Implementation and Upgrading of Operational I&C with Teleperm XP

Tianwan NPP

An Example for Multinational Co-operation

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Siemens Power Generation
Procurement Contract: Scope of Supply

> Main Control Room Equipment
> Process Control Systems: TXP, ...
  - Automation Systems: AS620 B, Simadyn D, SOE, ..
  - Operation and Monitoring System OM690
> Reactor Protection and Limitation System TXS
  - Analogue signal acquisition, conditioning and distribution
  - RPS, RLS and Reactor Power Control: processing, voting
  - Priority control (AV42-cabinets) for Actuators
  - Monitoring and Service equipment
> Instruments
  - Measurement Equipment,
  - I&C Cables, Junction Boxes, Protection Tubes
> Plant Simulator
> Interface Management: Signal Exchange via Different Interfaces
Procurement Contract: Scope of Supply

- **Process control level**
- **Communication level**
- **Automation level**
- **Individual control level**
- **Field level**

- **Plantbus**
- **Operation, Monitoring, Engineering, Diagnostics**
- **Open-loop control, Closed-loop control, Protection**
- **Drive control interface, Signal conditioning**
Main Control Room: Architecture
The Main Control Room
Scope of Supply for one Unit

> Process Control Systems: TXP, …

- **Automation Systems:**
  - AS620 B 65 cabinets
  - LAN Components
  - Turbine Control (Simadyn D + Aux. Systems) 4 cabinets
  - Sequence of Event System (SOE) 2 cabinets
  - Power Adjuster Modules in (S, SR, NS) 16 cabinets
  - Auxiliary Cabinets (S) 4 cabinets
  - Unit Generator Synchronization Equipment
TXP - Cabinet allocation in 6 Trains and 7 Rooms
Cabinet allocation in Train 1

We have drawn only the basic dimensions without the dimensions of doors and side walls. The frame dimensions of the cabinets of TX7 and TXS are the same, viz: 900 x 400 x 2300 mm (breadth x depth x height).

Each cabinet is fitted with a partition wall (TXS cabinet on the left hand side seen from the front, TXP cabinets on the right hand side seen from the front).

This partition walls are included in the breadth of 900 mm.

On the ends of the cabinet rows are covered with side panels (not include in 900 mm).

The frame dimensions of the AC/DC transducer cabinet see please the base drawing of the AC/DC cabinet.

Place for Cabinet: 34
Booking place: 29
Booking place TXS: 16
Booking place TXP: 7
Booking place AC/DC: 6
Spare place for I&C: 3
Spare place for AC/DC: 2
Spare place total: 5

All dimensions in mm

Mounting start line for erection TNP and TXS cabinets

Cabinet disposition double line is front side

Spare place with mounting rail and removable cover plate mounting rail with removable cover plate
Network Components (LAN)
Components for Operating and Monitoring: OM690 System

Standby Control Room (SCR)
- OT

Main Control Room (MCR)
- OT

I&C Service Center (TXP)
- ET
- DT

Terminal Bus
- PU
- SU
- ES
- DS

Plant Bus

Process Automation System
- TXP-AP
- TXP-AP

Connection to TXS System
- TXS Gateway

OT: Operating Terminal
PU: Processing Unit
SU: Server Unit
SC: Signal Conditioning
AP: Automation Processor
TE: Teleperm XP
TX: Teleperm X3
ES: Engineering System T3P
ET: Engineering Terminal
DS: Diagnostic System
DT: Diagnostic Terminal

TCP/IP
XU
TXP-Interface

Plant network, other computer systems
Components for Operating and Monitoring: OM690 System
OM690: Different Display Types for all Operation Phases

1 Plant displays

Plant displays are arranged in a display hierarchy. The display hierarchy for the TIANWAN NPS reflects the “functional division hierarchy” developed by the Russian designer of the NPP in cooperation with FANP/Siemens. Plant displays are designed based on the relevant P&I diagrams.

