INVERTER WELDING POWER SUPPLY

# IP-500A

# **OPERATION MANUAL**



Z11OM1203975-03

Thank you for purchasing our Inverter Welding Power Supply **IP-500A**. This operation manual describes its method of operation and precautions for use.

Read this operation manual carefully prior to use. Store appropriately for ready reference.

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## **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.



## 



Do not touch the inside of the Power Supply except as instructed.

The interior of this Power Supply carries high voltage. It is very dangerous to touch any parts except as instructed. When inspecting the interior of the Power Supply, be sure to turn off the power source of the Power Supply and wait for at least 5 minutes.



**Never disassemble, attempt to repair, or modify the Power Supply.** These actions can cause electric shock and fire. Consult us or your distributor for inspection and repair.

Never burn, destroy, cut, crush or chemically decompose the Power Supply.

This product incorporates parts containing gallium arsenide (GaAs).

## **1. Special Precautions**

	<b>M</b> WARNING
	<b>Do not insert your fingers or hands between the electrodes.</b> 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.
	<b>Ground the equipment.</b> If the Power Supply is not grounded, you may receive an electric shock in the event of malfunction or current leak. Be sure to perform grounding work. 400 V AC of input voltage: at least class C
	<b>Connect the specified cables securely.</b> Cables of insufficient current capacities and loose connections can cause fire and electric shock.
$\bigcirc$	<b>Do not damage the power cable and connecting cables.</b> 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. 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.

0	<b>Apply the specified supply voltage.</b> Application of a voltage outside the specified range may result in fire or electric shock.				
	<b>Do not allow water to come in contact with the equipment.</b> 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.				
$\bigcirc$	<b>Do not sit on or place objects on the Power Supply.</b> Failure to observe this precaution may lead to malfunction.				
	Keep combustible matter away from the Power Supply. Surface flash and expulsion may ignite combustible matter. If it is impossible to remove all combustible matter, cover it with non-combustible material.				
$\bigcirc$	<b>Do not cover the Power Supply with a blanket, cloth, etc.</b> Do not cover the Power Supply with a blanket, cloth, etc. while it is in use. The cover may be overheated and burned.				
$\bigcirc$	<b>Do not use this Power Supply for purposes other than welding.</b> Use of this Power Supply in a manner other than specified can cause electric shock and fire.				
	<b>Use ear protectors.</b> 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 Power Supply periodically. Maintain and inspect the Power Supply periodically, and repair any damage nearby before starting operation.				

## (2) Precautions for Handling

- When transporting or moving the Power Supply, do not lay it down. Also, handle the Power Supply with care so as not to make an impact such as drop on it.
- Install this Power Supply on a firm and level surface. If it is inclined, malfunction may result. For ventilation, provide 100 mm clearances to the intake and exhaust (See 5. (1)).
- Do not install the Power Supply 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 large amounts of vibration or shock, and
  - areas at an altitude above 1000 meters.
- Clean the exterior of the Power Supply using a soft, dry cloth or one slightly dampened with water. If the Power Supply is very dirty, use diluted neutral detergent or alcohol. Do not use paint thinner, benzine, etc., as they may discolor or deform the Power Supply.
- Do not insert a screw, coin, etc. into the Power Supply, as they may cause malfunction.
- Operate the Power Supply 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.
- Press switches/buttons one at a time. Pressing more than one switch/button at a time may result in a malfunction or failure. (However, the screen switching operations in 4. (8) I/O CHECK Screen, (9) INITIALIZE Screen, and (10) SCHEDULE COPY Screen are excluded.)
- The Power Supply is not equipped with auxiliary power such as an outlet for lighting.
- Following cables are separately needed to use the Power Supply:
  - Power cable, and cables connecting between the Power Supply and welding transformer,
  - welding transformer,
  - welding head, and
  - secondary conductor connecting between welding head and welding transformer.
- The RS-485 communication signal line is not attached. Prepare the crimp-on terminal and line for wiring to the terminal strip.
- The I/O signal line to start the Power Supply is not attached. Prepare the crimp-on terminal and line for wiring to the terminal strip.
- The Power Supply should be used with the industry power transmission and distribution network (industrial distribution equipment). Do not connect it to the public low-voltage distribution network (distribution equipment for non-industrial office or home use).

**1. Special Precautions** 

## (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) Warning Labels for Safety

On the main body are warning labels for safety. Their locations and meanings are as noted below.



Location: Power Supply interior, side surface of acrylic cover Meaning: **Shock hazard** 



Location: Power Supply interior, side surface of acrylic cover and output terminal cover Meaning: **Shock hazard** 



Location: Main unit cover Meaning: Caution for grounding connection



Location: Main unit cover Meaning: **Shock hazard** 



Location: Main unit cover Meaning: Caution for rotating object



Location: Input breaker cover Meaning: Shock hazard, Cautions for high voltage

## 1. Special Precautions

## **2. Features**

The **IP-500A** is an inverter-type power supply, specially designed to be used for spot welding and fusing.

In addition, it is small in size and convenient to move or shift. Monitor function is provided, which enables judging defective or non-defective welding.

- Welding-current monitoring function for judgment of weld quality
- Three control systems (Primary constant-current peak value control, Secondary constant-current effective value control, and Secondary constant-power effective value control) for stable weld quality.
- Upslope (downslope) can be set for Weld 1 and Weld 2, respectively.
- Use of an inverter allows for high power factor and stable power conditions
- Easy setting of a variety of items through the menu selection system
- Five protective functions for maximum ease of operation
  - No-current
  - No-voltage
  - Overcurrent
  - Temperature
  - Self diagnostics error

## **3. Name and Functions of Each Section**

## (1) Front



Detailed view of Operation panel

3. Name and Functions of Each Section

### ① LCD display

Displays 20 characters × 4 lines.

#### ② READY lamp (green)

Blinks until the preparation for welding is complete (about 10 seconds) and lights when the **IP-500A** is ready to start welding.

- The conditions to light this are as follows:
- The WELD lamp (see (6) is lighting up.
- The WELD ON/OFF (Pin 15) of the external interface is closed.
- No error occurs.
- The welding sequence is not in progress.
- The external communication is not in progress.

### ③ START lamp

Lights while the 1ST and 2ND input pins are input. However, when the start signal is turned off during a welding sequence, this remains lit until the sequence ends.

#### ④ TROUBLE lamp (orange)

Lights up when an error is detected. At this time, the **IP-500A** makes a peeping sound, and the work done is interrupted.

#### **S RESET key**

Used to reset the error display.

Eliminate the cause of the error before pressing this key to reset the error display.

### 6 WELD key

One of those required to activate the READY lamp. Pressing this key alternately lights and shuts off the lamp.

#### ⑦ WELD lamp (green)

Turns on when the WELD key is set to ON and turns off when it is set to OFF.

#### ⑧ Cursor keys

Used to move the cursor.

Used to move the cursor vertically or horizontally when selecting an item or inputting a value.

## 9 +/- key

Used to increase or decrease values of the selected item.

#### Image: MENU key

Used to switch the screen.

Used to switch the screen to various setting screens or the monitor screen.

## ① ENTER key

Used to write the setting.

After inputting the setting, be sure to press the ENTER key to write the data. If you move the cursor without pressing the ENTER key, the set contents are not switched.

## 12 Cooling fan filter cover

The cooling fan works when the internal temperature becomes 40°C or higher. A filter is provided inside this cover. To be removed for maintenance of the filter (See **12. Maintenance**).

#### 3. Name and Functions of Each Section

## (2) Rear



Terminal strip for external input/output signal
 Used to input the schedule signals and output error signals.

## **② Welding power supply breaker**

Used to accept the three-phase power supply for welding. (Note) This is not an earth leakage breaker. Prepare one separately if necessary.

- ③ Breaker lever Pulling up this lever supplies power; pushing down, disconnect power supply.
- ④ Trip button

Checks trip operation of the Breaker. Periodic checks are recommended.

## **S Welding transformer I/O connector**

For connecting the SENS cable of our welding transformer.

- ⑥ Terminal block for welding power output Used to connect to the input of the welding transformer.
- ⑦ Screw for connecting shielded line Connect the I/O shielded line.
- **8 COIL connector**

Used to connect the toroidal coil when another manufacturer's inverter transformer is used. (For the toroidal coil, see **10. (2) Options**.)

## 3. Name and Functions of Each Section

## 4. How to Operate Screens

## (1) STARTING Screen



(1) STARTING screen

The STARTING screen is displayed when the welding power supply is started. After the welding power supply is started, this screen is displayed for 10 seconds until welding is ready, the buzzer sounds once, and then the last displayed screen is displayed.

Each time the MENU key on the operation panel is pressed, screens are sequentially switched. (See figures below.)



Performing predetermined operation while a screen (2) to (7) is displayed displays a screen (8) to (10).

(8) I/O CHECK screen



When the ENTER, + and - keys are pressed simultaneously for a second, the I/O CHECK screen is displayed.

(9) INITIALIZE screen



When the RESET, + and - keys are pressed simultaneously for a second, the INITIALIZE screen is displayed.

(10) SCHEDULE COPY screen



When the MENU, + and - keys are pressed simultaneously for a second, the SCHEDULE COPY screen is displayed.

(11) ERROR screen



When an error occurs, the ERROR screen is displayed. (See 13. (1) Fault Code List.)

## (2) SCHEDULE Screen



On the SCHEDULE screen, welding schedules are set. 63 schedules (SCH#01 to 63) can be set. The weld time, current and others of each SCH can be set. The initial position of the cursor is the first digit of the SCH number and the number blinks.

The 1<sup>st</sup> line is fixed and shows SCH# $\square$  and CTRL (see **4. (6) (4)CTRL**) settings. The display of the 2<sup>nd</sup> to 10<sup>th</sup> lines is switched to the display block of 5<sup>th</sup>, 6<sup>th</sup> and 7<sup>th</sup> lines and that of 8<sup>th</sup>, 9<sup>th</sup> and 10<sup>th</sup> lines by moving the cursor.



Welding schedule and sign

	Setting item	Setting contents	Unit	Setting range	Initial value	CTRL setting				
1	SCH#	Schedule number	-	01 to 63	01					
2	UP1	Upslope 1 time	ms	00 to 99	00					
3	WEL1	Weld 1 time	ms	000 to 999	000					
4	DN1	Downslope 1 time	ms	00 to 99	00					
5	HEAT1	Weld 1 current	kA	0.20 to 5.00	0.20	Effective in PRIMARY/SECONDARY				
		Weld 1 voltage	V	0.20 to 9.99	0.20	Effective in VOLTAGE				
6	UP2	Upslope 2 time	ms	00 to 99	00					
$\bigcirc$	WEL2	Weld 2 time	ms	000 to 999	000					
8	DN2	Downslope 2 time	ms	00 to 99	00					
9	HEAT2	) HEAT2	HEAT2	HEAT2	HEAT2	Weld 2 current	kA	0.20 to 5.00	0.20	Effective in PRIMARY/SECONDARY
		Weld 2 voltage	V	0.20 to 9.99	0.20	Effective in VOLTAGE				
10	SQZ	Squeeze time	ms	0000 to 9999	0000					
1	COOL	Cooling time	ms	00 to 99	00					
(12)	HOLD	Hold time	ms	000 to 999	000					
(13)	TRANS No.	Transformer number	-	1 to 5	1					
14)	TURN RATIO	Turns ratio	-	001.0 to 199.9	001.0	Effective in PRIMARY				
(15)	GAIN	Control gain	-	1 to 9	1	Effective in SECONDARY/VOLTAGE				

## 1) SCH#

Sets the welding schedule number. Select from 01 to 63.

## 2 UP1

Set the upslope time (to increase the welding current gradually) for Weld 1. The setting range is 0 to 99 ms.

## 3 WEL1

Set the length of time to allow welding current to flow for Weld 1. The setting range is 0 to 999 ms. Set the total time of UP1 and DN1 to be shorter than WEL1. If not, "E-07 SCHEDULE SET ERROR" (Schedule setting error) will be displayed.

④ DN1

Set the downslope time (to decrease the welding current gradually) for Weld 1. The setting range is 0 to 99 ms.

## ⑤ HEAT1

Set the current or voltage for Weld 1. When CTRL (see **4. (6) (4)CTRL**) is changed, the items to be set also change.

⑥ UP2

Set the upslope time (to increase the welding current gradually) for Weld 2.

⑦ WEL2

Set the length of time to allow welding current to flow for Weld 2.

The setting range is 0 to 999 ms.

Set the total time of UP2 and DN2 to be shorter than WEL2. If not, "E-07 SCHEDULE SET ERROR" (Schedule setting error) will be displayed.

8 DN2

Set the downslope time (to decrease the welding current gradually) for Weld 2. The setting range is 0 to 99 ms.

9 HEAT2

Set the current or voltage for Weld 2. When CTRL (see **4. (6) (4)CTRL**) is changed, the items to be set also change.

10 SQZ

Set the length of time until proper squeeze is applied to workpiece (squeeze time). The setting range is 0 to 9999 ms.

1) COOL

Set the length of time to cool workpiece after turning off welding current (cooling time). The setting range is 0 to 99 ms.

## 12 HOLD

Set the length of time to hold workpiece after turning off welding current (hold time). The setting range is 0 to 999 ms.

13 TRANS No.

Sets the transformer number used in each welding schedule. The setting range is 1 to 5.

Functions when the transformer selector MA-650A is used.

1 TURN RATIO

Set the welding transformer turns ratio. The setting range is 1.0 to 199.9.

## Caution

When using in Primary constant-current peak value control, always set the correct turns ratio. An incorrect ratio will result in malfunction.

(15) GAIN

Sets the amount of feedback correction in Secondary constant-current effective value control and Secondary constant-voltage effective value control. The setting range is 1 to 9.

