

## Modular Industrial IoT interface hardware solution

Designed for industrial and commercial IoT monitoring and interface applications where reliability, rapid development and deployment are demanded. The Zen IoT hardware and monitoring solution delivers robust end to end field measurement to cloud service integration.

- › **Industrially hardened design and direct process interface design**
- › **IoT edge processor with real-time OS**
- › **Sophisticated embedded input conditioning and control functions including signal processing filters and alarms**
- › **Modular construction supports up to 22 measurement inputs, 8 analog output channels and up to 40 digital IO (including up to 7 relays)**
- › **Low power optimized design**

## Easily integrates with your existing automation system

The Zen IoT natively supports MQTT IoT communications protocol. ModBus RTU master/slave communication interface port provides direct connection to metering and control automation. Potential applications include remote machine and process monitoring of pumping, HVAC, IAQ, and energy systems. Onboard logic, math and control functions allow customization to match application measurement and monitoring requirement.

## Field process signals direct to wireless interface

Zen IoT converts, conditions and processes analog signals directly to wireless WiFi (801.11) or (eMTC) LTE Cat-M1. No additional wireless modem required.

## Extra cloud interface security and Store and Forward data integrity

Connection and data security are paramount, the Zen IoT provides peace of mind with Transport Layer Security (TLS) protocol. During a network communications failure event the Zen IoT Store and Forward functions locally buffers data, forwarding to the cloud server when network communications is reinstated, secure monitoring and recording with total data integrity.



## Key features:

- › DCS Define Cloud Services (DCS) connection
- › MQTT with Transport Layer Security (TLS 1.2)
- › Data record store and forward record buffer
- › RTC record data time stamp at origin
- › Application logic and math functions
- › PC configuration tools, USB interface
- › Wireless WiFi (801.11) or (eMTC) LTE Cat-M1
- › Up to 22 analog inputs
- › Up to 40 digital input/outputs
- › 8 Isolated process outputs (4-20mA)
- › Up to 7 Relay outputs
- › RS485 ModBus RTU master/slave interface
- › Local display (RS232C) interface port
- › AC mains and 24V low power operation

# Cloud connection options



## WiFi (801.11)

Enables LOS transmission up to 1500ft (450m) using the supplied 3dBi wireless antenna.



## (eMTC) LTE Cat-M1

4G cellular interface for Internet of Things (IoT) and machine-to-machine (M2M) communications.

## Connection to IoT Cloud services

The Zen IoT is preconfigured to connect to Define Cloud Services (DCS). Custom connection is available to your own or third party IoT server. Cloud communication is secured using TLS and uses MQTT IoT service transfer protocol. JSON packets contain industry standard SenML (Sensor mark-up language) data.

## Simple setup with Define WorkBench software

Define WorkBench configures the Zen IoT for analog and digital inputs, alarms, totalizers and counters, custom scaling for input linearization and scale setup. The cloud interface module configures data transfer to a cloud server.

