ENGINE GENERATOR

Instruction Manual

Safety Information

1. Carefully read this operation manual and its related textbooks beforehand for proper machinery operation.

2. Properly operate the machine after understanding the technical knowledge and safety information.

3. In this operation manual, major safety instructions are ranked as follows.

Without proper operation, there is a possibility that you are killed or seriously injured.

Without proper operation, there is a possibility that you are injured, and/or there is a possibility that property is damaged.

Note: You are strictly requested to follow “Caution” instruction with an equivalent attention to “Danger”.

Shows prohibited operation.

Shows compulsory operation.

4. Keep those warning labels visible with proper maintenance.

5. In order to avoid any danger, understand emergency operation, and also prepare an emergency contact, emergency aid and a fire extinguisher.

Prohibition Items in Operation

* No smoking! No fire! Otherwise, there is a possibility that you are injured by a fire explosion and a broken piece.
* No liquid container on the machine! Otherwise, there is a possibility of causing a fire and suffering from an electric shock.
* Don't step on and/or lean against the machine! Otherwise, there is a possibility that the machine falls down.
* Don't dismantle the machine! Otherwise, there is a possibility of suffering from high-voltage electricity and heavy-weighted components.
* Don't put a stick and/or a finger into a fan! Otherwise, there is a possibility that you are injured by turning fan.
* Don't put a metal stick and/or a finger into an input (or output) terminal board in the machine. Otherwise, there is a possibility of suffering an electric shock.
* Don't refueling while an engine works! Otherwise, there is a possibility that you are injured by a fire explosion and a broken piece.

Caution Items in Operation

* Operate the machine as the operation manual and instructions. Otherwise, there is a possibility that careless operation causes an electric shock and an accident.
* Stop the machine immediately after you recognize any extraordinary condition such as smoke and/or smell. Otherwise, there is a possibility of a fire on the machine.
* Keep the door closed for ordinary operation. If you carelessly touch the inside, there is a possibility that you get an electric shock and get burned.

Prohibition Items in Maintenance

* Don't inspect and don't repair the inside except for technical expert. Otherwise, there is a possibility of suffering from an electric shock, an injury and a burn, and/or there is a possibility of causing a fire on the machine.
* Don't carry any metallic belongings (e.g., wristwatch) during maintenance work! Otherwise, there is a possibility that you get an electric shock, burned and injured.
* Don't engage yourself to maintain the machine while electricity is applied! Confirm that the machine stops before maintenance work. There is a possibility that you get an electric shock, burned and injured.
* Don't touch any high temperature parts such as an engine! Otherwise, there is possibility that you get burned even after an engine was stopped.
* Use the same rating/typed genuine parts for replacement and avoid the mixture of new and old parts. Otherwise, there is a possibility of causing a fire.
* Don't touch the machine with a wet hand! Otherwise, there is a possibility that you get an electric shock.
* Make sure that the original manufacturer repair and replace the broken parts.
* Don't touch the parts directly. It's dangerous!
* Don't dismantle the machine. Otherwise, there is a possibility of causing a fire and suffering from an electric shock.

Caution Items in Maintenance

* Don't inspect and don't repair the inside except for technical expert. Otherwise, there is a possibility of suffering from an electric shock, an injury and a burn, and/or there is a possibility of causing a fire on the machine.
* Don't neglect the maintenance work to keep it well-conditioned. Otherwise, there is a possibility of causing a fire.
* Don't touch any electric-recharged parts such as a battery terminal. Otherwise, there is a possibility that you get an electric shock, burned and injured.
* Don't touch any high voltage portions on terminal boards inside the machine. Otherwise, there is a possibility that you get an electric shock, burned and injured.
* Properly carry out the maintenance works after carefully reading the operation manual and understanding it well. There is a possibility that careless maintenance causes a burn, a serious injury, and/or causes a fire on the machine by a fire explosion and a broken piece.

Contents

Part A

Names and Labels

of

ENGINE GENERATOR

Contents

1. Names

1.1 Names of Engine Generator

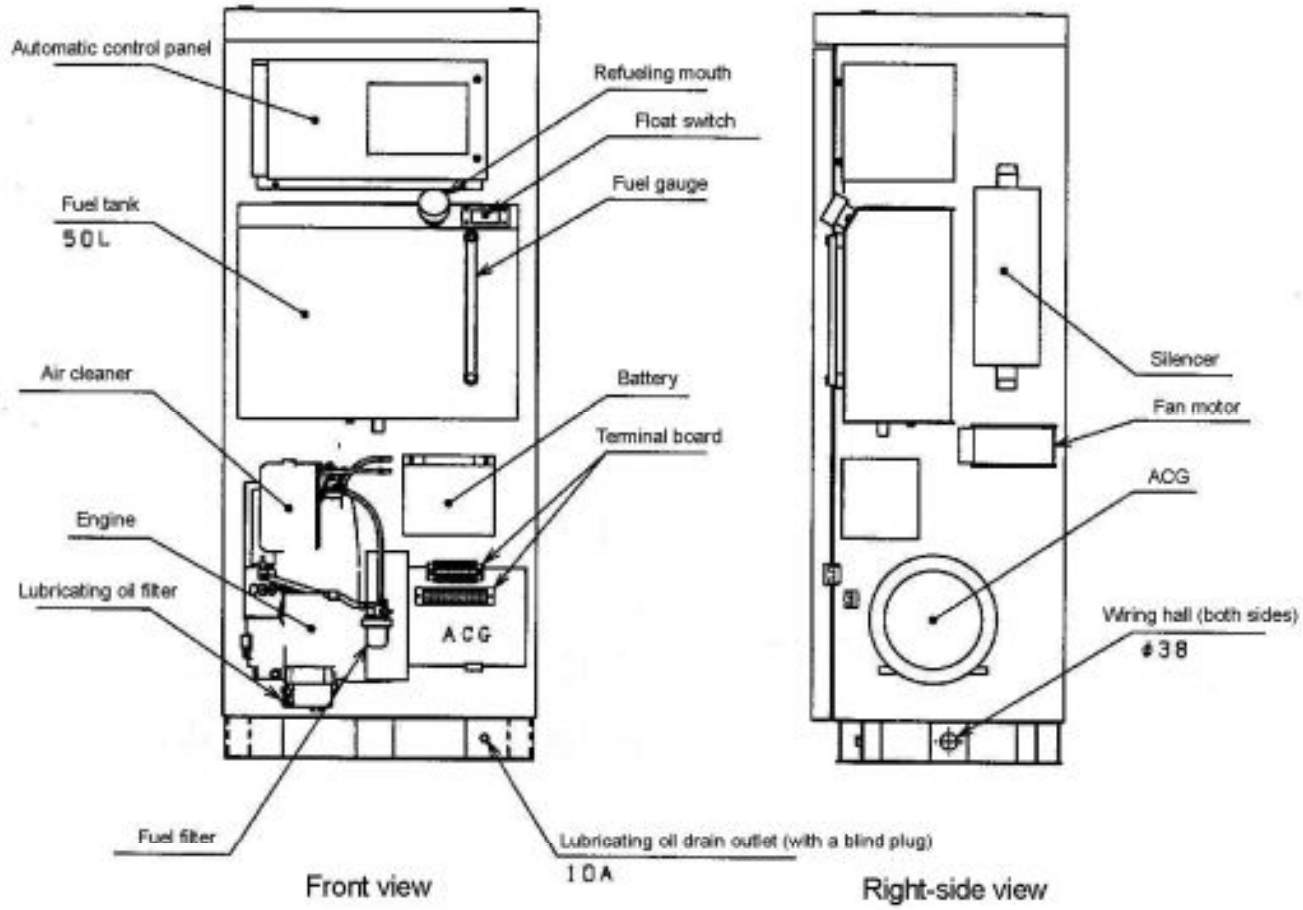


Figure 1-1 Names of Engine Generator

1.2 Names of Engine

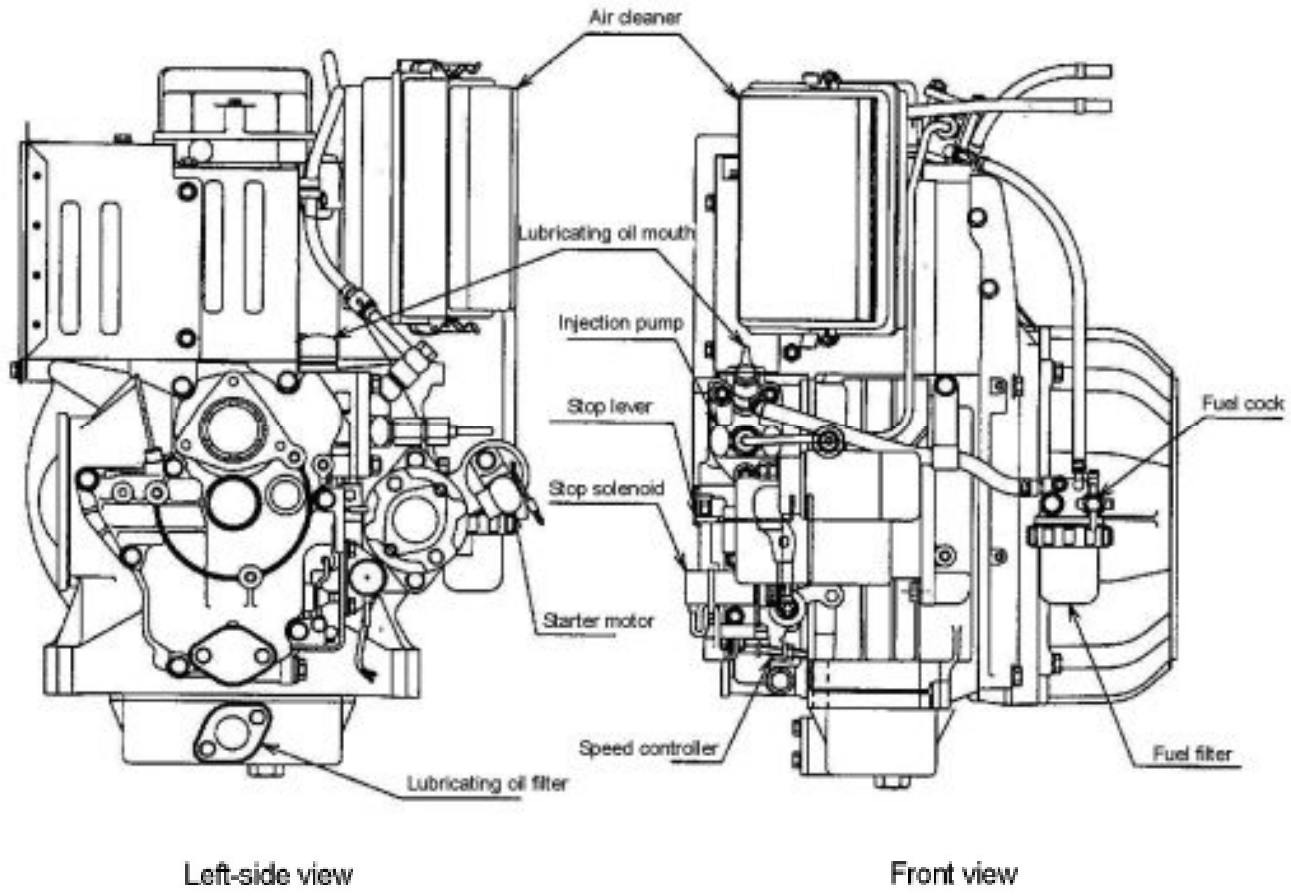


Figure 1-2 Names of Engine

* For emergency, stop the engine by pulling up the red-colored “Stop lever”.

2. Labels

2.1 Position and Content of Labels

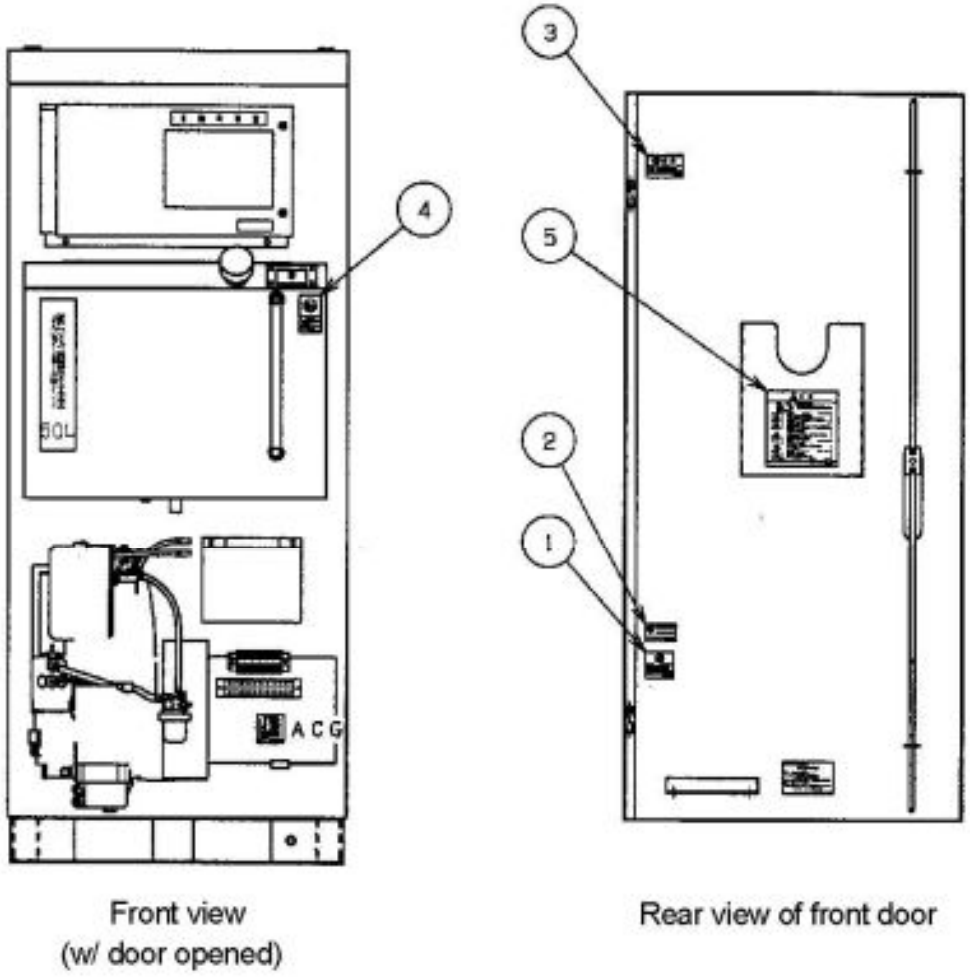


Figure 2-1 Position and Content of Labels (Front View)

1. Compulsory Label (Compel to connect earth)
2. Indication Label (Recycle the sealed battery)
3. Danger Label (Don't touch the battery charger)
4. Caution Label (Keep out fire or heat)
5. Caution Label (Each caution)

