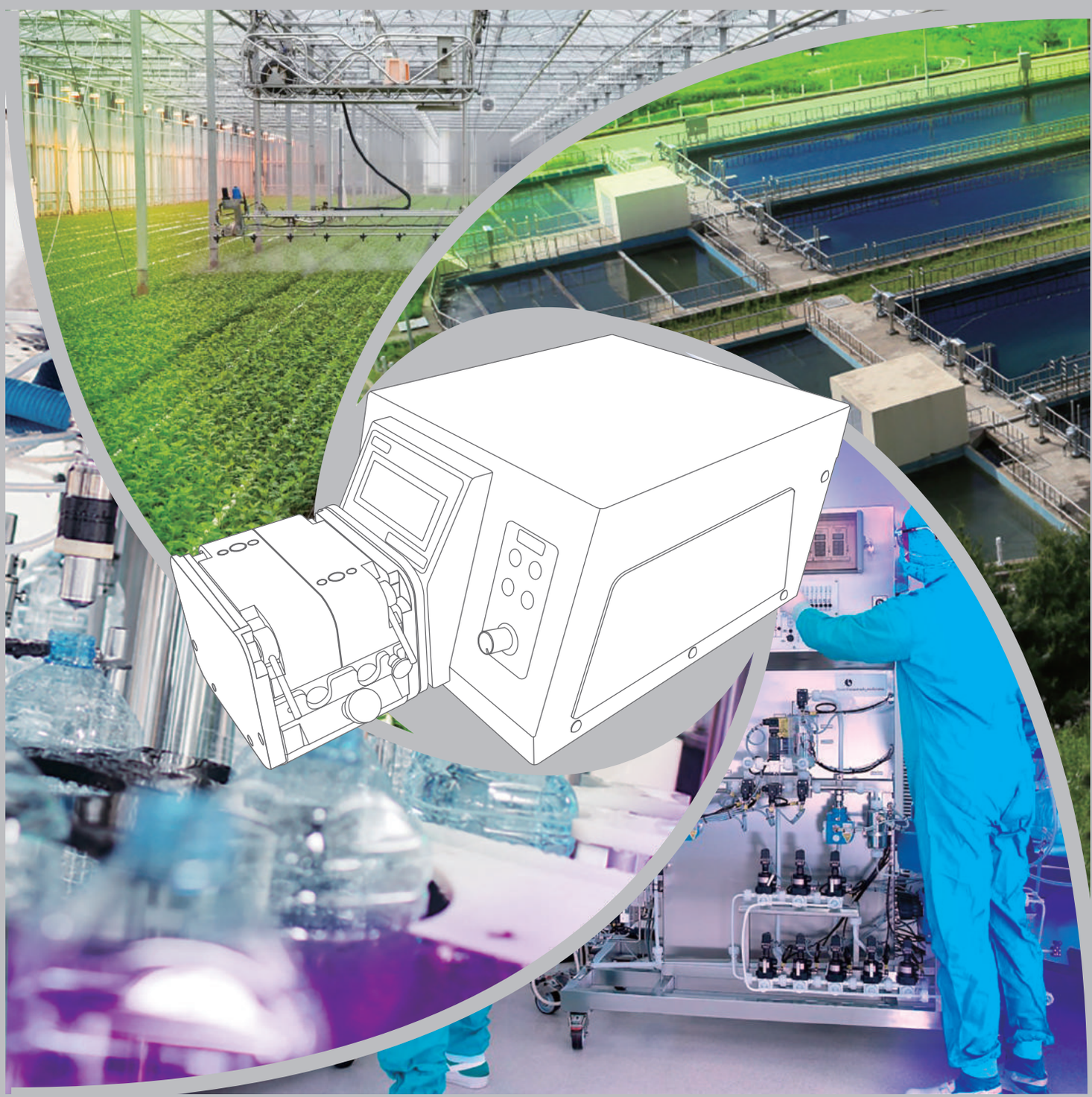
The highest results through endless challenges and efforts

E&M



Tube Pump Controller

ENM-TP-S1

E&M

Inspirations for the new world,
We lead the future through the ICT services.

Business line

Enterprise service business

· Smart Factory Solution
· Package Software Tool
· Process control system engineering
· Performance diagnosis and basic and execution design of industrial machines
· Design for analyzing and supplementing the existing systems
· Development of all kinds of software
· System Total Solution
(Ranging from inspection and basic design to manufacture, tests, and maintenance)

Manufacturing business

· Manufacture of control panels for monitoring instrumentation
· Manufacture of automatic panels, consoles, and TM/TC RTUs
· Manufacture of network equipment
· Manufacture of vibration monitoring equipment
· LCD equipment
· Manufacture of volumentric and vacuum pumps
· Major process control facilities
- HVAC, automobile welding and coating lines and others
- Environmental part: Water treatment, boiler rear facilities, incinerating facilities, and ship denitrification.
- Others : Petrochemical process and fiber production process

Information and Communications Construction Business

· Information and Communications Construction Business
· Ranging from inspection and basic design to manufacture, tests, and maintenance

Wholesale business

· Process meters : Flow rates / Pressure / Temperature / Water gauge, etc.
· Diagnosis meters : Vibratory machines, acoustimeters, etc.
· Power meters : Power analyses and power measurement
· Electric heating materials of industrial pumps, oil pressure pumps, vacuum pumps, and valves
· Lube Oil Unit
· Oil pressure equipment

Business performance

2016
- HHI vertical pump performance test facilities
- HHI vibration system facilities
- RCS facilities of Bakdal Sewage Treatment Center in Anyang

2017
- Measuring instruments and facilities of USP TEST LINE
- Devices for evaluating the durability of LP-SCR catalyzers
- Measuring instruments and facilities of HGS P3 HPRT pump performance test facilities
- RCS facilities and systems in Seolgok, Gapyeong-gun.
- Facilities of the Nanji Sewage Treatment Center
- Manufacture/Expansion of HMI for DAS of actuator performance evaluation systems and manufacture of solar photovoltatic/ESS convergence EMS control devices
- New product development project with an potion to purchase (Volumetric pump)
- Repair work of electric precipitator facilities in Sapaesan Tunnel
- The project for building a computer and machine room in the Cheongpyeong Armed Forces Hospital
- Inspection and repair of the regasification unit of LNG
- Construction for additional controling and measuring HPRT test facilities
- Development of OT Interface & GUI
- Building the system for monitoring power control of CAM-4 distribution facilities.
- Development of IoT data gathering systems, vibration-based synthetic sensor module / trial products for installing living labs
- Building the sensing environment of smart factories

2014
- KT Metro transmission equipment and other facilities
- Large high pressure pump test facilities
- Manufacture and installation of NCK control panels in Pyeongtaek
- Development of software for Power Analyzers

2015
- Manufacture of control panels for a pressurization water reservoir in Gumi
- Building sea water pumps and lines in Hyundai Heavy Industries Co., Ltd.(For testing engines)
- CHP-S1 DeNOx facilities of Kumho Petrochemical Co., Ltd.
- Test monitoring and recording system of boiler feed pumps in Hyundai Heavy Industries Co., Ltd.
- Sewage RCS control panels in Hwanggan, Yeongdong
- RCS control panels in Cheongju
- Manufacture and installation of vibration monitoring units
- Manufacture of 3kW BESS diagnosis devices for family use
- Manufacture of HMI for DAS of high speed motors and inverter performance evaluation systems
- LINAC remote control programs
- Sewage RCS facilities in Jungnang

2012
- Equipment work of PCB plating lines of Samsung Electro-Mechanics
- Manufacture and installation of RCS panels of 4,5, and 6 series in Nanji Sewage Treatment Center.
- Instrumentation and control systems of petrochemical pump performance test facilities
- Complex panel boards of POSCO

2013
- Delivery of Butterflies and Gate Valves for 6 lines in pump test facilities (MOV type)
- Replacement of RCS in Samcheok Public Sewage Treatment Center
- Manufacture of heating panels in Daegu
- Manufacture of GS POWER panels in Bucheon
- Construction work of PCS facilities for the tidal gate expansion project in Asan Bay
- Construction of extra-large pump test facilities of Hyosung Goodsprings (Measuring instruments, test systems, vacuum pumps and valves)
- Installation of PCS in Everland Environment Academy in Yongin
- Hyosung Lube Oil Unit - Hyosung Goodsprings
- Integrated installation of the new and old control chambers of the tidal gates in Asan Bay

2009
- Instrument and control systems of the two-phase construction of an additional wastewater reclamation and reusing system in Incheon International Airport
- Control panel in the De-NOx site of SK Energy Boiler
- Solar energy systems of semiconductor equipment

2011
- Relocation and tests of 5-speed transmission lines of Hyundai Powertech
- Automation of shell coating lines (Ammunition Support Command)
- Measuring and control systems of large pump performance test facilities

Certificate

Certificate of Patent

Tube pump head with a Y-shaped tube for removing pulsation

Certificate of Patent

Method to diagnose pump performance with a thermodynamic flowmeter

Certificate of Patent

Method to sense tube damage of the tube pump system and the tube pump system

Certificate of Patent

Tube pump system with a embedded control module

Certificate of Registration

Confirmation of venture businesses, the research and development company

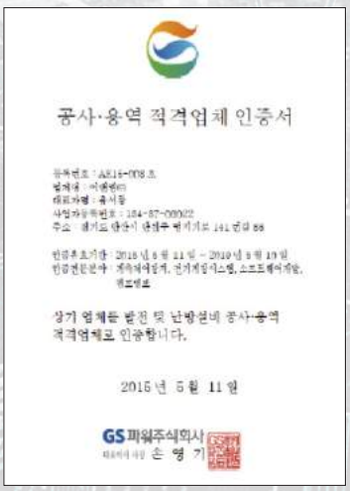
Certificate of the research center

Manufacturing Certificate
(Automatic control panel)

Manufacturing Certificate
(Instrumentation (Measuring) control devices)

Manufacturing Certificate
(Software development)

Manufacturing Certificate
(Process control panel)



Certificate of qualified company for construction and service (GS Power Co., Ltd.)