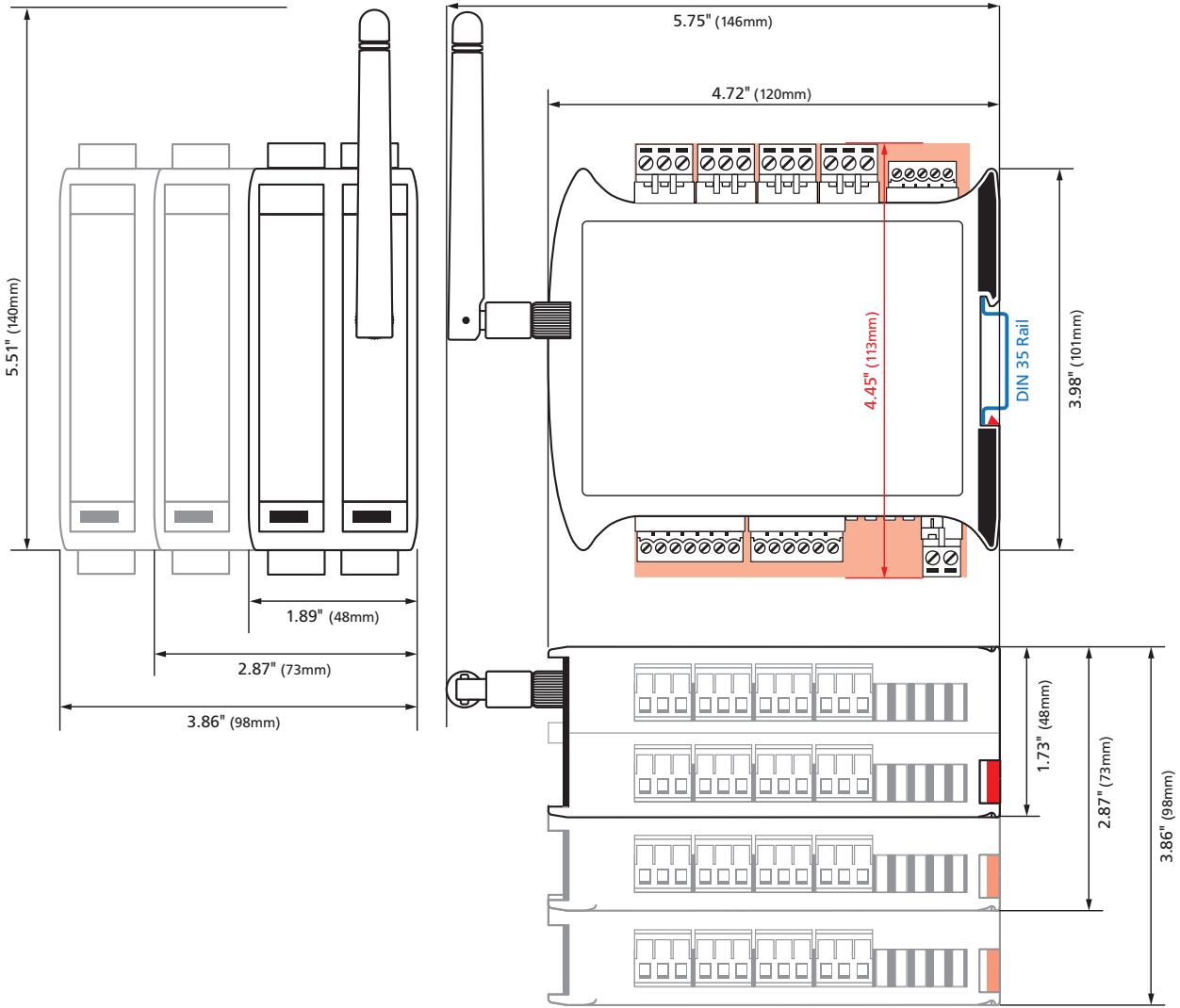
## Ordering Codes for Zen IoT

Model/Option Description Zen IoT	Non-Isolated Inputs With Exc. (4-20mA)	Partially Isolated Inputs (4-20mA)	Total Universal Isolated Input (TC/RTD/V/mA)	Isolated Output (4-20mA)	Model	Power supply	Wireless Comms WiFi/LTE	Added Analog IO Option
Zen IoT base configuration: MQTT cloud service interface – TLS security layer, store and forward record buffer, RTC data time stamp, 4x isolated universal inputs (TC/RTD/V/mA/Ratio)	2		4	ZEN6	ZEN6			
85-265 V AC/DC power supply	2		4			HV		
10-32 V DC power supply	2		4			LV		
No Wireless communication	2		4				–	
Cellular modem (eMTC) LTE Cat-M1	2		4				CM1	
WiFi (801.11)	2		4				WIF	
No Additional Analog IO	2							–
ADD 4x Universal input (isolated)	2		8					UI4
ADD 8x Universal input (isolated)	2		12					UI8
ADD 12x Universal input (isolated)	2		16					UI12
ADD 16x Process (4-20mA) input (non-isolated)	2	16	4					PI16
ADD 6x Universal input (isolated), 4x process (4-20mA) output (isolated)	2		4	4				UI6E4
ADD 8x Process (4-20mA) input (non-isolated), 8x process (4-20mA) output (isolated)	2	8	4	8				PI8E8

