Original instructions

HEAD CONTROLLER

MU-100A EU

OPERATION MANUAL

AMADA

AA04OM1170018-19

Thank you for purchasing our Head Controller **MU-100A**.
Please read this manual carefully to ensure correct use. Keep the manual handy after reading for future reference.

Contents

1. Special Precautions

(1) Safety Precautions

Before using, read "Safety Precautions" carefully to understand the correct method of use.

- These precautions are shown for safe use of our products and for prevention of damage or injury to operators or others. Be sure to read each of them, since all of them are important for safety.
- The meaning of the words and symbols is as follows.

⚠ DANGER

Denotes operations and practices that may imminently result in serious injury or loss of life if not correctly followed.

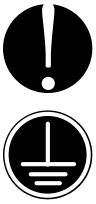
⚠ WARNING

Denotes operations and practices that may result in serious injury or loss of life if not correctly followed.

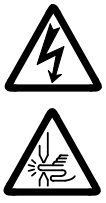
⚠ CAUTION

Denotes operations and practices that may result in personal injury or damage to the equipment if not correctly followed.

These symbols denote "prohibition". They are warnings about actions out of the scope of the warranty of the product.



These symbols denote actions which operators must take.



Each symbol with a triangle denotes that the content gives DANGER, WARNING or CAUTION to the operator.

⚠ DANGER

Never disassemble, attempt to repair, or modify the Controller.
These actions can cause electric shock and fire. Perform only the maintenance described in the operation manual.

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

⚠ WARNING

Do not insert your fingers or hands between the electrodes.
When welding, keep your fingers and hands away from the electrodes.

Do not touch any welded part or electrode during welding or just after completion of welding.
The welded parts of a workpiece, electrodes, and the arm are very hot.
Do not touch them; burns may result.

Ground the equipment.
If the Controller is not grounded, you may receive an electric shock in the event of malfunction or current leak.

Connect the specified cables securely.
Cables of insufficient current capacities and loose connections can cause fire and electric shock.

Do not damage the power cable and connecting cables.
Do not tread on, twist, or apply force to any cable. Doing so may cause the power cable and connecting cables to become broken, leading to electric shock and fire.

Do not use any damaged power cable, connecting cable, or plug.
Failure to observe this precaution can lead to electric shock, short circuit, or fire.
If any part must be replaced or requires repair, consult us or your distributor.

Stop the operation if any trouble occurs.
Continuous operation after occurrence of a trouble such as burning smell, abnormal sound, abnormal heat, smoke, etc. can cause electric shock and fire.
If such a trouble occurs, immediately consult us or your distributor.

Persons with pacemakers must stay clear of the welding machine.
A person who uses a pacemaker must not approach the welding machine or walk around the welding site while the welding machine is in operation, without being permitted by his/her doctor. The welding machine generates a magnetic field and has effects on the operation of the pacemaker while it is turned on.

Protective gear must be worn.
Put on protective gear such as protective gloves, long-sleeve jacket, leather apron, etc. Surface flash and expulsion can burn the skin if they touch the skin.

Wear protective glasses.
If you look at the flash directly during welding, your eyes may be damaged.
If any surface flash and expulsion gets in your eye, you may lose your eyesight.

⚠ CAUTION

Apply the specified supply voltage.
Application of a voltage outside the specified range may result in fire or electric shock.

Do not allow water to come in contact with the equipment.
Water on the electric parts can cause electric shock and short circuit.

Use proper tools (wire strippers, pressure wire connectors, etc.) for terminal treatment of the connecting cables.
Do not cut the wire conductor; fire or electric shock may result.

Install the equipment on a firm and level surface.
Injury may result if the equipment falls or is dropped.

Do not sit on or place objects on the Controller.
Failure to observe this precaution may lead to malfunction.

Keep combustible matter away from the Controller.
Surface flash and expulsion may ignite combustible matter. If it is impossible to remove all combustible matter, cover it with non-combustible material.

Do not cover the Controller with a blanket, cloth, etc.
Do not cover the Controller with a blanket, cloth, etc. while it is in use. The cover may be overheated and burned.

Do not use this Controller for purposes other than welding.
Use of this Controller in a manner other than specified can cause electric shock and fire.

Use ear protectors.
Loud noises can damage hearing.

Keep a fire extinguisher nearby.
Keep a fire extinguisher in the welding shop in case of fire.

Maintain and inspect the Controller periodically.
Maintain and inspect the Controller periodically, and repair any damage nearby before starting operation.

(2) Precautions for Handling

- Do not install the Controller in the following locations:
  - Damp areas (where the humidity is higher than 90%),
  - areas where temperatures are above 40°C or below 5°C
  - areas near a high noise source,
  - areas where chemicals are handled,
  - areas where water may condense,
  - dusty areas,
  - areas exposed to direct sunlight, and
  - areas exposed to large amounts of vibration or shock.

- Before installing the Controller, check the voltage and power supply frequency. Also, do not place objects around the power supply connector.

- This controller uses the sensor. For stable measurement, turn on the power a several tens of minutes before using the Controller.

- Clean the exterior of the Controller using a soft, dry cloth or one slightly dampened with water. If the Controller is very dirty, use diluted neutral detergent or alcohol. Do not use paint thinner, benzine, etc., as they may discolor or deform the Controller.

- Do not insert a screw, coin, etc. into the Controller, as they may cause malfunction.

- Operate the Controller in accordance with the method described in this operation manual.

- Press switches/buttons carefully by hand. Handling them roughly (using a screwdriver or the tip of pen) may result in a malfunction or failure.

- Operate the Controller in accordance with the method and connections described in this operation manual so as not to affect the protective functions.

(3) On 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.

(4) Model-Specific Function

There are 2 types of models: one has a sensor input for each of force and displacement, and the other has two sensor inputs for each.

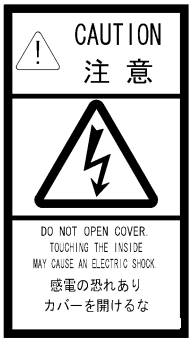
The standard model is **MU-100A-00-00**, and **MU-100A-00-01** is special. For **MU-100A-00-01**, contact us.

Model No.	Specifications
MU-100A-00-00	1-axis type: Force 1 and Displacement 1. Incremental type can be connected
MU-100A-00-01	2-axis type: Force 2 and Displacement 2. Incremental type can be connected

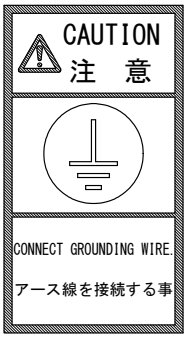
(5) Warning Labels for Safety

On the main body are warning labels for safety.

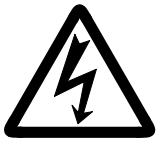
Their locations and meanings are as noted below.



Location: Controller top, back
Meaning: **Shock hazard**



Location: Controller top, back
Meaning: Caution for grounding connection



Location: Controller interior, back
Meaning: **Shock hazard**

2. Features

The Head Controller **MU-100A** is a controller that moves the welding head up and down with monitoring the weld force and displacement.

MU-100A offers the following features:

- **Measures weld force before/after welding**
  Measures weld force before welding, and outputs the start signal to the welding machine with an optional load cell. Also, measures workpiece thickness after welding, and outputs the judgment signal.
- **Measures workpiece thickness before welding, displacement and final workpiece thickness after welding**
  Measures workpiece thickness before welding, and outputs the start signal to the welding machine with an optional displacement sensor. Also, measures displacement and workpiece thickness after welding, and outputs the judgment signal.
- **Controls moving up and down of the welding head**
  Controls the valve of the welding head by the time.
- **Managing measurement data and settings with PC**
  You can transmit measurement data to your PC through the Ethernet, RS-232C or RS-485 interface. Also, you can transmit and receive the setting of **MU-100A**.
- **Supports a wide range of welding machines**
  The instrument supports single-phase AC, DC inverter, AC inverter, and transistor welding machines.
- **Supports the series or indirect head**
  Supports the series head or indirect head with up to 4 inputs (option) including 2 inputs of weld force and 2 inputs of displacement.
- **Supports multiple conditions**
  Up to 127 schedules can be stored.

3. Packing List

Check the contents of the package. In the case of damaged or missing items, please contact us.

(1) Accessories

The model numbers of accessories are subject to change without notice. Depending on the part to be changed, the mounting screw shape may change and a necessary tool may be different. For the latest parts information, contact a nearest sales office.

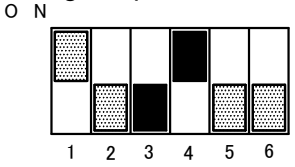
Item Name		Model No.	Q'ty	
			MU-100A-00-00	**MU-100A-00-01**
D-Sub connector	Plug	HDBB-25P(05)	1	2
	Case	HDB-CTH(4-40)(10)	1	2
	Plug	HDCB-37P(05)	1	2
	Case	HDC-CTH(4-40)(10)	1	2
Operation manual CD-ROM		AS1170020	1	1

(2) Options

Item Name	Model No.	Remarks
Power cable	KP-35 KS-16A SVT#18×3 B-TYPE	For 100 to 120 V AC
	KP244 VCTF3*1.25 KS160 3M gray	For 200 V AC
	CEE3P-W-1.8	For 200 to 240 V AC
Adapter for power cable	KPR-24(SB)-B	For 100 to 120 V AC
RS-232C harness	C06N-09FS-09FS-CROSS-WS15 (1.5 m)	Cross cable
RS-485 connector	L-04742-001	With 100 Ω termination resistance
LAN cable	KB-FL6E-03BK (3 m)	Straight
Load cell *1	LS-20NB (Rating: 20 N)	Type A
	LS-50NB (Rating: 50 N)	
	LS-200NB (Rating: 200 N)	
	LS-500NB (Rating: 500 N)	
	LS-2000NB (Rating: 2000 N)	
	LS-5000NB (Rating: 5000N)	
	SK-1177178 (Rating: 10000 N)	Type B
Load cell extension cable	HCPβ-C2T (2 m)	For Type A
	HCPβ-C3T (3 m)	
	HCPβ-C4T (4 m)	
	SK-1177168 (2 m)	For Type B
	SK-1177169 (3 m)	
	SK-1177170 (4 m)	
Displacement sensor	GS-1830A	Type C
	GS-1813A	
	LGK-110 (Discontinued)	Type D1
	LGF-125L-B (Discontinued)	
	LGF-150L-B (Discontinued)	
	LG200-110	Type D2
	LG100-125	
	LG100-150	
Displacement sensor conversion adapter	MU100A-C0.2O (0.2 m)	For Type C
	MU100A-C0.2M (0.2 m)	For Type D1
	SK-1213281	For Type D2
Sensor head	GT2-H12	Type E
Sensor head cable	GT2-CH2M (2 m)	
	GT2-CH5M (5 m)	
Pulse output amplifier cable *2	SK-1177093 (1.9 m)	For Type E

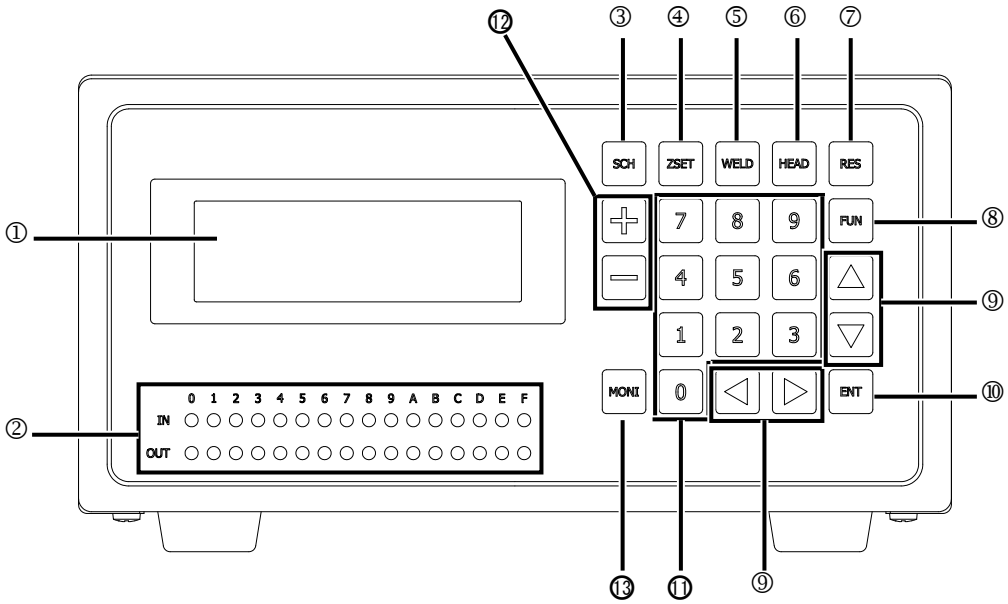
*1 For the load cell with 10000 N, contact us.

*2 Set the DIP switch for amplifier to “3: OFF” and “4: ON”. (Nos. 3 and 4 are for setting the pulse resolution of displacement sensor.)



4. Name and Functions of Each Section

(1) Front



①LCD: Displays the measured values and menus.

②IN/OUT lamps: Displays input/output status of interface.

③SCH key: Sets the schedule.

④ZSET key: Does the zero setting of the sensor and the load cell on the manual screen. For a load cell, do the zero setting with no pressure applied.

⑤WELD key: Outputs the WELD START signal. Use when outputting the WELD START signal during off-sequence periods.

Press WELD and 1 keys in this order to turn ON the WELD START1 output. To turn it OFF, press WELD and 1 keys again.
Press WELD and 2 keys in this order to turn ON the WELD START2 output. To turn it OFF, press WELD and 2 keys again. (valid when there is the second-axis I/O board)

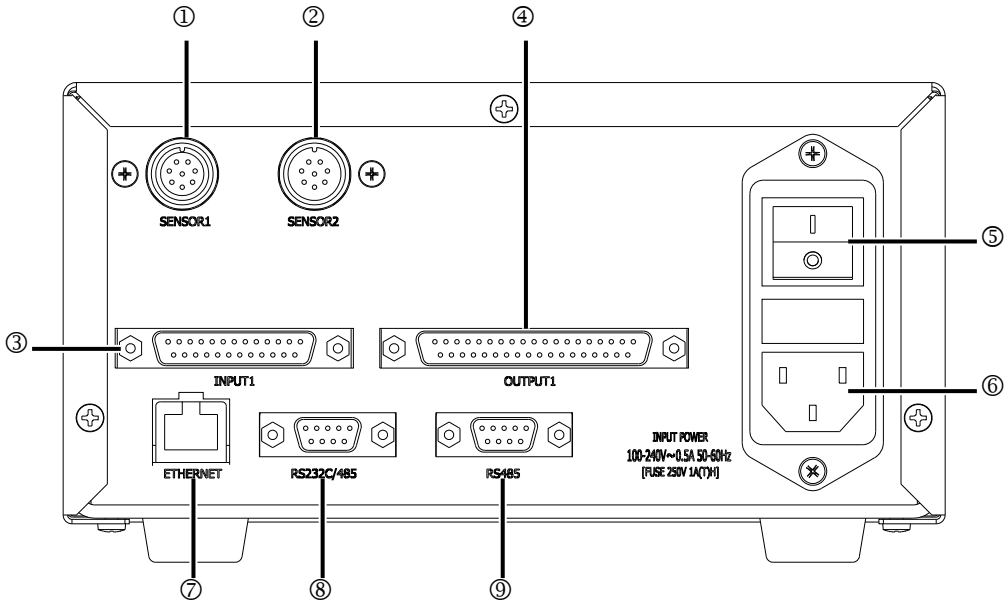
⑥HEAD key: Outputs the HEAD signal. Use when lowering the welding head during off-sequence periods.

Press HEAD , 1 and 1 keys in this order to turn ON the SV11 output. To turn it OFF, press HEAD , 1 and 1 keys again.
Press HEAD , 1 and 2 keys in this order to turn ON the SV12 output. To turn it OFF, press HEAD , 1 and 2 keys again.
Press HEAD , 1 and 3 keys in this order to turn ON the SV13 output. To turn it OFF, press HEAD , 1 and 3 keys again.
Press HEAD , 2 and 1 keys in this order to turn ON the SV21 output. To turn it OFF, press HEAD , 2 and 1 keys again. (valid when there is the second-axis I/O board)
Press HEAD , 2 and 2 keys in this order to turn ON the SV22 output. To turn it OFF, press HEAD , 2 and 2 keys again. (valid when there is the second-axis I/O board)
Press HEAD , 2 and 3 keys in this order to turn ON the SV23 output. To turn it OFF, press HEAD , 2 and 3 keys again. (valid when there is the second-axis I/O board)

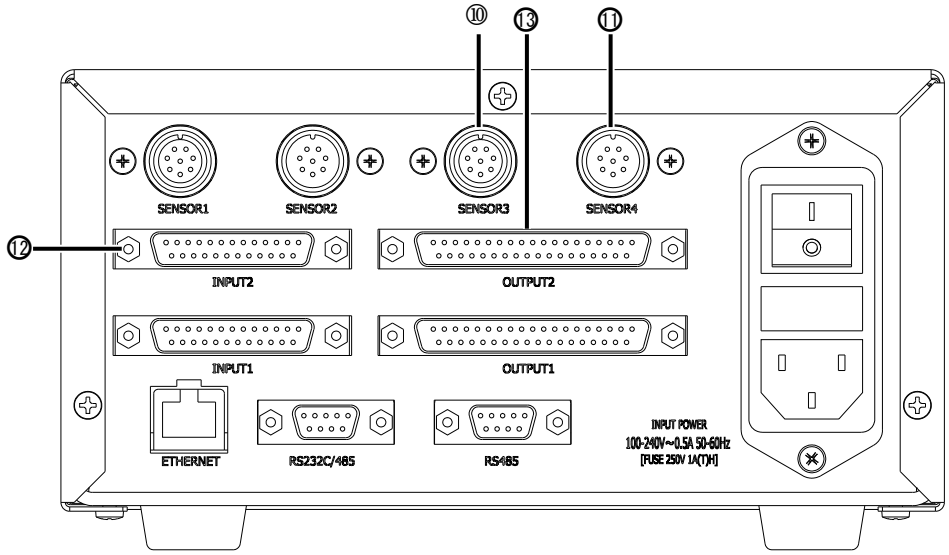
⑦RES key:	Resets the error.
⑧FUN key:	Sets the parameters.
⑨Direction key:	Moves the cursor from right to left or up and down.
⑩ENT key:	Establishes the setting.
⑪Numerical keypad:	Sets a number.
⑫Sign key:	Sets a sign.
⑬MONI key:	Displays the normal screen.

(2) Rear

1-axis type



2-axis type

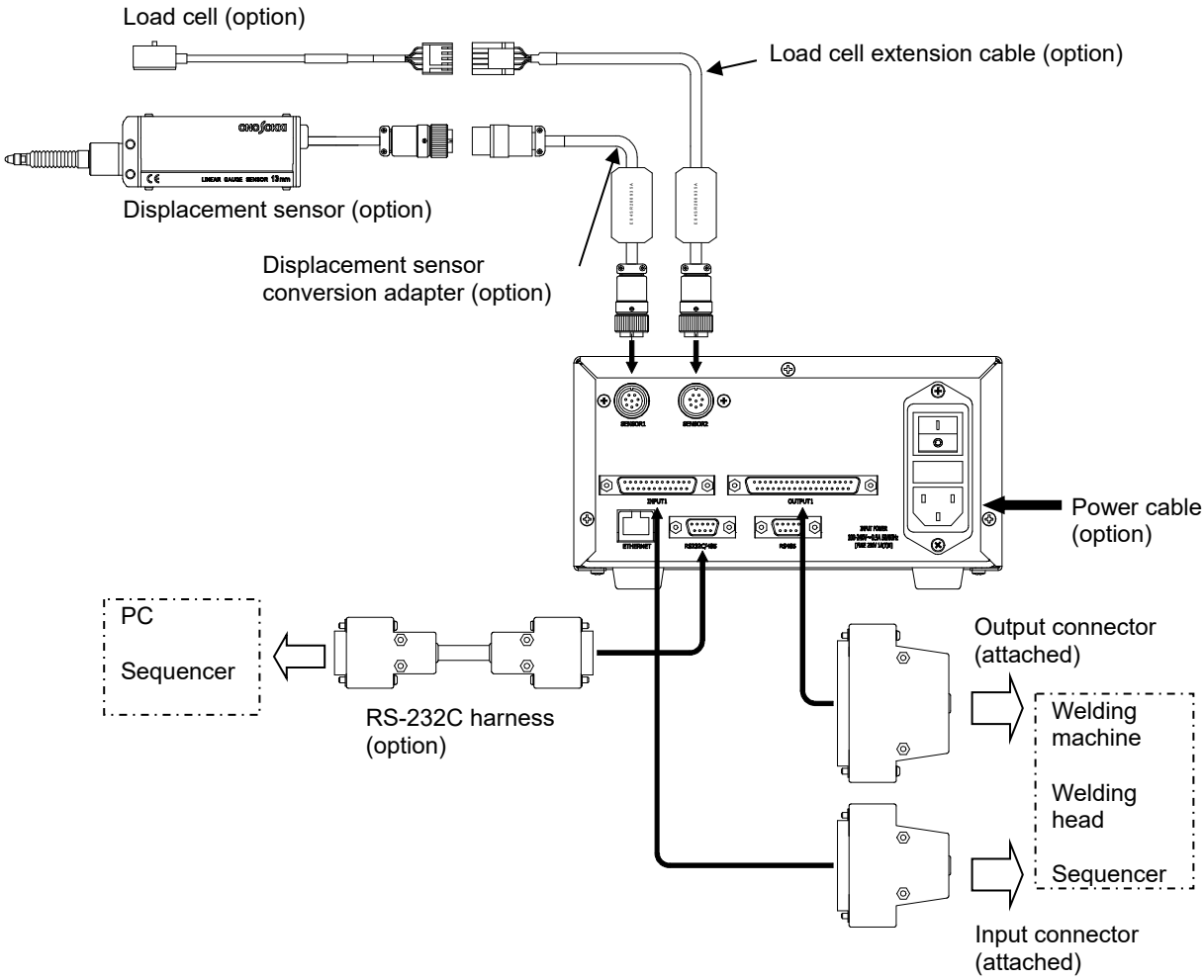


①SENSOR1 connector:	Connects the displacement sensor 1. When connecting the displacement sensor, use the dedicated adapter or extension cable.
②SENSOR2 connector:	Connects the load cell 1. When connecting the load cell, use the dedicated extension cable or connector.
③INPUT1 connector:	Connects the input signals of SENSOR1 and 2.
④OUTPUT1 connector:	Connects the output signals of SENSOR1 and 2.
⑤POWER switch:	Main power switch.
⑥AC inlet:	Connects the power cable.
⑦ETHERNET connector:	Connects the Ethernet.

⑧RS232C/485 connector:	Connects the RS-232C/RS-485.
⑨RS485 connector:	Connects the RS-485.
⑩SENSOR3 connector:	Connects the displacement sensor 2. When connecting the displacement sensor, use the dedicated adapter or extension cable.
⑪SENSOR4 connector:	Connects the load cell 2. When connecting the load cell, use the dedicated extension cable or connector.
⑫INPUT2 connector:	Connects the input signals of SENSOR3 and 4.
⑬OUTPUT2 connector:	Connects the output signals of SENSOR3 and 4.

5. Connection

Example connection

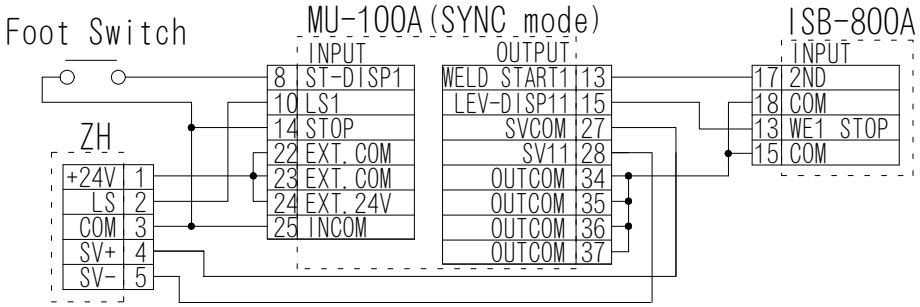


* To connect the displacement sensor or the load cell to the welding head and the follow-up mechanisms, refer to the documentation of the welding head and the follow-up mechanisms or contact us.

* For adjustment of the displacement sensor or the load cell in the welding head or follow-up mechanisms, refer to the documentation of the welding head and the follow-up mechanisms or contact us.

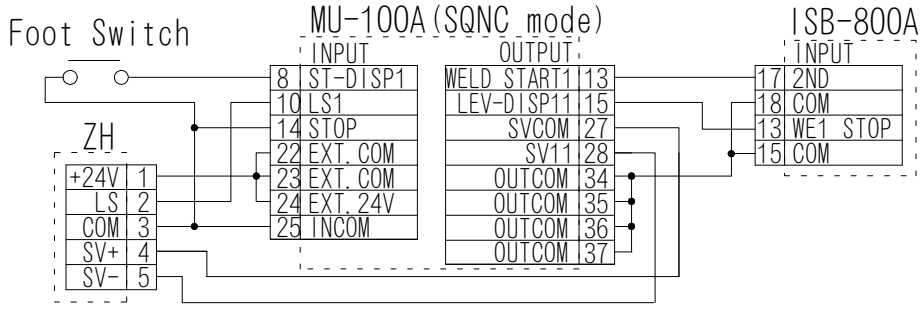
Example wiring 1: Connecting both displacement sensor and load cell

Set Disp Measure Mode to SYNC(0).



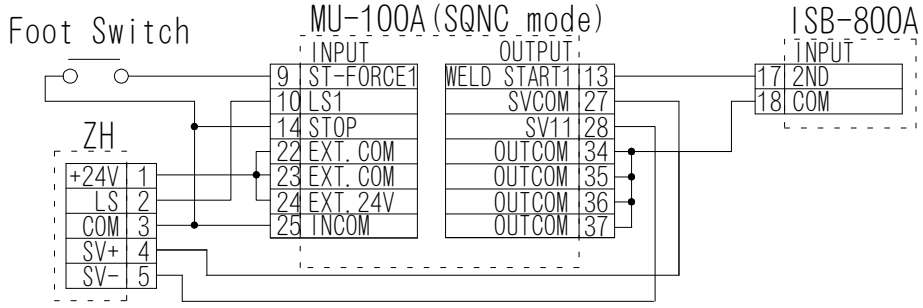
Example wiring 2: Connecting displacement sensor only

Set Disp Measure Mode to SQNC(1).

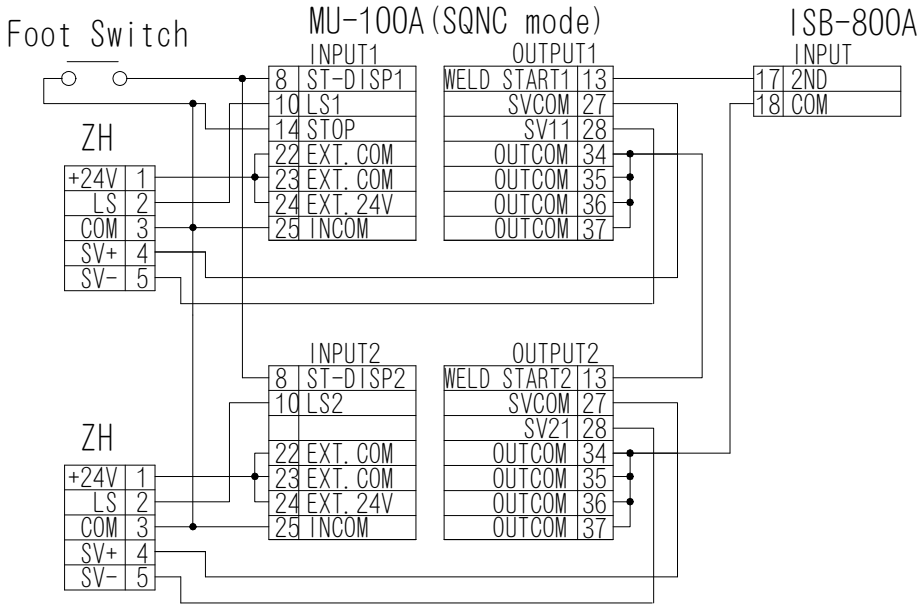


Example wiring 3: Connecting load cell only

Set Disp Measure Mode to SQNC(1) and Force Measure Mode to SQNC(0).



Example wiring 4: Connecting to a head having two force follow-up units such as series and indirect



* When connecting to other welding power supply or welding head, contact us.

6. Interface

(1) INPUT and OUTPUT Connectors

a. INPUT1 connector: KF22X-B25S-NJM(KYCON)

* For SENSOR1 and 2

* Use the shielded cable for the input cable and connect the shielded part to the ground.

No	Symbol	Contents
1	SCH1-1	The schedule switching signal for SENSOR1 and 2. Binary input. Up to 127 schedules can be switched.
2	SCH1-2	
3	SCH1-4	
4	SCH1-8	
5	SCH1-16	
6	SCH1-32	
7	SCH1-64	
8	ST-DISP1	The start signal when the Disp Measure Mode for SENSOR1 is set to SYNC, SQNC, or SH1,2,3. When it is set to SYNC, the start signal becomes common to SENSOR1 and 2.
9	ST-FORCE1	The start signal when the Force Measure Mode for SENSOR2 is set to SQNC, SH1 or TANG. Do not use when the Disp Measure Mode is set to SYNC.
10	LS1	Inputs the force-detecting signal for SENSOR1 and 2.
11	RESET-NG	Cancels the buzzer at the occurrence of error to return to the READY state. When the Output Select Time is set to TACT(0), the NG output is not reset.
12	RESET-CONT1	Resets the counter value of the specified schedule. Note) The count start value set in 23 Counter in the schedule setting is reset to 00000. (See **9. Schedule Setting**.)
13	FINISH1	When input during Weld-Time or Hold-Time for SENSOR1 and 2, the sequence operation ends.
14	STOP	Stop signal.
15	HEAD1	When input, SV11, SV12, SV13 outputs are turned ON. Note) For checking the operation of the welding head alone. Do not use in a normal sequence.
16	ZST-DISP1	The zero-setting input for the displacement sensor for SENSOR1.
17	INPUT11	Spare input signals.
18	INPUT12	
19	INPUT13	
20	INPUT14	
21	INPUT15	
22	EXT.COM	Common of internal circuit.
23	EXT.COM	
24	EXT.24V	+24V output for the input signals when using internal power supply.
25	INCOM	0V common for the input signals when using internal power supply.

b. INPUT2 connector: KF22X-B25S-NJM(KYCON)

* For SENSOR3 and 4 (option)

* Use the shielded cable for the input cable and connect the shielded part to the ground.

No	Symbol	Contents
1	SCH2-1	The schedule switching signal for SENSOR3 and 4. Binary input. Up to 127 schedules can be switched.
2	SCH2-2	
3	SCH2-4	
4	SCH2-8	
5	SCH2-16	
6	SCH2-32	
7	SCH2-64	
8	ST-DISP2	The start signal when the Disp Measure Mode for SENSOR3 is set to SYNC, SQNC, or SH1,2,3. When it is set to SYNC, the start signal becomes common to SENSOR3 and 4
9	ST-FORCE2	The start signal when the Force Measure Mode for SENSOR4 is set to SQNC, SH1, or TANG. Do not use when the Disp Measure Mode is set to SYNC.
10	LS2	Inputs the force-detecting signal for SENSOR3 and 4.
11	INPUT26	Spare input signal.
12	RESET-CONT2	Resets the counter value of the specified schedule. Note) The count start value set in 23 Counter in the schedule setting is reset to 00000. (See **9. Schedule Setting**.)
13	FINISH2	When input during Weld-Time or Hold-Time for SENSOR3 and 4, the sequence operation ends.
14	INPUT27	Spare input signal.
15	HEAD2	When input, SV21, SV22, SV23 outputs are turned ON. Note) For checking the operation of the welding head alone. Do not use in a normal sequence.
16	ZST-DISP2	The zero-setting input for the displacement sensor for SENSOR3.
17	INPUT21	Spare input signals.
18	INPUT22	
19	INPUT23	
20	INPUT24	
21	INPUT25	
22	EXT.COM	Common of internal circuit.
23	EXT.COM	
24	EXT.24V	+24V output for the input signals when using internal power supply.
25	INCOM	0V common for the input signals when using internal power supply.

c. OUTPUT1 connector: KF22X-B37S-NJM(KYCON)

* For SENSOR1 and 2

* Use the shielded cable for the output cable and connect the shielded part to the ground.

