IEI Smart Factory Solution

IEI's smart factory solution improves the production efficiency and warehouse management accuracy. To catch the wave of automatic assembly, robot system will be a major role along with the machine vision and motion control solutions. For factory automation control terminals, IEI offers industrial computing solutions with robust IP65 design, wide temperature, and flexible add-on card expansion. To elevate the efficiency of warehouse management, IEI provides UHF RFID and 1D/2D barcode reader solutions with various form factors.

Intelligent Energy Management

Intelligent Energy Management

IEI industrial machines can immediately transmit essential operating data — including energy consumption and status. This adds a continuous stream of useful data for plant managers and industrial engineers that can be mined across a facility's machines to detect key trends and worrisome failures. In other words, vital micro machine data gets aggregated into a valuable macro view of a facility.

Warehouse Management System

Warehouse Management System

One big trend in the future is the introduction of "transport systems" in the warehouse. The autonomous vehicles which can sense their surroundings independently using laser scanners, infrared sensors, and RFID chips, and navigate to their respective destinations autonomously.

The autonomous vehicles (autonomous transport robots) can travel on a track, form the basic elements of the solution. The panel PC, mobile computer and embedded computers form the entire control system.
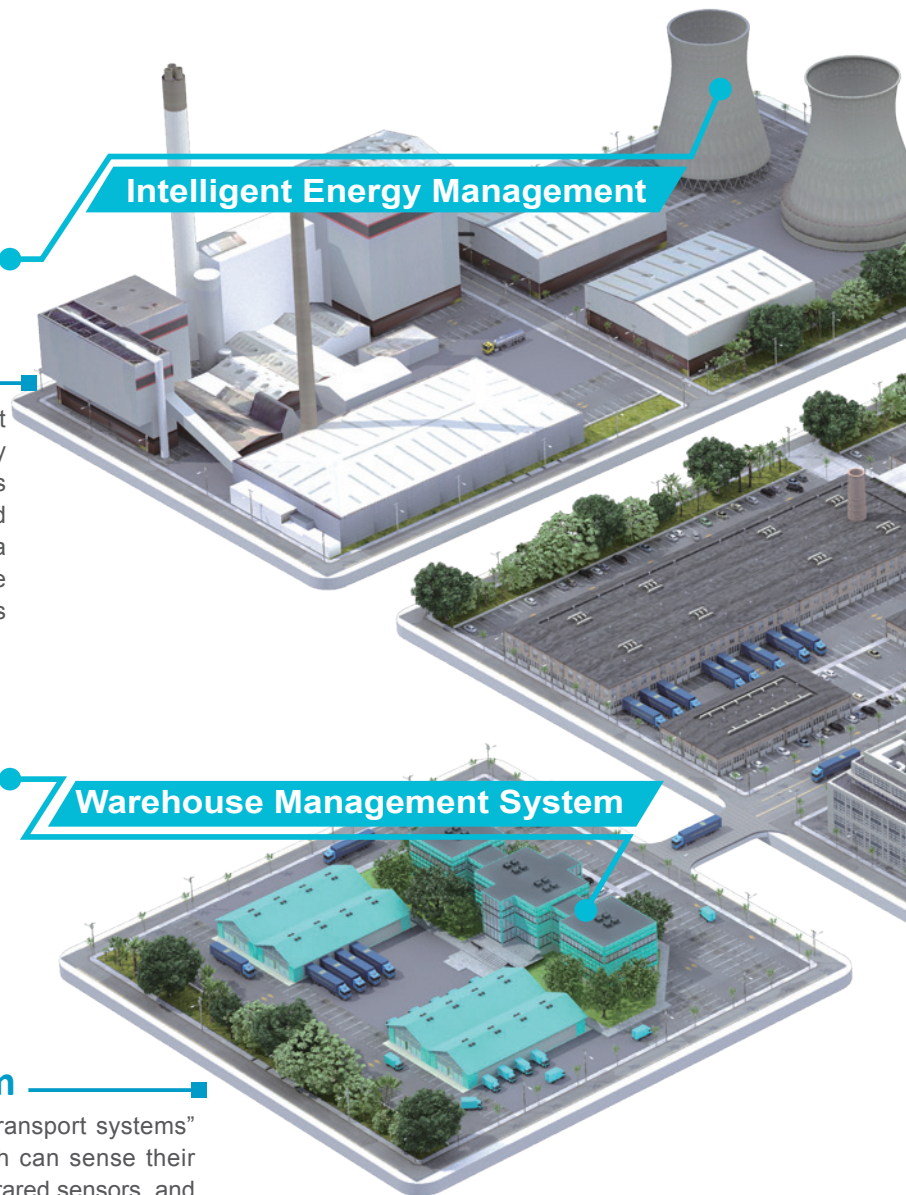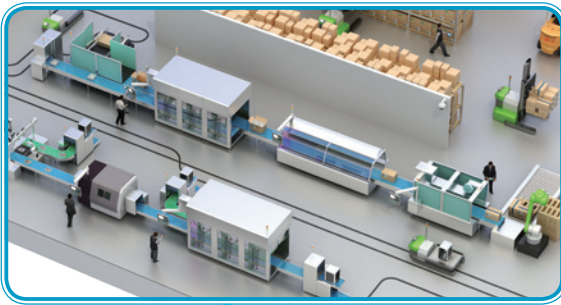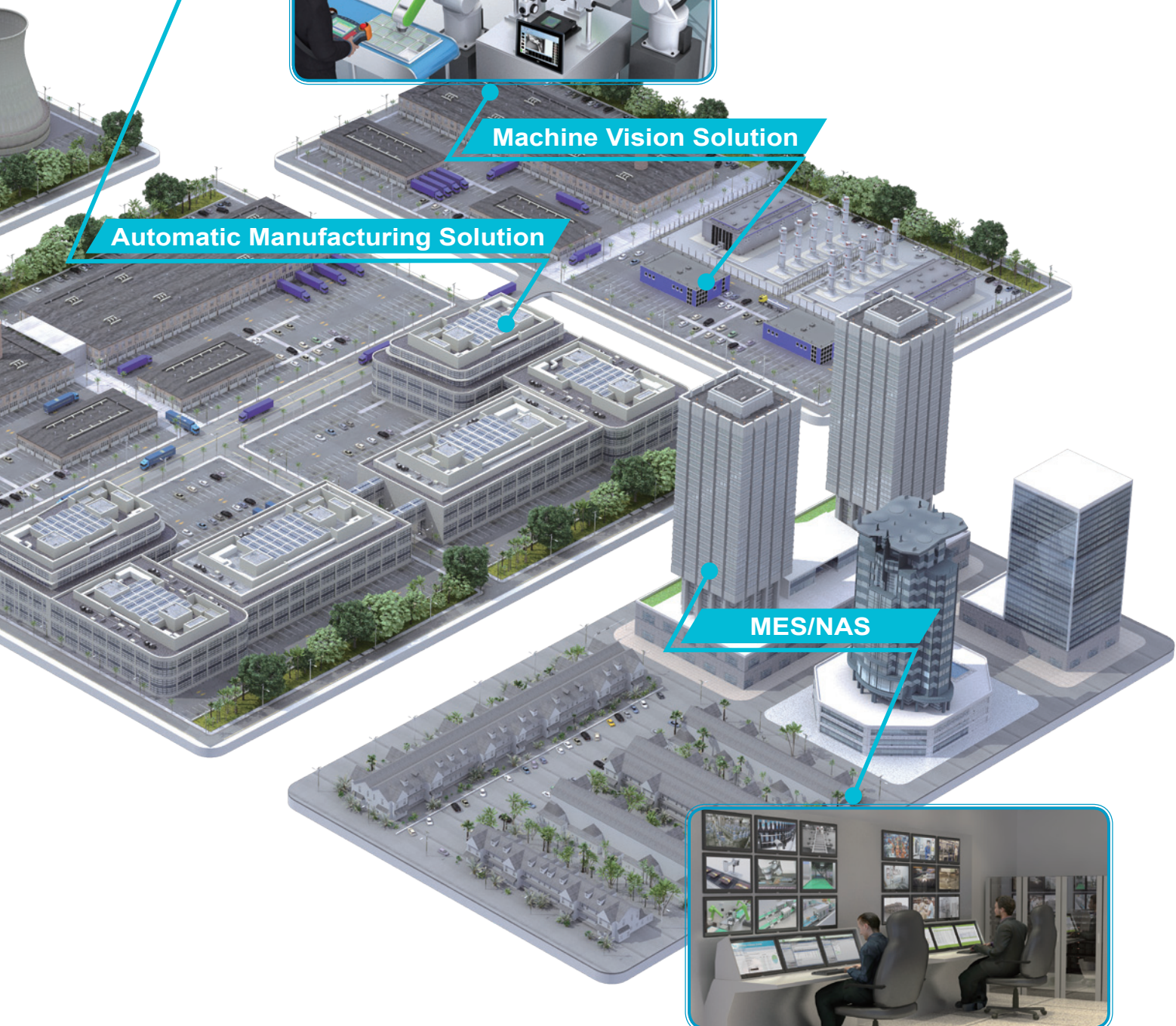
Automatic Manufacturing Solution

