56
4.29.5 AMT Appendix B - SCM and LPC rear view .....	57
<b>5.0 SFU User Guide .....</b>	<b>59</b>
5.1 Application .....	59
5.2 SFU general description .....	59
5.2.1 Electrical och mechanical specification .....	59
5.2.2 Function .....	60
5.3 Installation .....	60
5.3.1 Installation hardware .....	60
5.4 Maintenance .....	60
5.5 Troubleshooting .....	60
<b>6.0 LPU - LPC User Guide .....</b>	<b>61</b>
6.1 General .....	61
6.2 Application .....	61
6.2.1 Specifications .....	61
6.3 Connections and Control Panel .....	62
6.3.1 Rear .....	62
6.3.2 Front .....	62
6.4 Internal .....	63
6.5 Hardware set-up .....	64
6.5.1 Connecting SCM .....	64
6.5.2 Connecting PC .....	65
6.5.3 Connecting LMS .....	65
6.5.4 Connecting SIU .....	65

6.6 Maintenance .....	65
<b>7.0 SCF User Guide .....</b>	<b>67</b>
7.1 Application .....	67
7.2 References .....	67
7.3 Introduction .....	67
7.4 RELIANCE Intelligent Lighting Component Description .....	67
7.4.1 Electrical and Mechanical Specification .....	67
7.4.2 Functional Specification .....	67
7.5 Installation .....	67
7.5.1 Hardware Installation .....	67
7.6 Appendix .....	68
7.6.1 Appendix A .....	68
7.6.2 Appendix B .....	69
7.6.3 Appendix C .....	69
<b>8.0 SCM Rack User Guide .....</b>	<b>71</b>
8.1 Application .....	71
8.2 References .....	71
8.3 Introduction .....	71
8.4 RELIANCE Intelligent Lighting component description .....	71
8.4.1 General .....	71
8.4.2 Power supply .....	72
8.4.3 SCM-rack .....	73
8.4.4 Communication transformer .....	75
8.4.5 Backplane .....	76
8.4.6 SCM-board .....	81
8.5 Installation .....	82
8.5.1 Hardware installation .....	82
8.5.2 Software installation .....	84
8.6 Maintenance .....	84
8.6.1 SCM .....	84
8.7 Troubleshooting .....	85
<b>9.0 SIU User Guide .....</b>	<b>87</b>
9.1 Application .....	87
9.2 References .....	87
9.3 Introduction .....	87
9.4 Compatibility .....	87
9.5 Characteristics .....	87
9.5.1 Physical Appearance .....	87
9.5.2 Installation .....	88
9.5.3 Inputs and Outputs .....	88
9.5.4 Inputs .....	88
9.5.5 Input Scanning .....	88
9.5.6 Input Configuration .....	88
9.5.7 Input Filtering .....	89
9.6 Outputs .....	89
9.6.1 Power Output Characteristics .....	89
9.6.2 Protecting the Outputs .....	90
9.6.3 Output Configuration .....	90
9.7 Shared I/O .....	90
9.8 Sensor Test Function .....	90
9.9 Direction Detection .....	90
9.10 Programming .....	90
9.11 Appendix .....	91
9.11.1 Appendix A .....	91
9.11.2 Appendix B .....	91
9.11.3 Appendix C .....	92
9.11.4 Appendix D .....	92
<b>10.0 LMS User Guide .....</b>	<b>95</b>
10.1 References .....	95

10.2 Introduction .....	95
10.3 Operational characteristics .....	95
10.3.1 Power On or Default State .....	96
10.3.2 Safe State .....	96
10.3.3 Command Memory .....	96
10.3.4 Soft ON/OFF .....	96
10.3.5 Active failed lamp state response .....	96
10.3.6 RGL functionality .....	96
10.3.7 Running rabbit .....	96
10.4 Operational indications .....	96
10.5 Programming .....	96
10.6 Electrical and Mechanical Characteristics .....	97
10.7 Installation .....	100
10.7.1 Replacement of lamp .....	101
10.7.2 Calculating Transformer Rating .....	101
10.8 Troubleshooting .....	102
10.9 Parts available for ordering .....	102
<b>11.0 MBD User Guide .....</b>	<b>103</b>
11.1 Application .....	103
11.2 References .....	103
11.3 General .....	103
11.4 Characteristics .....	103
11.4.1 Physical appearance .....	103
11.4.2 Specification .....	104
11.4.3 Miscellaneous .....	104
11.5 Installation .....	105
11.5.1 Placing the MBD .....	105
11.5.2 Safety .....	105
11.6 Risk Analysis .....	106
11.6.1 Risk of collision .....	106
11.7 Risk of FOD .....	106
11.7.1 Hazardous event .....	107
11.7.2 Risk minimizing measures .....	107
11.7.3 Risk estimation .....	107
11.8 Example .....	107
11.9 Installation hardware .....	107
11.9.1 Preparations .....	107
11.9.2 Precautions .....	108
11.10 Mounting the MBD .....	108
11.11 Wiring work .....	108
11.12 Securing the MBD and post .....	109
11.13 Connecting Transmitter and Receiver .....	109
11.14 Commissioning the MBD .....	109
11.14.1 Indicators and jumpers .....	109
11.15 Channel selection .....	110
11.16 Alignment and testing .....	111
11.17 Documenting the installation .....	111
11.18 Maintenance .....	112
11.19 Troubleshooting .....	112
11.20 Appendix .....	113
11.20.1 Appendix – MBD microwave beam pattern .....	113
11.20.2 Appendix – MBD Installation Data .....	115
<b>12.0 NCU User Guide .....</b>	<b>117</b>
12.1 References .....	117
12.2 Introduction .....	117
12.3 AspGwy functions .....	117
12.3.1 Segment handling .....	117
12.4 Adjacent lamp calculation .....	118
12.5 Sensor .....	118
12.6 Basic SCM communication .....	118

12.6.1 SCM synchronization .....	118
12.7 Redundancy in AspGwy .....	118
12.8 RELIANCE Intelligent Lighting communication .....	119
12.8.1 Maintenance view .....	119
12.8.2 LMS Status view .....	120
12.8.3 SCM Status view .....	122
12.8.4 Sensor Status view .....	123
12.8.5 SCM Log view .....	124
12.8.6 Configuration Edit dialog .....	124
12.8.7 ASP Simulator view .....	125
12.9 Host communication .....	125
12.9.1 Modbus View .....	125
12.10 Electrical and Mechanical Characteristics .....	127
12.11 Installation .....	128
12.11.1 Hardware installation .....	128
12.11.2 Software installation .....	128
12.12 Maintenance .....	128
12.12.1 Yearly maintenance .....	128
12.12.2 Replacement .....	129
<b>13.0 ILDU User Guide .....</b>	<b>131</b>
13.1 Functionality and Operative indicators .....	131
13.2 Outline drawings .....	132
13.3 Installation .....	132
13.3.1 Installation of ILDU .....	132
13.3.2 Installation of inductive loops .....	133
13.4 Troubleshooting .....	134
13.5 Components for ordering .....	134
13.6 Spare parts .....	134
<b>14.0 RELIANCE Intelligent Lighting International Standards Compliancy List .....</b>	<b>135</b>
<b>15.0 Modbus Interface .....</b>	<b>137</b>
15.1 Application .....	137
15.2 Extended functions .....	137
15.3 Interface Protocol .....	137
15.3.1 Modbus Protocol Details .....	137
15.3.2 Initialization and Failsafe .....	137
15.3.3 Modbus Frame .....	138
15.3.4 Command and Status Details .....	139
15.4 Appendix .....	142
15.4.1 Appendix A – Stopbar .....	142
15.4.2 Appendix B – Advanced segment functions .....	147
15.4.3 Appendix C – 2A Intensity control .....	148
<b>16.0 Preventive Maintenance .....</b>	<b>151</b>
16.1 References .....	151
16.2 Introduction .....	151
16.3 Preventive Component Maintenance .....	151
16.3.1 NCU .....	151
16.3.2 SCM .....	152
16.3.3 SCF .....	152
16.3.4 LMS .....	152
16.3.5 SIU .....	153
16.3.6 MBD .....	153
16.3.7 SCI .....	153
16.3.8 SFU .....	153
16.3.9 LPC .....	153
<b>17.0 Troubleshooting and Maintenance .....</b>	<b>155</b>
17.1 Introduction .....	155
17.2 Maintenance .....	155
17.2.1 General .....	155

17.3 Troubleshooting ..... 155

    17.3.1 General ..... 155

**A.0 SUPPORT ..... 157**

    A.1 ADB SAFEGATE Website ..... 157

    A.2 Recycling ..... 157

        A.2.1 Local Authority Recycling ..... 157

        A.2.2 ADB SAFEGATE Recycling ..... 158



# List of Figures

Figure 1: RELIANCE Intelligent Lighting system block diagram .....	8
Figure 2: RELIANCE Intelligent Lighting system information exchange .....	10
Figure 3: ASP Maintenance Tool .....	15
Figure 4: Connection Manager .....	16
Figure 5: Confirmation window .....	16
Figure 6: System Inspector .....	17
Figure 7: Log window .....	18
Figure 8: LPU Manager .....	18
Figure 9: FCU Inspector .....	19
Figure 10: SCM Inspector .....	20
Figure 11: LPC I/O .....	20
Figure 12: Circuit Monitor .....	21
Figure 13: DB Capture .....	22
Figure 14: DB Explorer .....	23
Figure 15: Circuit Tuning .....	24
Figure 16: Enter PID number, if available .....	25
Figure 17: Confirm parameter download .....	25
Figure 18: Confirm parameter download. ....	26
Figure 19: Enter PID .....	27
Figure 20: Confirm parameter download .....	27
Figure 21: Reminder to turn on the output power .....	27
Figure 22: Lamp control .....	28
Figure 23: Found LMS .....	28
Figure 24: Checksum OK .....	28
Figure 25: Reminder to turn on the output power .....	29
Figure 26: Instructions for controlling the PROG switch .....	29
Figure 27: Found SIU .....	29
Figure 28: Checksum check OK .....	29
Figure 29: LPU Manager .....	30
Figure 30: Function test .....	31
Figure 31: SCM Maintenance view from AMT .....	32
Figure 32: Circuit Monitor Screen .....	38
Figure 33: Circuit Monitor Screen .....	39
Figure 34: Circuit Monitor log file viewer .....	39
Figure 35: Settings menu .....	41
Figure 36: AMT user interface .....	42

Figure 37: Combo-box .....	42
Figure 38: Parameter Editor .....	43
Figure 39: Hardware set-up .....	46
Figure 40: Open configuration .....	47
Figure 41: Select appropriate circuit .....	47
Figure 42: Circuit is selected .....	47
Figure 43: Select configuration .....	48
Figure 44: General settings tab .....	48
Figure 45: Frequency settings tab .....	48
Figure 46: Optimization settings tab .....	49
Figure 47: Preferred Frequencies settings tab .....	49
Figure 48: Start Sequence tab .....	49
Figure 49: Monitor Noise dialogue box .....	49
Figure 50: Noise Monitoring dialogue box .....	50
Figure 51: Frequency Sweep dialogue box .....	50
Figure 52: Low level logging of frequency sweep .....	50
Figure 53: Selected LMS in the Non Mapped window and one of its neighbors in the Reference List .....	51
Figure 54: Result of the manual assignment procedure viewed in the Mapped window .....	51
Figure 55: Update the circuit with new frequency parameters .....	51
Figure 56: Circuit update dialogue box .....	52
Figure 57: Exit the program .....	52
Figure 58: Save Script dialogue box .....	52
Figure 59: Save Log dialogue box .....	52
Figure 60: Self Hosted SCM .....	53
Figure 61: Front panel view of the new SCM 591813B and LPC version 3 .....	56
Figure 62: Front panel view of SCM 591813 and LPC version 2 .....	56
Figure 63: SCM and LPC rear view and interconnection .....	57
Figure 64: Signal Filter Unit .....	60
Figure 65: SFU connections .....	60
Figure 66: Rear .....	62
Figure 67: Front .....	62
Figure 68: LPC and SCM set-up .....	64
Figure 69: PC and LPC set-up .....	65
Figure 70: SCF installation overview .....	67
Figure 71: SCF ventilation .....	68
Figure 72: AT610063 .....	69
Figure 73: Principles for SCM-installation on a series circuit .....	72
Figure 74: Front .....	74
Figure 75: Rear .....	74
Figure 76: Filter time .....	89

Figure 77: Input/Output skeleton drawing .....	89
Figure 78: Example of D1 .....	90
Figure 79: Interfacing SG596530 to SIU with Sensor Test support. ....	92
Figure 80: RELIANCE IL single and dual LMS remote .....	95
Figure 81: Outline drawing single LMS 591886-11 .....	98
Figure 82: Outline drawing dual LMS 591886-22 .....	98
Figure 83: Outline drawing 48001420 Reliance IL dual LMS remote .....	100
Figure 84: Outline drawing 48001418 Reliance IL single LMS remote .....	100
Figure 85: Installation of LMS .....	101
Figure 86: Example of mounting of a post .....	108
Figure 87: Protection pattern of the MBD .....	113
Figure 88: Illustration of pattern width variations .....	114
Figure 89: Redundant NCU overview .....	118
Figure 90: ILDU with one inductive loop relay .....	132
Figure 91: ILDU with two inductive loop relays .....	132
Figure 92: ILDU with three inductive loop relays .....	132



## List of Tables

Table 1: RELIANCE Intelligent Lighting specific safety notes .....	5
Table 2: The Data window information .....	23
Table 3: Article numbers .....	102
Table 4: Spare parts .....	102
Table 5: Color code description .....	124
Table 6: Read Request .....	138
Table 7: Read Response .....	138
Table 8: Write Request .....	138
Table 9: Write Response .....	139





# 1.0 Safety

## Introduction to Safety






This section contains general safety instructions for installing and using ADB SAFEGATE equipment. Some safety instructions may not apply to the equipment in this manual. Task- and equipment-specific warnings are included in other sections of this manual where appropriate.

## 1.1 Safety Messages


### HAZARD Icons used in the manual

For all HAZARD symbols in use, see the Safety section. All symbols must comply with ISO and ANSI standards.

Carefully read and observe all safety instructions in this manual, which alert you to safety hazards and conditions that may result in personal injury, death or property and equipment damage and are accompanied by the symbol shown below.

	<b>WARNING</b> Failure to observe a warning may result in personal injury, death or equipment damage.
	<b>DANGER - Risk of electrical shock or ARC FLASH</b> Disconnect equipment from line voltage. Failure to observe this warning may result in personal injury, death, or equipment damage. ARC Flash may cause blindness, severe burns or death.
	<b>WARNING - Wear personal protective equipment</b> Failure to observe may result in serious injury.
	<b>WARNING - Do not touch</b> Failure to observe this warning may result in personal injury, death, or equipment damage.
	<b>CAUTION</b> Failure to observe a caution may result in equipment damage.

### Qualified Personnel

	<b>Important Information</b> The term <b>qualified personnel</b> is defined here as individuals who thoroughly understand the equipment and its safe 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 operating this equipment to ensure that its personnel meet these requirements. Always use required personal protective equipment (PPE) and follow safe electrical work practice.
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### 1.1.1 Introduction to Safety



#### CAUTION

##### Unsafe Equipment Use

This equipment may contain electrostatic devices, hazardous voltages and sharp edges on components

- Read installation instructions in their entirety before starting installation.
- Become familiar with the general safety instructions in this section of the manual before installing, operating, maintaining or repairing this equipment.
- Read and carefully follow the instructions throughout this manual for performing specific tasks and working with specific equipment.
- Make this manual available to 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.
- Install all electrical connections to local code.
- Use only electrical wire of sufficient gauge and insulation to handle the rated current demand. All wiring must meet local codes.
- Route electrical wiring along a protected path. Make sure they will not be damaged by moving equipment.
- Protect components from damage, wear, and harsh environment conditions.
- Allow ample room for maintenance, panel accessibility, and cover removal.
- Protect equipment with safety devices as specified by applicable safety regulations
- If safety devices must be removed for installation, install them immediately after the work is completed and check them for proper functioning prior to returning power to the circuit.

**Failure to follow this instruction can result in serious injury or equipment damage**

### Additional Reference Materials



#### Important Information

- IEC - International Standards and Conformity Assessment for all electrical, electronic and related technologies.
- IEC 60364 - Electrical Installations in Buildings.
- FAA Advisory: AC 150/5340-26 (current edition), Maintenance of Airport Visual Aid Facilities.
- Maintenance personnel must refer to the maintenance procedure described in the ICAO Airport Services Manual, Part 9.
- ANSI/NFPA 79, Electrical Standards for Metalworking Machine Tools.
- National and local electrical codes and standards.

### 1.1.2 Intended Use



#### CAUTION

##### Use this equipment as intended by the manufacturer

This equipment is designed to perform a specific function, do not use this equipment for other purposes

- Using this equipment in ways other than described in this manual may result in personal injury, death or property and equipment damage. Use this equipment only as described in this manual.

**Failure to follow this instruction can result in serious injury or equipment damage**

### 1.1.3 Operation Safety



#### CAUTION

##### **Improper Operation**

Do Not Operate this equipment other than as specified by the manufacturer

- Only qualified personnel, physically capable of operating the equipment and with no impairments in their judgment or reaction times, 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.
- Protect equipment with safety devices as specified by applicable safety regulations.
- If safety devices must be removed for installation, install them immediately after the work is completed and check them for proper functioning.
- Route electrical wiring along a protected path. Make sure they will not be damaged by moving equipment.
- 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.

**Failure to follow these instructions can result in equipment damage**

### 1.1.4 Maintenance Safety



#### DANGER

##### **Electric Shock Hazard**

This equipment may contain electrostatic devices

- 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.

**Failure to follow these instructions can result in death or equipment damage**

### 1.1.5 Material Handling Precautions, ESD



#### CAUTION

##### Electrostatic Sensitive Devices

This equipment may contain electrostatic devices

- Protect from electrostatic discharge.
- Electronic modules and components should be touched only when this is unavoidable e.g. soldering, replacement.
- Before touching any component of the cabinet you shall bring your body to the same potential as the cabinet by touching a conductive earthed part of the cabinet.
- Electronic modules or components must not be brought in contact with highly insulating materials such as plastic sheets, synthetic fiber clothing. They must be laid down on conductive surfaces.
- The tip of the soldering iron must be grounded.
- Electronic modules and components must be stored and transported in conductive packing.

**Failure to follow this instruction can result in equipment damage**

### 1.1.6 Arc Flash and Electric Shock Hazard



#### DANGER

##### Series Circuits have Hazardous Voltages

This equipment produces high voltages to maintain the specified current - Do NOT Disconnect while energized.

- Allow only qualified personnel to perform maintenance, troubleshooting, and repair tasks.
- Only persons who are properly trained and familiar with ADB SAFEGATE equipment are permitted to service this equipment.
- An open airfield current circuit is capable of generating >5000 Vac and may appear OFF to a meter.
- Never unplug a device from a constant current circuit while it is operating; Arc flash may result.
- Disconnect and lock out electrical power.
- Always use safety devices when working on this equipment.
- Follow the recommended maintenance procedures in the product manuals.
- Do not service or adjust any equipment unless another person trained in first aid and CPR is present.
- Connect all disconnected equipment ground cables and wires after servicing equipment. Ground all conductive equipment.
- Use only approved ADB SAFEGATE replacement parts. Using unapproved parts or making unapproved modifications to equipment may void agency approvals and create safety hazards.
- Check the 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 airfield electrical equipment.

**Failure to follow these instructions can result in death or equipment damage**

## 2.0 RELIANCE Intelligent Lighting Product Introduction

This manual has been compiled to give the reader an understanding of installation, operation and maintenance (IOM) procedures of RELIANCE™ Intelligent Lighting, with a focus on safety and efficiency.

### 2.1 RELIANCE Intelligent Lighting Safety notes

The RELIANCE Intelligent Lighting (IL) is for airport safety and efficiency. The design is according to strict airport industry standards for the safety of, and use by authorized airport personnel.

#### Airport Operations, Maintenance and other Authorized Personnel

This information is a summary of the safety requirements on operation and maintenance personnel based on general electrical and safety precautions.

RELIANCE™ IL should only be used by airport operations and maintenance personnel who have been properly trained in the use of the system. ADB SAFEGATE takes no responsibility for incorrect use of the system. All warnings contained in the text of this manual must be strictly observed.





Airport operations and maintenance personnel are strongly advised to observe the following symbols and safety advisories.



#### Note

It is very important for authorized personnel to study the entire manual before any installation, operation or maintenance work on the system is commenced. Review the Safety section.

**Table 1: RELIANCE Intelligent Lighting specific safety notes**

Symbol	Safety Advisory
	RELIANCE IL contains electrical circuits and devices, which may be hazardous to operators and maintenance personnel, if proper safety precautions are not observed. Only properly trained personnel should open enclosures or attempt to perform maintenance on these devices. Personnel are cautioned to read and thoroughly understand this manual before attempting to service any part of the system.
	RELIANCE IL contains 100 - 230 VAC electrical circuits that may be hazardous to operators or maintenance personnel if proper safety procedures are not observed. Shut down power before attempting to service the system. Power may be turned off at the main disconnect circuit breaker or at the breaker panel supplying AC power to the unit or system.
	<b>CAUTION</b> Some systems are supplied with a remote UPS, which may continue to supply power to the system, even when the breaker at the supply panel is switched off. Be sure to remove all power, before servicing this equipment.
	A chassis ground connection is provided in some parts of the system. Be sure to follow all applicable codes in making chassis ground connections.

### 2.2 Abbreviations used in RELIANCE Intelligent Lighting products

Abbreviation	Description
AC	Alternate Current
AMT	ASP Maintenance Tool (maintenance software tool)
RELIANCE IL	RELIANCE Intelligent Lighting
A-SMGCS	Advanced Surface Movement Guidance & Control System
CCR	Constant Current Regulator

Abbreviation	Description
CL	Center Line
CMS	Control and Monitoring System
CPU	Central Processing Unit
DC	Direct Current
ESD	Electrostatic Discharge
FAT	Factory Acceptance Test
FCU	Field Communication Unit (LMS or SIU)
HMI	Human Machine Interface
I/O	Input/ Output
ICD	Interface Control Document
ILDU	Inductive Loop Detector Unit
IOM	Installation Operation Maintenance
ISO	International Standardisation Organisation
IT	Information Technology
LCC	Life Cycle Cost
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LMS	Light Monitor- and Switch unit
LPC	LMS/SIU Programming Control Unit
LPU	LMS Programming Unit
MBD	Microwave Barrier Detector
MDT	Mean Down Time
MTBF	Mean Time Between Failure
MTTR	Mean Time To Repair
NCU	Network Concentrator Unit
NTP	Network Time Protocol
OP	Operator Panel unit
PCB	Printed Circuit Board
PID	Production Identification number
SCI	Series Circuit Inductor
SCF	Series Circuit Filter
SCM	Series Circuit Modem
SFU	Signal Filter Circuit
SIU	Sensor Interface Unit
SMGCS	Surface Movement Guidance & Control System
TCP/IP	Transmission Control Protocol/Internet Protocol
U/S	Unserviceable / Out of Service
UPS	Uninterruptible Power Supply



## 3.0 RELIANCE Intelligent Lighting System User Guide

RELIANCE Intelligent Lighting (IL) is designed to provide individual monitoring of airfield lighting using the series circuit as a means of communication for the lamp and sensor status information coming from the airfield. The same concept is used for lighting control, and as such provides the foundation for an SMGCS or A-SMGCS which includes for example automation of stopbars with or without sensors, taxiway guidance (routing), both in combination with status monitoring.

RELIANCE IL is a cost effective solution for upgrading existing or new series circuits with selective switching and/or individual monitoring of all or a selected number of lights in an airfield.

### 3.1 Individual Light Control and Monitoring System

The RELIANCE® Intelligent Lighting (IL) system is designed to provide individual monitoring of airfield lighting using the series circuit as a means of communication for the lamp and sensor status information coming from the airfield.

The same concept is used for lighting control, and as such provides the foundation for an SMGCS or A-SMGCS. This includes for example automation of stop bars, with or without sensors, and taxiway guidance in combination with status monitoring.

The RELIANCE Intelligent Lighting system is a cost-effective solution for upgrading existing or new series circuits with selective switching and/or individual monitoring of all or a selected number of lights in an airfield.

#### Basic system characteristics

- RELIANCE IQ
- LMS - Light Monitor and Switch Unit
- SIU - Sensor Interface Unit
- SCM and NCU - Series Circuit Modem and Network Concentrator Unit
- SCF - Series Circuit Filter
- Control System Interface
- Flexibility
- Availability
- Installation Requirements and Maintainability
- Failsafe Operation

For more detailed information regarding the RELIANCE Intelligent Lighting system components, see the System block diagram in this data sheet and the User' Guides.

#### RELIANCE IQ

The implementation of LED-based airfield lighting required electronics built into the light fixtures to convert 6.6A to whatever current the LEDs required. This opens the opportunity to use these electronics to also integrate the ILCMS functionality of the external remote into the fixture. This streamlining of the units increases reliability because there are far fewer secondary connectors as potential points of failure. In addition, intensity can be controlled by using powerline commands rather than following the CCR current.

#### LMS

The LMS concept used in the RELIANCE Intelligent Lighting system is designed to provide selective switching and/or monitoring of airfield lighting. Each light is individually controlled by the use of an addressable LMS switching unit connected to a standard series circuit isolation transformer. Communications to/from the LMS uses a unique power line communication technique, developed by ADB SAFEGATE, where the communication signals are superimposed on the series circuit current.

## SIU

Sensors for presence and direction detection of aircraft and vehicles on the airfield can easily be interfaced to the RELIANCE Intelligent Lighting system using an SIU. The SIU communicates the detect/no-detect status signals as well as its own status to the series circuit in the same manner as the LMS. The SIU is also connected to the secondary side of a standard isolation transformer using the standard 2-pin FAA-style connectors while its connection to the sensor is established using an IP68-rated, 7-pin connector. The SIU can supply the sensor with a DC-voltage.

## SCM and NCU

The NCU concentrates all status information coming from the field, for example lamp and sensor status. It transfers commands to the SCM, which constitutes the interface to the series circuit. The SCM interfaces to the series circuit through a standard isolation transformer and to the NCU via standard RS485 or RS232 serial communication.

## SCF

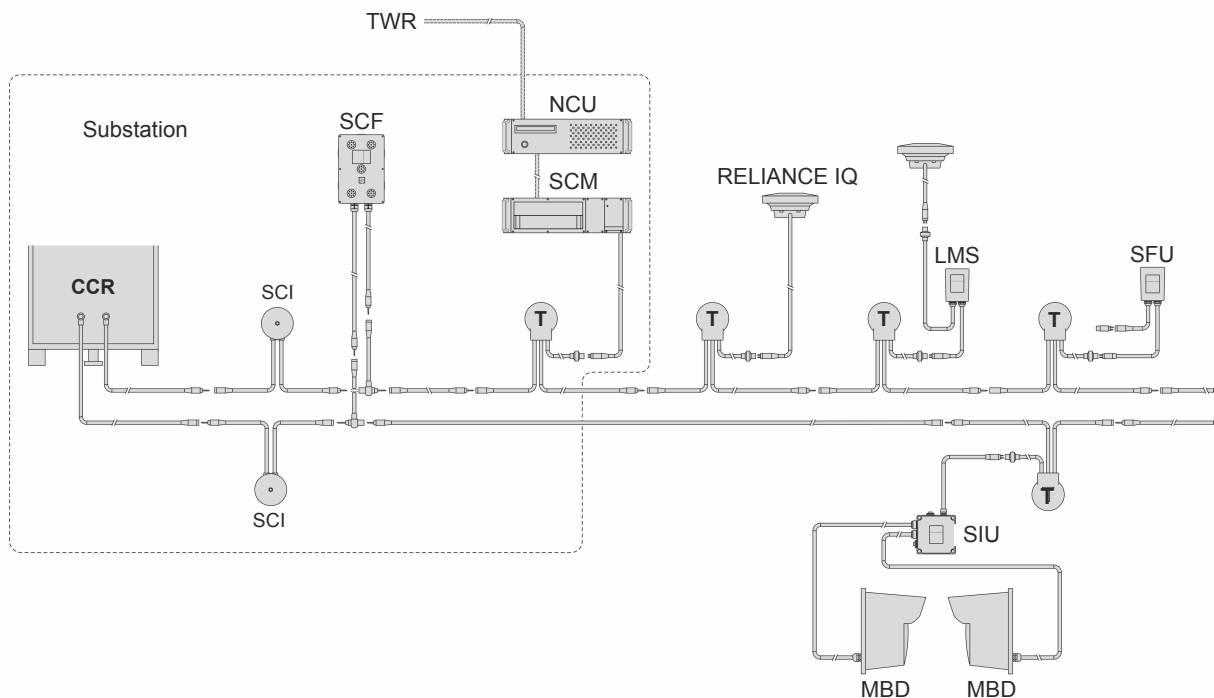
The SCF is connected across the CCR series circuit output and is used to contain the communication signaling within the airfield circuit and minimize feedback into the regulator.

## Control system interface

The NCU operates as the RELIANCE Intelligent Lighting system main interface interpreting commands sent from the host/supervisor system, including the RELIANCE Intelligent Lighting system, and in turn controlling the remote appropriate lighting as directed.

It maintains all lighting and error status as well as that of sensor detection as reported from the airfield components and thus is the central point of the RELIANCE Intelligent Lighting system as operated from each substation. Individual lights can be grouped in lighting segments spanning one or more series circuits, for example an interleaved stop bar. In turn, the NCU provides alarm status for percentage and adjacent lamp failure within those defined lighting segments per requirements for low visibility operations. Airfield lighting and RELIANCE Intelligent Lighting system component status are constantly monitored and updated to the host/supervisor system upon occurrence.

**Figure 1: RELIANCE Intelligent Lighting system block diagram**



## Flexibility

The segmentation of lights into selectively controlled blocks is made in the software, and not by means of cables and CCRs or selector switches. This reduces the installation and hardware costs substantially and increases the flexibility of the airfield lighting system. A segment can easily be redefined or added in the software with the possible addition of isolation transformers and LMSs in the airfield. The RELIANCE Intelligent Lighting system is designed to be modular and expandable, so that it can be readily modified to monitor and control additional lighting functions and series circuits.

## Availability

The series circuit cable transfers power to the lamp on the circuit and the same physical channel is used by the RELIANCE Intelligent Lighting system for communication. This implies that whenever there is power available to the lamps, the RELIANCE Intelligent Lighting system will have access to its communications channel and control and monitoring will be available. A discontinuity on the cable shield will not normally influence neither the lights nor the RELIANCE Intelligent Lighting system availability.

## Installation requirements and maintainability

The RELIANCE Intelligent Lighting system electrical requirements on a series circuit level are the same as a light fitting or an isolation transformer. The RELIANCE Intelligent Lighting system does not put any additional constraints on how the installation is done, hence there is no conflict either with for example electrical safety code, nor general or local standards, when installing this type of system. If a new series circuit is to be designed, ADB SAFEGATE has a set of general recommendations or preferences to apply regarding cable routing etc.

High-voltage equipment, connected to the primary of the series circuit, and low-voltage equipment, connected to the secondary of the series circuit, are physically separated. By separating them, the impact on system availability and personnel hazards due to maintenance efforts, is minimized.

## Failsafe operation

If a fault is detected on any system component, the NCU will provide the information to the host-system upon occurrence for the appropriate actions to be taken. Typical actions would be displaying a message to the maintenance station terminal and, if necessary, some indication at the operator terminals to signify any interference to operations.

In normal operations, the RELIANCE Intelligent Lighting system appears on the airfield as commanded by the host-system. In case of equipment or communication failures associated with the RELIANCE Intelligent Lighting system, the associated airfield lighting adopts the Failsafe or "safe-state" setting. This can happen on an individual circuit basis or the entire airfield depending upon one or more of the following circumstances:

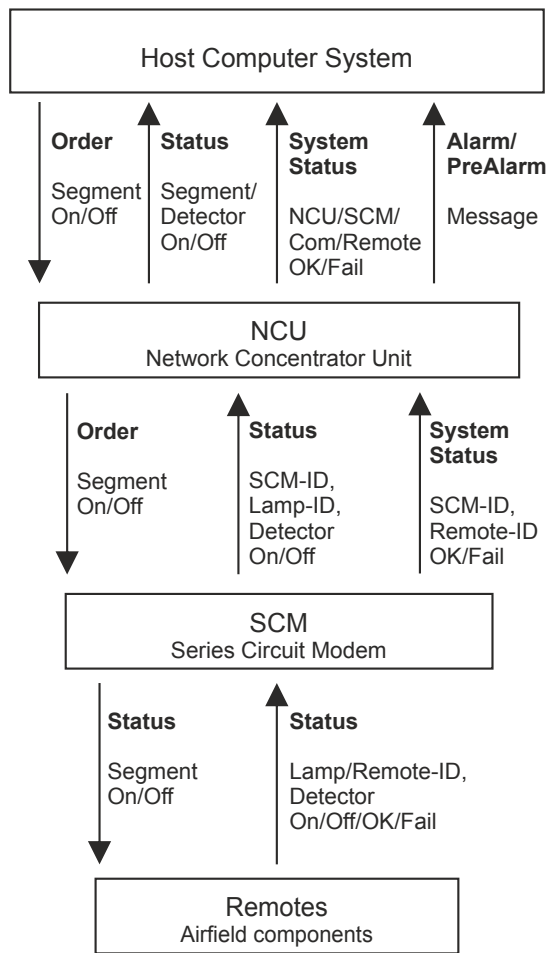
1. A **Set Failsafe** command is given by the host-system: The NCU sets airfield lighting to a predefined Failsafe state as commanded by the host-system. The airfield remains in this state under host-system control until the airfield lighting is commanded to another state.
2. Loss of communications with the host-system: The NCU assumes an error in the host-system control and sets airfield lighting to its predefined Failsafe state. The airfield remains in this state under RELIANCE Intelligent Lighting system control until communications is restored with the host-system and the airfield lighting is commanded to another state.
3. Loss of control operations by the NCU: Both redundant NCU computers or their application are turned OFF but the RELIANCE Intelligent Lighting system circuits remain ON. In such case, the signaling on the series circuit from the SCM will cease due to lack of NCU/SCM communications, thereby forcing the Remote to assume their pre-programmed Failsafe state. The pre-programmed Failsafe state matches that as would be commanded.
4. Loss of SCM, SCF, or related component in series circuit interface or SCM communications with the NCU: In such case, RELIANCE Intelligent Lighting system signaling on the series circuit will cease as a result of the hardware failure, thereby forcing the LMS to assume their pre-programmed Failsafe state.

## Communication principles

The communication between the components at the different levels is such that the higher level device always polls the lower level device, evaluates the answers, and determines the on/off and pass/fail status for the functions or components. If a unit fails to report within a predetermined amount of time, it is assumed to be failed until reported otherwise. The evaluation of conditions is performed at the lowest level possible and information condensed before transferred upward, resulting in minimized response time and transfer of information between each unit.

The information exchange is performed according to the structure shown in [Figure 2](#).

**Figure 2: RELIANCE Intelligent Lighting system information exchange**



## System response times

The RELIANCE Intelligent Lighting system is designed to provide up-to-date status information on individual lamps as well as light functions independently of the commanded lamp state, for example if the lamp is commanded on or off. This implies that provided the system and series circuit is energized, status on lights and light functions is continuously available.

The user of the system will be able to control desired light functions and on beforehand know in what shape the system is. Hence maintenance efforts may be launched as soon as any deficiencies are detected and well before the affected light functions are needed operationally.

The RELIANCE Intelligent Lighting system is designed to comply with operational requirements in terms of response times. In the chain of events, including air traffic controller reaction— system response time— physical changes in the field— pilot reaction, the system response time constitutes a minor part. Time critical functions like stop bar control have priority over less critical functions like, for example, runway edge light monitoring.

Response times are measured from the RELIANCE Intelligent Lighting system interface from the point in time when a command is received to the point in time when the corresponding status information, true feed back, is available. The only exception to the above is when a RELIANCE ALCMS control system is host in which case the response time includes host processing and overhead as well. In this case the response time is equivalent to the system response time.

## Stopbar response time

Maximum stop bar response time from receiving a command to true back indication is 2 seconds, typically less than 1 second. Sensor detection is typically reported within 1 second. The stopbar response time applies to both interleaved and non-interleaved configurations.

## Lamp Monitoring response time

A lamp failure is detected and reported within 5 seconds regardless of system configuration.

## Command Sequence response time

Maximum response time using multi segment commands result in system performance on par with the user requirements, typically 1-5 seconds. This applies regardless of the number of light segments involved. In case the light function only affects a few segments, the maximum response time is considerably lower. For single segment response time in general refer to Stopbar response time.

The consequence of the response time is that in an RELIANCE Intelligent Lighting system it is always possible to predict the maximum response time regardless of the system configuration.

## References

SG591835-3013 LMS User Guide

SG591870-3002 SCF User Guide

SG591880-3003 SCM-Rack User Guide

SG591885-3018 SIU User Guide

SG591847-3017 NCU User Guide

SG591890-3006 International Standards Compliancy List

## 3.2 Vault equipment

Equipment installed in a vault or a sub station is referred to as vault equipment. Examples of such equipment are the SCM, the SSU and the NCU.

### 3.2.1 Installation

- Requirement** Any active equipment connected to the series circuit must connect to the secondary of a standard isolation transformer. Active equipment such as modems must not be connected to the primary.
- Argument** No single unit on a series circuit must in case of failure be allowed to jeopardize the integrity of the circuit itself. By always connecting active equipment such as modems, to the secondary of an isolation transformer the result of a failure will be no worse than a failed lamp in terms of series circuit integrity, i.e. the series circuit itself will not be affected, nor will the CCR.
- Requirement** High voltage equipment (connected to the primary) shall be physically separated from low voltage equipment (connected to the secondary of an isolation transformer).
- Argument** High voltage and low voltage maintenance procedures are different and each one, when carried out, affects the availability of the system in different ways. By separating high voltage and low voltage equipment physically, the impact on system availability as a consequence of maintenance efforts is minimized. For example, if a modem needs maintenance the circuit is not affected and the CCR may be operated without constraints.

## 3.3 System response times

The airfield light control system shall be built to meet the operative demands and needs regarding response times. This means that time critical functions like stop-bar functions shall be given priority to, unlike less time critical functions like pure monitoring of lights.

### **3.3.1 Single command response time**

The response time for a command to be executed, such as a stopbar command shall be 1 second from that the controller pushes the button until the light is switched. The acknowledgment from that the stopbar light is switched until this is indicated on the controllers screen shall be 1 second.

### **3.3.2 Sensor response time**

The time to detect an activated incursion sensor shall be 1 second.

### **3.3.3 Failed lamp response time**

The response time for indication of a failed lamp shall be 5 seconds.

### **3.3.4 Multi-segment response time**

Multi-segment state change response times should always be less than 5 seconds, from the command is sent to all lights have switched, no matter the number of involved segments/lights. As an extreme, all lights on a single circuits shall be able to change state on command independently of each other and regardless of the desired light pattern and the number of lights involved, in less than 5 seconds. Multi-segment state change including true feedback shall be completed in less than 10 seconds.



## 4.0 AMT User Guide

This document describes the software ASP Maintenance Tool (AMT 591819), its functionalities and use.

### 4.1 Application

This document is intended for users that are well acquainted with RELIANCE Intelligent Lighting (IL). As AMT is created to simplify and increase efficiency at maintenance, commissioning and troubleshooting, the document is mainly for users that work with these activities.

Figures, function descriptions etc in this document is based on version 3.46 of AMT which implies that earlier versions do not necessarily work or look as described here. In those cases, consult the user manual for the earlier version.

### 4.2 References

SG591891-3001 AMT User Guide. <sup>1</sup>

### 4.3 Requirements

Following are the operative systems that are supported by AMT:

- Windows 98
- Windows 2000 Professional
- Windows NT 4.0 Workstation
- Windows XP Professional
- Windows 7
- Windows 10

In addition to that, the computer that AMT is running on must have:

- Monitor resolution at least 800 × 600
- USB port, USB-B cable
- Fontsize *small size* or 96 DPI. If other size is used, some of the windows in AMT can be distorted and/or impossible to read.

### 4.4 Different variants of AMT

AMT comes in two versions: AMT Basic and AMT Pro. The difference between them is the number of tools included. Exactly what is included in each variant is determined by ADB SAFEGATE.

#### 4.4.1 AMT Basic

The AMT Basic variant is intended for the user that only needs to program spare parts to RELIANCE IL. That includes programming of LMS, RELIANCE IQ, SIU and SCM. As a complement, tools can be included for configuration and monitoring of stand-alone RELIANCE IL, so called Self Hosted SCM.

#### 4.4.2 AMT Pro

The AMT Pro variant includes, in addition to what is supported by the Basic variant, also tools for commissioning, monitoring and troubleshooting of RELIANCE IL and its components.

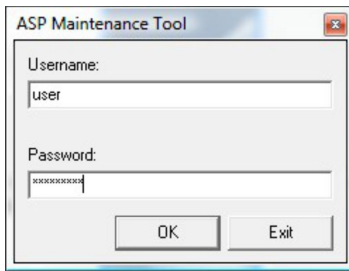
### 4.5 The user interface

This section describes the AMT user interface, and briefly describes the functionality that the different tools provide.

<sup>1</sup> Describes earlier AMT versions, before 3.0

### 4.5.1 Login

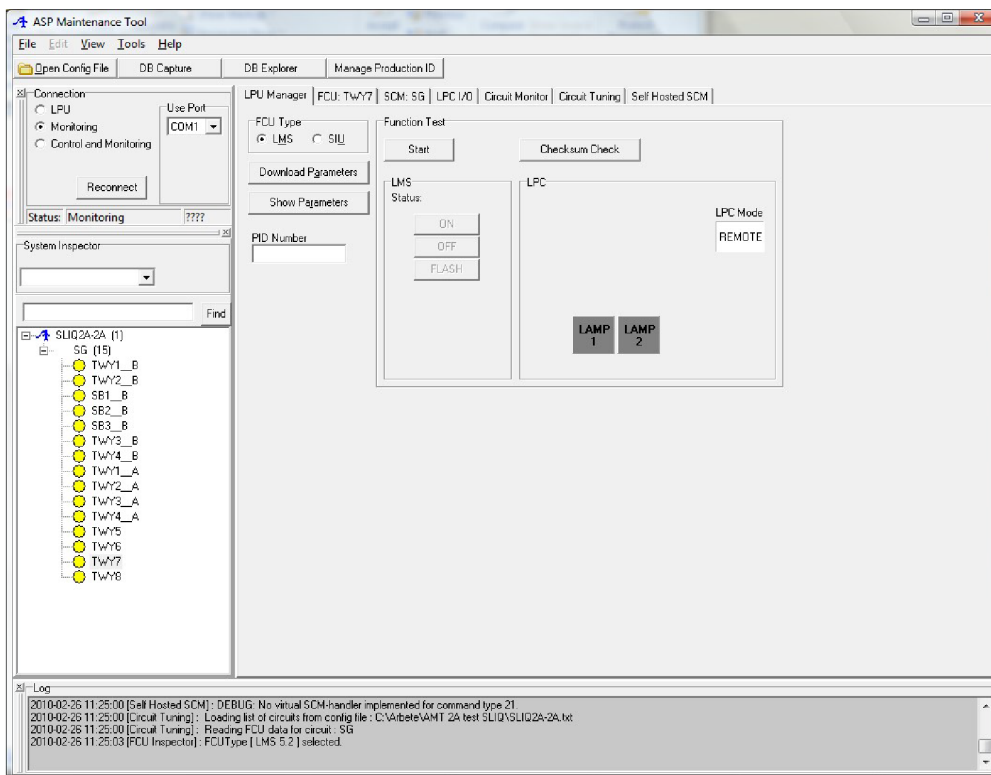
When AMT is started up a login dialog box is open. Type username and password, then click **OK** to continue.



See section [User groups](#) for more information about the administration of users and user groups.

### 4.5.2 Main window

If the username and login is correct the main window, **ASP Maintenance Tool**, opens.



The main window consists of three parts:

- To the left is a section for communication settings, **Connection**, and system configuration, **System Inspector**
- To the right is a section for different tools, of which each tool has its own tab
- At the bottom is a log window

At the top of the main window is a menu with a number of shortcut buttons.

### 4.5.2.1 To adjust the main window

The user has some freedom to adjust the look of AMT. The user can choose:

- Between the tools on the tabs and other functions integrated/docked in the main window *or* each of the tools in separate windows *or* a combination of the two
- Which of the tools and other functions to be visible

### 4.5.2.2 Undock

First check that the alternative **Lock layout** on the **View**-menu is deselected, then a tools window can be undocked.

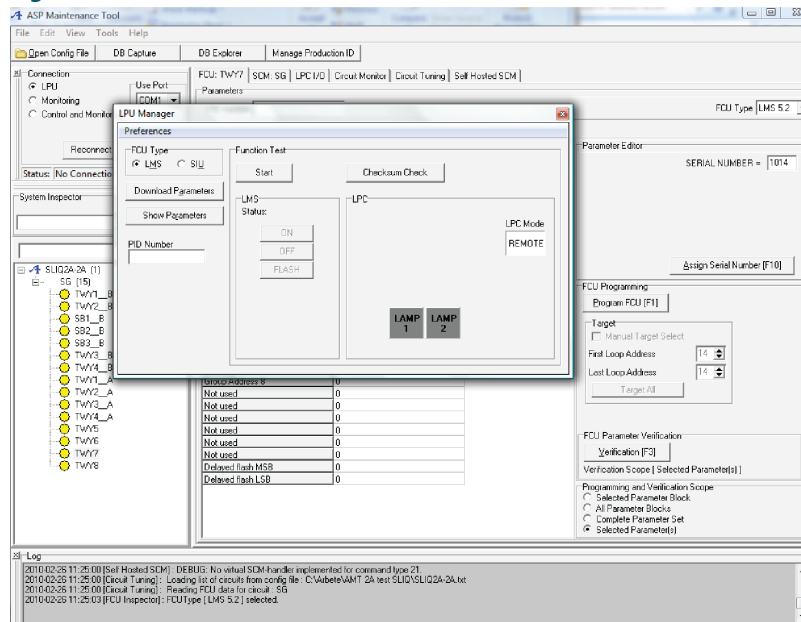
To undock for example a tools window from its tab, double-click on the tab, then the tool will get its own window. Alternatively drag and drop with left mouse button. The undocked window will always remain on top of the main window, so to be able to reach the main window; the undocked window may have to be moved.

Note that if either **Connection Manager** and **Inspector or Log**-window is undocked, the tools section will grow to the left and/or down.

### 4.5.2.3 Dock

To dock a tools window to the main window, grab the title bar of the window and drag it to the upper right corner of the main window. A frame is shown in the main window. Drop the title bar and the window is docked and gets its own tab.

**Figure 3: ASP Maintenance Tool**



If the **Log** window is intended to be docked, drag it to the bottom part of the main window. When the **Connection Manager** and **System Inspector** are separate windows and one of them is supposed to be docked, they must be dragged to the left part of the main window.

Note that not all windows can be docked everywhere:

- The tools windows can only be docked to the right part of the mains window
- **Connection Manager** and **System Inspector** can be docked either to the right or to the left part of the mains window.
- The **Log** window can only be docked at the bottom part of the main window.

### 4.5.2.4 Hide windows

To hide a window, either click on the close-button in the upper right or left corner or deselect the window in either the **View**- or **Tools**-menu.

#### 4.5.2.5 Show window

To show a window, select the window in either the **View**- or **Tools**-menu.

#### 4.5.2.6 Save layout

If **Save Layout** is selected in the **View**-menu, the program will start with the same layout as when it was shut down the previous time it was used.

#### 4.5.2.7 Lock layout

By selecting **Lock Layout** in the **View**-menu, tools windows can neither be docked or undocked. This does not influence the possibilities to show or hide windows. Every time AMT is started, **Lock Layout** will be activated. If the user wants to change the layout, **Lock Layout** must first be deselected.

