

Accelerometer with Earthquake Early Warning Algorithm (MA301+ & ICU-X2)



Innovation Product (Accelerometer with Earthquake Early Warning Algorithm)

Certificate No. 2021-461

우수연구개발제품 우수연구개발제품

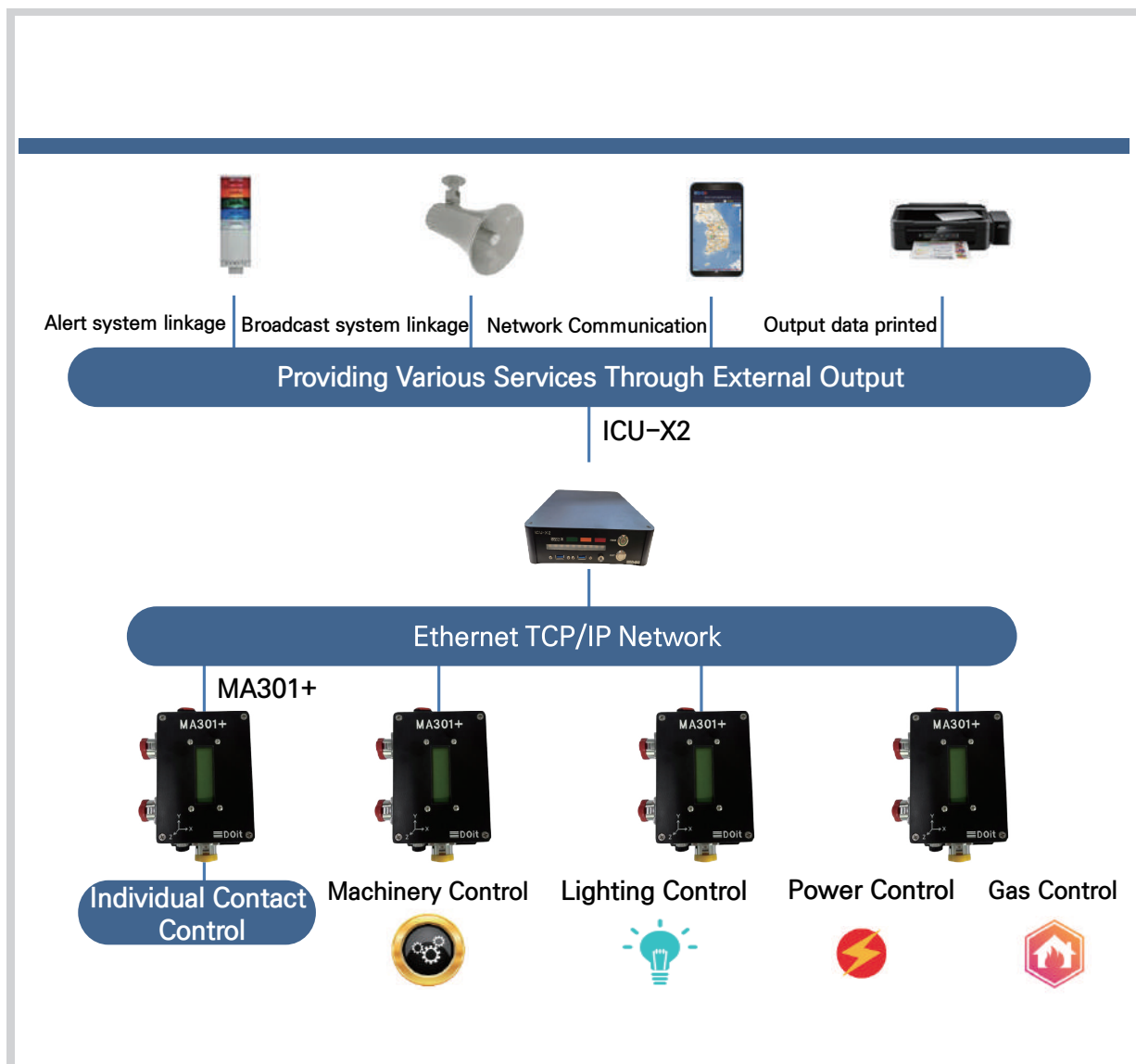


INNOBIZ



Accelerometer with Earthquake Early Warning Algorithm

- The P-wave earthquake pre-warning and emergency structural health monitoring system predicts the seismic intensity reaching the user's location for an earthquake of intensity 5 or higher that may cause damage to life and property, and provides the ability to prevent disaster damage through immediate warnings. It also provides a basic function of determining whether to conduct a precise diagnosis through a safety assessment of emergency building damage. It provides functions that can prevent secondary damage caused by earthquakes by linking with machinery, power, lighting, and gas facilities through external contacts when necessary. In addition, it is possible to operate in an integrated and compatible manner with other facilities through SI linkage for integrated management.
- Product Configuration Diagram