Manufacturing processes will increase in flexibility and allow for the economic production of small lot sizes. Robots, smart machines, and smart products that communicate with one another and make certain autonomous decisions will provide this flexibility.

Products, production processes, and production automation will be designed and commissioned virtually in one integrated process and through the collaboration of producers and suppliers.

Machine Vision Solution

Machine vision is the process of applying a range of technologies and methods to provide imaging-based automatic inspection, process control, robot guidance and more.

Machine Vision Solution

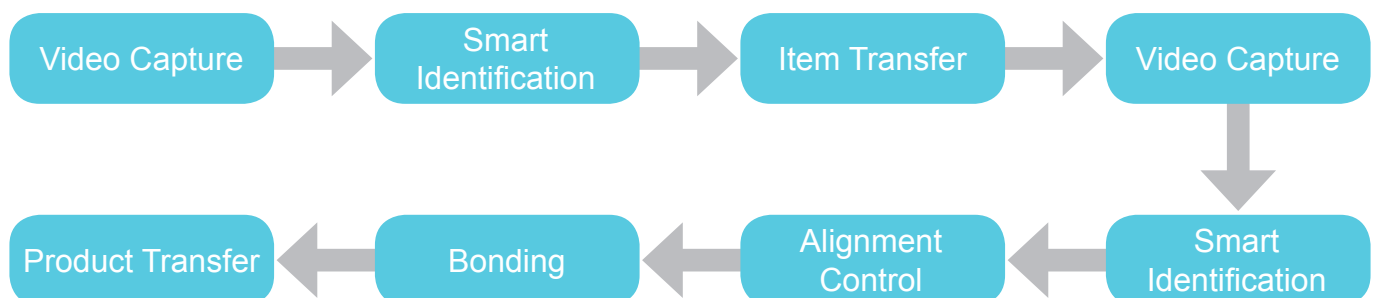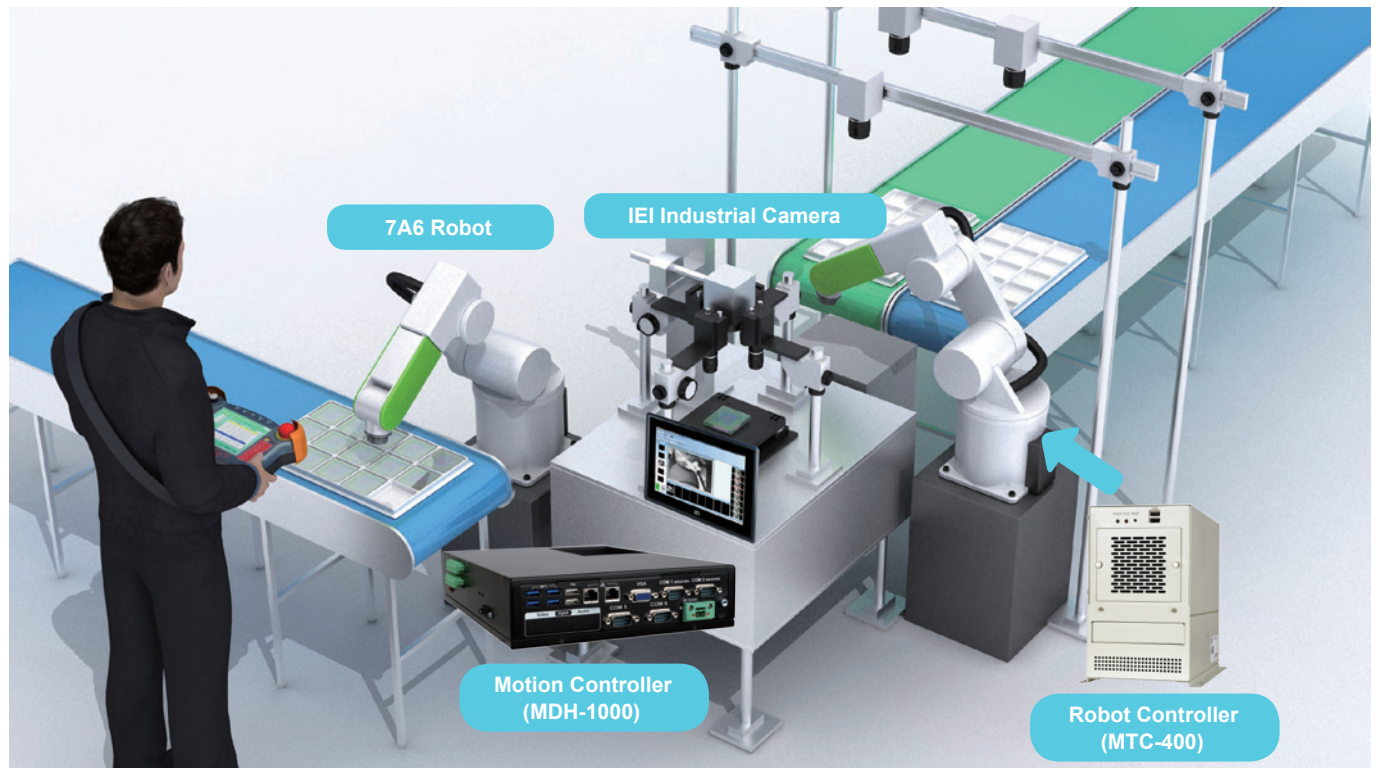**Automatic Manufacturing Solution**

MES/NAS

Automatic Manufacturing Solution

The next wave of manufacturing, Industry 4.0, will affect producers' entire value chain. From design to after-sales service, the production automation will be optimized through the integrated IT systems, robots, smart machines, motion controllers and embedded systems that communicate with one another. IEI provides not only elements of Industry 4.0 but also having a total solution of automatic manufacturing system, including industrial robot system and motion control system integration service.