No	Symbol	Contents
1	READY1	Device normal signal. Turned OFF while the setting screen is displayed.
2	GOOD-DISP1	The GOOD signal of displacement sensor when the Disp Measure Mode for SENSOR1 and 2 is set to SYNC, SQNC, or SH1,2,3. When it is set to SYNC, this is the GOOD signal common to the displacement sensor and the load cell.
3	GOOD-FORCE1	The GOOD signal of load cell when the Force Measure Mode for SENSOR2 is set to SQNC, SH1/2, or TANG. Do not use when the Disp Measure Mode is set to SYNC.
4	NG1	Output when the measured value for SENSOR1 and 2 is outside the upper/lower limit.
5	NG-UP1	Output when the measured value of the displacement sensor for SENSOR3 exceeds the upper limit.
6	NG-LO1	Output when the measured value of the displacement sensor for SENSOR3 falls below the lower limit.
7	NG-BEFORE1	Output when the before-welding workpiece thickness for SENSOR3 is NG.
8	NG-DISP1	Output when the displacement for SENSOR3 is NG.
9	NG-AFTER1	Output when the after-welding workpiece thickness for SENSOR3 is NG.
10	NG-FORCEUP1	Output when the measured value of the load cell for SENSOR4 exceeds the upper limit.
11	NG-FORCELO1	Output when the measured value of the load cell for SENSOR4 falls below the lower limit.
12	WARNING	Output when an ERROR occurs. (See **16. Troubleshooting**.)
13	WELD START1	The start signal for welding power supply for SENSOR1 and 2. Output for the time set in Weld-Time.
14	FINISH1	Output when the sequence operation for SENSOR1 and 2 ends.
15	LEV-DISP11	Output when the present value of the displacement sensor for SENSOR1 passes the setting.
16	LEV-DISP12	
17	LEV-DISP13	
18	LEV-FORCE11	Output when the present value of the load cell for SENSOR2 passes the setting.
19	LEV-FORCE12	
20	LEV-FORCE13	
21	OUTPUT11	Spare output signals.
22	OUTPUT12	
23	OUTPUT13	
24	OUTPUT14	
25	OUTPUT15	
26	OUTPUT16	
27	SVCOM1	Common for the solenoid valve control signal for SENSOR1 and 2.
28	SV11	The solenoid valve control signal for SENSOR1 and 2.
29	SV12	Spare solenoid valve control signal.
30	SV13	
31	V-SIG11	Converts the present value of the displacement sensor for SENSOR1 to voltage to output it. *1
32	V-SIG12	Converts the present value of the load cell for SENSOR2 to voltage to output it. *2
33	V-SIGCOM1	Common for voltage output for SENSOR1 and 2.
34	OUTCOM	Common for output signals for SENSOR1 and 2.
35	OUTCOM	
36	OUTCOM	
37	OUTCOM	

d. OUTPUT2 connector: KF22X-B37S-NJM(KYCON)

* For SENSOR3 and 4 (option)

* Use the shielded cable for the output cable and connect the shielded part to the ground.

No	Symbol	Contents
1	READY2	Device normal signal. Turned OFF while the setting screen is displayed.
2	GOOD-DISP2	The GOOD signal of displacement sensor when the Disp Measure Mode for SENSOR3 and 4 is set to SYNC, SQNC, or SH1,2,3. When it is set to SYNC, this is the GOOD signal common to the displacement sensor and the load cell.
3	GOOD-FORCE2	The GOOD signal of load cell when the Force Measure Mode for SENSOR4 is set to SQNC, SH1/2, or TANG. Do not use when the Disp Measure Mode is set to SYNC.
4	NG2	Output when the measured value for SENSOR3 and 4 is outside the upper/lower limit.
5	NG-UP2	Output when the measured value of the displacement sensor for SENSOR3 exceeds the upper limit.
6	NG-LO2	Output when the measured value of the displacement sensor for SENSOR3 falls below the lower limit.
7	NG-BEFORE2	Output when the before-welding workpiece thickness for SENSOR3 is NG.
8	NG-DISP2	Output when the displacement for SENSOR3 is NG.
9	NG-AFTER2	Output when the after-welding workpiece thickness for SENSOR3 is NG.
10	NG-FORCEUP2	Output when the measured value of the load cell for SENSOR4 exceeds the upper limit.
11	NG-FORCELO2	Output when the measured value of the load cell for SENSOR4 falls below the lower limit.
12	OUTPUT27	Spare output signal.
13	WELD START2	The start signal for welding power supply for SENSOR3 and 4. Output for the time set in Weld-Time.
14	FINISH2	Output when the sequence operation for SENSOR3 and 4 ends.
15	LEV-DISP21	Output when the present value of the displacement sensor for SENSOR3 passes the setting.
16	LEV-DISP22	
17	LEV-DISP23	
18	LEV-FORCE21	Output when the present value of the load cell for SENSOR4 passes the setting.
19	LEV-FORCE22	
20	LEV-FORCE23	
21	OUTPUT21	Spare output signals.
22	OUTPUT22	
23	OUTPUT23	
24	OUTPUT24	
25	OUTPUT25	
26	OUTPUT26	
27	SVCOM2	Common for the solenoid valve control signal for SENSOR3 and 4.
28	SV21	The solenoid valve control signal for SENSOR3 and 4.
29	SV22	Spare solenoid valve control signal.
30	SV23	
31	V-SIG21	Converts the present value of the displacement sensor for SENSOR3 to voltage to output it. *1
32	V-SIG22	Converts the present value of the load cell for SENSOR4 to voltage to output it. *2
33	V-SIGCOM2	Common for voltage output for SENSOR3 and 4.
34	OUTCOM	Common for output signals for SENSOR3 and 4.
35	OUTCOM	
36	OUTCOM	
37	OUTCOM	

*1 Output value of V-SIG11 and V-SIG21

According to the range set in “Disp Voltage Range” (see **8. Function Setting**), the present value of the displacement sensor is converted to ±10 V to be output (see table below). When the present value of displacement sensor exceeds the set range, the value is saturated with ±10 V.

Disp Voltage Range setting	Output voltage				
	+10 V	+5 V	0 V	-5 V	-10 V
0.255	+0.255 mm	+0.127 mm	0 mm	-0.127 mm	-0.255 mm
0.511	+0.511 mm	+0.255 mm	0 mm	-0.255 mm	-0.511 mm
1.023	+1.023 mm	+0.511 mm	0 mm	-0.511 mm	-1.023 mm
2.047	+2.047 mm	+1.023 mm	0 mm	-1.023 mm	-2.047 mm
4.095	+4.095 mm	+2.047 mm	0 mm	-2.047 mm	-4.095 mm
8.191	+8.191 mm	+4.095 mm	0 mm	-4.095 mm	-8.191 mm
16.383	+16.383 mm	+8.191 mm	0 mm	-8.191 mm	-16.383 mm
32.767	+32.767 mm	+16.38 mm	0 mm	-16.38 mm	-32.767 mm
65.535	+65.535 mm	+32.76 mm	0 mm	-32.76 mm	-65.535 mm

When monitoring the waveform with an oscilloscope, use an oscilloscope whose channels are insulated.

*2 Output value of V-SIG12 and V-SIG22

Based on the rated capacity set in “L.C. Rated Capacity” (see **8. Function Setting**), the load variation is converted to 0 to +10 V to be output (see table below). When the present value of the load cell exceeds the set rated capacity, the value is saturated with 10 V.

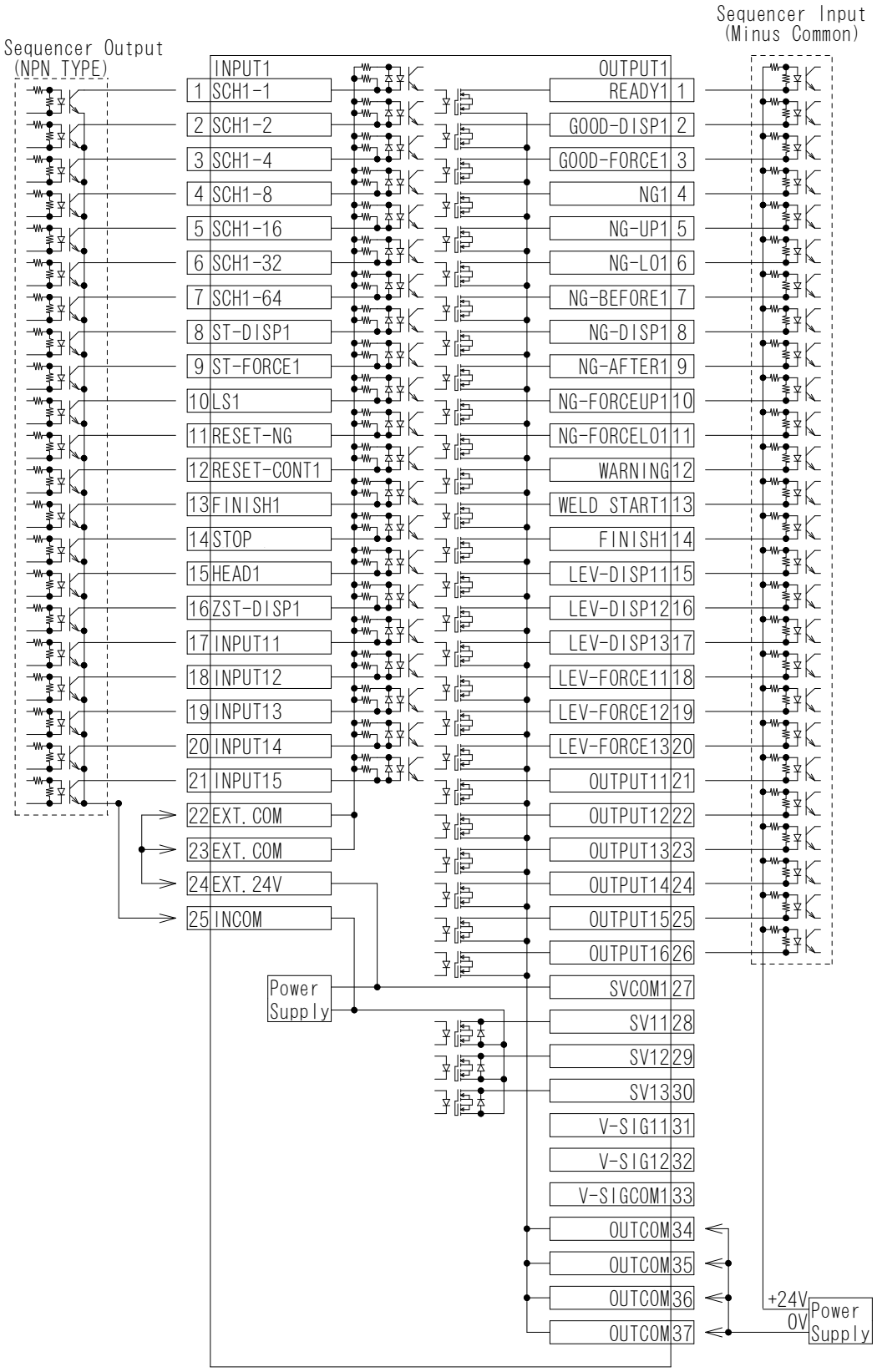
Load cell	Output voltage						
	0 V	+2 V	+4 V	+6 V	+8 V	+10 V	L.C. Rated Capacity
LS-20NC	0 N	4 N	8 N	12 N	16 N	20 N	20 N
LS-50NC	0 N	10 N	20 N	30 N	40 N	50 N	50 N
LS-200NC	0 N	40 N	80 N	120 N	160 N	200 N	200 N
LS-500NC	0 N	100 N	200 N	300 N	400 N	500 N	500 N
LS-2000NC	0 N	400 N	800 N	1200 N	1600 N	2000 N	2000 N
LS-5000NC	0 N	1000 N	2000 N	3000 N	4000 N	5000 N	5000 N
LCN-A-10KN	0 N	2000 N	4000 N	6000 N	8000 N	10000 N	10000 N

When monitoring the waveform with an oscilloscope, use an oscilloscope whose channels are insulated.

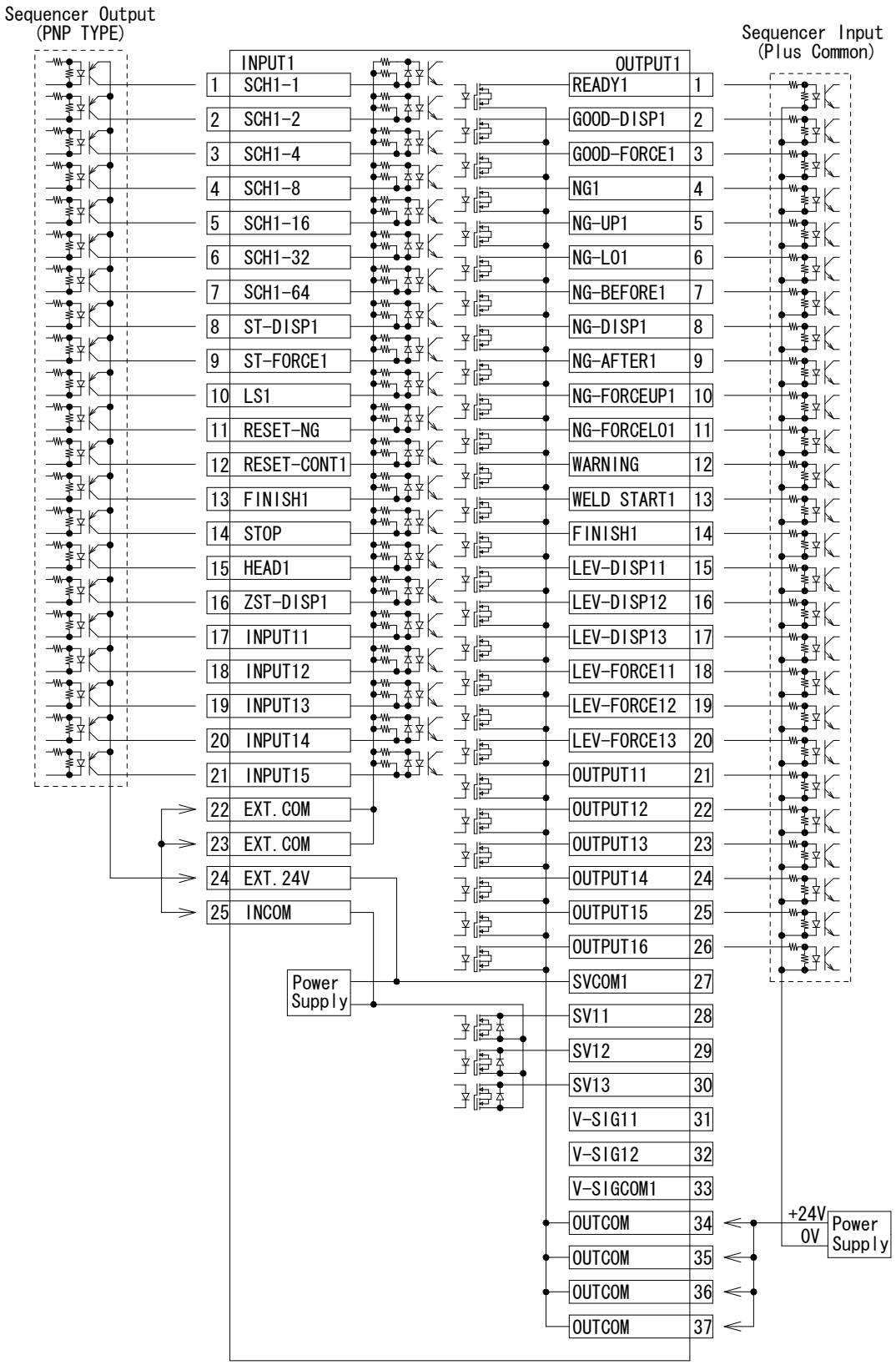
e. INPUT1, OUTPUT1 interface

* For SENSOR1 and 2

* Connection with equipment having a contact featuring NPN open collector when using internal power supply



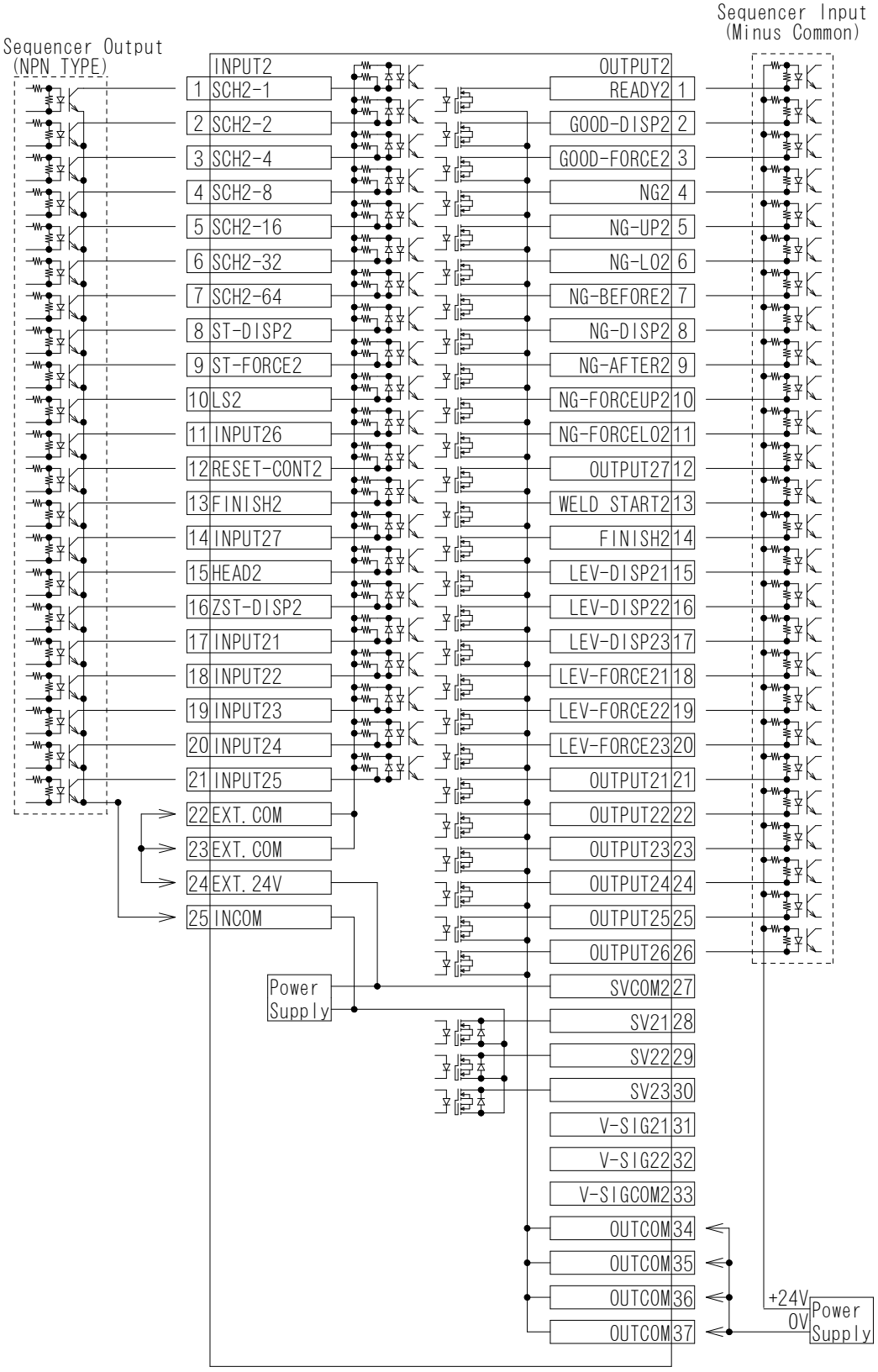
* Connection with equipment having a contact featuring PNP open collector when using internal power supply



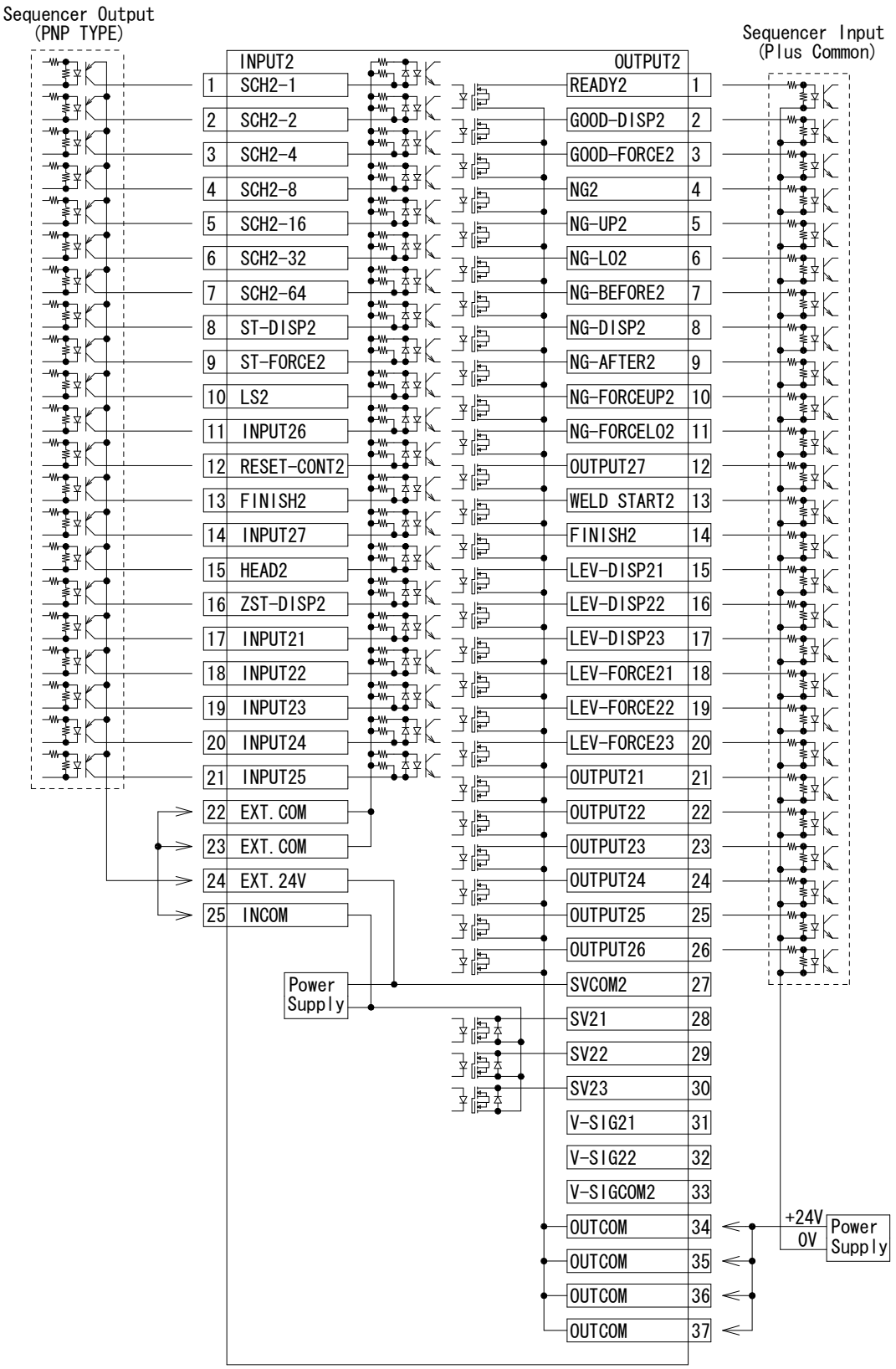
f. INPUT2, OUTPUT2 interface

* For SENSOR3 and 4 (option)

* Connection with equipment having a contact featuring NPN open collector when using internal power supply



* Connection with equipment having a contact featuring PNP open collector when using internal power supply



(2) RS232C, RS485 and ETHERNET Connectors

a. RS232C/485 connector

No	Symbol	Contents
1	-	Do not connect anything.
2	RXD	Connected to the RS-232C received data line.
3	TXD	Connected to the RS-232C send data line.
4	-	Do not connect anything.
5	GND	Connect to ground.
6	RS(+)	Connected to the RS-485 plus data line.
7	RTS	Connected to the RS-232C request to send.
8	-	Do not connect anything.
9	RS(-)	Connected to the RS-485 minus data line.

b. RS485 connector

No	Symbol	Contents
1	-	Do not connect anything.
2	-	
3	-	
4	-	
5	GND	Connect to ground.
6	RS(+)	Connected to the RS-485 plus data line.
7	-	Do not connect anything.
8	-	
9	RS(-)	Connected to the RS-485 minus data line.

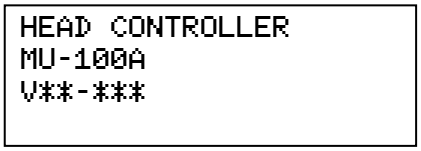
c. ETHERNET connector

No	Symbol	Contents
1	TD+	Connected to the send data line.
2	TD-	Connected to the send data line.
3	RD+	Connected to the received data line.
4	-	Do not connect anything.
5	-	
6	RD-	Connected to the received data line.
7	-	Do not connect anything.
8	-	

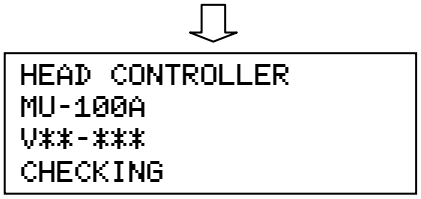
7. Program Display After Power-On

At power-on, version and initial check screens are displayed, followed by the normal screen.

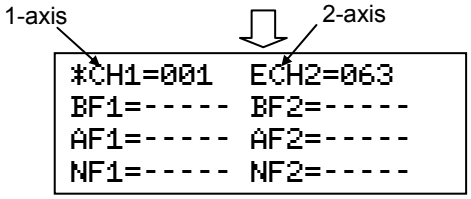
[Version screen]



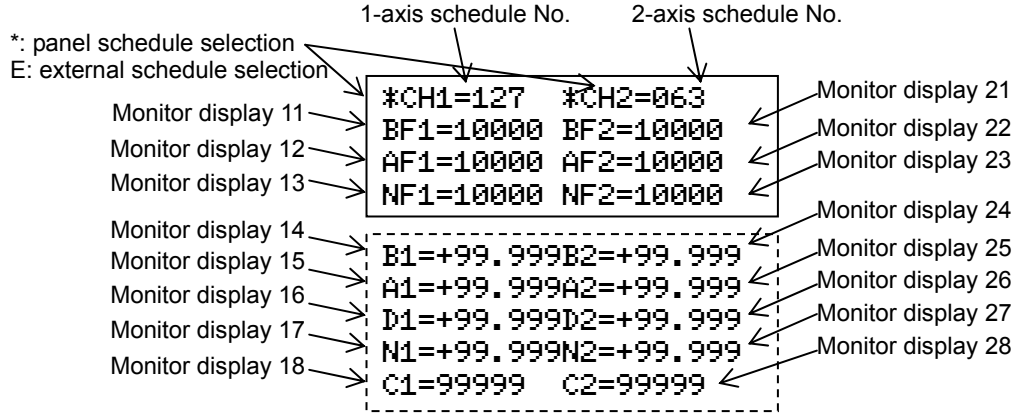
[Initial check screen]



[Normal screen]

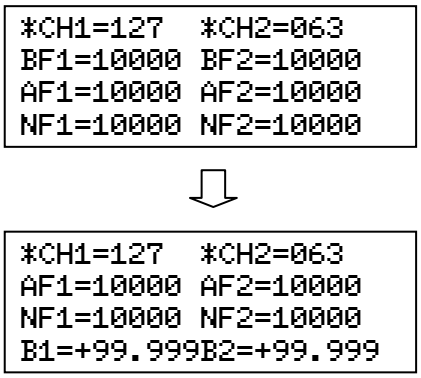


Explanation of normal screen



With the MONITOR DISPLAY parameters, items set for monitor displays 11 to 13 and 21 to 23 are mainly displayed. Press ▼ or ▲ key to display hidden monitor displays 14 to 18 and 24 to 28.

Example) Press ▼ key on the screen below to hide monitor displays 11 and 21 and display 14 and 24.



8. Function Setting

(1) Function Menu

When FUN key is pressed, the LCD display becomes as shown below.
Move the cursor to the function item to set with ▼, ▲ or numeric key, then press ENT to display the parameter setting screen of the selected function.

The function menu has following items:

Item No.	Item	Contents
0	Setup	Setting of common items
1	Monitor Display	Selection of items displayed on the monitor screen
2	LED Display	Selection of items displayed on LED
3	Communication	Communication setting
4	Duplicate	Copying of setting from schedule to schedule
5	Initialize	Data initialization
6	Manual	Display of the present value and zero setting of items

(2) Setting Common Items (0=Setup)

Sets common items.

a. Setup menu

When 0=Setup is selected, the LCD display becomes as shown below.

Select the axis to set and press ENT key to display the setup setting screen.

Move the cursor to the item number of parameter to set with ▼, ▲ or numeric key.
Next, move the cursor to the setting item to change with ▼ key, change it with ▼, ▲ or numeric key, establish it with ENT key.

b. Parameter item

* Highlighted items are initial values.

No	Item	Selections, Setting range	Description
1	Using sensor pattern	Sen_1/Load_1(0) Sen_2/Load_2(1)	Displays the usage state of the main unit. Sen_1/Load_1(0): 1-axis type 1 load cell and 1 displacement sensor can be connected. Sen_2/Load_2(1): 2-axis type 2 load cells and 2 displacement sensors can be connected. (Fixed before shipment. Cannot be changed.)
2	Sensor Type	Incremental(1)	Displays the connectable displacement sensor type. Incremental(1): Incremental type Ex.) Mitutoyo, Ono Sokki, Keyence, etc. (Fixed before shipment. Cannot be changed.)

No	Item	Selections, Setting range	Description
3	Disp Measure Mode	SYNC(0) SQNC(1) SH1(2) SH2(3) SH3(4)	Selects the measurement mode of the displacement sensor. SYNC(0): Synchro mode Mode for connecting both the load cell and the displacement sensor. The ST-DISP signal is input and the Before Weld Work is measured after Squeeze-Time. When it is within the upper/lower limit range, the Before Weld Force is measured. When it is within the upper/lower limit range, the sequence moves to Weld-Time and the WELD START signal is output. The sequence moves to Hold-Time after Weld-Time and the After Weld Work and Displacement are measured after Hold-Time. When it is within the upper/lower limit range, the GOOD signal is output. When outside the range, the NG signal is output. (When SYNC is set, the Force Measure Mode setting is ignored.) SQNC(1): Sequence mode Mode for connecting the displacement sensor only. The ST-DISP signal is input and the Before Weld Work is measured after the Squeeze-Time. When it is within the upper/lower limit range, the sequence moves to Weld-Time and the WELD START signal is output. The sequence moves to Hold-Time after Weld-Time and the After Hold-Time, the After Weld Work and Displacement are measured. When it is within the upper/lower limit range, the GOOD signal is output. When outside the range, the NG signal is output. SH1(2): Sample hold 1 mode Mode for connecting the displacement sensor only. Only when the ST-DISP signal is input, the Before Weld Work is measured. When it is within the upper/lower limit range, the GOOD signal is output. When outside the range, the NG signal is output. SH2(3): Sample hold 2 mode Mode for connecting the displacement sensor only. When the ST-DISP signal is input, the origin is set. After the Squeeze time, the sequence moves to Weld-Time and the WELD START signal is output. After Weld-Time, the After Weld Work is measured. When it is within the upper/lower limit range, the GOOD signal is output. When outside the range, the NG signal is output. SH3(4): Sample hold 3 mode Mode for connecting the displacement sensor only. When the first ST-DISP signal is input, the Before Weld Work is measured. When it is within the upper/lower limit range, the second ST-DISP signal becomes ready to be accepted. When the second ST-DISP signal is input, the After Weld Work and Displacement are measured. When it is within the upper/lower limit range, the GOOD signal is output. When outside the range, the NG signal is output. When using the load cell alone without using the displacement sensor, use SQNC, SH1, SH2, or SH3. Also, set the Force Measure Mode to OFF.
4	L.C. Rated Capacity	0 to 50000	Inputs the rated capacity (N) of the purchased load cell. When the unit is kgf or lbf, convert it into N. (Not changed by initialization.)
5	Loadcell Unit	N(0) kgf(1) lbf(2)	Inputs the unit of purchased load cell.

No	Item	Selections, Setting range	Description
6	L.C. Rated Output	0.000 to 2.500 mV	Inputs the rated output shown on the certificate of analysis of the purchased load cell. (Not changed by initialization.)
7	LS Input Validity	Valid(0) Invalid(1)	Sets whether to use the force-detecting signal input. Valid(0): Use Moves to the Before Weld Work after the LS signal is input. Invalid(1): Do not use Moves to Squeeze-Time after the ST-DISP signal is input.
8	Force Measure Mode	SQNC(0) SH1(1) SH2(2) TANG(3) OFF(4)	Selects the measurement mode of the load cell. SQNC(0): Sequence mode Mode for connecting the load cell only. The ST-FORCE signal is input and the Before Weld Force is measured after Squeeze-Time. When it is within the upper/lower limit range, the sequence moves to Weld-Time and the WELD START signal is output. The sequence moves to Hold-Time after Weld-Time and the After Weld Force is measured after Hold-Time. When it is within the upper/lower limit range, the GOOD signal is output. When outside the range, the NG signal is output. SH1(1): Sample hold 1 mode Mode for connecting the load cell only. Only when the ST-FORCE signal is input, the Before Weld Force is measured. When it is within the upper/lower limit range, the GOOD signal is output. When outside the range, the NG signal is output. SH2(2): Sample hold 2 mode Mode for connecting the load cell only. The sequence moves to Weld-Time and the WELD START signal is output when the value reached the Tangential Force setting. The weld force peak is measured during the Weld-Time. When it is within the upper/lower limit range set in the After Weld Force, the GOOD signal is output. When outside the range, the NG signal is output. When the Weld-Time setting is shorter than settings of Force Sampling and Force Average, the measurement is not done and "-" is displayed. Note) The ST-FORCE signal is not used. The weld force is accepted at all times except during sequence. TANG(3): Tangential mode Mode for connecting the load cell only. After the ST-FORCE signal is input, the sequence moves to Weld-Time when the value reached the Tangential Force setting, the WELD START signal is output, and then the sequence moves to Hold-Time after Weld-Time. The After Weld Force is measured at the point set in Tang Measure Point. When it is within the upper/lower limit range, the GOOD signal is output. When outside the range, the NG signal is output. OFF(4): Load cell off mode Mode that the measurement of the load cell is not done. (Ignored when the Disp Measure Mode is set to SYNC.) When using the load cell alone without using the displacement sensor, use SQNC, SH1, SH2 or TANG. Also, set the Disp Measure Mode to an item other than SYNC(0).

