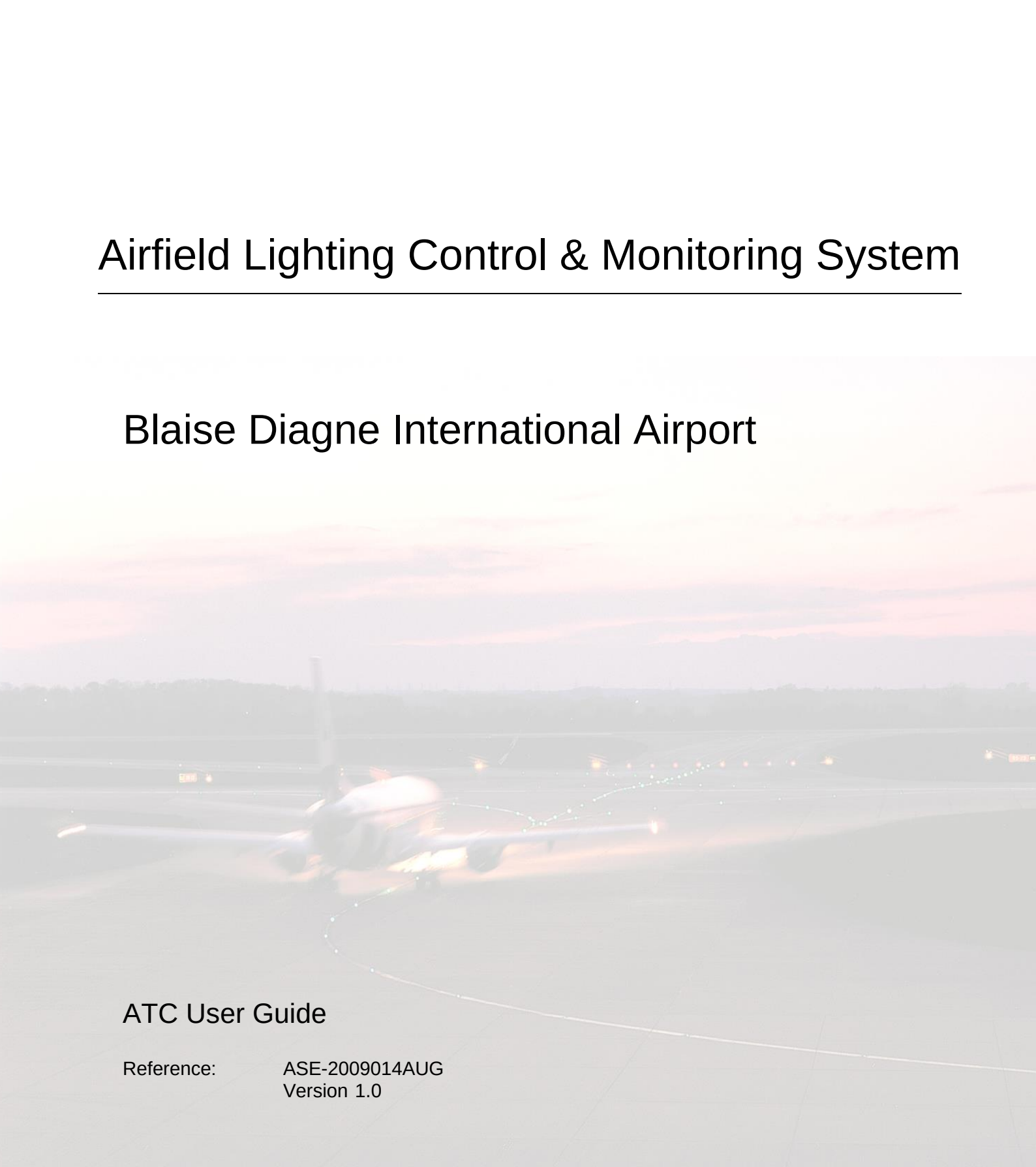
Airfield Lighting Control & Monitoring System

Blaise Diagne International Airport



ATC User Guide

Reference: ASE-2009014AUG
Version 1.0

ADB Airfield Solutions
Leuvensesteenweg 585
B-1930 Zaventem BELGIUM
Tel: +32 2 722 17 11
Fax: +32 2 722 17 64

REV	DATE	DESCRIPTION	RESPONSIBLE
1.0	06/2017	First issue for external use	FOL

1 Approval sheet

Author : F. Oldenhove

Date : 06/2017

Signature : _____

Authorized by : Jelu André

Date :

Signature : _____

Approved by :

Date :

Signature : _____

2 Table of Contents

3 Glossary

ACL	Approach Centre Line
AGL	Airfield Ground Lighting
AGL – function	A group of AGL Lighting circuits that are always controlled simultaneously.
ALCS	Airfield Lighting Control System
APR	Apron floodlighting mast
ASR	Approach Side Row lights
ATC	Air Traffic Control (tower).
Auxiliaries	All AGL Devices except those belonging to the series circuits.
BF	Constant current regulator Single phase.
AM	AGLAS Master
CCR	Constant Current Regulator.
CSM	Circuit Selector Module.
CST	Circuit Selector controlled by Thyristor (ADB)
DS	The DataServer is an application program that runs on the local controller computer handling the J-Bus communication MCR.
DTN	Background Visibility selection (for Day-Twilight-Night)
DV	Detailed View of an AGL equipment. This view regroups the status, alarm messages and individual control of this particular equipment.
Ethernet	Network protocol developed jointly by Xerox, Intel and Digital Equipment Corporation. Ethernet networks use CSMA/CD and run over a variety of cable types at 10 Mbs (megabits per second) or 100 Mbs.
FDE	The Feedback Date Extractor is an application program that runs on the HMI computer handling the J-Bus communication to the MCR.
FO-SC	Fibre Optic with SC standard connectors
GUI	Graphical User Interface
HMI	Human/Machine Interface
ILS	Instrument Landing System.
J-Bus	Field bus subset of MODBUS, witch allows interfacing the remote control and monitoring system with each current regulator.
LC	Local Controller is a computer that regulates the J-Bus communication link to MCR.
LED	Light Emitting Diode
LT	Landing T.
MCR	Microprocessor Controlled Constant Current Regulator
MICE	Hirschmann©: Optical Switch Module.
NBF	New BF.
PAPI	Precision Approach Path Indicator lights
PLC	Programmable Logic Controller. The RC uses Siemens PLC S7-300© series for controlling the I/O point of multiwire regulators and auxiliary circuits
RC	Remote Control (System).
RCL	Runway Centre Line lights
RE	Runway Edge lights
RTILS	Runway Threshold indicator lights.
RVR	Runway Visual Range (Visibility measurement)
SAT	Site Acceptance Test.
SB	Stopbar lights

SDD	System Design Document (This document has been approved by Airport authority before realisation of the RC).
SFL	Sequence Flasher.
SUB	AGL Substation
TCL	Taxiway Centre light
TCP/IP	Transmission Control Protocol Internetwork Protocol
TDZ	Touch Down Zone lights
TE	Taxiway Edge lights
THR	Threshold Lights
UTP	Unshielded Twisted Pair cable used for Ethernet protocol between computers (Short distance).
WC	Wind Cone.
WT	Wind T.

4 Introduction

4.1 Manuals overview

The Remote Control System for Visual Aids and Monitoring documentation is divided into 4 main documents:
ATC Manual describes all the functional aspects of the control software, giving a high level view of the system, focussed on the operational aspects of control for the AGL equipment and fast troubleshooting. The technical details of the sub components and maintenance-related activities will be skipped to maintenance manuals to keep this document as clear as possible. The ATC manual is mainly dedicated to Air and Ground traffic controllers.
Maintenance Manual is the key document for maintenance purpose. It gives a closer look of the technical details at equipment level. It also explains how to maintain the system, analyse the logs, search for errors, etc…
A series of **As-built Drawings** for the different Substations, ATC Tower.
Datasheets section regroups the all start-up documentation and user manuals provided by the manufacturer for each computerized item of the ALCS.

4.2 Purpose of this Document

This Maintenance Manual makes part of the ALCS manual package.
The Maintenance Manual describes the computerised remote control system based on the industrial control software designed and installed by ADB. It gives an overview of the control facilities and alarm event logging offered by the software. It mainly focuses on the maintenance and troubleshooting procedures of the ALCS system.

