Laser Scanning System for Welding

GWM-PFL/STD2-001

OPERATION MANUAL

- Scanner Head -

AMADA®

AA12OM1178704-23

About This Documentation

Thank you for purchasing our GWM-PFL/STD2-001 Laser Scanning System for Welding.

Please read this manual carefully to ensure correct use of the product. Keep the manual handy after reading for future reference.

1. Organization

This document for the GWM-PFL/STD2-001 Laser Scanning System for Welding describes installation, maintenance and system specifications. For instructions for welding control using the SWDraw2 application, refer to the manual for SWDraw2.

The documentation comprises the following sections:

- Scanner Controller

  Describes the part names, installation, maintenance, and specifications of the scanner controller.

- Scanner Head

  Describes the part names, installation, maintenance, and specifications of the scanner head.

- Warranty
- Address List

2. Note

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- Unauthorized reproduction of this manual in whole or part is prohibited.
- The contents of this manual are subject to change without notice.
- Every effort has been made to ensure the accuracy of this information. If you come across oversights or errors, please notify your dealer.
- Be sure to read the user's manuals for any equipment used in conjunction with the system (e.g., documentation for computer systems).

3. Symbols Used in this Manual

 CAUTION	Indicates instructions that must be followed to prevent hardware or software damage or operating errors.
 ATTENTION	Indicates additional information on a particular topic.

Menus, icons, buttons, windows, tabs	Enclosed in brackets. Example: Click the [OK] button.
Keyboard keys	Enclosed in angle brackets. Example: Press the <Tab> key.
References	Enclosed in quotes. Example: Refer to "Chapter 8-3.2 Changing Passwords" (page 5).

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Chapter 1 Special Precautions

1. Safety Precautions

Read these Safety Precautions thoroughly before use to ensure correct use of the system.

- The precaution points indicated here are intended to ensure safe operation of the system and prevent hazards or injury to users and other personnel.

  They are important details relating to safety and must be read carefully.

- The indications have the following meanings.

⚠ DANGER	Indicates that incorrect operation risks death or serious injury to personnel.
⚠ WARNING	Indicates that incorrect operation may result in death or serious injury to personnel.
⚠ CAUTION	Indicates that incorrect operation may result in injury to personnel or damage to property.

Indicates prohibited actions and warns of actions not covered by the product warranty.

Indicates actions that must be performed by users.

The triangular symbol indicates details that supplement DANGER, WARNING, or CAUTION points.


⚠ DANGER

Never dismantle, repair, or modify the system. Doing so may result in electric shock or fire.
Otherwise there is a risk of electric shock or fire. Do not attempt maintenance other than that described in the Operation Manual.

Do not look into or touch the beam.
Direct and scattered laser light is dangerous. Looking directly at the laser source risks blindness.

Never burn, destroy, cut, crush or chemically decompose the system.
This product incorporates parts containing gallium arsenide (GaAs).

⚠ WARNING

Wear protective goggles.
Protective goggles must always be worn when using the system.
Care must be taken even when wearing protective goggles, as looking directly at the laser source through protective goggles risks blindness. Protective goggles attenuate the laser beam, but does not block it.

Never subject parts of the body to laser radiation.
Otherwise there is a risk of burn injuries.

Do not damage power or connector cables.
Do not crush, twist, or pull cables. Damaged cables may result in electric shock, short-circuiting, or fire.
Contact your dealer or us if repair or replacement is necessary.

Connect securely using the specified cables.
Using cables with inadequate capacity or improper connections may result in fire or electric shock.

Connect optical fibers securely.
Improper connection may result in burn injuries or fire.

Stop using the system if a problem arises.
If a problem occurs such as a burning smell, abnormal noise, overheating, or smoke emission, continuing to use the system may result in electric shock or fire.
Contact your dealer or us immediately.

Use a stopper.
Laser radiation is hazardous to personnel.When operating the laser during maintenance work, use a stopper (light-absorbing/scattering body capable of withstanding high temperatures) to prevent laser emission beyond the stopper.

⚠ WARNING

Wear protective work clothing.
Wear protective clothing such as gloves, long-sleeved clothing, and a leather apron.
Spatter will cause burn injuries if it lands on the skin.

⚠ CAUTION

Keep away from water.
Subjecting electrical components to water may result in electric shock or short-circuiting.

Install in a firm location.
Otherwise there is a risk of injury if the system topples or falls from the installation location.

Keep away from flammable materials.
Otherwise there is a risk of fire if spatter created during laser emission lands on flammable materials.
If flammable materials cannot be removed from the vicinity, they must be covered with a non-flammable cover.

Provide fire extinguishers.
Fire extinguishers must be provided in the welding work area in case of fire.

Inspect and maintain the system periodically.
Inspect and maintain the system periodically, repairing damaged parts and components before use.

Do not point the laser beam at flammable materials.
Do not point the laser beam at flammable or combustible materials. Otherwise there is a risk of fire.

Keep connector plugs clean and insert fully.
There is a risk of overheating and fire if dust is allowed to accumulate or if plugs are not fully inserted.

Hold the plug body when inserting or removing.
There is a risk of damage to the cable and electric shock or fire if the cable is pulled to unplug.

Do not cover with blankets or sheets.
Do not cover the system with blankets or sheets while in use. Otherwise there is a risk of over-heating and fire.

2. Operating Precautions

(1) When scanning highly reflective materials (such as gold, silver, copper, or aluminum), be sure to contact us.

Depending on use conditions, the inside of the scanner head may be burnt.

(2) A person knowledgeable about laser radiation and laser systems should be appointed as a laser safety manager.

The laser safety manager should be responsible for managing the system key switches, providing safety instruction to laser operators, and supervising operations.

(3) Areas in which lasers are used must be partitioned from other areas by enclosing with fences.

These areas should be managed by a supervisor and marked with signs to prevent entry by unauthorized personnel.

(4) The system should be used in an ambient temperature range of 5°C to 35°C and humidity 80% RH or lower with no sudden temperature fluctuations. Avoid using the system in the following locations.

- Locations with dust or oil mist present
- Locations subject to vibration or impact
- Locations in which chemicals are used
- Locations subject to high noise
- Locations susceptible to condensation
- Locations with high concentrations of CO_2, NO_x, or SO_x (The ion-exchange resin life may be reduced by exposure to CO_2 concentrations of 0.1% or more.)

(5) There is a risk of condensation forming on the lens surface and debris adhering if the ambient temperature changes suddenly such as when turning on the heating in cold conditions. Avoid sudden temperature fluctuations. There is a likelihood that condensation has formed if the output decreases during initial operation. Stop using the system immediately, and check the lens surface if there is a likelihood of condensation.

(6) The exterior of the system should be wiped clean using a soft or moist cloth. If the exterior is particularly dirty, wipe clean using diluted detergent or alcohol.

(7) Do not drop foreign objects such as screws inside the system, as this may result in failure of the system.

(8) Operate the system as described in the attached Operation Manual.

(9) Do not turn off the power switch of the scanner controller while a computer is connected to the scanner controller.

(10) If a computer is connected, it will continue to access the memory card for about 15 seconds after going offline. During this time, do not turn off the power switch of the scanner controller.

(11) If a computer is connected, never disconnect the USB cable before turning off the power switch of the scanner controller.

(12) For more consistent scanning allow the unit to warm up for about 10 to 30 minutes after turning it on. The warmup time varies depending on the temperature and workpiece material.

