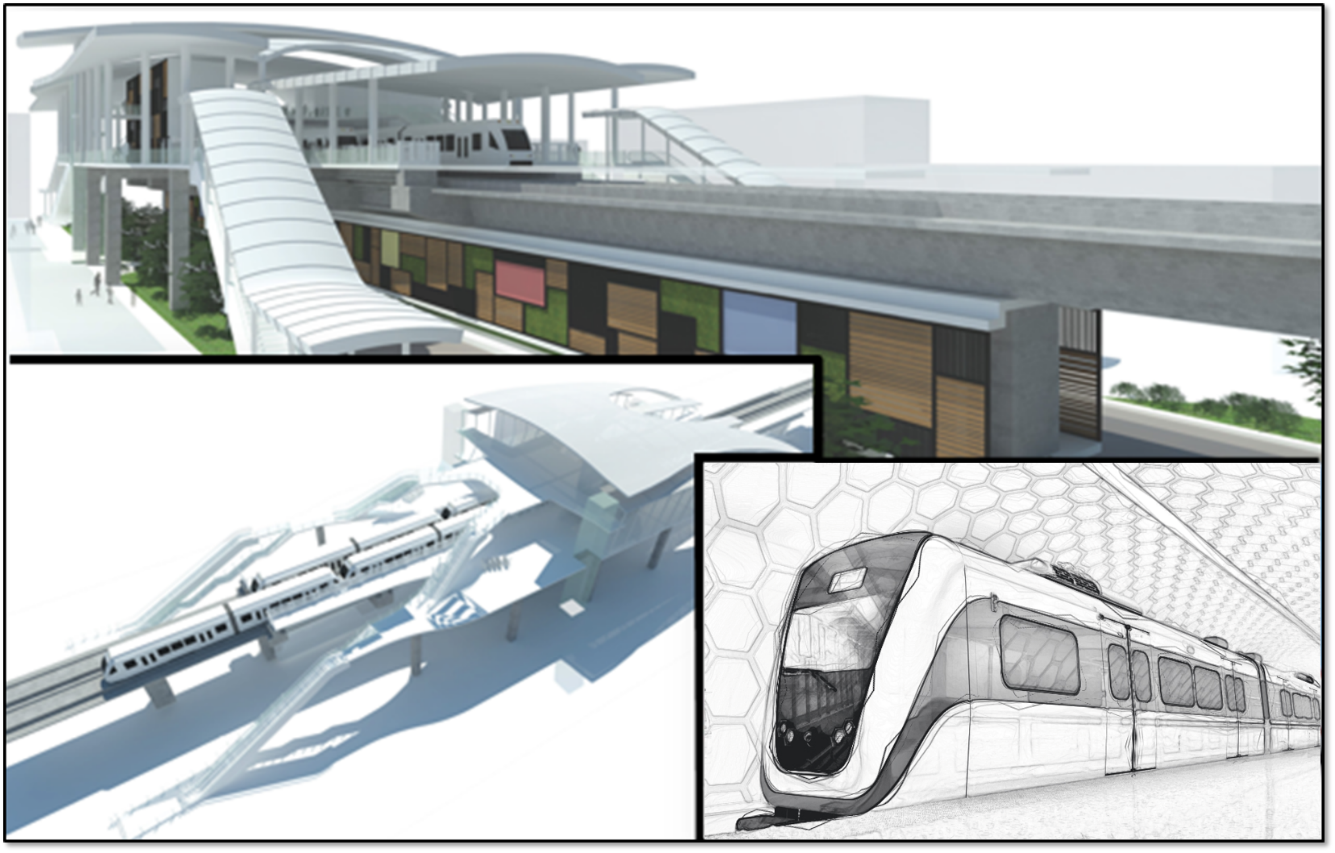


**PT Wijaya Karya (Persero), Tbk.**



**JAKARTA LRT PROJECT – CORRIDOR 1 (PHASE 1):**

**KELAPA GADING–VELODROME – PACKAGE P102**

**MAIN WORKS**

**INTERFACE CONTROL DOCUMENT**

**SCADA AND TELECOM**

Doc. No. WIKA-P102-ALL-440-ICD-33400-DOC

2 0 1 7

# VALIDATION SHEET

**INTERFACE DOCUMENT CONTROL**

**SCADA AND TELECOM**

Doc. No. WIKA-P102-ALL-440-ICD-33400-DOC

PROJECT NAME : CONSTRUCTION OF LRT CORRIDOR 1 (PHASE1): KELAPA GADING – VELODROME

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DATE : DECEMBER 2016

CONTRACTOR : PT WIJAYA KARYA (PERSERO),Tbk.