4.3 Patent right

The Human Machine Interface for Airport Traffic Control representation is protected for ADB by patent US 6,246,342 B1 dated June 12, 2001.

4.4 Users Regulations rules

The system is a closed ring system and cannot use any antivirus program.
Therefore it is **forbidden** to connect external components such as usb stick, external hard disc, floppy disc, SD card or memory cards, CD, DVD, internet connection or other components into the ALCS system (computers, fiber optical convertor …) or to play any type of game.
If this happens ADB will not be responsible for the malfunction (or crashing) of the system. Also the guaranty comes directly to an end.

5 Menu Window

The HMI is based on the Windows environment with easy access menus and screens displaying all information (e.g. click on the object for more info).
The main menu is a start-up window that allows entering directly to each page of the ALCS. This window shows several buttons for navigation. Pushing those buttons displays the corresponding screen described in the next paragraphs. This page is the first appearing at system start up.

The system can be used in two different ways:
The lighting **control part** is mainly dedicated to the tower operations, containing all means related to the sending of command to the airfield ground lighting equipment.

Airport Overview Window

The AGL **monitoring and troubleshooting part** is dedicated to the maintenance service team.

System Status Window

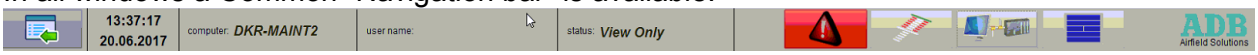
Substation Views

Alarm Window

System Tools Window

5.1.1 Navigation section

In all windows a Common “Navigation bar” is available.



This tool bar at the bottom of each screen displays the ADB-logo, the actual date and GMT time (needs to be updated at least monthly), the HMI that is in command and the user that is logged into the system. Furthermore, some more buttons are available in this bar:

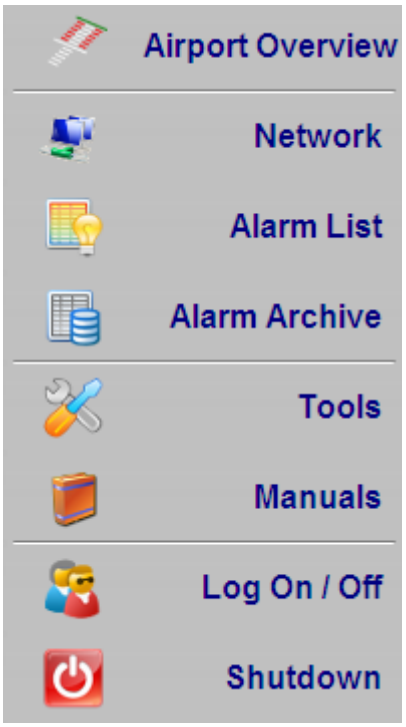
Alarm button, links to the alarm and event list. The alarm button will blink red or yellow when there is respectively a new alarm or warning. When acknowledged alarms or warnings exist, the button will remain respectively red or yellow.
- New alarms have a higher priority then acknowledged alarms.
- Alarms have a higher priority then Warnings.

Airport overview Button, access to the Airport overview Window. This window gives an overview of the current AGL status of the airport. Also, this page is used to alter AGL settings, like controlling functions or airport category.

System Status button, access to the System Status Window. The page displays info about the system equipment. This page can be used to verify faults & to monitor the system.

Menu button opens the home page of the ALCS. The home page links to the most important pages of the system.

Start Button, opens the menu. This menu provides the same buttons as described above and some more less important links:



ATC screens:
Airport overview window

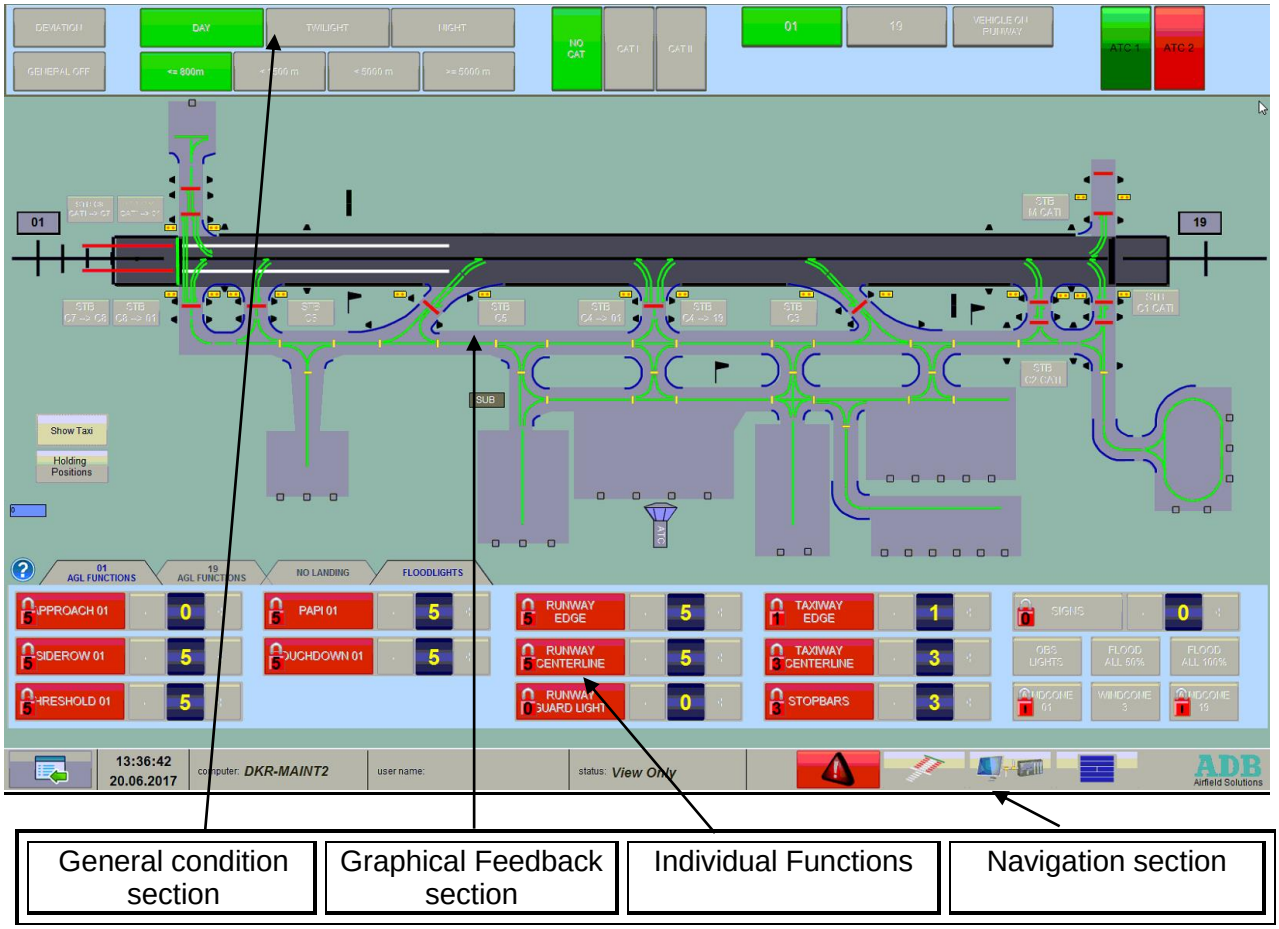
Maintenance screens:
- System status overview window
- Alarm List
- Alarm Log

Utility screens:
- Tools window
- Manuals window

Utility screens:
- Log On / Off possibility
- To Shut Down

5.2 Airport Overview Window

This window will be exclusively used for the control of the runway and taxiway by the Air Traffic Controller.
Remark: That chapter will not be developed in Details, for all details refer to the ATC User Manual.



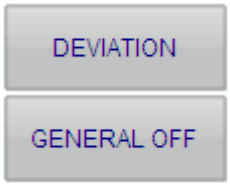
The Airport Overview Window contains four sections:

5.2.1 General Conditions section

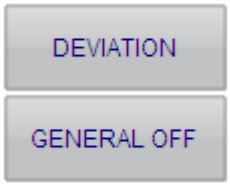
The upper part of the screen will be used for general control by sending command to all lighting circuits in accordance to modifiable pre-set tables. Every lighting circuits of one Airport has to be supplied at the right current intensity (step) depending of the visibility conditions (Runway Visual Range RVR and Background luminance) and the brightness of the other circuits.