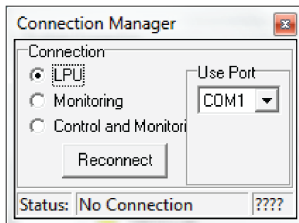
### 4.6 Communication settings

In order for AMT to work correctly, there must be an active connection to an SCM irrespective of if AMT is connected to a LPU or RELIANCE Intelligent Lighting (IL). Use **Connection manager** to specify type of connection and COM-port used on the computer.

If AMT is connected to an LPU, select LPU. If AMT is connected to RELIANCE IL, select either **Monitoring** or **Control and Monitoring**. To activate all functionalities in AMT, AMT must be run in **Control and Monitoring**-mode.

Actual state of the connection to the SCM is shown at the bottom of **Connection Manager**.

**Figure 4: Connection Manager**



#### 4.6.1 Monitoring

When AMT is connected to RELIANCE IL monitoring, meaning that RELIANCE IL is operative, AMT is only listening to the operative communication, **Listen Mode**. To avoid interference with the operative communication, all commanding functionality in AMT are blocked in the **Monitoring** mode. Every time AMT is started, **Monitoring** mode is pre-selected, and the user must by himself select **Control and Monitoring** mode.



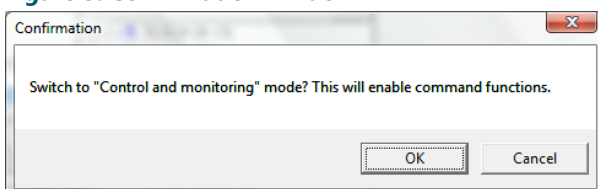
#### **WARNING**

The front switch on the SCM RS485/RS232 (alternatively REMOTE/LOCAL) must remain in RS485 to avoid interference with an operative system. By setting the switch to RS232 (LOCAL), the SCM will be taken out of operative running.

#### 4.6.2 Control and Monitoring

As opposed to **Monitoring**, **Control and Monitoring** means that AMT has exclusive access to the part of the system that is controlled by the SCM. When **Control and Monitoring** is selected, there are no functional restrictions comparing to the **Monitoring** mode. Every time the user is changing from **Monitoring** to **Control and Monitoring**, a dialogue window appears that asks the user to acknowledge before the change is made, to secure that **Control and Monitoring** mode is not selected by mistake.

**Figure 5: Confirmation window**



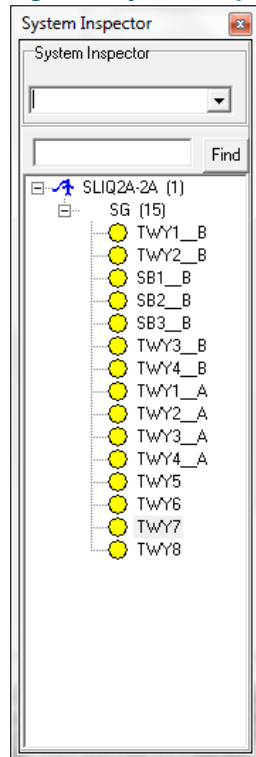
## 4.7 System configuration

A system configuration contains information about the different components in the system, mainly LMS, RELIANCE IQ and SIU. Many of the tools in AMT need access to a system configuration to be able to work correctly. **System Inspector** is used to load the system configuration, to navigate in it and in some cases to manipulate it.

The window is made up of two parts:

- At the top is a search field
- At the bottom is a tree structure where the configuration is shown

**Figure 6: System Inspector**



### 4.7.1 The configuration tree

The content of the configuration is shown in a tree structure where the uppermost level symbolizes the site. Below that level is the different circuits, and on the bottom level is the lamps and sensors. By selecting a lamp or sensor in the tree, it will automatically be active and available by all tools in AMT.

To the left of every lamp and sensor is an icon that symbolizes the object. Right-click on an active lamp or sensor, and a menu is shown with a number of available selections:

- **Collapse All:** Compress the tree so that only the uppermost level is visible.
- **Expand All:** Expands the tree so that all levels are visible.
- **Auto Expand:** If this function is active, all circuits will be compressed except the selected circuit.
- **Clear Status:** Resets the status indication that is shown to the left of the symbols for the object (lamp or sensor).

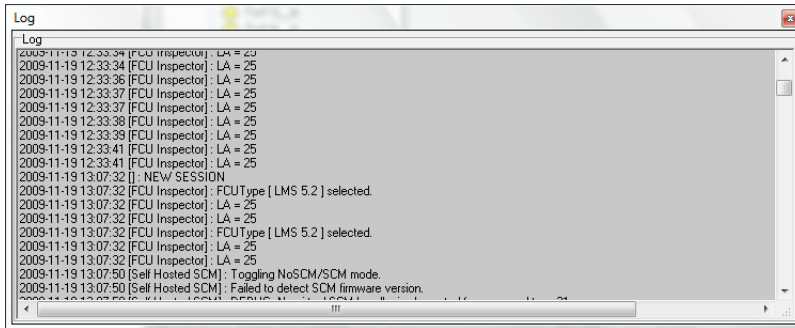
### 4.7.2 Search in the configuration

Write the complete or beginning part of the name in the search field and press enter. The first occurrence of the text string is shown by highlighting the object in the configuration tree.

## 4.8 Log window

The **Log** window is used to show events that are either initiated by the user or are a result of an action made in a tools window. All events are time stamped and the log is accumulative, which means that every time AMT is started, the log from the preceding session is opened and continued. Thereby, the log is a user's history for AMT on a specific computer.

**Figure 7: Log window**



## 4.9 Tools window

The tools in AMT are gathered in different tools windows. The type of tool and its use determines which tools window it belongs to.

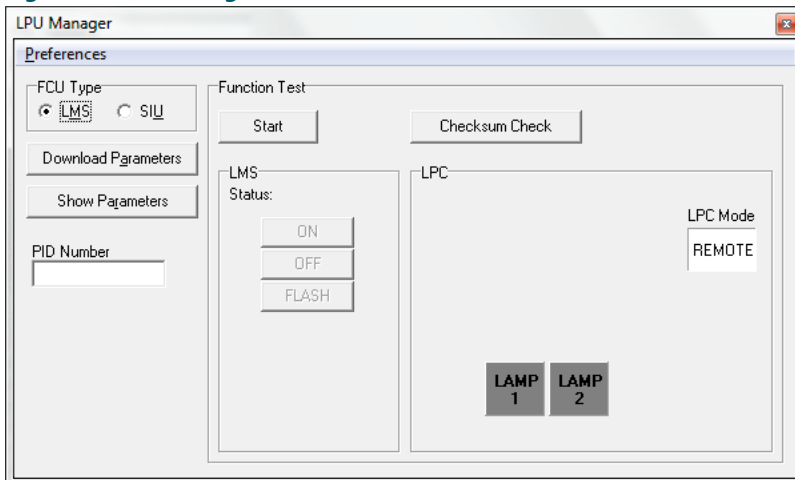
Available tool windows in AMT are:

- LPU Manager
- FCU Inspector
- SCM Inspector
- LPC I/O
- Circuit Monitor
- Circuit Tuning
- Self Hosted SCM

### 4.9.1 LPU Manager

The **LPU Manager** tool window is only used when AMT is connected to a LPU. The purpose of the window is to provide the user functionality for programming, verifying and testing FCUs (LMS, SIU and RELIANCE IQ). The functions in this window are only available when the LPU connection in **Connection Manager** is selected.

**Figure 8: LPU Manager**



**LPU Manager** can remotely control the LPU for automatic handling of the programming- and verifying sequences.

**FCU Type** allows the user to select the type of FCU (Field Communication Unit) to be programmed. **LMS** should be selected for LMS and RELIANCE IQ programming and **SIU** selected for SIU programming.

The button **Download Parameters** will start the programming sequence.

For further instructions on programming, see [Programming and test procedure](#).

## 4.9.2 FCU Inspector

In the case where parameters of an individual LMS, SIU or RELIANCE IQ need to be reviewed, edited or verified, the **FCU Inspector** provides access to every parameter and a couple of advanced programming- and verifying tools.

**Figure 9: FCU Inspector**

FCU: TWY7

Parameters

PID number

FCU Type LMS 5.2

BLK1 for LMS 5.2 | BLK2 for LMS 5.2 | BLK3 for LMS 5.2

Parameter Identification	Value
Serial Number	1014
Loop Address	14
Response Timeslot Sync 1	0
Response Timeslot Sync 2	11
Response Timeslot Sync 3	128
Response Timeslot Sync 4	128
Response Timeslot Sync 5	128
Response Timeslot Sync 6	128
Response Timeslot Sync 7	128
Response Timeslot Sync 8	128
RESPONSE	133
Group Address 1	6
Group Address 2	0
Group Address 3	0
Group Address 4	0
Group Address 5	0
Group Address 6	0
Group Address 7	0
Group Address 8	0
Not used	0
Not used	0
Not used	0
Not used	0
Not used	0
Not used	0
Not used	0
Delayed flash MSB	0
Delayed flash LSB	0

Parameter Editor

SERIAL NUMBER = 1014

Assign Serial Number [F10]

FCU Programming

Program FCU [F1]

Target

☐ Manual Target Select

First Loop Address 14

Last Loop Address 14

Target All

FCU Parameter Verification

Verification [F3]

Verification Scope [ Selected Parameter Block ]

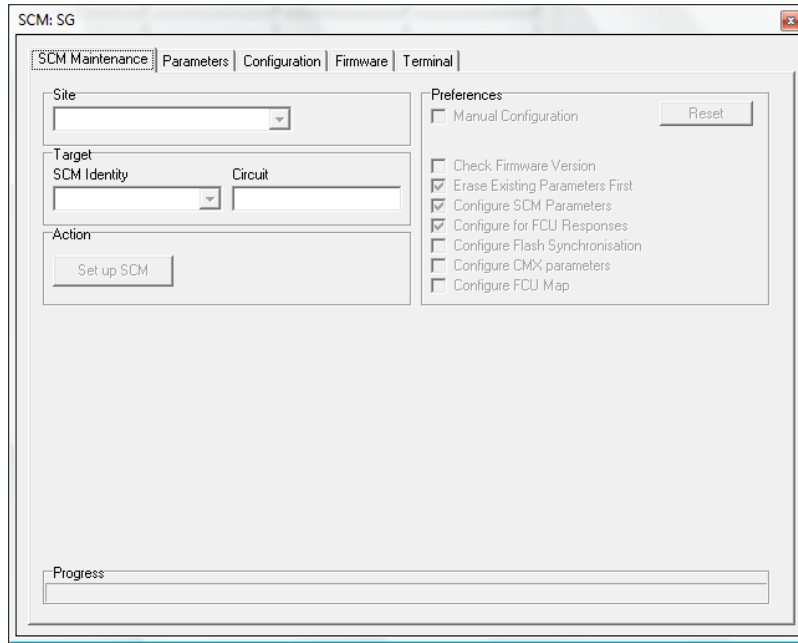
Programming and Verification Scope

- ☒ Selected Parameter Block
- ☐ All Parameter Blocks
- ☐ Complete Parameter Set
- ☐ Selected Parameter(s)

### 4.9.3 SCM Inspector

**SCM Inspector** provides access to individual SCM-parameters and functionality for down- and uploading of these parameters. There is also functionality for downloading new firmware to the SCM.

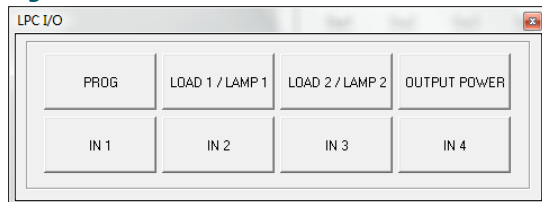
**Figure 10: SCM Inspector**



### 4.9.4 LPC I/O

The **LPC I/O** window provides direct control of certain buttons on the LPC provided. This is mainly for test purpose.

**Figure 11: LPC I/O**

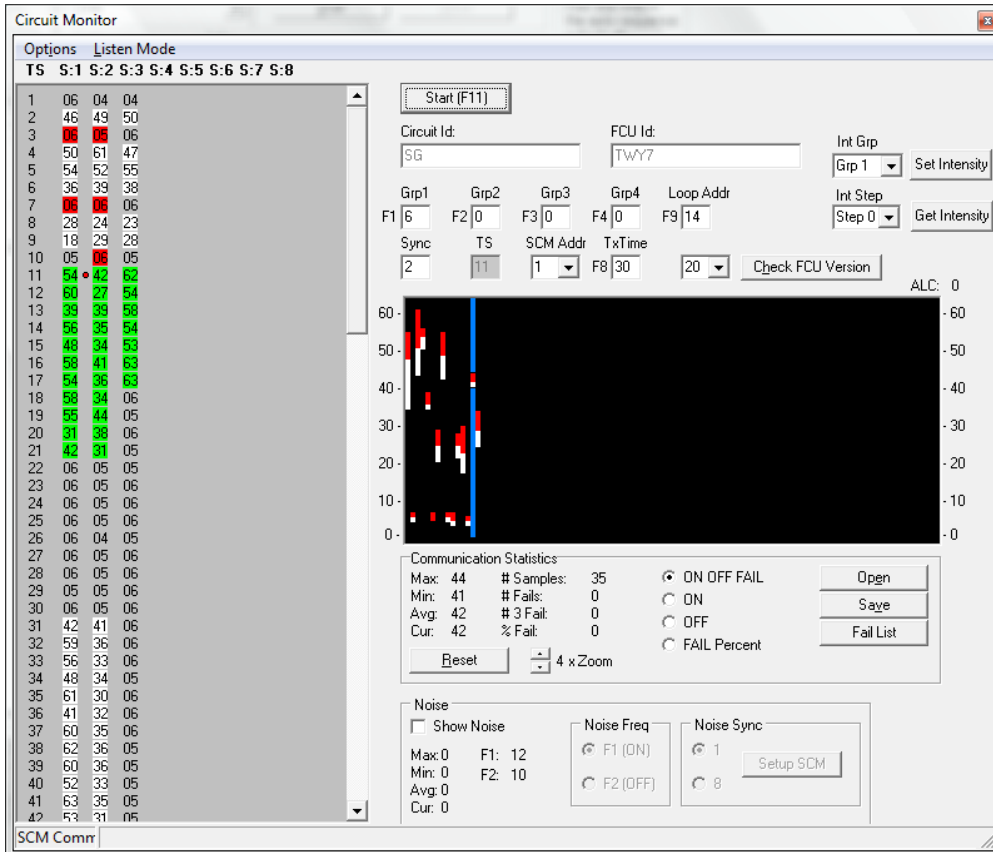




## 4.10 Circuit Monitor

One of the most versatile and useful tools is the **Circuit Monitor**. This tool provides monitoring as well as control of all units on the series circuit to which AMT is connected. The tool provides graphic presentation of signal- and noise levels, statistics and an advanced log function.

**Figure 12: Circuit Monitor**



### 4.10.1 Advanced logging

Data can be logged in a database for later evaluation. That includes raw data as well as status on system level. The logging can be initiated either manually or be programmed to start/stop at a specific time. Every logging sequence is time stamped with start- and stop time. Information about who has initiated the log as well as information about what AMT-version and computer have been used is also saved. The user must also state some Meta Data concerning the series circuit, CCR, filter units etc. If the user wants to, the log can be restricted to only include status changes for the system components. That is an advantage when long logging sequences are carried out, as the amount of logged data will be less extensive.

**Figure 13: DB Capture**

**DB Capture**

**Control**

Start

Pause

**Schedule**

☐ Enable Scheduling

Start: 2010-02-26 11:39:54

Stop: 2010-02-26 11:39:54

Commit

**Meta Data**

AMT 3.3 (Built on: Jan 21 2010, 16:43:56)

susannel OSD-SL

Circuit Note

CCR Note

SFU Note

Comment

### 4.10.2 Review Logged data

By using the **DB Explorer**, the user can navigate to a specific logging sequence to be able to evaluate it. Uppermost in DB Explorer is a list of carried out logging sequences sorted by date. By selecting a sequence in, supplementary details can be added in the Meta Data fields, CCR, SFU and other.

**Figure 14: DB Explorer**

When a specific logging sequence is selected in **Directory**, **Data** will show high level information from the selected circuit, as well as raw data. Every event is individually time stamped. Comments can be added to any event.

**Table 2: The Data window information**

Time Stamp:	Time stamp identifies when data in displayed record was captured.
ID:	FCU ID
Type:	LMS/SIU
State:	Indicates lamp state for LMS and detection state for SIU
State Change:	State change identified with reference to previous record
Level:	Signal level
Com Fail:	Number of communication failures
Com Count:	Number of communication repetitions
Start:	Indicates when capture was started for data to which the displayed record belongs
Comment:	User Comment

To the right in **DB Explorer** there are functions for filtering. Filtering can be based on:

- Date and time
- System ID
- State
- State change
- Signal level

- Communication fail percentage
- System component type
- Comment

Filtering can also be based on a combination of the above, and then only events that fulfill all selected criteria will be shown.

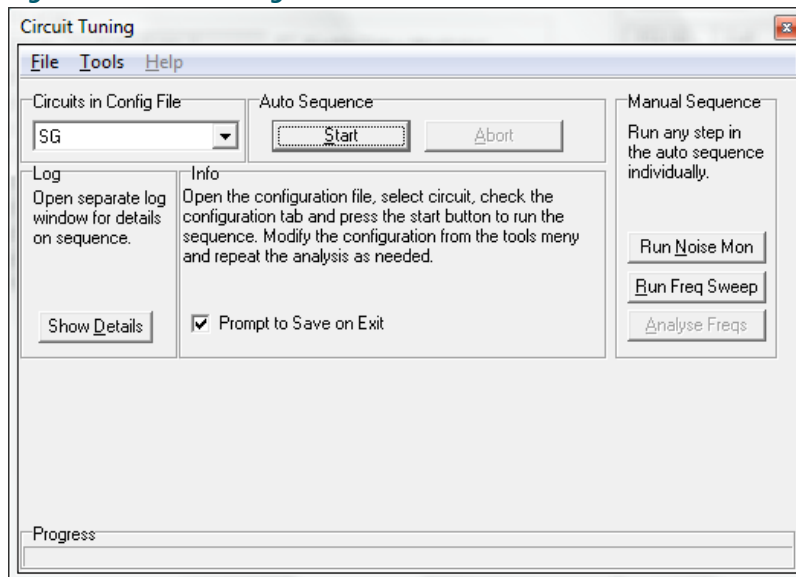
A filtered log can be exported to a separate database that can be sent by email or equivalent. Similarly, data can be imported to an existing database. This data will then be chronologically sorted in relation to the existing data in the database.

Selected log sequence can also be replayed in **Circuit Monitor** to get a graphical view of the communication.

## 4.11 Circuit Tuning

Circuit Tuning is a process that is used at commissioning RELIANCE IL, the **Circuit Tuning** tool provides fully automatic functions for that purpose.

**Figure 15: Circuit Tuning**



## 4.12 Self Hosted SCM

Some types of RELIANCE IL can be configured without an NCU. In those cases, the SCM will handle many of the functionalities that are normally handled by the NCU. The Self Hosted SCM tool includes functionality to configure the SCM as well as monitor the resulting system functionality.

## 4.13 To use AMT

This section describes a number of common tasks, and how to solve them with use of AMT and its functionalities.

### 4.13.1 Maintain LMS/SIU/RELIANCE IQ

To maintain LMS/SIU/RELIANCE IQ is mainly to program spare parts, modify parameters and test suspected malfunctioning units.

The following applies only when using the LPU version consisting of an LPC and an SCM interconnected, for programming LMSs, SIUs, RELIANCE IQs and maintaining SCMs.

Designations for the switches corresponds to SCM 591813B and LPC version 3. [Appendix](#) shows a layout of the different versions of the SCM and LPC.

New designation	Old designation
SCM RS485/RS232	Remote/Local
LPC Remote	Remote/Local
LPC LAMP 1	LOAD 1/LAMP 1
LPC LAMP 2	LOAD 2/LAMP 2

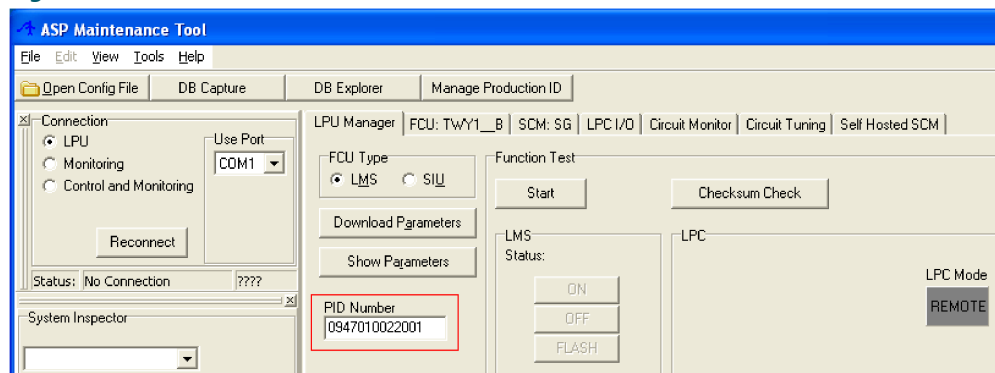
## 4.13.2 Programming and test procedure

### 4.13.2.1 Programming a LMS in Remote Control (Automatic) mode

When programming a large number of LMSs, the Remote Control Mode will help to simplify and speed up the process. In this mode the AMT software will automatically turn the LPC switches on/off, etc. Connect the hardware as described in [Hardware setup for Remote Control Mode](#). In the **Settings** menu it might also be needed to activate the **Remote Control LPC** item.

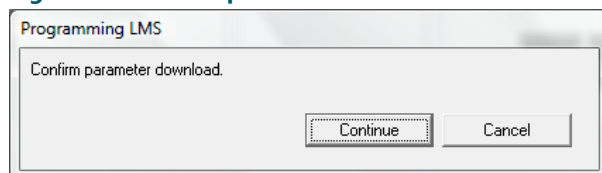
1. At the programming screen, select the correct configuration in the **System panel**.
2. Multiple choices for FCU Type are available, select **LMS**.
3. Release the **LAMP 1** or **LAMP 2** buttons on the LPC if any of the buttons are pressed in.
4. Connect the LMS male connector to an OUTPUT outlet on the LPC.
5. Connect the LMS female connector to an LMS outlet on the LPC.
6. Enter the PID number in the text field. If the LMS does not have a PID label, skip this step.

**Figure 16: Enter PID number, if available**



7. Identify the individual LMS intended to program by using the **Find** function to search for it or by selecting the ID in the System panel list.
8. To start the programming sequence, click **Download Parameters**.
9. To continue the download sequence, click **Continue**, see [Figure 17](#). If needed, click **Cancel** to stop the download sequence.

**Figure 17: Confirm parameter download**



10. A hardware initialization is started. The LMS version is identified and the optimal parameters for communication with the LMS are set. To start the parameter download sequence, click **OK** when the LMS version dialog box is displayed.

If the **Skip Version Control** is active, then no version control is performed.

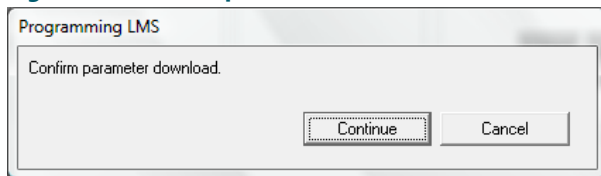
11. After downloading the parameters, which can take up to a minute, a checksum check will be done to ensure that the LMS has received the new parameters. If the checksum is correct a message box is shown to confirm.
12. If the checksum check of downloaded parameters is correct, the LMS may be disconnected and is ready to use.

#### 4.13.2.2 Programming a SIU in Remote Control (Automatic) Mode

If you need to program a large number of SIUs, then the Remote Control Mode will help you to simplify and speed up the process. In this mode the AMT software will automatically turn the LPC switches on/off, etc. Connect the hardware according to instructions, see [Hardware setup for Remote Control Mode](#). In the **Settings** menu you also need to activate the **Remote Control LPC**.

1. At the programming screen you first need to select the correct configuration in the **System panel**.
2. Multiple choices for FCU Type are available, select **SIU**.
3. Release the **LAMP 1** or **LAMP 2** buttons on the LPC if any of the buttons are pressed in.
4. Connect the SIU male connector to an OUTPUT outlet on the LPC.
5. Connect the SIU sensor interface connector to the SIU outlet on the LPC.
6. Identify the individual LMS intended to program by using the **Find** function to search for it or by selecting the ID in the System panel list.
7. To start the programming sequence, click **Download Parameters**.
8. To continue the download sequence, click **Continue**, see [Figure 18](#). If needed, click **Cancel** to stop the download sequence.

**Figure 18: Confirm parameter download.**



9. A hardware initialization is started only if the option **Skip Version Control** is deselected. The SIU version is identified and the optimal parameters for communication with the SIU are set. To start the parameter download sequence, click **OK** when the SIU version dialog box is displayed.

If the **Skip Version Control** is active no version control is performed.

10. After downloading the parameters, which can take up to a minute, a checksum check will be done to ensure that the SIU has received the new parameters. If the checksum is correct a message box is shown to confirm.
11. If the checksum is correct the SIU may be disconnected. To program another SIU repeat this procedure from step 4 above. However, if a message box states that the checksum is incorrect, then reprogram the same SIU unit from step 7 above.

#### 4.13.2.3 Programming a RELIANCE IQ

The programming of parameters is done in the **LPU Manager** window in AMT.

1. Make sure that the Remote button on the LPC is not pressed (off) before you start programming.
2. Connect the RELIANCE IQ male connector to an OUTPUT outlet on the LPC.
3. From the configuration list, select the correct light parameter name to configure.



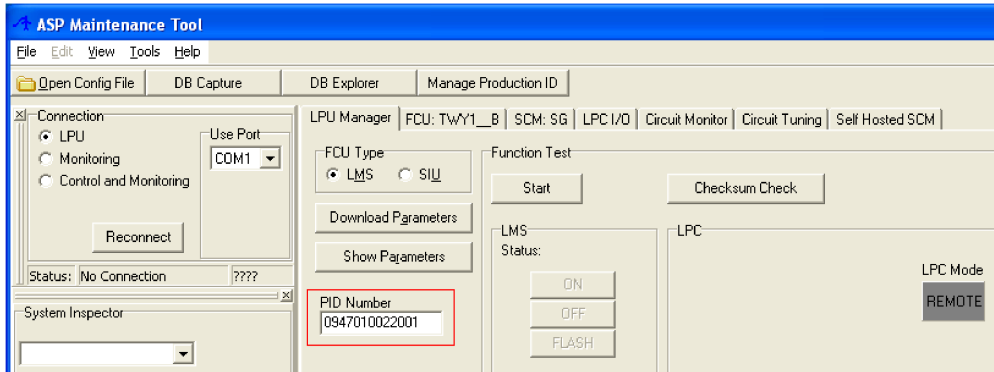
#### Note

The product may require configurations of both sides or only one side. Parameter name \_\_A is for A-side and \_\_B is for B-side of RELIANCE IQ.

4. Check the bottom of the RELIANCE IQ for Production ID (PID) number.

5. Enter the PID number in the text field.

**Figure 19: Enter PID**



6. To start the programming sequence, click **Download Parameters**.
7. To confirm parameter download, click **Continue**, see [Figure 20](#).

**Figure 20: Confirm parameter download**



8. After downloading the parameters, which can take up to a minute, a checksum check will be done to ensure that the RELIANCE IQ has received the new parameters. If the checksum is correct a message box is shown to confirm.
9. If the checksum is correct the LMS may be disconnected. To program another LMS, repeat this procedure from step 4 above. However, if a message box states that the checksum is incorrect then reprogram the same LMS unit from step 7 above.

#### 4.13.2.4 Programming a LMS in Manual Mode

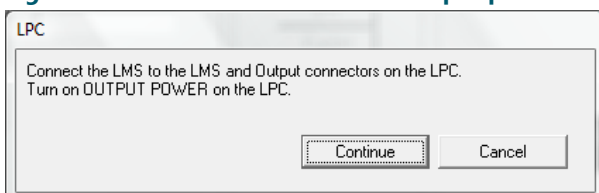


#### Note

The following method can only be used for LMS 591886. For Reliance Intelligent Lighting LMS remote, please use method according to [Programming a LMS in Remote Control \(Automatic\) mode](#).

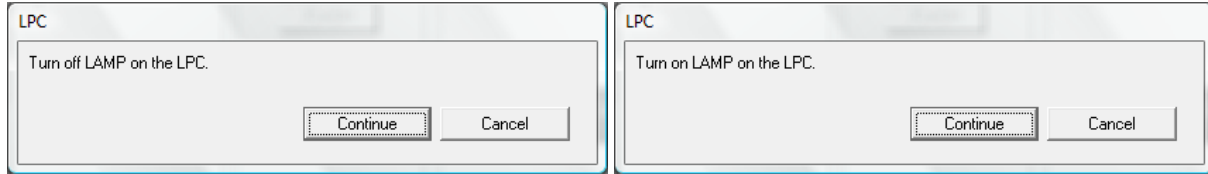
1. At the programming screen, select the correct configuration in the **System panel**.
2. Multiple choices for FCU Type are available, select **LMS**.
3. Connect the LMS male connector to an OUTPUT outlet on the LPC.
4. Connect the LMS female connector to an LMS outlet on the LPC.
5. Identify the individual LMS intended to program by using the **Find** function to search for it or by selecting the id in the System panel list.
6. To start the programming sequence, click **Download Parameters**.
7. A message box is shown as a reminder to turn on the OUTPUT POWER on the LPC, see [Figure 21](#).

**Figure 21: Reminder to turn on the output power**



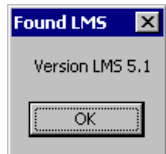
8. Follow the instructions on the screen for controlling the LAMP switch on the LPC, see [Figure 22](#).

**Figure 22: Lamp control**



9. A hardware initialization is started only if the option **Skip Version Control** is deselected. The LMS version is identified and the optimal parameters for communication with the LMS are set. To start the parameter download sequence, click **OK** when the LMS version dialog box is displayed, see [Figure 23](#).

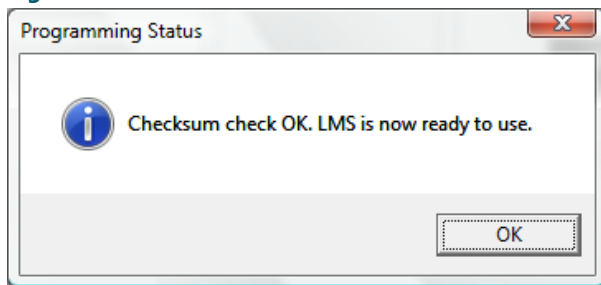
**Figure 23: Found LMS**



If the **Skip Version Control** is active, no version control is performed.

10. After downloading the parameters, which can take up to a minute, a checksum check will be done to ensure that the LMS has received the new parameters. If the checksum is correct a message box is shown to confirm, see [Figure 24](#).

**Figure 24: Checksum OK**



11. If the checksum is correct the LMS may be disconnected. To program another LMS, repeat this procedure from step 3 above. However, if a message box states that the checksum is incorrect, then you need to reprogram the same LMS unit from step 6 above.

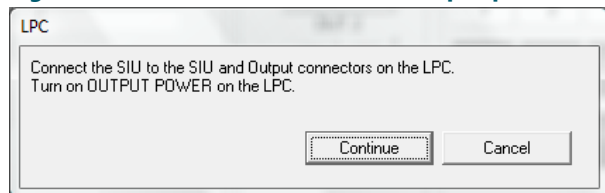
#### 4.13.2.5 Programming a SIU in Manual Mode

1. At the programming screen, select the correct configuration in the **System panel**.
2. Multiple choices for FCU Type are available, select **LMS**.
3. Release all the **IN** and **OUT** buttons as well as **LAMP 1** and **LAMP 2** on the LPC, if any of the buttons are pressed in.
4. Connect the SIU male connector to an OUTPUT outlet on the LPC.
5. Connect the SIU sensor interface connector to the SIU outlet on the LPC.
6. Identify the individual LMS intended to program by using the **Find** function to search for it or by selecting the id in the System panel list.
7. To start the programming sequence, click **Download Parameters**.



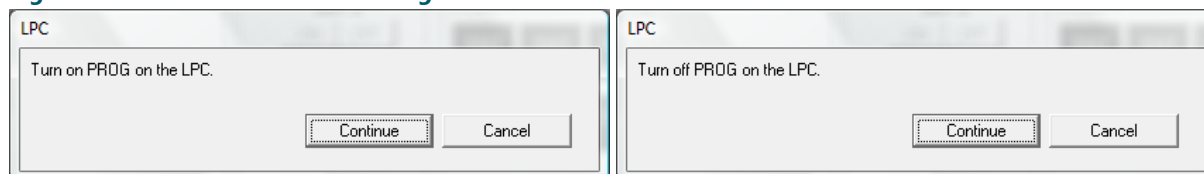
8. A message box shows a reminder to turn on the OUTPUT POWER on the LPC, see [Figure 25](#).

**Figure 25: Reminder to turn on the output power**



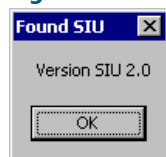
9. Follow the instructions on the screen for controlling the PROG switch on the LPC, see [Figure 26](#).

**Figure 26: Instructions for controlling the PROG switch**



10. A hardware initialization is started only if the option **Skip Version Control** is deselected. The SIU version is identified and the optimal parameters for communication with the SIU are set. Click **OK** to start the parameter download sequence, see [Figure 27](#).

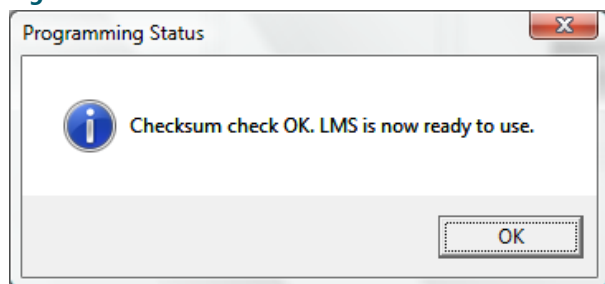
**Figure 27: Found SIU**



If the **Skip Version Control** is active no version control is performed.

11. After downloading the parameters, which can take up to a minute, a checksum check will be done to ensure that the SIU has received the new parameters. If the checksum is correct a message box is shown to confirm, see [Figure 28](#).

**Figure 28: Checksum check OK**



If the **Skip Version Control** is active, no version control is performed.

12. If the checksum is correct the SIU may be disconnected. To program another SIU, repeat this procedure from step 4 above. However, if a message box states that the checksum is incorrect, then reprogram the same SIU unit from step 7 above.

## 4.14 Testing functions

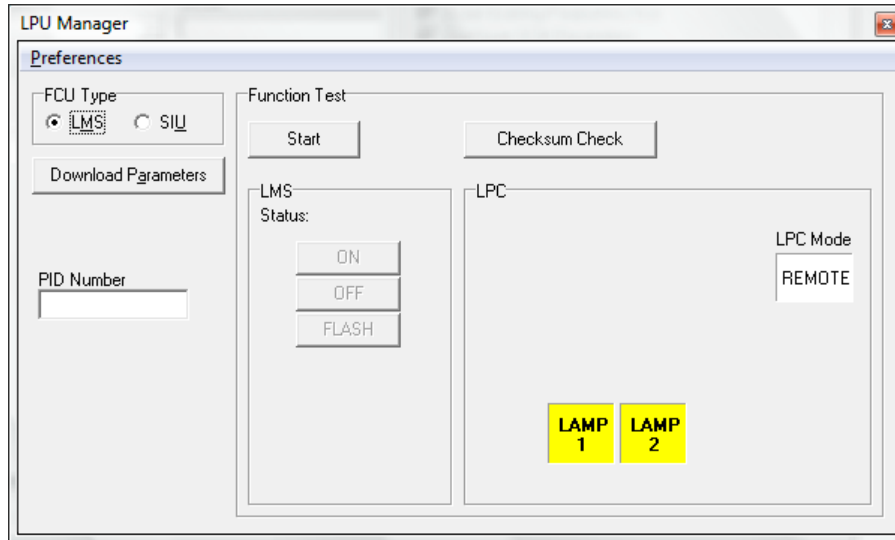
If **Remote Control Mode** is used the three test functions described below will automatically operate the switches on the LPC. If however **Manual Mode** is used the user has to manually operate the OUTPUT POWER switch on the LPC.

The **Remote** button can also be used to set if **Remote Control Mode** should be used or not. Note that the Remote switch on the LPC must be set to the same position.

#### 4.14.1 LMS function test

1. Choose the correct FCU ID in the list.
  2. Click **Start** to start the communication with the LMS. The status returned from the LMS is shown to the right of **Status**.  
There are three different status: ON (also implies to FLASH), OFF and LAMP FAIL (also implies FLASH), OFF and LAMP FAIL (also implies communication Error).
  3. If **Remote Control Mode** is activated, click on the **LAMP 1 / 2** buttons to disconnect the lamp. The LMS should then report LAMP FAIL.
- If **Remote Control Mode** is *not* activated the user must manually control the LAMP 1 and 2 buttons on the LPC.

Figure 29: LPU Manager



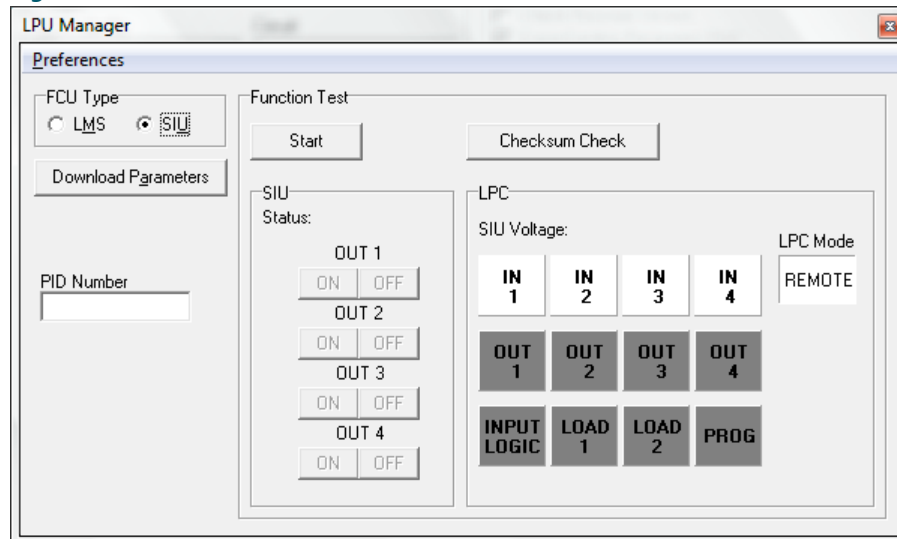
#### 4.14.2 SIU function test

There are three different states: *Detect*, *No Detect* and *Com. Error*.

There are eight buttons for controlling the four outputs ON and OFF (OUT 1 to OUT 4). Only the outputs that are controllable in the SIU parameters are enabled.

1. Choose the correct FCU ID in the list.
2. Click **Start** to start the communication with the SIU. The status returned from the SIU is shown to the right of **Status**.

**Figure 30: Function test**



#### 4.14.3 Remote control mode

**SIU Voltage** shows the SIU output voltage. For a more accurate reading, use the multimeter connection on the LPC.

IN 1 to IN 4 control the SIU inputs on the LPC. The color of the text in the buttons states what status the SIU is reporting for that particular input:

- **Black font:** Waiting for report from SIU
- **Green font:** The SIU reports with the same status as the current input
- **Red font:** The SIU reports with incorrect status

INPUT LOGIC has the same function as the corresponding switch on the LPC. That is to choose if the buttons IN 1 to IN 4 should be lit or not when the button is pressed in.

LOAD 1 and LOAD 2 is used for loading the SIU voltage output. The voltage shown to the right of **SIU Voltage** may drop slightly if any of the loads are activated. The load will automatically be turned off after about 10 seconds.

PROG has currently no function in **Remote Control Mode**.

#### 4.14.4 Manual mode

IN 1 to IN 4 shows the SIU reported status for that particular input. The answer is coded in three colors:

- **Green font:** The SIU reports that the current input is on
- **Orange font:** The SIU reports that the current input is off
- **Red font:** The SIU does not answer

### 4.15 SCM Maintenance

The following chapters describes the replacement of an SCM-board or an entire SCM unit and thereto-related configuration.

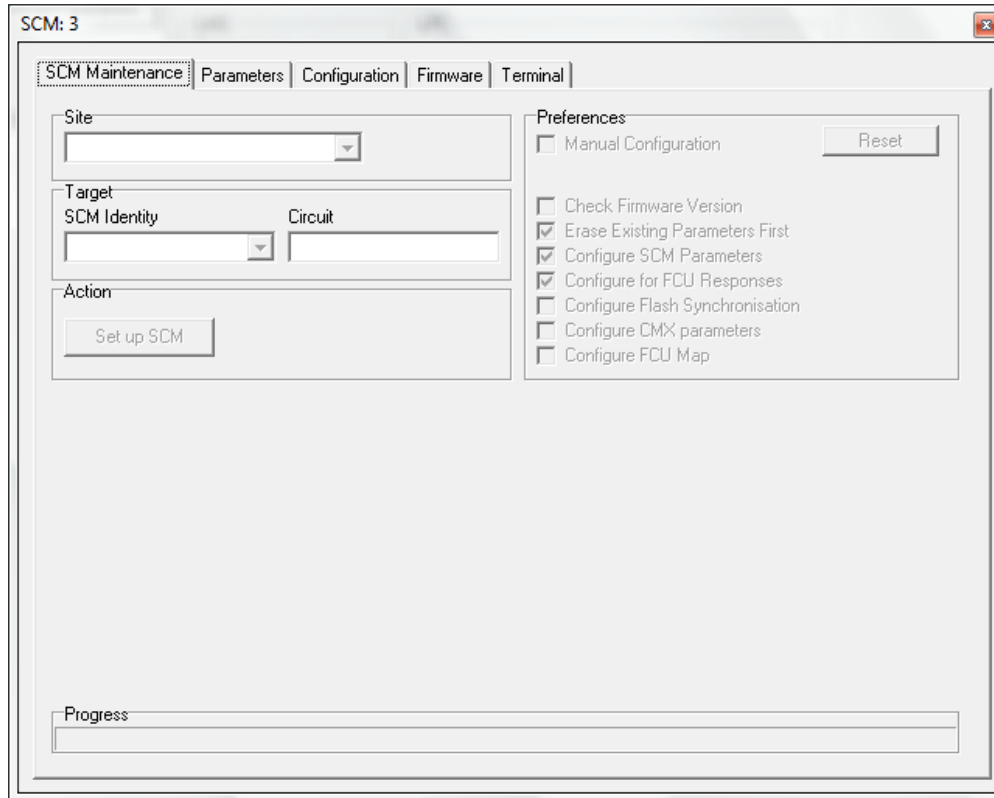
An SCM-board or an SCM unit is configured, through software, in accordance with the requirements set by the individual RELIANCE IL in terms of functionality and performance. This implies that if an SCM-board or an SCM unit is replaced the new board/unit will have to get a configuration matching that of the replaced board/unit for correct function in the system.

The configuration process consists of a few steps, of which two are described in [Loading SCM Configuration](#) and [Loading SCM Parameters](#), all possible to perform independently and/or manually if needed. To facilitate the configuration process AMT supports an automatic configuration process where the user only has to specify which SCM to configure.

#### 4.15.1 Activating SCM Maintenance

For correct operation make sure that the SCM about to be configured is connected to the PC running AMT before **SCM Maintenance** is activated. When the SCM is connected, check that it is powered on and confirm the position of the switch marked Local/Remote <sup>2</sup> to be Local. Activate SCM Maintenance from within AMT by selecting **SCM Configuration** from the menu or press F1.

**Figure 31: SCM Maintenance view from AMT**



**SCM Maintenance** display is divided into three separate areas, see [Figure 31](#). The top left portion contains the **Site**, **Target** and **Action** panels, where site and SCM-target units are selected to specify the SCM to configure. The **Set Up SCM** button starts the configuration process.

The **Preferences** area, to the right, contains a range of options for customizing the configuration process. Normally the check box labeled **Manual Configuration** is unchecked. Note that depending on how AMT is configured the Manual Configuration option may not be available, and then the panel is empty.

The **Status** information, at the bottom, is a log file window. The log file shows all user actions as well as configuration process status and error messages. Note that the log file is saved every time AMT is terminated, hence it shows SCM Maintenance history in addition to current activities.

A **Progress** indicator is located below the Status information window.

<sup>2</sup> When the frequency sweep sequence has ended, AMT will start to download the best set of frequency parameters to each individual LMS. There may be a few LMS's that AMT has failed to find any frequencies to use, which can for example be due to that those LMS's are failing. Assignment of parameters to those LMS's must therefore be done manually. The Earlier versions of the SCM-board have the switch marked Local/Remote, which corresponds to RS232/RS485.

### 4.15.2 SCM Maintenance sequence

The process consists of three simple steps, provided that AMT is communicating with the SCM-board to be configured.

1. Select site and SCM from the combo boxes labeled **Site** and **Target**. The circuit associated to the selected SCM is shown to the right of the **Target** combo box.
2. Start the configuration process by pressing the **Set Up SCM** button. The configuration is normally completed in two to ten seconds.
3. Verify the proper completion of the configuration process by observing the messages displayed in the **Status** window.

### 4.15.3 Troubleshooting SCM Maintenance

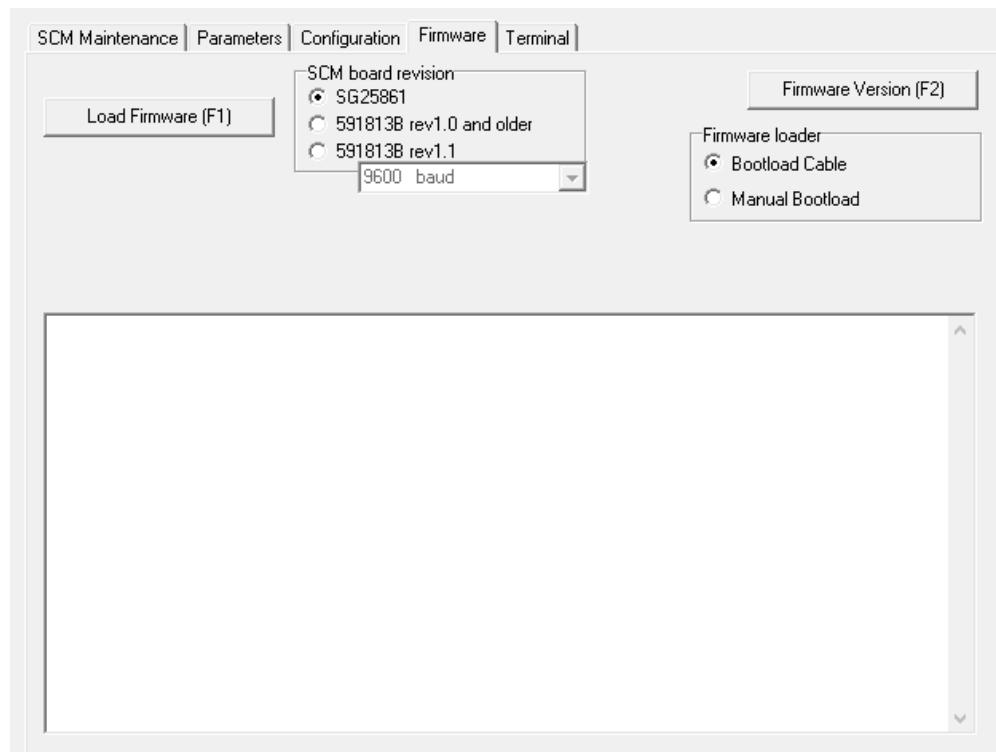
The SCM Maintenance feature in AMT relies on the existence of an INI-file, which contains the site specifics of the configuration process. Secondly all individual SCM configuration files for the particular site(s) must be available to AMT. Both the INI-file and the SCM configuration files are normally included in the AMT-distribution for a particular site.

If any of these files are missing or if there is any other kind of problem the Status window will display detailed information about the problem. To solve the problem please contact ADB SAFEGATE support for assistance.