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# ABBREVIATIONS

|  |  |
| --- | --- |
| FOTS | Fibre Optic Transmission System |
| HMI | Human Machine Interface |
| ICD | Interface Control Document |
| IO | Input Output |
| LAN | Local Area Network |
| SNMP | Simple Network Management Protocol |
| SCADA | Supervisory Control and Data Acquisition |
| TCP | Transmission Control Protocol |
| UDP | User Datagram Protocol |
| NMS | Network Management System |
| MPLS/IP | Multiprotocol Label Switching/Internet Protocol |
| MIB | Management Information Base |
| OID | Object Identifier |
| PDU | Protocol Data Unit |
| SAT | Site Acceptance Test |
| FAT | Factory Acceptance Test |
| EMC | Electromagnetic Compatibility |
| LRT | Light Rail Transit |
| NTP | Network Time Protocol |
| SNTP | Simple Network Time Protocol |
| AP | Access Point |
| IP | Internet Protocol |
| iPCF | Industrial Point Coordination Function |
| MAC | Media Access Control |
| OCC | Operation Control Centre |
| PNIO | Profinet Input Output |
| PoE | Power of Ethernet |
| RM | Redundancy Manager |
| RMON | Remote Monitoring |
| RSTP | Rapid Spanning Tree Protocol |
| WAN | Wireless Area Network |
| WAP | Wireless Access Point |
| WDS | Wireless Distributed System |
| CER | Common Equipment Room |
| TETRA | Terrestrial Trunked Radio |
| TNX | Tetra Node Exchange |
| PA | Public Address |
| PI | Passenger Information |
| PIDS | Passenger Information Display System |
| VoIP | Voice over Internet Protocol |
| PHP/HP | Passenger Help Point/Help Point |
| CXS | NetSpire Communication Exchange Server |
| SDK | Software Development Kit |
| NAC | Network Audio Controller |
| NAM | Network Audio Module |
| PEI | Passenger Emergency Intercom |
| ET | Emergency Telephony |
| MSPK | Monitor Speaker |
| VCU | Video Control Unit |
| DVA | Digital Voice Announcement |
| PIS | Passenger Information System |

# Introduction

## Purpose of Document

This ICD describes interface between Telecom (FOTS, Master Clock, WAN, Radio and PIS) and Supervisory Control & Data Acquisition (SCADA) in order to achieve coordinated design and construction. This ICD shall be considered as live document and revised at regular intervals to assure it remains current and satisfy each system’s compliance. Any revision to this ICD shall be mutually accepted by both Telecom and SCADA upon submitted to employer’s representative.

This ICD specifies the interface requirements for both parties to operate accordingly. It describes the concept of operations for the interface, defines the message structure and protocols that govern data exchange as well as identifies communication paths, and identifies the communication paths in which the data expected to flow.

## Overview of the Interface

Telecommunication system is an important thing in Jakarta LRT. The Telecommunication System is a system to handle all information management in railway routes, between train and station, station and control central system, between subsystem or give information to passenger. Its includes FOTS, WAN, Radio, Master Clock and Passenger Information System. All equipment in Telecom System are collected centralised on each subsystem server.

On the other hand, Supervisory Control and Data Acquisition (SCADA) provides control and monitoring of mechanical & electrical equipment as well as monitors the health status of each Telecom equipment. All Telecom devices shall be monitored and given appropriate alarm status according to collected data to SCADA using specified protocol.

To integrate with SCADA there are two types protocol that will be used in Telecom System are Simple Network Management Protocol (SNMP) and Software Development Kit (SDK). SNMP will be used in FOTS, WAN, Radio and Master Clock, while SDK used in Passenger Information System.