No	Item	Selections, Setting range	Description
9	Self Hold Validity	Valid(0) Invalid(1)	Selects pulse input or hold input for the start input. Valid(0): Pulse input Input 20ms or more. Invalid(1): Hold input When the signal is turned OFF before moving to Weld-Time, the sequence operation is interrupted.
10	Output Select Time	TACT(0) 50ms(1) 100ms(2) 200ms(3) 300ms(4)	Selects the output state of the GOOD/NG/FINISH output. TACT(0): Hold output. Turns OFF at the start of the next measurement. 50ms(1): Outputs for 50ms. 100ms(2): Outputs for 100ms. 200ms(3): Outputs for 200ms. 300ms(4): Outputs for 300ms.
11	Output Settings	Normal Close(0) Normal Open(1)	Selects the logical state of the GOOD/NG/FINISH/WELD START output. Normal Close(0): Normal close Normal Open(1): Normal open
12	Level Select Time	TACT(0) 50ms(1) 100ms(2) 200ms(3) 300ms(4)	Selects the output state of the level output. TACT(0): Hold output. Turns OFF at the start of the next measurement. 50ms(1): Outputs for 50ms. 100ms(2): Outputs for 100ms. 200ms(3): Outputs for 200ms. 300ms(4): Outputs for 300ms.
13	Level Settings	Normal Close(0) Normal Open(1)	Selects the logical state of the LEV-DISP/LEV-FORCE output. Normal Close(0): Normal close Normal Open(1): Normal open
14	Head Position	TOP(0) HOLD(1)	Selects the state of the welding head at the occurrence of error. TOP(0): The SV signal is turned OFF. HOLD(1): The SV signal is kept ON.
15	Finish Validity	Valid(0) Invalid(1)	Sets whether to output the FINISH signal at STOP or NG. Valid(0): Output Invalid(1): Do not output
16	Disp Voltage Range	±65.535mm(0) ±32.767mm(1) ±16.383mm(2) ±8.191mm(3) ±4.095mm(4) ±2.047mm(5) ±1.023mm(6) ±0.511mm(7) ±0.255mm(8)	Selects the voltage output range of the displacement sensor. Saturated when the length is longer than the setting. ±65.535mm (0): Outputs -65.535 to +65.535mm with -10 to +10V voltage. ±32.767mm(1): Outputs -32.767 to +32.767mm with -10 to +10V voltage. ±16.383mm(2): Outputs -16.383 to +16.383mm with -10 to +10V voltage. ±8.191mm(3): Outputs -8.191 to +8.191mm with -10 to +10V voltage. ±4.095mm(4): Outputs -4.095 to +4.095mm with -10 to +10V voltage. ±2.047mm(5): Outputs -2.047 to +2.047mm with -10 to +10V voltage. ±1.023mm(6): Outputs -1.023 to +1.023mm with -10 to +10V voltage. ±0.511mm(7): Outputs -0.511 to +0.511mm with -10 to +10V voltage. ±0.255mm(8): Outputs -0.255 to +0.255mm with -10 to +10V voltage.
17	Direction Select	-(CCW)(0) +(CW)(1)	Selects the sign of the displacement sensor. -(CCW)(0): Decreases in the direction that the rod is pushed. +(CW)(1): Increases in the direction that the rod is pushed.

No	Item	Selections, Setting range	Description
18	Sensor Motion Detect	0.000 to 0.100mm	Inputs the allowable vibration range of displacement sensor. Vibrates when the welding head moves down and it stops by making contact with workpiece. Depending on device, mechanical vibration occurs. To properly detect the stop, allowable vibration range can be set. If vibration stronger than the set allowable vibration range, the sequence cannot move on. In such cases, change the setting. When “0” is set, vibration is not checked. Invalid when the LS Input Validity is set to Valid(0).
19	L.C. Motion Detect	At 20N: 0 to 2.00 At 50N: 0 to 5.00 At 200N: 0 to 20.0 At 500N: 0 to 50.0 At 2000N: 0 to 200 At 5000N: 0 to 500 At 10000N: 0 to 1000	Inputs the allowable vibration range of load cell. Up to 10% of the load cell rated capacity can be set. Vibrates when the welding head moves down and it stops by making contact with workpiece. Depending on device, mechanical vibration occurs. To properly detect the stop, allowable vibration range can be set. If vibration stronger than the set allowable vibration range, the sequence cannot move on. In such cases, change the setting. When “0” is set, vibration is not checked. Invalid when the LS Input Validity is set to Valid(0).
20	Zero Point Setting	All(0) Select(1)	Selects whether to set the origin of the displacement sensor is set for all SCH simultaneously or each SCH. All(0): all SCHs simultaneously Select(1): each SCH
21	Head Error Time	0.00 to 9.99sec	Sets the time from the start signal input to the LS signal input. When the force-detecting signal is not input even after the time, an error occurs. When 0.00sec is set, the error is not detected. Invalid when the LS Input Validity is set to Invalid(1).
22	Finish Error Time	0.00 to 9.99sec	Sets the time from the WELD START signal output to the FINISH signal input. When the FINISH signal is not input even after the time, an error occurs. When 0.00sec is set, the error is not detected.
23	Buzzer	On(0) Off(1)	Sets whether to sound the buzzer at the occurrence of error and NG. On(0): Sound Off(1): Do not sound
24	Tang Measure Point	Weld(0) Hold(1)	When the measurement mode of the load cell is TANG, selects the force measurement point, after Weld-Time or after Hold-Time. Weld(0): After Weld-Time Hold(1): After Hold-Time
25	Brightness	0 to 10(5)	Adjusts the contrast.
26	Ready Output	Measurement ON(0) Control ON(1)	Selects the output state of the ready output. Measurement ON(0): Measurement available mode The READY is not output at STOP input, occurrence of NG/WARNING, measurement operation, communication operation, WELD and HEAD operation with panel switch, MANUAL measurement, and schedule setting. Control ON(1): Device operation mode The READY is not output at WELD and HEAD operation with panel switch, MANUAL measurement, and schedule setting.
27	Disp Level Mode	HEIGHT1(0) HEIGHT2(1)	Selects the type of measurement value displayed for after-weld work thickness. HEIGHT1(0): Makes the level setting with the travel distance from the zero setting position HEIGHT2(1): Makes the level setting setting the travel distance after Before Work as 0.

No	Item	Selections, Setting range	Description
28	Force Sampling	1Hz(0) 5Hz(1) 10Hz(2) 20Hz(3) 50Hz(4) 100Hz(5) 200Hz(6) 500Hz(7) 1000Hz(8) 2000Hz(9)	Selects the sampling frequency measuring the weld force value internally.
29	Force Average	1(0) 2(1) 4(2) 8(3) 16(4) 64(5) 256(6) 1024(7)	Measures the weld force value internally and sets the number of average.

(3) Selecting Items Displayed on LCD (1=Monitor Display)

Selects the monitored values displayed on the normal screen.
For 2-axis type, first axis (Axis1) and second axis (Axis2) can be selected respectively.

a. Parameter item

Item		Selections		Remarks
Symbol	Description	Initial value	Selections	
MD11	Monitor Display11	Before Force(0)	Before Force(0) After Force(1) Now Force(2) Before Work(3) After Work(4) Displacement(5) Now Work(6) Counter(7)	First axis
MD12	Monitor Display12	After Force(1)		
MD13	Monitor Display13	Now Force(2)		
MD14	Monitor Display14	Before Work(3)		
MD15	Monitor Display15	After Work(4)		
MD16	Monitor Display16	Displacement(5)		
MD17	Monitor Display17	Now Work(6)		
MD18	Monitor Display18	Counter(7)		
MD21	Monitor Display21	Before Force(0)		Second axis
MD22	Monitor Display22	After Force(1)		
MD23	Monitor Display23	Now Force(2)		
MD24	Monitor Display24	Before Work(3)		
MD25	Monitor Display25	After Work(4)		
MD26	Monitor Display26	Displacement(5)		
MD27	Monitor Display27	Now Work(6)		
MD28	Monitor Display28	Counter(7)		

b. Selections

Before Force(0): Before-welding force value
After Force(1): After-welding force value
Now Force(2): Present force value
Before Work(3): Before-welding workpiece thickness
After Work(4): After-welding workpiece thickness
Displacement(5): Displacement
Now Work(6): Present workpiece thickness
Counter(7): Counter value

(4) Selecting Items Displayed on LED (2=LED Display)

Selects the input/output signals to display the status on the INPUT LED and OUTPUT LED.

a. INPUT LED parameter item

Item			Selections		
Sym-bol	Description	LED display	Initial value	Selections	
				First axis	Second axis
IL0	Input LED Display0	IN 0	SCH1-1(0)	SCH1-1(0)	SCH2-1(21)
IL1	Input LED Display1	IN 1	SCH1-2(1)	SCH1-2(1)	SCH2-2(22)
IL2	Input LED Display2	IN 2	SCH1-4(2)	SCH1-4(2)	SCH2-4(23)
IL3	Input LED Display3	IN 3	SCH1-8(3)	SCH1-8(3)	SCH2-8(24)
IL4	Input LED Display4	IN 4	SCH1-16(4)	SCH1-16(4)	SCH2-16(25)
IL5	Input LED Display5	IN 5	SCH1-32(5)	SCH1-32(5)	SCH2-32(26)
IL6	Input LED Display6	IN 6	SCH1-64(6)	SCH1-64(6)	SCH2-64(27)
IL7	Input LED Display7	IN 7	ST-DISP1(7)	ST-DISP1(7)	ST-DISP2(28)
IL8	Input LED Display8	IN 8	ST-FORCE1(8)	ST-FORCE1(8)	ST-FORCE2(29)
IL9	Input LED Display9	IN 9	LS1(9)	LS1(9)	LS2(30)
ILA	Input LED DisplayA	IN A	RESET-NG(10)	RESET-NG(10)	INPUT26(31)
ILB	Input LED DisplayB	IN B	RESET-CONT1(11)	RESET-CONT1(11)	RESET-CONT2(32)
ILC	Input LED DisplayC	IN C	FINISH1(12)	FINISH1(12)	FINISH2(33)
ILD	Input LED DisplayD	IN D	ESTOP(13)	ESTOP(13)	INPUT27(34)
ILE	Input LED DisplayE	IN E	HEAD1(14)	HEAD1(14)	HEAD2(35)
ILF	Input LED DisplayF	IN F	ZST-DISP1(15)	ZST-DISP1(15)	ZST-DISP2(36)
				INPUT11(16)	INPUT21(37)
				INPUT12(17)	INPUT22(38)
				INPUT13(18)	INPUT23(39)
				INPUT14(19)	INPUT24(40)
				INPUT15(20)	INPUT25(41)

b. OUTPUT LED parameter item

Item			Selections		
Sym-bol	Description	LED display	Initial value	Selections	
				First axis	Second axis
OL0	Output LED Display0	OUT 0	READY1(0)	READY1(0)	READY2(29)
OL1	Output LED Display1	OUT 1	GOOD-DISP1(1)	GOOD-DISP1(1)	GOOD-DISP2(30)
OL2	Output LED Display2	OUT 2	GOOD-FORCE1(2)	GOOD-FORCE1(2)	GOOD-FORCE2(31)
OL3	Output LED Display3	OUT 3	NG1(3)	NG1(3)	NG2(32)
OL4	Output LED Display4	OUT 4	NG-UP1(4)	NG-UP1(4)	NG-UP2(33)
OL5	Output LED Display5	OUT 5	NG-LO1(5)	NG-LO1(5)	NG-LO2(34)
OL6	Output LED Display6	OUT 6	NG-BEFORE1(6)	NG-BEFORE1(6)	NG-BEFORE2(35)
OL7	Output LED Display7	OUT 7	NG-DISP1(7)	NG-DISP1(7)	NG-DISP2(36)
OL8	Output LED Display8	OUT 8	NG-AFTER1(8)	NG-AFTER1(8)	NG-AFTER2(37)
OL9	Output LED Display9	OUT 9	NG-FORCEUP1(9)	NG-FORCEUP1(9)	NG-FORCEUP2(38)
OLA	Output LED DisplayA	OUT A	NG-FORCELO1(10)	NG-FORCELO1(10)	NG-FORCELO2(39)
OLB	Output LED DisplayB	OUT B	WARNING(11)	WARNING(11)	
OLC	Output LED DisplayC	OUT C	WELD START1(12)	WELD START1(12)	WELD START2(40)
OLD	Output LED DisplayD	OUT D	FINISH1(13)	FINISH1(13)	FINISH2(41)
OLE	Output LED DisplayE	OUT E	LEV-DISP11(14)	LEV-DISP11(14)	LEV-DISP21(42)
OLF	Output LED DisplayF	OUT F	LEV-DISP12(15)	LEV-DISP12(15)	LEV-DISP22(43)
				LEV-DISP13(16)	LEV-DISP23(44)
				LEV-FORCE11(17)	LEV-FORCE21(45)
				LEV-FORCE12(18)	LEV-FORCE22(46)
				LEV-FORCE13(19)	LEV-FORCE23(47)
				SV11(20)	SV21(48)
				SV12(21)	SV22(49)
				SV13(22)	SV23(50)
				OUTPUT11(23)	OUTPUT21(51)
				OUTPUT12(24)	OUTPUT22(52)
				OUTPUT13(25)	OUTPUT23(53)
				OUTPUT14(26)	OUTPUT24(54)
				OUTPUT15(27)	OUTPUT25(55)
				OUTPUT16(28)	OUTPUT26(56)

(5) Setting Communication Items (3=Communication)

Sets items relating communication.
After changing these setting, turn on the power again.

a. Parameter item

* Highlighted items are initial values.

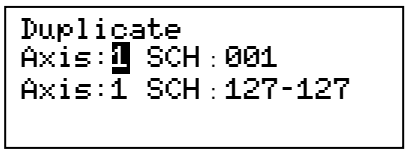
Item No.	Item	Selections, Setting range	Description
1	IP Address	0,0,0,0	Inputs the IP address. Be sure to assign the IP address is the number specific to device. Used when using ETHERNET.
2	Subnet mask	255.255.255.0	Inputs the subnet mask. Used when using ETHERNET.
3	Default gateway	0,0,0,0	Inputs the default gateway. Used when using ETHERNET.
4	Port number	0 to 9999(1)	Inputs the port number. Used when using ETHERNET.
5	Baud rate	9600(0) 19200(1) 38400(2) 57600(3)	Selects the baud rate. Used when using RS-232C or RS-485.
6	Data bits	7(0) 8(1)	Selects the data bit. Used when using RS-232C or RS-485.
7	Parity	None(0) Even(1) Odd(2)	Selects the parity. Used when using RS-232C or RS-485.
8	Stop bits	1(0) 2(1)	Selects the stop bit. Used when using RS-232C or RS-485.
9	Flow control	None(0) Xon/Xoff(1) Hardware(2)	Selects the flow control. Used when using RS-232C. Set it to None(0) normally.
10	Device Address	1 to 99	Inputs the device address number. In RS-232C or ETHERNET, the number is included in communication data as device address number. Use it for identification of device. In RS-485, the device address number is used in communication. Be sure to assign the number specific to device.
11	Checksum data	No(0) Yes(1)	Sets whether to use FCS (frame checksum).
12	Port type	RS232C(0) RS485(1)	Selects the communication. The selected one becomes valid.
13	Comm Control	OFF(0) -->(1) <->(2)	Selects the communication function. OFF(0): No communication -->(1): One-way communication <->(2): Two-way communication
14	MAC Address	00-60-D5-02-**-**	Displays the MAC address. (Factory setting. Cannot be changed.)

(6) Copying a Schedule (4=Duplicate)

Copies the setting of a schedule to another schedule.

a. Procedure

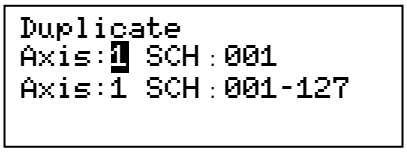
When FUN, 4 and ENT keys are pressed in this order, the LCD display becomes as shown below.



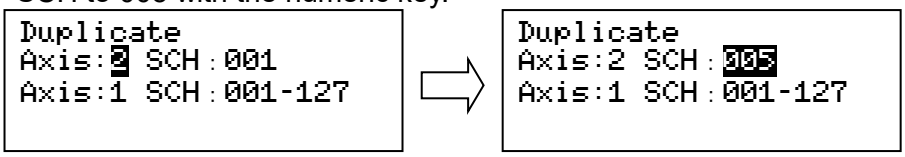
Move the cursor with ▼ or ▲ keys.
Input the number of copy source axes and the schedule number, input the number of copy destination axis and the schedule number, and establish it with ENT key.
For an axis, only 1 can be input in Axis.

Example) Copy the SCH005 conditions of 2-axis to SCH002 to 030 of 1-axis.

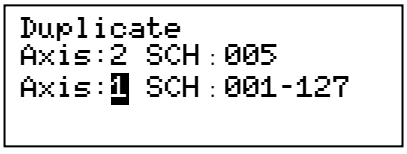
Initial screen



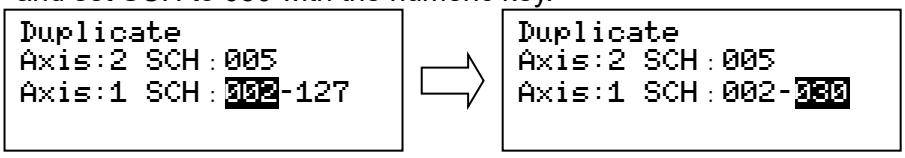
Set the copy source axis to 2 with the numeric key. Move the cursor and set SCH to 005 with the numeric key.



Move the cursor to the copy destination axis and set it to 1 with the numeric key.



Move the cursor and set SCH to 002 with the numeric key. Move the cursor and set SCH to 030 with the numeric key.



Press ENT key to start writing.

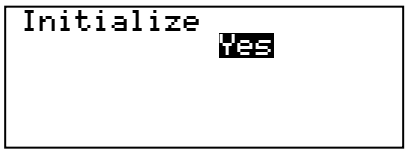
Caution: When the schedule is copied to another axis, do the zero setting of load cell for the copy destination axis.

(7) Initializing Settings (5=Initialize)

Initializes the contents of SCH setting and Function setting.
Some settings are not initialized.

a. Procedure

When FUN, 5 and ENT keys are pressed in this order, the LCD display becomes as shown below.



Press ▼ or ▲ key to select Yes or No.
Select Yes and then press ENT key to initialize data.
The data other than the fixed data is initialized.

(8) Displaying Present Values (6=Manual)

Displays the present values of the load cell and displacement sensor.
Also, manually sets the load cell and the displacement sensor to zero.
F1, F2, D1, and D2 values are not cleared by initialization.

a. Display item

When FUN, 6 and ENT keys are pressed in this order, the LCD display becomes as shown below. (Screens for 2-axis type are shown below.)

```
Manual SCH127
F1=10000  F2=10000
D1=+99.999D2=+99.999
Schedule Number
```

F1: 1-axis force F2: 2-axis force
D1: 1-axis displacement D2: 2-axis displacement

b. Zero setting procedure of load cell

Move the cursor to the axis to set to zero (F1 or F2) with ▼ or ▲ key.

```
Manual SCH127
F1=10000  F2=10000
D1=+99.999D2=+99.999
Schedule Number
```

Let the load cell in zero pressure.
When ZSET key is pressed, 0 is displayed. The zero setting is complete.

```
Manual SCH127
F1=00000  F2=10000
D1=+99.999D2=+99.999
Schedule Number
```

Caution: Do not do the zero setting with applying pressure. Since the zero display will get wrong, do not set to zero many times.

c. Zero setting procedure of displacement sensor

Move the cursor to the axis to set to zero (D1 or D2) with ▼ or ▲ key.

```
Manual SCH127
F1=10000  F2=10000
D1=+99.999D2=+99.999
Schedule Number
```

When ZSET key is pressed, 0 is displayed. The zero setting is complete.

```
Manual SCH127
F1=00000  F2=10000
D1=  0.000D2=+99.999
Schedule Number
```

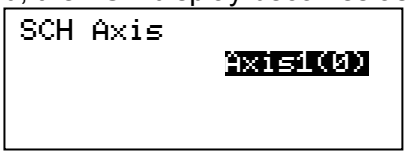
Caution: Be sure to do the zero setting after power-on.

9. Schedule Setting

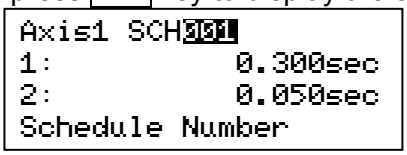
a. Schedule menu

Sets each schedule.

When SCH key is pressed, the LCD display becomes as shown below.



Select the axis to set and press ENT key to display the schedule setting screen.



Move the cursor to the schedule item number to set with ▼, ▲ or numeric key.
Next, move the cursor to the setting item to change with ▼ key, change it with ▼, ▲ or numeric key, and establish it with ENT key.

b. Parameter item

	Setting item	Setting range	Initial value	Description
	Schedule Number	1 to 127	-	Sets the schedule number.
1	Squeeze-Time	0.000 to 9.999sec	0.300sec	Sets the squeeze time.
2	Weld-Time		0.050sec	Sets the weld time (including the cool time).
3	Hold-Time		0.300sec	Sets the hold time.
4	Before Weld Work LO	-99.999 to +99.999mm	-99.999mm	Sets the lower limit of the before-welding workpiece thickness.
5	Before Weld Work UP		+99.999mm	Sets the upper limit of the before-welding workpiece thickness.
6	After Weld Work LO		-99.999mm	Sets the lower limit of the after-welding workpiece thickness.
7	After Weld Work UP		+99.999mm	Sets the upper limit of the after-welding workpiece thickness.
8	Displacement LO		-99.999mm	Sets the lower limit of the displacement.
9	Displacement UP		+99.999mm	Sets the upper limit of the displacement.
10	Before Weld Force LO	*1	0.00N	Sets the lower limit of the before-welding force.
11	Before Weld Force UP		Rated value	Sets the upper limit of the before-welding force.
12	After Weld Force LO		0.00N	Sets the lower limit of the after-welding force.
13	After Weld Force UP		Rated value	Sets the upper limit of the after-welding force.

	Setting item	Setting range	Initial value	Description
14	Displacement Level1	-99.999 to +99.999mm	+0.000mm	Sets the displacement level 1.
15	Displacement Level2	-99.999 to +99.999mm	+0.000mm	Sets the displacement level 2.
16	Displacement Level3	-99.999 to +99.999mm	+0.000mm	Sets the displacement level 3.
17	Force Level1	*1	0.00N	Sets the force level 1.
18	Force Level2		0.00N	Sets the force level 2.
19	Force Level3		0.00N	Sets the force level 3.
20	Force Offset		+0.00N	Sets the force offset.
21	Tangential Force		0.00N	Sets the force value to output the weld signal in the tangential mode.
22	Preset counter	00000 to 99999	99999	Sets the preset counter value. When 00000 is set, the preset error does not occur.
23	Counter	00000 to 99999	00000	Sets the count start value.

*1: The load cell setting range of each rated value is as follows:

20N: 0.00 to 20.00 N
50N: 0.00 to 50.00 N
200N: 0.0 to 200.0 N
500N: 0.0 to 500.0 N
2000N: 0 to 2000 N
5000N: 0 to 5000 N
10000N: 0 to 10000 N

c. NG output condition

When the measured value is outside the setting range, NG is output as follows.

Setting item \ OUTPUT Pin No.		4	5	6	7	8	9	10	11
		NG	NG-UP	NG-LO	NG-BEFORE	NG-DISP	NG-AFTER	NG-FORCE UP	NG-FORCE LO
4	Before Weld Work LO	○	-	○	○	-	-	-	-
5	Before Weld Work UP	○	○	-	○	-	-	-	-
6	After Weld Work LO	○	-	○	-	-	○	-	-
7	After Weld Work UP	○	○	-	-	-	○	-	-
8	Displacement LO	○	-	○	-	○	-	-	-
9	Displacement UP	○	○	-	-	○	-	-	-
10	Before Weld Force LO	○	-	-	-	-	-	-	○
11	Before Weld Force UP	○	-	-	-	-	-	○	-
12	After Weld Force LO	○	-	-	-	-	-	-	○
13	After Weld Force UP	○	-	-	-	-	-	○	-

○: output when the value is outside the setting range.

Caution: The next measurement cannot be done unless the Controller is returned to the READY state by inputting the RESET-NG signal or pressing RES key on the front panel.

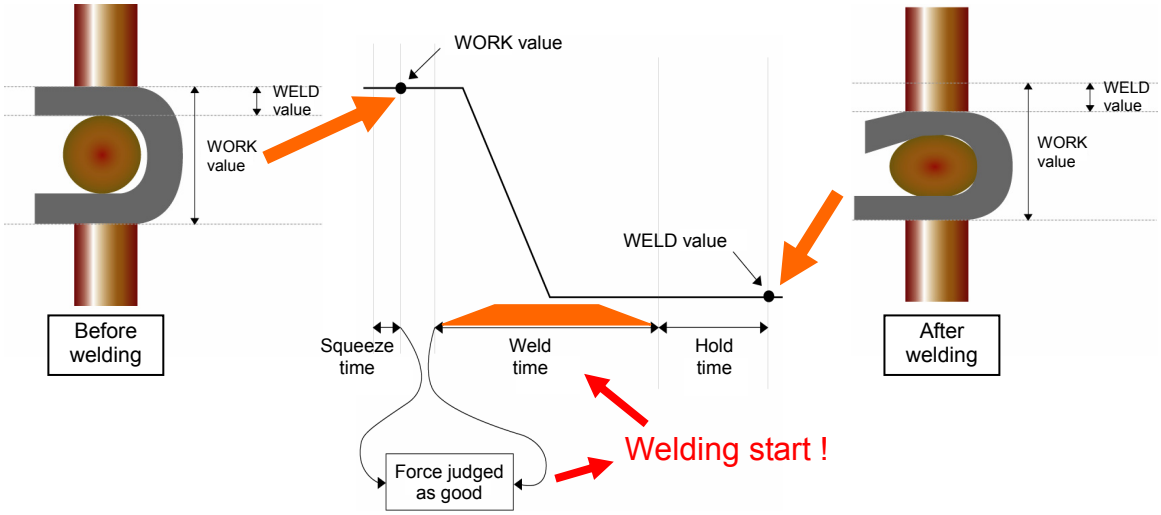
10. Setting of Measurement Mode and Schedule

(1) Synchro Mode “Disp Measure Mode : SYNC(0)”

This is the mode for measuring force and displacement. The before/after-welding force, workpiece thickness, and workpiece displacement can be measured and judged.

Variability of welding can be minimized by performing welding after judging the before-welding force.

The presence of workpiece and abnormality in workpiece can be checked by measuring the workpiece thickness before welding. Also, the finished dimension can be checked by measuring the workpiece displacement.



a. Setting of measurement mode

①Press FUN, 0 and ENT keys in this order to select “0=Setup”.

②Select the setting object between “Axis1(0)” (first axis) and “Axis2(1)” (second axis). “Axis2(1)” can be set for the 2-axis type (option).

③Set No.3 “Disp Measure Mode” (measurement mode of displacement sensor) to “SYNC(0)” (synchro mode).

④Set the rated capacity of the connected load cell in No.4 “L.C. Rated Capacity”. The rated capacity of the load cell is shown on the certificate of the load cell.

⑤Select the force unit from “N(0)”, “kgf(1)”, and “lbf(2)” in No.5 “Loadcell Unit”.

⑥Set the rated output of the connected load cell in No.6 “L.C. Rated Output”. The rated output of the load cell is shown on the certificate of the load cell.

⑦When there is a limit switch for force check, set No.7 “LS Input Validity” (use of force-detecting signal input) to “Valid(0)”. When not using the force-detecting signal (LS), set it to “Invalid(1)”.

b. Setting of measurement condition

①Press MONI key to display the normal screen.

②Press SCH key to select “SCH Axis”.

③Select the setting object between “Axis1(0)” (first axis) and “Axis2(1)” (second axis) to set the schedule number.

④Set No.1 “Squeeze-Time”, No.2 “Weld-Time”, and No.3 “Hold-Time” to the time same as the set time for the welding power supply. Set the weld time to the time longer than the set time for the welding power supply.

⑤Set the monitoring level according to your use conditions.

Monitoring of the before-welding workpiece thickness
No.4 “Before Weld Work LO” (before-welding workpiece thickness lower limit)
No.5 “Before Weld Work UP” (before-welding workpiece thickness upper limit)

Monitoring of the after-welding workpiece thickness
No.6 “After Weld Work LO” (after-welding workpiece thickness lower limit)
No.7 “After Weld Work UP” (after-welding workpiece thickness upper limit)

Monitoring of the workpiece displacement
No.8 “Displacement LO” (workpiece displacement lower limit)
No.9 “Displacement UP” (workpiece displacement upper limit)

Monitoring of the before-welding force
No.10 “Before Weld Force LO” (before-welding force lower limit)
No.11 “Before Weld Force UP” (before-welding force upper limit)

Monitoring of the after-welding force
No.12 “After Weld Force LO” (after-welding force lower limit)
No.13 “After Weld Force UP” (after-welding force upper limit)

⑥Set the level output according to your use conditions.

Displacement level output
No.14 “Displacement Level1”
No.15 “Displacement Level2”
No.16 “Displacement Level3”

The displacement level outputs the external output signals “LEV-DISP11 to 13, 21 to 23” when the value of the displacement sensor passes the set value displacement level output.

By connecting the external output signals to the weld stop input of the welding power supply, you can stop the welding after the displacement value reaches the set value.

Force level output
No.17 “Force Level1”
No.18 “Force Level2”
No.19 “Force Level3”

The force level outputs the external output signals “LEV-FORCE11 to 13, 21 to 23” when the weld force exceeds the set value.

c. Measurement

①Press MONI key to display the normal screen.

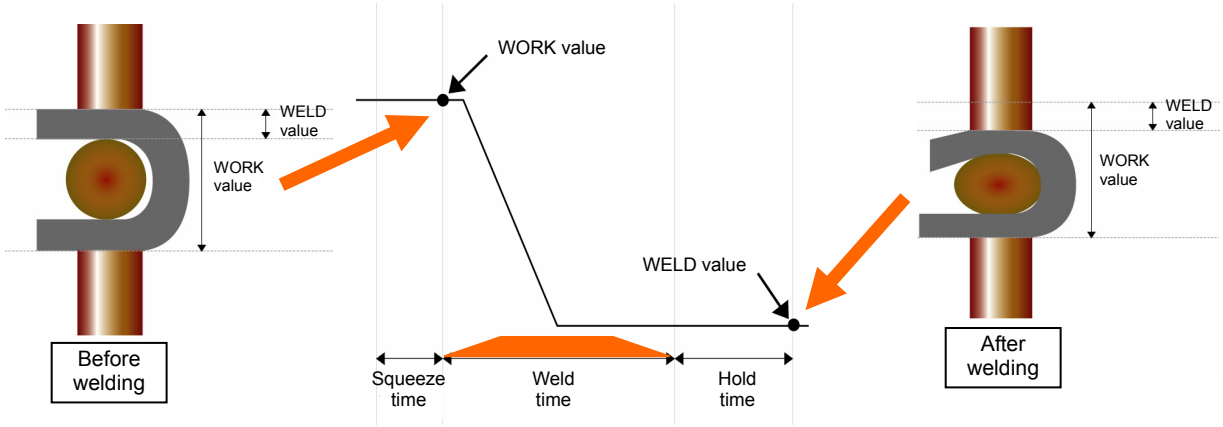
②Set the schedule by selecting schedule switching signals “SCH1”, “SCH2”, “SCH4”, “SCH8”, “SCH16”, “SCH32”, and “SCH64” or via the panel.

③Input “ST-DISP1” or “ST-DISP2” (second axis) to make a measurement.

(2) Sequence Mode “Disp Measure Mode : SQNC(1)”

This is the mode for measuring displacement. The before/after-welding workpiece thickness and workpiece displacement can be measured and judged.

The presence of workpiece and abnormality in workpiece can be checked by measuring the workpiece thickness before welding. Also, the finished dimension can be checked by measuring the workpiece displacement.



a. Setting of measurement mode

①Press FUN, 0 and ENT keys in this order to select “0=Setup”.

②Select the setting object between “Axis1(0)” (first axis) and “Axis2(1)” (second axis). “Axis2(1)” can be set for the 2-axis type (option).

③Set No.3 “Disp Measure Mode” (measurement mode of displacement sensor) to “SQNC(1)” (sequence mode).

④When there is a limit switch for force check, set No.7 “LS Input Validity” (use of force-detecting signal input) to “Valid(0)”. When not using the force-detecting signal (LS), set it to “Invalid(1)”.

⑤When not using the load cell, set No.8 “Force Measure Mode” (measurement mode of load cell) to “OFF(4)” (load cell off mode).

b. Setting of measurement schedule

①Press MONI key to display the normal screen.

②Press SCH key to select “SCH Axis”.

③Select the setting object between “Axis1(0)” (first axis) and “Axis2(1)” (second axis) to set the schedule number.

④Set No.1 “Squeeze-Time”, No.2 “Weld-Time”, and No.3 “Hold-Time” to the time same as the set time for the welding power supply. Set the weld time to the time longer than the set time for the welding power supply.

⑤Set the monitoring level according to your use conditions.