Automatic Product Line

On a production line, products are conveyed from one process to another by the conveyor belt. Using the video captured by the smart camera, the production location information is sent to the iRX6-MTC400 robot controller. After calculation, the robot controller will send a control command to control the 7A6 robot to grasp the item from the source position and place it on the optical alignment machine. The optical alignment machine is composed of the MDH-1000 integrated motion control system, IEI industrial cameras, and XXY alignment platform. After placing the item on the optical alignment machine, the smart control software of the MDH-1000 will activate the industrial camera to capture images of the item to locate the positioning symbol on the item. After confirming relevant position and angle, the MDH-1000 will control the motion platform to complete alignment and assembly. Then the 7A6 industrial robot will transfer the item to the conveyor belt of the next process to finish the processing work of this station.

7A6 Robot

IEI Industrial Camera

Motion Controller (MDH-1000)

Robot Controller (MTC-400)

Video Capture → Smart Identification → Item Transfer → Video Capture

↓

Product Transfer ← Bonding ← Alignment Control ← Smart Identification

Advanced Robot/Motion Controller Architecture

MTC-400

Robot Control Software →

Robot Arm 7A6

High-performance robotic arms from Motorocon are equipped with genuine HD decelerator from Japan and exclusive robot harnesses imported from Switzerland to ensure product reliability. These robotic arms have high precision, high payload, intuitive operation, high safety, and expandability

● **Functionality and reliability**

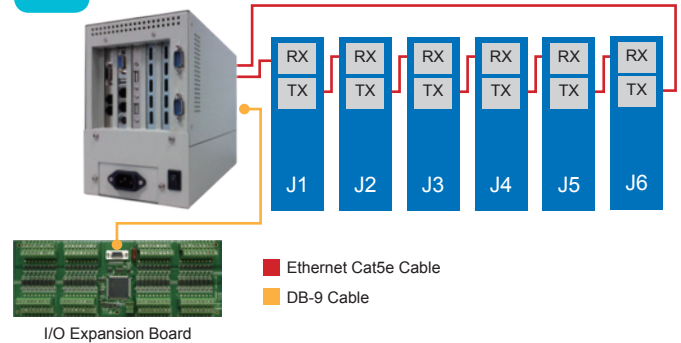The MTC-400 is verified by robotic arm 7A6

● **Further programming development**

Friendly secondary development function for users to equip robots with more functions, such as Visual C++, Visual Basic, BCB, Visual C#, Labvie
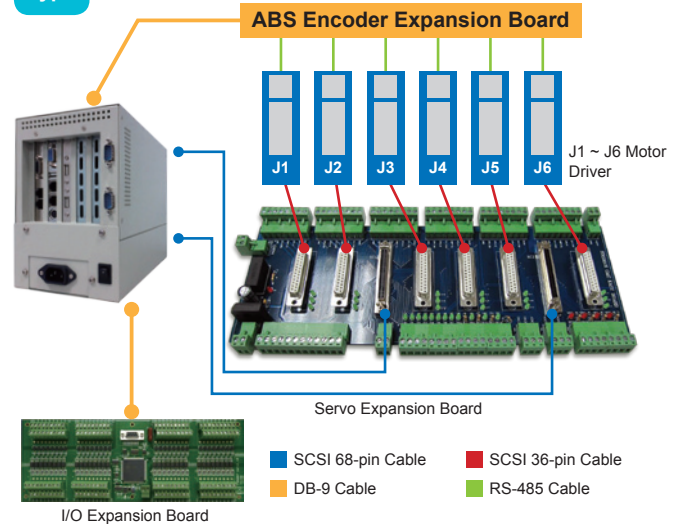
● **Link type**

The Robot Controller can control and link to digital and pulse output motor systems and IT equipped with real-time control and unique singular point estimation functions to ensure the operational reliability of robots.
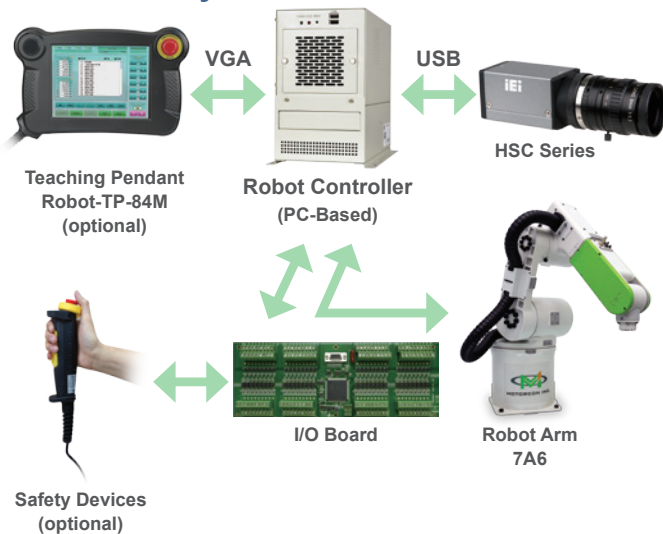
Link Type **Serial digital communication control interface**

RX	RX	RX	RX	RX	RX
TX	TX	TX	TX	TX	TX
J1	J2	J3	J4	J5	J6

I/O Expansion Board

■ Ethernet Cat5e Cable
■ DB-9 Cable

System Architecture

VGA ↔ ... ↔ **USB**

Teaching Pendant Robot-TP-84M (optional)

Robot Controller (PC-Based)

HSC Series

Safety Devices (optional)

I/O Board

Robot Arm 7A6

Link Type **Standard pulse output control interface**

ABS Encoder Expansion Board

| J1 | J2 | J3 | J4 | J5 | J6 |

J1 ~ J6 Motor Driver

Servo Expansion Board

I/O Expansion Board

■ SCSI 68-pin Cable   ■ SCSI 36-pin Cable
■ DB-9 Cable   ■ RS-485 Cable

Economy Robot/Motion Controller Architecture

The motion controller (MDH-1000) is a fanless embedded system integrating industrial computer, motion control card, servo wiring board and I/O wiring board which has multi motion control and multi I/O control functions. The advantages include small size, easy wiring and installation.