Though 1 is the initial value, the larger value will give the shorter rise time. (Invalid in Primary constant-current peak value control.)

## Caution

Control gain refers to a correction amount in feedback control.

Although the current rises more rapidly with greater control gain, the current waveform may experience overshoot. On the other hand, a smaller control gain suppresses current waveform overshoot but causes a slower increase in current. The Power Supply offers nine (9) choices of gain levels (1–9).



## (3) MONITOR Screen





Example display of no measurement (initial display)

MONITOR <good> SCH#01</good>	MONITOR< NG > SCH#01
[ms] [kA] [V] [%]	[ms][kA] [V] [%]
1:100 1.00 0.04 17.9	1:100 1.00 0.04 17.8
2:100 1.00 0.04 17.5	2:100 1.00 0.04 17.7

Example display of GOOD (normal welding)

Example display of NG (abnormal welding)

On the MONITOR screen, the work state at welding is checked. The welding result of each SCH is displayed.

The initial position of the cursor is the first digit of the SCH number and the number blinks.

The  $1^{st}$  line shows the judgment result and the SCH number. The  $2^{nd}$  line shows the unit of each measured value. The  $3^{rd}$  line shows the monitor result of Weld 1. The  $4^{th}$  line shows the monitor result of Weld 2.

	Setting item	Setting contents	Unit	Setting range	Initial value
2	SCH#	Schedule number	-	01 to 63	01
	Display item	Display contents	Unit	Display range	Initial display
1	<good ng=""></good>	Judgment result	-	GOOD/NG	
3	1-[ms]	Monitor value of WELD1 time	ms	000 to 999	
4	1-[kA]	Monitor value of WELD1 current	kA	0.00 to 9.99	-,
5	1-[V]	Monitor value of WELD1 voltage	V	0.00 to 9.99	
6	1-[%]	Monitor value of WELD1 pulse width	%	00.0 to 99.9	
7	2-[ms]	Monitor value of WELD2 time	ms	000 to 999	
8	2-[kA]	Monitor value of WELD2 current	kA	0.00 to 9.99	
9	2-[V]	Monitor value of WELD2 voltage	V	0.00 to 9.99	
10	2-[%]	Monitor value of WELD2 pulse width	%	00.0 to 99.9	

## Caution

- When the schedule number is changed by the schedule number selection inputs (Pins 7 to 12) of the external input/output signal before welding, the SCH# number (schedule number) in the MONITOR screen is automatically switched after welding.
- In the pulse widths (6) and (10), the widest pulse among the supplied primary pulse current is displayed as a percentage of pulse width in full wave mode.

## (4) MONITOR SET Screen





On the MONITOR SET screen, upper/lower limits of the welding current and voltage are set.

The initial position of the cursor is the first digit of the SCH number and the number blinks.

The 1<sup>st</sup> and 2<sup>nd</sup> lines show the SCH number and the unit of each set value.

On the 3<sup>rd</sup> and 4<sup>th</sup> lines, each upper/lower limit value is set. By moving the cursor between WEL1 setting (3<sup>rd</sup> and 4<sup>th</sup> lines) and WEL2 setting (5<sup>th</sup> and 6<sup>th</sup> lines), the display of WEL1 setting (3<sup>rd</sup> and 4<sup>th</sup> lines) and that of WEL2 setting (5<sup>th</sup> and 6<sup>th</sup> lines) can be switched.

	Setting item	Setting contents	Unit	Setting range	Initial value
1	SCH#	Schedule number	-	01 to 63	01
2	1H-[ms]	Upper limit of WELD1 time	ms	000 to 999	999
3	1H-[kA]	Upper limit of WELD1 current	kA	0.00 to 9.99	9.99
4	1H-[V]	Upper limit of WELD1 voltage	V	0.00 to 9.99	9.99
5	1H-[%]	Upper limit of WELD1 pulse width	%	010 to 100	100
6	1L-[ms]	Lower limit of WELD1 time	ms	0.00 to 9.99	000
$\overline{\mathcal{O}}$	1L-[kA]	Lower limit of WELD1 current	kA	0.00 to 9.99	0.00

	Setting item	Setting contents	Unit	Setting range	Initial value
8	1L-[V]	Lower limit of WELD1 voltage	V	0.00 to 9.99	0.00
9	2H-[ms]	Upper limit of WELD2 time	ms	000 to 999	999
10	2H-[kA]	Upper limit of WELD2 current	kA	0.00 to 9.99	9.99
1	2H-[V]	Upper limit of WELD2 voltage	V	0.00 to 9.99	9.99
(12)	2H-[%]	Upper limit of WELD2 pulse width	%	010 to 100	100
(13)	2L-[ms]	Lower limit of WELD2 time	ms	0.00 to 9.99	000
(14)	2L-[kA]	Lower limit of WELD2 current	kA	0.00 to 9.99	0.00
(15)	2L-[V]	Lower limit of WELD2 voltage	V	0.00 to 9.99	0.00

## (5) MONITOR MODE Screen



On the MONITOR MODE screen, the level for error judgment, the time range for upper/lower limit judgment and others are set.

The initial position of the cursor is the second digit of "NO CURR.TIME=  $\underline{\Box}$  ms" and the number blinks.

The 1<sup>st</sup> line is fixed and shows MONITOR MODE.

The display of the 2<sup>nd</sup> to 6<sup>th</sup> lines is moved by the cursor.

":" indicates the selected item and "=" indicates the numerical setting item.



	Setting item	Setting contents	Unit	Setting range	Initial value
1	NO CURR.TIME	No-current detection ignore time	ms	01 to 99	99
2	NO CURR.LEV.	No-current detection level	kA	0.00 to 9.99	0.00
3	NO VOLT.LEV.	No-voltage detection level	V	0.00 to 9.99	0.00
4	MON.FST TIME	Monitor start time	ms	00 to 15	15
5	MON.SLOPE	Monitor slope measurement mode	-	EXCLUDE/ INCLUDE	EXCLUDE

## 1 NO CURR.TIME

Set the time that the **IP-500A** will ignore the detection of no-current error/no-voltage error. The absence of welding current will not be detected as "E-08 NO CURRENT ERROR" (No-current error) or "E-09 NO VOLTAGE ERROR" (No-voltage error) as long as the absence lasts for a period within the time set here.

If, for example, you select 3 ms, the absence of current will not be detected as an error

as long as it lasts no more than 3 ms. An absence of current will be detected as an error if it lasts for 4 ms or more, the TROUBLE lamp lights up, and an error code appears on the LCD display. COOL/HOLD times are not included in the time until the absence of current is detected.

The setting range is 1 to 99 ms.

## 2 NO CURR.LEV.

Set the current level for determining the absence of current as "E-08 NO CURRENT ERROR" (No-current error).

The TROUBLE lamp will light up, an error code appears on the LCD display, and operation will stop if the monitored value falls below the level set here.

In the case of PRIMARY (primary constant-current peak value control), supplying current with the welding transformer's secondary side open will cause an excitation current to flow through the primary side. Set the current level slightly higher than the monitored current.

The setting range is 0 to 9.99 kA.

#### Caution

No judgment as to no-current error will be made if you select 0.00 kA (initial value). If the toroidal coil is disconnected in secondary control, excessive current may flow.

#### ③ NO VOLT.LEV.

Set the voltage level for determining the absence of voltage as "E-09 NO VOLTAGE ERROR" (No-voltage error).

The TROUBLE lamp will light up, an error code appears on the LCD display, and operation will stop if the monitored value falls below the level set here. The setting range is 0 to 9.99 V.

## Caution

No judgment as to no-voltage error will be made if you select 0.00 V (initial value). If the voltage detecting cable is disconnected in secondary control, excessive current may flow.

### (4) MON.FST TIME

Use this setting to specify the start time to measure the monitored value (current, voltage, pulse width). The setting range is 1 to 15 ms.

Use this setting to exclude the initial rise of current from measurement.

The monitored value will not be displayed if the weld time is shorter than MON. FST TIME. The monitored value will not be also judged.



## t = MON. FST TIME

## 5 MON.SLOPE

Select whether or not to include a slope period in the monitored value to be displayed. This function is applied to current, voltage and pulse width. The weld time is not applied.

Setting	Explanation		
EXCLUDE	Slope period will not be included.		
INCLUDE	Slope period will be included.		

## (6) MODE SELECT Screen



	Setting item	Setting contents	Unit	Setting range	Initial value
1	PARITY CHECK	Parity check	-	ON/OFF	OFF
2	ST.DELAY TIME	Start signal stabilization time	ms	01 to 20	20
3	ST.SIGNAL	Start mode	-	LATCHED/PULSED	LATCHED
4	CTRL	Control method	-	PRIMARY LIMIT/ SECONDARY RMS/ VOLTAGE RMS	PRIMARY LIMIT
5	GOOD/END TIME	GOOD/END signal output time	ms	000 to 200	200
6	NG OUTPUT	Error output setting	-	N.O./N.C.	N.C.
7	RESTART	Restart method selection	-	RESET/ NEXT START	RESET
8	TRANS SCAN	Transformer scan	-	OFF/1-1/1-2/1-3/ 1-4/1-5	OFF

AN:

SE

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1

1 PARITY CHECK

9<sup>th</sup> line

.

This check allows for detection of a failure resulting from a wire break in the schedule number selection input (Pins 7 to 12) signal lines. At ON, be sure that the total number of closed schedule number selection input and parity input (Pin 13) signal lines is always odd. If it is even, "E-04 PARITY ERROR" (Parity error) is displayed. At OFF, parity check will not be performed.

(See Note 1, "Schedule Nos. and Schedule Number Selection Input Pins.")

### 2 ST.DELAY TIME

Set the time from when the start signal (1ST and 2ND) is input to when an operation is started.

When the contents of the schedule setting of the determined SCH number is not proper, "E-07 SCHEDULE SET ERROR" (Schedule setting error) is displayed. (For proper conditions, see **13. (1) Fault Code List** - E-07.)

When the start signal is turned off within the set time after it is input, an operation is not started.

The setting range is 1 to 20 ms.

#### Example)

In Fig. (A), SCH1 and SCH8 are ON when the set time of ST.DELAY TIME has elapsed. Therefore, welding is performed using SCH9 (1+8=9).

In Fig. (B), only SCH8 is ON. As a result, welding is performed using SCH8.

SCH 16 and 32 are invalid because they are OFF when the set time of ST.DELAY TIME has elapsed.

(B)

	ST. DELAY_TI	ME set time		ST. DELAY	TIME set t	ime
2ND	<u></u>	>   ON	2ND	OFF	<>	ON
SCH1	OFF	ON	SCH1	<u>OFF</u>		0FF
SCH2	<u>OFF</u>	OFF	SCH2	<u>OFF</u>		0FF
SCH4	OFF	0FF	SCH4	_0FF		<u>OFF</u>
SCH8	OFF	(ON	SCH8	OFF		ON
SCH16	OFF	OFF	SCH16	_0FF		ON
SCH32	OFF	OFF	_ SCH32	ON		0FF

## ③ ST.SIGNAL

Sets the input method of the start signal (2ND) for starting the welding sequence.

Setting	Explanation
LATCHED	The welding sequence halts if the start signal stops till the end of the squeeze time.
PULSED	When the start signal is input for more than the time set through ST.DELAY TIME and then stops, the welding sequence will proceed to completion.

## (4) CTRL

Select one from the following three welding current control methods.

Setting	Explanation
PRIMARY LIMIT	Welding is performed in Primary constant-current peak value control.
SECONDARY RMS	Welding is performed in Secondary constant-current effective value control.
VOLTAGE RMS	Welding is performed in Secondary constant-voltage effective value control.

(See Note 2, Control method of the inverter welding power supply.)

## 5 GOOD/END TIME

Sets the output time when the GOOD and END signals are output after the welding sequence is complete. The setting range is 0 to 200 ms.

When 0 ms is set, the output is held until the next 1ST or 2ND signal input is determined.

## **⑥** NG OUTPUT

Sets the output mode of the NG1 (ERROR) signal and the NG2 (CAUTION) signal. (See **6. Interface**.)

Setting	Explanation
N.C.	Closed at normal / Open at error (Normally Close)
N.O.	Open at normal / Closed at error (Normally Open)

## ⑦ RESTART

Selects the restarting method when the following error occurs after the welding sequence is complete and the output operation of the NG1 (ERROR) and NG2 (CAUTION) signals.

- E-08 NO CURRENT ERROR (No-current error)
- E-09 NO VOLTAGE ERROR (No-voltage error)
- E-11 OUT LIMIT OF CURRENT ERROR (Outside upper/lower limit of current)
- E-12 OUT LIMIT OF VOLTAGE ERROR (Outside upper/lower limit of voltage)
- E-13 OUT LIMIT OF TIME ERROR (Outside upper/lower limit of weld time)
- E-14 OUT LIMIT OF PULSE WIDTH ERROR (Outside upper/lower limit of pulse width)

Setting	Explanation				
RESET	<ul> <li>The NG1 (ERROR) signal is output. (Same as when an error other than above occurs.)</li> <li>When TRANS SCAN (*1) is used and an error shown above occurs in the middle of a series of schedule numbers (SCH #), welding ends using the schedule number (SCH #) at that time.</li> <li>An error can be canceled by inputting the RESET key or the RESET signal.</li> </ul>				
NEXT START	<ul> <li>The NG2 (CAUTION) signal is output.</li> <li>Even when TRANS SCAN (*1) is used and an error shown above occurs in the middle of a series of schedule numbers (SCH #), welding is performed up to the last schedule number (SCH #).</li> <li>An error can be canceled by inputting the RESET key or the RESET signal.</li> <li>Even if the RESET key or the RESET signal is not input, an error is canceled by inputting the start signal (1ST/2ND) and the next sequence starts.</li> </ul>				

(\*1) For TRANS SCAN, see **(8) TRANS SCAN**.