## Structure of Document

This ICD document consists of several sections:

Section 1 – Introduces content of the document

Section 2 – List document used as reference,

Section 3 – List information to be exchanged by two parties,

Section 4 – Specifies physical interface between two systems,

Section 5 – Specifies functional interface, protocol, & acquisition cycle,

Section 6 – Describes system behaviour in failure condition,

Section 7 – Details site access and install location,

Section 8 – Details of test,

Section 9 – List key dates and milestone

Section 10 – Compliance to electromagnetic compatibility

Section 11 – List compliance to interface matrix

# Reference Documents

**TABLE 1.- REFERENCE DOCUMENTS**

|  |  |  |  |
| --- | --- | --- | --- |
| **No** | **Document Title** | **Document Reference Number** | **Rev.** |
| 1 | General Specifications | 362748-MMI-MVI1-XX-SP-000-0011 | Rev.A |
| 2 | Technical Specification | 362748-MMI-MVI1-XX-SP-000-0010 | Rev.A |
| 3 | Interfaces Matrix | Appendix H - 362748-MMI-MVI1-XX-RP-760-0001 |  |
| 4 | Preliminary Design Report Volume 1 | 362748-MMI-MVI1-XX-RP-000-0002 |  |
| 5 | Preliminary Design Report Volume 2 | 362748-MMI-MVI1-XX-RP-000-0003 |  |
| 6 | Baseline Programme V3 | WIKA-P102-ALL-000-PRG-0001 |  |

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# Interface Requirement

* This Interface Specification outlines the interfacing requirements during the execution of the Works ensuring that:

1. All interface issues between the SCADA WPC and the Telecommunication WPC are satisfactorily identified and resolved.
2. All interfaces shall meet the requirements of the respective specifications and achieve the required interface functions.
3. Design, supply, installation and testing of the interfaces are fully coordinated.
4. Facilities/provisions supplied under the Contracts of both WPCs are fully compatible with each other.

* The SCADA shall the Lead WPC. SCADA will be the lead for making the Interface Specification (IS), Interface Control Document and SCADA Drawing. The Telecommunication WPC shall take lead in developing drawings which shall include the CSD and SEM drawings. The SCADA WPC shall be assigned as the Contributor WPC for Telecommunication drawing and shall provide relevant data and inputs via their IMS, and shall jointly review and sign-off the drawing prepared by the Telecommunication WPC.
* The SCADA WPC and the Telecommunication WPC shall review and comment on any design information received from the other party. Notification to WIKA is required if there is any change that involve contractual implications.
* The Telecommunication WPC shall attend interface meetings upon request by the SCADA WPC, and vice versa, when necessary.
* The interface between SCADA WPC and Telecommunication Works shall include, but not be limited to, the following :

1. Information Exchange
2. Physical Interface
3. Electrical Interface
4. Functional and Software Interface, as applicable
5. Provision, Delivery and Installation
6. Testing and Commissioning
7. Electromagnetic Compatibility

This comprises the following, but is not limited to:

1. Cable containment and routes including details of cable troughs for SCADA equipment, cable draw pits, metallic cable tiles and cable risers;
2. Design, supply, installation, testing and commissioning of lightning protection, earthing and bonding;

# Information Exchange

## General



**FIGURE 1. DATA EXCHANGE FOTS-SCADA**



**FIGURE 2. DATA EXCHANGE BETWEEN SCADA-WAN**



**FIGURE 3. DATA EXCHANGE BETWEEN MASTER CLOCK-SCADA**



**FIGURE 4. DATA EXCHANGE BETWEEN TETRA-SCADA**



**FIGURE 5. DATA EXCHANGE PA-SCADA**



**FIGURE 6. DATA EXCHANGE PHP-SCADA**



**FIGURE 7. DATA EXCHANGE VOIP-SCADA**



**FIGURE 8. DATA EXCHANGE PID SYSTEM-SCADA**

For FOTS, Master Clock, WAN and Radio, SCADA will monitor health status of Telecom device by giving appropriate alarms/notification. Under abnormal condition, Telecom device (SNMP agent) shall send an SNMP trap to SCADA. Master Clock acts as NTP server providing time to all managed device, including SCADA.

For Passenger Information System, SCADA provides monitoring and controlling function for Passenger Information System. SCADA monitored health and alarm status all device and control some function as describe in Figure 5 – Figure 8 for each device.