USB

Conveyer Belt Motor

Alignment Machine Motor

Alignment Machine Motor

Motor Control 8
Motor Control 7
Motor Control 6
Motor Control 5

Motor Control 4
Motor Control 3

Motor Control 1
Motor Control 2
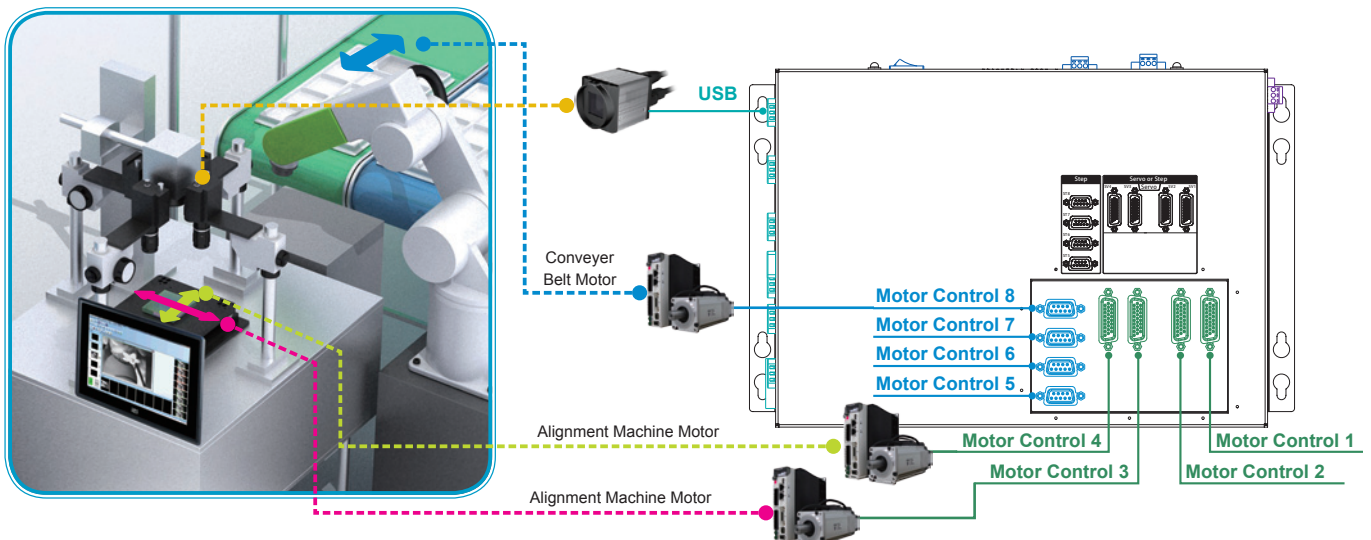
Automated Guided Vehicle

The motion controller (MDH-1000) is a fanless embedded system integrating industrial computer, motion control card, servo wiring board and I/O wiring board which has multi motion control and multi I/O control functions. The advantages include small size, easy wiring and installation.The 4-axis servo motor for motion control which is compatible with the absolute servo systems from different manufacturers, including Panasonic, Delta, Gotrend, Sankyo, etc. It has great compatibility to use in the motion control applications.

USB — USB Camera

VGA — DM-F Series

MDH-1000

Motor Control 8
Motor Control 7
Motor Control 6
Motor Control 5

Output — Headlight

Motor Control 1
Motor Control 2
Motor Control 3
Motor Control 4

Tires

Automated Guided Vehicle Architecture

QNAP NAS

ICECARE-10W
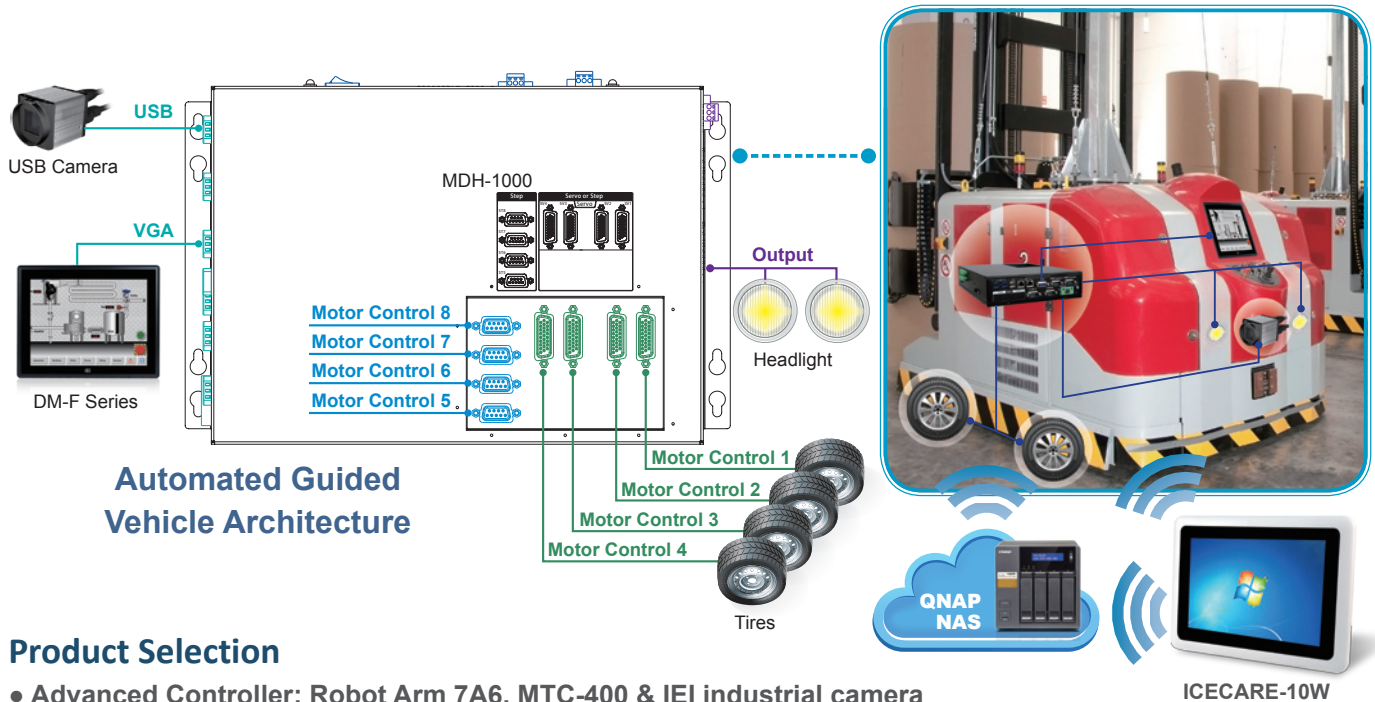
Product Selection

● **Advanced Controller: Robot Arm 7A6, MTC-400 & IEI industrial camera**
● **Economy Controller: MDH-1000 & IEI industrial camera**

7A6
Robot Arm
● Payload: 7kg
● Rotation: 6-axis
● Speed: 6165 mm/s

Robot-TP-84M
8.4" Easy-to-use Control Terminal
● Completely dust and splash proof (IP 64) design
● Safety functions: emergency stop, 3-position deadman switch, mode selection switch.

MDH-1000
Motion Controller
● Fanless design
● 8 axes of pulse type motor control
● 4-axis servo/step motor and 4-axis step motor
● Pulse output support A/B Phase, Pulse/Dir, CW/CCW mode

DM-F Series
IP 65 Flat Bezel Industrial Monitor
● 6.5" to 24" resistive/PCAP monitor
● Extended operating temperature: -20°C ~ 60°C

USB3 Vision camera Series
HSC-13M3-O
● On-Semi PYTHON 1300 CMOS sensor
● Resolution 1280x1024

HSC-13C4-E
● E2V CMOS sensor
● Resolution 1280x1024

MTC-400
Robot Controller
● Supports 3~6 axes vertical articulated robot, SCARA robot, delta robot
● Multi-axis contouring accuracy and command resolution of +/-0.001mm and +/-0.001°

Advanced Controller Applications

● Loading/Unloading
● Screw Locking
● Cutting
● Gluing Robot
● Palletizer
● Welding Robot
● Picking/Packing
● Transport
● Grinding
● Assembly