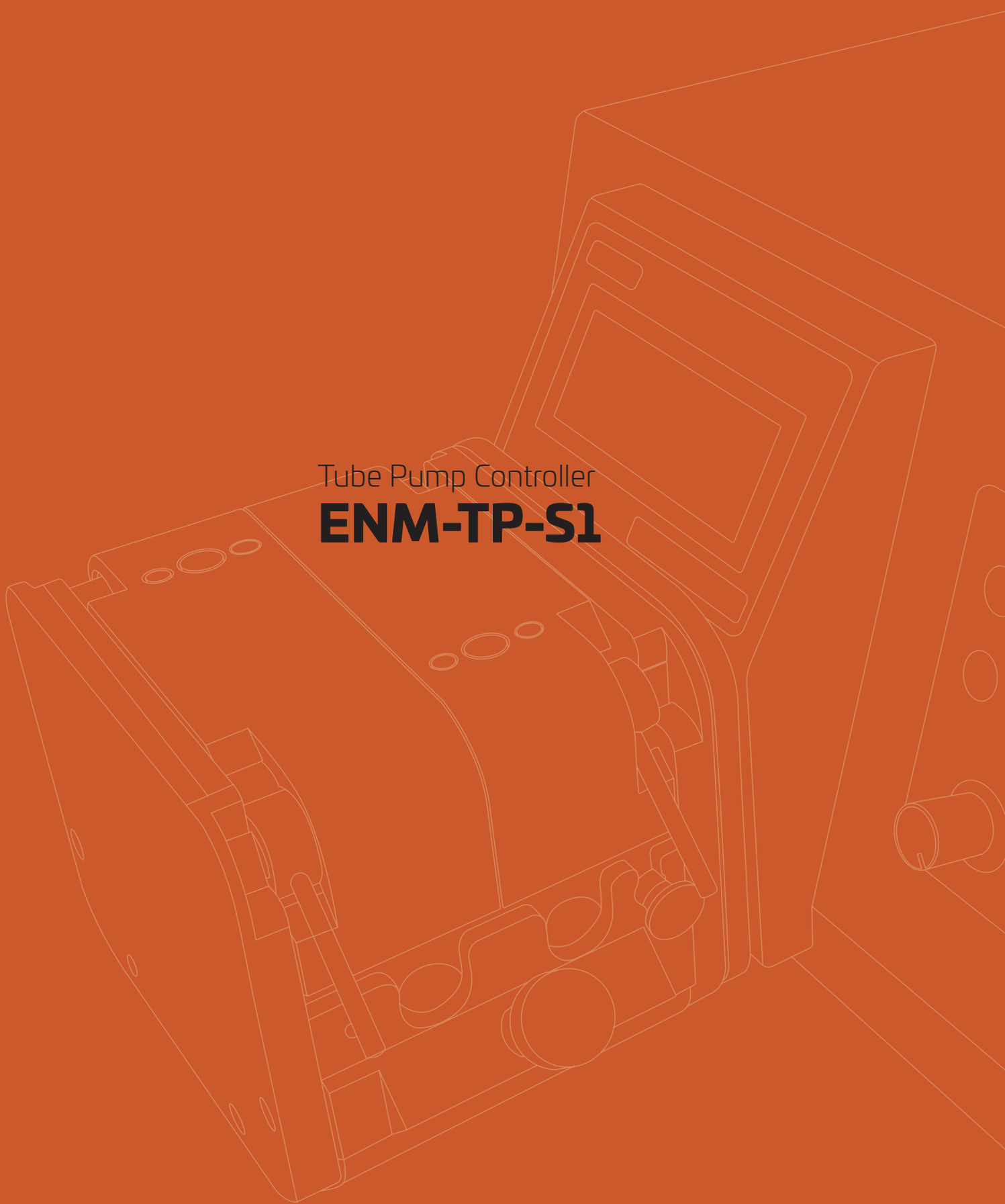
Certificate of Information and Communications Construction Business

Confirmation of Software Licensee

Membership card of the Korea Information and Communication Contractors Association

Tube Pump Controller

ENM-TP-S1



Contents

Tube Pump Controller

ENM-TP-S1

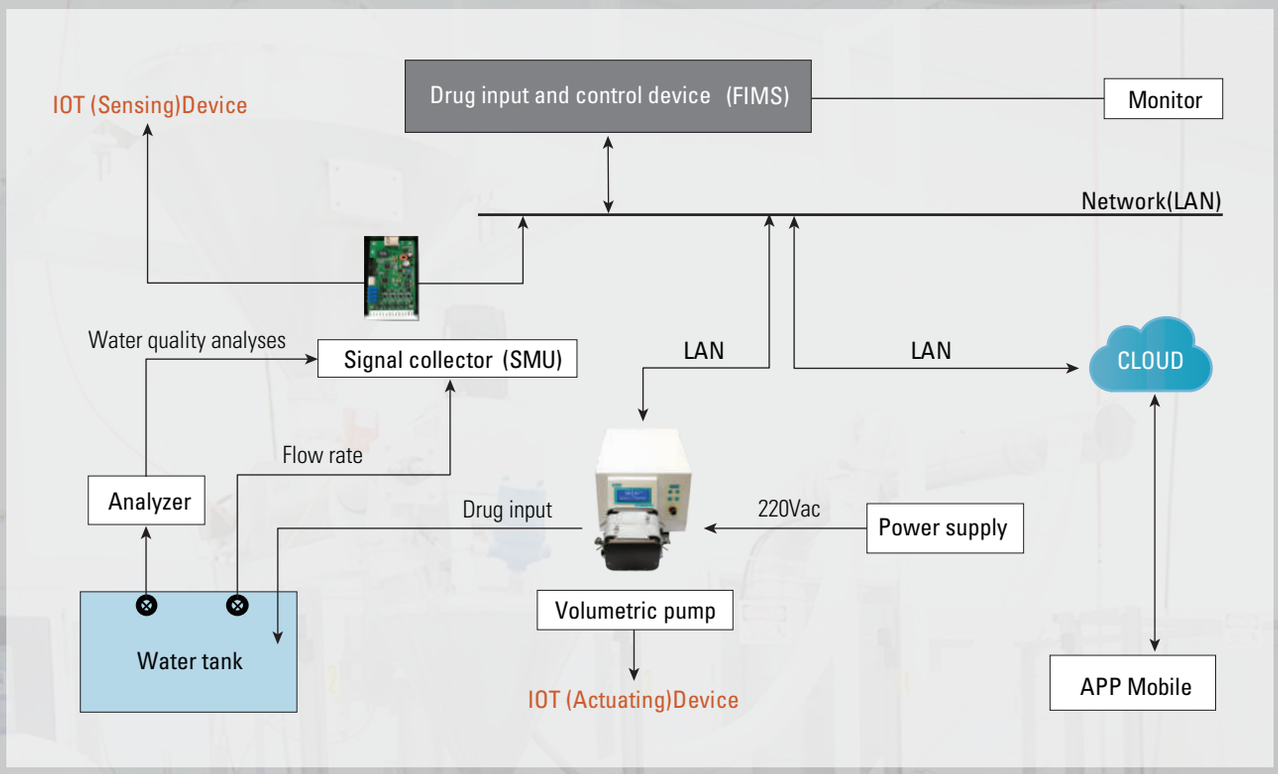
Tube pumps are the pumps for controling liquid materials which continue to flow in tubes exactly.
E&M Tube Pump System can be applied to various sectors because it is easy to control it and very effective as the manless automatic injection system that fixed quantities can be controled.