## ⑧ TRANS SCAN

Select a mode of the transformer selecting function.

Up to 5 welding transformers can be switched by connecting the optional transformer selector **MA-650A** to the **IP-500A** and welding is performed using the selected schedule number and successive schedule numbers in order. Select a setting from 1-2 to 1-5 when connecting the transformer selector **MA-650A**.

Also, this setting switches the detection method of the thermo signal input: the external interface and the welding transformer I/O connector.

Setting	Explanation		
OFF	Sets when connecting a transformer other than ours. Set when not using the welding transformer I/O connector on the rear panel.		
1-1	<ul> <li>When connecting our welding transformer, set either of 1-1 to 1-5. The welding transformer I/O connector on the rear panel is used.</li> <li>Welding is performed using the selected schedule number (SCH n) and then successive schedule numbers n+1, n+2, n+3, n+4 At this time, welding is performed in sequence using transformer No. set on each SCHEDULE screen.</li> <li>1-1: Welding is performed using the transformer of the selected SCH. When connecting to our welding transformer are to this mode over for one on one</li> </ul>		
1-2	<ul> <li>connecting to our weiging transformer, set to this mode even for one-on-one connection to the transformer.</li> <li>1-2: Welding is performed in sequence using 2 successive SCHs from the selected SCH.</li> <li>1-3: Welding is performed in sequence using 3 successive SCHs from the selected SCH.</li> <li>1-4: Welding is performed in sequence using 4 successive SCHs from the selected SCH.</li> <li>1-5: Welding is performed in sequence using 5 successive SCHs from the selected SCH.</li> </ul>		
1-3	<ul> <li>* When SCH63 is selected, welding is performed using SCH63 first, then using SCH1, SCH2 in order.</li> <li>Example)</li> <li>When SCH2, 3, 4, 5, and 6 are selecting transformer numbers 4, 2, 3, 5, and</li> </ul>		
1-4	<sup>1</sup> respectively, and you start weiding using SCH2, weiding is performed using SCH2 (TR4) first, then SCH3 (TR2), SCH4 (TR3), SCH5 (TR5), and lastly SCH6 (TR1). (See figure below.)		
1-5	TR4       TR2       TR3       TR5       TR1         Welding sequence       SCH2       SCH3       SCH4       SCH5       SCH6         (SQZ~HOLD)       END       C       C       C         A: ST.DELAY TIME       B: 13 ms or less       C: GOOD/END TIME		

	Closed Blank : Open						
SCHEDULE	SCH 1	SCH 2	SCH 4	SCH 8	SCH16	SCH32	PARITY
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
:							
:							
:							
:							
60							
60							
62							
63							

## Note 1, Schedule Nos. and Schedule Number Selection Input Pins

## Note 2, Control method of the inverter welding power supply

The explanations for each control method of the inverter welding power supply is as follows.

Control method	Feature	Application	Control mechanism
PRIMARY LIMIT Primary constant-current peak value control (PWM peak value control)	Requires no connection of toroidal coil on the secondary side of the transformer. Requires turns ratio setting of the inverter transformer. The loss inside the transformer is not considered. Compared to the effective value control, the rise of the current is fast, but the effective current changes depending on how large the current ripple is.	Used for welding of coated metal or dissimilar metal.	Sets the primary current obtained by the set current and the transformer turns ratio as current limiter, and controls pulse width so that the switching is turned off when the primary current detected by the current sensor mounted into the power supply has reached to the current limiter.
SECONDRY RMS Secondary constant-current control (PWM effective value control)*	Compared to the primary constant-current control, the current accuracy is high since the welding is directly controlled, being detecting the welding current.	Commonly used for general welding.	Detects the welding current with toroidal coil to compare the measured current obtained by calculating with each control frequency to the set current, and controls pulse width so that there is no difference in these values.
VOLTAGE RMS Secondary constant-voltage control (PWM effective value control)	Controls with the voltage between electrodes. Provides welding without expulsion by making voltage from the rise constant and reducing the current.	Used for welding of high specific resistance material, welding of high contact resistance workpiece such as cross wire, and projection welding, which has resistance change in early welding to reduce explosion.	Detects the voltage between electrodes with the voltage detecting cable to compare the measured current obtained by calculating with each control frequency to the set voltage, and controls pulse width so that there is no difference in these values.

## Note 3, Thermo signal input of the external input/output signal

Only when TRANS SCAN is OFF, THERMOSTAT (Pin 22) for the thermo signal input of the external interface is enabled, and when the thermo signal input is open, "E-15 TRIP OF EXTERNAL THERMO ERROR" (External transformer thermos error) occurs.

When TRANS SCAN is not OFF, the thermo error is detected by the signal from the thermo sensor input to the welding transformer I/O connector through the separately sold SENS cable, not by the external interface.

Set when combining with our inverter welding transformer.

## (7) SETUP Screen



On the SETUP screen, the **IP-500A**'s basic setting and communication setting are performed.

The initial position of the cursor is the first digit of "DEVICE No.=  $\Box \Box$ " and the number blinks.

The 1<sup>st</sup> line shows the screen name "SETUP" (fixed).

The display of the 2<sup>nd</sup> to 6<sup>th</sup> lines is scrolled one line at a time by the cursor.



	Item Item contents D		Display cont	Display contents	
1	ROM Ver#	Program version	V**-***		
	Setting item	Setting contents	Setting range	Initial value	
2	DEVICE No.	Device number	01 to 31	01	
3	LCD CONTRAST	LCD contrast	01 to 16	08	
4	COMM CONTROL	Communication function	OFF/>/<->	OFF	
5	BAUD RATE	Baud rate	9600/19200/38400	9600	

## 1 ROM Ver#

The program version of the IP-500A is displayed. (\* Display only and no setting)

## 2 DEVICE No.

Input the identification No. of your Power Supply. The setting range is 1 to 31. If you have two or more Power Supply units, input 01 for the first one, 02 for the second one, 03 for the third one, and so on.

## ③ LCD CONTRAST

Sets the contrast of characters on the LCD display. The setting range is 1 to 16. The larger the value, the darker the character.

## (4) COMM CONTROL

Selects the communication function.

Setting	Explanation
OFF	No communication
>	One-way communication
<->	Both-way communication

## **⑤** BAUD RATE

Selects the external communication speed.

Setting	Explanation
9600	Communication at 9600 bps
19200	Communication at 19200 bps
38400	Communication at 38400 bps

## (8) I/O CHECK Screen



On the I/O CHECK screen, input/output of the external I/O is checked. When the ENTER, + and - keys are pressed simultaneously for a second, the I/O CHECK screen is displayed.

Can be moved from any of the following screens.

- SCHEDULE screen
- MONITOR screen
- MONITOR SET screen
- MONITOR MODE screen
- MODE SELECT screen
- SETUP screen

	Expression	Contents	Explanation
1	IN	Input signal of the external interface	"*" for input ON and "(blank)" for OFF
2	TR	Input signal of the welding transformer I/O connector	"*" for input ON and "(blank)" for OFF
3	OUT	Output signal of the external interface	"1" for output ON and "0" for OFF

For the relationship between numbers and input signals of IN and TR and the relationship between numbers and output signals of OUT, see table below. When the MENU key is pressed, the SCHEDULE screen is displayed.

		Signal name														
$\backslash$	0	1	2	3	4	5	6	7	8	9	А	В	С	D	E	F
IN	EMG STOP	1ST	2ND	SCH1	SCH2	SCH4	SCH8	SCH16	SCH32	PARITY	WELD	RESET	KEY	WELD1 STOP	WELD2 STOP	THERMO
TR	TR1 THERMO	TR2 THERMO	TR3 THERMO	TR4 THERMO	TR5 THERMO											
OUT	READY	GOOD	END	NG1 (ERROR)	NG2 (CAUTION)	WELD SIGNAL	SOL	(Unused)								

When the 1ST and 2ND signals is input, the display cannot be moved from the I/O CHECK screen to other screens.

The NG1 (ERROR) and NG2 (CAUTION) signals do not depend on the NG OUTPUT (error output setting) setting.

4. How to Operate Screens

## (9) INITIALIZE Screen



On the INITIALIZE screen, all data is initialized.

When the RESET, + and - keys are pressed simultaneously foe a second, the INITIALIZE screen is displayed.

Can be moved from any of the following screens.

- SCHEDULE screen
- MONITOR screen
- MONITOR SET screen
- MONITOR MODE screen
- MODE SELECT screen
- SETUP screen



Select YES or NO that appears to the right of "ALL DATA CLEAR?" by pressing the + or - key and press the ENTER key.

Selecting NO and pressing the ENTER key displays the SCHEDULE screen without initialization.

Selecting YES and pressing the ENTER key starts the initialization.

When the initialization is complete, "DATA CLEAR FINISHED!" is displayed.



Press the MENU key or the cursor key to return to the SCHEDULE screen.

4. How to Operate Screens
### (10) SCHEDULE COPY Screen



On the SCHEDULE COPY screen, schedules are copied.

When the MENU, + and - keys are pressed simultaneously for a second, the SCHEDULE COPY screen is displayed.

Can be moved from any of the following screens.

- SCHEDULE screen
- MONITOR screen
- MONITOR SET screen
- MONITOR MODE screen
- MODE SELECT screen
- SETUP screen



- ① Copy source SCH number: 01 to 63 (initial value: 01)
- (2) Copy destination SCH number at the start: 01 to 63 (initial value: 01)
- ③ Copy destination SCH number at the end: 01 to 63 (initial value: 01)
- ④ Copy start confirmation: YES or NO (initial value: NO) Press the + key for YES and the - key for NO.
- \* Set 2 and 3 so that  $2 \leq 3$ .

Selecting NO and pressing the ENTER key displays the SCHEDULE screen without copying.

Selecting YES and pressing the ENTER key starts copying.

When copying is complete, "SCH COPY FINISHED!!" is displayed.

#### 4. How to Operate Screens



Press the MENU key or cursor key to return to the SCHEDULE screen.

- Example 1) When copying the schedule of SCH#01 to that of SCH#02 Set to "#01  $\rightarrow$  #02-02." Schedule of SCH#01 is copied to SCH#02.
- Example 2) When copying the schedule of SCH#01 to those of SCH#02 to SCH#05

Set to "#01  $\rightarrow$  #02-05." Schedule of SCH#01 is copied to SCH#02 to SCH#05.

### (11) ERROR Screen



The ERROR screen is displayed when an error occurs. (See **13. (1) Fault Code list**.)



(Example: ERROR screen when E-11 has occurred)

While the ERROR screen is displayed, the buzzer sounds continuously. How to cancel the error differs depending on the RESTART (restart method) setting in the MODE SELECT screen. (See table below.)

<b>RESTART</b> setting	How to reset errors		
RESET	- RESET key		
	- RESET signal input		
	- RESET key		
	- RESET signal input		
	- When an error occurs after welding sequence ends, an error is canceled by the start signal (1ST and 2ND) is input and the next sequence starts.		
	E-08 NO CURRENT ERROR (No-current error)		
	E-09 NO VOLTAGE ERROR (No-voltage error)		
NEXT START	E-11 OUT LIMIT OF CURRENT ERROR (Outside upper/lower limit of current)		
	E-12 OUT LIMIT OF VOLTAGE ERROR (Outside upper/lower limit of voltage)		
	E-13 OUT LIMIT OF TIME ERROR (Outside upper/lower limit		
	of weld time)		
	E-14 OUT LIMIT OF PULSE WIDTH ERROR (Outside upper/lower limit of pulse width)		

#### 4. How to Operate Screens

# **5. Installation and Connection**

### (1) Installation Place



Install the Power Supply in a sure place at a level with the ground surface. If the product is operated in inclined or fallen form, a failure will occur.

When planning for the installation, allow at least the figured clearance on each side from the wall, as referred to the figures below, for improving the effect of heat release.

Allow at least 100 mm or more from the end of the wiring outlet projected at the output terminal cover in the rear potion of the **IP-500A**.

As the IP-500A should be air-cooled, do not install it in a closed area.



5. Installation and Connection

### (2) Grounding Work

Perform class C grounding work (grounding resistance: 10  $\Omega$  max., grounding wire:  $\phi 1.6$  min.).

### (3) Basic Connection





Be sure to ground the equipment. Be sure to install the terminal cover after wiring.

Be sure to install an earth leakage breaker on electricity input part to protect from an over current and electric leak.

#### Breaker rated current

Calculate the average Input current using output current (momentary maximum current) and duty cycle:

Average input current = I x 0.817 x  $\sqrt{\frac{\alpha}{100}}$ 

I : Primary output current (momentary maximum current) of IP-500A  $\alpha$  : Duty cycle (%)

Select the breaker rated current of at least the average input current above. Check the coordination of output current (momentary maximum current) and tripping time on the tripping characteristic curve of the breaker to select the appropriate breaker.

#### (Example)

Transformer secondary current = 5000 A / Duty cycle = 7% Transformer used: IT-H190A6, Set current: 5000 A, Duty cycle: 7%, and Transformer turns ratio: 50 : 1 (400 V)

Primary output current =  $5000 \div 50 = 100 \text{ A}$ 

$$100 \times 0.817 \times \sqrt{\frac{7}{100}} = 22 \text{ (A)}$$

Breaker of at least 22A (30A) must be selected.

5. Installation and Connection

#### **1** When using our transformer (IT-H190A6)



Earth leakage breaker

- (Note 1) All items other than the IP-500A are sold separately.
- (Note 2) Use the SENS cable SK-05741 specified by us.
- (Note 3) The screw of the power cable for the IP-500A is M8 (M6 for the PE terminal). The screw of the output cable is M6 for U, V and PE.
- (Note 4) On the MODE SELECT screen, set TRANS SCAN to 1-1.