Economy Controller Applications

● Alignment System
● Automatic Guide
● Automatic Production Line
● Automatic Test Machine
● Machine Vision
● Position Control
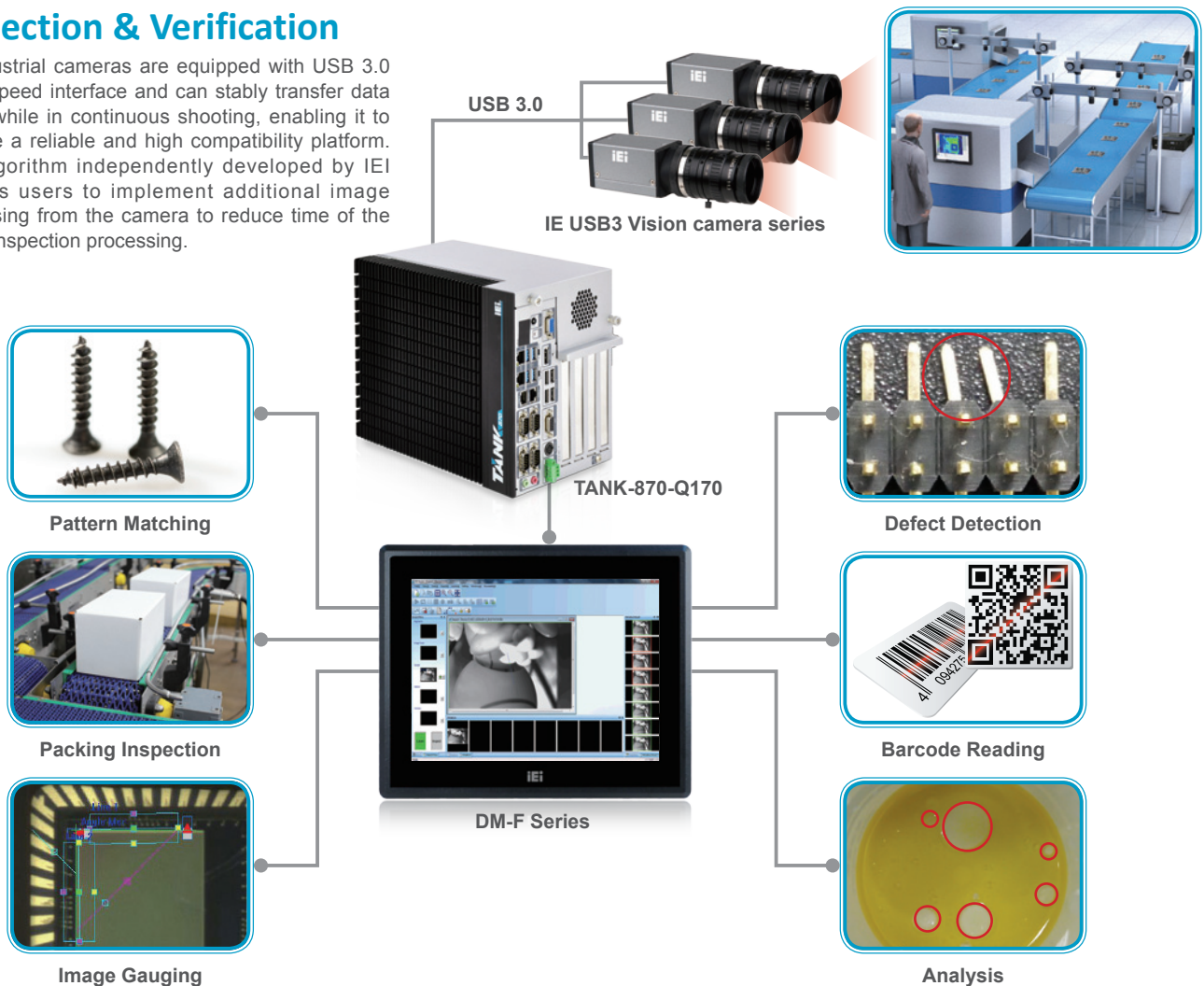● Production Line Control System

Machine Vision Solution

Machine vision is a replacement for human vision and judgment by using video cameras, software and computers to perform an inspection task, such as gauging, counting as well as barcode and optical character reading (OCR). IEI designs and develops advanced industrial cameras, barcode readers and embedded computers, which can be used to perform reliably at higher speed and with greater precision.

Inspection & Verification

IEI industrial cameras are equipped with USB 3.0 SuperSpeed interface and can stably transfer data to PC while in continuous shooting, enabling it to become a reliable and high compatibility platform. The algorithm independently developed by IEI enables users to implement additional image processing from the camera to reduce time of the image inspection processing.

USB 3.0

IE USB3 Vision camera series

TANK-870-Q170

DM-F Series

Pattern Matching

Packing Inspection

Image Gauging

Defect Detection

Barcode Reading

Analysis

IEI Smart Factory Solution

Product Selection: HSC-13M-O/HSC-13C4-E & TANK-870-Q170

IPMI 2.0 Compliant

TANK-870-Q170
- Support three independent video outputs
- Support IEI iRIS-2400 (IPMI 2.0 compliant)

USB3 Vision camera Series

HSC-13M3-O
- On-Semi PYTHON 1300 CMOS sensor
- Resolution 1280x1024

HSC-13C4-E
- E2V CMOS sensor
- Resolution 1280x1024

TANK-6000-C226
- Support IPMI 2.0 via IEI iRIS solution
- Workstation with Intel® C226 chipset

IPMI 2.0 Compliant

IMBA-Q170-i2
- Support triple display with HDMI/DVI/VGA
- Support USB 3.0, SATA 6Gb/s and PCI Express Gen3
- Support IPMI 2.0 via iRIS-2400 module

DM-F Series
- Robust IP 65 aluminum front bezel
- HDMI/DisplayPort/VGA flexible video input solution

IMBA-BDE
- Intel® Xeon processor D-1500 product family
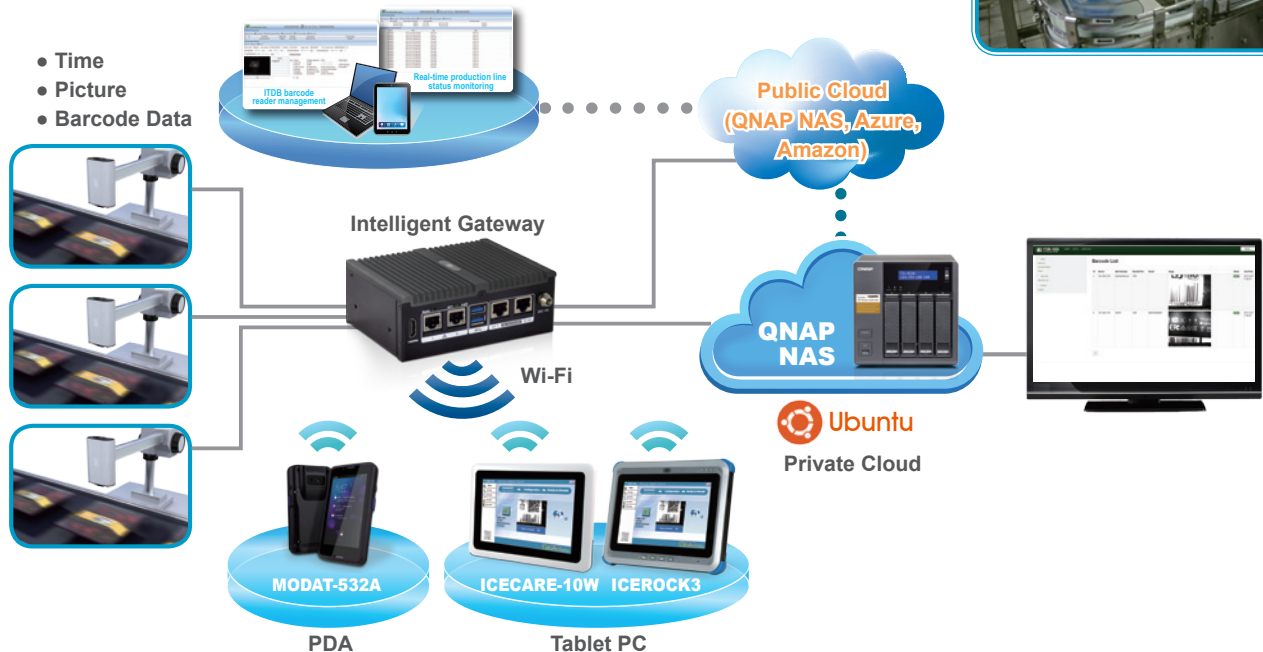- Intel® 10 GbE supported