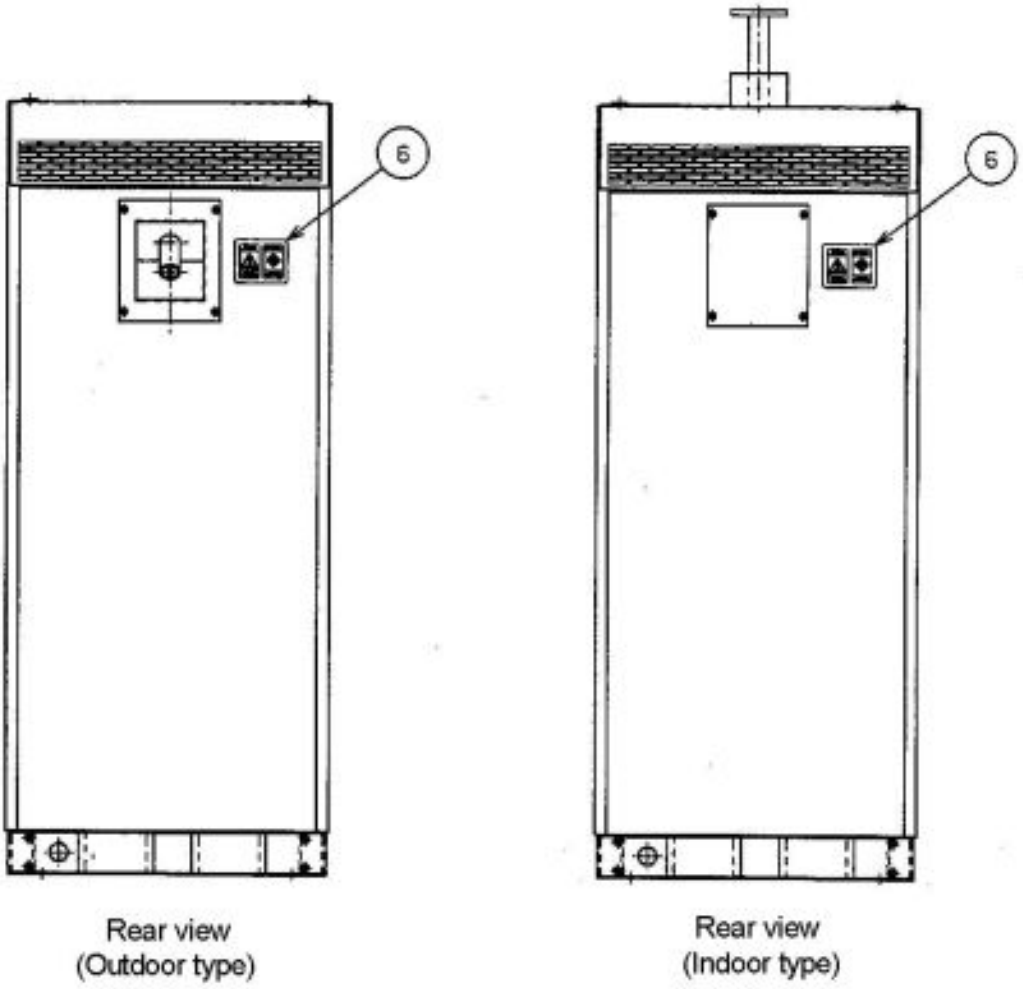


Figure 2-2 Position and Content of Labels (Rear View)

6. Caution label (Exhaust gas)

Part B

Operation Manual

of

AUTOMATIC CONTROL PANEL

Carefully read this operation manual beforehand for proper machinery operation.

Contents

1. Names and Functions of Automatic Control Panel

Automatic Control Panel consists of *Operation/Indication Panel* to confirm running states, *Switch Portion* for control power supply, *Main Circuit Breaker*, *Dipswitch* for setting Periodic Maintenance Running and *Control Portion*.

1.1 Names and Functions of Operation/Indication Panel

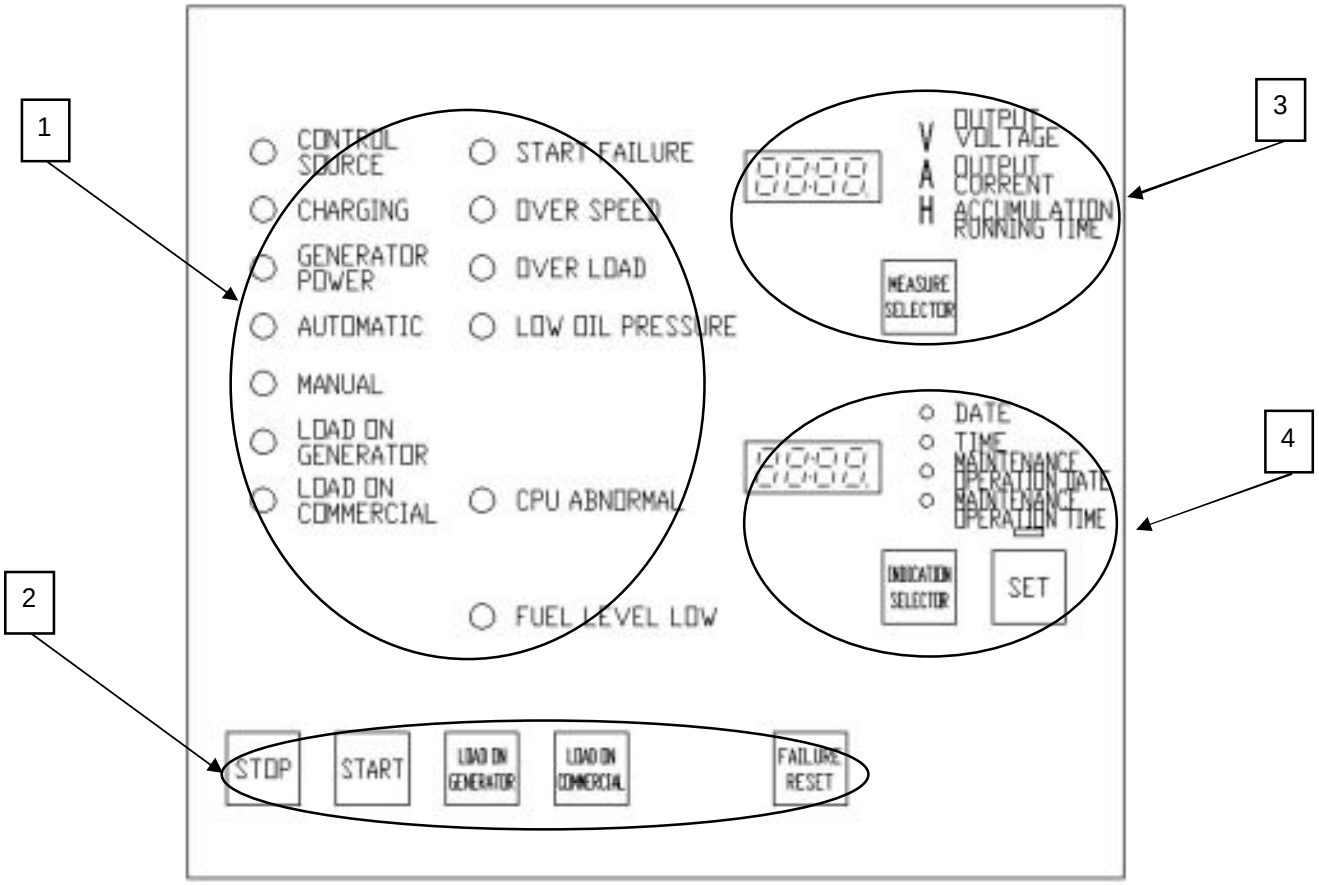


Figure 1-1 Operation/Indication Panel

Operation/Indication Panel functions as follows.

1. Status Indicator : Indicate running status and warning of extraordinary condition.
2. Operation Key : Switchover the running condition.
3. Monitor : Display Output Voltage, Output Current and Accumulation Running Time.
4. Timer : Display Date, Time, Periodical Maintenance Running Day and Time.

Table 1-1 Names and Functions of Status Indicator

No.	Item	LED indicator	Status (When LED turns on)
1	CONTROL SOURCE	GREEN	Control source is normal.
2	CHARGING	GREEN	Battery charger is working.
3	GENERATOR POWER	GREEN	Generator voltage is over 85 VAC.
4	AUTOMATIC	GREEN	Under Automatic Operation Mode.
5	MANUAL	GREEN	Under Manual Operation Mode.
6	LOAD ON GENERATOR	GREEN	Generated power is being supplied to the load.
7	LOAD ON COMMERCIAL	GREEN	Commercial power is being supplied to the load.
8	START FAILURE	RED	Action of engine start fails 3 times.
9	OVER SPEED	RED	Revolution speed is over the 113% of the rating.
10	OVER LOAD	RED	Load current is over the 118% of the rating.
11	LOW OIL PRESSURE	RED	Lubricating oil pressure of the engine is under 0.3kg ·f/c m^2.
12	CPU ABNORMAL	RED	Microcomputer circuit of the control panel is extraordinary.
13	FUEL LEVEL LOW	ORANGE	Remaining fuel is less than 30% of the full level.

Table 1-2 Names and Functions of Operation Key

No.	Item	Function
1	STOP	Stop the engine. (at Manual Operation Mode only)
2	START	Start the engine. (at Manual Operation Mode only)
3	LOAD ON GENERATOR	Generated power is supplied to the load. (at Manual Operation Mode only)
4	LOAD ON COMMERCIAL	Commercial power is supplied to the load. (at Manual Operation Mode only)
5	FAILURE RESET	Restore normal running after solving failure factors.

Table 1-3 Names and Functions of Monitor

No.	Item	Function
1	OUTPUT VOLTAGE	Display engine-generated output voltage when “V” indicator turns on.
2	OUTPUT CURRENT	Display output load current when “A” indicator turns on.
3	ACCUMULATION RUNNING TIME	Display accumulation running time of the engine when “H” indicator turns on.
4	MEASURE SELECTOR Key	Use to select the display item (output voltage, output current and accumulation running time).

Display item is changed in turn by pushing “MEASURE SELECTOR” key.

“OUTPUT VOLTAGE” ➡ “OUTPUT CURRENT” ➡ “ACCUMULATION RUNNING TIME”

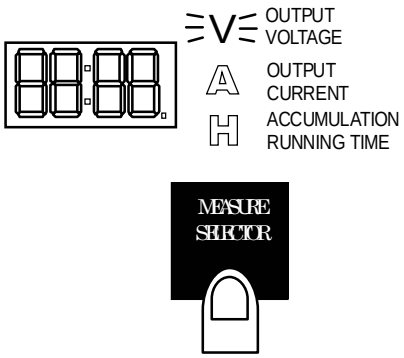
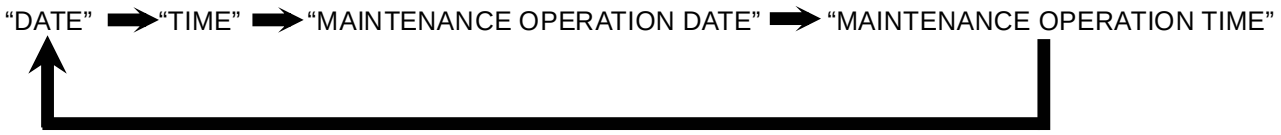
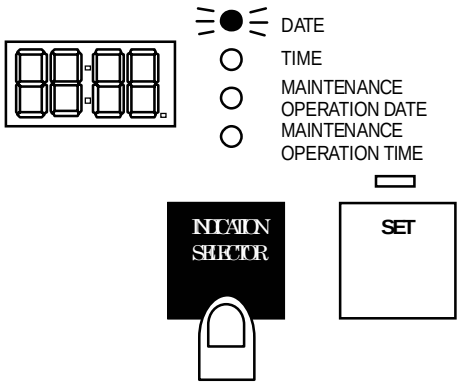


Table 1-4 Names and Functions of Timer

No.	Item	Function
1	DATE	Display month and day when side LED lights on.
2	TIME	Display hour and minute when side LED lights on.
3	MAINTENANCE OPERATION DATE	Display the next periodic maintenance running date when side LED lights on.
4	MAINTENANCE OPERATION TIME	Display the start time of the periodic maintenance running when side LED lights on.
5	INDICATION SELECTOR Key	Use to select the display item (date, time, periodic maintenance running date and time).
6	SET Key	Use after setting of date, time, periodic maintenance running day and time.

Display item is changed in turn by pushing “INDICATION SELECTOR” key.





1.2 Names and Functions of Switch Portion

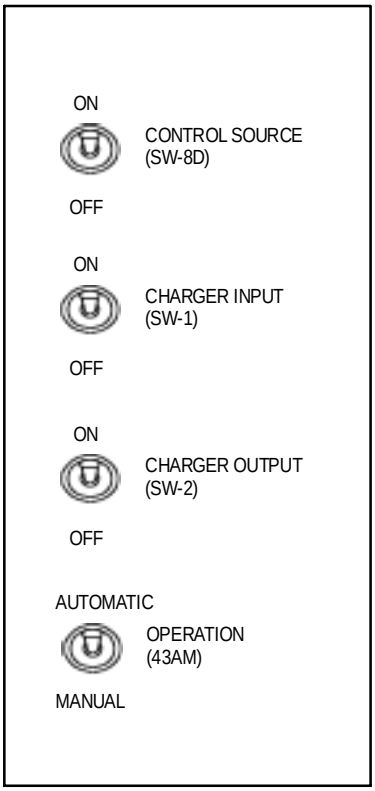


Figure 1-2 Switch Portion

Table 1-5 Names and Functions of Switch Portion

No.	Item	Function	
1	CONTROL SOURCE	Switch (ON/OFF) for control source.	
2	CHARGER INPUT	Switch (ON/OFF) for charger AC input.	
3	CHARGER OUTPUT	Switch (ON/OFF) for charger DC output.	
4	OPERATION	AUTOMATIC	Switch (AUTOMATIC/MANUAL) for operation mode.
		MANUAL	

1.3 Names and Functions of Main Circuit Breaker

Main Circuit Breaker is mounted inside the Automatic Control Panel.

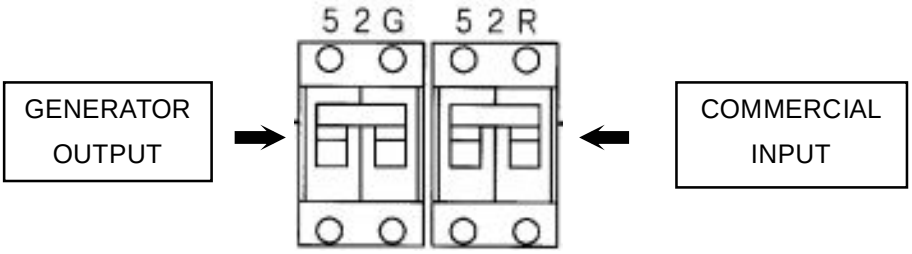


Figure 1-3 Main Circuit Breaker

Table 1-6 Names and Functions of Main Circuit Breaker

No.	Item	Function
1	COMMERCIAL INPUT	Breaker for commercial source input
2	GENERATOR OUTPUT	Breaker for engine-generated output

1.4 Names and Functions of Dipswitch

Dipswitch is mounted on the control PC board of the backside of the control panel.

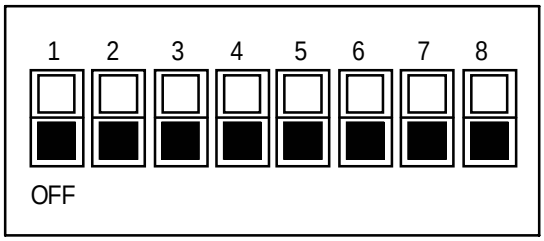


Figure 1-4 Dipswitch

Table 1-7 Names and Functions of Dipswitch

No.	Item		Function
1	SW2	1,2	Set interval of periodic maintenance running. Interval: 1 week, 2 weeks, 4 weeks and 8 weeks
		3,4	Set time duration of periodic maintenance running. Duration: 1 minute, 3 minutes, 5 minutes and 10 minutes
		5-8	Don't alter the setting, otherwise the machine may not work ordinary.
2	SW3	1-8	N/A

1.5 Names and Functions of Control Portion

Control Portion equips functions of sequence control and automatic voltage control of the engine.

Table 1-8 Names and Functions of Control Portion

No.	Item	Function
1	Automatic Voltage Regulator	Regulate the engine generated output voltage automatically.
2	Sequence Control	Control the machine with microcomputer.

