

# THE NAKED SCIENTISTS

## Automatic Fare Collection and Advanced Metering Infrastructure

Transportation and Retail



Automatic Fare Collection



Advanced Metering Infrastructure



Integrated, Multi-modal, Multi-operator and Multi-media ticketing & contactless payments & metering solution

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# Abbreviations

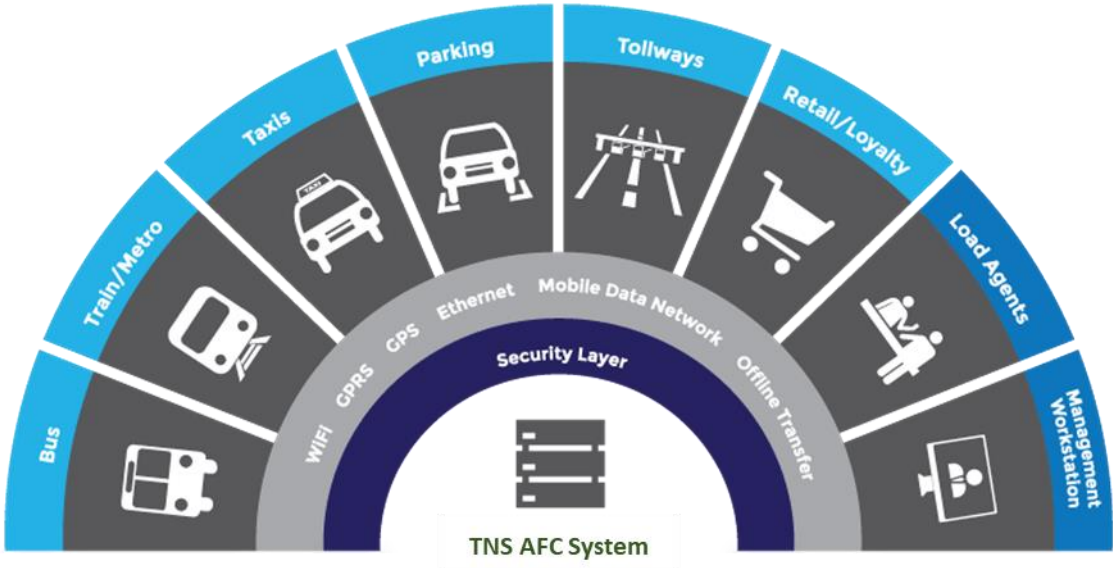
- IoT = Internet-of-Things
- LoRa = Long Range
- OCR = Optical character recognition
- SWaMM = SmartWater Metering Middleware
- DBMS = database management system
- RBAC = Role Based Access Control
- MQTT = Message Queuing Telemetry Transport
- LoraWAN = Low Power WAN Protocol for Internet of Things
- AMQP = Advanced Message Queuing Protocol
- AMR = Automatic Meter Reading
- AMI = Advanced Metering Infrastructure
- RMR = Remote Meter Reading
- NB-IoT = Narrowband IoT
- API = Application Programming Interface
- SCADA = Supervisory Control And Data Acquisition

# Welcome to The Naked Scientists

As contactless payments become the norm, fuelled by the proliferation of contactless bank cards, wearables and mobile wallet payments, many services providers are looking to benefit from the huge commercial value that a contactless EMV service can provide.



The Naked Scientists (TNS) is a future technology leader that supplies private industry and governments in Africa with advanced end-to-end Automated Fare Collection (AFC) solutions, Advanced Public Transport Management Systems (APTMS), Smart Parking solutions and Advanced Metering Infrastructure (AMI) for Smart Water Meter and Automatic Meter Reading (AMR) or Remote Meter Management solutions.



TNS implements and manage intelligent solutions for water supply facilities, automated fare collection, payments, access, passenger information and loyalty systems. Our solutions are quick and easy to deploy and integrate, and generated use or consumption data and insights are accessible to third-party systems.

The Naked Scientists, headquartered in Sandton, South Africa, is a fully owned subsidiary of Masala Ramabulana Holdings. TNS provides Automatic Fare Collection (AFC) System for micro payment operations, including Bus, Rail, Road Toll, Parking, Fast Food, Convenience Stores, Service Stations and Vending System, enhancing the efficiency of fare collection by expanding customer base, increasing transaction speed and reducing operation costs.

Our AFC solutions help transport authorities ease passenger movement and embrace new innovations, to provide the most efficient transit system possible for their passengers and non-transit clients. For passengers, fare collection is only a small part of their travel time, but it significantly impacts their overall experience. Customers expect a seamless travel experience and our solution address issues like missed bus or trains due to long lines at ticket purchasing points.

TNS also offer Smart Water Metering solutions which enables Automatic Meter Reading (AMR) and Remote Meter Reading (RMR) via Radio Frequency (RF), GPRS, Narrow Band IoT (NB-IoT) and Long Range (LoRa) technologies. Through continuous innovation, we transform complex cutting-edge technologies into affordable, reliable solutions for accurate flow and energy measurement.

At the core of our solution is Smart Water Metering Middleware (SWaMM), an interoperable wireless IoT middleware that is

capable of interfacing with a wide range of smart water meters operating with different protocols. We make it is much easier and faster to read water meters accurately. As the reading costs fall, the benefits start rising. Operator realise reduced labour costs, easier collection of water meter bills, effective management of consumers records such as payments, debts, invoices and valve states.

It connects devices more simply and efficiently on already established mobile networks, and handles small amounts of fairly infrequent 2-way data, securely and reliably. Complete digital system avoids reading errors. Water consumption can be observed and managed reliably.

Customers can manage their own consumption level, records such as invoice, debts, payment etc. from internet with their passwords. It connects devices more simply and efficiently on already established mobile networks, and handles small amounts of fairly infrequent 2-way data, securely and reliably.

The system has no limitation of the quantity of meters to be installed on network. Operators have the chance of acting faster in case of a damage or illegal consumption detected in the water supply infrastructure.

As both industries moves towards account-based systems, we have continued to innovate and enhance our offering to support these advanced solutions.

# Who We Are

An ICT solutions company that offer all fare modes and payment methods including closed loop systems e.g. smart cards or ePurse, open loop systems and payments e.g. contactless EMV, account-based solutions and mobile payments, top ups, apps and ticketing plus automatic meter reading and remote meter management.

# Our Vision

Offer a continent-wide integrated single mobile platform that will creating new opportunities for interoperability of AFC and AMI systems across multiple sectors.

# Our Mission

- ☞ To be a reliable and valuable project partner in the industry based on experience, quality and commitment.
- ☞ To help customers succeed in their widely differing industries.
- ☞ To handle the challenges from thousands of projects and evolve our products and services on a rolling basis.
- ☞ Quality product within specified time frames.
- ☞ To offer uncompromising quality, outstanding customer benefit and high operational dependability.
- ☞ To implement custom solutions and application-oriented products with the highest flexibility, with precision and economically.
- ☞ To assure commitment to community responsibility.

# TNS Value Philosophy

### Quality

Our work is thorough and our solution robust, because it really matters to us to do what is right - for our clients, our people, and our investors.

### Integrity

Honesty and integrity with our clients at every stage of the process forms the basis of the company’s corporate culture.

### Partnership

We build long-term relationships with our customers and our shareholders

### Commitment

We work with integrity and discipline and deliver to our promise.

### Innovative

We strive for continuous growth through innovation and deliver solutions that constantly evolve with changing industry and clients’ needs.

### Collaborative

We don't just work for our clients; we partner with them to help them deliver value to their customers.



# Why Choose Us

- ☞ We offer open architecture platforms to readily take advantage of emerging technologies and trends.
- ☞ Our solutions are highly scalable and built for efficiently linking together a complex network of partners.
- ☞ Our solutions give you easy access to data and insights needed to drive business and service improvements.
- ☞ Our solutions are an essential part of fare collection, payment, settlement and processing for transit, Road Toll, Parking, Fast Food, Convenience Stores, Vending Systems clients and for Residential, Commercial and Industrial flow and energy measuring.
- ☞ We have developed capacity to enable us to respond to client requests within reasonable turnaround times.
- ☞ It is a company guiding principle that we deliver twice in use value than in the monetary value we receive for services rendered.
- ☞ Optimum turnkey and consultancy services.

# Our Team

TNS's team is made up of experts with extensive experiences in Public Key Infrastructure (PKI), Smart Card Security, Electronic Purse applications and SWaMM, and is dedicated to the innovation in AFC and AMR technologies, and perfection of AFC and AMI solutions to meet the needs of highly competitive and fast-paced markets. TNS pledges to deliver feature-rich AFC and AMI systems and products using the latest technologies in the field.

# Standards

Our Automatic fare collection products, technologies and solutions comply with the following:



- ☞ PC/SC (Personal Computer Smart Card) standard defined by the Consortium led by Microsoft
- ☞ EMV standard defined by EuroPay, MasterCard, VISA, Discover
- ☞ USB certification defined by USB consortium
- ☞ EMV CAP (Chip Authentication Program) and VISA DPA (Dynamic Passcode Authentication)

Our operations, solutions and products for the Smart Water System comply with the following quality systems and accreditations: ISO 9001, ISO 7816, ISO 17020, ISO 17025, ISO 27001, ISO 14001 and OHSAS 45001.

## Worldwide Partners



## Benefits - AFC System

### For Commuters

- ☞ Shortened transaction times and easier rebates during transfers
- ☞ Reduced cash handling
- ☞ Discounted bus fares and benefits through merchant-sponsored loyalty programs
- ☞ Need not to pay more because of exact money charge

### For Transport Operators

- ☞ Reduced Operating Costs
  - Collection and processing of cash and selling paper ticket may cost transport operators 10-15% of their total revenue to collect fares
- ☞ Increased Revenue
  - Ridership is increased due more efficient system
  - Previous non-riders are attracted to a cheaper, faster system
- ☞ Wide Range of Fare Options through single Pay Medium
  - Expanded adoption of electronic stored value, including replenishment of a transit account
  - Increased flexibility to consider distance-based or time-of-day pricing options

- 📍 Increased service efficiency
  - Transaction can be done within 0.3s and boarding rates increasing per minute, substantially cutting trip times
- 📍 Easy monitoring and improvement of the overall infrastructure
  - Detailed and comprehensive transaction records maintained through backend system
  - Range of data reports available including Traffic Analysis, Ridership Analysis, etc.
- Data mining – Cardholders information
- 📍 Better fare policy and structure decisions
  - Ability to offer a wide variety of fare options using a single payment medium
  - Expanded adoption of electronic stored value, including replenishment of a transit account
  - Increased flexibility to consider distance-based or time-of-day pricing options

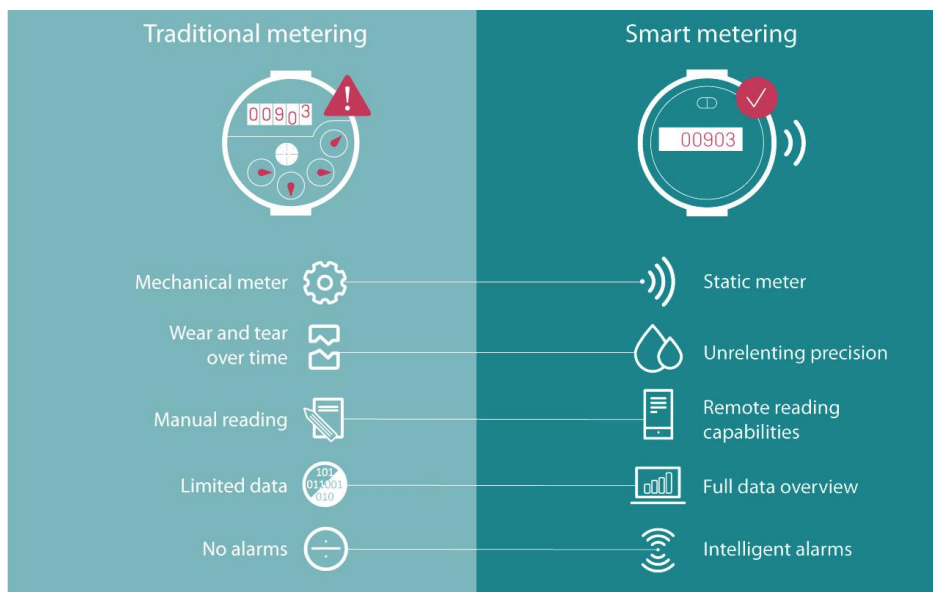
**For Card Issuers**

- 📍 Increased cash in hand from the cards' floats/deposits
- 📍 Operating funds generated from leftover stored value for cardholders leaving the system

**For Governments**

- 📍 Improved city image
- 📍 Better strategic transport policy
- 📍 More efficient energy usage through better public transportation utilization percentage
- 📍 Reduce number of coins and notes in circulation
- 📍 Increased inter-operability of the public transportation

## Benefits - AMI System





## For Water Supplier

- ☞ The capability to measure lower flows to earn more revenue from water distributed.
- ☞ Provide utilities with accurate and flexible data for billing, operations optimizations and non-revenue water reductions.
- ☞ Sustained meter accuracy because there are no moving parts susceptible to wear and tear.
- ☞ Performance indicators and demand forecasting
- ☞ Leak detection - Notification alarms for leaks and bursts to reduce non-revenue water.
- ☞ Improved customer service with data loggers inside the meter to investigate specific events that occurred on the customer-side of the meter.
- ☞ Enhance demand management strategies by enabling better use of existing water supplies before plans are made to further increase supply.
- ☞ Makes it possible for a water system to earn more revenue on a consistent basis.

