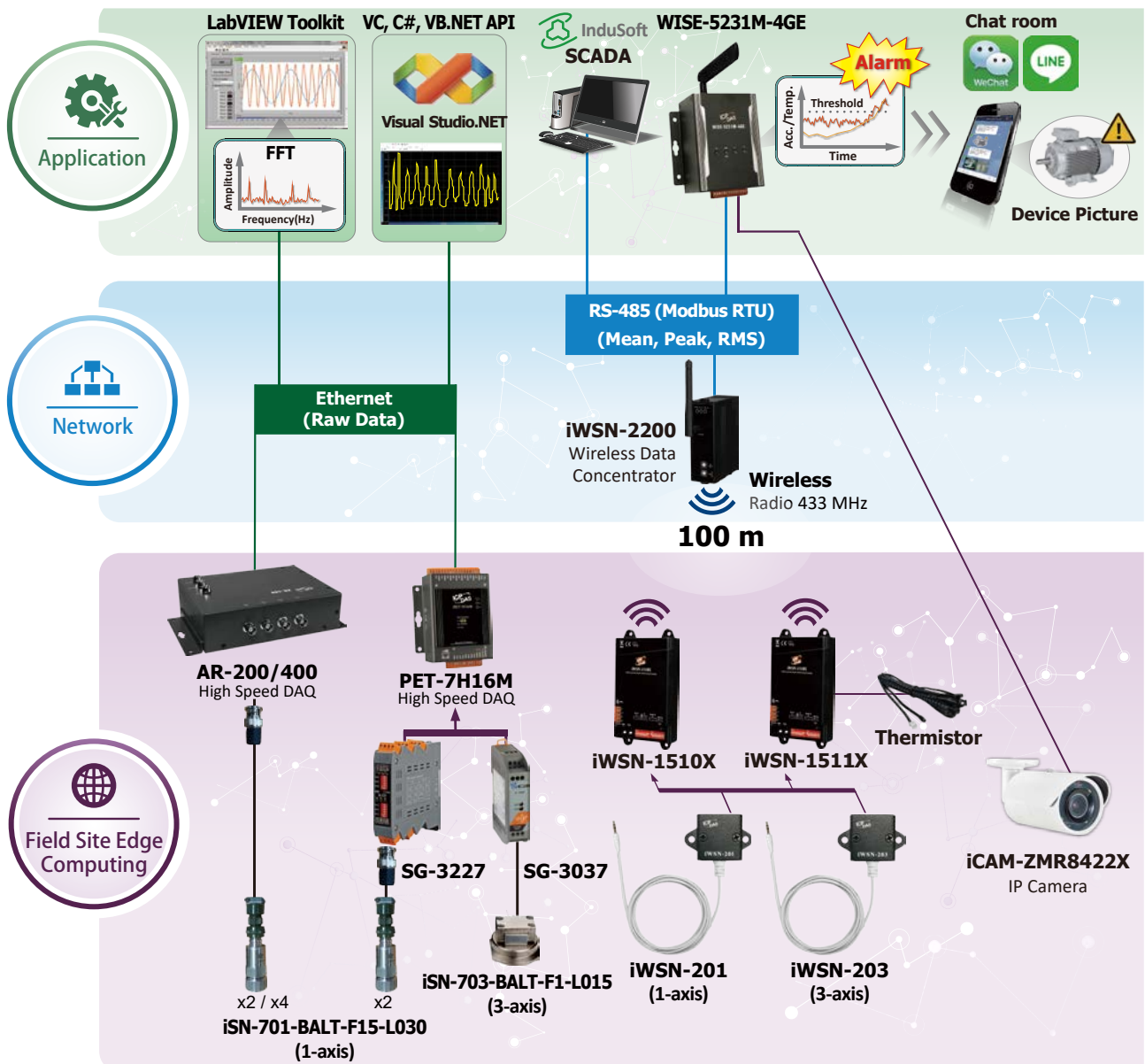


Vibration Measurement Solution

1. Overview

In recent years, the concept of predictive maintenance is gaining increased attention in industries. Its purpose is to perform diagnosis and maintenance of the equipment when initial abnormality of the equipment is found; so that the failures will not be accumulated and further causing serious damage. ICP DAS has developed a series of vibration measurement products which can perform measurement to meet different requirements for all kinds of on-site machines in different applications, and then provide result of fault diagnosis and data analysis. "IWSN Vibration Sensor" series is suitable for sampling low-frequency rotating equipment. It features edge computing and self-powered wireless design which make it easy for used in a production line system and can save cost in wiring; while the "Accelerometer Data Logger Module" series and "Signal Conditioning Modules for Vibration Sensors+ PET-7H16M" series support data acquisition of high sampling rate of vibration data.



Classification:

A. Ethernet High-speed Data Acquisition Module PET-7H16M/7H24M + SG Series + Accelerometer

- High sampling rate for the online data acquisition.
- Provide raw data. (.csv, .txt, .tdm file formats)
- Can mix-use voltage, current, thermocouple, RTD signals with the help of SG-3000 modules.



PET-7H16M
PET-7H24M



SG-3227
SG-3037



iSN-701-BALT-F15-L030
iSN-703-BALT-F1-L015

B. Accelerometer Data Logger Module AR Series + 1-axis Accelerometer

- High sampling rate for scheduled on-line and off-line data acquisition.
- Provide raw data. (.csv, .txt, .tdm file formats)
- Built-in IEPE interface.



