Stirrer

Model LT400A/400B
Model LT400C/400D
Model LT500A/500B

Instruction Manual

First Edition

- **Thank you for choosing LT series Stirrers by Yamato Scientific Co., Ltd.**
- **For proper equipment operation, please read and become thoroughly familiar with this instruction manual before use. Always keep equipment documentation safe and close at hand for convenient future reference.**

Warning: **Read instruction manual warnings and cautions carefully and completely before proceeding.**

Yamato Scientific America Inc.

Santa Clara, CA

Printed on recycled paper

Table of contents

1. SAFETY PRECAUTIONS

Explanation of Safety Symbols

A Word Regarding Symbols

Various symbols are provided throughout this text and on equipment to ensure safe operation. Failure to comprehend the operational hazards and risks associated with these symbols may lead to adverse results as explained below. Become thoroughly familiar with all symbols and their meanings by carefully reading the following text regarding symbols before proceeding

Warning Signifies a situation which may result in serious injury or death (Note 1.)

Caution Signifies a situation which may result in minor injury (Note 2) and/or property damage (Note 3.)

(Note 1) Serious injury is defined as bodily wounds, electrocution, bone breaks/fractures or poisoning, which may cause debilitation requiring extended hospitalization and/or outpatient treatment.

(Note 2) Minor injury is defined as bodily wounds or electrocution, which will not require extended hospitalization or outpatient treatment.

(Note 3) Property damage is defined as damage to facilities, equipment, buildings or other property.

Symbol Meanings

Signifies warning or caution.
Specific explanation will follow symbol.

Signifiies restriction.
Specific restrictions will follow symbol.

Signifies an action or actions which operator must undertake.
Specific instructions will follow symbol.

1. SAFETY PRECAUTIONS

Symbol Glossary

Warning

General Warning

Danger!: High Voltage

Danger!: Extremely Hot

Danger!: Moving Parts

Danger!: Blast Hazard

Caution

General Caution

Caution: Electrical Shock Hazard!

Caution: Burn Hazard!

Caution: Do Not Heat Without Water!

Caution: May Leak Water!

Caution: Water Only

Caution: Toxic Chemicals

Restriction

General Restriction

No Open Flame

Do Not Disassemble

Do Not Touch

Action

General Action Required

Connect Ground Wire

Level Installation Required

Disconnect Power

Inspect Regularly

1. SAFETY PRECAUTIONS

⚠ Warning

Never operate equipment near combustible gases/fumes.

Do not install or operate LT series unit near flammable or explosive gases/fumes. Unit is NOT fire or blast resistant. Negligent use could cause a fire/explosion.
See “List of Hazardous Substances (P.15).

Always ground equipment.

Always ground this unit properly to avoid electric shock.

DO NOT operate equipment when abnormalities are detected.

If smoke or unusual odors begin emitting from unit, or if any other abnormalities are detected, terminate operation immediately, turn off power switch and disconnect power cable. Continued operation may result in fire or electric shock.

DO NOT operate equipment with power cable bundled or tangled.

Operating unit with the power cable bundled or otherwise tangled, may cause power cable to overheat and/or catch fire.

DO NOT damage power cable.

Damaging the power cable by forcibly bending, pulling or twisting may cause fire or electric shock to the operator.

NEVER process explosive or combustible substances.

Attempting to process/use explosive or combustible substances in/near unit may cause explosion or fire. See “List of Hazardous Substances” (P.15).

NEVER disassemble or modify equipment.

Attempting to dismantle or modify unit in any way, may cause malfunction, fire or electric shock.

⚠ Caution

DO NOT operate equipment during thunderstorms.

In the event of a thunderstorm, terminate operation and turn off power switch immediately. A direct lightning strike may cause damage to equipment, or result in fire or electric shock.

2. PRE-OPERATION PROCEDURES

Installation Precautions & Preparations

1. Choose an appropriate installation site.

Do not install LT series unit:

- where flammable or corrosive gases/fumes will be generated.
- where exterior temperature will exceed 35ºC, will fall below 5ºC or will fluctuate.
- in excessively humid or dusty locations.
- where there is constant vibration.
- in direct sunlight or outdoors.

Be sure there is sufficient space and ventilation around unit when installed.