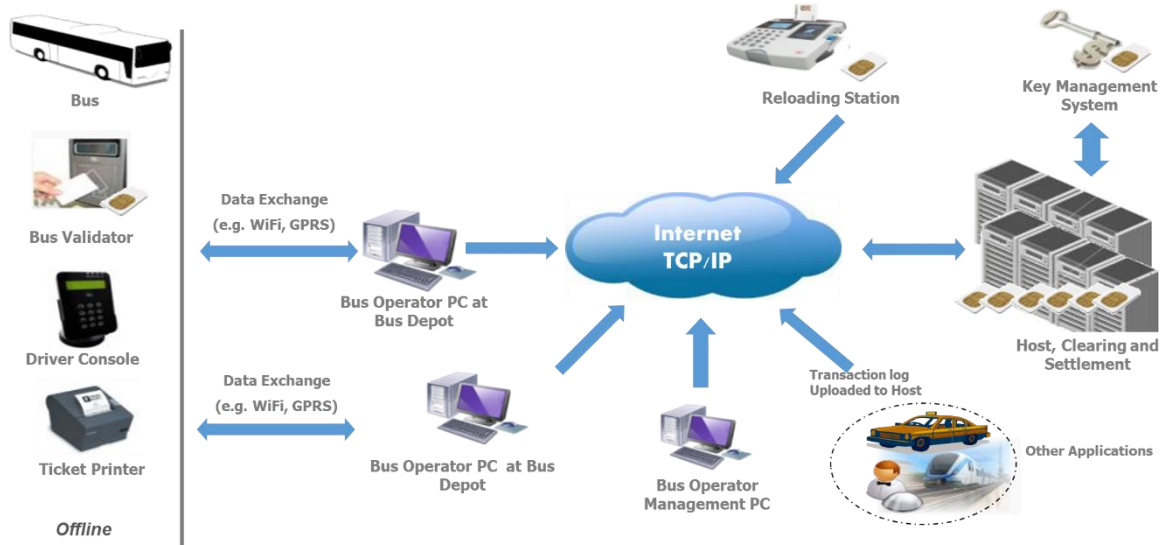
## For Customer

- ☞ Smart meters can provide information on when/where is water being used
- ☞ Comparisons of own water use against other customers
- ☞ Quick leak detection
- ☞ Smart apps can also be developed for customers to enable them compare their water usage with
  - Neighbours in the same street or suburb
  - Standard profiles e.g. consumers with the same socio-demographic factors

- ☞ Your water system will stand on solid ground to earn enough revenue to support operational costs and future capital needs.
- ☞ With smart (static) water meters, cities can increase their water systems' accounts receivable to help overcome the future infrastructure challenges on the horizon.
- ☞ Implements AMR system that uses the open technology of Android devices.
- ☞ Enables a much easier and cost-efficient way to read meters with smartphone or tablet.
- ☞ Smart meters not only allow for remote meter reading but also allow high-resolution consumption data to be sent to the customer.
- ☞ This data can be used to raise awareness of water consumption and allow customers to develop their own strategies to reduce water usage.
- ☞ Energy reduction.

- The most efficient users in the city
- ☞ Forecast their next water bill
- ☞ Prevent Water Meter Reading Scams
  - The utility company will not need to send people to your house to read the meter
  - They will just bill you electronically.
- ☞ Accurate Readings than the standard water meters you will only be billed for the exact amount of water that you use every month.

## Why TNS's AFC Solutions (ePurse)



- Ω State-of-the-art bus validator
  - OEM to one of the world biggest AFC solution providers
  - 10K+ units of bus validators were delivered
  - EMV Level 1 & 2, Visa payWave, MasterCard PayPass, Discovery, American Express
- Ω Certified card operating system (PKI COS)
- Ω Cryptography and key management expertise
  - Strong R&D team
  - Over 100 in-house experts experienced in Public Key Infrastructure and electronic purse applications
- Ω Ease of deployment and adaptation by customers
  - In-house developed technologies and end-to-end solution
  - Easy to adapt to customers' requirements
  - Projects: Colombia, Rwanda, Nigeria, Uganda, Philippines, etc.
- Ω Technologies to extend AFC payment to retail and home
  - Wide range of payment related products
- Dual interface E-Purse card certified by PBOC 2.0
  - Projects: France, Greece, Turkey, Nigeria, Bangladesh, etc.
- Ω SAM (Security Access Module) systems
  - In-house developed for over 19 years
  - Specifically designed for AFC application to secure the payment system
- Ω Flexible clearing and settlement systems
  - Support multi-merchant, multi-acquirer and multi-issuer
  - As a central unit which connects to all the clearing systems supplied by different solution providers
- Ω Web-based scalable software
  - Multiple levels of concurrency for fast and high performance for large volume of users
  - Multiple levels of authentication, authorization, and firewall
  - Sound architecture with Service Oriented Architecture (SOA) for easy integration with other systems

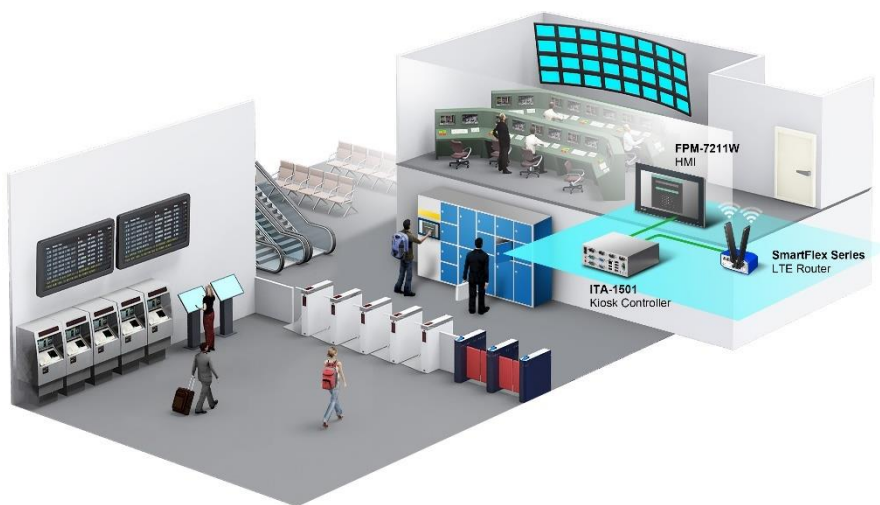
## Services - AFC

TNS's services offering include Smartcard Operation Service, AFC Infrastructure Operation Service, Clearing and Settlement Service, and Smartcard and RF related Value-added services.

### a. Smartcard Operation Service

TNS has issue millions of smartcards in South African and across the continent obeying the international standard ISO 14443 Type A, B. We maintain reload devices, and provide auto-reload service and internet or mobile recharging services.

### b. AFC Infrastructure Operation Service



TNS designs, owns and maintains all types of devices and related equipment for the AFC market, including RF one journey ticket issuer, open electronic gate, bus driver consoles and smartcard validators.

### c. Clearing and Settlement Service

TNS operates the clearing and settlement centre and offers ASP Model6. We offer AFC dedicated to single operator, as well as AFC utilized by multiple operators featuring clearing house.

### d. Value-added Service

TNS provides smartcard payment services to non-transit markets, such as convenience stores, museums, and other merchant sites. We also provide RF based payment services to toll gates, parking lots and taxis. Finally, TNS provides payment and reload services through internet and mobile phones.

The service is not limited to fare payment, but also fare collection, reservation by mobile phone, and electric money usage at convenience store and restaurants.

**Decrease fare collection costs by 50%**

## Services - AMI

### a. System Support

TNS offers fast and effective support for your meter reading system. We take care of software updates and, once a year, we give you input on how you can optimize your IT system.

### b. System Hosting

TNS will help you with your server operation, software installation, maintenance and data back-up. Using us to host your meter reading system allow you to spend more of your time and resources on what you do best. We deliver the competences, the experience and the equipment you need.

### c. System Operation

We handle everything from collecting and validating your meter data to administering meter replacement and monitoring your meter reading performance thus, we operate your entire meter reading system.

### d. Technical Support

TNS provides factory certified repairs, calibrations and re-inspection services for TNS metering technology products. Normally, the products should work reliably if the installation procedure and usage instruction are carefully followed. We also train clients on ultrasonic flow measurement technology, instrumentation and applications.

## Solutions

TNS provides revolutionary yet scalable and flexible solutions to public transport companies and merchants. Our end-to-end AFC solution is a reusable contactless stored value smart card for making electronic payments in online or offline systems.

### a. Integrated Solutions



We have developed an integrated ticketing system and a common electronic purse system that allows cardholders to use a single card to travel on any public transport systems and make purchases at retail outlets. The common electronic purse card system can provide unparalleled convenience to cardholders by simplifying payment processes.

With all applications integrated into one system, both cards and applications can be easily managed through a most cost-effective infrastructure.

**b. Bus Solutions**

TNS’s AFC Solution enables bus operators to issue contactless smart cards and cash paper tickets. Verification and reloading are conveniently done through mobile and desktop units.



Our user-friendly fare collection system, together with a portfolio of data analysis tools allow bus operators to quickly and easily make informed strategic decisions and manage daily operations.

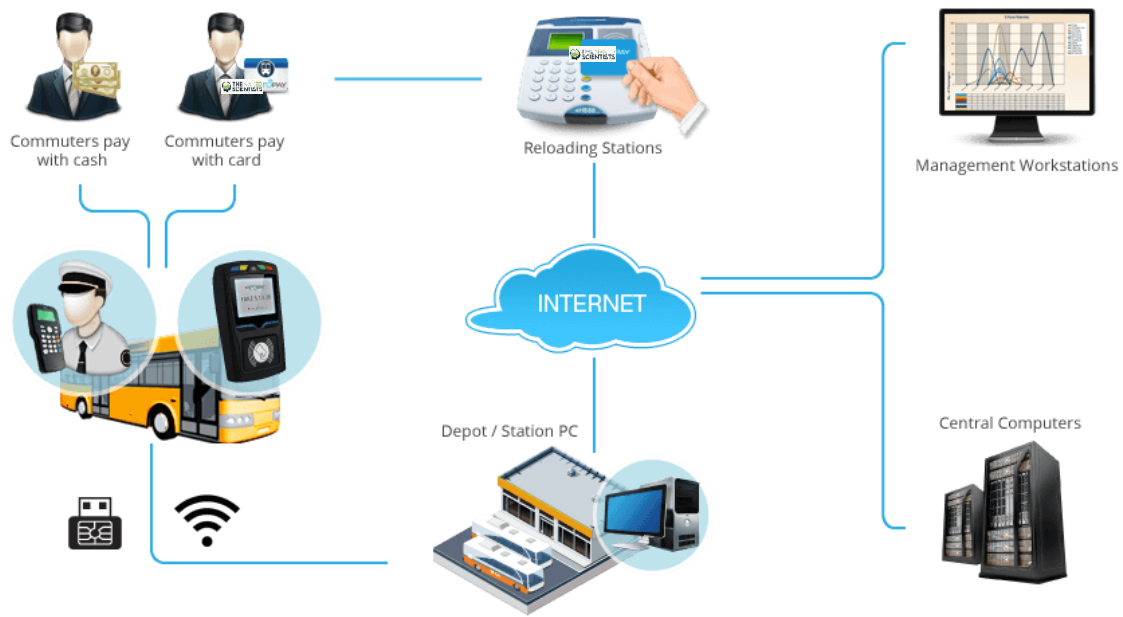
Our solution is the perfect tool to combat the challenges unique to public transportation, resulting in a more efficient system for both operators and passengers. The scalable and adaptable AFC solution modules can be tailored to suit the local needs and environment of each customer, and has been proven to increase ridership and fare revenue whilst reducing operation costs and fare loss.