AR-200
AR-400



iSN-701-BALT-F15-L030

C. iWSN Vibration Sensor Series

- Low sampling rate and time selectable (1/10/30/60 second) for on-line data acquisition.
- Provide features. (RMS, Mean, Max.)
- Built-in MENS sensor.



iWSN-1510X
iWSN-1511X



iWSN-201
iWSN-203

Properties Comparison:

Classification	A		B		C	
Module	PET-7H16M/PET-7H24M		AR-200	AR-400	iWSN-1510X/iWSN-1511X	
+ Module	SG-3037	SG-3227			iWSN-201	iWSN-203
+ Accelerometer	iSN-703-BALT-F1-L015	iSN-701-BALT-F15-L030	iSN-701-BALT-F15-L030			
Measurement Type	Voltage	IEPE signal	IEPE signal, Edge computing		MEMS sensor, Edge computing	
Data Type	Raw data Export to text file (.csv, .txt) or NI TDMS file (.tdm) by SDK API				RMS, Mean, Maximum	RMS, Mean, Maximum, Triaxial vector
Channel	3	2	2	4	1	3 (XYZ axis)
Sampling Rate (Max.)	200 kHz (PET-7H16M) 128 kHz (PET-7H24M)		200 kHz	125 kHz	10kHz	1.5kHz
Data Storage	--	--	4 GB microSDHC (*)		--	--
Abnormal Alarm	--	--	Threshold trigger (relay)		--	--
Communication	Wired		Wired		Wireless	
Power Supply	DC		DC		CT inductive charging (lithium cell)	

*: Can support up to 32 GB microSDHC

Signal Conditioning Modules for Vibration Sensors

SG-3037 and SG-3227 are vibration signal conditioning modules for vibration measurement. SG-3037 with 3 channel analog inputs can connect to the voltage output accelerometer (3-axis of iSN-703-BALT-F1-L015). SG-3227 with 2 channel IEPE interface is suitable for the IEPE accelerometer (1-axis of iSN-701-BALT-F15-L030). SG-3037/SG-3227 can convert the signal measured from the accelerometer into the analog voltage output. It collects the vibration data through the PET-7H16M module, and then send them via high-speed Ethernet to the data center for processing and analysis.



SG-3037



SG-3227

Models	SG-3037	SG-3227
Analog Input for Accelerometer		
Channel	3	2
Wiring	5 wires	Differential
Signal	Voltage	IEPE
Type	0 ~ 24 V	0 ~ 28 V
Gain	-	x1, x10, x100
Bandwidth	50 KHz	x1, x10 Gain : 80 kHz ; x100 Gain : 50 kHz
Accuracy	±5% of FSR	
Excitation Current	-	2 mA, 4 mA, 6 mA, 10 mA
Excitation Voltage	24 V	-
Supported Accelerometer	iSN-703-BALT-F1-L015 (3-Axis) x 1	iSN-701-BALT-F15-L030 (1-Axis) x 2
Analog Output		
Channel	3	2

Accelerometer



iSN-701-BALT-F15-L030
(1-axis Accelerometer)



iSN-703-BALT-F1-L015
(3-axis Accelerometer)

iSN-701-BALT-Mbase01
(Magnetic Base)

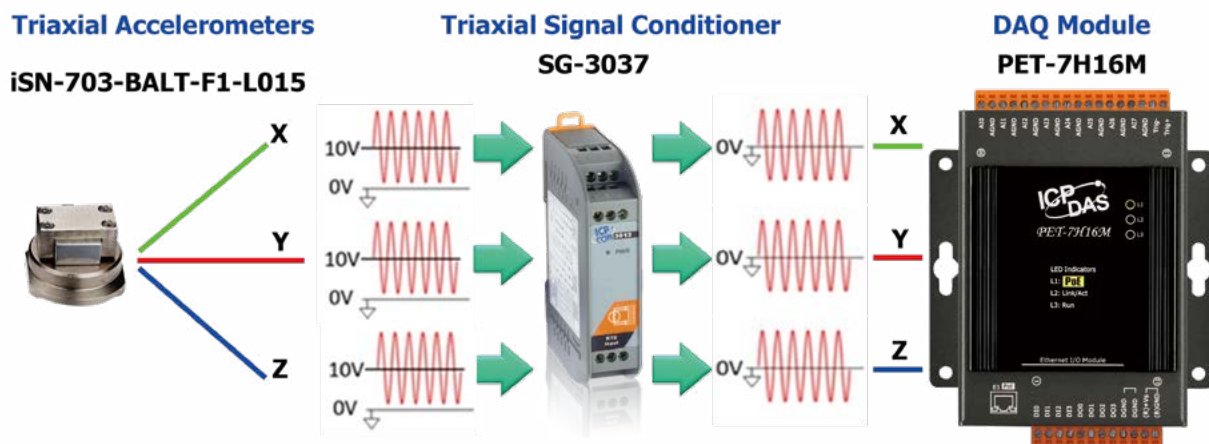


iSN-701-BALT-F15-L030 and iSN-703-BALT-F1-L015 are high sensitivity accelerometer. iSN-701-BALT-F15-L030 is a homotaxial IEPE accelerometer and iSN-703-BALT-F1-L015 is a triaxial accelerometer that simultaneously measures vibration in three orthogonal axes. These sensors are designed primarily for vibration analysis applications.

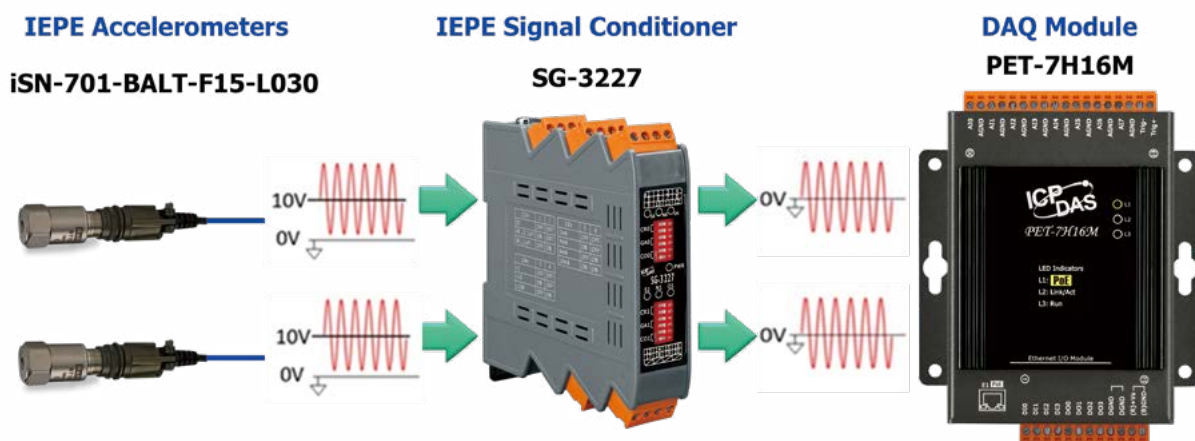
Models	iSN-701-BALT-F15-L030	iSN-703-BALT-F1-L015
Type	1-Axis (IEPE)	3-Axis
Sensitivity	100 mV/g	400 mV/g per axis
Frequency Response	0.5 Hz ~ 15 kHz	10 Hz ~ 1 KHz
Measuring range	±80 g	±18 g
Bias Voltage	10-14 VDC	10 ± 0.5 VDC
Power Requirement		
Voltage	18-30 VDC	22 - 26 VDC
Current	2~10 mA	3 mA
Mechanism		
Cable Length	3 m	1.5 m
Magnetic Base	iSN-701-BALT-Mbase01 (optional)	Included

