Installation Guide

FX1000
Safety Precautions and Installation Guide

IM 04L21B01-03EN

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YOKOGAWA
Yokogawa Electric Corporation

Introduction

Thank you for purchasing the FX1000 (FX). This manual describes the safty precautions and installation and wiring procedures of the FX1000.

For FX1000 topics such as the package contents, safety precautions, and detailed handling procedures, see the electronic manuals, which are stored in PDF format on the included CD.

1. Safety Precautions

The following safety symbols are used on the product and in this manual.

WARNING

Calls attention to actions or conditions that could cause serious or fatal injury to the user, and indicates precautions that should be taken to prevent such occurrences.

CAUTION

Calls attention to actions or conditions that could cause injury to the user or damage to the instrument or property and indicates precautions that should be taken to prevent such occurrences.

Protective ground terminal

Alternating current

Direct current

Note

Identifies important information required to operate the instrument.

■ Safety Precautions

- This instrument conforms to IEC safety class I (provided with terminal for protective grounding), Installation Category II, and EN61326-1 (EMC standard), Measurement Category II (CAT II)*.
  * Measurement category II (CAT II) applies to measuring circuits connected to low voltage installation, and electrical instruments supplied with power from fixed equipment such as electric switchboards.
- This instrument is an EN61326-1 (EMC standard) class A instrument (for use in commercial, industrial, or business environments).
- The general safety precautions described here must be observed during all phases of operation. If the FX is used in a manner not described in this manual, the FX safety features may be impaired. Yokogawa Electric Corporation assumes no liability for the customer's failure to comply with these requirements.
- The FX is designed for indoor use.

■ About This Manual

- Please pass this manual to the end user. We also ask you to store this manual in a safe place.
- Read this manual thoroughly and have a clear understanding of the product before operation.
- This manual explains the functions of the product. It does not guarantee that the product will suit a particular purpose of the user.

■ Precautions Related to the Protection, Safety, and Alteration of the Product

- For the protection and safe use of the product and the system in which this product is incorporated, be sure to follow the instructions and precautions on safety that are stated in this manual whenever you handle the product. Take special note that if you handle the product in a manner that violates these instructions, the protection functionality of the product may be damaged or impaired. In such cases, YOKOGAWA does not guarantee the quality, performance, function, and safety of product.
- When installing protection and/or safety circuits such as lightning protection devices and equipment for the product and control system or designing or installing separate protection and/or safety circuits for fool-proof design and fail-safe design of the processes and lines that use the product and the control system, the user should implement these using additional devices and equipment.
- If you are replacing parts or consumable items of the product, make sure to use parts specified by YOKOGAWA.
- This product is not designed or manufactured to be used in critical applications that directly affect or threaten human lives. Such applications include nuclear power equipment, devices using radioactivity, railway facilities, aviation equipment, air navigation facilities, aviation facilities, and medical equipment. If so used, it is the user's responsibility to include in the system additional equipment and devices that ensure personnel safety.
- Do not modify this product.

WARNING

- **Use the Correct Power Supply**
  Ensure that the source voltage matches the voltage of the power supply before turning ON the power.
- **Connect the Protective Grounding Terminal**
  Make sure to connect the protective grounding to prevent electric shock before turning ON the power.
- **Do Not Impair the Protective Grounding**
  Never cut off the internal or external protective grounding wire or disconnect the wiring of the protective grounding terminal. Doing so invalidates the protective functions of the instrument and poses a potential shock hazard.
- **Do Not Operate with Defective Protective Grounding**
  Do not operate the instrument if the protective grounding might be defective. Also, make sure to check them before operation.
- **Do Not Operate in an Explosive Atmosphere**
  Do not operate the instrument in the presence of flammable liquids or vapors. Operation in such an environment constitutes a safety hazard. Prolonged use in a highly dense corrosive gas (H_2S, SOx, etc.) will cause a malfunction.
- **Do Not Remove Covers**
  The cover should be removed by YOKOGAWA's qualified personnel only. Opening the cover is dangerous, because some areas inside the instrument have high voltages.
- **Ground the Instrument before Making External Connections**
  Connect the protective grounding before connecting to the item under measurement or control unit.
- **Damage to the Protection**
  Operating the instrument in a manner not described in this manual may damage the instrument's protection.

