

◆ Eco-creative Activities

Green Manufacturing Lines and Green Design

To supply environmentally friendly products to customers, parts and materials acquired by green purchasing must be used, and environmentally friendly manufacturing lines must be used to produce environmentally friendly products. The Yokogawa Group has made real progress in this field.

1. Green Manufacturing Line Improvement Rules

The Manufacturing Line Improvement Rules were enacted in March 2002 for eliminating waste. The objectives are to improve the environment by building environmentally friendly manufacturing lines, raising productivity with fewer resources, reducing the environmental burden, avoiding environmental risks, and decreasing the manufacturing cost. Each production line is comprehensively assessed in terms of energy efficiency, resource efficiency, use of toxic substances, waste emissions, packing, environmental risk posed by toxic substances, and so on, and then refined into a green manufacturing line. The rules began being enforced as a trial at the Kofu plant and will be progressively applied at other Group firms.

(1) Assessment before Improvement

A line to be improved is assessed using the Green Manufacturing Assessment Sheet, and the top three annual burdens in each category, costs, and statuses of control for toxic substances are quantitatively evaluated. Subsequently, items to be improved are analyzed using the Green Manufacturing Line Improvement Guideline, which was drawn up on the basis of the Group's years of expertise. Then, the identified items are improved using the Green Manufacturing Improvement Sheet which contains a Plan-Do-Check-Action cycle.

(2) Assessment after Improvement

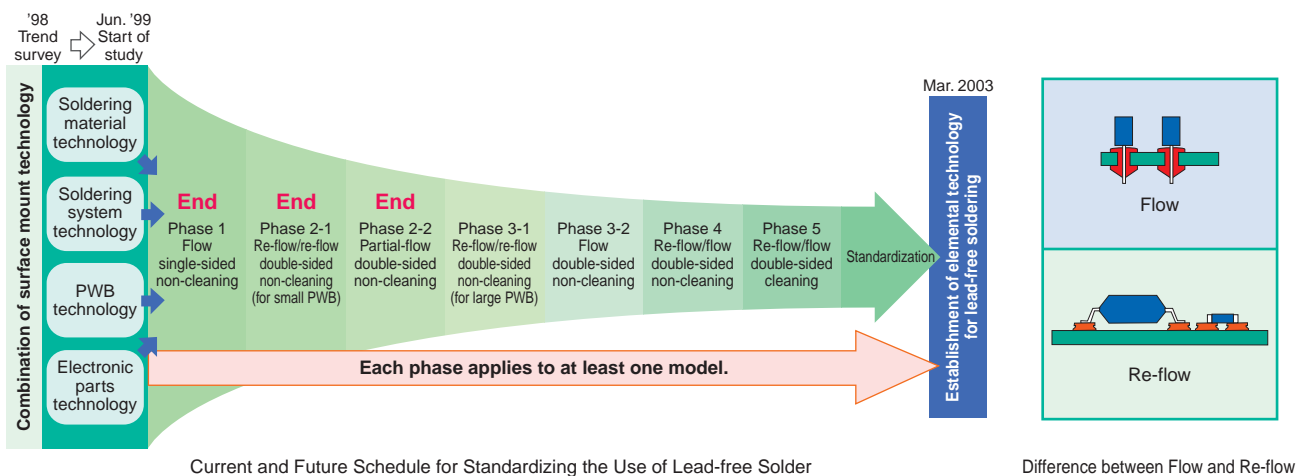
After improvements have been made, the results are filled in on the Green Manufacturing Assessment Sheet and the effects are quantitatively evaluated. For each item in the "energy efficiency" objective category, the evaluation rating is "AAA" if the item was improved by 6% or more, "AA" if improved by 3% or more, "A" if improved by 1% or more, "B" if unchanged, and "C" if worsened. For other categories, the evaluation ratings are "AAA" if the item was improved by 20% or more, "AA" if improved by 10% or more, "A" if improved by 5% or more, and thereafter the same as for energy efficiency. The highest rating within each objective category applies to the rating for the category.