Do not set it to OFF to enable the thermo signal of the welding transformer.

(Note 5) Do not connect the voltage detection wiring to V-SENS (Pins 38 and 39) of the input/output terminal strip.

5. Installation and Connection

#### <sup>②</sup> When using another manufacturer's transformer



- (Note 1) All items other than the IP-500A are sold separately.
- (Note 2) In Secondary constant-current effective value control, attach the optional toroidal coil to the secondary conductor and connect it to the COIL connector. In Secondary constant-voltage effective value control, connect the voltage detecting cable neat the electrode and connect the other side to Pins 38 and 39 on the external input/output signal terminal strip.
- (Note 3) The screw of the power cable for the **IP-500A** is M8 (M6 for the PE terminal). The screw of the output cable is M6 for U, V and PE.
- (Note 4) On the MODE SELECT screen, set TRANS SCAN to OFF. (See 4. (6) (8).)
- (Note 5) Connect the transformer thermo signal line (Pins 21 and 22) of the external input/output signal pins. When the transformer thermo signal is not input (open state), "E-15 TRIP OF EXTERNAL THERMO ERROR" occurs.

#### 5. Installation and Connection

### (4) Connection Procedure

#### **1** When using our transformer (IT-H190A6)

 Connection to the transformer's input terminal block and the SENS cable Use the output cable to connect the welding power output terminal block on the Power Supply's rear panel with the welding transformer's input terminal block. (For the output cable specification, see 10. (2) Options.)



#### 2) Connecting the power cable

Connect the power supply to the Welding Power Supply Breaker on the rear panel using the input cable. (See **10. (2) Options**.) Ground the [**PE**] terminal.

3) Connecting the necessary cables to the Connecting terminal strip for External Input/Output Signal

Prepare a connecting cable referring to **6. Interface**.

#### **2** When using another manufacturer's transformer

#### 1) Connection to the welding transformer's input terminal block

Use the output cable to connect the welding power output terminal block on the Power Supply's rear panel with the welding transformer's input terminal block. For the connection to the welding transformer, refer to the operation manual for the welding transformer.

2) Connecting a toroidal coil for welding transformer secondary current detection

Connect a toroidal coil to the COIL connector on the rear panel.

- **3)** When there is thermo sensor in the welding transformer Connect to THERMOSTAT (Pin 22) of the external interface. (See **6. Interface**.)
- 4) When detecting the welding transformer secondary voltage Connect the voltage detecting cable to VOLT SENS (Pins 38 and 39) of the external interface. (See 6. Interface.)
- 5) Connecting the power cable

Connect the power supply to the Welding Power Supply Breaker on the rear panel using the input cable. (See **10. (2) Options**.) Ground the [**PE**] terminal.

6) Connecting the necessary cables to the Connecting terminal strip for External Input/Output Signal

Prepare a connecting cable referring to **6. Interface**.

## 6. Interface

### (1) Connection Diagram for External Input/Output Signals



Specifications of Terminal Strip for External Input/Output Signals		
Crimp-on terminals allowed to be installed per a terminal	2 pieces max.	
Size of crimp-on terminal	M3 or M3.5 (7.1 mm wide)	
Recommended cable cross-section	0.2 mm <sup>2</sup> min.	

(Note 1) Use the shielded cable for the interface input/output cable and connect the shielded part to the screw for connecting shielded line on the rear panel.

(Note 2) The rated output of the solenoid valves SOL POWER (Pin 34) and SOL (Pin 36) is 24 V AC/DC or 120 V AC at 0.1 A. Do not connect the solenoid valve exceeding this.

6. Interface
6-2

# (2) Description of External I/O Signals

Pin No.	Name	Description		
1	INT.24V	Pin 1 is 24 V DC present. (Maximum rating: 24 V DC, 0.4 A) Pin 2 is a COM pin for input circuits of the external interface. When using a contact or open collector (sink type) PLC (programmable logic controller) as an input signal (e.g., for startup or schedule selection), connect pins 1 and 2.		
2	EXT.COM	open pin 1 and connect pin 2 and the positive or negative pin of the 24 V DC power supply. <b>Caution</b> Do not use pin 1 unless connecting it to pin 2 or 3, or connecting pin 34 to drive the solenoid valve. Failure to observe this precaution will result in malfunction.		
3	STOP	Stop pin. Normally, connect pins 3 and 1.Opening this pin will cause "E-05 STOP ERROR" to occur, stopping operation.Open this pin when you wish to stop the sequence halfway through when using starting signal self-hold input.20 ms or more is required for receiving the input signal.CautionThis has not an emergency stop function.If you need an emergency stop function, separately install the circuit to cut off the power to the Power Supply.		
4	1ST	1ST input pin. Closing this pin will close SOL of pin 36. Since the welding sequence does not start, you can adjust or check the force position. When the 2ND pin is closed after this, a welding can be done at the most appropriate force position. The start signal stabilizing time can be changed in the range of 1 to 20 ms. (Also applied to the 2ND signal.)		
5	2ND	2ND input pin. Closing this pin will start the welding sequence. The start signal stabilizing time can be changed in the range of 1 to 20 ms. (Also applied to the 1ST signal.)		
6 14 16 21 23	СОМ	COM pin. This pin is internally connected to the GND chassis.		
7 8 9 10 11 12	SCH 1 SCH 2 SCH 4 SCH 8 SCH16 SCH32	Schedule number selection input pins. Select the schedule number by the binary combination of closed pin numbers. The schedule number selected by the I/O connectors has precedence over that selected on screen. If you wish to select the schedule number through on-screen manipulation, leave all pins 7 to 12 open. (See <b>4. (6)</b> Note 1, Schedule Nos. and Schedule Selection Pins.)		

Pin No.	Name	Description		
13	PARITY	Parity input pin. This pin allows for detection of a wire break in the schedule number selection signal lines. Be sure that the total number of closed schedule number selection input pins of pins 7 to 12 and parity signal lines is always odd. (See <b>4. (6)</b> Note 1, Schedule Nos. and Schedule Selection Pins.)		
15	WELD ON/OFF	<ul> <li>Weld ON/OFF input pin. Close this pin to turn ON the WELD</li> <li>ON/OFF signal, and open it to turn it OFF.</li> <li>Leaving this pin open will shut off welding current even when the sequence operation is performed. Use this pin, for example, to start the sequence experimentally.</li> <li>20 ms or more is required for receiving the input signal.</li> </ul>		
17	RESET	Error/caution reset input pin. Eliminate the cause of error or caution and close this pin to reset the error/caution indication and NG1 (ERROR) signal (Pin 30) output/NG2 (CAUTION) signal (Pin 31) output. 20 ms or more is required for receiving the input signal		
18	KEY LOCK	Program inhibit input pin. Closing this pin will not allow you to change all settings.		
19	WELD1 STOP	WELD1 stop input pin. Closing this pin during the WELD1 sequence will switch the sequence to COOL (skip function). This does not work when this pin is closed during a sequence other than WELD1. When this pin is closed before startup, "E-06 WELDING STOP ERROR" occurs after the start signal is input. When this pin is closed before WELD1 welding start after startup, the current is supplied for at least a control cycle and WELD1 is stopped to switch the sequence to COOL		
20	WELD2 STOP	WELD2 stop input pin. Closing this pin during the WELD2 sequence will switch the sequence to HOLD (skip function). This does not work when this pin is closed during a sequence other than WELD2. When this pin is closed before startup, "E-06 WELDING STOP ERROR" occurs after the start signal is input. When this pin is closed before WELD2 welding start after startup, the current is supplied for at least a control cycle and WELD2 is stopped to switch the sequence to HOLD.		
22	THERMOSTAT	<ul> <li>Thermo signal pin when using another manufacture's inverter transformer.</li> <li>Connect to the transformer thermostat or diode thermostat.</li> <li>Opening the pin will result in a thermostat error.</li> <li>20 ms or more is required for receiving the input signal.</li> </ul>		
24	RS485 (+)	RS485 (+) pin for external communication.		
25	RS485 (-)	RS485 (-) pin for external communication.		
26	RS485 SHIELD	RS485 shield pin for external communication.		
27	READY	<ul> <li>Welding ready signal output pin.</li> <li>This pin is closed when all the following are satisfied:</li> <li>(1) The WELD lamp on the panel lights up.</li> <li>(2) The WELD ON/OFF input of the external interface is closed.</li> <li>(3) No error occurs.</li> <li>(4) The welding sequence is not in progress.</li> <li>(5) The external communication is not in progress.</li> </ul>		

#### IP-500A

Pin No.	Name	Description			
28	GOOD	Welding normal signal output pin. This pin is closed when the measured value is within the range set in the MONITOR SET screen after a welding sequence ends. Setting range of output time: 0 to 200 ms (Output is kept in 0 ms.) (See <b>4. (6) (5)GOOD/END TIME</b> .) (See <b>8. Timing Chart</b> .) The contact is roted at 24// PC at 20 mA (comisenducted relation)			
29	END	Welding end signal output pin. This pin is closed each time when a sequence ends. Setting range of output time: 0 to 200 ms (Output is kept in 0 ms.) (See <b>4. (6) ⑤GOOD/END TIME</b> .) (See <b>8. Timing Chart</b> .) The contact is rated at 24 V DC at 20 mA (semiconductor relay)			
30	NG1 (ERROR)	<ul> <li>Error signal output pin. This signal is output when any of the following applies:</li> <li>when abnormality such as "E-05 STOP ERROR" occurs in the welding power supply</li> <li>when RESET is set for RESTART and the measured value is outside the range set on the MONITOR SET screen after the welding sequence ends.</li> <li>when RESET is set for RESTART and "E-08 NO CURRENT ERROR" or "E-09 NO VOLTAGE ERROR" occurs.</li> <li>If an error signal is output, operation will halt until the RESET key or the RESET signal (Pin 17) is input. (See 4. (6)  RESTART.)</li> <li>When N.O. is set for NG OUTPUT, the pin is open with the power turned on, but becomes closed with an error occurring.</li> <li>When N.C. is set for NG OUTPUT, the pin is closed with the power turned on, but becomes open with an error occurring.</li> <li>(See 4. (6)  MG OUTPUT.)</li> <li>The contact is rated at 24 V DC at 20 mA (semiconductor relay).</li> </ul>			
31	NG2 (CAUTION)	<ul> <li>Caution signal output pin. This signal is output when any of the following applies:</li> <li>when NEXT START is set for RESTART and the measured value is outside the range set on the MONITOR SET screen after the welding sequence ends.</li> <li>when NEXT START is set for RESTART and "E-08 NO CURRENT ERROR" or "E-09 NO VOLTAGE ERROR" occurs.</li> <li>If a caution signal is output, operation will halt until the RESET key or the RESET signal (Pin 17) is input. Also, the welding sequence can be restarted by inputting the start signal 1ST (Pin 4) or 2ND (Pin 5). (See 4. (6) ⑦RESTART.)</li> <li>When N.O. is set for NG OUTPUT, the pin is open with the power turned on, but becomes closed with an error occurring. When N.C. is set for NG OUTPUT, the pin is closed with the power turned on, but becomes open with an error occurring. (See 4. (6) ⑥NG OUTPUT.)</li> </ul>			

Pin No.	Name	Description		
32	WELD SIGNAL	Welding timing signal output pin. This pin is closed during welding (WELD1, WELD2). This is not output during COOL. When the weld time is set for WELD1 or WELD2, this pin is closed even if WELD ON/OFF is started with OFF. (See <b>8. Timing Chart</b> .) The contact is rated at 24 V DC at 20 mA (semiconductor relay).		
33	OUT COM	Common pin for output pins.		
34	SOL POWER	Power input pin to drive the solenoid valve. Input 120 V AC or 24 V AC/DC power.		
35 <sup>*1</sup>	SOL COM	COM pin for the solenoid valve.		
<b>36</b> *²	SOL	Solenoid valve output pin. These pins are closed for the duration of the 1ST (Pin 4) input and the 2ND (Pin 5) input. Output between SQZ and HOLD. (For details of operation, see <b>8. Timing Chart</b> .) The contact is rated at 120 V AC or 24 V AC/DC at 0.1 A (semiconductor relay). Use a solenoid valve with a current capacity of 0.1 A or less.		
37	(Unused)	Not used.		
38 39	VOLT SENS	Welding transformer secondary voltage input pins. Connect to the electrodes of the welding head during constant-voltage control or when monitoring the welding transformer secondary voltage.		

\*1 When using 24 V DC solenoid, install diodes on measures to prevent surge voltage. Example) When inputting + to Pin 36 and – to Pin 35



\*2 When solenoid valves are activated by the use of an internal power supply



### (3) Connection of Input Signals

 Connection with equipment having a contact input Connect pins 1 and 2.



Connection with equipment featuring NPN open collector output (when using internal power supply) Connect pins 1 and 2.



③ Connection with equipment featuring PNP current output (when using external power supply)

Connect the negative side of an external 24 V DC power supply to pin 2.



④ Connection with equipment featuring NPN open collector output (when using external power supply)

Connect the positive side of an external 24 V DC power supply to pin 2.



(Note) The circuit between pins 1-2-3, 15-16, and 22-23 are closed when shipped. Disconnect unnecessary jumper wires referring to each connection.

6. Interface

# 7. Basic Operation

#### (1) Turn on the welding power

① Pull up the breaker lever at the rear of the **IP-500A** to turn on the welding power.



IP-500A rear

After power-on, the STARTING screen appears at the LCD display.
 Also, the READY lamp blinks for 10 seconds, then goes off after 10 seconds.
 However, when the lighting conditions of the READY lamp are satisfied, it comes on.



STARTING screen

(2) Set the welding schedule (See 4. (2) SCHEDULE Screen.)

- ① Press the MENU key to call the SCHEDULE screen.
- ② Set each item. Set it a little lower than the standard for the first welding.