5.2.1.1. Control Selection

Every HMI is able to take the control of the runway and to send commands to the regulators and auxiliary circuits. The button [ATC1] shows if the HMI is actually in command.
The “HMI-Master” (from which commands are entered, this will usually be the ATC-HMI) is represented in *bright green* background, while the “HMI-Slave” are represented in *dark green* and in case of failure, the corresponding button will be lit in red.

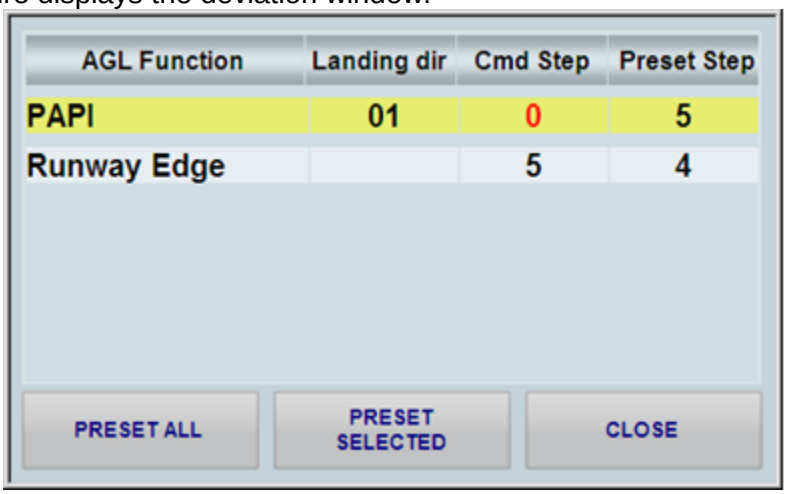


The [DEVIATION] button allows returning to the default conditions after a manual change. Pushing this button opens the deviation window (see below).
The [GENERAL OFF] button allows switching OFF all circuits of the Airfield Ground Lighting system. One confirmation pop-up window (Confirm/Cancel) prevents accidental clicking.



The [DEVIATION] button allows returning to the default conditions after a manual change. Pushing this button opens the deviation window (see below).
The [GENERAL OFF] button allows switching OFF all circuits of the Airfield Ground Lighting system. One confirmation pop-up window (Confirm/Cancel) prevents accidental clicking.

The following picture displays the deviation window:



The commanded step is displayed in red when the current selected step is at least one step below the step defined in the default brightness table.

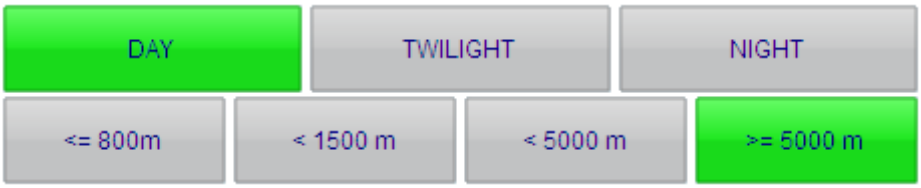
[PRESET ALL] When the Preset button is pressed the displayed functions will be reset the preset step. In order to prevent accidents a confirmation pop up will appear asking to verify if these modification will not affect the movement of the runway.

[PRESET SELECTED] If a function is selected (mouse click on the function), the “preset selected” button will be available. When the Preset Selected button is displayed, the selected function will be reset to its preset step as defined in the default brightness table.

[CLOSE] Pressing this button closes the deviation window without any change made to the functions.

Note: Deviation from the default conditions (on the request of pilots) remains possible by entering commands in the “Individual Control” section. If the default conditions are no longer valid, then the colour of the [PRESET] button goes to orange.

5.2.1.2. Visibility Conditions



Three buttons to enter the background luminance: [DAY], [TWILIGHT] and [NIGHT]. These buttons are interlocked: only ONE button can be activated at the same time.
Four buttons to enter the meteorological visibility (Runway Visual Range): [<= 800m], [800m to 1500 m], [1500m to 5000m] and [>= 5000m]. These buttons are interlocked: at each moment only ONE button can be activated.

5.2.1.3. Category

Buttons allow the operator to set the airport operational Category conditions.

5.2.1.4. Landing Direction

2 buttons that determine the Landing Direction (Runway In Use). These buttons are interlocked: only ONE button can be activated at the same time. When the landing direction 01 is selected, the 01-approach lighting is ON (Landing and Take Off at 01).

Note: Deviation from the default conditions (on the request of pilots) remains possible by entering commands in the "Individual Control" section. If the default conditions are no longer valid, then the colour of the [PRESET] button goes to orange.

5.2.2 Graphical Feedback section

The "Graphical Feedback" section presents a "live" picture of the Airbase. Conform to the ICAO annex 14, following type of AGL function feedback is displayed:
Note that the illumination of the graphical feedback representation corresponds to one actual back-indication coming from the constant current regulator.

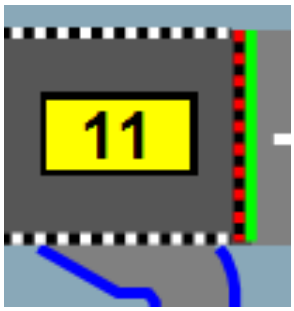
5.2.3 Display of the feedback's

These dynamic objects – represented in the "Graphical Feedback" section – represent true status feedback. This means that the object can be represented in three different states:

1. Black for not activated AGL functions (Status=OFF)
2. Flashing between the physical colour of the object and black for functions that have a status discrepancy or that do not respond to the system (Status=FAILURE)

3. The physical colour of the object for the functions that are operational and responding to the system (Status=ON).

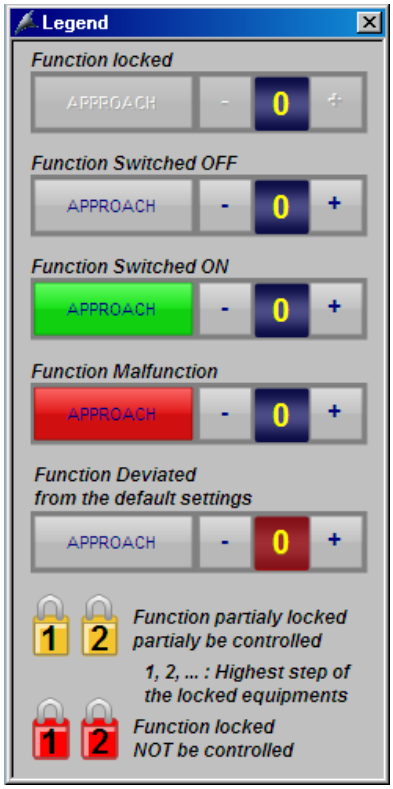
Since this feedback is generated on AGL-function level (could be a group of regulators), it may be difficult to determine from this window in which AFL-equipment exactly an error has occurred. Therefore the CCR/Auxiliaries status window is available. All the AGL functions using more than one regulator (interleaved circuits for example), are represented in a way allowing the identification in case of failure if one of both circuits is down. The following picture shows that at least one of the Runway Edge CCR's is ON (Cf. The line is dashed. Note that an alarm message will be generated and the control button will be red).



Generic screen, layout can differ based on actual Airport setup.

5.2.4 Individual Function Control section

This part of the screen will be used if the operator wants to deviate from the default settings in order to meet the requirement of the pilot or sudden variation of weather.



When the button is grey, the lights of the related function are OFF.

When the button is Green, the lights of the related function are ON (This information is also available in the Graphical Feedback section).

When the button is displayed in Red: a problem has occurred and the maintenance staff should check the alarm section; the HMI in question can't assure the correct operation of this AGL function.

The seven segment display will be blue if the actual step is in accordance with the pre-defined table and in dark red if there is a deviation of more than one step under. (See §6: Attachment 1: Automatic Brightness selection table)

A yellow padlock will appear on the button if one of the CCR's controlled by the button is in Maintenance mode or Out of Service and can not be controlled by the AT operator. A red padlock will appear if all CCR are in Maintenance mode or Out of Service.

The ATC commanded step will be applied to the CCR when mode is transferred back to Tower control mode.