MA301+

- This product is the first MEMS-type seismic accelerometer in Korea equipped with a P-wave earthquake early warning algorithm that can detect shear waves (P waves) caused by an earthquake and predict and warn of the maximum intensity of the subsequent waves (S waves) that reach the "user location" through R&D performed under the Land, Infrastructure and Transport Technology Commercialization Support Project (total project cost of USD 1.7 billion (3 years)). It provides an optimized solution for earthquake pre-warning and structural health monitoring.



Innovation Product

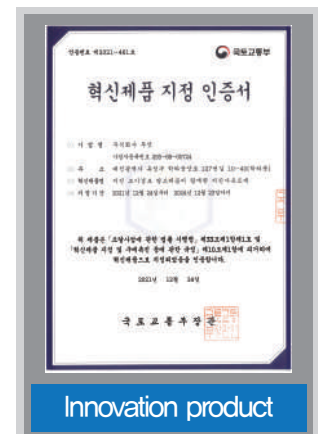


Product Specification

- Measurement Range : $\pm 2g$ (3 axis)
- Sensitivity : 400mV/g
- Frequency Range : DC to 250Hz
- Resolution : 24 bit
- Sampling : Max 500Hz
- Trigger : PGA, Pd, STA/LTA
- Dynamic Range : More than 90 dB
- Componet Error : within 1%
- Battery : 8 Hour
- Voltage Linearity Ratio : within 1%
- Display : 16X2 Line
- I/O Port : Ethernet(TCP/IP or UDP), Serial(RS232C)
- Time Sync : NTP / GPS / RTC
- Power : 48~52VDC POE
- Size : (D)148 (W)108 (H)75
- Weight : 1.1 Kg
- IP Rating : IP67
- Memory : 32 GB(SD card)

Product Features

- Advance warning through prediction of maximum intensity of S wave
- Applying 3 Trigger Algorithms (Pd, PGA, STA/LTA)
- Single network cable power and communication line configuration (PoE)
- NTP/GPS/RTC support for time synchronization
- Easy IP communication support with DHCP and Static protocols
- Contact signal output alarm, broadcast system linkage and device control
- Product waterproof/dustproof (IP67) certification from authorized institutions
- KC certified products for electromagnetic compatibility
- Innovation certification product (Ministry of Land, Infrastructure Transport)
- CE certified products



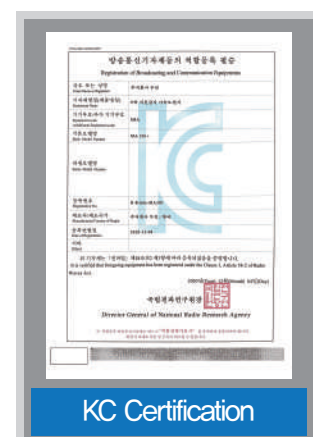
Performance Test Report



Algorithm Test Report



IP67 Certification



KC Certification

ICU-X2 (Data Collection Alarm Device)

- This product is a data collection alarm device that is linked with MA301+, and enables real-time monitoring along with data collection. It is also equipped with a false alarm prevention and emergency building damage assessment algorithm, and provides stability assessment (whether or not a precise diagnosis is made) for emergency building damage based on the maximum inter-story displacement ratio, natural frequency change rate, and design acceleration exceedance rate, which are domestic emergency building stability assessment indices.



- ▶ **Product Specification**

- | | |
|--------------------------------------|--|
| – Processor : Intel 9th | – Wireless Communication : WIFI, Bluetooth |
| – Core : 2.0–2.9 Ghz 4 Core | – Alarm Terminal : 3–Stage LED |
| – Graphic : Intel HD 615 | – OS : Windows 10 |
| – Storage : 64 GB(Scalable) | – Algorithm : Structural Health Monitoring |
| – Input Port : 6 Port(Scalable) | 2 of 3 false alarm Prevention |
| – USB : USB 3.0 x 2 | – Size : (D)220 (W)250 (H)60 |
| – HDMI : HDMI 2.0B | – Wiegth : 1.5 Kg |
| – Contact Terminal : 2 contact point | |