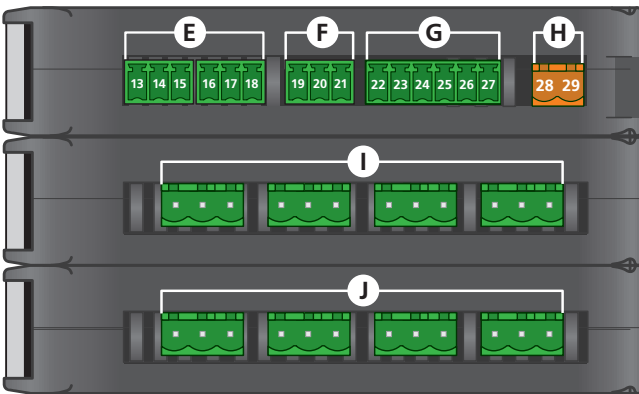
## Required Accessories (Sold Separately)

<b>BRIDGE-KEY</b>	USB Bridge Key, required to program this instrument using free WorkBench software.
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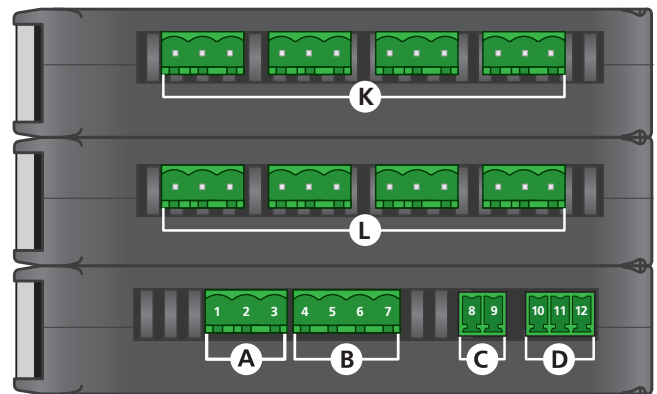
# Case Dimensions



# Connectors – main processor



Color Label Facing Down

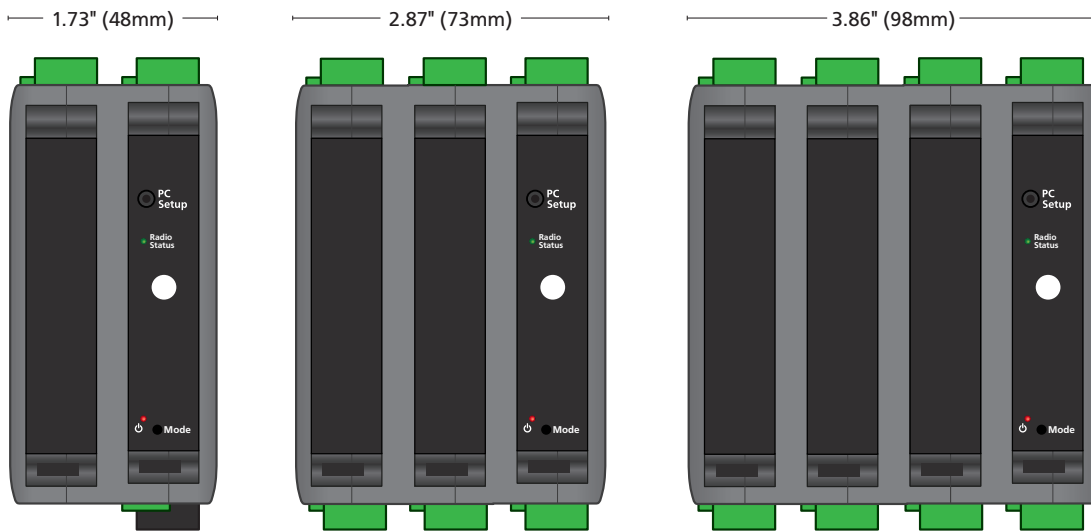


Color Label Facing Up

- (A & B) Relay outputs
- (C) Logic output open collector
- (D) RS485 Port
- (E) Analog (4-20mA) inputs
- (F) R232 Display Port
- (G) Digital inputs

- (H) Power supply (HV shown)
- (I) Universal analog inputs
- (J & K) Additional universal analog inputs (UI8 and UI12 models only)
- (L) Universal analog inputs