5.2.5 Individual Function Control section

This part of the screen will be used if the operator wants to deviate from the default settings in order to meet the requirement of the pilot or sudden variation of weather.

5.2.5.1. Use of the buttons

The big button containing the name of the function allows the ON/OFF functionality in accordance with the Landing Direction, the RVR and the Background settings. When the function is not in the default brightness selection and is switched on the default brightness level will be step 2.
The 7-segments display shows the actual brightness step of the regulator (if 2 CCR's are provided for this function, the back-indication will show the highest value). The [+] and [–] buttons are used for increasing or decreasing of the brightness step by 1.

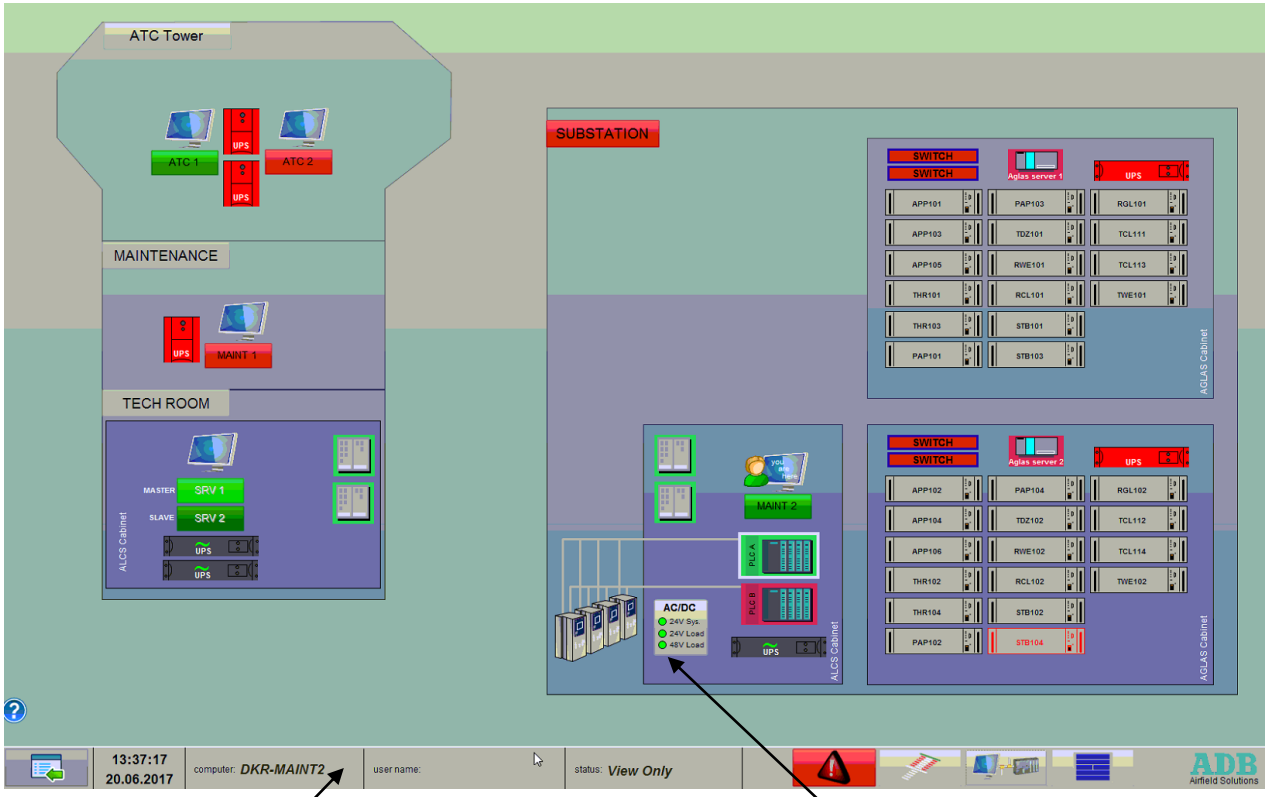
If a function is not available for a particular Landing direction, the corresponding button and his graphical object will not be displayed.

5.2.5.1. Help function

In the left corner at the bottom you can find a question mark  , clicking on this question mark will open a legend window that gives some helpful information about the information presented on the screen.

5.3 System Status Window

The system status window gives a graphical representation of the complete Remote Control System (without AGL devices). This window is the start point of maintenance and troubleshooting work but is also useful for operator. It has 2 basic functions:



5.3.1 Introduction

The system status window gives a graphical representation of the complete Remote Control System (without AGL devices). On this window, users can easily identify the location and the impact of a certain malfunction.

5.3.2 HMI computers status

For each computer in the ALCS system you can find here the following information:

- Where are you?
- Is that Station in ATC control? Is that station controlling the ALCS as an ATC operator?
- Is that Station defective?

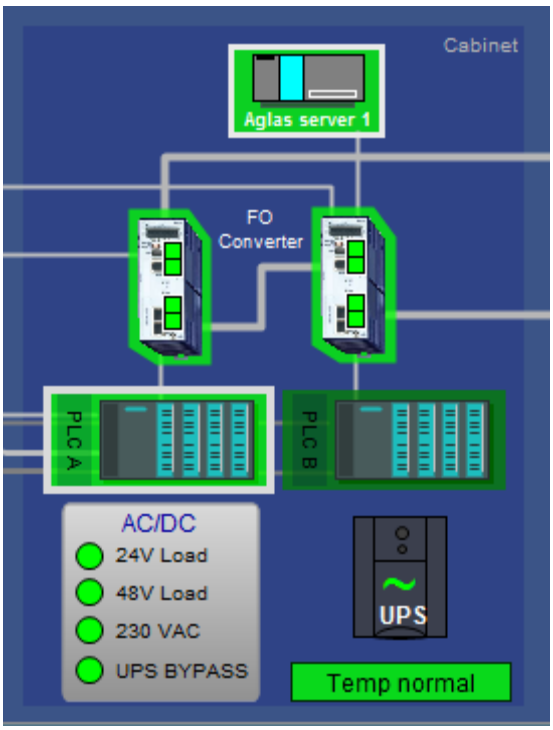
Note: The individual control of the CCR does not required to be in command.

The System Status window allows status monitoring of the HMI computers connected to the system.

- Computer in bright green means no alarm and this HMI is *in command* for the moment.
- Computer in dark green means no alarm and this HMI in stand-by (able to take command if requested).
- Computer in red means that the system has lost the communication link with it. The red colour means that all the local controllers and all the PLC modules have lost the communication to this particular computer.

5.3.3 Cabinet status

The operational status of the different system cabinets can also be found here. In each cabinet which include a PLC a system monitoring is available.



Generic screen, layout can differ based on actual Airport setup.

This will monitor the different critical aspects of the system.
The background colour indicates the status of the system:

Green = status OK,
red = status not OK
yellow = warning
grey = not monitored.

Following devices are being monitored:

- PLC
- Network Switch:

- 24V DC Power supply of the interface relays
- 48V DC Power supply of the interface relays
- Cabinet temperature
- Detailed UPS monitoring:

Legend of UPS:

: UPS on Main Power

: UPS on Battery

: UPS on low Battery

: Replace UPS Battery

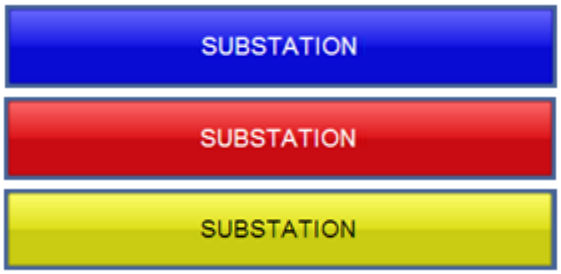
: UPS Fault (failure)

The SYSTEM STATUS window also makes it possible to localize system failures in order to warn the maintenance staff. A standard colour code is used to indicate the status of the different elements.