Applications:

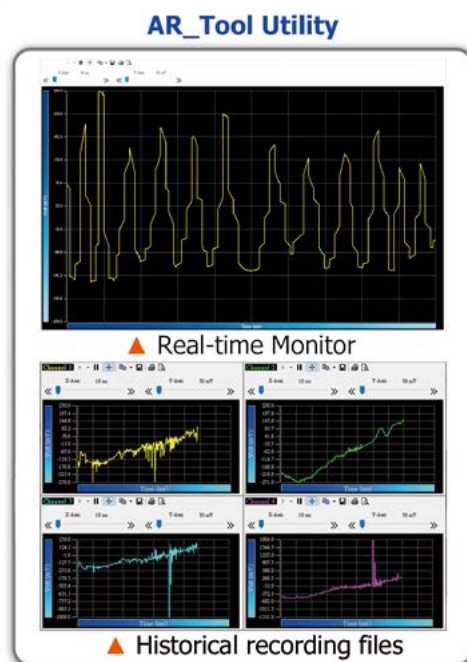
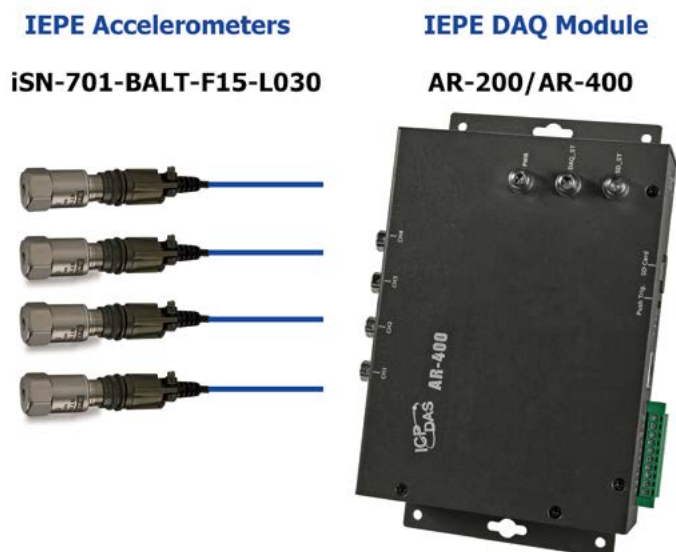
● PET-7H16M connect SG-3037 with iSN-703-BALT-F1-L015



● PET-7H16M connect SG-3227 with iSN-701-BALT-F15-L030



● AR-200/AR-400 with iSN-701-BALT-F15-L030



2. Ethernet High-speed Data Acquisition Module: PET-7H16M / PET-7H24M

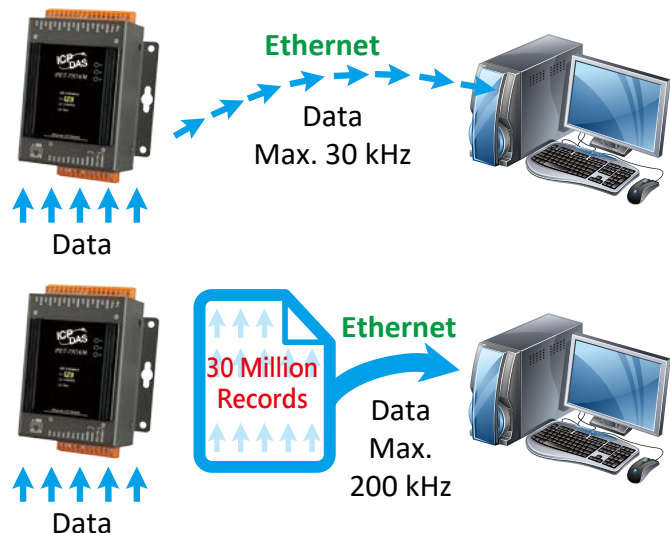


The PET-7H16M/PET-7H24M is a high speed data acquisition devices with a built-in POE Ethernet communication port for data transfer over a network. PET-7H16M includes 8 high-speed 16-bit single-ended Analog input channels (200 kHz sample and hold for all 8 channels) and PET-7H24M includes 4 high-speed 24-bit differential Analog input channels (128 kHz sample and hold for all 4 channels). All high speed data acquisition modules allow A/D signal conversion simultaneously on each channel and provide the programmable input range on all analog input channels. In addition to supporting Analog Input channels, the module also provides Digital Input / Digital Output / Counter / Encoder with different combinations and different numbers of channels. The module provides 4 kV ESD protection as well as 2500 VDC intra-module isolation.

Features:

① Data transmission mode

1. Continuous transmission. After starting A/D acquisition, data is continuously transmitted to the Host PC.
2. After collecting N data samples, the data is transferred to the Host PC.
 - a. After starting A/D acquisition, the data will be temporarily stored in the memory on the PET-7H16M/PET-7H24M module, and wait until a command is received from the Host PC, before transferring the collected data to the Host PC.
 - b. The memory capacity allows temporary storage of up to 30 million data samples.



② A/D trigger mode

1. Software AD Data Acquisition mode

The A/D acquisition parameters are configured via a command from the Host PC. The continuous A/D acquisition or the acquisition of N data samples begins after the command is triggered.