(13) Use only memory cards purchased from us. If commercial cards are used, the unit may not function normally.

(14) Before inserting or removing memory cards, always turn off the power switch of the scanner controller. If the power switch of the scanner controller is on when cards are inserted or removed, data may be lost or the memory card may become unusable.

(15) Back up memory card data regularly. If the memory card data becomes corrupted, it may prevent normal scanned or the equipment may not start.

(16) The number of times memory cards are inserted or removed depends on the manufacturer's nominal number of times (10000 times).

(17) When a supervisor or operator enters the area where the laser is used, protective measures not to exceed the MPE* level must be taken.

* MPE: The maximum level of permissible exposure of the eyes or skin to laser beams. Abbreviation of Maximum Permissible Exposure.

* For other information on managing laser equipment or the MPE level, refer to the following standards.

IEC Standards IEC60825-1 "Safety of laser products Part1: Equipment Classifications, requirements and use's guide"

[Warning/Caution label details]

3. For Disposal

This product incorporates parts containing gallium arsenide (GaAs). At the time of disposal, separate it from general industrial waste or domestic waste and carry out the disposal in accordance with applicable laws and regulations.

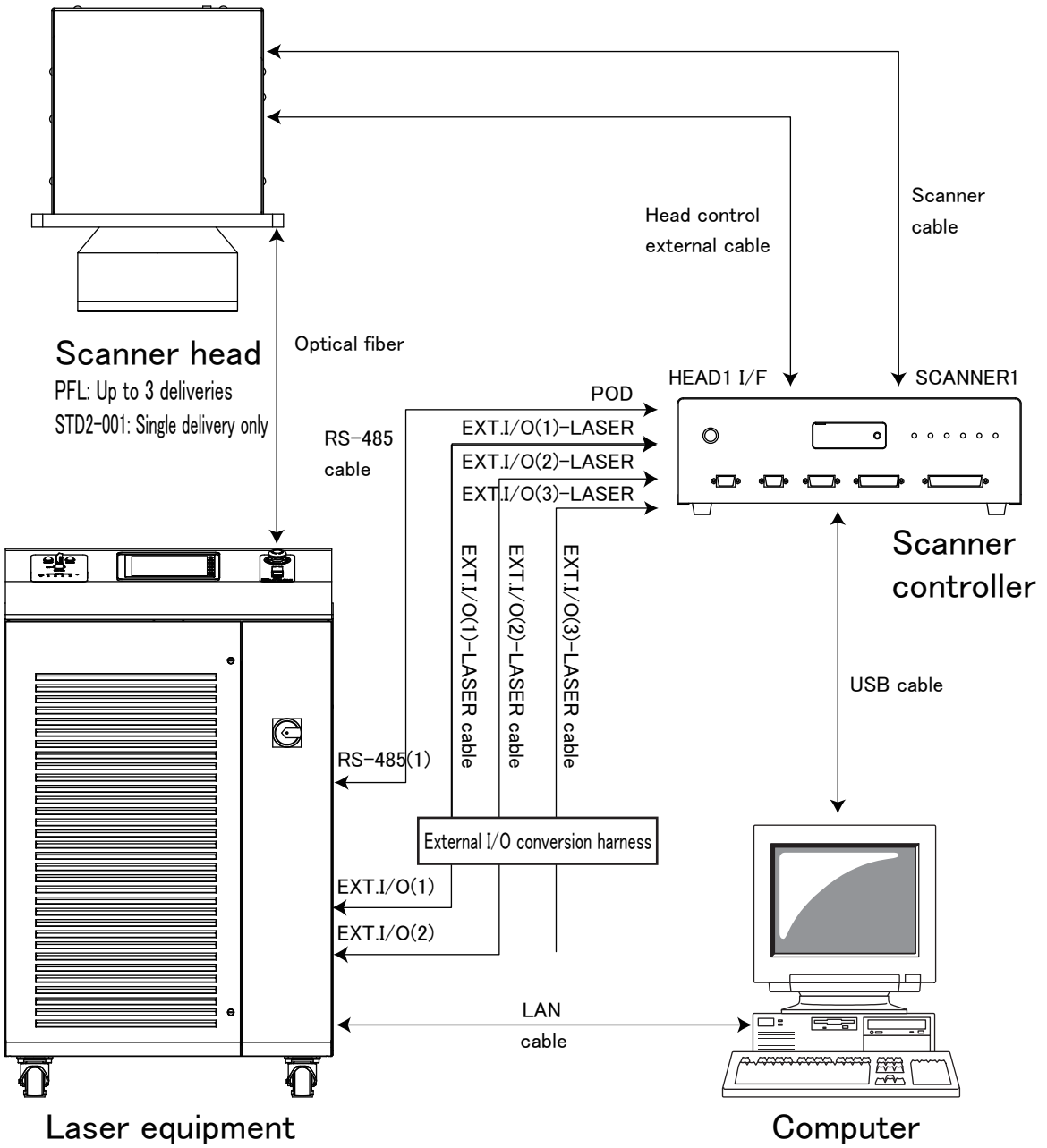
Chapter 2 Features

This product is a high-precision laser scanning system for welding which is used in the emitter for laser light sent via optical fiber from the laser equipment and combined with a scanner controller.

Also, the digital scanner improves scanner performance such as reduction of temperature drift, precision of repetition position, and scanning speed.

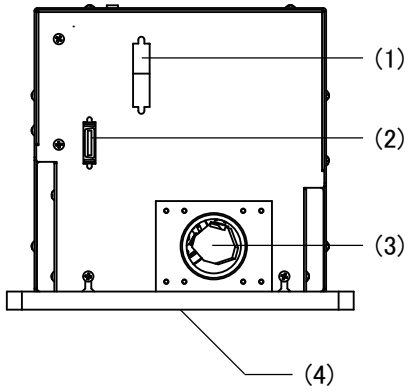
Chapter 3 System Configuration

1. Overall Configuration



2. Name and Functions of Each Section

2.1. Rear



(1) Head I/F connector

For connection to the HEAD1 to 3 I/F connector of the scanner controller using the head control external cable.

(2) Scanner connector

For connection to the SCANNER1 to 3 connector of the scanner controller using the scanner cable.

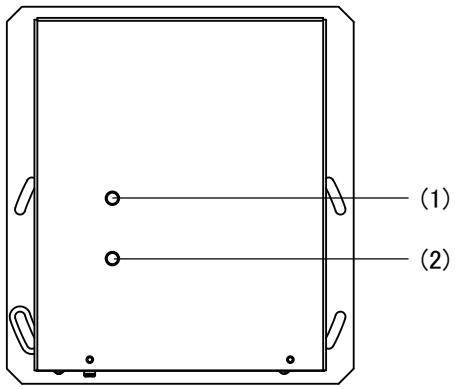
(3) Collimator lens unit connecting port

For connection to the collimator lens unit.

(4) fθ lens connecting port

For connection to fθ lens.