CAUTION

This instrument is a Class A product. Operation of this instrument in a residential area may cause radio interference, in which case the user is required to take appropriate measures to correct the interference.

■ Exemption from Responsibility

- YOKOGAWA makes no warranties regarding the product except those stated in the WARRANTY that is provided separately.
- YOKOGAWA assumes no liability to any party for any loss or damage, direct or indirect, caused by the user or any unpredictable defect of the product.

2. Installation

■ Installation Location

Install the FX indoors in an environment that meets the following conditions:

- **Instrumentation Panel**
  The FX is designed to be installed in an instrumentation panel.
- **Well-Ventilated Location**
  To prevent overheating, install the FX in a well-ventilated location. For the panel cut dimensions when arranging multiple FXs, see "External Dimensions and Panel Cutout Dimensions." When other instruments are installed next to the FX, follow the panel cut dimensions to provide adequate space around the FX.
- **Minimal Mechanical Vibrations**
  Install the FX in a location that has minimal mechanical vibrations. Installing the FX in a location that is subject to large levels of mechanical vibration will not only put added stress on its components, it may also impede ordinary measurement.
- **Level Location**
  Install the FX in a level location so that it is not slanted to the left or the right (however, the FX can be inclined up to 30 degrees backward for panel mounting).

Note

Condensation may form when moving the FX from an environment whose temperature or humidity is low to an environment whose temperature or humidity is high, or when there is a sudden change in temperature. Temperature or humidity changes may also result in thermocouple measurement errors. In these kinds of circumstances, let the FX adjust to the new environment for at least an hour before using it.

Do not install the FX in the following places.

- **Outdoors**
- **In Direct Sunlight or Near Heat Sources**
  Install the FX in a place that is near room temperature (23°C) and that is not subject to large temperature fluctuations. Placing the FX in direct sunlight or near heat sources can cause adverse effects on the internal circuitry.
- **Where an Excessive Amount of Soot, Steam, Moisture, Dust, or Corrosive Gases Are Present**
  Soot, steam, moisture, dust, and corrosive gases will adversely affect the FX. Avoid installing the FX in such locations.
- **Near Strong Magnetic Field Sources**
  Do not bring magnets or instruments that produce electromagnetic fields close to the FX. Operating the FX near strong magnetic fields can cause measurement errors.
- **Where the Display Is Difficult to See**
  The FX uses an LCD screen, so it is difficult to view the display from an extreme angle. Install the FX so that the user can view the display directly from the front.

■ Installation Procedure

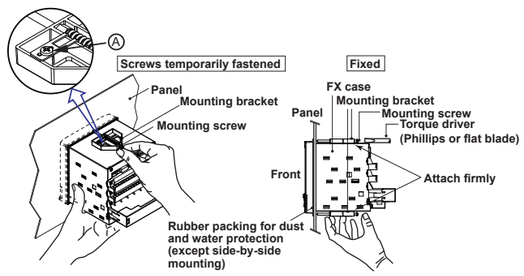
Use a steel panel that is 2 mm to 26 mm thick.

1) Insert the FX through the front of the panel.
2) Mount the FX to the panel using the included mounting brackets as shown in the figure below.

- Use two mounting brackets to support the top and bottom or the left and right sides of the case (remove the stickers that are covering the holes before you attach the brackets).
- Follow the procedure below to mount the FX to the panel.
  - First, attach the two mounting brackets and temporarily tighten the mounting screws.
  - Next, fix the FX in place by tightening the mounting screws with the appropriate torque. When the FX is approximately perpendicular to the panel, press the mounting brackets so that they are in contact with the case, and fully tighten the mounting screws.
- Tighten the mounting bracket screws until you hear clicks.