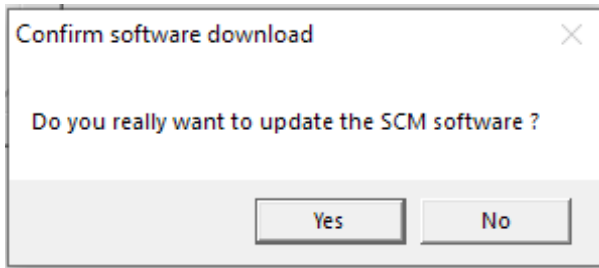
## 4.16 Loading SCM Firmware

<b>Load Firmware</b>	Starts loading of software to the SCM.
<b>Firmware Loader</b>	Sets the way the SCM is set to firmware loading mode. The option bootloader cable should always be used.
<b>Firmware Version</b>	Shows the software version of the currently loaded firmware in the SCM.
<b>Cancel</b>	Cancels a firmware download.

1. To load firmware to an SCM make sure the correct board revision is selected
2. Make sure **Firmware Loader** is set to **Bootload Cable**.



3. Click **Load Firmware** and select the correct firmware file with the filename format S-records.
4. To confirm downloading of new software, click **Yes** in the dialogue box.



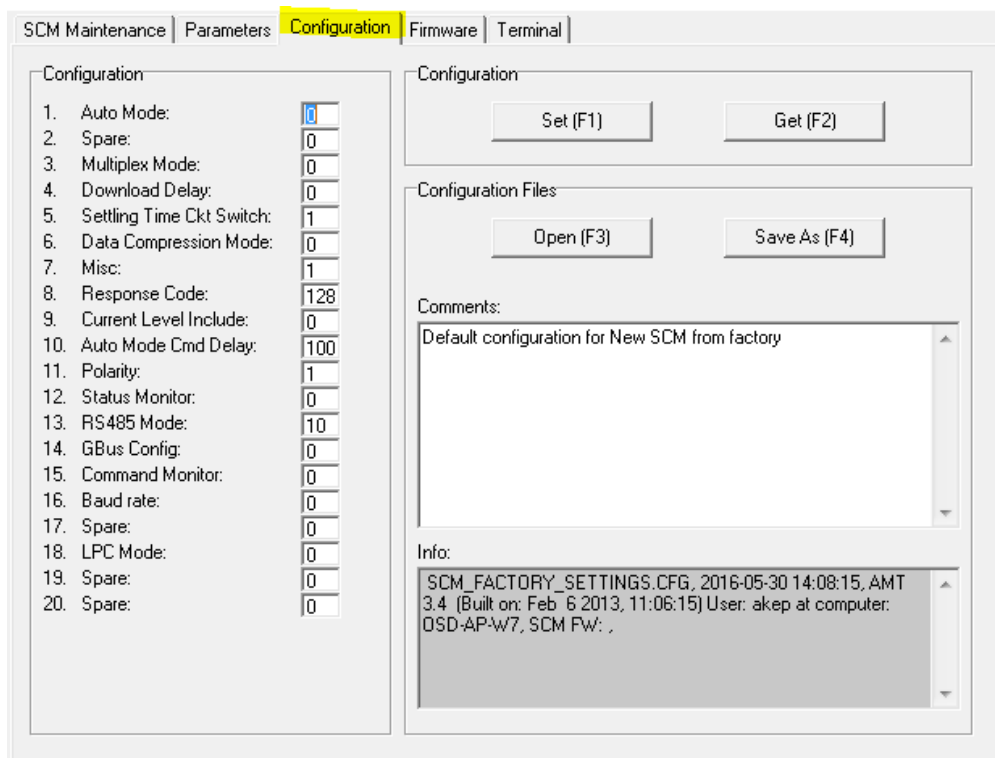
5. Wait for the update to complete, the download may take up to four minutes to complete
6. **Firmware installation completed successfully** will be shown in the message box if the operation is successful.

## 4.17 Advanced Maintenance

The following chapters describe the manual loading of parameters to the SCM. These functions shall only be used if the user has the right knowledge and has been educated for this purpose.

### 4.17.1 Loading SCM Configuration

- **Set:** Sends the SCM configuration currently shown on the screen to the SCM
- **Get:** Receives the configuration from the SCM and shows it on the screen
- **Open:** Opens an SCM configuration file and shows it on the screen
- **Save:** Saves the currently shown configuration on the screen to a file
- **Comments:** In this field general information can be added and saved with the configuration file
- **Info:** This field shows information from the last time the configuration file was saved



1. Press **Open** to select the SCM configuration file (file extension CFG).
2. Press **Set** to send the configuration file to the SCM.



### Note

If the SCM configuration settings are changed remember to save the new settings.

Save the old settings to a *changed* name file and the new settings to the *existing* file name. To make the SCM maintenance work as intended, make sure to save the new settings with the same filename as before. If not, the SCM configuration file will *not* be read automatically when using SCM maintenance function.

## 4.17.2 Loading SCM Parameters

- **Set:** Sends the parameters currently shown on the screen to the SCM
- **Get:** Receives parameters from the SCM and shows them on the screen
- **Open:** Opens an SCM parameter file and show the parameters on the screen
- **Save:** Saves the currently shown parameters on the screen to a file
- **Erase all SCM parameters:** Erases the parameter sets for all modem addresses in the SCM
- **Erase SCM parameter set:** Erases the parameter set for the SCM address specified in the Unit Number field
- **SCM ID:** In this field a description of the SCM be added and saved with the parameter file

- **Comments:** In this field general information can be added and saved with the parameter file
- **Info:** Shows information from the last time the parameter file was saved

1. Press **Open** to select the SCM parameter file (file extension SCM).
2. Press **Set** to send the parameter file to the SCM.

### **i** Note

If the SCM parameter settings are changed, remember to save the new settings.

Save the old settings to a *changed* name file and the new settings to the *existing* file name. To make the SCM maintenance work as intended, make sure to save the new settings with the same filename as before. If not, the SCM configuration file will *not* be read automatically when using SCM maintenance function.

## 4.18 Circuit Maintenance

The term Circuit Maintenance refers to circuit monitoring and circuit tuning.

Circuit tuning is the process tuning the communication between the field- and the vault-units, i.e. the LMSs, SIUs and the SCMs, in RELIANCE Intelligent Lighting (IL).

Circuit monitoring includes low level RELIANCE IL performance monitoring.

Both circuit tuning and circuit monitoring are always performed during RELIANCE IL commissioning. In addition, especially circuit monitoring is an essential and powerful tool when doing RELIANCE IL troubleshooting.

## 4.19 Circuit Monitor

### **i** Note

The circuit monitor is intended for advanced users only.



The Circuit Monitor feature in AMT provides a user-friendly interface to low-level RELIANCE IL performance monitoring. It supports the following:

- Circuit communication monitoring with communication statistics and log functions
- Command interface for sending ON/OFF and FLASH-commands
- LMS and SIU version query support

The best way to learn how to make the most use of the Circuit Monitor is to actually use it.

This section provides a walk-through to present the basic properties and procedures associated with the Circuit Monitor functionality in AMT.

#### 4.19.1 Monitoring Circuit Communication

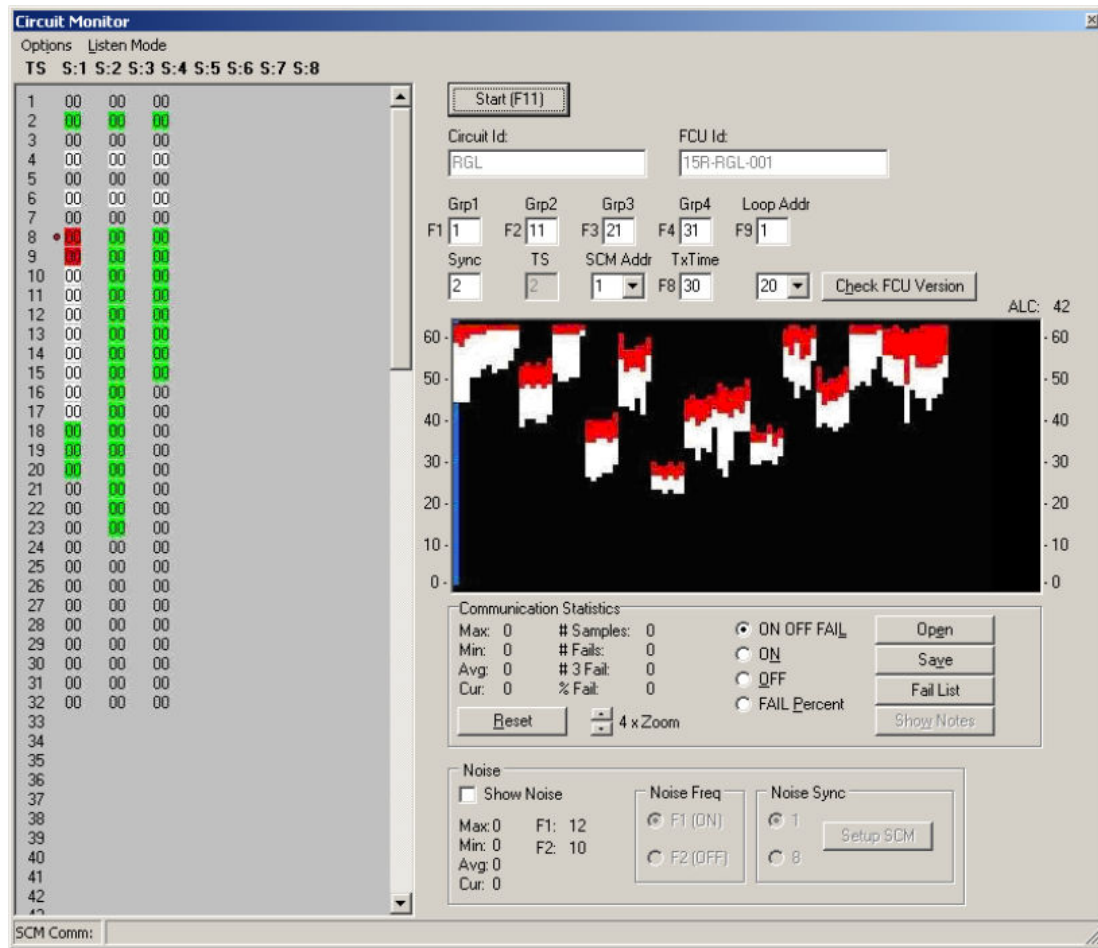
The left half of the **Circuit Monitor** screen, see [Figure 32](#), contains a matrix where the rows correspond to time slots (TS) and the columns to sync words (S:). In every location where a time slot and a sync word meet, an FCU can be configured to communicate.

Start the communication sequence by clicking the **Start** button or **F11**. Depending on the system configuration file content one or several columns will soon be filled with signal level data. A red dot indicates the time slot and sync word combination for the FCU currently selected in the **FCU Id** box. By selecting another **FCU Id** the red dot will change location based on the communication parameters of the FCU selected. Note that whether FCUs are in sequence or not, with reference to time slots and sync word numbers, depend on the configuration.

The number next to the red dot is the received signal strength for the selected FCU. The color indicates the commanded state. Green corresponds to ON (or DETECTION if it is a SIU), e.g. 43, and white to OFF (or NO DETECTION if it is a SIU), e.g. 45. A communication problem with the selected FCU is indicated with a red color, e.g. 05.

All system events, such as status changes or orders, are logged in the window at the bottom of the main log window. The log window can be enlarged by dragging the vertical splitter bar up or down.

**Figure 32: Circuit Monitor Screen**



In the middle to the right a graphical presentation of the signal levels is displayed. A blue cursor indicates the position of the FCU currently selected. A zoom feature allows the user to zoom-in on or zoom-out off the graph.

The panel below the graph, labeled **Communication Statistics**, displays the following numerical statistics for the selected FCU:

- Maximum signal level value monitored, Max.
- Minimum signal level value monitored, Min.
- Average signal level value monitored, Avg.
- Number of communication cycles, #Cycles.
- Number of communication dropouts, #Fails.
- Number of communication dropouts three in a row, #3Fail.
- Percentage of communication failures, %Fail.

By clicking the **Reset** button, statistics are reset and communication cycle counter restarts from zero.

All statistics graphically presented can be filtered to a certain degree. The type of filter used is controlled by the four item radio buttons below the graphical display where:

- ON OFF FAIL, considers signal levels for all report states, i.e. ON and OFF and in addition communication failure (FAIL).
- ON, filters out all data except signal levels received where the matching state is ON.

- ON, filters out all data except signal levels received where the matching state is OFF.
- FAIL Percentage, displays only fail percentage data.

By clicking the **Fail List** button a list of all FCUs with a least one communications failure will be displayed.

Statistics can be saved for later processing by clicking the **Save** button. When doing so the user will have the possibility to enter some comments, which will be saved with the data.

**Figure 33: Circuit Monitor Screen**

Log File Notes

Date and time: 2002-01-31 14:09:03

SCM Config: 0,0,0,0,1,0,0,128,0,100,1,0,15,0,0,0,0,1,0,0,

SCM Params: 0,10,8,6,5,1,61,15,30,150,0,61,86,255,1,0,0,0,0,0,

SCM Software: \$Name: R5H \$, \$Date: Jan 14 2002 13:47:12 \$, \$State: Exp \$

SCM Version: 6023

Circuit Id: TC395

CCR Step: Step 1

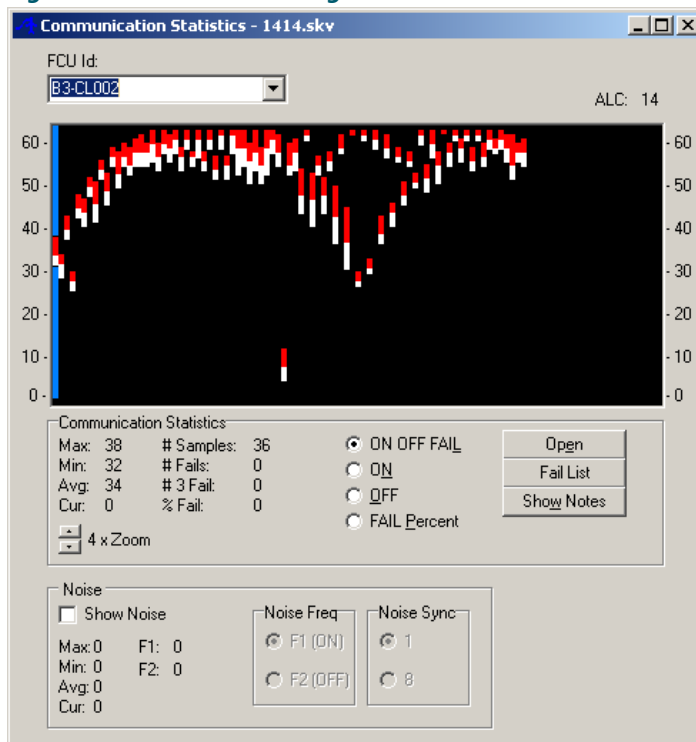
SFU Notes: None

Notes: On and off samples

OK Cancel

Data recorded at a previous occasion may be displayed graphically at any time by opening the corresponding log file by clicking the **Open** button, the log viewer window will then be shown. To view the log file notes saved with the data, click **Show Notes**.

**Figure 34: Circuit Monitor log file viewer**



#### 4.19.2 Evaluation of monitored communication

To be able to evaluate if monitored signal levels are good or bad, the signal levels must be related to a threshold value. This threshold value determines if a lamp/FCU shall be reported as failing, i.e if its signal level is lower than the threshold value. This threshold is normally set right between the lowest signal level for any FCU on the circuit and the noise level of the background noise that always exist on a series circuit. The threshold value is defined among all other SCM parameters, and is called Minimum Detection Level (MDL), and must not be modified without consulting a very advanced user.

To find out the noise level on a series circuit can only be done by a very advanced user, because the noise level is dependent on a number of things, e.g. CCR-intensity, noise crosstalk from nearby circuits, system configuration etc. A simplified method is to measure the noise level on a series circuit is to look at an empty syncword-timeslot-combination in the signal level-matrix, such a position can normally be found for timeslots in the first row of the matrix. The signal level that is presented in an *empty* timeslot syncword-timeslot-combination is the noise level, note that this noise level is not graphically presented but can only be read in the matrix.

Generally can be said that:

1. If the signal level from a FCU is constantly below the threshold value, signal level marked red, indicates that there is a faulty lamp/LMS .
2. If the signal level from an FCU varies between red marking and green or white marking, may (or may not) indicate that the FCU or cabling/contacts to the FCU are faulty.

Note that if situation 1 arises, it implies that the faulty lamp/LMS also is reported and presented in the host control system and to correct that problem, the normal maintenance procedures shall be performed.

If on the other hand the situation 2 arises, that must not necessarily mean that it is reported and presented to the host control system. This situation may (or may not) indicate a potential problem. A very advanced user should be consulted.

## 4.20 Sending Commands

The upper right corner of the circuit monitor display contains a number of buttons dedicated to various kinds of commanding of the FCUs on the series circuit being monitored.

To command an individual FCU select it from the **FCU Id** box and press:

- F9 to turn the lamp off
- Ctrl + F9 to turn the lamp on
- Shift + F9 to flash the lamp

Note that **Loop Address Cmd** must be selected in the **Settings** menu before this type command can be used. All FCU-types does not support this type of command.

To command a group to which a particular FCU belongs, select the FCU from the **FCU Id** box and press:

- Fx to turn the lamp off
- Ctrl + Fx to turn the lamp on
- Shift + Fx to flash the lamp

Since an FCU can belong to several different groups replace Fx above with F1, F2, F3 or F4 depending on the configuration for the FCU selected. Note that a group command will most likely affect other FCUs on the circuit apart from the one selected.

## 4.21 FCU Version Query

An FCU version query checks the firmware version for a selected FCU. First select the firmware version you would like to check in the list to the left of the **Check FCU Version** button and then click the button. The responses from the selected sync word are displayed in the response matrix to the left. This implies that even though a particular FCU is of interest all FCUs on the same sync word will respond. A green response color corresponds to a matching firmware version while an amber response color corresponds to a mismatch.

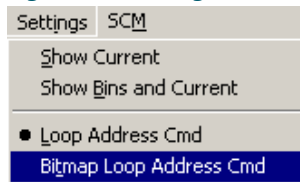
## 4.22 Menu Command Reference

Selecting **Settings** from the menu and four options will display:

- **Show Current:** Shows the approximate current in amperes. This function *will* need a change in one of the SCM parameters to work.
- **Show Bins and Current:** Shows the approximate current in amperes. This function will *not* need a change in one of the SCM parameters to work.

- **Loop Address Cmd:** Enable/disable this particular type of command.
- **Bitmap Loop Address Cmd:** Outside the scope of this document. Always disabled.

**Figure 35: Settings menu**



## 4.23 Other Commands

The circuit monitor function in AMT supports apart from the above-mentioned commands and features some additional ones. Since they are intended for very advanced users only they are outside the scope of the document.

One such feature is the **TxTime** button to the left of the **Check FCU Version** button or the Show Noise function at the bottom of the screen.

## 4.24 Advanced functions

The advanced functions are part of AMT Pro and are only available for privileged or administrator users.

### 4.24.1 FCU Maintenance

Not all versions of AMT support **FCU Maintenance** as described below.

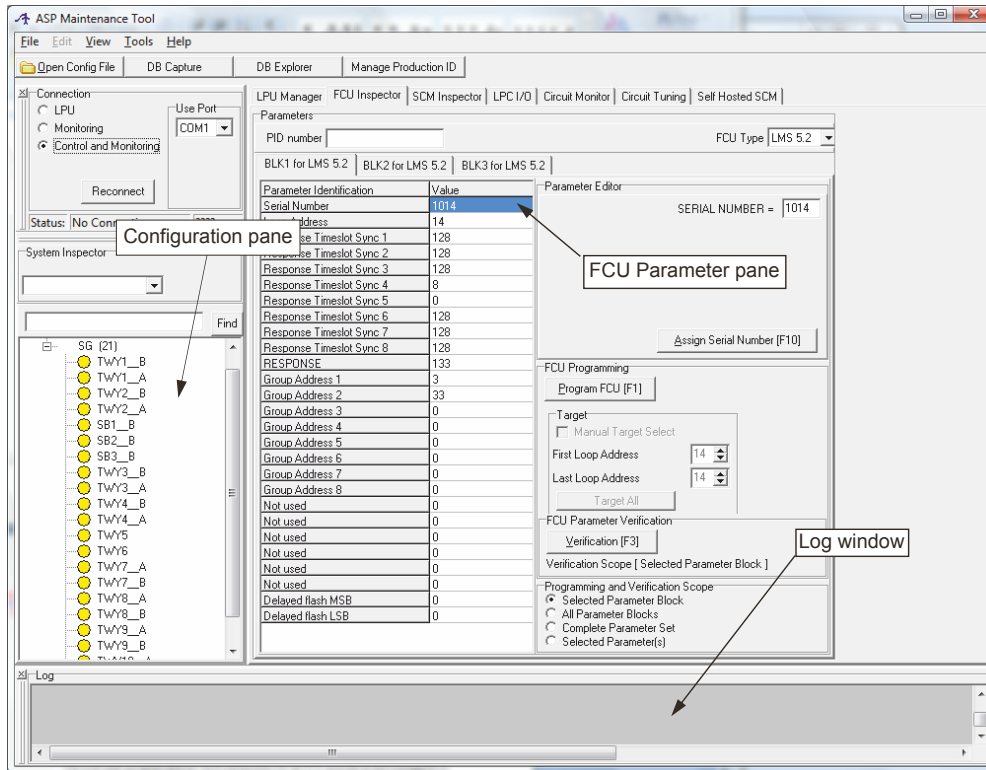
The term FCU Maintenance refers, in this document, to the process of working with LMS- or SIU-parameters in terms of modification and/or verification.

#### 4.24.1.1 User Interface

The **FCU Maintenance** user interface consists of three main components; the parameter pane, the configuration pane and the log window.

It is possible to adjust the size of the window according to preferences.

**Figure 36: AMT user interface**



#### 4.24.1.2 The Configuration pane

In order to use the configuration pane a configuration file is needed. If this type of file is available, load the file by clicking **Open Config File**. AMT will automatically or semi-automatically convert older version configuration files. In the latter case the user will be prompted for additional information.

From the configuration file, in the **Configuration** pane, the user may select an individual FCU by clicking on it. This will transfer the parameters for the selected FCU to the **Parameter** pane.

The user may program and/or verify parameters for an FCU present in the configuration file.

Programming and verification is always performed on FCU-level in the configuration pane as opposed to parameter or parameter block level in the FCU parameter pane.

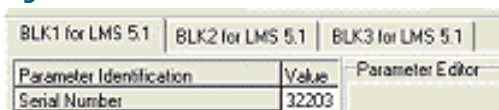
If no configuration file exists the user will still be able to perform FCU Maintenance from the FCU Parameter pane.

#### 4.24.1.3 The FCU Parameter pane

The FCU **Parameter** pane is basically a parameter editor which allows the user to modify (program) and verify parameters for several FCU-types.

The user selects the FCU-type from the combo-box in the upper right hand corner of the FCU Parameter Pane.

**Figure 37: Combo-box**



The tabbed parameter set will automatically reflect the properties of the FCU-type selected both in terms of the number of parameter sets and the parameters contained therein.

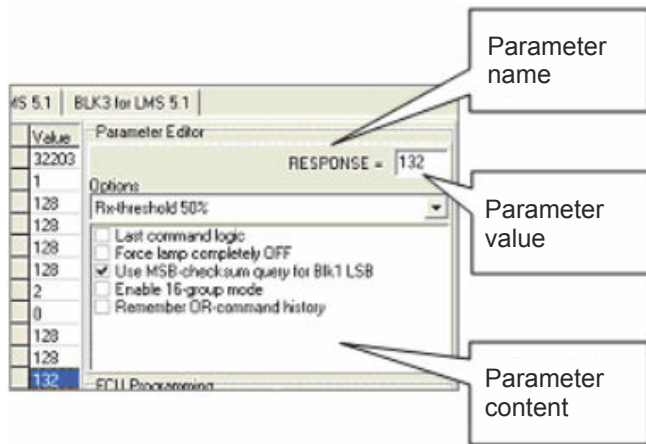
Furthermore, the programming and verification options will adjust to correspond to the capabilities of the FCU-type currently selected. When switching from one FCU-type to another the parameter values for the type switched out are saved.

## Editing Parameter Values

To edit a particular parameter value the user has to first select the tab which contains the proper parameter block and then select the parameter.

When a parameter is selected the **Parameter Editor** panel will show all the options associated with the particular parameter. The user may enter the parameter value directly or select and/or check/uncheck the options presented.

**Figure 38: Parameter Editor**



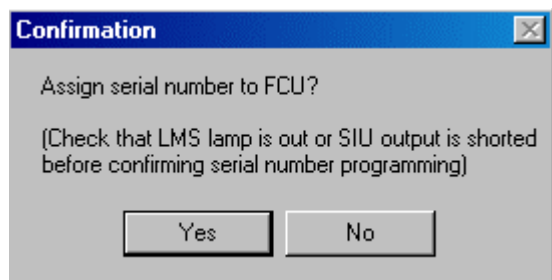
## Programming Parameter

The programming options vary depending on the capabilities of the FCU-type selected. In general terms on older FCU-type supports less sophisticated options.



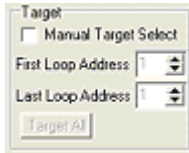
The basic programming options allows for programming an individual parameter block or a full parameter set. The more advanced programming options supported by the newer FCU-types include single parameter programming and subset programming including target range selection. The user selects what to program from the *Programming and Verification Scope* radio buttons. The options available are:

- *Selected Parameter Block* which will program the complete parameter block visible on the currently selected tab.
- *All Parameter Blocks* which will program all parameter blocks on all tabs applicable to the selected FCU-type.
- *Complete Parameter Set* which will program all parameter blocks exactly as *All Parameter Blocks* but in addition include *Serial Number Programming* or any other type of programming which require the user to perform manual procedures like for example removing the lamp or shorting the SIU output. In this case the user is notified a requested to confirm the action before proceeding. *Complete Parameter Set*-programming is usually only executed when a FCU is replaced and hence not when connected to the series circuit but to an LPU.



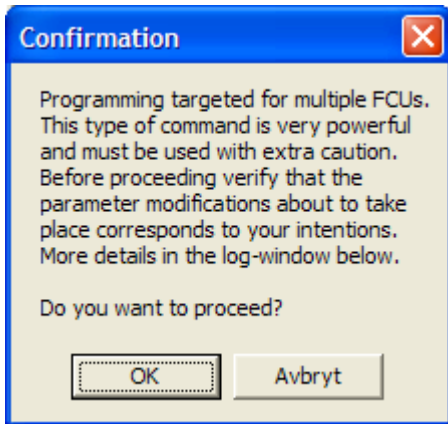
- *Selected Parameters* which programs only the parameter(s) currently selected by the user. The user may select several parameters in one parameter block by holding down the <shift>-key and pressing the ↓-key one or more times. If multiple parameter selection isn't supported by the selected FCU-type or parameter block the selection will disappear as soon as the <shift>-key is released.

In cases where the user may program a set of FCUs with the same parameters the **Target** panel will be visible and enabled. The default selection is the currently selected FCU.



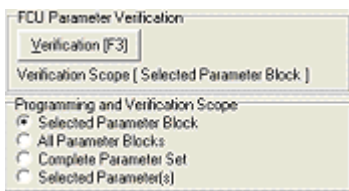
The user is also given the opportunity to confirm actions which requires extra care, which is the case for target ranges including multiple FCUs.

Finally, to invoke the programming press the *Program FCU*-button or F1.



## Verifying Parameters

Verifying parameters uses the same procedure as for the programming. The user selects the scope for the verification from the same radio-buttons used for selecting the programming scope. The options available will depend on the FCU-type selected and its capabilities.



The most basic verification is single parameter block verification which is supported by all FCU-types. More advanced is the single parameter or parameter subset verification.

Finally, to invoke the verification press the *Verification*-button or F3.

## 4.25 Circuit Tuning



### Note

The circuit tuning tool is intended for advanced users only.

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### 4.25.1 Why circuit tuning?

#### 4.25.1.1 RELIANCE Intelligent Lighting power cable communication

RELIANCE Intelligent Lighting is designed to provide individual monitoring of airfield lighting using the series circuit as a means of communication for the monitored status of the lamps and sensors in the airfield.



All series circuit communication signaling information is provided by the Network Concentrator Unit (NCU) and passed on through a Series Circuit Modem (SCM) to a standard isolation transformer which interfaces the signaling to/from the series-circuit. A Series Circuit Filter (SCF) is connected across the constant current regulator (CCR) series circuit output and is used to contain the signaling within the airfield circuit and minimize feedback into the regulator. Communications between the SCM and the LMS and SIU in the airfield is provided by power line carrier, where the signals are interfaced to the series-circuit power cable through a standard isolation transformer connected to the SCM and the same in the airfield for each LMS/SIU.

The communication between SCM and LMS/SIU on the power cable is based on a ADB SAFEGATE proprietary communication protocol where SCM acts as a master, sending status queries and commands to the LMS/SIU, and the LMS/SIU responds accordingly. The data communication protocol is coded by different signal frequencies that are superimposed on the power line carrier.

#### 4.25.1.2 Circuit tuning principles

Circuit tuning is a procedure that is performed at commissioning of RELIANCE Intelligent Lighting, to adopt the communication between SCM and LMS/SIU to the specific series circuit, and thereby optimizing the communication reliability. Because the power cable communication between SCM and LMS/SIU is dependent on circuit layout, circuit load and circuit insulation resistance, the circuit tuning must be done for each circuit individually.

#### 4.25.1.3 Frequency tuning

Frequency tuning is one part of the circuit tuning procedure performed at system commissioning. The frequency tuning procedure is a method to find the best signal frequencies for each LMS/SIU to use in the communication with the SCM. What frequencies are best to use is, as mentioned earlier, dependent on circuit layout, circuit load and circuit insulation resistance. That implies that if any of these circuit characteristics changes on an already commissioned system, the RELIANCE Intelligent Lighting communication can be degraded.

#### 4.25.1.4 A word of caution

Frequency tuning for resolving communication problems, without supervision of ADB SAFEGATE authorized personnel, is not something that should be done without thought.

First must be concluded that the communication problems are not due to installation problems, LMS failures, earth faults etc, see RELIANCE Intelligent Lighting maintenance manual for troubleshooting. If a frequency tuning is run before such errors are cleaned up, there is a large possibility that the result does not get satisfactory, and the tuning procedure must be run again with the circuit clean.

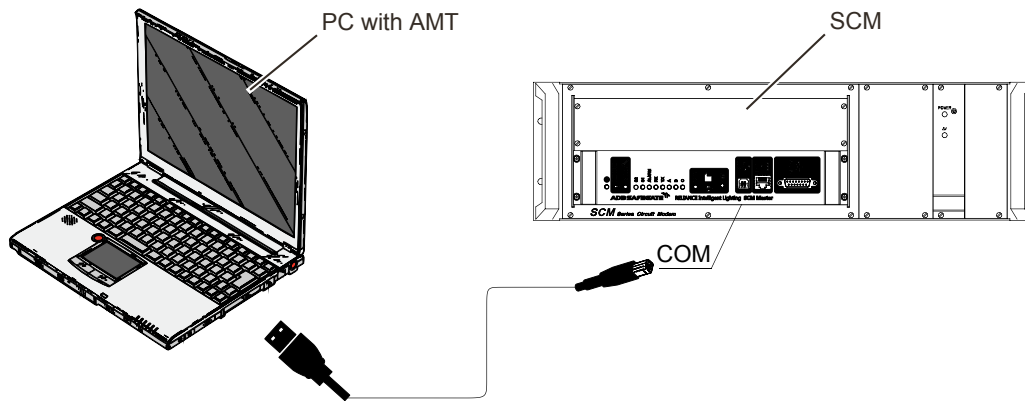
### 4.26 Frequency tuning by AMT

Frequency tuning by AMT is a fully computerized method to find the best signal frequencies for the communication between SCM and LMS. AMT makes it possible to connect a maintenance laptop to the COM1-port on a SCM and run the AMT software to automatically optimize the communication on the specific series circuit.

### 4.26.1 Hardware set-up

A maintenance computer with AMT installed connects to the series circuit that is intended to be tuned, via USB A to B cable to COM connector on the front panel of the SCM. Put the Remote/Local switch on the front panel of the SCM to *Local*.

**Figure 39: Hardware set-up**



### 4.26.2 AMT frequency tuning principles

AMT will, through the SCM, communicate with every LMS on a circuit at a number of predefined frequencies. After all frequencies have been tested, AMT will select the best frequencies to use for each individual LMS, and update the circuit with the result by downloading communication parameters for the selected frequencies both to the SCM and to all the LMS's on the circuit. The LMS- and SCM configuration database must thereafter be updated with the new assigned parameters.

### 4.26.3 Before starting AMT frequency tuning sequence

During the time an AMT frequency tuning sequence is running, all circuits on site but the one that is intended to be tuned, must either be communicating via the CU, or be de-energized. All circuits on-site also include circuits that run from another vault on the same RWY, but not circuits on other RWY's.

This precaution is to prevent undesirable interference with the circuit that is intended to be tuned.

#### 4.26.4 AMT frequency tuning sequence

The Circuit Tuning box will open. The box consists of a number of buttons and windows. The Session History window logs all actions with timestamp, a separate log window for low level details on the tuning sequence can be viewed if button **Show Details** is clicked. The remaining buttons and windows in the box will be explained later.

1. Open the appropriate LMS configuration file by selecting **File > Open Config**, Figure 40. When the configuration file is selected, it is possible to select the circuit, which is intended to be tuned, and to which the SCM is connected to, Figure 41 and Figure 42.

Figure 40: Open configuration

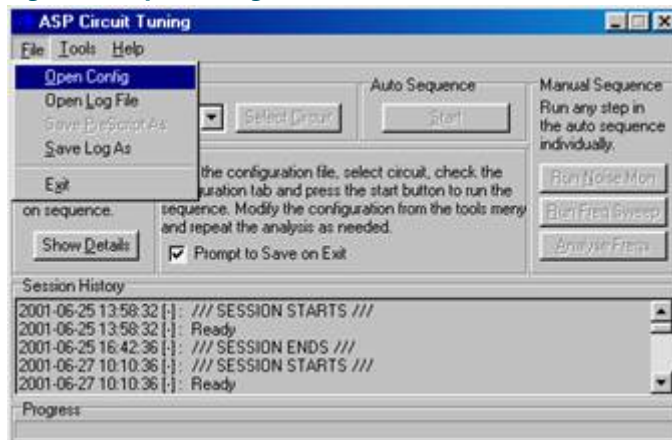


Figure 41: Select appropriate circuit

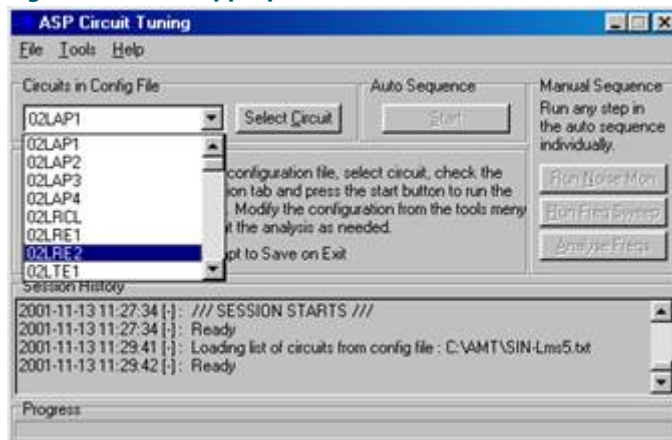
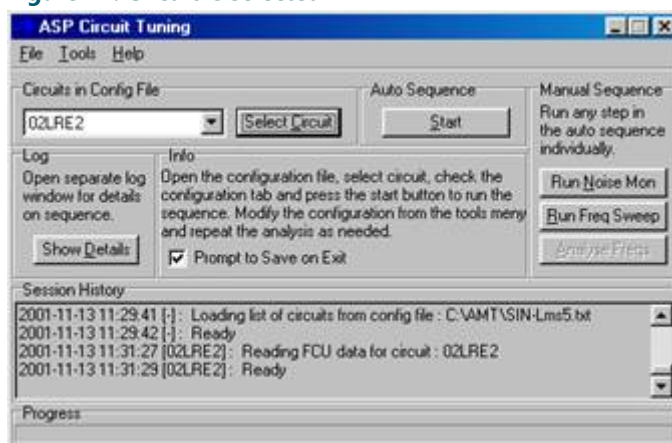


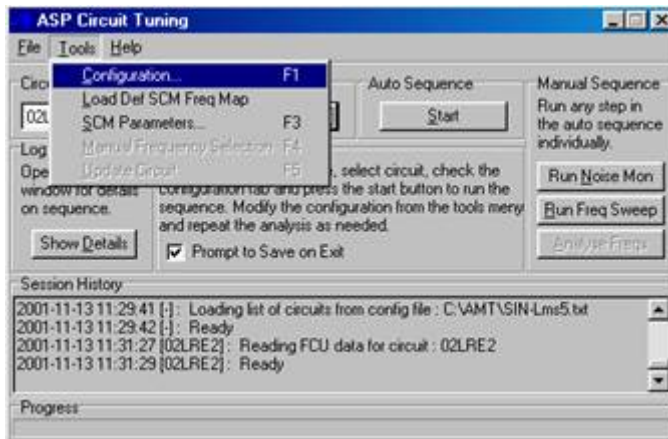
Figure 42: Circuit is selected



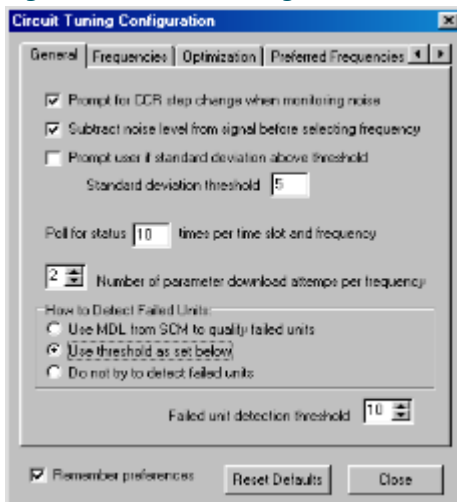
2. Before the frequency tuning can start, a number of parameters must be set. This is done by selecting **Tools > Configuration**, Figure 43, and the **Circuit Tuning Configuration** box will open, Figure 44. There are five tabs with

settings: **General**, **Frequencies**, **Optimization**, **Preferred Frequencies** and **Miscellaneous**. These settings are normally not modified, default settings are used, see [Figure 44](#), [Figure 45](#), [Figure 46](#) and [Figure 47](#).

**Figure 43: Select configuration**



**Figure 44: General settings tab**



**Figure 45: Frequency settings tab**

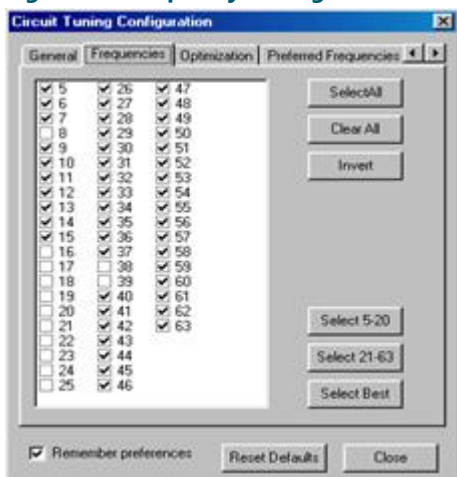


Figure 46: Optimization settings tab

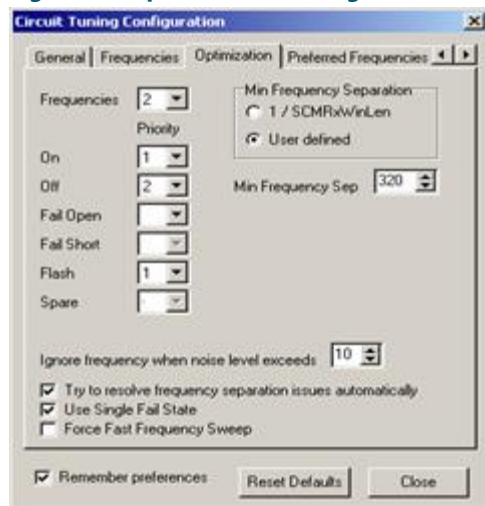
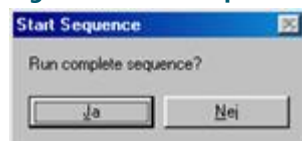


Figure 47: Preferred Frequencies settings tab



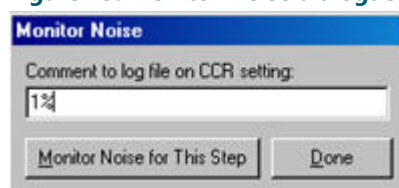
3. Start the frequency tuning sequence by clicking the button **Auto Sequence Start**. A dialogue box will open, asking if a complete sequence will be run, [Figure 48](#), click **Yes**.

Figure 48: Start Sequence tab



4. Then the **Monitor Noise** dialogue box will open. The circuit noise will now be monitored at every CCR intensity step (current level). The reason why the noise is monitored is to make it possible for AMT to calculate signal-to-noise ratios. The CCR steps has to be set manually; first set the CCR on lowest operational intensity step and write a comment to the log file, for example 1%, [Figure 49](#). Click **Monitor Noise for This Step**, and the SCM will now collect noise data for this CCR step. After a few seconds the **Monitor Noise** dialogue box will re-open; set the CCR intensity at the next higher intensity step and write a comment to the log file, for example 3%, and click **Monitor Noise for This Step**.

Figure 49: Monitor Noise dialogue box



5. Continue to monitor the noise on all CCR intensity steps. When all steps are monitored, click **Done** in the **Monitor Noise** dialogue box. The **Noise Monitoring** dialogue box will open, asking if all CCR steps are done. Click **Yes**, [Figure 50](#).

**Figure 50: Noise Monitoring dialogue box**



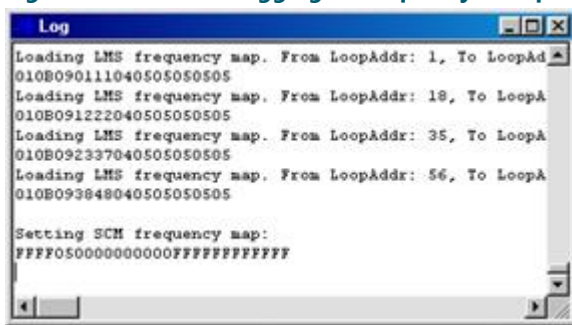
6. The **Frequency Sweep** dialogue box will open, [Figure 51](#). Set the CCR at desired intensity step, 10% is a suitable value. Click **OK** to start sequence.

**Figure 51: Frequency Sweep dialogue box**



7. Now the frequency sweeping process will start. That means all frequencies that are configured in the **Circuit Tuning Configuration** box, **Frequency** settings, [Figure 45](#), will be tested (default values). Details on the tuning sequence can be viewed if the button **Show Details** in the **Circuit Tuning** box is clicked, [Figure 29](#). These low level details will be saved in a text file in the end of the tuning process, and can be used by ADB SAFEGATE personnel for troubleshooting.

**Figure 52: Low level logging of frequency sweep**



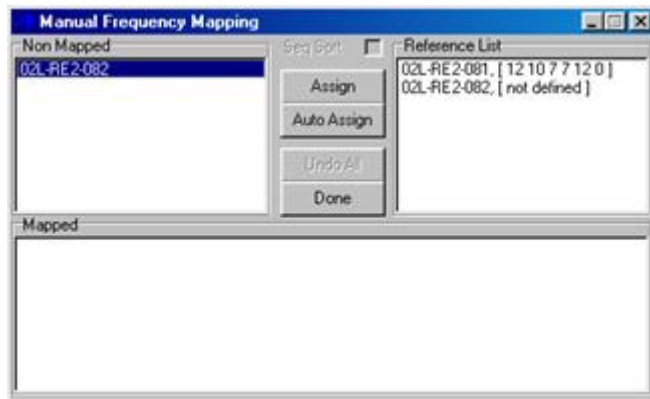
8. When the frequency sweep sequence has ended, AMT will start to download the best set of frequency parameters to each individual LMS. There may be a few LMS's that AMT has failed to find any frequencies to use, which can for example be due to that those LMS's are failing. Assignment of parameters to those LMS's must therefore be done manually. The **Manual Frequency Mapping** box will open and the user can manually assign communication parameters to those LMS's, [Figure 30](#). All LMS's will be viewed in the **Reference List** window, and the non assigned LMS's in the **Non Mapped** window. The method to assign parameters to the non assigned LMS's is to select a LMS in the **Non Mapped** window and select the neighbor<sup>3</sup> LMS in the **Reference List** and click **Assign**. This assignment procedure must be done for all non assigned LMS's in the **Non Mapped** window. The result of the manual assignments is viewed in the **Mapped** window, [Figure 31](#). It is also possible to do **Auto Assign**, where AMT give the non mapped LMS's the same parameters as the LMS's that has fixture-ID number closest to the non mapped LMS's. This method is though not as accurate as the manual assignment because it is not in all cases true that the electrical neighbor to a non mapped LMS also has closest fixture-ID

<sup>3</sup> When the frequency sweep sequence has ended, AMT will start to download the best set of frequency parameters to each individual LMS. There may be a few LMS's that AMT has failed to find any frequencies to use, which can for example be due to that those LMS's are failing. Assignment of parameters to those LMS's must therefore be done manually. The Neighbor LMS's means LMS's that are installed next to each other on the series circuit, from an electrical point of view. Note that two LMS's with fixture-ID numbers closest to each other not necessary need to be electrical neighbors, because often the fixtures are installed on different legs (out-going and in-going) of the primary circuit when the two primary cable legs are running in parallel through the same manholes. To figure out neighbor LMS's, it is necessary to examine the primary cable drawings.

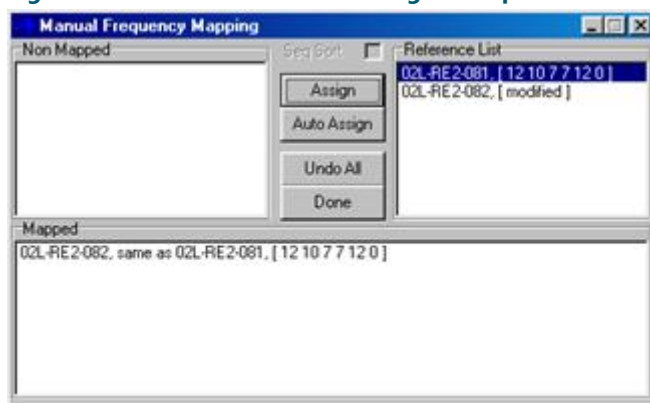


number. A LMS that is manually or auto assigned in AMT during a frequency tuning *must* be programmed with the LPU after the parameter database has been updated.

**Figure 53: Selected LMS in the Non Mapped window and one of its neighbors in the Reference List**



**Figure 54: Result of the manual assignment procedure viewed in the Mapped window**

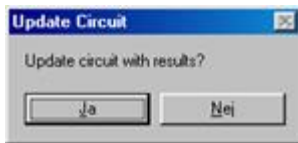


9. Then it is time to update the circuit by downloading the new parameters to all LMS's on the circuit and the SCM. From the **Circuit Tuning** box, select **Tools > Update Circuit**, Figure 55. The **Update Circuit** dialogue box opens, to double check if the user really wants to update the circuit, Figure 56, click **Yes**.

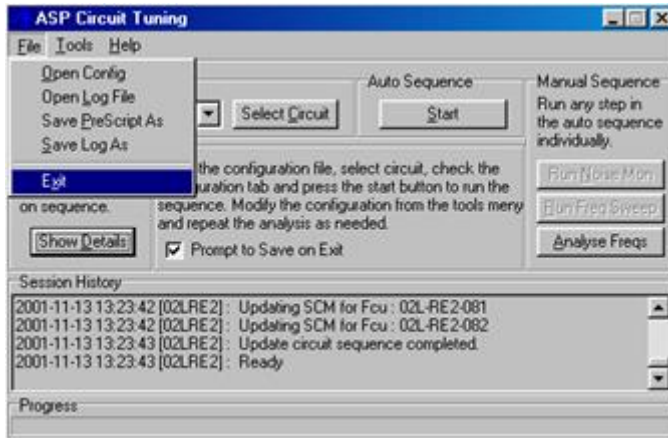
The progress bar in the **Circuit Tuning** box monitors the progress of the update circuit process, it takes several minutes, depending on the number of LMS's on the circuit.