Colour	Status or operating mode
Dark green	Standby: Equipment is on-line ready for active work in case of problem (redundant unit). For example: HMI= active but not in command
Light green	Control: Equipment is on-line and doing active work (primary unit)
Yellow	Warning
Red	Alarm
White	No Internet Connection

5.3.4 AGL substation monitoring

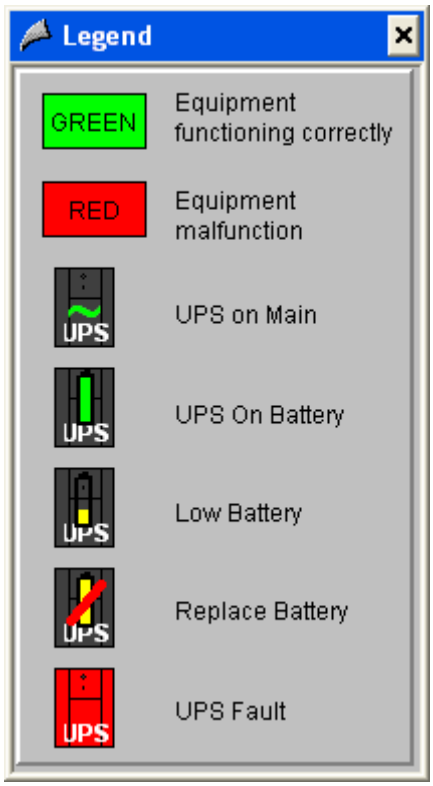
When no alarms or warnings occur in the substation the buttons are Blue.
When at least one alarm occurs in one substation, the corresponding button is Red.
The Yellow colour gives the same information concerning the warning events.



5.3.5 Help Function

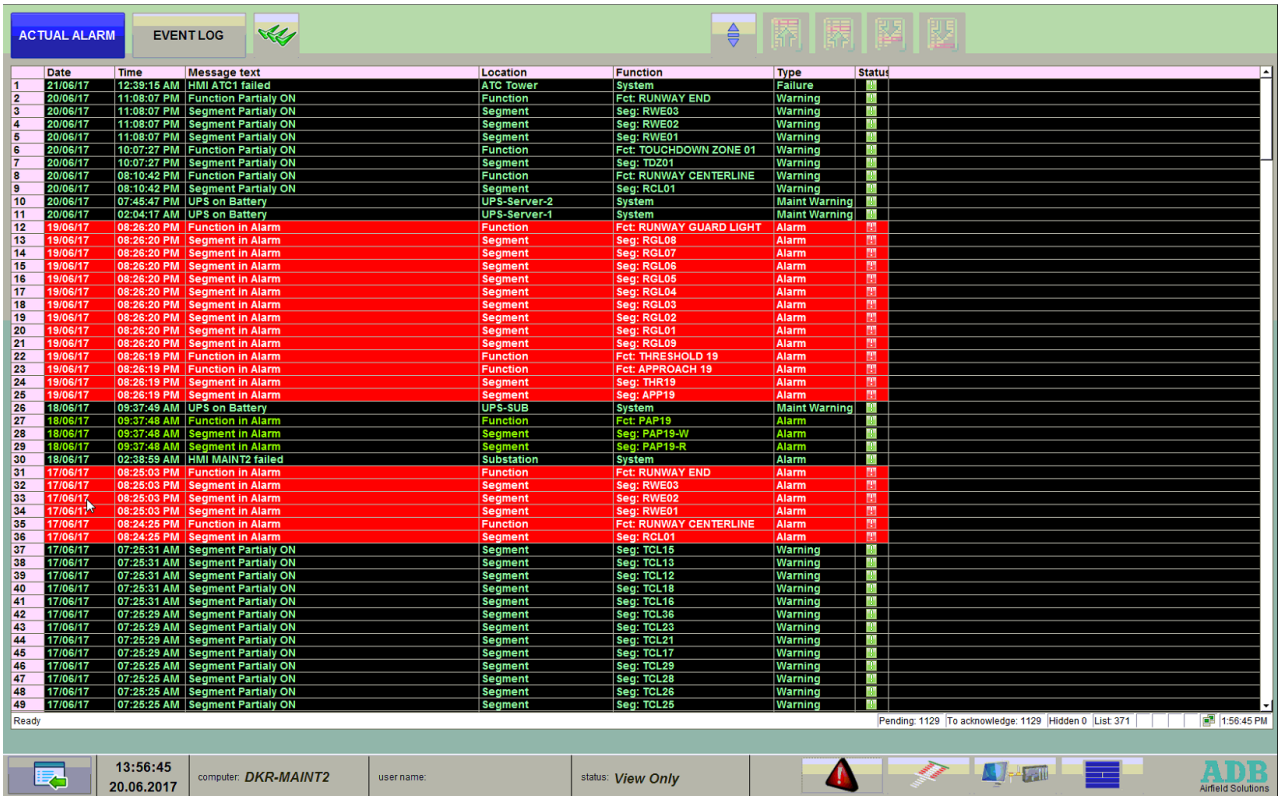
In the left corner at the bottom you can find a question mark  , clicking on this question mark will open a legend window that gives some helpful information about the information presented on the screen.

Remark: Clicking the legend closes the window.



5.4 Alarm Window

5.4.1 Actual Alarms Window



The alarm window represents FAILURES, ALARMS and WARNINGS that are actually affecting the system at this moment, in chronological order.
Depending on the logged in user the most important (Failure & Warnings - all users) or all alarms (Maintenance Warning, Alarm, Warning & Failure - maintenance users) are displayed.

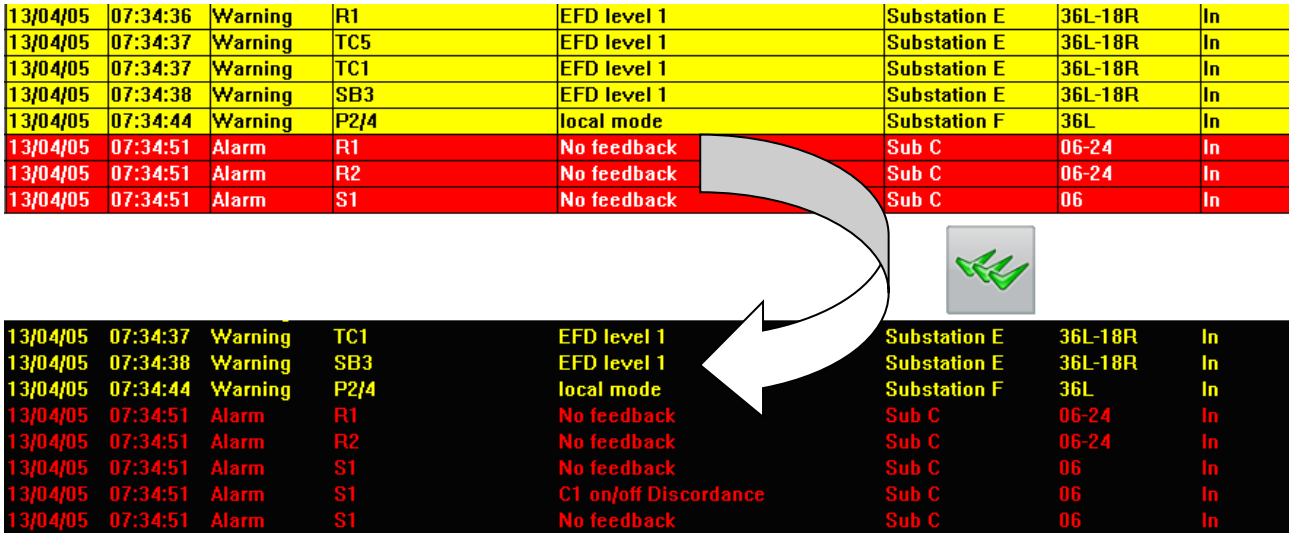
5.4.1.1. Colour Code

The alarms are displayed using a predefined colour code:

- **UNACKNOWLEDGED WARNINGS** are displayed using a black font colour on a yellow background: they indicate a failure in the lighting that still allows control. (low level problems in the lighting system that do not affect the control e.g. manual ON)
- **UNACKNOWLEDGED ALARMS** are displayed using a white colour font on a red background: they indicate a failure in the lighting system that affects control capabilities of the HMI. (high level problems in the lighting system that affect the control e.g. CCR Error)
- **ACKNOWLEDGED WARNINGS** are displayed using a yellow font colour on a black background.
- **ACKNOWLEDGED ALARMS** are displayed using a red font colour on a black background.
- **CLEARED MESSAGES** are displayed using a green font on a grey background: these messages have not been acknowledged by the user but have been solved. Acknowledging this kind of messages will remove them from the list of actual alarms.