CAUTION

- **Using more than the appropriate torque to tighten the screws can deform the case or damage the brackets.**
- **Be sure not to insert foreign objects or tools into the case through the mounting bracket holes.**
- **Do not touch the screw at the top of the mounting bracket (A). Loosening or tightening this screw may cause the FX to malfunction.**



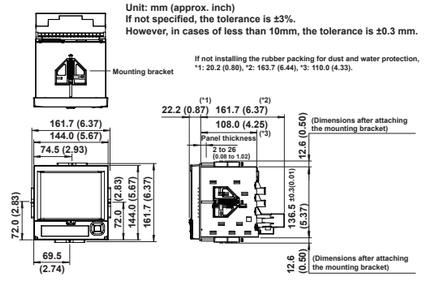
(In the figure, the mounting brackets are used on the top and bottom of the case.)

Note

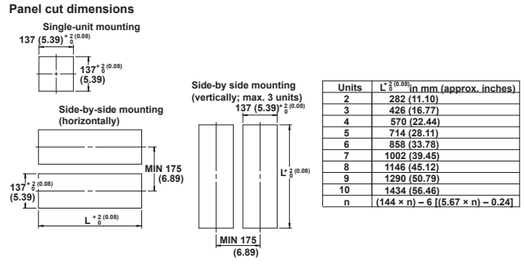
To achieve sufficient dust proofing and waterproofing, mount the FX in the middle of the panel cut out. However, do not use the rubber packing if you are mounting two instruments side by side or one on top of the other.

■ External Dimensions and Panel Cutout Dimensions

External dimensions



Panel cut dimensions



Units	L +2 0 (+0.08 0) in mm (approx. inches)
2	282 (11.10)
3	426 (16.77)
4	570 (22.44)
5	714 (28.11)
6	858 (33.78)
7	1002 (39.45)
8	1146 (45.12)
9	1290 (50.79)
10	1434 (56.46)
n	(144 × n) – 6 [(5.67 × n) – 0.24]

3. Wiring

■ Input Signal Wiring

WARNING

To prevent electric shock while wiring, make sure that the power supply is turned off.

CAUTION

- **Applying a strong tension to the input and output signal cables connected to the FX may damage the cables or the FX terminals. To avoid applying tension directly to the terminals, fix all cables to the rear of the mounting panel.**
- **To prevent fire, use signal cables with a temperature rating of 70°C or more.**
- **Do not apply voltages that exceed the following values to the input terminals. Doing so may damage the FX.**
  - **Maximum input voltage: ±60 VDC**
  - **Maximum common mode voltage: ±60 VDC (under measurement category II conditions)**
- **The FX is an installation category II product.**

Precautions to Be Taken While Wiring

Take the following precautions when wiring the input signal cables.
When using a screw terminal, we recommend that you use a crimp-on lug with an insulation sleeve (designed for 3 mm screws).
Take measures to prevent noise from entering the measurement circuit.

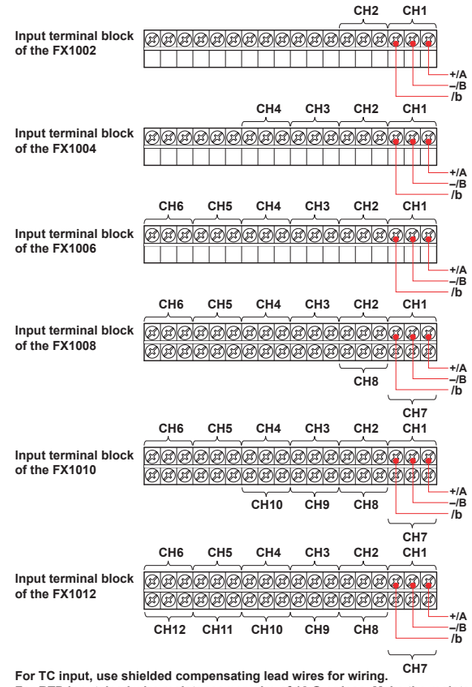
- Move the measurement circuit away from the power cable (power circuit) and ground circuit.
- Ideally, the object being measured should not generate noise. However, if this is unavoidable, isolate the measurement circuit from the object. Also, ground the object being measured.
- Shielded wires should be used to minimize the noise caused by electrostatic induction. Connect the shield to the ground terminal of the FX as necessary (make sure you are not grounding at two points).
- To minimize noise caused by electromagnetic induction, twist the measurement circuit wires at short, equal intervals.
- Make sure to earth ground the protective ground terminal through minimum resistance (less than 100 Ω).