(3) Overall Evaluation and Qualification for Green Manufacturing Line

The evaluation criteria are that no item must be rated "C" and that all categories must be rated "A" or higher. The Green Manufacturing Line Qualification is given based on the plant's or section's own judgment using the criterion that the overall rating must be "A" or higher. These efforts to improve manufacturing lines are attracting widespread interest in the manufacturing industry. By collecting many productive suggestions arising through improvement efforts, and by enriching the contents of the Green Manufacturing Line Improvement Guideline, we will upgrade our manufacturing technologies in line with environmental protection needs in the new century.

2. Lead-free Solder

It has been shown that lead can impair the physical and mental development of children. Hence, the European Union is now (as of May 2002) preparing the Waste from Electrical and Electronic Equipment (WEEE) and Restrictions on Hazardous Substances (ROHS)



directives, which will require that all products sold from 2006 do not contain lead or mercury. The Yokogawa Group has traditionally used lead-tin solder to bond electronic parts to printed boards; however, we anticipated these initiatives and have been progressively eliminating the use of lead.

We began to develop lead-free solder in 1999 for printed boards of power supplies that were being developed by the Component Business Division. By combining surface mount technology including soldering material technology, soldering system technology, printed board technology, and electronic parts technology, we will achieve lead-free soldering. As of March 2002, we have established techniques up to partial-flow, double-sided non-cleaning, enabling lead-free products with single-sided flow soldering to be shipped from April 2002.

3. Environmentally Friendly Design

For the environmentally friendly design of products, it is vital to assist engineers with appropriate design and assessment methods. The Yokogawa Group has successively drawn up design and assessment criteria since 1997, and published design criteria titled "Environmentally Friendly Material Selection Standard" (see the next page for details) in fiscal 2001. A guideline for energy-efficient design is due to be released in fiscal 2002.

(1) Environmentally Friendly Product Design Guideline

Enacted in 1997. This guideline defines mandatory rules on "green" product design, and addresses aspects such as the design of long-life products, design of energy-efficient products, design of resource-efficient products, selection of materials and parts, and selection of machining and assembly methods that take recycling and disposal into account.

(2) Environmental Assessment Standard for Product Design

Enacted in 1997. The environmental impact of every product design plan drawn up according to the Environmentally Friendly Product Design Guideline is assessed in accordance with this standard. A series of product assessments are carried out to examine each product design on 29 assessment items through initial, intermediate, and final design reviews, and a final pass/fail judgment is made.

(3) Standard for Products Containing Toxic Substances

Enacted in 1998. Environmental impact must be considered even when selecting materials and parts for a product. This standard regulates the use of toxic substances, clearly categorizing toxic substances into prohibited substances and reduced-usage substances. Each product design must ensure that the parts and materials used do not contain environmentally harmful or prohibited substances.

(4) Life-cycle Assessment Standard

Enacted in 1999. Life-cycle assessment (LCA) was introduced to assess the impact and potential effect of a specific product on the environment through out its lifecycle. The energy consumption and emissions, such as carbon dioxide, of a product over its lifecycle are ascertained quantitatively by a life-cycle assessment.

(5) Recyclable Product Design Standard

Enacted in 2000, this standard defines mandatory rules for product design in line with the 3Rs: to "reduce" the waste from used products or parts, and to "reuse" and "recycle" used products. This standard is applied from the early stages of product design and adherence to the standard is checked at each phase of the design review.

4. Environmentally Friendly Material Selection Standard

This standard defines criteria to be met when selecting environmentally friendly materials in the product design stage, and must apply to all products developed from fiscal 2002.

The “environmentally friendly materials” in this standard are materials that contain no toxic substances and/or that are easy to recycle. “Toxic substances” are those defined in the Standard for Products Containing Toxic Substances. Particularly, this standard clearly requires that hexahydric chromium, which is highly poisonous, and halide flame retardants, which produce dioxins when incinerated, must not be used. The standard also introduces concrete, recommended goods and provides precautions for use so that engineers can select chromium-free and halogen-free materials.

Regarding avoiding chromium compounds, the features, sample applications, and properties including corrosion resistance, electric conductivity, and coating applicability of some chromium-free steel sheets are shown as specific examples. As for avoidance of halides, examples of some halogen-free plastic molds and printed boards are shown and their general performance characteristics such as flame resistance and insulation resistance are given. Steels, copper,

copper alloys, and aluminum are given as examples of easy-to-recycle materials. The materials recommended in the criteria will be revised in due course as new alternatives emerge.