Monitoring of the before-welding workpiece thickness
No.4 “Before Weld Work LO” (before-welding workpiece thickness lower limit)
No.5 “Before Weld Work UP” (before-welding workpiece thickness upper limit)

Monitoring of the after-welding workpiece thickness
No.6 “After Weld Work LO” (after-welding workpiece thickness lower limit)
No.7 “After Weld Work UP” (after-welding workpiece thickness upper limit)

Monitoring of the workpiece displacement
No.8 “Displacement LO” (workpiece displacement lower limit)
No.9 “Displacement UP” (workpiece displacement upper limit)

⑥Set the level output according to your use conditions.

Displacement level output
No.14 “Displacement Level1”
No.15 “Displacement Level2”
No.16 “Displacement Level3”

By connecting the external output signals “LEV-DISP11 to 13, 21 to 23” to the weld stop input of the welding power supply, you can stop the welding after the displacement value reaches the set value.

c. Measurement

①Press MONI key to display the normal screen.

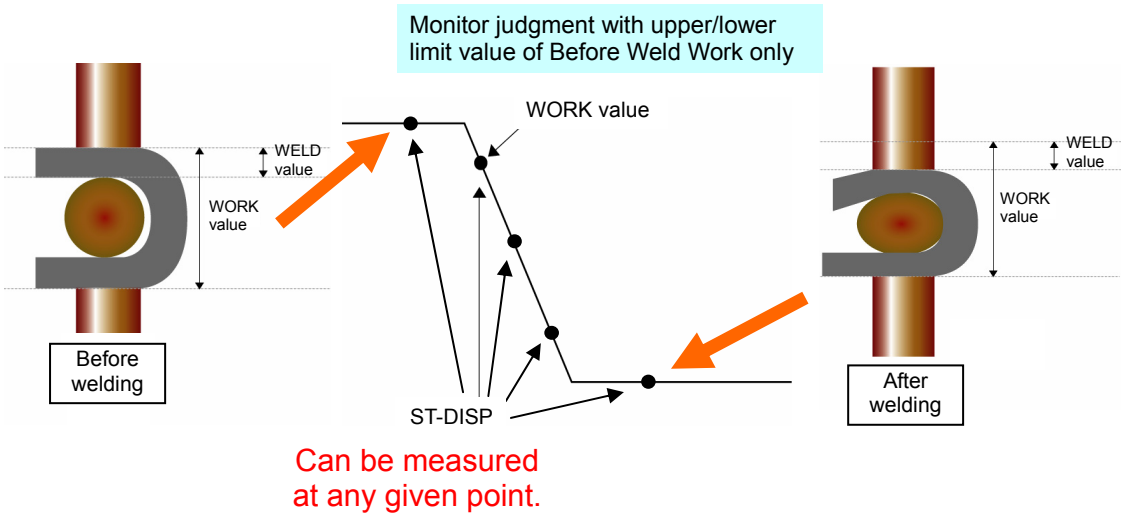
②Set the schedule by selecting schedule switching signals “SCH1”, “SCH2”, “SCH4”, “SCH8”, “SCH16”, “SCH32”, and “SCH64” or via the panel.

③Input “ST-DISP1” or “ST-DISP2” (second axis) to make a measurement.

(3) Sample Hold 1 Mode “Disp Measure Mode : SH1(2)”

This is the mode for measuring displacement. The workpiece thickness can be measured and judged at the input of “ST-DISP1” or “ST-DISP2” (second axis).

(The workpiece thickness can be measured and checked at a given point in time.)



a. Setting of measurement mode

①Press FUN, 0 and ENT keys in this order to select “0=Setup”.

②Select the setting object between “Axis1(0)” (first axis) and “Axis2(1)” (second axis).

③Set No.3 “Disp Measure Mode” (measurement mode of displacement sensor) to “SH1(2)” (sample hold 1 mode).

④When not using the load cell, set No.8 “Force Measure Mode” (measurement mode of load cell) to “OFF(4)” (load cell off mode).

b. Setting of measurement schedule

①Press MONI key to display the normal screen.

②Press SCH key to select “SCH Axis”.

③Select the setting object between “Axis1(0)” (first axis) and “Axis2(1)” (second axis) to set the schedule number.

④Set the monitoring level according to your use conditions.

Monitoring of the before-welding workpiece thickness
No.4 “Before Weld Work LO” (before-welding workpiece thickness lower limit)
No.5 “Before Weld Work UP” (before-welding workpiece thickness upper limit)

c. Measurement

①Press MONI key to display the normal screen.

②Set the schedule by selecting schedule switching signals “SCH1”, “SCH2”, “SCH4”, “SCH8”, “SCH16”, “SCH32”, and “SCH64” or via the panel.

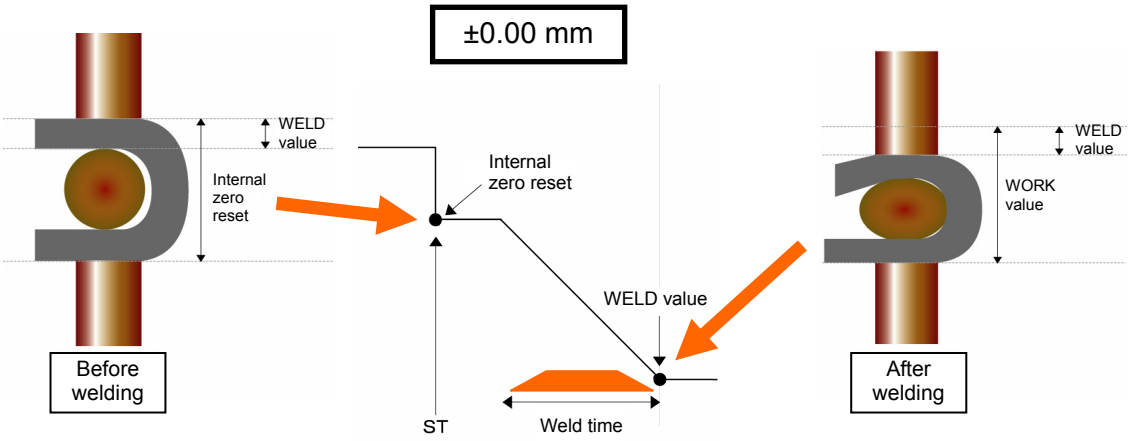
③Input “ST-DISP1” or “ST-DISP2” (second axis) to make a measurement.

(4) Sample Hold 2 Mode “Disp Measure Mode : SH2(3)”

This is the mode for measuring displacement. The displacement from “ST-DISP1” or “ST-DISP2” (second axis) input to the end of welding can be measured and judged.

(The displacement can be checked at a given point in time.)

This is used for stopping welding at the set displacement after internally resetting displacement to zero before welding.



a. Setting of measurement mode

①Press FUN, 0 and ENT keys in this order to select “0=Setup”.

②Select the setting object between “Axis1(0)” (first axis) and “Axis2(1)” (second axis).

③Set No.3 “Disp Measure Mode” (measurement mode of displacement sensor) to “SH2(3)” (sample hold 2 mode).

④When not using the load cell, set No.8 “Force Measure Mode” (measurement mode of load cell) to “OFF(4)” (load cell off mode).

b. Setting of measurement schedule

①Press MONI key to display the normal screen.

②Press SCH key to select “SCH Axis”.

③Select the setting object between “Axis1(0)” (first axis) and “Axis2(1)” (second axis) to set the schedule number.

④Set the monitoring level according to your use conditions.

Monitoring of the after-welding workpiece thickness
No.6 “After Weld Work LO” (after-welding workpiece thickness lower limit)
No.7 “After Weld Work UP” (after-welding workpiece thickness upper limit)

⑤Set the level output according to your use conditions.

Displacement level output
No.14 “Displacement Level1”
No.15 “Displacement Level2”
No.16 “Displacement Level3”

By connecting the external output signals “LEV-DISP11 to 13, 21 to 23” to the weld stop input of the welding power supply, you can stop the welding after the displacement value reaches the set value.

c. Measurement

①Press MONI key to display the normal screen.

②Set the schedule by selecting schedule switching signals “SCH1”, “SCH2”, “SCH4”, “SCH8”, “SCH16”, “SCH32”, and “SCH64” or via the panel.

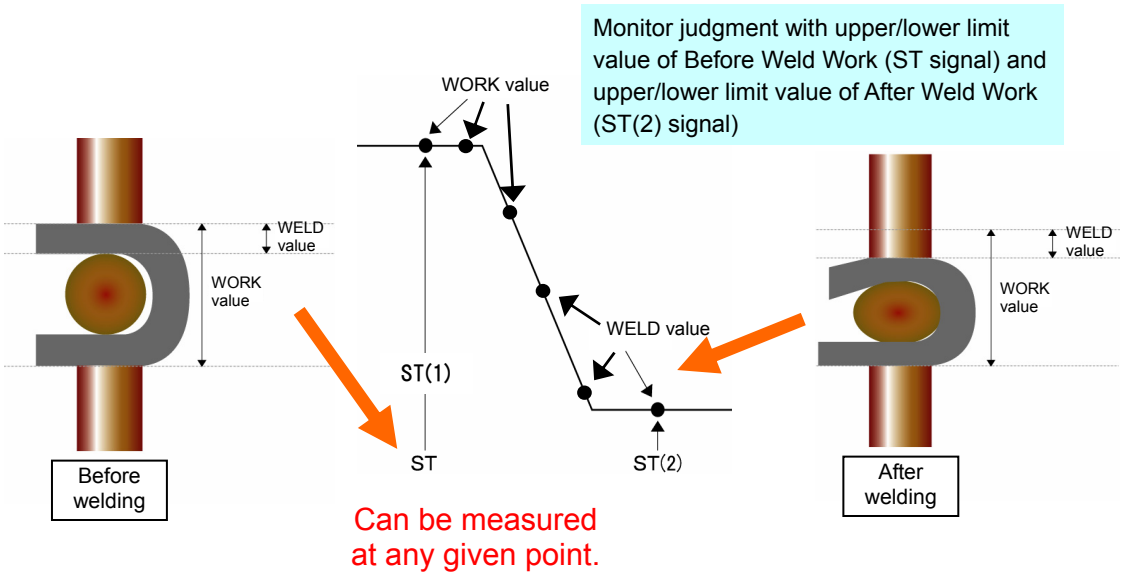
③Input “ST-DISP1” or “ST-DISP2” (second axis) to make a measurement.

(5) Sample Hold 3 Mode “Disp Measure Mode : SH3(4)”

This is the mode for measuring displacement. The workpiece thickness and displacement while “ST-DISP1” or “ST-DISP2” (second axis) is input twice can be measured and judged.

The workpiece thickness and displacement can be measured at a given point in time.

Measurement and judgment can be done by inputting the measurement timing via PLC.



a. Setting of measurement mode

①Press FUN, 0 and ENT keys in this order to select “0=Setup”.

②Select the setting object between “Axis1(0)” (first axis) and “Axis2(1)” (second axis).

③Set No.3 “Disp Measure Mode” (measurement mode of displacement sensor) to “SH3(4)” (sample hold 3 mode).

④When not using the load cell, set No.8 “Force Measure Mode” (measurement mode of load cell) to “OFF(4)” (load cell off mode).

b. Setting of measurement schedule

①Press MONI key to display the normal screen.

②Press SCH key to select “SCH Axis”.

③Select the setting object between “Axis1(0)” (first axis) and “Axis2(1)” (second axis) to set the schedule number.

④Set the monitoring level according to your use conditions.

Monitoring of the before-welding workpiece thickness
No.4 “Before Weld Work LO” (before-welding workpiece thickness lower limit)
No.5 “Before Weld Work UP” (before-welding workpiece thickness upper limit)

Monitoring of the after-welding workpiece thickness
No.6 “After Weld Work LO” (after-welding workpiece thickness lower limit)
No.7 “After Weld Work UP” (after-welding workpiece thickness upper limit)

Monitoring of the workpiece displacement
No.8 “Displacement LO” (workpiece displacement lower limit)
No.9 “Displacement UP” (workpiece displacement upper limit)

⑤Set the level output according to your use conditions.

Displacement level output
No.14 “Displacement Level1”
No.15 “Displacement Level2”
No.16 “Displacement Level3”

By connecting the external output signals “LEV-DISP11 to 13, 21 to 23” to the weld stop input of the welding power supply, you can stop the welding after the displacement value reaches the set value.

c. Measurement

①Press MONI key to display the normal screen.

②Set the schedule by selecting schedule switching signals “SCH1”, “SCH2”, “SCH4”, “SCH8”, “SCH16”, “SCH32”, and “SCH64” or via the panel.

③Input “ST-DISP1” or “ST-DISP2” (second axis) to make a measurement.

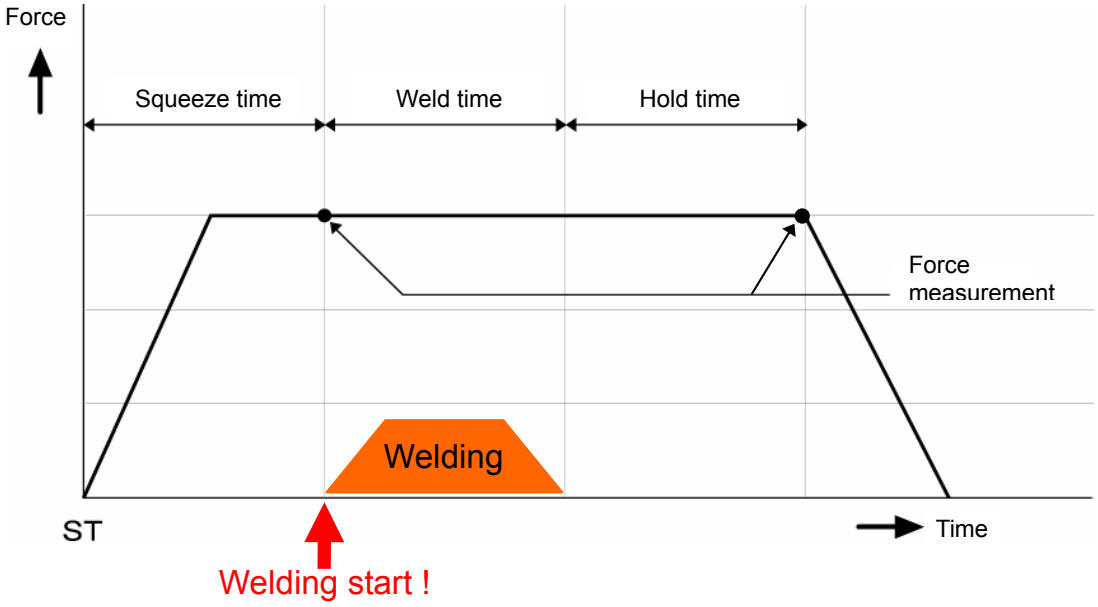
(6) Sequence Mode “Force Measure Mode : SQNC(0)”

This is the mode for measuring force. The before/after welding force can be measured and judged.

Variability of welding can be minimized by performing welding after judging the before-welding force.

When the before-welding force is outside the judgment range, the welding can be stopped.

The welding head can be sequentially controlled.



a. Setting of measurement mode

①Press FUN, 0 and ENT keys in this order to select “0=Setup”.

②Select the setting object between “Axis1(0)” (first axis) and “Axis2(1)” (second axis).

③Set No.3 “Disp Measure Mode” (measurement mode of displacement sensor) to an item other than “SYNC(0)” (synchro mode); “SQNC(1)” (sequence mode), “SH1(2)”, “SH2(3)”, or “SH3(4)” (sample hold mode).

④Set the rated capacity of the connected load cell in No.4 “L.C. Rated Capacity”. The rated capacity of the load cell is shown on the certificate of the load cell.

⑤Select the force unit from “N(0)”, “kgf(1)”, and “lbf(2)” in No.5 “Loadcell Unit”.

⑥Set the rated output of the connected load cell in No.6 “L.C. Rated Output”. The rated output of the load cell is shown on the certificate of the load cell.

⑦When there is a limit switch for force check, set No.7 “LS Input Validity” (use of force-detecting signal input) to “Valid(0)”. When not using the force-detecting signal (LS), set it to “Invalid(1)”.

⑧Set No.8 “Force Measure Mode” (measurement mode of load cell) to “SQNC(0)” (sequence mode).

b. Setting of measurement schedule

①Press MONI key to display the normal screen.

②Press SCH key to select “SCH Axis”.

③Select the setting object between “Axis1(0)” (first axis) and “Axis2(1)” (second axis) to set the schedule number.

④Set No.1 “Squeeze-Time”, No.2 “Weld-Time”, and No.3 “Hold-Time” to the time same as the set time for the welding power supply. When “LS Input Validity” (force-detecting signal input) is set to “Valid(0)”, “Squeeze-Time” setting is unnecessary.

⑤Set the monitoring level according to your use conditions.

Monitoring of the before-welding force
No.10 “Before Weld Force LO” (before-welding force lower limit)
No.11 “Before Weld Force UP” (before-welding force upper limit)

Monitoring of the after-welding force
No.12 “After Weld Force LO” (after-welding force lower limit)
No.13 “After Weld Force UP” (after-welding force upper limit)

⑥Set the level output according to your use conditions.

Use of Force level output
No.17 “Force Level1”
No.18 “Force Level2”
No.19 “Force Level3”

c. Measurement

①Press MONI key to display the normal screen.

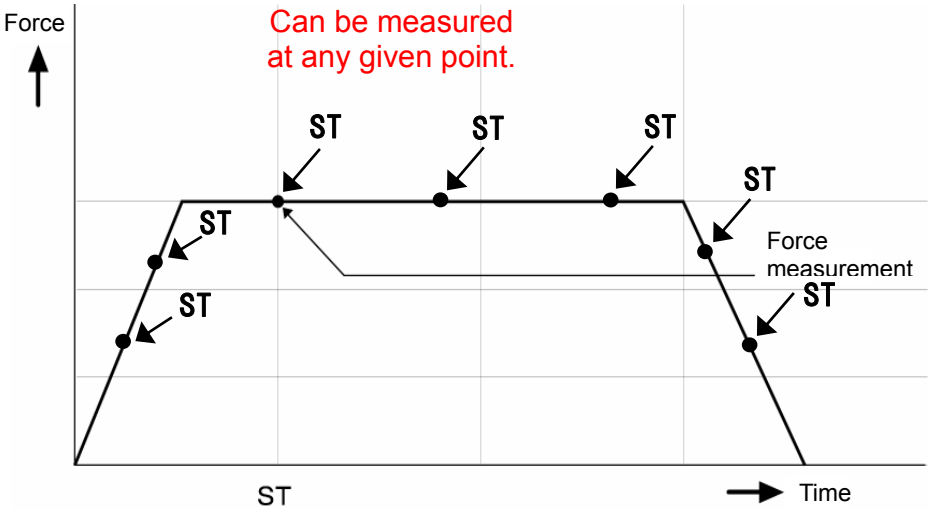
②Set the schedule by selecting schedule switching signals “SCH1”, “SCH2”, “SCH4”, “SCH8”, “SCH16”, “SCH32”, and “SCH64” or via the panel.

③Input “ST-FORCE1” or “ST-FORCE2” (second axis) to make a measurement.

(7) Sample Hold 1 Mode “Force Measure Mode : SH1(1)”

This is the mode for measuring force. The force can be measured and judged at the input of “ST-FORCE1” or “ST-FORCE2” (second axis).

(The weld force can be measured at a given point in time.)



a. Setting of measurement mode

①Press FUN, 0 and ENT keys in this order to select “0=Setup”.

②Select the setting object between “Axis1(0)” (first axis) and “Axis2(1)” (second axis).

③Set No.3 “Disp Measure Mode” (measurement mode of displacement sensor) to an item other than “SYNC(0)” (synchro mode); “SQNC(1)” (sequence mode), “SH1(2)”, “SH2(3)”, or “SH3(4)” (sample hold mode).

④Set the rated capacity of the connected load cell in No.4 “L.C. Rated Capacity”. The rated capacity of the load cell is shown on the certificate of the load cell.

⑤Select the force unit from “N(0)”, “kgf(1)”, and “lbf(2)” in No.5 “Loadcell Unit”.

⑥Set the rated output of the connected load cell in No.6 “L.C. Rated Output”. The rated output of the load cell is shown on the certificate of the load cell.

⑦Set No.8 “Force Measure Mode” (measurement mode of load cell) to “SH1(1)” (sample hold 1 mode).

b. Setting of measurement schedule

①Press MONI key to display the normal screen.

②Press SCH key to select “SCH Axis”.

③Select the setting object between “Axis1(0)” (first axis) and “Axis2(1)” (second axis) to set the schedule number.

④Set the monitoring level according to your use conditions.

Monitoring of the before-welding force
No.10 “Before Weld Force LO” (before-welding force lower limit)
No.11 “Before Weld Force UP” (before-welding force upper limit)

c. Measurement

①Press MONI key to display the normal screen.

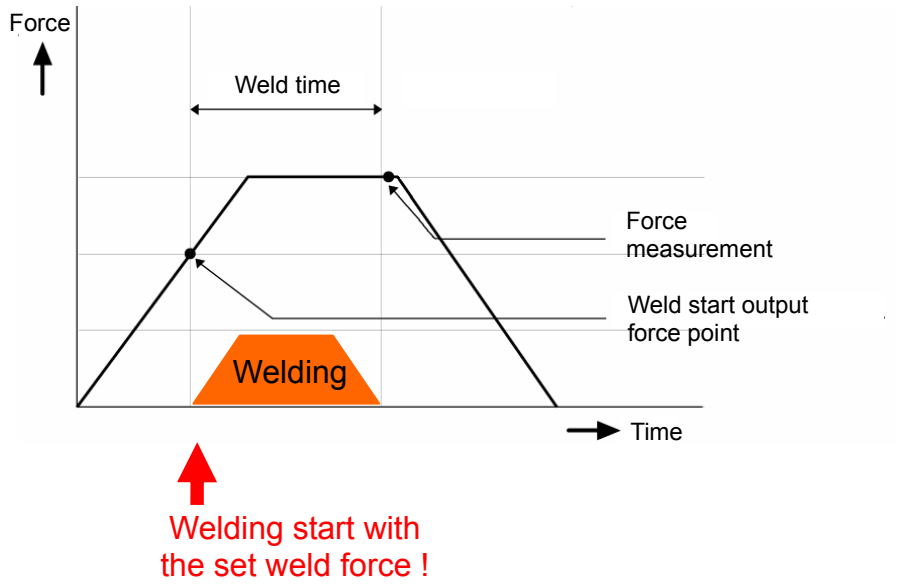
②Set the schedule by selecting schedule switching signals “SCH1”, “SCH2”, “SCH4”, “SCH8”, “SCH16”, “SCH32”, and “SCH64” or via the panel.

③Input “ST-FORCE1” or “ST-FORCE2” (second axis) to make a measurement.

(8) Sample Hold 2 Mode “Force Measure Mode : SH2(2)”

This is the mode for measuring force. The welding starts when the set weld force value is reached, and the maximum force during welding can be measured and judged.

The welding can be started with a given weld force.



a. Setting of measurement mode

①Press FUN, 0 and ENT keys in this order to select “0=Setup”.

②Select the setting object between “Axis1(0)” (first axis) and “Axis2(1)” (second axis).

③Set No.3 “Disp Measure Mode” (measurement mode of displacement sensor) to an item other than “SYNC(0)” (synchro mode); “SQNC(1)” (sequence mode), “SH1(2)”, “SH2(3)”, or “SH3(4)” (sample hold mode).

④Set the rated capacity of the connected load cell in No.4 “L.C. Rated Capacity”. The rated capacity of the load cell is shown on the certificate of the load cell.

⑤Select the force unit from “N(0)”, “kgf(1)”, and “lbf(2)” in No.5 “Loadcell Unit”.

⑥Set the rated output of the connected load cell in No.6 “L.C. Rated Output”. The rated output of the load cell is shown on the certificate of the load cell.

⑦Set No.8 “Force Measure Mode” (measurement mode of load cell) to “SH2(2)” (sample hold 2 mode).

b. Setting of measurement schedule

①Press MONI key to display the normal screen.

②Press SCH key to select “SCH Axis”.

③Select the setting object between “Axis1(0)” (first axis) and “Axis2(1)” (second axis) to set the schedule number.

④Set No.2 “Weld-Time” to the time longer than the set time for the welding power supply.

⑤Set the monitoring level according to your use conditions.

When No.2 “Weld-Time” is shorter than the setting of No.28 “Force Sampling” or “Force Average”, the setting is not done.

Monitoring of the force during welding
No.12 “After Weld Force LO” (after-welding force lower limit)
No.13 “After Weld Force UP” (after-welding force upper limit)

⑥Set the level output according to your use conditions.

Use of the force level output
No.17 “Force Level1”
No.18 “Force Level2”
No.19 “Force Level3”

⑦Set the weld start output force value to your use conditions.

Setting of the weld start output force value
No.21 “Tangential Force”

c. Measurement

①Press MONI key to display the normal screen.

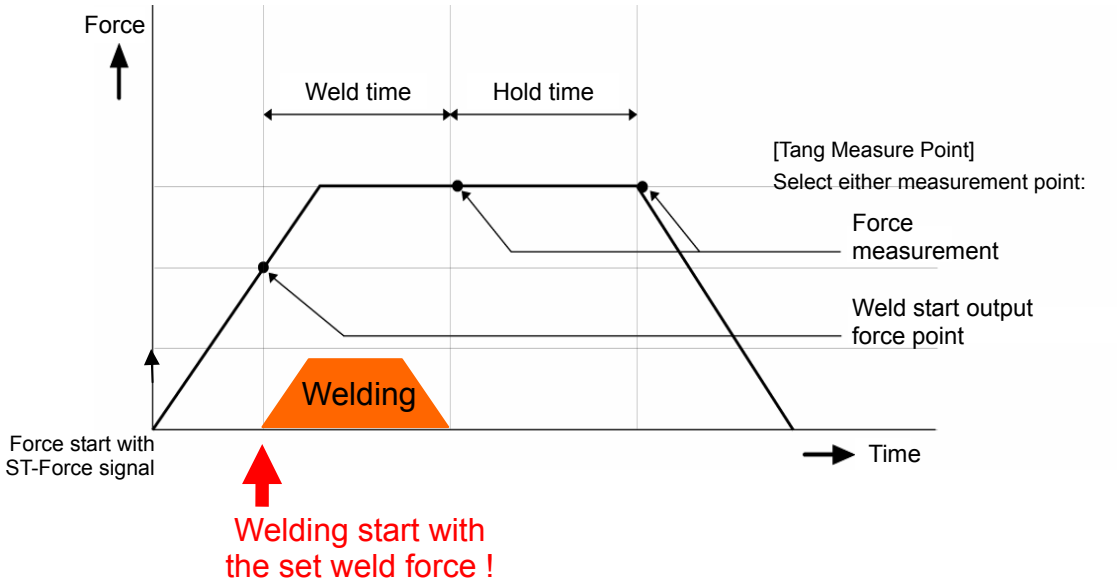
②Set the schedule by selecting schedule switching signals “SCH1”, “SCH2”, “SCH4”, “SCH8”, “SCH16”, “SCH32”, and “SCH64” or via the panel.

③Apply the force to the load cell with the ready state. When the force value reached the setting of No.21 “Tangential Force”, the sequence moves to Weld-Time and the measurement is done.
“ST-FORCE1” or “ST-FORCE2” (second axis) is not used. Also, two axes do not start simultaneously.

(9) Tangential Mode “Force Measure Mode : TANG(3)”

This is the mode for measuring force. The welding starts when the set weld force value is reached, and the after-welding force can be measured and judged.

The welding can be started with a given weld force.



a. Setting of measurement mode

①Press FUN, 0 and ENT keys in this order to select “0=Setup”.

②Select the setting object between “Axis1(0)” (first axis) and “Axis2(1)” (second axis).

③Set No.3 “Disp Measure Mode” (measurement mode of displacement sensor) to an item other than “SYNC(0)” (synchro mode); “SQNC(1)” (sequence mode), “SH1(2)”, “SH2(3)”, or “SH3(4)” (sample hold mode).

④Set the rated capacity of the connected load cell in No.4 “L.C. Rated Capacity”. The rated capacity of the load cell is shown on the certificate of the load cell.

⑤Select the force unit from “N(0)”, “kgf(1)”, and “lbf(2)” in No.5 “Loadcell Unit”.

⑥Set the rated output of the connected load cell in No.6 “L.C. Rated Output”. The rated output of the load cell is shown on the certificate of the load cell.

⑦When there is a limit switch for force check, set No.7 “LS Input Validity” (use of force-detecting signal input) to “Valid(0)”. When not using the force-detecting signal (LS), set it to “Invalid(1)”.

⑧Set No.8 “Force Measure Mode” (measurement mode of load cell) to “TANG(3)” (tangential mode).

⑨Set the measurement point for “After Weld Force” in No.24 “Tang Measure Point” to “Weld(0)” or “Hold(1)”.

b. Setting of measurement schedule

①Press MONI key to display the normal screen.

②Press SCH key to select “SCH Axis”.

③Select the setting object between “Axis1(0)” (first axis) and “Axis2(1)” (second axis) to set the schedule number.

④Set No.1 “Squeeze-Time”, No.2 “Weld-Time”, and No.3 “Hold-Time” to the time longer than the set time for the welding power supply. Set the weld time to the time longer than the set time for the welding power supply.

⑤Set the monitoring level according to your use conditions.

Monitoring of the before-welding force
No.10 “Before Weld Force LO” (before-welding force lower limit)
No.11 “Before Weld Force UP” (before-welding force upper limit)

Monitoring of the after-welding force
No.12 “After Weld Force LO” (after-welding force lower limit)
No.13 “After Weld Force UP” (after-welding force upper limit)

⑥Set the level output according to your use conditions.

Use of the force level output
No.17 “Force Level1”
No.18 “Force Level2”
No.19 “Force Level3”

⑦Set the weld start output force value to your use conditions.

Setting of the weld start output force value
No.21 “Tangential Force”

c. Measurement

①Press MONI key to display the normal screen.

②Set the schedule by selecting schedule switching signals “SCH1”, “SCH2”, “SCH4”, “SCH8”, “SCH16”, “SCH32”, and “SCH64” or via the panel.

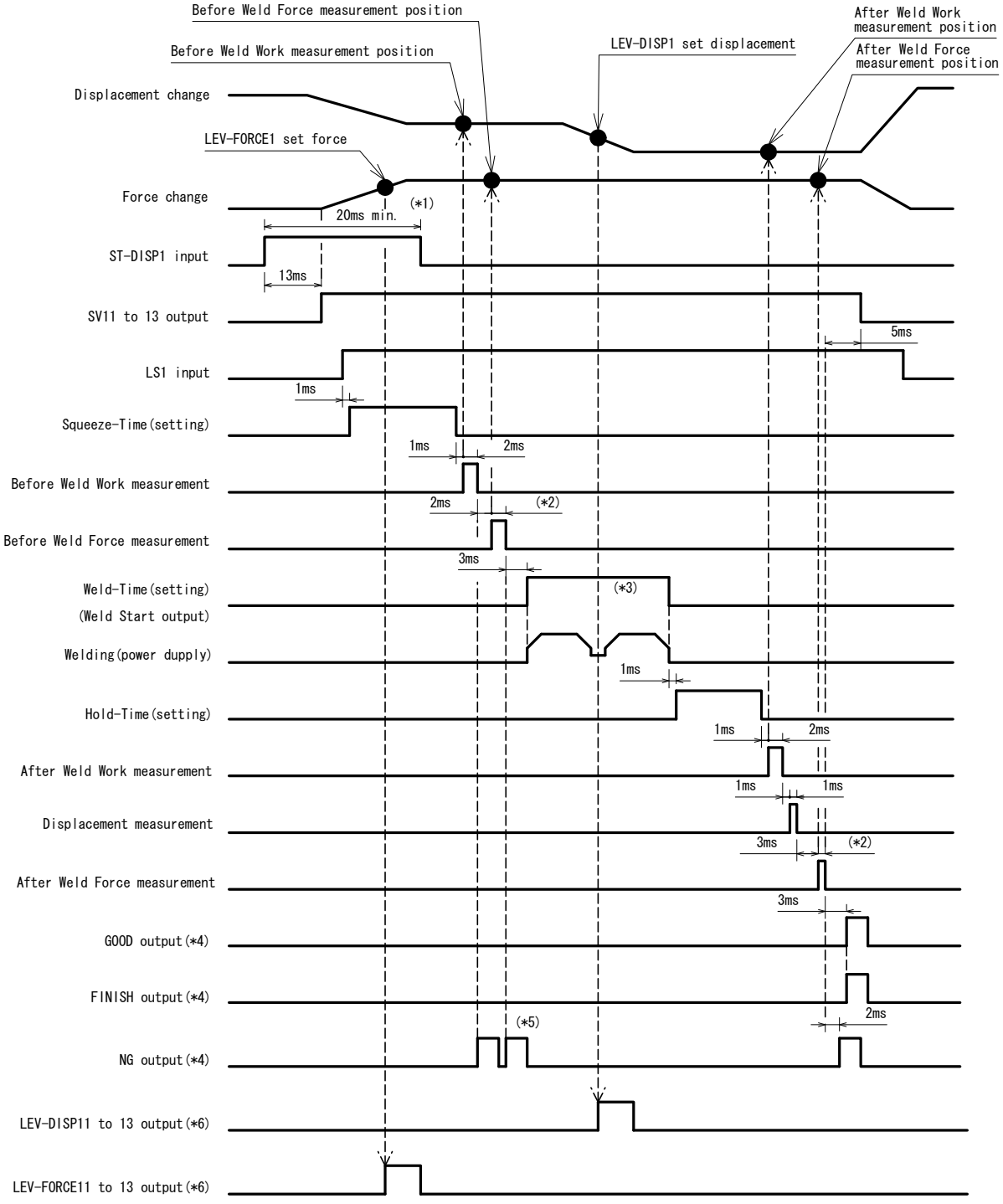
③Input “ST-FORCE1” or “ST-FORCE2” (second axis) to make a measurement.

