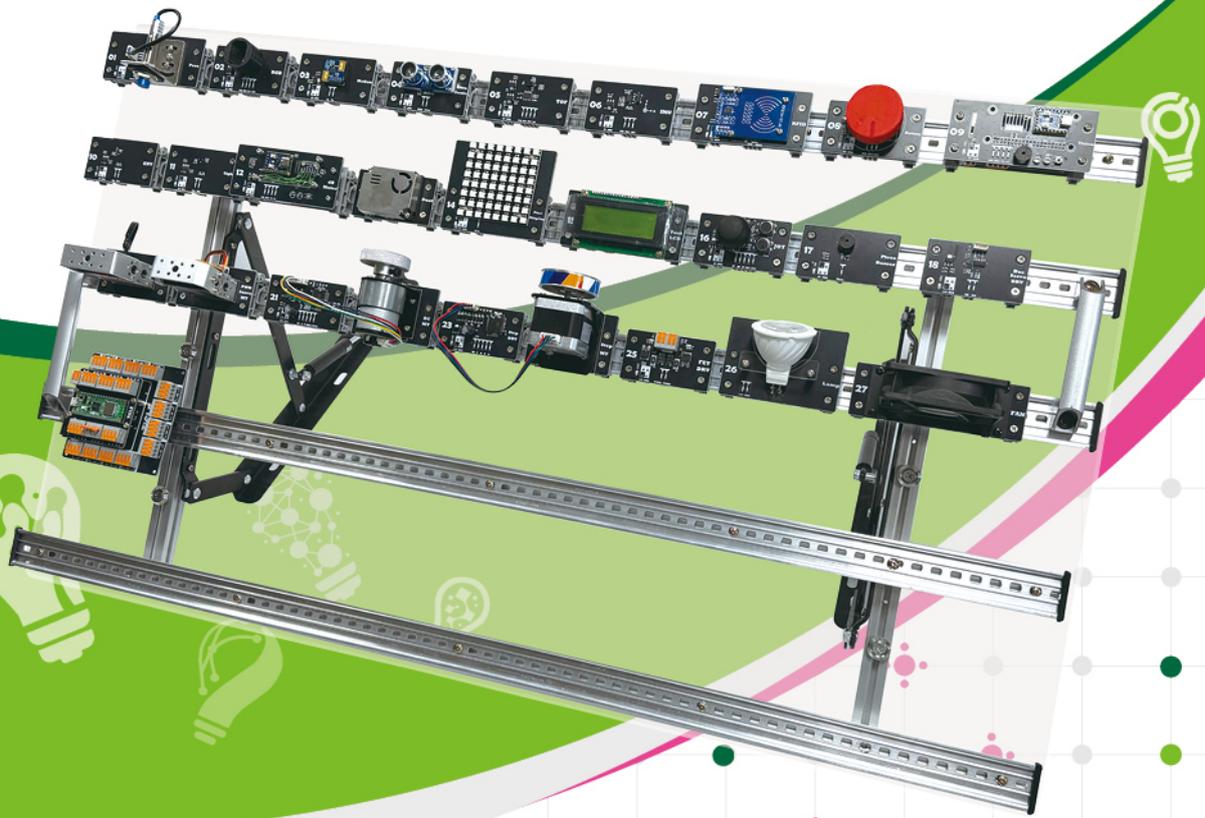# Modular Physical Computing Training Equipment

