

SALT HARVESTER OPERATOR INTERFACE UPGRADE



Upgrade the ageing and obsolete OPUS A5 display with current OPUS A6 as a full form fit and function replacement

OVERVIEW

The objective of the project is to replace the old operating interface (OPUS A5) to new interface (OPUS A6) due to salt crystals built-up inside the old screen. The main challenge is that original program of ECM and CAN library (database) were not available. The opus display was connected to ECM over CAN bus and communications follow J1939 standard. So we did reverse engineering of CAN bus messages and used that information to program the new OPUS display.

CUSTOMER

The customer is one of the major resource industry players involved in salt mining, operating in Western Australia. They have salt mines at several locations in the State. To harvest the salt from the ponds, they are using a salt harvester which is custom built on earthmoving track machine, fitted with 345 CL Power pack.



PROBLEM

The customer use Salt harvesters built on CAT chassis extensively modified for this application and ruggedized to withstand the rigors of the corrosive sea salt environment. As the machine was ageing, components were gradually wearing out which also include the main Operator Interface (OPUS A5) which communicates over CAN bus with the ECUs controlling the harvester operations using SAE-J1939 protocol for communication. The entire system was designed and all the ECUs were originally programmed by Caterpillar, USA and commissioned in 2008. OPUS A5 being superseded with a completely new OPUS A6 and without the availability of the source code, it was only a matter of time, till the failure of the Operator Interface. The operator interface/ display is an integral component of the salt harvester. If the display fails, then it will severely impact salt harvesting and disrupt their operations. Over time, salt crystals built up inside the display (OPUS A5), also made the screen difficult to see and use.



Old OPUS A5 Display

CAN Automation was contracted to identify a replacement Display from the current generation of OPUS range and was required to re-create maximum functionality of the original display which it was meant to be replaced. In short, a full form fit and function replacement. This will help the customer continue their salt harvesting and plan a timed retirement of the machine when a full replacement is procured and commissioned.



New OPUS A6 display supplied

SOLUTION

Replacement of the OPUS A5 with the new OPUS A6 was agreed as the way to go. But re-creating the full functionality required a lot of challenges to overcome.

So, the problem was broken up into the following steps:

- Study machine operations closely
- Collect data about various functions
- Log CAN Bus data
- Analysis of data collected with live and off



- line interpretation of data
- Linking messages with physical events
- Document and summarize every message and link to physical events.
- Analyse the user screens and interpret screen operation and logic.
- Re-create the functions in the new Display OPUS A6
- Map the messages with functions and I/O conditions.
- Add diagnostic and alarm messages.
- Install and observe machine function with new OPUS A6

Having broken down the problem into smaller tasks, we visited the site multiple times, spent many hours with the operator on the machine, logged, identified and mapped every message in the CAN Bus network linking Opus A5 with the machine's ECU. CAN crocodile was used to sniff the CAN Bus messages without breaking into the physically secured network, and using Kvaser memorator we logged all the messages for replaying and analysis off line using X analyser 3 Pro (CAN Analyser with J1939 interpreter). This helped us to resolve messages and link bit and byte-wise information with measured and identified physical events. After resolving standard J1939 messages, we set to work on proprietary messages. With the immense data collected and working with the machine aided by technical support from our Head office we also managed to understand proprietary messages and correlated them with diagnostic and alarm events in the machine. After meticulously documenting every detail, the new operator interface OPUS A6 (Gen 2 of 2021 build) was programmed and installed in the machine.



Products used

- Kvaser USB-CAN interface (licensed with X-analyser 3 Pro)
- Kvaser Data logger/

memorator

- CAN Crocodile (Contactless CAN reader)
- OPUS A6 interface
- X-Analyser 3 Pro Software (Warwick Controls)



Brands used