11. Timing Chart (1-axis Type)

(1) Synchro Mode “Disp Measure Mode : SYNC(0)”

When 0=Setup parameter of the function menu is set as follows:

① Disp Measure Mode setting: SYNC(0)
② LS Input Validity setting: Valid(0)
③ Self Hold Validity setting: Valid(0)



*1 When Self Hold Validity is set to Invalid(1), hold the ST-DISP input until the vibration check ends.

*2 The output time of Before/After Weld Time varies depending on settings of Force Sampling and Force Average.

*3 Set the time longer than the total weld time of welding machine for Weld-Time.

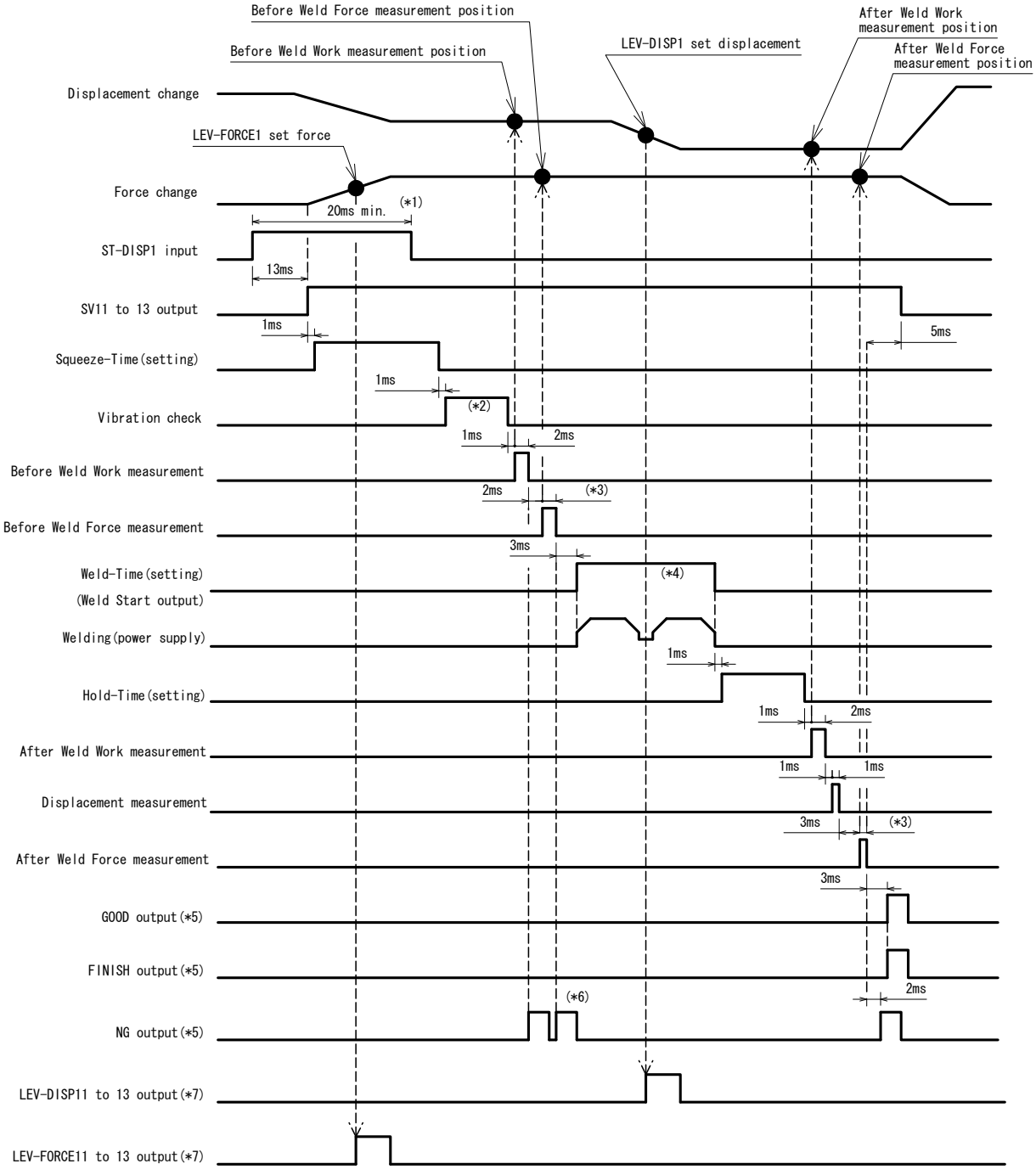
*4 The output time can be selected with Output Select Time.

*5 When NG is output, the sequence ends.

*6 The output time can be selected with Level Select Time.

When 0=Setup parameter of the function menu is set as follows:

① Disp Measure Mode setting: SYNC(0)
② LS Input Validity setting: Invalid(1)
③ Self Hold Validity setting: Valid(0)



*1 When Self Hold Validity is set to Invalid(1), hold the ST-DISP input until the vibration check ends.

*2 Varies depending on the allowable vibration range setting and vibration stability time.

*3 The output time of Before/After Weld Time varies depending on settings of Force Sampling and Force Average.

*4 Set the time longer than the total weld time of welding machine for Weld-Time.

*5 The output time can be selected with Output Select Time.

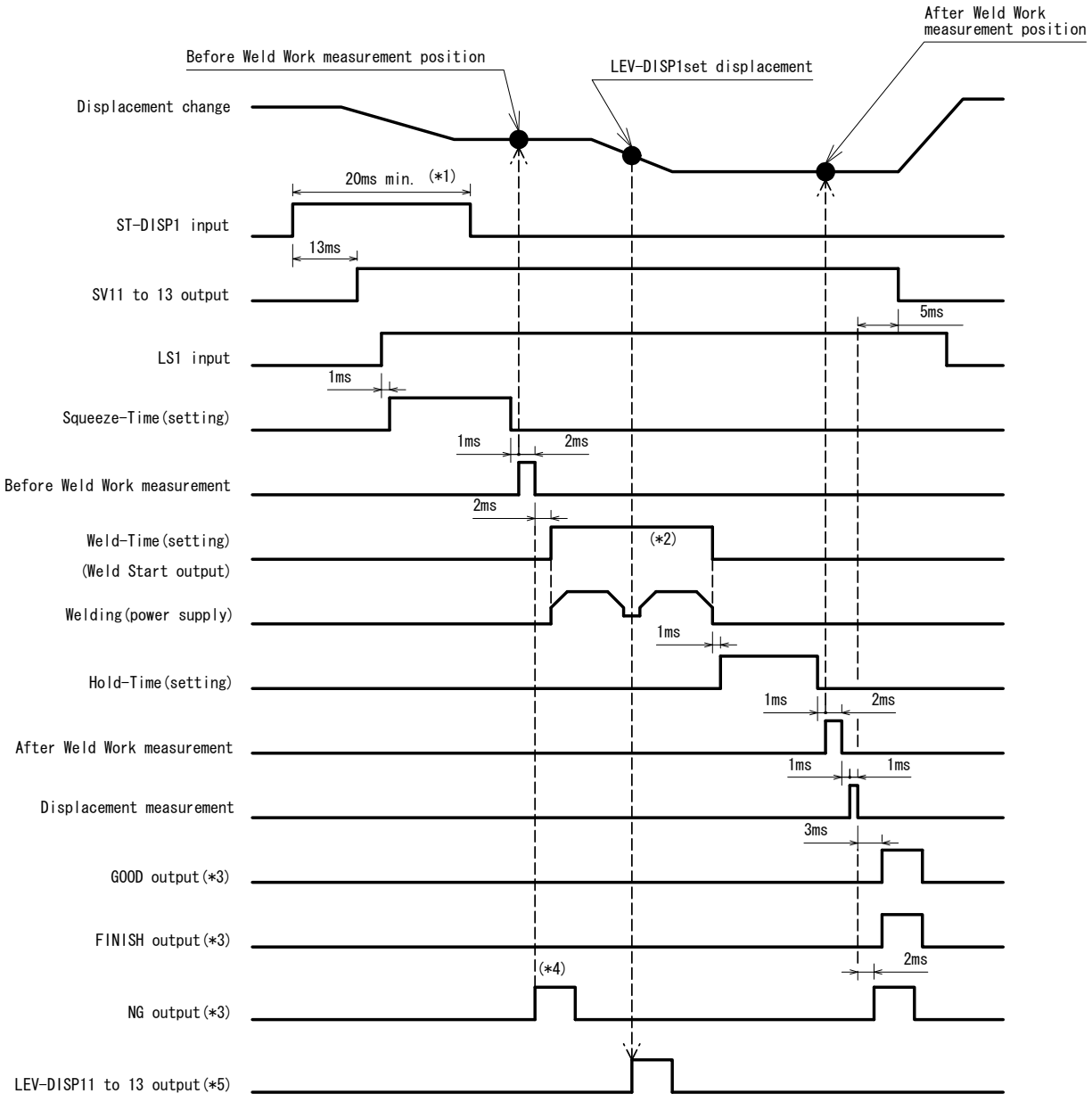
*6 When NG is output, the sequence ends.

*7 The output time can be selected with Level Select Time.

(2) Sequence Mode “Disp Measure Mode : SQNC(1)”

When 0=Setup parameter of the function menu is set as follows:

① Disp Measure Mode setting: SQNC(1)
② LS Input Validity setting: Valid(0)
③ Self Hold Validity setting: Valid(0)



*1 When Self Hold Validity is set to Invalid(1), hold the ST-DISP input until the vibration check ends.

*2 Set the time longer than the total weld time of welding machine for Weld-Time.

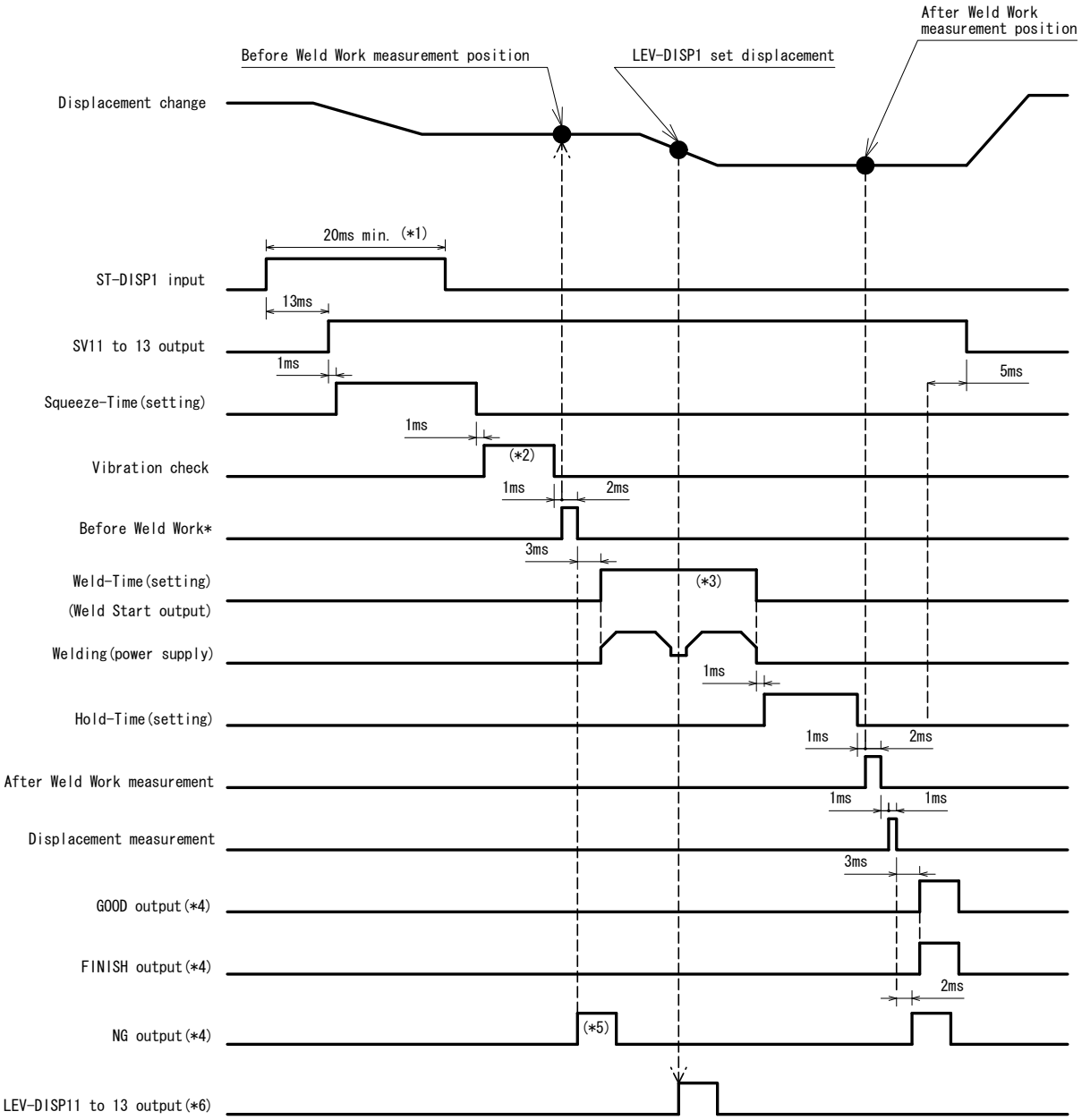
*3 The output time can be selected with Output Select Time.

*4 When NG is output, the sequence ends.

*5 The output time can be selected with Level Select Time.

When 0=Setup parameter of the function menu is set as follows:

① Disp Measure Mode setting: SQNC(1)
② LS Input Validity setting: Invalid(1)
③ Self Hold Validity setting: Valid(0)



*1 When Self Hold Validity is set to Invalid(1), hold the ST-DISP input until the vibration check ends.

*2 Varies depending on the allowable vibration range setting and vibration stability time.

*3 Set the time longer than the total weld time of welding machine for Weld-Time.

*4 The output time can be selected with Output Select Time.

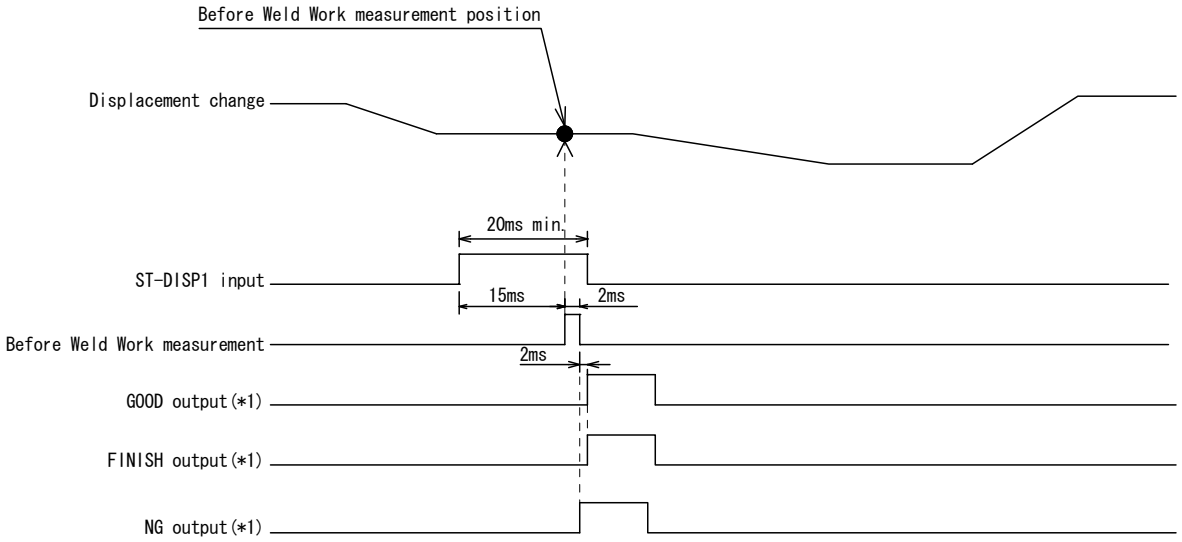
*5 When NG is output, the sequence ends.

*6 The output time can be selected with Level Select Time.

(3) Sample Hold 1 Mode “Disp Measure Mode : SH1(2)”

When 0=Setup parameter of the function menu is set as follows:

① Disp Measure Mode setting: SH1(2)

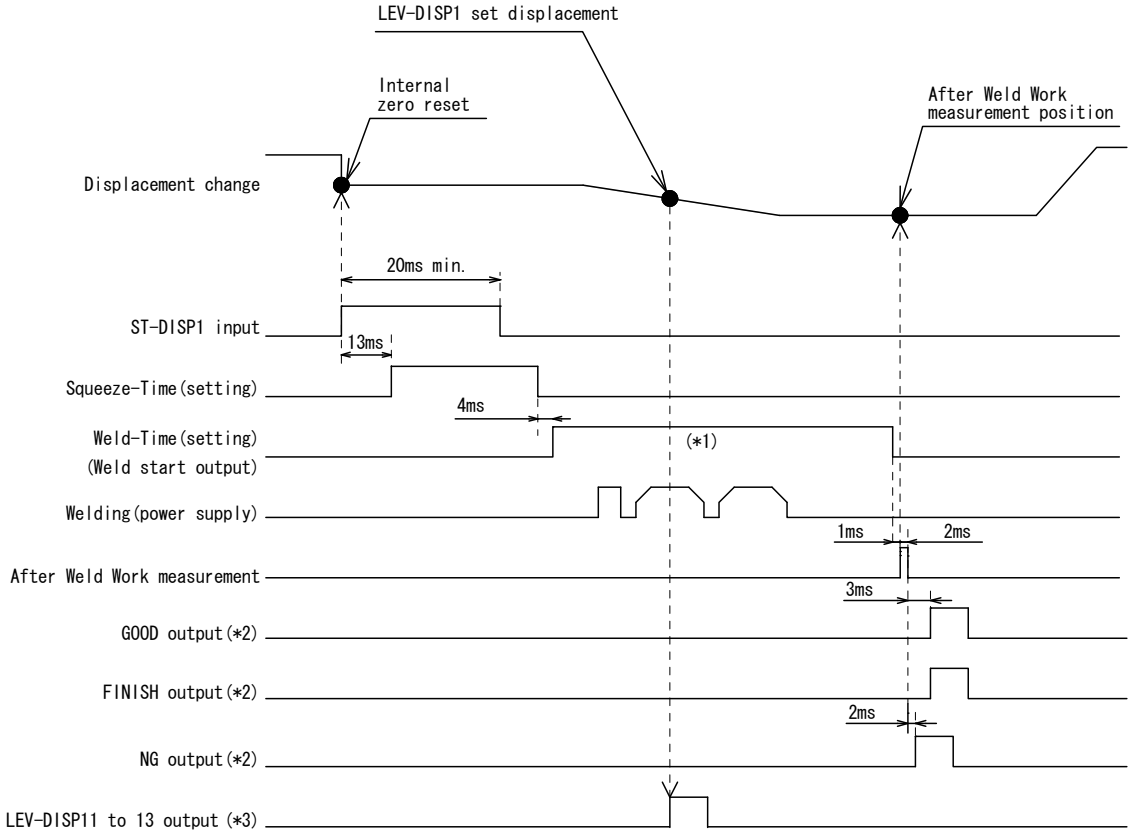


*1 The output time can be selected with Output Select Time.

(4) Sample Hold 2 Mode “Disp Measure Mode : SH2(3)”

When 0=Setup parameter of the function menu is set as follows:

① Disp Measure Mode setting: SH2(3)



*1 Set the time longer than the total weld time of welding machine for Weld-Time.

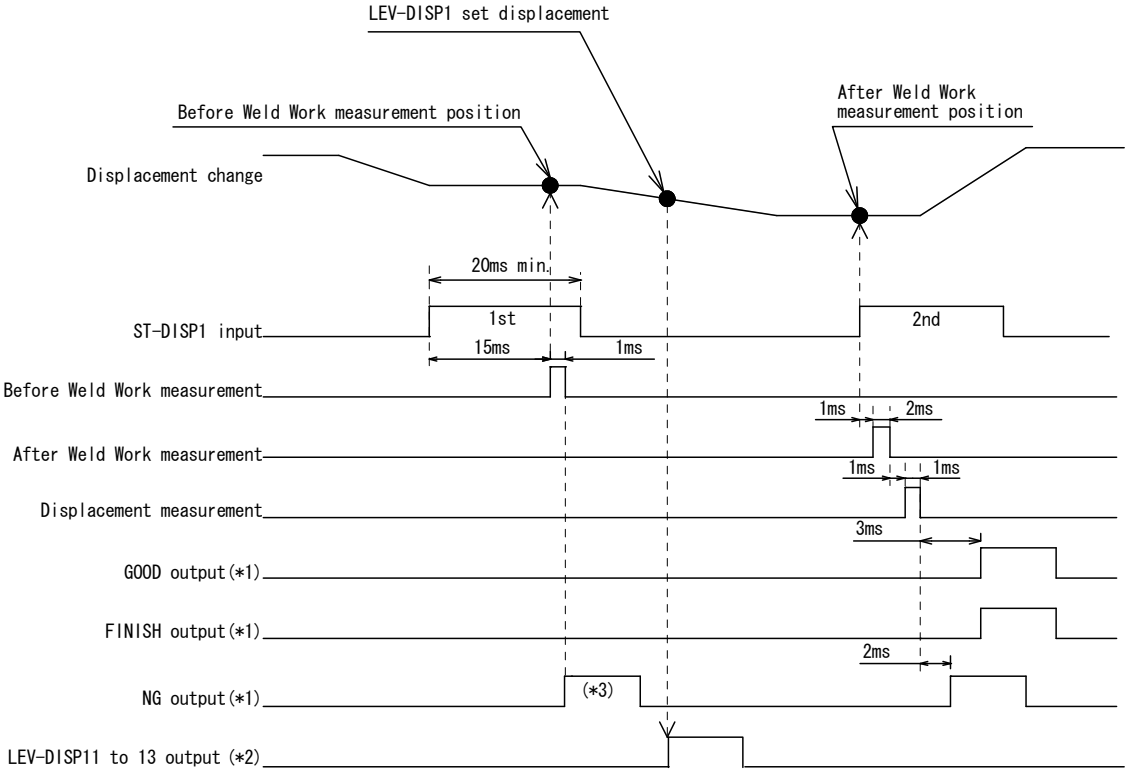
*2 The output time can be selected with Output Select Time.

*3 The output time can be selected with Level Select Time.

(5) Sample Hold 3 Mode “Disp Measure Mode : SH3(4)”

When 0=Setup parameter of the function menu is set as follows:

① Disp Measure Mode setting: SH3(4)



*1 The output time can be selected with Output Select Time.

*2 The output time can be selected with Level Select Time.

*3 When NG is output, the sequence ends.

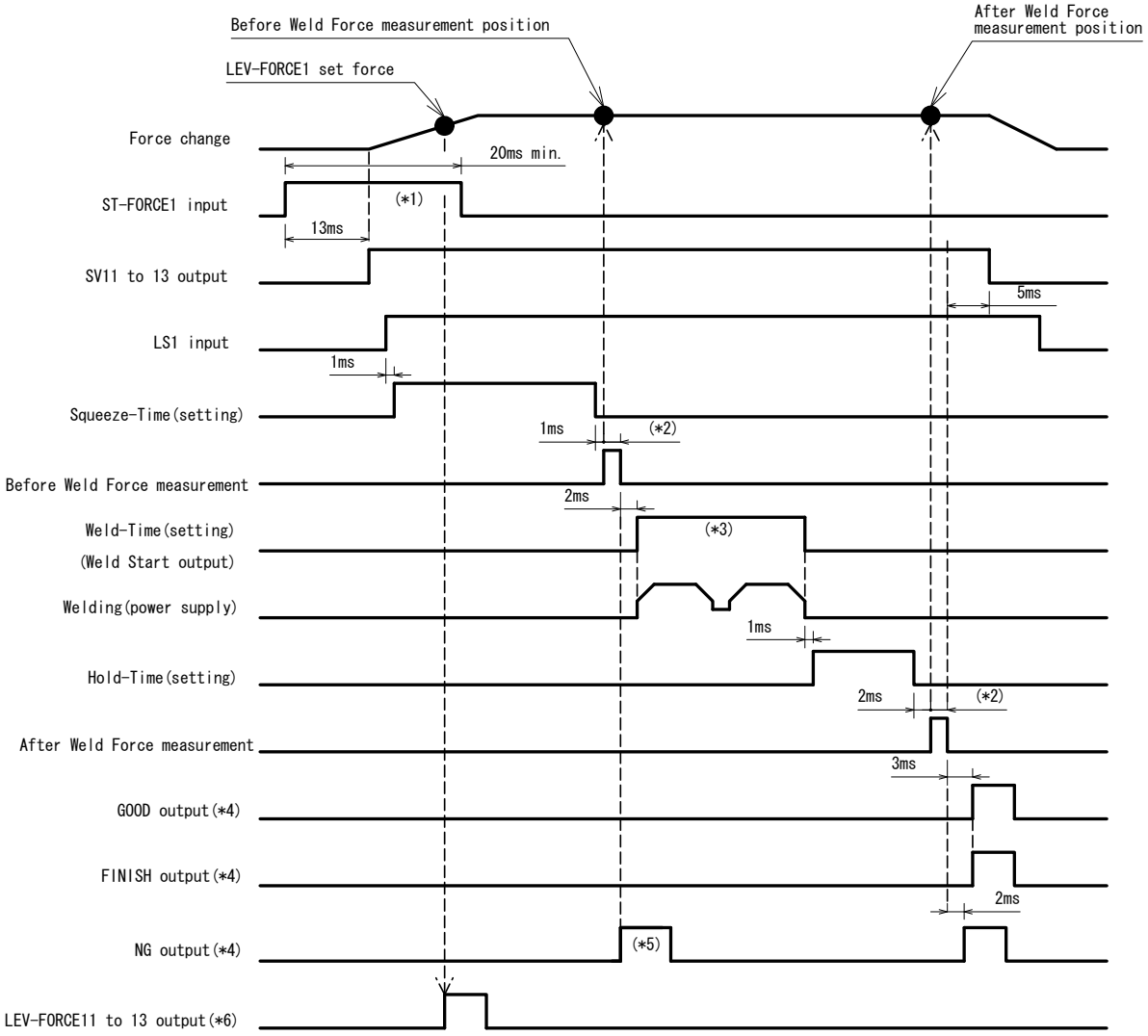
(6) Sequence Mode “Force Measure Mode : SQNC(0)”

When 0=Setup parameter of the function menu is set as follows:

① Force Measure Mode setting: SQNC(0)

② LS Input Validity setting: Valid(0)

③ Self Hold Validity setting: Valid(0)



*1 When Self Hold Validity is set to Invalid(1), hold the ST-FORCE input until the vibration check ends.

*2 The output time of Before/After Weld Time varies depending on settings of Force Sampling and Force Average.

*3 Set the time longer than the total weld time of welding machine for Weld-Time.

*4 The output time can be selected with Output Select Time.

*5 When NG is output, the sequence ends.

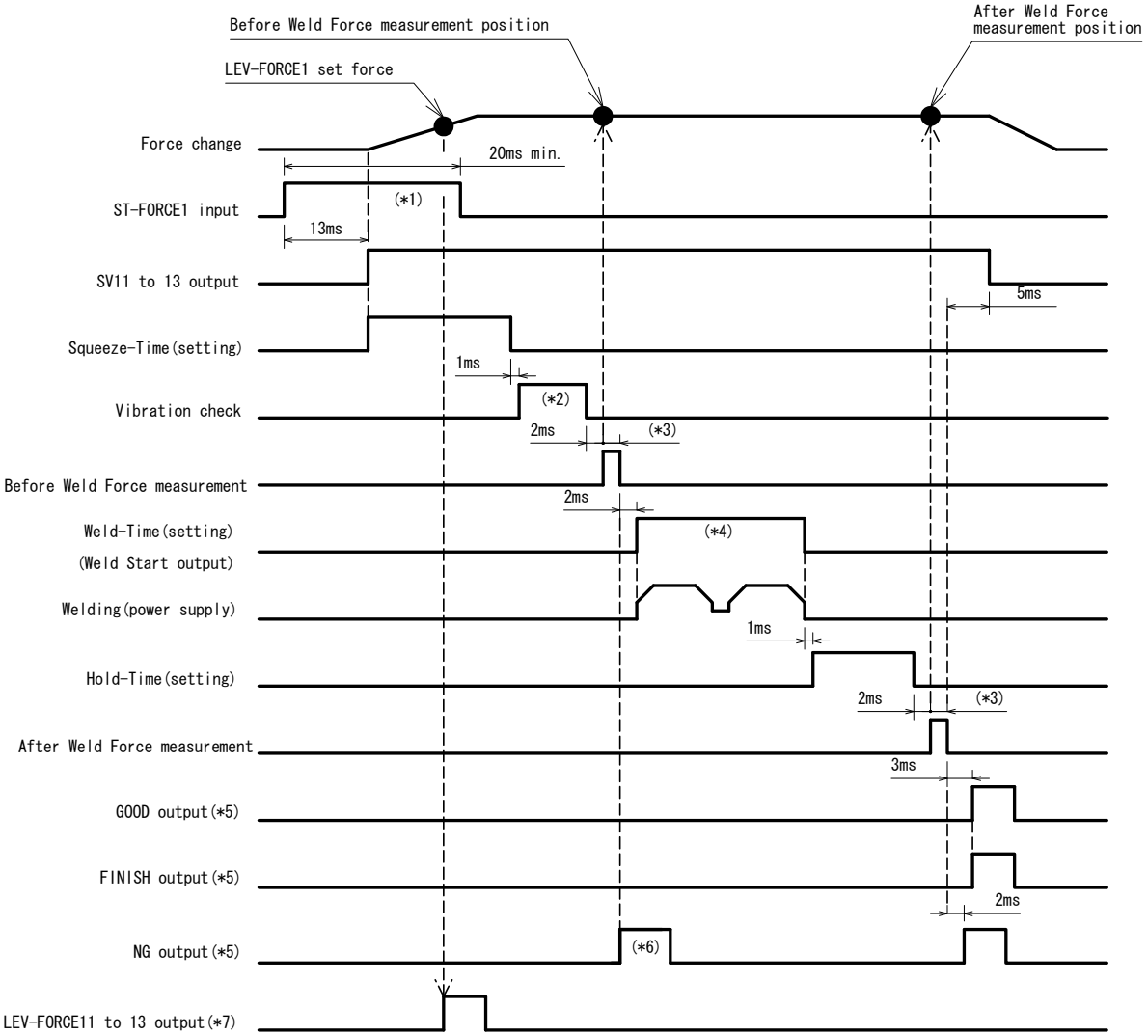
*6 The output time can be selected with Level Select Time.

When 0=Setup parameter of the function menu is set as follows:

① Force Measure Mode setting: SQNC(0)

② LS Input Validity setting: Invalid(1)

③ Self Hold Validity setting: Valid(0)



*1 When Self Hold Validity is set to Invalid(1), hold the ST-FORCE input until the vibration check ends.

*2 Varies depending on the allowable vibration range setting and vibration stability time.

*3 The output time of Before/After Weld Time varies depending on settings of Force Sampling and Force Average.

*4 Set the time longer than the total weld time of welding machine for Weld-Time.

*5 The output time can be selected with Output Select Time.

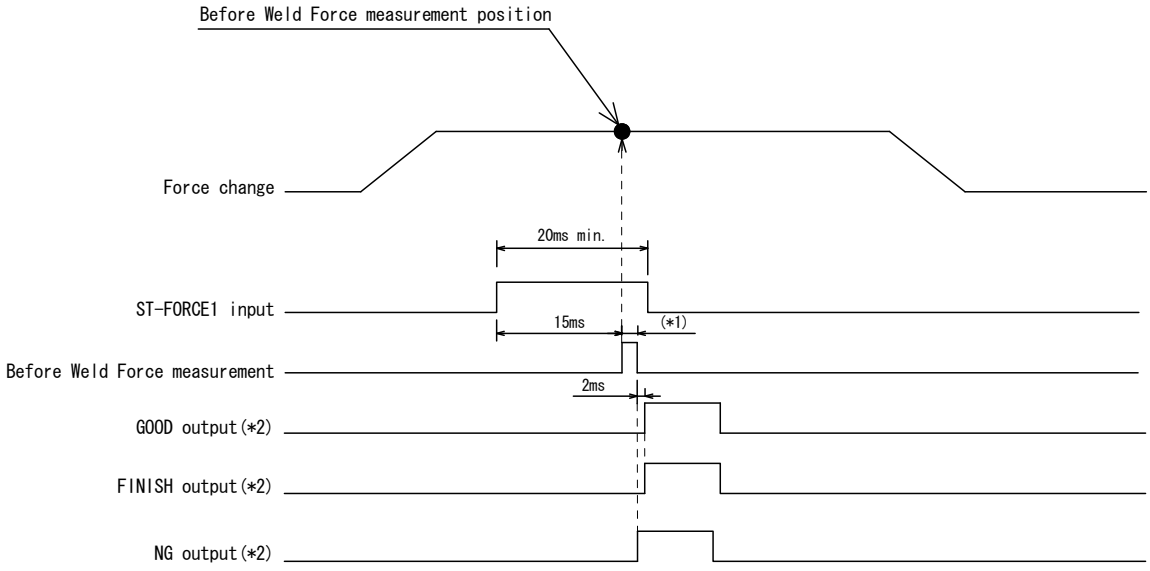
*6 When NG is output, the sequence ends.