2.2. Top

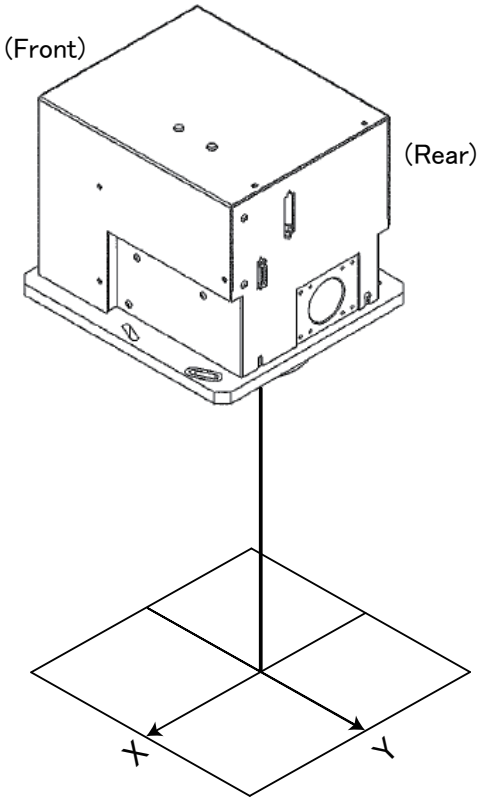


(1) LED (Yellow)

Lights up when the LD of the laser equipment is ON.

(2) LED (Green)

Lights up when the shutter of the laser equipment is open.

CAUTION	The positional relationship between coordinate axes XY and the center of lens is as shown below. 

Chapter 4 Installation

1. Unpacking

1.1. Lifting and Transporting Container

 CAUTION	When moving the container, use a cart or ensure at least two people carry it.

	Dimension	Mass (including contents)
Container for scanner head and accessories	Approx. 420 (H) x 350 (W) x 370 (D) mm	See "Chapter 6-2. Scanner Head Unit" (page 21) .

1.2. Checking the Contents of Container

Verify that contents of the container agree with the following list.

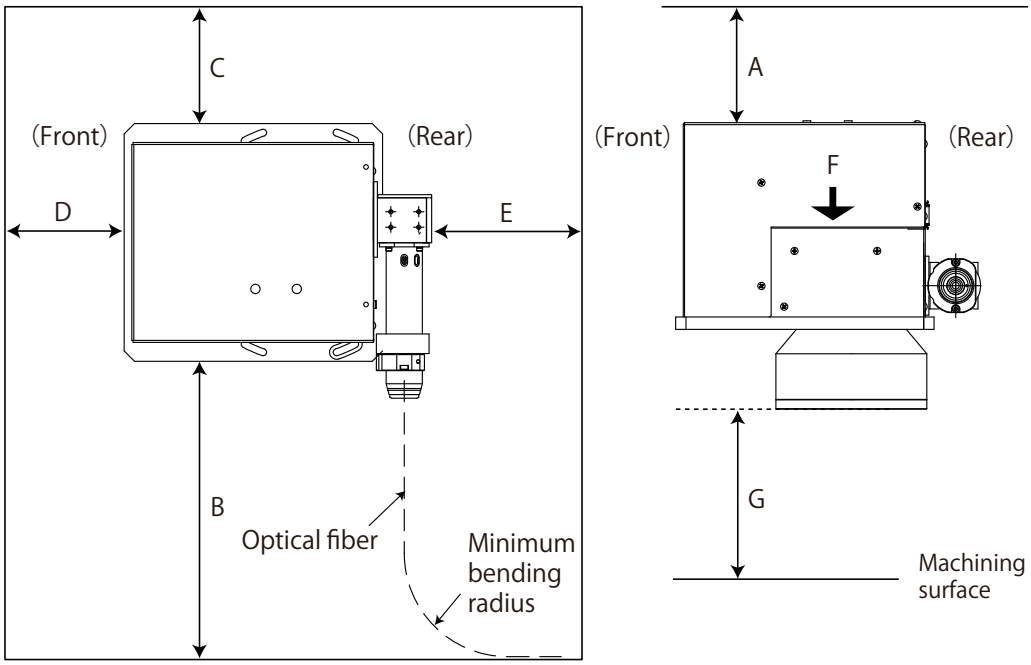
The components marked with * are built in the unit.

Component	Quantity
Scanner head	1
fθ lens *	1
Collimator lens unit *	1

2. Installation

2.1. Installation Requirements

Refer to the following figure when installing the scanner head. Install the scanner head in a well-ventilated location. Because scanning may produce dust and particulates, we recommend installing a dust collector.



Required Clearance and Mass Support

A. Clearance on top	At least 300 mm
B. Clearance on right side	At least 300 mm
C. Clearance on left side	At least 300 mm
D. Clearance in front	At least 300 mm
E. Clearance in back	At least 300 mm
F. Mass	See "Chapter 6-2. Scanner Head Unit" (page 21) .
G. Work distance	See "Chapter 5-3. Machining Parameters" (page 18) .

CAUTION	The optical fiber has its minimum bending radius. Refer to the operation manual for the laser equipment connected to install the scanner head so as not to bend the optical fiber beyond its minimum bending radius.

CAUTION	When moving the scanner head, support the head on right and left to avoid touching the lens. Do not hold the fiber or other cables.

Keep the following points in mind when installing the scanner head.

(1) The work distance is the distance from the outermost surface of the lens' protective glass to the focal position. Depending on differences in scanning conditions and from device to device, the work distance may result in slight variations. Make sure the scanner head is installed to permit adjustment in the range of ±10 mm relative to these values.

(2) Install the scanner head so that you can adjust and maintain level after installation.

(3) For the scanner head mounting platform, use a sheet of metal at least 10 mm thick.

(4) Protect the mounting platform from vibrations.

Vibrations of 0.1 G or less during operations are generally acceptable, but even lesser vibrations under certain conditions may affect or distort scanning or lead to damage.

(5) Keep the mounting platform separate from conveyor lines or other equipment to prevent vibration and impact.

(6) When using two opposing scanner heads, install them so that the laser of neither head is aimed at the other head.

A laser directed at parts within the other scanner head may burn the unit interior.

(7) When scanning highly reflective materials (such as gold, silver, copper, aluminum, steel, or stainless steel), make sure the focal distance is correct.

Putting workpieces in a position other than the lens focal position may cause the laser to reflect from the workpiece, burning the inside of the scanner head.

(8) Install the scanner head so that the laser is not aimed at the ceiling.

This precaution is intended to protect users from looking directly into laser output unit and to facilitate maintenance.

2.2. Connections

(1) Avoid bundling connecting cables or remote control cables with other power cables.

The resulting electromagnetic noise may cause malfunctions.

(2) When connecting optical fibers, take care to avoid soiling or damaging the ends of the fiber.

Retain the caps originally attached to the scanner head and optical fiber in a safe location for future use. You will need them again if the optical fiber is removed.

(3) The software driver must be installed before connecting a computer to the scanner controller. Refer to the manual for SWDraw2 for instructions on installing the driver.

(4) In case of an optional CCD camera attached, a dedicated power supply, cables and a cross-line generator are coming with it.

