Transmission & Distribution
Power Electronic Activities

AREVA

Document status	☐ PRE preliminary	☐ FIN for information & comments	☒ FAP for approval
☐ APP approved	☐ APR approved with remarks	☐ FCO for construction	☐ ASB as built

РУСАЛ
RUSSIAN ENGINEERING COMPANY

INTERFACE SPECIFICATION DOCUMENT (ISD)

LEVEL 2 - LEVEL 3

Ind	Dates	Written by	Checked by	Approved	Modifications to document
G	24/11/10	E.PONCE			Update during internal FAT
F	15/12/08	E. PONCE	P. SABOURET	P. CHAZAL	Upgrade from comments of customer
E	08/12/08	E. PONCE	P. SABOURET	P. CHAZAL	Upgrade from comments of customer
D	08/12/08	E. PONCE	P. SABOURET	P. CHAZAL	Change of the GPS clock IP address
C	08/12/08	E. PONCE	P. SABOURET	P. CHAZAL	Initial time of counting calculation
B	08/12/08	E. PONCE	A. CARBONNE	P. CHAZAL	Upgrade from comments of customer
A	01/02/08	E. PONCE	A. CARBONNE	P. CHAZAL	Original issue

TaAS No :

BoAS No°:

S/C Name :

S/C Number :

Date : Visa :

First issue	Date	Name
Issued	01/02/08	E. PONCE
Checked	01/02/08	A. CARBONNE
Approved	01/02/08	P. CHAZAL

Project N° : **4814 810 / 811**

INTERFACE SPECIFICATION DOCUMENT (ISD)

LEVEL 2 - LEVEL 3

Document N° : **4EZI0009 - G**

TAISHET
SUBSTATIONS for 2 SERIES – 400 kA
6 RECTIFIER GROUPS - 85 KA – 1500 VDC
GIS 220KV & AUXILIARIES

BOGUSHANY
SUBSTATIONS for 2 SERIES – 320 kA
5 RECTIFIER GROUPS - 85 KA – 1500 VDC
GIS 220KV & AUXILIARIES

Indice	Purposes of the modification
A	Original edition
B	Upgrade from comments of customer
C	Page 9 to 11 : Add of customized counting calculation Add values « START » and « RANGE » for the caluclation of the mean values
D	Change of the GPS clock IP address
E	Upgrade from comments of customer on DN120 Section 3 – 3.1 : is dedicated to OPC-DA and 3.2 is dedicated to SQR. Section 3.1.1 : Taishet current range in table changed from 400kA to 415kA. Section 3.1.2 : Alarms have been removed
F	Upgrade from comments of customer on DN128 Sections 2.2 and 3.2.1 : add OPC TAGs precision and SQL request
G	Add of L3_NEW_SETPOINT

Distribution

- **TAIBOG Coordinator**
  Victor Banshikov

- **Taishet Management Team**
  Yuri Karmornikov – Project Manager
  Igor Apolinsky - Engineering

- **Bogushany Management Team**
  Dmitry Burlikov – Project Manager
  Sergey Kirillov – Engineering

- **AREVA T&D - SPS**
  Marc Bolze

- **AREVA T&D - PEM**
  Paul Chazal
  Patrick Sabouret

- **AREVA T&D - PEB**
  Uwe Meier
  Sten Garmshausen

TABLE OF CONTENTS

N° de Page

1. INTRODUCTION

1.1 PURPOSE

This document aims to define interfaces of Areva's substation automation system with external automation system.

External automation systems are:

- systems that are not part of the Areva's Rectifier Transformer Substation automation system scope
- systems that have to interact with Areva's Rectifier Transformer Substation automation systems