Product Features

- » Real-time seismic measurement data collection and monitoring function
- » 3-Stage alert issuance based on the scale of the event
- » Support for earthquake pre-warning broadcasting system function
- » Frequency response mode, hodogram, and displacement analysis techniques
- » false alarm prevention function through 2 of 3 algorithm
- » Device control possible using 2 relay contact signals
- » Provides stability assessment for structural health monitoring (whether or not precise diagnosis is required)

건축물 손상도 평가 결과 보고서

□ 건물 건축물 손상도 평가 결과

평가자료	현상(결과)가		평가기준		안전관리기준
	양호	단호	양호	단호	
외관상관측평가	0.64	0.64	양호	양호	1% 이하
구조안전성 판정률	0.49	0.49	양호	양호	20% 이하
유사구조물 손상도	0.00	0.00	양호	양호	20% 이하

□ 건축물 손상도 판정기준은 건축구조기준 제 4.2.1항에 의거 판정
 □ 유사구조물 판정기준은 건축구조기준 제 4.2.1항에 의거 판정
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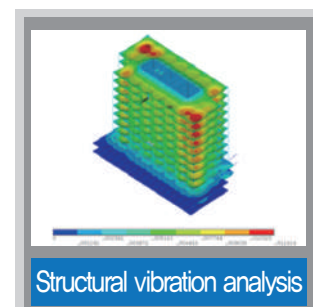
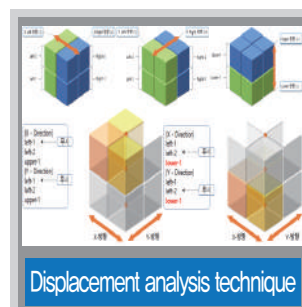
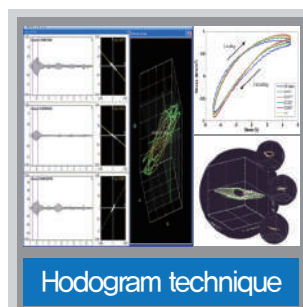
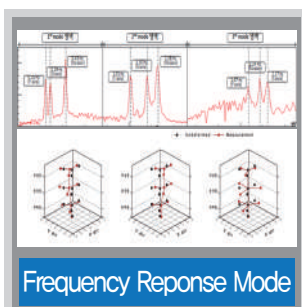
□ 데이터 정보

□ 데이터가이드(이하)

현상		단호		단호	
계정항목	계정값	계정항목	계정값	계정항목	계정값
외관상	10.61	양호	64.00	외관상	64.00
구조안전성	10.61	양호	64.00	구조안전성	64.00
유사구조물	0.00	양호	0.00	유사구조물	0.00

※ 부속자료

외관상(현상)		구조안전성(단호)		안전관리 기준 단호(단호)	안전관리 기준 단호(단호)
단호	단호	단호	단호		
외관상	4.69	1.34	2.03	3	100.00
구조안전성	4.69	1.34	2.03		



Product Features

Novelty

- › Innovation certification product (Ministry of Land, Infrastructure Transport)
- › MEMS seismic accelerometer equipped with Korea's first P-wave earthquake early warning algorithm
- › Integrated earthquake disaster response system capable of supporting earthquake pre-warning and structural health monitoring assessment functions

Technicality

- › Proven superior quality performance through performance testing and official certification from an authorized institution
- › Application of alert technology through prediction of S-wave intensity reaching user location
- › Structural health monitoring assessment algorithm, it provides a function to precisely diagnose and determine the safety of buildings damaged by earthquakes

Applicability

- › Maintaining stability according to the installation environment (IP and KC certified product)
- › Minimizing Earthquake Early Warning Blind Zone
- › It is more effective than the state-run emergency disaster text service (common service) by providing predictions and warnings of earthquake occurrence based on the user's location



Since it is possible to build an earthquake disaster response system at low cost, it can be applied to the private sector that is vulnerable to earthquake damage

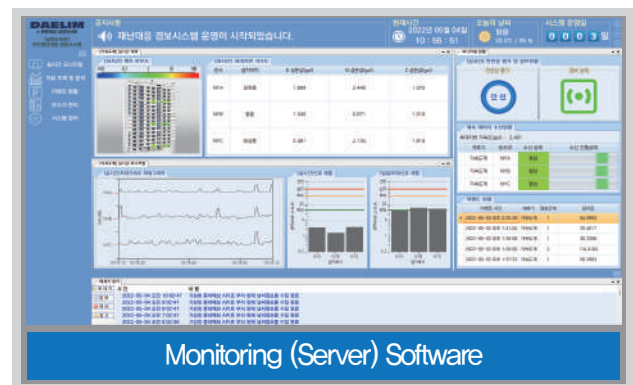
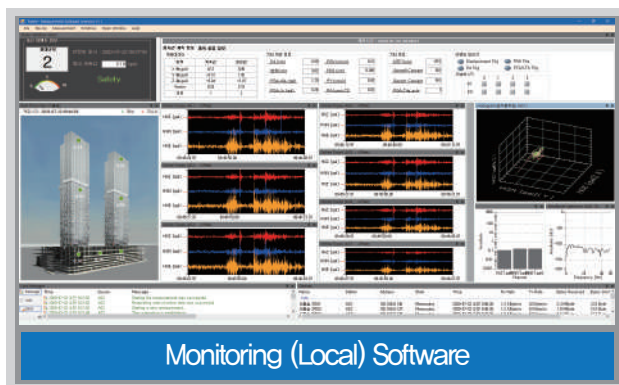
Software