**Figure 55: Update the circuit with new frequency parameters**

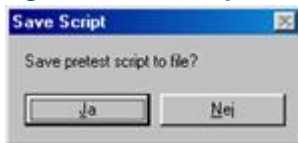


**Figure 56: Circuit update dialogue box**

10. Now, the frequency tuning sequence is finished, the LMS's on the circuit and the SCM is updated with the new parameters. Exit the program from **Circuit Tuning**, select **File > Exit**, [Figure 57](#).

**Figure 57: Exit the program**

11. The dialogue boxes **Save Script** and **Save Log** opens, see [Figure 58](#) and [Figure 59](#). Click **Yes** to save the log given the default name XXXXXX.log where XXXXXX represents the circuit name, for example 02LRE1.log. This information, if needed, can be used by ADB SAFEGATE personnel for troubleshooting purposes.

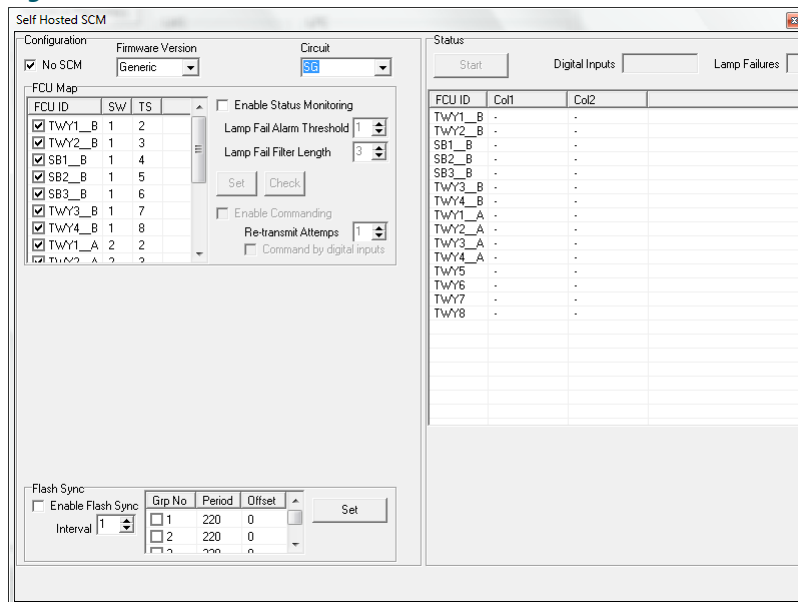
**Figure 58: Save Script dialogue box****Figure 59: Save Log dialogue box**



## 4.27 Self Hosted SCM

Some types of RELIANCE IL can be configured without a NCU. In those cases, the SCM will handle many of the functionalities that are normally handled by the NCU. The *Self Hosted SCM* tool includes functionality to configure the SCM as well as monitor the resulting system functionality.

Figure 60: Self Hosted SCM



The tool window for **Self Hosted SCM** is divided into two parts:

- Configuration functionality
- Monitoring functionality

### 4.27.1 Configuration functionality

The configuration functionalities are on the left side of the tools window. The principles of the *Self Hosted SCM* concept is that the SCM handles both the communication on the series circuit as well as is aware of the operative configuration, i.e. what fixtures/LMS are on the circuit (information that normally is handled by the CU). The SCM can therefore monitor the lamp status, generate alarms or synchronize RGL flashing and other functionalities.

Uppermost in the configuration functions is the *FCU Map*, with which the complete, or selected parts of the configuration (marked in the list) for a specific circuit is downloaded to the SCM with the **Set**-button. If there is need to control the resemblance between the downloaded information and the information in a configuration file, which can be done with the **Check**-button. In the cases where downloaded records are the same as the content in the configuration file, the records in the list will be shadowed. To set a threshold value for summary alarm, a specific number of lamps, use the *Lamp Fail Alarm Threshold*. The filter length of the alarm threshold (i.e. the number of consecutive lamp fail responses to set an alarm) use the *Fail Filter Length*.

The configuring of flash synchronizing is set at the bottom of the configuring section of the tools window. The synchronizing sequence is activated there, it is also configured for the groups included in the synchronizing sequence and the *Offset* between the groups. The *Period* is calculated directly from the information in the configuration file and cannot be modified by the user. The interval between the synchronizing sequences is set by *Interval* in number of minutes (50 seconds @ 60Hz mains).



#### Note

The monitoring functionality always should be activated after configuration changes have been made, to verify that the system function.

### 4.27.2 Monitoring functionality

The monitoring functionality is fully implemented in firmware 6025 and later.

The monitoring functionality is activated with the **Start**-button. State for every fixture is presented in the list, and the numbers of lamp failures are shown to the right. The monitoring continues as long as the SCM is active or **Stop** is pressed.

## 4.28 User handling

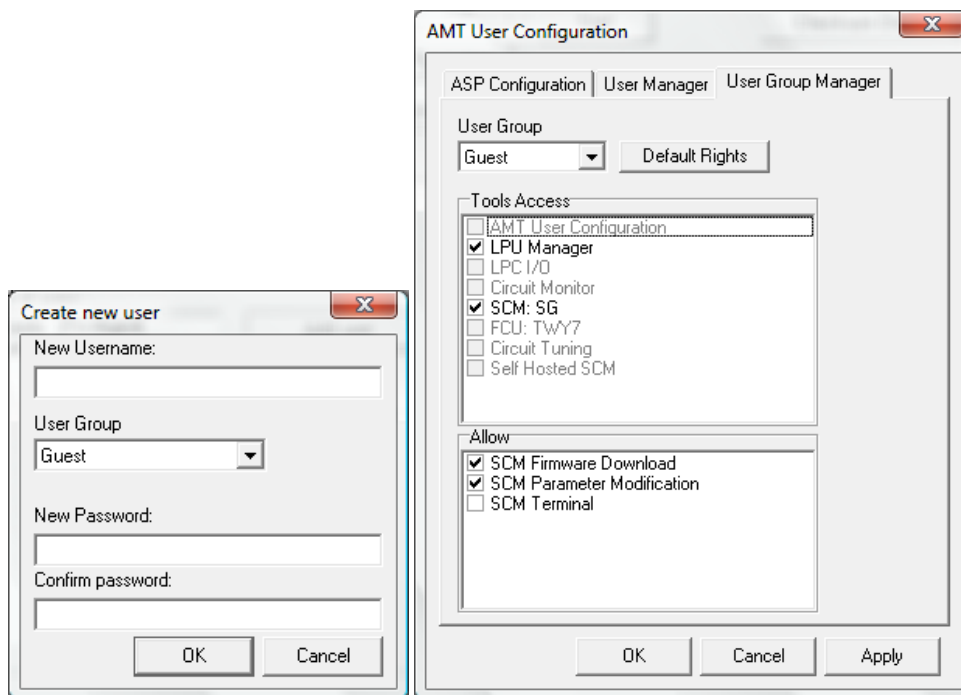
To get access to the functionalities in AMT, the user must, as previously described, log in when the program is started.

Depending on what access rights the user has, some functions in AMT can either be completely or partially blocked. Which functionality that is available is also depending on which variant of AMT that is used, see [Different variants of AMT](#).

### 4.28.1 User groups

AMT is using four user groups to configure access privileges for individual users:

- Administrators
- Privileged users
- Users
- Guests



To each of the different user groups, access rights are configured, both access to different tools windows and access to specific functions within a tools window. The four user groups are in a hierarchic order in that way that *Administrators* are in the top and *Guests* are in the bottom of the hierarchical scale. *Administrators* have, per definition, complete access rights without any restrictions. As a consequence of that, an *Administrator* can give access rights for all other user groups, while a *Privileged User* are allowed to give access rights to *Users* and *Guests*, based on the access rights the *Privileged User* have been given. Similarly, a *User* can give access rights to *Guests*.

*Privileged Users* can only create users that belong to the user groups *User* or *Guests*, that is if *Privileged Users* have been given the access rights to create users.

To administrate users and/or give access rights for user groups, open *Admin Settings* from the *File/Preferences*-menu.

## 4.29 Appendix

### 4.29.1 LPU

The LPU, LMS/SIU Programming Unit, consists of an SCM and an LPC.

Before programming an FCU you must have a proper setup of the hardware. APPENDIX A and APPENDIX B will help you to interconnect and setup the SCM and LPC correctly. Depending on if you program in Manual Mode or Remote Control Mode you choose a different setup procedure.

These procedures are described below, as [Hardware setup for Manual Mode](#), and as [Hardware setup for Remote Control Mode](#).

#### 4.29.2 Hardware setup for Manual Mode

1. On the back of both the LPC and the SCM is a small box. Interconnect the two units with the provided transparent shielded Ölflex cable, see [AMT Appendix B - SCM and LPC rear view](#)
2. Turn the SCM on. The Power switch is on the back of the SCM. A green LED on the front should now be on.
3. The RS485/RS232 (Local/Remote) switch on the front of the SCM should be in the RS232 (Local) position. A red LED on the front should be on, indicating the local state.
4. Turn the Laptop/PC on and load Windows.
5. Connect the USB cable between the SCM and Laptop/PC.
6. Start AMT and make sure the correct COM port is selected in the Connection Manager, see [Communication settings settings](#).
7. If you are using a laptop, make sure to connect the power adapter. A laptop running on batteries might not be able to deliver enough power to the COM port for reliable communication.
8. For programming in Manual Mode you do not need to interconnect the LPC and SCM, using two cables with 25 pins D-SUB connectors on the back of the LPC and SCM units.
9. For manual programming, release the Remote switch on the LPC (set the LOCAL/REMOTE switch to LOCAL on an LPC version 2). Turn on the green main switch on the LPC.
10. Press the OUTPUT POWER switch, the green button marked I, on the LPC .

#### 4.29.3 Hardware setup for Remote Control Mode

Follow these steps before programming an FCU in Remote Control Mode:

1. On the back of both the LPC and the SCM is a small box. Interconnect the two units with the provided transparent shielded Ölflex cable, see [AMT Appendix B - SCM and LPC rear view](#).
2. Turn on the SCM. The power switch is on the back of the SCM. A green LED on the front should now be on.
3. The RS485/RS232 (Local/Remote) switch on the front of the SCM should be in the RS232 (Local) position. A red LED on the front should be on, indicating the local state.
4. Turn the laptop/PC on and load Windows.
5. Connect the USB cable between the SCM and Laptop/PC.
6. Start AMT and make sure the correct COM port is selected in the Connection Manager, See [Communication settings settings](#).
7. If you are using a laptop, then connect the power adapter. A laptop running on its own batteries might not be able to deliver enough power to the COM port for reliable communication.
8. For programming in Remote Control Mode you need to interconnect the LPC and SCM, using two cables with 25 pins D-SUB connectors. The outlets are found on the back of these units. ADB SAFEGATE can provide cables.
9. For programming in Remote Control Mode, turn on the Remote switch (set the LOCAL/REMOTE switch to REMOTE on an LPC version 2).
10. Turn on the green main switch on the LPC.

4.29.4 AMT Appendix A - SCM and LPC front panels

Figure 61: Front panel view of the new SCM 591813B and LPC version 3

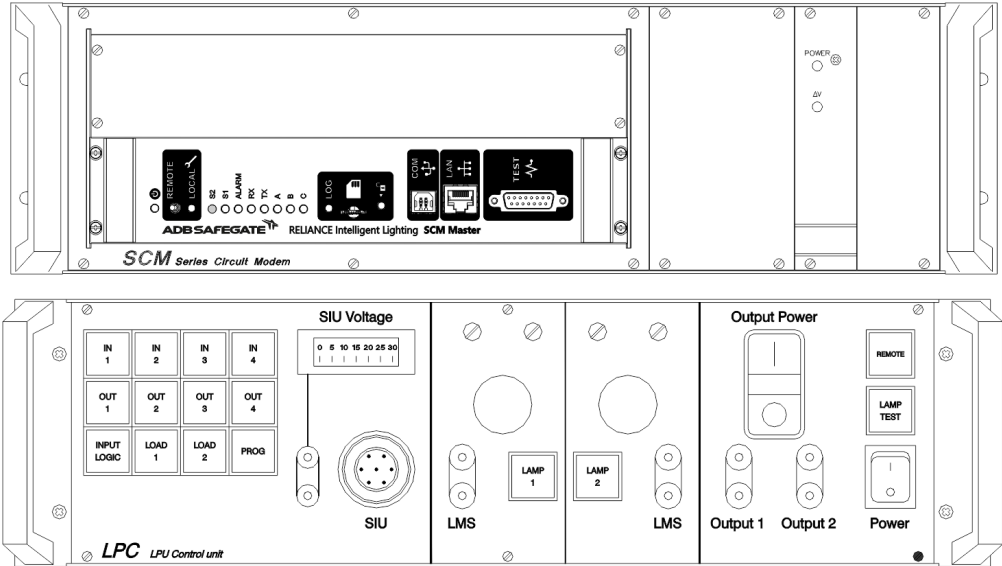
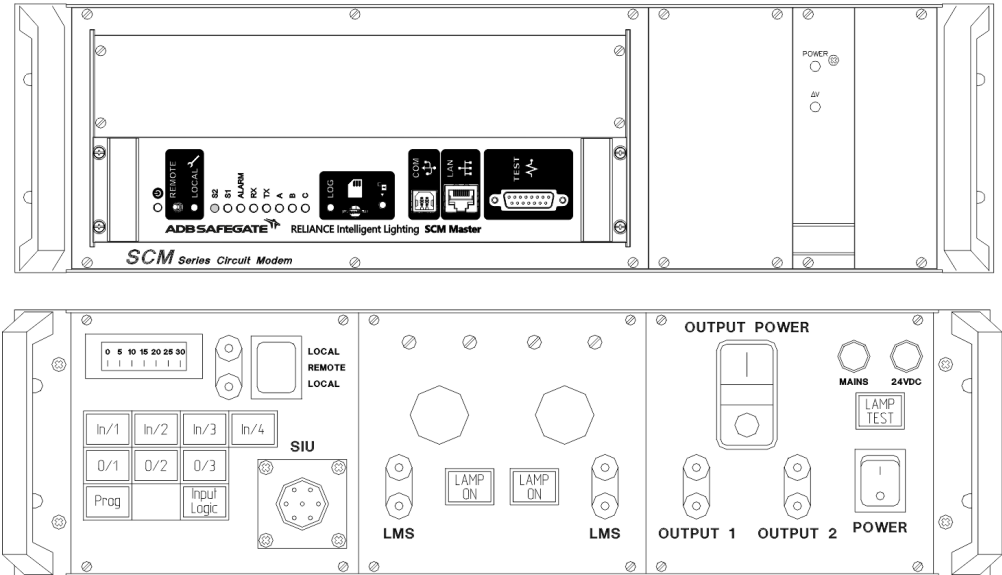


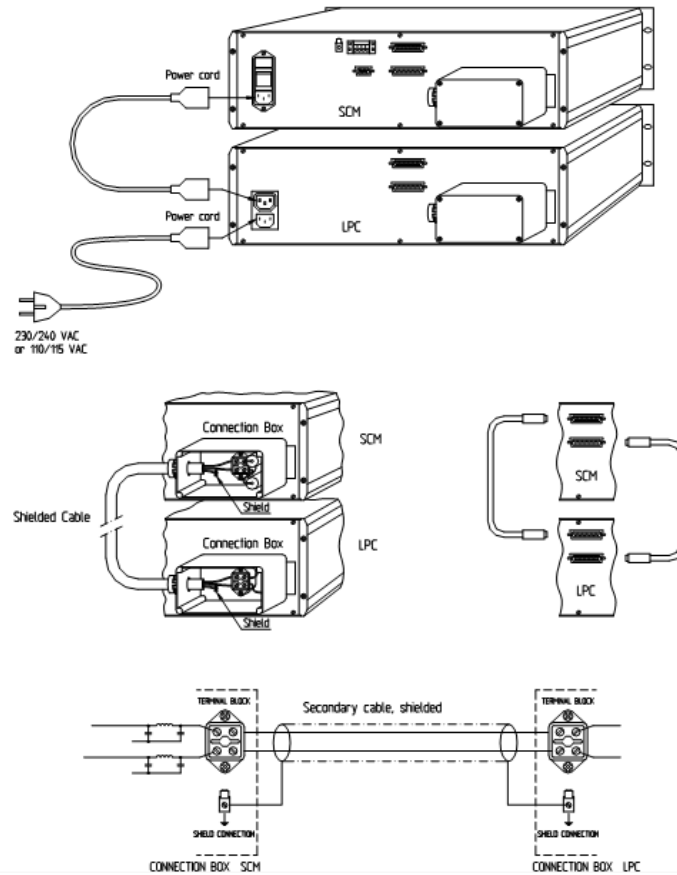
Figure 62: Front panel view of SCM 591813 and LPC version 2



#### 4.29.5 AMT Appendix B - SCM and LPC rear view

Figure displays the rear of an SCM and LPC, and how these units are interconnected.

**Figure 63: SCM and LPC rear view and interconnection**





## 5.0 SFU User Guide

This document describes the Signal Filter Unit (SFU) and summarizes its characteristics.

The purpose of the SFU is to, if necessary, balance RELIANCE Intelligent Lighting communication signals that are superimposed on the series system power cables.

### 5.1 Application

This document applies for SFU 591876-B, 591877-B and 591858-B. It includes specification, installation, maintenance and troubleshooting of SFU.

### 5.2 SFU general description

#### 5.2.1 Electrical och mechanical specification

Unless differently noted, all maximum values are absolute maximum values.

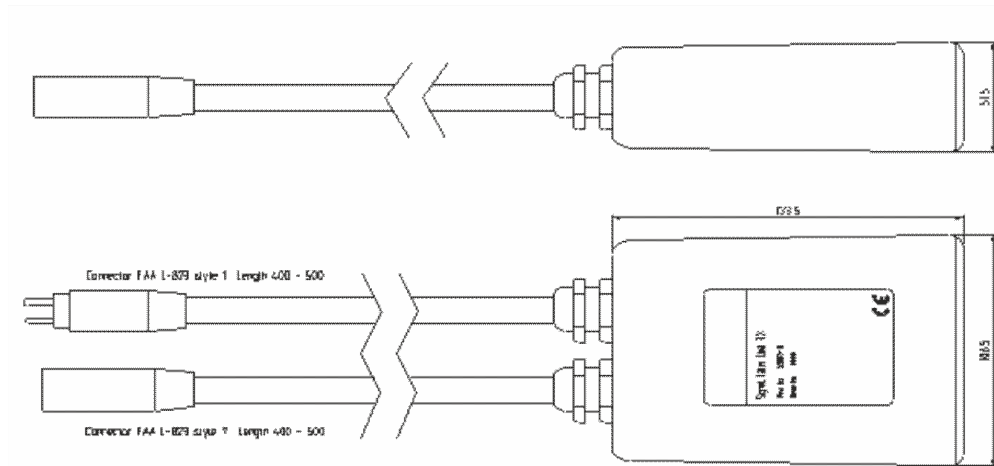
Characteristics	Symbol	Min	Typ	Max	Unit
<b>Series circuit</b>					
Supply power from series circuit (50/60Hz)	$I_{\text{supply voltage}}$	2.5	-	7.1 <sup>1</sup>	$A_{\text{RMS}}$
				8.2 <sup>2</sup>	$A_{\text{RMS}}$
Isolation voltage	$V_{\text{ISO}}$	1500	-	-	VAC
Connecting isolation transformer <sup>3</sup>	$P_{\text{IT}}$	200	<b>200</b>	200	W
Power dissipation	$P_{\text{loss}}$	0	-	10	W
<b>Environment</b>					
Humidity	RH	0	-	100	%
Ambient temperature operation	$T_{\text{A}}$	-30	-	+65	° C
Ambient temperature storage	$T_{\text{STG}}$	-30	-	+100	° C
Encapsulation	IP68				
<b>Mechanical data</b>					
Dimensions without cabling	Width	$L_{\text{b}}$	-	<b>106.5</b>	mm
	Length	$L_{\text{l}}$	-	<b>133.5</b>	mm
	Height	$L_{\text{h}}$	-	<b>51.5</b>	mm
Secondary cabling (FAA L-823 class A contacts)	$L_{\text{k}}$	-	<b>400</b>	-	mm
Weight	-	-	<b>1.8</b>	-	kg

#### Notes

<sup>1</sup> According to FAA advisory circular 150/5345-47A (isolation transformer for airfield visual aids)

<sup>2</sup> During max 1 second, according to FAA advisory circular 150/5345-10E (specifications for constant current regulators).

<sup>3</sup> Optimal functionality is obtained with Amerace 200W isolation transformer type TA200665-01.

**Figure 64: Signal Filter Unit**

### 5.2.2 Function

The purpose of the SFU is to, if necessary, balance RELIANCE IL communication signals that are superimposed on the series system power cables.

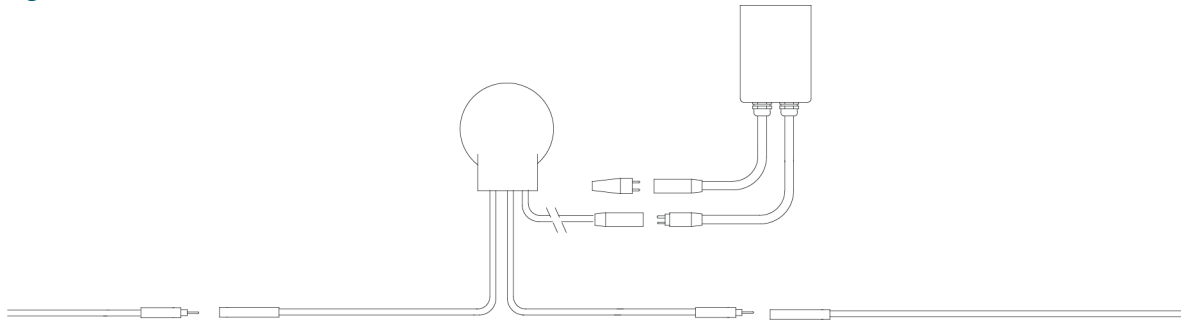
It is a fully passive component, without possibility to communicate with other parts of RELIANCE IL. The SFU is manufactured with rigorous requirements to obtain a robust system design that maximizes the reliability of the system. The SFU comes in two versions, SFU3:1 (591876-B), SFU3:3 (591878-B), they are mechanically identical but have different filter characteristics.

## 5.3 Installation

### 5.3.1 Installation hardware

The SFU male contact is connected to the series circuit with an isolation transformer (Amerace 200W type TA200665-01). The female contact is either connected to a short circuit plug, or to another SFU (that is connected to short circuit plug).

To determine where on the series circuit the SFU should be installed for maximum performance is normally done during commissioning. The SFU installation is documented with respect to series circuit, position and type.

**Figure 65: SFU connections**

## 5.4 Maintenance

No maintenance is needed after installation.

## 5.5 Troubleshooting

Because the SFU is a passive component, there is no feedback to the system that indicates component status (OK/fail). If a SFU is failing, it is likely that there will be a situation where the SCM-LMS communication ability will be decreased within a small isolated area on the series circuit, which can result in false lamp/LMS-failures within that area. Normally the SFU's are installed on only one position on each series circuit, so identification and replacement of a failing unit is a simple process.



## 6.0 LPU - LPC User Guide

This document describes the LPU - LPC and summarizes its characteristics.

### 6.1 General

The combination LPU (LPC + SCM) and AMT constitutes a tool required for programming of LMS and SIU - in the long term an expected maintenance action, required when replacing broken units.

LPU also gives the possibility to make a functional test of an LMS or SIU.

The LPC comes with all cables required for connecting the PC, SCM, LMS and SIU and can be used for new as well as old versions of LMS and SIU. To connect the old version of SIU (591805 ver. 1.3) an adapter cable (594113) is required – to be ordered separately.

LPC supplies current (as a CCR) to the connected units (SCM, LMS, SIU) on the "mini series circuit". It also contains an isolation transformer for feeding the LMS and/or SIU plus a normal secondary load (45W / 6,6A) for the LMS and a control panel simulating external equipment for the SIU (e.g. a sensor).

The control buttons and the internal control board are designed to ease the operation of the LPC. For full functionality a Windows-based PC running the maintenance tool AMT is required.



#### Note

For instructions for functional test or programming of LMS and SIU, see AMT User Guide.

### 6.2 Application

This document gives an introductory description of LPU – LMS/SIU Programming Unit, made up by the LPC and the SCM, with LPC 591859 ver. 3 in focus.

For details on the SCM, refer to the SCM User Guide.

This document describes the set up, control panel, function, some maintenance issues, etc. for the LPC.



#### Note

When it comes to instructions for functional test or programming of LMS and SIU, please refer to the AMT User Guide.

#### 6.2.1 Specifications

Parameter		Symbol	Min	Typ	Max	Unit
<b>Power Supply</b>						
Supply voltage	Voltage selector: 120	V <sub>120</sub>	100	<b>115</b>	120	V AC
	Voltage selector: 240	V <sub>240</sub>	200	<b>230</b>	240	V AC
Power frequency		f	50	-	60	Hz
Power consumption		P			200	W
<b>Environment</b>						
Humidity ( <i>non condensing</i> )		RH	10	-	95	%
Ambient temperature, operation		T <sub>A</sub>	-5	-	+55	° C
Ambient temperature, storage		T <sub>STG</sub>	-20	-	+70	° C

Parameter		Symbol	Min	Typ	Max	Unit
<b>Mechanical data</b>						
Dimensions	Width (rear)	$L_w$	-	450	-	mm
	Width (front)	$L_f$	-	483	-	mm
	Depth (excl. handles)	$L_d$	-	375	.	mm
	Height (excl. feet)	$L_h$	-	133	-	mm
Weight	Excl. cables	m	-	16.5	-	kg

## 6.3 Connections and Control Panel

### 6.3.1 Rear

The *fused inlet* is located at the left. The fuse drawer allows for a spare fuse as well (T 2A @ 240V). Just above, the *voltage selector* (120 / 240) is located, preset for 240 V at delivery.

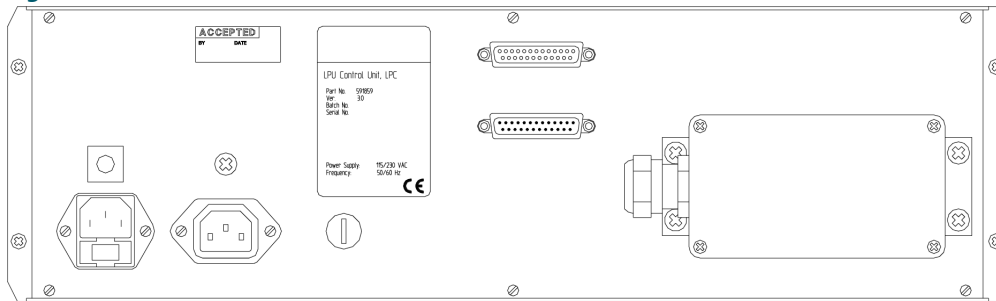
Next to the inlet is an *outlet* for power take-off for the SCM – this way, both LPC and SCM can be switched on/off by the same main switch. Then, there is a *fuse* (T 2A) for internal 24V supply.

In the upper D25-connector *outputs* (SIU supply voltage, SIU outputs) are found - for status reading using AMT.

In the lower D25-connector there are *inputs* for remote control of the LPC, at programming or test of LMS and SIU, using AMT.

The EMI-box at the right contains terminals for *connection of SCM*, used for communication (superimposing data) on the "local series circuit".

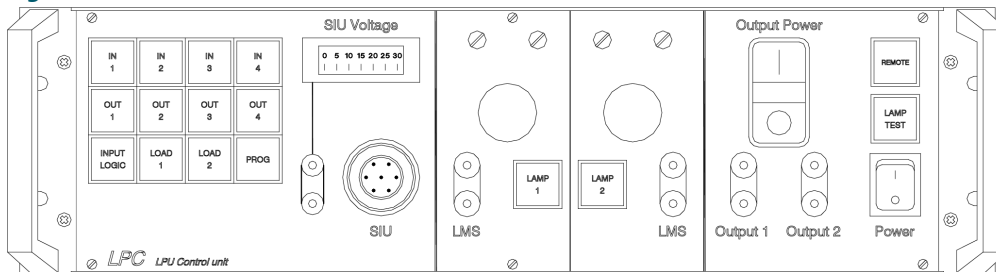
**Figure 66: Rear**



### 6.3.2 Front

The front is divided into 3 sections: SIU - LMS - General functions

**Figure 67: Front**



#### 6.3.2.1 SIU-section

The buttons IN1, IN2, IN3, and IN4 set the input state for each of the SIU inputs.

Normal position for INPUT LOGIC, not pressed (indicator off), will turn on the indicators IN1 to IN4 when not pressed (out) and turn them off when pressed.

If INPUT LOGIC is pressed (indicator on), IN1 to IN4 indicators will instead be turned on as they are pressed.

Independent of INPUT LOGIC – if any of or both IN1 and IN2 are out, AMT displays: SIU status = Detect (the opposite can be set by SIU parameters).

OUT1, OUT2, OUT3, and OUT4 indicate the state of each separate SIU output.

OUT4 is normally activated which means the SIU can supply voltage to external equipment, normally a sensor (MBD).

With the SIU connected to *Output 1* (or *Output 2*), to the 7-pole SIU-connector and *Output Power* being switched on the SIU Voltage-instrument shows the output voltage of the SIU (parameter electable: 12/15/24 VDC).

An external V-meter may be connected to the panel mounted terminals.



### Note

Some inputs are interconnected to the outputs in the SIU. This makes *OUT3* activated simultaneously with *IN3*, the same applies for *OUT2* and *IN4*.

The load capacity of the SIU can be tested using LOAD 1 and LOAD 2.

For **12 V**: LOAD 1 + LOAD 2, **15V**: LOAD 1, **24V**: LOAD 2 The load test will show some decrease of the voltage (@ 15V: approx. 14V).

PROG button should only be used when prompted by AMT (SIU programming).

IN1 to IN4, LOAD 1, LOAD 2 and PROG can be remotely controlled (AMT).

#### 6.3.2.2 LMS-section

The LMS-section (middle) is divided in two where each side has its connections for LMS to lamp, a push button that disconnects the lamp (when programming or at functional test). The LMS may be connected to any of the two lamps.

LAMP 1 and LAMP 2 connects the lamp when pressed (indicator on) and can be remotely controlled from AMT.

Lamp type: 45 W / 6,6 A (Pk30d)

#### 6.3.2.3 General functions

The general control functions are located to the right. The **Power** button will switch on the LPC and supply voltage to the SCM (if connected as sketch below). The button will illuminate when activated.

The big button, **Output Power**, will energize the connected LMS and/or SIU when pressing I – to turn off, press O. The button will illuminate when activated. **Output Power** will be interlocked only if the REMOTE button is out.

REMOTE must be pressed to enable the remote control of LPC from AMT.

The two (2) (current supply) outputs **Output 1** and **Output 2** are in series. LMS and/or SIU may be connected to any of these. An output not used must be bypassed by shortening the output with a Short Circuit Plug (supplied).

All indicator lamps can be tested by pressing the LAMP TEST button. This test does not include the 45W lamps.

The indicator lamps are back lighted to ease the use when using the LPC in a room with softened lights. The back light level is factory set but may be adjusted with an internal potentiometer.

## 6.4 Internal



### Note

Be sure to disconnect the mains connection when opening the LPC for any adjustment.

By removing the top cover you'll find all internal components, most of them connected by plugs to the control board. On this board a trimmer (*V ADJ*) is located, for adjustment of the back light level. There are also three (3) switches that set the operating current (typ. 3,5-4,5 A) for the LMS/SIU and hence the intensity of the 45 W lamps

- **50-60 HZ (S1):** Pos. 60 will give a higher current and is intended to compensate for the impedance increase at 60 Hz.
- **27-30 V (S2):** refers to internal voltage at 50 Hz
- **S2-33 V (S3):** refers to internal voltage at 50 Hz Pos. S2 refers to 27 V or 30 V dep. on the S2 position

Factory settings (50Hz): S1=50, S2=30, S3=33

For 60 Hz, change S1 to position 60 to increase the intensity of the 45 W lamps.

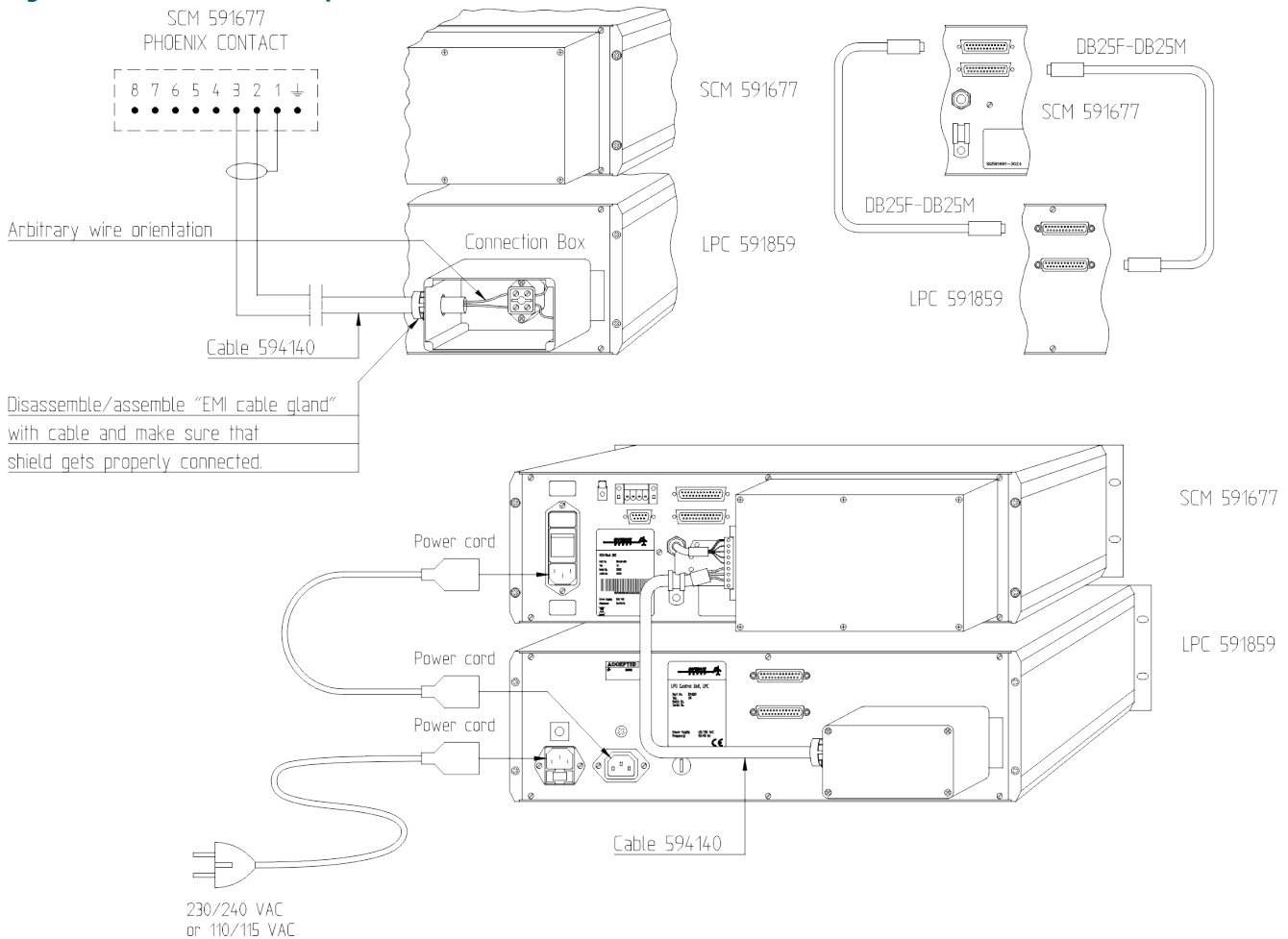
## 6.5 Hardware set-up

First check the voltage selector to be in the appropriate position: 120 or 240 V.

### 6.5.1 Connecting SCM

Connections between LPC and SCM are made at the rear, see [Figure 68](#). All cables supplied with delivery.

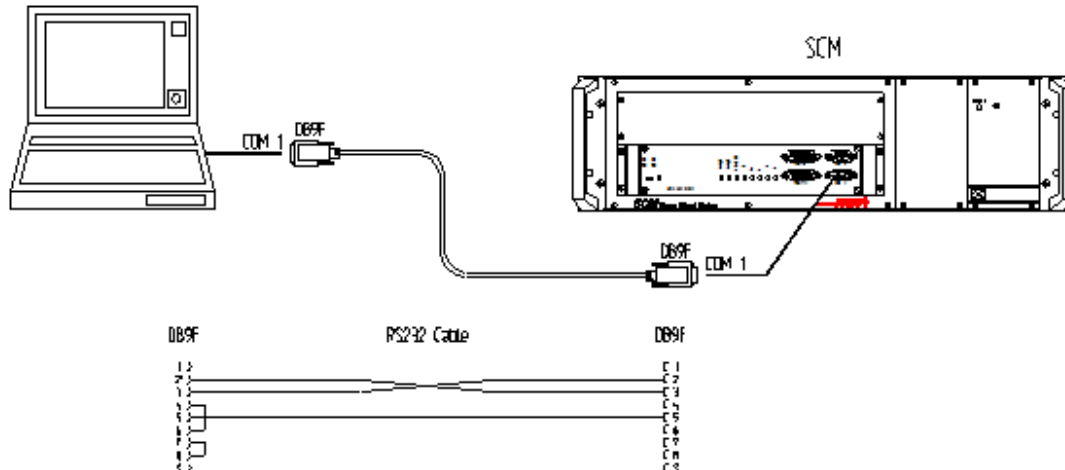
**Figure 68: LPC and SCM set-up**



### 6.5.2 Connecting PC

Use the supplied USB cable to connect the PC and LPC.

**Figure 69: PC and LPC set-up**



### 6.5.3 Connecting LMS

Use the supplied cable 594115 to connect to **Output 1** or to **Output 2**.

The Short Circuit Plug should be plugged into the output not in use (Output 2 or Output 1) – the two outputs are connected in series and gives equal functionality.

Then use the cable 594116 to connect to LMS at LAMP 1 or to LMS at LAMP 2 .

### 6.5.4 Connecting SIU

Use the cable 594115 to connect the SIU to **Output 1** (alt. **Output 2**, as above) - remember the Short Circuit Plug!

For SIU ver.2.0 (591885) use the cable 594112 (supplied) to connect to the SIU-connector on the LPC. To connect the old version of SIU (591805, ver.1.3) an adapter cable is required (594113, to be ordered separately).

## 6.6 Maintenance

The LPC is designed for highest reliability during many years and will require only a minimum of maintenance.

Depending on the use some parts may wear out and be subject to replacement – most likely the plugs and connectors – avoid mechanical stress on these parts.

If not finding the appropriate spare part, please contact ADB SAFEGATE for advice.



## 7.0 SCF User Guide

This document describes the Series Circuit Filter (SCF) product number 591870-1.

### 7.1 Application

This chapter for the Series Circuit Filter (SCF) covers specifications, installation, maintenance and troubleshooting of an SCF.

### 7.2 References

SG591890-3007 RELIANCE Intelligent Lighting General Description

### 7.3 Introduction

The SCF prevents the communication signals, superimposed on the series circuit by the SCM, to interfere with the CCR.

### 7.4 RELIANCE Intelligent Lighting Component Description

The SCF is an all passive device.

#### 7.4.1 Electrical and Mechanical Specification

Refer to § [Electrical and Mechanical Characteristics](#).

#### 7.4.2 Functional Specification

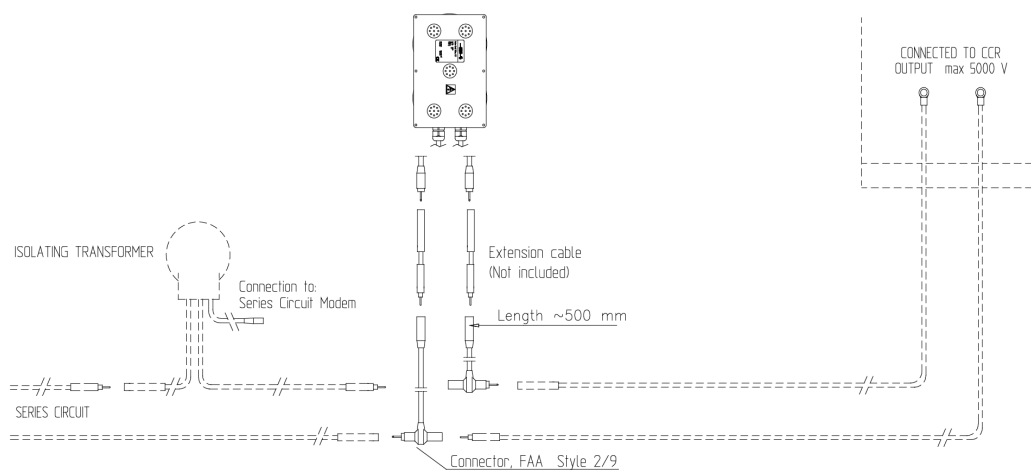
The SCF virtually short circuits the communication signals superimposed on the series circuit by the SCM, and thus prevent them from interfering with the CCR. The SCF also prevents noise from the CCR from interfering with the RELIANCE Intelligent Lighting communication.

### 7.5 Installation

#### 7.5.1 Hardware Installation

The SCF is connected across the CCR output on the high voltage side of the series circuit. Preferable the SCF is positioned close to the CCR.

**Figure 70: SCF installation overview**

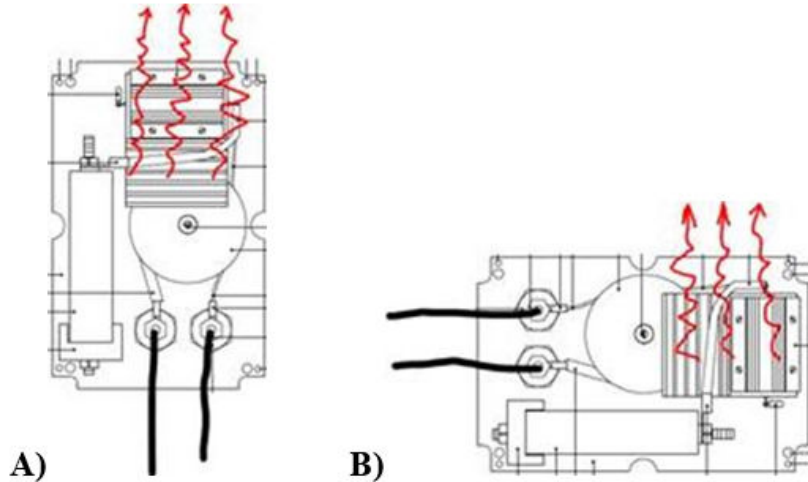


At installation, make sure to keep the SCF ventilation openings free from obstructions with minimum 20 centimeters of space, this to allow proper air flow and ventilation.

Wall-mounted (A) it is recommended to keep the cable entries at the bottom of the SCF. Optionally the cables can be placed on the left side of the SCF (B). Both installations allow the heat from the resistors to evacuate, see [Figure 71](#).

Mounted horizontally on a shelf, place the SCF on its back to make sure the ventilation openings are free.

**Figure 71: SCF ventilation**



## 7.6 Appendix

### 7.6.1 Appendix A

#### 7.6.1.1 Electrical and Mechanical Characteristics

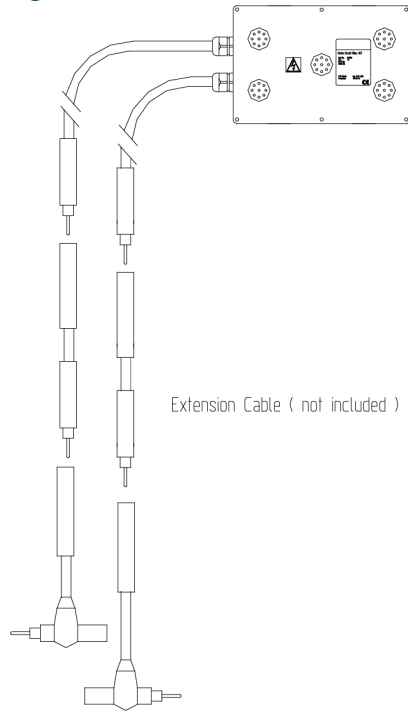
Unless differently noted, all maximum values are absolute maximum values.

Characteristics		Symbol	Min	Typ	Max	Unit
<b>Electrical</b>						
Voltage across series circuit terminals		$V_{CCR}$	-	-	5000	VAC
<b>Environment</b>						
Operating humidity range <a href="#">[1]</a>		RH	10	-	+95	%
Operating temperature range		$T_A$	-5	-	+55	° C
Storage temperature range		$T_S$	-20	-	+70	° C
<b>Mechanical data</b>						
Dimensions	Width	W	-	<b>240</b>	-	mm
	Depth	D	-	<b>160</b>	-	mm
	Height	H	-	<b>120</b>	-	mm
Weight				<b>3.5</b>	-	kg



According to drawing [Figure 72](#).

**Figure 72: AT610063**



[1] Non-condensing.

## 7.6.2 Appendix B

### 7.6.2.1 Maintenance

No special maintenance is required.

## 7.6.3 Appendix C

### 7.6.3.1 Troubleshooting

In case any trouble related to the SCF is encountered, always replaced the unit. Never open up or try to repair an SCF.

If the SCF fails the most apparent indication would be that the RELIANCE IL communication quality on the circuit drops considerably leading to a sudden increase in false lamp status indications and/or communication drop-outs.

Since the design of the SCF uses only a few passive components, the reliability of the SCF is expected to be very high. Hence the most likely cause for trouble with the SCF is associated to its connection to the series circuit, i.e. mechanically oriented.



## 8.0 SCM Rack User Guide

This document describes 19" Rack for 8 SCM board from a user perspective. The description includes Backplane, SCM board with daughterboard and external communication transformer.

### 8.1 Application

This chapter for the 19" Rack for 8 SCM board covers specification, installation, set-up, maintenance and troubleshooting.

### 8.2 References

SG591883-3006 SCM Rack Configuration (template)

SG591891-3001 AMT User Guide

SG591890-3014 RELIANCE Intelligent Lighting Preventive Maintenance.doc

SG591890-3004 RELIANCE Intelligent Lighting – troubleshooting and maintenance

### 8.3 Introduction

The SCM constitutes the station-placed master-unit for Power Line Communication in RELIANCE Intelligent Lighting. By superimposing signals, which represent data, on the current in a series circuit (normally 2.8-6.6 A), each SCM can communicate with LMS and SIU on the circuit to turn on/off lamps and monitor status for lamps and sensors.

This 19" Rack for 8 SCM boards, hereafter called SCM-Rack, enables a compact installation of up to 8 SCM-boards in a single rack. The SCM-rack provides the following functionalities, e.g.:

- Selectable RS-232 or RS-485 interface for each SCM-board
- Support for two RS-485 channels (A/B), for each SCM-board
- Built in, selectable RS-485 termination and *failsafe*-connection, for each SCM-board.
- Built in, selectable RS-485 buses (common for several cards)
- Common power supply – Selective/separate fuses for each SCM-board
- Support digital interface for controlling, e.g. for LPC
- Common data bus (G-bus), e.g. for synchronizing purposes

The complete SCM-rack, including SCM-boards and daughterboards, is CE-approved.

## 8.4 RELIANCE Intelligent Lighting component description

### 8.4.1 General

Referring to [General](#) the complete SCM-rack can be described as following.

