![Fuji Electric logo] **Fuji Electric**

Innovating Energy Technology

Ultrasonic Flowmeter for Steam

World's first clamp-on type saturated steam flow measurements

Contributes to "visualization" of steam flow and works in combination with EMS to optimize energy and achieve energy savings.
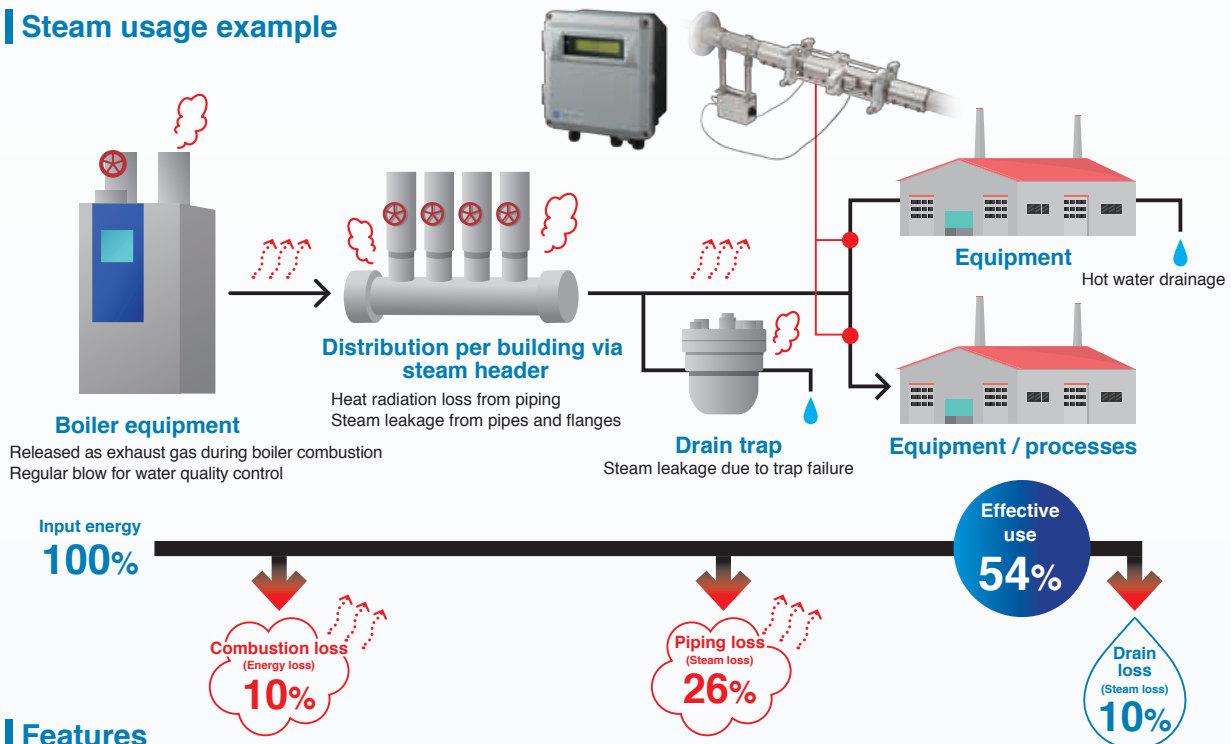
☑ **Installable without turning off steam line
No piping work required**

☑ **Effective use of steam energy
without pressure loss**

☑ **Less maintenance costs
due to no moving parts**

Makes it easy to "visualize" steam

Steam used in factories is produced in boilers and then lost due to pipe heat dissipation loss and steam leakage. This ultrasonic flowmeter for steam can be mounted easily without Plumbing. Operation of equipment is not necessary to stop when a steam flowmeter is added to the plant. "Visualization" of steam flow can be achieved in factories and facilities where it was previously difficult to perform. It helps optimum energy savings and energy management in factories.

