GRP

EFS by GRP

Primary circuit insulation monitoring

'Feel your Airport'

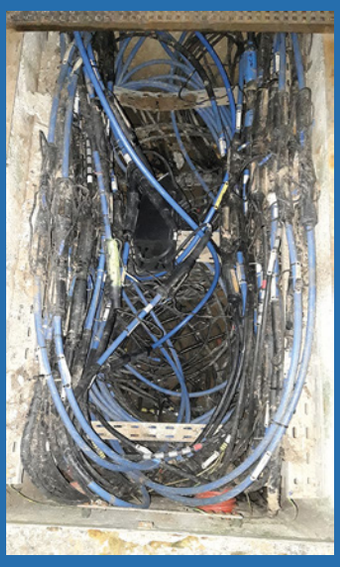
Primary Cable is the Backbone

Introduction

AGL primary circuits cables are the key component of the airfield infrastructure. There are **hundreds of kilometres** installed in a mid-sized Airport They are required to power the airfield ground lights, while they are the most common communication medium for Individual Light Control & Monitoring Systems (ILCMS) that allows the implementation of high demanding ATC (Air Traffic Control) solutions like follow the greens or A-SMGCS (Advanced-Surface Movement Guidance and Control Systems) to improve Airport capacity.

AGL primary circuit cables insulation level to earth is a **main concern** for airports. It may not be a big issue from an electrical point of view because CCRs (Constant Current Regulators) do not stop operation while detecting a low insulation level, mainly below 50MΩ. Nevertheless, it may have an **impact on operation** as a low insulation can affect airfield ground lights brightness levels, due to current bypassing through earth, or it may also be a first advice of a serious failure (open circuit) that it is a **major safety risk for AGL electricians** while working in areas or manholes with live circuits, even if not the one they are working on. Apart from all of that, low insulation level affects dramatically the performance of some ILCMS systems installed in airports, thus it could cause serious operational issues, reducing airport capacity by losing guidance functionalities in ATC.

Nowadays, airport routine maintenance personnel routinely checks AGL primary circuit cables insulation by the **measurement provided by the CCR** (fast and non-accurate) or by using a **megohmmeter** (time consuming due to the circuit decommissioning process to connect megohmmeter to AGL circuit but accurate). When a low insulation is detected, they react immediately planning its reparation.



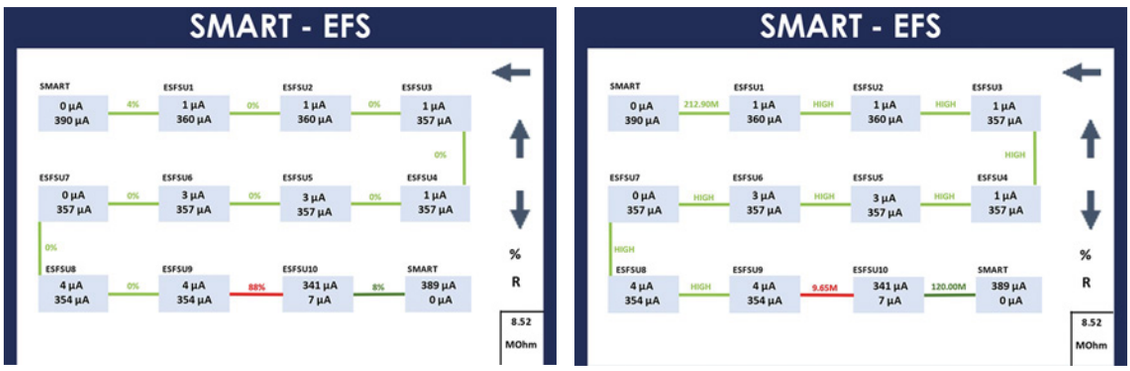
Fault finding process is a dichotomous method to find which section of AGL primary cable has the worst insulation value. Once the section is found, the root cause of the problem has to be determined: cables, connectors, or transformers. It has to be considered that in general there is not just one section of low insulation, there could be several, which increases difficulty in finding and repair. Usually, sections are defined from manhole to manhole, because this is where AGL electricians can use a megohmmeter to measure insulation.

The fault finding process has impact in airport operation because AGL circuit has to be decommissioned. Depending on where manholes are located, the access to them may imply taxiway/ runway closures or not. Which force AGL electricians to work in coordination with ATC on a free slot basis. Besides, certain airports use **deep cans** instead of manholes, **worsening the whole process** due to the difficult access to them and the need to remove the light.

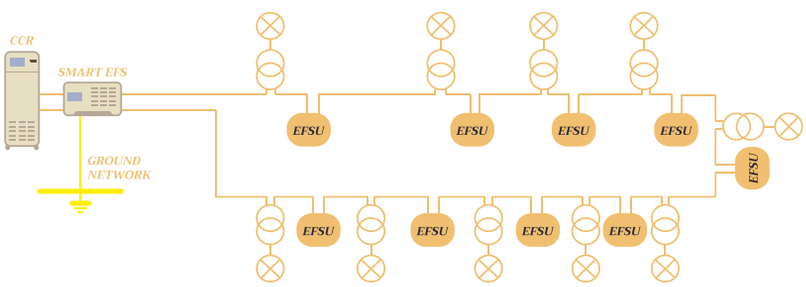
Summarizing, fault finding is a **time-consuming task** ranging from 6 hours to several days.