Immediately Implementing Logistics and Manufacturing Sensing Scenarios

TICLE Sensor

HANBACK ELECTRONICS

Since 1984

Homepage

TICLE Sensor

- Modular Physical Computing Training Equipment that immediately implements logistics and manufacturing sensing scenario without soldering or breadboard
- Support real-time and non-real-time job separation through Dual -Core ARM Cortex-M33 Main Processor
- Rapidly replace sensor/actuator and optimize PBL repetitive experiment through lever connector-based free wiring
- Freely place/rearrange module with clip bracket + layout board of DIN Rail structure for industrial equipment, Resistant to collision/vibration and Quickly configure Line Tracing, Conveyor and Sorting Layout
- Provide object identification/distance/position/posture/speed/recognition sensor and drive/feedback actuator to implement advanced PBL project
- Power module corresponds to various devices (ex: DC motor 12 V, servo 5 V, logic 3.3 V)
- Pop Plus library makes it possible to pipeline Sensing → Control → Actuator with a few lines in MicroPython, extending to physical AI creation
- Provide open-source MQTT broker that supports SSL/TLS encryption/authentication, QoS/topic-specific ACL
- Provide Python/MicroPython integrated development environment including real-time log·serial console·firmware transfer·package management
- Configurate no-code Android/IOS remote control GUI with Blynk example
- Provide physical AI application example based on PySide6·Vision perception·AI STT

Software Specifications

Embedded Runtime Environment for MCU

- MicroPython Version 1.26 or higher
- Supports PIO 0 - 3 (12 state machines)

Pop plus Library for MCU

- upaho, ublynk, ufilter, utools, Din, Dout, Adc, Pwm, I²C , ReplSerial
- Multiple control components (Button, Relay, Servo, Ultrasonic etc)

Integrated Development Environment for PC

- replx with VSCode
- Real-time log/serial console, firmware transfer, package management work-flow

Hardware Specifications

WorkCell Base

Size : 920 x 550 mm
For module layout and cabling
· 5ea DIN Rail Block

Core

Size : 65 x 85 mm
Dual Core ARM Cortex-M33
· Equipped with DSP, single-precision FPU · providing a simplified double-precision (F64) calculation coprocessor
Connectivity : Wi-Fi, Bluetooth, UART, USB
Interface
· 26 GPIOs based on lever connector. +5V Tolerant

Power

Size : 150 x 70 mm
Interface
· +12V DC In · +12V Lever Connector 4 ea · +5V Lever Connector 20 ea · +3.3V Lever Connector 4 ea · GND Lever Connector 24 ea

Object Detection Block

Proximity Inductive Sensor

- GPIO interface
- Detects the presence of metallic objects

Color Sensor

- I²C Interface
- Red, Green, Blue (RGB), and White Light Sensing with IR Blocking Filter

Motion Sensor

- Asynchronous serial communication
- Detection Distance : 900 cm
- Beam Angle : 100° x 40°
- Eye Safe : Class 1 laser device compliant

Distance Measurement Block

Ultrasonic Sensor

- GPIO interface
- Effectual angle : <15°
- Ranging distance : 3 – 200 cm

TOF Sensor

- I²C Interface
- Emitter : 940 nm invisible Class 1 VCSEL (vertical cavity surface-emitting laser)
- Resolution : 1 mm depth, 4×4 or 8×8 sensor zones
- Ranging distance : 3 – 300 cm

Positioning Block

9 Axis IMU Sensor

- I²C Interface
- 16bit gyroscope, 14bit accelerometer and a full performance geomagnetic
- Outputs : Quaternion, Euler angles, Rotation vector, Linear acceleration, Gravity, Heading

Identification Block

RFID Reader & Tag

- SPI Interface
- Operation Frequency : 13.56MHz
- Supported card : mifare1 S50, mifare1 S70, mifare UltraLight, mifare Pro, mifare Desfire

Positioning & Speed Measurement Block

Magnetic Rotary Encoders

- I²C Interface
- 360° contact-less angle position sensor
- Angle accuracy 0.05° after system linearization and averaging

Object Detection & Identification Block

Vision Sensor

- GPIO(Trigger IO), UART, Wi-Fi Interface
- 1080p30 / 720p60 / VGA 90 fps
- 1D(EAN-13 / EAN-8, UPC-A / UPC-E, Code 128, Code 39, Interleaved 2 of 5 (ITF)), 2D(QR Code)
- Color Detection, Object Detection
- CMOS 5M Image Sensor (default)
- CMOS 12M Image Sensor (option)

Environmental stability Block

Environment Sensor

- I²C Interface
- Relative humidity : 0% – 100%, ±0.008%RH
- Temperature : –40℃ – +85 ℃, 0.01℃
- Pressure : 300hPa – 1100hPa, 0.18PA, highest over-sampling
- Gas : IAQ, bVOC & CO2 equivalents (ppm), Gas scan result (%) & Intensity level