Applied sectors

- Drug input systems
- Water management systems
- Drug input systems of intake stations and water treatment plants
- Smart farm culture fluid transportation systems
- Systems of food and beverage and food research centers
- Water management systems of water and sewage management centers
- Systems of medical devices and the medical industry

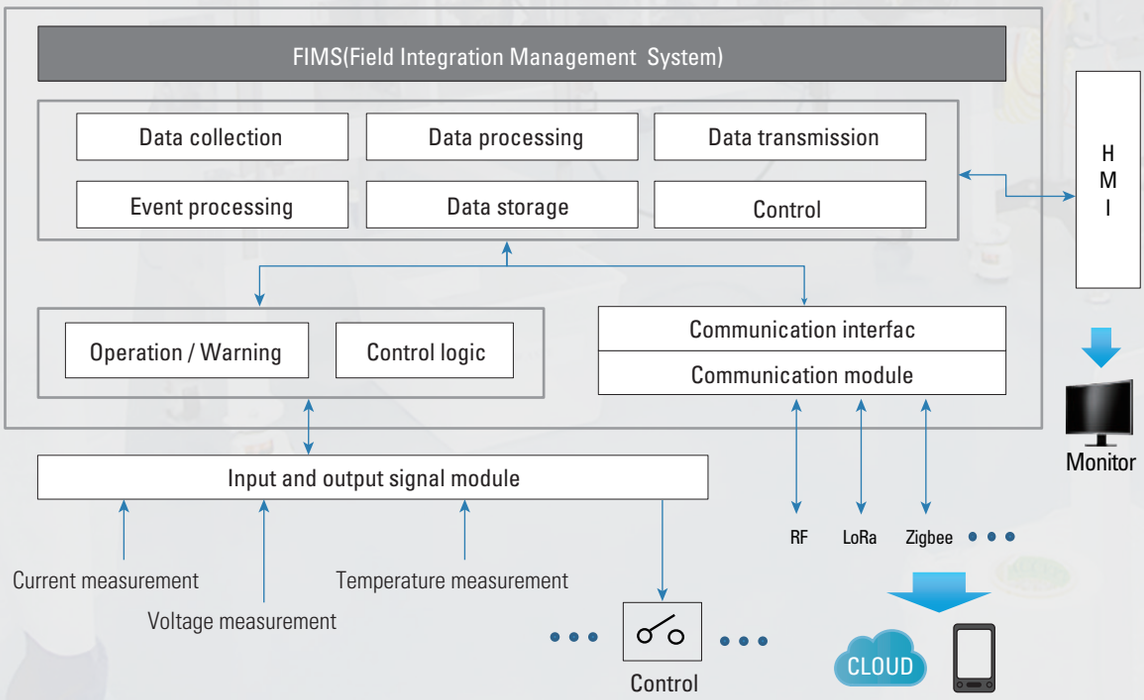
Autonomy | Easy control | Economy | Made in Korea | Safety

Process chart of the drug input and control system(Tube pump system)



FIMS(Field Integration Management System)

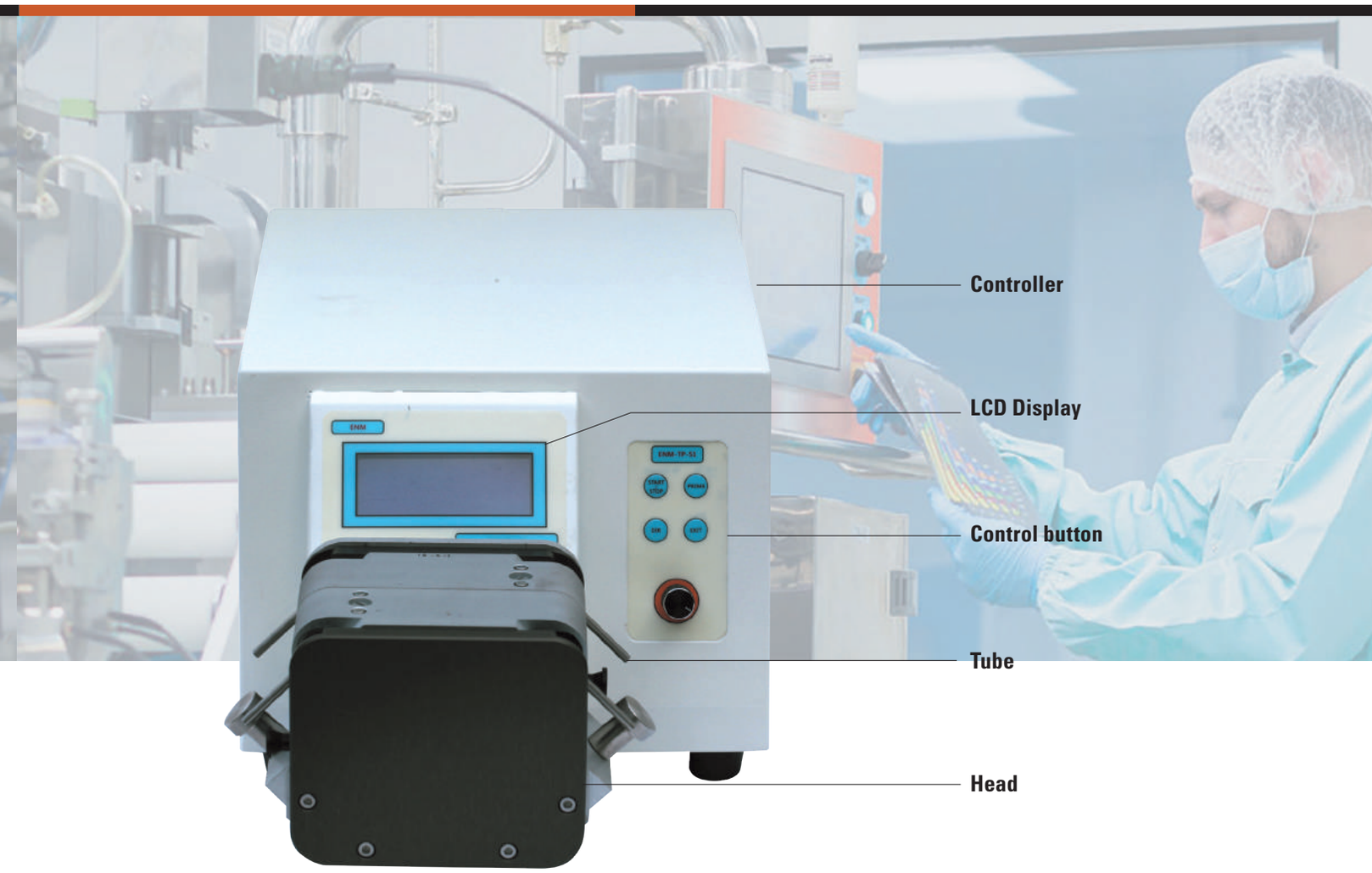
- Gateway
- Protocol analyses and processing
- Communication
- Data Analysis and Event Processing
- Execution processing and order. Control Unit



Controller Specifications

- **Speed** : 1 ~ 350rpm
- **Speed Resolution** : 1rpm
- **Control mode** : Internal, Gate, Trigger, 4~20mA Control
- **Display** : LCD for Running State
- **Dispensing Volume** : 0.1mL ~ 2.0L/min Setting
- **Dispensing Calibration** : Calibrate dispensing volume to improve accuracy(0.1ml/min)
- **Copy Number** : 1 ~ 9999 Copy
- **Pause Time** : 0.1Sec ~ 100Min
- **Back Suction Circle** : 0.0Sec ~ 99.9Sec
- **External Control** : Gate, Trigger, 4~20mA Control, Communication Output
- **Speed Output** : Current, TTL, Communication Output
- **Start/Stop** : TTL Output, Communication Output
- **Direction Output** : Communication Output
- **Communication interface** : Ethernet, RS-232, 4~20mA
- **Power Off Memory** : Emergency stop operation after eset (Current Control Mode)
- **Prime** : Function for fast filling and emptying at full speed (Max 350rom)
- **Dimension** : 280 x 190 x 160
- **Power Supply** : AC 220V/150W, 200W
- **Operating Temperature** : 0 ~ 50˚C
- **Relative Humidity** : <80%
- **IP Rating** : IP31
- **Weight** : 5.0Kg

Name of each department



· **Head :** The 2 head and 6 roller method is applied and used by combining it with a controller.

· **LCD Display :** Displays setting values, menus, and current values.

· **Tube :** Volume of the tube increases or decreases depending on the rotation of the roller in the head. Liquids are transported as suction and discharge are done due to static and negative pressure.

· **Controller :** The main controller of the tube pump for controling fixed quantities

· **Control button :** Push and knob switches which can be set and controlled

- Start/Stop : Button to start or pause operation of the pump.
- PRIME : Button to start or pause the highest speed
- DIR : Button to set the tube pump's transportation directions
- EXIT : Button to exit the setting menu
- Knob S/W (Knob switch)

: Changes flow rates by turning the knob switch clockwise or counterclockwise in the Flowrate Model.

: Selects and changes the setting values that you try to change by pressing the knob switch and entering the menu.