1.2 REFERENCE DOCUMENTS

Id	Designation	Reference number
[SYDD]	System definition document	4EZH0231
[SL_DIAG]	Single line diagram	3EUH0033
[EQ_LST]	Equipment list	4ERH0003
[AF_LST]	List of alarm & fault	
[IO_LST]	List of inputs & outputs	
[ISD_HV]	ISD – Level 0/1 external interfaces.	
[ISD_L3]	ISD – Level 2 - Level 3 interface	4EZI0009
[L3_MAP]	ISD – Level 2 - Level 3 interface Data	4ELI0001
[MMI_L1]	ISD – Level 1 Man Machine Interface	
[MMI_L2]	ISD – Level 2 Man Machine Interface	4EZH0232
[CASD_SA]	CASD – System Analysis.	
[CASD_RGP]	CASD – Rectifier group protections	
[CASD_REG]	CASD – Current regulation mgt	
[CASD_AUX]	CASD – Auxiliary power supply mgt	
[ESD_HV]	ESD – Incoming HV	
[ESD_TRF]	ESD –Transformer systems	
[ESD_REC]	ESD – Rectifier system	
[ESD_CTR]	ESD – Transformers cooling system	
[ESD_CRC]	ESD – Rectifier cooling system	
[ESD_DCS]	ESD – DC Switches	

2. PRELIMINARY

2.1 EXTERNAL SYSTEMS IDENTIFICATION

According to the retained automation system architecture, the external automation systems are identified in the following schema :

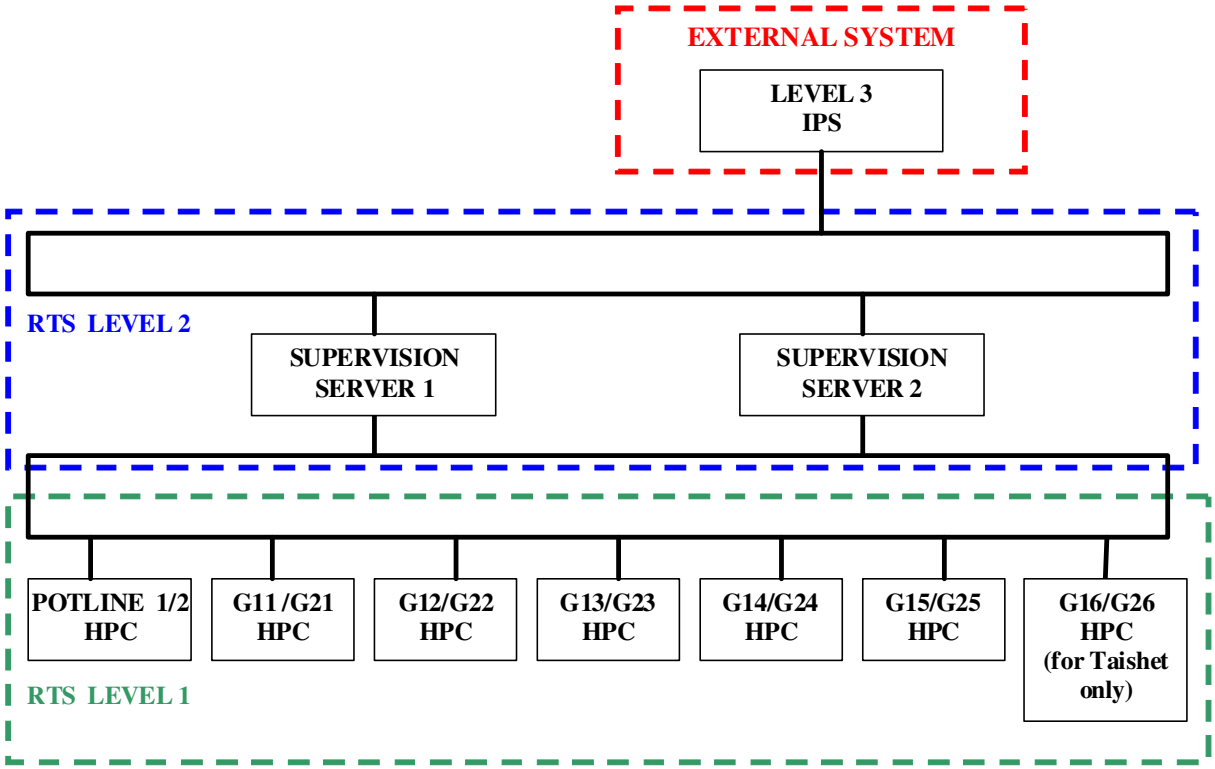

Figure 1: External automation systems presentation

The only system that has to interact with the Areva's automation system is the Level 3 system (IPS).