Note: A colour reminder can be found at the bottom of the screen.

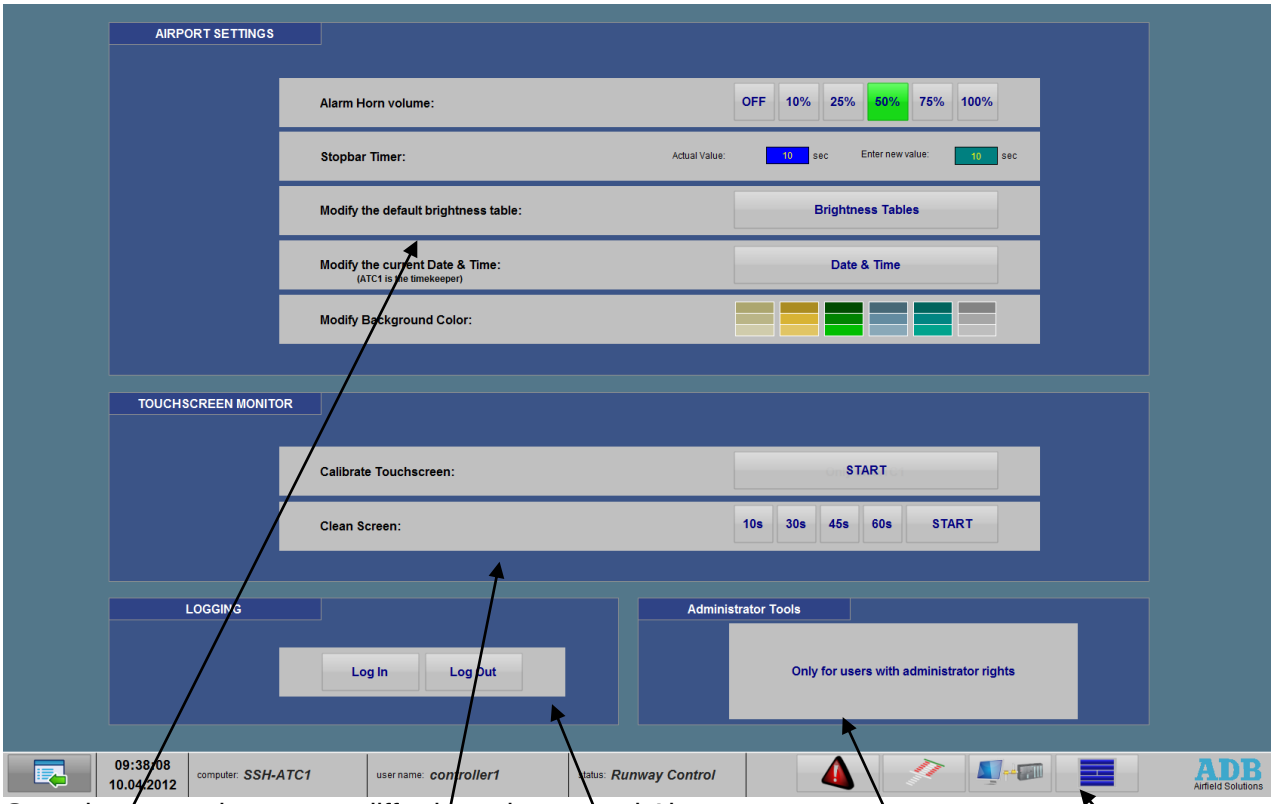
5.4.1.2. Acknowledgement



The entering of a new alarm will trigger an audio alarm to drawn the attention.

The first button of the alarm toolbar allows acknowledging at once all alarms displayed. Pressing this button will acknowledge the alarms on each HMI at once.

5.5 Tools Window

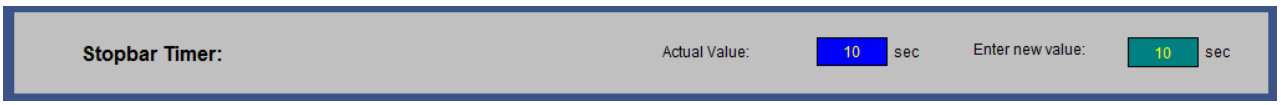


Generic screen, layout can differ based on actual Airport setup.

Airport settings section	Touch screen functions	Log in / log out section	ADB Tools (ADB use only)	Navigation section

5.5.1 Airport Settings

5.5.1.1. Stopbar Timer



Allow the ATC Supervisor to define the timers for the Stopbar automatic relighting.

5.5.1.2. Alarm Horn

Allow the operator (Supervisor or Maintenance) to disable or to change the volume of the alarm sound (horn) on the computer.

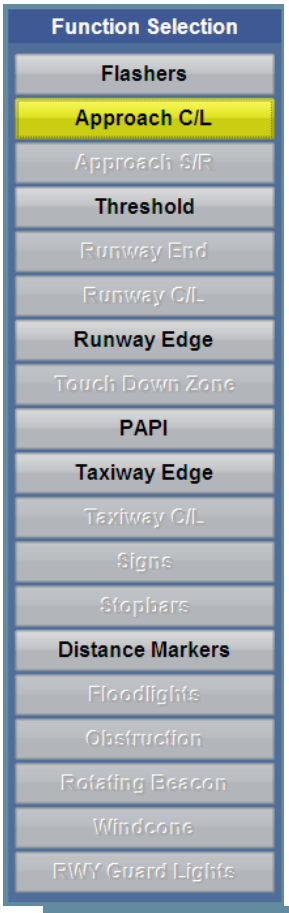
5.5.1.3. Default Brightness Tables

This button shows the brightness step values for the AGL circuits considering the actual background luminance, the runway visual range and the category of operations.
When the Controller selects the RVR, DTN or CAT buttons in the general “Airport Overview Window”, those commands will be sent to all circuits of the corresponding landing direction.
Those values can be adapted. Supervisor rights are required to change the values and can be done on each HMI computer.
The new values will be updated automatically to all the HMI computers online and to the PLC.
To apply the new changes on the Airfield lighting go to the runway overview page, press “deviation” and then press “Preset all”.
This Brightness Tables page is in “view only” mode for all other users.

The following picture gives a typical default brightness table:

Generic screen, layout can differ based on actual Airport setup.

Important Warning: The default brightness steps values have been calculated based on the ICAO light intensity recommendations and the optics measurements for each type of lamp (Approach, Runway, Taxiway...). Deviating from those tables must be handled with great care and by fully responsible person for this purpose only an ATC supervisor & administrator login allows it.