Easy to configure and manage modules equips operators with the flexibility to accommodate different business and fare structures, and operating environments.

**Bus System Architecture**

- ☞ The solution comprises different subsystems, namely Reloading System, On-Board system, Depot Computer System, and Central Computer System.
- ☞ Reloading System is a subsystem in which cardholders pay to cashier in return for e-money.
- ☞ On-board system comprises Bus Validator, Driver Console and Ticket Printer, and Electronic Ticketing Machine (Optional). While all of the above are with payment functions, cardholder can also reload his/her card at Electronic Ticketing Machine.
- ☞ Depot Computer System gathers and uploads transaction records from On-Board System, meanwhile Central Computer System, where all the transaction records are stored, sends across data to On-Board System via Depot Computer System.

**Stop losing money. Keep payments safe and secure.**



## STANDARD BUS AFC SOLUTION ARCHITECTURE

Bus AFC Overview	
<b>Card Sales</b>	Commuter buys AFC card at customer service centres or bus interchanges. The customer service counter is equipped with Reloading Terminal.
<b>Card Payment</b>	Upon boarding the bus, commuters tap AFC cards at Bus Validator installed on the bus. For fixed fare, commuters only tap at Bus Validator once upon entry. For distanced-based fare, commuters tap in and out in order to get the exact amount of fare deducted.
<b>Cash Payment</b>	For commuters who pay in cash, drivers select the fare amount and print out paper receipts as tickets using Driver Console. A paper ticket with boarding stop, date and time, fare amount and security check-code will be printed.
<b>Inspection</b>	For ticket inspection, ticket inspector with Ticket Inspector terminal checks the boarding and alighting stations, transaction amount and card information recorded in the cards. Inspector will check the printed paper tickets for commuters who pay in cash.
<b>Data Exchange</b>	Transaction records are uploaded to and blacklist is downloaded from Central Computer. Bus Validator communicates to Central Computer on regular basis via mobile communication (GPRS/WiFi). Communication between Reloading Terminal and Central Computer is done via LAN network.
<b>Backend Processing</b>	Central Computer checks transaction certificate to ensure that there is no tampering of transaction record. It also checks the debit certificate to ensure that the money is indeed debited from the card by the said terminal.
<b>Reports</b>	With the transaction records, Central Computer can generate different kinds of report and analysis, e.g. top-up statistics, debit statistics, bus report, bus line report, ridership analysis, etc.

### Bus Solution Featured Components

#### 1. Reloading Terminal

The Reloading Terminal is a secure and feature-rich smart card terminal for reloading stored value into AFC cards. The Reloading Terminal equipped with Load SAM (LSAM) is capable of Triple DES mutual authentication with AFC cards to ensure the security of card reload.



### Key Features

- ☞ Cortex-A7 Quad-Core, Main frequency:1.1GHz
- ☞ 1GB RAM + 8GB Flash
- ☞ Micro SD Card: Up to 32G
- ☞ 1 SIM Slot & 2 SAM Slot
- ☞ Android 5.1 with security payment system
- ☞ 5.5" IPS 1280x720 pixels
- ☞ 5.0 megapixel, auto flash and auto focus
- ☞ Capacitive touch screen, supports finger & stylus input
- ☞ GPS, Supports A-GPS
- ☞ LTE-FDD/LTE-TDD/WCDMA/TD-SCDMA/WCDMA/CDMA/GSM
- ☞ WiFi:802.11b/g/n
- ☞ Bluetooth:2.1
- ☞ Li-ion, 2600 mAh x 7.2V



## 2. Bus Validator

The Bus Validator is designed specifically for use in AFC systems on buses, for validating and debit of AFC cards. The Bus Validator performs mission-critical functions and completes every transaction within 0.3 seconds. With various communication interfaces (GPRS, 4G, 3G, Wi-Fi), the Bus Validator can be connected to the Driver Console and other on-board IT systems for a broad range of functions.

### Key Features

- ☞ ARM Cortex-A8 1GHz Processor
- ☞ 4GB Flash (Available space for user: 900mb)
- ☞ 512MB RAM
- ☞ 32KB Tamper Protected RAM
- ☞ 4.3-in TFT-LCD, 480 x 272 Colors, Touchscreen Capacitive type
- ☞ 6 LED Status Indicators (4pcs at the front and 2pcs at the back)
- ☞ 4 back-lit buttons
- ☞ Built-in 10/100-base-T Ethernet
- ☞ 1D/2D Barcode Support
- ☞ Supports ISO 14443 Type A and B cards, MIFARE®, FeliCa, and all 4 types of NFC (ISO/IEC 18092) tags
- ☞ 4 ISO 7816-compliant SAM slot (Class A, B, C)
- ☞ RS-232 x 1, RS-485 x 1, USB x1
- ☞ Real-Time Clock (RTC)
- ☞ 4G/3G/GPRS Cellular Support
- ☞ IEEE 802.11 b/g/n Wifi Support
- ☞ GPS/AGPS Support
- ☞ Bluetooth 4.0 dual mode



## 3. Driver Console and Ticket Printer

The Driver Console is an intelligent control panel for bus drivers to issue paper tickets for cash payment and monitor statuses of the Bus Validators installed on buses. It is connected to the Bus Validator and Ticket Printer. Its 4 LEDs and a 12-key capacitive touch keypad interface allows drivers to quickly and easily control the system.

### Key Features

- ☞ Capacitive Touch Screen
- ☞ Toughened glass capacitive touch panel, 6H hardness



- 🔗 3.5mm audio jack, supports HDMI audio output
- 🔗 Also supports VGA input

- 🔗 7inch IPS screen,1024x600 hardware resolution, configurable by software (up to 1920x1080)

#### 4. Electronic Ticketing Machine

The Electronic Ticketing Machine is a portable terminal for bus conductors or ticket sellers to reload AFC cards and issue paper tickets for cash payment. It can be used as Ticket Inspector to check the validity of AFC cards. With the high speed A8 core, it offers high processing speed, various modes for connectivity and large memory. The built-in terminal printer on the device allows fast receipt printing for passengers.

##### Key Features

- 🔗 A8 processor running on embedded Linux
- 🔗 Support for ISO14443 Type A & B, MiFare, NFC
- 🔗 2 SAM card slots and 1 full-sized contact card slot
- 🔗 Connectivity: USB, Wi-Fi, GPRS, WCDMA
- 🔗 Portable with rechargeable battery sustaining 10-12 hours operation
- 🔗 Thermal printer



#### 5. Depot Computer System

The Depot Computer System is a PC-based software to download transaction files from Bus Validators, and to upload configuration files and hotlist files to Bus Validators via local area network. It acts as a data concentrator to handle data exchange between front-end and Central Computer System on regular basis.

##### Key Features

- 🔗 Collects transaction data from Bus Validator and submits it to the Central Computer System
- 🔗 Downloads configuration data from the Central Computer System and uploads it to Bus Validators
- 🔗 Monitors the status of Bus Validator
- 🔗 Report generation
- 🔗 Standard PC in LAN with Bus Validator
- 🔗 Alarm for exceptional cases



#### 6. Central Computer System

The TNS Central Computer System is the central clearing house system to verify and process transactions and to perform clearing and settlement functions. The Central Computer System comprises of six primary modules – the System Parameter, Card Management, Transaction Management, Operation Management, Report and Analysis, and Clearing and Settlement.

##### Key Features

- 🔗 Validation of Transaction, POS Certificate and Debit and Credit Signatures
- 🔗 E-purse ID and Transaction Counter Verification

- 🔗 Transaction and Card Balance Audit
- 🔗 Key Management System Interfacing
- 🔗 Capable of multi-issuer and multi-acquirer systems
- 🔗 High data integrity with database cluster, multiple levels of data backup, data recollection mechanisms and sound transaction processing techniques
- 🔗 Multiple levels of authentication, authorization, firewall, Intrusion Prevention System (IPS) and Hardware Security Module (HSM)



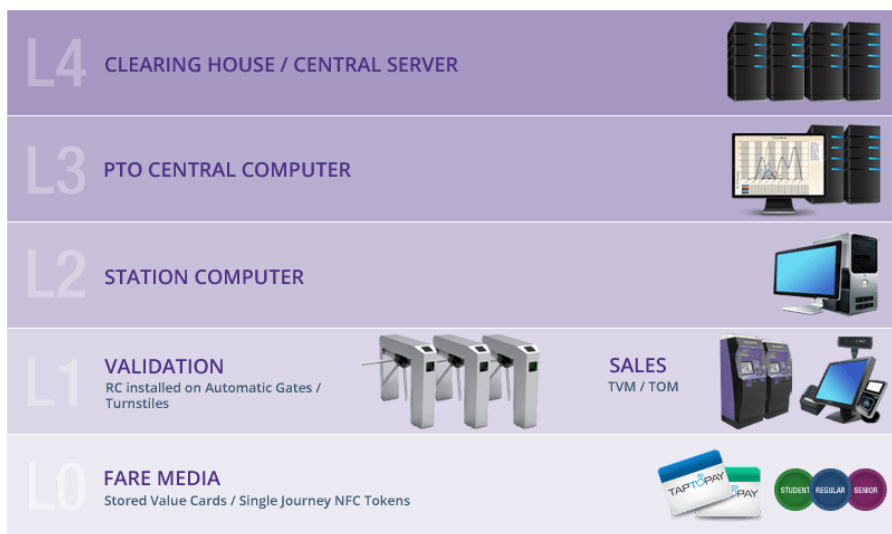
### c. Solutions for Metro and Railway

This AFC Solution can be implemented for metro, light rail, BRT and regional rail systems. Our station and central computer systems ensure visibility and reliability in revenue management, passenger management and operations management at all levels. Fully integrated systems allow operators to efficiently manage and control all devices and equipment installed, including automatic gates, ticket validators, ticket vending machines, and ticket offices in a convenient manner.

Operators are able issue tickets and to verify validity of tickets, provide card and ticket related customer services, for instance ticket adjustment and refund.

#### Metro/Rail System Architecture

- 🔗 The solution is divided into multiple levels in accordance with system architecture.
- 🔗 Level 0 is defined as Fare Media, by which passengers pay for fare.
- 🔗 Front-end devices, i.e. Ticket Vending Machine, Ticket Office Machine, and Automatic Gate, are found at Level 1.
- 🔗 Station Computer System at Level 2 links up all the Level 1 devices at a station together.
- 🔗 Transport Operator Computer System at Level 3 connects the Station Computer Systems of an operator with Central Computer System at Level 4.



STANDARD METRO/RAILWAY AFC SOLUTION ARCHITECTURE







Railway AFC Overview	
<b>Card Sales</b>	Commuter buys AFC card at Ticket Office Machine at metro station.
<b>Single Journey Ticket</b>	For commuters who pay in cash for a single journey, commuters purchase single journey tickets at Ticket Vending Machine installed at station in unpaid area. A ticket will be issued with the information of ticket type, entry and exit station and date and time.
<b>Fare Payment</b>	To enter the station, commuters tap AFC cards at Automatic Gate installed in station between the unpaid area and paid area.
<b>Data Exchange</b>	Transaction records are uploaded to and blacklist downloaded from Station Computer. Ticket Office Machine, Automatic Gate, Ticket Vending Machine will communicate to Station Computer on real-time basis.
<b>Data Transmission</b>	After the receipt of transactions, Station Computer submits transactions records to Central Computer via Transport Operation Central Computer which is optional.
<b>Backend Processing</b>	Central Computer checks transaction certificate to ensure that there is no tampering of transaction record. It also checks debit certificate to ensure that the money is indeed debited from the card by the said terminal.
<b>Reports</b>	With transaction records, Central Computer can generate different kinds of report and analysis, e.g. top-up statistics, debit statistics, bus report, bus line report, ridership analysis, etc. Station Computer is able to generate reports for the station it locates at.

## Metro and Railway Featured Components

### 1. Ticket Office Machine

The Ticket Office Machine is designed especially for use in AFC systems for metro and railway, for ticket issuance, reloading, ticket refund, ticket adjustment and AFC card services. It is installed between the unpaid area and paid area at stations and operated by station personnel. It has a full suite of operations and service capability, for both single journey tickets and AFC cards.