Chapter 5 Specifications

1. Basic Specifications

Item		Specifications
Corresponding wavelength		1060 to 1100 nm, 650 nm (Guide beam)
Maximum allowable laser power		1000 W
Ambient temperature		5°C to 35°C (with no condensation or freeze) Note: Contact us when using in ambient temperature below 5°C.
Ambient humidity		80% RH or lower (with no condensation or freeze)
Temperature during storage		-10°C to 55°C (with no condensation or freeze)
Humidity during storage		80% RH or lower (with no condensation or freeze)
Vibration during transport (with packaged)		1.0 G or less (horizontal), 2.0 G or less (vertical)
Impact during transport (with packaged)		10.0 G or less (horizontal), 20.0 G or less (vertical)
Dust, Oil mist		IP50
Electromagnetic compatibility standards	Immunity	Complied with the following: IEC61000-4-2 (Electro-static immunity: Contact discharge±6kV, Aerial discharge±8kV) IEC61000-4-3 (Radiated field: 10V/m 80-1000MHz) IEC61000-4-4 (Fast transient burst noise: Power supply±2kV, Transmission line±1kV) IEC61000-4-5 (Lightning surge: Power supply (L1-L2) ±1kV, Power supply (L1-E,L2-E) ±2kV) IEC61000-4-6 (Conducted immunity: 10V/m 0.15-80MHz) IEC61000-4-8 (Magnetic field immunity: 36A/m) IEC61000-4-11 (Dips/Interrupts)
	Emission	Complied with the following: EN55011:2007+A2:2007 (Radiated disturbance) EN55011:2007+A2:2007 (Conducted disturbance)
Maximum scanning speed		28.76 rad/s
Scanner setting time		2 ms max.
Power supply voltage		24 V±1.2 V
Power consumption		Average: Approx. 7 W (per head), Peak: Approx. 40 W (per head)
External dimensions*		230(W) mm × 250(D) mm × 200(H) mm
Mass*		Approx. 6.5 kg

* Output unit, collimator lens and fθ lens are not included.

2. Lens Unit Lineup

Corresponding model	Fiber connector	Collimator lens		fθ lens		Machining area (mm)
		Item No.	f	Item No.	f (mm)	
ML-3060AS	RQB	1178709 1178710 1178711	f40 f60 f75	1186257	f82	□20
				1190425	f163	□78
				1187278	f163	□94
				1178932	f306	□150
				1178919	f420	□220
ML-3030AS	D80	1180491 1180492 1180493	f40 f60 f75	1186257	f82	□20
				1190425	f163	□78
				1187278	f163	□94
				1178932	f306	□150
				1178919	f420	□220
ML-3015AS	D80	1180491 1180492 1180493 1180494	f40 f60 f75 f90	1186257	f82	□20
				1190425	f163	□78
				1187278	f163	□94
				1178932	f306	□150
				1178919	f420	□220

3. Machining Parameters

Image ratio	Machining area	Work distance	Positioning resolution	Repeated positioning accuracy *	Machining position drift
0.9	□20 mm ±0.5%	Approx. 84.6 mm	2 µm	8 µm max.	2 µm/°C max.
1.1					
1.4					
2.1					
1.8	□78 mm ±0.5%	Approx. 205 mm	4 µm	15 µm max.	6 µm/°C max.
2.2					
2.7					
4.1					
1.8	□94 mm ±0.5%	Approx. 206 mm	4 µm	15 µm max.	6 µm/°C max.
2.2					
2.7					
4.1					
3.4	□150 mm ±0.5%	Approx. 374 mm	8 µm	30 µm max.	12 µm/°C max.
4.1					
5.1					
7.7					
4.7	□220 mm ±0.5%	Approx. 499 mm	11 µm	40 µm max.	16 µm/°C max.
5.6					
7.0					
10.5					

* When the operating temperature variation range is 1°C or lower and thirty minutes have passed from warm-up.

■ Machining speed (Varies depending on operating conditions)

Time T required for machining one point is calculated approximately using the equation below, but actual machining times may differ.

T (ms) = (movement time) + (standing time after jump) + 1 ms + (laser output time) + 1 ms

(Where movement time (ms) = Movement distance (mm) / Jump speed (mm/s)
standing time after jump (ms) = 2 (default)
Laser output time (ms) = 1, 2, 3, ...)

- Usage conditions example 1

Laser output	Pulse width 2 ms
Distance between each point	1 mm max.
Machining area	35 mm dia.
Jump speed	2300 mm/s
Machining time per point	6 ms
Machining speed	Approx. 166 points per second

- Usage time example 2

Laser output	Pulse width 5 ms
Distance between each point	10 mm max.
Machining area	100 mm dia.
Jump speed	4700 mm/s
Machining time per point	9.002 ms
Machining speed	Approx. 111 points per second

However, must not exceed the maximum ratings of the laser equipment used.

4. Parameter Setting Ranges for Various Lenses

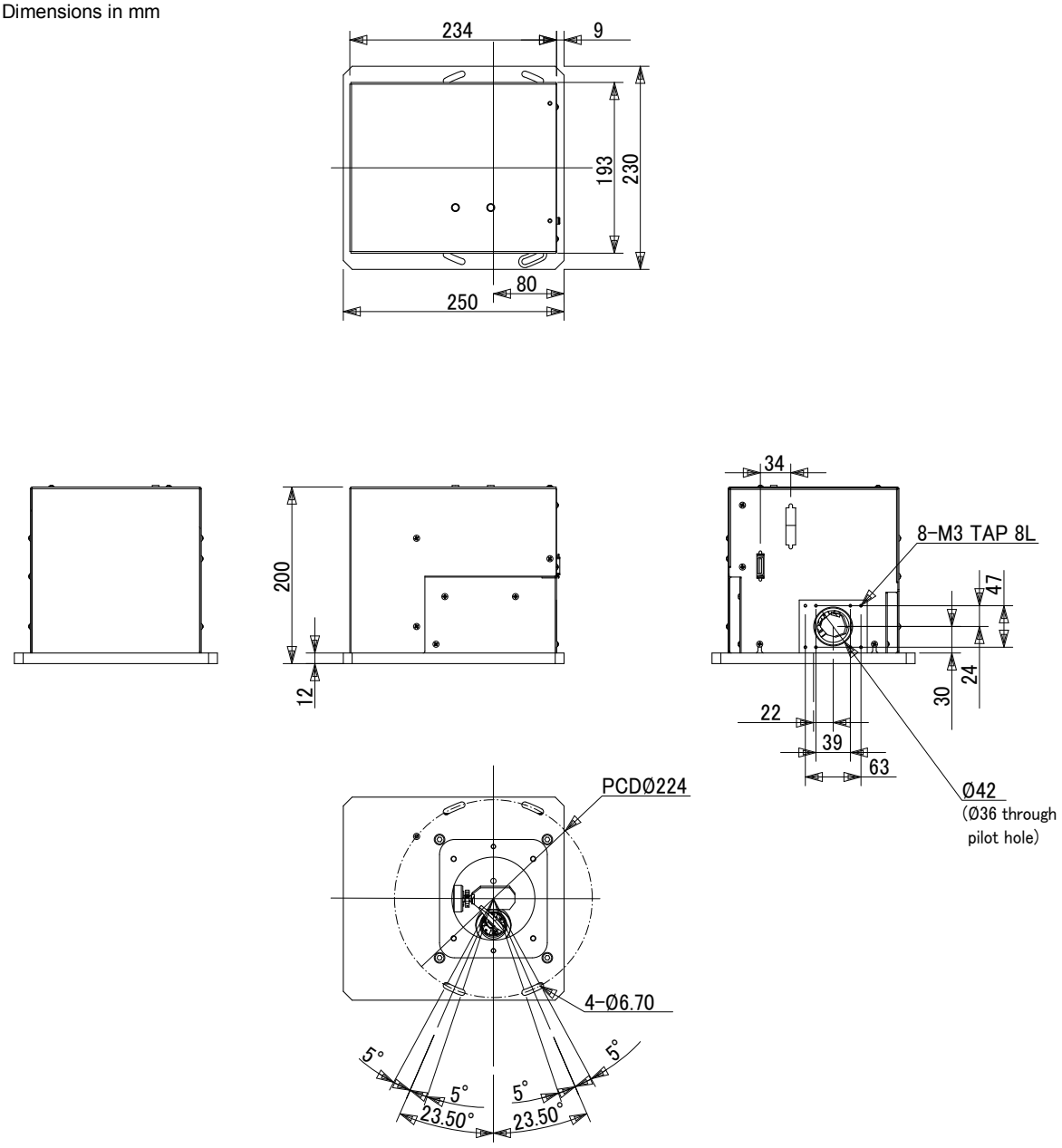
Lens type		f82	f163	f163	f306	f420
Machining area	(mm)	□20	□78	□94	□150	□220
Starting X-Coord / X-Coordinate	Minimum (mm)	-10	-39	-47	-75	-110
	Maximum (mm)	10	39	47	75	110
Starting Y-Coord / Y-Coordinate	Minimum (mm)	-10	-39	-47	-75	-110
	Maximum (mm)	10	39	47	75	110
Ending X-Coord	Minimum (mm)	-10	-39	-47	-75	-110
	Maximum (mm)	10	39	47	75	110
Ending Y-Coord	Minimum (mm)	-10	-39	-47	-75	-110
	Maximum (mm)	10	39	47	75	110
Central X-Coord	Minimum (mm)	-10	-39	-47	-75	-110
	Maximum (mm)	10	39	47	75	110
Central Y-Coord	Minimum (mm)	-10	-39	-47	-75	-110
	Maximum (mm)	10	39	47	75	110
X-Coor Const Pt	Minimum (mm)	-10	-39	-47	-75	-110
	Maximum (mm)	10	39	47	75	110
Y-Coor Const Pt	Minimum (mm)	-10	-39	-47	-75	-110
	Maximum (mm)	10	39	47	75	110
Radius	Minimum (mm)	-10	-39	-47	-75	-110
	Maximum (mm)	10	39	47	75	110
X Offset / Y Offset	Minimum (mm)	-10	-39	-47	-75	-110
	Maximum (mm)	10	39	47	75	110
Scanning Speed	Minimum (mm/s)	1	1	1	1	1
	Maximum (mm/s)	2300	4700	4700	8000	10000
Jump Speed	Minimum (mm/s)	1	1	1	1	1
	Maximum (mm/s)	2300	4700	4700	8000	10000
Wobbling Width*	Minimum (mm)	0.01	0.01	0.01	0.01	0.01
	Maximum (mm)	5	5	5	5	5
Wobbling Frequency*	Minimum (Hz)	1	1	1	1	1
	Maximum (Hz)	1000	1000	1000	1000	1000