2. External Digital Signal Event Trigger mode (*Only for PET-7H16M)

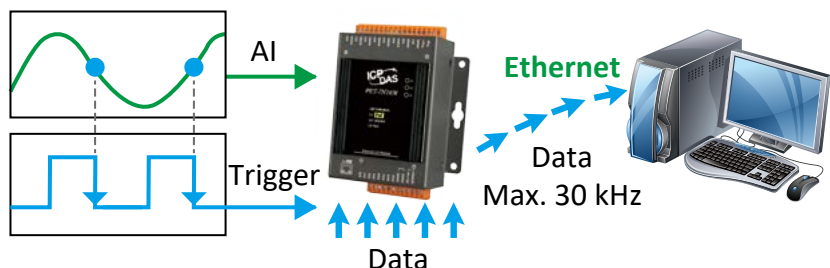
The A/D acquisition parameters are configured via a command from the Host PC, and then triggered via an external electrical signal. The A/D acquisition of the N data samples is then started.

3. Analog Input Trigger mode

The A/D acquisition parameters are configured via a command from the Host PC. When the analog input value is higher or lower than the set specific voltage value, the A/D acquisition of the N data is started.

4. External Clock Signal synchronization A/D Acquisition mode (*Only for PET-7H16M)

The speed of the A/D acquisition and the amount of data acquired are controlled by external electrical signals. A falling edge for each output waveform triggers an AD conversion.



External Clock Signal synchronization A/D Acquisition mode

③ External Digital Signal Event Trigger mode

A/D acquisition is performed in external digital event trigger mode (triggering the electrical signal is the falling edge trigger). The maximum sampling rate per channel is 200 kHz, and A/D acquisition of N data samples is performed.

1. Pre-Trigger (acquisition of N data samples)

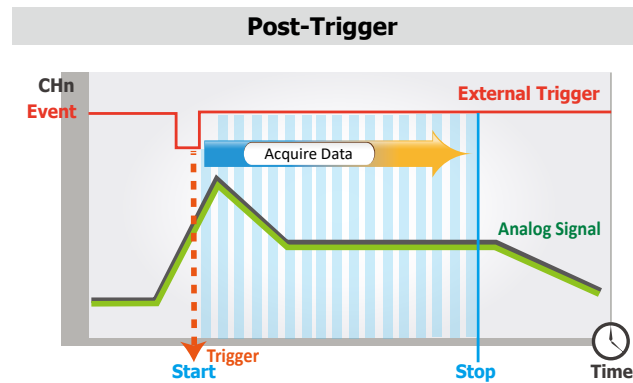
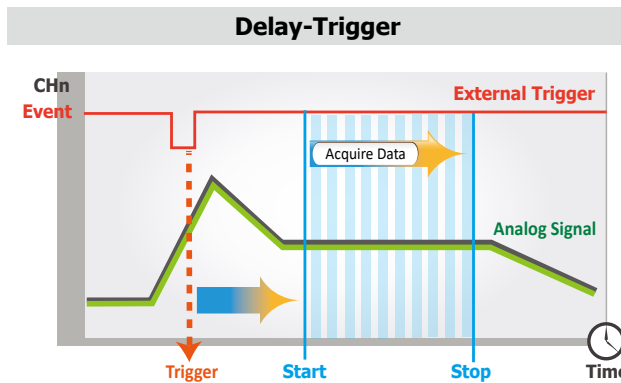
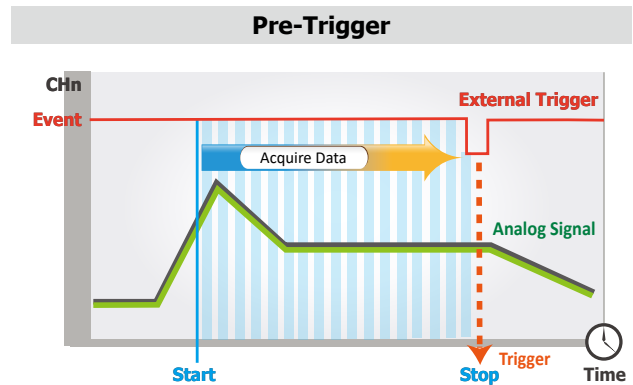
The A/D data is continually collected and is temporarily stored in the memory on the PET-7H16M until the trigger signal is received. Once the trigger signal is received, the collected N data samples are then transferred to the Host PC.

2. Post-Trigger (acquisition of N data samples)

In this mode, the A/D acquisition of the N data samples is started once the trigger signal is received.

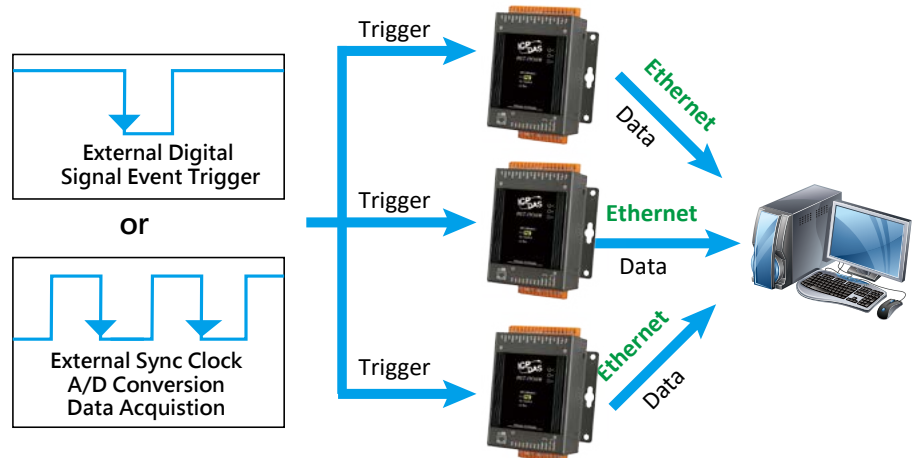
3. Delay-Trigger (acquisition of N data samples)

The A/D acquisition of the N data samples is started once the programmed delay period from the trigger has elapsed.