#### Key Features




-  Configurable tickets and products available
-  Fare media status enquiry
-  Fare adjustment in case of wrong data encoded in tickets
-  Ticket analyser to check validity of ticket, fare data, remaining value of AFC Card
-  Audit trail to monitor and track the login of operators
-  AFC Card services: card issuance, card reloading, card refund, card enquiry, card replacement



### 2. Ticket Vending Machine

The Ticket Vending Machine is an unmanned machine installed in the unpaid area at stations, for ticket issuance and reloading. A Man Machine Interface (MMI) screen is provided as combined passenger information display and control panel to passenger interaction. It is connected to the Station Computer for transaction and configuration data exchange.

#### Key Features

-  Configurable tickets and products available
-  Record of ticket price, type of ticket, date and time and terminal information
-  Fare media sales



- ☞ Acceptable of bank notes and coins
- ☞ Change of bank notes/coins

- ☞ Status reporting to Station Computer

### 3. Automatic Gate

The Automatic Gate is designed especially for use in AFC systems for metro or railway for ticket validation and access control. It is equipped with Ticket Validator, single journey ticket collector and various sensors. It is installed between the unpaid area and paid area and enables passenger to pass through the aisle between the two areas.

#### Key Features

- ☞ Can be configured as Entry Aisle, Exit Aisle and Reversible Aisle
- ☞ Validates ticket and controls access
- ☞ Collects single journey ticket



- ☞ Uploads transaction data and transmits status to Station Computer System
- ☞ Indicates status of gate (i.e. in, out or out-of-order)
- ☞ Reliability: MTBF > 10,000 hours

#### Components

- ☞ Controller Board
- ☞ Reader component
- ☞ Single journey ticket collector
- ☞ Safety sensors
- ☞ Passenger information display (TFT screen)
- ☞ UPS
- ☞ Alarm speaker

### 4. Station Computer System

The TNS Station Computer System monitors all devices and equipment installed in a station and communicates with the Central Computer System. It receives the information on statuses of devices (e.g. whether the Automatic Gate is set to be in or out, number of single journey tickets collected in Automatic Gate) and sends out control commands. It also collects transaction data and uploads to the Central Computer System.

#### Key Features

- ☞ Supervises controls and monitors AFC devices
- ☞ Collects transaction data and passes it up to level 3
- ☞ Downloads equipment configuration data to equipment
- ☞ Equipment controls
- ☞ Alarm detection
- ☞ Report generation
- ☞ Operator Shift Management
- ☞ Ticket Stock Control



#### Components

- ☞ Station Control Console
- ☞ Station PC
- ☞ Report printer
- ☞ Alarm log line printer
- ☞ PCM connector

## 5. Central Computer System

The TNS Central Computer System is the central clearing house system to verify and process transactions and to perform clearing and settlement functions. The Central Computer System comprises of six primary modules – the System Parameter, Card Management, Transaction Management, Operation Management, Report and Analysis, and Clearing and Settlement.

### Key Features

- ☞ Validation of Transaction, POS Certificate and Debit and Credit Signatures
- ☞ E-purse ID and Transaction Counter Verification
- ☞ Transaction and Card Balance Audit
- ☞ Key Management System Interfacing
- ☞ Capable of multi-issuer and multi-acquirer systems
- ☞ High data integrity with database cluster, multiple levels of data backup, data recollection mechanisms and sound transaction processing techniques
- ☞ Multiple levels of authentication, authorization, firewall, Intrusion Prevention System (IPS) and Hardware Security Module (HSM)



## d. Solutions for Retail

TNS'S AFC Solution for Retail is a prepaid stored value card that can store electronic cash, points, bonus, rewards and entitlements, where merchants and operators can define the reward schemes for their customers. It is an ideal way to increase customer experience, loyalty and satisfaction, improve retention, and build brand awareness.



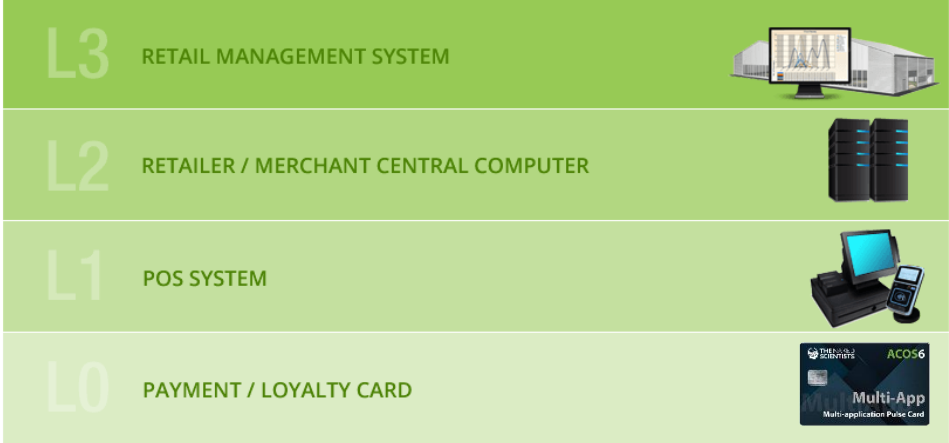
It allows a single contactless card to be used in multiple applications in addition to transport, providing unparalleled convenience. Cardholders can reload and pay for goods and services by card at any of retail outlets, while merchants can assess their own performance through a comprehensive monitoring system provided by TNS.

Its ease of administration allows for a wide range of applications, including multi-merchant support, branded and co-branded cards, and many more business strategies. The solution improves operational efficiency and transparency for merchants.



### System Architecture

The solution consists of a POS system, Retail Management System, and Central Computer System. The POS system includes all the front-end devices installed at retail outlets, while Central Computer System centralizes the two-way data transmission between the Retail Management System and the POS system of a merchant.



### STANDARD RETAIL SOLUTION ARCHITECTURE

Railway AFC Overview	
<b>Consumption</b>	Consumers pay for goods and services from merchants using AFC cards at POS. POS also accepts cash and records every transaction in the system.
<b>POS</b>	POS performs other services, e.g. refund of goods, record of inventory out, reload for AFC cards, etc.
<b>Loyalty</b>	AFC cards are designed with loyalty program whereby merchants can form alliance and offer rewards and discounts as incentive programs to attract more business.
<b>Data Exchange</b>	Transaction records in POS are uploaded to and blacklist is downloaded from Central Computer.
<b>Backend Processing</b>	Central Computer checks transaction certificate to ensure that there is no tampering of transaction record. It also checks the debit certificate to ensure that the money is indeed debited from the card by the said terminal.
<b>Retail Management</b>	Central Computer submits transaction records to Retail Management System which is provided by third party for reconciliation and stock control.

### e. Card Printing



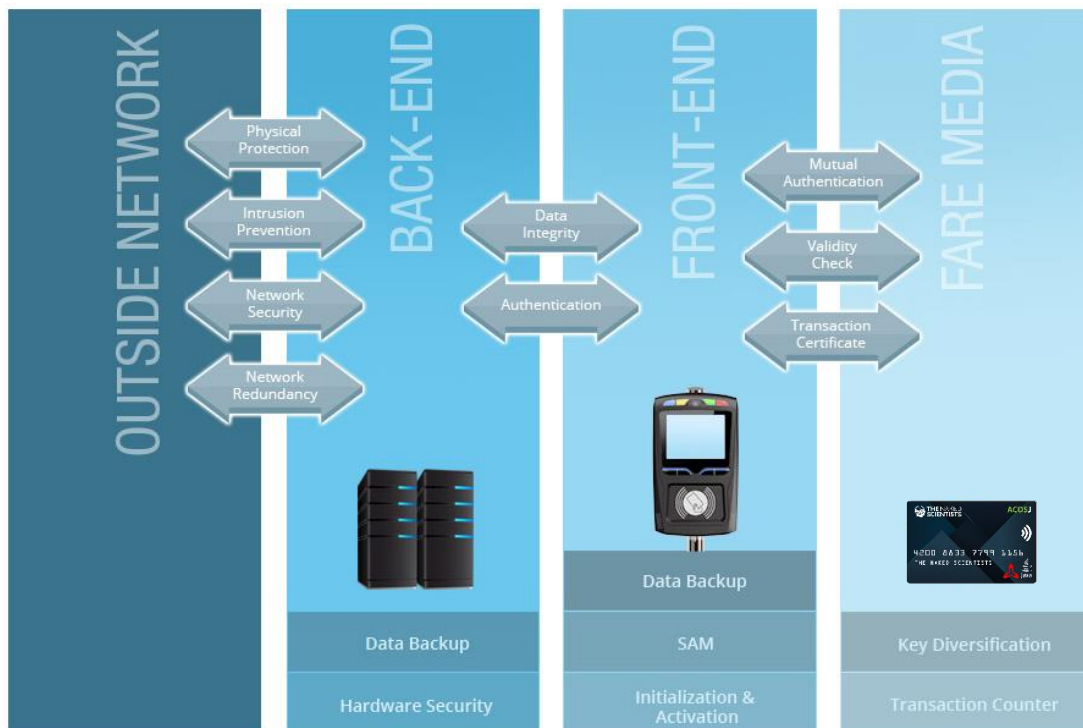
TNS smart cards are available for custom branding and promotional purposes. We welcome OEM enquiries for design printing at a reasonable cost. Furthermore, customers can buy white ACS cards, which they can personalize themselves. For price details on customized printing.

# System Features

## AFC System Features

### a. System Security

The TNS Key Management System (KMS) executes system security design by conditioning electronic purses (E-Purse) and Security Access Modules (SAM) such that any subsystem interacting with the E-Purse requires a SAM to enforce secured implementation of the application program. The SAM is a specifically designed security application residing inside a CPU smart card, which enhances and complements security of off-the-shelf E-Purse smart cards.



The TNS Key Management System (KMS) executes system security design by conditioning electronic purses (E-Purse) and Security Access Modules (SAM) such that any subsystem interacting with the E-Purse must require a SAM to enforce secured implementation of the application program. The SAM is specially designed security application residing inside a CPU smart card, which enhances and complements security of off-the-shelf E-Purse smart cards.

All security-sensitive decisions can only be made inside the security module to prevent application programmers being able to access to cryptographic keys or modify any processes made in module. Security modules are autonomous intelligent smart cards using cryptographic keys as the basis for security. Cryptographic keys are isolated and decoupled from the application program and programmers through the KMS.

## Faster and risk-free contactless payments

## Key Features

- 🔑 Cryptographic keys generated by random keys created by user (System Operator) using multiple seeds controlled by user
- 🔑 User-definable multiple sets of keys
- 🔑 One key one purpose for card authentication, terminal authentication, acquirer transaction certification, debit certification, issuer debit transaction signature, credit certification, credit transaction signature
- 🔑 Keys resided in various types of SAMs on a need-to-have basis
- 🔑 Secured online and offline key updates
- 🔑 Unique Card Identification Number and Authentication Code
- 🔑 Key Management System to ensure secure Security Access Module (SAM) card creation
- 🔑 Secure mechanism for retrieving and backing-up keys
- 🔑 Exclusive confinement of keys into the SAM once they are loaded
- 🔑 Triple DES Crypto Engine for secure high-speed transactions
- 🔑 Authentication, signature and verification computations on keys
- 🔑 Support for multiple card issuers, multiple acquirers and multiple fund issuers
- 🔑 Secured offline reloading of E-Purse with limited risk exposure of e-money

## b. System Highlights

Flexible, scalable and easily adopted. The system, including hardware and software, can be enhanced after deployment to fit the changing needs of customers in line with the customers' growth.

### 1. Multi-issuer, Multi-Acquirer and Multi-application

The TNS Central Computer System is crucial in supporting clearing for multiple service providers as well as multiple card issuers and acquirers, in addition to settlements among participants.

Many AFC or electronic purse applications start with a single issuer and single merchant. Over time, these may be expanded to include other participants, be it a multi-modal transport system or retail outlets, convenient stores, parking, or vending machines and so forth.

A smart card cryptography key –based security design, coupled with backend auditing ensures the utmost security and generates high levels of confidence and trust between participants.

### 2. Offline Reload and Fund Transfer

A Security Access Module (SAM) and Activation Card System is implemented to limit the risk of offline reloading and prevent fraud and theft. In all TNS AFC solutions, every single cent of electronic money is accounted for at all times.

An advantage of using a smart card in AFC solutions is that a smart card allows transactions to be done securely without relying on an online infrastructure. In places where such infrastructure is not always be available, debit and reload transactions need to be carried out offline.

### 3. Auto and Deferred Reload

The Auto and Deferred Reload System allow cardholders to send instructions remotely to reload non-anonymous AFC cards, tied to cardholders, via SMS, USSD and web portals. Actual reloading is realised when the cards are presented at the front-end terminals.