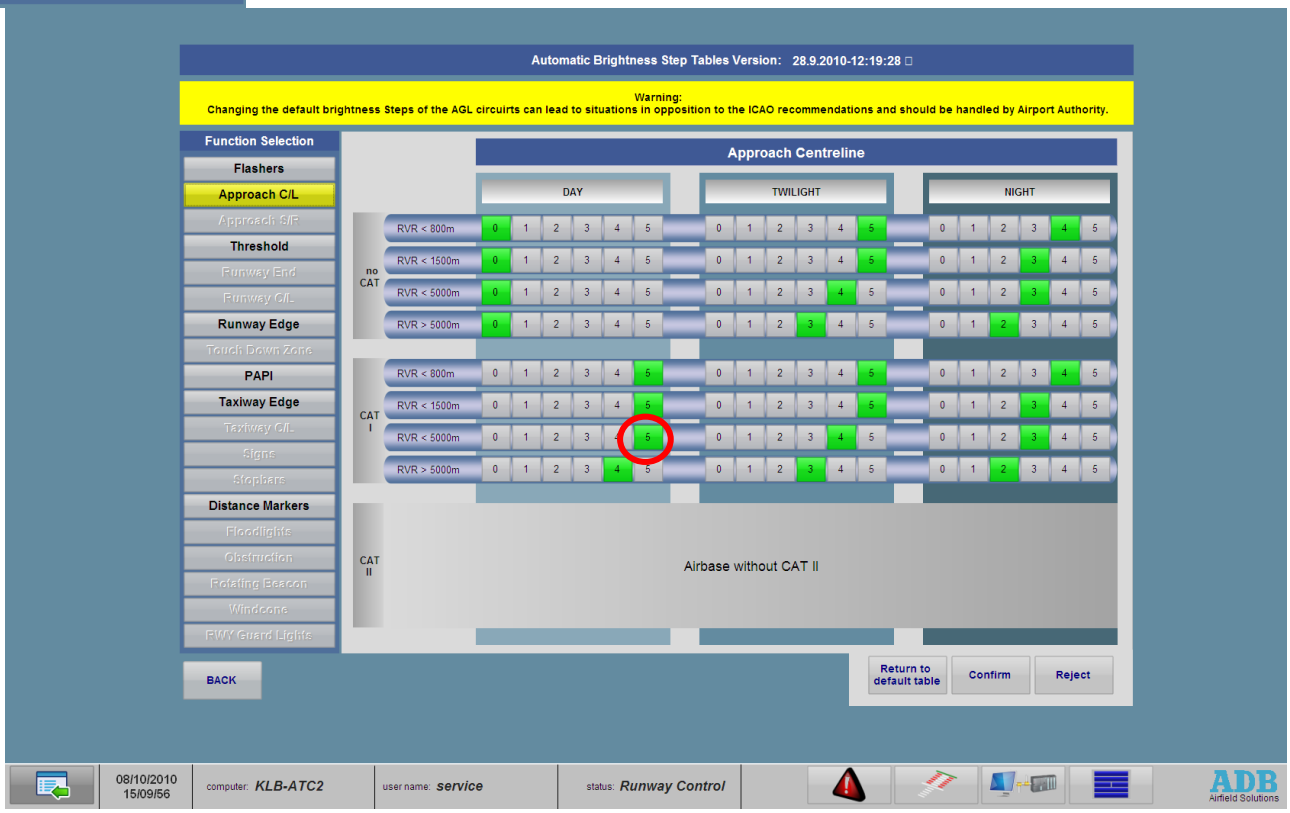


For each function by clicking on the corresponded button you will find its brightness table.

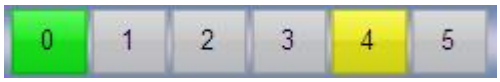
Click on the corresponded function button and you can change the brightness steps in his table that show up with all the step buttons in the 3 conditions:

- Background luminance
- Runway visual range
- Category of operation

Only the functions that are used in the ALCS project will be enabled.
For example by clicking on the “Approach C/L” button the following picture gives the table that the Approach C/L function requires to have a brightness step of 5 during Day when RVR<5000m and the runway is dedicated in CAT1 operation.



Brightness table of Approach C/L with a new proposed step (step 4 as example)



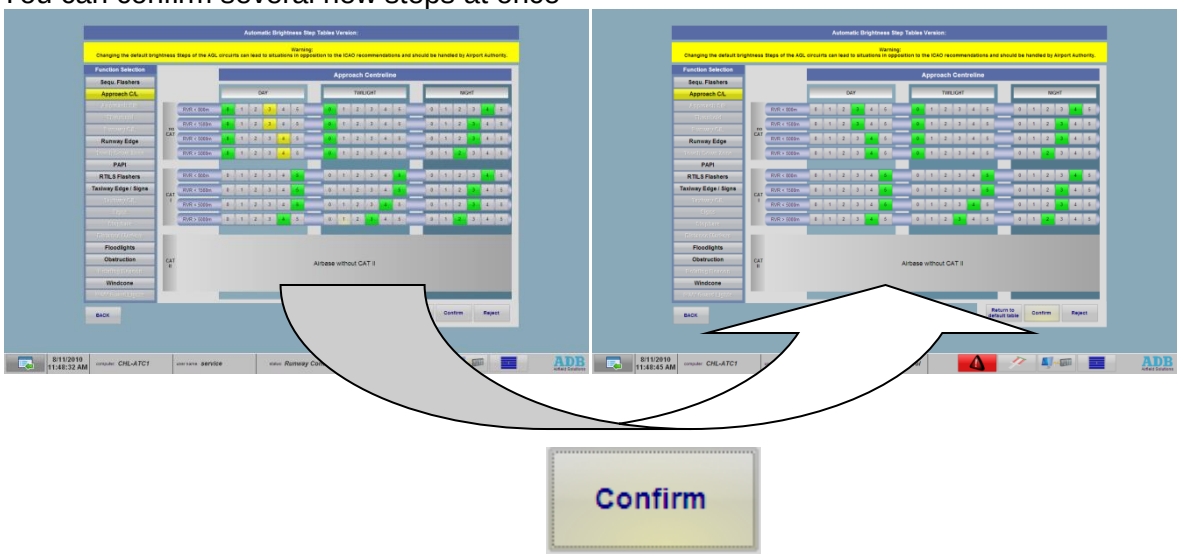
Brightness step buttons:

- The green “step” buttons in the brightness table are the existing value for each RVR depending on the background luminance and category.
- The yellow “step” button is the new value but not yet set.

Choose a new value by clicking on a step button (step-4 button for this example) and it will become yellow.
You can still change a “yellow” selection by clicking on another step button or on the green button from its own row.

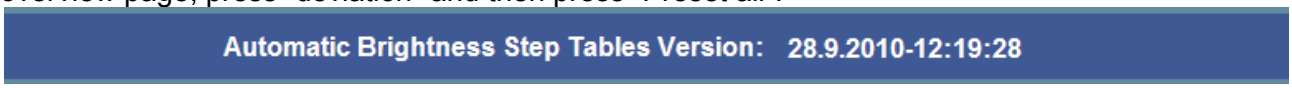
- To set this new value push the “Confirm” button on the screen.
- The “Reject” button will clear all the yellow buttons at ones.

You can confirm several new steps at once



To start from or return to the default brightness table (ICAO recommended) push the “Return to default table” button. The brightness table will be proposing the default state by putting buttons in yellow.
From here you can accept this state by pushing the confirm button or you can make changes before pushing the confirm button. (If needed to reject the propose default state push than the “Reject” button.)

The new values are now saved in the runtime database and also saved in the static database for the local computers and PLC. To apply the new changes on the Airfield lighting go to the runway overview page, press “deviation” and then press “Preset all”.

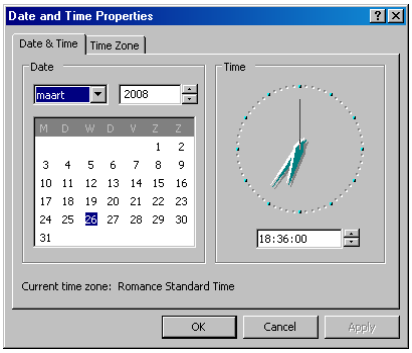


The confirmation of the version now installed on this computer is registered in the box “Version Control:” on top of the screen.
[28.9.2010– 12:19:28] for example is the date of the last change to the configuration, this is the version of the brightness table in use.

Important Warning: The default brightness steps values have been calculated based on the ICAO light intensity recommendations and the optics measurements for each type of lamp (Approach, Runway, Taxiway...). Deviating from those tables must be handled with great care and by fully responsible person.

5.5.1.4. Modify the current Date & Time

Time is set to the Greenwich Meridian Standard Time (GMT) during development. All computers are synchronised and the time master is ATC1 computer.
This allows the system administrator (administrator log in) to modify/adjust the date and time of the system. This will only be accessible from the HMI ATC1 located in ATC.



5.5.1.5. Modify Background Colour

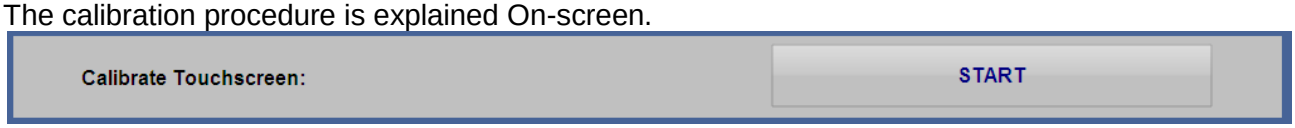
The background colour is configurable. 6 background colours available. Click on the desired colour to change the background colour. Each colour block has 3 sub colours, one for Day, Twilight and Night setting.