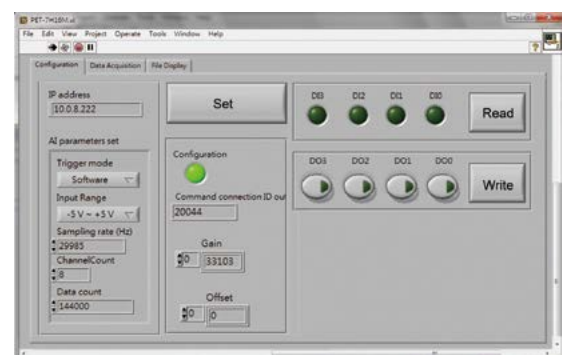
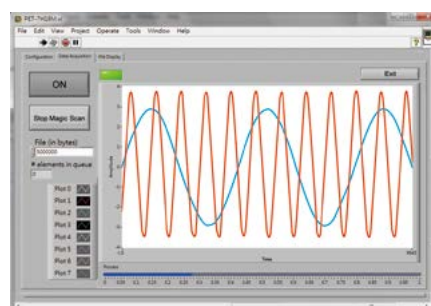
④ A/D synchronization trigger between multiple modules

The A/D acquisition parameters are configured via a command from the Host PC, and are triggered by an external digital signal event, the A/D acquisition of N data samples, or A/D acquisition via the synchronization of an external clock signal.



⑤ Software support

1. Microsoft VC, C#, VB.NET SDK API and Demo for Windows
2. LabVIEW Toolkit and Demo for Windows
3. Library and Demo for Linux



PET-7H16M / PET-7H24M Selection Guide:



System Specifications

Communication		EMS Protection		Mechanical	
Ethernet Port	1 x RJ-45, 10/100 Base-TX	ESD (IEC 61000-4-2)	4 kV Contact for each Terminal and 8 kV Air for Random Point	Dimensions (W × L × H)	76 mm × 120 mm × 38 mm
PoE	Yes	EFT (IEC 61000-4-4)	+/-4 kV for Power	Installation	DIN-Rail or Wall Mounting
Security	ID, Password and IP Filter	Power		Enclosures	Metal
LED Indicators		Reverse Polarity Protection	Yes	Environment	
System Operation	Yes	Powered from Terminal Block	+12 ~ +48 VDC	Operating Temperature	-25 ~ +75° C
Ethernet Link/Act	Yes	Consumption	2.6 W	Storage Temperature	-30 ~ +80° C
PoE Power	Yes			Humidity	10 to 90 % RH, Non-condensing
2-way Isolation					
Ethernet	1500 VDC				
I/O	2500 VDC				