Steam usage example

Boiler equipment
Released as exhaust gas during boiler combustion
Regular blow for water quality control

Distribution per building via steam header
Heat radiation loss from piping
Steam leakage from pipes and flanges

Drain trap
Steam leakage due to trap failure

Equipment
Hot water drainage

Equipment / processes

Input energy
100%

Combustion loss
(Energy loss)
10%

Piping loss
(Steam loss)
26%

Effective use
54%

Drain loss
(Steam loss)
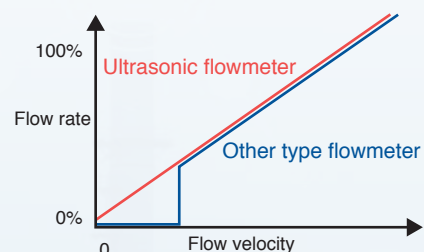**10%**

Features

No plumbing required

Installable with no pipe cutting or flange processing. Installable without stopping production lines and no steam leakage concerns since plumbing is not required.

Conventional: In-line type	New: Clamp-on type
Pipe cutting Flange processing	Measurements without cutting pipes
Piping work required **Concerns about steam leakage pressure loss...**	Piping work not required **No concerns about steam leakage or pressure loss**

No pressure loss

The ultrasonic sensors do not interfere with the steam flow.

Conventional: In-line type	New: Clamp-on type
There is pressure loss	**No pressure loss**

Less maintenance cost

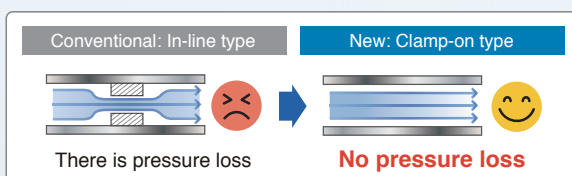No moving parts help to reduce regular maintenance costs such as cleaning.

Enables measurements at low flow rates

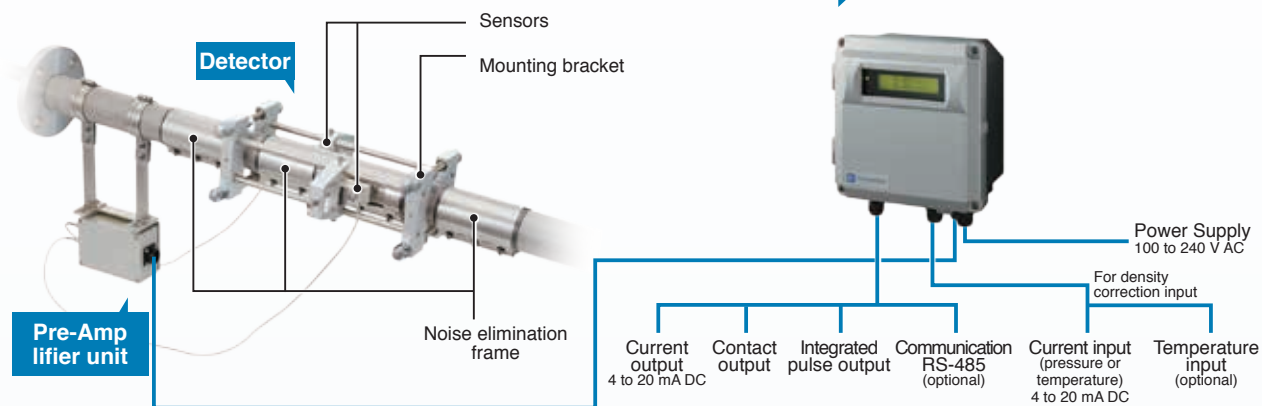The ultrasonic flowmeter can meusure at low flow rate, even at flow rates of 0.