* Automatic voltage regulator is equipped inside the Automatic Control Panel.

2 Setting

Caution Items in Operation

* Operate the machine as the operation manual instructs. Otherwise, there is a possibility that careless operation causes an electric shock and an accident.
* Stop the machine immediately after you recognize any extraordinary condition such as smoke and/or smell. Otherwise, there is a possibility of a fire on the machine.
* Keep the door closed for ordinary operation. If you carelessly touch the inside, there is a possibility that you get an electric shock and get burned.

Prohibition Items in Operation

* No smoking! No fire! Otherwise, there is a possibility that you are injured by a fire explosion and a broken piece.
* No liquid container on the machine! Otherwise, there is a possibility of causing a fire and suffering from an electric shock.
* Don't step on and/or lean against the machine! Otherwise, there is a possibility that the machine falls down.
* Don't dismantle the machine! Otherwise, there is a possibility of suffering from high-voltage electricity and heavy-weighted components.
* Don't put a stick and/or a finger into a fan! Otherwise, there is a possibility that you are injured by turning fan.
* Don't put a metal stick and/or a finger into an input/output terminal board in the machine! Otherwise, there is a possibility of suffering an electric shock.
* Don't unnecessarily change setting of a timer and dipswitch! Otherwise, the machine may not work ordinary.

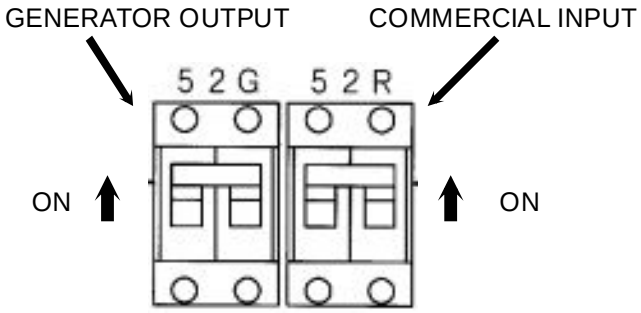
2.1 Preparation for Operation

Please confirm the following items before operation.

1. Main Circuit Breaker is ”OFF”.
   52G, 52R
2. Switches on the Switch Portion are “OFF”.
   “CONTROL SOURCE” (SW-8D), “CHARGER INPUT” (SW-1), “CHARGER OUTPUT” (SW-2)
3. “OPERATION” switch (43AM) on the Switch Portion is stayed at “MANUAL” side.
4. Commercial power is available.
5. The load side is ready to be supplied electricity.

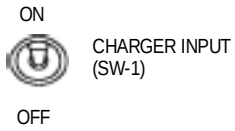
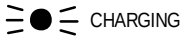
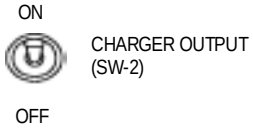
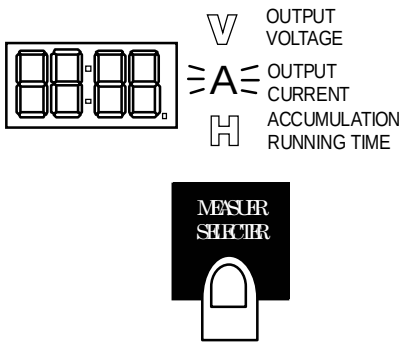
2.1.1 Operation of Main Circuit Breaker

By the following operation, commercial or generated power is readily supplied to the load.

No.	Operation	State and Indication
1	Turn the “COMMERCIAL INPUT” breaker (52R) to ”ON”.	Electric power is supplied to the load from commercial.
2	Turn the “GENERATOR OUTPUT” breaker (52G) to ”ON”. 	

2.1.2 Operation of Switch Portion

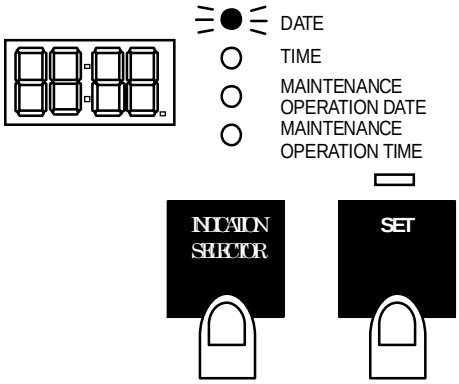
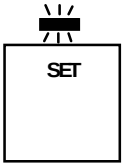
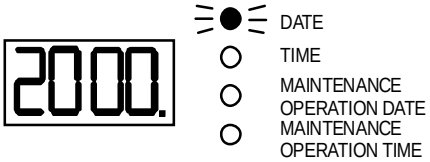
By the following operation, battery is recharged via Battery Charger and electric power is supplied to the Control Portion.

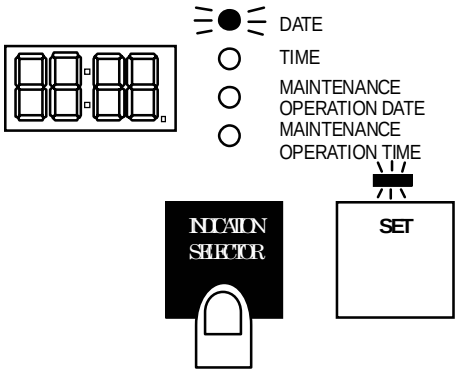
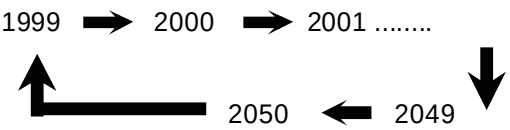
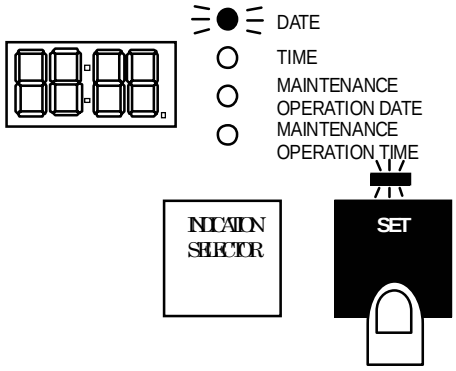
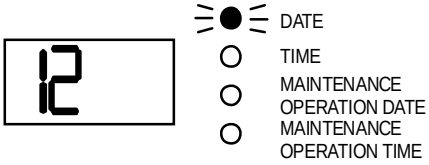
No.	Operation	State and Indication
1	Turn the “CHARGER INPUT” switch (SW-1) to “ON”.  	“CHARGING” indicator lights on. 
2	Turn the “CHARGER OUTPUT” switch (SW-2) to “ON”  	Battery is recharged.
3	Turn the “CONTROL SOURCE” switch (SW-8D) to “ON”.  	Control Portion begins to work and “CONTROL SOURCE” indicator lights on.  “MANUAL” indicator and ”LOAD ON COMMERCIAL” indicator light on. “DATE” on the Timer and ”OUTPUT VOLTAGE” on the Monitor are displayed.
4	Select and display the output current by pushing “MEASURE SELECTOR” key on the Monitor.  Please confirm that output current does not exceed the rated value.	The rated value is 5kVA. When the load current exceeds the rated value, ”OVER LOAD” indicator lights on. Please refer to “4. Action at Failure and Trouble” to release “OVER LOAD” situation.

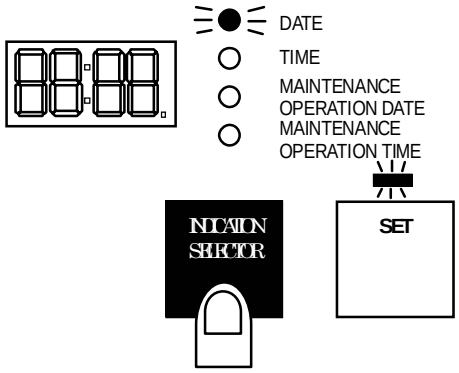
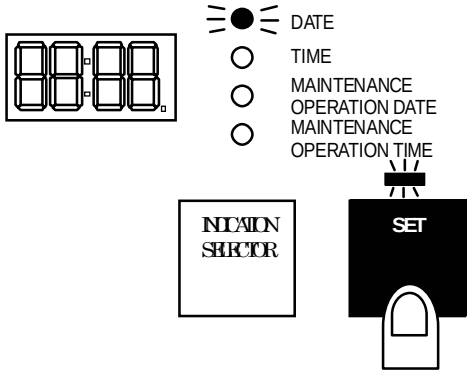
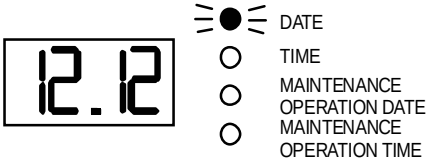
2.2 Adjust Date and Time

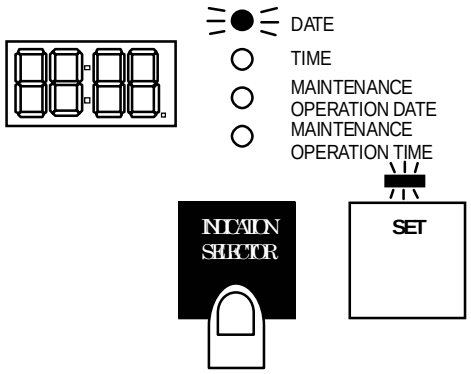
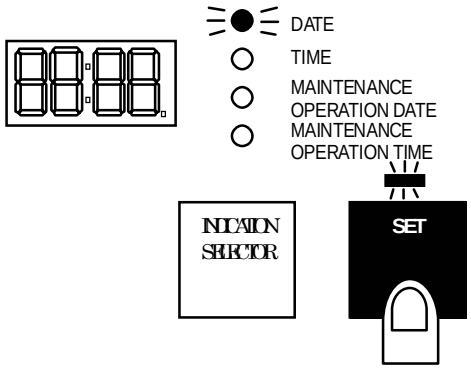
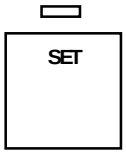
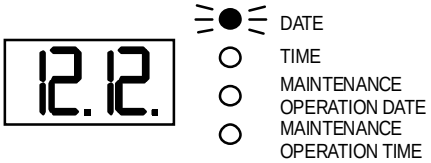
2.2.1 Adjust Method of “Date”

Please adjust date by the following procedure.

No.	Operation	State and indication
1	Push “INDICATION SELECTOR” key and “SET” key simultaneously for 2 seconds at least. 	
2	After beep, release hand from keys. Alter the calendar year : Go to No. 3. Not alter the calendar year : Go to No. 4.	Indicator above the “SET” key lights on.  Calendar year is displayed. 

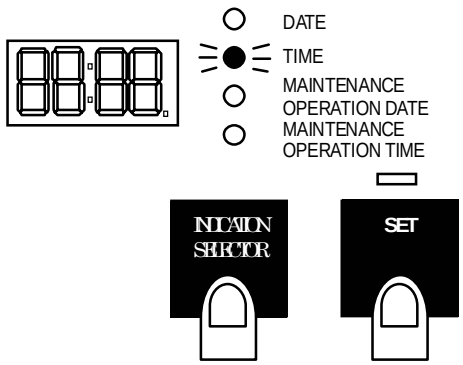
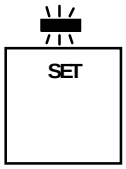
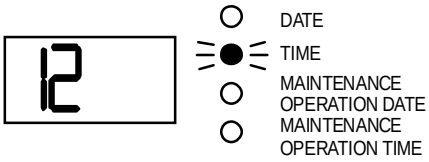
No.	Operation	State and indication
3	Push “INDICATION SELECTOR” key.  * By pushing key continuously, calendar year changes acceleratingly. After completing adjustment of calendar year: Go to No.4.	Calendar year changes 1 year incrementally. 
4	Push “SET” key.  Alter the month : Go to No. 5. Not alter the month : Go to No. 6.	Month is displayed. 

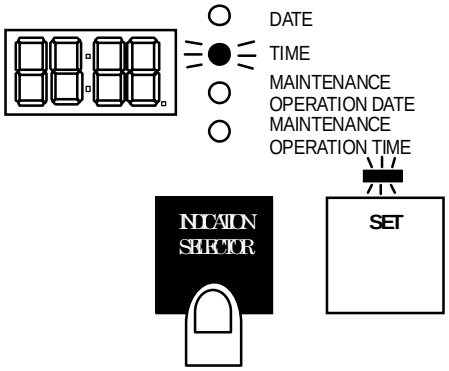
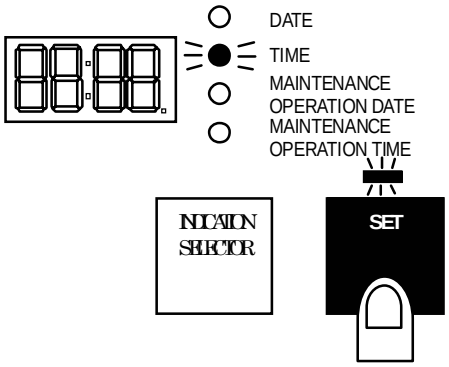
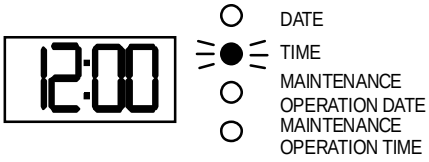
No.	Operation	State and indication
5	Push “INDICATION SELECTOR” key.  * By pushing key continuously, month changes acceleratingly. After completing adjustment of month: Go to No. 6.	Month changes 1 month incrementally.
6	Push “SET” key.  Alter the day : Go to No. 7. Not alter the day : Go to No. 8.	Month and day are displayed. 

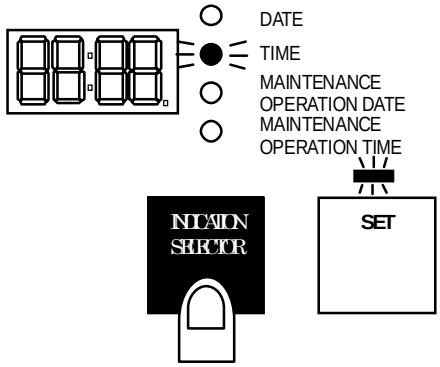
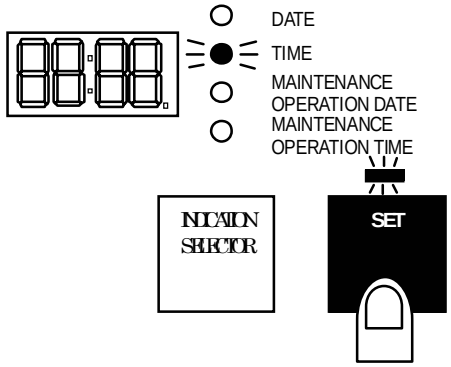
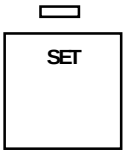
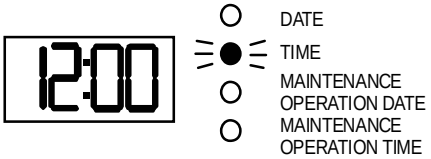
No.	Operation	State and indication
7	Push “INDICATION SELECTOR” key.  * By pushing key continuously, day changes acceleratingly. After completing adjustment of the day: Go to No. 8.	Day changes 1 day incrementally.
8	Push “SET” key.  By the above procedure, adjustment of date completes.	Indicator above “SET” key lights off.  Month and day are displayed. 

2.2.2 Adjust Method of “Time”

Please adjust time by the following procedure.

No.	Operation	State and indication
1	Push “INDICATION SELECTOR” key and “SET” key simultaneously for 2 seconds at least. 	
2	After beep, release hand from keys. Alter the hour : Go to No. 3. Not alter the hour : Go to No. 4.	Indicator above “SET” key lights on.  Hour is displayed. 