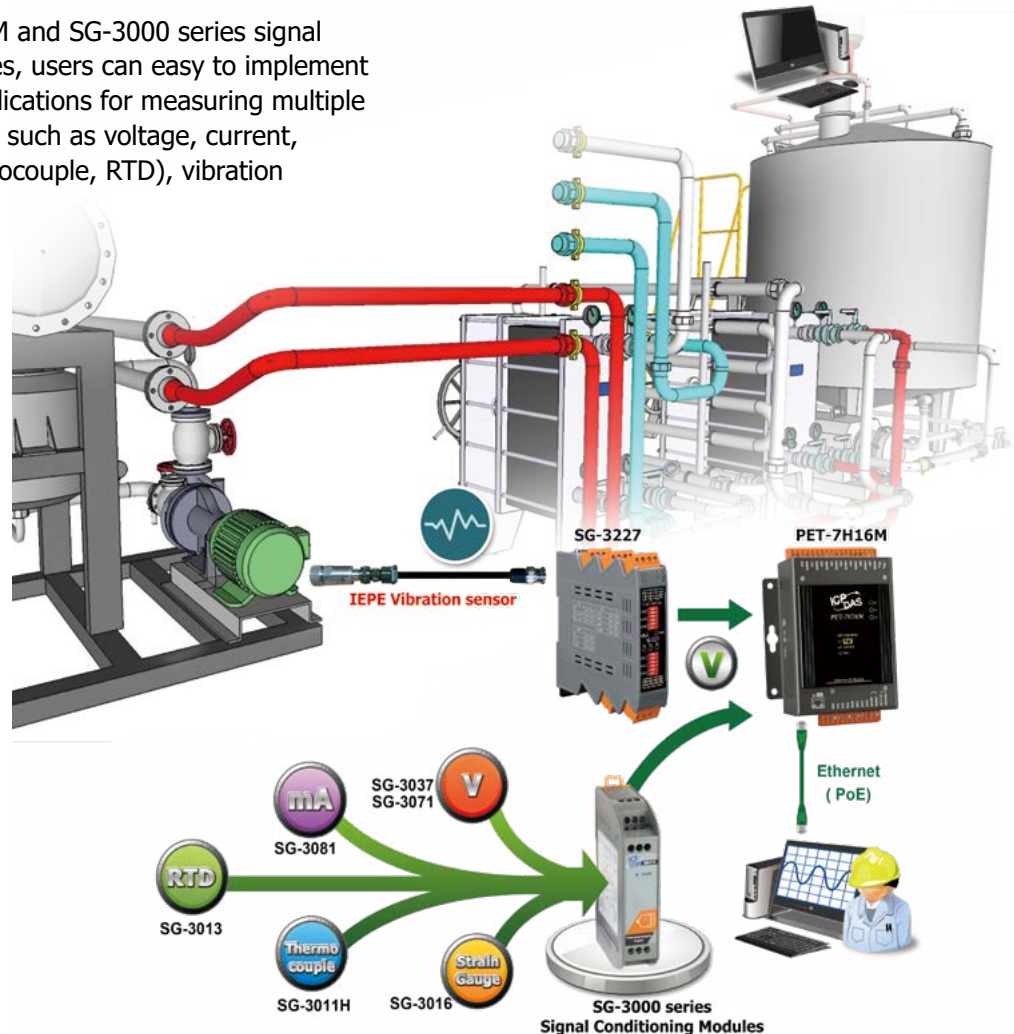
I/O Specifications

Module	PET-7H24M	PET-7H16M
Analog Input		
Channels	4 differential Simultaneously	8 Single-ended
Resolution	24-bit	16-bit
Sampling Rate	128KS/s (Each Channel)	200 kS/s (Each Channel)
Bipolar Input (Programmabl)	±10 V, ±5 V ±2.5 V ±1.25V ±0.625V ±300mV ±150mV ±75mV ±40mV ±20mV	±10 V, ±5 V
FIFO Size	4 k Samples	2 K Samples
Accuracy	+/- 0.01% of FSR @+/-10 V, +/- 0.02% of FSR @±5 V ±2.5 V, +/- 0.02% of FSR @ ±1.25V ±0.625V +/- 0.1% of FSR @±300mV ±150mV ±75mV ±40mV +/- 0.2% of FSR@±20mV	0.05 % of FSR, +/- 1 LSB @ 25 °C, +/-10 V
AD Trigger Mode (Programmable)	Software/ Analog Input Trigger	Software/ Analog Input/ External Clock Trigger/ Digital Trigger (Post/Pre/Delay trigger)
Analog Output		
Channels	2	N/A
Type	±10 V, ±5 V, 0~5V, 0~10V	
Resolution	12-bit	
Accuracy	+/- 0.1% of FSR	
Encoder Input		
Counter	32-bit	N/A
Encoder Mode	Quadrant /CW/ CCW and Pulse/Dir	
Counting Rate	Quadrant Counting: 2 MHz (Max.) CW/CCW: 6 MHz (Max.); Pulse/Dir: 6 MHz (Max.)	
On Voltage Level	+3.5 ~ +5 VDC	
Off Voltage Level	+0.8 VDC Max.	
Programmable digital filter	0.55 ~ 33.3 μs	
Isolation	2500 VDC	
Digital Input		
Channels	3	4
Contact	Wet Contact	Wet Contact
Sink/Source (NPN/PNP)	Sink/Source	Sink/Source
On Voltage Level	+5 ~ +30 VDC	+5 ~ +30 VDC
Off Voltage Level	2 VDC Max.	1 VDC Max.
Counter	N/A	32 bits Max. Count, 1 kHz Max. Input Frequency
Digital Output		
Channels	4	4
Type	Isolated Open Collector	Isolated Open Collector
Sink/Source (NPN/PNP)	Sink	Sink
Load Voltage	+5 ~ +30 VDC	+5 ~ +30 VDC
Short-circuit Protection	Yes	Yes
Overload Protection	1.3 A	1.3 A
External Clock Trigger / Digital Trigger		
Trigger Pulse Width	N/A	1.5 μs Min.
Trigger Type		Falling Edge
On Voltage Level		+5 ~ +5.5 VDC @ 15 mA
Off Voltage Level		< 0.8 VDC
Counter		32 bits Max. Count, 30 kHz Max. Input Frequency

Application:

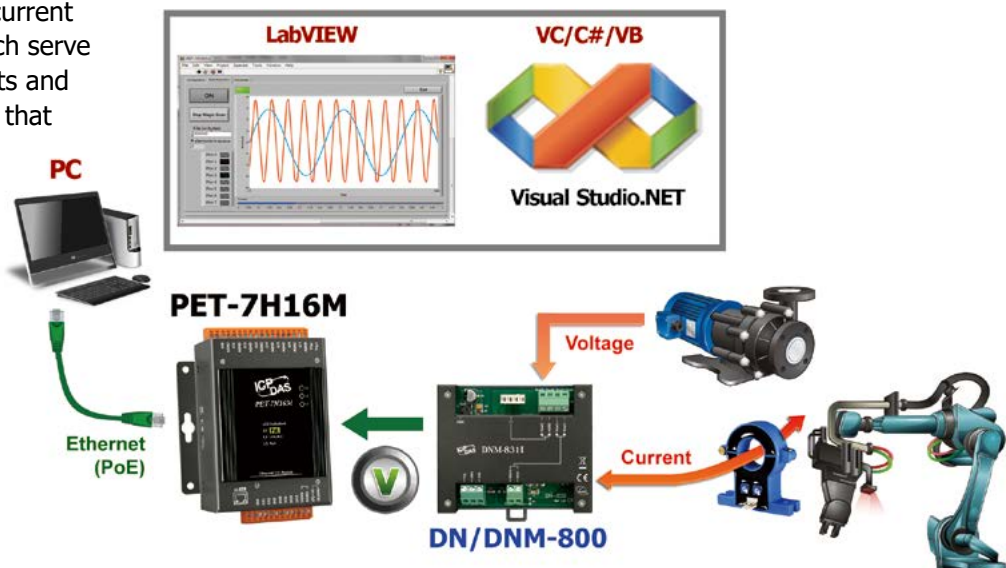
● High speed vibration, strain gauge and temperature measurement applications

With the PET-7H16M and SG-3000 series signal conditioning modules, users can easily implement remote sensing applications for measuring multiple analog input signals such as voltage, current, temperature (thermocouple, RTD), vibration (IEPE sensor) and strain gauge based on an Ethernet network, and collect data from various fields for advanced analysis.



● Power monitoring applications for electric motor and robotic arm facilities

By utilizing the high speed data acquisition capability of PET-7H16M combined with DN-800/DNM-800 series modules, the real-time power monitoring applications for a high-voltage/ large-current manufacturing facility built with a motor or a robotic arm can be easy and quick to develop. It also helps to collect data for failure analysis and diagnosis. The DN-800/DNM-800 series modules are voltage attenuators and current transformers which serve to convert currents and voltages to levels that are suitable for measurement.



3. Accelerometer Data Logger Module : AR Series



AR-200

AR-400

Features:

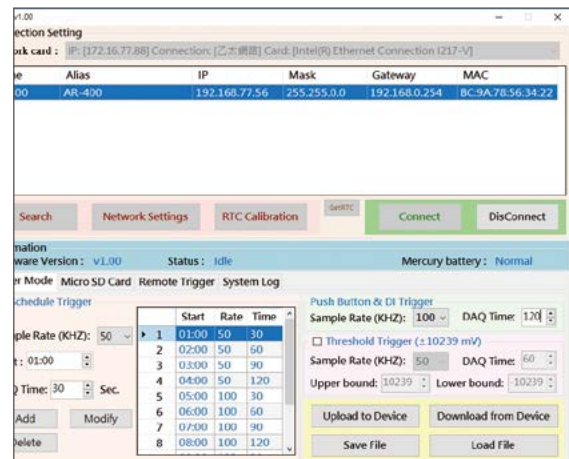
- 2 or 4 simultaneous, 16-bit resolution ADC
- Support 2 or 4 IEPE input and built-in 3 mA excitation current
- Dynamic range: $\pm 10V$
- AR-200 support sample rate: 200kHz, 100kHz, 50kHz
- AR-400 support sample rate: 125kHz, 100kHz, 50kHz
- Max. Recording time: 30 m (5kHz) / 20 m (10kHz) / 10 m (20kHz) / 2 m (50kHz or more)
- Flexible trigger modes: Push button trigger, Schedule trigger, analog threshold trigger, digital input trigger and utility remote trigger
- Supports 4 to 32 GB microSD card