2.2 INTERFACE IDENTIFICATION

The interface type is the data exchange interface. It defines data exchanges between the ITS and the Areva's RTS automation system.
The data are exchanged between level 3 system and Areva's RTS system using two ways :

- the supervision system, through the OPC-DA protocol;
  the OPC Tags to use by the Level 3 are in the tables of chapters 3.1.1 and following, in the column "OPC Identifier";

- the SQL database of the supervision servers, through SQL requests;
  the table to read by the level 3 and a SQL request example are in the chapter 3.2.1.

3. INTERFACE DESCRIPTION

3.1 LEVEL 2 - LEVEL 3 INTERFACE THROUH OPC-DA

This interface describes the solution to exchange real-time data between the Rectifier Transformer Substation system and the level 3 system (IPS).

This interface is implemented on the level 2 system. This system is the supervision system hosted by redunded PCVUE software package.
The supervision system, that implements an OPC-DA server solution, is used to exchange real-time data with the IPS; this system is redunded, and the variables also; the PCVUE user interface is designed in Russian language.

As the supervision system gathers all the RTS system data, this OPC interface is able to provide all the information :

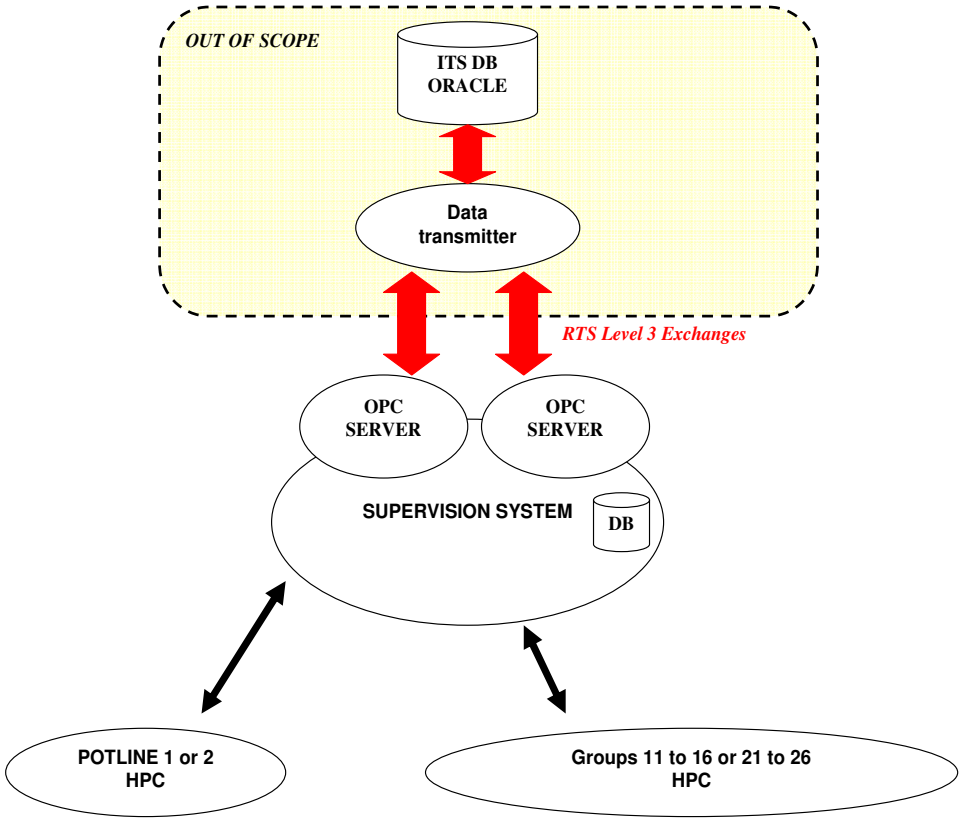

Figure 2: RTS-IPS interface description

The IPS connects to the RTS system using the supervision system OPC server, from any PC logged with any username, but by using the next authentication parameters for the OPC connexion :