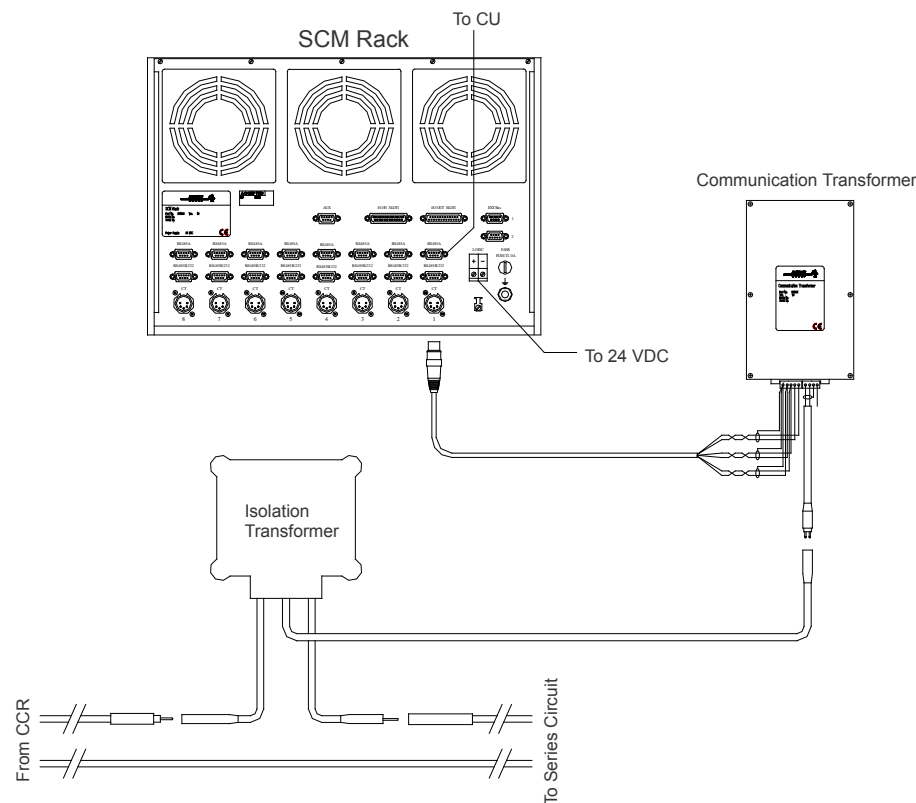
The SCM-rack is powered by an external 24VDC supply, that can be connected to the terminals on the backside of the rack. The rack has 8 slots for installation of up to 8 SCM-boards.

Each SCM-board requires an external Communication transformer. These are normally placed in same cabinet as the SCM-rack. The Communication transformer is connected to a standard Isolation transformer (200W / 6,6A).

The Isolation transformer is connected to the series circuit where RELIANCE Intelligent Lighting components (LMS, SIU) are installed for controlling and monitoring of lamps or sensors.

Each SCM-board is connected via respective RS485 (alt.RS232) connectors on the backside of the rack for communication with the CU.

Figure 73: Principles for SCM-installation on a series circuit



**Note**  
Configuration with one circuit depicted.

### 8.4.2 Power supply

An external power supply unit, 24 VDC is used to power the rack. The power supply unit must comply with the electrical specifications of the SCM-rack. As all SCM do not transmit at exactly the same time (different phases etc) the peak current values are assumed not to coincide – as a rule of thumb max. RMS-value + 40% can be used to calculate the necessary peak current from the power supply.

ADB SAFEGATE can provide suitable power supply for one or more SCM-racks. Configurations with or without redundancy, with or without status signals, e.g. for PLC-supervision, can be supplied.

The external power supply is normally installed in the same cabinet as the SCM-rack(s). Separate fuses above each slot gives selective protection for malfunctions on the SCM board level.

Fuse	Position	Description
T 4.0A (5x20 mm)	Front	Individual fuse for each SCM board slot (1-8)
T 1.0A (5x20 mm)	Rear	Internal cooling fans (3)

## 8.4.3 SCM-rack

### 8.4.3.1 Specifications

Parameter		Symbol	Min	Typ	Max	Unit
<b>Power supply</b>						
Supply voltage		V	22	<b>24</b>	28	V DC
Current consumption RMS	1 SCM-board, transmit	I <sub>1</sub>	0,5	-	2,1	A
	8 SCM-board, transmit	I <sub>8</sub>	4	-	17	A
Current consumption peak	1 SCM-board, transmit	I <sub>1p</sub>	2,4	-	3,7	A <sub>peak</sub>
	8 SCM-board, transmit	I <sub>8p</sub>	19	-	30	A <sub>peak</sub>
Power losses	1 SCM-board	P <sub>1</sub>	5	-	15	W
	8 SCM-board	P <sub>8</sub>	40	-	120	W
<b>Interface</b>						
Series circuit via Communication transformer		P <sub>S</sub>	-	200	-	W
		I <sub>S</sub>	2,5	-	6,6	A
<b>Environment</b>						
Humidity ( <i>non condensing</i> )		RH	10	-	95	%
Ambient temperature, operation		T <sub>A</sub>	-5	-	+55	° C
Ambient temperature, storage		T <sub>STG</sub>	-20	-	+70	° C
<b>Mechanical data</b>						
Dimensions	Width ( <i>rear</i> )	L <sub>w</sub>		442		mm
	Width ( <i>front</i> )	L <sub>f</sub>		483		mm
	Depth	L <sub>d</sub>		350		mm
	Height	L <sub>h</sub>		310		mm
Weight	Without SCM-boards	m <sub>n</sub>		8.0		kg
	8 SCM-boards	m <sub>g</sub>		14.4		Kg



#### Note

Actual current consumption (RMS/peak) and heat power loss depends on transmit power (parameters set at commissioning). Values at 24VDC supply.

### 8.4.3.2 Connections - rear

On the rear, all connections required for installation and operation of the SCM-rack can be found. Each channel (1-8) is identified by the numbers below the connectors.

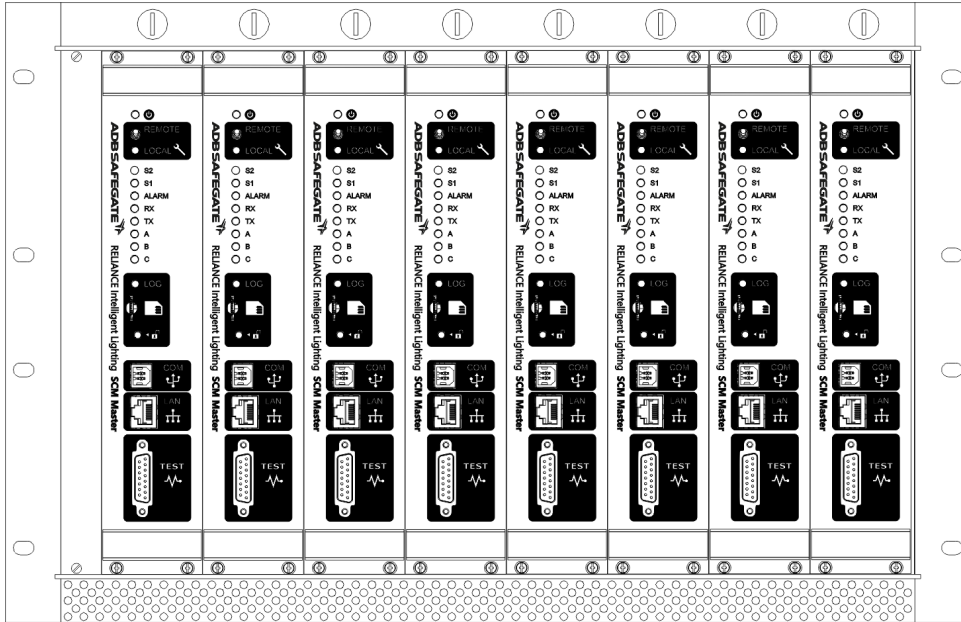
Connector (rear)	Description
RS485A	RS485, channel A (comm. with CU)
RS485B/232	RS485, channel B alternatively RS232 (comm. With CU). RS485 alt. RS232 is selected by jumpers on the backplane.
CT	Connection to Communication transformer
24 V DC	Connection to power supply
Earth bolt	Connection to protective earth - PE
AUX	Not used

Connector (rear)	Description
I/O IN SLOT 1	Digital / analog inputs (only slot 1)
I/O OUT SLOT 1	Digital outputs (only slot 1)
EXT BUS (1 & 2)	External connection (G-bus)

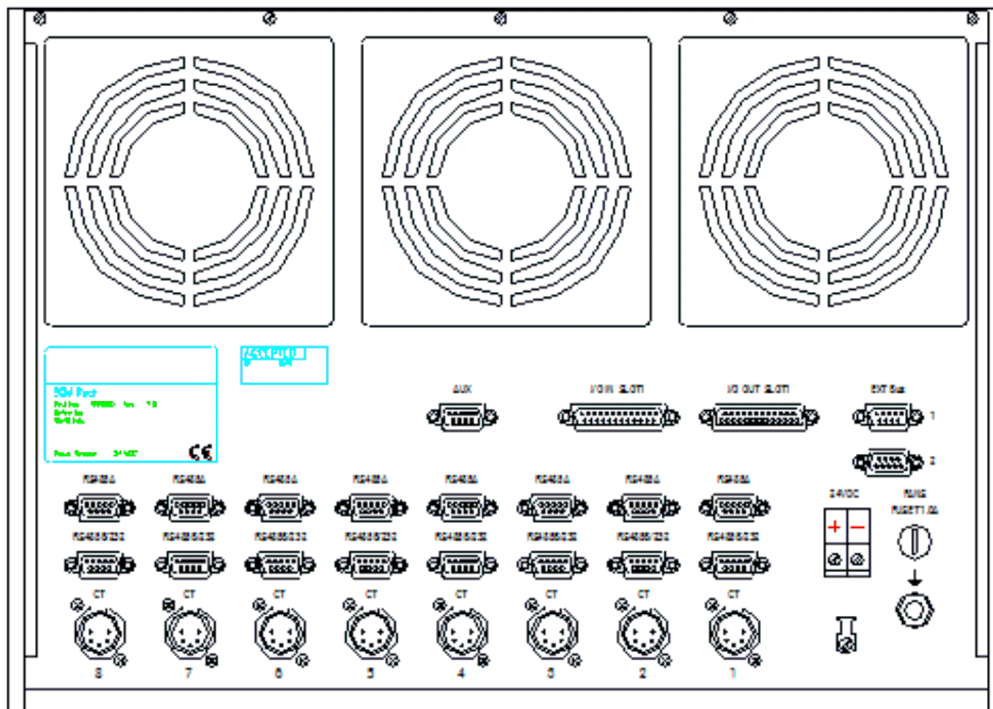
### 8.4.3.3 Front and rear of SCM-rack

Equip the SCM-rack with desired number of SCM-boards, 1-8. Not used slots should be covered by blind front panels.

**Figure 74: Front**



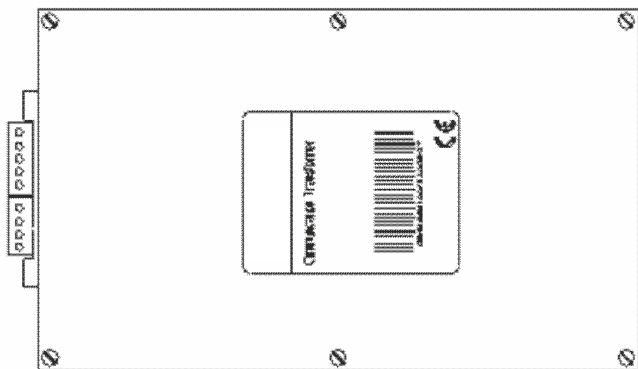
**Figure 75: Rear**



#### 8.4.4 Communication transformer

For each SCM-board, a Communication transformer is required. It adapts the series circuit's 6.6A-system to the transmit- and receive circuitry on the SCM-board. The communication signals will be superimposed on the series circuit current by this transformer.

It interfaces to the series circuit through a standard 200W isolation transformer.



Parameter	Symbol	Min	Typ	Max	Unit
<b>Environment</b>					
Humidity ( <i>non condensing</i> )	RH	10	-	95 <sup>n</sup>	%
Ambient temperature, operation	T <sub>A</sub>	-5	-	+55	°C
Ambient temperature, storage	T <sub>STG</sub>	-20	-	+70	°C
Power losses	P <sub>I</sub>	-	-	15	W
<b>Mechanical data</b>					
Dimensions	Width front	L <sub>w</sub>	-	200	- mm
	Depth	L <sub>d</sub>	-	120	- mm
	Height	L <sub>h</sub>	-	90	- mm
Weight			-	2.2	- kg

### 8.4.5 Backplane

The backplane accommodates 8 SCM-boards, motherboard and daughterboard. The first position gives full functionality for the SCM-board, i.e. includes digital I/O for controlling purposes, e.g. LPC which is used for LMS and SIU programming. Besides communication on the series circuit with LMS and SIU, all slots provide:

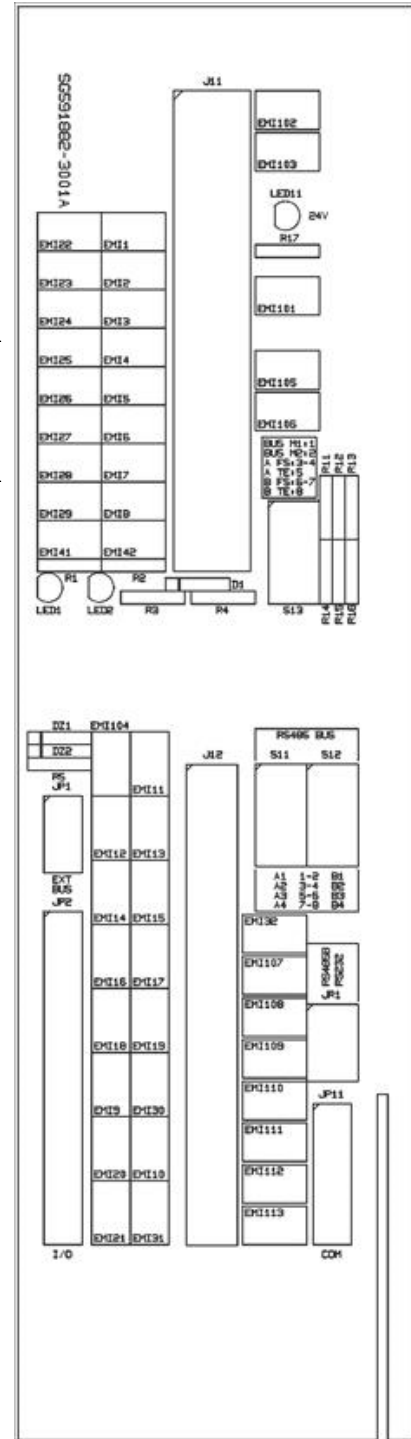
- Selectable RS-232 or RS-485 interface
- Two RS-485 channels (A/B)
- Selectable RS-485 terminations & "failsafe"-cfg
- Selectable RS-485 data buses (common for several SCM-boards)
- Common data bus (G-bus), e.g. for synchronization



#### Note

Configuration/jumpers are set by ADB SAFEGATE personnel at commissioning – ref. to SG591883-3006

The first slot of the backplane is shown to the right =>  
Slot 2 to 8 does not include the components to the left of the card connectors (J11, J12) but otherwise corresponding components.





#### 8.4.5.1 LED-indications

The external 24 V voltage supply provides power to each slot, via the individual fuses (placed above each slot, on the front). On the upper half of the backplane 24 V is indicated according to following scheme:

Indicator	Indicates
LED11	24 V – slot 1
LED21	24 V – slot 2
LED31	24 V – slot 3
LED41	24 V – slot 4
LED51	24 V – slot 5
LED61	24 V – slot 6
LED71	24 V – slot 7
LED81	24 V – slot 8

To the left of slot 1 there are two indicators for the common data bus (G-bus):

Indicator	Indicates
LED1	G-bus, Master 1 active
LED2	G-bus, Master 2 active

#### 8.4.5.2 RS-232/RS-485 alternative

Each slot has two serial communication ports. The first one is only for RS-485, while the other one is either for RS-485 or RS-232.

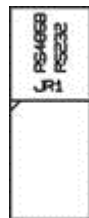
On the backplane of the SCM-rack there are 8 sets of COM-connectors, one set for each slot:

RS485A Channel A – only for RS-485

RS485B/232 Channel B – selectable as RS-485 or RS-232

The channel B mode is selected by the multi-jumpers JR1 to JR8, placed on the lower half of the backplane just above the ribbon cable connector.

SCM slot	Jumper / Position	Left	Right
1	JR1	RS-485B	RS-232
2	JR2	RS-485B	RS-232
3	JR3	RS-485B	RS-232
4	JR4	RS-485B	RS-232
5	JR5	RS-485B	RS-232
6	JR6	RS-485B	RS-232
7	JR7	RS-485B	RS-232
8	JR8	RS-485B	RS-232



**Factory settings:** RS-485B for all slots


#### 8.4.5.3 RS-485 Terminations and Failsafe

The RS-485 standard recommend a termination with the characteristic impedance (120 Ohm) at the last RS-485 unit in the line. **Only one RS-485 termination must exist for each RS-485 bus.**

To define the *inactivity setting – Failsafe* for the bus, resistors be jumpered to the + and – rails of the bus. If *Failsafe* is intended to be used, **this must only be set for one unit on the same RS-485 bus.**

RS-485 Termination and Failsafe is selected with DIL-switches S13 to S83 (corresponding to slot 1 to 8).

Function	Switch position (S13 to S83)
RS-485A Failsafe	3 and 4 ON
RS-485A Termination	5 ON
RS-485B Failsafe	6 and 7 ON
RS-485B Termination	8 ON



**ON** corresponds to the DIL-switch being **depressed on the right side**.

<b>Factory settings:</b>	All switches OFF (OPEN)
	NO Failsafe
	NO Termination

#### 8.4.5.4 Multidrop - RS-485 buses

Using multidrop only one RS-485 connector is connected, for each bus, to the COM-ports on the rear of the rack. This reduces the amount of cabling.

For each SCM-board 4 different buses can be selected for channel A and/or B. Each bus can include 1 to 8 (all) SCM-boards – it is however recommended to keep the number low because common bus means lower communication speed. A practical maximum is 3 SCM-boards per bus.

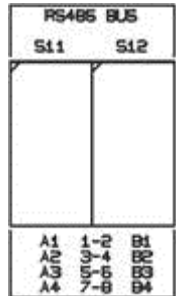
#### Note

Multidrop should only be used for non time critical applications, such as lamp monitoring – not for lamp controlling where short response times should be given priority to.

It is possible to connect an SCM-board to different buses for A- respective B channel – normally both channels share the same bus.

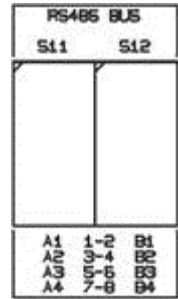
RS-485A bus options is done by the DIL-switches S11 to S81:

SCM slot	DIL-switch	RS-485 Bus A1	RS-485 Bus A2	RS-485 Bus A3	RS-485 Bus A4
1	S11	1+2 on	3+4 on	5+6 on	7+8 on
2	S21	1+2 on	3+4 on	5+6 on	7+8 on
3	S31	1+2 on	3+4 on	5+6 on	7+8 on
4	S41	1+2 on	3+4 on	5+6 on	7+8 on
5	S51	1+2 on	3+4 on	5+6 on	7+8 on
6	S61	1+2 on	3+4 on	5+6 on	7+8 on
7	S71	1+2 on	3+4 on	5+6 on	7+8 on
8	S81	1+2 on	3+4 on	5+6 on	7+8 on



RS-485B bus options is done by the DIL-switches S12 to S82:

SCM slot	DIL-switch	RS-485 Bus B1	RS-485 Bus B2	RS-485 Bus B3	RS-485 Bus B4
1	S12	1+2 on	3+4 on	5+6 on	7+8 on
2	S22	1+2 on	3+4 on	5+6 on	7+8 on
3	S32	1+2 on	3+4 on	5+6 on	7+8 on
4	S42	1+2 on	3+4 on	5+6 on	7+8 on
5	S52	1+2 on	3+4 on	5+6 on	7+8 on
6	S62	1+2 on	3+4 on	5+6 on	7+8 on
7	S72	1+2 on	3+4 on	5+6 on	7+8 on
8	S82	1+2 on	3+4 on	5+6 on	7+8 on



**ON** corresponds to the DIL-switch being **depressed on the right side**.

**Factory settings:** All switches OFF – no *multidrop*

#### 8.4.5.5 G-bus: Master, Slaves

Two separate buses, e.g. for synchronizing of activities on several SCM-boards, are located on the backplane. E.g. one of the SCM-boards can be selected as *Master* and will be synchronizing the other SCM-boards connected to the bus (*Slaves*).

There is also support for *multi-master mode* where several masters can co-exist on the same bus.

*Masters* (M1, M2) can be enabled individually or both at the same time, e.g. for redundancy reasons at failure of one of them.

**All SCM-boards** are connected to the two buses *G-bus 1* and *G-bus 2* and will, if configured so, therefore be *Slaves*.

The two *G-buses* can also be externally connected to other SCM-racks for synchronization. For this purpose there are two EXT.BUS-connectors on the backside of the SCM-rack.

DIL-switches S13 to S83 (corresponding to slot 1-8) decides which SCM will be selected as Master for each. G-bus:

Function	Switch position (S13 to S83)
Master M1	1 ON
Master M2	2 ON



**ON** corresponds to the DIL-switch being **depressed on the right side**.

**Factory settings:** All switches = OFF (OPEN)

No Master is selected

### 8.4.5.6 Digital I/Os

The first slot provides full functionality for the SCM-board, including digital I/Os for controlling purposes, e.g. for LPC, which is used for programming of LMS and SIU. These digital I/Os are available on two separate connectors on the rear of the SCM-rack:

- I/O IN SLOT 1                      *4 Digital / Analog (0-5 V, 8 bits ADC) inputs*
- I/O OUT SLOT 1                      *8 Digital outputs, "Open-collector"-type*

The digital outputs are normally used for other tasks on the SCM-board. To use as separate controllable outputs, adapted software and/or parameters is required - same for reading the digital inputs.

I/O IN SLOT 1		I/O OUT SLOT 1	
D25M- pin	Function	D25F- pin	Function
1	Dig/Ana IN1 (0 ..+5V)	1	Dig. UT 1
2	Dig/Ana IN2 (0 ..+5V)	2	Dig. UT 2
3	Dig/Ana IN3 (0 ..+5V)	3	Dig. UT 3
4	Dig/Ana IN4 (0 ..+5V)	4	Dig. UT 4
5 – 8	Not used	5	Dig. UT 5
9 – 10	N/C	6	Dig. UT 6
11 – 13	+24V	7	Dig. UT 7
14 – 21	Buffered (3k3) +24V	8	Dig. UT 8
22 – 23	Analog ground	9	Relay 1 – NO
24 – 25	Digital ground	10	Relay 2 – NO
		11	+12V (isol.)
		12	GND (isol.)
		13	-12V (isol.)
		14 - 21	+24V
		22	Relay 1 – COM
		23	Relay 2 – COM
		24 - 25	N/C

### 8.4.6 SCM-board

This document describes SCM boards with article number SG25861. For information on SCM boards with article number 591813B please refer to user manual RELIANCE Intelligent Lighting version 1.0.

The name, which stands for Series Circuit Modem, implies that this board is used for communication on the series circuit. The SCM-board constitutes of a *motherboard* and onto that mounted a *daughterboard*. A complete SCM-board is needed for each series circuit to communicate with LMS and/or SIU. The principles of communication is based on FSK, frequency shift, but adapted to series circuit systems where long cables as well as clusters of isolation transformers and (normally) thyristor noise must be mastered.

Available for communication with system above (normally NCU):

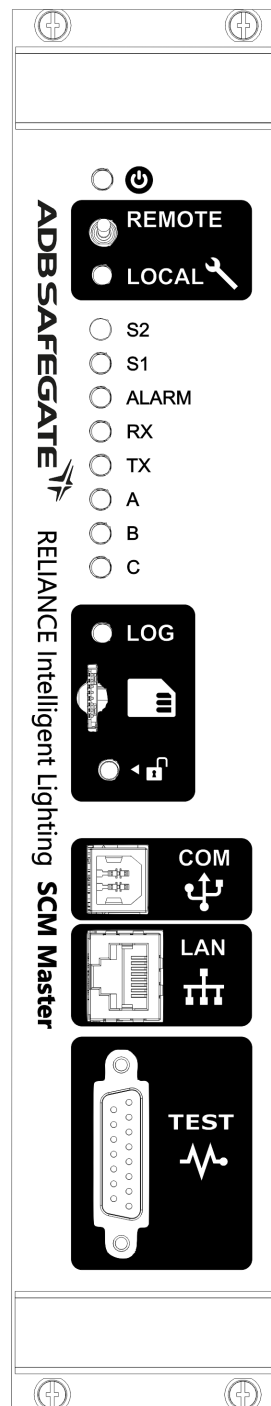
- Selectable RS-232 or RS-485 interface
- Two RS-485 channels (A/B)
- Selectable RS-485 termination

Described in [RS-232/RS-485 alternative](#), and [RS-485 Terminations and Failsafe](#).

For e.g. synchronization of activities on several SCM-boards:

- Common bus (G-bus)

Described in [G-bus: Master, Slaves](#).



#### 8.4.6.1 Front switch RS485/RS232

The position of the front switch selects *Local* or *Remote* mode as communication interface to host system.

- For NCU, *Remote* (RS-485) is normally selected
- For maintenance, with e.g. AMT and laptop-PC, *Local* (USB) is normally selected

*Local* is indicated by the yellow LED next to the switch.

### 8.4.6.2 LED-indicators

The indicators are software- and parameter controlled. At normal operation the following applies:

Text	Color	Indicates
S2	Green	Not used
S1	Green	No current in series circuit (below threshold value)
Alarm	Red	Summary alarm e.g. initiation at CCR power on, and after SCM power on.
Rx	Green	Receives data from NCU (or AMT/laptop)
Tx	Yellow	Transmits data from NCU (or AMT/laptop)
A	Yellow	Indicates channel A (RS-485A) available as communication channel to NCU
B	Yellow	Indicates channel B (RS-485B) available as communication channel to NCU
C	Green	SCM transmits status question/order to LMS/SIU

### 8.4.6.3 Front connectors

The four connectors on the SCM-board front has the following functionality:

Connector	Description
COM	USB/B connector for connecting to AMT via standard USB-A to B cable
TEST	Test points



#### Note

Advanced maintenance and commissioning is only performed by or with support from ADB SAFEGATE personnel.

### 8.4.6.4 Jumpers

There are a number of jumpers on the SCM-board which must be correctly configured to ensure correct operation.

Jumper	Position / Function	Normal position
<b>P200</b> (Termination RS485A)	In = Terminated, <b>Out = Not terminated</b>	Out
<b>P201</b> (Termination RS485B)	In = Terminated, <b>Out = Not terminated</b>	Out
L3 (Receiver gain)	In = High, Out = Low	Not used
<b>SL4</b> (Pgm load mode)	In = Progr.load., <b>Out = Operative</b>	Out
<b>SL5</b> (Pgm load, ext. control)	<b>In = Available</b> , Out = Not available	In
<b>SL6</b> (Reset, ext. control)	<b>In = Available</b> , Out = Not available	In

## 8.5 Installation

### 8.5.1 Hardware installation

All installation must be carried out with power disconnected and according to supplied instructions. Normally SCM-racks, communication transformers and power supply unit will be installed in the same cabinet. A typical 2 m-cabinet (W=80, D=80) will accommodate up to 3 SCM-racks, 24 communication transformers and power supply unit, to serve 24 series circuits with RELIANCE Intelligent Lighting communication.

ADB SAFEGATE offers standard solutions for the mounting and can deliver factory built cabinets.

### 8.5.1.1 Power supply

Follow the manufacturer's recommendations regarding mounting, cooling, protection etc. To get selective protection at failure it is recommended that, if several SCM-racks are using same power supply, each SCM-rack is protected by an individual fuse. This will also ease replacement of a defect SCM-rack. ADB SAFEGATE can provide suitable power supply for one or more SCM-racks.

All connections must be made according to supplied connection diagrams.

### 8.5.1.2 SCM-rack

The SCM-rack should be mounted giving access to its front and back. All connections are made on the back. A cabinet with a removable back cover or a back door or a cabinet with a swing frame can be used. The latter solution allows installation towards a wall.

All connections must be made according to supplied connection diagrams.

### 8.5.1.3 Communication transformer

These will normally be placed in same cabinet as the SCM-racks. If installed outside the cabinet, the cable length should not exceed 10 meters between SCM-rack and communication transformer. Shielded cable, connectors and cable type corresponding to cabinet-internal wiring should be used (Part no. 594102).

The communication transformer is then connected to a standard Isolation transformer (200W/6.6A). The cable length between them should not exceed 40 meters. Shielded cable according to supplied documentation should be used.

The communication transformers emit some heat (see [Communication transformer](#)) and should therefore be mounted with good ventilation.

All connections must be made according to supplied connection diagrams.

Contact ADB SAFEGATE for information regarding suitable cable types.

### 8.5.1.4 SCM-board

#### 8.5.1.4.1 Handling

The SCM-board includes components sensitive to ESD. The board must therefore be handled carefully. Before it is removed from its packing (ESD protective bag), touch a grounded object (the SCM-rack or the cabinet), to discharge yourself! Best is to use an ESD wrist-strap connected to ground. Hold the SCM-board in front/edges and avoid touching the components on the PCB.

#### 8.5.1.4.2 Installation/replacement

Each slot in the SCM-rack is individually fused. When installing or replacing an SCM-board, the power should be interrupted to the associated slot. In the meantime remaining SCM-boards can stay in operation, which will minimize the operational consequences.

First remove the fuse (T 4,0 A) above the associated slot before the SCM-board is removed or inserted.

The SCM-board is mounted with four screws in the corners of its front panel. Carefully remove the old board from its slot and put it in a safe place (ESD protective bag).

When replacing a board, make sure that all jumpers are mounted correctly on the motherboard as well as on the daughterboard. Compare with the old SCM-board or see [Jumpers](#).

Insert and mount the board, then restore the fuse to power up the board again.

Regarding software parameter configurations etc, see [Maintenance](#).

### 8.5.1.5 Cooling

The cabinet must not be closed, but must have ventilation for both incoming and outgoing air. Forced ventilation (evacuating cabinet fan) is recommended, especially in fully equipped cabinets.

For the cooling of the SCM-rack, the airflow must not be blocked as the intake is at the lower position of the front. The exhaust is on the back.

The communication transformers must also be mounted to allow good circulation of air.

## 8.5.2 Software installation

Only the SCM-board contains software.

### 8.5.2.1 SCM-board

At the system commissioning, ADB SAFEGATE will see to that correct software is installed. The user should not need to install any software.

See also chapter [SCM-board](#).

## 8.6 Maintenance

For preventive maintenance instructions, see [Preventive Maintenance](#), document SG591890-3014.

For general maintenance instructions, see [Troubleshooting and Maintenance](#), document SG591890-3004.

### 8.6.1 SCM

#### 8.6.1.1 SCM-rack

The SCM-rack does not require any regularly maintenance, but an overall checking of the operation, e.g. the function of the internal fans, is recommended once in a while. The fuse for the fans is located on the back of the rack.

##### 8.6.1.1.1 Replacement

At replacement of the SCM-rack, the power supply must be turned off and be disconnected. Consult installation drawings to see how.

1. Remove all SCM-boards from the old rack.

Make sure to keep track of which slot they are placed in so that they are put back in the correct slot in the new rack. Use labels to facilitate the marking. See also SCM [Installation/replacement](#).

2. Disconnect all cables on the rear of the rack.

Make sure to keep track of where to reconnect each connector.

3. Dismount the old rack, then mount the new rack in the cabinet and reconnect all cables.

4. Connect all cables on the rear of the rack.

The backplane of the SCM-rack has a large number of DIP-switches and jumpers. Compare settings with the old rack and make sure that all switches/jumpers are at same positions as in the old rack. Also refer to the as-built document SCM Rack Configuration. Then remount the SCM-boards.

5. Finalize by reconnecting the power supply and make sure that the operation is correct.

#### 8.6.1.2 SCM-board

The SCM-board does normally not require any regularly maintenance. Replacement is only needed at a board failure.

##### 8.6.1.2.1 Hardware

For replacement of SCM-board, see chapter SCM-board - Installation / replacement (above).

##### 8.6.1.2.2 Software

Normally, all SCM-boards in the system delivery have the same software installed. An exception could be if a single board has been replaced.



---

#### 8.6.1.2.3 Parameters

Each SCM-board contains a set of parameters unique for each circuit. The parameters typically depends on total load, that is:

- number of LMS, SIU and isolation transformers on the circuit
- circuit length
- the distribution of the load
- noise environment

These parameters and more will be optimized by ADB SAFEGATE personnel at commissioning and must be preserved to ensure correct operation.

#### 8.6.1.2.4 Replacement

At replacement of SCM-board, the new board must have correct software and parameters installed. How this is checked and how to download software and parameters, see document AMT User Guide - SG591891-3001, chapter [SCM Maintenance](#).

### 8.7 Troubleshooting

According to [Troubleshooting and Maintenance](#), document SG591890-3004.

As knowledge of the complete RELIANCE Intelligent Lighting (IL) is a prerequisite for effective troubleshooting and correcting malfunctions or failures, it is strongly recommended that maintenance personnel have attended the RELIANCE IL training that ADB SAFEGATE offers.



## 9.0 SIU User Guide

This document describes the Sensor Interface Unit (SIU) and summarizes its characteristics.

### 9.1 Application

This document applies to SIU 591885 with firmware version 2.0.

### 9.2 References

SG591891-3001 AMT User Guide

### 9.3 Introduction

In RELIANCE Intelligent Lighting the Sensor Interface Unit (SIU) constitutes one of the basic field-installed components. The LMS is another such component.

An SIU is designed to control, monitor and power, up to four external sensors or various other types of equipment that support control and feedback through digital I/O.

The SIU is addressed by the SCM to, on command; switch *on* or *off* anyone of its four outputs. The SCM receives a back-indication from the SIU that reflects the current input status, e.g. *detection* or *no-detection*, *sensor status* etc., depending on configuration and application.

In addition several higher level functions like direction detection and sensor testing are supported.

To what extent all available features in RELIANCE IL in general and in an SIU in particular, are used in a specific application depends on the application itself. Hence it is possible that not all features mentioned in this document are used in a particular application.

### 9.4 Compatibility

The SIU 591885 is backwards compatible with the SIU 591805 both in terms of handling and functionality. This implies that an SIU 591885 can be used (transparently) as a spare in a system originally equipped with the SIU 591805.

Mechanically the SIU 591885 is different from the SIU 591805. The former has four connectors for external equipment while the latter only has one. Furthermore, the connector type is not the same for the two different types of SIU.

Equipment formerly connected to an SIU 591805 shall be connected to an SIU 591885 using an adapter cable (594110).

### 9.5 Characteristics

The application specific functional properties of an SIU are controlled by a set of parameters downloaded to the unit prior to installation. These parameters may also be modified after installation. The mechanism used to download parameters to an SIU in the field uses the same power line communication channel used for commands from the SCM and status back indication from the SIU. See [Programming](#).

This document does not contain any detailed information on specific parameters since all necessary information for programming an SIU being a part of RELIANCE IL, is contained in a database, unique to each system. If an SIU needs to be replaced parameters are fetched from the database and downloaded to the unit.

Below a summary of the most prominent features of an SIU is found, including mechanical and electrical characteristics.

#### 9.5.1 Physical Appearance

The SIU is equipped with four connectors for sensors and other equipment in addition to the series circuit interface connector, which connects to the secondary of a standard isolation transformer. See section [Electrical and Mechanical Characteristics](#) for details.

The four connectors for sensor interfacing are identical with reference to pin-configuration. See section [I/O-Connector Configuration](#) for details. Consequently the connectors are not marked for identification.

## 9.5.2 Installation

Connect the SIU to the secondary of an isolation transformer and to the external equipment to control and monitor. See I/O-Connector Configuration and Cable Recommendations for details on connector pin configuration and cable recommendations.



### CAUTION

Special attention should be paid when connecting external cables to the SIU inputs:

- Make sure that all connectors are clean and properly assembled before connecting them to the SIU. The connector insert must be perpendicular to the connector surface, if not so the connector needs to be disassembled, then reassembled and checked before connected to the SIU.
- Tighten the locking ring by hand (no tools must be used). Make sure that the threads mate properly before applying force. Failure to comply with this requirement may lead to permanent damage to the connector.
- SIU connectors not used must be equipped with sealing caps. Make sure that they are properly tightened. Replace caps not fully functional.
- When an external connector is connected to the SIU, there will be two sealing caps no longer used. Put them together and tighten them to avoid dirt interfering with future use.

## 9.5.3 Inputs and Outputs

Refer to [I/O-Connector Configuration](#) for information on connector layout and pin numbers.

## 9.5.4 Inputs

The SIU supports four separate inputs of which two are shared with outputs. They are: IN1 [\[1\]](#) , IN2, IN3 (shared with OUT3) and IN4 (shared with OUT2). Requirement on device supplying input signal: current sinking, NPN or contact closure to ground (SIU Common terminal).

[\[1\]](#) In the documentation for SIU 591805 IN1 and IN2 are denoted DET1 and DET2 respectively while IN3 and IN4 are called ST AT US1 and ST AT US2.

## 9.5.5 Input Scanning

The SIU scans its inputs once every half cycle of the mains frequency, i.e. with a frequency of 100Hz @ 50Hz and 120Hz @ 60Hz. The physical state of the signal for every individual input is filtered by the SIU and the result is denoted Input status. Input status can be either passive or active.

## 9.5.6 Input Configuration

The relation between the physical input signal and the input status in terms of passive or active is configurable and denoted *input logic*. This implies that depending on configuration, the SIU will either match a physical contact closure to ground to physical input status passive (logic 0) or physical input status active (logic 1). The table below list all possible combinations.

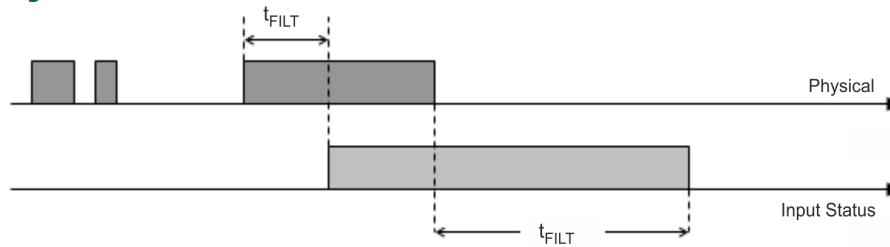
Input Logic	Physical Input	Status	Logic Equivalent
0	Floating	Passive	0
0	Shorted to GND	Active	1
1	Floating	Active	1
1	Shorted to GND	Passive	0

Recommended input logic = 1, i.e. an input not connected or floating is active, hence an alarm can be generated if a cable is cut.

### 9.5.7 Input Filtering

The input filter consists of a digital low-pass filter, which is designed to filter out glitches and de-bounce the input signal. Basically the filter requires the input signal change from passive to active to last for a certain period of time referred to as the *filter time*,  $t_{FILT}$  according to Figure 76.

**Figure 76: Filter time**



In addition the input status can be configured to last beyond the point in time where the physical input signal has disappeared.

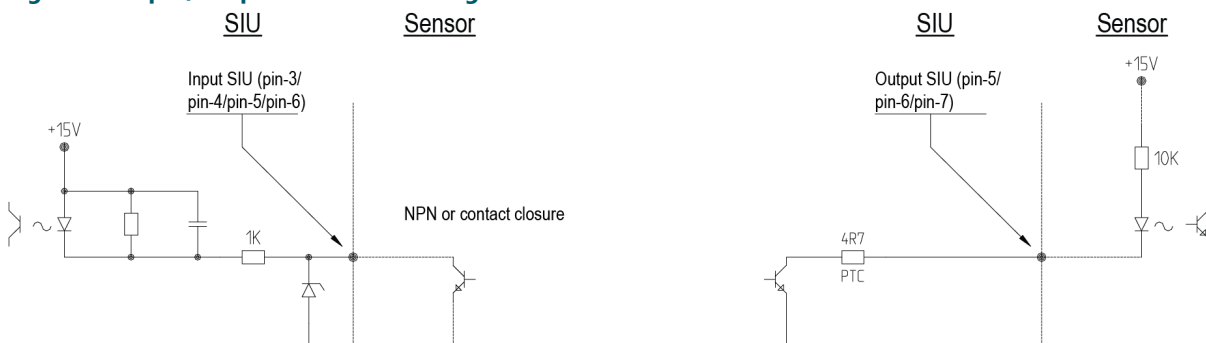
## 9.6 Outputs

The SIU supports four separate outputs of which two are shared with inputs and one is a programmable power output. They are: OUT1, OUT2 (shared with IN4), OUT3 (shared with IN3) and OUT4 (power output).

OUT1, OUT2 and OUT3 are open collector outputs, which sink a maximum of 100mA per output, at a maximum voltage of 26VDC.

OUT4 is a programmable voltage output, 12VDC at  $I_{max} = 625mA$ , 15VDC at  $I_{max} = 500mA$  or 24VDC at  $I_{max} = 300mA$ .

**Figure 77: Input/Output skeleton drawing**



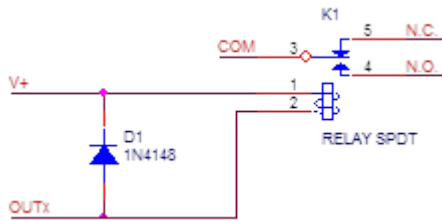
### 9.6.1 Power Output Characteristics

The SIU hardware supports voltage fold back on OUT4. In other words, output voltage will decrease as current increases. Software monitors the voltage level continuously and if it falls below a certain threshold, which depends on the programmed output voltage level, OUT4 will be turned off in order to protect the output (short circuit protection). When the SIU has detected excessive current drain for OUT4, the output will be turned back on for 100ms once every second until the current drain is within limits again in which case OUT4 will be left on.

## 9.6.2 Protecting the Outputs

When an output is driving a relay, a free-wheel diode must be added across the relay coil for protection of the output, see D1 in Figure 78, where 1N4148 is an example. Note that V+ in the figure may be either OUT4 or a voltage external to the SIU (in the latter case the SIU Common terminal shall be connected to the ground reference for V+). The maximum V+ voltage allowed is 26VDC.

**Figure 78: Example of D1**



## 9.6.3 Output Configuration

Each output can be individually controlled by command from the SCM.

In addition each output can be independently configured to either accept or discard commands from host. This implies that to control an output remotely it must have an address assigned for control and be configured for control.

The SIU supports a feature where an output turned on by command from host is automatically turned off after a certain period of time.

If communication between the SIU and the SCM is interrupted or lost the SIU is programmed to either leave the outputs unchanged or set them to a state corresponding to the power on state defined. This mechanism is referred to as *Safe State*.

OUT1, OUT2 and OUT3 are said to be active or on when sinking current and passive or off when floating while OUT4 is active or on when supplying power to the load and passive or off when not.

## 9.7 Shared I/O

Inputs and outputs sharing the same pin require the one to be used exclusively of the other. Note that this applies to the SIU as a unit.

## 9.8 Sensor Test Function

The SIU supports a function, which can be configured to periodically, as often as every 10 seconds, test a sensor. The basic operation is that the SIU turns off the transmitter side of the sensor while monitoring the receiver side for detection. If the receiver side does not detect the missing transmitter signal it indicates a sensor failure, which the SIU will report.

While the sensor test is in progress, live sensor status is suppressed which implies that the sensor function will be unavailable throughout the duration of the test sequence. Typically the sensor test sequence takes less than one second to complete.

The following requirements must be met for correct operation of the sensor test function:

- The sensor used must have an input, which allows the SIU to turn off the transmitter side
- Both the receiver and the transmitter in a sensor pair must be connected to the same SIU

The ADB SAFEGATE MBD (596530) meets these requirements.

## 9.9 Direction Detection

The SIU can be configured to evaluate signals from several sensors thereby enabling detection of direction of movement.

## 9.10 Programming

The procedure through which the SIU is configured is referred to as Programming or Parameter download. SIU programming description in detail, see [AMT User Guide](#).

## 9.11 Appendix

### 9.11.1 Appendix A

#### 9.11.1.1 I/O-Connector Configuration

The table below refers to all four I/O-connectors available on the SIU.

Pin#	Name	Description
1	OUT4	Output 4, power output
2	Common	Common reference to all signals
3	IN1	Input 1, in compatibility mode referred to as DET1.
4	IN2	Input 2, in compatibility mode referred to as DET2.
5	IN3/OUT3	Combined Input 3 and Output 3. In compatibility mode IN3 is referred to as ST AT US1.
6	IN4/OUT2	Combined Input 4 and Output 2. In compatibility mode IN4 is referred to as ST AT US2.
7	OUT1	Output 1

#### 9.11.1.2 Cable Recommendations

Select cable cross-section for connecting the SIU to the sensor or any other equipment, according to the table below.

Max Distance [m]	Cross Section [mm <sup>2</sup> ]	Comment
100	0.5	Provided 1V voltage drop is acceptable for the cable itself and the sensor current drain is less than 150 mA.
150	0.75	
200	1.0	
300	1.5	

For any other combination of cable length and current drain use the following formula to calculate appropriate cross-section for the cable:

$$A = (0.0344 \cdot I_{\text{DRAIN}} \cdot L) / V_{\text{DROP}}$$

where

- A is the cross-section [mm<sup>2</sup>]
- I is the current [A]
- L is the distance between the SIU and the equipment (sensor) to connect [m]
- V<sub>DROP</sub> is the voltage drop [V] across the cable itself

### 9.11.2 Appendix B

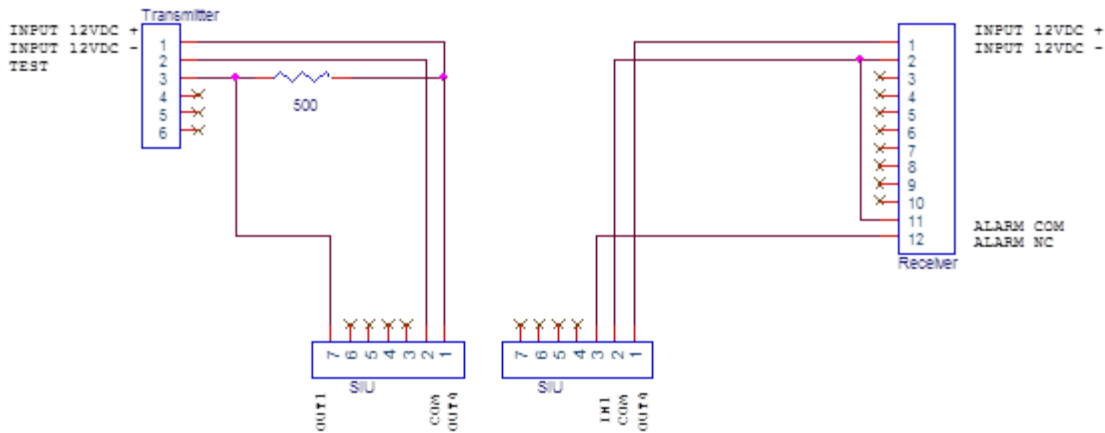
#### 9.11.2.1 Configuring Sensor Test for SG596530

The checklist below assumes that a single sensor, including receiver and transmitter, is connected to the same SIU.

Step	Action	Comment
1	Connect a 500 W resistor between power supply (+) and TEST-terminal in transmitter.	See <a href="#">figure 1</a> .
2	Connect TEST-terminal in transmitter to SIU OUT1 (pin 7 in connector).	See <a href="#">figure 1</a> .
3	Connect power supply terminals in transmitter to SIU OUT4 (+) and Common (-) (pins 1 and 2 in connector).	See <a href="#">figure 1</a> .

Step	Action	Comment
4	Connect a wire between power supply (-) and ALARM RELAY COM-terminal in receiver.	See figure 1.
5	Connect ALARM RELAY NC-terminal in receiver to SIU IN1 (pin 3 in connector).	See figure 1.
6	Connect power supply terminals in receiver to SIU OUT4 (+) and Common (-) (pins 1 and 2 in connector).	See figure 1.
7	Make sure that the HOLD-potentiometer in the receiver is adjusted for minimal hold time (0.5s) and that the NORMAL/L AT CH-jumper is set for NORMAL .	Turn potentiometer counter clock wise to stop position for minimal hold time.