100%
Flow rate
Ultrasonic flowmeter
Other type flowmeter
0%
0   Flow velocity

Convertible to mass flow rate

The measured volume flow measurement and density (fixed value) input can be converted to mass flow rate and output. Density correction can also be performed by measuring the pressure (4 to 20 mA DC) and temperature (with resistance bulb) of the saturated steam and inputting as external signal (AI).
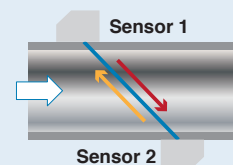
flow

Equipment configuration

Detector

Sensors

Mounting bracket

Pre-Amplifier unit

Noise elimination frame

Flow transmitter

Power Supply
100 to 240 V AC

For density correction input

Current output
4 to 20 mA DC

Contact output

Integrated pulse output

Communication RS-485
(optional)

Current input
(pressure or temperature)
4 to 20 mA DC

Temperature input
(optional)

[RS-485 communication enables the following]
- Setting of parameters
- Checking of received waveforms
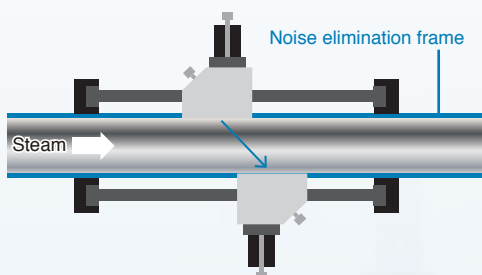- Grasping of trends in measurement data, etc.
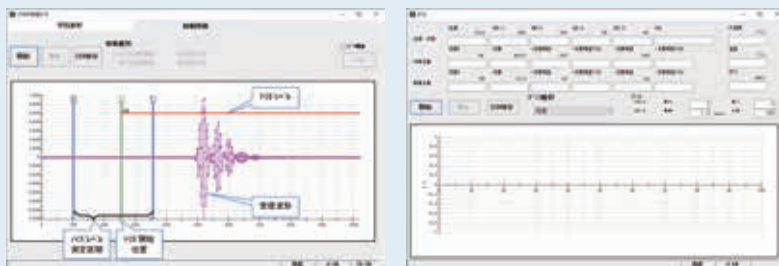
Measurement principle:
- Transit-time difference

A pair of sensors are installed on the outside wall of the pipe, facing each other diagonally. The sensors emit ultrasonic pulse in turn, and detect the transit time difference of the pulse, by which the flow rate is calculated.

Sensor 1

Sensor 2

Accurate flow measurement

Noise elimination frame

The heat-resistant rubber frame on the piping surface can reduce noise and accurate cabtuning of the ultrasonic signals is achieuable.

Noise elimination frame

Steam

Without noise elimination frame | With noise elimination frame

Cross section

Cross section

Noise

Signal

Noise

Signal

Transmission sensor

Pipe

Receiving sensor

Noise elimination frame

Large Noise

Noise reduction

Algorithm dedicated for steam measurement
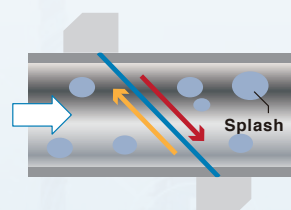
Conventional analog processing

Measurement failure may occur due to interruption by splash.

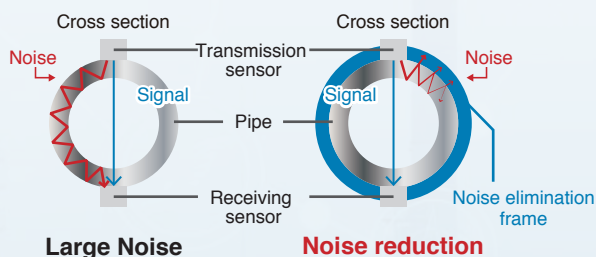Splash
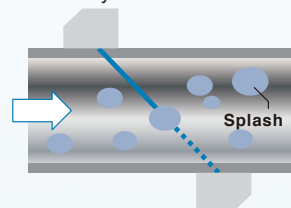
Digital processing by Fuji own algorithm

Normal transit of ultrasonic waves and synchronons addition processing of received signal.