2. Install on a level surface.

Install unit on a level and even surface. Failure to do so may result in abnormal vibrations or noise, possibly causing complications and/or malfunction.

3. Install out of harm's way.

Unit may fall over or shift in an earthquake or other unforeseen incident, resulting in personal injury. Taking appropriate safety measures and installing unit out of harm's way is strongly recommended.

4. Install in a location free of flammables and explosives.

Never install near flammables or explosives. This unit is NOT fire or blast resistant. Simply switching the power "ON" or "OFF" can produce a spark, which could relay during operation, causing a fire or explosion when near flammable or explosive fluids, chemicals or gases/fumes. See "List of Hazardous Substances" (P.15).

5. Connect to a dedicated power supply.

Choosing a dedicated power terminal or wall outlet which properly meets electrical rating specification of LT unit is strongly recommended.
(Unit may be safely operated in a voltage range of VAC100~VAC125.)

Electrical rating:	LT400A/B/C/D	100V~125V 200VA±10% (2A at VAC100; 1.7A at VAC120)
	LT500A/B	100V~125V 400VA±10% (4A at VAC100; 3.3A at VAC120)

2. PRE-OPERATION PROCEDURES

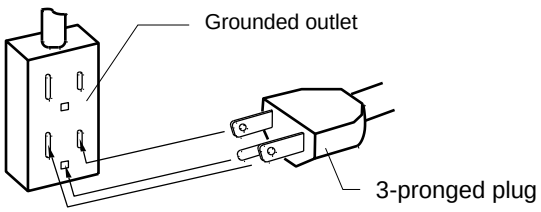
6. Handle power cable with care.

- Never operate unit with power cable bundled or tangled; and do not modifiy, bend, forcibly twist or pull on power cable. Doing so may cause fire and/or electrical shock.
- Do not risk damage to power cable by positioning it under desks or chairs, or by pinching it between objects. Doing so may cause fire and/or electrical shock.
- Do not place power cable near kerosene/electric heaters or other heat-generating devices. Doing so may cause power cable insulation to overheat, melt and/or catch fire, which may result in electric shock.
- Turn off power switch immediately and disconnect from facility terminal or outlet, if power cable becomes partially severed or damaged in any way. Failure to do so may result in fire or electric shock.
- Contact a local dealer or Yamato sales office for information about replacing power cable if it is damaged.
- Always connect power cable to appropriate facility outlet or terminal.

7. Ground wire MUST be connected properly.

- Ground wire must be connected to a proper grounding line or teminal in order to avoid electrical shock.
- Never connect ground wire to gas lines or water pipes.
- Never connect ground wire to telephone grounding lines or lightening rods. Doing so may result in fire or electric shock.
- Never insert multiple plugs into a single outlet. Doing so may result in power cable overheating, fire or drop in voltage.

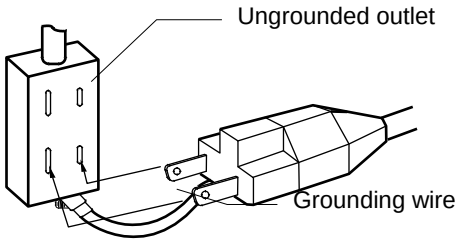
Connect to grounded outlet.



When no grounding terminal is found:

Grounding to Electrical Equipment Technical Standards, Section 19, class D (Grounding Resistance Max. 100Ω) is required in Japan. Contact a local dealer, electrician, or Yamato Sales office for location-specific electrical requirements.