Machines host names: SRV1 and SRV2 for all Potline

OPC Server ID: SV.OPCDAServer.1

Login: SRV1\Supervisor or SRV2\Supervisor

Password: Taibog

3.1.1 ITS ⇒ RTS commands

There are three informations coming from the IPS:

OPC Identifier	TYPE	Range	Comment
SERIE.POTLINE. L3_SETPOINT_VALUE	DINT	0-N kA (*)	Potline DC current setpoint to be applied manually by the supervision operator.
SERIE.POTLINE. L3_NEW_SETPOINT	BOOL	0-1	Potline DC current setpoint update
SERIE.POTLINE.AVERAGE.DAY.START	DINT	0-23 default = 0	Day hour of the starting of the customized day for the calculation of the average day
SERIE.POTLINE.AVERAGE.DAY.RANGE	DINT	2,3,4,6,8,12,24 default = 24	Day length of the customized day for the calculation of the average day (under-multiple of 24)
(*)N = 450 for Taishet with 6 groups available, 415 for Taishet with 1 to 5 group aivalable, 350 for Bogushany with 5 groups available, 320 for Bogushany with 1 to 4 group aivalable			

3.1.2 RTS ⇒ ITS measures

The measures and states that comes from the group controllers :

OPC Identifier	TYPE	Range	Comment
SERIE.G01.DCCURRENT	DINT	0-85 kA	Group 11 or 21 instantaneous DC current
SERIE.G01.DCVOLTAGE	DINT	0-1570 kV	Group 11 or 21 instantaneous DC voltage
..... Same 2 data for each 5 or 6 groups G01 to G05 for Bogushany and to G06 for Taishet			

The measures and states that comes from the potline controller :

OPC Identifier	TYPE	Range	Comment
SERIE.POTLINE.DCCURRENT	DINT	0-450 kA	Potline 1 instantaneous DC current.
SERIE.POTLINE.DCVOLTAGE	DINT	0-1570 V	Potline 1 instantaneous DC voltage.

Additionally, an alarms/faults list for the Potlines and the groups is given in the annex excel document [L3_MAP] (tab).

- Alarms/faults from the potlines in the "POTLINE ALARMS-FAULTS" tab. OPC Tags are given from the potline OPC tag root (SERIE.POTLINE). Then, when an alarm is given with the tag ALARM1, the full OPC tag is SERIE.POTLINE.ALARM1

- Alarms/faults from the groups in the "GROUP ALARMS-FAULTS" tab. OPC Tags are given from the group OPC tag root (SERIE.G0x). Then, when an alarm is given with the tag OLTC.ALARM2, the full OPC tag is SERIE.Gxx.OLTC.ALARM2

3.1.3 RTS ⇒ ITS counting and averages

OPC Identifier	TYPE	Range	Comment
SERIE.POTLINE.COUNT.5MN.CURRENT	DINT	0-450 kAh	DC current counting of the expired last 5 minutes.
SERIE.POTLINE.COUNT.5MN.VOLTAGE	DINT	0-1570 Vh	DC voltage counting of the expired last 5 minutes.
SERIE.POTLINE.AVERAGE.HOUR.CURRENT	DINT	0-450 kA	Instantaneous DC current average of the expired last 60 mn
SERIE.POTLINE.AVERAGE.HOUR.VOLTAGE	DINT	0-1570 V	Instantaneous DC voltage average of the expired last 60 mn
SERIE.POTLINE.AVERAGE.DAY.CURRENT	DINT	0-450 kA	Instantaneous DC current average of the expired last 24 h,or customized AVERAGE.DAY.RANGE
SERIE.POTLINE.AVERAGE.DAY.VOLTAGE	DINT	0-1570 V	Instantaneous DC voltage average of the expired last 24 h, or customized AVERAGE.DAY.RANGE

These values provided by the counting and average are only information. Their precision is not certified, and then, these values cannot be used for advanced functions such as power contract management systems.

3.1.4 Customized average shift

The counting 5 minutes is the counting value of last expired 5 minutes.
Between 12:15:10 and 12:19:55, the value is the result of the counting between 12:10 and 12:15; it is updated between 12:20:00: and 12:20:10.