* "Wobbling Width" and "Wobbling Frequency" may not work as being set depending on the combination of parameters.

Chapter 6 Outline Drawing

1. Scanner Alone

Dimensions in mm



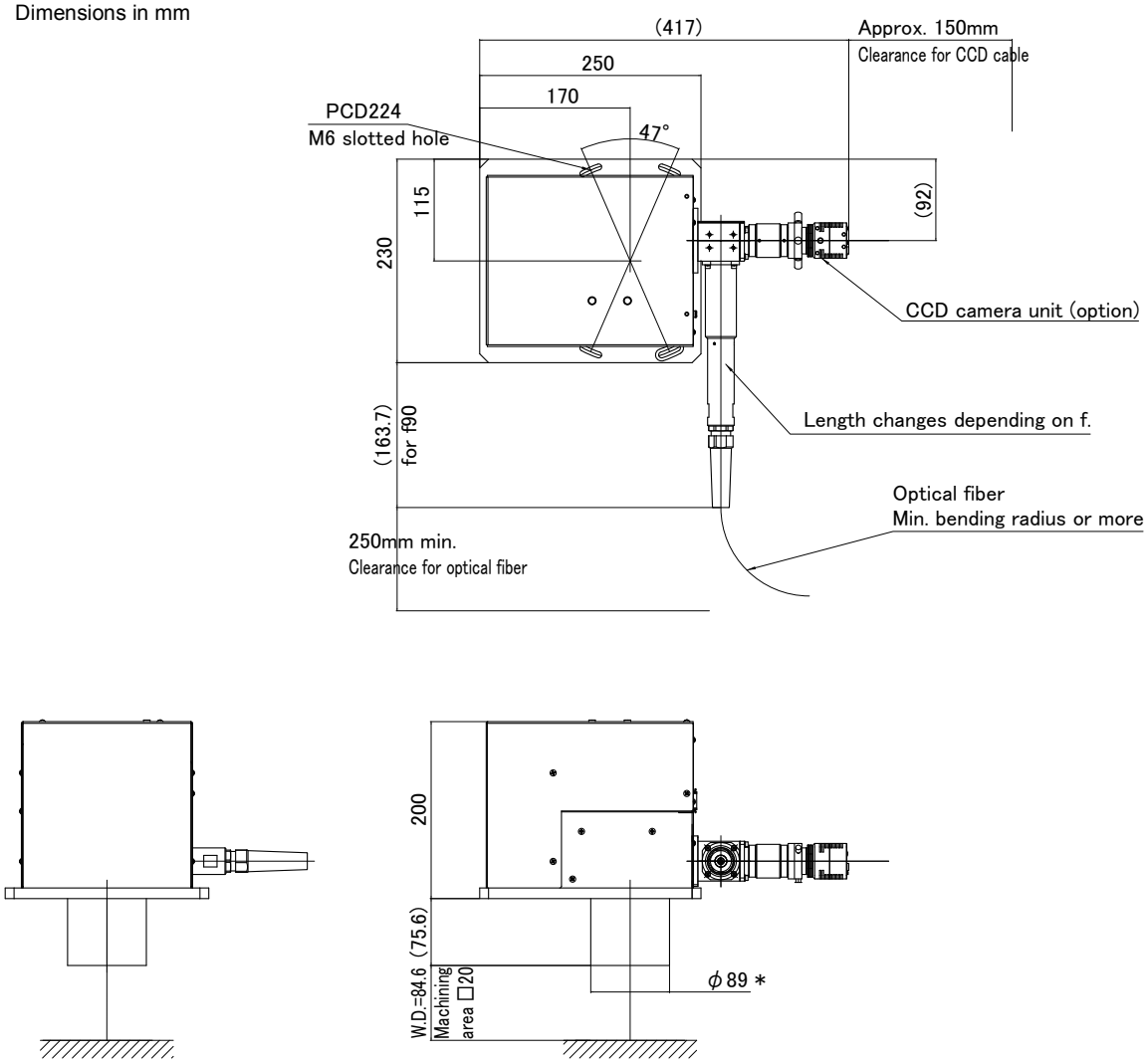
Output unit, collimator lens and fθ lens are not included in the drawing above.