No.	Operation	State and indication
3	Push “INDICATION SELECTOR” key.  * By pushing key continuously, hour changes acceleratingly. After completing adjustment of hour: Go to No. 4.	Hour changes 1 hour incrementally.
4	Push “SET” key.  Alter the minute : Go to No. 5. Not alter the minute : Go to No. 6.	Hour and minute are displayed. 

No.	Operation	State and indication
5	Push “INDICATION SELECTOR” key.  * By pushing key continuously, minute changes acceleratingly. After completing adjustment of minute: Go to No. 6.	Minute changes 1 minute incrementally.
6	Push “SET” key.  * If you push “SET” key with a time signal at the same time, you can correctly set the current time. By the above procedure, adjustment of time completes.	Indicator above “SET” key lights off.  Hour and minute are displayed. 

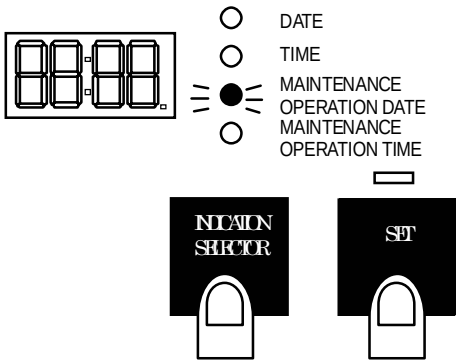
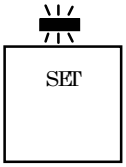
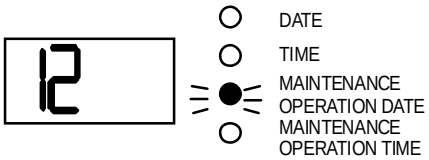
2.3 Setting of Periodic Maintenance Running

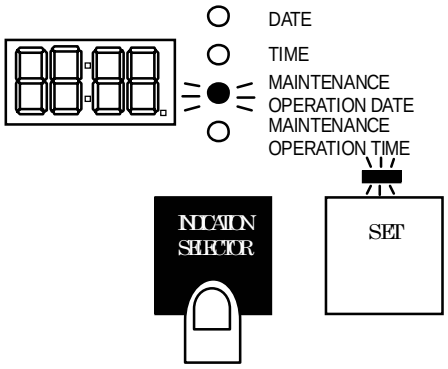
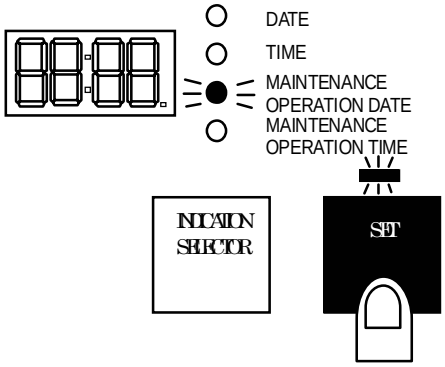
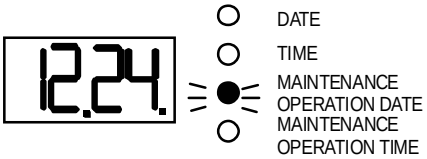
If this machine does not run for a long time, some parts may be getting damaged or less quality. To prevent such situation, this machine has a function to run periodically as the setting date, time and interval. This is “Periodic Maintenance Running”.

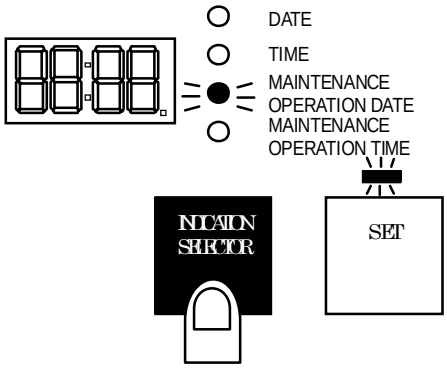
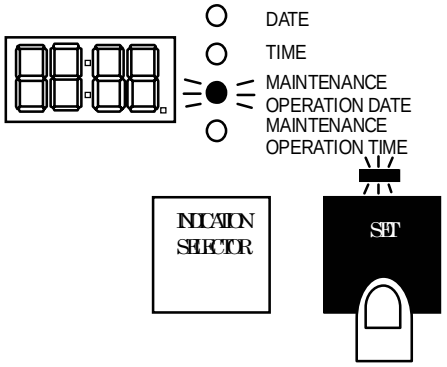
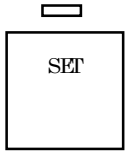
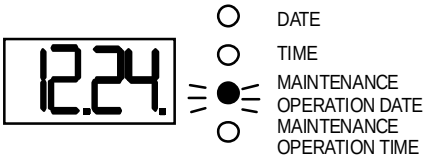
2.3.1 Setting Method of Periodic Maintenance Running Date

Please set the periodic maintenance running date by the following procedure.

Note At shipment, it sets as “January 1st".

No.	Operation	State and indication
1	Push “INDICATION SELECTOR” key and “SET” key simultaneously for 2 seconds at least. 	
2	After beep, release hand from keys. Alter the month : Go to No. 3. Not alter the month : Go to No. 4.	Indicator above “SET” key lights on.  Month is displayed. 

No.	Operation	State and indication
3	Push “INDICATION SELECTOR” key.  * By pushing key continuously, month changes acceleratingly. After completing adjustment of month: Go to No. 4.	Month changes 1 month incrementally.
4	Push “SET” key.  Alter the day : Go to No. 5. Not alter the day : Go to No. 6.	Month and day are displayed. 

No.	Operation	State and indication
5	Push “INDICATION SELECTOR” key.  * By pushing key continuously, day changes acceleratingly. After completing adjustment of day: Go to No. 6.	Day changes 1 day incrementally.
6	Push “SET” key.  By the above procedure, adjustment of the periodic maintenance running date completes.	Indicator above “SET” key lights off.  Month and day are displayed. 

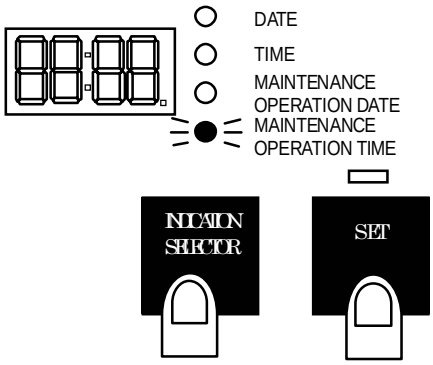
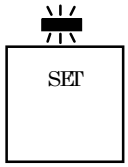
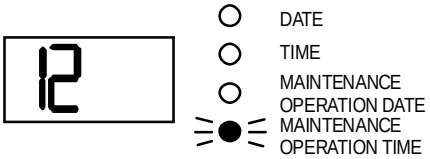
The first periodic maintenance running will be carried out at the setting date as above. After finishing the running, the next periodic maintenance running date will be displayed automatically.

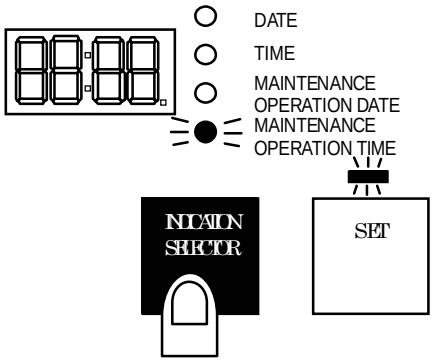
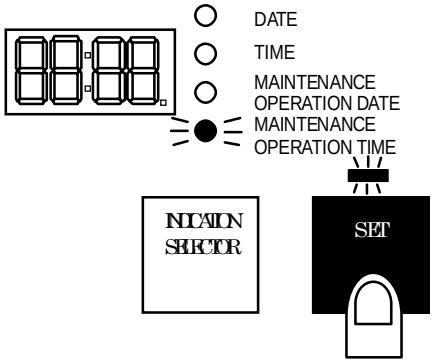
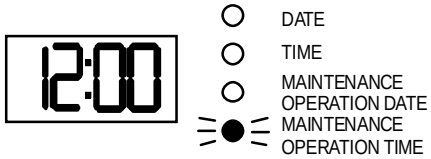
Interval and time duration of periodic maintenance running are set with Dipswitch inside the Automatic Control Panel. Please refer to “2.3.3 Setting of Interval and Time Duration of Periodic Maintenance Running” for alternation of the setting.

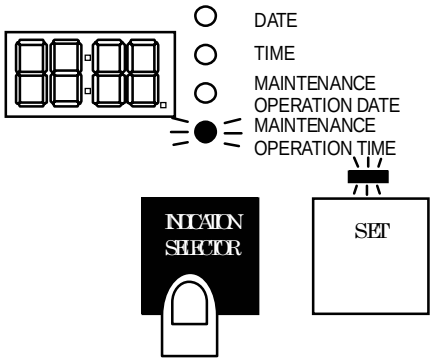
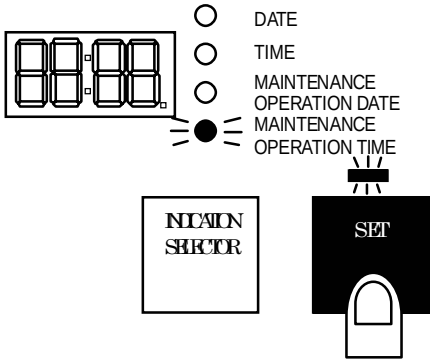
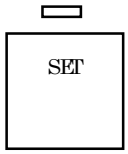
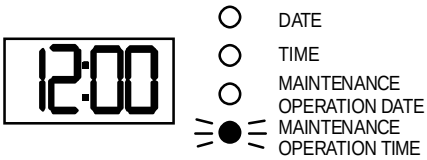
2.3.2 Setting Method of Periodic Maintenance Running Time

Please set the periodic maintenance running time by the following procedure.

Note At shipment, it sets as “00:00”.

No.	Operation	State and indication
1	Push “INDICATION SELECTOR” key and “SET” key simultaneously for 2 seconds at least. 	
2	After beep, release hand from keys. Alter the hour : Go to No. 3. Not alter the hour : Go to No. 4.	Indicator above “SET” key lights on.  Hour is displayed. 

No.	Operation	State and indication
3	Push “INDICATION SELECTOR” key.  * By pushing key continuality, hour changes acceleratory. After completing adjustment of hour: Go to No. 4.	Hour changes 1 hour incrementally.
4	Push “SET” key.  Alter the minute : Go to No. 5. Not alter the minute : Go to No. 6.	Hour and minute are displayed. 

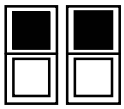
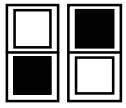
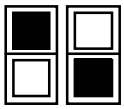
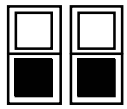
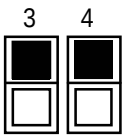
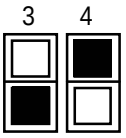
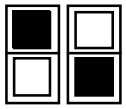
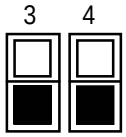
No.	Operation	State and indication
5	Push “INDICATION SELECTOR” key.  * By pushing key continuality, minute changes acceleratingly. After completing adjustment of minute: Go to No. 6.	Minute changes 1 minute incrementally.
6	Push “SET” key.  By the above procedure, adjustment of periodic maintenance running time completes.	Indicator above “SET” key lights off.  Hour and minute are displayed. 

2.3.3 Setting of Interval and Time Duration of Periodic Maintenance Running

Interval and time duration are set with Dipswitch “SW2”.

Please refer to “1.4 Names and Functions of Dipswitch“.

Table 2-1 Dipswitch Setting of Interval and Time Duration of Periodic Maintenance Running

No.	Item	Setting
1	Interval	1 week:  2 weeks:  3 weeks:  4 weeks: 
2	Time Duration	1 minute:  3 minutes:  5 minutes:  10 minutes: 

3. Operation

Caution Items in Operation

* Operate the machine as the operation manual instructs. Otherwise, there is a possibility that careless operation causes an electric shock and an accident.
* Stop the machine immediately after you recognize any extraordinary condition such as smoke and / or smell. Otherwise, there is a possibility of a fire on the machine.
* Keep the door closed for ordinary operation. If you carelessly touch the inside, there is a possibility that you get an electric shock and get burned.

Prohibition Items in Operation

* No smoking! No fire! Otherwise, there is a possibility that you are injured by a fire explosion and a broken piece.
* No liquid container on the machine! Otherwise, there is a possibility of causing a fire and suffering from an electric shock.
* Don't step on and/or lean against the machine! Otherwise, there is a possibility that the machine falls down.
* Don't dismantle the machine! Otherwise, there is a possibility of suffering from high-voltage electricity and heavy-weighted components.
* Don't put a stick and/or a finger into a fan! Otherwise, there is a possibility that you are injured by turning fan.
* Don't put a metal stick and/or a finger into an input / output terminal board in the machine! Otherwise, there is a possibility of suffering an electric shock.
* Don't unnecessarily change setting of a timer and dipswitch! Otherwise, the machine may not work ordinary.

3.1 Available Operation Mode

Automatic Operation Mode and Manual Operation Mode are available. Operation mode is selected with the "OPERATION" switch on the Switch Portion.

Automatic Operation Mode

This is an ordinary operation mode.

1. At the failure of commercial power supply, the engine automatically starts. And generated power is supplied to the load immediately after the voltage reaches the rated value. At the restoration of commercial power, the supplied power to load switches automatically from generated power to commercial power, and the engine stops accordingly.
2. The Periodic Maintenance Running is carried out with the preset interval, hour and time duration.

Manual Operation Mode

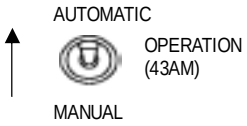
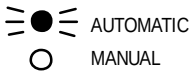
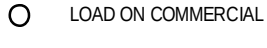
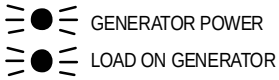
This mode adopts manually to start/stop the engine and switch the power source.

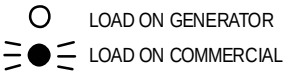
Use this mode only if necessary. (For example, recognition after maintenance, confirmation of trouble, etc.)

3.2 Automatic Operation Mode

Make sure of operating at Automatic Operation Mode by selecting “AUTOMATIC” side of “OPERATION” switch on the Switch Portion.

3.2.1 Power Failure and Power Restoration

No.	Operation	State and indication
1	Confirm that the “OPERATION” switch (43AM) on the Switch Portion is stayed at “AUTOMATIC” side. If “MANUAL” side, switch to “AUTOMATIC” side. 	“MANUAL” indicator lights off. “AUTOMATIC” indicator lights on. 
2	<u>Flow of Action at Power Failure</u> 1. Power failure occurs and commercial power supply stops accordingly. 2. The engine automatically starts after passage of “Failure Confirmation Time”. (“Failure Confirmation Time” is set about 2 seconds.) In case that the commercial power restores before end of Failure Confirmation Time, commercial power is automatically supplied to the load. 3. Generated power is supplied to the load immediately after the voltage reaches the rated value. The engine runs consecutively for 24 hours at max unless the commercial power restores. (fully fueled)	“LOAD ON COMMERCIAL” indicator lights off.  “GENERATOR POWER” indicator lights on. “LOAD ON GENERATOR” indicator lights on. 

No.	Operation	State and indication
3	<u>Flow of Action at Power Restoration</u> 1. Supplied power to the load is automatically switched from generator side to the commercial side after passage of “Restoration Confirmation Time”. (“Restoration Confirmation Time” is set about 30 seconds.) In case that the commercial power fails again before end of Restoration Confirmation Time, generated power is automatically supplied to the load immediately. CAUTION Power interruption of approx 50ms occurs at the switching time. 2. After switching, engine continues idling. 3. The engine automatically stops after passage of “Idling Confirmation Time”. (“Idling Confirmation Time” is set about 30 seconds.) In case that the commercial power fails again before end of Idling Confirmation Time, generated power is automatically supplied to the load immediately. The engine stands by until the next commercial power failure or periodic maintenance running.	“LOAD ON GENERATOR” indication lights off. “LOAD ON COMMERCIAL” indication lights on.  “GENERATOR POWER” indicator lights off. 