The results of counting are given in Ah. For example, if the DC current is always 120 kA, the results of counting will be :

- 5 minutes countings ⇒ 10 kAh

The average values are the average values of the measures of :

- a sliding period of 60 mn, for the average hour,
- a fixed period of "AVERAGE.DAY.RANGE" hours (24 h by default) for the average day.

Thus, "average hour" represents the average of the expired hour if read in the 5 minutes after the end of an hour :

- average from 12:00 to 13:00 can be read between 13:00:10 and 13:04:55.

The "average day" represents the average of the last expired period of AVERAGE.DAY.RANGE hours, starting at AVERAGE.DAY.START :

- if RANGE = 8 and START = 2, average of the "day" starting at 02:00:00 and finishing at 10:00:00 can be read between 10:00:10 and 17:59:55.

So, the RANGE should be a under-multiple of 24 (2,3,4,6,8,12,24) to assume to have an entire number of customized day inside a real day.

3.2 LEVEL 2 - LEVEL 3 INTERFACE THROUH SQL REQUESTS

This interface describes the solution to exchange historical data between the Rectifier Transformer Substation system and the level 3 system (IPS).

This interface is implemented on SQL databases of the level 2 servers.
It is able to provide the counting of current and voltage hour by hour for the last two months.

The Level 3 can connect on both servers SRV1 and SRV2 (redunded SQL databases) using the following SQL username and password :

Machines host names: SRV1 and SRV2 for all Potline

SQL username: sa

SQL password: Arevatd

SQL instance: sqlserver

3.2.1 RTS => ITS historics

The table to use is described as following :

Name: HISTORAP

Columns: HORODATE as char(13) for yyyy/mm/dd:hh

COUNT_CURRENT as real for current counters

COUNT_VOLTAGE as real for voltage counters

An example of SQL request for reading these data is :

Select * from HISTORAP where HORODATE = “2009/01/10:12”

This example of SQL request reads the current and voltage counting for the hour number 12 (between 12:01 and 13:00).

NB : the hour is between 00 and 23.

3.3 NETWORK DEVICES ADDRESSING INTERFACE

Device	IP Address	Comment
RTS LEVEL 1 NETWORK – "*" = Potline 1 or 2 – for Taishet & Bogushany		
MST*_HPC	172.22.81.*10 / 24	Potline * HPC controller
G*1_HPC	172.22.81.*11 / 24	Group G*1 HPC controller
G*2_HPC	172.22.81.*12 / 24	Group G*2 HPC controller
G*3_HPC	172.22.81.*13 / 24	Group G*3 HPC controller
G*4_HPC	172.22.81.*14 / 24	Group G*4 HPC controller
G*5_HPC	172.22.81.*15 / 24	Group G*5 HPC controller
G*6_HPC	172.22.81.*16 / 24	Group G*6 HPC controller (Taishet only)
MST*_SW	172.22.81.*20 / 24	Potline * network switch
G*1_SW	172.22.81.*21 / 24	Group G*1 network switch
G*2_SW	172.22.81.*52 / 24	Group G*2 network switch
G*3_SW	172.22.81.*23 / 24	Group G*3 network switch
G*4_SW	172.22.81.*24 / 24	Group G*4 network switch
G*5_SW	172.22.81.*25 / 24	Group G*5 network switch
G*6_SW	172.22.81.*26 / 24	Group G*6 network switch (Taishet only)
L1S1_SW	172.22.81.*31 / 24	Supervision server 1 Potline 1 switch
L1S2_SW	172.22.81.*32 / 24	Supervision server 2 Potline 1 switch
SRV1	172.22.81.*41 / 24	Supervision server 1, on network level 1
SRV2	172.22.81.*42 / 24	Supervision server 2, on network level 1
GPS	172.22.81.*44 / 24	GPS Clock system
RTS LEVEL 2 NETWORK – "*" = Potline 1 or 2 – for Taishet & Bogushany		
SRV1	172.22.82.*41 / 24	Supervision server 1, on network level 2
SRV2	172.22.82.*42 / 24	Supervision server 2, on network level 2
PRT	172.22.82.*43 / 24	Printer
L2S1_SW	172.22.82.*21 / 24	Supervision server 1 switch
L2S2_SW	172.22.82.*22 / 24	Supervision server 2 switch
L3_SW	172.22.82.*23 / 24	Level 3 switch
Maintenance Laptops (detailed by substation)		
L1_MNT_T	172.22.81.200 / 24	Level 1 maintenance laptop for Taishet
L1_MNT_B	172.22.81.201 / 24	Level 1 maintenance laptop for Bogushany
L1_TAI	172.22.81.202 / 24	Laptop for Taishet Level 1 Areva maintenance in Massy
L1_BOG	172.22.81.203 / 24	Laptop for Bogushany Level 1 Areva maintenance in Massy