2. Scanner Head Unit

2.1. f82

Total mass: Approx. 9.6 kg

Dimensions in mm

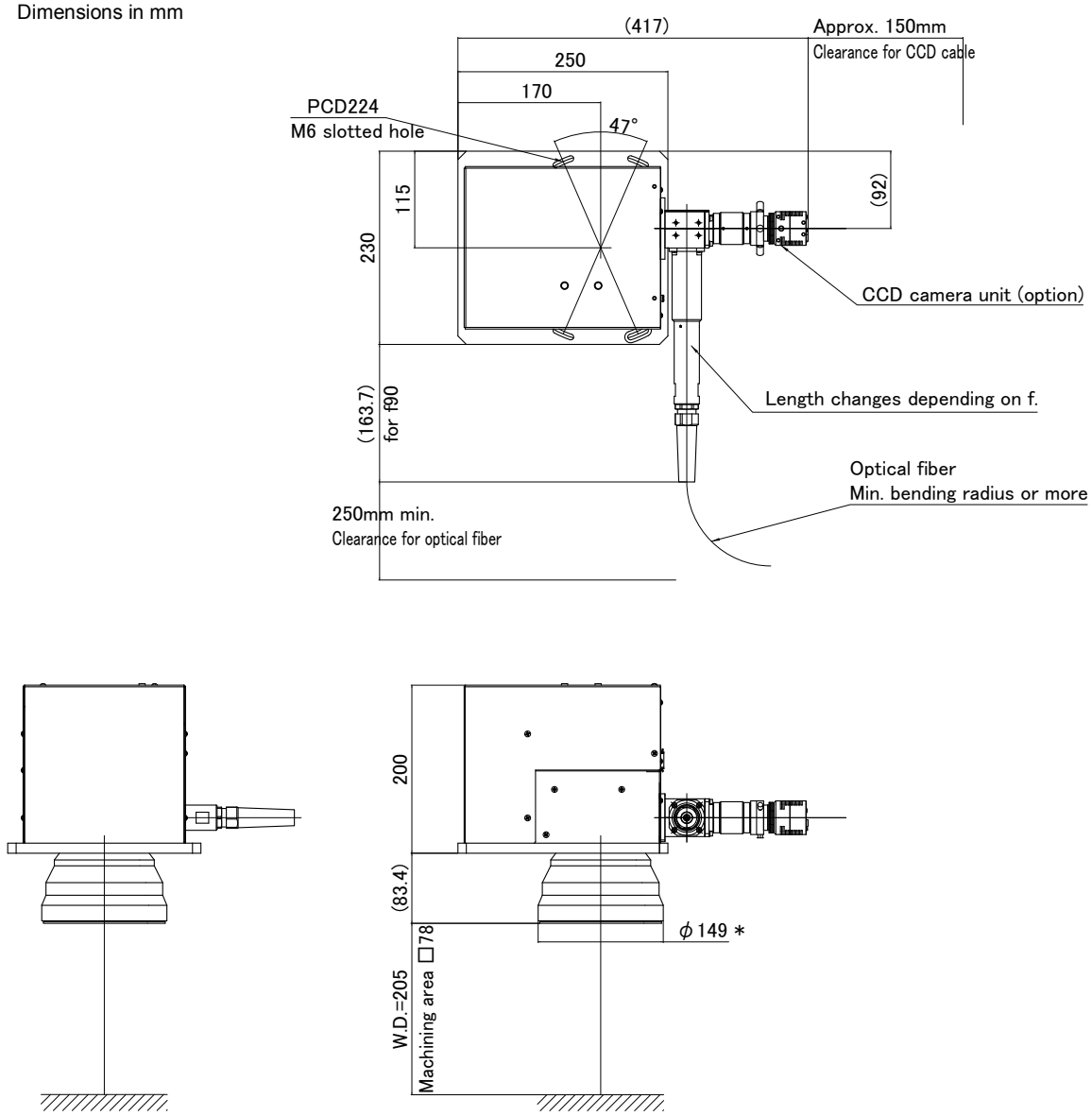


* For recommended dimensions of the mounting plate, see "Chapter 6-2.6. Recommended Dimension of the Mounting Plate" (page 26) .

2.2. f163 (□78)

Total mass: Approx. 10.8 kg

Dimensions in mm

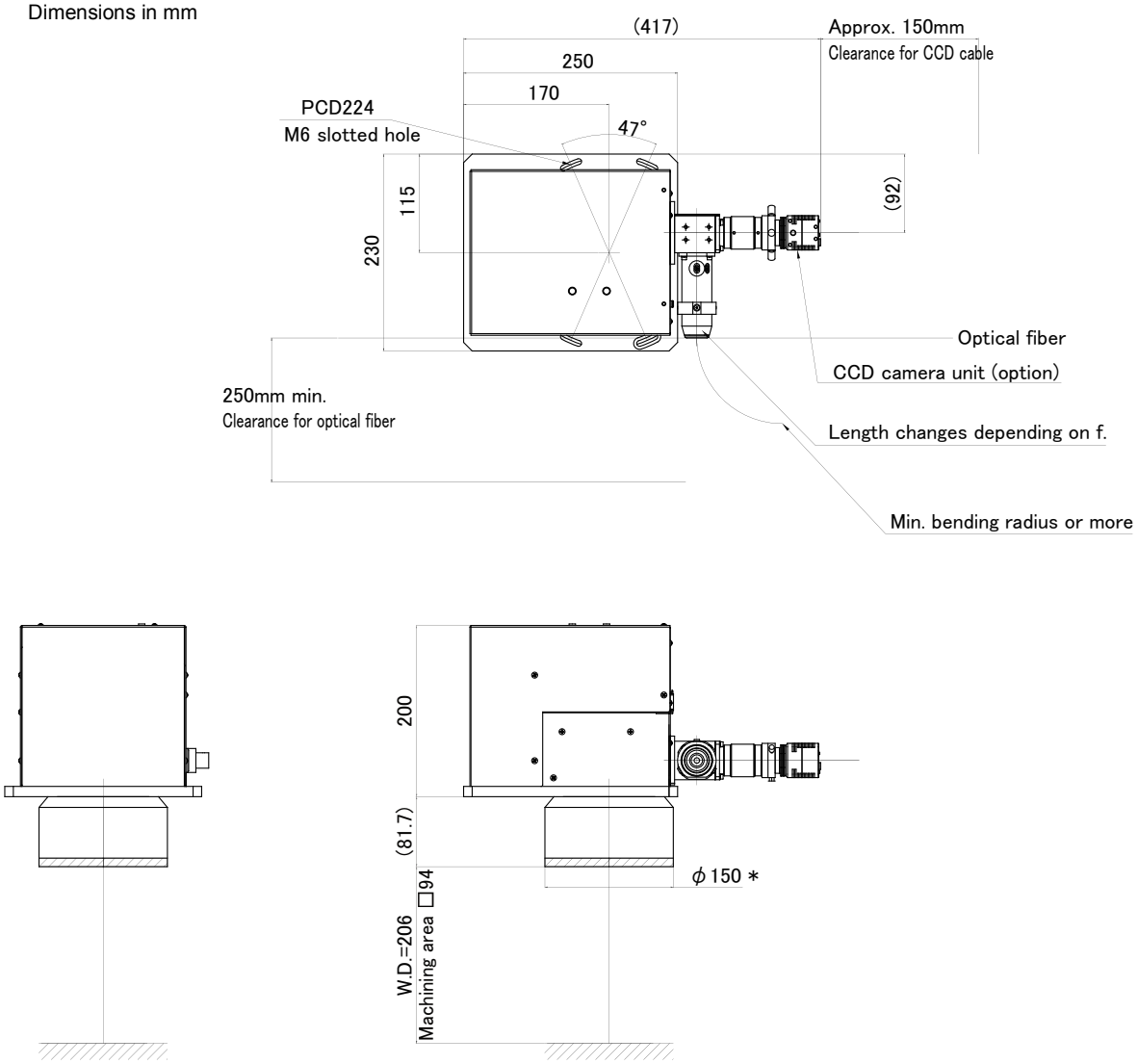


* For recommended dimensions of the mounting plate, see "Chapter 6-2.6. Recommended Dimension of the Mounting Plate" (page 26) .