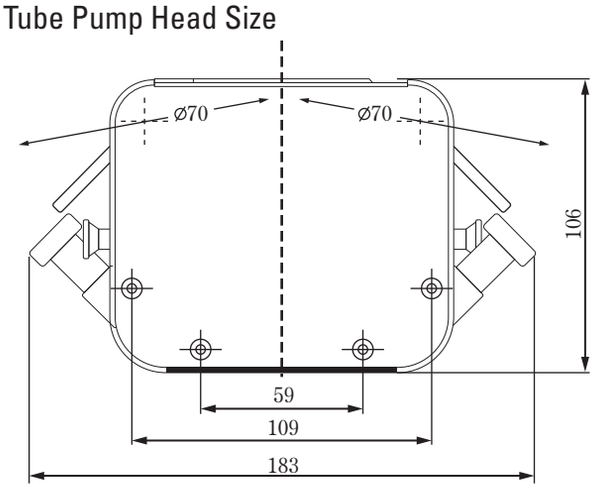
Tube Pump Head Specifications

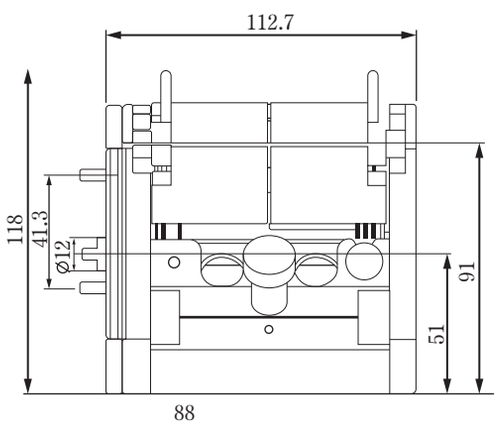
- Special tubing assembly, low pulse, high accuracy
- Designed for high precision and medium volume dispensing
- All Metal structure
- Higher flow rate and pressure than ENM-PH-14, 16, 18
- Pressure : ~ 4bar

Tube Pump Head Specifications

Model	Roller Number	Roller Material	Housing Material	Speed (rpm)	Tubing	200rpm Flow Rate (mL/min)	Ref Volume	Ref Time	Precision	Weight
ENM-PH-14	6	Stainless Steel	Aluminum Alloy	Max350	1.6	338	0.1ml	0.1sec	±2%	2.0Kg
					3.2	688	0.1ml	0.1sec	±2%	
					4.8	1026	0.1ml	0.1sec	±2%	
					6.4	1364	0.1ml	0.1sec	±2%	
					7.9	1692	0.1ml	0.1sec	±2%	
					9.6	2052	0.1ml	0.1sec	±2%	
ENM-PH-16					1.6	324	0.1ml	0.1sec	±2%	
					3.2	660	0.1ml	0.1sec	±2%	
					4.8	984	0.1ml	0.1sec	±2%	
					6.4	1308	0.1ml	0.1sec	±2%	
					7.9	1622	0.1ml	0.1sec	±2%	
					9.6	1968	0.1ml	0.1sec	±2%	
ENM-PH-18					1.6	312	0.1ml	0.1sec	±2%	
					3.2	634	0.1ml	0.1sec	±2%	
					4.8	945	0.1ml	0.1sec	±2%	
					6.4	1258	0.1ml	0.1sec	±2%	
					7.9	1560	0.1ml	0.1sec	±2%	
					9.6	1892	0.1ml	0.1sec	±2%	