Applications

- Quality Checking
- Subassembly Verification
- Packing Inspection

IoT High Speed Barcode Reader

Installing ITDB Series barcode reader with QNAP NAS system allows you to manage your production lines in a more efficient way. The NAS can act as a private cloud or a public cloud. An ITDB system that runs over an IP network infrastructure enables the decoded images and results to be distributed to any number of sites, within the constraints of available bandwidth.

IoT 1D/2D Barcode Reader Solution

- Time
- Picture
- Barcode Data

ITDB barcode reader management

Real-time production line status monitoring

Intelligent Gateway

Wi-Fi

Public Cloud (QNAP NAS, Azure, Amazon)

QNAP NAS

Ubuntu
Private Cloud

MODAT-532A
PDA

ICECARE-10W ICEROCK3
Tablet PC

Product Selection: ITDB 100 Series and QNAP NAS ES1640dc v2

ITDB-100L / ITDB-100HD

High Speed 2D Barcode Reader

Supporting remote monitoring and control via PC/NAS/Android phones & tablets

ES1640dc v2
- Dual active controllers, NVRAM cache, dual mini-SAS channel backup, 40GbE-ready, SAS 12Gb/s-enabled
- Data deduplication and compression allows hosting over 500 VDI in one chassis
- Near-limitless snapshots and supporting VMware®, Microsoft® Hyper-V, KVM and advanced virtualization features

Applications

- Logistics
- Airport
- High-speed Manufacturing Line

Intelligent Energy Management

With a growing interest in renewable energy resources globally, the sun and the wind have become one of the most rapidly growing eco-friendly alternative energy sources in the recent years.

By using solar thermal panels and wind turbines, both sunlight and wind are transformed into electricity ready to be consumed at factory and any other establishments that require electricity. These two will be the most important power production units of any hybrid system up to date.

Information about power production and consumption will be collected and used by the control unit to create profiles of power consumption/production for each source/load of the system. Once these profiles are created a better and tighter management can be deployed.
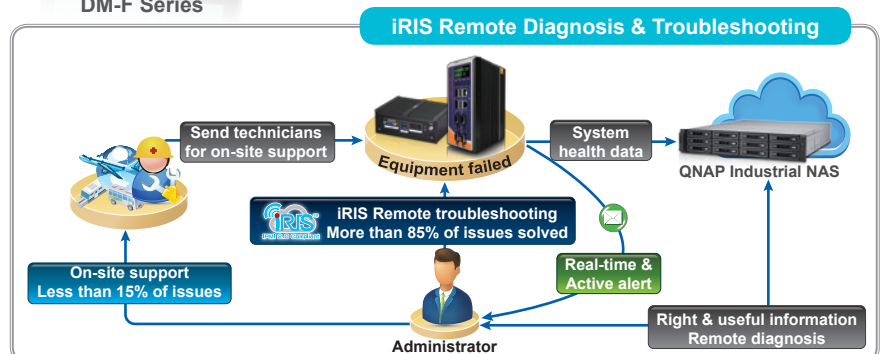

Energy Data Collection & Analysis

Information technology adds intelligence to factories from design to the end of the process. Today's technologies automate the collection, storage and retrieval of data from across multiple factories and factory sub-systems to make that data available for decision makers, from facility managers to supervisors.

Energy Source

Data Collector

Data Analysis

I/O Module

DRPC

uIBX

Wind Turbine

Solar Power

DM-F Series

- **Wide Temperature Support**
  Devices under hazardous weather -20ºC ~ 60ºC
- **Intelligent Remote Control Management**
  » iRIS modules compliant with IPMI 2.0
  » Fault detection and diagnostics save energy by quickly identifying inefficiencies and operational problems, helping managers achieve and sustain high performance.

- **Energy Information**
  Data dashboards display information like load profile analysis, energy usage benchmarking, utility rate benchmarking, and energy budget tracking.

Product Selection

DRPC series & uIBX series

iRIS ™
IPMI 2.0 Compliant

DRPC Series

uIBX Series

iRIS Remote Diagnosis & Troubleshooting

Send technicians for on-site support

Equipment failed

System health data

QNAP Industrial NAS

iRIS Remote troubleshooting More than 85% of issues solved

On-site support Less than 15% of issues

Real-time & Active alert

Right & useful information Remote diagnosis

Administrator

Warehouse Management System (WMS)

Material input/output management and examination are the duty of a warehouse. As quantity inconsistency is the most common problem in handwritten vouchers, personnel will be unable to capture the exact quantity of material input, shipping, and stock and implement first in first out (FIFO) control. Even worse, personnel will need to spend more time on finding raw materials, and can not trace incoming materials effectively. IEI thus introduces Warehouse Management System (WMS) to provide convenient and traceable management through cloud computing. The benefits of the WMS include:

- Ensure traceability for raw material input and product shipping.
- Shorten material selection and shipping time.
- Enhance warehouse management efficiency and accuracy.
- Ensure real-time warehouse information.
- Minimize customer complaints from man-induced mistakes.
- Enable real-time capture of fleet status and enhance vehicle dispatch flexibility.

Smart Warehouse Management Solutions

Deliveryman can scan the delivery receipt through the barcode reader to upload goods data back to the goods management system for instant update.

ICEROCK3-T10

- Mobile device with 10.1" LCD PCAP touch and IP 64 compliance
- Support NFC/RFID and barcode reader
- GPS, 3G, Wi-Fi
- Dual battery power
- Suitable for delivery personnel

MODAT-532A

- Hand-held device with 5.3" LCD PCAP touch and IP 67 compliance
- Suitable for delivery personnel
- Support NFC and barcode reader
- GPS positioning, 4G, Wi-Fi connection

AFL3-12A Panel PC

- IP 64 compliant front panel with multi-touch
- Equipped dual LAN (GbE), Wi-Fi
- Optional 2D barcode reader
- Suitable for warehouse management

ICECARE-10W

- Hand-held device with 10.1" LCD PCAP touch
- Support NFC/RFID and barcode reader
- GPS positioning, 3G/Wi-Fi
- Suitable for warehouse personnel

The warehouse personnel can use the barcode reader to scan barcodes of stock-ins and stock-outs information then upload the stock data to the inventory management system for instant update.

The AFL3/INOX/PPC-F/UPC panel PCs support wide-range operating temperature so that they can be deployed in any high-orlow-temperature warehouses.