2.3. f163 (□94)

Total mass: Approx. 11.1 kg

Dimensions in mm

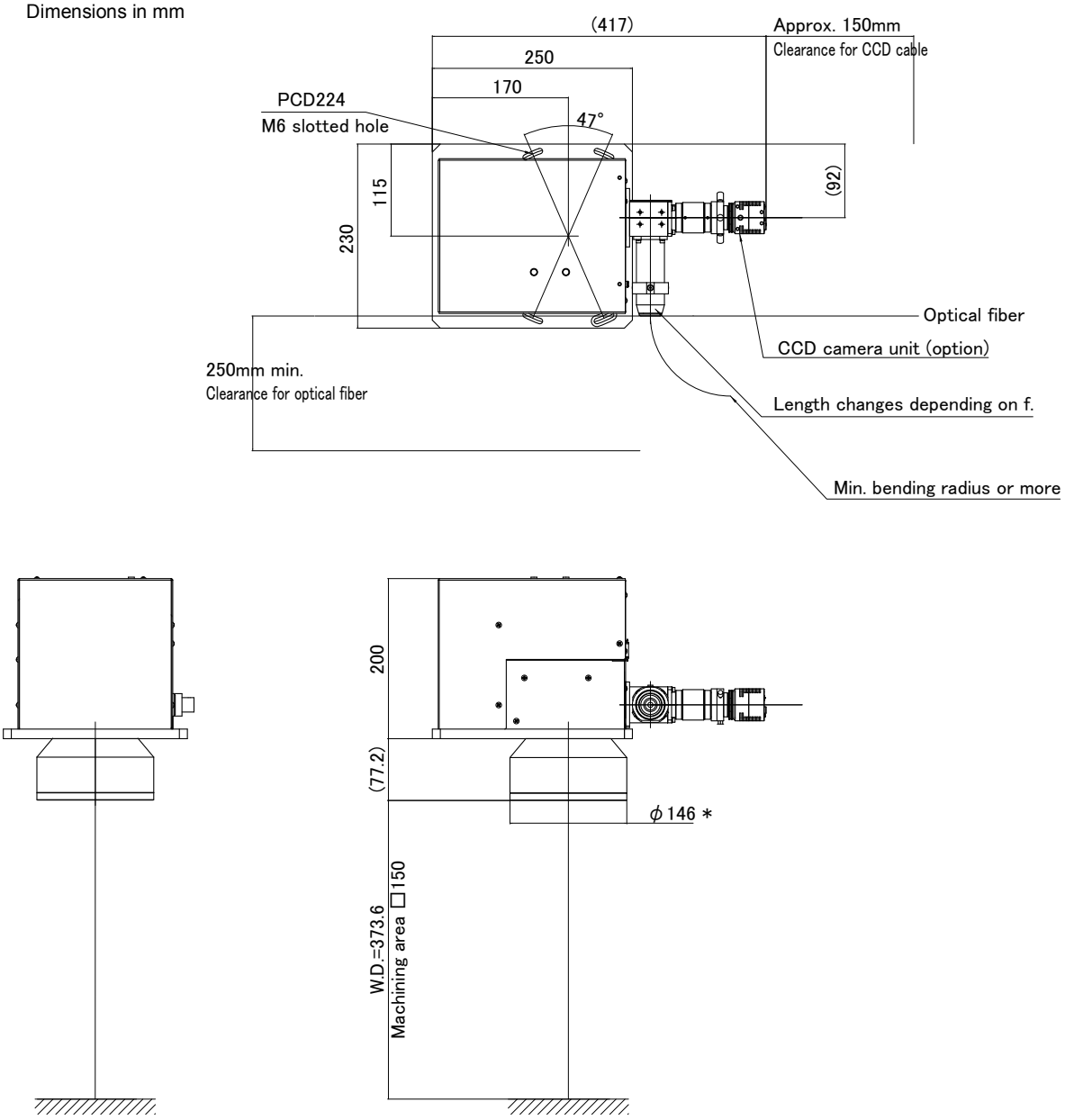


* For recommended dimensions of the mounting plate, see "Chapter 6-2.6. Recommended Dimension of the Mounting Plate" (page 26) .