## Information to be supplied by Telecom

1. Port Number of Ethernet Switch for interfacing SCADA
2. IP address all of FOTS device
3. System Architecture FOTS
4. PIS equipment IP Address
5. Messages content for PA and PID
6. PA Zone list
7. NetSpire SDK API Reference Manual
8. System Architecture for PA, PID, VoIP and PHP
9. PIS IO List/ SNMP Trap list
10. Master Clock SNMP Trap List
11. WAN SNMP Trap List
12. TETRA SNMP Trap List

## Information to be supplied by SCADA

1. Total Ethernet Port needed by SCADA listed below

**TABLE 2. SCADA ETHERNET PORT NEEDED**

|  |  |  |
| --- | --- | --- |
| **Location** | **Description** | **Port** |
| OCC | Workstation to Switch Patch Panel | 4 |
| Server to Switch in Server Room | 2 |
| BCC | Workstation to Switch Patch Panel | 2 |
| Server to Switch in Server Room | 2 |
| Typical Station | Workstation to Switch Patch Panel | 2 |
| Server to Switch in Server Room | 2 |
| RTU to Switch in Equipment Room | 4 |

1. Train Information (Schedule, Time Arrival, Train Position)

# Physical Interface

## General

Physical interface between each Telecom Subsystem Server and a SCADA Server is done by the ethernet switch installed in CER at OCC and Telecom Room at each of station. For interfacing with SCADA, an interface port shall be provided.

## Requirements

### Types of Interfaces

|  |  |
| --- | --- |
| Interface Type | RJ-45 Connector, CAT6 |
| Network | Ethernet; |
| Communication transmission Speed | 100 Mbit/sec. |

Mechanical Characteristics of RJ45 will be used for this interface

* Category 6
* IEC 11801
* 8-pin screen twisted pair

CAT6 cable will be used and 8 wire positions in RJ45 patch cord

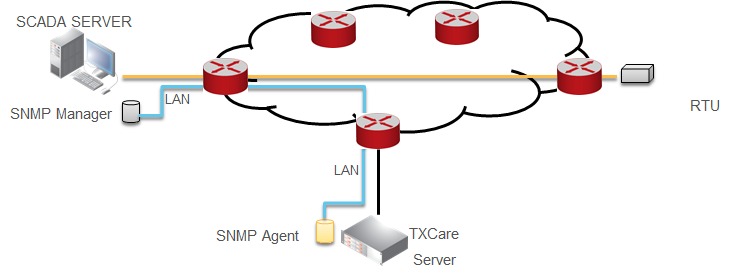
  
**FIGURE 9. CAT 6 PIN DIAGRAM**

### Location

LAN Cable connect to Ethernet switch L2 in CER at OCC and Telecom Room at Station

# Functional Interface

## Overview of Interface Diagram



**FIGURE 10. SCADA-FOTS SYSTEM OVERVIEW**

Figure 10 above illustrated overview of interface between SCADA and FOTS. SCADA as SNMP Manager will connect to TXCare Server as SNMP Agent using SNMPv2.



**FIGURE 11. WAN-BACKBONE-SCADA SYSTEM OVERVIEW**

General event/alarms regarding device status shall be sent by WAN devices including Wayside AP, Wayside Ethernet Switch, Rolling Stock AP, and Rolling Stock Ethernet Switch, via SNMPv1 traps. In Figure 11 WAPs and switches act as SNMP Agent while SCADA the role of the manager. SCADA will only have monitoring function to the WAN equipment that located on both rolling stock and wayside.



**FIGURE 12. MASTER CLOCK-SCADA SYSTEM OVERVIEW**

Master Clock takes role as NTP Server (stratum-1) providing time signal broadcasted to whole network. Because all systems are critically time dependent, every managed device shall refer its local time to NTP server. Master Clock shall broadcast the data, through NTPv4 (newest standard) and Its simplified version (SNTPv4) periodically to ensure all managed devices have same time reference. The SCADA shall monitor health status of Master Clock via SNMPv2.



**FIGURE 13. TETRA-SCADA SYSTEM OVERVIEW**

Figure 13 above illustrated overview of interface between SCADA and TETRA radio. SCADA as SNMP Manager will connect to Tetra Node Exchange (TNX) Server as SNMP Agent using SNMPv1. TNX provides single custom SNMP MIB that represent the entire TETRA Radio infrastructure. Detail of SNMP MIB shall be described in the appendix 8.



**FIGURE 14. PASSENGER INFORMATION SYSTEM OVERVIEW**

Figure 14 above illustrated interface overview between SCADA and PI System using SDK. The NetSpire SDK API provides a library with support for C++/Java/C#/.NET to integrate with SCADA System. SCADA will developed the driver using C++ language.

## Monitoring Functional Interface

The SCADA System will monitoring of health and alarm status all of FOTS, WAN, Master Clock, and Radio equipment via Simple Network Management Protocol version (SNMP). Detail of IO List health and alarm status refer to appendix 1, Appendix 4, Appendix 5, Appendix 6 and Appendix 8.