*7 The output time can be selected with Level Select Time.

(7) Sample Hold 1 Mode “Force Measure Mode : SH1(1)”

When 0=Setup parameter of the function menu is set as follows:

① Force Measure Mode setting: SH1(1)



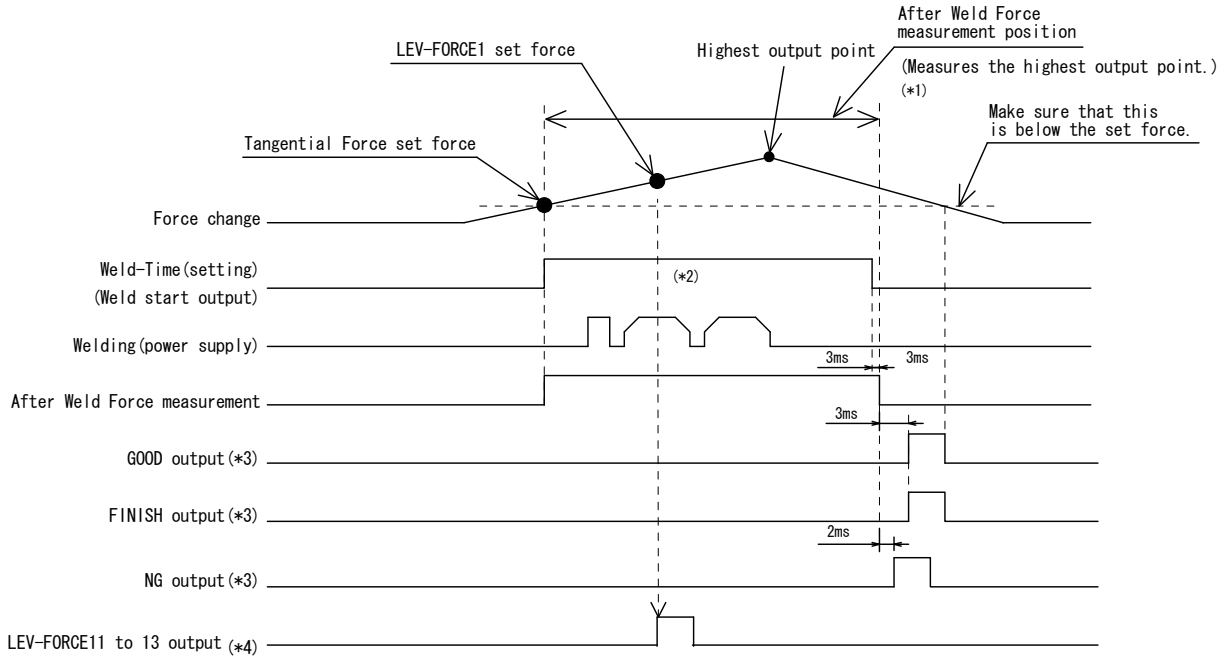
*1 The output time of Before Weld Time varies depending on settings of Force Sampling and Force Average.

*2 The output time can be selected with Output Select Time.

(8) Sample Hold 1 Mode “Force Measure Mode : SH2(2)”

When 0=Setup parameter of the function menu is set as follows:

① Force Measure Mode setting: SH2(2)



*1 When After Weld Time measurement time exceeds Weld-Time depending on settings of Force Sampling and Force Average, “-----” is displayed.

*2 Set the time longer than the total weld time of welding machine for Weld-Time.

*3 The output time can be selected with Output Select Time.

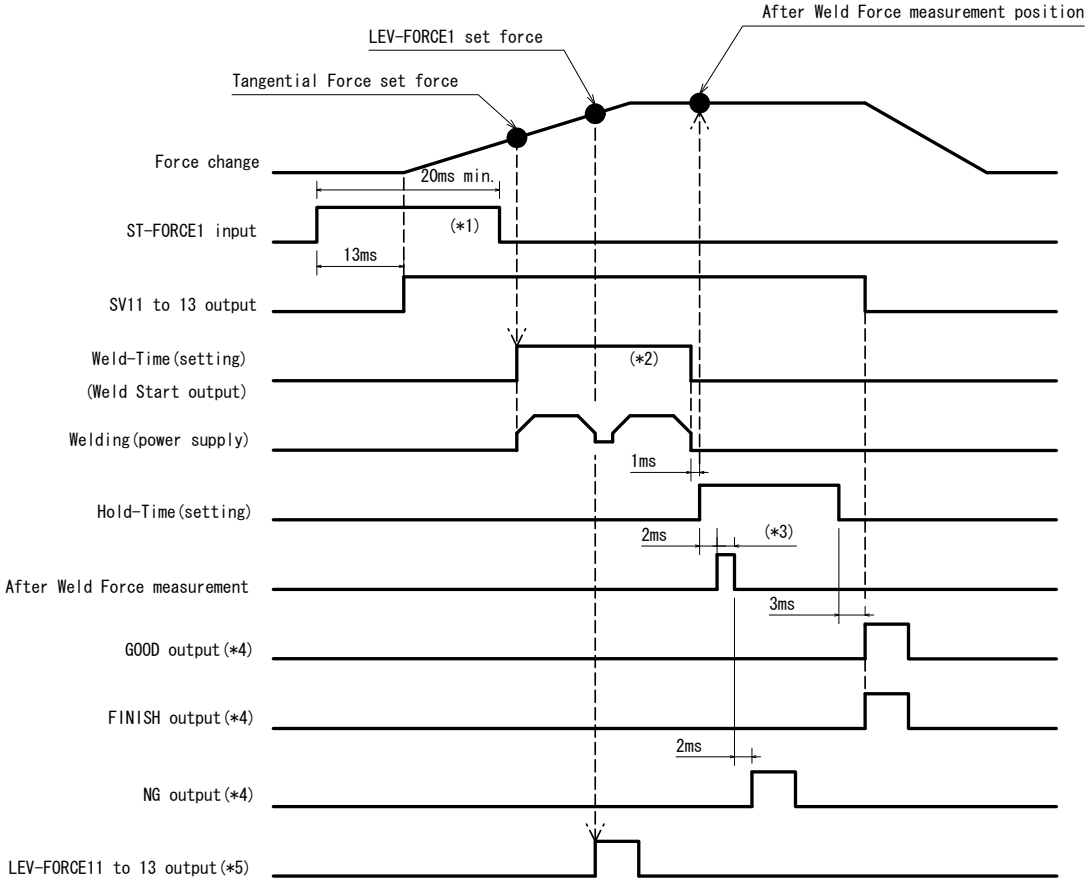
*4 The output time can be selected with Level Select Time.

*5 Since the Weld Start is output when the sequence reaches the Tangential Force setting in this mode, simultaneous start is not performed in 2-axis type.

(9) Tangential Mode “Force Measure Mode : TANG(3)”

When 0=Setup parameter of the function menu is set as follows:

① Force Measure Mode setting: TANG(3)
② Tang Measure Point setting: Weld(0)



*1 When Self Hold Validity is set to Invalid(1), hold the ST-FORCE input until the sequence moves to Weld-Time.

*2 Set the time longer than the total weld time of welding machine for Weld-Time.

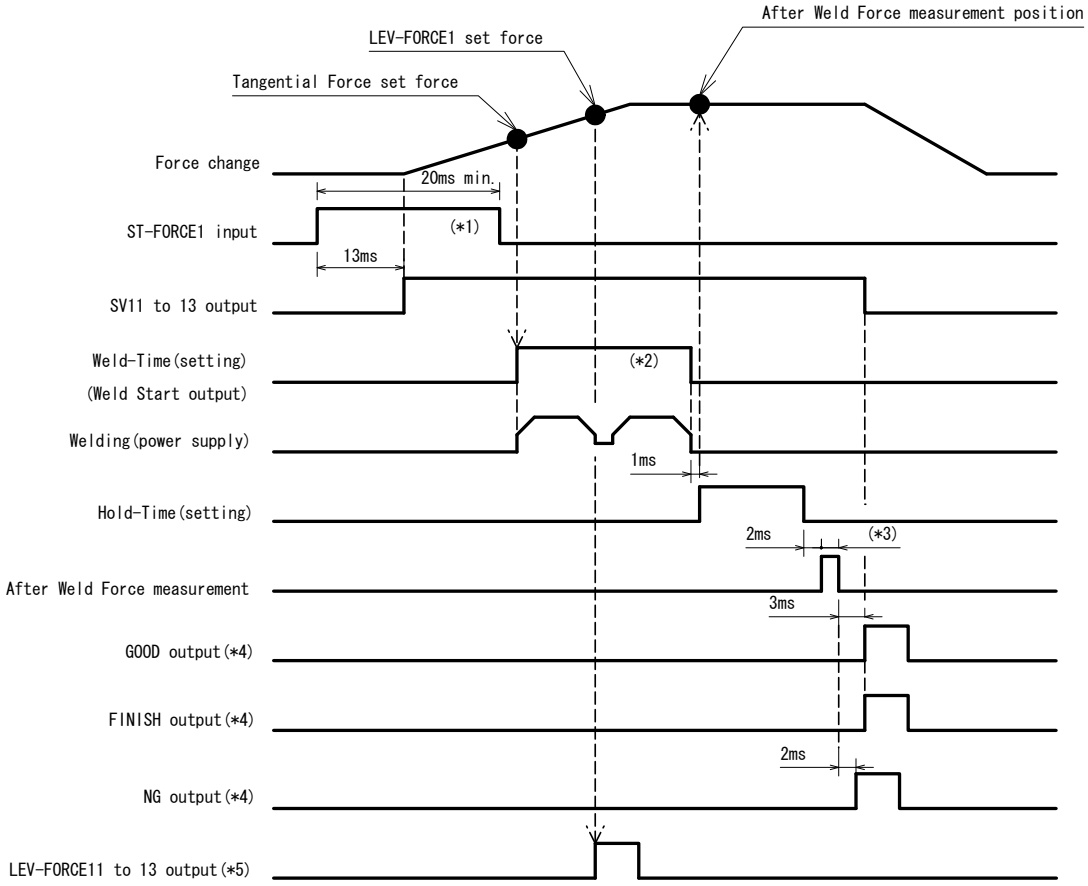
*3 The output time of After Weld Time varies depending on settings of Force Sampling and Force Average.

*4 The output time can be selected with Output Select Time.

*5 The output time can be selected with Level Select Time.

When 0=Setup parameter of the function menu is set as follows:

① Force Measure Mode setting: TANG(3)
② Tang Measure Point setting: Hold(1)



*1 When Self Hold Validity is set to Invalid(1), hold the ST-FORCE input until the sequence moves to Weld-Time.

*2 Set the time longer than the total weld time of welding machine for Weld-Time.

*3 The output time of After Weld Time varies depending on settings of Force Sampling and Force Average.

*4 The output time can be selected with Output Select Time.

*5 The output time can be selected with Level Select Time.

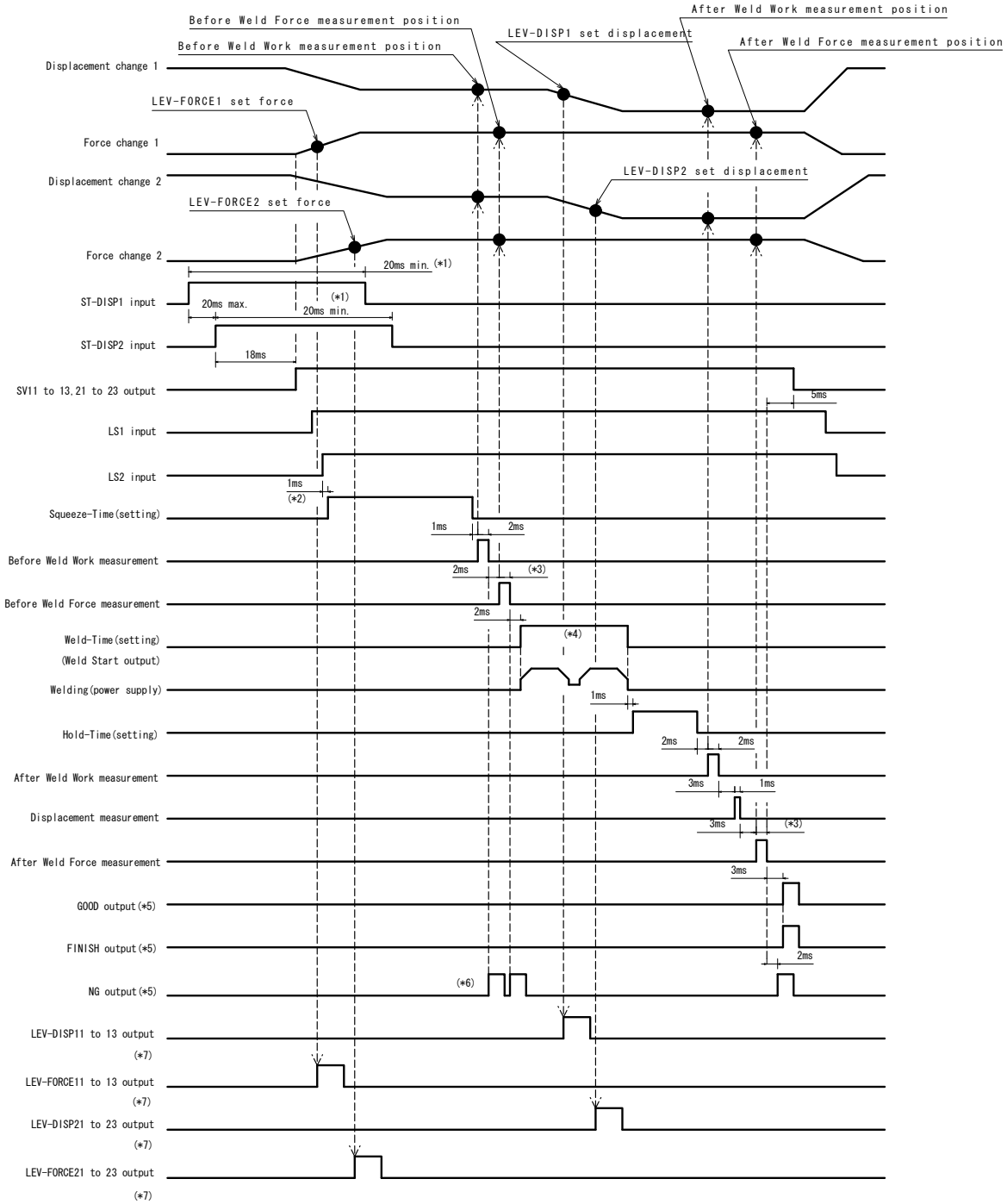
12. Timing Chart (2-axis Type)

Timing charts when ST-DISP(FORCE)1 and 2 are simultaneously turned on are shown below.
Both setup parameters and Squeeze/Weld/Hold Time operate with settings of Axis1.

(1) Synchro Mode “Disp Measure Mode : SYNC(0)”

When 0=Setup parameter of the function menu is set as follows:

① Disp Measure Mode setting: SYNC(0)
② LS Input Validity setting: Valid(0)
③ Self Hold Validity setting: Valid(0)



*1 When Self Hold Validity is set to Invalid(1), hold the ST-DISP input until the sequence moves to Weld-Time.

*2 Time from when both LS1 and 2 are input.

*3 The output time of Before/After Weld Time varies depending on settings of Force Sampling and Force Average.

*4 Set the time longer than the total weld time of welding machine for Weld-Time.

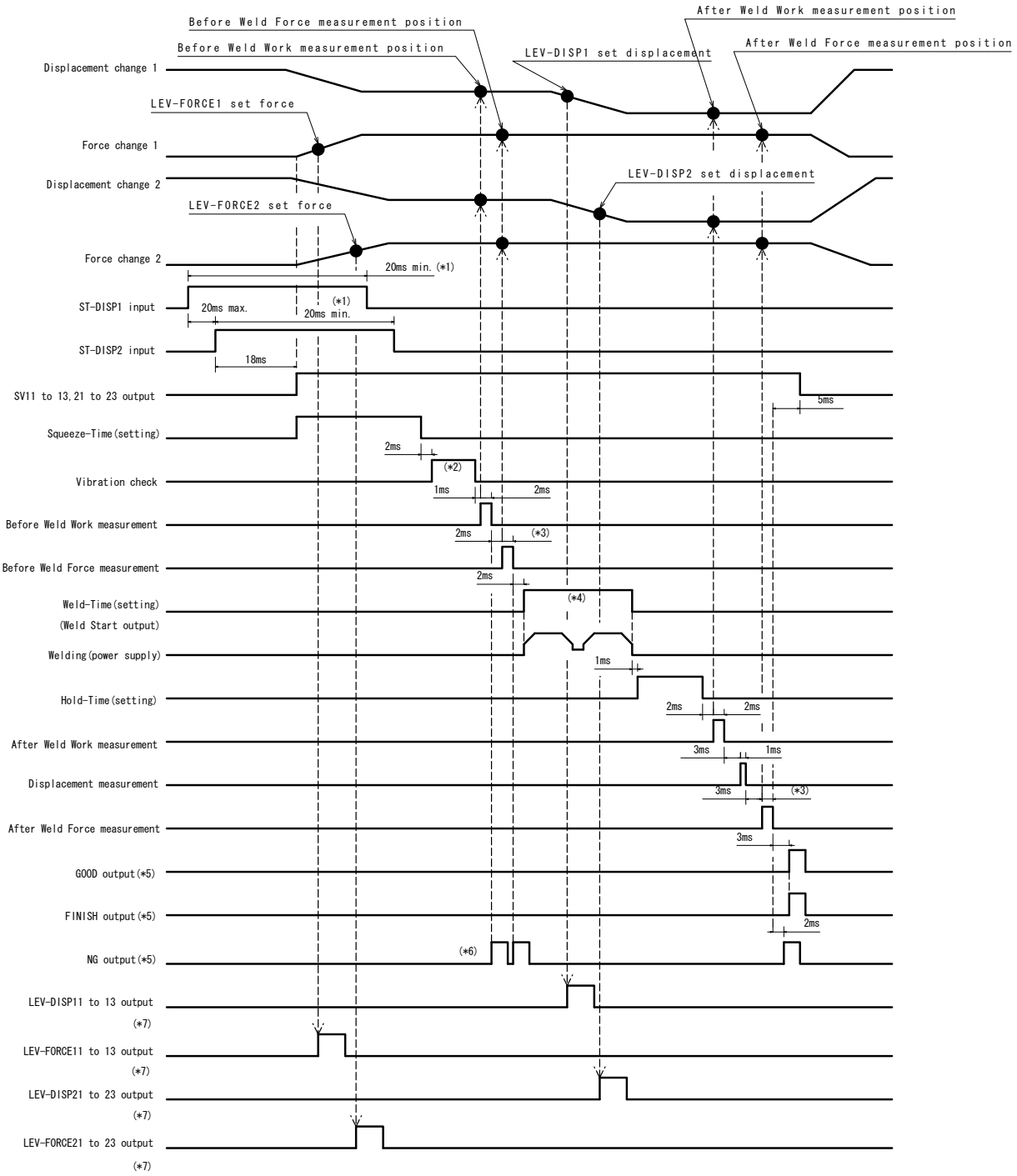
*5 The output time can be selected with Output Select Time.

*6 When NG is output, the sequence ends.

*7 The output time can be selected with Level Select Time.

When 0=Setup parameter of the function menu is set as follows:

① Disp Measure Mode setting: SYNC(0)
② LS Input Validity setting: Invalid(1)
③ Self Hold Validity setting: Valid(0)



*1 When Self Hold Validity is set to Invalid(1), hold the ST-DISP input until the sequence moves to Weld-Time.

*2 Varies depending on the allowable vibration range setting and vibration stability time.

*3 The output time of Before/After Weld Time varies depending on settings of Force Sampling and Force Average.

*4 Set the time longer than the total weld time of welding machine for Weld-Time.

*5 The output time can be selected with Output Select Time.

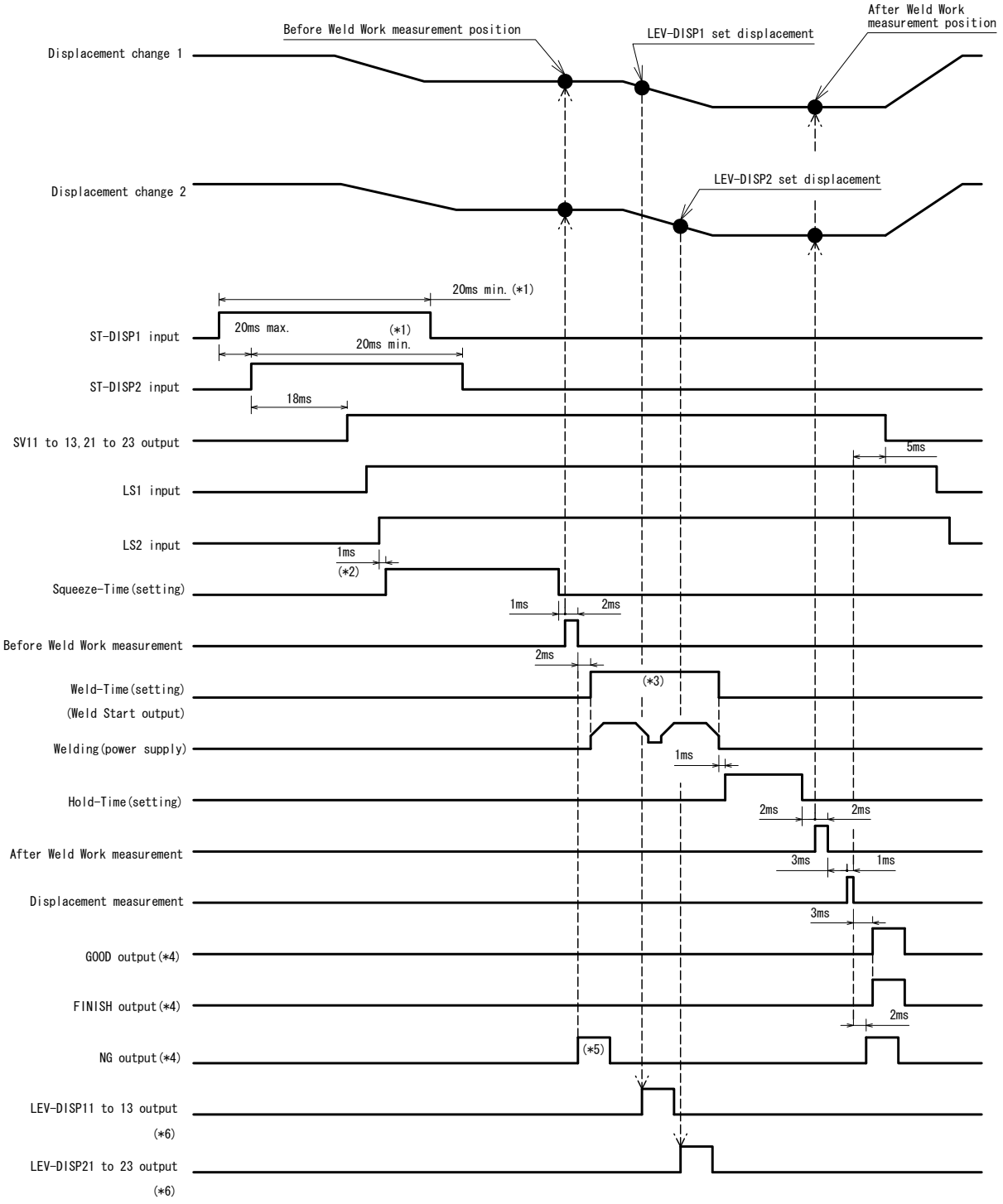
*6 When NG is output, the sequence ends.

*7 The output time can be selected with Level Select Time.

(2) Sequence Mode “Disp Measure Mode : SQNC(1)”

When 0=Setup parameter of the function menu is set as follows:

① Disp Measure Mode setting: SQNC(1)
② LS Input Validity setting: Valid(0)
③ Self Hold Validity setting: Valid(0)



*1 When Self Hold Validity is set to Invalid(1), hold the ST-DISP input until the sequence moves to Weld-Time.

*2 Set the time longer than the total weld time of welding machine for Weld-Time.

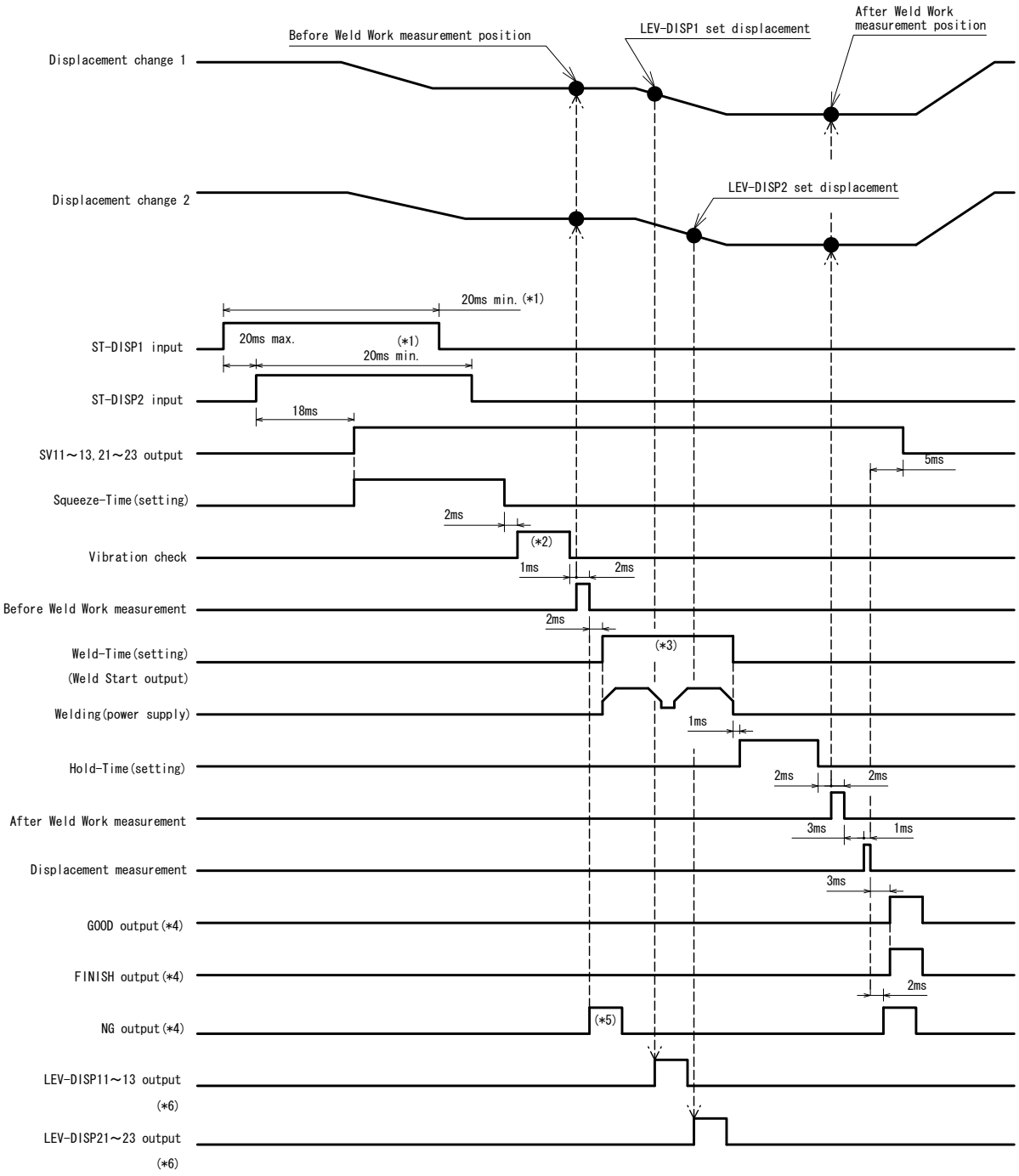
*3 The output time can be selected with Output Select Time.

*4 When NG is output, the sequence ends.

*5 The output time can be selected with Level Select Time.

When 0=Setup parameter of the function menu is set as follows:

① Disp Measure Mode setting: SQNC(1)
② LS Input Validity setting: Invalid(1)
③ Self Hold Validity setting: Valid(0)



*1 When Self Hold Validity is set to Invalid(1), hold the ST-DISP input until the sequence moves to Weld-Time.

*2 Varies depending on the allowable vibration range setting and vibration stability time.

*3 Set the time longer than the total weld time of welding machine for Weld-Time.

*4 The output time can be selected with Output Select Time.

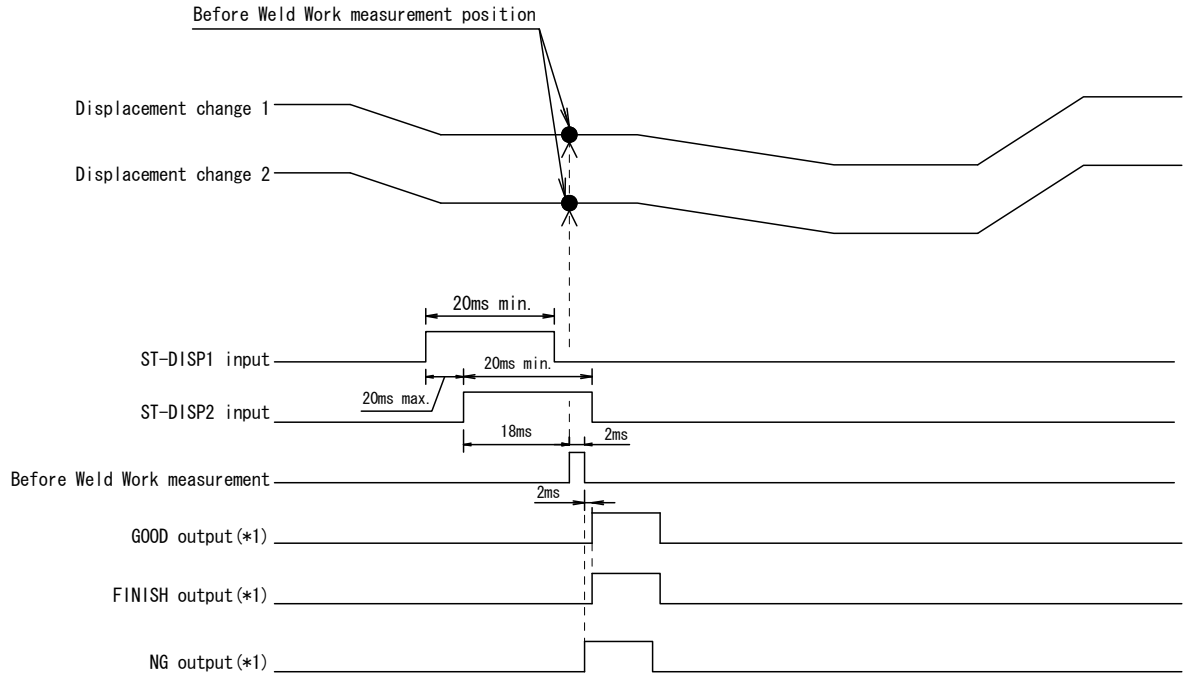
*5 When NG is output, the sequence ends.

*6 The output time can be selected with Level Select Time.

(3) Sample Hold 1 Mode “Disp Measure Mode : SH1(2)”

When 0=Setup parameter of the function menu is set as follows:

① Disp Measure Mode setting: SH1(2)

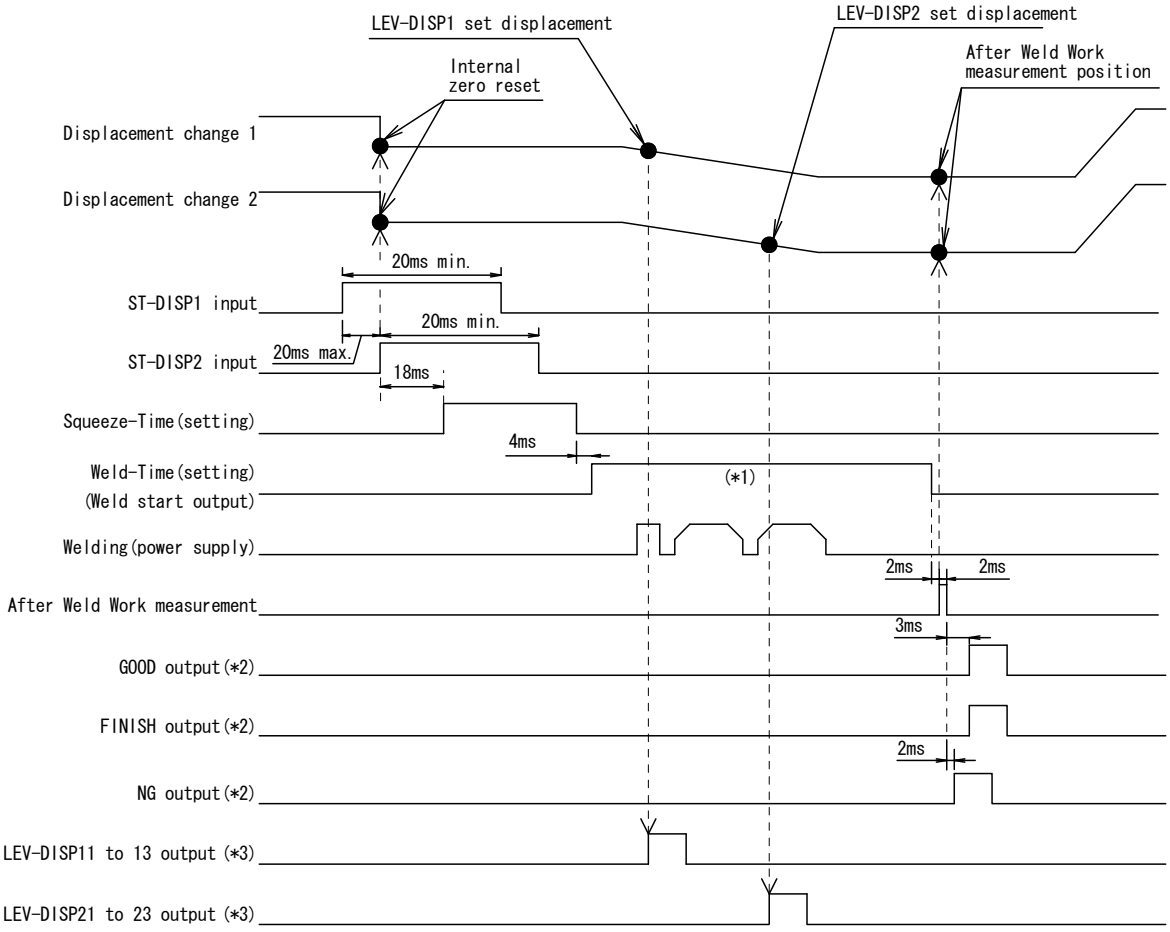


*1 The output time can be selected with Output Select Time.