2.4. f306

Total mass: Approx. 10.1 kg

Dimensions in mm

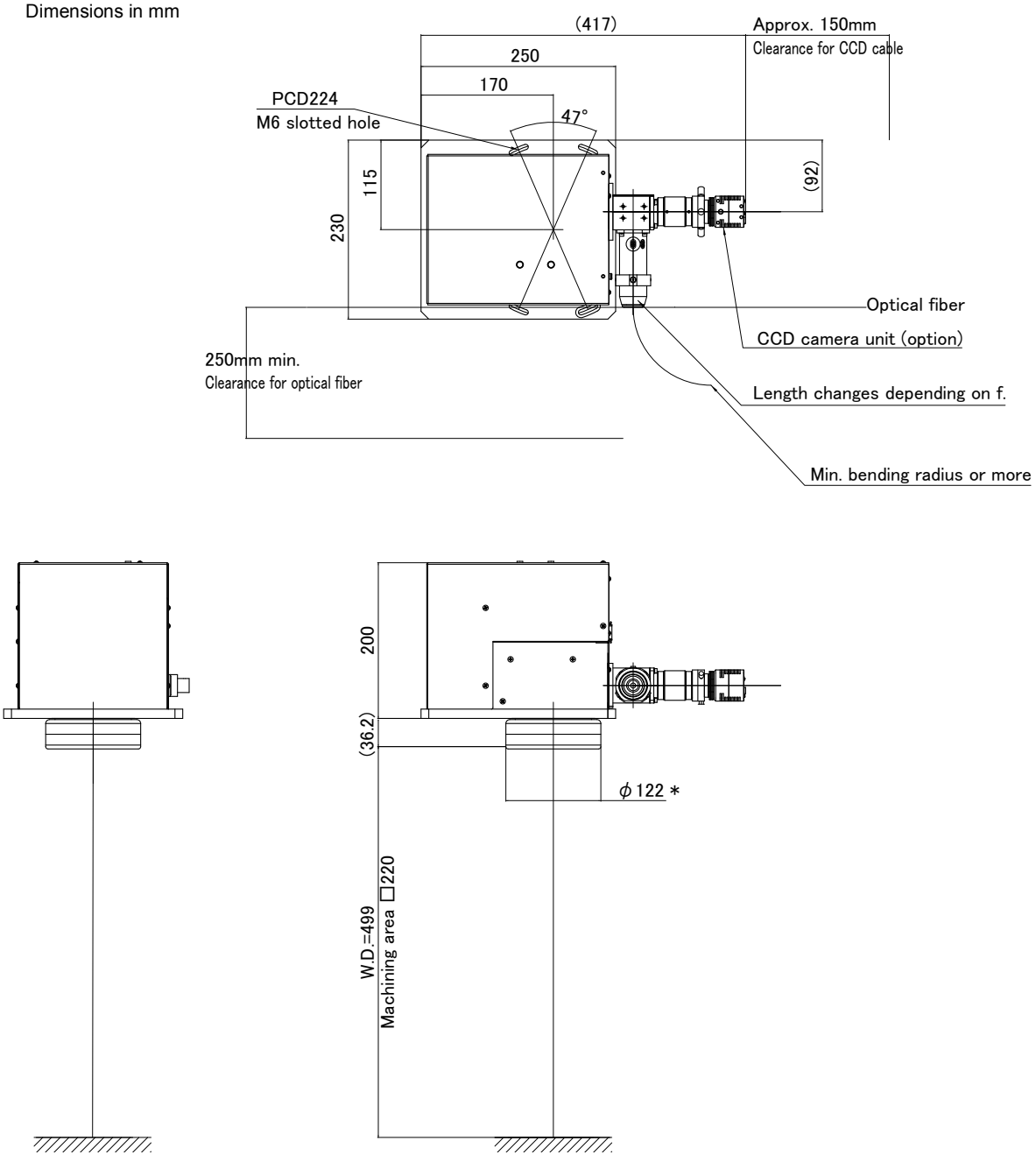


* For recommended dimensions of the mounting plate, see "Chapter 6-2.6. Recommended Dimension of the Mounting Plate" (page 26) .

2.5. f420

Total mass: Approx. 9.3 kg

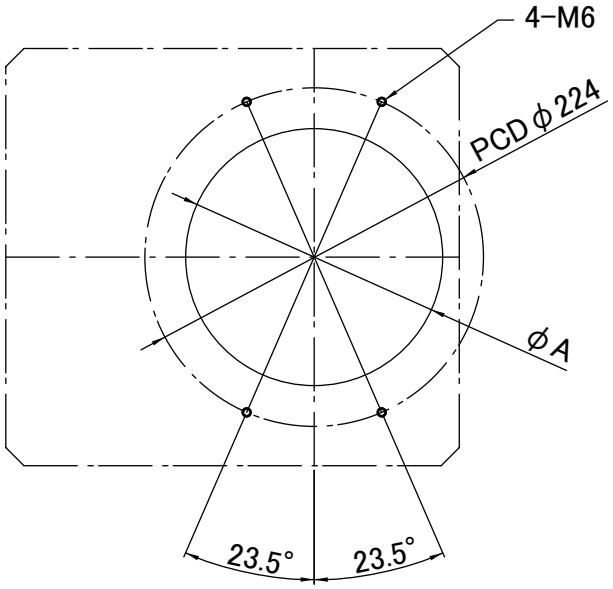
Dimensions in mm



* For recommended dimensions of the mounting plate, see "Chapter 6-2.6. Recommended Dimension of the Mounting Plate" (page 26) .

2.6. Recommended Dimension of the Mounting Plate

Dimensions in mm



fθ	Recommended hole diameter
f82	103
f163 (□78, □94)	160
f306	155
f420	130

Chapter 7 Inspection and Parts Replacement

1. Before Inspection and Parts Replacement

This section describes simple maintenance tasks that can be performed by users.

 CAUTION	Before performing any maintenance tasks, turn OFF the equipment and wait at least five minutes to stop the equipment safely. Touching the equipment interior when it is on may result in electric shock.

 CAUTION	• Use our genuine maintenance parts. • For defect caused by non-genuine maintenance parts or use of non-genuine maintenance parts, the repair is charged even if it is still within the maintenance contract period or the warranty period.

For optimal performance, we recommend performing annual inspections and comprehensive overhauls once every two years.

For more information, please contact us.

2. Parts Replacement

As user-serviceable parts wear with use, performance will decline, eventually requiring repairs or replacement.

Inspect the unit regularly, referring to the guidelines provided in the following table:

Component		Model No.	Schedule*1 (Recommended)	Maintenance*2
fθ lens	f82	S4LFT0082/328	5 years	Replace
	f163 (□78)	SL-1064-94-163Q-V1		
	f163 (□94)	S4LFT2174/328		
	f306	PO1160337		
	f420	S4LFT1420/328		
fθ lens protective glass	f82	S4LPG0082/328	Daily 1 year*3	Clean Replace
	f163 (□78)	WFS-138-25		
	f163 (□94)	Protective glass for S4LFT2174(2175)/328		

Component		Model No.	Schedule*1 (Recommended)	Maintenance*2
fθ lens protective glass	f306	PO1162296	Daily 1 year*3	Clean Replace
	f420	S4LPG4160/328		
Scanner unit	X motor unit	PO1155776	10^9 seek*4	Replace
	Y motor unit	PO1155778		

*1 The schedule means the maintenance time or expected life of the part, and is different from the warranty period.

*2 Replace parts when their service lives expire or if they are burned or defective.

*3 Depends on the usage of equipment.

*4 The schedule for motor units is defined as the end of the service life of scanner motor bearing. The seek time that the bearing reaches the end of its service life is 1000000000 (ten billion) times. However, the actual schedule differs depending on your layout or operating time. For example, the bearing tends to be worn out quickly for the application like repeating movement in a very small angle at high speed.

3. Protective Glass Inspection and Replacement

The protective glass is designed to prevent the lens from atmospheric dust, spatter from the workpiece, and so on. If dirty, this may lead to laser power loss. Therefore, regular cleaning and replacement is necessary.

Clean or replace if the protective glass becomes dirty.

3.1. Preparation

Have the following ready when cleaning or replacing the protective glass.

- Air blow
- Lens cleaning paper
- Ethanol

3.2. Cleaning the Protective Glass

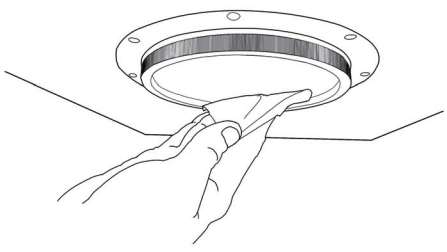
1 Turn OFF the power for the laser welder.

2 Blow off foreign particles by using the air blow.

3 If the foreign particles cannot be eliminated, apply a few drops of ethanol to the lens cleaning paper. Wipe the protective glass as shown, in a spiraling motion from the center out.

If the ethanol fails to clean the protective glass, replace the protective glass with a new one.

Bottom of scanner head



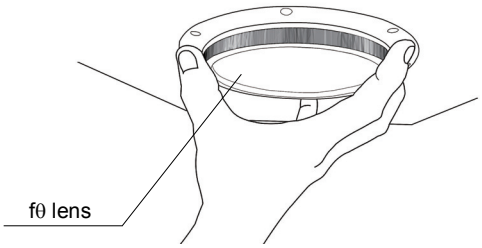
Wipe in a spiraling motion

3.3. Replacing the Protective Glass

1 Turn OFF the power for the laser welder.

2 Unscrew to remove the protective glass holder from the scanner head.

Bottom of scanner head

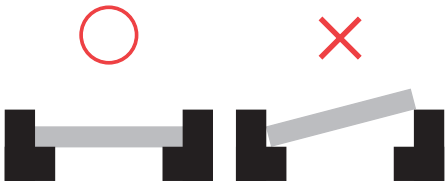


CAUTION	To avoid damage, be careful to avoid dropping the protective glass.

3 Fit a new protective glass into the protective glass holder's stepped section.

CAUTION	• The protective glass may be damaged if it is not properly fitted into the stepped section. • Depending on the protective glass, be careful of its orientation.

Protective glass sectional view



4 Reattach the protective glass holder to the scanner head.