#### (3) Start the operation

Input the start signal while the READY lamp is NOT on, and check each sequential operation.



When confirming the operation, check that the SQZ time (squeeze time) is sufficient. If the welding current flows before the welding electrode force becomes sufficient, spatters are produced.

2 Set a workpiece and weld it.

Turn on the WELD key on the front panel and the external interface WELD ON/OFF (Pin 15).

Check that the READY lamp lights up, then supply the welding current. At this time, confirm that the welding current is flowing normally by checking the WELD lamp and the MONITOR screen.

- ③ Re-set the schedule so that the workpiece will be welded adequately.
- ④ When welding plural workpieces according to plural schedules, change the schedule number and set a new time and welding current.
- Set the upper and lower limits of the welding current and the weld time on the MONITOR SET screen for each schedule number if necessary. (See 4. (4) MONITOR SET Screen.)

#### (4) Turn off the welding power

① Push down the breaker lever at the rear of the **IP-500A** to turn off the welding power.



IP-500A rear

2 Panel LEDs and the LCD display go off.

# 8. Timing Chart

### (1) Basic Sequence

Shown below is a basic sequence when TRANS SCAN is set to OFF.



A: ST.DELAY TIME (Start signal stabilizing time. See 4. (6) ②ST.DELAY TIME.)

19200

38400

B: GOOD/END TIME (GOOD/END signal output time. See **4. (6) (5)GOOD/END TIME**.) C: Single-directional communication output time

40 ms max.

20 ms max.

 COMM CONTROL (\*1)
 BAUD RATE (\*2)
 Communication output time

 OFF
 0 ms

 -->
 9600
 80 ms max.

(\*1) See 4. (7) ④COMM CONTROL.

(\*2) See 4. (7) **5**BAUD RATE.

(Single-directional communication)

- Note 1: When LATCHED is selected for ST.SIGNAL (See **4. (6) ③ST.SIGNAL**.) and the 2ND input is open during SQZ, the sequence stops.
- Note 2: When the welding starts using 2ND only, see the timing indicated by the line "----."

### (2) Sequence when the Monitor Judgment is NG

Operation when the monitor judgment is NG depending on the RESTART setting (See **4. (6) (7)RESTART**.) changes as follows. (The TRANS SCAN setting (See **4. (6) (8)TRANS SCAN**.) is OFF.)

① When RESTART is set to RESET

A sample weld sequence is shown, which represents the occasion where NG1 (ERROR) is output when a monitored value goes out of the range between the upper and lower limit set in the MONITOR SET screen.



- A: ST.DELAY TIME (Start signal stabilizing time. See 4. (6) ②ST.DELAY TIME.)
- B: GOOD/END TIME (GOOD/END signal output time. See **4. (6) (5)GOOD/END TIME**.) C: Single-directional communication output time

COMM CONTROL (*1)	BAUD RATE (*2)	Communication output time
OFF	-	0 ms
>	9600	80 ms max.
(Single-directional	19200	40 ms max.
communication)	38400	20 ms max.

- (\*1) See 4. (7) ④COMM CONTROL.
- (\*2) See 4. (7) **5**BAUD RATE.

2 When RESTART is set to NEXT START

A sample weld sequence is shown, which represents the occasion where the CAUTION signal is output when a monitored value goes out of the range between the upper and lower limit set in the MONITOR SET screen.



A: ST.DELAY TIME (Start signal stabilizing time. See 4. (6) (2) ST.DELAY TIME.)

B: GOOD/END TIME (GOOD/END signal output time. See **4. (6) (5)GOOD/END TIME**.) C: Single-directional communication output time

COMM CONTROL (*1)	BAUD RATE (*2)	Communication output time
OFF	-	0 ms
>	9600	80 ms max.
(Single-directional	19200	40 ms max.
communication)	38400	20 ms max.

(\*1) See 4. (7) ④COMM CONTROL.

(\*2) See 4. (7) **5**BAUD RATE.

Note 1: NG2 (CAUTION) is output until the RESET or the next 2ND is input. (The line "----" indicates the timing when 2ND is input.)

### (3) Occurrence of an Error during Welding Sequence

A sample weld sequence is shown, which represents the occasion where an error (\*1) occurs.

When an error occurs, a weld sequence is not performed after that.



A: ST.DELAY TIME (Start signal stabilizing time)

(\*1) The relevant error codes are as follows. Error code: E-01 to 03, E-05, E-08 to 10, and E-15 to 16 (For details of error codes, see 13. Troubleshooting.)

### (4) Sequence in TRANS SCAN

Shown below is the sequence when using the **IP-500A** in combination with the transformer selector **MA-650A**. (For details of function, see **4. (6) (B)TRANS SCAN**.)

Sequence when TRANS SCAN is set to 1-5 (SCH2 is selected)

External input SCH2	
READY	
External output SOL Transformer switch 1~5	SCH2's SCH3's SCH4's SCH5's SCH6's TRANS No. TRANS No. TRANS No. TRANS No. TRANS No.
Welding sequence (SQ7~HOLD)	D     E     E     E     E       SCH2     SCH3     SCH4     SCH5     SCH6
External output GOOD	
RS-485 Single-directional communication	ř

A: ST.DELAY TIME (Start signal stabilizing time. See **4. (6) (2)ST.DELAY TIME**.) B: GOOD/END TIME (GOOD/END signal output time. See **4. (6) (5)GOOD/END TIME**.) C: Single-directional communication output time

COMM CONTROL (*1)	BAUD RATE (*2)	Communication output time
OFF	-	0 ms
>	9600	80 ms max.
(Single-directional	19200	40 ms max.
communication)	38400	20 ms max.

(\*1) See 4. (7) **(COMM CONTROL**.

(\*2) See 4. (7) **5**BAUD RATE.

D: 3 ms

E: 13 ms max.

# (5) Sequence when the Monitor Judgment of TRANS SCAN is NG

Operation when the monitor judgment is NG depending on the RESTART setting (See **4. (6) (7)RESTART**.) changes as follows. (The TRANS SCAN setting (See **4. (6) (8)TRANS SCAN**) is not OFF.)

1 When RESTART is set to RESET

When the monitor judgment is NG in SCH3, NG1 (ERROR) is output without performing the welding sequence of SCH4 or later.



- A: ST.DELAY TIME (Start signal stabilizing time. See **4. (6) (2)ST.DELAY TIME**.)
- B: GOOD/END TIME (GOOD/END signal output time. See **4. (6) (5)GOOD/END TIME**.) C: Single-directional communication output time

COMM CONTROL (*1)	BAUD RATE (*2)	Communication output time
OFF	-	0 ms
>	9600	80 ms max.
(Single-directional	19200	40 ms max.
communication)	38400	20 ms max.

(\*1) See 4. (7) ④COMM CONTROL.

(\*2) See 4. (7) **5**BAUD RATE.

② When RESTART is set to NEXT START

Even when the monitor judgment is NG in SCH3, the welding sequence is performed to the last SCH6 and NG2 (CAUTION) is output.

External input	<u></u>	
READY	Ţ	
External output SOL	ļ	
Transformer switch	SCH2's SCH3's SCH4's SCH5's SCH6's TRANS No. TRANS No. TRANS No. TRANS No.	
Welding sequence	D E E E E E E E E E E E E E E E E E E E	3.
	ج ا	1
 External output		
NG2(CAUTION)		C
RS-485		<u>}-i</u>
Single-directional communication		

- A: ST.DELAY TIME (Start signal stabilizing time. See 4. (6) ②ST.DELAY TIME.)
- B: GOOD/END TIME (GOOD/END signal output time. See **4. (6) (5)GOOD/END TIME**.) C: Single-directional communication output time

COMM CONTROL (*1)	BAUD RATE (*2)	Communication output time
OFF	-	0 ms
>	9600	80 ms max.
(Single-directional	19200	40 ms max.
communication)	38400	20 ms max.

(\*1) See 4. (7) ④ COMM CONTROL.

(\*2) See 4. (7) **5**BAUD RATE.

# **9. External Communication Function**

### (1) Introduction

The **IP-500A** can be used to set schedules from an externally-connected personal computer (abbreviated as PC) or to read monitored data and several kind of status data.

Prepare the program and its development environment for controlling the Power Supply on the customer side.

#### (2) Data Transmission

- Transmission Mode RS-485, Asynchronous, Half-Duplex
- ② Transmission Rate Select either of the followings at BAUD RATE in the SETUP screen: 9600, 19200, 38400 bps
- ③ Data Format

Start bit	1
Data bit	8
Stop bit	1
Parity bit	Even

Character Code
 ASCII

### (3) Configuration



- (Note 1) When controlling two or more devices with one host computer, register the device No. for each device. Set Device No. at the SETUP screen in **7. Basic Operation**.
- (Note 2) Do not assign one number to more than one device. Also, do not send data simultaneously from two or more devices in the single-directional communication mode. Otherwise, data collision and inappropriate system operations may result.
- (Note 3) The RS-232C/RS-485 conversion adapter is not included in the accessories. It is required to prepare the adapter at customer's side.

### (4) Protocol (Single-Directional Communication)

Single-directional communication mode (when the setting of **4. (7) (4)COMM CONTROL** is -->)

Data is output one-sidedly from the **IP-500A** after each welding or a fault has occurred.

① Monitor data

Commands transmitted from the IP-500A to the host computer are as follows:

	ltem	Display	Range	Length
1	Device number	nn	01 to 31	2
2	Delimiter	,		1
3	Schedule number	nn	01 to 63	2
4	Delimiter	,		1
5	Weld time of WELD1	nnnms	000 to 999ms	5
6	Delimiter	,		1
7	Current value of WELD1	n.nnkA	0.00 to 9.99kA	6
8	Delimiter	,		1
9	Voltage value of WELD1	n.nnV	0.00 to 9.99V	5
10	Delimiter	,		1
11	Pulse width of WELD1	nn.n%	10.0 to 99.9%	5
12	Delimiter	,		1
13	Weld time of WELD2	nnnms	000 to 999ms	5
14	Delimiter	,		1
15	Current value of WELD2	n.nnkA	0.00 to 9.99kA	6
16	Delimiter	,		1
17	Voltage value of WELD2	n.nnV	0.00 to 9.99V	5
18	Delimiter	,		1
19	Pulse width of WELD2	nn.n%	10.0 to 99.9%	5
20	Return code	[CR]	(0x0d)	1
21	Feed code	[LF]	(0x0a)	1

Communication example:

"IP-500A  $\rightarrow$  Host computer"

01,63,199ms,1.99kA,1.00V,59.9%,299ms,2.99kA,2.00V,69.9%[CR][LF]

9. External Communication Function

#### 2 Error code

Commands transmitted from the **IP-500A** to the host computer when an error has occurred in the **IP-500A** are as follows:

	Item	Display	Range	Length
1	Device number	nn	01 to 31	2
2	Delimiter	3		1
3	Schedule number	nn	01 to 63	2
4	Delimiter	,		1
5	Error code 1 (*1)	Enn	E01 to E17	3
6	Delimiter (*1)	,		1
	(*1) When two or more error codes occur, all error codes are transmitted in order of "occurred error code 1", "delimiter", "occurred error code 2", … "occurred error code N". (See Communication example.)			
7	Error code 2 (*1)	Enn	E01 to E17	3
8	Delimiter (*1)	,		1
•	•			
•	•			
•	•	Γ	Γ	
n	Error code N	Enn	E01 to E17	3
n+1	Delimiter (*1)	3		1
n+2	Return code	[CR]	(0x0d)	1
n+3	Feed code	[LF]	(0x0a)	1

(\*1) See table.

(For details of error codes, see (6) Data Code Table ③Error code.)

(\*2) Error codes are transmitted when errors are detected. For the monitored value error, however, the error is transmitted after the monitored data is transmitted.

Communication example:

- i) When an error code occurs (Device number: 01, Schedule number: 63) "IP-500A → Host computer" 01,63,E04,[CR][LF]
- When three error codes occur (Device number: 01, Schedule number: 63)
   "IP-500A → Host computer" 01,63,E04,E05,E06,[CR][LF]

③ Monitor data when TRANS SCAN is set

When TRANS SCAN is set to 1-2, 1-3, 1-4, or 1-5 to perform welding with two or more welding transformers connected, the **IP-500A** transmits the monitor data of all schedules in a batch after welding.

For the output monitor data, see 9. (4) ①Monitor data.

For details of TRANS SCAN function, see 4. (6) (8) TRANS SCAN.

Setting TRANS SCAN to 1-1 or OFF results in the same behavior as **9. (4)** (1) **Monitor data**.

Communication example:

The following i) to iii) are examples when TRANS SCAN is set to 1-5 and welding is started using SCH2.