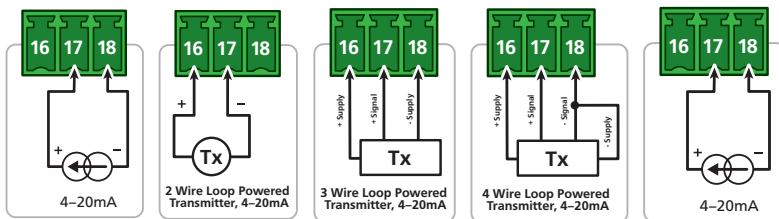
# Connectors – expansion IO



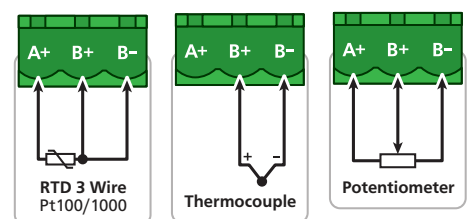
## Dimensions of model configurations

1.73" wide (48mm)	2.87" wide (73mm)	3.86" wide (98mm)
Zen6-HV	Zen6-HV-CM1-UI8	Zen6-HV-WIF-UI8-DIO12
Zen6-HV-CM1	Zen6-LV-CM1-PI16	Zen6-HV-CM1-PI16-DIO12
Zen6-LV-WIF	Zen6-HV-WIF-UI6E4	Zen6-HV-CM1-PI8E8-DIO12

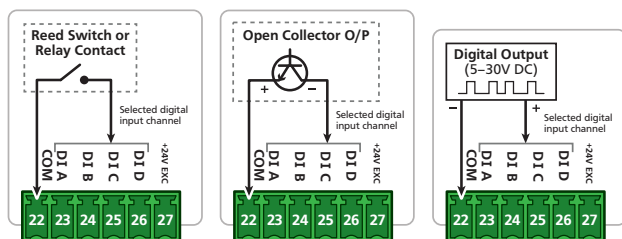
## Non-isolated mA input



## Configurable isolated universal input

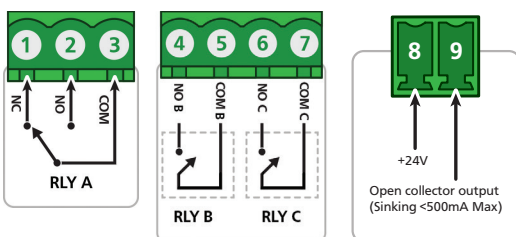


## Digital and logic input

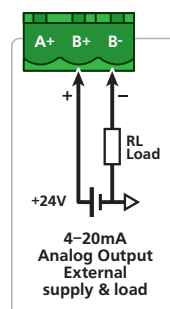


**NOTE**  
 The Digital Inputs can be configured in software to be either **Sinking** (active low input) or **Sourcing** (active high input). The diagrams in this manual are for **Sinking** wiring, which is the default configuration. To view **Sourcing** wiring, please refer to the help information provided in Define WorkBench.

## Relay output



## Process mA output



## Warranty

Define Instruments warrants that its products are free from defects in material and workmanship under normal use and service for a period of five years from the date of shipment. Define Instruments' obligations under this warranty are limited to replacement or repair, at its option, at its factory, of any of the products which are returned to Define Instruments' facility (within the applicable period after shipment), transportation charges prepaid, and which are, after examination, disclosed to the satisfaction of Define Instruments to be defective.

Warranty does not apply to any equipment which has been repaired or altered, (except by Define Instruments), or which has been subjected to misuse, negligence or accident. In no case shall Define Instruments' liability exceed the original purchase price. The aforementioned provisions do not extend the original warranty period of any product which has been either repaired or replaced by Define Instruments.