Tube Pump Head Size



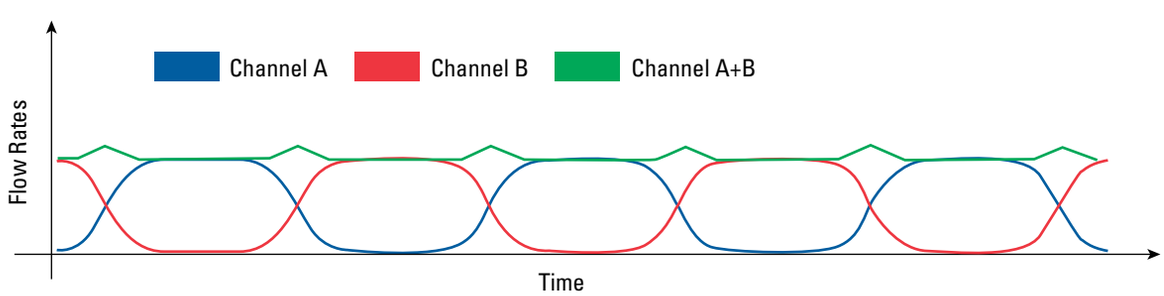


Tube Pump Head Assembly & Function

Special tubing assembly

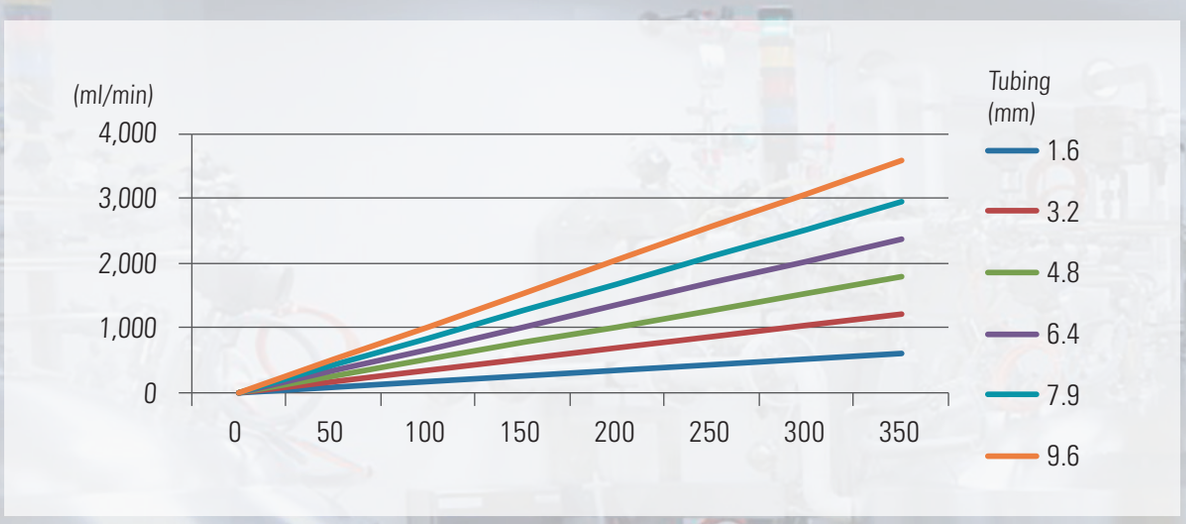
Y Connector

Phase compensation schematic

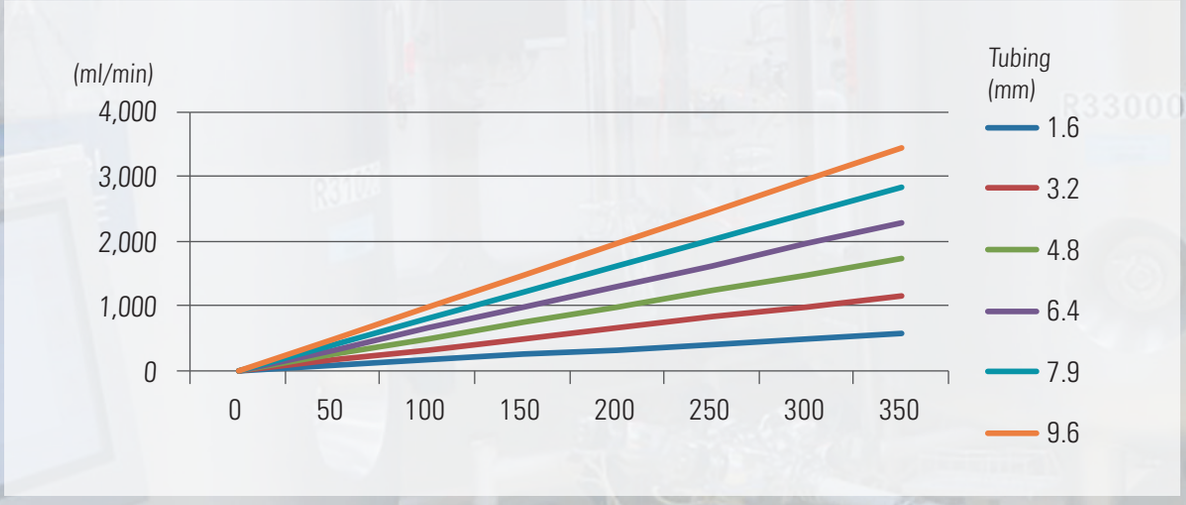


Tubing Flow Rate s Curve

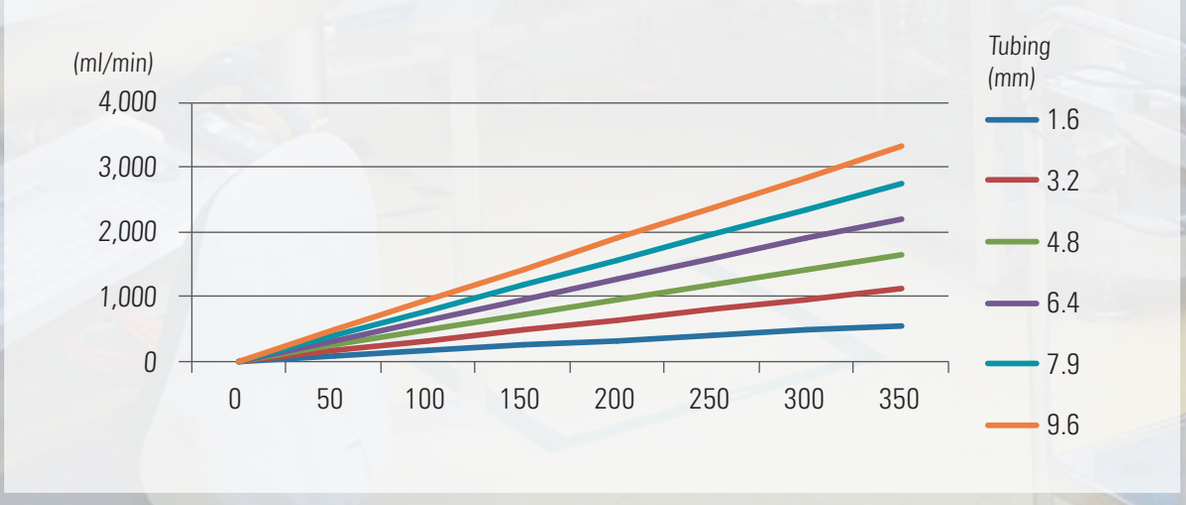
ENM-PH-14



ENM-PH-16



ENM-PH-18

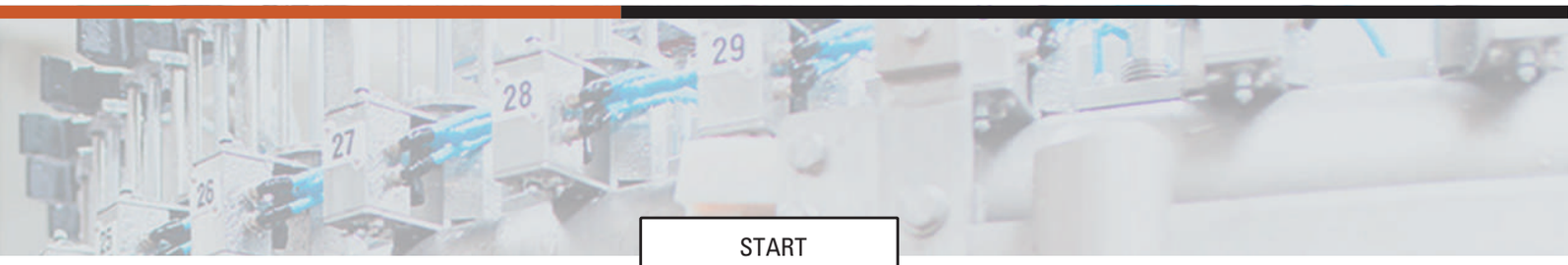


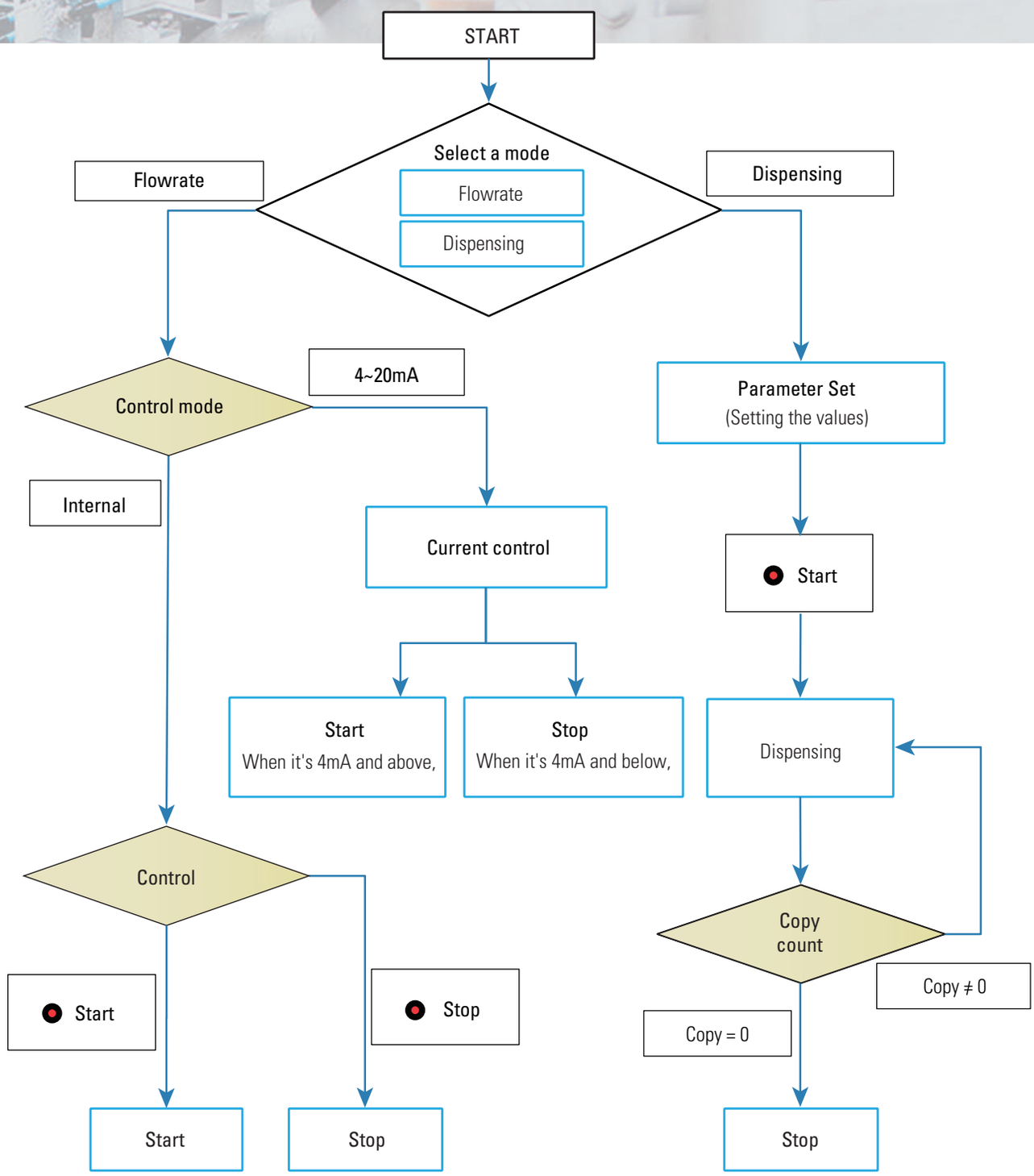
Tube Pump Tubing

Tubing Size(mm)	1.6	3.2	4.8	6.4	7.9	9.6
Tubing material (Silicon/Norprene/Marprene)	1.6	3.2	4.8	6.4	7.9	9.6
Wallthicknessofdomestictubing (mm)	1.6				2.4	
Innerdiameterofdomestictubing (mm)	1.6	3.2	4.8	6.4	7.9	9.6
Maximum pressure (Mpa)	0.17		0.14	0.1	0.14	
Tubing						

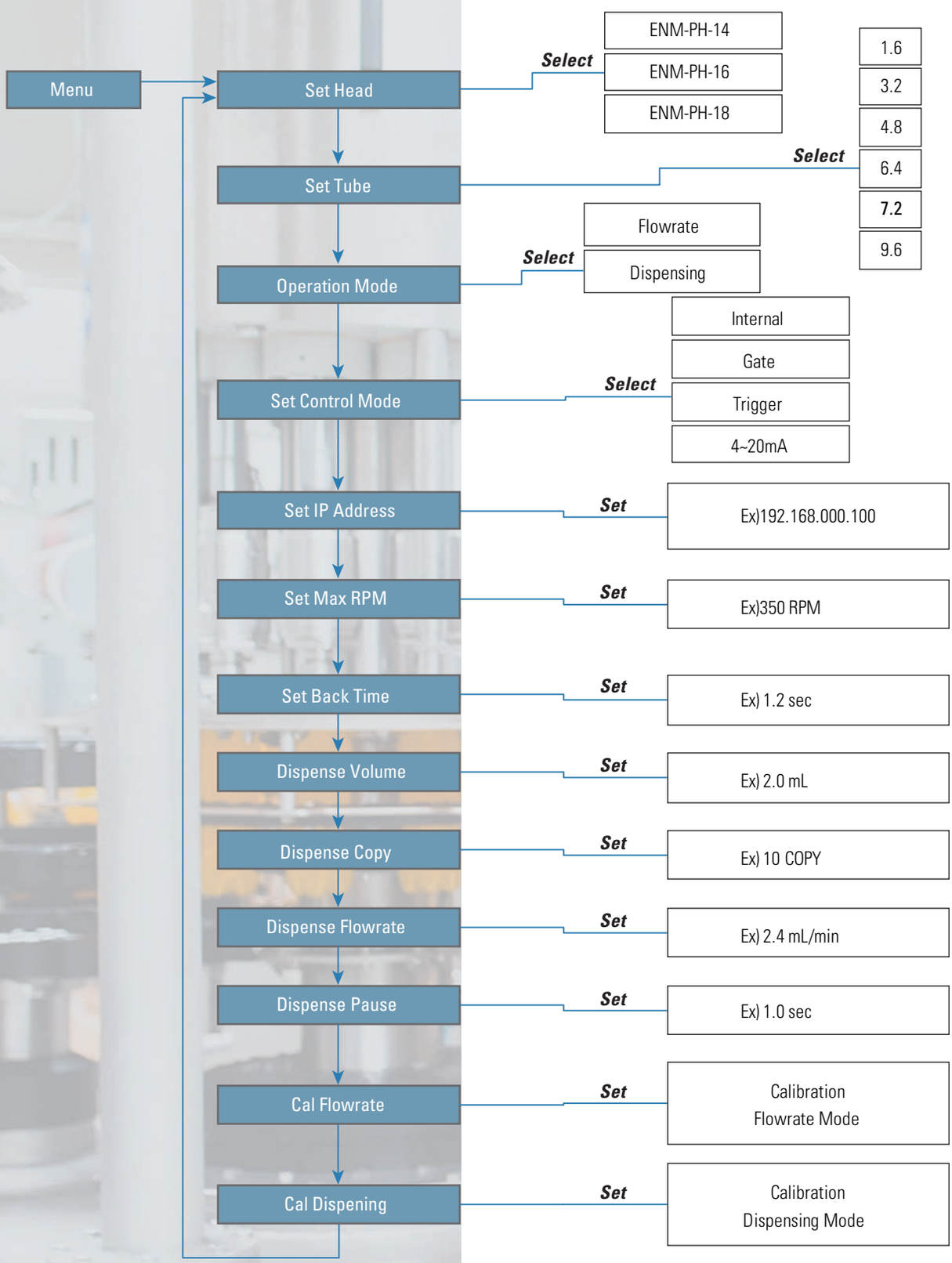
No.	Model No.	Remarks
1	Tubing1.6	1.6mm (Inner),(1~50m)
2	Tubing3.2	3.2mm (Inner),(1~50m)
3	Tubing4.8	4.8mm (Inner),(1~50m)
4	Tubing6.4	6.4mm (Inner),(1~50m)
5	Tubing7.9	7.9mm (Inner),(1~50m)
6	Tubing9.6	9.6mm (Inner),(1~50m)
7	YConnector1.6	1.6mm (Inner)
8	YConnector3.2	3.2mm (Inner)
9	YConnector4.8	4.8mm (Inner)
10	YConnector6.4	6.4mm (Inner)
11	YConnector7.9	7.9mm (Inner)
12	YConnector9.6	9.6mm (Inner)