Fleet Logistics Applications

Fleet management and dispatching efficiency can be improved by taking the advantages of the 3G connection of the IKARPC panel PC to send real-time information to the dispatching center for confirming vehicle locations (GPS) and driving conditions (OBD-II). The IVS-100-BT in-vehicle system not only has the features mentioned above, but it also supports driving condition recording by installing video capture system, and features UHF-RFID for real-time goods monitoring, allowing users to easily and instantly manage and control the fleet and goods.
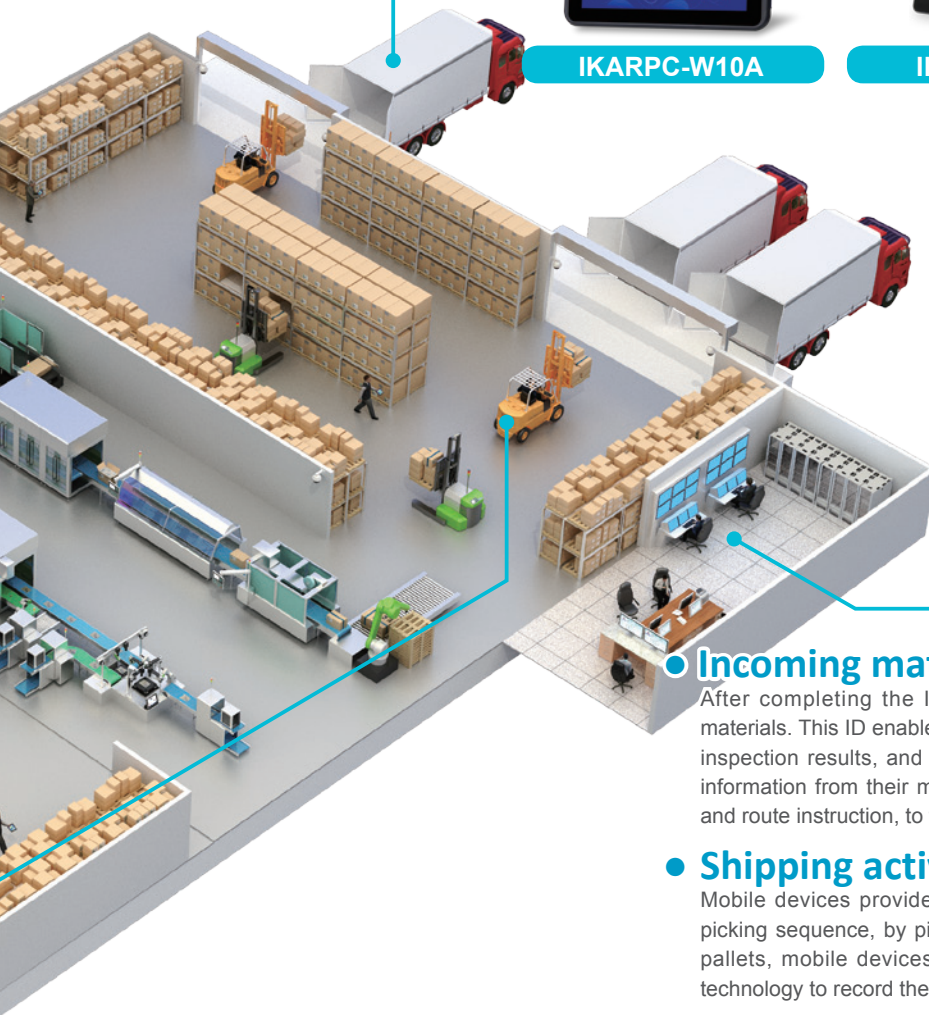
IKARPC-W10A

IKARPC-07A

IVS-100-BT

QNAP NAS

Incoming materials

After completing the IQC inspection, the system generates an ID for raw materials. This ID enables users to trace the supplier, material incoming date, IQC inspection results, and supplier lot number. Warehouse personnel can retrieve information from their mobile devices, including the storage lot of raw materials and route instruction, to facilitate slotting raw materials.

Shipping activities

Mobile devices provide picking personnel shipping list to manage picking by picking sequence, by picking route, and by FIFO. When shipping products with pallets, mobile devices will collect the product ID on the shelve using RFID technology to record the shipping order and transportation information.

INOX-F15A
- IP69K Touch panel PC
- SUS304 Stainless Steel Housing

UPC
- Full IP66 touch panel PC
- Wi-Fi, Bluetooth supported
- Optional RFID reader
- Suitable for forklift application

AFL3 Panel PC
- Support multi-touch, IP 64 compliant front panel
- Equipped dual LAN (GbE) and Wi-Fi

PPC-F Series
- PPC-F heavy industrial panel PC
- Support multi-touch, IP 65 compliant front panel
- Equipped dual LAN (GbE) and Wi-Fi

Warehouse Management: Receiving/Dispatching Materials

Receiving

- Handheld device application: After receiving goods and signing on the delivery man's handheld device, the cloud-based inventory management system will be updated in real time.

ICEROCK3-T10

MODAT-532

Receiving/ Dispatching Materials

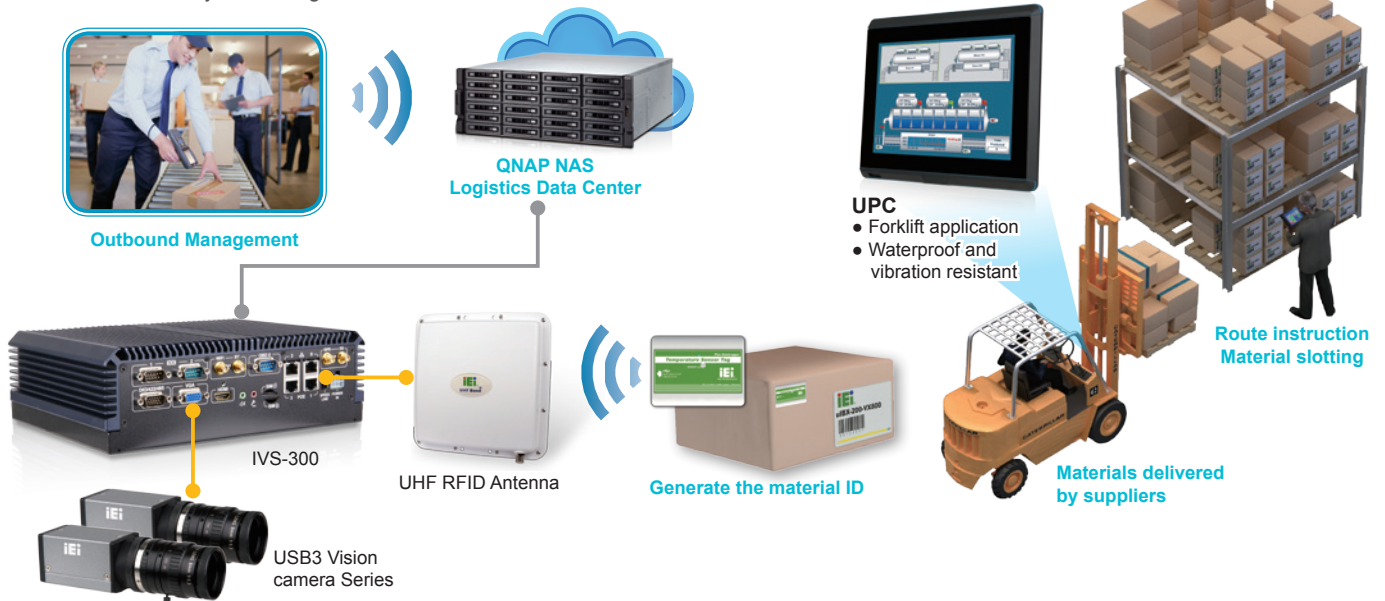**QNAP NAS Logistics Data Center**

Receiving/Dispatching

- AFL3/PPC-F series with barcode reader can be used to scan the barcode of the incoming/outgoing package.
- ICECARE-10W mobile device are both equipped with barcode reader to scan package barcodes easily
- Data can be uploaded to the cloud immediately