3.2.2 Periodic Maintenance Running

For Periodic Maintenance Running, make sure of operating at Automatic Operation Mode by selecting "AUTOMATIC" side of "OPERATION" switch on the Switch Portion.

No.	Operation	State and indication
1	Periodic Maintenance Running is carried out according to the setting in "2.3 Setting of Periodic Maintenance Running".	
2	Please refer to "2.3 Setting of Periodic Maintenance Running" for change of date, time, interval and time duration of Periodic Maintenance Running.	

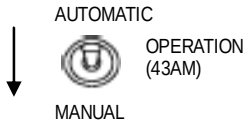
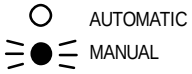
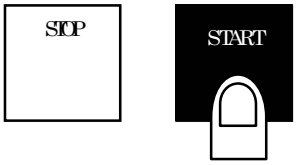
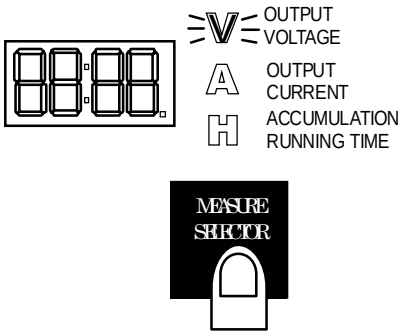
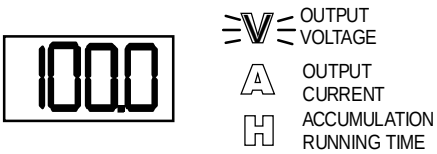
3.3 Manual Operation Mode

Please confirm the following items before performing manual operation.

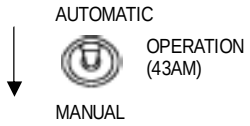
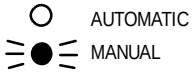
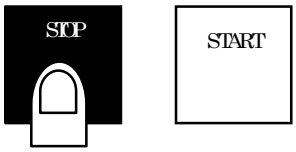
1. The engine stops. "GENERATOR POWER" indicator lights off.
2. The status of the load is ready to switch the power source.

Power interruption of approx. 50ms occurs by switching power sources with manual operation.
At power failure under the Manual Operation Mode, power is not supplied to the load until the power source is switched with "LOAD ON GENERATOR" key.

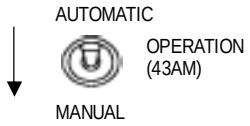
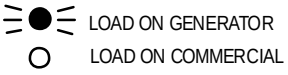
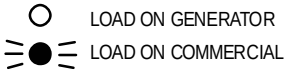
3.3.1 Start the Engine

No.	Operation	State and indication
1	Confirm that the “OPERATION” switch (43AM) on the Switch Portion is stayed at “MANUAL” side. If “AUTOMATIC” side, switch to “MANUAL” side. 	“AUTOMATIC” indicator lights off. “MANUAL” indicator lights on. 
2	Push “START” key. 	The engine starts. ”GENERATOR POWER” indicator lights on after the generated voltage reaches the rated value. 
3	Select and display “OUTPUT VOLTAGE” by pushing “MEASURE SELECTOR” key on the Monitor.  Please confirm that the output voltage does not exceed the rated value. When the output voltage does not meet the rated value, please adjust the voltage by referring “3.4 Adjustment of Generator Output Voltage“.	

3.3.2 Stop the Engine

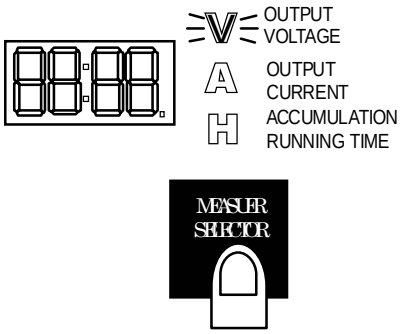
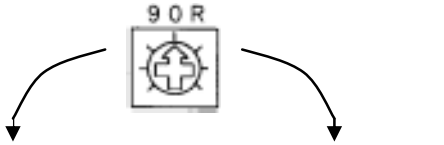
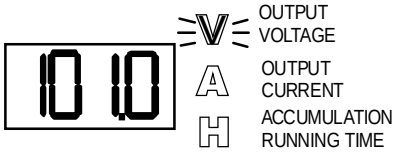
No.	Operation	State and indication
1	Confirm that the “OPERATION” switch (43AM) on the Switch Portion is stayed at “MANUAL” side. If “AUTOMATIC” side, switch to “MANUAL” side. 	“AUTOMATIC” indicator lights off. “MANUAL” indicator lights on. 
2	Push “STOP” key.  CAUTION After stop operation, the engine does not restart for 20 seconds.	The engine stops. “GENERATOR POWER” indicator lights off. 

3.3.3 Switch the Power Source

No.	Operation	State and indication
1	Confirm that the “OPERATION” switch (43AM) on the Switch Portion is stayed at “MANUAL” side. If “AUTOMATIC” side, switch to “MANUAL” side. 	“AUTOMATIC” indicator lights off. “MANUAL” indicator lights on. 
2	<u>From Commercial to Generator</u> Push “LOAD ON GENERATOR” key. 	Power is supplied to the load from generator. “LOAD ON COMMERCIAL” indicator lights off. “LOAD ON GENERATOR” indicator lights on. 
3	<u>From Generator to Commercial</u> Push “LOAD ON COMMERCIAL” key. 	Power is supplied to the load from commercial. “LOAD ON GENERATOR” indicator lights off. “LOAD ON COMMERCIAL” indicator lights on. 

3.4 Adjustment of Generator Output Voltage

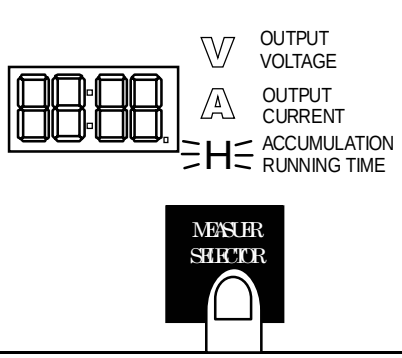
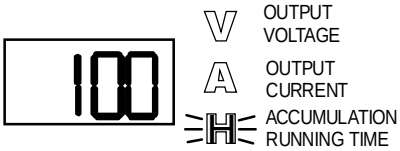
Generator output voltage is adjusted to the rated value (100VAC) before shipment.
This adjustment is carried out only in case that readjustment is needed depending on the load.

No.	Operation	State and indication
1	Select and display “OUTPUT VOLTAGE” by pushing “MEASURE SELECTOR” key on the Monitor. 	
2	Adjust the output voltage with in ±2% of the rated value by the voltage adjustment volume on RYU-PKG (relay board).  Low voltage High voltage	

3.5 Checking the Accumulation Running Time of the Engine

Check the accumulation running time of the engine to estimate the timing of replacing engine oil, filters and so on.

Please refer to attached maintenance check for replacement period and so on.

No.	Operation	State and indication
1	Select and display “ACCUMULATION RUNNING TIME” by pushing “MEASURE SELECTOR” key on the Monitor. 	Accumulation running time of the engine is displayed. 

4. Action at Failure and Trouble

* Please take restoration actions safely at the time of failure and / or trouble.
* Please contact us before taking restoration actions. Unreasonable restoration may cause a fire.
* Restoration action is only exclusively allowed for the specially trained engineer.

When trouble occur

When trouble occurs, please contact us after grasping trouble contents with the Operation / Indication Panel.

4.1 Operation and Indication at Failure

Trouble content is known with Status Indication on the Operation / Indication Panel.

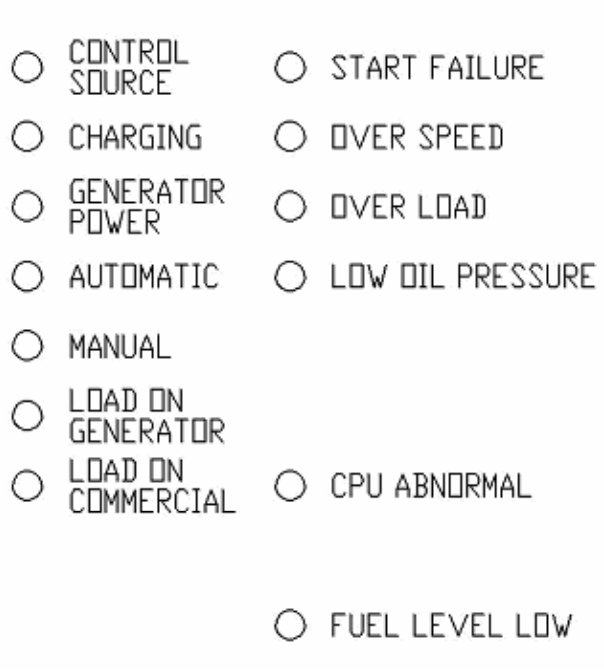


Table 4-1 Failure Situation and Restoration

	No.	Failure Indication	Situation	Evadable Action	Restoration Method
Failure	1	START FAILURE	Action of engine start fails 3 times.	Engine stops	There is something abnormal in the engine. Please contact us.
	2	OVER SPEED	Revolution speed is over the 113% of the rating.		There is something abnormal in the engine. Please contact us.
	3	OVER LOAD	Load current is over the 118% of the rating.		Adjust the load current by load side.
	4	LOW OIL PRESSURE	Lubricating oil pressure of the engine is under 0.3kg ˙f/c m^2.		There is a possibility of deterioration of lubricating oil or failure of fan motor. Please check and contact us if the replacing time is over.
	5	CPU ABNORMAL	Microcomputer circuit of the control panel is extraordinary.		There is something abnormal in CPU circuit operation. Please contact us.
Warning	6	FUEL LEVEL LOW	Remaining fuel is less than 30% of the full level.		Please stop the engine, and refuel the designated fuel.

4.2 Failure Reset

After solving a failure mentioned Table 4-1, please do the following “FAILURE RESET” operation.

No	Operation	State and indication
1	Push “FAILURE RESET” key.  * “FUEL LEVEL LOW” indicator automatically lights off when fuel level exceed 30% by refueling.	Indicator of the failure lights off.

Part C

Maintenance Manual

of

ENGINE GENERATOR

Read this instruction manual well to maintain a device function, and perform maintenance check regularly.

Prohibition

* Don't inspect and don't repair the inside except for technical expert. Otherwise, there is a possibility of suffering from an electric shock, an injury and a burn, and/or there is a possibility of causing a fire on the machine.
* Don't carry any metallic belongings (e.g., wristwatch) during maintenance work! Otherwise, there is a possibility that you get an electric shock, burned and injured.
* Don't engage yourself to maintain the machine while electricity is applied! Confirm that the machine stops before maintenance work. There is a possibility that you get an electric shock, burned and injured.
* Don't touch any high temperature parts such as an engine! Otherwise, there is possibility that you get burned even after an engine was stopped.
* Use the same rating/typed genuine parts for replacement and avoid the mixture of new and old parts. There is a possibility of causing a fire.
* Don't touch the machine with a wet hand! Otherwise, there is possibility that you get an electric shock.
* Make sure that the original manufacturer repair and replace the broken parts.
* Don't touch the parts directly. It's dangerous!
* Don't dismantle the machine. There is a possibility of causing a fire and suffering from an electric shock.

Caution

* Don't inspect and don't repair the inside except for technical expert. Otherwise, there is a possibility of suffering from an electric shock, an injury and a burn, and/or there is a possibility of causing a fire on the machine.
* At the time of maintenance work, connection wire to battery minus (-) terminal mast be disconnected so that the engine can not start during work. Otherwise there is a possibility that you get an electric shock, burned and injured.
* Don't neglect the maintenance work to keep it well conditioned. Otherwise, there is a possibility of causing a fire.
* Don't touch any electric-recharged parts such as a battery terminal. Otherwise, there is a possibility that you get an electric shock, burned and injured.
* Don't touch any high voltage portions on terminal boards inside the machine. Otherwise, there is a possibility that you get an electric shock, burned and injured.
* Properly carry out the maintenance works after carefully reading the operation manual and understanding it well. There is a possibility that careless maintenance causes a burn, a serious injury, and/or causes a fire on the machine by a fire explosion and a broken piece.

Contents

1. Maintenance

It is necessary for safety running of the engine generator to maintain it at normal state and also keep the surrounding condition around it appropriately.

Figure 1-1 shows correct running condition.

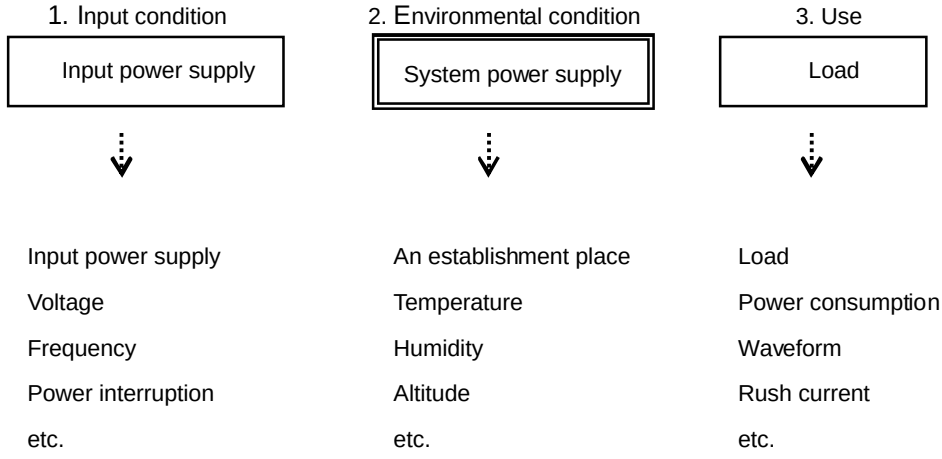


Figure 1-1 Correct Running Condition

About 1-3, maintain conditions are mentioned in the specification.
In case that the actual condition is not consistent with the specification, please contact the manufacturer.

2. Instructions at Maintenance

1. Deep attention to the engine should be paid not to start by power failure during maintenance work.
2. The necessary number of spare parts for replacement or repair should be always prepared.
3. After finishing the maintenance work, it should be reconfirmed that all kinds of switches, relays and indications work well.
4. Confirm the number of spare parts and tools.
5. Carefully select a proper dress code for maintenance work. It is dangerous to wear longer strings and wide cuffs to be rolled up/picked up into the machine.

3. Regular Maintenance

In order to prevent unexpected troubles at the machine, the following regular maintenance works should be done.

No.	Check Item		Judgment Criteria	Remarks
1	Check by measurement		Is the indication value of the monitor on the panel within the range of the rated value?	* Please check residual quantity of fuel and fill up it if necessary. * When the output current exceeds the rated value, please reduce the current by adjusting load and use within the range of the rated value.
2	Check by senses	Sight	* Aren't there crack, discoloration or corrosion of parts? * Aren't the intake, exhaust or vent closed? * Doesn't the terminal/part slacken? * Isn't there dirt on the filters? * Do switches and/or indications operate normally? * Isn't there leakage of fuel or oil? * Isn't there dirt of engine oil? * Isn't color of exhaust gas colored unusual?	Please contact us immediately if you recognize any extraordinary condition. Do not leave it running. It is dangerous!
		Smell	* Doesn't it smell differently?	
		Hearing	* Doesn't it sound differently? (While running) * Isn't there any sudden and/or peculiar noise? * Isn't there unusual vibration?	
		Touch	* Isn't there abnormally hot point? (Do not touch directly in hand! Dangerous!!)	