SCADA provides monitoring and controlling function for Passenger Information System. SCADA monitored health and alarm status all device and control some function as describe in Figure 5 – Figure 8 for each device.

For monitoring functional interface, SCADA monitored health and status every device to analyse as preventive maintenance.

For controlling functional interface, NetSpire SDK provided for the following controlling functional areas:

1. Controlling public address announcements locally and via network connected locations.
2. Controlling telephony and intercom communication
3. Controlling visual display
4. Controlling recorded audio announcements (DVA)

SCADA transmit signalling information (train schedule, time arrival, train position) to CXS Server to announce in display or PA.

SCADA may retrieve information from CXS synchronously or asynchronously in accordance with polling or event based.

## Simple Network Management Protocol (SNMP)

### Protocol Definition

Simple Network Management Protocol (SNMP) is one of the Internet Standard Protocol for collecting and organizing information of managed devices within IP network. SNMP works based on client-server model. Typically, managed devices such as Router and Ethernet Switch take role as server (agent) while Network Management Server (NMS) is the client. There are three different version of SNMP namely SNMPv1, SNMPv2, and SNMPv3. Those three version differs on their respective performance, flexibility, and security. The different between version of SNMP will describe in Appendix 9.

Network management using SNMP primarily enables:

• Monitoring of network devices

• Remote control and remote configuration of network devices

• Fault recognition and notification.

### Protocol exchanges or frames formats



**FIGURE 15. SNMPV1 PROTOCOL DATA UNIT**

In summary, SNMP message is transported in IP and uses UDP protocol in its transport layer. The message’s header contains version field and community name. Version indicates in which the message based on. Community string, basically an arbitrary data, pairs specific agent with manager and used as security purpose.

To interface using SNMP, both of SCADA and Telecom System have to do some configuration.

SCADA as a SNMP Manager should do some of the following configuration.

1. Enable “SNMP Trap” services. The SNMP uses the default UDP port 161 for receiving general SNMP messages and UDP port 162 for receiving SNMP Traps (firewalls must be configured to allow UDP traffic on port 161 and port 162).
2. Configure specifying devices IP Address based on list below.

Master Clock Server : 10.203.91.4

TNX Server (Radio) : 10.211.91.4

TXCare Server (FOTS) : 10.200.91.4

WAN Device : describe in Appendix 7

1. Configure SNMP version used individually on subsystem based on list below.

Master Clock Server : SNMP v2

TNX Server (Radio) : SNMP v1

TXCare Server (FOTS) : SNMP v2

WAN devices : SNMP v1

1. Configure the SNMP trap message list by its MIB file or input OID manually. For the SNMP trap list each Telecom Subsystem (FOTS, WAN, Radio, Master Clock) describe in Appendix 1, Appendix 4, Appendix 5, Appendix 6, and Appendix 8.

Telecom Subsystem that contain of FOTS, WAN, Master Clock and Radio as a SNMP agent have to set up devices or server to send traps to SCADA server. Telecom subsystem devices or server must enable the SNMP broadcast and configure SCADA server IP in 10.202.91.4 as trap destination.

## Software Development Kit (SDK) Open Access

### Protocol Definition

SCADA and Passenger Information System communicate with custom protocol. SCADA develop the protocol to access Passenger Information System Server (CXS Server) using NetSpire SDK Library in C++ language. SCADA Sever have to specify CXS Server IP at 10.207.91.5

For more detail about NetSpire SDK Library refer to Reference Manual NetSpire SDK Library.

### Protocol Exchange or frames formats

NetSpire has library AudioServer class that provides the primary interface to SCADA communicate with a NetSpire system.

An object of AudioServer Class is intended to be created when SCADA initiates a connection to the system, and the object retained during the lifetime of the connection. It can be deleted once there is no further need to communicate with the NetSpire System. It has been designed to allow creating an AudioServer object at the start of the client application, which uses this object for communications until the client application terminates.

Once an AudioServer objected is created, it will attempt to connect to CSX or MCX servers specified by the customer as arguments to the connect() method. The connection will be reported as established once the AudioServer instance connects to a server with active (primary) role. Once connected to a server, the connection to all specified servers will be automatically managed by the AudioServer object.

For example, if the connected server is powered off or becomes unreachable, the AudioServer will report this to the client application and will attempt to connect to another server that may have taken over the active (primary) role.