Tube Pump State Chart





Tube Pump Menu Chart



Tube Pump Unit Configuration

```
Set.Head
  ENM-PH-14
* ENM-PH-16
  ENM-PH-18
```

· **Set Head** : Selects a head size
(Can select ENM-PH14/16/18.).

```
Set.Tube
  1.6
* 3.2
  4.8 ↓
```

· **Set Tube** : Selects a tube size
(Can select 1.6/3.2/4.8/6.4/7.9/9.6.).

```
Operating Mode
* Flowrate
  Dispensing
```

· **Operation Mode** : Selects an operational mode
(Can select Flowrate/Dispensing.).

```
Set.Control Mode
* Gate
  Trigger
  4-20mA
```

· **Set Control Mode** : Selects a control mode.
(Can select Internal/Gate/Trigger/4~20mA.)

```
Set.IP Address
* 192.168.000.100
```

· **Set IP Address** : Sets Ethernet IP.

```
Set.MaxRPM
* 350.0 RPM
```

· **Set MaxRPM** : Can set the maximum speed
(Can set upto ~350rpm.).

```
Set.Back Time
* 1.2 sec
```

· **Set Back Time** : Sets back time when the Dispensing Mode is operated.

```
Dispense.Volume
* 2.0 mL
```

· **Dispense Volume** : Sets the amount of injection when the Dispensing Mode is operated.

```
Dispense.Copy
* 10 COPY
```

· **Dispense Copy** : Sets frequency of injection when the Dispensing Mode is operated.

```
Dispense.
Flowrate
* 2.4 mL/min
```

· **Dispense Flowrate** : Sets the flow rates when the Dispensing Mode is operated.

```
Dispense.Pause
* 1.0 sec
```

· **Dispense Pause** : Sets pulse time when the Dispensing Mode is operated.

```
Cal.Flowrate
* 30.0 sec
* 40.00 mL
```

· **Cal Flowrate** : Start the device with the Start button by setting fine control of the flow rate, time, and the flow rates.

· Inputs the actual flow rate in the flow rate value of the tube pump by comparing the flow rate displayed during the setting time with it.

· Check the values by using the time and actually input flow rate values and starting the device with the Start button.

· Fine control is completed when the flow rate displayed during the setting time is the same with the actual flow rate.

```
Cal.Dispensing
* 60.0 sec
* 60.000 mL
```

· **Cal Dispensing** : Start the device with the Start button by setting fine control, time, and the flow rate of Dispensing.

· Inputs the actual flow rate in the flow rate value of the tube pump by comparing the flow rate displayed during the setting time with it.

· Check the values by using the time and actually input flow rate values and starting the device with the Start button.

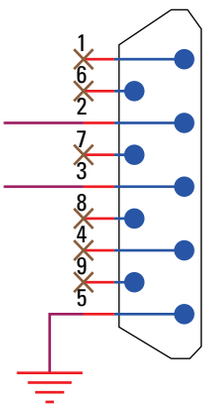
· Fine control is completed when the flow rate displayed during the setting time is the same with the actual flow rate.

Remote data monitoring (ENM-PT-HMI)

- IP Address Set
- Display Select
- Max rpm Set
- State Set
- Dispense Volume Display
- Dispense Flowrate Display
- Copy Number Set
- Pause Set
- Cal Flowrate Set
- Cal Dispensing Set
- Head Select
- Tube Select
- Control mode Select
- Operating mode Select
- START/STOP Control
- Dir Control

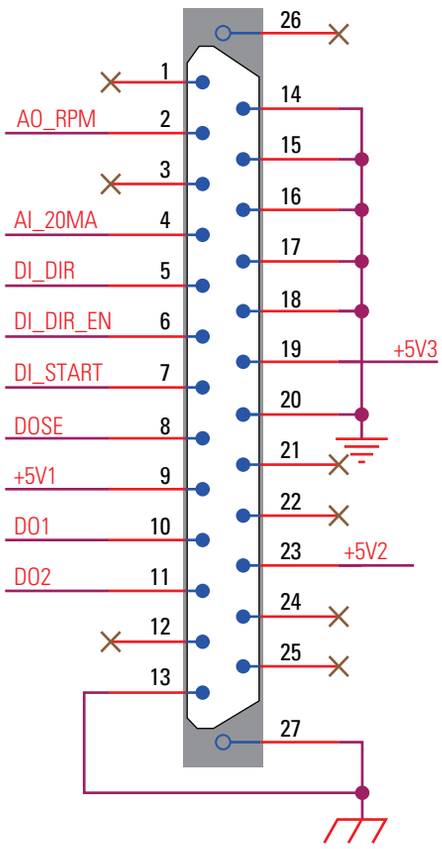
Pin Connector composition

COM DB9/MALE



Pin No.	NAME	Pin No.	NAME
1	N.C	5	GND
2	RXD	6	N.C
3	TXD	7	N.C
4	N.C	8	N.C

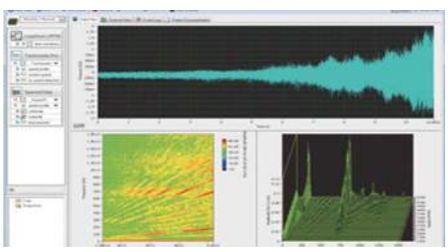
CON1 DB25(Female)

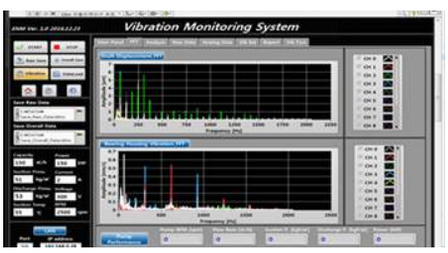


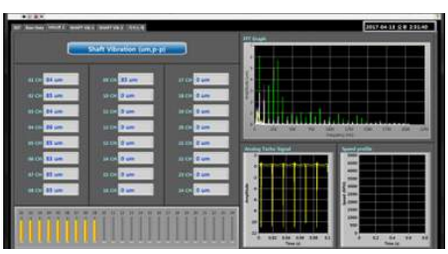
Pin No.	NAME	Pin No.	NAME
1	N.C	17	GND
2	AO_RPM	18	GND
3	N.C	19	+5V3
4	AI_20mA	20	GND
5	DI_DIR	21	N.C
6	DI_DIR_EN	22	N.C
7	DI_START	23	+5V2
8	DOSE	24	N.C
9	+5V1	25	N.C
10	DO1	26	N.C(No Pin)
11	DO2	27	GND(Shield)
12	N.C		
13	GND		
14	GND		
15	GND		
16	GND		