<u>Leak of Lubricating Oil and Exhaust Gas</u>

By deterioration of pipe composition and/or pipe joint, leak at their joint occurs inevitably.

When notice leak, please wipe it off.

When leak gets worse, regard it as an aging deterioration of material, and seal it up at the time of maintenance.

Fuel is light oil (Type JIS2).

For use at place of under minus(-) 10℃ in winter, fuel type should be JIS3 or SPECIAL3 rating.

4. Periodic Maintenance

Please carry out the following periodic maintenance items every six (6) month or one (1) year.

1. Check of appearance
   Aren't there crack, discolor, corrosion on a part?
2. Check of screwed portions
   Aren't there slack screws on the Engine, Generator, Automatic Control Panel or Connection Terminal Board?
   If there is, tight it.
3. Check of contact abrasion
   Aren't there contact abrasions of switch or relay?
4. Removal of dust and dirt
   Wipe it off because dust and/or dirt in a machine cause insulation deterioration and abnormal temperature rise.
5. Drainage of water in fuel tank
   Drain water in a tank periodically through drain valve.

* Please contact and ask us for more detail information about maintenance work if necessary.

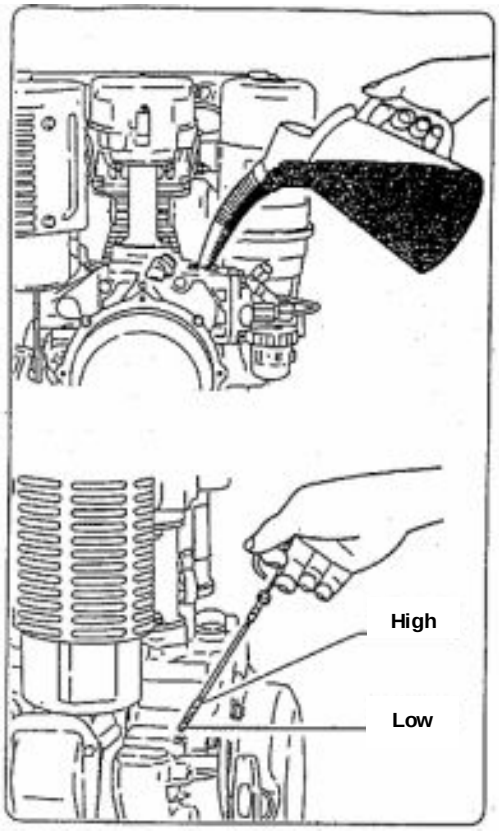
5. Periodic Replacement of Parts

Period of replacement or washing of a part depends on condition of site and/or running.
However, standard maintenance is the following.

No.	Parts		Period of replacement	Remarks
1		Battery	3 years	There is a case that lifetime shorten depending on environment. At the time of battery remove, take off minus (-) terminal at first. At the time of battery installation, connect plus (+) terminal at first. There is a possibility of touching between tools and surrounding metal fitting. Therefore, it is dangerous if you do not take off minus (-) terminal of battery at first.
2	Replace	Fan Motor	3 years of accumulation running time	
3		Fuse	Every 4-6 years considering aging deterioration	Please check every fuse at the time of battery replacement.
4		Engine Oil	Whichever earlier, 1 year or 50 hours of accumulation running time	
5		Oil Filter	Whichever earlier, 3 years or 100 hours of accumulation running time	
6		Air Filter	Every 6 years considering aging deterioration	
7		Fuel Filter	Whichever earlier, 3 years or 100 hours of accumulation running time	
8		Package	About 6 years	
9		Automatic Voltage Regulator	About 6 years	
10		Battery Charger	About 6 years	
11		Breaker for wiring	About 9 years	

No.	Parts		Period of replacement	Remarks
12	Replace	Switch / Contact maker	About 6 years	
13		Relay / Timer	About 6 years	There is a case lifetime shorten depending on environment.
14		Surge Absorbers	About 6 years	
15		Rubber Packing	Every 3-6 years considering aging deterioration	
16		Rubber Hoses	Every 3 years considering aging deterioration	
17		Space Heater	About 6 years	
18	Cleaning / Washing	Air Cleaner	Whichever earlier, 2 years or 100 hours of accumulation running time	
19		Oil Filter	Whichever earlier, 2 years or 100 hours of accumulation running time	
20		Intake Filter	1 year	Degree of dirt and dust depends on environment. When dirt is observed, please wash it out.
21		Fuel Filter	Whichever earlier, 2 years or 200 hours of accumulation running time	

Expect (durable) life is 15 years life long once the parts mentioned above are newly replaced.
However, the life is greatly influenced by environment.



Pouring Method of Engine Lubricating Oil

Please pour oil up to the upper limit by measuring quantity with oil level gauge.

Pour quantity is approx. 1.6 litters.

After pouring oil up to the height of standard level, please run the engine for a several minutes and stop the engine. Approx. 10 minutes after, confirm the height of oil level again. Supply the shortage if the oil quantity is not enough.

Viscosity of oil is exclusively the following diesel engine oil.

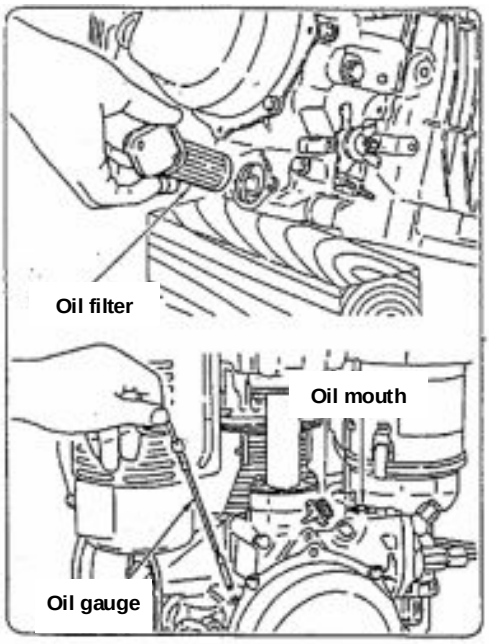
SAE 10W-30

"Multi-grade type" engine oil, which has slight change of viscosity with seasonal temperature variation, is recommended.

By using this type of oil, oil management becomes easy.

Quality deterioration and shortage of oil cause engine trouble such as “burn out”.

Please use CC grade or CD grade quality of oil.



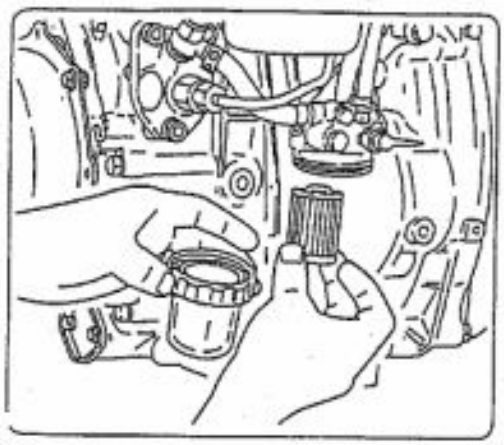
Replacement of Engine Oil and Cleaning of Oil Filter

Please drain out the engine oil by taking off oil drain plug.

Please put a pan under oil drain outlet.

Please do not drop oil spill inside a machine.

When an oil filter stained, please wash well it with light oil.

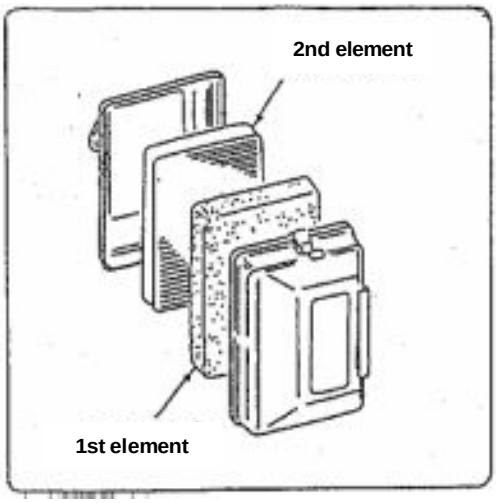


Cleaning of Fuel Filter

Fuel injection pump is made very precisely.
Therefore, please clean up elements and/or cups elaborately. Otherwise plunger is damaged by adulterating oil with dust or water, and engine is burn at worst case.
And please tighten them at reassemble work not to cause fuel leak.
Please wash elements with light oil elaborately.
In case the water and/or alien substance remains in a cup of fuel filter, please clean it up.
During cleaning work, keep a fuel filter cock closed.
After cleaning work, please remove air from fuel system.

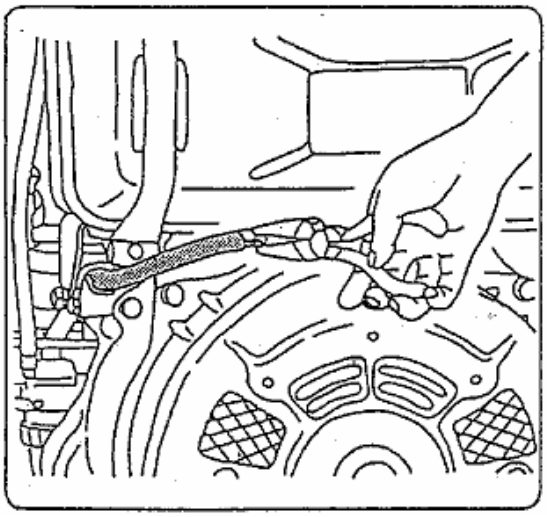
Air Removal from a Fuel System

Air removal is automatically done.
When generator starts manually, air inside engine and fuel pipe flows into fuel tank through fuel return pipe, consequently air removal is completed.
It is not necessary to do removal if refueled before empty.



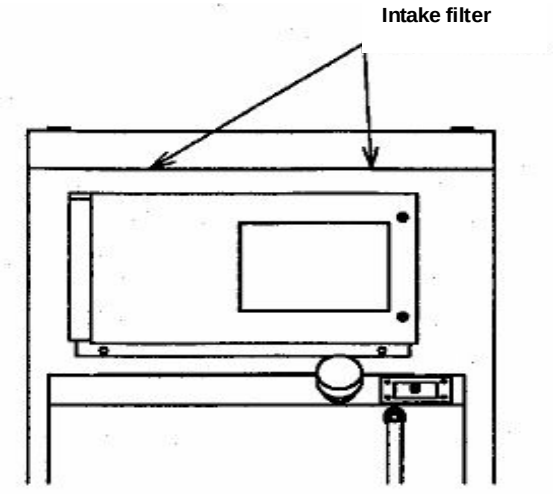
Cleaning of an Air Cleaner

Air cleaner serves to supply clean air into engine by removing dust.
When air cleaner is heavy stained, symptom of failed running such as engine start miss and/or power shortage is caused, and engine life becomes extremely shortened.
Please soap well the 1st and 2nd elements and dry them up.
Then, resemble them.



Replacement of Fuel Pipe

Replacement of fuel pipe is recommended every 2 years.
However, please replace immediately if fuel leaks.
Fuel pipe replacement work must be carried out after completely draining fuel out of fuel tank.



Washing of Intake Filter

Please soap well intake filter on the upper side of generator cubicle, and dry it up. Then, remount it.

6. Long-term Custody

For long-term custody, please do the following.

Charge of Battery

Battery life becomes shortened by self-discharge if not used for long term.
Please protect battery terminals by disconnecting wires from terminals.
Please recharge the battery once every 6 months.

CAUTION

Battery becomes unavailable if leave it unused for 6 months or longer.

www.densei-lambda.com

Power-EX

DENSEI-LAMBDA 9126

User's Guide

1200VA/1500VA

DENSEI-LAMBDA
An Invensys company

DS001-04-02

Class B EMC Statements

NOTE This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

VCCI Notice for Class B Equipment

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づくクラスB情報技術装置です。この装置は、家庭環境で使用することを目的としていますが、この装置がラジオやテレビジョン受信装置に近接して使用されると受信障害を引き起こすことがあります。取扱説明書に従って正しい取り扱いをしてください。

Special Symbols

The following are examples of symbols used on the UPS to alert you to important information:

RISK OF ELECTRIC SHOCK - Indicates that a risk of electric shock is present and the associated warning should be observed.

CAUTION: REFER TO OPERATOR'S MANUAL - Refer to your operator's manual for additional information, such as important operating and maintenance instructions.

This symbol indicates that you should not discard the UPS or the UPS batteries in the trash. The UPS may contain sealed, lead acid batteries. Batteries must be recycled.

Table of Contents

1. Summary

"Densei-Lambda 9126 - The Ultimate Online UPS !"

The Densei-Lambda 9126 uninterruptible power system (UPS) protects your sensitive electronic equipment from the most common power problems including power failures, power sags, power surges, brownouts, line noise, high voltage spikes, frequency variations, switching transients, and harmonic distortion.

Power outages can occur when you least expect it and power quality can be erratic. These power problems have the potential to corrupt critical data, destroy unsaved work sessions, and damage hardware causing hours of lost productivity and expensive repairs.

With the Densei-Lambda 9126, you can safely eliminate the effects of power disturbances and guard the integrity of your equipment. Figure 1 shows the Densei-Lambda 9126 UPS with an optional Extended Battery Module (EBM).

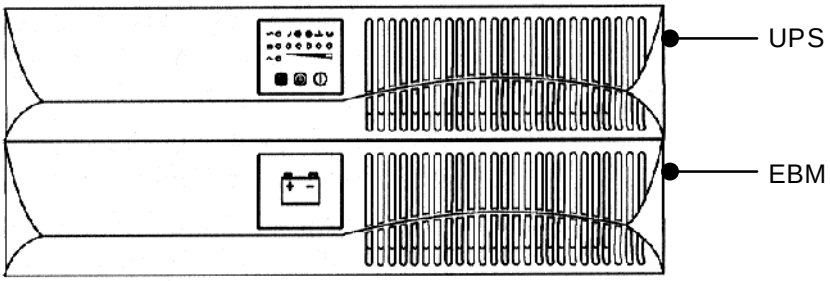


Figure 1. The Densei-Lambda 9126

Because an integral part of power protection is power management software, the Densei-Lambda 9126 comes fully equipped with a communication port, serial cable, and a CD containing for networked systems.

Providing outstanding performance and reliability, the Densei-Lambda 9126's unique benefits include the following:

- Fourth-Generation Online design with pure sine wave output. The UPS filters and regulates incoming AC power and provides consistent power to your equipment without draining the battery.
- 2U rack height conserves valuable rack space.
- Advanced Battery Management Plus (ABM Plus) doubles battery service life, optimizes recharge time.
- With the two-in-one form factor, you can use the UPS in a rack-mount configuration or as a standalone cabinet.
- Hours of extended run time with up to two EBMs.
- Sequential shutdown and load management through separate receptacle groups, called load segments.
- Network Transient Protector guards your network communications equipment from surges. Low voltage models can also guard modems, fax machines, or other telecommunications equipment.
- Emergency shutdown control through the Remote Emergency Power-Off (REPO) port.
- Start-on-battery capability allows you to power up the UPS even if utility power is not available.
- The Densei-Lambda 9126 is backed by worldwide agency approvals.

2. Safety Warnings

Read the following precautions before you install the UPS.

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS. This manual contains important instructions that you should follow during installation and maintenance of the UPS and batteries. Please read all instructions before operating the equipment and save this manual for future reference.

DANGER

This UPS contains LETHAL VOLTAGES. All repairs and service should be performed by AUTHORIZED SERVICE PERSONNEL ONLY. There are NO USER SERVICEABLE PARTS inside the UPS.