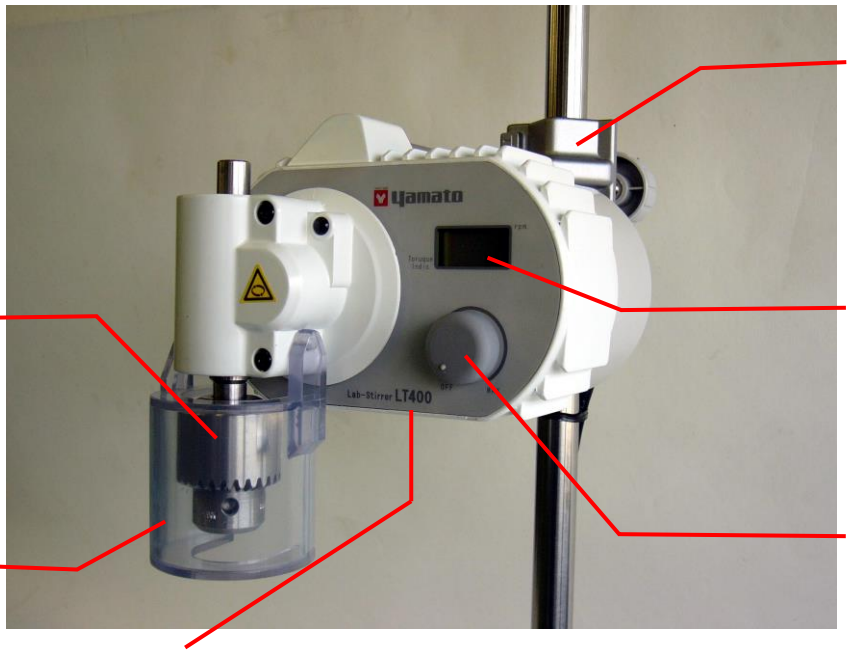
Use grounded adapter for ungrounded outlets.



↑ Insert grounded power plug into ground adapter. Connect grounding wire (green) from ground adapter to a ground terminal.

3. COMPONENT NAMES & FUNCTIONS

Main Unit Overview



Rating sticker with model and serial numbers is located on back of unit.

Symbol	Name	Functions
①	Digital Tachometer/Torque Load Meter	Displays rotation speed of stirring motor [in rpm] and torque load [in stages, up to 5]. Flashes【- - - -】when thermal protection switch has been tripped.
②	Power & Speed Dial	Turn dial clockwise to turn power ON and increase rotation speed.
③	φ8mm Stirring Chuck	Stirring shaft* up to φ8mm may be inserted into chuck.
④	Holding Clamp	Allows main unit to be affixed on stand* and height to be adjusted.
⑤	Safety cover	Prevents objects from being caught in chuck or shaft during operation.

*Stand, stirring shafts and blades are sold separately.

Unit Overview & Features

Overview

LT series stirrers include the higher torque LT400A and LT500A, the LT400B and LT500B which are balanced for both speed and torque, the high-speed LT400C and the speedy, yet versatile LT400D.

LT units are designed to be user-friendly and safe with a light-weight aluminum die-cast body, SUS chuck, current restriction circuit for overload protection, and a thermal protection switch to prevent overheating.

Features

- Quiet operation maintains optimal work environment, producing minimal interference for other lab personnel and equipment.
- High sensitivity feedback system maintains constant speed with changing viscosity during operation.
- Safety-oriented design:
  Current limitation circuit and thermal protection switch prevent current overloads and overheating. Non-sparking brushless motor and airtight body prevent fire and combustion hazards. Chuck safety cover protects against binding and tangling hazards.

4. OPERATION PROCEDURES

Operation Preparation & Procedures

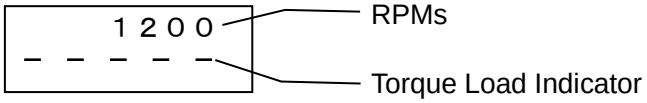
Installation & Operation

1. Preparation
   (1) Select a stable install location, such as on a laboratory table.
   (2) Use a stable stand with shaft diameter of ϕ20mm~ϕ25mm.
   Y-type rack (sold separately) is recommended.
   (3) Use appropriate stirring shaft (up to ϕ8mm) and stirring blades (sold separately).

2. Installing the main unit
   (1) Secure main unit to stand shaft with attached holding clamp.
   (2) Loosen shaft chuck and securely chuck the stirring shaft, using the supplied chuck wrench.
   (3) Install stirring blades securely and attach the safety cover.
   (4) Be sure the power/speed dial is OFF, then connect power cable to an appropriate terminal or outlet.

3. Operating the unit
   When container with fluid is in place, turn ON and set speed dial as desired.

   The torque meter in the LCD display shows load in up to five stages. Each dash (-) represents one stage; one indicating lowest load and five indicating highest.
   Overload status is shown by five flashing indicators (dashes) in the torque meter, signifying that torque load maximum has been exceeded.