#### c. Operations Flow

TNS AFC Solutions can be expanded to support multi-modal transport systems such as citywide MRT, Bus, Taxi, together with retail outlets, petrol stations, convenient stores, and self service and on-street parking, vending machines, and more. With such a broad range of application and participants involved, the TNS Central Computer System is crucial in supporting clearing and settlement for multiple service providers as well as multiple card issuers and acquirers.

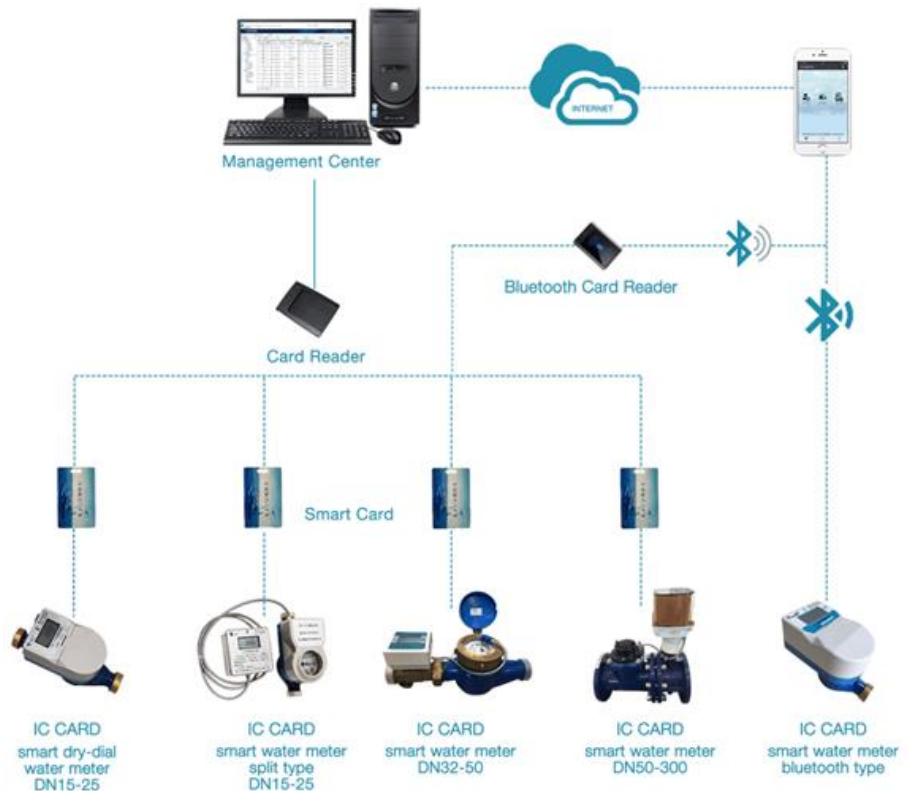
The TNS Central Computer System supports clearing and settlement for multiple service providers, card issuers and acquirers, as is necessary in a multi-application system.

#### The Operation Flow of an AFC system goes through five major steps:

1. Generation of Electronic Money (E-Money)
2. Reloading E-Money onto AFC Cards
3. Debiting E-Money inside AFC Cards for payment
4. Upload of transactions and data exchange
5. Clearing and Settlement

#### AMI System Features

TNS cutting edge automatic meter reading system integrates both wired and wireless AMR/AMI (Advanced Metering Infrastructure) technologies. It provides a unified platform for meter reading and data management through M-Bus networks, RF wireless networks, GSM networks, GPRS networks and TCP/IP networks. In addition, it works seamlessly with integrated billing software to make data exchange easy, fast and reliable.



Our advanced, highly robust meter reading solution delivers comprehensive usage information as well as timely, high-resolution meter reading. This data enables gas, water, heat and electric utilities to eliminate on-site visits and estimated reads, reduce theft and loss, implement time-of-use billing, and profit from all of the financial and operational benefits of fixed-network AMR/AMI.

### How it works

Based on a flexible, expandable, multi-tier architecture. It can accommodate a variety of metering networks, such as M-Bus, RF wireless, GSM/GPRS, and TCP/IP. The data centre software communicates with those networks through a standardized platform, which allows a client to start with a simple AMR system and gradually expand to a large metering system.

TNS's AMR system communicates with utility meters using MBus protocol and is open to other protocols allowing other brand utility meters to be integrated into the TNS's AMR system.

### Features

- Fixed M-Bus AMR/AMI System
- Fixed Wireless AMR/AMI System
- Mobile Meter Reading System
- Discover all meters automatically
- Assign meters to clients
- Automatically read meters and save data to the database
- Export data to billing software
- Generate reports

### Applications

AMI several applications including:

- Water and Wastewater
- Chemical Industry
- HVAC and Facility Management
- Food and Beverage
- Power and Thermal Plant

## 1. Water and Wastewater Applications

Inline flow meters for irrigation, water and wastewater consist of permanent installation flowmeters and semi-portable. Well-suited for checking installed meters, leakage determination, network analysis and flow survey.

### a. Permanent Installation Flowmeters

Works well for applications where long-term flow monitoring is needed. Rich output functions enable you to trigger an alarm, drive relay or valve, connect to PLC or computer and network through two-wire bus or GSM/SPRS wireless system.

### b. Inline Ultrasonic Water Meter

Alternative to conventional mechanic water meters, ideal for monitoring flow in residential and commercial buildings. This flowmeter does not have moving parts, needs no maintenance and has much a longer life span than mechanical meters. Solar-powered and battery-powered flowmeters.

### **i. Regular water**

- 🔗 City water
- 🔗 Well water
- 🔗 Sea water
- 🔗 River water
- 🔗 Portable water
- 🔗 Heating or cooling water
- 🔗 Metropolitan water distribution
- 🔗 Water in residential or commercial buildings

### **ii. Sewage and Wastewater Treatment Plants**

- 🔗 TNS Metering Technology offers a wide range of flowmeter products for whole water and wastewater treatment processes.
- 🔗 Sewage inlet flow
- 🔗 Provides reliable and accurate flow measurement.
- 🔗 Outlet flow or any flow with particles less than 2%
- 🔗 Ultrasonic flowmeters providing low-cost and maintenance-free solutions for monitoring water flow for Raw sewage, Reclaimed water, Sludge and Processed water.

### **iii. Irrigation and Agricultural Automation**

TNS Metering Technology has an excellent selection of products suitable for irrigation and agricultural automation applications. No moving parts and therefore do not block flow and need almost no maintenance. And, unlike their mechanical counterparts, our products' performance does not degrade over time.

- 🔗 Mobility handheld flowmeter.
- 🔗 Applications include flow survey and meter verification.
- 🔗 Non-intrusive long-term flow monitoring
- 🔗 Wireless capability and telemetry ready.

### **iv. Utility and Management Applications**

TNS utility meter solutions provide sustained accuracy, lead to conservation of resources, and reduce overall operational costs.

- 🔗 Water Meters
- 🔗 Heat Meters
- 🔗 Electricity Meters
- 🔗 Gas Meters

## **2. Chemical Industry Applications**

TNS Metering provides non-intrusive measurement solutions for the chemical industry where aggressive and toxic liquids needed to be monitored. Utilize ultrasonic transducers to measure the chemical liquid flow from the outside of a pipe accurately and reliably. Widely used in process monitoring and control of liquids where maintenance can be achieved without breaking into the pipe work and where meter process compatibility is achieved using the existing pipe work.

Applicable pipe sizes: 1" and above and Pipe material can be plastic or metal.



## Liquids:

- ☞ Any aggressive chemical or toxic media
- ☞ Conductive or non-conductive liquids
- ☞ Inspection of pipe installation
- ☞ Nitric acid or liquid ammonium nitrate in fertilizer manufacturing plants
- ☞ Liquids containing fibres or solids
- ☞ Liquids containing polymers
- ☞ Highly concentrated sulphuric acid
- ☞ Preliminary products in the production of polyurethane
- ☞ Water or oil for heat transfer
- ☞ Pump control, pump protection

## Unit Features Include:

- ☞ Flow control
- ☞ Product identification
- ☞ Leakage detection
- ☞ Chemical proportioning system for an accurate volumetric ratio to be maintained between the process liquid volume and the chemical injection volume
- ☞ Batching
- ☞ Truck loading
- ☞ DI water

## 3. Food & Beverage Applications

For food and beverage processing plants, engaging in blending and batching of foods and drinks where issues of hygiene and contamination are of major concern. Also good for measuring the raw materials used for production.

- ☞ Portable and permanent installation, non-intrusive flow meter ideal for general liquid flow survey.
- ☞ Non-intrusive flow measurement. No contact with liquid in the pipe, thus, no contamination.

## 4. Pharmaceutical and Semiconductor Applications

Permanent installation and portable **Non-intrusive flowmeters** for high-purity liquids or aggressive liquids. Those meters can be serviced without having to shut down the process.

## 5. Power and Thermal Plant Applications

TNS meters for long-term flow monitoring, either ultrasonic flowmeter or magnetic flowmeter can be used for thermal energy measurement. They are good for both hot water and chilled water applications; efficiency monitoring and improvement of liquid-based heating or cooling systems, including solar or geothermal systems.

## Products - AFI


We continue to invest in our associates, facilities, the services we offer and the quality products we design, manufacture and supply to serve our customers and to maintain a competitive edge in the markets we do business in. Products are divided into seven product families: Smart Cards & Smart Card Operating Systems, PC-Linked Smart Card Readers, Contactless Readers, Mobile Card Readers, Smart Card Readers with PIN-Pad, PC-Linked Readers with Mass Storage and Smart Card Reader Modules.

## Smart Cards & Smart Card Operating Systems

TNS develops and provide smart card with a proprietary smart card operation system (ACOS). ACOS cards meet the security requirements of these applications via multilevel secured access hierarchy.

A. Contact Interface		
<p><b>ACOS3 Microprocessor Card (Contact)</b></p> <p>Easy-to-use microprocessor smart card line with a wide range of memory capabilities</p>		<p><b>Primary Applications</b></p> <ul style="list-style-type: none"> <li> e-Government</li> <li> e-Healthcare</li> <li> Access Control</li> <li> Network Security</li> <li> e-Purse and Loyalty</li> </ul>
<p><b>Overview</b></p> <p>ACS develops smart card operating systems (ACOS) as its intellectual property. Developed by our dedicated team of specialists, the ACOS3 Microprocessor Card unlocks the potential of a smart card. It enables a single card to support various applications such as loyalty program, parking registration, access control, e-ID, and electronic purse.</p> <p>ACOS3 is specifically designed for highly secure payment applications. Featuring a high degree of security, ACOS3 is particularly suitable for secure loyalty programs, identification and e-Purse applications. Likewise, it may be utilized for common payment solutions.</p> <p>Additionally, security provided by ACOS3 may be further enhanced by utilizing ACOS6-SAM, which by enabling Mutual Authentication, Secure Messaging, Key Diversification and Key Injection, perfectly secures various applications.</p>		
<p><b>Features</b></p> <ul style="list-style-type: none"> <li> 32KB or 72KB of EEPROM memory for application data</li> <li> Compliance with ISO 7816 Parts 1, 2 and 3 <ul style="list-style-type: none"> <li> Supports T = 0 direct protocol</li> <li> Supports high-speed transmission rate from 9.6 to 223.2 kbps with modifiable ATR</li> <li> Supports ISO 7816 Part 4 File Structures: Transparent, Linear Fixed</li> </ul> </li> <li> Supports DES/3DES and MAC <span style="margin-left: 150px;"> Has five secret codes + Issuer code</span></li> <li> Has PIN code that may be updated by the card holder <span style="margin-left: 150px;"> Supports Key Pair for Mutual Authentication</span></li> <li> Supports Session Key based on FIPS140-2 compliant true random numbers</li> <li> Supports Secure Messaging to ensure that the data is secured from third party attacks</li> <li> Supports Account File Data Structure that can be enabled for secure purse/payment applications</li> </ul>		
<p><b>ACOS3X eXpress Microprocessor Card (Contact)</b></p> <p>eXpress microprocessor card with superior security, processing time &amp; memory size</p>		<p><b>Primary Applications</b></p> <ul style="list-style-type: none"> <li> e-Government</li> <li> e-Healthcare</li> <li> Access Control</li> <li> Network Security</li> <li> e-Purse and Loyalty</li> </ul>
<p><b>Overview</b></p> <p>The new ACOS3x eXpress Microprocessor Card is based on the ACOS3 platform, which has met recognizable success worldwide with its proprietary high security yet user-friendly file structures. It comes with the following superior features:</p> <ul style="list-style-type: none"> <li> Triple-DES (3DES) Crypto-Engine Hardware <span style="margin-left: 150px;"> Faster processing time</span></li> <li> Larger EEPROM memory size of up to 256 KB <span style="margin-left: 150px;"> Maximum support of 128 user files</span></li> </ul> <p>ACOS3X contains a powerful microprocessor and is fully compatible with other members of the ACOS3 product line. Security via ACOS3X can thus be achieved easily without sacrificing the computation time on cryptogram.</p> <p>Similar to ACOS3, ACOS3X enables a single card to support various applications such as loyalty program, parking registration, access control, e-ID and electronic purse.</p> <p>ACOS3X may also be paired with ACOS6-SAM for mutual authentication, secure messaging and key diversification, in order to provide utmost security for any application</p>		
<p><b>Features</b></p> <ul style="list-style-type: none"> <li> Full 256KB of EEPROM memory for application data</li> <li> Compliance with ISO 7816 Parts 1, 2 and 3 <ul style="list-style-type: none"> <li> Supports T = 0 direct protocol</li> <li> Supports high-speed transmission rate from 9.6 to 223.2 kbps with modifiable ATR</li> <li> Supports ISO 7816 Part 4 File Structures: Transparent, Linear Fixed</li> </ul> </li> <li> Supports DES/3DES hardware crypto-engine <span style="margin-left: 150px;"> Has five secret codes + Issuer code</span></li> <li> Has PIN code that may be updated by the card holder <span style="margin-left: 150px;"> Supports Key Pair for Mutual Authentication</span></li> <li> Supports Session Key based on FIPS140-2 compliant true random numbers</li> <li> Supports Secure Messaging and MAC option to ensure that the data is secured from third party attacks</li> <li> Enhanced security with ACOS6-SAM cards</li> <li> Supports Account File Data Structure that can be enabled for secure purse/payment applications</li> </ul>		