5. Eco-labeling

In 1999, the Yokogawa Group adopted ISO14021-stipulated Eco-label Type II, an environmental labeling based on self-declarations without independent third-party certification, the first measuring instrument manufacturer to do so. Eco-labels are displayed on those products that were designed according to the above-mentioned design criteria, meet the environmental assessment standard, exhibit superior environmental performance to respective earlier models or similar products of other suppliers, and aid customers in their environmental protection activities. The label features a meter, symbolizing our business, as a motif and displays particular refinements and features of the corresponding product beneath the meter symbol. Five models were registered as Eco-labeled products in 1999, one model was added in 2000, and two in 2001, totaling eight Eco-labeled products to date. Detailed environmental information on our eco-labeled products can be found at www.yokogawa.com/Measurement.

Eco-labeled Products



DL7200/DL7100/DL1540C Digital Oscilloscopes for multimedia and mechatronics product development



PZ4000 Power Analyzer for power-efficient design and engineering



WT200/WT210/WT230 Digital Power Meters



MV100/MV200 MobileCorders for resource-efficient paper-free recording



DX100/DX200 Network Recorders and **CX1000/CX2000** Control and Measuring Stations for plant instrumentation

The Yokogawa Group consistently strives to develop, design, manufacture, and display an Eco-label on the catalog for every electronic measuring instrument that meets the Group's own criteria.



Green Products

In fiscal 2001, we rolled out 14 new environmentally friendly products that passed the environmental assessment. Some examples are introduced below.

1. NFJT100-H100 Field Control Junction (FCJ)

The Yokogawa Group offers STARDOM as a network-based manufacturing solution for integrated management of manufacturing systems by linking up temperature indicators/controllers, power meters, display units, and various controllers scattered at manufacturing sites as well as linking up business framework systems. The FCJ, one of the key components of this solution, is an autonomous controller featuring compact hardware and highly independent architecture, making it ideal for distributed installation nearby or inside each machine or equipment. In comparison to the *CENTUM CS 1000's control station which has equivalent functions, the FCJ reduces the number of types of materials by 6, the area of printed boards by 78%, the weight by 91%, the number of parts by 161, the power consumption during usage by 84%, and the total weight of packing materials by 50%. As a result, the lifecycle environmental burden

is greatly reduced; the product consumes 52.7% less energy and produces 52.6% less carbon dioxide, 53.0% less nitrogen oxides, and 52.8% less sulfur oxides.

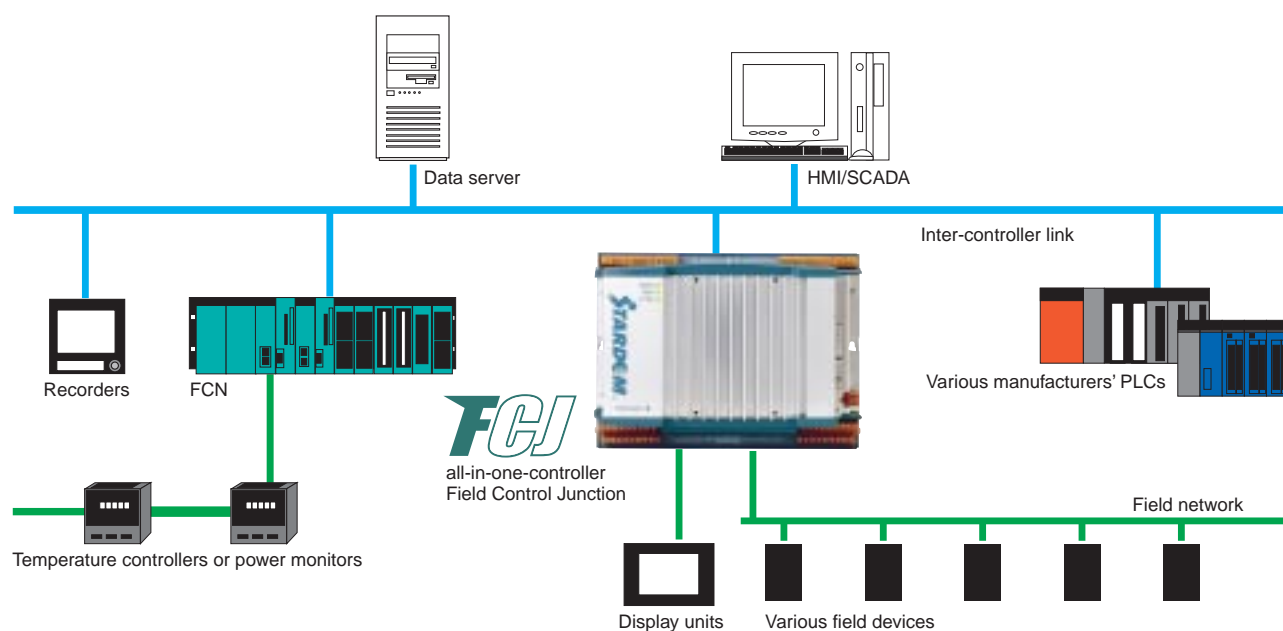
* The CENTUM CS 1000 is a production control system.