⚠ When operation is stopped due to the thermal protection switch being tripped, turn power OFF and wait at least 30 minutes, until motor cools. Reduce fluid viscosity and/or change to a stirring blade which will decrease load on the motor.
The internal thermal protection switch trips to cut off electrical current to the motor when temperature rises beyond an established upper limit, preventing motor burnout.

Optional Accessory Items

Product code No.	Item name	Specifications
231086	Y-Stand	Shaft diameter 25 mm x length 725 mm
231384	Stirring shaft	Shaft diameter 8mm x length 500 mm
231077	Stirring blades: Four blades	ϕ75 mm w/M5 screw
231076	Stirring blades: Four blades	ϕ60 mm w/M5 screw
231075	Stirring blades: Four blades	ϕ40 mm w/M5 screw
231065	Stirring blades: Two blades	ϕ100 mm w/M5 screw
231083	Stirring blades: Two blades	ϕ28mm w/M5 screw
280081	Stirring blades for small-mouth containers	Two45 mm blades w/M5 screw
231385	Glass blade	Shaft diameter ϕ8×500 ㎜ L Two blades, diameter 60 ㎜
231064	Turbine blade with disc	ϕ100 mm w/M5 screw
231062	Turbine blade with disc	ϕ60 mm w/M5 screw
231386	Turbine blade with disc for two-step operation	60mm diameter blade for ϕ8mm shaft

5. HANDLING PRECAUTIONS

⚠ Warning

1. DO NOT process hazardous of harmful substances.

Never process explosive or flammable items. Fire or explosion causing serious injury or death may result. See “List of Hazardous Substances” (P.15) for more information on these items.

2. DO NOT operate equipment when abnormalities are detected.

If unit begins emitting smoke or abnormal odors for reasons unknown, turn off power switch immediately, disconnect power cable from power supply, and contact a local dealer or Yamato sales office for assistance. Continuing to operate without addressing abnormalities may cause fire or electric shock, resulting in serious injury or death. Never attempt to disassemble or repair unit. Repairs should be always be performed by a certified technician.

3. DO NOT modify.

Never attempt to modify or customize unit. Warranty will be voided and malfunction or damage causing a fire or electric shock may result.

⚠ Caution

1. DO NOT operate unit during thunderstorms.

In the event of a thunderstorm, turn power OFF and disconnect power cable immediately. A lightning strike may cause equipment damage resulting in a fire or electric shock.

2. Power failure recovery.

Unmanned operation is an injury hazard. In the event that unit may be unattended when power is restored, following an outage, be sure to turn power OFF immediately when a power outage occurs.

6. MAINTENANCE PROCEDURES

Daily Inspection & Maintenance

Be sure to conduct daily inspections and maintenance for continued optimal performance.

⚠ Warning

- Disconnect power cable unless before conducting inspection and maintenance procedures.
- Wait until unit has cooled to normal temperature before conducting maintenance.
- Never attempt to disassemble unit.

⚠ Caution

- Clean by wiping down with a soft, damp cloth. Never clean using benzene, thinner, scouring powder or other abrasive cleansers, and do not use scrubbing brushes or brillo-type pads. Deformity, discoloration or other cosmetic damage may result.

7. STORAGE & DISPOSAL

⚠ Caution	⚠ Warning
If unit is to be out of service or unused for an extended length of time: ● Turn power OFF and disconnect power cable.	Disposal: ●Do not leave unit unattended, or where children can have access. ● Remove power cable before disposal. ● Dispose as bulky or industrial waste.

Disposal Considerations

Dispose of or recycle this unit in a responsible and environmentally friendly manner.
Yamato Scientific Co., Ltd. strongly recommends disassembling unit, as far as is possible, in order to separate parts and recycle them in contribution to preserving the global environment.

Major components and materials comprising LT series units are listed in table below:

Major Components	Materials
Exterior	
External Structure	Baked-on Melamine resin coating, aluminum, stainless steel
Electrical	
Switches and Relays	Resin, copper and other composites
Circuit Boards	Fiberglass and other composites
Power Cable	Resin sheath, copper, nickel and other composites
Wiring	Flame-retardant vinyl, copper, nickel and other composites
Stickers	Resin material

8.TROUBLESHOOTING

Error Codes

If unit inadvertently falls into fluid or if fluid enters the unit and/or motor, turn power OFF and disconnect power cable immediately. DO NOT attempt to dry unit out and resume operation. This is extremely hazardous and may result in electric shock or fire. Contact a dealer or a Yamato sales office to arrange unit inspection by a certified technician.