<p><b>ACOS5-64 V3.00</b> <b>Cryptographic Card (Contact)</b></p> <p>Cryptographic smart card for Public Key Infrastructure (PKI) and other high-security level applications</p>	 	<p><b>Primary Applications</b></p> <ul style="list-style-type: none"> <li> e-Government  Secured Email</li> <li> Banking &amp; Payment</li> <li> Access Control  e-Healthcare</li> <li> Network Security</li> <li> Digital Signature</li> <li> Public Key Infrastructure</li> </ul>
<p><b>Overview</b></p> <p>ACOS5-64 v3.00 is a FIPS 140-2 Level 3 Certified Cryptographic Smart Card which is fully compliant with ISO7816-1/2/3/4/8/9 and common criteria EAL5+ (chip level) specifications.</p> <p>It is specifically designed to enhance the security and performance of RSA Public-key cryptographic operations, which are essential factors in applications requiring smart card PKI, digital signature and high-level security.</p> <p>ACS also offers PKI software solution which includes software applications and middleware that enables the ACOS5-64 to be used in Windows®, Linux® and MAC® platforms. By requesting for a digital certificate from a Public Certificate Authority (CA) or an in-house CA, one can use ACOS5-64 in a variety of applications, namely:</p> <ul style="list-style-type: none"> <li> Secure and Digital Email Signing</li> <li> Remote Network/VPN Authentication Logon</li> <li> PDF Document Encryption</li> <li> Logical PC Access</li> <li> Digital Signature on Documents</li> <li> Secure Hard Disk Partition</li> </ul>		
<p><b>Features</b></p> <ul style="list-style-type: none"> <li> Full 64KB of EEPROM memory for application data</li> <li> FIPS140-2 (US Federal Information Processing Standards) Certified</li> <li> Compliance with ISO 7816 Parts 1, 2, 3, 4, 8, and 9 <ul style="list-style-type: none"> <li> Supports T = 0 direct protocol</li> <li> Supports high-speed transmission rate from 9.6 to 223.2 kbps</li> <li> Supports ISO 7816 Part 4 File Structures: Transparent, Linear Fixed, Linear Variable, Cyclic</li> </ul> </li> <li> Supports DES/3DES/3K3DES/AES-128/AES-192/AES-256/RSA (up to 4,096 bits)</li> <li> Supports SHA-1, SHA-256 hashing algorithm  Common Criteria EAL5+ (Chip Level)</li> <li> Supports Secure Messaging and MAC option to ensure that the data is secured from third party attacks</li> <li> Supports Mutual Authentication and Session Key generation</li> <li> Supports multi-level secured access hierarchy  Supports Anti-tearing function</li> <li> Supports the following software: <ul style="list-style-type: none"> <li> Microsoft Crypto-API, Microsoft CNG and PKCS #11 Middleware (Refer to ACOS5-64 Client Kit)</li> <li> Secure Online Certificate Generation</li> <li> Outlook, Windows Mail, Outlook Express and Mozilla Thunderbird mail signing and encryption (S/MIME)</li> <li> Mozilla Firefox  Internet Explorer  Smart Card Logon</li> <li> Microsoft Office  Open Office  Adobe Reader  Lotus Notes</li> </ul> </li> </ul>		
<p><b>ACOS6 Multi-application &amp; Purse Card (Contact)</b></p> <p>All-in-one, multi-application contact card especially suited for e-purse applications</p>		<p><b>Primary Applications</b></p> <ul style="list-style-type: none"> <li> e-Government  e-Healthcare</li> <li> Banking &amp; Payment</li> <li> Access Control  Network Security</li> <li> e-Purse &amp; Loyalty  Transportation</li> </ul>
<p><b>Overview</b></p> <p>The ACOS6 Multi-application &amp; Purse Card (MAP Card) is a high speed and flexible smart card offering cost effective solutions. It is specifically designed to address the requirements of multiple applications and multiple e-purses with secure access hierarchy of multiple levels.</p> <p>ACOS6 allows for multiple secure e-purses, which are suitable for a wide range of applications in government services, payment applications, online top-up, loyalty programs and more.</p> <p>ACOS6 provides a secure environment for each independent application. This function makes it the most suitable for incorporating various independent applications into only one card, thus providing cost effective solutions to developers, and a convenient platform to end users.</p> <p>Security provided by ACOS6 can further be enhanced by the ACOS6-SAM (Security Access Module) card that enables mutual authentication, secure messaging and key diversification.</p>		
<p><b>Features</b></p> <ul style="list-style-type: none"> <li> Full 64KB of EEPROM memory for application data</li> <li> Compliance with ISO 7816 Parts 1, 2, 3, and 4 <ul style="list-style-type: none"> <li> Supports high-speed transmission rate from 9.6 to 223.2 kbps</li> <li> Supports ISO 7816 Part 4 File Structures: Transparent, Linear Fixed, Linear Variable, Cyclic</li> </ul> </li> <li> Supports DES/3DES</li> <li> Supports hardware-based random number generator compliant to FIPS140-2</li> <li> Supports Secure Messaging function ensuring data transfers are confidential and authenticated</li> <li> Has multiple secure e-Purse available for payment applications</li> <li> Supports multi-level secured access hierarchy  Supports Anti-tearing done on file headers and PIN commands</li> </ul>		

<p><b>ACOS6-SAM Secure Access Module Card (Contact)</b></p> <p>Tiny SAM card that ensures ultimate security</p>	 	<p><b>Primary Applications</b></p> <ul style="list-style-type: none"> <li> e-Government</li> <li> Banking &amp; Payment</li> <li> e-Purse &amp; Loyalty</li> <li> Network Security</li> <li> Hardware Security Engine</li> <li> Access Control</li> <li> Transportation</li> <li> e-Healthcare</li> </ul>
<p><b>Overview</b></p> <p>The ACOS6 Secure Access Module (SAM) is designed as a general cryptogram computation module or as a security authentication module for ACOS contact client cards - ACOS3, ACOS6, ACOS7 and ACOS10, and common contactless client cards - DESFire, DESFire EV1, Ultralight-C and Mifare Plus.</p> <p>The ACOS6-SAM card securely stores cryptographic keys and uses these keys to compute cryptograms for other applications or smart cards. Using this, terminals need not know the master key(s) of an application, considering that the keys never leave the ACOS6-SAM.</p> <p>The ACOS6-SAM card can perform:</p> <p><b>Mutual Authentication:</b> To guarantee the authenticity of the terminal and the client card</p> <p><b>Secure Messaging:</b> To ensure that the data transmission between the card and terminal/server is secured and not susceptible to eavesdropping, replay attack and unauthorized modification</p> <p><b>Purse MAC Computation:</b> To authenticate and ensure data integrity of data and commands that are transferred into the card and vice versa</p> <p><b>Key Diversification:</b> To enable diversified entry of keys without exposing the master key</p> <p><b>Secure Key Injection:</b> To ensure the key injection from SAM to client cards for contactless cards with protection of Encryption and Message Authentication Code, besides, key(s) may be changed after injection</p>		
<p><b>Features</b></p> <ul style="list-style-type: none"> <li> Full 64KB of EEPROM memory for application data</li> <li> Compliance with ISO 7816 Parts 1, 2, 3, and 4 <ul style="list-style-type: none"> <li> Supports high-speed transmission rate from 9.6 to 223.2 kbps</li> <li> Supports ISO 7816 Part 4 File Structures: Transparent, Linear Fixed, Linear Variable, Cyclic</li> </ul> </li> <li> Supports DES/3DES/3K3DES</li> <li> Supports AES128/AES-192</li> <li> Supports hardware-based random number generator compliant to FIPS140-2</li> <li> Supports Mutual Authentication and Session Key generation</li> <li> Supports Secure Messaging function ensuring data transfers are confidential and authenticated</li> <li> Supports Access Module pairs with ACOS3, ACOS6, ACOS7, ACOS10, Mifare Ultralight C, DESFire, DESFire EV1, and Mifare Plus cards</li> <li> Stores and performs all key operations for mutual authentication, encrypted PIN submission, secure messaging, and e-Purse commands</li> <li> Supports multi-level secured access hierarchy</li> <li> Supports Anti-tearing function</li> </ul>		
<p><b>ACOS10 PBOC2.0 EDEP Payment Card (Contact)</b></p> <p>e-Deposit and e-Payment card with multiple interface options for versatility in banking applications</p>	 	<p><b>Primary Applications</b></p> <ul style="list-style-type: none"> <li> e-Government</li> <li> Banking &amp; Payment</li> <li> e-Healthcare</li> <li> Network Security</li> <li> Access Control</li> <li> e-Purse &amp; Loyalty</li> </ul>
<p><b>Overview</b></p> <p>ACOS10 received the PBOC2.0 certification after passing a series of stringent tests including electrical, mechanical, reliability, and secure command and transaction testing.</p> <p>ACOS10 EDEP is propelled by the ACOS10 card operating system, which is compliant with ISO 7816 parts 1-4 and allows users to write multiple applications in one card. As such, ACOS10 card is the best choice for providing a very flexible and cost-effective payment solution to developers, and a convenient platform to end users.</p> <p>ACOS10 is applicable for various transactions such as:</p> <ul style="list-style-type: none"> <li> Credit and Debit</li> <li> Purchase</li> <li> Cash withdrawal</li> <li> Balance inquiry</li> <li> Transaction log review</li> </ul> <p>Besides, security provided by ACOS10 can further be enhanced by using the ACOS6-SAM card that enables key storage, cryptogram calculation and key diversification.</p>		
<p><b>Features</b></p> <ul style="list-style-type: none"> <li> Full 32 KB of EEPROM for application data</li> <li> Compliance with ISO 7816 Parts 1, 2, 3, 4 <ul style="list-style-type: none"> <li> Supports T=0 Protocol</li> <li> ISO 7816 Part 4 File Structures namely: Transparent, Linear fixed, Linear Variable, Cyclic</li> <li> High-speed transmission rate from 9.6 to 223.2 kbps</li> </ul> </li> <li> Supports DES/3DES</li> <li> Supports multi-level secured access hierarchy</li> <li> Supports hardware-based random number generator compliant to FIPS140-2</li> <li> Supports Secure Messaging function ensuring data transfers are confidential and authenticated</li> <li> Supports Anti-tearing function</li> <li> Supports PBOC 2.0 e-Deposit and e-Purse payment applications</li> </ul>		