WARNING

- This UPS contains its own energy source (batteries). The output receptacles may carry live voltage even when the UPS is not connected to an AC supply.
- Do not remove or unplug the input cord when the UPS is turned on. This removes the safety ground from the UPS and the equipment connected to the UPS.
- To reduce the risk of fire or electric shock, install this UPS in a temperature and humidity controlled, indoor environment, free of conductive contaminants. Ambient temperature must not exceed 40° C (104° F). Do not operate near water or excessive humidity (95% max).
- To comply with international standards and wiring regulations, the total equipment connected to the output of this UPS must not have an earth leakage current greater than 1.5 milliamperes.

CAUTION

- Batteries can present a risk of electrical shock or burn from high short-circuit current. Observe proper precautions. Servicing should be performed by qualified service personnel knowledgeable of batteries and required precautions. Keep unauthorized personnel away from batteries.
- Proper disposal of batteries is required. Refer to your local codes for disposal requirements.
- Never dispose of batteries in a fire. Batteries may explode when exposed to flame.

3. Installation

The section explains:

- Equipment inspection
- UPS setup and installation
- UPS rear panels

3-1 Inspecting the Equipment

If any equipment has been damaged during shipment, keep the shipping cartons and packing materials for the carrier or place of purchase and file a claim for shipping damage. If you discover damage after acceptance, file a claim for concealed damage.

3-2 UPS Setup

The Densei-Lambda 9126 UPS is designed for flexible configurations and can be installed in a rack or as a standalone cabinet.

If you are installing the UPS in a rack, continue to the following section “Rack-Mount Setup;” otherwise, continue to “Cabinet Setup” on page 6.

(1) Rack-Mount Setup

The UPS can be installed in 19 inch racks and needs only 2U of valuable rack space.

NOTE Mounting rails are required for each cabinet. If rails are not already installed in your rack, contact your local distributor to order a rail kit.

Use the following procedure to install the UPS in a rack:

1. Place the UPS on a flat, stable surface with the front of the UPS facing toward you.
2. Attach the mounting handles to the bracket with the screws provided in the accessory kit (see Figure 2).
3. Align the mounting brackets with the screw holes on the side of the UPS and secure with the supplied screws (see Figure 2).
4. If installing optional Extended Battery Modules, repeat Steps 1 through 3 for each cabinet.

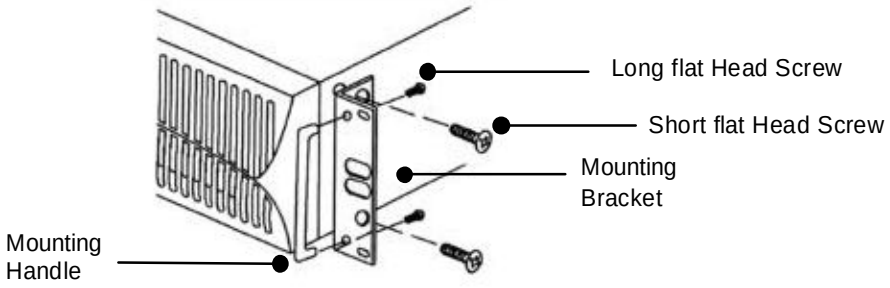


Figure 2. Installing the Mounting Brackets

NOTE The EBMs must be installed below the UPS as shown in Figure 3.

5. Slide the UPS and any optional EBMs into the rack. Continue to “Installing the UPS" on page 8 to complete the installation.

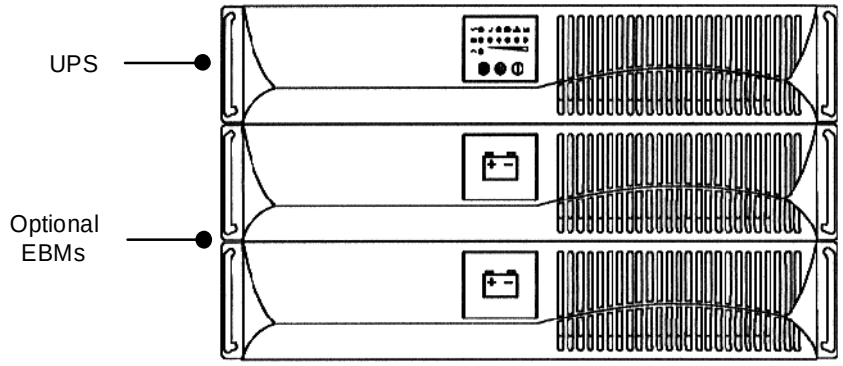


Figure 3. Rack-Mount UPS with EBMs

(2) Cabinet Setup

You can position the UPS cabinets horizontally or vertically. When positioning the cabinets horizontally, the EBMs must be placed below the UPS (see Figure 4).

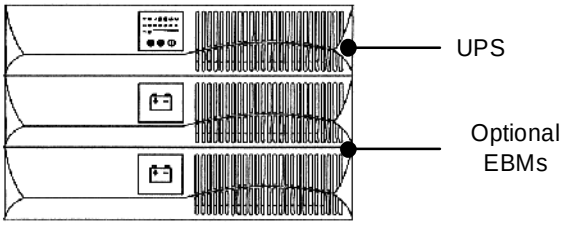


Figure 4. Horizontal Cabinet Setup

NOTE The air vents should be at the top of the unit when positioned vertical.

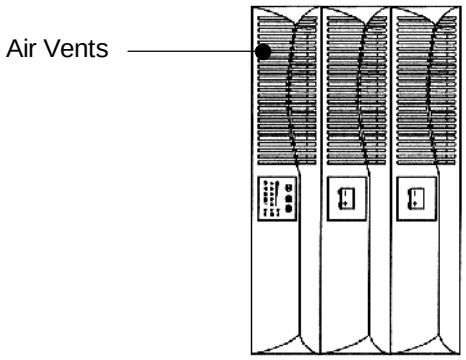


Figure 5 Vertical Cabinet Setup

When a single UPS cabinet is positioned vertically, the UPS stands must be attached to the bottom of the cabinet tower:

1. Place the UPS horizontally, so that the left end of the unit is accessible.
2. Slide and position the UPS stands over the end of the unit so that the weight of the UPS is evenly distributed (see Figure 6). Secure the stands with the screws provided in the accessory kit.

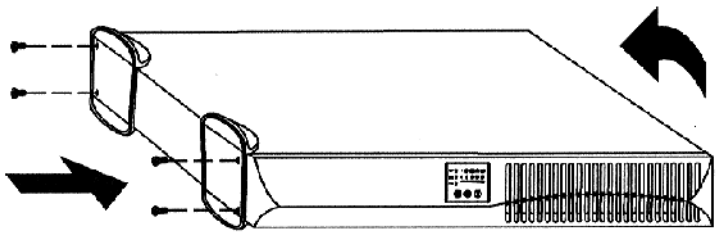


Figure 6. Installing the UPS Stands

3. Carefully position the unit upright on the UPS stands (see Figure 7). Continue to the following section, “(3)Installing the UPS”

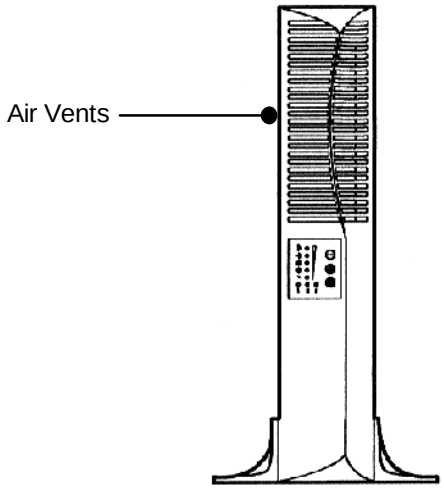


Figure 7. UPS Cabinet with Stands

(3) Installing the UPS

The following steps explain how to install the UPS. Figure 9 shows a typical installation only. See "3-3 UPS Rear Panels" on page 11 for the rear panel of each model.

CAUTION

A small amount of arcing may occur when connecting an Extended Battery Module to the UPS. This is normal and will not harm personnel. Insert the EBM cable into the UPS battery connector quickly and firmly.

Do not make unauthorized changes to the UPS; otherwise, damage may occur to your equipment and void your warranty.

1. If installing an optional EBM, continue to Step 2; otherwise, skip to Step 7.
   Steps 2-4 are not required for rack-mount installations.
2. Remove the adjacent corner screws from the rear panels as shown in Figure 8 to install the EBM brackets.
3. Align each EBM bracket with the screw holes and secure with the screws removed in Step 2.

4. If installing additional EBMs, repeat Steps 2 and 3 for each cabinet.

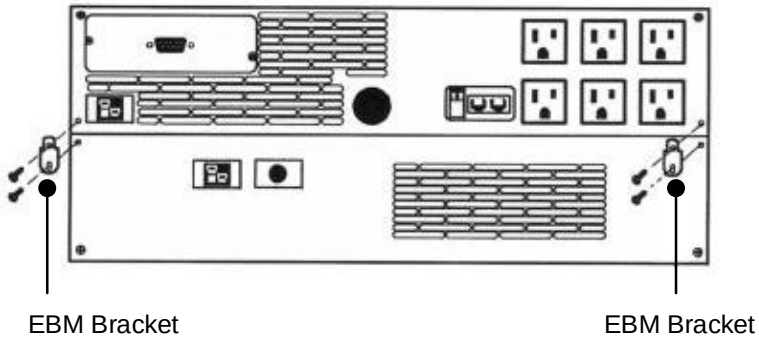


Figure 8. Installing the EBM Brackets

5. Plug the EBM cable into the battery connector on the UPS rear panel (see Figure 9).
6. If additional EBMs are to be installed, plug the EBM cable of the second cabinet into the battery connector on the first EBM. Repeat for each additional EBM. Up to four EBMs may be connected to the UPS.

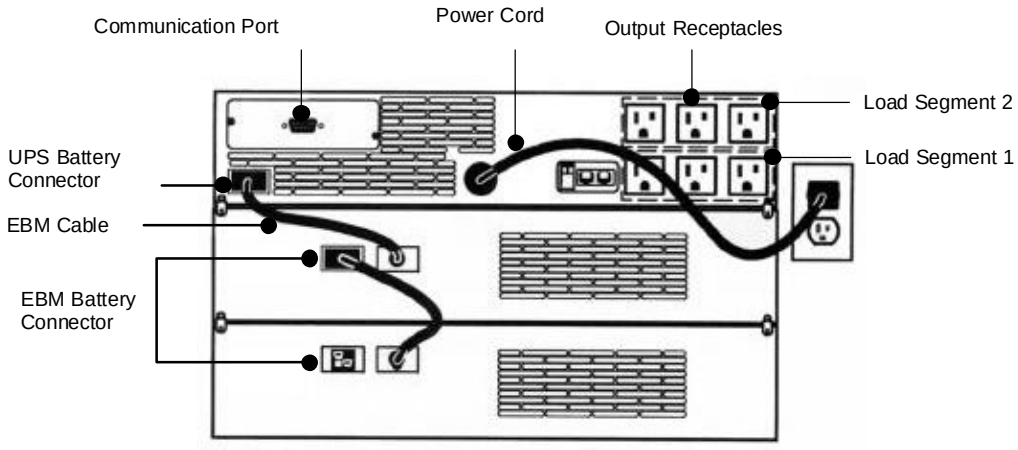


Figure 9. Typical UPS Installation

7. If you are installing power management software, connect your computer to the UPS communication port using the supplied communication cable.
8. Plug the equipment to be protected into the appropriate UPS output receptacles (see page 30 for more information on load segments).

   DO NOT protect laser printers with the UPS because of the exceptionally high power requirements of the heating elements.
9. On 230V models, plug the detachable UPS power cord into the input connector on the UPS rear panel.
10. Plug the UPS power cord into a power outlet. All front panel indicators flash briefly and the UPS conducts a self-test. When the self-test is complete, the ⎍ indicator flashes, indicating the UPS is in Standby mode with the equipment offline. If the ⊘ indicator flashes, see page 33.

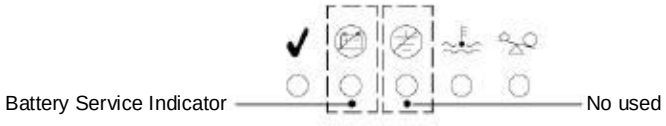


Figure 10 Fault Indicators

11. Start the UPS by pressing the On | button (see Figure 12 on page 12). The ⎍ indicator stops flashing and the bar graph indicators display the percentage of load being applied to the UPS.

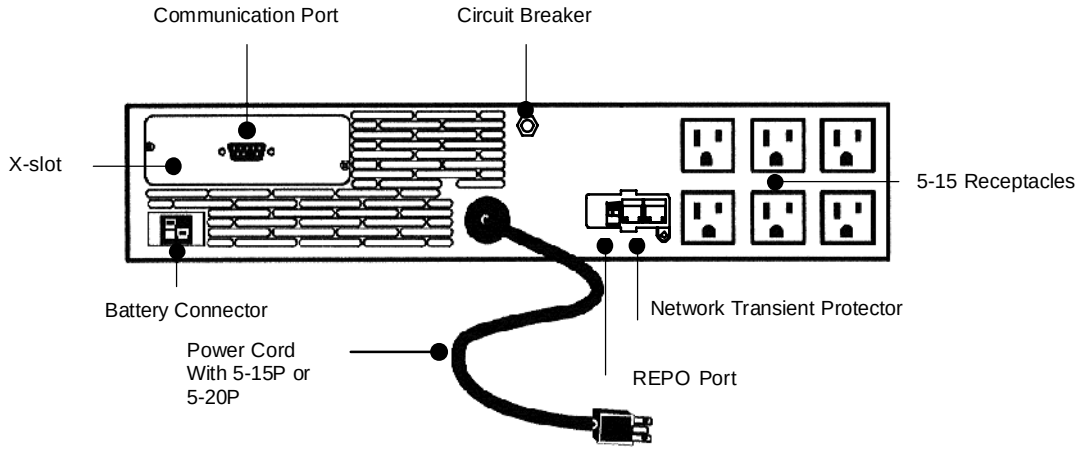
    The UPS is now in Normal mode and supplying power to your equipment. To learn how to operate the UPS, see "Operation" on page 12. To change the factory-set defaults, see -Configuration" on page 17.

NOTE The batteries charge to 80% capacity in approximately 5 hours. However, it is recommended that the batteries charge for 24 hours after installation or long-term storage.

3-3 UPS Rear Panels

This section shows the rear panels of the Densei-Lambda 9126 models.

<DL9126 1200jL / DL9126 1500jL>



<DL9126 1500jHL>

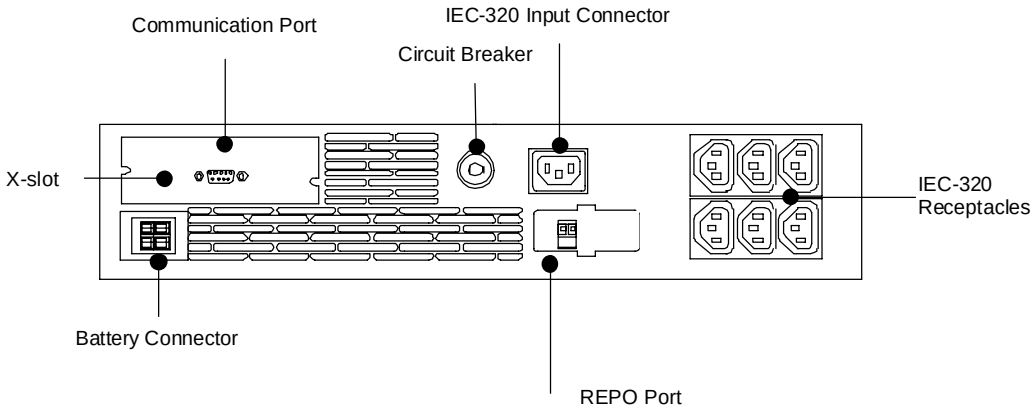


Figure 11. Rear Panel

4. Operation

This section describes:

- Operation Mode
- Turning the UPS on and off

4-1 Operation Modes

Densei-Lambda 9126's front panel indicates the UPS status through the UPS indicators. Figure 12 shows the UPS front panel indicators and controls.