Note:/24 at the end of IP address, means 255.255.255.0

4. ANNEX

4.1 AUTOMATION SYSTEM ARCHITECTURE

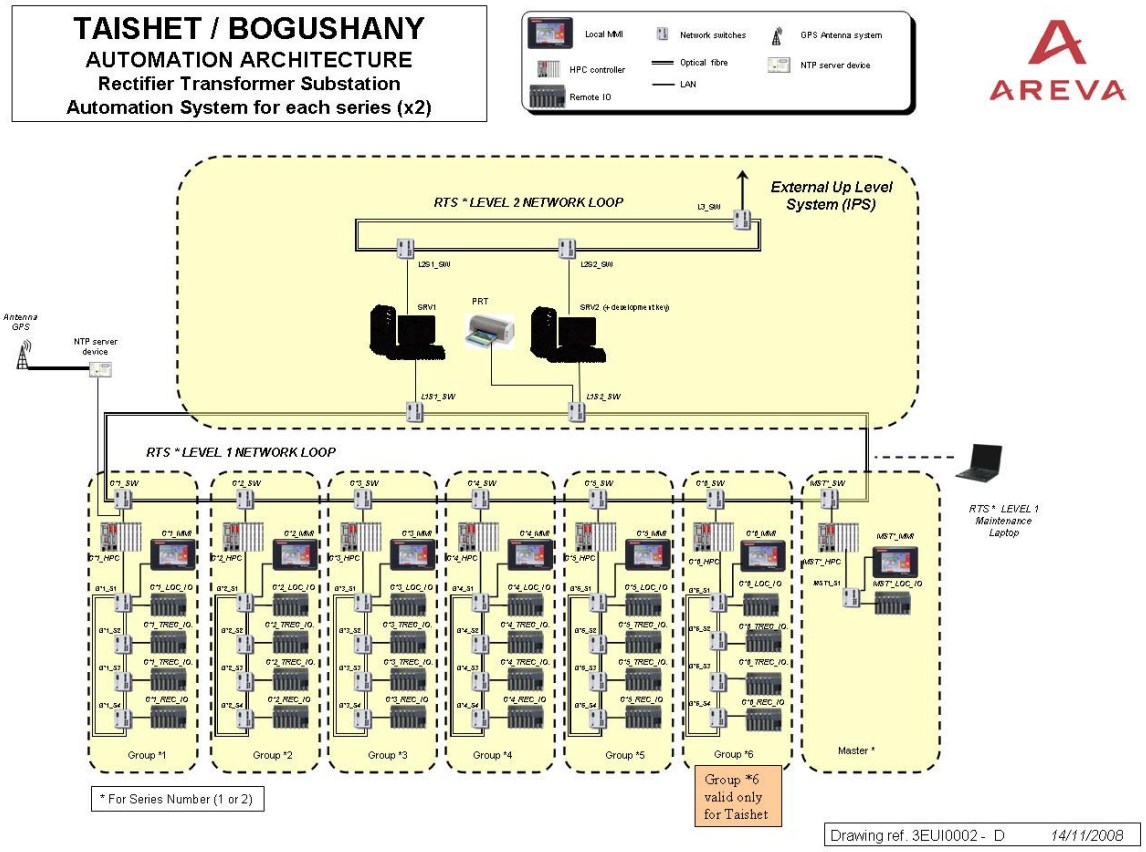

Figure 3: RTS automation system architecture