Introduction:

AR-200 / AR-400 is a high-performance dynamic signal acquisition module equipped with 2 / 4 analog input channels providing simultaneous-sampling at up to 200/125 kHz per channel. The module has a built-in 16-bit resolution ADC and 3 mA excitation current to measure IEPE sensors, and a micro SDHC flash card for data logging. It also supports flexible trigger modes, sampling rates, and recording time span, making it ideal for signal measurement in vibration applications.

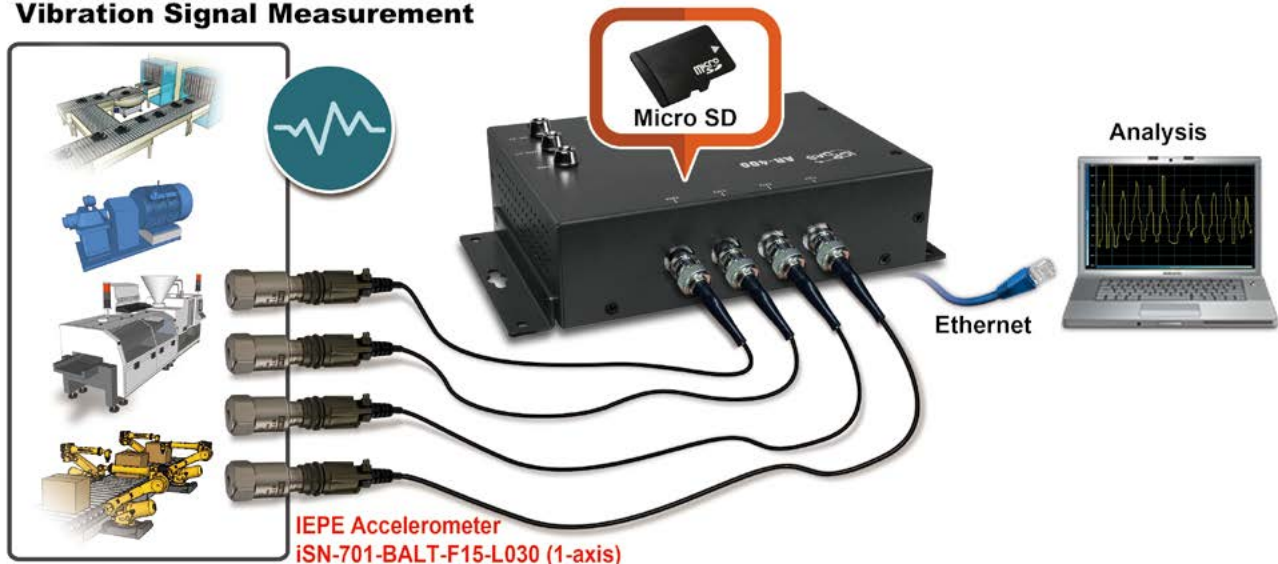
Utility:

- Provide device search function.
- Support trigger mode configuration
- Support RTC calibration
- Show system event log
- Support utility remote trigger mode
- Provide recording file (*.ar) convert to various file type (*.xls, *.csv, *.txt, *.tdm)



Application:

Vibration Signal Measurement



Application:

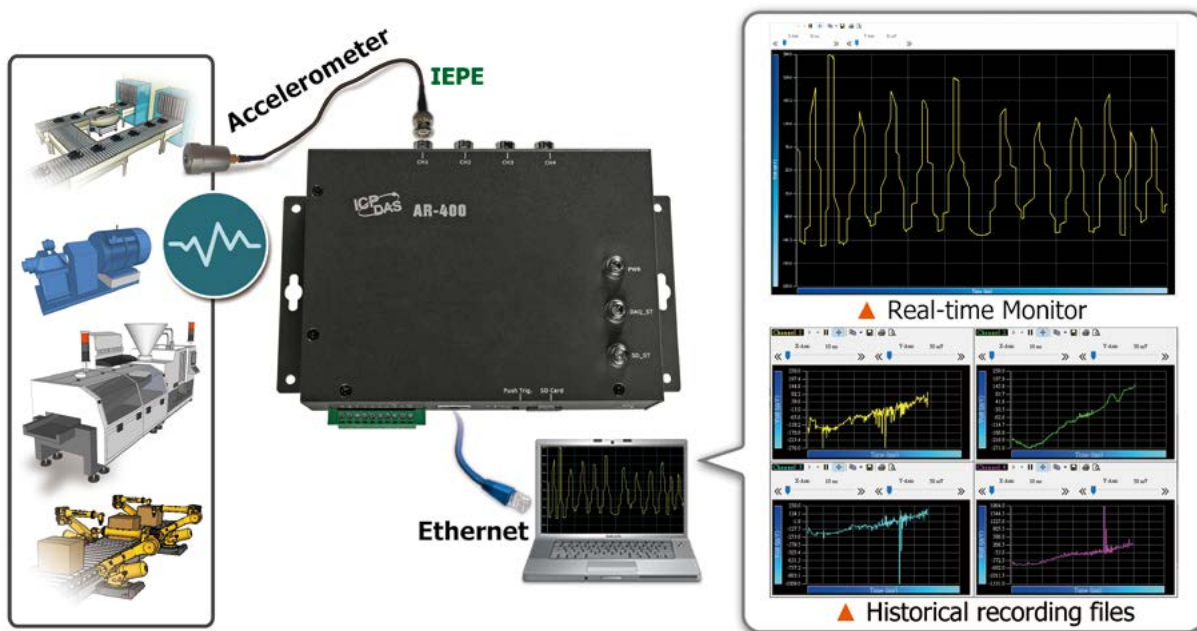
● Vibration waveform display function

■ Real-time waveform display

The user can monitor the machine's vibration status through the utility software to monitor the online vibration signal on each channel, which is convenient for the on-site staff to debug and diagnose at the first time.