To transmit and receiving information, SCADA using NetSpire SDK Library. The Object library that SCADA use as shown in Table 3.

**TABLE 3.- NETSPIRE SDK LIBRARY**

| NetSpire SDK Class | Description |
| --- | --- |
| AudioServer Class | The interface to the CXS is represented by the AudioServer Class. The AudioServer class should be instantiated on application start, deleted on application completion |
| Device Class | Provides both static and state information on devices within the NetSpire System. |
| PAController Class | PAController class provides an interface retrieve a list of PA sources (e.g. microphones) PA sinks (audio outputs comprising one or more amplifiers and speakers) and zones. The interface allows monitoring the state of all sources and sinks and making live PA using these components. |
| Message Class | represents message to play on audio and visual devices, and is used as a parameter when playing a message via PAController |
| PASource Class | represents an audio source and used to retrieve information on the audio source and set its gain level. |
| PASink Class | represents a target for PA and DVA. These form part of audio zones, and each sink is comprised of one or more amplifier outputs and speakers. This class provides an interface to query the status of a sink, and set their configuration including gain levels. |
| VisualDisplay Class | represents a display device suitable for displaying visual output such as static or dynamic text, images, videos, and customised display templates including these visual types. |
| PaTrigger Class | used to define a trigger to enable/disable PA |
| PaSelector Class | used to select pre-configured audio sinks. |
| PaZone Class | Represent an audio zoe, and is a collection of PaSinks |
| CallController Class | Provides an interface to query current calls, initiate new calls, and manage (e.g. hold/transfer/terminate) existing calls. |
| PassengerInformationServer Class | supporting all objects and methods associated with the provision of passenger information in the system. |
| TripStop Class | TripStop objects include information for each stop in a trip. This information includes the station and the platform within that station. |
| ServiceStop Class | ServiceStop has dynamic arrival and departure time information which is updated in real-time by the system as required. |
| Vehicle Class | The Vehicle objects represent and track vehicles in the system like trains, busses, trams and ferries |
| PlatformInfo Class | represent specification locations within stop where a vehicle can stop. |
| Station Class | represents a location where a vehicle can stop |

For more detail about member function or method each Class refer to Appendix 11 and NetSpire SDK Reference Manual.

SCADA have controlling function, to access the devices SCADA must configure specify IP address for all device that describe in Appendix 10.

SCADA give train information to CXS Server using ScheduleDefinition Class Reference. ScheduleDefinition class stores information on a schedule announcement. Scheduled announcement are executed on destinations specified in the schedule by the CXS.

ScheduleDefinition has public attributes as shown below.

**TABLE 4.- PUBLIC ATTRIBUTES OF SCHEDULEDEFIITION CLASS**

|  |  |
| --- | --- |
| Public Attributes | Data Type |
| Id | Int |
| description | String |
| startYear | Int |
| startMonth | Int |
| startDay | Int |
| startHour | Int |
| startMinute | int |
| endYear | Int |
| endMonth | Int |
| endDay | Int |
| endHour | Int |
| endMinute | Int |
| dayMask | Int |
| frequency | Int |
| dictionaryItems | Unsigned int |
| Zones | string |

For attribute dayMask, ScheduleDefinition Class use hex or decimal code.

## Timing and Acquisition Cycle

Trap/alarm information from SNMP will be sent based on the condition (event based). The SNMP request/response procedure to show the detail information regarding the trap shall only be generated once the event risen. Other than that, counter type shall be transmitted periodically with fixed cycle (3s period).

The information data transmitted from SCADA to CSX server using SDK by polling method in fixed cycle 3 seconds.

On the other hand, SCADA may retrieve information from CXS synchronously or asynchronously using SDK in accordance with the following:

1. Polling : Calling the method AudioServer returns a list of Device objects, where each device object includes status information of a device.
2. Event based : SCADA can register observers which are executed by the API library in the event of a status change. Some of the observers send updated status information by sending an updated Device object that includes the updated state.

# Degraded Mode

SCADA server which is equipped with dual hardware that is physically identical. Each Telecom Subsystem (FOTS, WAN, Radio, Master Clock, Passenger Information System) have two servers are physically supplied so that Telecom Subsystem server #1 is active and Telecom Subsystem server #2 is operated as a standby.