2. AT7018A Switching Power Supply

The AT7018A is a power adapter used for inkjet printers, and was developed under commission from a customer wishing to cut power consumption in the standby state. For this, a new IC was developed, and parts in the basic circuitry were reduced to achieve downsizing. These features and an added overload protection succeeded in reducing the standby-state power consumption from 2.2 watts for a conventional low-cost printer, to 0.9 watts. This meets the criterion (1 watt or less) of Blue Angel, one of Eco-labels. As a result, the AT7018A consumes 50.4% less energy and produces 48.8% less carbon dioxide, 51.1% less nitrogen oxides, and 46.8% less sulfur oxides.



AT7018A



Example of STARDOM System Configuration

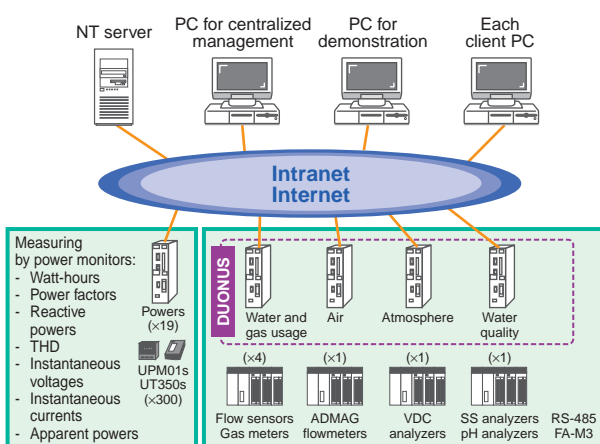
Environmental Solution Proposals

The Yokogawa Group combines its environmentally friendly products with expertise gained through environmental management activities to propose solutions to customers' business activities and systems for environmental measurement. The ultimate objective is to help reduce the impact on the global environment and build a sustainable society.

1. Energy and Environment Monitoring System and Services

The Yokogawa Group supplies a wealth of measuring instruments for resource, energy, and environmental measurement, as well as systems comprising those instruments for managing environmental burdens, resources, and productivity. The Group believes that environmental activities begin with monitoring. Therefore, we accurately ascertain the current impact on the environment, then offer customers solutions for improvement, take remedial action, verify the improvements, and maintain them based on a Plan-Do-Check-Action cycle. One of the underlying technologies of this series of services is our WebReport21@ energy and environmental monitoring system consisting of a resource and energy monitoring system and an environmental monitoring system.

An environmental impact monitoring system has been demonstrated at the Kofu plant, where 26 Yokogawa DUONUS field servers are installed for monitoring the power, water, gas, and atmospheric statuses at approximately 300 points. These DUONUSs



Energy and Environmental Monitoring System (at Kofu plant)

are networked to enable continuous power and environmental monitoring on the Web and reduction of the environmental burden. The system reduced power consumption by 154 MWh in two months.