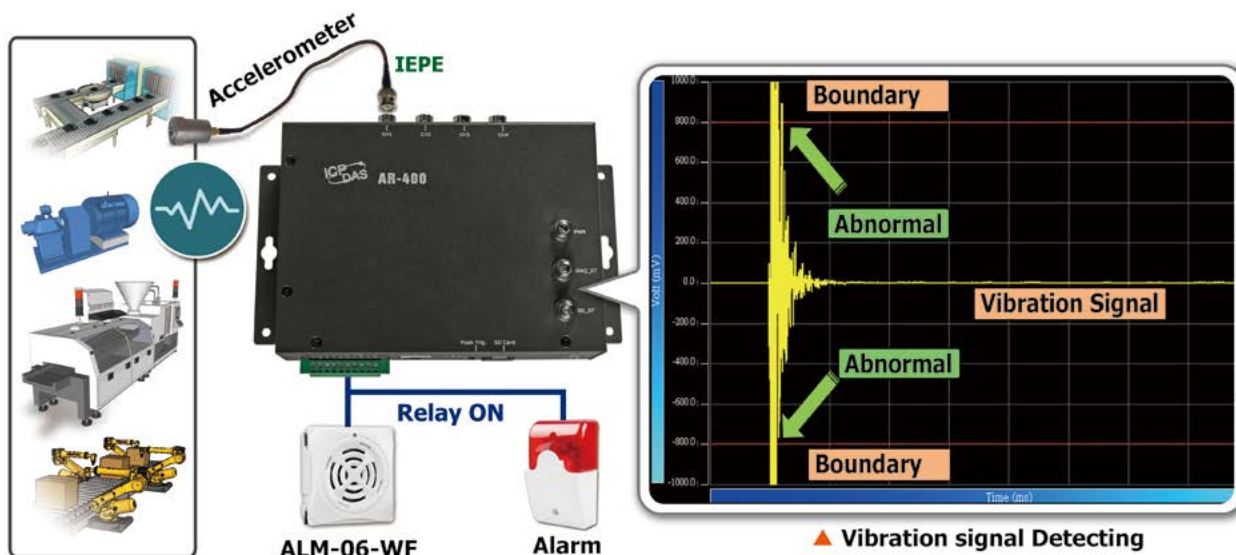
■ Historical waveform recording files playback

The vibration signal can be recorded and stored in the flash card of the AR-200/AR-400 module. The user can download the recording file back to the computer and play it through the utility software, and convert the vibration signal into a waveform display, which is easy for the user to use. The difference between the signal and the signal between the channels is observed to facilitate further vibration analysis and processing.





● Vibration signal abnormal alarm function

The AR-200/AR-400 module has a threshold trigger function. The user can use the Real-time waveform display function to set the appropriate threshold. When the detected signal exceeds the threshold, an abnormal alarm and the relay on the module will be issued immediately. The ALM-06-WF or the alarm connected to the relay will be activated, so that the field staff can immediately know that the machine has an abnormality for disposal, and then the recording file playback function can be used to check the abnormal vibration.



4. iWSN Vibration Sensor Series

The iWSN vibration sensor series includes "Wireless Data Concentrator", "Wireless Signal Sensing Module" and "I/O Expansion Module". The data concentrator collects the vibration signal data and provides them to the local officers for reference via the touch PAC of ICP DAS and sends the data to the cloud for management and monitoring via the WISE controller. Also, it can send alarms to the instant messaging APP.

Module	iWSN-201 1-axis Vibration Sensor	iWSN-203 3-axis Vibration Sensor
Product Picture		
Sensing Parameter		
Type	1-Axis MEMS	3-Axis MEMS
Rate	Up to 10 kHz	Up to 1.5 kHz
Range	±8g	
Output Interface		
Data Type (g)	Uniaxial RMS, Maximum	X, Y, Z axes of the RMS, the maximum value; triaxial vector value
Mechanism		
Dimension (LxWxH)	51mm x 30mm x 15mm	
Installation	Wall mount/ Magnetic mount	
Cable Length	1.5 M	
Others		
Operation Temp.	-25°C ~ +75°C	



Wireless Data Concentrator:

iWSN-2200 Series



The iWSN-2200 series collects and returns data from the sensor, and includes the Modbus RTU or Modbus TCP standard communication protocol that allows you to connect with upper system or graphics control software.

Wireless Signal Sensing Module:

iWSN-1500 Series



Depending on various field applications, not only the vibration sensors are supported, but also the expansion sensing modules of temperature/ humidity, CO₂, VOC and CO.

I/O Expansion Module:

iWSN-200 Series



Provide the interface of vibration measurement. Transfer the vibration measurement data back to the wireless data concentrator via the wireless signal sensing module.

● iWSN Vibration Solution: improve the efficiency of traditional On-Site Inspection

In order to maintain normal production operations in factories, regular maintenance must be performed on important equipment. In the past, the vibration data is obtained by on-site inspection; the equipment is regularly checked one by one in a regular route. The data is manually recorded on papers which is labor-intensive, time-consuming and error-prone. The data is not easy to retrieve and analyze, and duplicate measurements or inappropriate inspections may occur. ICP DAS iWSN Vibration Sensor Series uses iWSN-1510X / iWSN-1511X and iWSN-201, or iWSN-203 with thermistor for measuring vibration of the device and temperature detection. The data of vibration/temperature can be long-term recorded and then effectively solve the reliability issue that on-site inspection may involve. Its self-powered wireless design makes it easy to be installed and maintained. The onsite personnel can also set the limit range via WISE series IIoT Edge Controller so that when the collected data exceeds the range of the limit, the alarm message or image of the device can be sent via SMS or LINE/WeChat groups immediately. The control center or related personnel can be notified in real time and estimate or arrange when maintenance should be performed.



▲ Prior Art: Traditional on-site inspection

▼ ICP DAS iWSN Vibration Solution