[Error Codes]

Confirm error code and immediately halt operation.

Code	Possible causes and solutions
1) Loc	Displayed when motor or shaft becomes bound or caught for two or more minutes. Operation force quits. Remove objects or materials causing the bind and restart unit to recover operation.
2) Err1	Motor over-speed stop. Displayed when motor/shaft rotation beyond 4255rpm is detected. Operation force-quits. Restart unit to recover operation.
3) ――――	Thermal stop. Displayed when motor overheats and thermal protection switch is tripped. Automatic recovery after sufficient cool-down.

Troubleshooting Guide

Symptom	Check
Operation stops.	Unit may be overheated, tripping the thermal switch. Turn power OFF and allow 30 minutes for motor to cool sufficiently. Reduce fluid viscosity and/or change to a stirring blade which decreases load on motor.
Unit does not turn ON.	● Confirm that power supply is delivering sufficient voltage to unit. ● Confirm whether a power outage is in progress.

◆ If problem persists, turn power OFF, disconnect power cable and contact a local dealer or Yamato sales office for assistance.

Caution:
Do not attempt to perform insulation resistance test on LT series units. Damage to internal circuit boards may result.

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Requests for Repair

When a problem occurs, terminate operation immediately, turn off power switch and disconnect power cable.
Contact a local dealer or Yamato sales office for assistance.

The following information is required for all repairs.
- Model name
- Serial Number
- Date (year/month/day) of purchase
- Description of problem in as much detail as possible

Guaranteed Supply Period for Repair Parts

Guaranteed maximum supply period for repair parts is 7 (seven) years from date of discontinuation for LT series stirrers. “Repair parts” is defined as components which, when installed, allow for continued unit operation.