Operating Software

- » A monitoring program that provides real-time monitoring and warning of seismic waves reaching the "user location" and measurement settings and monitoring functions to identify damage characteristics to buildings due to earthquakes

S/W Features

- » MA301+ and multi-channel sensor measurement
- » Apply various digital filters and offset functions
- » Continuous monitoring and early warning functions
- » Event data storage and transmission function (MiniSeed)
- » Data inquiry and analysis/event status/management, etc.
- » Structural health monitoring assessment and event outcome reports

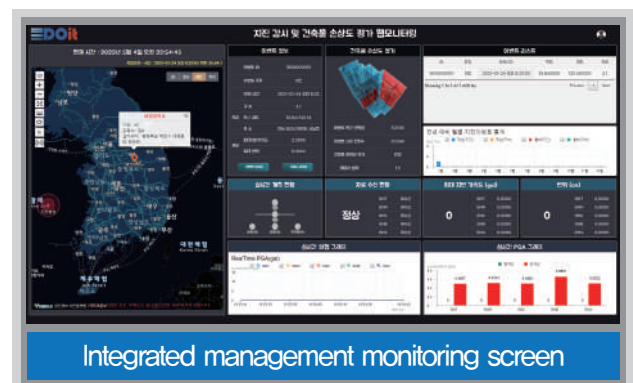
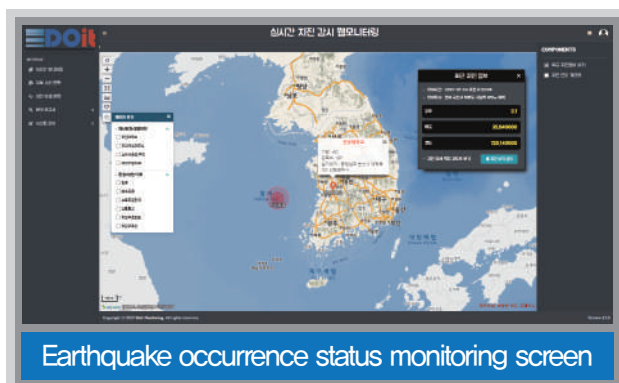


Integrated Software

- » Integrated management program for operating P-wave earthquake pre-warning and emergency structural health monitoring assessment system

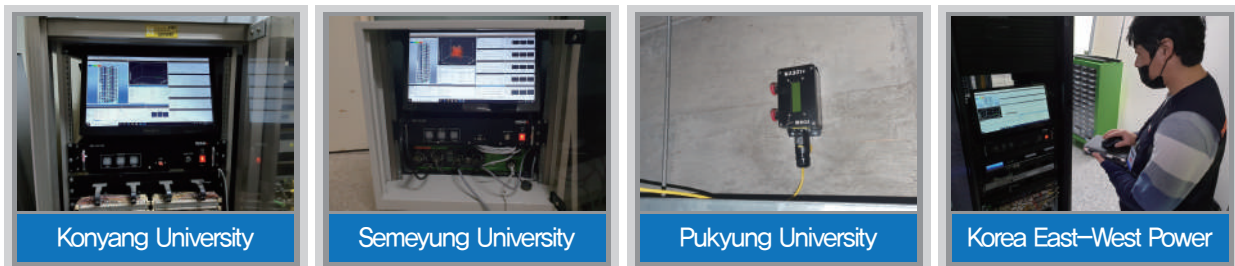
S/W Features

- » Multi-monitoring possible
- » Alert issuance (SMS and message transmission)
- » Monitoring of expected arrival time according to earthquake
- » Real-time monitoring/data storage and transmission/analysis functions
- » Status/event occurrence status/system status by observatory
- » Structural health assessment monitoring/event analysis results report