<p><b>Memory Cards</b></p> <p>Memory cards of differing capabilities, supported by ACS's line of smart card readers</p>		<p><b>Primary Applications</b></p> <ul style="list-style-type: none"> <li>🔗 Access Control</li> <li>🔗 e-Purse &amp; Loyalty</li> </ul>
<p><b>Overview</b></p> <p>TNS offers a variety of memory cards that may be used with a range of smart card readers/writers. These are the SLE5542 and the SLE5528 memory cards.</p>		
<p><b>Features</b></p> <ul style="list-style-type: none"> <li>🔗 SLE5542 is 100% functional compatible to SLE4442</li> <li>🔗 Write-protect function</li> <li>🔗 EEPROM is organized 256 x 8 bit offering the possibility of programmable write protection for each byte</li> <li>🔗 Data Memory alterable only after verification of 3-Byte Programmable Security Code (PSC)</li> <li>🔗 Intelligent 256-Bytes EEPROM</li> <li>🔗 Programmable Security Code (PSC)</li> </ul> <p><b>SLE5528 Memory Card Features:</b></p> <ul style="list-style-type: none"> <li>🔗 SLE5528 is 100% functional compatible to SLE4428</li> <li>🔗 Write-protect function</li> <li>🔗 All the memory, except for the PSC, can always be read</li> <li>🔗 After eight successive incorrect entries the error counter will block any subsequent attempt at PSC verification and hence any possibility to write and erase</li> <li>🔗 1KB EEPROM</li> <li>🔗 Programmable Security Code verification logic</li> <li>🔗 The memory can be written or erased only after PSC verification</li> </ul>		
<p><b>ACOSJ-V VISA Certified EMV Payment Card (Contact)</b></p> <p>A VISA Certified (Visa Credit, Debit and Prepaid) EMV Payment card solution based on JAVA card platform.</p>		<p><b>Primary Applications</b></p> <ul style="list-style-type: none"> <li>🔗 Banking &amp; Payment</li> <li>🔗 e-Purse Application</li> </ul>
<p><b>Overview</b></p> <p>ACOSJ-V is Visa Credit, Debit and Prepaid certified and supports all VSDC 2.8.1G functionalities.</p> <p>ACOSJ-V, powered by Java Card Technology, is an advanced EMV payment card solution for financial institutions. It is also compliant with Global Platform card specifications and equipped with powerful cryptographic capabilities for enhancing the security and performance of cryptographic operations and data management needed for financial applications.</p> <p>It is available in contact, contactless, and dual-interface options in both card and module form factors.</p>		
<p><b>Features</b></p> <ul style="list-style-type: none"> <li>🔗 Supports T=0 protocol</li> <li>🔗 Supports DES/3DES</li> <li>🔗 Supports SHA1/SHA224/SHA256/SHA384/SHA512</li> <li>🔗 Compliance with JAVA Card Specification Version 3.0.4</li> <li>🔗 Compliance with Mapping Guidelines 1.0.1</li> <li>🔗 Compliance with VCPs 2.1.3b</li> <li>🔗 Supports AES</li> <li>🔗 Supports RSA (768 to 2048 bits)</li> <li>🔗 Compliance with ISO 7816 Parts 1, 2, 3, 4</li> <li>🔗 Compliance with Global Platform Specification Version 2.2.1</li> <li>🔗 Compliance with VIS 1.5.4b</li> <li>🔗 Compliance with Visa Prepaid 1.1.3a</li> </ul>		
<p><b>B. Contactless Interface</b></p>		
<p><b>ACOS3 Microprocessor Card (Contactless)</b></p> <p>Easy-to-use microprocessor smart card line with a wide range of memory capabilities</p>		<p><b>Primary Applications</b></p> <ul style="list-style-type: none"> <li>🔗 e-Government</li> <li>🔗 Access Control</li> <li>🔗 e-Purse &amp; Loyalty</li> <li>🔗 e-Healthcare</li> <li>🔗 Network Security</li> <li>🔗 Transportation</li> </ul>
<p><b>Overview</b></p> <p>TNS develops smart card operating systems (ACOS) as its intellectual property. Developed by our dedicated team of specialists, the ACOS3 Microprocessor Card unlocks the potential of a smart card. It enables a single card to support various applications such as loyalty program, parking registration, access control, e-ID, and electronic purse.</p> <p>ACOS3 is specifically designed for highly secure payment applications. Featuring a high degree of security, ACOS3 is particularly suitable for secure loyalty programs, identification and e-Purse applications. Likewise, it may be utilized for common payment solutions.</p> <p>Additionally, security provided by ACOS3 may be further enhanced by utilizing ACOS6-SAM, which, by enabling Mutual Authentication, Secure Messaging, Key Diversification and Key Injection, perfectly secures various applications.</p>		
<p><b>Features</b></p> <ul style="list-style-type: none"> <li>🔗 8KB of EEPROM memory for application data</li> <li>🔗 Compliance with ISO 14443 Parts 1, 2, 3, and 4 <ul style="list-style-type: none"> <li>○ Fully compatible with ISO14443A</li> <li>○ Supports T = CL protocol</li> <li>○ Supports high-speed transmission rate from 106 to 848 kbps</li> </ul> </li> <li>🔗 Supports DES/3DES and MAC</li> <li>🔗 Has five secret codes + Issuer code</li> </ul>		



<ul style="list-style-type: none"> <li> Has PIN code that may be updated by the card holder</li> <li> Supports Session Key based on FIPS140-2 compliant true random numbers</li> <li> Supports Secure Messaging to ensure that the data is secured from third party attacks</li> <li> Supports Account File Data Structure that can be enabled for secure purse/payment applications</li> </ul>			<ul style="list-style-type: none"> <li> Supports Key Pair for Mutual Authentication</li> </ul>		
<p><b>ACOS5-EVO PKI Smart Card (Contactless)</b></p> <p>PKI Smart Card supporting ECC and RSA with extended APDU support.</p>		<p style="text-align: center;"><b>Primary Applications</b></p> <ul style="list-style-type: none"> <li> e-Government</li> <li> Access Control</li> <li> Public Key Infrastructure</li> <li> Digital Signature</li> <li> Secured Email</li> <li> Network Security</li> </ul>			
<p><b>Overview</b></p> <p>The ACOS5-EVO, is the latest addition to the ACOS5 Series, that provides additional features such as support for ECC and RSA algorithms and extended APDU. It also supports DES, 3DES, AES, CMAC and SHA (up to 512bits).</p> <p>It is compliant with international standards for PKI smart cards such as FIPS 140-2 (US Federal Information Processing Standards) Level 3 and CC EAL 5+ (chip level) making it ideal for public-key based applications such as digital signing, email security, online log-on, network log-in, blockchain applications, and others.</p> <p>It is available in combi, contact and contactless interface.</p>					
<p><b>Features</b></p> <ul style="list-style-type: none"> <li> 192 KB for application data</li> <li> Compliance with ISO 14443 Parts 1, 2, 3 and 4 <ul style="list-style-type: none"> <li> Supports T=CL</li> <li> Compatible with ISO 14443 Type A</li> </ul> </li> <li> Cryptographic Algorithms Supported <ul style="list-style-type: none"> <li> ECC: Curves P-224/P-256/P-384/P-521</li> <li> AES: 128/192/256-bits (ECB, CBC)</li> <li> Hash: SHA1, SHA224, SHA256, SHA384, SHA512</li> <li> Random Number Generation: Deterministic RNG, Non-deterministic RNG</li> </ul> </li> <li> Supports Secure Messaging function for confidential and authenticated data transfers</li> <li> Supports Mutual authentication (terminal-to-card &amp; card-to-terminal) with session key generation for encryption and MAC</li> <li> Supports multi-level security access hierarchy</li> <li> Complies with CC EAL 5+ (Chip Level) and FIPS 140-2</li> <li> Supports high-speed transmission rate up to 424.000 bps</li> <li> RSA: up to 4096 bits</li> <li> DES/3DES: 56/112/168-bits (ECB, CBC)</li> <li> MAC: CBC-MAC (DES/3DES, AES), CMAC (3DES, AES)</li> <li> Supports anti-tearing features</li> </ul>					
<p><b>ACOS10 PBOC2.0 EDEP Payment Card (Contactless)</b></p> <p>e-Deposit and e-Payment card with multiple interface options for versatility in banking applications</p>		<p style="text-align: center;"><b>Primary Applications</b></p> <ul style="list-style-type: none"> <li> e-Government</li> <li> Access Control</li> <li> e-Purse &amp; Loyalty</li> <li> Banking &amp; Payment</li> <li> Network Security</li> <li> Transportation</li> </ul>			
<p><b>Overview</b></p> <p>The ACOS5-EVO, is the latest addition to the ACOS5 Series, that provides additional features such as support for ECC and RSA algorithms and extended APDU. It also supports DES, 3DES, AES, CMAC and SHA (up to 512bits).</p> <p>It is compliant with international standards for PKI smart cards such as FIPS 140-2 (US Federal Information Processing Standards) Level 3 and CC EAL 5+ (chip level) making it ideal for public-key based applications such as digital signing, email security, online log-on, network log-in, blockchain applications, and others.</p> <p>It is available in combi, contact and contactless interface.</p>					
<p><b>Features</b></p> <p>ACOS10 received the PBOC2.0 certification after passing a series of stringent tests including electrical, mechanical, reliability, and secure command and transaction testing.</p> <p>ACOS10 EDEP is propelled by the ACOS10 card operating system, which is compliant with ISO 7816 parts 1-4 and allows users to write multiple applications in one card. As such, ACOS10 card is the best choice for providing a very flexible and cost-effective payment solution to developers, and a convenient platform to end users.</p> <p>ACOS10 is applicable for various transactions such as:</p> <ul style="list-style-type: none"> <li> Credit and Debit</li> <li> Balance inquiry</li> <li> Purchase</li> <li> Transaction log review</li> <li> Cash withdrawal</li> </ul> <p>Besides, security provided by ACOS10 can further be enhanced by using the ACOS6-SAM card that enables key storage, cryptogram calculation and key diversification.</p>					




<p><b>ACOSJ Java Card (Contactless)</b></p> <p>JAVA card solution compliant with GlobalPlatform Card specifications for secure and easy application development</p>		<p><b>Primary Applications</b></p> <ul style="list-style-type: none"> <li> e-Government</li> <li> e-Healthcare</li> <li> Secured Email</li> <li> Public Key Infrastructure</li> <li> Digital Signature</li> <li> Banking &amp; Payment</li> <li> Access Control</li> <li> Transportation</li> </ul>
<p><b>Overview</b></p> <p>ACOSJ is a smart card operating system developed by Advanced Card Systems Ltd. Compliant with Global Platform Card specifications and powered by Java Card Technology, it provides a secure platform for rapid application development of many value-adding applets, including e-banking, e-payment, loyalty, e-government, and public key infrastructure (PKI). ACOSJ has a fast read/write speed, is highly durable, and can house multiple secure applications. It comes in module and card options.</p> <p>ACOSJ is equipped with powerful cryptographic capabilities. These enhance the security and performance of cryptographic operations and data management, both of which are essential to fulfilling the security requirements of smart card applications.</p>		
<p><b>Features</b></p> <ul style="list-style-type: none"> <li> Full 40KB of EEPROM memory for application data</li> <li> Compliance with ISO 14443 Part 1, 2, 3, 4 <ul style="list-style-type: none"> <li> Supports T = CL direct protocol</li> <li> Supports high-speed transmission rate from 9.6 to 223.2 kbps with modifiable ATR</li> </ul> </li> <li> Supports DES/3DES/3K3DES/AES-128/AES-192/AES-256</li> <li> Supports SHA1/SHA224/SHA256/SHA384/SHA512</li> <li> Supports SEED (128 bits)</li> <li> EMVCo (Chip Level) Certified</li> <li> Compliance with Global Platform Specification Version 2.2.1</li> <li> Compliance with Mapping Guidelines 1.0.1</li> <li> Supports Mutual Authentication</li> <li> Supports RSA (up to 2048 bits) and ECC (up to 384 bits)</li> <li> Supports SM2/SM3/SM4</li> <li> Common Criteria EAL5+ (Chip Level) Certified</li> <li> Compliance with Java Card Specification Version 3.0.4</li> <li> Supports Secure Messaging</li> <li> Supports Anti-tearing function</li> </ul>		
<p><b>ACOSJ-P PBOC 3.0 DC/EC Card (Contactless)</b></p> <p>JAVA card solution with built in PBOC 3.0-certified applet, compliant with the UnionPay standard</p>		<p><b>Primary Applications</b></p> <ul style="list-style-type: none"> <li> e-Government</li> <li> Banking &amp; Payment</li> <li> e-Healthcare</li> </ul>
<p><b>Overview</b></p> <p>With a built-in PBOC 3.0-certified Java applet, ACOSJ-P provides a secure and easy application platform for unlocking possibilities and realizing potential in payment and other value-added services.</p> <p>ACOSJ-P supports international cryptographic algorithms and complies with the UnionPay standard. It completely meets the requirements of Debit Credit (DC), electronic cash (EC), QPBOC and other financial applications.</p> <p>With its fast read/write speed, high durability and unique security architecture, a single ACOSJ-P card can house multiple highly secure applications, including banking applications.</p>		
<p><b>Features</b></p> <ul style="list-style-type: none"> <li> 12KB of EEPROM memory for application data</li> <li> Compliance with ISO 14443 Parts 1, 2, 3, 4 <ul style="list-style-type: none"> <li> Supports T=CL direct protocol and fully compatible with ISO 14443 A</li> <li> Supports high-speed transmission rate from 9.6 to 232.2 kbps with modifiable ATR</li> </ul> </li> <li> Supports DES/3DES/3K3DES/AES-128/AES-192/AES-256</li> <li> Supports SHA1</li> <li> Common Criteria EAL5+ (Chip Level) Certified</li> <li> Compliance with Java Card Specification Version 3.0.4</li> <li> Compliance with Global Platform Specification Version 2.2.1</li> <li> Compliance with PBOC3.0 Standard</li> <li> Supports Secure Messaging</li> <li> Supports RSA (up to 2048 bits)</li> <li> Supports SM2/SM3/SM4</li> <li> EMVCo (Chip Level) Certified</li> <li> Supports Anti-tearing function</li> <li> Compliance with Mapping Guidelines 1.0.1</li> <li> Supports Mutual Authentication</li> </ul>		
<p><b>ACOSJ-V VISA Certified EMV Payment Card (Contactless)</b></p> <p>A VISA Certified (Visa Credit, Debit and Prepaid) EMV Payment card solution based on JAVA card platform.</p>		<p><b>Primary Applications</b></p> <ul style="list-style-type: none"> <li> Banking &amp; Payment</li> <li> e-Purse Application</li> </ul>
<p><b>Overview</b></p> <p>ACOSJ-V is Visa Credit, Debit and Prepaid certified and supports all VSDC 2.8.1G functionalities.</p> <p>ACOSJ-V, powered by Java Card Technology, is an advanced EMV payment card solution for financial institutions. It is also compliant with Global Platform card specifications and equipped with powerful cryptographic capabilities for enhancing the security and performance of cryptographic operations and data management needed for financial applications.</p> <p>It is available in contact, contactless, and dual-interface options in both card and module form factors.</p>		