When using internal reference junction compensation on the thermocouple input, take measures to stabilize the temperature at the input terminal.

- Always use the terminal cover.
- Do not use thick wires which may cause large heat dissipation (we recommend a cross sectional area of 0.5 mm^2 or less).
- Make sure that the ambient temperature remains reasonably stable. Large temperature fluctuations can occur if a nearby fan turns on or off.

Connecting the input wires in parallel with other devices can cause signal degradation, affecting all connected devices. If you need to make a parallel connection, then

- Turn the burnout detection function off.
- Ground the instruments to the same point.
- Do not turn other instruments on or off during operation. This can have adverse effects on the other instruments.
- RTDs cannot be wired in parallel.



For TC input, use shielded compensating lead wires for wiring.
For RTD input, lead wire resistance per wire of 10 Ω or less. Make the resistances of the three wires equal.
For DCA input, example: for 4 to 20 mA input, use a shunt resistor of 250 Ω ± 0.1%.

Note

RTD input terminals A and B are isolated on each channel. Terminal b is shorted internally across all channels. However, terminal b is also isolated on each channel on models with the /N2 option (3 leg isolated RTD).

■ Optional Terminal Wiring

WARNING

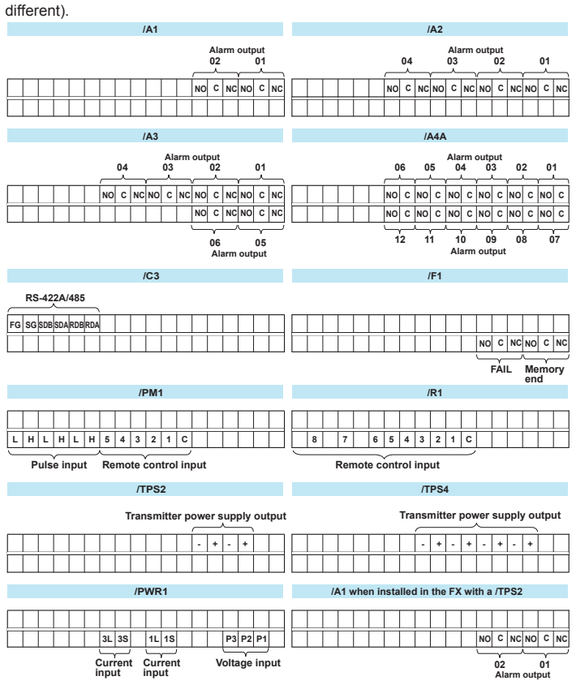
- **To prevent electric shock while wiring, make sure that the power supply is turned off.**
- **If a voltage of more than 30 VAC or 60 VDC is to be applied to the output terminals, use ring-tongue crimp-on lugs with insulation sleeves on all terminals to prevent the signal cables from slipping out when the screws become loose. Furthermore, use double-insulated cables (dielectric strength of 3000 VAC or more) for the signal cables on which a voltage of 30 VAC or 60 VDC or more is to be applied. For all other signal cables, use basic insulated cables (dielectric strength of 1500 VAC). To prevent electric shock, attach the terminal cover after wiring and make sure not to touch the terminals.**

CAUTION

- **Use the following circuit voltages for the connection to the alarm/FAIL/status output terminal.**
  - **When the connection is to Mains Circuits (primary power supply circuits): 150 V or less**
  - **When the connection is to circuits derived from Mains Circuits (secondary power supply circuits): 250 V or less (Keep the Mains Circuit voltage at 300 V or less, and use an isolation transformer.)**
- **To prevent fire, use signal cables with a temperature rating of 70°C or more.**
- **Applying a strong tension to the input and output signal cables connected to the FX may damage the cables or the FX terminals. To avoid applying tension directly to the terminals, fix all cables to the rear of the mounting panel.**
- **Do not short the transmitter power supply output terminal or apply external voltage to it. Doing so may damage the instrument.**
- **When using the transmitter power supply output terminal, do not use current that is equal to or greater than the maximum output current (25 mADC). Doing so may damage the instrument.**

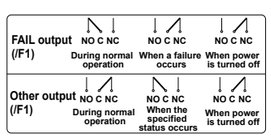
Precautions to Be Taken While Wiring

We recommend that you use crimp-on lugs (designed for 3 mm screws) with insulation sleeves to connect to the optional terminals.
The following figures show the terminal positions for each option when only that option is installed. Even if you have installed a number of options, the individual terminal positions of the options do not change (except for the case where you have installed both the /TPS2 and /A1 options; in this case, the /A1 terminal positions are different).