Installation performance

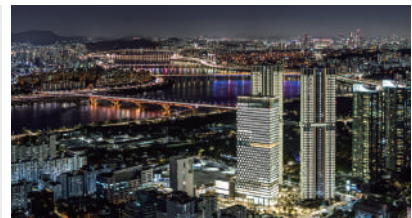
Testbed Operation Case



Installation Performance (1)

Seoul Acro Forest Apartment

- Contract contents : Earthquake early warning and real-time earthquake warning with 3 sensors installed on the ground floor
- Contract name : Installation of earthquake pre-warning and emergency structural health monitoring system
- Period : 2020.04.27 ~ 2020.12.22



Busan Byeoksan Asta Apartment

- Contract contents : In the event of an event, an alarm is sent to residents through the linked in-house alarm broadcast system
- Contract name : Installation of seismometer and wind direction/speed
- Period : 2020.07.14 ~ 2020.08.14



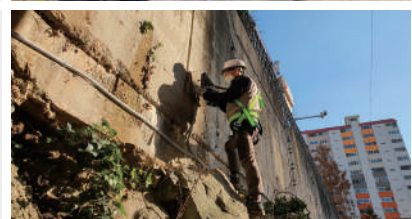
Gyeongsangbuk-do Office of Education College Scholastic Ability Test

- Contract contents : To prepare for earthquake emergencies and minimize casualties through the earthquake early warning system
- Contract name : Operation of the Earthquake emergency response situation room
- Period : 2021.11.03 ~ 2021.11.20



Gwangju Nam-gu Office Disaster Risk Improvement District

- Contract contents : Detect the risk of collapse due to earthquakes and vibrations in advance and perform evacuation of residents and follow-up safety measures through early warning
- Contract name : installation of disaster response early warning system
- Period : 2021.9.28 ~ 2022.01.25



e-Pyeonhansesang Namyang New Town

- Contract contents : Monitor in real time and alert residents through the linked in-house alarm broadcast system when an event occurs
- Contract name : Earthquake monitoring and wind direction installation work
- Period : 2022.04.17 ~ 2022.11.20



Korea Electric Power Research Institute

- Contract contents : Measurement of tension and natural frequency of rope cables used
- Contract name : Tension and natural frequency measurements
- Period : 2022.03.16 ~ 2022.05.01



Installation performance

Installation Performance (2)

Public Procurement Service Innovative Product Pilot Purchase

- Contract contents : 2022 Innovative product pilot purchase
- Orderer : Public Procurement Service
- Period : 2022.09.28 ~ 2022.12.27



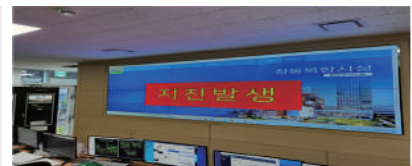
Ministry of Science and ICT Pilot Purchase

- Contract contents : 2022 Ministry of Science and ICT innovation product purchase
- Orderer : Ministry of Science and ICT
- Period : 2022.10.04 ~ 2022.11.03



Changdong Startup and Cultural Industry Complex

- Contract contents : Information and communication construction earthquake detection
- Orderer : Daerim Co., Ltd.
- Period : 2022.05.17 ~ 2023.07.20



e-Pyeonhangesang Gocheon Parkruce

- Contract contents : Earthquake wind direction/speed installation work
- Orderer : Dongshin Information and Communications
- Period : 2023.05.17 ~ 2023.08.30



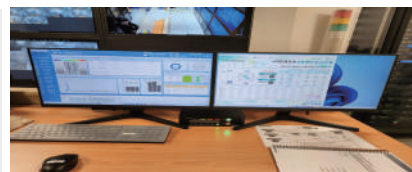
Hwaseong Dongtan 94BL

- Contract contents : Hwaseong Dongtan 94BL earthquake wind direction
- Orderer : Dongshin Information and Communications
- Period : 2023.08.02 ~ 2024.03.31



e-Pyeonhangesang Geomdan Urban Centro

- Contract contents : Earthquake detection and wind direction/speed detection system
- Orderer : UPIENC Co., Ltd.
- Period : 2023.10.13 ~ 2024.02.29



e-Pyeonhangesang Siheung Janghyeon First Venue

- Contract contents : Earthquake detection and wind direction/speed detection installation
- Orderer : Funny Focus Co., Ltd.
- Period : 2024.02.19 ~ 2024.08.31



e-Pyeonhangesang Anyang Naengcheon

- Contract contents : Earthquake detection facility construction
- Orderer : UPIENC Co., Ltd.
- Period : 2024.08.29 ~ 2024.12.31





for Vision, Dream, Future Together!!



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