Splash

Ensured sufficient signal level by summing flow rate signals

Ordering code

Flow transmitter

Code 4 5 6 7 8   9

F S J | **1** | **Y** | **1** | **-** |

Digit	Specifications	Note:	Code
4	**Wiring port, mounting method**		
	With water-proof gland, wall mount	Note	L
	With union (for plica tube) gland, wall mount		M
	With water-proof gland, pipe mount		N
	With union (for plica tube) gland, pipe mount		P
5	**Power Supply**		
	100 to 240 V AC, 50/60 Hz		1
6	**Explosion-proof specification**		
	None		Y
7	**Parameter setting/tag plate (flow transmitter)**		
	None		Y
	With setting		A
	With setting + tag plate (flow transmitter)		B
	Tag plate (flow transmitter)		C
8	Revision code		1
9	**<Option functions>**		
	None		Y
	Communication (RS-485)		D
	Temperature input (Pt100)		E
	Communication (RS-485) + temperature input (Pt100)		F

Note) Specifications for the wiring port are as follows.
    With water-proof gland: G1/2 and G3/8 (female screw)
    With union (for plica tube) gland: G1/2 (female screw)

Detector

Code 4 5 6 7   9

F S X | **5** | **S** | **Y** | **1** | **-** | **S**

Digit	Specifications	Note:	Code
4	**Pipe diameter**		
	50A		5
5	**Sensor fixing bracket, noise damping frame**		
	Standard		S
6	**Explosion-proof specification**		
	None		Y
7	**Acoustic coupler, tag plate (detector)**		
	None		Y
	High-temperature grease		D
	High-temperature silicon rubber (for long-term installation)	Note	E
	Tag plate (detector)		F
	High-temperature grease + tag plate (detector)		G
	High-temperature silicon rubber (for long-term installation) + tag plate	Note	H
8	Revision code		1
9	**Preamp unit**		
	Standard		S

Dedicated signal cable

Code 4 5 6 7 8

F L Y | **E** | | | **1**

Digit	Specifications	Code
4	**Applications**	
	Flow transmitter for steam (FSJ), detector for steam (FSX)	E
5 6 7	**Dedicated cable length**	
	5m	005
	10m	010
	15m	015
	20m	020
	25m	025
	30m	030
	Other	ZZZ
8	Revision code	1

Specifications

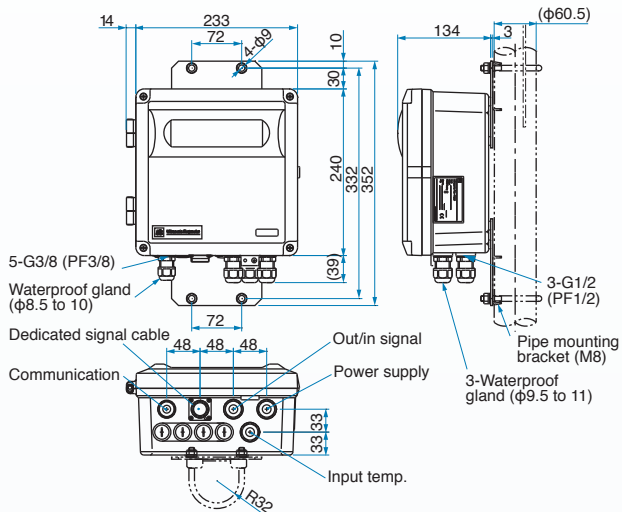| Item	Specifications
Mounting method	Clamp-on type
Measurement fluid	Saturated steam
Measuring method	Transit time difference
Flow velocity	0 to ±50 m/s
Accuracy	For required straight pipe length (upstream: 20 D or longer; downstream: 10 D or longer) Flow velocity 10 m/s or less: ±0.3 m/s Flow velocity 10 to 30 m/s: ±3% of rate Flow velocity above 30 to 50 m/s: ±5% of rate
Required straight pipe length	Upstream: 20 D or longer; downstream: 10 D or longer
Piping material	Carbon steel, stainless steel
Pipe diameter	50 A (diameter size lineup expansion under development)
Pipe thickness	2.8 to 3.9 mm
Fluid temperature	120 to 180°C
Fluid pressure	0.1 to 0.9 MPa (G)
Moisture and splash	Wetness: 0%, there should be no splashing
Input (For mass flow rate conversion)	Current input (4 to 20 mA DC) ×1 Temperature input (resistance bulb) ×1 (optional)
Output	Current output (4 to 20 mA DC) ×1 Total pulse output ×1 Contact output ×1
Mass flow rate conversion	fixed value input (density) · temperature input · pressure input
Communication	RS-485 (optional) Ethernet (optional: under development)
Power supply/ consumption	100 to 240 V AC, 20 VA
Degree of protection	IP67 (with connectors fitting)
Ambient temperature	-20 to +60°C
Ambient humidity	95% RH or less
Grounding	Class D grounding with ground resistance of 100Ω or less