- i) When the welding sequence is complete normally (no error occurs) "IP-500A  $\rightarrow$  Host computer" 01,02,100ms,1.10kA,1.50V,40.0%,200ms,2.10kA,1.70V,60.0%[CR][LF] 01,03,100ms,1.20kA,1.52V,42.5%,200ms,2.20kA,1.72V,62.5%[CR][LF] 01,04,100ms,1.30kA,1.54V,45.0%,200ms,2.30kA,1.74V,65.0%[CR][LF] 01,05,100ms,1.40kA,1.56V,47.5%,200ms,2.40kA,1.76V,67.5%[CR][LF] 01,06,100ms,1.50kA,1.58V,50.0%,200ms,2.50kA,1.78V,70.0%[CR][LF]
- When the setting is SCH4 and "E-11 OUT LIMIT OF CURRENT ERROR" (Outside upper/lower limit of current) occurs (When the RESTART setting (\*1) is NEXT START) "IP-500A → Host computer" 01,02,100ms,1.10kA,1.50V,40.0%,200ms,2.10kA,1.70V,60.0%[CR][LF] 01,03,100ms,1.20kA,1.52V,42.5%,200ms,2.20kA,1.72V,62.5%[CR][LF] 01,04,100ms,3.00kA,2.00V,80.0%,200ms,3.00kA,2.00V,80.0%[CR][LF] 01,05,100ms,1.40kA,1.56V,47.5%,200ms,2.40kA,1.76V,67.5%[CR][LF] 01,06,100ms,1.50kA,1.58V,50.0%,200ms,2.50kA,1.78V,70.0%[CR][LF] 01,04,E11,[CR][LF]
- When the setting is SCH4 and "E-11 OUT LIMIT OF CURRENT ERROR" (Outside upper/lower limit of current) occurs (When the RESTART setting (\*1) is RESET)
   "IP-500A → Host computer" 01,02,100ms,1.10kA,1.50V,40.0%,200ms,2.10kA,1.70V,60.0%[CR][LF] 01,03,100ms,1.20kA,1.52V,42.5%,200ms,2.20kA,1.72V,62.5%[CR][LF] 01,04,100ms,3.00kA,2.00V,80.0%,200ms,3.00kA,2.00V,80.0%[CR][LF] 01,04,E11,[CR][LF]
- (\*1) For the RESTART function, see **4. (6) (7)RESTART**.

#### (5) Protocol (Bi-Directional Communication)

Bi-directional communication mode (when the setting of **4.** (7) ④ COMM CONTROL is <-->)

Monitor data can be read and schedule data can be read or written according to the command on the host computer side.

Data which can be read or written in the bi-directional communication of the **IP-500A** are as follows:

- ① Reading the model name and the ROM version
- 2 Reading the schedule data
- ③ Writing the schedule data
- ④ Reading the specified item
- (5) Writing the specified item
- 6 Reading the error status
- $\bigcirc$  Error reset by the external communication

When the read/write command is sent from the host computer, the **IP-500A** sends back data.

Do not send the next command until the data is sent back or the timeout time passes when sending command.

When using a write command, a newly set data is returned from the **IP-500A** for check.

When a wrong data is written, a currently set value is returned for check. (When a part of telegraphic message is wrong, normal data is converted and sent back, and the wrong data returns the original set value.)

Do not perform the bi-directional communication during setting operation or until the READY signal is output.

① Reading the model name and the ROM version

The model number and program version of the specified device number or all connected devices are read.

### <Reading request data> (Host computer $\Rightarrow$ **IP-500A**)

Commands transmitted from the host computer to the **IP-500A** are as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Device number (*1)	nn	01 to 31	2
3	Read code			1
4	Return code	[CR]	(0x0d)	1
5	Feed code	[LF]	(0x0a)	1

(\*1) When specifying "\*\*" for the device number and requesting reading, all devices connected respond.
 When all devices respond, a time lag till the response time is the number of devices × 100 ms.

<Output data for reading request> (**IP-500A**  $\Rightarrow$  Host computer) Commands transmitted from the **IP-500A** to the host computer are as follows:

	Item	Display	Range	Length
1	Start code	!		1
2	Device number	nn	01 to 31	2
3	Delimiter	:		1
4	Model number	IP-500A		7
5	Delimiter	,		1
6	Program version	Vnn-nnn (*2)		7
7	Return code	[CR]	(0x0d)	1
8	Feed code	[LF]	(0x0a)	1

(\*2) In "Vnn-nnn", "V" is fixed, the trailing "n" is alphabet, and other "n"s are numbers.

Communication example:

Reading the model name of the **IP-500A** and the ROM version (Device number: 01)

"Host computer  $\rightarrow$  **IP-500A**" #01I[CR][LF]

"IP-500A  $\rightarrow$  Host computer" !01: IP-500A,V00-00A[CR][LF] 2 Reading the schedule data

All contents of the schedule data of the specified device number or a common schedule data are read.

<Reading request data> (Host computer  $\Rightarrow$  **IP-500A**) Commands transmitted from the host computer to the **IP-500A** are as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Device number	nn	01 to 31	2
3	Read code	R		1
4	Schedule number (*1)	***	000 to 063	3
5	Delimiter	*		1
6	Return code	[CR]	(0x0d)	1
7	Feed code	[LF]	(0x0a)	1

(\*1) When specifying "000" for the schedule number and requesting reading, a common schedule data (see (6) Data Code Table ①Schedule data) is read.

<Output data for reading request> (**IP-500A**  $\Rightarrow$  Host computer) Commands transmitted from the **IP-500A** to the host computer are as follows:

	Item	Display	Range	Length
1	Start code	!		1
2	Device number	nn	01 to 31	2
3	Schedule number	***	000 to 063	3
4	Delimiter	:		1
5	<output data="" for="" reading="" request=""> (*2) (*3)</output>			
6	Return code	[CR]	(0x0d)	1
7	Feed code	[LF]	(0x0a)	1

- (\*2) For the order of the output data, see (6) Data Code Table ①Schedule data.
- (\*3) The output data is separated by "," for each parameter. (See Communication example.)

Communication example:

Reading schedule data of the IP-500A (common schedule data) (Device number: 01)
 "Host computer → IP-500A"
 #01R000\*[CR][LF]

"IP-500A → Host computer" !01000: 50,0.10,0.10,10,0,0,10,1,0,100,0,1,0,08,0,2[CR][LF]  ii) Reading schedule data of the IP-500A (data for each schedule number) (Device number: 01, Schedule number: 02)
 "Host computer → IP-500A" #01R002\*[CR][LF]

"IP-500A  $\rightarrow$  Host computer"

!01002: 0000ms,00ms,000ms,00ms,00ms,000ms,000ms,000ms,000ms, 0.20kA,0.20kA,0.20V,0.20V,1,050.0,1,999ms,000ms,9.99kA,0.00kA, 9.99V,0.00V,100%,999ms,000ms,9.99kA,0.00kA,9.99V,0.00V,100%[CR][LF]
③ Writing the schedule data

All parameters of the schedule data or a common schedule data of the specified device number are written.

#### <Writing request data> (Host computer $\Rightarrow$ IP-500A)

Commands transmitted from the host computer to the IP-500A are as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Device number	nn	01 to 31	2
3	Write code	W		1
4	Schedule number (*1)	***	000 to 063	3
5	Delimiter	:		1
6	<data requesting="" td="" writing<=""><td>g&gt; (*2) (*3)</td><td></td><td></td></data>	g> (*2) (*3)		
7	Return code	[CR]	(0x0d)	1
8	Feed code	[LF]	(0x0a)	1

(\*1) When specifying "000" for schedule number and requesting writing, a common schedule data (see **(6) Data Code Table** ①Schedule data) is written.

- (\*2) Separate the data requesting writing by "," for each parameter. (See Communication example.)
- (\*3) For the order of the data requesting writing, see (6) Data Code Table ① Schedule data.

<Output data for writing request> (**IP-500A**  $\Rightarrow$  Host computer)

	Item	Display	Range	Length
1	Start code	!		1
2	Device number	nn	01 to 31	2
3	Schedule number	***	000 to 063	3
4	Delimiter	:		1
5	<output data="" for="" td="" writing<=""><td>request&gt; (*3) (*4) (*5)</td><td>)</td><td></td></output>	request> (*3) (*4) (*5)	)	
6	Return code	[CR]	(0x0d)	1
7	Feed code	[LF]	(0x0a)	1

(\*3) For the order of data output for writing request, see (6) Data Code Table ① Schedule data.

- (\*4) The output data is separated by "," for each parameter. (See Communication example.)
- (\*5) When the writing of data outside the settable range is requested, the data before being written is returned as it is.

Communication example:

i) Writing schedule data of the IP-500A (common schedule data) (Device number: 01)
 "Host computer → IP-500A"
 #01W000: 50,0.10,0.10,10,0,0,10,1,0,100,0,1,0,16[CR][LF]

"**IP-500A** → Host computer" !01000: 50,0.10,0.10,10,0,0,10,1,0,100,0,1,0,16,0,2[CR][LF]

Writing schedule data of the IP-500A (data for each schedule number) (Device number: 01, Schedule number: 02)
 "Host computer → IP-500A"
 #01W002: 1101ms,42ms,150ms,50ms,02ms,05ms,023ms,10ms,112ms, 1.50kA,0.80kA,1.20V,0.60V,1,064.5,1,989ms,001ms,6.98kA,0.20kA, 8.96V,3.21V,056%,111ms,021ms,1.01kA,1.22kA,9.99V,0.67V,090%[CR][LF]

"IP-500A  $\rightarrow$  Host computer"

!01002: 1101ms,42ms,150ms,50ms,02ms,05ms,023ms,10ms,112ms, 1.50kA,0.80kA,1.20V,0.60V,1,064.5,1,989ms,001ms,6.98kA,0.20kA, 8.96V,3.21V,056%,111ms,021ms,1.01kA,1.22kA,9.99V,0.67V,090%[CR][LF] ④ Reading the specified item

An optional parameter of the schedule data of the specified device number is read.

<Reading request data> (Host computer  $\Rightarrow$  **IP-500A**) Commands transmitted from the host computer to the **IP-500A** are as follows:

	ltem	Display	Range	Length
1	Start code	#		1
2	Device number	nn	01 to 31	2
3	Read code	R		1
4	Schedule number	***	001 to 063	3
5	Specified code (*1)	***		3
6	Return code	[CR]	(0x0d)	1
7	Feed code	[LF]	(0x0a)	1

(\*1) The specified code consists of the first character is alphabet and the remaining two characters are number. For the specified code list, see (6) Data Code Table ②Specified item.

<Output data for reading request> (**IP-500A**  $\Rightarrow$  Host computer) Commands transmitted from the **IP-500A** to the host computer are as follows:

	Item	Display	Range	Length
1	Start code	!		1
2	Device number	nn	01 to 31	2
3	Schedule number	***	001 to 063	3
4	Specified code (*1)	***		3
5	Delimiter	:		1
6	<output data="" for="" reading<="" td=""><td>g request&gt;(*2)</td><td></td><td></td></output>	g request>(*2)		
7	Return code	[CR]	(0x0d)	1
8	Feed code	[LF]	(0x0a)	1

(\*2) Data corresponding to the parameter specified when requesting reading is output. For details of the output data, see (6) Data Code Table ②Specified item.

Communication example:

Reading Weld 1 current (HEAT1) of the IP-500A (Device number: 01, Schedule number: 10)
 "Host computer → IP-500A"
 #01R010H01[CR][LF]

"IP-500A → Host computer" !01010H01: 5.00kA[CR][LF] ii) Reading Weld 1 time (WEL1) of the IP-500A (Device number: 01, Schedule number: 10)
 "Host computer → IP-500A"
 #01R010T02[CR][LF]

"IP-500A  $\rightarrow$  Host computer" !01010T02: 100ms[CR][LF] (5) Writing the specified item

An optional parameter of the schedule data of the specified device number is written.

<Writing request data> (Host computer  $\Rightarrow$  IP-500A)

Commands transmitted from the host computer to the IP-500A are as follows:

	ltem	Display	Range	Length
1	Start code	#		1
2	Device number	Device number nn 01 to 31		2
3	Write code	W		1
4	Schedule number	***	001 to 063	3
5	Specified code (*1)	***		3
6	Delimiter	:		
7	<data requesting="" td="" writing<=""><td>g&gt; (*2)</td><td></td><td></td></data>	g> (*2)		
8	Return code	[CR]	(0x0d)	1
9	Feed code	[LF]	(0x0a)	1

(\*1) The specified code consists of the first character is alphabet and the remaining two characters are number. For the specified code list, see (6) Data Code Table ②Specified item.

(\*2) The set value of the parameter to write is input. For the range of inputtable value, see (6) Data Code Table ②Specified item.

<Output data for writing request> (IP-500A  $\Rightarrow$  Host computer) Commands transmitted from the IP-500A to the host computer are as follows:

	Item	Display	Range	Length
1	Start code	!		1
2	Device number	nn	01 to 31	2
3	Schedule number	***	001 to 063	3
4	Specified code	***		3
5	Delimiter	:		1
6	<output data="" for="" td="" writing<=""><td>request&gt; (*3) (*4)</td><td></td><td></td></output>	request> (*3) (*4)		
7	Return code	[CR]	(0x0d)	1
8	Feed code	[LF]	(0x0a)	1

(\*3) The set value of the parameter specified when requesting writing is output.

(\*4) When the writing of data outside the settable range is requested, the data before being written is returned as it is.

Communication example:

Writing Weld 1 current (HEAT1) of the IP-500A (Device number: 01, Schedule number: 10)
 "Host computer → IP-500A"
 #01W010H01: 5.00kA[CR][LF]

"IP-500A → Host computer" !01010H01: 5.00kA[CR][LF]

Writing Weld 1 time (WEL1) of the IP-500A (Device number: 01, Schedule number: 10)
 "Host computer → IP-500A"
 #01W010T02: 100ms[CR][LF]

"IP-500A → Host computer" !01010T02: 100ms[CR][LF] 6 Reading the error status

The abnormal state of the **IP-500A** is read.

<Reading request data> (Host computer  $\Rightarrow$  **IP-500A**) Commands transmitted from the host computer to the **IP-500A** are as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Device number	nn	01 to 31	2
3	Read code	R		1
4	Specified code	E99		3
5	Return code	[CR]	(0x0d)	1
6	Feed code	[LF]	(0x0a)	1

<Output data for reading request> (**IP-500A**  $\Rightarrow$  Host computer) Commands transmitted from the **IP-500A** to the host computer are as follows:

	Item	Display	Range	Length
1	Start code	!		1
2	Device number	nn	01 to 31	2
3	Specified code	E99		3
4	Delimiter	:		1
5	Error code 1 (*1)	nn	00, 03 to 17	2
6	Delimiter (*1)	,		1
	(*1) When two or more error codes occur, all error codes are transmitted in order of "occurred error code 1", "delimiter", "occurred error code 2", … "occurred error code N". (See Communication example.)			
7	Error code 2 (*1)	nn	00, 03 to 17	2
8	Delimiter (*1)	,		1
•	•			
•	•			
•	•	Γ	I	
n	Error code N (*1)	nn	00, 03 to 17	2
n+1	Delimiter (*1)	,		1
n+2	Return code	[CR]	(0x0d)	1
n+3	Feed code	[LF]	(0x0a)	1

(\*1) See table.

