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TITLE :	SPECIFICATION OF IBERDROLA FUNCTIONS: "DETECT ROTOR EXCITATION POWER CONSUMPTION (S37)"
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CONTENTS

0. OBJECTIVE OF THE FUNCTION

The objective of the function is to report the excitation power and compare it with theoretical manufacturer excitation power consumption. In this function the excitation power curve will be registered and compared with the supplier curve in starting or stopping periods.

1. FUNCTION ENVIRONMENT

The function will be monitoring the real excitation power consumption and comparing with theoretical. So, the information presented to the user contains the real and theoretical excitation power consumption. In starting or stopping periods, when generator is synchronised and increasing or decreasing power, the function will register theoretical and real excitation power curve and will draw both on operator request.

This evaluation will be executed every time the input data described below is selected from SCADA sensors by the monitoring system, and will use the most recent data collected by the instrumentation in real time. The results obtained from the execution of the function will be stored into the real-time DB.

The sequence of requests and responses of the function is the following:

Event	Request/Response (RQ/RS)	From	To
Monitoring Request	RQ	Function	Function
Collect Data (continuous extern function with a fixed sample interval)	RQ	Function	Data Acquisition System (D.A.S.)
Data Collected (continuous function with a fixed sample interval)	RS	Data Acquisition System (D.A.S.)	Data Base
Select Data (on monitoring request)	RQ	Function	Function
Data Selected (on monitoring request)	RS	Data Base	Function
Perform Monitoring	RQ	Function	Function
Store Results	RS	Function	Data Base

2. INPUT DATA DEFINITION

Input data will be the following SCADA signals:

Rotor signals:

XA-V0201 EXCITATION_TENSION (Pelton)
(Analogic, V, range 0:1000)
XA-V0202 EXCITATION_CURRENT(Pelton)
(Analogic, A, range 0:6000)

XA-V0109 EXCITATION_TENSION (Francis)
(Analogic, V, range 0:1000)
XA-V0110 EXCITATION_CURRENT(Francis)
(Analogic, A, range 0:6000)

Stator signals:

XA-V0113 STATOR_TENSION (Pelton)
(Analogic, KV, range 0:16,5)
XA-V0112 STATOR_CURRENT(Pelton)
(Analogic, A, range 0:6000)

XA-V0106 STATOR_TENSION (Francis)
(Analogic, KV, range 0:16,5)
XA-V0105 STATOR_CURRENT (Francis)
(Analogic, A, range 0:6000)

XA-V0114 ACTIVE_POWER (Pelton)
(Analogic, MW, range 0:180)
XA-V0115 REACTIVE_POWER (Pelton)
(Analogic, MVAr, range -90:+90)

XA-V0107 ACTIVE_POWER(Francis)
(Analogic, MW, range 0:180)
XA-V0108 REACTIVE_POWER (Francis)
(Analogic, MVAr, range -90:+90)

3. OUTPUT DATA DEFINITION

The output of this function will be used to estimate the probability of a generator malfunction

The output will be:
- real excitation power consumption
- theoretical excitation power consumption
- active power generated
- reactive power generated

- excitation tension
- excitation current
- generator tension
- generator current
- In starting or stopping periods, when generator is synchronised and increasing or decreasing power, the function will register theoretical and real excitation power curve and will draw both on operator request

4. DYNAMIC BEHAVIOUR

As mentioned in section 1., the function will make some simple calculations to transform the initial data selected from the D.A.S. So, the function will be executed when retrieving data from SCADA by the monitoring system, and the results stored into the real-time DB.

5. DATA PROCESSING (ALGORITHMS)

In this section we will define the model used to determine the theoretical and real excitation power consumption.

MW= Stator Active Power (MW)
EP= Excitation power (kW)
ET= Excitation tension (kV)
EC= Excitation current (kA)

Theoretical excitation power:

Pelton:

$EP_{T\text{-}PELT} = 49 + 0{,}1604424 * MW_{PEL} + 2{,}644032 \cdot 10^{-3} * (MW_{PEL})^{2}$

Francis:
$EP_{T\text{-}FRAN} = 33 - 0{,}1428528 * MW_{FRAN} + 7{,}142842\ 10^{-3} * (MW_{FRAN})^{2}$

Real excitation power:

Pelton:
$EP_{R\text{-}PELT} = ET_{PEL} * EC_{PEL}$

Francis:
$EP_{R\text{-}FRAN} = ET_{FRAN} * EC_{FRAN}$

6. INTERFACES

6.1 OPERATOR INTERFACES

The operator interfaces will be the same of those relative to monitoring tasks, since the result of this function will be used in monitoring tasks.

The implementation of this function can be done in C or C++.

The simulation of the system for testing purposes can be done easily by including in the D.B. some historical incident data.

6.2 SYSTEM INTERFACES

The system interfaces are the input and output data specified above.

7. ERROR MANAGEMENT

- Input data into normal limits
- Control software errors (overflow, division by zero).
- To discard abnormal input values (deviation from the mean)
- Control null values or not existent (for a given period) in B.D.
- Control result values (not negative, for example).
- Errors must be included in separate files/tables, identified by a key and containing error type.
- All kind of error signals from the computer must be captured in the function.

8. CONSTRAINTS

The only real-time constraint is the availability of data in the D.B. for the chosen period of time. This means that the process for the data gathering from the sensors must insert data into the D.B. almost continuously (with a sample rate to determine).

9. HARDWARE AND SOFTWARE REQUIREMENTS

C,C++ (Borland), Oracle, PC architecture, Windows-NT.

10. TEST PLAN

The testing of this function will be specified in the WP6 IBERDROLA documents for the Adaptation and Experimentation Specifications of the System.

Among other features the following will be tested:

- Control of incorrect input data/input data format.
- Values by default.
- To prove that the resulting values keep into normal limits.
- Control of limit values.