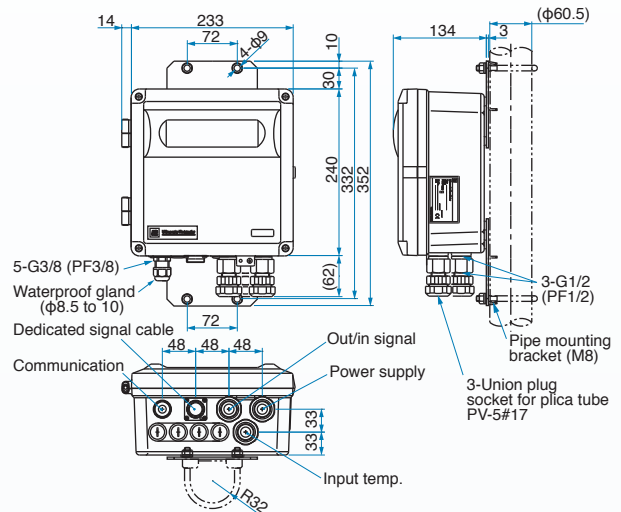Measurement may be unavailable depending on conditions.

Outline diagram

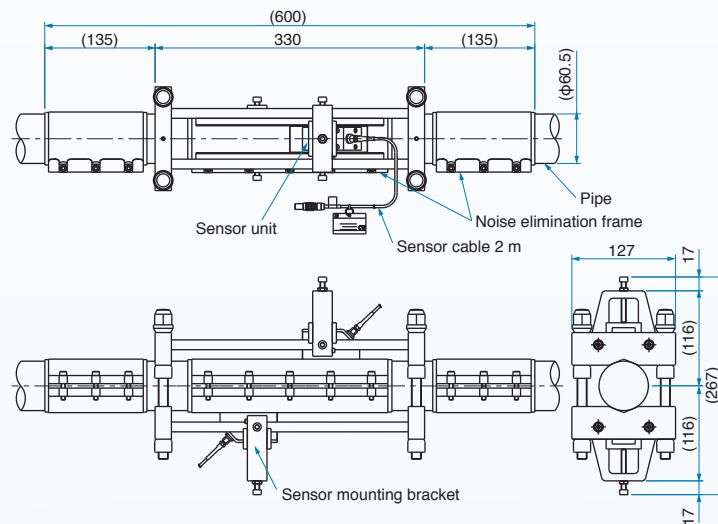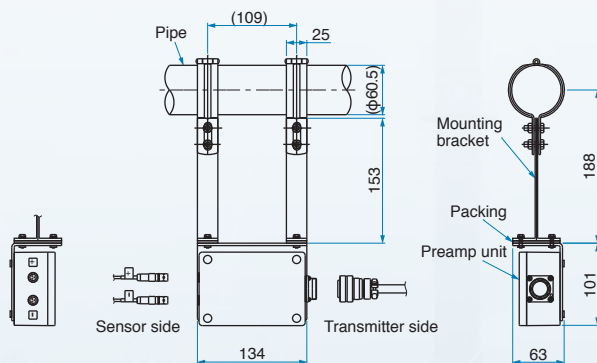### ■ Flow transmitter (Type: FSJL FSJN)