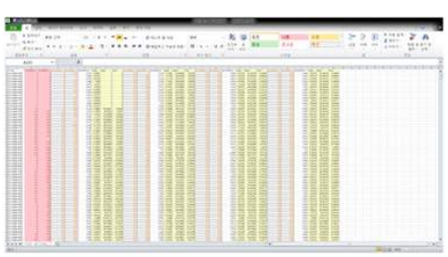
System Configuration

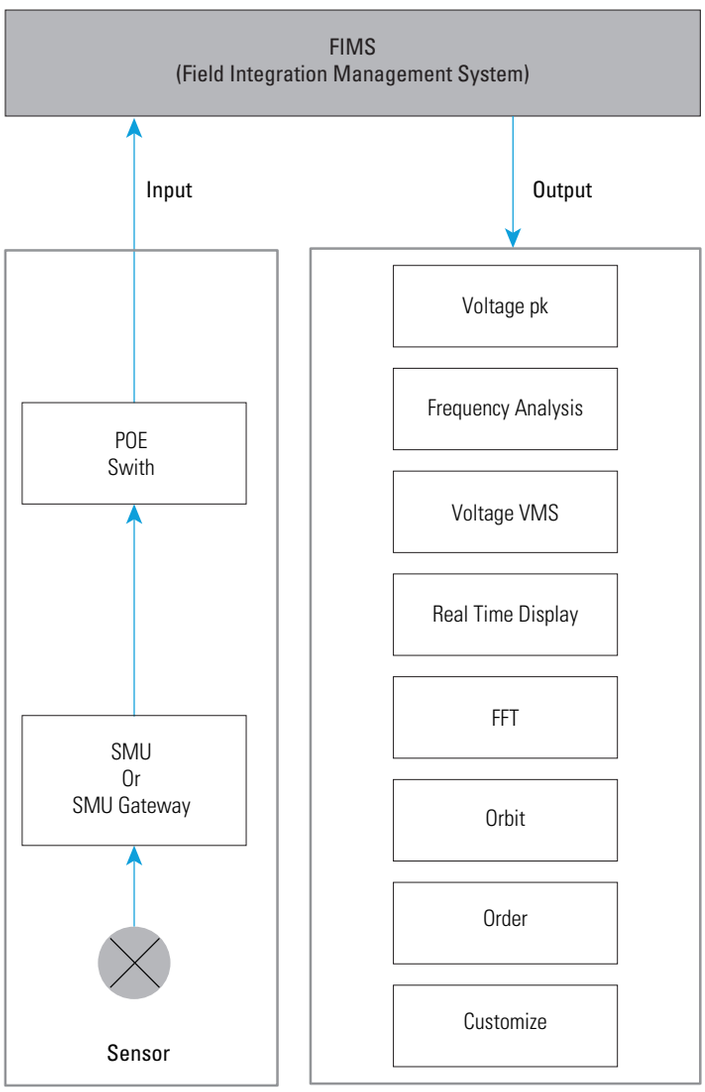
Sensor (Vibration) measurement and analysis system with Sensor(SMU)







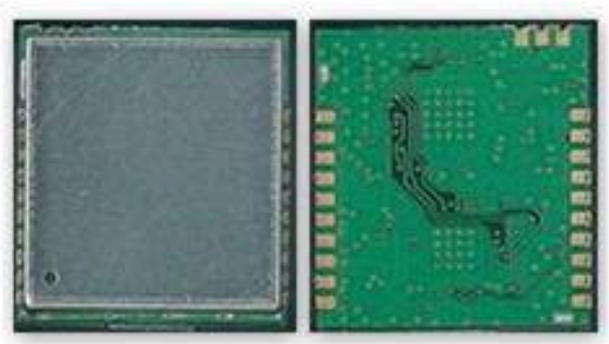




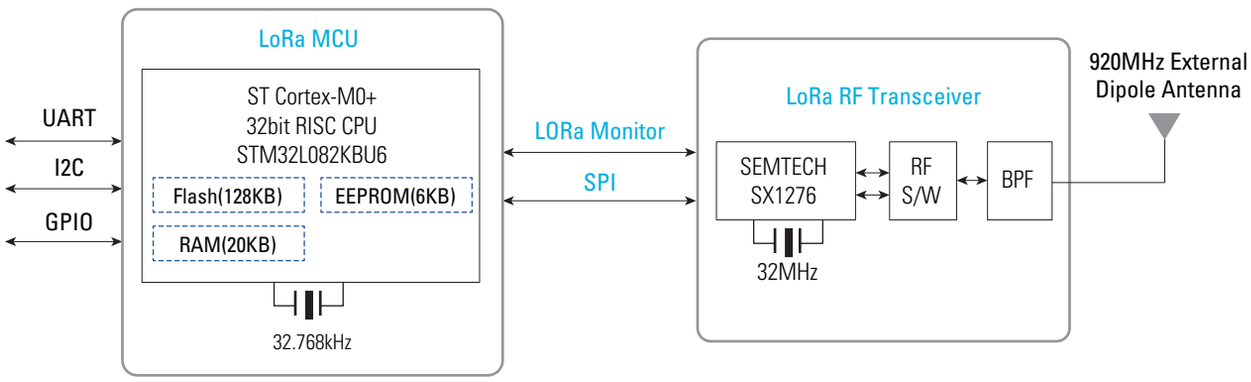
<Block Diagram>

1. Measuring and monitoring vibration data of important facilities with the vibration measurement and analysis system.
2. Performance diagnosis and evaluation by analyzing vibration
3. Measuring and analyzing acceleration, speed, displacement, TimeBase, FFT, Order Tracking, Orbit, and Impact
4. User customized visualization work and output of the report forms

Wireless communication monitoring(LoRa)



<SKT LoRa Module (TLT01CS1)>



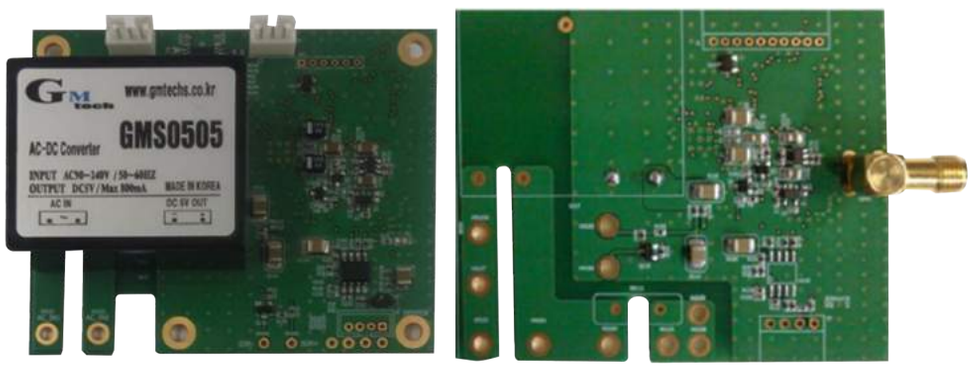
<Block Diagram>

Wireless Communication based on LoRa Technology

1. Operating on 920MHz Unlicensed ISM band
2. AES 128-bit H/W Encryption Engine
3. Low Power Consumption MCU : Cortex- M0+
4. RoHS compliant
5. Various peripheral
6. 128KB internal Flash Memory

System Configuration

Wireless communication monitoring(ENM-RF)



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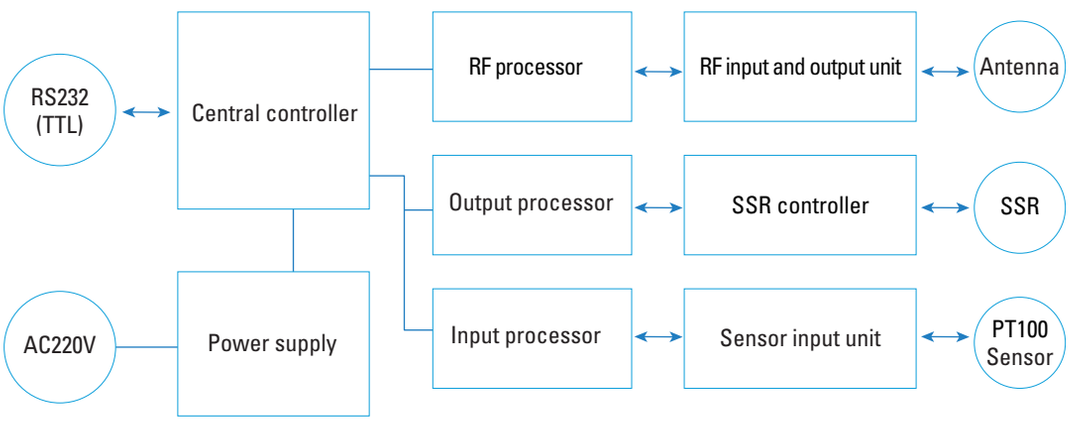
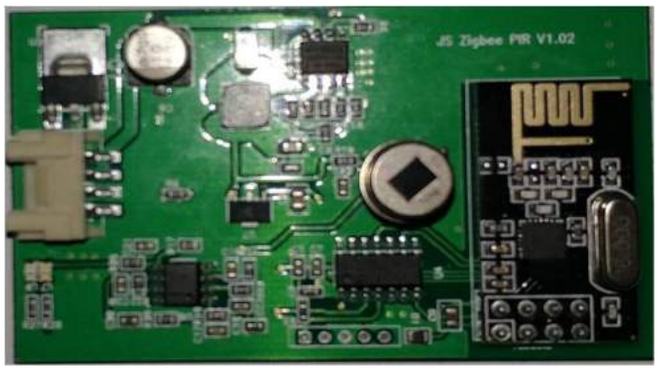