**Figure 79: Interfacing SG596530 to SIU with Sensor Test support.**



### 9.11.3 Appendix C

#### 9.11.3.1 Troubleshooting

The most common cause for SIU malfunction is erroneous installation. It is recommended to always start by verifying the connections, both to the series circuit and to the external equipment (sensor). Make sure to check cables and connectors thoroughly (see Installation and I/O-Connector Configuration).

Proceed with verifying that the SIU power output (OUT4) provides the programmed output voltage. Check both with and without the sensor(s) connected. If the voltage level fluctuates between the programmed level and zero this is a good indicator of a possible problem in the cable connecting for example a sensor to the SIU or an over load condition.

If the cause for failure has not been identified by now it is not unlikely that either a sensor failure or an SIU failure is the cause of the problem. In this case start by verifying the sensor function. If the sensor checks out okay, replace the SIU.

### 9.11.4 Appendix D

#### 9.11.4.1 Electrical and Mechanical Characteristics

Unless differently noted, all maximum values are absolute maximum values. All voltages are with reference to the SIU Common, pin2.

Characteristic	Symbol	Min	Typ	Max	Unit
<b>Series Circuit</b>					
Supply current from series circuit (50/60Hz)	$I_{SUPPLY}$	2.5	-	7.1 [1]	$A_{RMS}$
				8.2 [2]	$A_{RMS}$
Peak input voltage series circuit terminals	$V_{SUPPLY}$	-	-	40	VAC
Isolation voltage	$V_{ISO}$	1500	-	-	VAC
Interface isolation transformer rating	$P_{IT}$	65	<b>100</b>	200	W



Characteristic		Symbol	Min	Typ	Max	Unit
<b>I/O</b>						
Output power OUT4		P <sub>OUT4</sub>	0	-	7.5	W
Voltage OUT4 (Min values apply to full load and max values to zero load. Note that load includes cable and connected equipment.)	12VDC	V <sub>OUT4</sub>	10.5	<b>12</b>	12.5	VDC
	15VDC	V <sub>OUT4</sub>	13.8	<b>15</b>	15.6	VDC
	24VDC	V <sub>OUT4</sub>	23.0	<b>24</b>	25.0	VDC
Current drain OUT4	12VDC	I <sub>OUT4</sub>	0	-	625	mA
	15VDC	I <sub>OUT4</sub>	0	-	500	mA
	24VDC	I <sub>OUT4</sub>	0	-	300	mA
Current drain (sink) per output excluding OUT4		I <sub>S</sub>	0	-	100	mA
Input voltage IN1, IN2, IN3/OUT3, IN4/OUT2, OUT1, OUT4		V <sub>IN</sub>	0	-	26	VDC
Input impedance IN1, IN2, IN3 and IN4 all to OUT4		Z <sub>IN</sub>	1000	-	-	W
<b>Environment</b>						
Operating humidity range		RH	0	-	100	%
Operating temperature range		T <sub>A</sub>	-30	-	+65	° C
Storage temperature range		T <sub>STG</sub>	-30	-	+100	° C
Encapsulation class		IP68				
Dimensions excluding cables	Width	L <sub>W</sub>	-	<b>165</b>	-	mm
	Length	L <sub>L</sub>	-	<b>165</b>	-	mm
	Depth	L <sub>D</sub>	-	<b>105</b>	-	mm
Secondary cable length (FAA-style connector)		L <sub>SC</sub>	-	<b>250</b>	-	mm
Weight			-	<b>4.3</b>	-	kg

[1] In accordance with FAA advisory circular 150/5345-47A (Isolation transformers for airport lighting systems).

[2] For max 1s, in accordance with FAA advisory circular 150/5345-10E (Specification for CCRs and regulator monitors).



## 10.0 LMS User Guide

This document describes the following versions of LMS from both a technical- and an operational perspective:

- 591886-11 Single LMS
- 591886-22 Dual LMS
- 48001418 Reliance Intelligent Lighting Single LMS Remote
- 48001420 Reliance Intelligent Lighting Dual LMS Remote

**Figure 80: RELIANCE IL single and dual LMS remote**



### 10.1 References

[AMT User Guide](#)

### 10.2 Introduction

The LMS is one of several components in RELIANCE Intelligent Lighting, which normally is installed in manholes/hand holes the field. Other such components are the SIU and the SFU.

The basic function of a LMS is to control and monitor on lamp (single-LMS) or two lamps separately (dual-LMS).

The LMS communicates over the series circuit with the SCM using a unique power line communication technique developed by Safegate. From a system perspective the SCM controls the communication (master) and the LMS and the SIU respond to its commands (slave).

The LMS will on command either turn on or turn off or flash the lights connected to it. In addition the LMS back indicates the status of the lamps to the SCM. Lamp status includes both lamp filament status and operational status, i.e. if the lamp is on, off, flashing or defect.

### 10.3 Operational characteristics

To which extent all LMS functionalities are used, is determined by the application. This means that all functionality described in this document is not necessary used at a specific installation. Below is a summary of the most prominent functionalities that are available in LMS.

### 10.3.1 Power On or Default State

The LMS is configured to set the lamp to a predefined state when the series circuit is energized. This feature is called Default State and the options are LAMP ON, LAMP OFF or LAMP FLASHING. Which option to select depends on the light function to which the LMS belongs and the operative requirements.

### 10.3.2 Safe State

In case the communication between the LMS and the SCM is interrupted or lost the LMS will after a programmable timeout set the lamp to a predefined state known as Safe State. Safe state can be set to LAMP ON , LAMP OFF, LAMP FLASHING or *no change*.

### 10.3.3 Command Memory

When the current in the series circuit is lost because the CCR is turned off or for any other reason, the LMS will remember the current lamp status for a limited amount of time. The LMS can be configured to, once current is restored in the circuit, set the lamp to the remembered state, typically the last commanded state before power was lost. This feature will, when enabled, override the Default State.

It's possible to apply a condition based on the amount time current was gone and have the LMS set the lamp to Default State if current was restored beyond this time limit. The time limit is programmable from one to approximately 20 seconds.

### 10.3.4 Soft ON/OFF

The LMS can be programmed to delay the physical turn on or turn off of the lamp upon reception of a command from the SCM. The feature is called SoftON/SoftOFF and its purpose is to mitigate the sudden load change to which the CCR is subjected when a large portion of the load is commanded on or off with a single command. The command acknowledge from the LMS will not be affected, and thereby neither the response time. Without this feature it might not be possible to turn on or off all or most lights on a circuit with a single command without the CCR tripping either because of over- or under-current.

The physical delay is programmable on an individual level in 10ms increments. There will be no response time impact when SoftON/SoftOFF is enabled.

### 10.3.5 Active failed lamp state response

The LMS can be programmed to actively report failed lamps, which makes it possible, on system level, to keep distinct a failed lamp from a failed LMS.

### 10.3.6 RGL functionality

The LMS can be used as a RGL flasher, maintain flashing synchronization in compliance with official standards.

### 10.3.7 Running rabbit

The LMS can be used to create different types of Running rabbit patterns on the series circuit.

## 10.4 Operational indications

As the LMS is an airfield device, there are no visible operational indications on the unit, other than that at the field level by the ability to turn ON/OFF/FLASH the lighting as commanded.

## 10.5 Programming

The application specific functional properties of a LMS are controlled by a set of parameters originally downloaded to the unit prior to installation. These parameters may also be modified after installation. The mechanism used to download parameters to a LMS in the field uses the same power line communication channel used for commands from the SCM and status back indication from the LMS.

Normally all necessary information for programming a LMS being a part of RELIANCE IL is contained in a database, unique to each system. If an LMS needs to be replaced, parameters are fetched from the database and downloaded to the unit, using a LMS Programming Unit (LPU).

For programming procedures, refer to document [AMT User Guide](#).

## 10.6 Electrical and Mechanical Characteristics

### LMS 591886-11 and LMS 591886-22

Unless otherwise noted, all maximum values are absolute maximum values.

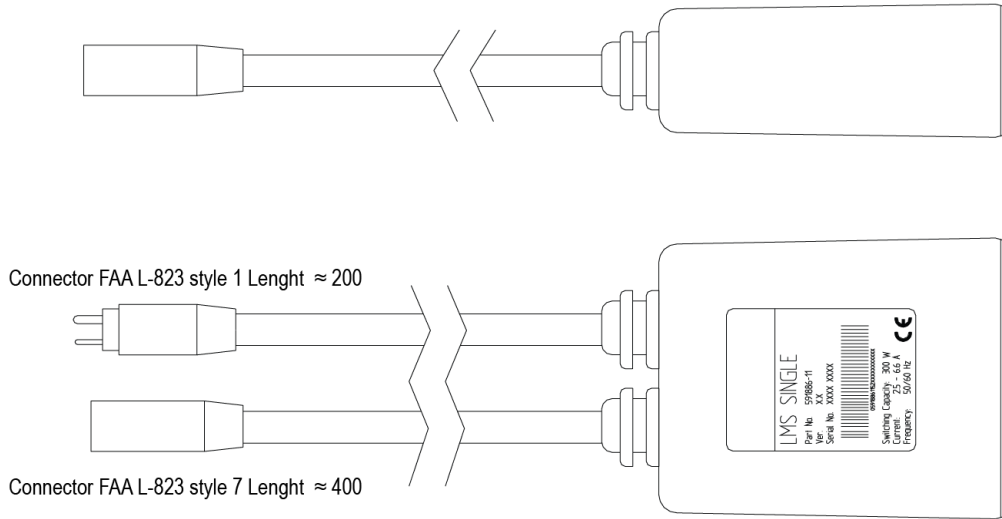
Characteristic	Symbol	Min	Typ	Max	Unit
<b>Series Circuit</b>					
Supply current from series circuit (50/60Hz)	I <sub>SUPPLY</sub>	2.5	-	7.1 [1]	A <sub>RMS</sub>
				8.2 [2]	A <sub>RMS</sub>
Peak input voltage series circuit terminals Single LMS	V <sub>SUPPLY</sub>	-	-	130	VAC
Peak input voltage series circuit terminals Dual LMS	V <sub>SUPPLY</sub>	-	-	260	VAC
Isolation voltage	V <sub>ISO</sub>	1500	-	-	VAC
Interface isolation transformer rating	P <sub>IT</sub>	45	-	500	W
<b>Output</b>					
Lamp wattage each lamp @ 6.6 A <sub>RMS</sub>	P <sub>LAMP</sub>	0	-	300 [3]	W
<b>Miscellaneous</b>					
LMS power consumption @ 6.6 A <sub>RMS</sub> Single LMS	P <sub>LMS</sub>	-	7.5	10	W
LMS power consumption @ 6.6 A <sub>RMS</sub> Dual LMS	P <sub>LMS</sub>	-	7.5	11	W
<b>Environment</b>					
Operating humidity range	RH	0	-	100	%
Operating temperature range	T <sub>A</sub>	-30	-	+65	° C
Storage temperature range	T <sub>STG</sub>	-30	-	+100	° C
Encapsulation class	IP68				
Dimensions excluding cables Single LMS	Width	L <sub>W</sub>	-	<b>161</b>	mm
	Length	L <sub>L</sub>	-	<b>109.5</b>	mm
	Depth	L <sub>D</sub>	-	<b>56.8</b>	mm
Dimensions excluding cables Dual LMS	Width	L <sub>W</sub>	-	<b>1</b>	mm
	Length	L <sub>L</sub>	-	<b>133.5</b>	mm
	Depth	L <sub>D</sub>	-	<b>51.5</b>	mm
Secondary cable length	L <sub>female</sub>	-	<b>0.4</b>	-	m
	L <sub>male</sub>	-	<b>0.2</b>	-	m
Weight Single LMS		-	<b>1.4</b>	-	kg
Weight Dual LMS		-	<b>1.6</b>	-	kg

[1] In accordance with FAA advisory circular 150/5345-47A (Isolation transformers for airport lighting systems).

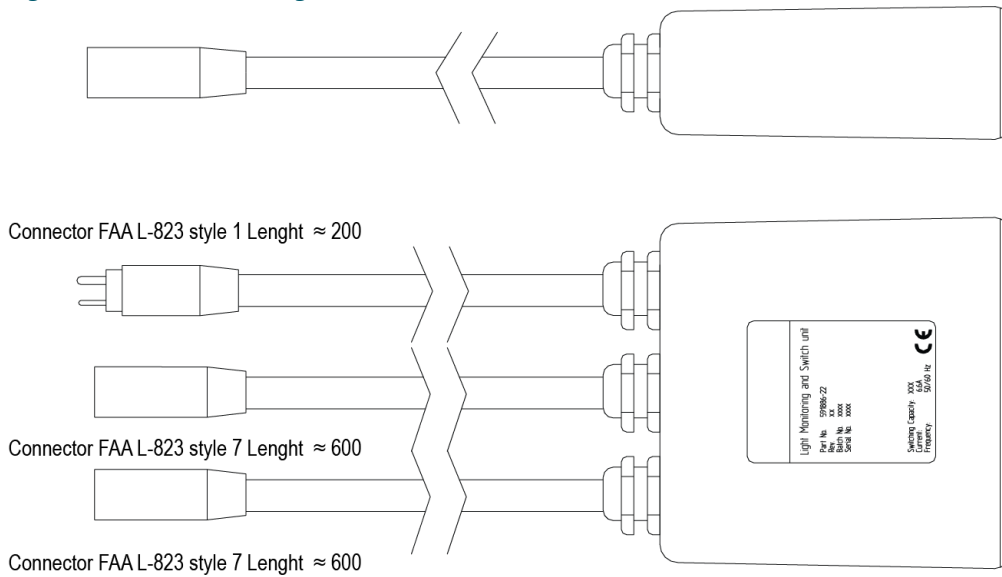
[2] For max 1s, in accordance with FAA advisory circular 150/5345-10E (Specification for CCRs and regulator monitors).

[3] Provided  $I_{PEAK}/I_{RMS} \leq 2.9$ .

**Figure 81: Outline drawing single LMS 591886-11**



**Figure 82: Outline drawing dual LMS 591886-22**



## Reliance Intelligent Lighting LMS Remote (48001418 and 48001420)

Unless otherwise noted, all maximum values are absolute maximum values.

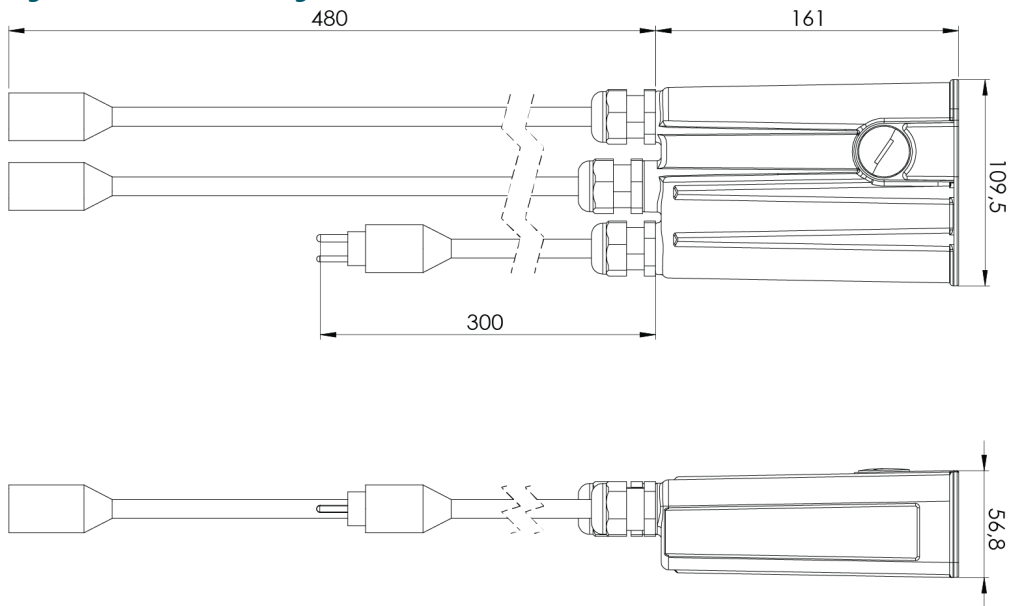
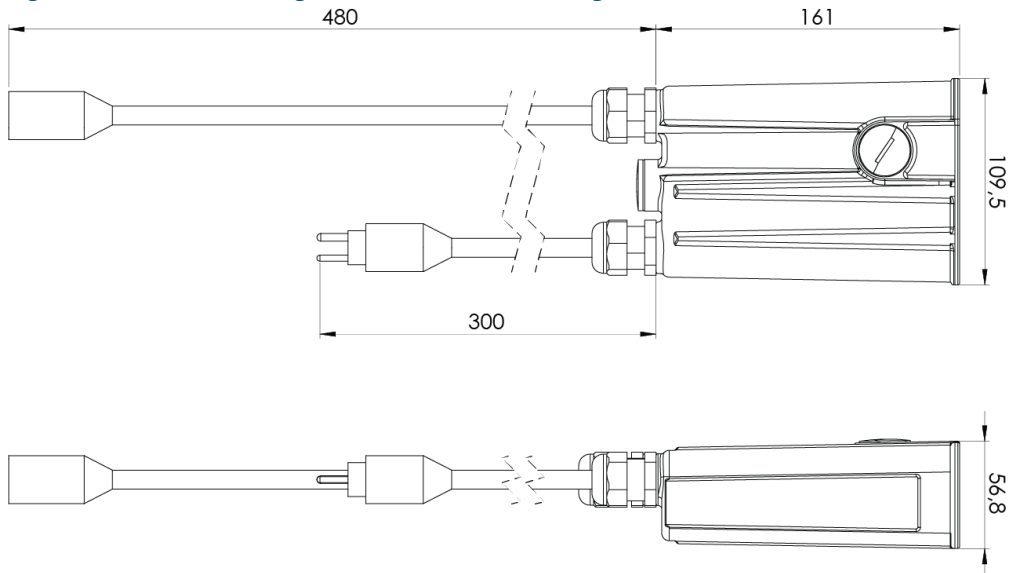
Characteristic	Symbol	Min	Typ	Max	Unit
<b>Series Circuit</b>					
Supply current from series circuit (50/60Hz)	$I_{SUPPLY}$	2.5	-	7.1 [1]	$A_{RMS}$
				8.2 [2]	$A_{RMS}$
Peak input voltage series circuit terminals Single LMS	$V_{SUPPLY}$	-	-	130	VAC
Peak input voltage series circuit terminals Dual LMS	$V_{SUPPLY}$	-	-	260	VAC
Isolation voltage	$V_{ISO}$	1500	-	-	VAC
Interface isolation transformer rating	$P_{IT}$	45	-	500	W

Characteristic	Symbol	Min	Typ	Max	Unit
<b>Output</b>					
Lamp wattage each lamp @ 6.6 A <sub>RMS</sub>	P <sub>LAMP</sub>	0	-	300 [3]	W
<b>Miscellaneous</b>					
LMS power consumption @ 6.6 A <sub>RMS</sub> Single LMS	P <sub>LMS</sub>	-	7.5	10	W
LMS power consumption @ 6.6 A <sub>RMS</sub> Dual LMS	P <sub>LMS</sub>	-	7.5	11	W
<b>Environment</b>					
Operating humidity range	RH	0	-	100	%
Operating temperature range	T <sub>A</sub>	-30	-	+65	° C
Storage temperature range	T <sub>STG</sub>	-30	-	+100	° C
Encapsulation class	IP68				
Dimensions excluding cables Single LMS	Width	L <sub>W</sub>	-	<b>161</b>	mm
	Length	L <sub>L</sub>	-	<b>109.5</b>	mm
	Depth	L <sub>D</sub>	-	<b>56.8</b>	mm
Dimensions excluding cables Dual LMS	Width	L <sub>W</sub>	-	<b>161</b>	mm
	Length	L <sub>L</sub>	-	<b>109.5</b>	mm
	Depth	L <sub>D</sub>	-	<b>56.8</b>	mm
Secondary cable length	L <sub>female</sub>	-	<b>0.48</b>	-	m
	L <sub>male</sub>		<b>0.30</b>		m
Weight Single LMS		-	<b>1.4</b>	-	kg
Weight Dual LMS		-	<b>1.6</b>	-	kg

[1] In accordance with FAA advisory circular 150/5345-47A (Isolation transformers for airport lighting systems).

[2] For max 1s, in accordance with FAA advisory circular 150/5345-10E (Specification for CCRs and regulator monitors).

[3] Provided  $I_{PEAK}/I_{RMS} \leq 2.9$ .

**Figure 83: Outline drawing 48001420 Reliance IL dual LMS remote****Figure 84: Outline drawing 48001418 Reliance IL single LMS remote**

## 10.7 Installation

The dual LMS connects to the secondary of a standard isolation transformer and to one or two lamps. For details on recommended transformer rating, see [Calculating Transformer Rating](#).

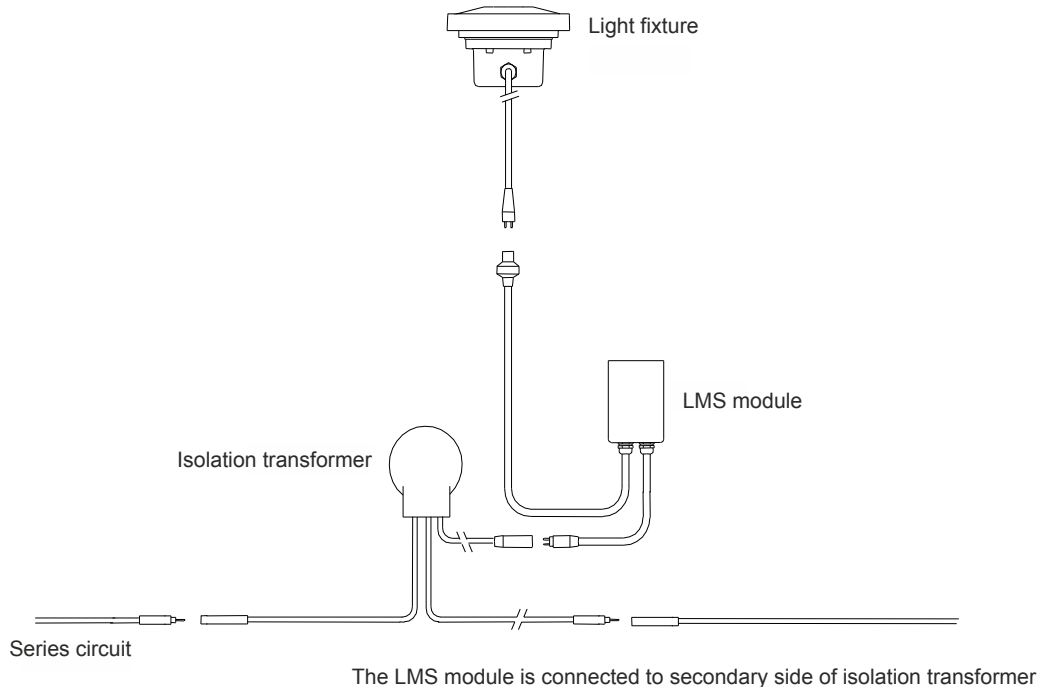




## Note

The LMS supports grounded as well as ungrounded configurations, but no more than one ground point on the isolation transformer secondary is allowed. In other words, either the secondary of the isolation transformer or the lamp fixture may be grounded but not both. If both sides are grounded the LMS will not work properly.

**Figure 85: Installation of LMS**



### 10.7.1 Replacement of lamp

#### LMS 591886-11 and LMS 591886-22

For the LMS to detect a replaced lamp after a lamp failure, both lamps must be disconnected and after that reconnected with two good lamps (applies only to dual lamp LMS). This procedure does not impose any restrictions on the normal maintenance procedures, as replacement of a lamp normally is carried out by replacing the whole fixture.

#### Reliance Intelligent Lighting LMS Remote (48001418 and 48001420)

The procedures for lamp replacement will depend on site-specific configuration and version of the remote. A new lamp will always be detected after power cycling, but the remote could also be configured to detect a new lamp automatically at replacement, thereby avoiding to impose any restrictions on the normal maintenance procedures.

### 10.7.2 Calculating Transformer Rating

To calculate the minimum power rating for the isolation transformer to which the LMS is connected, use the following formula:

$$P_{IT} = P_{LAMP1} + P_{LAMP2} + P_{LMS} + (0.0344 * 6.6^2 * (L_{CABLE}) / A)$$

where

- $P_{LAMP1}$  = power consumption of lamp [W]
- $P_{LAMP2}$  = power consumption of second lamp for **dual** LMS calculation only [W]
- $P_{LMS}$  = power consumption of the LMS [W]

- $L_{\text{CABLE}}$  = total length of secondary cable [m]
- $A$  = cross section of the secondary cable (cable between LMS and lamp) [mm<sup>2</sup>]

For 2.5 mm<sup>2</sup> secondary cable the above translates to:

$$P_{\text{IT}} = P_{\text{LAMP1}} + P_{\text{LAMP2}} + P_{\text{LMS}} + 0.6 (L_{\text{CABLE}})$$

For 4.0 mm<sup>2</sup> secondary cable:

$$P_{\text{IT}} = P_{\text{LAMP1}} + P_{\text{LAMP2}} + P_{\text{LMS}} + 0.4 (L_{\text{CABLE}})$$



### Note

The minimum recommended isolation transformer rating for use with LMS is 65W, even if the result of  $P_{\text{IT}}$  calculation is lower. This is to ensure optimal conditions for the powerline communication.

The formula does not account for tolerances of the isolation transformer power rating, nor does it account for the efficiency and the ratio of the transformer. Consequently, the calculated transformer **rating** is conservative but nevertheless it is not recommended to use transformers with power rating below the calculated.

## 10.8 Troubleshooting

Among the most common causes for failure or malfunction is erroneous installation in terms of bad cables, ground faults, shorts through e.g. water penetration in the light fixture, problems with the installation transformer and/or defective connectors.

If the problem remains even after the above have been confirmed okay, replace the LMS. If the problem remains after replacement this indicates that the cause is most likely to be found in the installation.

## 10.9 Parts available for ordering

**Table 3: Article numbers**

Article number	Description
SG13713	591886-11 Single LMS
SG14517	591886-11 Single LMS. Pre-configured with customer specific configuration.
SG13716	591886-22 Dual LMS
SG14519	591886-22 Dual LMS. Pre-configured with customer specific configuration.
SG25832	48001418 Reliance IL Single LMS Remote
SG25833	48001418 Reliance IL Single LMS Remote. Pre-configured with customer specific configuration.
SG25834	48001420 Reliance IL Dual LMS Remote
SG25835	48001420 Reliance IL Dual LMS Remote. Pre-configured with customer specific configuration.

**Table 4: Spare parts**

Article number	Description
SP012870	Blind plug and o-ring for JTAG connector. Kit of 10 pieces
SG13713	591886-11 Single LMS
SG13716	591886-22 Dual LMS
SG25832	48001418 Reliance IL Single LMS Remote
SG25834	48001420 Reliance IL Dual LMS Remote

## 11.0 MBD User Guide

This document describes the Microwave Barrier Detector (MBD) in its application in RELIANCE Intelligent Lighting provided by ADB SAFEGATE.

Refer to the original documentation Technical Manual for Model 310B Outdoor Microwave Link, included in the delivery, for a more detailed description.

### 11.1 Application

This document explains and describes the MBD from an operational perspective in RELIANCE IL and covers specifications, installation, maintenance and troubleshooting of the MBD. Applies to product versions 596530-1, -2 and -3.

### 11.2 References

SG591885-3018 SIU User Guide

SG596530-3015 MBD Installation data (see Appendix)

SG596530-3009 Manual Testsystem RM82

Technical Manual for Model 310B Outdoor Microwave Link

### 11.3 General

The MBD setup is integrated to RELIANCE Intelligent Lighting for use in detection of aircraft and vehicles at strategically located positions in the airfield. The MBD setup uses a separate Transmitter and Receiver unit, a detector pair, as a means of creating a line-of-detection type signal path.

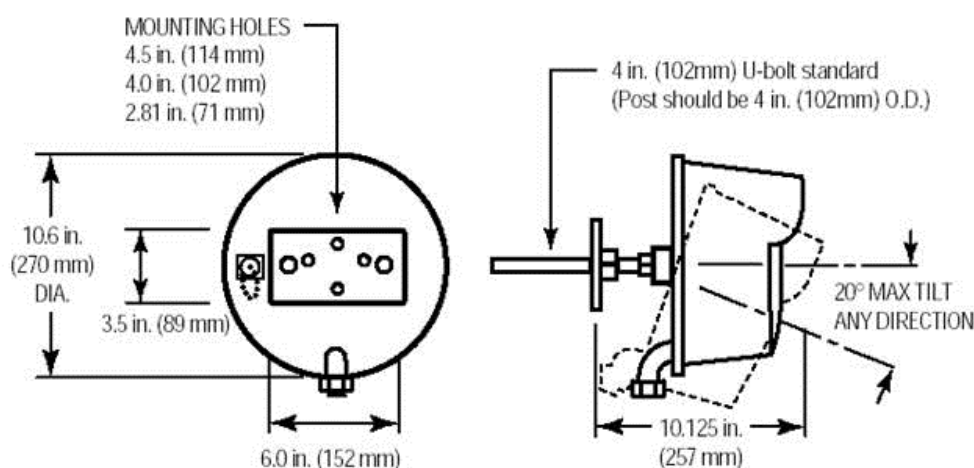
When an aircraft or vehicle crosses this signal path, detection is registered by a loss or influence of microwave-signal on the receiver end of the detector pair and the MBD reports detect to the SIU.

An MBD pair connected to SIU supports autonomous sensor test. More details on this subject can be found in the [SIU User Guide](#), SG591885-3018.

### 11.4 Characteristics

#### 11.4.1 Physical appearance

The MBD 596530 consists of two units, Transmitter and Receiver, each with a mounting bracket for a  $\pm 100$  millimeter, or  $\pm 60$  millimeter, post.



### 11.4.2 Specification

Specification	Symbol	Min	Typ	Max	Unit
<b>Operational</b>					
591830-1, 591830-3 Distance between transmitter and receiver	$L_{\text{range}}$	20	-	<b>120</b>	m
591830-2 Distance between transmitter and receiver	$L_{\text{range}}$	30	-	<b>450</b>	m
Target velocity (@ 36 kg , $\varnothing$ 30 cm ) Rem . For large objects (aircrafts, vehicles) the maximum target velocity will be noticeably higher	$v_t$	0.03 0.1	- -	15 54	m/s km/h
<b>Power requirement</b>					
Voltage supply transmitter or receiver	$V_s$	11	<b>12</b>	14	VDC
Current consumption transmitter	$I_{tx}$	90	<b>120</b>	150	mA
Current consumption receiver	$I_{rx}$	15	<b>20</b>	25	mA
<b>Microwave</b>					
596530-1, 596530-3 Signal peak power	$P_s$ (peak)	-	<b>0.5</b>	-	mW
596530-1, 596530-3 Signal average power	$P_s$ (avg)	-	<b>0.25</b>	-	mW
596530-2 Signal peak power	$P_s$ (peak)	-	<b>6</b>	-	mW
596530-2 Signal average power	$P_s$ (avg)	-	<b>3</b>	-	mW
Carrier frequency (K-band)	$f_{\text{carrier}}$	-	24.200 <sup>1</sup>	-	GHz
<b>Mechanical</b>					
Dimensions, transmitter and receiver	$\varnothing$	-	<b>270</b>	-	mm
	Depth	-	<b>224</b>	-	mm
Weight, transmitter and receiver		-	<b>2</b>	-	kg/each
<b>Environmental</b>					
Operating temperature		-40	-	+66	°C
Humidity		0	-	100	%

#### Notes

<sup>1</sup> Other frequencies in the K-band (country specific) available on request



#### Note

Maximum distance for reliable function varies depending on installation height, flatness and structure of the pavement and terrain.

### 11.4.3 Miscellaneous

Electrical fuses:

- Transmitter: 0,5 A (fast), 6,3x32 mm
- Receiver: 0,25 A (fast), 6,3x32 mm

Contact data for Alarm relay and Tamper switch: 28VDC / 2A

The MBD units have **CE** approval.

## 11.5 Installation

### 11.5.1 Placing the MBD

Before placing the MBD, an analysis must be made to ensure:

- System functionality
- Sensor functionality
- Safety

#### 11.5.1.1 System functionality

The MBD pair must be installed so that its *line of detection* is at the intended position to monitor, e.g. just behind a stopbar on the taxiway.

#### 11.5.1.2 MBD functionality

- Please observe that the maximum allowable distance between the sensor Transmitter and Receiver must be respected. The maximum range will be limited by the terrain and how well vegetation and snow are removed. Although the maximum distance is said in the datasheet to be 450 meters (low power model: 120 meters) it is recommended to keep the distance within 120 meters (low power model: 80 meters), especially in areas where heavy rain or snow can be expected.
- The area between Transmitter and Receiver must be free of tall grass, weeds, debris and obstructions.
- The Transmitter and Receiver must be mounted on a rigid surface or post as unwanted vibrations may cause spurious detections. For more information, see [Installation hardware](#).
- For proper function of the MBD, the line of aim between the Transmitter and the Receiver must be high enough above the crest of the runway/taxiway, typically between 60 cm and 115 centimeters - this is to avoid problems due to microwave multipath interference. A suitable height will be decided at commissioning - until then, the posts should be long enough to allow for adjustment up to 115 centimeters above the crest. For more information, see [Installation hardware](#).
- The Transmitter and Receiver must be powered at all times monitoring of vehicles is desired. When using the SIU to power and monitor the Transmitter and Receiver, the isolating transformer supplying the SIU must be connected to a series circuit that is powered. For more information, see [Connecting Transmitter and Receiver](#). Loss of power will disable the MBD sensor function and hence no vehicle movements can be monitored.

### 11.5.2 Safety

All means must be taken to ensure that the MBD installation does not reduce the safety or increase the risk of a potential collision. The following reasoning refers to applicable standard, runway/taxiway width and camber, current aircraft and their dimensions. In the following text the MBD will be referred to as the Sensor.

#### 11.5.2.1 Reference

Applicable standard (ICAO Annex 14, Fourth Edition July 2004), 9.9 *Siting of equipment and installations on operational areas* says:

9.9.4 Recommendation: *Any equipment or installation required for air navigation purposes which must be located on the non-graded portion of a runway strip should be regarded as an obstacle and should be frangible and mounted as low as possible.*

#### 11.5.2.2 Runway/taxiway dimensions

The width of a runway depends on its code and is typically 30, 45 or 60 meters.

To promote drainage of water the surface should be cambered - the transverse slope should not exceed 1.5% (code C, D, E or F) or 2% (code A or B). In case the landing gear is near or at the edge of the runway there will be an inclination of wings caused by this cambering, i.e. the ground clearance will be reduced outside the edge.

### 11.5.2.3 Aircraft dimensions

To avoid collision Aircraft – Sensor, the placing of the MBD is restricted by the dimensions of aircrafts operated at the airport - of most interest are:

- Distance between outer point of landing gear and outer point of outer engine
- Distance between outer point of landing gear and outer point of wing
- Ground clearance outside the outer engine

These data can be found in manuals (*Airplane Characteristics for Airport Planning*) from the aircraft industry, e.g. for:

- Boeing [http://www.boeing.com/assocproducts/aircompat/plan\\_manuals.html](http://www.boeing.com/assocproducts/aircompat/plan_manuals.html)
- Airbus The consultation and download of technical data are available for registered users in the Airbus customer portal Airbus|World at [www.airbusworld.com](http://www.airbusworld.com)

## 11.6 Risk Analysis

### 11.6.1 Risk of collision

#### 11.6.1.1 Hazardous events

Foreseeable hazardous events:

- Collision Landing gear - Sensor
- Collision Engine - Sensor
- Collision Wing - Sensor

#### 11.6.1.2 Risk minimizing measures

- Sensors shall be placed as far as possible from the runway/taxiway edge to minimize the risk of collision.
- Highest point of Sensor shall be significantly lower than the lowest point of any part of the aircraft that may pass above the sensor while the landing gear is on and not beside the runway/taxiway.
- The sensor construction is made frangible (the post has an integrated breakable coupling) and its mass is low.

#### 11.6.1.3 Risk estimation

1. For a *Collision Landing Gear - Sensor* to occur, an aircraft must pass with its landing gear outside the runway/taxiway edge. The risk of such a collision is considered to be negligible compared to other risks in that situation.
2. For a *Collision Engine - Sensor* to occur, while the landing gear is on and not beside the runway/taxiway, the distance between runway/taxiway edge and Sensor must be less than the distance between Landing Gear and Engine. Provided that the sensors are installed such that the distance between runway/taxiway edge and sensor is greater (with a *safety margin of 2 m*) than the distance between Landing Gear and Engine, the probability for a collision Engine - Sensor is negligible.
3. For a *Collision Wing - Sensor* to occur, while the landing gear is on and not beside the runway/taxiway, the lowest point of the wing passing above the Sensor must be lower than or equal to the highest point of the sensor. Provided that the sensors are installed such that there is a safety margin of at least 1.5 meters between said points of the wing and sensor, swing and inclination (due to cambering of runway/taxiway) of wings will be allowed for and the probability for a collision Wing – Sensor will be negligible.

## 11.7 Risk of FOD

FOD stands for Foreign Object Debris or Foreign Object Damage.

### 11.7.1 Hazardous event

Foreseeable hazardous event:

- Damage on aircraft or human caused by sensor head, mounting assembly or post being teared off, e.g. by the jet blast.

### 11.7.2 Risk minimizing measures

The sensor head, mounting assembly and post are secured to the concrete base with a safety catch wire as instructed in this manual, MBD User Guide.

### 11.7.3 Risk estimation

The probability for loose objects causing any damage on aircraft or human is reduced to a minimum by using the safety catch wire.

The risk of FOD is therefore considered to be negligible.

## 11.8 Example

Currently, the longest distance between landing gear and engine is found on the B747: Approximately 16 meters. For the new A380 this distance is approximately 20 meters, however only a few airports will be trafficked by this aircraft).

Provided that the Sensor is placed at least 18 meters away from the edge and looking only at aircraft where the wing span is wide enough to pass above the sensors, the lowest point of the wing above ground will exceed 3 meters (least found marginal is for B707-320/420).

Provided that the Sensor protrudes above the ground level at runway/taxiway edge less than 1.5 meters, the clearance will be at least 1.5 meters allowing for swing and inclination (due to cambering of runway/taxiway) of wings.

For a runway width of 60 meters the distance between a Sensor pair, Transmitter and Receiver, will then need to be  $60 + 18 \times 2 = 96$  meters or more ( $< 120$  meters).

## 11.9 Installation hardware

### 11.9.1 Preparations

Prepare a rigid mounting surface for the MBD Transmitter and Receiver. Do not mount units on a vibrating surface or post.

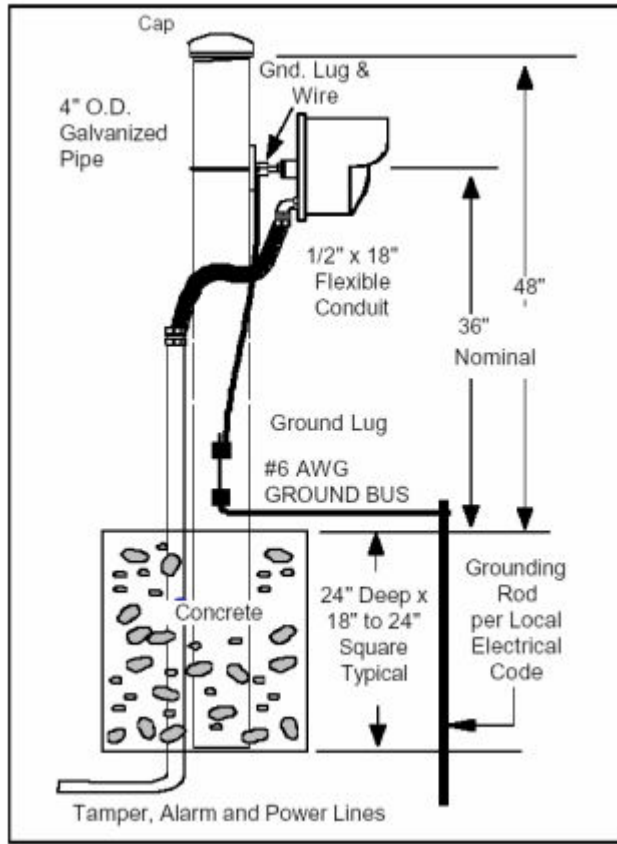
A recommended mounting post is a 3 ½ inch / 90 mm galvanized pipe (outside diameter 4 inches / 100 mm), attached to a (prefabricated) concrete base. A 60 mm post may be used if that better suits the prefabricated base. The post should protrude above ground level of the area to guard (center/crest of Taxiway/Runway) to a height of 4 feet / 1.2 m – this implies the posts must be higher when mounted on shoulders that fall off from the Taxiway/Runway edges.

See [Figure 86](#) as an example.

### 11.9.2 Precautions

The posts should have an integrated breakable coupling to allow for collapse if submitted to a hitting object, such as an aircraft or vehicle. The breakable coupling must be located just above ground level!

**Figure 86: Example of mounting of a post**



### 11.10 Mounting the MBD

1. Remove the MBD units from the shipping containers. Separate the swivel assembly from the mounting plate by turning the large nuts counter-clockwise. Large nuts require 1 1/4 inch (32mm) open-end wrench.
2. Secure the mounting bracket to the post with U-bolt or to other mounting surface with appropriate screws or fasteners.
3. Secure the swivel assembly to the Transmitter and Receiver and attach to mounting bracket.
4. Rotate the Transmitter and Receiver so that the conduit fittings are pointed straight down.
5. Tighten the large nuts on the swivel assembly to hold the units in place.
6. Mount the Transmitter and Receiver 2 1/2 to 3 feet / 0.75 to 1.0 m above ground level of the area to guard (center/crest of Taxiway/Runway) and allow for height adjustment of at least plus or minus 6 inches / 15cm. Height adjustment may be required during final alignment to achieve optimum protection pattern.

### 11.11 Wiring work

An 18-inch / 46 cm 1/2 inch flex conduit is recommended between conduit fitting of MBD units and rigid conduit. Continue from here with a conduit to the manhole (pit) where the related SIU is located.

Insert wires through conduit fitting. Leave enough slack in wires so that the MBD units may be adjusted in height and tilted after radomes are replaced.





## Note

After wiring is complete, it is recommended that entry conduit be filled sealed) with non corrosive sealant such as Dow-Corning #738 RTV. This will prevent moist air in the conduit system from entering the MBD Transmitter or Receiver.

## 11.12 Securing the MBD and post

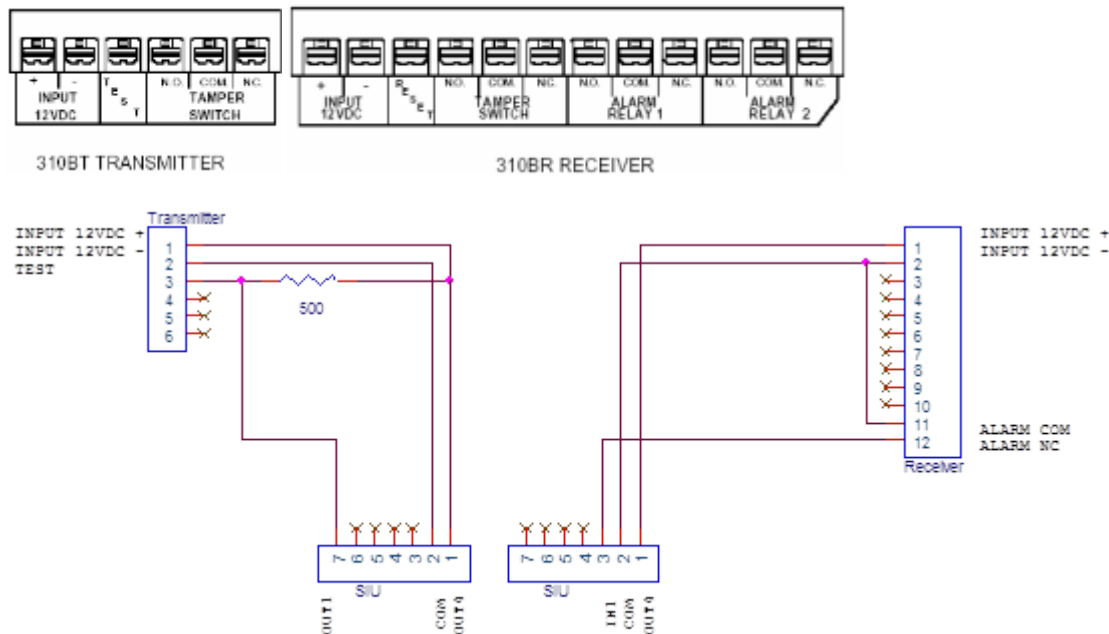
Securely fasten a ring bolt to the concrete base. A ring bolt should also be mounted on the lower part of the post, just above the breakable coupling.

A safety catch wire with spring safety hooks attached at both ends should then be fastened between the base ring bolt and the MBD. The wire should pass through the post's ring bolt and then be connected to e.g. the swivel assembly between the mounting plate and the MBD head.

## 11.13 Connecting Transmitter and Receiver

The procedure is the same for both Transmitter and Receiver unit:

- Remove the radome of the MBD by removing the six radome screws.
- Insert power and alarm circuit (RX only) wires through conduit fitting. Leave enough slack in wires so that the unit may be adjusted in height and tilted after radome is replaced.
- Make connections to the terminal strip according to labelled terminal functions (See Figure)
- Observe the resistor (500 Ohm) in the Transmitter and the jumper in the Receiver.
- Attach power wires to terminal identified as +12VDC (Positive) and GND (Negative). OBSERVE POLARITY. (wrong polarity will blow the fuse - Keep spare fuses available)
- If not continuing with the commissioning at this stage, replace radomes on Transmitter and Receiver using all six screws.



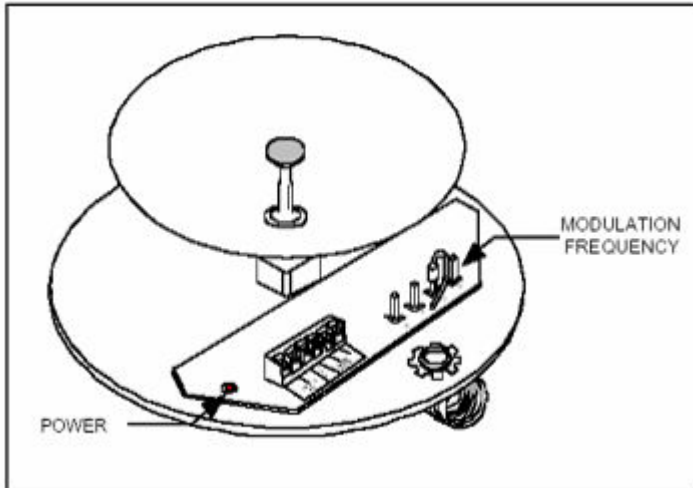
## 11.14 Commissioning the MBD

### 11.14.1 Indicators and jumpers

#### 11.14.1.1 Transmitter

MODULATION FREQUENCY: Channel selection field: A – B – C – D

POWER (LED): Power indication



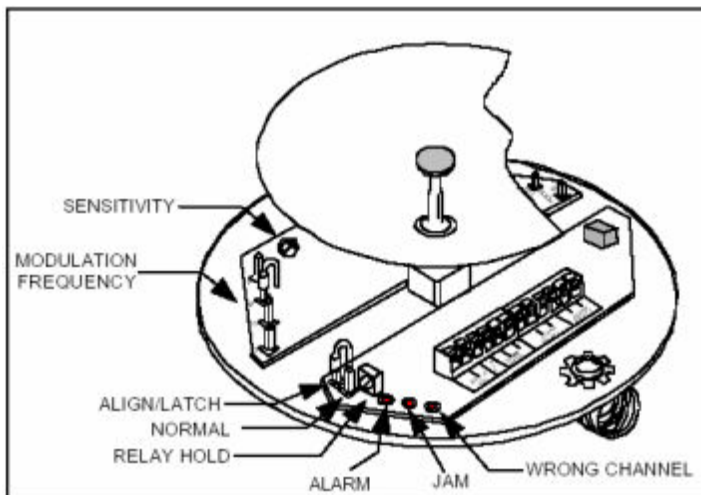
#### 11.14.1.2 Receiver

MODULATION FREQUENCY: Channel selection field: A – B – C – D

ALARM (LED): Indicates detection of an object

JAMMING (LED): Indicates interference with other Tx unit

WRONG CHANNEL (LED): Indicates Tx & RX set to different channels <sup>2</sup>, ALIGN/LATCH alt. NORMAL: ALIGN/LATCH latches ALARM on detect, faster tracking of align level when using RM82 (Link Performance Test Set).