5-G3/8 (PF3/8)
Waterproof gland (φ8.5 to 10)
Dedicated signal cable
Communication
Out/in signal
Power supply
3-Waterproof gland (φ9.5 to 11)
Input temp.
3-G1/2 (PF1/2)
Pipe mounting bracket (M8)

■ Flow transmitter (Type: FSJM FSJP)

5-G3/8 (PF3/8)
Waterproof gland (φ8.5 to 10)
Dedicated signal cable
Communication
Out/in signal
Power supply
3-Union plug socket for plica tube PV-5#17
Input temp.
3-G1/2 (PF1/2)
Pipe mounting bracket (M8)

■ Detector (Type: FSX)

Sensor unit
Sensor cable 2 m
Noise elimination frame
Pipe
Sensor mounting bracket

■ Pre-amplifier

Pipe
Sensor side
Transmitter side
Mounting bracket
Packing
Preamp unit

■ Dedicated signal cable (Type: FLYE)

L (cable length (m): to be specified)

5
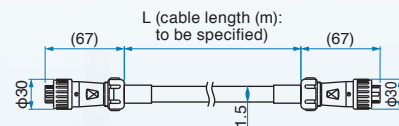
Fuji Electric's EMS Solution

"Visualization", "Recognition" and "Optimization".

The 3-steps contrubute to your energy management sollution, based on our vision of creating daily and continuous improvement of "energy management".