System presentation

Earth Fault Search system (EFS) is a **kind of distributed megohmmeter** that maps in less than 15 minutes each AGL primary circuit section insulation level, providing a clear indication of insulation status in colours (green, orange and red) while at the same time it provides each section **percentage of losses or resistance to earth in MΩ.**



As a first consequence, it reduces dramatically the time spent on fault finding. Which implies reducing infrastructure unservice ability time (AGL circuits, taxiways or runway) and increases AGL electrician availability time for other tasks, like, for example, repair earth fault. As summary, definitely the EFS-GRP use is a **big increase of efficiency**.



Apart from previous benefits, if EFS-GRP system is connected to a maintenance system (GRP has one), a CMS (Control and Monitoring System) or just a logging app (provided for free with the EFS-GRP system), Airport will benefit from logging measures allowing **predictive maintenance** to set place and understanding deeply circuit status behaviour along the different weather seasons.

How is this possible? Thanks to GRP's **cutting-edge patented power line communication** technology for AGL primary circuits (ILCMS-GRP), Field modules can be spread along the circuit, mainly installed in manholes, in order to define sections so as to optimise the mapping precision and reduce as much as possible intervention time in case of fault detection. A master unit per AGL circuit will manage the whole measurement process.

System components

These field modules are called **EFSU** (Earth Fault Search Unit), their protection index is IP68, and they are completely protected by PUR (Polyurethane Resin) coating. They are connected **directly to the AGL primary** circuit through two FAA standard connectors.

Why is the use of ILCMS-GRP technology required? Because is the most reliable and straight forward way to send measures back to a master equipment. In the same time, field modules are connected to the AGL primary circuit: **simplicity and no additional communication** infrastructure required.

The master unit is an indoor equipment that is connected to the CCR feeding the AGL circuit on one side and to the AGL primary circuit on the other side. It is called **SMART-EFS** and is fully compatible with AGL operation conditions. It is a high voltage device and, as such, provides all required protections to the operator while in use.

EFS-GRP can be either a fix system or a mobile one. Mobile concept comes from the fact that SMART-EFS can be connected to several pre-arranged and pre-defined AGL circuits where a certain amount of EFSU have been installed and commissioned: **EFSUs need to be permanently installed on the same circuit**. This is an option to reduce the investment required for such a system but losing the chance to implement automatic measurement because human action will be required to connect the Mobile SMART-EFS to the AGL circuit and perform the measures in local mode in coordination with ATC.

Nevertheless, human action to connect the **Mobile SMART-EFS** output connector to the CCR feeding the AGL circuit to be measured is limited. This connector is a cut-out handle compatible with the one CCRs are provided with, so **minimum connection time also in this case**.

The Mobile SMART-EFS is a kind of customized carriage equipped with one computer and one **21**" touch screen to launch measurements and log them using a customized APP. It has a **19**" rack body where a number of standard rack units could be specified by customer as per his needs. For example, drawer for tools, empty shelf for papers, auxiliary outlet for tools charging, etc. The picture shows a drawer with key-lock.

System process

No matter the type of system, fix or mobile, the SMART-EFS manages the whole measurement process once it is launched. Due to the fact that the EFS-GRP system principle is based in high voltage measurement like the one performed by megohmmeters, it disconnects AGL circuit from CCR while injecting high voltage (5kV max). It is done using its high voltage switches and requires an **interlock** connection with the CCR in order to stop its operation before switching. Therefore, the following phases are defined:

- **Checking/calibrating**. It a phase to measure the AGL circuit insulation to earth and determines which voltage will be used in EFS measures. CCR is disconnected from load. The phase takes less than 1 minute. AGL circuit insulation should be below 100MΩ in order to proceed with measuring phase. Measuring one side:
  - **Charging**. It is a phase to make sure EFSUs had enough energy to perform their measures while high voltage is injected. It takes less than four minutes.
  - **Measuring** itself. The CCR is disconnected and high voltage is injected. EFSU are still in operation even though there is no power in AGL circuit. EFSUs record leakage current in the AGL circuit. This phase takes less than one minute.
  - **Measures recovering**. The CCR is connected to the load and all EFSU measures are remotely read using ILCMS-GRP technology. This process takes less than one minute.

Process is repeated in the other side of the AGL circuit and result mapping is calculated using both side measurements. Whole process takes **no more than 15 minutes**.

GRP Iluminación, S.A.U.

Calle de los Reyes Católicos, 6. Nave 102
28108 - Alcobendas (Madrid) - Spain / +34 91 327 19 66

GRP
www.grp-airsys.com