- Overview level
- Process area level
- Process sub area level
- Functional group level
- Component level

2 Dynamic Functional Diagrams

3 Process information displays

Process information displays may be sub-divided into 2 groups:
- Standard process information displays: Trend displays, Bar displays
- Individual process information displays
  Individual process information displays present information about the technological process in an arrangement, which fulfils the requirements of the operators in specific situations (start-up, shutdown, power operation, incidental and accidental situations.
- SPDS displays

4 Alarm sequence display
OM690: Operation and Monitoring Display
OM690 Dynamic Function Diagram

Logic diagram:
Dynamized
- Signal status 1
- Signal status 0
- Signal fault
- Signal not available

Identification code, tag no. or text

Logic diagram identification code
OM690 Process Information Display

- Supply: 0 kg/s to 20 kg/s
- Remv Clnt: 0 kg/s to 300 kg/s
- Condensate: F KBC 001 Cond
- Chemicals preparation: F KBD 002
- Water storage: F JNK 003 004
- "Pure" Condensate: F JNK 005
- Chemicals preparation: P PC 009
- Water storage: JKT 010 & JEF 011
- Pressures: P >0.3 MPa & L <0.15 m
- Temperature: T 100 Cel
- Chemicals preparation: VBCDA 015
- Drn Clnt: BINB2 038
- PCond: Pps 037
- VBCDA: L 038
- Condensate: PC 039
- Cond: T/L Clnt PRZR 016 017
- 6t/h to 60t/h
- Supply 0 kg/s to 15 kg/s
- Remv Clnt 0 kg/s to 20 kg/s
- Water storage: KBB 023 025 026
- S/up S/d: F 024
OM690 System: Displays for Safety Parameter
### OM690 System: Alarm Sequence Display System

<table>
<thead>
<tr>
<th>C</th>
<th>0RL24 S001 6</th>
<th>XB01 YP01 6</th>
<th>Minimum flow valve Not Open</th>
<th>28.11.99 13:13:49</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>0RL32 L010 26</td>
<td>XH01 YP01 6</td>
<td>Oil-vessel feedwater pump level (High)</td>
<td>28.11.99 13:13:54</td>
</tr>
<tr>
<td>W</td>
<td>0RL22 T012 26</td>
<td>XH03 YP01 6</td>
<td>Temp. radial bearing pre-pump Too High</td>
<td>28.11.99 13:13:59</td>
</tr>
<tr>
<td>W</td>
<td>0RL32 L010 26</td>
<td>XH01 YP01 6</td>
<td>Oil-vessel feedwater pump level High</td>
<td>28.11.99 13:14:25</td>
</tr>
<tr>
<td>W</td>
<td>0RL22 T012 26</td>
<td>XH03 YP01 6</td>
<td>Temp. radial bearing pre-pump (Too High)</td>
<td>28.11.99 13:14:30</td>
</tr>
</tbody>
</table>

Display mode-Zero Page
Scope of Supply for one Unit: Instruments, Cables

> **Analogue parameters** 6070
  - Temperature: 3000
  - Pressure, differential pressure, level, flow rate: 2430
  - chemical parameters: 270
  - Electrical parameter: 370

> **Binary input/parameters:** 2600

> **Junction Boxes:** 1100

> **Cables - different categories:** approx. 1000 km

> **Protection tubes for primary and secondary loop:** approx. 1000 pcs
Scope of Supply for one Unit:
Open and Closed Loop controls: The Quantity a measure of the Automation Degree

> Control of Actuators
  - Motor/heater: 1200
  - Shut-off valves: 2900
  - Control valves: 260
  - Solenoid valves: 100

> Open and Closed Loop Controls
  - Closed loop Controls: 260
  - Open loop 1100
    - group control, 25
    - sub-group control, 250
    - Sub-loop control 825
Plant Full Scale Simulator: A Copy of the Main Control Room
Siemens and FANP managing the Interfaces: Design, Implementation and Testing

- Neutron Flux Monitoring Equipment
- Monitoring, Control, and Diagnoses System
- Incore Instrumentation System
- Turbine Hydraulic Control System
- Generator Diagnostic
- Electrical Equipment
- Chemical Analyses Primary Circuit
- Polar Crane
- Automated Radiation Monitoring System
- CCI, Auxitrol, Vanatom, Diff. Actuator Supplier
- Black Boxes in HVAC, Diesel, ...
- Industrial Anti-Seismic Protection System
- Main Coolant Pump Monitoring and Diagnostic System
- Power Breaker System
- Rod Control and Indication
- Main I&C
  - TXP, TXS, ..
Scope of Services

- Project Management
- Engineering
- Procurement and Shipment
- Testing (Factory Tests, FAT, ...)
- Training
- Supervision for Installation and Commissioning
- Performance Tests
- Interface Management
- Provisions of documents/support for PSAR and FSAR
- Supporting the Client in Authority Questions
Scope of Services

> Procurement and Transport

- About 1,600 Delivery Packages with 14,000 Positions
- Co-operation with approx. 60 sub suppliers
- Logistics for approx. 280 delivery packages
  by sea freight (70) and air freight (210)