Acoustic Sensor

- GPIO(Trigger IO), UART, Wi-Fi Interface
- MEMS with a range of about 60Hz – 20KHz
- SPL Measurement: Fast (125 ms) / Slow (1 s) / Impulse (35 ms)
- FFT/Spectrum : N=512/1024/2048
- Smoothing : Number Weighted (EMA), Moving Average
- Voice/environmental sound sensing

Dust Sensor

- I²C Interface
- Particle size range : 0.3㎛~ 10㎛
- Resolution : 1 ㎍/m

Light Sensor

- I²C Interface
- range : 1 – 65535 lux

Actuators for Sensor Test

RGB LEDs

- One wire digital control Interface
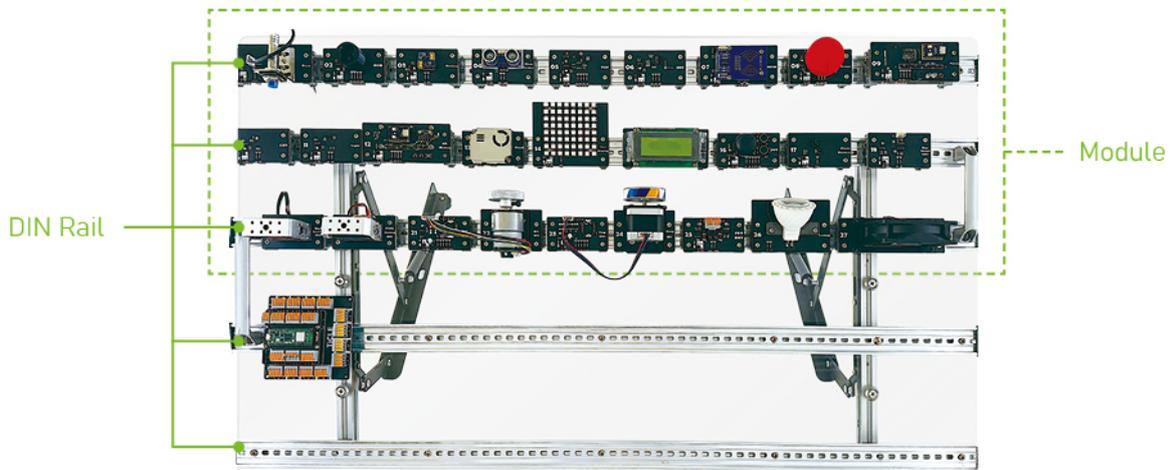- RGB LED 64ea

Text LCD

- I²C Interface
- 20 characters x 4 Lines

Joystick with Button

- ADC / GPIO Interface
- Joystick X / Y
- Button Switch 2ea

Lamp : 12V DC LED

Motors

- 5V Serial Bus Servo Motor
- 5V PWM Servo Motor
- 12V DC Motor with encoder
- 12V DC Fan
- 12V Step Motor

Sound : Piezo Buzzer

Layout

Module

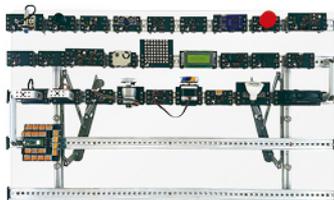DIN Rail

Training Contents

- Digital/Analog IO, Switch/Indicator
- DC Motor + Encoder – Speed Control
- Bus Serial Servo – Position/Gate Operation
- Logistics Identification I
  – Proximity Inductive, Color, PIR
- Distance Sensing – Ultrasonic vs ToF

- Inertial sensing – 9-axis IMU and filtering
- ID tracking – RFID
- Camera-based vision – marker/color tracking
- Environmental sensing – temperature/humidity gas/barometric pressure/illumination
- RT/NRT separation and scheduling

Components

TICLE-Sensor

Micro B Type Magnetic
USB Cable

DC 5V 4A
Adaptor

Male to Male Jumper
Cable 1set

* The above information is subject to change or modification due to product upgrades or other reasons.