# General specifications

## Power

**Power supply** 85–265V AC (HV)  
10–32V DC (LV)

**Power consumption** 10W max, 6W typical

## Excitation output

24V DC @ 200mA maximum. Total on all +24V output pins

## Data Logging

31,774 samples with up to 30 parameters plus time stamp per sample. 32 MB capacity

Available with Real-Time Clock (RTC) option

RTC time base UTC

Local time in device with automatic daylight savings adjustment

## Analog input

2x (4–20mA) process input

**Input resolution** 12 bits

**Accuracy**  $\leq \pm 1.0\%$  FSO (unless otherwise stated in input specifications)

**Input isolation:** Not isolated to power supply or digital inputs

## General specifications

**Linearity & repeatability**  $\leq \pm 0.1\%$  FSO

**RF immunity**  $\leq \pm 1\%$  effect FSO typical

**Noise immunity (CMRR)** 160dB tested at 300V RMS 50Hz

**Permanent memory (E<sup>2</sup>ROM)** 100,000 writes per input parameter

## Relay output

**1 x Change over Form C Relay** (15A 250V AC or 15A 30V DC)

**2x Form A Relays** (3A 250V AC or 3A 30V DC)

## Logic output

**1 x Logic output** Open collector, (80mA maximum capacity)

## Digital input

**Functions** Status, up counter, up/down counter with direction, debounced counter, frequency, gated frequency

**Counter register output** 32 bit

**Frequency range** 0–10,000Hz (Reduced to 0–1,000Hz in Sleep Mode)

**Input types** NPN, PNP, Clean Contact, Voltage 2–30V DC

**Threshold** 1.65V typical

**Debounce counter range** 0–100Hz

**Isolation:** Not isolated to power supply or analog inputs

## Comms

**Protocols** Modbus RTU, MQTT, RS485 or Define ASCII, EIA485 compliant

**Default comm port** RS485. Selectable baud rate 2400–230400 baud  
Format 8 bit, no parity, 1 stop bit

RS232 display port meets TIA/EIA-232-F and ITU v28 standards

**Functional isolation:** 1,500VDC (1 min)  
Electrical isolation 42VAC/ DC (continuous)

## Programming

**USB programmable** Via 'PC Setup' port using Bridge Key USB programmer (sold separately)

**Define WorkBench** Simple configuration using Define WorkBench: [defineinstruments.com/workbench](https://defineinstruments.com/workbench)

## Wireless comms interface

WiFi (801.11)

Cellular modem (eMTC) LTE Cat-M1 Regions NA, E1 and AU

## TLS security protocol

Transport Layer Security (TLS) V1.2 with server certificate and X.509 client certificate authentication

## Over Air Updates

Over The Air updates are available for main plugins, custom macros, certificates, cloud adapter firmware updates (WiFi and cellular)

## MQTT interface

Based on MQTT 3.1.1 with QoS 0 & 1

## Construction

**Casing** DIN 35 rail mounting; Material: ABS inflammability V0 (UL94)

Phoenix type removable screw terminal connectors

## Dimensions (H x W x D)

6 input channels  
3.98 x 1.73 x 4.72" (101 x 48 x 120mm)\*

14 input channels  
3.98 x 2.87 x 4.72" (101 x 73 x 120mm)\*

22 input channels  
3.98 x 3.86 x 4.72" (101 x 98 x 120mm)\*

\*Excludes antenna and connectors

**Required mounting height with antenna**

4.65" (118mm), WiFi model only

## Environmental conditions

**Operating temperature** –40 to 176°F (–40 to 80°C)

**Storage temperature** –40 to 176°F (–40 to 80°C)

**Operating humidity** 5–85% RH max, non-condensing

## Compliance approvals

EN-61326-1:2006

EMC: EN61326-1: 2006 Class A

EN61326-1: 2006 Industrial Locations

EN50581: 2012 RoHS

Safety: EN61010, 1:2010, CuL (file listing pending)