For details of error codes, see (6) Data Code Table ③Error code.

Communication example:

Reading the abnormal state of the IP-500A (an error code occurred) (Device number: 01)
 "Host computer → IP-500A"
 #01RE99[CR][LF]

"IP-500A  $\rightarrow$  Host computer" !01E99:16,[CR][LF]

 ii) Reading the abnormal state of the IP-500A (three error codes occurred) (Device number: 01)
 "Host computer → IP-500A" #01RE99[CR][LF]

"**IP-500A** → Host computer" !01E99:11,12,13,[CR][LF]  $\bigcirc$  Error reset by the external communication

The IP-500A can reset errors by the external communication.

<Request data of error reset by the external communication> (Host computer ⇒ IP-500A)

Commands transmitted from the host computer to the IP-500A are as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Device number	nn	01 to 31	2
3	Read code	R		1
4	Specified code	E00		3
5	Return code	[CR]	(0x0d)	1
6	Feed code	[LF]	(0x0a)	1

<Output data for error reset by the external communication> (IP-500A  $\Rightarrow$  Host computer)

Commands transmitted from the IP-500A to the host computer are as follows:

	Item	Display	Range	Length
1	Start code	!		1
2	Device number	nn	01 to 31	2
3	Specified code	E00		3
4	Delimiter	:		1
5	Error code 1 (*1)	00		2
6	Return code	[CR]	(0x0d)	1
7	Feed code	[LF]	(0x0a)	1

(\*1) For details of error codes, see (6) Data Code Table ③Error code.

Communication example:

 i) Error reset by the external communication of the IP-500A (Device number: 01) "Host computer → IP-500A" #01RE00[CR][LF]

"IP-500A  $\rightarrow$  Host computer" !01E00: 00[CR][LF]

## (6) Data Code Table

1 Schedule data

◇Common	schedule	data	<schedule< th=""><th>number:</th><th>&lt;000&gt;</th></schedule<>	number:	<000>

	ltem	Contents	Display	Range	Length
1	NO CURR.TIME	No-current detection ignore time	nn	00 to 99	2
2	NO CURR.LEV.	No-current detection level	n.nn	0.00 to 9.99	4
3	NO VOLT.LEV.	No-voltage detection level	n.nn	0.00 to 9.99	4
4	MON.FST TIME	Monitor start time	nn	00 to 15	2
5	MON.SLOPE	Monitor slope measurement mode	n	0: EXCLUDE 1: INCLUDE	1
6	PARITY CHECK	Parity check	n	0: OFF 1: ON	1
7	ST.DELAY TIME	Start signal stabilizing time	nn	01 to 20	2
8	ST.SIGNAL	Start mode	n	0: LATCHED 1: PULSED	1
9	CTRL	Control method	n	0: PRIMARY LIMIT 1: SECONDARY RMS 2: VOLTAGE RMS	1
10	GOOD/END TIME	GOOD/END signal output time	nnn	000 to 200	3
11	NG OUTPUT	Error output setting	n	0: N.O. 1: N.C.	1
12	RESTART	Restart method selection	n	0: NEXT START 1: RESET	1
13	TRANS SCAN	Transformer scan	n	0: OFF 1: 1-1 2: 1-2 3: 1-3 4: 1-4 5: 1-5	1
14	LCD CONTRAST	LCD contrast	nn	01 (bright) to 16 (dark)	2
15*	COMM CONTROL	Communication direction	n	0: OFF 1:> (single direction) 2: <-> (bi-direction)	1
16*	BAUD RATE	Baud rate	n	0: 9600 1: 19200 2: 38400	1

(\*) Items inhibited from setting (When writing the schedule data, data 1 to 14 can be written.)

	ltem	Contents	Character string	Range	Length
1	SQZ[ms]	Squeeze time	nnnms	0000 to 9999	6
2	UP1[ms]	Upslope 1 time	nnms	00 to 99	4
3	WEL1[ms]	Weld 1 time	nnnms	000 to 999	5
4	DN1[ms]	Downslope 1 time	nnms	00 to 99	4
5	COOL[ms]	Cooling time	nnms	00 to 99	4
6	UP2[ms]	Upslope 2 time	nnms	00 to 99	4
7	WEL2[ms]	Weld 2 time	nnnms	000 to 999	5
8	DN2[ms]	Downslope 2 time	nnms	00 to 99	4
9	HOLD[ms]	Hold time	nnnms	000 to 999	5
10	HEAT1[kA]	Weld 1 current	n.nnkA	0.20 to 5.00	6
11	HEAT2[kA]	Weld 2 current	n.nnkA	0.20 to 5.00	6
12	HEAT1[V]	Weld 1 voltage	n.nnV	0.20 to 9.99	5
13	HEAT2[V]	Weld 2 voltage	n.nnV	0.20 to 9.99	5
14	TRANS No.	Transformer number	n	1 to 5	1
15	TURN RATIO	Transformer turns ratio	nnn.n	001.0 to 199.9	5
16	GAIN	Control gain	n	1 to 9	1
17	1H-[ms]	Upper limit of Weld 1 time	nnnms	000 to 999	5
18	1L-[ms]	Lower limit of Weld 1 time	nnnms	000 to 999	5
19	1H-[kA]	Upper limit of Weld 1 current	n.nnkA	0.00 to 9.99	6
20	1L-[kA]	Lower limit of Weld 1 current	n.nnkA	0.00 to 9.99	6
21	1H-[V]	Upper limit of Weld 1 voltage	n.nnV	0.00 to 9.99	5
22	1L-[V]	Lower limit of Weld 1 voltage	n.nnV	0.00 to 9.99	5
23	1H-[%]	Upper limit of Weld 1 pulse width	nnn%	010 to 100	4
24	2H-[ms]	Upper limit of Weld 2 time	nnnms	000 to 999	5
25	2L-[ms]	Lower limit of Weld 2 time	nnnms	000 to 999	5
26	2H-[kA]	Upper limit of Weld 2 current	n.nnkA	0.00 to 9.99	6
27	2L-[kA]	Lower limit of Weld 2 current	n.nnkA	0.00 to 9.99	6
28	2H-[V]	Upper limit of Weld 2 voltage	n.nnV	0.00 to 9.99	5
29	2L-[V]	Lower limit of Weld 2 voltage	n.nnV	0.00 to 9.99	5
30	2H-[%]	Upper limit of Weld 2 pulse width	nnn%	010 to 100	4

♦Data for each schedule number <Schedule number: 001 to 063>

② Specified item

Specified code		ltem	Contents	Character string	Range	Length
	01	UP1[ms]	Upslope 1 time	nnms	00 to 99	4
	02	WEL1[ms]	Weld 1 time	nnnms	000 to 999	5
	03	DN1[ms]	Downslope 1 time	nnms	00 to 99	4
	04	UP2[ms]	Upslope 2 time	nnms	00 to 99	4
Т	05	WEL2[ms]	Weld 2 time	nnnms	000 to 999	5
	06	DN2[ms]	Downslope 2 time	nnms	00 to 99	4
	11	SQZ[ms]	Squeeze time	nnnnms	0000 to 9999	6
	12	COOL[ms]	Cooling time	nnms	00 to 99	4
	13	HOLD[ms]	Hold time	nnnms	000 to 999	5

### ♦Schedule time setting

### ♦Welding current setting

Specified code		ltem	Contents	Character string	Range	Length
ц	01	HEAT1[kA]	Weld 1 current	n.nnkA	0.20 to 5.00	6
п	02	HEAT2[kA]	Weld 2 current	n.nnkA	0.20 to 5.00	6

### ♦Welding voltage setting

Specified code		ltem	Contents	Character string	Range	Length
V	01	HEAT1[V]	Weld 1 voltage	n.nnV	0.20 to 9.99	5
v	02	HEAT2[V]	Weld 2 voltage	n.nnV	0.20 to 9.99	5

### ♦Other setting

Specified code		ltem	Contents	Character string	Range	Length
01		TRANS No.	Transformer number	n	1 to 5	1
0	02	TURN RATIO	Transformer turns ratio	nnn.n	001.0 to 199.9	5
	03	GAIN	Control gain	n	1 to 9	1

Specified code		ltem	Contents	Character string	Range	Length
	01	1-[ms]	Monitor value of Weld 1 time	nnnms	000 to 999	5
	02	1-[kA]	Monitor value of Weld 1 current	n.nnkA	0.00 to 9.99	6
	03	1-[V]	Monitor value of Weld 1 voltage	n.nnV	0.00 to 9.99	5
5.4	04	1-[%]	Monitor value of Weld 1 pulse width	nn.n%	00.0 to 99.9	5
IVI	11	2-[ms]	Monitor value of Weld 2 time	nnnms	000 to 999	5
	12	2-[kA]	Monitor value of Weld 2 current	n.nnkA	0.00 to 9.99	6
	13	2-[V]	Monitor value of Weld 2 voltage	n.nnV	0.00 to 9.99	5
	14	2-[%]	Monitor value of Weld 2 pulse width	nn.n%	00.0 to 99.9	5

Monitor data (Reading only) (\*1) (\*2)

(\*1) When the TRANS SCAN setting is not 1-1 or OFF, specify the schedule number to read the monitor data each time.

(\*2) When there is no monitor data, "0" is transmitted.

Specified code		ltem	Contents	Character string	Range	Length
	01	1H-[ms]	Upper limit of Weld 1 time	nnnms	000 to 999	5
	02	1L-[ms]	Lower limit of Weld 1 time	nnnms	000 to 999	5
	03	1H-[kA]	Upper limit of Weld 1 current	n.nnkA	0.00 to 9.99	6
	04	1L-[kA]	Lower limit of Weld 1 current	n.nnkA	0.00 to 9.99	6
	05	1H-[V]	Upper limit of Weld 1 voltage	n.nnV	0.00 to 9.99	5
	06	1L-[V]	Lower limit of Weld 1 voltage	n.nnV	0.00 to 9.99	5
N	07	1H-[%]	Upper limit of Weld 1 pulse width	nnn%	010 to 100	4
	11	1H-[ms]	Upper limit of Weld 1 time	nnnms	000 to 999	5
	12	1L-[ms]	Lower limit of Weld 1 time	nnnms	000 to 999	5
	13	1H-[kA]	Upper limit of Weld 1 current	n.nnkA	0.00 to 9.99	6
	14	1L-[kA]	Lower limit of Weld 1 current	n.nnkA	0.00 to 9.99	6
	15	1H-[V]	Upper limit of Weld 1 voltage	n.nnV	0.00 to 9.99	5
	16	1L-[V]	Lower limit of Weld 1 voltage	n.nnV	0.00 to 9.99	5
	17	1H-[%]	Upper limit of Weld 1 pulse width	nnn%	010 to 100	4

♦Upper/lower limit judgment setting

③ Error code

S	Specified code		Item	Contents	Data	Char- acter string	Length														
	00	Error reset	-	-	00																
			-	No error	00																
			E-03 MEMORY ERROR	Memory error	03																
			E-04 PARITY ERROR	Parity error	04																
			E-05 STOP ERROR	Stop error	05																
			E-06 WELDING STOP ERROR	Weld stop error	06																
			E-07 SCHEDULE SET ERROR	Schedule setting error	07	07 08															
		Reading 99 Reading error status E-10 O ERROF CURRE E-11 O CURRE E-12 O VOLTA E-13 O ERROF	E-08 NO CURRENT ERROR	No-current error	08																
			Reading 99 error status	E-09 NO VOLTAGE ERROR	No-voltage error	09															
				Reading error status	Reading error status	Reading error status	Reading error status	Reading error status	Reading error status	Reading error status	Reading error status	Reading error status	Reading error status	Reading error			E-10 OVER CURRENT ERROR	Overvoltage error	10		
Е	99														E-11 OUT LIMIT OF CURRENT ERROR	Outside upper/lower limit of current	11	nn	2		
														E-12 OUT LIMIT OF VOLTAGE ERROR	Outside upper/lower limit of voltage	12					
			E-13 OUT LIMIT OF TIME ERROR	Outside upper/lower limit of time	13																
			E-14 OUT LIMIT OF PULSE WIDTH ERROR	Outside upper/lower limit of pulse width	14	-															
			E-15 TRIP OF EXTERNAL THERMO ERROR	External thermos error	15																
			E-16 TRIP OF INTERNAL THERMO ERROR	Internal thermos error	16																
			E-17 COMM SET ERROR	Communication setting error	17																

# **10. Specifications**

# (1) Specifications

Model No.	IP-500A-00-00				
Input voltage range	3-phase, 380 to 415 V AC ±	10% (50/60 Hz)			
Max. output current	200 A (peak value)	200 A (peak value)			
Maximum capacity	112 kVA (input voltage at 41	5 V AC)			
Rating capacity	42 kVA (input voltage at 415	5 V AC)			
Control frequency	2 kHz				
Number of schedules	63				
Control method	Primary constant-current peak value control Secondary constant-current effective value control Secondary constant-voltage effective value control				
Setting range	SQZ/ squeeze time UP1/ upslope 1 time WEL1/ weld 1 time DN1/ downslope 1 time COOL/ cooling time UP2/ upslope 2 time WEL2/ weld 2 time DN2/ downslope 2 time HOLD/ hold time HEAT1/ weld 1 current (voltage) HEAT2/ weld 2 current	0000 to 9999 ms 00 to 99 ms 000 to 999 ms 00 to 99 ms 00 to 99 ms 00 to 99 ms 000 to 999 ms 000 to 999 ms 000 to 999 ms 0.20 to 5.00 kA (0.20 to 9.99 V) (Note 1) 0.20 to 5.00 kA (0.20 to 9.99 V)			
Transformer turns	(voltage)	(Note 1)			
ratio	1 to 0				
Monitor	Current Voltage Time Pulse width	0.00 to 9.99 kA 0.00 to 9.99 V 000 to 999 ms 00.0 to 99.9%			
Transformer number	1 to 5	·			
State indicator LED	LED READY lamp TROUBLE lamp START lamp WELD lamp				
Number of valves	1				
Communication method	RS-485				
Cooling method	Forced air-cooled				
Operating environment (Note 2)	Ambient temperature Humidity Altitude	+5 to +40°C 90% max. (no condensation) 1000 m max.			