**FAST / SLOW** (not visible in figure): Selection of maximum speed for the object to be detected; **15 m/s** or 3 m/s. These figures are not direct applicable, but indicate fast or slow response to an object.

RELAY HOLD (HOLD IN): Adjustable hold time (0,5-60 seconds) at ALARM

SENSITIVITY: Adjustable sensitivity; applies to the size, weight, geometry and speed of the object

### 11.15 Channel selection

The MBD features four (4) field selectable modulation frequencies. It is advantageous to use different modulation frequencies on MBDs operating within close proximity. Different modulation frequencies reduce the possibility of cross-link modulation or mutual interference.

<sup>1</sup> Could also give ALARM

<sup>2</sup> 1

Attach PCB jumper wire to appropriate terminal to select desired channel (A, B, C, D). The Receiver and Transmitter **MUST** be operated on the same frequency or it will result in an alarm condition.

## 11.16 Alignment and testing

To set up the MBD Transmitter and Receiver:

1. Apply power to the Transmitter and Receiver. If MBD is powered by an SIU the Corresponding Series Circuit (CCR) must be energized.
2. Remove the radomes from both Transmitter and Receiver. Make sure the identical modulation frequency is being used on the Transmitter and Receiver.
3. Visually aim the Transmitter and Receiver for bore-sight alignment.
4. On the Receiver, move the ALIGN/LATCH – NORMAL jumper to ALIGN/LATCH position.
5. Connect the RM82 to the MS connector on the back of Receiver, select ALIGN on RM82, alternatively connect a Voltmeter to TP1 and GND on the Receiver PCB.  
This level to be observed will from now on be referred to as ALIGN-level.
6. Swivel Receiver up and down, side to side, raise or lower to obtain maximum ALIGN-level, then tighten locking nut on mounting bracket to secure sensor in this position.
7. Swivel Transmitter up and down, side to side, raise or lower. At the same time, at the Receiver, observe meter to obtain maximum ALIGN-level. Tighten locking nut on mounting bracket to secure sensor in this position.  
The ALIGN-level must exceed 0.1 (RM82) alternatively 0.5 V (Voltmeter). Normally, expect at least the double value (>0.2 / >1.0 V).
8. Disconnect the RM82 or Voltmeter and move the ALIGN/LATCH – NORMAL jumper back to position NORMAL.
9. Move the FAST/SLOW jumper to FAST position, set HOLD IN to minimum (max. CCW) and adjust to lowest sensitivity, i.e. SENSITIVITY max. CCW.
10. Perform a walk-test, while monitoring the ALARM indication LED, to check that the MBD is working.
11. Use a fast vehicle, e.g. a car, to check that the MBD detects at desired high speed when passing at the mid, left and right side of the taxiway.  
Normally SENSITIVITY must be raised, typically to 2/7 of scale (2<sup>nd</sup> scale division). To avoid spurious detection, do not turn SENSITIVITY beyond mid setting.
12. Replace radomes on Transmitter and Receiver using all six screws. Make sure the protecting cap for the MS connector on the Receiver is replaced.

## 11.17 Documenting the installation

To make maintenance and follow-up easier should, for all MBDs in the installation, use the MBD Installation Data document found [Appendix – MBD Installation Data](#).

The following information should be recorded in the MBD Installation Data document.

- Distance Transmitter - Receiver
- Mounting height, Transmitter and Receiver
- Supply voltage, Transmitter and Receiver
- Channel selection (A – B – C – D)
- Jumper settings (ALIGN/LATCH – **NORMAL**, **FAST**/SLOW)
- SENSITIVITY setting
- HOLD IN setting
- ALIGN-level (RM82)

When maintaining, troubleshooting or replacing defect units recorded values and data should be checked and updated.

When applicable, make notes:

- Waxing of radomes - date!
- Maintenance – specify, date!

## 11.18 Maintenance

After setting up the MBDs at installation, as described above, no further calibration should be required. To remain a trouble free system we recommend to:

1. Wax the radomes
  - a) Do this every 3 to 6 months. Use *Turtle clear vinyl top wax* or equivalent. This will make the water and dust easier run off and reduce the risk for signal drop, which can cause spurious detection.
2. Keep the area between Transmitter and Receiver clean
  - a) Remove and keep free of tall grass, weeds, debris, and obstructions. In wintertime, keep the area free from snow. Snow obstructions may affect the microwave pattern and thereby block a real or cause a spurious detection.
3. Inspect the MBD installation periodically
  - a) Perform an inspection at least every 6 months. Check and update the installation data, recorded in the MBD Installation Data document. Look for any damages (cracks, leakage, rust, etc.), and check and clear the area, if required, not to interfere with the function of the MBD.
4. Repair
  - a) Repair if required and take measures against potential problems.
5. Record
  - a) Keep a record of all maintenance performed in the [Appendix – MBD Installation Data](#) document.

## 11.19 Troubleshooting

In this system, for detection of vehicle movements on taxiways and runways, the MBD constitutes the lowest level. The system includes:

- MBD - Transmitter and Receiver that together form a line of detection
- SIU - same for Transmitter and Receiver (power supply, status reading, self test of MBD's line of detection)
- SCM - collects, via SIU, status for MBD
- CU - transfers MBD-status from SCM to host system
- Host system - presentation of Sensor-status (detection, fault)

MBD and SIU (together) are treated as a *Sensor* by the host system and at a fault condition, either on the MBD or SIU, a common fault indication is given for the Sensor in the host system.

A Sensor fault could appear either at the MBD, the cable between MBD and SIU, or at the SIU. Focus here is on the MBD and the cable between MBD and SIU.

**START by checking that:**

- Transmitter and Receiver are aligned correctly and free from damages
- Transmitter and Receiver are both supplied with power
- All jumpers and settings are according to what has been registered in the MBD Installation Data document.

**FAULT OBSERVATION / Reason:**

- Not detecting at all or just sometimes
  - SENSITIVITY setting is to low
  - Cable fault - Pin 3 (DET) is in contact with *low*
  - MBD-Receiver bad
- Detecting continuously or without reason (no blocking object)
  - Transmitter and Receiver not aligned correctly
    - Check ALIGN-level with RM82
  - Cable fault - Transmitter or Receiver not connected (contact loose)
  - Cable fault - Pin 3 (DET) in contact with *high*
  - Cable fault - Pin 7 (TEST) in contact with *high* or not connected
  - SENSITIVITY setting is to high
  - Fuse blown in Transmitter or Receiver
  - MBD-Receiver bad
  - MBD-Transmitter bad

Observe that all four (4) connectors (only 2 are being used) on the SIU are in parallel. Thereby a suspected cable fault could exist in any of the cables or connectors for the Transmitter or the Receiver

- Adjust or repair when required. Make notes in the MBD Installation Data document

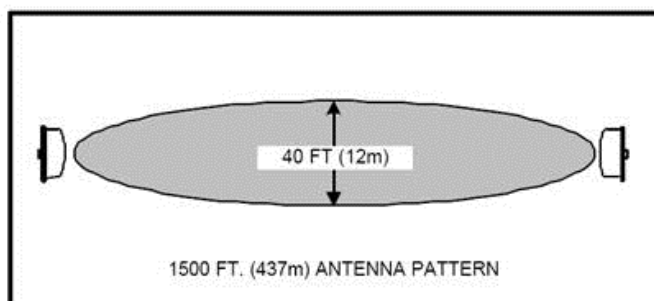
## 11.20 Appendix

### 11.20.1 Appendix – MBD microwave beam pattern

This section is intended to be a technical orientation of the MBD beam pattern. Note that below figures are typically valid at the mounting height of the MBD.

Typical maximum width protection pattern of the MBD is shown in [Figure 87](#), for mounting height of 0.75 meter above smooth earth.

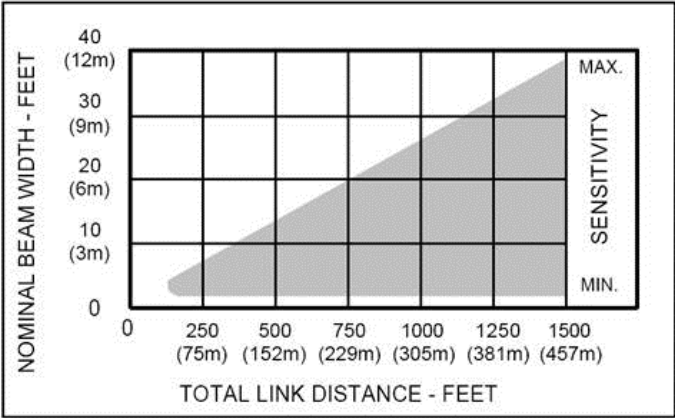
**Figure 87: Protection pattern of the MBD**



Maximum width occurs when Transmitter-Receiver distance is maximum and Receiver "Sensitivity" control is set to maximum.

Figure 88 illustrates how pattern width varies with Transmitter-Receiver distance and sensitivity setting. Actual patterns will vary somewhat with site topography and surface condition. Generally, lower mounting height or rougher surface will increase pattern width. For example, if the total link distance is 230 meter and the sensitivity adjustment set to mid-point, the figure indicates the detection pattern width to be 3.6 meter.

Figure 88: Illustration of pattern width variations









## 12.0 NCU User Guide

This document describes the NCU 591943 product from an operational perspective. It includes functionality, interface views, installation and maintenance.

Project specific information, like detailed interface protocol or detailed hardware installation drawings, are not described in this document, as they may vary from project to project.

### 12.1 References

SG591890-3023C RELIANCE Intelligent Lighting Modbus Interface

### 12.2 Introduction

The purpose of the NCU is to provide a powerful interface to all the lights, sensors and miscellaneous equipment that are controlled and monitored by RELIANCE Intelligent Lighting. The NCU may be connected to different Host systems through a number of supported protocols.

The NCU comprises both the hardware (the computer) and the software run on it. The main application run on the NCU is the AspGwy. The AspGwy controls the interface between the NCU and the SCMs and it also processes the commands to be sent and receives the status from LMSs and SIUs.

Each component that is monitored and/or controlled through the NCU is defined as a separate RELIANCE IL object. The different RELIANCE IL objects offer basically three levels of abstraction for control and monitoring:

- Physical level; individual components installed in the system, LMS, SIU and SCM
- Logical level; control and monitoring abstractions which involve any number of physical units, light segment and sensor
- Complex logical level; powerful abstraction involving a number of logical abstractions, stopbar

### 12.3 AspGwy functions

#### 12.3.1 Segment handling

A segment is defined as a group of lamps controlled together. A segment can be divided over multiple SCMs.

A Segment is controlled by sending a "Group command" to a SCM.

##### 12.3.1.1 Segment status

The SCM replies with the status of the lamps. A segment status is calculated on the basis of the lamps states in this segment. But since there are multiple lamps there can be multiple states. Calculating the segment status is not always straightforward. The default is that the segment is considered on when 100 % of the lamps are reporting ON or reporting lamp failure.

##### 12.3.1.2 Command repetition

When a segment has lamps which is not in the correct state (ON/OFF) then the command to set the lamps in the correct state will be repeated a configurable number of times ( default=3). If the lamp is still not reporting correct state the command repetition will drop to a lower configurable interval (default=2 minutes).

##### 12.3.1.3 No circuit power handling

When the AspGwy receives the *No circuit power* signal from the SCM it will set all the lamps as being off. If the segment is wanted off this is not a problem. But if the segment is wanted on this will result in a reference error. The Host system is responsible for handling eventual reference errors.

##### 12.3.1.4 Command optimization

The AspGwy optimizes the command method used to get the most efficient way of communicating. This is depending on which and how many segments to send commands to. The optimization can not be used if flashing segments have to be updated.

## 12.4 Adjacent lamp calculation

The AspGwy include an adjacent lamp calculation algorithm. Information regarding adjacent lamp error is given within one segment. If information regarding adjacent lamps between segments is needed this has to be calculated in system logic at a higher level.

Segments controlled and/or monitored by two different NCUs (e.g in two substations) will not be evaluated for adjacent lamp error, this will be the responsibility of the Host system.

## 12.5 Sensor

The AspGwy can receive status signals from the field sensors connected to RELIANCE IL via SIU (e.g Microwave Barrier Detectors or Inductive Loop Sensors). Field sensors are typically used in stopbar systems to handle switching of interlocked stopbar- and taxiway centerline segments.

## 12.6 Basic SCM communication

The most fundamental part of the AspGwy is administrating the SCM communication - almost every other module will depend on this module. The physical interface for the SCM communication is a RS485 link between the NCU and SCM.

### 12.6.1 SCM synchronization

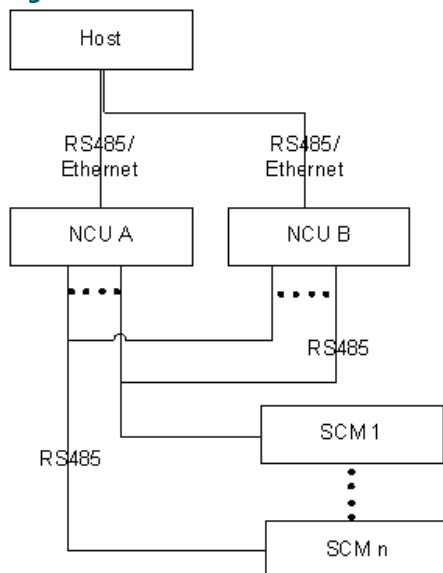
Under certain circumstances there is a risk for crosstalk between two or more circuits. As a method to overcome negative effects on RELIANCE IL performance due to this, it is possible to let the AspGwy application synchronize the communication sequence in a pre-defined way.

## 12.7 Redundancy in AspGwy

It is possible and recommended to set up two NCUs for redundancy.

Handling the redundancy is using the fact that the NCU-SCM communication is already based on RS485, well suited for multidrop communication. Like a multi drop setup it is possible to attach both NCUs to the same serial SCM communication line, see [Figure 89](#).

**Figure 89: Redundant NCU overview**



Any of the two NCUs can be active for any of the connected SCMs. The NCU-to-SCM switchover is done automatically depending on which one is first to establish connection with the SCM. Both NCUs read and receive status from the SCMs, i.e LMS and SIU states, hence both NCUs are ready to take over if the other fails.

## 12.8 RELIANCE Intelligent Lighting communication

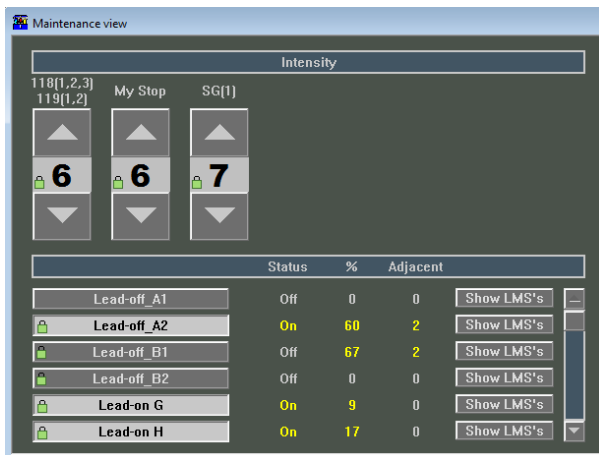
When the application is running on the NCU you could see the little icon on the Task Tray of the computer.



When the AspGwy is opened (password protected) or configured for the specific site to be permanent open, you could see different views as LMS Status view, SCM Status view and Sensor Status view. If they are not visible, go to the **View** menu and then select to open either one or all of these windows.

### 12.8.1 Maintenance view

The main window in the Local ASP Control, **Maintenance view**, allow direct local control of the field equipment. From this window it is possible to monitor and override the control of the connected segments. With 2A mode activated it is also possible to control the intensity settings of the different segments.



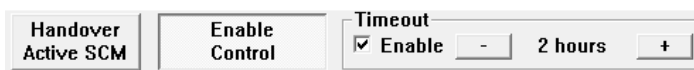
The segments are turned On/Off by clicking on the corresponding segment on the left side.

Column	Description
Status	Indicates if segment is turned On or Off
%	States the percentage of faults present on that segment
Adjacent	Indicates how many adjacent lamp faults that are present on the corresponding segment

By clicking the **Show LMS's** button on the right side, an **LMS Status View** window will open for the corresponding segment showing the status of the LMS's. In this window it is also possible to see if it is a Lamp fault or LMS fault that is present. See LMS Status View section below for more information.

#### 12.8.1.1 SCM control

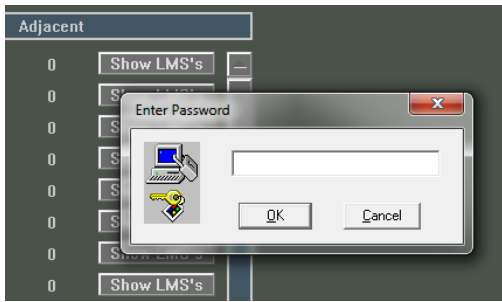
To control the FCUs and segments connected to the NCU the **Enable Control** button must be selected. When having a redundant NCU setup it is possible to hand over the control of a SCM from one NCU to another. Only the active NCU can control the lights. In case a circuit is interleaved it may be required to switch the active NCU from one NCU to another in order to control both interleaved SCM on the same NCU. The SCM Status view shows if a NCU is active towards a specific SCM.



If control is only required for a shorter period of time, tick the box **Enable** in the **Timeout** box, then choose time needed by by clicking + or - button to add or subtract hours. Once the timeout has expired the local control will be disabled and control is returned to normal operation.

### 12.8.1.2 System features

To activate the system features with Response time etc. press Ctrl+Alt+Shift+D and enter the correct password in the **Enter Password** dialog box.



When activated a **Response time** column will appear next to the other columns in **Maintenance view** as well as other system features activated by this command.





### 12.8.2 LMS Status view

In the **LMS Status view** it is possible to see the status for each light/LMS controlled by the NCU.

ID	Segment	Seq nr	Scm	Sync	TS	System status	Last reply	Int...	Re...	Lo...	Sam...	Fault...	% Fa...	Refer...	Ignor...	% Ig...	3 faults	3 La...
TCL25_B	Lead-on_A	2	SG	0	13	Off	Off	4	63%	39%	4524	0	0.00	4	0	0.00	0	0
TCL19_B	Lead-on_A	3	SG	0	12	Off	Off	4	63%	39%	4524	0	0.00	4	0	0.00	0	0
TCL17_B	Lead-on_A	4	SG	0	11	Off	Off	4	63%	39%	4524	0	0.00	4	0	0.00	0	0
TCL17_A	Lead-off_A2	0	SG	1	11	On	On	4	80%	61%	4520	0	0.00	0	0	0.00	0	0
TCL19_A	Lead-off_A2	1	SG	1	12	On	On	4	80%	63%	4520	0	0.00	0	0	0.00	0	0
TCL25_A	Lead-off_A2	2	SG	1	13	On	On	4	77%	63%	4520	0	0.00	0	0	0.00	0	0
TCL26_A	Lead-off_A2	3	SG	1	14	On	On	4	80%	63%	4520	0	0.00	0	0	0.00	0	0
TCL28_A	Lead-off_A2	4	SG	1	15	On	On	4	82%	61%	4520	0	0.00	0	0	0.00	0	0
STB.A.33	Stopbar_A	0	SG	1	7	On	On	4	85%	61%	4520	0	0.00	1	0	0.00	0	0
STB.A.32	Stopbar_A	1	SG	1	6	On	On	4	80%	61%	4520	0	0.00	1	0	0.00	0	0
STB.A.31	Stopbar_A	2	SG	1	5	On	On	4	85%	60%	4520	0	0.00	1	0	0.00	0	0
STB.A.30	Stopbar_A	3	SG	1	4	On	On	4	84%	61%	4520	0	0.00	1	0	0.00	0	0
STB.A.29	Stopbar_A	4	SG	1	3	On	On	4	85%	60%	4520	0	0.00	1	0	0.00	0	0
TCL36_B	Lead-up_A	0	SG	0	18	On	On	4	82%	46%	4524	0	0.00	0	0	0.00	0	0
TCL35_B	Lead-up_A	1	SG	0	17	On	On	4	82%	49%	4524	0	0.00	0	0	0.00	0	0
TCL34_B	Lead-up_A	2	SG	0	16	On	On	4	79%	47%	4524	0	0.00	0	0	0.00	0	0
TCL34_A	Lead-off_A1	0	SG	1	16	On	On	4	87%	61%	4520	0	0.00	0	0	0.00	0	0
TCL35_A	Lead-off_A1	1	SG	1	17	On	On	4	84%	61%	4520	0	0.00	0	0	0.00	0	0
TCL36_A	Lead-off_A1	2	SG	1	18	On	On	4	84%	61%	4520	0	0.00	0	0	0.00	0	0
RWY.CL16	RWY_CL	0	SG	0	19	On	On	4	79%	47%	4524	0	0.00	0	0	0.00	0	0
RWY.CL27	RWY_CL	1	SG	0	20	Error,Off	LMS Fail	4	9%	15%	4520	4281	94.71	0	73	37.24	16	0
RWY.CL39	RWY_CL	2	SG	0	21	Error,Off	LMS Fail	4	9%	15%	4518	4286	94.86	0	69	35.38	19	0
RWY.CL41	RWY_CL	3	SG	0	22	Error,Off	LMS Fail	7	7%	15%	4522	4419	97.72	0	0	0.00	4	0

The information shown in the LMS status window is:

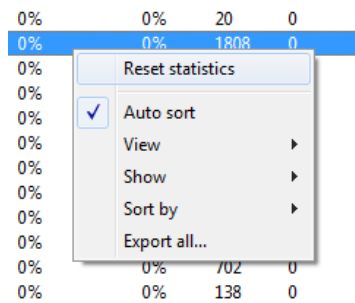
Column	Description
ID	Name on the light fixture and LMS
Segment	Name of the light segment to which the LMS belongs
Seq.Nr	The sequence number of the physical placement of the LMS in the segment
Scm	The SCM name to which the LMS belongs
Sync	The LMS sync used (part of the unique address on the circuit)
TS	The LMS time slot used (part of the unique address on the circuit)
System Status	Status on the light, reported to Host system (On, Off, Error, Lamp Error Communication Error)
Last Reply	The last status reply from LMS (On, Off, Lamp Fail, LMS Fail)
Intensity	The intensity of the LMS
Response level	The last response level of the physical signal from the LMS
Lowest response level	The lowest <i>Response level</i> observed
Samples	The number of samples received since start of application or last reset of status window.
Faults communication	The amount of samples from the LMS which have responded communication faults.
% faults communication	Percentage of collected samples which have been reported fail.
Reference faults	N/A
Ignored faults	N/A
% ignored when ok	N/A
# faults	Number of fails which have been reported to the Host system.
<div>  <b>Note</b> </div> <div># indicates how many samples from LMS must report fail, before it is sent up in the system. This is done to avoid reporting temporary disturbance on the circuit.</div>	
# lamp faults	Number of collected samples lamp faults which have been reported to the Host system.
<div>  <b>Note</b> </div> <div># indicates how many samples from LMS must report lamp fault, before it is sent up in the system. This is done to avoid reporting temporary disturbance on the circuit.</div>	
Forced	N/A

#### 12.8.2.1 Sort of information in status window

It is possible to sort the status information. Just click in the header with the mouse to choose according to which column to sort the information.

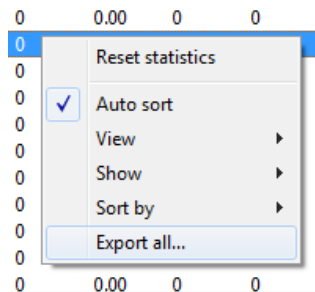
#### 12.8.2.2 Reset of information in status window

To reset the collected information and start counting the samples from scratch, right-click and from the drop-down list choose and click **Reset statistics** (information for one LMS). To reset all, select all rows with CTRL+A and select **Reset statistics** in the menu.



### 12.8.2.3 Export information from Status view

The collected status can be exported to a file. Right-click on the mouse button in the window and select **Export all**.



### 12.8.3 SCM Status view

In the **SCM Status view** it is possible to see the status for each SCM controlled by the NCU.

SCM Status view												
Name	Addr...	Ready	Conn...	Power	Status	Invalid inputs	Last s...	All sy...	Com...	Powe...	Flash...	Short ...
118	3	Yes	Yes	Yes	Active	0	2	1,2,			Yes	922
119	2	Yes	Yes	Yes	Active	0	3	3,4,			Yes	875
SG	1	Yes	Yes	Yes	Active	0	1	0,1,			No	422

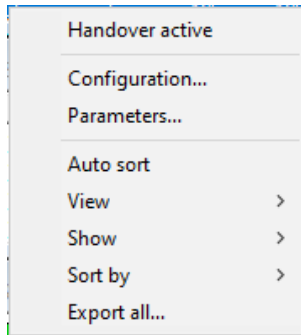
The information shown in the SCM status window is:

Column	Description
Name	Name of the SCM
Address	The modem address to the SCM
Ready	The indication that AspGwy is up and running
Connected	Information if it possible to communicate with the SCM
Power	Information if it is power or not in the circuit.
Status	The status of the AspGwy communication (Active, Connecting, Disconnected or Passive) Passive indicates that the SCM is controlled by another (redundant) NCU.
Invalid inputs	Shows the number of control inputs from the CMS that is not valid. Typically, there is one control input for each segment. When for instance the Modbus interface is disconnected this will show up as invalid inputs.
Last sync	The sync from which the information is last collected
All Syncs	States all syncs which are used by the SCM

It is possible to double-click on a SCM to show the SCM Log view.

The same possibilities, as for the LMS status window, apply for the SCM status window. You could sort, reset information and export collected status information.

Changing Configuration and Parameters is possible when the system features are enabled. Select and right-click a SCM to open the menu with available filters.



For the edit dialog, see [Configuration Edit dialog](#).

### 12.8.4 Sensor Status view

In the **Sensor Status view** it is possible to see the status for all sensors controlled by the NCU.

ID	Scm	(Sync, TS)	System Status	Faults	Last Reply	Response Level	Samples	Fails	2 Fails	% Fails	Last detect time	Detect count
1D11	TC6	(3,20)	On	0	On	63%	81	0	0	0%	2008-02-05 12:42:04	1
2D11	TC6	(3,21)	Off	0	Off	63%	81	0	0	0%	?	0
1B4	TC6	(3,22)	Error	1	Sensor Fail	0%	81	50	25	61%	?	0
2B4	TC6	(3,23)	Off	0	Off	63%	81	0	0	0%	?	0

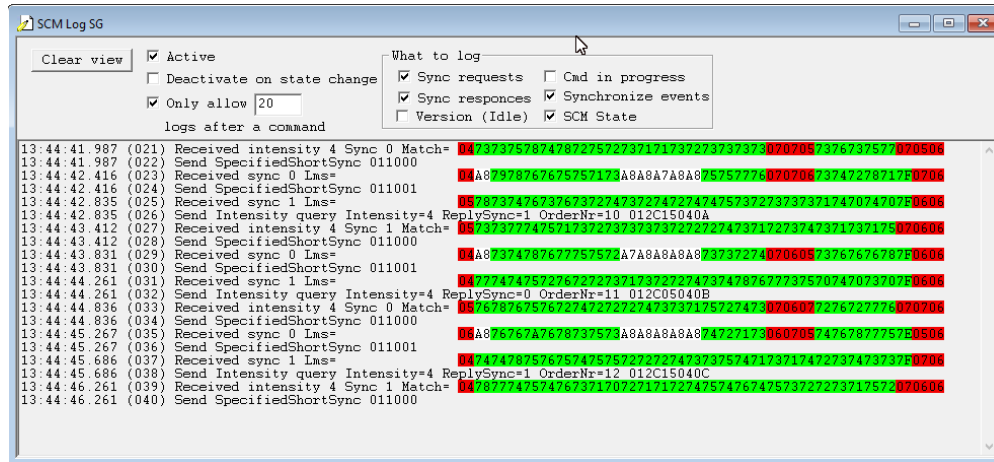
The information shown in the Sensor status window is:

Column	Description
ID	Name on the sensor
Scm	The SCM name to which the sensor belongs
Sync, TS	The sync and time slot used (part of the unique address on the circuit)
System Status	Status on the sensor, reported to Host system (Off, On, Error)
Faults	N/A
Last Reply	The last status reply from SIU (On, Off, Sensor Fail)
Response Level	The physical signal response level from the SIU
Samples	The number of samples received since start of application or last reset of status window.
Fails	The amount of samples from the SIU which have responded fail.
# Fails	Number of fails which have been reported to the Host system. <u>Note:</u> # indicates how many samples from SIU must report fail, before it is sent up in the system. This is done to avoid reporting temporary disturbance on the circuit.
% Fails	Percentage of collected samples which have been reported fail.
Last detect time	The time stamp for the last detect from the sensor
Detect count	The number of detect from the sensor

The same possibilities, as for the LMS status window, apply for the Sensor status window. You could sort, reset information and export collected status information.

### 12.8.5 SCM Log view

In the **SCM Log** view it is possible to see detailed information about the communication with each SCM.



In the top of the window it is possible to select what is shown in the bottom part of the window. The bottom part shows each message send to the SCM and the received reply. For replies that contain circuit data this is shown as a long string of characters. Each circuit unit reply is described with two characters in this string. The first pair of characters describe the circuit unit with time slot 0. Each pair is color coded as described in the Table 5 below.

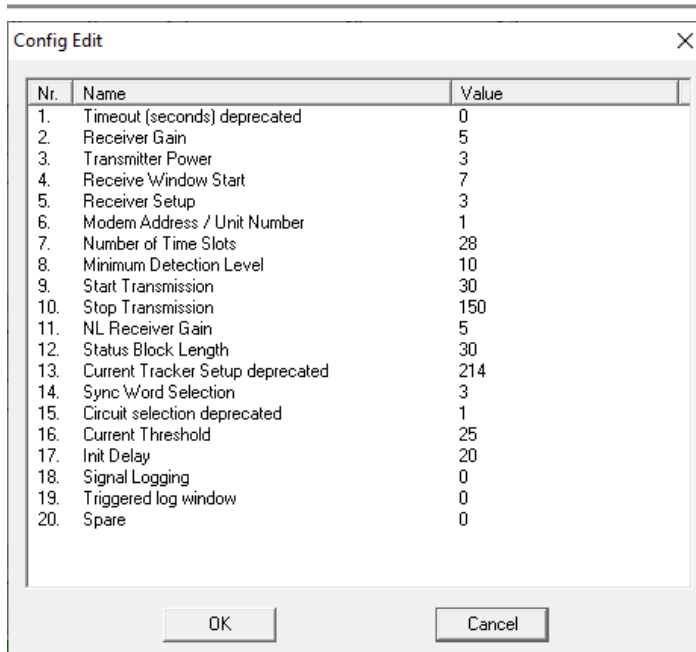
**Table 5: Color code description**

Color	Description
Green	This is a ON or YES reply
White	This is a OFF or NO reply
Yellow	This is a Lamp fault reply
Red	This is a communication fault

### 12.8.6 Configuration Edit dialog

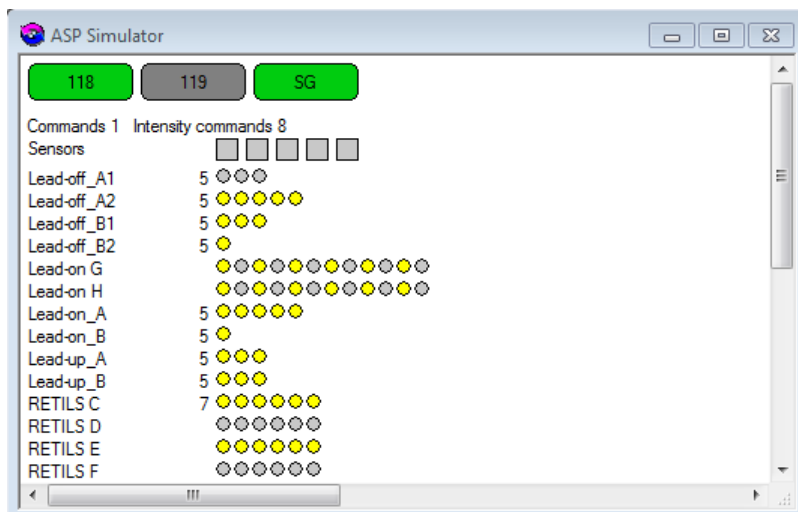
This dialog allows changing Configuration in the SCM. For detail on the values, refer to the SCM documentation.





### 12.8.7 ASP Simulator view

In the **ASP Simulator** view it is possible to simulate the change of state of segments and fixtures as well as arrange lamp faults and change of intensity commands. Left-click segments to simulate toggle on/off. Right-click on a fixture to open up sub menu and change the state.

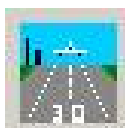


## 12.9 Host communication

The NCU supports a number of standard host communication protocols, of which the Modbus protocol is the most common.

### 12.9.1 Modbus View

When the application is running on the NCU you could see the little icon on the Task Tray of the computer.



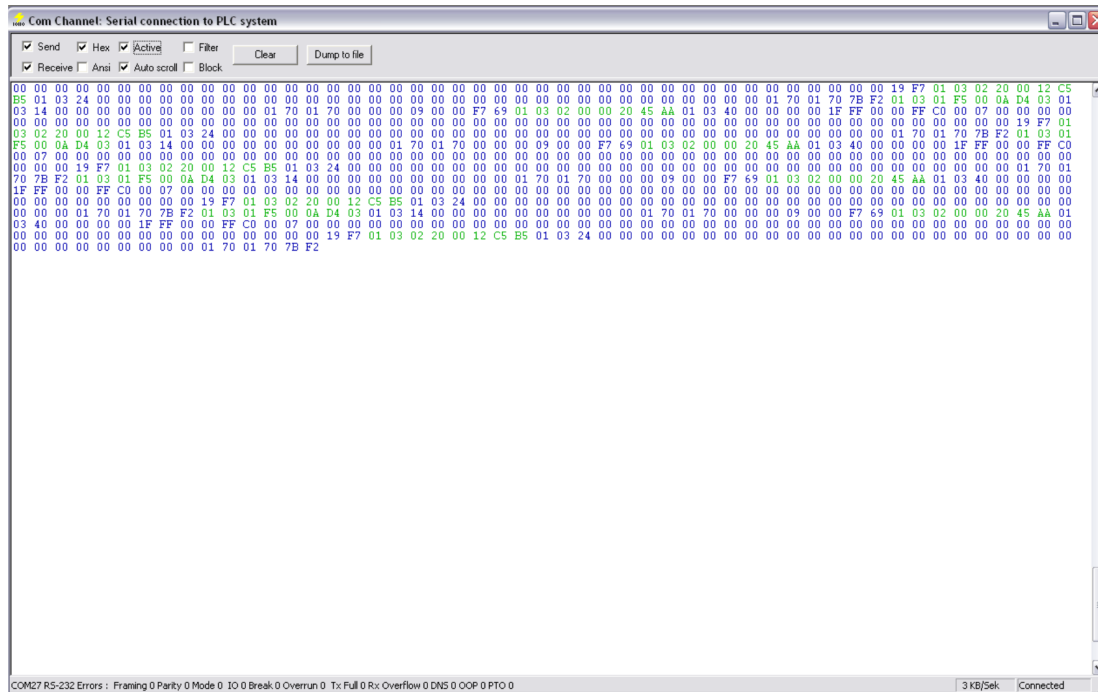
The window view to see the packages received and sent in the NCU via the Modbus interface are opened inside the ModbusGwy application. When the ModbusGwy is opened (password protected) or configured for the specific site to be permanent open.

For information regarding the Modbus Host Interface Communication, see ref SG591890-3023C [Modbus Interface](#).

### 12.9.1.1 View window of raw data sent/received

Go to **View** menu and select **Com Channel:....** In the pop up window, select **Connection to PLC system** and then click **OK**.

The window view opened looks like the picture below.



In accordance with the Modbus protocol you could see the sent commands from the Host system (shown in green text) and the response from the NCU (shown in blue text).

In the Modbus view window it is possible to select:

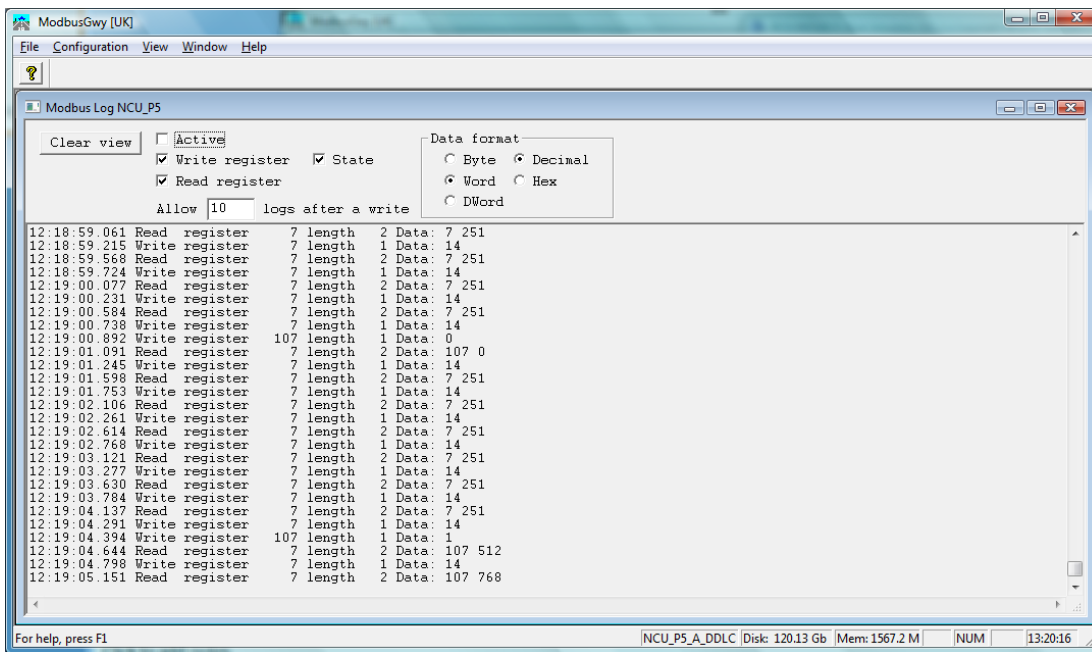
- **Send:** Shows the data sent from the NCU to the Host
- **Receive:** Shows the data sent from the Host to the NCU
- **Active:** When selected the data is continues written in the window. When not selected the data is no longer written in the window and it is possible to scroll in the window to see the old data.

The **Hex** and **Auto scroll** options should always be selected.

### 12.9.1.2 View window of data sent/received

Go to menu "View" and select "Base IO..". In the pop up window select the name on the IO channel to show and press the OK button.

The window view opened looks like the picture below.



In accordance with the Modbus protocol you could see the read and write commands from the Host system and the response data.

Each line from the example above should be interpreted as:

12:19:05.151 Read register 7 length 2 Data: 107 768

In the Modbus view window it is possible to select:

- **Write register:** Shows the data written to the NCU by the Host
- **Read register:** Shows the data read from the NCU by the Host
- **Active:** When selected the data is continues written in the window. When not selected the data is no longer written in the window and it is possible to scroll in the window to see the old data.

It is possible to choose if the data should be presented in the view window as Decimal or Hexadecimal. It is also possible to choose if the data should be presented as bytes (8 bit), words (16 bit) or Dword (32 bit).

## 12.10 Electrical and Mechanical Characteristics

The electrical and mechanical characteristics for the NCU computer are described in the information included from the computer manufacturer or on their web site support.

Interface specifications		
Interface to Host-System	Electrical	RS232C/485 or Ethernet
	Protocol	Modbus RTU and JBUS
		SIEMENS RK512/3964R
Interface to SCM	Electrical	RS232C/485
	Protocol	ADB SAFEGATE proprietary

## 12.11 Installation

### 12.11.1 Hardware installation

Depending on system configuration, the NCU connects to a number of SCMs for series circuit communication, and to the Host system.

Also depending on the system configuration and to support different electrical interface the NCU comes equipped with different types of added boards, e.g for Ethernet, RS485, Profibus.

For details on how the NCU should be installed refer to project specific installation drawings.

### 12.11.2 Software installation

For various reasons, the user may be requested by ADB SAFEGATE to update the NCU software or configuration.


#### 12.11.2.1 Prepare for the NCU configuration

Unzip the received configuration and put the full structure on a USB-key. It is important that the folder structure is preserved since the configuration load program (SoftwareLoader) on the NCU computer is looking for updates on a specific path.

#### 12.11.2.2 Installation

The program that loads the configuration to the NCU is in the C:\SafeControl directory and is called SoftwareLoader.exe.

##### 12.11.2.2.1 First time, no previous configuration

Put the USB-key into one of the USB contacts on the front of the NCU. Double-click on the desktop icon  , **Restart/Start NCU application**, pointing at the file C:\SafeControl\SoftwareLoader.exe.

One other way to load the configuration is to restart the NCU computer, then the SoftwareLoader will start up automatically and install the configuration from the USB-key.

##### 12.11.2.2.2 New update of the configuration

To load the update of the configuration into the NCU you first need to stop the applications running on the NCU. Stop the

applications running by double-clicking on the desktop icon  , **Terminate/Stop NCU application**, pointing at the file C:\SafeControl\Terminate.cmd.

Then put the USB-key into one of the USB contacts on the front of the NCU. Double-click on the desktop icon **Restart/Start NCU application**, pointing at the file C:\SafeControl\SoftwareLoader.exe.

## 12.12 Maintenance

### 12.12.1 Yearly maintenance

- Ocular inspection:
  - Check for damages or overheating
  - Check fans operating properly
  - Clean, remove dust
- Software configuration verification:
  - Check configuration version Version information is found in the file "Version.tst" in the C:\SafeControl\ directory.
  - Check for free disk space. A minimum of 10% free disk space is required.

- 
- Power cycle the NCU to verify that Windows boots up and starts the software automatically.
  - In case the NCU is connected to a network or if a USB stick has been connected to the NCU a PC with an AntiVirus software should be connected and used to scan the NCU for virus.
  - Make sure that PC time is correct.

### **12.12.2 Replacement**

A NCU with the specific site configuration is ordered from ADB SAFEGATE to be a replacement or spare part for an existing NCU.



## 13.0 ILDU User Guide

ILDU 596525 is one of the components in the RELIANCE Intelligent Lighting system installed in the airfield. Other components are the LMS, SIU and SFU.

The functionality of the ILDU 596525 is detection of vehicles by inductive loops. The ILDU evaluates if vehicles are located on any of the inductive loops which are connected to the ILDU, and transmits detect/ no detect to the SIU. The SIU communicates the signals to the SCM via the series circuit cable. Other information that may be transmitted from the ILDU is sensor status (sensor FAIL/OK).

For technical information regarding the inductive loop relay, refer to Manual SD-IND 2.1 SK.

### 13.1 Functionality and Operative indicators

An ILDU 596525 consists of:

- A Detector box 596524 (equipped with DIN-rail, terminal blocks and cable glands)
- A Sensorlogic box 596525
- A LED-reader 596527
- Several inductive loop relays SD-IND 2.1 SK suited for the number of inductive loops to connect to the ILDU

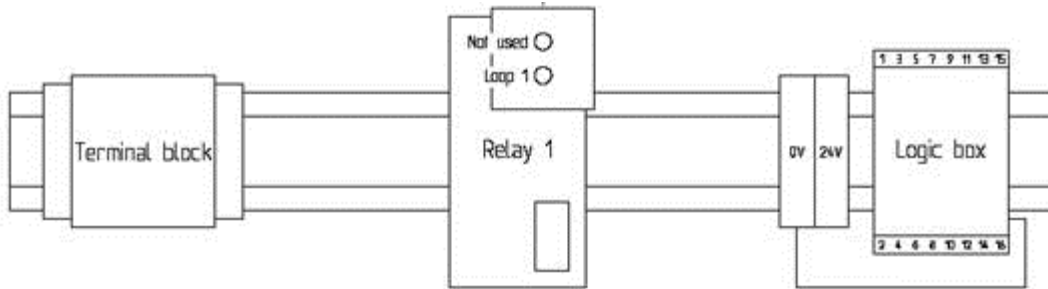
When the relay detects a vehicle inside the inductive loop, the opening relay contact opens and the closing relay contact closes. The relay LED starts then to flash at a frequency of about 0.7Hz. On top of the LED, a LED-reader 596527 is mounted, monitoring the status of the LED. The status of the LED and the relay contacts are fed to the Sensorlogic box. The Sensorlogic box determines DETECT/ NO DETECT and sensor status FAIL/OK.

- The ILDU summation signal DET (Sensorlogic box terminal 5) gets high ("open-collector" type) if at least one of the channels on an inductive loop relay's closing contact closes.
- The SIU interprets the DET signal as a DETECT if the signal is high.
- The ILDU summation signal ERR (Sensorlogic box terminal 9) gets high ("open-collector" type) if at least one channel of an inductive loop relay's opening contact opens at the same time as the same channel's LED is off.
- The SIU interprets ERR as a sensor fail if ERR goes back and forth between high and low at a frequency of 0.7Hz or slower.

## 13.2 Outline drawings

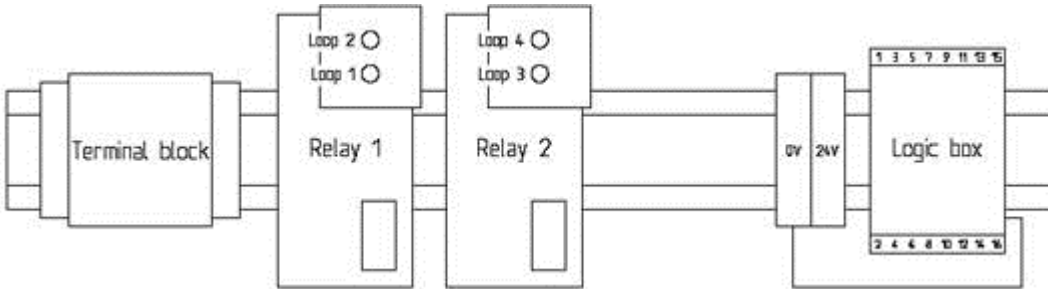
**Figure 90: ILDU with one inductive loop relay**

596525-1 and 596525-2 configured for one respective two inductive loops.



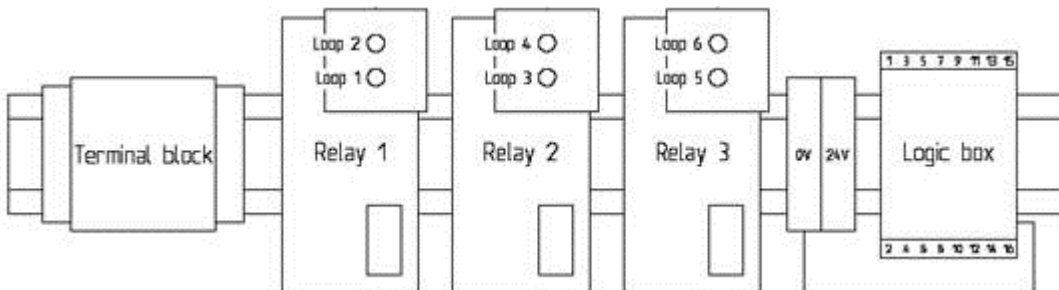
**Figure 91: ILDU with two inductive loop relays**

596525-3 and 596525-4 configured for three respective four inductive loops.



**Figure 92: ILDU with three inductive loop relays**

596525-5 and 596525-6 configured for five respective six inductive loops.