10. SPECIFICATIONS

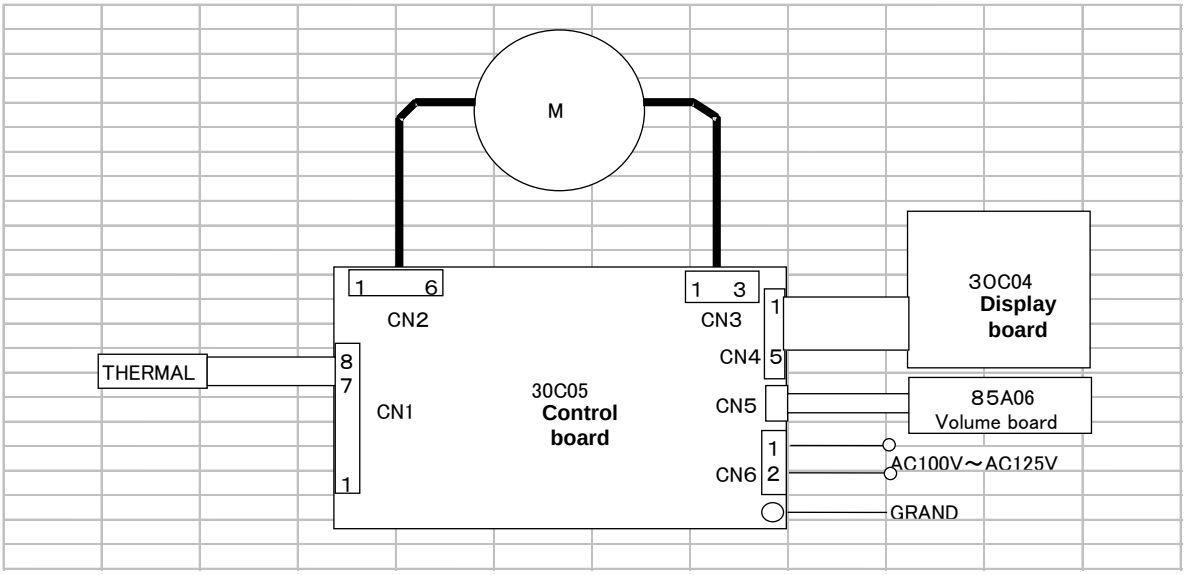
LT400 series

Model	LT400A	LT400B	LT400C	LT400D
Application	High viscosity	Medium viscosity	Low to medium viscosity	Low viscosity
Speed Range (in rpm)	10~300	15~600	25~1200	60~3000
Rated Torque	0.9N·m (9.0 kg f·cm)	0.5N·m (6.0 kg f·cm)	0.3N·m (3.0 kg f·cm)	0.1N·m (1.0 kg f·cm)
Motor	DC brushless motor B type insulation Output:35W			
Rotation Control	Feedback Control			
Display Indicators	Rotation speed: four digits digital, overload indicator, torque indicator (one stage = 20% load)			
Chuck	ϕ8 ㎜ SUS drill chuck			
Safety Devices	Current limiting circuit, Thermal protection switch - Maximum motor coil temperature: 110°C Safety cover			
Power Cable	Power cord with a 3p plug: 2m			
Power/Power Consumption	Single phase: 100V~120V±10% for 50/60 Hz 200VA			
Dimensions & Weight	Main body：146W×154D×165H ㎜ 2.4 ㎏			
Included Items	Holding clamp x 1, safety cover x 1, Shaft chuck wrench x 1 Operating manual x 1			

LT500 series

Model	LT500A	LT500B
Application	Medium viscosity	Medium viscosity
Rotation Speed	15~600 rpm	25~1200 rpm
Rated Torque	0.9N·m (9.0 ㎏ f·cm)	0.5N·m (6.0 ㎏ f·cm)
Motor	DC brushless motor B type insulation Output: 65W	
Rotation Control	Feedback Control	
Display Indicators	Rotation speed: four digits digital, overload indicator, torque indicator (one stage = 20% load)	
Chuck	SUS drill chuck for ϕ8 mm	
Safety Devices	Current limiting circuit, Thermal protector: Maximum motor coil temperature: 90°C Safety cover	
Power Cable	Power cord with a 3p plug: 2m	
Power/Power Consumption	Single phase: 100V~120V±10% for 50/60 Hz 400VA	
Dimensions & Weight	Main body: 146W x 154D x 165H mm 2.4kg	
Included Items	Clamp holder x 1, safety cover x 1, Shaft chuck wrench x 1 Operating manual x 1	

11. WIRING DIAGRAM



Symbol	Part name	Symbol	Part name
70C05	LT500 control circuit board	85A06	Speed control dial (volume)
30C05	LT400 control circuit board	M	DC brushless motor
30C04	LCD circuit board	THERMAL	Thermal sensor

12. REPLACEMENT PARTS LIST

Component name	Part No.	Specification	Manufacturer
Shaft chuck	LT00009868	For SUS ϕ8	Yamato Scientific
Chuck wrench	LT00009869		Yamato Scientific
Safety cover	LT00011266		Yamato Scientific
Brushless motor	LT00009871	FZ4047	Yamato Scientific
Control circuit board for LT400	LT00009872	30C05	Yamato Scientific
For LT500	LT00010325	70C05	Yamato Scientific
Display circuit board	LT00009873	30C04	Yamato Scientific
Volume (speed control dial)	LT00009874	85A06	Yamato Scientific
Power cord	LT00009875	3P	Yamato Scientific

Do not attempt to perform insulation resistance test on LT series units. Damage to internal circuit boards may result.

13. LIST OF HAZARDOUS SUBSTANCES

Never process any explosive, flammable samples and also samples contained with those substances.