<Block Diagram>

Hardware		Radio		Movement	
CPU	EFM32Gxxx	Frequency band	424Mhz	Input power supply	AC220V
CORE	ARM Coretex-M3 32bit RISC	Communication method	2FSK	Output	AC220V 7.5KW
USART	debug port 115200bps	Type of radio wave	F1D	Input	PT100 Sencor 0.5°C Scale
TIMER	16bit count	Radio output	10mW	Movement temperature	-20 ~ 70°C

Wireless communication monitoring(Zigbee)



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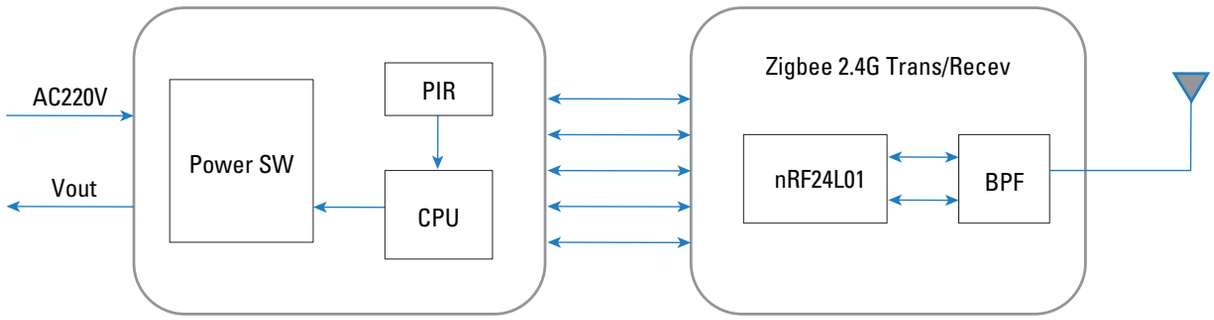


<Block Diagram>

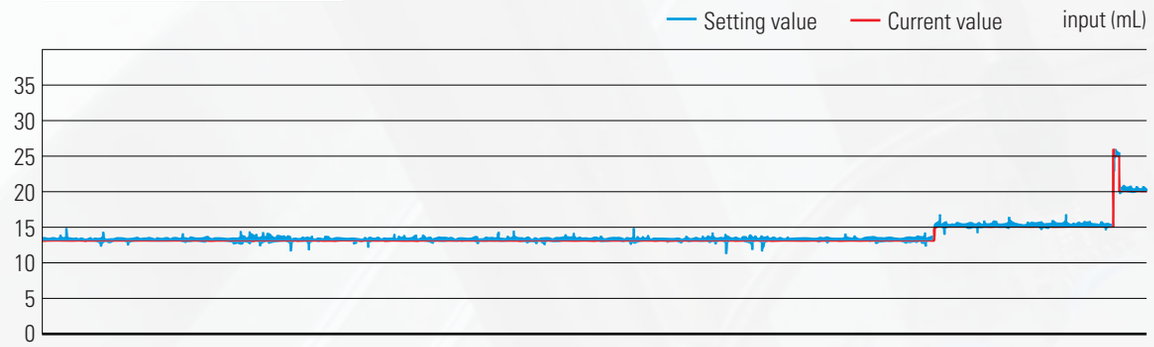
Wireless Communication based on Zigbee Technology

1. IEEE 802.15.4 MAC and PHY
2. Operating on 2.4GHz ISM band
3. Up to 16 Channels at 250kbps
4. Ultra Low Power Consumption
5. Range: Up to 100m, 65000 nodes
6. Application: Light Switch, Dimmer, Sensor(PIR)

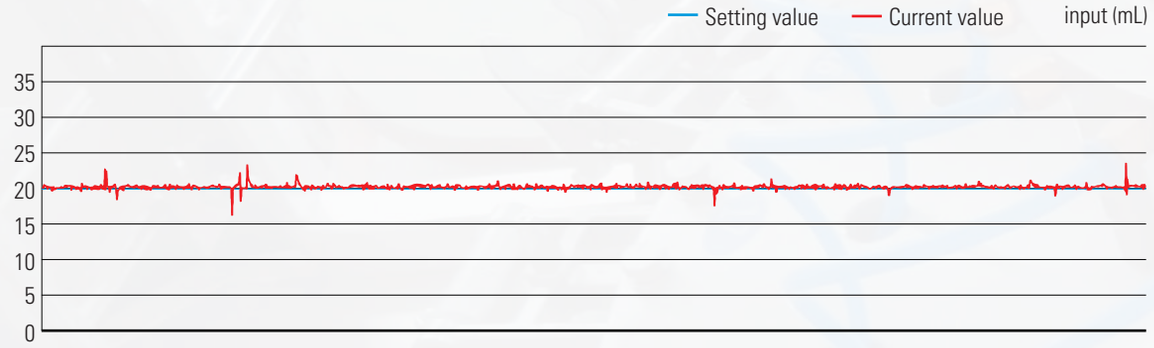
Spot test

Test data in the sites

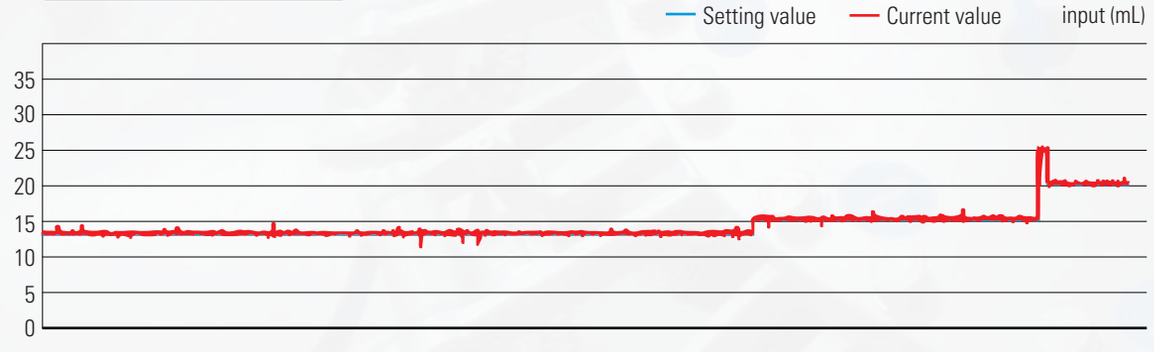
2017.01.20 ~ 2017.03.08



2017.03.08 ~ 2017.03.09

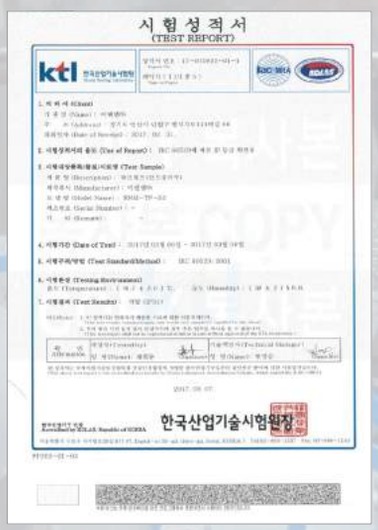


2017.02.08 ~ 2017.03.09

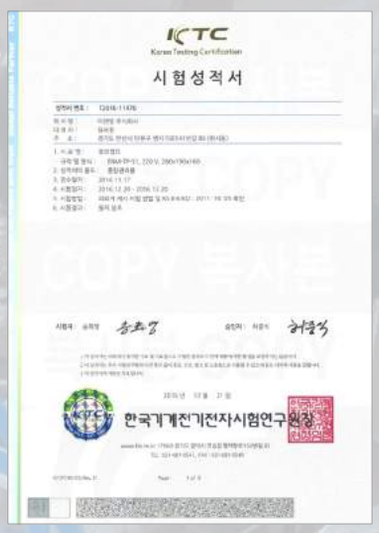


Patents and Certificates

Industrial intellectual property rights and patent of the tube pump



Test Report (IP-31)



Test Report (Evaluation of Reliability)

Certificate of Patent

Tube pump system with a embedded control module

Certificate of Patent

Method to sense tube damage of the tube pump system and the tube pump system

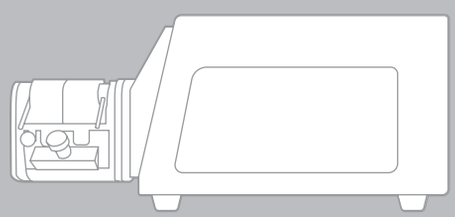
Certificate of Patent

Tube pump head with a Y-shaped tube for removing pulsation

Certificate of Patent

Method to diagnose pump performance with a thermodynamic flowmeter

No.	Title	Application number	Patent Date	Registration date
1	Tube pump system with a embedded control module	10-2016-0165429 (10-1809123)	2016.09.12	20171208
2	Method to sense tube damage of the tube pump system and the tube pump system	10-2017-0025899 (10-1809129)	2017.02.28	20171208
3	Tube pump head with a Y-shaped tube for removing pulsation	10-2017-0025892 (10-1809128)	20170228	20171208
4	Method to diagnose pump performance with a thermodynamic flowmeter	10-2013-0045968 (10-1483241)	20130425	20150109



E&M

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