(4) Sample Hold 2 Mode “Disp Measure Mode : SH2(3)”

When 0=Setup parameter of the function menu is set as follows:

① Disp Measure Mode setting: SH2(3)



*1 Set the time longer than the total weld time of welding machine for Weld-Time.

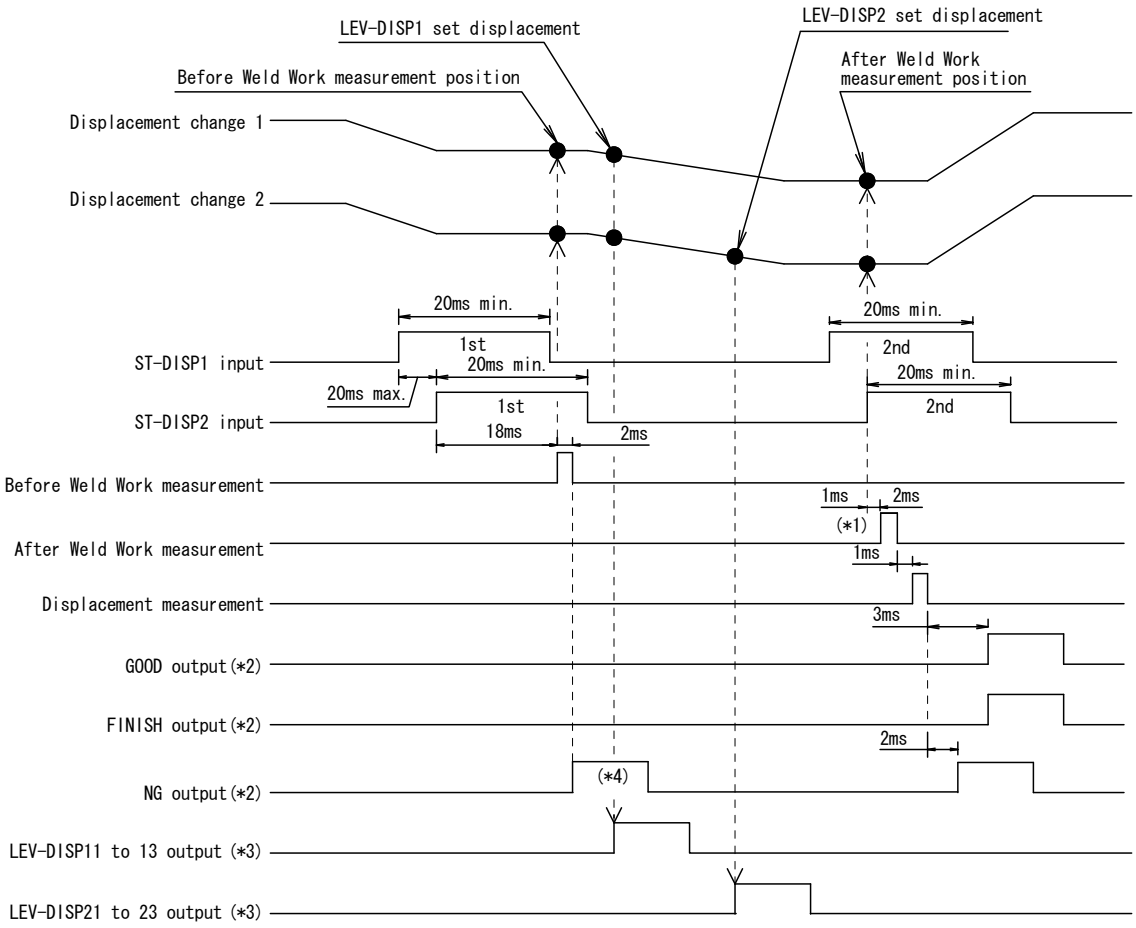
*2 The output time can be selected with Output Select Time.

*3 The output time can be selected with Level Select Time.

(5) Sample Hold 3 Mode “Disp Measure Mode : SH3(4)”

When 0=Setup parameter of the function menu is set as follows:

① Disp Measure Mode setting: SH3(4)



*1 Time from when both ST-DISP1 and 2 (second time) are input.

*2 The output time can be selected with Output Select Time.

*3 The output time can be selected with Level Select Time.

*4 When NG is output, the sequence ends.

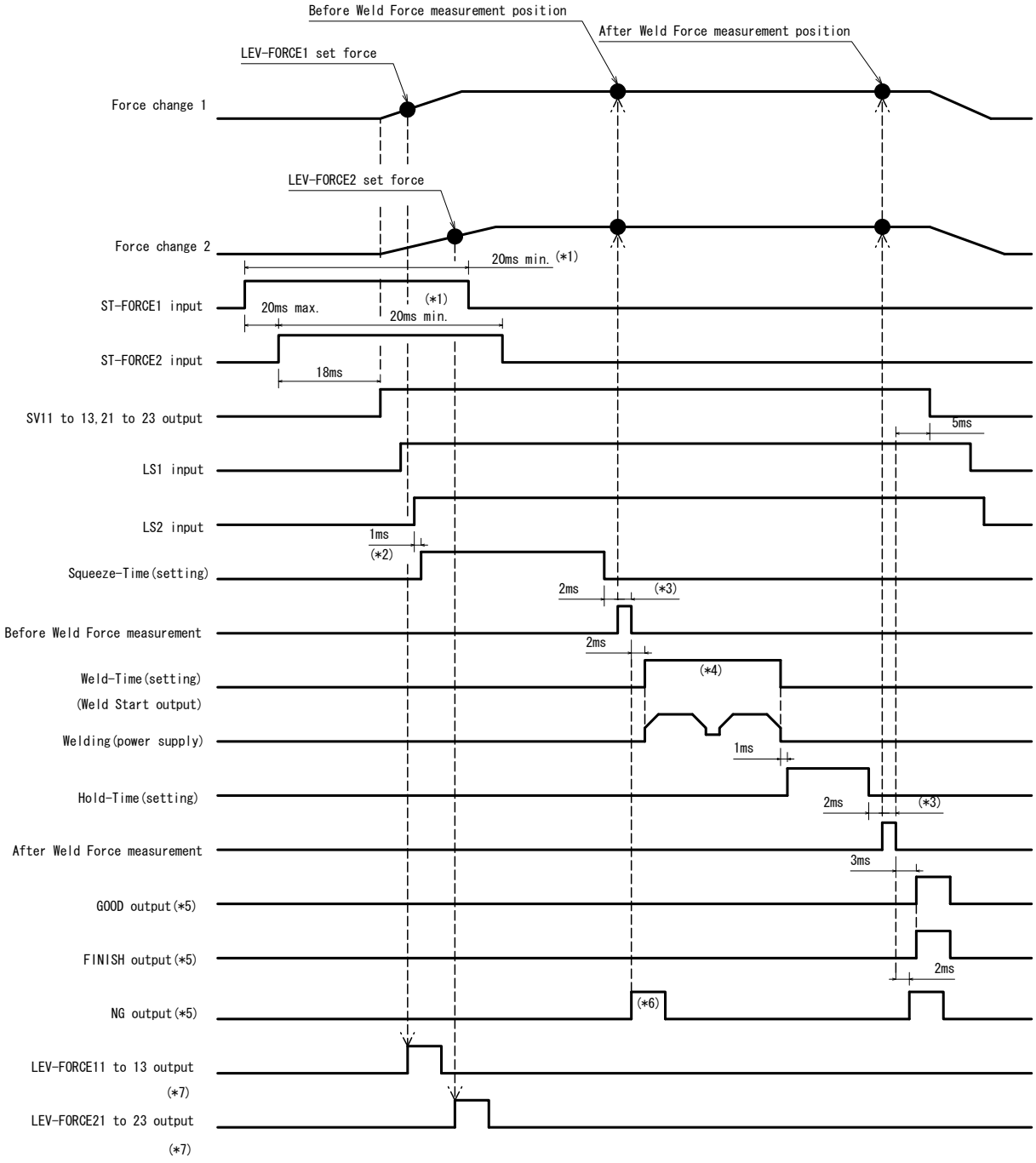
(6) Sequence Mode “Force Measure Mode : SQNC(0)”

When 0=Setup parameter of the function menu is set as follows:

① Force Measure Mode setting: SQNC(0)

② LS Input Validity setting: Valid(0)

③ Self Hold Validity setting: Valid(0)



*1 When Self Hold Validity is set to Invalid(1), hold the ST-FORCE input until the sequence moves to Weld-Time.

*2 Time from when both LS1 and 2 are input.

*3 The output time of Before/After Weld Time varies depending on settings of Force Sampling and Force Average.

*4 Set the time longer than the total weld time of welding machine for Weld-Time.

*5 The output time can be selected with Output Select Time.

*6 When NG is output, the sequence ends.

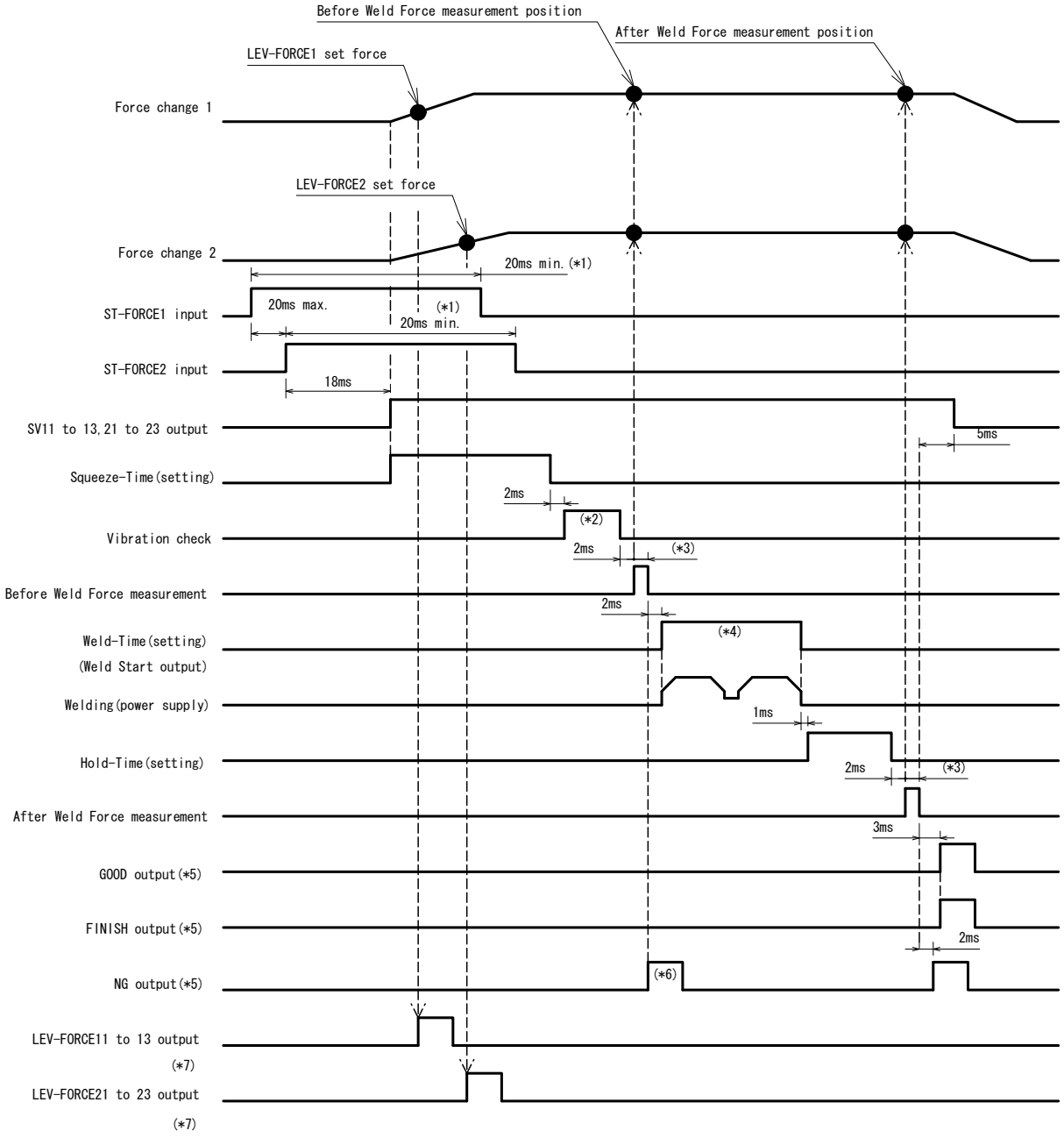
*7 The output time can be selected with Level Select Time.

When 0=Setup parameter of the function menu is set as follows:

① Force Measure Mode setting: SQNC(0)

② LS Input Validity setting: Invalid(1)

③ Self Hold Validity setting: Valid(0)



*1 When Self Hold Validity is set to Invalid(1), hold the ST-FORCE input until the sequence moves to Weld-Time.

*2 Varies depending on the allowable vibration range setting and vibration stability time.

*3 The output time of Before/After Weld Time varies depending on settings of Force Sampling and Force Average.

*4 Set the time longer than the total weld time of welding machine for Weld-Time.

*5 The output time can be selected with Output Select Time.

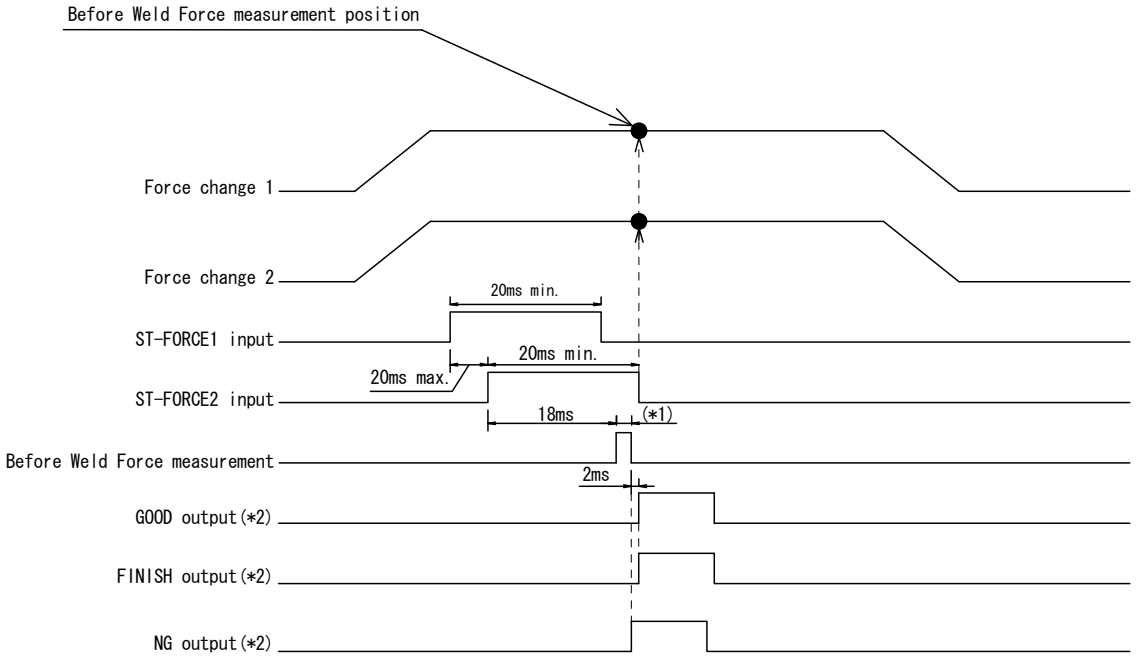
*6 When NG is output, the sequence ends.

*7 The output time can be selected with Level Select Time.

(7) Sample Hold 1 Mode “Force Measure Mode : SH1(1)”

When 0=Setup parameter of the function menu is set as follows:

① Force Measure Mode setting: SH1(1)



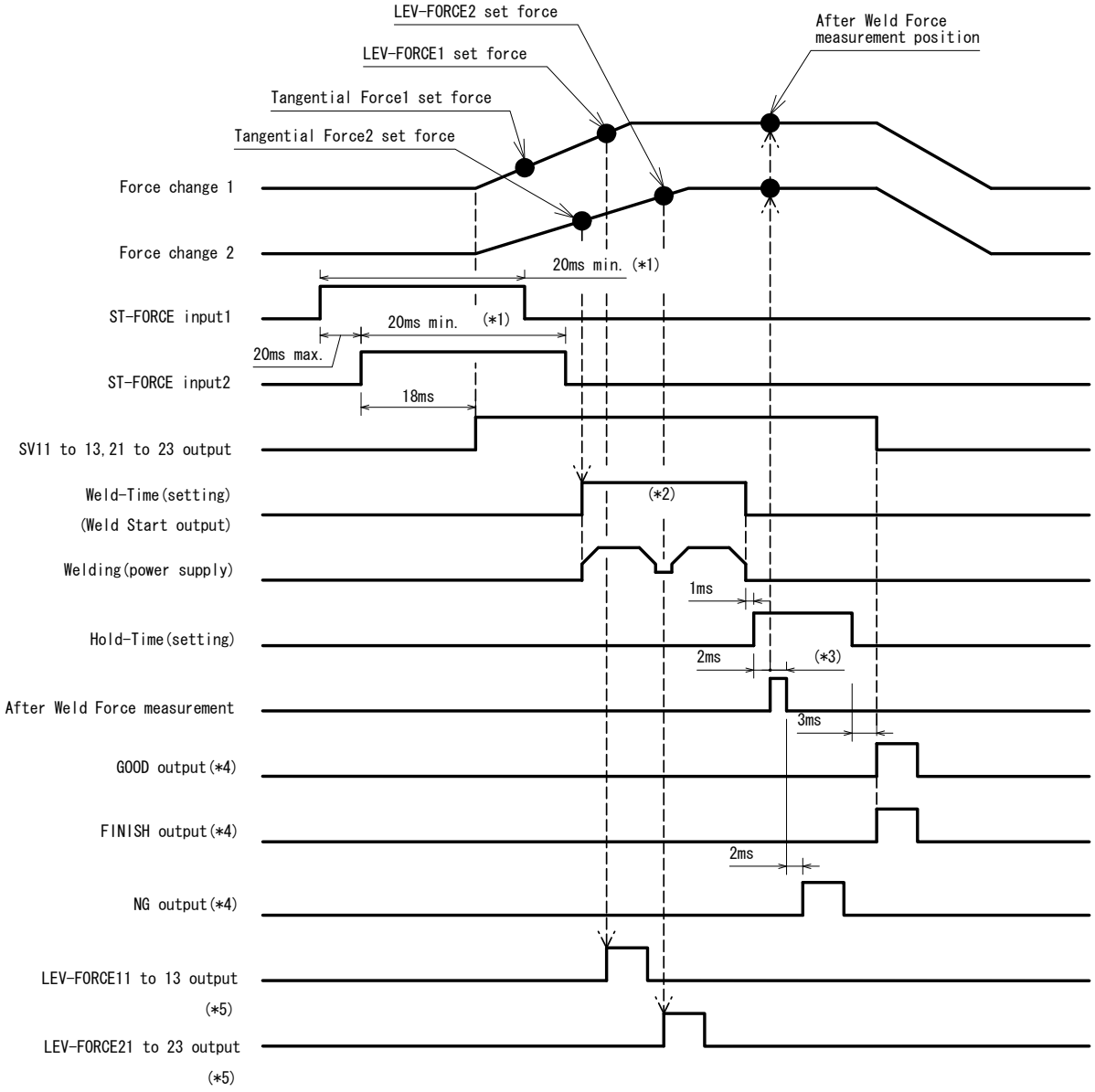
*1 The output time of Before Weld Time varies depending on settings of Force Sampling and Force Average.

*2 The output time can be selected with Output Select Time.

(8) Tangential Mode “Force Measure Mode : TANG(3)”

When 0=Setup parameter of the function menu is set as follows:

① Force Measure Mode setting: TANG(3)
② Tang Measure Point setting: Weld(0)



*1 When Self Hold Validity is set to Invalid(1), hold the ST-FORCE input until the sequence moves to Weld-Time.

*2 Set the time longer than the total weld time of welding machine for Weld-Time. Starts when the sequence reaches the Tangential Force setting of both Axis 1 and 2.

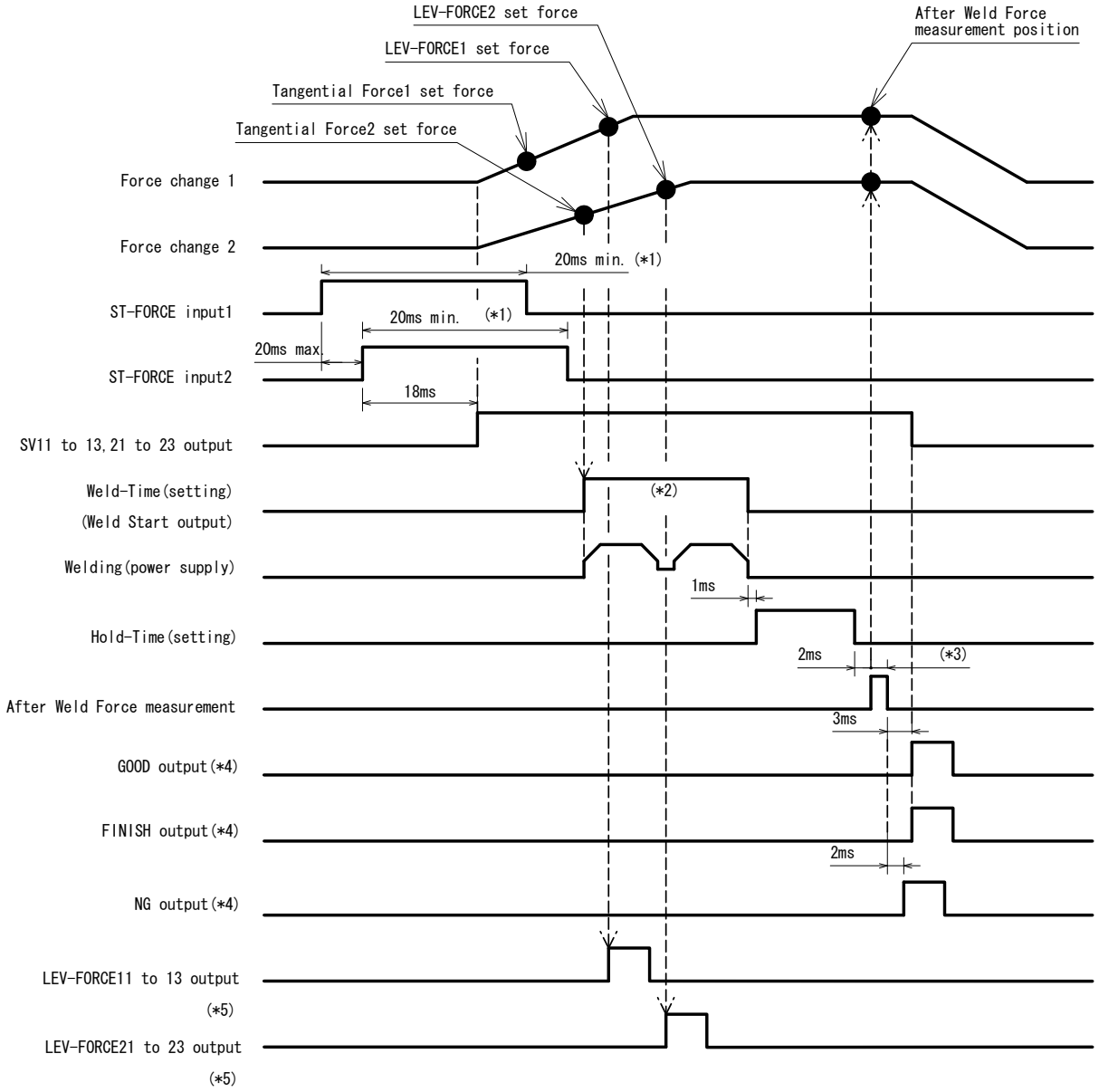
*3 The output time of After Weld Time varies depending on settings of Force Sampling and Force Average.

*4 The output time can be selected with Output Select Time.

*5 The output time can be selected with Level Select Time.

When 0=Setup parameter of the function menu is set as follows:

① Force Measure Mode setting: TANG(3)
② Tang Measure Point setting: Hold(1)



*1 When Self Hold Validity is set to Invalid(1), hold the ST-FORCE input until the sequence moves to Weld-Time.

*2 Set the time longer than the total weld time of welding machine for Weld-Time. Starts when the sequence reaches the Tangential Force setting of both Axis 1 and 2.

*3 The output time of After Weld Time varies depending on settings of Force Sampling and Force Average.

*4 The output time can be selected with Output Select Time.

*5 The output time can be selected with Level Select Time.

13. Data Communication

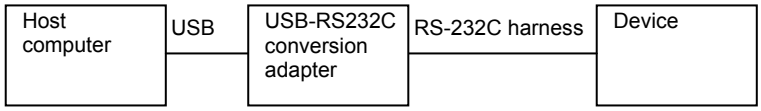
(1) Data Transmission

Item		Contents
Mode		EIA RS-485-compliant, half-duplex, asynchronous, multi-dropped connection (up to 31 devices) EIA RS-232C-compliant, full-duplex IEEE.802.3-compliant (10BASE-T/100BASE-TX)
Transmission rate (Baud rate)*		9600, 19200, 38400, 57600 bps
Data format	Data bit*	7, 8
	Parity*	None, odd, even
	Stop bit*	1, 2
	Flow control*	None, Xon/Xoff, hardware
FCS (frame checksum)*		With, without (HEX display of simply added value by 1 byte from the first character to the character before FCS)
Character code		ASCII

* Set by “3=Communication” parameter (see **8.(5)**).

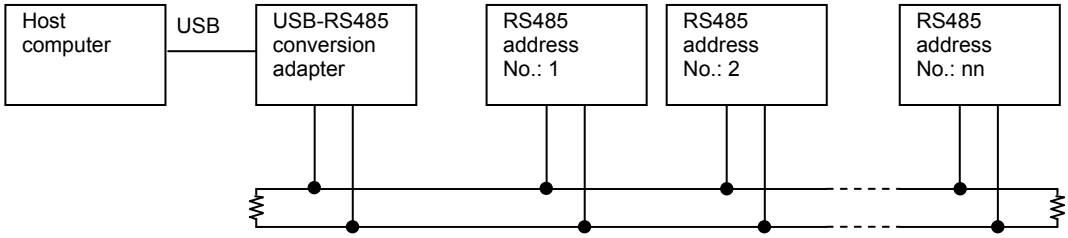
(2) Configuration

a. RS-232C



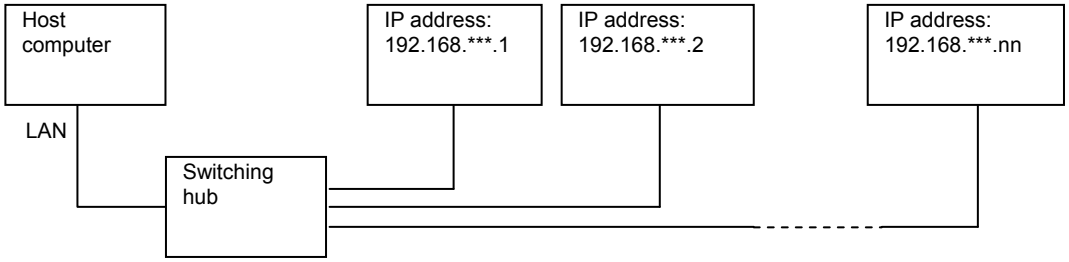
* Prepare the USB-RS232C conversion adapter at customer's side.
* The RS-232C harness is optional.

b. RS-485



* Prepare the USB-RS232C conversion adapter and cable at customer's side.
* Mount 100Ω of termination resistance at either end of the RS-485 cable.
* The RS-485 connector (with termination resistance) is optional.
* Up to 31 devices can be connected.
* In the single-directional communication, only one device can be connected.

c. Ethernet



* Prepare the switching hub at customer's side.
* The LAN cable is optional.

(3) Protocol

a. Single-directional communication

The measured value is automatically sent after each measurement. When the measurement is done, the past measured values are deleted.
When the measurement is not done, "-" or space is displayed.

Note) For the 2-axis type, if the welding starts with only one axis, the previous measured values of another axis is sent.

Data strings:

!31:127,99999,5000.0,N,5000.0,N,-99.999,N,-99.999,N,-99.999,N,
A B C D E F G H I J K L M
127,99999,5000.0,N,5000.0,N,-------,,-99.999,N,-99.999,N,FF [CR][LF]
N O P Q R S T U V W X Y Z

	Character String	Item		Data length	Remarks
A	nn	Device address number		Fixed to 2 digits, 1 to 99	
B	nnn	1-axis	Schedule number	Fixed to 3 digits, 1 to 127	
C	nnnnn		Counter	Fixed to 5 digits, 0 to 99999	
D	nnnnn		Before-welding force	Refer to Table 1.	
E	n		Before-welding force judgment	Refer to Table 2.	
F	nnnnn		After-welding force	Refer to Table 1.	
G	n		After-welding force judgment	Refer to Table 2.	
H	nnn.nnn		Before-welding workpiece thickness	Refer to Table 1.	
I	n		Before-welding workpiece thickness	Refer to Table 2.	
J	nnn.nnn		After-welding workpiece thickness	Refer to Table 1.	
K	n		After-welding workpiece thickness	Refer to Table 2.	
L	nnn.nnn		Displacement	Refer to Table 1.	
M	n		Displacement judgment	Refer to Table 2.	
N	nnn	2-axis	Schedule number	3 digits, 1 to 127	At no 2-axis: --- (3 digits)
O	nnnnn		Counter	5 digits, 0 to 99999	At no 2-axis: ----- (5 digits)
P	nnnnn		Before-welding force	Refer to Table 1.	
Q	n		Before-welding force judgment	Refer to Table 2.	
R	nnnnn		After-welding force	Refer to Table 1.	
S	n		After-welding force judgment	Refer to Table 2.	
T	nnn.nnn		Before-welding workpiece thickness	Refer to Table 1.	
U	n		Before-welding workpiece thickness	Refer to Table 2.	
V	nnn.nnn		After-welding workpiece thickness	Refer to Table 1.	
W	n		After-welding workpiece thickness	Refer to Table 2.	
X	nnn.nnn		Displacement	Refer to Table 1.	
Y	n		Displacement judgment	Refer to Table 2.	
Z	nn		FCS (frame checksum)	2 digits, 0 to FF	At no FCS setting: "**"

* Table 1

Unit	Data length (including symbol and decimal point)
At N	Decimal point position **.**: **.** (5 digits) ***.*: ***.* (5 digits) *****: ***** (5 digits) At no measurement or no 2-axis: ----- (5 digits)
At kgf At lbf	Decimal point position *.***: *.*** (5 digits) **.**: **.** (5 digits) ***.*: ***.* (5 digits) ****.: ****. (5 digits) At no measurement or no 2-axis: ----- (5 digits)
At mm	±**.*** (7 digits) At no measurement or no 2-axis: ---.--- (7 digits)

* Table 2

Code	Judgment
Space (20H)	No judgment
N (4EH)	Normal (GOOD)
H (48H)	Upper limit error (Upper limit NG)
L (4CH)	Lower limit error (Lower limit NG)

b. Bi-directional communication

Meaning of symbol

ID1, ID2: Device address number
Fixed to 2 digits (ID1= Ten's place, ID2= One's place)

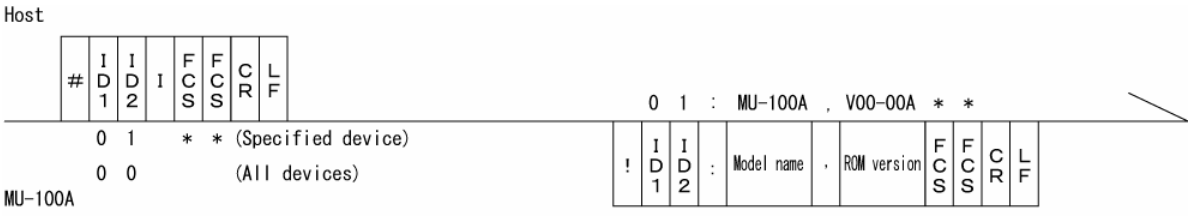
AX1: Axis number
Fixed to 1 digit (1 or 2)

SH1, SH2, SH3: Schedule number
Fixed to 3 digits (SH1= Hundred's place, SH2= Ten's place, SH3= One's place)

CD1, CD2, CD3: Specified code
CD1 ---------- Alphabet classified symbol
CD2 and CD3 -- Code classified number

1.	Inquiry of Model name and ROM version	# Device No. I

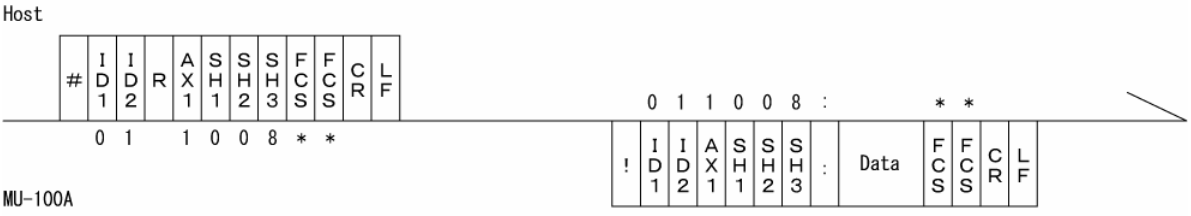
Example: Model name of Device No.01 and the ROM version → **MU-100A** and the ROM version is V00-00A.