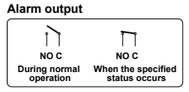
- **Alarm Output Terminal (/A1, /A2, and /A3), FAIL Output Terminal and Memory End Output Terminal (/F1)**

Output format: Relay contact
Contact rating: 250 VAC (50/60 Hz)/3 A, 250 VDC/0.1 A (load resistance)
Withstand voltage: 1600 VAC (50/60 Hz) for one minute (between output terminals and the ground terminal)



- **Alarm Output Terminal (/A4A)**

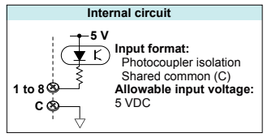
Output format: Relay contact
Contact rating: 250 VAC (50/60 Hz)/3 A, 250 VDC/0.1 A (load resistance)
Withstand voltage: 1600 VAC (50/60 Hz) for one minute (between output terminals and the ground terminal)



- **Remote Control Input Terminal (/R1)**

• Relay contact input (voltage-free contact)
Contact open at 200 Ω or less
Contact closed at 100 kΩ or greater

• Transistor input (open collector)
On voltage: 0.5 V or less (30 mADC)
Leakage current when turned off: 0.25 mA or less

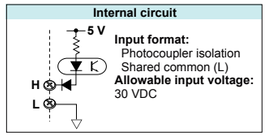


Withstand voltage: 1000 VDC for one minute between input terminals and the ground terminal

- **Pulse Input Terminal (/PM1)**

• Relay contact input (voltage-free contact)
Contact open at 200 Ω or less
Contact closed at 100 kΩ or greater

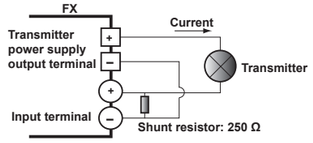
• Transistor input (open collector)
On voltage: 0.5 V or less (30 mADC)
Leakage current when turned off: 0.25 mA or less



Withstand voltage: 1000 VDC for one minute between input terminals and the ground terminal

- **24 VDC Transmitter Power Supply Output Terminal (/TPS2, /TPS4)**

Connect the FX to the transmitter as shown below.



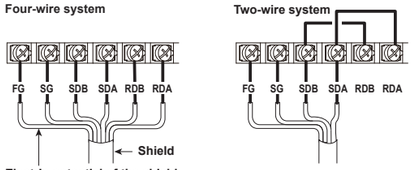
Note

To reduce noise, use a shielded cable for wiring. Connect the shield to the ground terminal of the FX.

- **Serial Communication Interface (/C2)**

9-pin D-sub RS-232 connector

- **Serial Communication Interface (/C3)**



Electric potential of the shield

FG (Frame Ground) Case ground of the FX
SG (Signal Ground) Signal ground
SDB (Send Data B) Send data B (+)
SDA (Send Data A) Send data A (–)
RDB (Received Data B) Receive data B (+)
RDA (Received Data A) Receive data A (–)

Recommended length of stripped wire: 9 mm.
Recommended tightening torque: 0.4 to 0.5 N•m

Cable
There are two types of cables available: the four-wire cable and the two-wire cable, which is used only for the Modbus protocol.
The cable must meet the following specifications.
- Type: Shielded twisted pair cable. 3 pairs, 24 AWG or more (four wire); 2 pairs, 24 AWG or more (two wires).
- Characteristic impedance: 100Ω
- Capacitance: 50 pF/m
- Total cable length: Up to 1.2 km

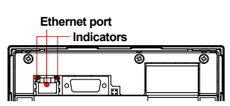
- **Connecting to the USB Port (/USB1)**

The USB port complies with USB revision 1.1. The USB port is installed on the FX's front panel.