STEP1 Visualization

Understanding energy usage

Understanding present situations and taking effective action immediately

1. Ascertaining the state of energy by measuring it at key points

2. Deploying known and feasible energy-saving measures

**Energy load adjustment**

Load

Time

MICREX-VieW
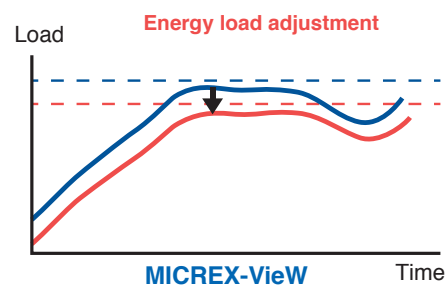
STEP2 Recognition

Energy management

Countermeasure point extraction and effect analysis

1. Achieving points of improvement while eliminating waste through energy-saving analysis support environment deployment

2. Establishing a daily improvement cycle

3. Model energy consumption trends through data collection

Reduced energy consumption through increased efficiency
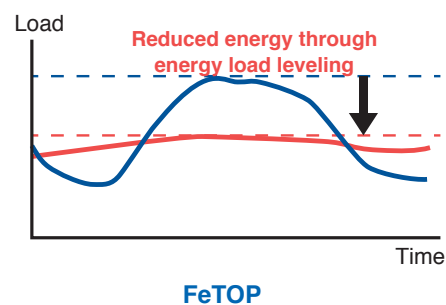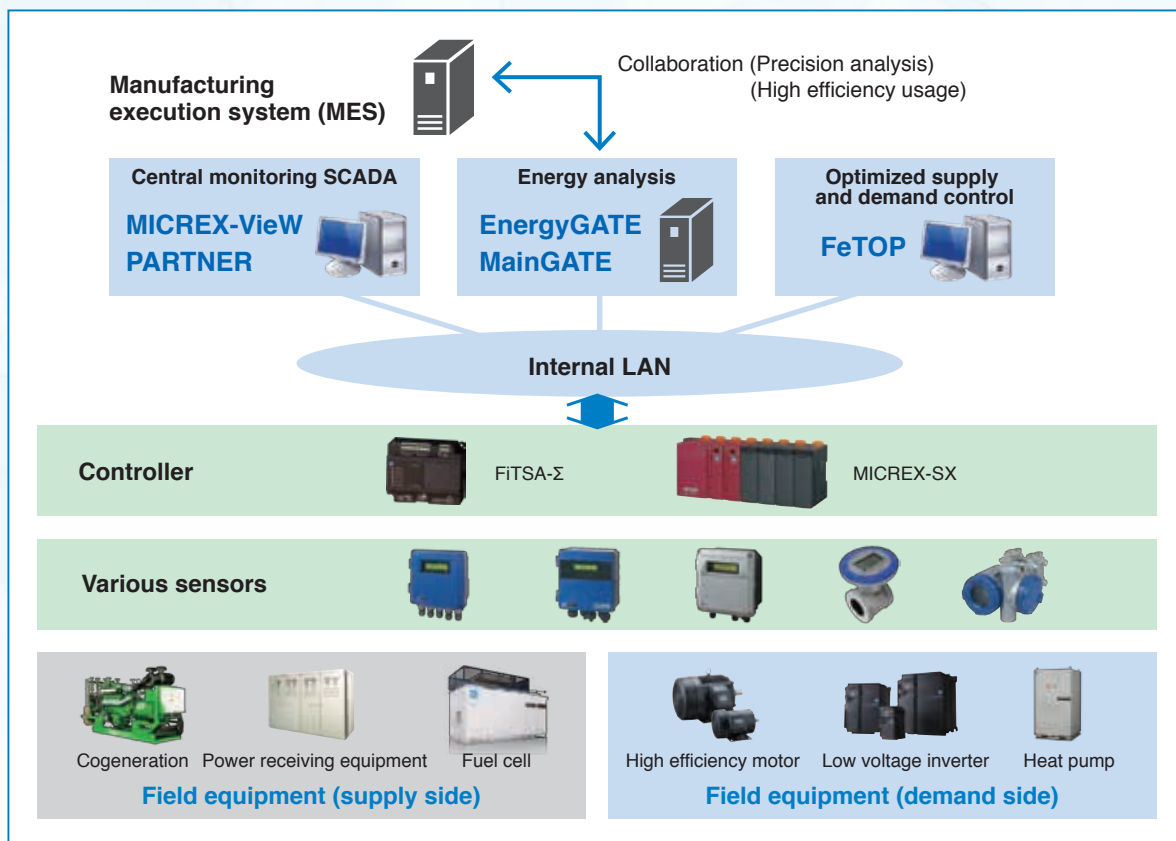
Load