1. In case that one of the two redundant hardware components in the SCADA server fails SCADA server interface with Telecom Subsystem Server Continuously without interruption
2. In case of Telecom Subsystem Server #2 (Standby) failure  
   Telecom Subsystem Server #1 is in the Active state and continuously provides on-line information to the SCADA server. Therefore Telecom Subsystem Server #1 interface with SCADA server continuously without interruption
3. In case of Telecom Subsystem Server #1 (Active) failure  
   Telecom Subsystem Server #2 is switched to Active and Telecom Subsystem Server #2 provides on-line information to the SCADA server. Therefore Telecom Subsystem Server #2 interface with SCADA server continuously without interruption

# Provision, Delivery and Installation

**TABLE 5.- PROVISION, DELIVERY AND INSTALLATION**

| **Item** | **Interface** | **Design** | **Supply** | **Install** | **Testing** | **Remarks** |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | LAN cable from SCADA to Ethernet Switch FOTS in patch panel | SCADA (PT. LEN) | SCADA (PT. LEN) | SCADA (PT. LEN) | SCADA (PT. LEN) |  |
| 2 | Custom SNMP MIB represent IO List | Telecom  (PT.LEN) | Telecom  (PT.LEN) | Telecom  (PT.LEN) | SCADA (PT. LEN) |  |
| 3 | SDK Library | Telecom  (PT.LEN) | Telecom  (PT.LEN) | Telecom  (PT.LEN) | Telecom  (PT.LEN) |  |

**TABLE 6.- DELIVERY AND INSPECTION**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Item** | **Activity** | **Who in Charge** | **Pre-Conditions** | **Remarks** |
| 1 | Packing for Delivery from factory | SCADA |  |  |
| 2 | Relevant paper works and clearance for export | SCADA |  |  |
| 3 | Freight and insurance | SCADA |  |  |
| 4 | Import clearance | SCADA |  |  |
| 5 | Import duty and other relevant duties | SCADA |  |  |
| 6 | Inland transportation to site | SCADA |  |  |
| 7 | Clear passage route in depot | SCADA |  |  |
| 8 | Unloading to site | SCADA |  |  |
| 9 | Storage | SCADA |  |  |
| 10 | Installation | SCADA |  |  |
| 11 | Electric connection | SCADA |  |  |

# Testing and Commissioning

Testing and commissioning will be done by two party SCADA and Telecom System.

**TABLE 7. - TESTING AND COMMISSIONING**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Item** | **Activity** | **Who in Charge** | **Pre-Conditions** | **Remarks** |
| 1 | Testing procedure | PT.LEN |  |  |
| 2 | Availability of power supply | SAMJIN |  | In the event the power supply not available, Wika-Gedung to be responsible to provide Genset |
| 3 | FAT (Factory Acceptance Test) | PT.LEN |  | To be provided together with invitation for testing to ICE and MMI, other party required |
| 4 | SIT (Site Installation Test) | PT.LEN |  |  |
| 5 | SAT (Site Acceptance Test) | PT.LEN |  |  |
| 6 | Signing of the test document | PT.LEN  ICE  MMI |  |  |

# Interface Programme

**TABLE 8.- TELECOMMUNICATION AND SCADA INTERFACE PROGRAM**

|  |  |
| --- | --- |
| **Milestone** | **Date** |
|
| Interface Control Document Draft | 31/07/2017 |
| Interface Specification Coordination | 31/07/2017 |
| Interface Control Document Final | 01/11/2017 |
| Passenger Information System FAT | 27/12/2017 |
| Master Clock FAT | 27/12/2017 |
| WAN FAT | 21/11/2017 |
| FOTS FAT | 06/01/2018 |
| TETRA FAT | 28/02/2018 |
| SCADA FAT | 28/01/2018 |
| SCADA Point Test | 16/04/2018 |
| Interface test with SCADA (with power/telecom) | 13/08/2018 |
| SAT (Site Acceptance Test) | 07/09/2018 |
| OIT (Overall Integration Test) | 12/10/2018 |
| TRU (Trial Run) | 02/11/2018 |

# Electromagnetic Compatibility

Each interfacing party shall perform a study of the compatibility of equipment based on the EMC management and EMC Control Plans by the project System Assurance team of Wika. Each party is responsible to respond to the SA team for their own scope when required.