#### IP-500A

Transportation and	Ambient temperature -10 to +55°C				
storage conditions	Humidity	90% max. (no condensation)			
Heat-resistant class	E				
Case protection	IP20				
	Overcurrent	150 A Fuse			
Protective	No-current	<ul> <li>The supply of current is stopped in the following cases:</li> <li>a. When a primary current is not detected in Primary constant-current peak value control.</li> <li>b. When a secondary current is not detected in Secondary constant-current effective value control.</li> </ul>			
	No-voltage	Under Secondary constant-voltage effective value control, the supply of current is stopped when a secondary voltage cannot be detected.			
	Temperature	Overheating of power unit of inverter and welding transformer are detected.			
	Self-diagnostic error	Setting data (e.g., schedule settings) are diagnosed.			
Setting accuracy	Within ±3% of full scale (No	ote 3)			
Repetition accuracy	Within 4% of full scale (Note 3)				
Outline dimensions	269 (H) mm × 172 (W) mm × 576.5 (D) mm (Not including projection) 269 (H) mm × 172 (W) mm × 616 (D) mm (Including projection)				
Mass	Approx. 17 kg				
Accessory	Operation manual: 1 copy				

(Note 1) 0.20 to 5.00 kA for Primary constant-current peak value control and Secondary constant-current effective value control,
 0.20 to 9.99 V for Secondary constant-voltage effective value control,
 The setting range of the primary current is welding current setting range ÷ transformer turns ratio ≤ 200 A or less

- (Note 2) Use this product in the environment without conductive dust. If conductive dust enters in the product, this may result in a failure, electric shock, or fire. When using this product in this environment, make contact with us.
- (Note 3) Using the fixed load and the specified transformer.
  - The weld time is 100 ms. The measurement range is from 60 to 100 ms.
  - The voltage may be out of the range due to the induced electromotive force.

## (2) Options (Sold Separately)

### ① Input Cables

If a customer procures the cable by oneself, prepare it in accordance with the following right-hand specifications.

Model No.	Length	]	Sp	pecifications
PK-1176990	2 m		Rated voltage	600 V AC min.
PK-1176991	5 m		Section area	14 mm <sup>2</sup> min.
PK-1176992	10 m		No. of cores	4
PK-1176993	15 m		Cable dia.	25 mm max.
PK-1176994	20 m		Crimp-on terminal	LOAD side: M8 LINE side: M6
PK-1176995	2 m		Rated voltage	600 V AC min.
PK-1176996	5 m		Section area	14 mm <sup>2</sup> min.
PK-1176997	10 m		No. of cores	4
PK-1176998	15 m		Cable dia.	25 mm max.
PK-1176999	20 m		Crimp-on terminal	LOAD and LINE sides: M8

#### **② Output Cables**

If a customer procures the cable by oneself, prepare it in accordance with the following right-hand specifications.

Туре	Model No.	Length		Specifications			
For	PK-1173690	2 m	\	Rated voltage	600 V AC min.		
transformer with M6	PK-1173691	5 m	$   \rangle$	Section area	14 mm <sup>2</sup> min.		
terminal	PK-1173692	10 m		No. of cores	3		

#### **③ SENS Cables**

Туре	Model No.			
For our dedicated transformer	SK-05741-002	2 m		
	SK-05741-005	5 m		
	SK-05741-010	10 m		

### ④ Others

ltem	Model No.	Length
ISO toroidal agil	MB-400M (Approx. 120 mm in dia.)	Cable,
150 toroidal coll	MB-800M	3 m
	(Approx. 250 mm in dia.)	

#### IP-500A

## (3) Duty Cycle Graph



\* Maximum weld time: 1998 ms, ambient temperature: 40°C

## (4) Schematic



# **11. Outline Drawing**

(Dimensions in mm)



# **12.** Maintenance

### (1) Cleaning and Replacement of Filter

The IP-500A has filters at its intake.



Clean the filter once a month.

When cleaning it, cleanse with neutral detergent water.

If it gets badly stained, replace it with a new one.

(The replacement filter's name is filter and its item number is 1211672.)

If the filter is clogged, air does not flow enough, causing internal temperature to rise and malfunction.



Observe the following procedures.

① Insert a screwdriver into holes on bottom of filter to remove the filter cover.



Pilter is inside the filter cover.
 Remove it and cleanse with neutral detergent water.



③ After drying the filter, return it (a new one when replacing) onto the filter cover. Secure the filter cover to the intake.

### 12. Maintenance

# **13. Troubleshooting**

### (1) Fault Code List

In the event of a problem with the Power Supply, the operation panel displays the fault code and message.

In such cases, read this section carefully, then inspect the equipment and take the necessary countermeasures. If you have any questions, consult us or your distributor.

Fault code	Error message	Cause	Measures
E-01	SYSTEM ERROR	Error has been detected on control system of <b>IP-500A</b> .	Once turn off power and turn on again. If this error is displayed again, repair is required. Contact us.
E-02	RAM MEMORY ERROR	Monitor data or schedule number data stored in memory are broken down.	<ul> <li>Check all the settings. If the data in memory is damaged, the following are possible causes:</li> <li>Generation of powerful power supply or electrostatic noise</li> <li>Abnormal supply voltage resulting, for example, from lightening or induced lightening</li> </ul>
E-03	MEMORY ERROR	The welding schedule data is different from the programmed one.	Initialize memory. (See <b>4. (9)</b> <b>INITIALIZE Screen</b> .) If the error occurs again after initialization, the Power Supply needs repair. Contact us. It would be useful to record the settings in preparation for data damage. To print the settings, use <b>14. Schedule Data Table</b> .
E-04	PARITY ERROR	Cable to input start signal is broken, and a parity check error is detected.	Check start signal input cable.
E-05	STOP ERROR	<ol> <li>External stop input signal (STOP, Pin 3) is open.</li> <li>Power supply for external input (INT.24V, Pin 1) is not connected to stop input signal (STOP).</li> </ol>	<ol> <li>Rectify cause of stop, and then close stop circuit.</li> <li>Check external input signal for proper connection.</li> </ol>
E-06	WELDING STOP ERROR	The start signal is input while the welding stop signal (WELD1/2 STOP, Pin 19/20) is input.	Check the welding stop input signal. (See <b>6. (2) Description of External</b> <b>I/O Signals</b> .)
E-07	SCHEDULE SET ERROR	<ul> <li>Condition settings in the SCHEDULE screen are not proper.</li> <li>1. Primary current of turns ratio is out of range of the following formula:</li> <li>5 ≤ <u>HEAT setting</u> ≤ 200</li> <li>2. The WELD1 and WELD2 values are all "0."</li> <li>3. The total time of upslope (UP) and downslope (DN) is longer than WELD.</li> </ul>	Correct each setting.

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Fault code	Error message	Cause	Measures
E-08	NO CURRENT ERROR	<ol> <li>The welding current is no detected.</li> <li>NO CURR.LEV. is high.</li> <li>Fuse inside the equipment is blown.</li> <li>When using another manufacturer's inverter transformer, toroidal coil is not connected (in Secondary constant-current effective control).</li> <li>IP-500A starts welding before force is applied to the head.</li> <li>Force of welding electrode is not sufficient.</li> </ol>	<ol> <li>Set a lower NO CURR.LEV. (See         <ol> <li>(5) MONITOR MODE Screen.)</li> <li>The fuse needs replacement. Contact us.</li> <li>Connect toroidal coil, referring to                 <ol> <li>Installation and Connection.</li> <li>Adjust the timing so that the start signal of IP-500A is input after force is applied to workpiece.</li> <li>Adjust force.</li> </ol> </li> </ol> </li> </ol>
E-09	NO VOLTAGE ERROR	<ol> <li>No detection of the voltage across welding electrodes.</li> <li>NO VOLT.LEV. is high.</li> <li><b>IP-500A</b> starts welding before force is applied to the head.</li> </ol>	<ol> <li>Make sure that the cable detecting the voltage across welding electrodes is connected.</li> <li>Set a lower NO VOLT.LEV. (See 4. (5) MONITOR MODE Screen.)</li> <li>Adjust the timing so that the start signal of IP-500A is input after force is applied to workpiece.</li> </ol>
E-10	OVER CURRENT ERROR	Primary current of the transformer above 220 A is detected.	<ol> <li>Check for welding transformer and welding electrode problems.</li> <li>Check that the toroidal coil or the voltage detecting cable is connected in the secondary control.</li> </ol>
E-11	OUT LIMIT OF CURRENT ERROR	Welding current is out of setting range of upper/lower limit on the MONITOR SET screen.	Check for stained welding electrode or loose cable connection.
E-12	OUT LIMIT OF VOLTAGE ERROR	Secondary voltage is out of setting range of upper/lower limit on the MONITOR SET screen.	Check for stained welding electrode and low electrode force.
E-13	OUT LIMIT OF TIME ERROR	Weld time is out of setting range of upper/lower limit on the MONITOR SET screen.	Check the welding stop input (WELD1/2 STOP, Pin 19/20) of the external interface.
E-14	OUT LIMIT OF PULSE WIDTH ERROR	Pulse width of welding current is out of setting range of upper/lower limit on the MONITOR SET screen.	<ol> <li>Check that the transformer capacity is sufficient.</li> <li>Check workpiece and welding electrode.</li> </ol>
E-15	TRIP OF EXTERNAL THERMO ERROR	<ol> <li>Temperature of welding transformer rises and external thermostat input circuit opens.</li> <li>When using our inverter transformer, the SENS cable is not connected.</li> <li>When using another manufacturer's inverter transformer, Transformer thermo signal line is not connected to the transformer thermo signal input pin (THERMOSTAT, Pin 22) is not connected.</li> </ol>	<ol> <li>Lower temperature of transformer. When using water-cooled transformer, properly adjust temperature and flow rate of cooling water.</li> <li>Check the SENS cable for proper connection.</li> <li>Check the transformer thermo signal line for proper connection.</li> </ol>
E-16	I RIP OF INTERNAL THERMO ERROR	Internal temperature of equipment rises and thermostat for power transistor in power unit is open.	Ensure that the duty cycle does not exceed the specified value. (See <b>10.</b> (3) Duty Cycle.)

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Fault code	Error message	Cause	Measures
E-17	COMM SET ERROR	When writing data in bi-directional communication mode at external communication, data which is out of the range is written or data format is wrong.	Check the write data or the data format.

# **14. Schedule Data Table**

### (1) SCHEDULE Screen

Setting screen	Setting item	Unit	Initial	SCH	SCH	SCH	SCH	SCH
			value					
SCHEDULE	UP1	ms	00					
	WEL1	ms	000					
	DN1	ms	00					
	HEAT1 (PRI,SCD)	kA	0.20					
	(VLT)	V	0.20					
	UP2	ms	00					
	WEL2	ms	000					
	DN2	ms	00					
	HEAT2 (PRI,SCD)	kA	0.20					
	(VLT)	V	0.20					
	SQZ	ms	0000					
	COOL	ms	00					
	HOLD	ms	000					
	TRANS No.	-	1					
	TURN RATIO	-	001.0					
	GAIN	-	1					

### (2) MONITOR SET Screen

Setting screen	Setti	ng item	Unit	Initial	SCH	SCH	SCH	SCH	SCH
				value					
MONITOR SET	WEL1	1H-[ms]	ms	999					
		1H-[kA]	kA	9.99					
		1H-[V]	V	9.99					
		1H-[%]	%	100					
		1L-[ms]	ms	000					
		1L-[kA]	kA	0.00					
		1L-[V]	V	0.00					
	WEL2	2H-[ms]	ms	999					
		2H-[kA]	kA	9.99					
		2H-[V]	V	9.99					
		2H-[%]	%	100					
		2L-[ms]	ms	000					
		2L-[kA]	kA	0.00					
		2L-[V]	V	0.00					

### (3) MONITOR MODE Screen

Setting screen	Setting item	Unit	Initial value	Setting
MONITOR MODE	NO CURR.TIME	ms	99	
	NO CURR.LEV.	kA	0.00	
	NO VOLT.LEV.	V	0.00	
	MON.FST TIME	ms	15	
	MON.SLOPE	-	EXCLUDE	

### (4) MODE SELECT Screen

Setting screen	Setting item	Unit	Initial value	Setting
MODE SELECT	PARITY CHECK	-	OFF	
	ST.DELAY TIME	ms	20	
	ST.SIGNAL	-	LATCHED	
	CTRL	-	PRIMARY LIMIT	
	GOOD/END TIME	ms	200	
	NG OUTPUT	-	N.C.	
	RESTART	-	RESET	
	TRANS SCAN	-	OFF	

### (5) SETUP Screen

Setting screen	Setting item	Initial value	Setting
SETUP	DEVICE No.	01	
	LCD CONTRAST	08	
	COMM CONTROL	OFF	
	BAUD RATE	9600	