Time

MainGATE
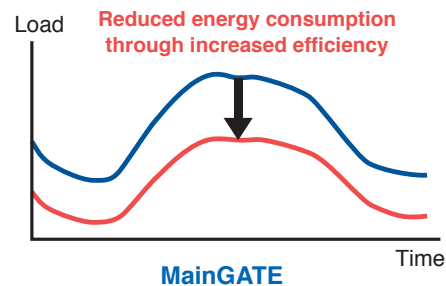
STEP3 Optimization

Energy usage optimization

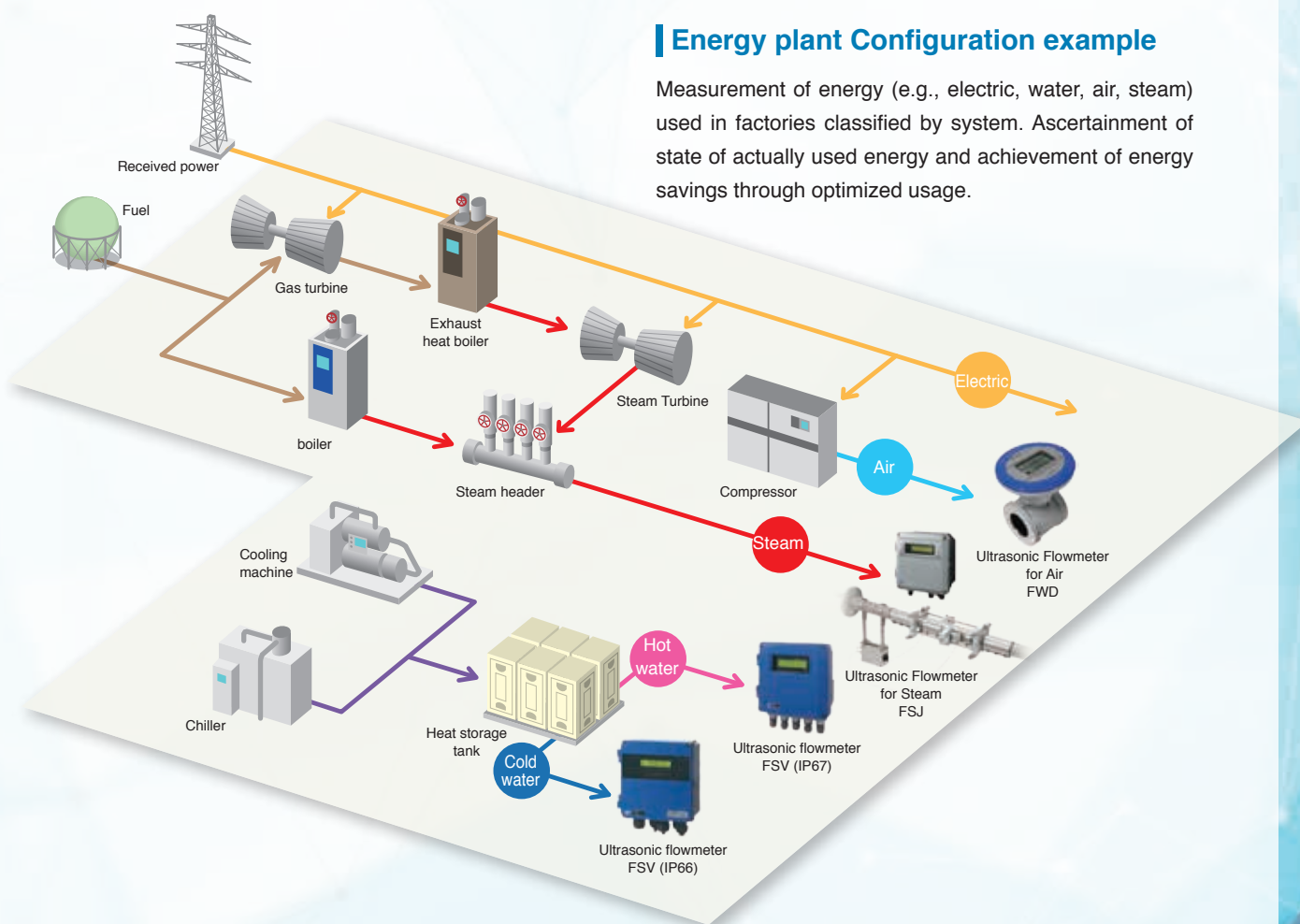Optimized usage, management and capital investment

1. Further reducing energy costs through use of energy-saving equipment and control technology

2. Achieving optimum supply control based on energy consumption models

3. Leveling energy loads through use of power generation and storage devices

Reduced energy through energy load leveling

Load

Time

FeTOP

Manufacturing execution system (MES)

Collaboration (Precision analysis)
(High efficiency usage)

Central monitoring SCADA	Energy analysis	Optimized supply and demand control
MICREX-VieW PARTNER	**EnergyGATE MainGATE**	**FeTOP**

Internal LAN

Controller FiTSA-Σ MICREX-SX

Various sensors

Cogeneration Power receiving equipment Fuel cell
Field equipment (supply side)

High efficiency motor Low voltage inverter Heat pump
Field equipment (demand side)

Energy plant Configuration example

Measurement of energy (e.g., electric, water, air, steam) used in factories classified by system. Ascertainment of state of actually used energy and achievement of energy savings through optimized usage.

Received power

Fuel

Gas turbine

Exhaust heat boiler

boiler

Steam Turbine

Steam header

Compressor

Electric

Air

Cooling machine

Steam

Chiller

Heat storage tank

Hot water

Cold water

Ultrasonic Flowmeter for Air FWD

Ultrasonic Flowmeter for Steam FSJ

Ultrasonic flowmeter FSV (IP67)

Ultrasonic flowmeter FSV (IP66)

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