# Compliance to Interface Matrix

**TABLE 15.- COMPLIANCE TO INTERFACE MATRIX**

| **POS** | **DISCIPLINE** | **SYSTEM** | **POS** | **DISCIPLINE** | **SYSTEM** | **TYPE** | **DESCRIPTION** | **COMPLIANCE STATUS** | **DOC. / DRAWINGS REFERENCE** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 441 | SCADA | SCADA Servers, RTUs, I/Os SCADA Workstation etc. | 441 | FOTS | Fibre Optic Cables, Structured Cabling | Phy & Func | All SCADA equipment signals will be transmitted through Fibre Optic Transmission System | Comply | Interfaces Matrix- Appendix H - 362748-MMI-MVI1-XX-RP-760-0001 |
|  |  | SCADA Servers, | 441 | FOTS | All Fibre Optic Transmission System Assets | Phy & Func | SCADA will monitor health and alarm status of Fibre Optic Transmission System Equipment | Comply | Interfaces Matrix- Appendix H - 362748-MMI-MVI1-XX-RP-760-0001 |
|  |  | SCADA Workstation, Server | 415 | PA | Audio Routers | Phy & Func | SCADA Workstation will allow the operator to selsct PA Zone, broadcast pre-recorded and live announcement | Comply | Interfaces Matrix- Appendix H - 362748-MMI-MVI1-XX-RP-760-0001 |
|  |  | SCADA Workstation, Server |  | PHP System | PHP Units | Phy & Func | SCADA Workstation will display the status of PHPs, trigger the video footage of activated PHP, and provide answering selection | Comply | Interfaces Matrix- Appendix H - 362748-MMI-MVI1-XX-RP-760-0001 |
|  |  | SCADA Workstation, Server | 417 | Passenger Information | PID Servers | Phy & Func | SCADA Workstation will allow the operator to broadcast live text messages to any of the PID displays. | Comply | Interfaces Matrix- Appendix H - 362748-MMI-MVI1-XX-RP-760-0001 |
|  |  | SCADA Server | 415 | PA | All PA Assets | Phy & Func | SCADA will monitor health and alarm status of PA equipment | Comply | Interfaces Matrix- Appendix H - 362748-MMI-MVI1-XX-RP-760-0001 |
|  |  | SCADA Server |  | PHP System | PHP units | Phy & Func | SCADA will monitor health and alarm status of PHP equipment | Comply | Interfaces Matrix- Appendix H - 362748-MMI-MVI1-XX-RP-760-0001 |
|  |  | SCADA Server | 413 | IP Telephony System | All IP Telephony Assets | Phy & Func | SCADA will monitor health and alarm status of IP Telephony equipment | Comply | Interfaces Matrix- Appendix H - 362748-MMI-MVI1-XX-RP-760-0001 |
|  |  | SCADA Workstation, Server |  | Master Clock System | Master Clock | Phys & Func. | SCADA Server will be time synchronised with the Master Clock | Comply | Interfaces Matrix- Appendix H - 362748-MMI-MVI1-XX-RP-760-0001 |
|  |  | SCADA Server |  | Master Clock System | Master Clock | Phys & Func | SCADA Server will monitor health and alarm status of Master Clock equipment | Comply | Interfaces Matrix- Appendix H - 362748-MMI-MVI1-XX-RP-760-0001 |
| 441 | SCADA | SCADA Server | 412 | TETRA Digital Voice and Data System | TETRA | Phy & Func | SCADA will monitor health and alarm status of TETRA Radio equipment | Comply | Interfaces Matrix- Appendix H - 362748-MMI-MVI1-XX-RP-760-0001 |

**APPENDIX A**

*FOTS TXCare Health and Alarm Status*

**APPENDIX B**

*IP Address Assignment*

**APPENDIX C**

*Backbone System Schematics*

**APPENDIX D**

*Master Clock Spectracom SNMP Trap List*

**APPENDIX E**

*WAN Scalance X SNMP Trap List*

**APPENDIX F**

*WAN Scalance W700 Specific SNMP Trap*

**APPENDIX G**

*WAN Equipment List*

**APPENDIX H**

*TETRA TNX SNMP Trap List*

**APPENDIX I**

*Summary of Different between SNMPv1, SNMPv2, and SNMPv3*

**APPENDIX J**

*PIS Equipment List*

**APPENDIX K**

*PIS Monitoring and Controlling Functional Interface*

**APPENDIX L**

*PIS Health and Alarm Status Devices*

**APPENDIX M**

*PIS NetSpire Alarm System*

**APPENDIX N**

*PIS System Architecture*