Order Picking

AFL3-12A

PPC-F Series

ICECARE-10W

Warehouse Management: Inbound/Outbound

- Automation system for scanning incoming/outgoing goods
- Warehouse security monitoring

Outbound Management

QNAP NAS Logistics Data Center

UPC
- Forklift application
- Waterproof and vibration resistant

Route instruction Material slotting

IVS-300

UHF RFID Antenna

Generate the material ID

Materials delivered by suppliers

USB3 Vision camera Series

Fleet Management

- GPS for vehicle tracking
- 3G/4G capability for data transmission
- OBD-II interface for vehicle diagnosis

GPS

3G/4G

Remote Management

Management Center

Server-Side Software

IKARPC-W10A

IKARPC-07A

IVS-300-ULT3/IVS-300-BT

MES

MES Software System Solution

Most manufacturing industries require a lot of labor work in production, production line and equipment management, and production data collection. While modern manufacture-based enterprises need to face land acquisition difficulty, labor cost rise, and labor recruitment difficulty, new employees who are not familiar with production operation will increase defect rate. How to implement effective control has become a real problem to many manufacture-based enterprises.

Advantages of smart solutions

- Enable process management and optimization. Increase product tractability.
- Provide production scheduling and effective management for production quantity.
- Provide electronic SOPs to enhance product yield rate.
- Ensure equipment management and integration for effective labor hourmanagement and equipment availability.
- Implement automation to reduce labor costs and stabilize production rhythm.

Smart operation

- ID creation: After IQC inspections, an ID (barcode or RFID) is assigned to the material to accelerate information collection and accuracy in the production process.
- Information analysis: Production data is digitized for production scheduling and management to generate real-time data regarding schedule accomplishment rate, quality report, and production.
- Automatic material replenishment: Materials are fed to each station by means of the AGV system to reduce storage space on the production line.
- Electronic SOP: Provide clear and correct SOPs to each station to ensure the correct version is in place.
- Equipment monitoring: Integrate data of production equipment, monitor equipment status, and provide equipment parameters.
- Robotic arm: Assists in routine handling operation and stabilize production pace.
- Quality management: Measure product quality after production and manage product quality analysis.

Production record

Products are effectively recorded during production with traceability to to their in-process quality analysis, installed parts and components, suppliers and customers, and transportation methods.

Product Selection

TANK Series and QNAP NAS
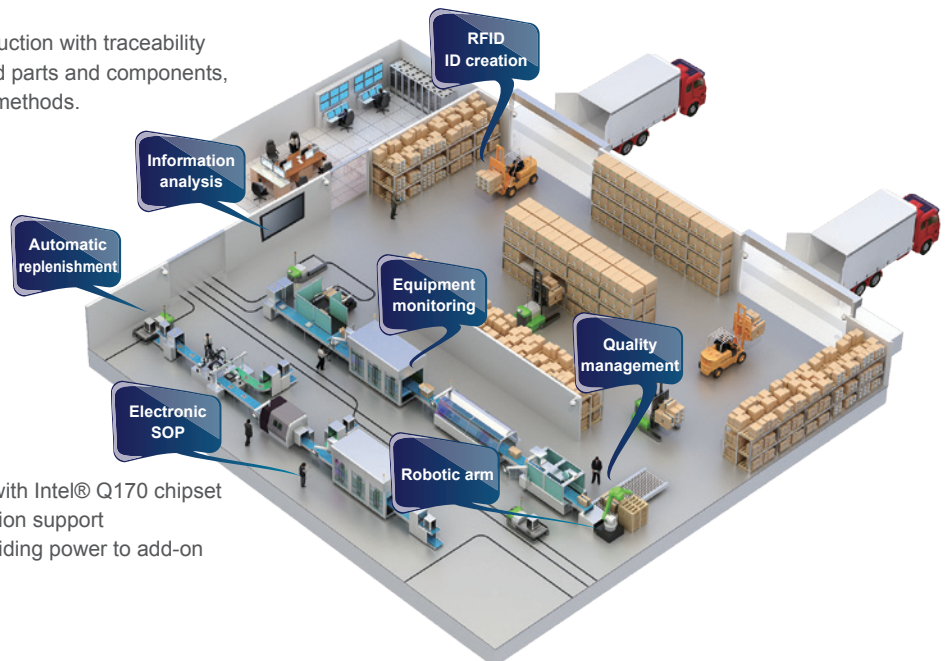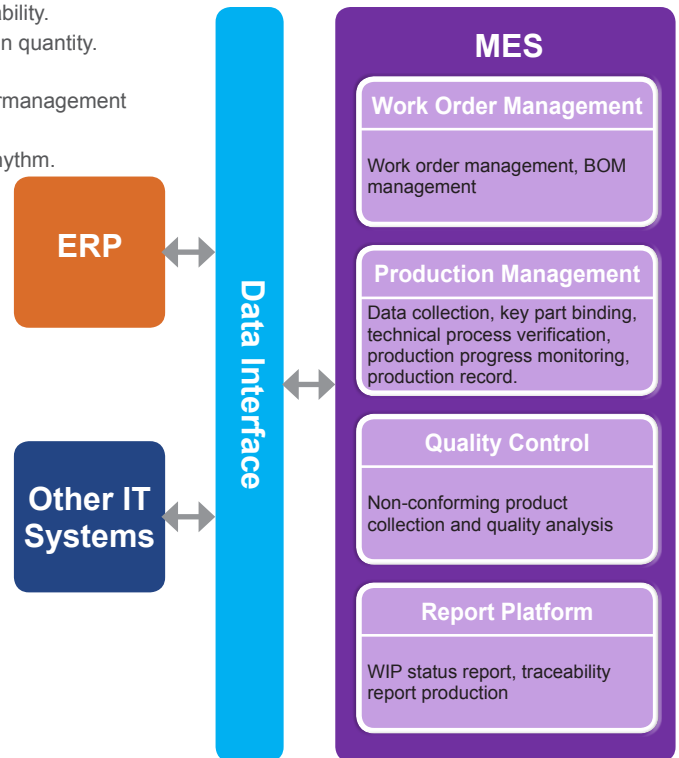
TANK-870-Q170
- 6th Gen Intel® Core™ processor platform with Intel® Q170 chipset
- Triple independent display with high resolution support
- On-board internal power connector for providing power to add-on cards

TVS-ECx80U-SAS Series
- 10GbE-ready, up to 3,800+ MB/s throughput and 268,000+ IOPS for breakthrough performance
- Qtier Technology: Auto tiering crucial to storage efficiency
- Built-in 256GB mSATA modules for caching

System Framework

ERP

Other IT Systems

Data Interface

MES

Work Order Management
Work order management, BOM management

Production Management
Data collection, key part binding, technical process verification, production progress monitoring, production record.

Quality Control
Non-conforming product collection and quality analysis

Report Platform
WIP status report, traceability report production

RFID ID creation

Information analysis

Automatic replenishment

Equipment monitoring

Quality management

Electronic SOP

Robotic arm

Applications

- Industry Workstation