Explosive Substance	①Nitroglycol, Glycerine trinitrate, Cellulose Nitrate and other explosive nitrate esters
	②Trinitrobenzen, Trinitrotoluene, Picric Acid and other explosive nitro compounds
	③Acetyl Hydroperoxide, Methyl Ethyl Ketone Peroxide, Benzoyl Peroxide and other organic peroxides
	④Metallic Azide, including Sodium Azide, etc.
ExplosiveSsubstances	①Metal “Lithium” ②Metal “Potassium” ③Metal “Natrium” ④Yellow Phosphorus ⑤Phosphorus Sulfide ⑥Red Phosphorus⑦Phosphorus Sulfide ⑧Celluloids, Calcium Carbide (a.k.a, Carbide)⑨Lime Phosphide⑩Magnesium Powder ⑪Aluminum Powder ⑫Metal Powder other than Magnesium and Aluminum Powder ⑬Sodium Dithionous Acid (a.k.a., Hydrosulphite)
Oxidizing Substances	①Potassium Chlorate, Sodium Chlorate, Ammonium Chlorate, and other chlorates
	②Potassium Perchlorate, Sodium Perchlorate, Ammonium Perchlorate, and other perchlorates
	③Potassium Peroxide, Sodium Peroxide, Barium Peroxide, and other inorganic peroxides
	④Potassium Nitrate, Sodium Nitrate, Ammonium Nitrate, and other nitrates
	⑤Sodium Chlorite and other chlorites
	⑥Calcium Hypochlorite and other hypochlorites
Flammable Substances	① Ethyl Ether, Gasoline, Acetaldehyde, Propylene Chloride, Carbon Disulfide, and other substances with ignition point at a degree 30 or more degrees below zero.
	②n-hexane, Ethylene Oxide, Acetone, Benzene, Methyl Ethyl Ketone and other substances with ignition point between 30 degrees below zero and less than zero.
	③Methanol, Ethanol, Xylene, Pentyl n-acetate, (a.k.a.amyl n-acetate) and other substances with ignition point between zero and less than 30 degrees.
	④Kerosene, Light Oil, Terebinth Oil, Isopenthyl Alcohol(a.k.a. Isoamyl Alcohol), Acetic Acid and other substances with ignition point between 30 degrees and less than 65 degrees.
Combustible Gas	Hydrogen, Acetylene, Ethylene, Methane, Ethane, Propane, Butane and other gases combustible at 15℃ at one air pressure.

(Quoted from the separate table 1 in Article 6, the enforcement order of the Industrial Safety and Health Law)

14. SETUP CHECKLIST

*Set unit up according to the following: (Confirm optional items or special specifications separately)

Model	Serial number	Date	Installed by (company or personnel)	Installation approved by	Assessed by

№	Item	Implementation Procedure	Manual Section & Reference Page	Assessed by
Specifications				
1	Included Items	Confirm actual items against list of included items	10.Specifications 13	
2	Installation	・Visual site check ・Caution: check for operation hazards	2. Installation Preparation & Precautions ・Choose an appropriate installation site 4	
		・Secure a location		
Operation-related matters				
1	Source Voltage	・Measure line voltage (power terminal or outlet) with a voltmeter ・Measure line voltage during operation. (must meet required rating) Caution: Confirm outlet rating or breaker power rating meets unit requirements.	2. Installation Preparation & Precautions ・Connect to a dedicated power supply 4 ・Ground wire must be connected properly 5 10.Specifications ・Power supply specification 13	
2	Operation	・Start operation Set to maximum speed and confirm stability	4. Operation Procedures 7 5. Handling Precautions 8	
Description				
1	Operational Descriptions	Explain function of each component as written in instruction manual	1. Safety Precautions 1~ ~13.List of Hazardous Substances 15	
2	Error codes	Explain error codes and reset procedures as written in instruction manual	8. Troubleshooting 11~ ~9. Service & Repair 12	
3	Inspection & Maintenance	Explain of inspection and maintenance procedure as written in instruction manual	6. Maintenance Procedures ・Daily Inspection & Maintenance 9	
4	Installation Data Entry Completion	・Fill in installation date and name of installing personnel or company on unit “OK and Service Sticker” ・Explain how to contact technician	9. Service & Repair 12	

⚠ **Do not attempt to perform insulation resistance test on LT series units. Damage to internal circuit boards may result.**

Limited Liability

Always operate equipment in strict compliance to the handling and operation procedures set forth by this instruction manual.

Yamato Scientific Co., Ltd. assumes no responsibility for malfunction, damage, injury or death, resulting from negligent equipment use.

Never attempt to disassemble, repair or perform any procedure on DKN-C series units which are not expressly mandated by this manual. Doing so may result in equipment malfunction, serious personal injury or death.

Notice

- **Instruction manual descriptions and specifications are subject to change without notice.**
- **Yamato Scientific Co., Ltd. will replace flawed instruction manuals (pages missing, pages out of order, etc.) upon request.**

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First Edition June 2, 2017

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