5.5.2 Touch screen monitor

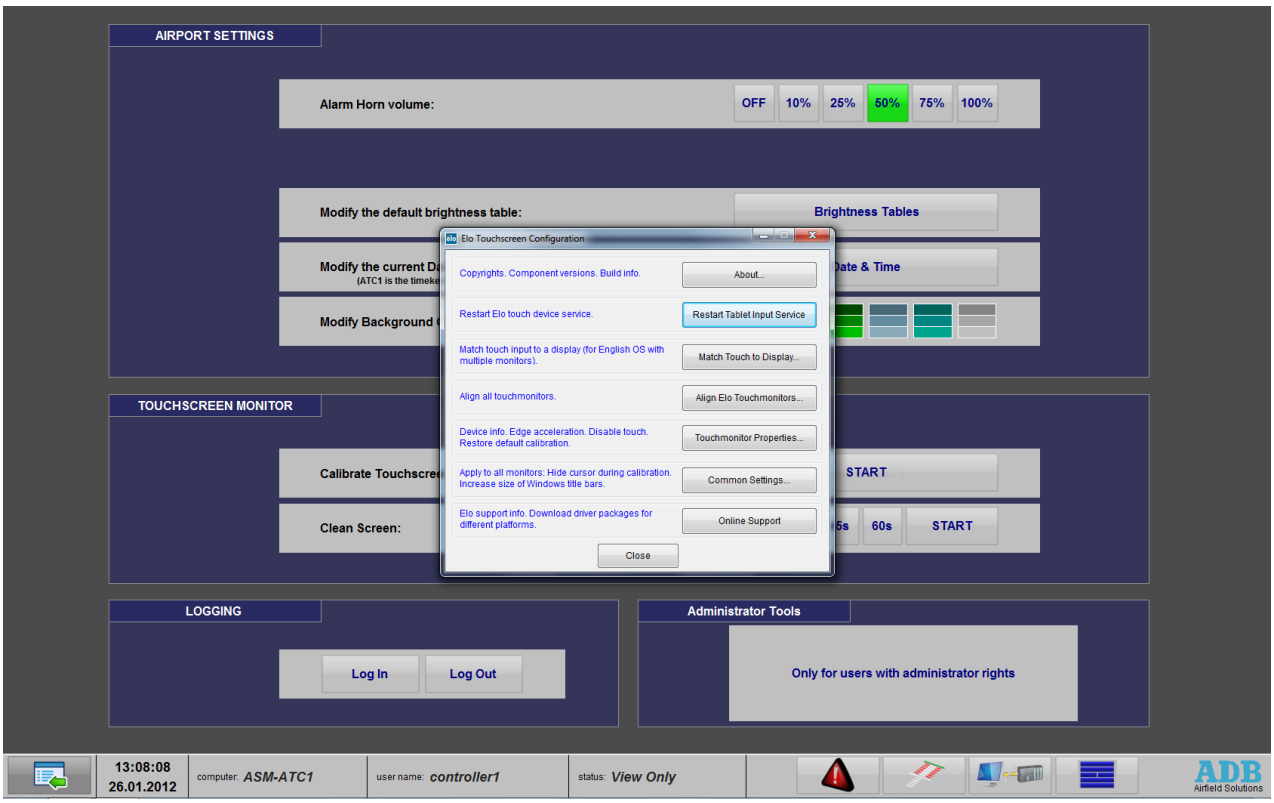
For locations where the inputs are given through a Touch screen monitor, the corresponding tab enables calibration and cleaning of the monitor.

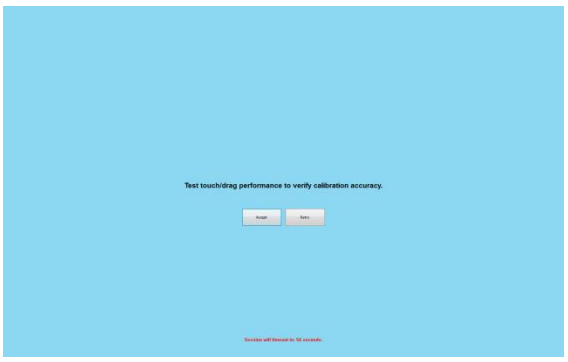
5.5.2.1. Calibration of the Touch screen monitor

Calibration of the Touch screen monitor is used to refine the cursor positioning with the finger inputs.
The calibration procedure is explained On-screen.



Then press on the "**Align Elo Touchmonitors**" button.

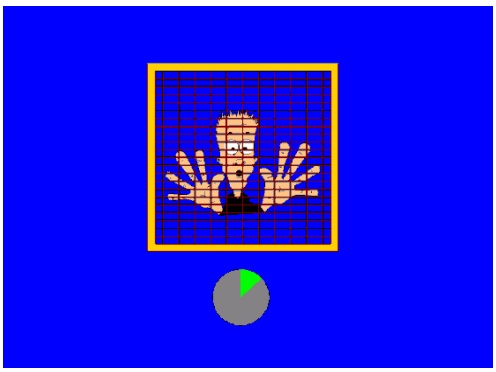




5.5.2.2. Clean Screen

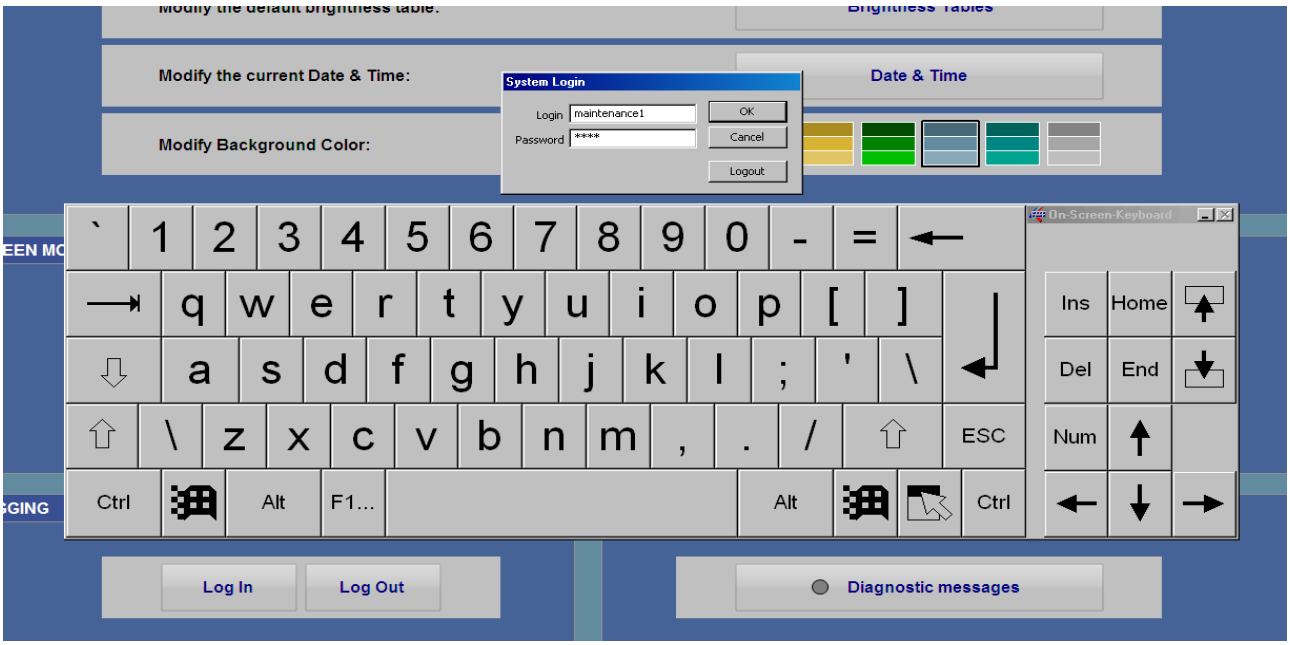
The cleaning function temporarily disables the input function of the screen, so that the monitor surface can be cleaned without accidentally clicking a button. The numerical buttons correspond to the duration of the inactivity.
The system allows 4 different blocking durations: 10, 30, 45 or 60 Seconds

During that time the following picture will appear on the screen with a graphical display that represents the already elapsed time.



5.5.3 Logging

[Log IN]: Button for enabling the pop-up window for entering the user and password with a on-screen keyboard (See Log-in Authorizations)
[Log OUT]: Button for close the work session and logging the current user out.
A user can also log in by pressing CTRL+I and log out by pressing CTRL+O.



If the PC is equipped with a touch screen, a software keyboard will pop up as soon as the login credentials are requested.