## 13.3 Installation

### 13.3.1 Installation of ILDU

At replacement of ILDU:

- Make sure that ILDU is without power, by either turning off the series circuit, or disconnecting the SIU.
- Open the top cover of the ILDU by turning the four screws in the corners of the ILDU top cover.
- Disconnect the inductive loops on the terminal blocks. Disconnect the SIU cabling on the terminal blocks. Loose the cable glands to the ILDU.
- Pull out the cabling. Pull in the cabling in the new ILDU.
- Connect to the terminal blocks, tighten cable glands and close the top cover.
- Power up the ILDU.



### 13.3.1.1 Electrical and Mechanical Characteristics

Parameter	Symbol	Min	Type	Max	Unit
<b>Power supply (normally from SIU)</b>					
Voltage	V	20.4	24	26.4	VDC
Current consumption, per relay	I	-	100	-	mA
<b>Signal interface (normally to SIU)</b>					
"Open-collector"-type	I <sub>S</sub>	-	-	500	mA
	V <sub>S</sub>	-	-	50	VDC
Parameter	Symbol	Min	Type	Max	Unit
<b>Environment</b>					
Encapsulation class IP65					
Ambient temperature, operation	T <sub>A</sub>	-20	-	+70	° C
Ambient temperature, storing	T <sub>STG</sub>	-40	-	+70	° C
<b>Mechanical data</b>					
Dimensions	Width	L <sub>w</sub>	-	270	mm
	Depth	L <sub>d</sub>	-	170	mm
	Height	L <sub>h</sub>	-	35	mm
Weight			2.7	-	kg

### 13.3.2 Installation of inductive loops

This chapter describes principles of how inductive loops for the ILDU should be installed. Detailed installation specification is supplied by ADB SAFEGATE for each project.

#### 13.3.2.1 Loop Geometry, Type and Installation

The loops must be installed according to project specific Safegate specification. Generally, loops shall be 3m deep (vehicle moving direction) and not wider than 10m, 3 turns of cable for each loop.

Loops connected to same relay can be spaced 0.5m apart. Loops connected to different loop relays must be spaced 2m apart.

Return paths from all loop can be run in same trace to the ILDU. The return path must run at least 0.5m from the loops. In the return paths, the cables from each loop must form a twisted pair (at least 20 windings/meter).

Safegate use a special type of cable for loops and return path: ÖLFON FEP 0.75 mm<sup>2</sup>.

Large metal pieces must not be located inside the loops.

#### 13.3.2.2 Loop traces

The traces for the inductive loops shall be 5-8 mm wide and 50-60 mm deep.

All corners must be protected so that the loop cable does not get damaged. Due to temperature variations and other causes, the loop cable could be moving slightly.

The protection could for example be a piece of PVC cable sheet in all 90-degree corners.

#### 13.3.2.3 Covering the traces

After all loop cable have been installed in the traces, a rubber band is covered the loop cable. On top of the rubber, epoxy is molded.

### 13.3.2.4 Loop connection to ILDU

At the ILDU installation location (for example a manhole), the loop cables should be connected to the ILDU cabling. The connection must be made watertight, for example a molding box.

## 13.4 Troubleshooting

Note that the ILDU functionality consists of light-sensitive components. Exposure to the daylight when removing the top cover can imply a disturbance of phototransistors which makes the ILDU to give false signals to the SIU. If troubleshooting is performed in daylight, the phototransistors must be protected from the daylight in order to get reliable results.

Here comes a description of the typical erroneous functions, possible causes and their corrective actions:

Erroneous function	Possible cause	Corrective action
The relay LED flashes faster than 1 Hz frequency.	The inductive loop is shorted or open circuit.	Examine the loop and correct the failure.
	Relay faulty.	Replace relay.
Rely LED goes ON when a vehicle is detected, but its contacts does not open/close.	Relay faulty.	Replace relay.
The relay LED goes ON when a vehicle is detected, the relay contacts open/close, but the SIU reports no detect.	Cable connections are loose.	Check and tighten the cable connections.
	Sensorlogic box faulty.	Replace Sensorlogic box.
Relay LED goes ON when a vehicle is detected, the relay contact open/close, the SIU reports detect and sensor fail.	LED-reader faulty.	Replace LED-reader.
	Sensorlogic box faulty.	Replace Sensorlogic box.
	Relay faulty.	Replace relay.

## 13.5 Components for ordering

Code	Name
596524	Sensor box
596525-X	ILDU complete, where X specifies number of channels/inductive loops
596526	Sensorlogic box
596527	LED-reader
DOCOTEC SD-IND 2.1 SK	Inductive loop relay

## 13.6 Spare parts

Spare parts are available for ILDU 596525 fittings. For more information see the Spare Parts List document.



### Note

Contact ADB SAFEGATE for assistance with ordering spare parts.

## 14.0 RELIANCE Intelligent Lighting International Standards Compliance List

This document applies to ADB SAFEGATE RELIANCE Intelligent Lighting system and lists international standards that the system comply with.

Standard	Status	Comments
SS-EN ISO 9001:1994	Complies	-
EMC directive for generic emission standard EN 50 081-1:1992	Complies	-
EMC directive for generic immunity standard EN 50 082-2:1995	Complies	-
ICAO Aerodromes Annex 14	Complies	-
ICAO Aerodrome Design Manual Part 4 Visual Aids 9157-AN/901	Complies	-
ICAO Manual On SMGCS 9476-AN/927	Complies	<p>A SMGCS (Surface Movement Guidance and Control System) is a subset of an A-SMGCS (Advanced Surface Movement Guidance and Control System). An A-SMGCS consist of many modules, e.g.</p> <ul style="list-style-type: none"> <li>• Vehicle surveillance</li> <li>• Vehicle separation</li> <li>• Vehicle identification</li> <li>• Routing</li> <li>• Guidance and control</li> </ul> <p>All these modules can only by realized by different kinds of system working together, e.g.</p> <ul style="list-style-type: none"> <li>• SLC system (Single Lamp Control)</li> <li>• SMR system (Surface Movement Radar)</li> <li>• RTF system (Radiotelephony)</li> <li>• MET system (Meteorological)</li> <li>• ATM system (Air Traffic Management)</li> </ul> <p>Therefore, a standalone Single Lamp Control System cannot be fully compliant with all modules, but the Safegate ASP-system is compliant with the modules that can be related to control of the airfield lamps, e.g.</p> <ul style="list-style-type: none"> <li>• Routing</li> <li>• Guidance and control</li> </ul>
ICAO Manual On A-SMGCS Draft		
FAA Advisory Circular on SMGCS AC120-57A		
FAA Advisory Circular on Low Visibility Taxiway Lighting Systems AC150/5340-28		
FAA Advisory Circular on Low Visibility Taxiway Lighting Systems AC150/5340-28	Complies	<p>Chapter 8.g.(2)(e) – Failure modes of In-pavement RGL's.</p> <p>The synchronization between RGL's is based on that the communication between SCM and LMS's is intact, so that the SCM can send synchronization signals to the LMS's. Each LMS also has an internal synchronization that will keep the RGL's synchronized in case of communication failure. Therefore, it can be anticipated that in most working conditions the synchronization will be maintained even at control system communication failure.</p>



## 15.0 Modbus Interface

This document provides information about status and control data details for each type of RELIANCE Intelligent Lighting equipment provided in the Modbus Interface.

### 15.1 Application

This document describes the interface details between RELIANCE Intelligent Lighting and the host system at airport. The specific interface memory bitmaps for a project can be found in a separate document describing the Wordbit table.

### 15.2 Extended functions

The basic functions include SCM, Sensor, Segment Control, Segment Status and Lamp Status.

Besides these basic functions some extended functions can be included as options. These functions will be described in the appendixes:

- Appendix A: [Appendix A – Stopbar](#)
- Appendix B: [Appendix B – Advanced segment functions](#)
- Appendix C: [Appendix C – 2A Intensity control](#)

### 15.3 Interface Protocol

#### 15.3.1 Modbus Protocol Details

The host to NCU interface is based on Modbus RTU.

ADB SAFEGATE supports both Serial and Ethernet implementations. Serial parameters are: RS-232 (or RS-485):

- Baudrate 9600 (up to 115200)
- 8 data bits
- Even parity
- 1 stop bit
- The NCU will be slave (server) and the HOST system will be the master (client)
- The HOST system shall typically use Slave Address 1 (configurable) when communicating with the NCU

Ethernet parameters are:

- IP Address (to be decided)
- Port 502 (changeable)

The HOST system will poll the NCU at periodic interval to read the status of all equipment.

#### 15.3.2 Initialization and Failsafe

In projects where the HOST system performs control (and not just monitoring) the NCU expects the Host system to cyclic perform the control.

The NCU will enter *Failsafe* mode programmed in LMS if the HOST system stops the write request.

Segment commands (on or off) must be sent to NCU when connection is established with NCU before Failsafe is removed.

### 15.3.3 Modbus Frame

Below is a description of the Modbus Protocol for Serial interface. The protocol is similar in the TCP version except that a 7 byte header is added and the CRC is not used.

**Table 6: Read Request**

Field Name	Example (Hex)
Slave Address	01
Function	03
Starting Address HI	00
Starting Address LO	64
No. of Registers HI	00
No. of Registers LO	00
CRC	xx

**Table 7: Read Response**

Field Name	Example (Hex)
Slave Address	01
Function	03
Byte count	80
Data HI	xx
Data LO	xx
Data Hi	xx
Data LO	xx
... (repeated for remaining bytes)	
CRC	xx

**Table 8: Write Request**

Field Name	Example (Hex)
Slave Address	01
Function	10
Starting Address HI	00
Starting Address LO	01
No. of Registers HI	00
No. of Registers LO	01
Byte count	02

**Table 8: Write Request (Continued)**

Field Name	Example (Hex)
Data HI	xx
Data LO	xx
CRC	xx

**Table 9: Write Response**

Field Name	Example (Hex)
Slave Address	01
Function	10
Starting Address HI	00
Starting Address LO	01
No. of Registers HI	00
No. of Registers LO	01
CRC	xx

### 15.3.4 Command and Status Details

#### 15.3.4.1 NCU Status word

Status bit value	Indication	Description
0	NCU OK	NCU ok. Data valid.
1	NCU Fail	Internal error in NCU.

The NCU status word, bit 0 should be read to ensure that received data is valid! Only if bit 0 = 0, the information beneath is valid!

#### 15.3.4.2 Heart Beat Words

Command Word Loopback	Indication	Description
0..65535	NCU Alive	Can be used by Host System to implement Heart beat signal

The Host system shall be able to detect if the NCU responds.

The NCU Heart Beat Command word will by internal loopback be indicated in NCU Heart Beat Status word. Host system can use this to implement a Heart Beat by value.



#### Note

If the Host system can detect from its Modbus Client, whether the NCU is responding to the Modbus polls, then such a signal can be used as an alternative way for determining if the NCU is Alive.

#### 15.3.4.3 SCM

The Serial Circuit Modem (SCM) can provide status of its operation.

#### 15.3.4.3.1 SCM Communication error

Error bit value	Indication	Description
0	OK	The SCM is communicating OK.
1	SCM communication failure	<p>The SCM is not communicating with the NCU. The cause may be one or more of the following events:</p> <ul style="list-style-type: none"> <li>• It has failed its internal diagnostics</li> <li>• It has suffered an internal or external power failure</li> <li>• It has been switched to "Local" mode</li> <li>• The link between the SCM and the NCU has been cut or disconnected</li> </ul>



#### Note

During SCM communication error the LMS will physical enter Failsafe state. However the LMS status reported to the host system will be unchanged.

#### 15.3.4.3.2 SCM Circuit power off

Circuit power off bit value	Indication	Description
0	Circuit power ON	The series circuit is powered ON.
1	Circuit power OFF	<p>The SCM has detected that the series circuit power is OFF. The cause may be one or more of the following events:</p> <ul style="list-style-type: none"> <li>• The CCR has been turned OFF</li> <li>• The CCR has failed, and thus been turned OFF</li> <li>• The connection between the SCM and its isolation transformer on the series circuit has been cut or disconnected, either internally or externally. <b>NOTE:</b> This is the ONLY notification that is given for this potential error, as the LMS will not signal an error in this situation</li> </ul>



#### Note

When Circuit power off is set the Segment state and Lamp state changes to off for units on corresponding circuit.

### 15.3.4.4 Segment

#### 15.3.4.4.1 Segment Command

The Segment Command is used in projects where the HOST system performs control of segments.

Command bit value	Command	Description
0	OFF	Command a segment OFF
1	ON	Command a segment ON

The Segment command bit defines the commanded state for the associated segment. Host System can both write and read command state.



#### 15.3.4.4.2 Segment State

State bit value	State	Description
0	OFF	The segment is OFF
1	ON	The segment is ON

The Segment state bit will depend upon the setting of Back Indication.

Default back indication will be "True feedback". In this mode the State bit will be updated when ever all LMS (without error or lamp fault) has indicated their correct state.

If back indication is set to a percentage then the state bit will be updated as soon as enough LMS has reported back correct state.

If back indication is set to "First LMS", the state bit will be updated as soon as the first LMS reports correct state.



#### Note

The segment state can be used for On/Off animation on the host system. However if the Host system want to apply a segment fault animation, then it will be up to the Host system to deem segments in error, based upon the reported LMS Errors and the rules that apply in the specific airport.

#### 15.3.4.5 Sensor

The Sensors can provide status of their operation

##### 15.3.4.5.1 Sensor State

State bit value	Indication	Description
0	No detect	
1	Detect	



#### Note

If the series circuit power, i.e. the CCR, is turned OFF the NCU will set the sensor status to No detect.

##### 15.3.4.5.2 Sensor Error

Error bit value	Indication	Description
0	OK	The sensor is working correctly.
1	Sensor failure	The sensor is broken or disconnected.



#### Note

If the series circuit power, i.e. the CCR, is turned OFF, the NCU will retain the sensor error information at least until the series circuit power is turned ON, or the NCU is rebooted.

#### 15.3.4.6 Lamp and LMS

The lamp/LMS error information could be combined, one bit used to indicated lamp or LMS error, or separated, lamp error and LMS error are reported separately in two different bits. The standard if nothing is specified is to separate these two errors.

##### 15.3.4.6.1 Command

Control of individual LMS has not yet been implemented in the Modbus Interface. In order to turn on/off lamps segment controls must be issued.

### 15.3.4.6.2 Lamp State

State bit value	Indication	Description
0	OFF	The lamp is OFF.
1	ON	The lamp is ON.



#### Note

If the series circuit power, i.e. the CCR, is turned OFF the NCU will set the LMS status to OFF. The only exception are LMS's with either Error or Lamp fail which will retain their status information at least until the series circuit power is turned ON, or the NCU is rebooted.

### 15.3.4.6.3 Lamp Error

Error bit value	Indication	Description
0	OK	The lamp is working correctly.
1	Lamp failure	The lamp is broken or disconnected.



#### Note

If the series circuit power, i.e. the CCR, is turned OFF, the NCU will retain the lamp error information at least until the series circuit power is turned ON, or the NCU is rebooted.

### 15.3.4.6.4 LMS Error

Error bit value	Indication	Description
0	OK	LMS is working correctly.
1	LMS failure	LMS is broken or disconnected.



#### Note

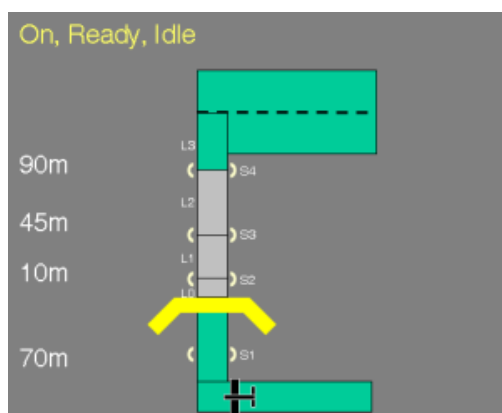
If the series circuit power, i.e. the CCR, is turned OFF, the NCU will retain the LMS error information at least until the series circuit power is turned ON, or the NCU is rebooted.

## 15.4 Appendix

### 15.4.1 Appendix A – Stopbar

#### 15.4.1.1 Stopbar

As an option it is possible to configure a stop bar functionality in the interface. Below is a description of the essentials in the Stop bar model.



Up to 4 sensors can be configured.

The first sensor in the model S1 will be the presence sensor. Ideal placement for this sensor is approximately 70m in front of the sensor, so that an airplane waiting at the Stopbar has passed the sensor.

The second sensor S2 will be controlling the re-lighting of the stop bar and turn off Lead On segment L0. In lack of this sensor the stopbar model will use a timer T1. This sensor will also be used for Incursion detection in case an airplane crosses a lit stopbar towards the runway. Ideal placement for this sensor is right behind the stopbar.

S3 turns off Lead On segment L1. In lack of this sensor the stopbar model will use a timer T2.

S4 turns off Lead On segment L2. In lack of this sensor the stopbar model will use a timer T3

L3 is a fixed segment that runs to the end of the Lead On TCL into the runway.

In most cases the actual Stopbar applications at an airport will only have a subset of the described sensors and Lead on segment. But even then the model can be used as not all the sensors and Lead On in the model need to be configured. The table below shows some of the possible applications where the model can be used.

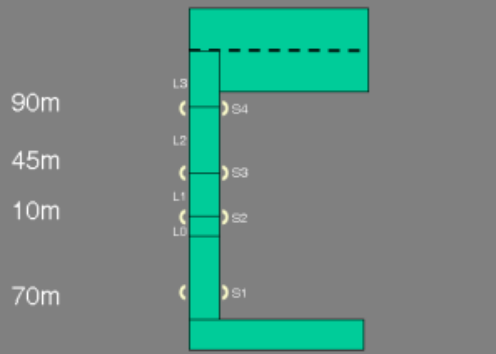
	Stopbar Segment	90m Lead On	45/50m Lead On	2nd Lead On 45/50-90 m behind Stop Bar	2nd Lead On Extended to Runway	3rd Lead On Extended to Runway	Timer Stopbar + 1st Lead On	Timer Stopbar	Timer Lead On 1	Timer Lead On 2	Sensor 70m in front of Stopbar	Sensor Right behind Stopbar	Sensor at 90m	Sensor at 45/50m	Runway Incursion Detection	Remark
x = Includes Oi = Option 1, 2, ... Ai = Alternative 1, 2, ...																
ICAO Basic	x	x					x							O1		
ICAO Standard	x	x						x	x		x	x	x			
FAA Standard	x		x	A1	A2		x			x				x		A1 and A2 are two alternatives
SG Fast w. Presence	x		x	x		x		x	x	x	x	x		O1	x	Length of 1st Lead On can vary

The pictures below illustrate the used notations:

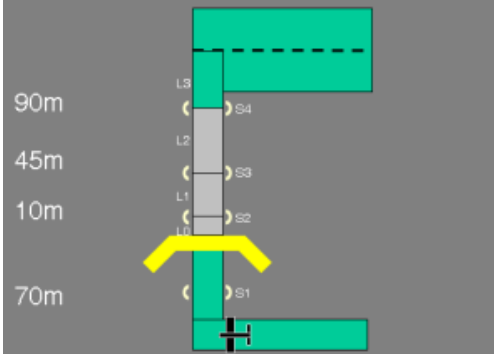
- **Stopbar:** Can be On or Off
- **Stopbar State:** Can be Ready, Enter or Leave
- **Aircraft incursion detection:** Can be Idle, Presence or Exit

## Departures

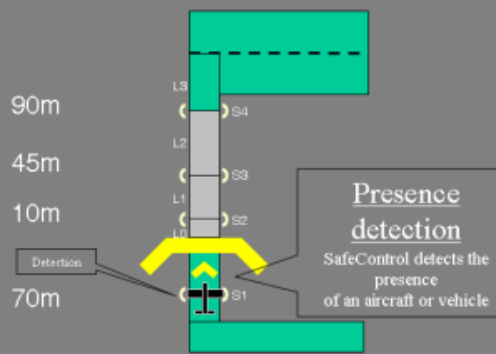
Off - Normal segment control



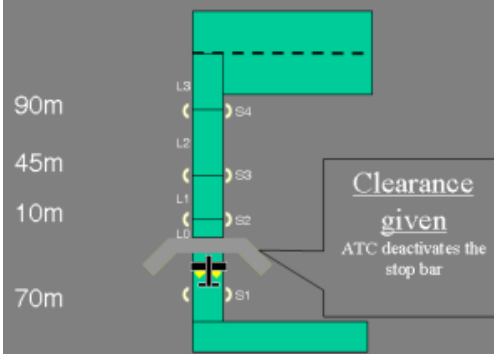
On, Ready, Idle



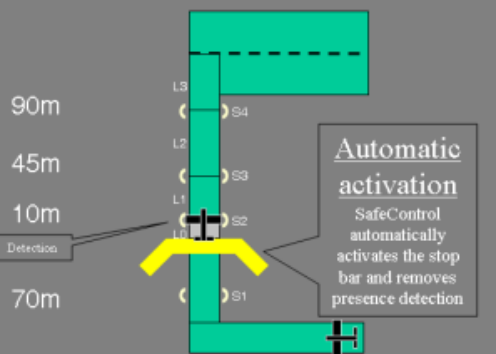
On, Ready, Presence



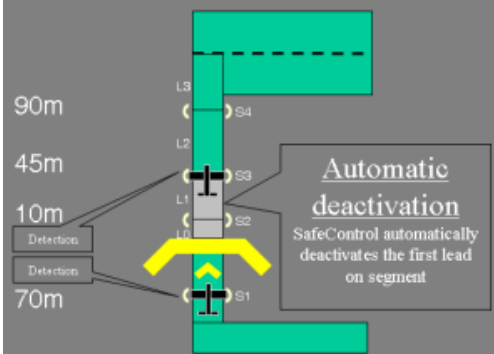
On, Enter, Presence

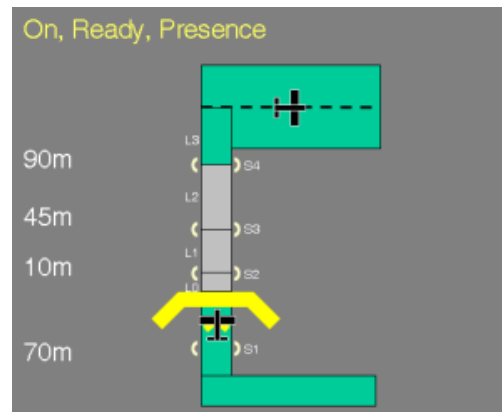
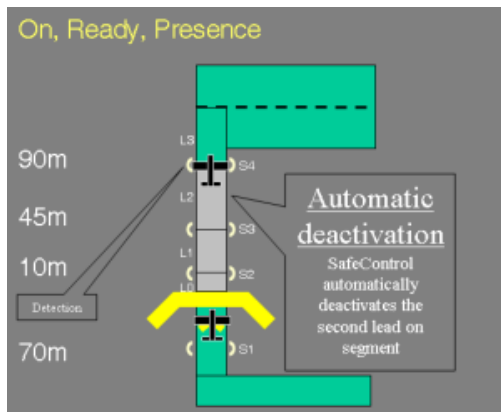


On, Leave, Idle

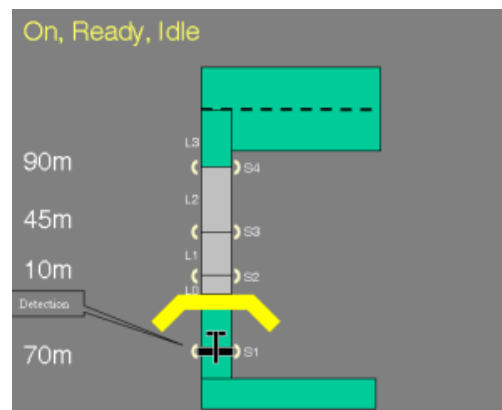
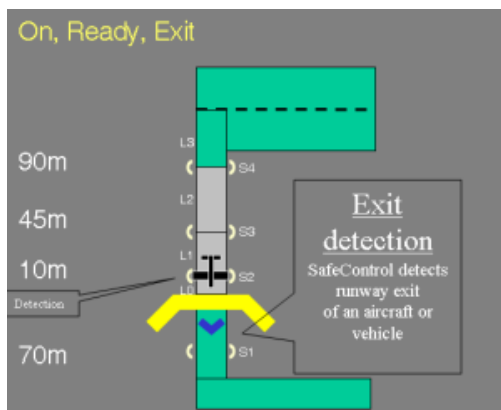


On, Leave, Presence

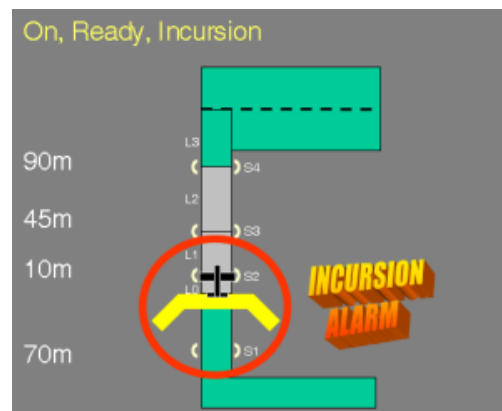
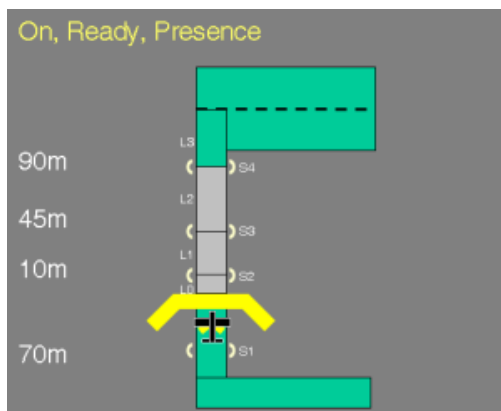




## Arrivals



## Incursion



The Presence detection function will be based upon two sensors: Presence sensor S1 placed approximately 70 m in front of the stopbar and the Stopbar Sensor S2 placed directly after the stopbar. The presence detection can be Idle, Exit or Presence.

When no air plane is detected the presence detection is in Idle.

If the S2 sensor gets the next detect it indicates that an air plane is Exiting the runway and the Presence state is set to exit. The exit state will remain until S1 detects, upon which the Presence state is set to Idle. Multiple Detections on S1 during the next 30 seconds will be allowed.

If the S1 sensor gets the next detect it indicates that an air plane has approached the stopbar towards the runway and the presence state is set to presence. This state will remain until S2 detects upon which the presence state sets to idle. Multiple Detections on S2 during the next 30 seconds will be allowed. When S2 detects it is checked whether the Stopbar has been turned off. If this is not the Case the Incursion State will be set indicating that the air plane has crossed the stopbar without permission. The Incursion state will remain set for 30 seconds.

The command Toggle Presence detection can be used to reset/set the presence state in case the presence logic ends in a wrong state.

#### 15.4.1.1.1 Stopbar Command

Below is the Stopbar command word.

Bit	Command	Bit Clear	Transition to bit Set	Comment
0	Control On	No action	Turn On SB (Ready)	Only effective when Stopbar is Off. Set the Stopbar to Ready State.
1	Control Off	No action	Turn Off SB (Off)	Set the Stopbar to Off State
2	Sequence Control	No action	Toggle Sequence	If Stopbar is Off set the Stopbar to Ready If Stopbar is Ready set the Stopbar to Enter If Stopbar is Enter set the Stopbar to Leave. If Stopbar is Leave set the Stopbar to Enter.
3	Extend Sequence	No action	Extend time	Reload Enter or Leave Timer
4	Enable Sensor	No action	Enable Sensor	Use Sensors - default
5	Disable Sensor	No action	Disable Sensor	Disregard any Sensor inputs. Prohibits Incursion and run the Stopbar Macro in Timed mode.
6	Enable Lead On	No Action	Enable Lead On	Turn on the Lead On TCL in Off, Enter and Leave state - default.
7	Disable Lead On	No Action	Disable Lead On	Do not turn on the Lead On TCL in Off, Enter and Leave state.
8	Toggle Presence Detection	No Action	Toggles Presence Detection	If Presence is detected clear the Presence state If Presence is not detected set the Presence state.
9	Reset	No Action	Reset	Only effective when Stopbar is On and in a sequence. Sets the Stopbar to Ready State.
10 – 15	Reserved	-	-	Read as 0

Every command is issued when bits transit from 0 to 1. When the command has been executed the control word should be set to zero. The use of a command pulse will avoid any unwanted commands to be re-issued in case of link problems.

When the Modbus link is failing then the Stopbar will enter failsafe state. After such disconnect the Stopbar must be initialized in order to leave failsafe state. The initialization shall be done either by sending a Turn On or a Turn Off in order to turn the stopbar either on or off.

When the stopbar is in OFF state the Lead On segments will be controlled as set by the Segment Command. In any other case the Lead On segment will be controlled by the Stopbar Macro. In case it is not desirable to have the Lead On turned on during the sequence, e.g if all other TCL is turned off at the airport, then the Disable TCL command can be issued.

The Enter and Leave time will be configured to 45 seconds.

In case the ASP Gateway should be restarted any settings made on Enable/Disable sensor, Enable/Disable Lead On and Presence detection will be lost. The ASP Gateway will enter the default settings on these data which is: Enable sensor, Enable Lead On and Idle. The Host Control system must in this case re-apply any settings made earlier.

#### 15.4.1.1.2 Stopbar Status

Below is the stop bar Status word.

Bit	Status	Comment
0	ON	Bit will remain set while the Stop bar is not Off
1	Ready	Bit will remain set while the stopbar is in Ready State.
2	Enter	-

Bit	Status	Comment
3	Leave 1	-
4	Leave 2	-
5	Sensors Enabled	-
6	Lead On Enabled	Stop bar and Lead On segments will be in failsafe.
7	Un-initialized	-
8	Idle	Neither Presence nor Exiting is detected
9	Presence	Presence State
10	Exit	Exit State
11	Incursion	Detect from Incursion sensor when Stopbar macro is ON
12	Stop bar lamp fault and pattern error	Bit will be set when the stop bar has 3 or more lamp faults or at least 2 adjacent lamp faults.
13-15	(reserved)	

#### 15.4.1.1.3 Stopbar error indication

In the extended stopbar function the following 3 indication exist for back indication of Stopbar Segment. Generally the Stopbar can be used operational when the stopbar is on (more than 50% lamps operational). However in Low Visibility it is recommended that no adjacent lamp fail exist (2 lamps in fail next to each other) and that the amount of failed lamps do not reach 3 lamps.

The status data of the stopbar will be available for the Host system.

##### 15.4.1.1.3.1 Stopbar Segment Number of lamp in error

Error word value	Description
0..65535	The number of failed lamps in a stopbar segment.

The Stopbar segment Lamp fail indicates the number of failed lamps in the stopbar.

##### 15.4.1.1.3.2 Stopbar Segment Adjacent Error

Adjacent bit value	Indication	Description
0	OK	The segment has no adjacent lamp fail.
1	Adjacent Lamp fail	The segment has at least one adjacent lamp fail

The Stopbar segment Adjacent Lamp fail indicates that at least two lamps next to each other have lamp fails.

## 15.4.2 Appendix B – Advanced segment functions

### 15.4.2.1 Light segment functions

The general light system object can be used for status monitoring of a light system such as a taxiway or runway light systems.

#### 15.4.2.1.1 Segment Lamp fail

Error word value	Description
0..65535	The number of failed lamps in a light segment

The segment Lamp fail indicates the number of failed lamps in the Light segment.

#### 15.4.2.1.2 Segment Adjacent error

Adjacent bit value	Indication	Description
0	OK	The segment has no adjacent lamp fail.
1	Adjacent Lamp fail	The segment has at least one adjacent lamp fail

The light segment Adjacent Lamp fail indicates that at least two lamps next to each other have lamp fails.

### 15.4.3 Appendix C – 2A Intensity control

#### 15.4.3.1 Intensity control

As an option it is possible to configure intensity control in the interface.

The 2A-system concept is based the traditional series circuit design but instead of controlling light intensity using the CCR it is set at a fixed current level and intensity is set by command using the communications channel made available by RELIANCE Intelligent Lighting.

2A intensity control implies no additional functionality compared to traditional intensity control. However, intensity control and circuit power will be handled by two separate systems, namely RELIANCE IL and the CCR as opposed to the traditional approach where both are handled by the CCR.

The CCR will be used to:

- Turn the circuit on or off

RELIANCE Intelligent Lighting will be used to:

- Set the light intensity
  - For an entire circuit, or
  - For a subset of the lights on a circuit
  - Monitor light intensity settings

The primary design objectives for the 2A-system intensity control setup is to mimic the functionality available using traditional CCR-hosted intensity control with minimal impact on the existing system's design, function and performance yet adding valuable functionality on the application level.

The 2A intensity control provides, in addition to functionalities available using traditional intensity control, intensity control on group level, i.e. intensity can be set to different levels for different light on the same circuit. This will make it possible to co-locate for example RGL-, stopbar-, taxiway center line- and taxiway edge lights on the same circuit.

##### 15.4.3.1.1 Intensity Group Command

Each light segment has an entity within an intensity group. An intensity group is defined as the group of segments that needs to be intensity controlled in the same way.

The NCU can have many intensity groups depending on how many circuits it is controlling. It may also only have 1 intensity groups even when there are many circuits.

For each intensity groups the intensity can be set to different steps, for example, when the system is used as a 3 step intensity control step 0,5,6,7 is normally used.

When changing intensity from i.e. 4 to 7 there is no need to set step 5 and 6, simply set the new wanted intensity. The intensity for the different step is set by default according to the table below. However it is possible to configure for arbitrary light intensities for the seven intensity levels.



The table below is the intensity group command word;

Command word value	Command	Description
0	Intensity step 0	Default this step will produce 0 % light output.
1	Intensity step 1	Default this step will produce 0.1% light output. This is not visible and is only used to monitor if the lamps are working without turning them on.
2	Intensity step 2	Default this step will produce 0.3% light output Normally this is not used
3	Intensity step 3	Default this step will produce 1% light output
4	Intensity step 4	Default this step will produce 3% light output
5	Intensity step 5	Default this step will produce 10% light output
6	Intensity step 6	Default this step will produce 30% light output
7	Intensity step 7	Default this step will produce 100% light output

Host System can both write and read command state, for each light intensity group.

#### 15.4.3.1.2 Lamp Intensity Failure

The lamp intensity failure signal indicates whether the lamp intensity deviates from the requested intensity. When a change in intensity is requested, there will be a short time until the NCU has actually changed the light output from the lamp. The NCU will keep the previous value of the "Intensity failure" signal in this short time period. The "Intensity failure" will be set when the NCU has failed to change the intensity to the requested intensity.

State bit value	Indication	Description
0	OK	The lamp corresponds to commanded intensity
1	Intensity failure	The lamp does not correspond to commanded intensity



## 16.0 Preventive Maintenance

This document contains information on recommended preventive maintenance activities applicable to RELIANCE Intelligent Lighting.

### 16.1 References

For details on RELIANCE IL component characteristics and handling, see RELIANCE IL component user guides and maintenance guides.

### 16.2 Introduction

Preventive maintenance involves the regular inspection, testing, and replacement or repair of equipment and operational systems. Much as the name implies, preventive maintenance or PM, refers to performing proactive maintenance in order to prevent system problems. This is contrasted to diagnostic or corrective maintenance, which is performed to correct an already-existing problem.

A preventive maintenance program can prevent breakdowns and failures through adjustment, repair, or replacement of equipment before a major breakdown or failure occurs.

Preventive maintenance for RELIANCE Intelligent Lighting is not mandatory although it is recommended that the below described activities, or a subset thereof, are incorporated into the preventive maintenance program at whichever site where RELIANCE IL is installed.

### 16.3 Preventive Component Maintenance

The recommended maintenance activities and the recommended frequency at which they are carried out are based on experience and common practice.

Quarterly frequency is equivalent to once every three months.

Annually frequency is equivalent to once every year.

Information and guidance on how to perform the recommended preventive maintenance activities are found in each component's user guide and/or maintenance guide.

#### 16.3.1 NCU

Refer to the table below for the recommended preventive maintenance activities that apply to the NCU. Note that not all items apply to all NCU hardware configurations.

Recommended Preventive Maintenance Activity NCU	Recommended Frequency
Check power supply fan for ventilation and dirt build up and clean if necessary.	Quarterly
Check case fan(s) for ventilation and dirt build up and clean fan(s) and filter if necessary.	Quarterly
Check CPU-fan for ventilation and dirt build up and replace if necessary.	Quarterly
Check detachable hard disc bay fan for ventilation and dirt build up and clean fan if necessary [1] .	Annually
Clean exterior of case.	Annually
Clean exterior of monitor.	Annually
Check and clean interior, back plane and expansion cards if necessary.	Annually
Check internal connections and cables.	Annually
Check external connections and cables.	Annually
Clean keyboard.	Annually
Replace case fan filter(s).	Every 2 years

Recommended Preventive Maintenance Activity NCU	Recommended Frequency
Replace CPU-fan.	Every 5 years
Replace case fan(s).	Every 5 years
Replace power supply.	Every 7 years
Replace complete unit.	Every 15 years

[1] Detachable hard disc bay is not included for all CU hardware configurations.

### 16.3.2 SCM

Refer to the table below for the recommended preventive maintenance activities that apply to the SCM. Note that not all items apply to all SCM hardware configurations.

Recommended Preventive Maintenance Activity SCM	Recommended Frequency
Clean exterior of case.	Annually
Check and clean interior if necessary.	Annually
Check internal connections and cables.	Annually
Check external connections and cables.	Annually
Check the tightening of the terminal screws connecting the communication transformer to the external 200W transformer [1].	Annually
Check cabinet fans for ventilation and dirt build up and clean if necessary [2].	Annually
Replace power supply.	Every 7 years
Replace complete unit.	Every 15 years

[1] Failure to do this check can generate enough heating to burn the communication transformer.

[2] Cabinet fans only apply to the SG591883 SCM-rack.

### 16.3.3 SCF

Refer to the table below for the recommended preventive maintenance activities that apply to the SCF. Note that not all items apply to all SCF hardware configurations.

Recommended Preventive Maintenance Activity SCF	Recommended Frequency
Clean exterior of case.	Annually
Check external connections and cables.	Annually
Check and clean interior if necessary.	Every 5 years
Check internal connections and cables.	Every 5 years
Replace complete unit.	Every 15 years

### 16.3.4 LMS

Refer to the table below for the recommended preventive maintenance activities that apply to the LMS.

Recommended Preventive Maintenance Activity LMS	Recommended Frequency
Reprogram configuration parameters.	Every 10 years

### 16.3.5 SIU

Refer to the table below for the recommended preventive maintenance activities that apply to the SIU.

Recommended Preventive Maintenance Activity SIU	Recommended Frequency
Reprogram configuration parameters.	Every 10 years

### 16.3.6 MBD

Refer to the table below for the recommended preventive maintenance activities that apply to the MBD.

Recommended Preventive Maintenance Activity MBD	Recommended Frequency
Clean and wax exterior of case.	Quarterly
Check alignment and adjust if necessary.	Annually
Check and clean interior if necessary.	Annually
Check internal connections and cables.	Annually
Check external connections and cables.	Annually
Replace complete unit.	Every 10 years

### 16.3.7 SCI

Refer to the table below for the recommended preventive maintenance activities that apply to the SCI.

Recommended Preventive Maintenance Activity SCI	Recommended Frequency
Check external connections and cables.	Annually
Replace complete unit.	Every 15 years

### 16.3.8 SFU

Refer to the table below for the recommended preventive maintenance activities that apply to the SFU.

Recommended Preventive Maintenance Activity SFU	Recommended Frequency
Replace complete unit.	Every 15 years

### 16.3.9 LPC

Refer to the table below for the recommended preventive maintenance activities that apply to the LPC.

Recommended Preventive Maintenance Activity LPC	Recommended Frequency
Replace 6.6 A <sub>RMS</sub> lamps.	Annually
Check lamps in buttons and replace if necessary.	Annually
Clean exterior of case.	Annually
Check and clean interior if necessary.	Annually
Check internal connections and cables.	Annually
Check external connections and cables.	Annually



## 17.0 Troubleshooting and Maintenance

This document describes troubleshooting and maintenance of RELIANCE Intelligent Lighting with LMSs, SIUs, SCMs, SCFs, and NCUs.

### 17.1 Introduction

It is assumed the reader of the guide is familiar with RELIANCE Intelligent Lighting (IL), its components and functions.

The aim of this guide is to give advice for troubleshooting problems which have temporarily caused the system to be out of operation or caused functionality performance problems. Follow the recommendations and procedures in this guide to find the reason for a problem and a resolution.

The user manual for other specific RELIANCE IL components contains procedures for troubleshooting which are not covered in this document.

### 17.2 Maintenance

#### 17.2.1 General

In general, RELIANCE Intelligent Lighting components do not require any special maintenance after installation. For more information, see specific component user guides.

On occasion, special requirements may be necessary for maintenance procedures as follows.

##### 17.2.1.1 Replace a component

All components, excluding the SCF, must be configured according to its function in the system. When a component is replaced it must be configured in the same way.

##### 17.2.1.1.1 Replace an LMS or SIU

When an LMS or SIU is replaced the new unit must be re-configured with the same parameters. For more information, see the AMT user guide for LMS-SIU parameters.

##### 17.2.1.1.2 Replace an SCM

When replacing an SCM-card the new unit must be re-configured with the same parameters. For more information, see the AMT user guide for LMS-SIU parameters.

##### 17.2.1.1.3 Replace an SCF

No special procedures are required for replacing an SCF.

##### 17.2.1.1.4 Replace an NCU

For more information, see the NCU user guide and other site specific documentation.

### 17.3 Troubleshooting

#### 17.3.1 General

The focus for this section is to troubleshoot initially at RELIANCE Intelligent Lighting (IL) level. The aim is to eliminate the RELIANCE IL components not at fault and to identify the component at fault. Fault resolution is then continued with the identified component's specific user guide information.



#### Note

Troubleshooting procedures for each specific RELIANCE IL component are available in specific user guides.

The normal procedure after the faulty RELIANCE IL component is localized is to replace it and carry out a more advanced testing of the faulty component. This procedure is normally carried out by ADB SAFEGATE personnel, with the exception of basic problems such as a faulty fuse.

### 17.3.1.1 Standard Troubleshooting Procedure

It is important to always check the following before starting any advanced troubleshooting procedures:

#### 17.3.1.1.1 Power Supply

Make sure all units are on and all fuses are working. Many problems are caused due to blown fuses or power supply problems.

#### 17.3.1.1.2 Communication

Make sure all communication links are working by checking cabling and contact plugs. Check equipment with LEDs, which indicate send and receive, for abnormal functionality.

#### 17.3.1.1.3 Accessories or other equipment

Make sure accessories or other equipment in the system works normally, especially equipment which RELIANCE IL depends on for normal operation, for example, CCRs, control and UPS systems. Check with manufacturer's documentation for correct procedures.

#### 17.3.1.1.4 Specification

Make sure that RELIANCE IL is working within its specifications, both electrically and functionally.

### 17.3.1.2 Advanced troubleshooting procedures

Advanced troubleshooting requires RELIANCE IL software and in-depth knowledge about the RELIANCE IL design, installation and configuration. For more information or assistance, contact ADB SAFEGATE.



## Appendix A: SUPPORT

Our experienced engineers are available for support and service at all times, 24 hour/7 days a week. They are part of a dynamic organization making sure the entire ADB SAFEGATE is committed to minimal disturbance for airport operations.

### ADB SAFEGATE Support

#### Live Technical Support - Americas

If at any time you have a question or concern about your product, just contact ADB SAFEGATE's technical service department. Trained in all areas of system issues, troubleshooting, quality control and technical assistance, our highly experienced Technical support specialists are available 24 hours a day, seven days a week to provide assistance over the phone.

**ADB SAFEGATE Americas Technical Service & Support (US & Canada): +1-800-545-4157**

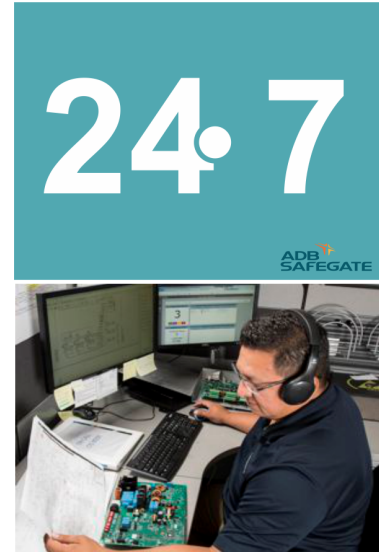
**ADB SAFEGATE Americas Technical Service & Support (International): +1-614-861-1304**

During regular business hours, you can also Chat with a Service Technician. We look forward to working with you!

#### Before You Call

When you have an airfield lighting or system control system problem it is our goal to support airfield maintenance staff as quickly as possible. To support this effort we ask that you have the following information ready before calling.

- The *airport code*
- If not with an airport, then company name (prefer customer id number)
- Contact phone number and email address
- Product with part number preferable or product number
- Have you reviewed the product's manual and troubleshooting guide
- Do you have a *True RMS* meter available (and any other necessary tools)
- Be located with the product ready to troubleshoot



#### Note

For more information, see [www.adbsafegate.com](http://www.adbsafegate.com), or contact ADB SAFEGATE Support via email at [support@adbsafegate.com](mailto:support@adbsafegate.com) or

Brussels: +32 2 722 17 11

Rest of Europe: +46 (0) 40 699 17 40

Americas: +1 614 861 1304. Press 3 for technical service or press 4 for sales support.

China: +86 (10) 8476 0106

### A.1 ADB SAFEGATE Website

The ADB SAFEGATE website, [www.adbsafegate.com](http://www.adbsafegate.com), offers information regarding our airport solutions, products, company, news, links, downloads, references, contacts and more.

### A.2 Recycling

#### A.2.1 Local Authority Recycling

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

### A.2.2 ADB SAFEGATE Recycling

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

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

All items returned must be clearly labeled as follows:

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

ADB SAFEGATE will continue to monitor and update according for any future requirements for *EU directives* as and when *EU member states* implement new *regulations* and or *amendments*. It is our aim to maintain our *compliance plan* and assist our customers.

## Company Addresses

ADB SAFEGATE	ADB SAFEGATE, Belgium: Leuvensesteenweg 585, B-1930 Zaventem Belgium
Contact: Tel.: +32 2 722 17 11, Fax: +32 2 722 17 64	Email: <a href="mailto:marketing@adbsafegate.com">marketing@adbsafegate.com</a> Internet: <a href="http://www.adbsafegate.com">www.adbsafegate.com</a>
Americas LLC	ADB SAFEGATE, Americas: 977 Gahanna Parkway, Columbus, OH 43230 USA
Contact: Tel.: +1 (614) 861 1304, Fax: +1 (614) 864 2069	Email: <a href="mailto:sales.us@adbsafegate.com">sales.us@adbsafegate.com</a> Internet: <a href="http://www.adbsafegate.com">www.adbsafegate.com</a>
ADB SAFEGATE Sweden AB	ADB SAFEGATE, Sweden: Djurhagegatan 19 SE-213 76 Malmö Sweden
Contact: Tel.: +46 (0)40 699 17 00, Fax: +46 (0)40 699 17 30	Email: <a href="mailto:marketing@adbsafegate.com">marketing@adbsafegate.com</a> Internet: <a href="http://www.adbsafegate.com">www.adbsafegate.com</a>
ADB SAFEGATE Airfield Technologies Ltd. China	ADB SAFEGATE, China: Unit 603, D Block, CAMIC International Convention Center, No 3, Hua Jia Di East road, ChaoYang district, Beijing 100102 P.R. China
Contact: Tel.: +86 (10) 8476 0106, Fax: +86 (10) 8476 0090	Email: <a href="mailto:china@safegate.com">china@safegate.com</a> Internet: <a href="http://www.adbsafegate.com">www.adbsafegate.com</a>
ADB SAFEGATE Germany GmbH	ADB SAFEGATE Germany GmbH, Mannheim: Konrad-Zuse-Ring 6, D-68163 Mannheim Germany
Contact: Tel.: +49 (621) 87 55 76-0, Fax: +49 (621) 87 55 76-55	Email: <a href="mailto:marketing@adbsafegate.com">marketing@adbsafegate.com</a> Internet: <a href="http://www.adbsafegate.com">www.adbsafegate.com</a>



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