- **Connecting to the Ethernet Port (/C7)**

CAUTION

Do not connect an Ethernet cable whose plug does not comply with FCC specifications. If you do, the FX may malfunction.

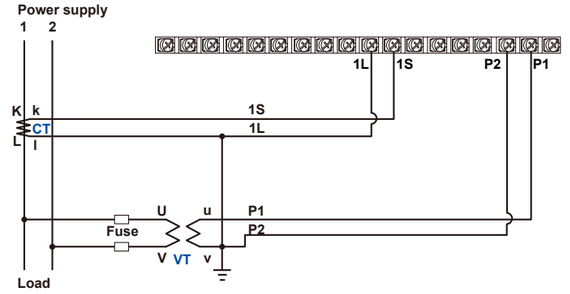


- **Connecting to the Power Measurement Terminal (/PWR1)**

CAUTION

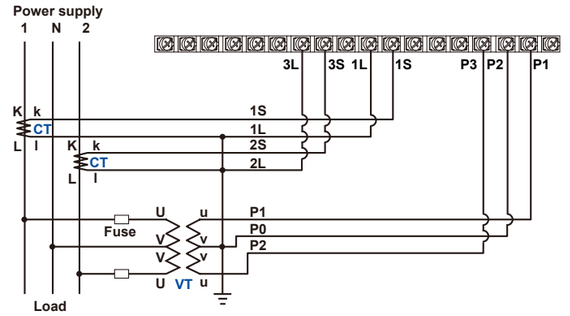
- **If you are not using a VT and a CT, do not ground the input circuit.**
- **If you are wiring through conduits (metal tubes designed for wiring), install the CT (current transformer) inside a panel.**
- **Wire the voltage input and the current input within the same circuit.**

Single-phase two-wire system

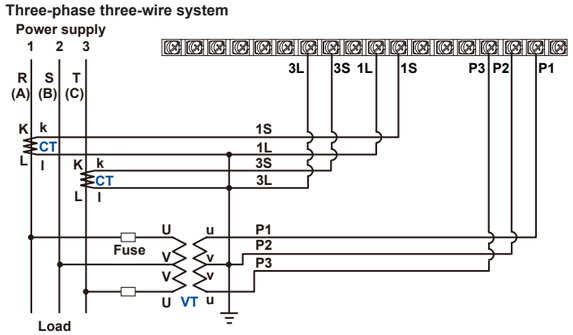


Single-phase three-wire system

For a single-phase three-wire system, connect wires to the terminal block as follows.



Three-phase three-wire system

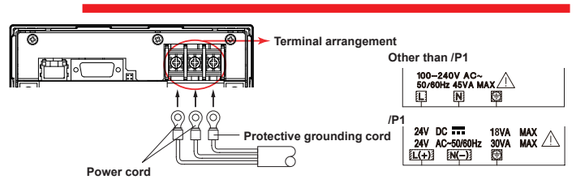


■ Wiring the Power Supply

Make sure to follow the warnings below when wiring the power supply. Failure to do so may cause electric shock or damage to the instrument.

WARNING

- **To prevent electric shock, ensure that the power supply is turned off.**
- **To prevent fire, use 600 V PVC insulated wires (AWG20 to AWG16; JISC3307) or wires or cables with equivalent or better performance.**
- **Make sure to earth ground the protective earth terminal through a grounding resistance of 100 Ω or less before you turn on the power.**
- **Use crimp-on lugs (designed for 4 mm screws) with insulation sleeves to connect both the power cord and the protective ground.**
- **To prevent electric shock, be sure to close the transparent cover for the power supply wires.**
- **Provide a power switch (double-pole type) on the power supply line to separate the FX from the main power supply. Use labels to indicate that this switch is for cutting off the power supply to the FX and to indicate ON and OFF.**
  Switch specifications
  Steady-state current rating: 1 A or more (other than /P1); 3 A or more (/P1)
  Inrush current rating: 60 A or more (other than /P1); 70 A or more (/P1)
  Use a switch that complies with IEC60947-1 and IEC60947-3.
- **Connect a fuse (between 2 A and 15 A) to the power supply line.**
- **Do not add a switch or fuse to the ground line.**