2. Soil and Ground Water Purification Support Services

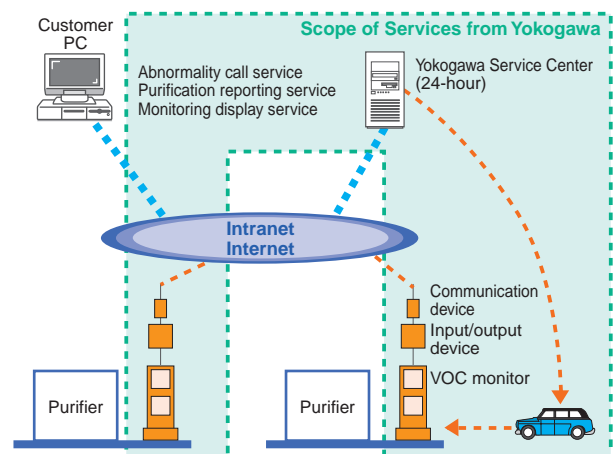
The Yokogawa Groups supports the total purification of soil and ground water polluted by volatile organic compounds (VOCs) and oils. The Group developed an online VOC monitor which is vital for risk management and effective purification, and offers the following services for short-term purification projects:

- a. Rental VOC monitors
- b. Purification management ASP (application service provider) services
- c. Adjustment and maintenance management outsourcing

3. Boiler Refresh Engineering

Boilers, which burn fossil fuels, have high environmental impact among industrial equipment. The boiler refresh engineering service is designed to improve the efficiency and reduce the environmental impact of boiler equipment.

Many boilers currently in industrial use were constructed in the 1960s and 1970s and their control systems do not consider energy efficiency. We first carry out simple boiler diagnostics considering control and measurement to identify any problems, then optimize the boiler tuning to solve the problems. Some examples of improvements made are listed below.

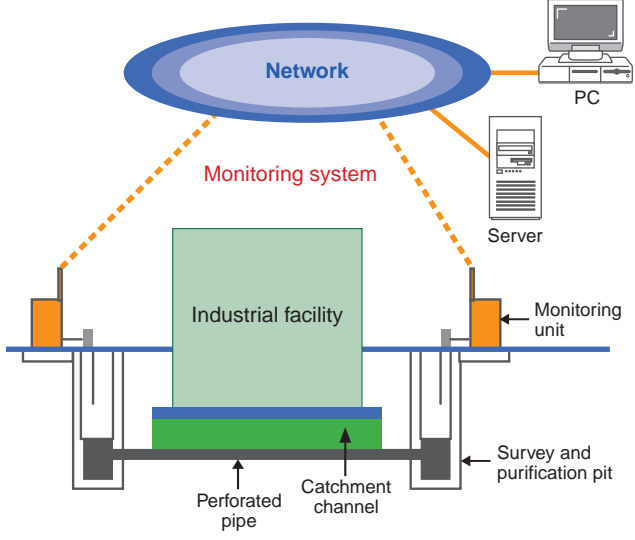


Concept of Soil and Ground Water Purification Support Services

Adoption of oxygen control	<ul style="list-style-type: none"> Flue gas oxygen control optimally decreased the air-fuel ratio and improved the efficiency, reducing the annual fuel bill for heavy oil by approximately 2 million yen.
Tuning of feedwater pump speed control	<ul style="list-style-type: none"> Proper control of the feedwater pump speed to regulate the discharge pressure to the minimum level reduced the annual power consumption by approximately 6 million yen.
Drum level stabilization control	<ul style="list-style-type: none"> Minimizing the heat loss caused by fluctuations in the drum level reduced the annual fuel bill for heavy oil by approximately 1.3 million yen.

4. Eco-based Monitoring System (EBMS)

The Pollutant Release and Transfer Register (PRTR) Law has been enacted in Japan, governing the releases of pollutants from industrial facilities and legislating measures against soil and ground water pollution. It is thus important to immediately detect toxic substances that have penetrated into the ground, in order to minimize the diffusion of soil and ground water pollutants. The Yokogawa Group and Kajima Corporation have jointly proposed the Eco-based Monitoring System to avoid the risk of soil and ground water pollution by monitoring pollutants immediately after their release from an industrial facility, and includes purification measures as an option. The monitoring system supplied by the Yokogawa Group can be tailored as required, including offline sampling and analyses of pollutants up to real-time continuous automatic measurement.



Concept of Eco-based Monitoring System