・ When 0 is set for both ID1 and ID2, all devices connected reply.

2.	Schedule data reading	# Device No. R Axis No. Schedule number *

Example: Read all data of Schedule No. “008” for 1-axis of the specified Device No.01.

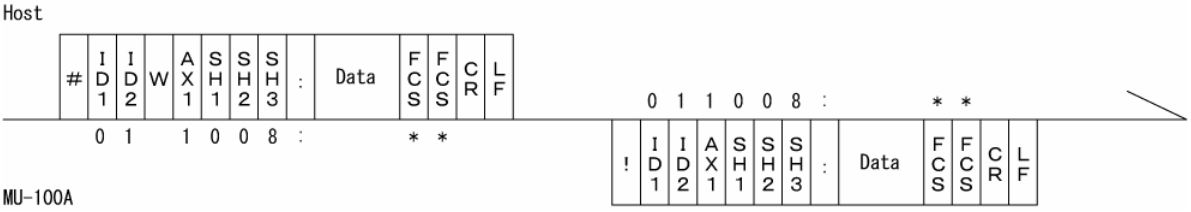


Insert [,] between data for a schedule.

- When SH1, SH2 and SH3 (schedule number) are “000”, Setup data are read.
- For the data order of a schedule, see **c. Code table of schedule data of each schedule number**.

3.	Schedule data setting	# Device No. W Axis No. Schedule number , Data

Example: Set the data contents of Schedule number “008” for 1-axis of the specified device No.01.

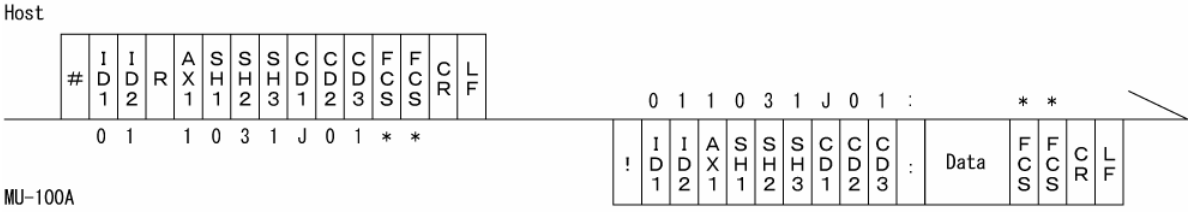


Insert [,] between data for a schedule.

- When SH1, SH2 and SH3 (schedule number) are “000”, Setup data are set.
- For the data order of a schedule, see **c. Code table of schedule data of each schedule number**.
- The set data is returned as a confirmation data.
  When data which is outside the range is set, previous data is returned.

4.	Specified item reading	# Device No. R Axis No. Schedule number Specified code

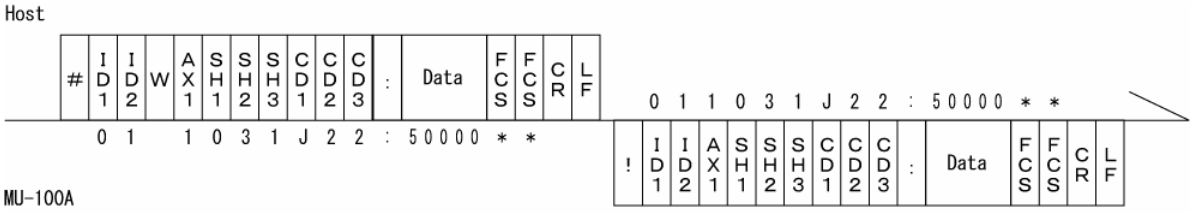
Example: Read the squeeze time (1.000 sec) of schedule number “031” for 1-axis of Device No.01.



- For CD1 (alphabet classified symbol), CD2 and CD3 (code classified number), see data code tables **c** to **g**.

5.	Specified item setting	# Device No. W Axis No. Schedule number Specified code , Data

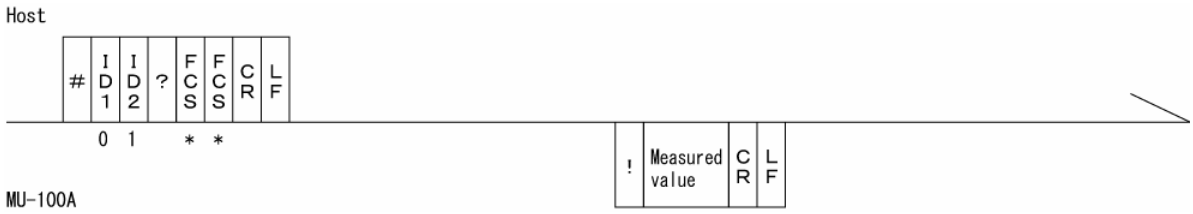
Example: Set the preset counter value of Schedule number “031” for 1-axis of Device No. 01 to 50000.



- The set data is returned as a confirmation data.
  When data which is outside the range is set, previous data is returned.
- For CD1 (alphabet classified symbol), CD2 and CD3 (code classified number), see data code table.

6.	Measurement item reading	# Device No. ?

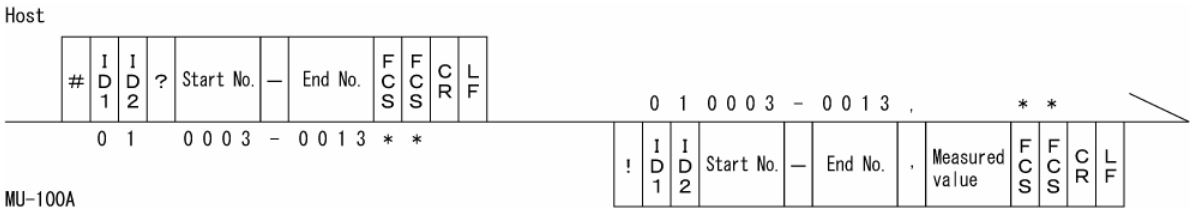
Example: Read the measured value of Device No. 01.



- The final measured value is read. (Insert [,] between each measurement item.)
- The measured value is the same as Code table A to Z in **a. Single-directional communication**.

7.	Specified measurement item reading	# Device No. ? Start No. – End No.

Example: Read measured values from Counter (0003) to Displacement judgment (0013) for 1-axis of Device No.01.



- The specified number’s measured value of the last measured data is read. (Insert [,] between each measurement item.)
- For the measured value, see **h. Code table of measurement data**.

c. Code table of schedule data of each schedule number
(Axis number: 1 to 2, Schedule number: 001 to 127)

Specified code	Character string	Item	Setting range
J01	n.nnn	Squeeze time	0 to 9.999
J02	n.nnn	Weld time	0 to 9.999
J03	n.nnn	Hold time	0 to 9.999
J04	nnn.nnn	Lower limit of before-welding workpiece thickness	-99.999 to +99.999
J05	nnn.nnn	Upper limit of before-welding workpiece thickness	-99.999 to +99.999
J06	nnn.nnn	Lower limit of after-welding workpiece thickness	-99.999 to +99.999
J07	nnn.nnn	Upper limit of after-welding workpiece thickness	-99.999 to +99.999
J08	nnn.nnn	Lower limit of displacement	-99.999 to +99.999
J09	nnn.nnn	Upper limit of displacement	-99.999 to +99.999
J10	nnnnn	Lower limit of before-welding force	At 20N: 0 to 20.00 At 50N: 0 to 50.00 At 200N: 0 to 200.0 At 500N: 0 to 500.0 At 2000N: 0 to 02000 At 5000N: 0 to 05000 At 10000N: 0 to 10000
J11		Upper limit of before-welding force	
J12		Lower limit of after-welding force	
J13		Upper limit of after-welding force	
J14	nnn.nnn	Displacement level setting 1	-99.999 to +99.999
J15	nnn.nnn	Displacement level setting 2	-99.999 to +99.999
J16	nnn.nnn	Displacement level setting 3	-99.999 to +99.999
J17	nnnnn	Weld force level setting 1	At 20N: 0 to 20.00 At 50N: 0 to 50.00 At 200N: 0 to 200.0 At 500N: 0 to 500.0 At 2000N: 0 to 02000 At 5000N: 0 to 05000 At 10000N: 0 to 10000
J18		Weld force level setting 2	
J19		Weld force level setting 3	
J20		Force offset	
J21		Tangential force	
J22	nnnnn	Preset counter value	0 to 99999
J23	nnnnn	Count start value	0 to 99999

* The setting range of force offset is as follows:

Decimal point position **.** : +**.** or -**.** (5 digits) (L.C. Rated Capacity 0 to 99N)
Decimal point position ***.* : +***.* or -***** (5 digits) (L.C. Rated Capacity 100 to 999N)
Decimal point position ***** : +0**** or -0**** (5 digits) (L.C. Rated Capacity 1000 to 9999N)
Decimal point position ***** : +***** or -***** (5 digits) (L.C. Rated Capacity 10000 to 99999N)

d. Item data: Code table of setup data

(Axis number: 1 to 2, Schedule number: 000)

Specified code	Character string	Item	Selections, Setting range	Remarks
K01	n	Using sensor pattern	Sen_1/Load_1(0) Sen_2/Load_2(1)	Factory setting. Cannot be changed.
K02	n	Sensor type	Incremental(1)	Factory setting. Cannot be changed.
K03	n	Displacement measurement mode	SYNC(0) SQNC(1) SH1(2) SH2(3) SH3(4)	
K04	nnnnn	Load cell type (Input the rating.)	0 to 50000	Cannot be changed. Set via the panel.
K05	n	Load cell unit	N(0) kgf(1) lbf(2)	
K06	n.nnn	Load cell rated value	0.000 to 2.500	Unit: mV Cannot be changed. Set via the panel.
K07	n	LS input valid/invalid	Valid(0) Invalid(1)	
K08	n	Force measurement mode	SQNC(0) SH1(1) SH2(2) TANG(3) OFF(4)	
K09	n	Start self hold valid/invalid	Valid(0) Invalid(1)	
K10	n	GOOD/NG/FINISH output time selection	TACT(0) 50ms(1) 100ms(2) 200ms(3) 300ms(4)	
K11	n	GOOD/NG/FINISH output setting	Normal Close(0) Normal Open(1)	
K12	n	Level output time selection	TACT(0) 50ms(1) 100ms(2) 200ms(3) 300ms(4)	
K13	n	Level output setting	Normal Close(0) Normal Open(1)	
K14	n	Head position at the occurrence of error	TOP(0) HOLD(1)	
K15	n	FINISH input valid/invalid	Valid(0) Invalid(1)	

Specified code	Character string	Item	Selections, Setting range	Remarks
K16	n	Displacement analog range	At 1LDG03, 1LDC04: ±65.535mm(0) ±32.767mm(1) ±16.383mm(2) ±8.191mm(3) ±4.095mm(4) ±2.047mm(5) ±1.023mm(6) ±0.511mm(7) ±0.255mm(8)	
K17	n	Sensor sign selection	-(CCW)(0) +(CW)(1)	
K18	n.nnn	Displacement vibration detection	0.000 to 0.100	Unit: mm
K19	nn.nn nnn.n nnnnn	Weld force allowable vibration range	At 20N: 0 to 02.00 At 50N: 0 to 05.00 At 200N: 0 to 020.0 At 500N: 0 to 050.0 At 2000N: 0 to 0200 At 5000N: 0 to 0500 At 10000N: 0 to 01000	Up to 10% of the load cell rating can be set.
K20	n	Sensor origin setting	All(0) Select(1)	
K21	n.nn	HEAD error time	0 to 9.99	Unit: sec
K22	n.nn	FINISH error time	0 to 9.99	Unit: sec
K23	n	Buzzer sound	On(0) Off(1)	
K24	n	Force measurement point	Weld(0) Hold(1)	
K25	nn	LCD contrast	1 to 10	
K26	n	Ready output	Measurement ON(0) Control ON(1)	
K27	n	Internal origin setting	HEIGHT1(0) HEIGHT2(1)	
K28	n	Sampling frequency	1Hz(0) 5Hz(1) 10Hz(2) 20Hz(3) 50Hz(4) 100Hz(5) 200Hz(6) 500Hz(7) 1000Hz(8) 2000Hz(9)	
K29	n	Number of average	1(0) 2(1) 4(2) 8(3) 16(4) 64(5) 256(6) 1024(7)	

e. Item data: Code table of Monitor Display

Specified code	Character string	Item	Selections, Setting range	Remarks
M11	n	Monitor display11	Before Force(0) After Force(1) Now Force(2) Before Work(3) After Work(4) Now Work(5) Displacement(6) Counter(7)	1-axis
M12	n	Monitor display12		
M13	n	Monitor display13		
M14	n	Monitor display14		
M15	n	Monitor display15		
M16	n	Monitor display16		
M17	n	Monitor display17		
M18	n	Monitor display18		
M21	n	Monitor display21		2-axis
M22	n	Monitor display22		
M23	n	Monitor display23		
M24	n	Monitor display24		
M25	n	Monitor display25		
M26	n	Monitor display26		
M27	n	Monitor display27		
M28	n	Monitor display28		

f. Item data: Code table of LED display

Specified code	Character string	Item	Parameter symbol display	Selections, Setting range	
				1-axis	2-axis
L01	nn	IN LED display 0	IL0	SCH1-1(0) SCH1-2(1) SCH1-4(2) SCH1-8(3) SCH1-16(4) SCH1-32(5) SCH1-64(6) ST-DISP1(7) ST-FORCE1(8) LS1(9) RESET-NG(10) RESET-CONT1(11) FINISH1(12) ESTOP(13) HEAD1(14) ZST-DISP1(15) INPUT11(16) INPUT12(17) INPUT13(18) INPUT14(19) INPUT15(20)	SCH2-1(21) SCH2-2(22) SCH2-4(23) SCH2-8(24) SCH2-16(25) SCH2-32(26) SCH2-64(27) ST-DISP2(28) ST-FORCE2(29) LS2(30) INPUT26(31) RESET-CONT2(32) FINISH2(33) INPUT27(34) HEAD2(35) ZST-DISP2(36) INPUT21(37) INPUT22(38) INPUT23(39) INPUT24(40) INPUT25(41)
L02	nn	IN LED display 1	IL1		
L03	nn	IN LED display 2	IL2		
L04	nn	IN LED display 3	IL3		
L05	nn	IN LED display 4	IL4		
L06	nn	IN LED display 5	IL5		
L07	nn	IN LED display 6	IL6		
L08	nn	IN LED display 7	IL7		
L09	nn	IN LED display 8	IL8		
L10	nn	IN LED display 9	IL9		
L11	nn	IN LED display A	ILA		
L12	nn	IN LED display B	ILB		
L13	nn	IN LED display C	ILC		
L14	nn	IN LED display D	ILD		
L15	nn	IN LED display E	ILE		
L16	nn	IN LED display F	ILF		

* 1 digits or 2 digits can be set in READY(0) to NG-FORCEUP1(9).
When the data of READY(0) to NG-FORCEUP1(9) is read, [SP] is added at the head.
The parameter symbol display is the item number in Function 2=LED Display.

Specified code	Character string	Item	Parameter symbol display	Selections、Setting range	
				1-axis	2-axis
L17	nn	OUT LED display 0	OL0	READY1(0) GOOD-DISP1(1) GOOD-FORCE1(2) NG1(3) NG-UP1(4) NG-LO1(5) NG-BEFORE1(6) NG-DISP1(7) NG-AFTER1(8) NG-FORCEUP1(9) NG-FORCELO1(10) WARNING(11) WELD START1(12) FINISH1(13) LEV-DISP11(14) LEV-DISP12(15) LEV-DISP13(16) LEV-FORCE11(17) LEV-FORCE12(18) LEV-FORCE13(19) SV11(20) SV12(21) SV13(22) OUTPUT11(23) OUTPUT12(24) OUTPUT13(25) OUTPUT14(26) OUTPUT15(27) OUTPUT16(28)	READY2(29) GOOD-DISP2(30) GOOD-FORCE2(31) NG2(32) NG-UP2(33) NG-LO2(34) NG-BEFORE2(35) NG-DISP2(36) NG-AFTER2(37) NG-FORCEUP2(38) NG-FORCELO2(39) WELD START2(40) FINISH2(41) LEV-DISP21(42) LEV-DISP22(43) LEV-DISP23(44) LEV-FORCE21(45) LEV-FORCE22(46) LEV-FORCE23(47) SV21(48) SV22(49) SV23(50) OUTPUT21(51) OUTPUT22(52) OUTPUT23(53) OUTPUT24(54) OUTPUT25(55) OUTPUT26(56)
L18	nn	OUT LED display 1	OL1		
L19	nn	OUT LED display 2	OL2		
L20	nn	OUT LED display 3	OL3		
L21	nn	OUT LED display 4	OL4		
L22	nn	OUT LED display 5	OL5		
L23	nn	OUT LED display 6	OL6		
L24	nn	OUT LED display 7	OL7		
L25	nn	OUT LED display 8	OL8		
L26	nn	OUT LED display 9	OL9		
L27	nn	OUT LED display A	OLA		
L28	nn	OUT LED display B	OLB		
L29	nn	OUT LED display C	OLC		
L30	nn	OUT LED display D	OLD		
L31	nn	OUT LED display E	OLE		
L32	nn	OUT LED display F	OLF		

* 1 digits or 2 digits can be set in READY(0) to NG-FORCEUP1(9).
When the data of READY(0) to NG-FORCEUP1(9) is read, [SP] is added at the head.
The parameter symbol display is the item number in Function 2=LED Display.

g. Item data: Code table of communication

Specified code	Character string	Item	Selections, Setting range
V01	nnn.nnn.nnn.nnn	IP address	0,0,0,0
V02	nnn.nnn.nnn.nnn	Subnet mask	255.255.255.0
V03	nnn.nnn.nnn.nnn	Default gateway	0,0,0,0
V04	nnnn	Port number	0 to 9999
V05	n	Baud rate	9600(0) 19200(1) 38400(2) 57600(3)
V06	n	Data bit	7(0) 8(1)
V07	n	Parity	None(0) Even(1) Odd(2)
V08	n	Stop bit	1(0) 2(1)
V09	n	Flow control	None(0) Xon/Xoff(1) Hardware(2)
V10	nn	RS485 address	1 to 99
V11	n	With or without FCS (frame checksum)	No(0) Yes(1)
V12	n	Communication selection	RS232C(0) RS485(1)
V13	n	Communication function	OFF(0) -->(1) <->(2)
V14	nn-nn-nn-nn-nn-nn	MAC address	00-60-D5-02-**-**

* Cannot be changed via communication. Set via the panel.
* After changing settings above, turn on the power again.

h. Code table of measurement data

No.	Character string	Item		Setting range
0001	nn	Device address number		Fixed to 2 digits, 1 to 99
0002	nnn	1-axis	Schedule number	Fixed to 3 digits, 1 to 127
0003	nnnnn		Counter	Fixed to 5 digits, 0 to 99999
0004	nnnnn		Before-welding force	Refer to Table 1.
0005	n		Before-welding force judgment	Refer to Table 2.
0006	nnnnn		After-welding force	Refer to Table 1.
0007	n		After-welding force judgment	Refer to Table 2.
0008	nnn.nnn		Before-welding workpiece thickness	Refer to Table 1.
0009	n		Before-welding workpiece thickness judgment	Refer to Table 2.
0010	nnn.nnn		After-welding workpiece thickness	Refer to Table 1.
0011	n		After-welding workpiece thickness judgment	Refer to Table 2.
0012	nnn.nnn		Displacement	Refer to Table 1.
0013	n		Displacement judgment	Refer to Table 2.
0014	nnn	2-axis	Schedule number	3 digits, 1 to 127 At no 2-axis: --- (3 digits)
0015	nnnnn		Counter	5 digits, 0 to 99999 At no 2-axis: ----- (5 digits)
0016	nnnnn		Before-welding force	Refer to Table 1.
0017	n		Before-welding force judgment	Refer to Table 2.
0018	nnnnn		After-welding force	Refer to Table 1.
0019	n		After-welding force judgment	Refer to Table 2.
0020	nnn.nnn		Before-welding workpiece thickness	Refer to Table 1.
0021	n		Before-welding workpiece thickness judgment	Refer to Table 2.
0022	nnn.nnn		After-welding workpiece thickness	Refer to Table 1.
0023	n		After-welding workpiece thickness judgment	Refer to Table 2.
0024	nnn.nnn		Displacement	Refer to Table 1.
0025	n		Displacement judgment	Refer to Table 2.
0026	nn		FCS (frame checksum)	2 digits, 0 to FF At no data: "**"
0027	nnnnn	1-axis	Weld force manual value	Refer to Table 1.
0028	nnn.nnn		Displacement manual value	Refer to Table 1.
0029	nnnnn	2-axis	Weld force manual value	Refer to Table 1.
0030	nnn.nnn		Displacement manual value	Refer to Table 1.

* Table 1

Unit	Data length (including symbol and decimal point)
At N	Decimal point position **.**: **.** (5 digits) ***.*: ***.* (5 digits) *****: ***** (5 digits) At no measurement or no 2-axis: ----- (5 digits)
At kgf At lbf	Decimal point position *.***: *.*** (5 digits) **.**: **.** (5 digits) ***.*: ***.* (5 digits) ****.: ****. (5 digits) At no measurement or no 2-axis: ----- (5 digits)
At mm	±**.*** (7 digits) At no measurement and no 2-axis: ---.--- (7 digits)

* Table 2

Code	Judgment
Space (20H)	No judgment
N (4EH)	Normal (GOOD)
H (48H)	Upper limit error (Upper limit NG)
L (4CH)	Lower limit error (Lower limit NG)

14. Specifications

(1) Basic Specifications

Item		Contents
Power supply voltage		Single-phase, 100 to 240 V AC±10% (50/60 Hz), 0.5 A
Fuse rating		250V1A
Operating environment		Temperature 5 to 40°C, Humidity 90% or less
Storage environment		0 to 55°C
Outline dimensions		109 (H) × 200 (W) × 268 (D) mm (not including projection)
Mass		3.3 kg
Control mode	Displacement sensor + Load cell	SYNC
	Displacement sensor	SQNC, SH1, SH2, SH3
	Load cell	SQNC, SH1, SH2, TANG
Time setting		Squeeze time, Weld time, Hold time
Time setting range		0 to 9.999 sec
Number of schedules		127
Counter		Start counter, Preset counter
Communication		Ethernet, RS-232C, RS-485
Displacement sensor	Applicable sensor	Incremental type
	Measurement range	0 to ±50.000 mm
	Upper/lower limit setting range	0 to ±99.999 mm
	Resolution	1 µm
	Measurement item	Before-welding workpiece thickness, After-welding workpiece thickness, Displacement
	Level outputs	3
	Analog output	1 (output delay time: approx. 1.5 ms)
	Origin setting	Valid
	Accuracy	30-mm displacement sensor or shorter: ±0.015 mm (*) 50-mm displacement sensor: ±0.025 mm (*)
Load cell	Measurement range, Resolution	1.00 to 20.00 N, 2.50 to 50.00 N: 0.01N increments
		10.0 to 200.0 N, 25.0 to 500.0 N: 0.1N increments
		100 to 2000 N, 250 to 5000 N: 1N increment
		500 to 10000 N: 10N increments
	Upper/lower limit setting range	0 to 20.00 N, 0 to 50.00 N: 0.01N increments
		0 to 200.0 N, 0 to 500.0 N: 0.1N increments
		0 to 2000 N, 0 to 5000 N: 1N increment
		0 to 10000 N: 10N increments
	Applicable rated output	0 to 2 mV/V
	Measurement item	Before-welding force, After-welding force
	Level outputs	3
	Analog output	1 (The output delay time varies according to the Force Sampling setting.)
	Zero setting	Valid
	Accuracy	Full scale±3% (*)

* When using the sensor purchased from us.

(2) Board List for Maintenance

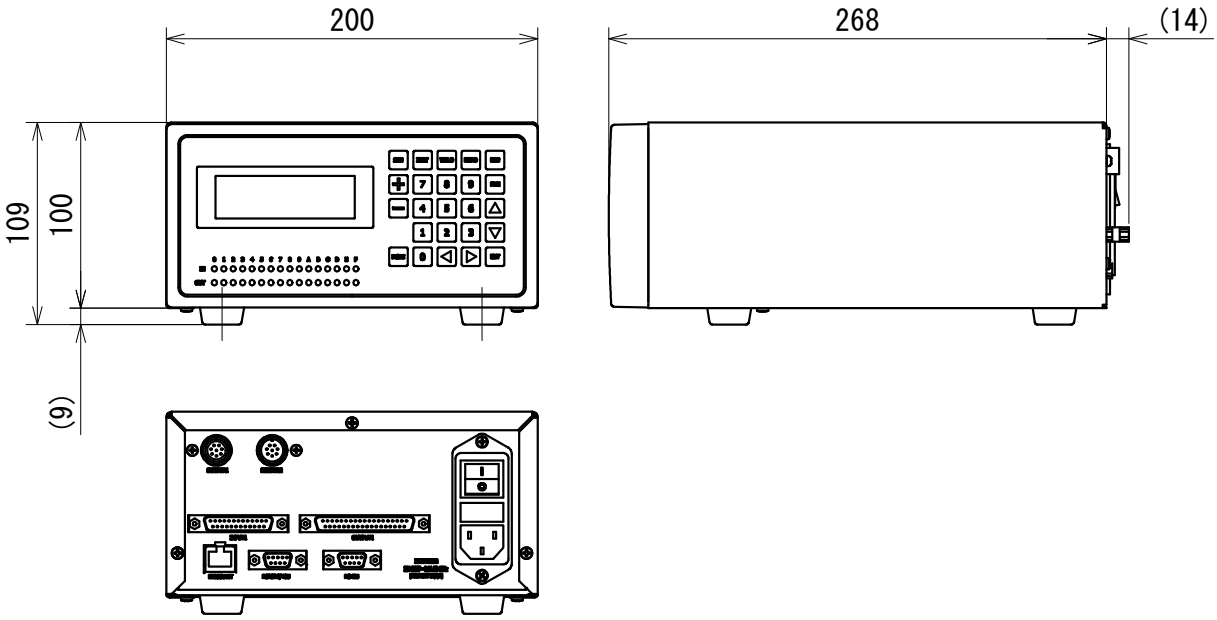
For repair or replacement, contact us.

Board name	Board No.
Main board	ME-3018
Front board	ME-3019
Rear board	ME-3020

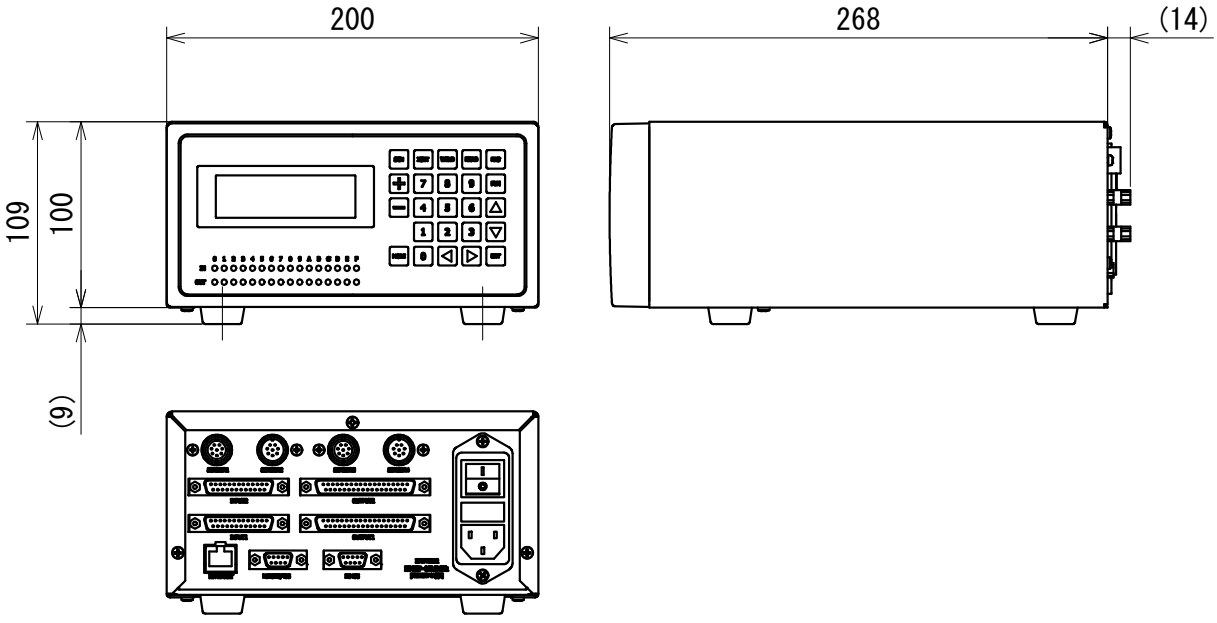
15. Outline Drawing

(Dimensions in mm)

a. 1-axis type



b. 2-axis type



16. Troubleshooting

When the following errors occur, the WARNING signal is output.

Display	Contents	Cause	Measures
Axis1 PRESET ERROR Axis2 PRESET ERROR	PRESET error	The counter value has reached the PRESET value.	Change the PRESET value or turn on the power supply again to reset the counter value to the counter value on the schedule setting.
Axis1 LC OVER ERROR Axis2 LC OVER ERROR	Load cell error	The weld force of load cell exceeds 120% of rating. The load cell is disconnected. (*)	Set the weld force to 120% or less of rating. Check that the load cell is disconnected or have a bad connection. Excessive pressure is applied on the load cell and it may malfunction. Contact us.
STOP ERROR	STOP error	STOP input becomes open.	Short the STOP input.
CPU ERROR	CPU error	The CPU malfunctions.	The CPU element may malfunction. Contact us.
MEMORY ERROR	Memory error	The contents of the memory is abnormal.	Reset the error. The setting has been initialized, so set it again. If the error occurs again, memory element may malfunction. Contact us. When the memory is rewritten by noise, take measures against noise around.
Axis1 HEAD ERROR Axis2 HEAD ERROR	LS signal error	The force-detecting signal (LS signal) is not input even after the Head Error Time.	Check for the connection. When the connection is proper, check for the limit switch on the welding head.
Axis1 FINISH ERROR Axis2 FINISH ERROR	FINISH signal error	The finish signal is not input even after the Finish Error Time followed by the WELD START signal output.	Check for the connection. When the connection is proper, check that the welding power supply outputs the finish signal.

* When the load cell with 10000 N is disconnected, NG may be output.

17. Calibration

Regular calibration is required to maintain the **MU-100A** performance.
Calibration is conducted at our facility.
For calibration, please send your displacement sensor and force sensor together with the **MU-100A**. Depending on the operating environment, the extent of deterioration varies from one **MU-100A** to another. Therefore, the **MU-100A** must be calibrated together with the displacement sensor and the force sensor as a set.
To issue a calibration certificate such as traceability, we conduct calibration at our site with charge.
For more information about calibration, contact us.

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CE

AMADA WELD TECH CO., LTD.

EU Declaration of Conformity

The company/manufacturer: **AMADA WELD TECH CO., LTD.**
95-3, Futatsuka, Noda-City, 278-0016 JAPAN

Herewith declares in his own sole responsibility conformity of the product

Designation: **HEAD CONTROLLER**

Types/Serial Number, etc.: **MU-100A-00-00**
MU-100A-00-01

With applicable regulations below

EC Directive: **Low Voltage Directive 2014/35/EU**
EMC Directive 2014/30/EU
RoHS Directive 2011/65/EU , (EU)2015 / 863

Harmonized European/International Standards applied:
ISO 12100 : 2010 , ISO 13849-1 : 2015
IEC 60204-1 : 2016
IEC 62135-1 : 2015 / COR1 : 2016 , IEC 62135-2 : 2020

Importer Distributor in EU:
(please place distributor/importer stamp here)

AMADA WELD TECH GmbH
Lindberghstrasse 1, DE-82178 Puchheim, GERMANY
Tel: + 49 8983 9403 - 0

Division: **AMADA WELD TECH CO., LTD.**

2021.5.20

Noda-City/Japan 2021-05-20
Place and Date

T. Jingu

Toshiaki Jingu / General Manager Quality Guarantee Department
Name/Signature/Position

Note: This Declaration certifies conformity with the above mentioned Directive(s), but gives no assurances of properties within the meaning of the Law concerning product liability and ProdSG. It becomes invalid if any technical or other modification are carried out without manufacturers consent.

64G091-07-5