Use a power supply that meets the following conditions:

Item	Condition (Other than /P1)	Condition (/P1)
Rated supply voltage	100 to 240 VAC	24 VDC/AC
Allowable power supply voltage range	90 to 132, 180 to 264 VAC	21.6 to 26.4 VDC/AC
Rated power supply frequency	50/60 Hz	50/60 Hz (for AC)
Allowable power supply frequency range	50/60 Hz ± 2%	50/60 Hz ± 2% (for AC)
Maximum power consumption	35 VA (100 V), 45 VA (240 V)	18 VA (for DC), 30 VA (for AC)

Note

Do not use a supply voltage of 132 to 180 VAC, as this may have adverse effects on the measurement accuracy.

4. Protection of Environment

■ Control of Pollution Caused by the Product

This is an explanation for the product based on "Control of pollution caused by Electronic Information Products" in the People's Republic of China.
产品中有毒有害物质或元素的名称及含量

部件名称		有毒有害物质或元素					
		铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr6+)	多溴联苯 (PBB)	多溴二苯醚 (PBDB)
显示器 (LCD)		N/A	N/A	N/A	N/A	✓	✓
印刷电路板		N/A	N/A	N/A	N/A	✓	✓
内部接线材料		N/A	N/A	N/A	N/A	✓	✓
外壳 / 机箱	塑料	N/A	N/A	N/A	N/A	✓	✓
	金属	N/A	N/A	N/A	N/A	✓	✓
电源		N/A	N/A	N/A	N/A	✓	✓
操作键		N/A	N/A	N/A	N/A	✓	✓
标准附件 / 可选附件	用于端子的螺丝	N/A	N/A	N/A	N/A	✓	✓
	安装支架	N/A	N/A	N/A	N/A	✓	✓
	CF 卡	N/A	N/A	N/A	N/A	✓	✓
	分流电阻	N/A	N/A	N/A	N/A	✓	✓
✓：表示该部件的所有均质材料中的有毒有害物质或元素的含量均低于 SJ/T11363-2006 标准所规定的限量要求。							
N/A：表示该部件中至少有一种均质材料中的有毒有害物质或元素的含量超过 SJ/T11363-2006 标准所规定的限量要求。							

环保使用期限

该标识适用于 2006 年 2 月 28 日颁布的《电子信息产品污染控制管理办法》以及 SJ/T11364 - 2006《电子信息产品污染控制标识要求》中所述，在中华人民共和国（除台湾、香港和澳门外）销售的电子信息产品的环保使用期限。
只要您遵守该产品相关的安全及使用注意事项，在自制造日起算的年限内，则不会因产品中有害物质泄漏或突发变异，而造成对环境的污染或对人体及财产产生恶劣影响

■ Waste Electrical and Electronic Equipment (WEEE), Directive 2002/96/EC

This is an explanation of how to dispose of this product based on Waste Electrical and Electronic Equipment (WEEE), Directive 2002/96/EC. This directive is only valid in the EU.

Marking

This product complies with the WEEE Directive (2002/96/EC) marking requirement. This marking indicates that you must not discard this electrical/electronic product in domestic household waste.

Product Category

With reference to the equipment types in the WEEE directive Annex 1, this product is classified as a "Monitoring and Control instrumentation" product. Do not dispose in domestic household waste. When disposing products in the EU, contact your local Yokogawa Europe B.V. office.

■ How to Dispose the Batteries

This is an explanation about the new EU Battery Directive (DIRECTIVE 2006/66/EC). This directive is only valid in the EU.
Batteries are included in this product. Batteries incorporated into this product cannot be removed by yourself. Dispose them together with this product. When you dispose this product in the EU, contact your local Yokogawa Europe B.V.office. Do not dispose them as domestic household waste.
Battery type: Lithium battery
Notice: The symbol (see above) means they shall be sorted out and collected as ordained in ANNEX II in DIRECTIVE 2006/66/EC.

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