# General specifications

## Input

**Input isolation** 2,500V AC 1 minute between all input channels

**Isolation test voltage** 1000V DC for 1min (Analog input to digital input, analog input to analog input)

**Input resolution** 16 bits

**Accurate to**  $\leq \pm 0.1\%$  FSO

## Thermocouple input

### Thermocouple types

**B**= 32 to 3272°F (0 to 1800°C)

**E**= -328 to 1292°F (-200 to 700°C)

**J**= -328 to 1832°F (-200 to 1000°C)

**K**= -328 to 2300°F (-200 to 1260°C)

**N**= -328 to 2372°F (-200 to 1300°C)

**R**= 32 to 3092°F (0 to 1700°C)

**S**= 32 to 3092°F (0 to 1700°C)

**T**= -328 to 752°F (-200 to 400°C)

**Input impedance**  $>500\text{K}\Omega$

**T/C lead resistance** 100 $\Omega$  max

**Cold junction compensation** 14 to 140°F (-10 to 60°C)

**CJC drift**  $<0.02^\circ\text{C}$

**Accuracy** 0.1% of FSO  $\pm 1^\circ\text{C}$  typical

**Sensor open** Upscale

## RTD Input

**RTD input type** Pt100 3 wire RTD DIN 43760: 1980 RTD Pt1000 3 wire RTD standard

### Range

-328–572°F (-200–300°C) = 0.02°F (0.01°C) resolution

-328–1472°F (-200–800°C) = 0.1°F (0.1°C) resolution

**Lead resistance** 10 $\Omega$ /lead max recommended

**Sensor current** 0.6mA continuous

**Sensor fail** upscale

### Accuracy

-328–572°F (-200–300°C) =  $\pm 0.1^\circ\text{C}$

-328–1472°F (-200–800°C) =  $\pm 0.3^\circ\text{C}$

**Ambient drift** 0.003°C/°C typical

## Current Input

**Range** 0–20mA, 4–20mA

**Input impedance** 45 $\Omega$

**Max over-range** Protected by PTC to 24V DC

**Linearity & repeatability** 0.1% FSO max

**Accuracy** 0.1% FSO max

**Channel separation** 0.001% max

**Ambient drift** 0.003%/°C FSO typical

**RF immunity** 1% effect FSO typical

## Voltage Input

**Ranges**  $\pm 200\text{mV}$ ,  $-200\text{mV}$  to 1V, 0–10V, 0–18V

**Input impedance**  $>500\text{K}\Omega$  on all ranges

**Maximum over voltage** 24V DC

**Linearity & repeatability** 0.1% FSO max

**Accuracy** 0.1% FSO max

**Channel separation** 0.001% max

**Ambient drift** 0.003%/°C FSO typical

**RF immunity** 1% effect FSO typical

## Potentiometer input

Potentiometer input 3-wire

**Excitation voltage** Variable

**Potentiometer resistance**  $<2\text{k}\Omega$  low pot,  $>2\text{k}\Omega$  high pot

**Field programmable zero** 0–90% of span

**Field programmable span** 0.1–100%

**Linearity & repeatability**  $\leq \pm 0.05\%$  fso

**Response time** 100msec

**Ambient drift**  $<50\text{ppm}$

## Digital Pulse Input

**Frequency range** 0–2500.0Hz

**Fast counter range** 0–2500.0Hz

**Frequency resolution** 0.1Hz

**Sensors** Open collector (NPN, PNP), TTL or Clean Contact

**Debounce counter range** 0–50Hz max

**Counter register output** 32 bit

**Accuracy**  $\pm 0.5\%$

## Analog Output

**Analog output type** Loop powered, isolated 4–20mA or 20–4mA DC

**Isolation** Isolated to Digital IO GND

**Isolation test voltage** 1400Vrms for 1min. Working voltage 125V DC

**Resolution** 15 bits, 16000 steps

**Loop drop** 10V max

**Linearity & repeatability** 0.1% FSO max

**Accuracy** 0.1% FSO max

## Digital I/O Expansion (optional)

**4 x Form A Relays** 3A (3A 250V AC or 3A 30V DC)

**16 x Bipolar digital inputs** 24V compatible. Up to 2.5KV RMS isolation. Inputs are separated into 2 isolated groups of 8 channels

**12 x Digital open collector outputs.** Outputs are separated into 2 groups of 6. 0.5A max on each group. Non isolated.

## Non-isolated Process input

**Range** 0–20mA, 4–20mA

**Input impedance** 45 $\Omega$

**Max over-range** Protected by PTC to 24V DC

**Linearity & repeatability** 0.1% FSO max

**Isolation** - none to other process inputs, 2500V AC 1 minute to all other input/output

**Ambient drift** 0.003%/°C FSO typical



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