Features	
 Supports T=CL protocol	 Supports AES
 Supports DES/3DES	 Supports RSA (768 to 2048 bits)
 Supports SHA1/SHA224/SHA256/SHA384/SHA512	 Compliance with ISO 14443
 Compliance with JAVA Card Specification Version 3.0.4	 Compliance with Mapping Guidelines 1.0.1
 Compliance with Global Platform Specification Version 2.2.1	 Compliance with VIS 1.5.4b
 Compliance with VCPS 2.1.3b	 Compliance with Visa Prepaid 1.1.3a



## Products - AMI

A. LORA AMR Water Meters	
<p><b>Brand name:</b> LoRa Wireless AMR Water Meter</p> <p><b>Material:</b> brass</p> <p><b>Standard:</b> ISO4064</p> <p><b>Size:</b> DN15~DN25</p> <p><b>Temperature Class:</b> T30, T90</p> <p><b>Battery (life in yrs.):</b> 6-10</p>	 <p><b>LoRa Water Meter Smart Residential AMR</b> LORA wireless water meter using of advanced wireless transmission technology, it transforms metered information of conventional mechanical water meter into electrical signal have it stored by micro-electronics control circuit. It is able to automatically read the metering data via wireless remote network and control the close open of the valve.</p>
<p><b>Brand name:</b> LoRa Wireless AMR Water Meter</p> <p><b>Material:</b> brass</p> <p><b>Standard:</b> ISO4064</p> <p><b>Size:</b> DN15~DN25</p> <p><b>Temperature Class:</b> T30, T90</p> <p><b>Battery (life in yrs.):</b> 6-10</p>	 <p><b>LoRa Water Meter inside house brass</b> LORA wireless water meter using of advanced wireless transmission technology, it transforms metered information of conventional mechanical water meter into electrical signal have it stored by micro-electronics control circuit. It is able to automatically read the metering data via wireless remote network and control the close open of the valve.</p>
<p><b>Brand name:</b> LoRa Wireless AMR Water Meter</p> <p><b>Material:</b> brass</p> <p><b>Standard:</b> ISO4064</p> <p><b>Size:</b> DN15~DN25</p> <p><b>Temperature Class:</b> T30, T90</p> <p><b>Battery (life in yrs.):</b> 6-10</p>	 <p><b>Water Meter LoRa Remote Readout IC Card / Water Meter Lora Digital Intelligent Plastic / Digital Smart LoRa AMR Remote Wireless Water Meter</b> LORA wireless water meter using of advanced wireless transmission technology, it transforms metered information of conventional mechanical water meter into electrical signal have it stored by micro-electronics control circuit. It is able to automatically read the metering data via wireless remote network and control the close open of the valve.</p>
B. NB-IOT AMR Water Meters	
<p><b>Brand name:</b> NB IoT Water Meter</p> <p><b>Material:</b> brass</p> <p><b>Standard:</b> ISO4064</p> <p><b>Size:</b> DN15~DN25</p> <p><b>Temperature Class:</b> T30, T90</p> <p><b>Battery (life in yrs.):</b> 6-10</p>	 <p><b>Water Meter NB IoT Digital Cheap Remote / Smart NB IoT Water Meter</b> LORA wireless water meter using of advanced wireless transmission technology, it transforms metered information of conventional mechanical water meter into electrical signal have it stored by micro-electronics control circuit. It is able to automatically read the metering data via wireless remote network and control the close open of the valve.</p>
C. GPRS AMR Water Meters	
<p><b>Brand name:</b> GPRS AMR Water Meter</p> <p><b>Material:</b> brass</p> <p><b>Standard:</b> ISO4064</p> <p><b>Size:</b> DN15~DN25</p> <p><b>Temperature Class:</b> T30, T90</p> <p><b>Battery (life in yrs.):</b> 6-10</p>	 <p><b>Water Meter GPRS 25mm Smart Smart</b> GPRS Wireless Water Meter blong to high-tech products in the smart water meter, using of advanced wireless transmission technology. It transmission metered information of conventional mechanical water meter to Cloud server via GPRS. It is able to automatically read the metering data via wireless remote network and control the close/open of the valve, and is also able to transfer the data to the back-office system (data center) after reading the meters by a wireless handset reader.</p>
<p><b>Brand Name:</b> GPRS AMR Water Meter</p> <p><b>Material:</b> Brass</p> <p><b>Standard:</b> ISO4064</p> <p><b>Size:</b> DN15~DN25</p> <p><b>Temperature Class:</b> T30, T90</p> <p><b>Battery (Life In Yrs.):</b> 6-10</p>	 <p><b>Water Meter GPRS Smart Systems Brass</b> GPRS Wireless Water Meter Blong To High-Tech Products In The Smart Water Meter, Using Of Advanced Wireless Transmission Technology. It Transmission Metered Information Of Conventional Mechanical Water Meter To Cloud Server Via GPRS. Lt Is Able To Automatically Read The Metering Data Via Wireless Remote Network And Control The Close/Open Of The Valve, And Is Also Able To Transfer The Data To The Back-Office System (Data Center) After Reading The Meters By A Wireless Handset Reader.</p>
<p><b>Brand name:</b> GPRS AMR Water Meter</p> <p><b>Material:</b> brass</p> <p><b>Standard:</b> ISO4064</p> <p><b>Size:</b> DN15~DN25</p> <p><b>Temperature Class:</b> T30, T90</p> <p><b>Battery (life in yrs.):</b> 6-10</p>	 <p><b>GPRS Water Meter Digital Sensor dn15mm</b> GPRS Wireless Water Meter blong to high-tech products in the smart water meter, using of advanced wireless transmission technology. It transmission metered information of conventional mechanical water meter to Cloud server via GPRS. It is able to automatically read the metering data via wireless remote network and control the close/open of the valve, and is also able to transfer the data to the back-office system (data center) after reading the meters by a wireless handset reader.</p>

## D. Prepaid AMR Water Meters

<p><b>Type:</b> Dry-dial  <b>Material:</b> brass  <b>Standard:</b> ISO4064 Class B  <b>Size:</b> DN15~DN25  <b>Temperature Class:</b> T30, T90  <b>Battery (life in yrs.):</b> 6-10</p>	<p><b>IC Card Smart Valve Control Water Meter</b></p> 	<p><b>Type:</b> Dry-dial  <b>Material:</b> brass  <b>Standard:</b> ISO4064 Class B  <b>Size:</b> DN15~DN25  <b>Temperature Class:</b> T30, T90  <b>Battery (life in yrs.):</b> 6-10</p>	<p><b>IC Card Smart Water Meter Split Type</b></p> 
<p><b>Type:</b> Dry-dial  <b>Material:</b> Brass pipe  <b>Standard:</b> ISO4064 Class B  <b>Size:</b> DN32~DN40  <b>Temperature Class:</b> T30  <b>Battery (life in yrs.):</b> 6-10</p>	<p><b>IC Card Smart Water Meter</b></p> 	<p><b>Type:</b> Dry-dial  <b>Material:</b> Cast iron pipe  <b>Standard:</b> ISO4064 Class B  <b>Size:</b> DN15~DN25  <b>Temperature Class:</b> T30  <b>Battery (life in yrs.):</b> 6-10</p>	<p><b>Butterfly Valve Bulk Prepaid Water Meter</b></p> 

## E. Ultrasonic Water Meters

<p><b>Brand name:</b> Bulk Ultrasonic Water Meter  <b>Material:</b> Ductile Iron  <b>Standard:</b> ISO4064  <b>Size:</b> DN15~DN40  DN50~DN300  DN100~DN300  <b>Temperature Class:</b> T30, T50  T70  <b>Max Pressure:</b> 1.6MPa  <b>Battery (life in yrs.):</b> 10</p>	<p><b>Ultrasonic Flow Meter Sensor Smart / Ultrasonic Water Flow Meter Digital Display</b></p>  <p>Ultrasonic water meter is to detect ultrasonic waves in the water downstream and counter current propagation time difference, This new all-electronic water meter is calculated by the program analysis and processing of water flow rate and then calculate the water flow. The meter is of multi-Channel design capable of marking double-section measurements with a highest possible measuring accuracy under various pipe flow conditions. The meter is of a though-bore design and has no mechanical moving parts. Because of no pressure loss, energy consumption of water pumps and hence operating costs of water supply enterprise is drastically reduced. The meter is battery powered with a micropower consumption design and a measuring cycle of one second. It can work uninterruptedly for a period of over 10 years with only one battery (Power consumption: <math>\leq 0.5mW</math>). The meter is high in reliability and is capable of keeping long-term working at any flowrate point without being affected by magnetic interference. It is highly sensitive to a minimal starting flowrate with a high accuracy (A flow velocity as low as 0.002m/s can be detected). It is provided with a multiple output-ting function. Through linking up with GSM for wireless data transmission, a monitoring system can be formed up for minitoring working state of meter and pipe network.</p>
<p><b>Brand name:</b> Bulk Ultrasonic Water Meter  <b>Material:</b> Ductile Iron  <b>Standard:</b> ISO4064  <b>Size:</b> DN15~DN40  <b>Temperature Class:</b> T50  <b>Max Pressure:</b> 1.6MPa</p>	<p><b>Ultrasonic Water Flow Sensor Cheap</b></p>  <p>Ultrasonic water meter is to detect ultrasonic waves in the water downstream and counter current propagation time difference, This new all-electronic water meter is calculated by the program analysis and processing of water flow rate and then calculate the water flow. Large dynamic range is R250 and (Metrological properties) better than Class D. It is designed with a protection class of IP68. The meter can keep on working under long-term submersion in water and works with micro-power consumption technology. A flowrate as low as 1.5L/H can be precisely measured. The meter has no mechanical moving parts. Because of no pressure loss, energy consumption of water pumps and hence operating cost of water supply enterprise is drastically reduced and the service life will be longer. The meter enjoys the merits of being compacted in size and high in stability and anti-interference capability. Thanks to be application of ultrasonic measuring technology, it is possible to mount the meter at any angles without being affected in measuring accuracy. Moreover, the pressure loss of pipe flow can be reduced to a minimum. It supports photoelectric, RS-485 and M-BUS output interfaces and provides Radio Frequency and remote meter data reading functions to facilitate centralized management of users. Whenever the pipe network runs abnormally, the abnormality information can be timely reported to upper level.</p>



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