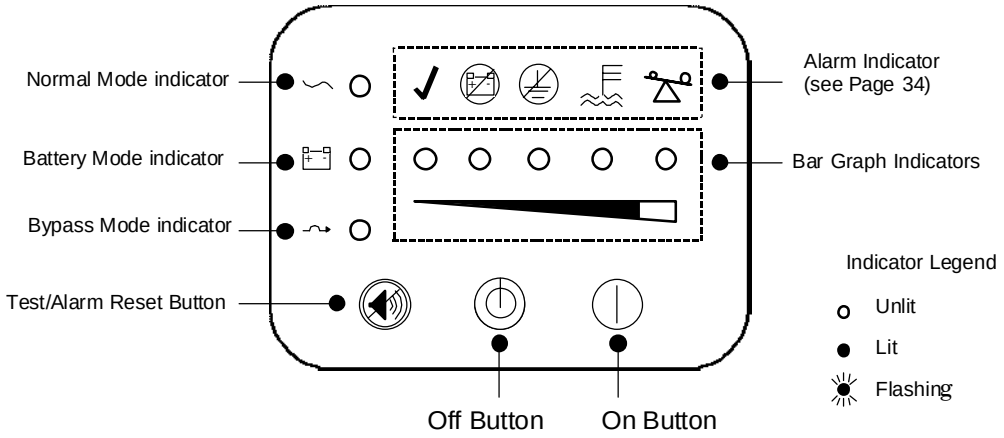


Figure 12 UPS Front Panel

Table 1 Operation Mode

	Normal Mode Drive	Normal Mode Standby	Battery Mode Drive	Battery Mode Standby	PowerShare Mode Drive	Bypass Mode Drive	Bypass Mode Standby
Normal Mode Indicator	**Lit**	**Flashing**	**Unlit**	**Unlit**	**Lit**	**Unlit**	**Unlit**
Battery Mode Indicator	**Unlit**	**Unlit**	**Lit**	**Flashing**	**Lit**	**Unlit**	**Unlit**
Bypass Mode Indicator	**Unlit** ***1**	**Unlit** ***1**	**Unlit**	**Unlit**	**Unlit** ***1**	**Lit**	**Flashing**

*1: Flashing = Bypass Not Available

(1) Normal Mode

During Normal mode, the ∿ indicator illuminates and the front panel displays the percentage of UPS load capacity being used by the protected equipment (see Figure 13). The UPS monitors and charges the batteries as needed and provides power protection to your equipment.

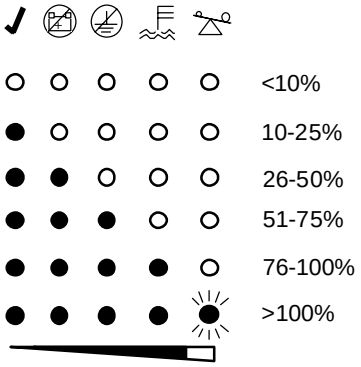


Figure 13 Load Level Indicator

The LEDs do not illuminate when the UPS load is less than approximately 10%. Each LED represents 1/4 of a full load rating. When all of the bar graph indicators are illuminated and the ⚠ indicator flashes, power requirements exceed UPS capacity; see page 34 for more information.

(2) Battery Mode

When the UPS is operating during a power outage, the alarm beeps once per second and the indicator illuminates. The front panel displays the approximate percentage of battery capacity remaining (see Figure 14). When the utility power returns, the UPS switches to Normal mode operation while the battery recharges.

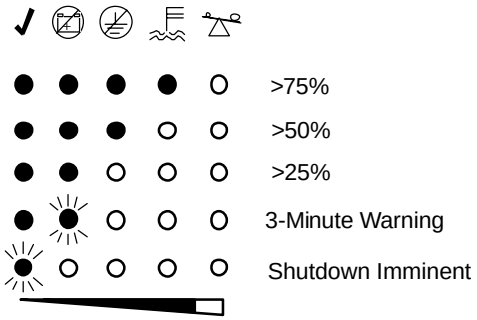


Figure 14 Battery Capacity Indicators

If battery capacity becomes low while in Battery mode, the indicator flashes and the alarm sounds continuously, indicating approximately three minutes of battery time remaining. When shutdown is imminent, the ✓ indicator flashes.

NOTE Depending on the UPS load, the 3-minute warning may occur before the batteries reach 25% capacity; the front panel immediately displays the 3-minute warning. For UPS and Extended Battery Module run times, see Table 13 on page 32.

NOTE These warnings are approximate, and the actual time to shutdown may vary significantly. Once these warnings are indicated, immediately complete and save your work to prevent data loss and similar difficulties. When utility power is restored after the UPS shuts down, the UPS automatically restarts.

(3) Bypass Mode

In the event of a UPS overload or internal failure, the UPS transfers your equipment to utility power. Battery mode is not available; however, the utility power continues to be passively filtered by the UPS. The alarm sounds and the ↷ indicator illuminates. The UPS switches to Bypass mode when:

- The UPS has an Overtemperature condition.
- The UPS has an overload condition of 101 to 110% for 2 minutes.
- The UPS has an overload condition of 111 to 150% for 30 seconds.
- The UPS detects a fault in the battery or UPS electronics.

(4) Standby Mode

When the UPS is turned off and remains plugged into a power outlet, the UPS is in Standby mode. The √ indicator flashes and the bar graph indicators are off, indicating that power is not available from the UPS output receptacles. The battery recharges when necessary.

(5) PowerShare Mode

This operation mode supplies insufficient power from a Internal batteries when input electric power is insufficient. However, this function does not operate during bypass operation. The power share mode is an urgent mode in the case temporarily exceeding rating of the UPS. It corresponds to a momentary increase the output power , to a temporary decrease of the input voltage. The state in the mode can be confirmed by LED display of a front panel.

When the PowerShare mode often occurs, the capacity of the input power of UPS is insufficient or the output electric power of UPS has exceeded rating. In this case , It becomes impossible to hold enough run time in Utility failure that because UPS is consumed battery power in Powershare mode. Moreover the life cycle of a battery become short , because UPS repeat frequent electrical charge and discharge.
Please do not become keep use in the state.

4-2 Turning the UPS ON/OFF

(1) Turning the UPS ON

After the UPS is connected to a power outlet, it conducts a self-test and enters Standby mode. To turn on the UPS, press the On | button on the front panel (shown in Figure 12 on page 12). The ∿ indicator illuminates and the bar graph indicators display the percentage of load being applied to the UPS.

(2) Starting the UPS on Battery

To turn on the UPS without using utility power, press and hold the On | button for at least four seconds. The UPS supplies power to your equipment and goes into Battery mode. When the UPS starts on battery, it does not conduct a self-test to conserve battery power.

Note : Before using this function, The battery must be charged the utility power supply just the once.

(3) Turning the UPS OFF

To turn off the UPS:

1. Press and hold the Off ⏻ button for approximately three seconds. The UPS switches to Standby mode and removes power from the UPS output receptacles.
2. Unplug the UPS from the power outlet; the UPS shuts down in five seconds. All front panel indicators flash briefly prior to shutdown. If you do not unplug the UPS, it remains in Standby mode.

Pressing the ⏻ Off button while the UPS is in Battery mode causes the UPS to shut down immediately.

(4) Initiating the Self-Test

Press and hold the 🔇 button for three seconds to initiate the self-test. During the five-second test, the bar graph indicators cycle through twice. If the UPS finds a problem, an LED indicates where the problem is. For more information, see “Troubleshooting” on page 33.

NOTE The batteries must be fully charged and the UPS must not be in Battery mode to perform the self-test.

5. Configuration

This section describes how to reconfigure options using the Configuration mode, including:

- Number of EBMs
- Select from REPO or Remote ON/OFF
- Contact type of REPO and Remote ON/OFF
- Alarm sounds of Input Fault
- Nominal Input voltage

5-1 Configuration Mode

When the UPS is in Configuration mode, the bar graph indicators represent the configuration options. The control buttons (On | button and button) are used to modify the UPS configuration. Figure 15 shows the LEDs and Table 2 to Table 6 explains the corresponding options.

NOTE The UPS can be configured while in Battery mode. If the UPS switches to battery power while in Configuration mode, the UPS remains in Configuration mode and indicates Battery mode on the front panel.

CAUTION

DO NOT press the Off button while the UPS is in Configuration mode; pressing the Off button removes all power to your equipment immediately and the UPS enters Standby mode.

1. Press the On | button and the button simultaneously for one beep. The UPS switches to Configuration mode. The bar graph indicators flash briefly and then display the enabled options.
2. Operation of an option setting is divided into two kinds, "Item selection", and "Content selection. " The configurations of a setting are changed: "Item selection" scrolls lighting LED with a ON button. And "Content selection" change content by scrolling Flashing LED with a BUZZ button.

3. Press the On | button and the button simultaneously to exit Configuration mode at any time.

NOTE The UPS exits Configuration mode automatically after two minutes.

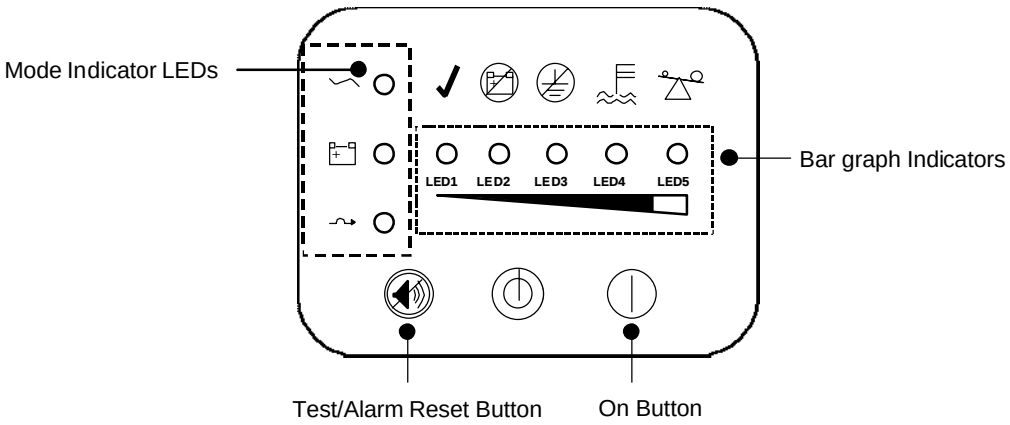
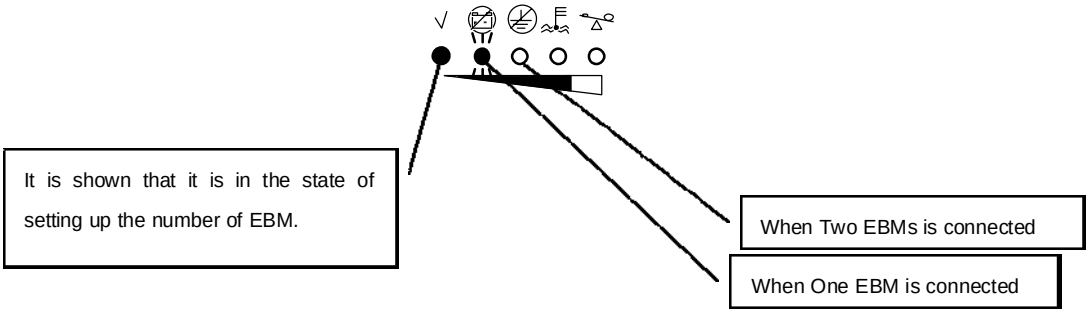


Figure 15 Using the Configuration Mode

(1) Number of EBMs

Table 2

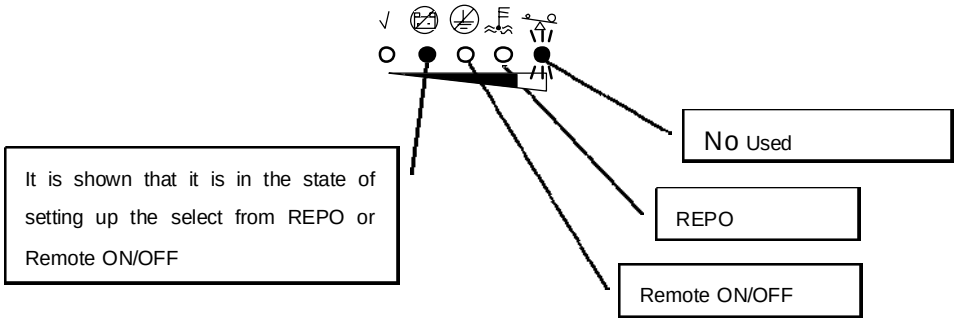
LED 1 ✓	LED 2	LED 3	LED 4	LED 5	Default	Contents
Lit	Unlit	Unlit	Unlit	Unlit	$	None
Lit	Flashing	Unlit	Unlit	Unlit		One EBM Connected
Lit	Unlit	Flashing	Unlit	Unlit		Two EBMs Connected



(2) REPO or Remote ON/OFF

Table 3

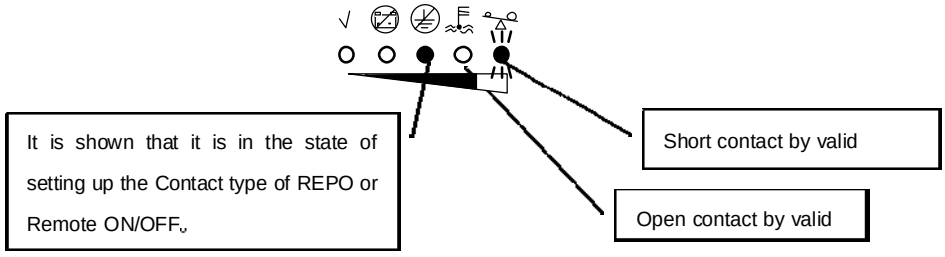
LED 1 ✓	LED 2	LED 3	LED 4	LED 5	Default	Contents
Unlit	Lit	Unlit	Unlit	Flashing		When both are no used
Unlit	Lit	Unlit	Flashing	Unlit	$	When using a REPO signal
Unlit	Lit	Flashing	Unlit	Unlit		When using a Remote ON/OFF signal



(3) Contact Type of REPO and Remote ON/OFF

Table 4

LED 1 ✓	LED 2	LED 3	LED 4	LED 5	Default	Contents
Unlit	Unlit	Lit	Unlit	Flashing	$	Short contact by valid
Unlit	Unlit	Lit	Flashing	Unlit		Open contact by valid

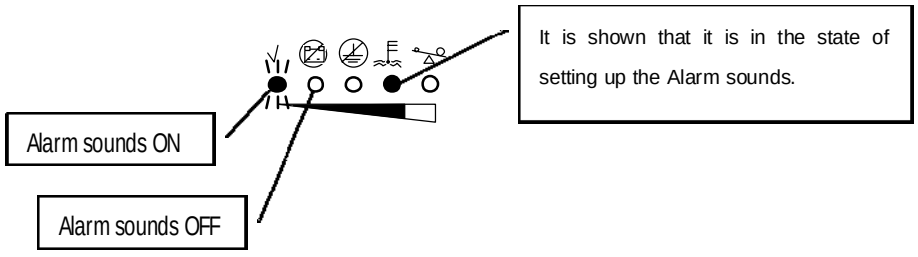


NOTE : The contents of change become effective after restarting.

(4) Alarm sounds of Input Fault

Table 5

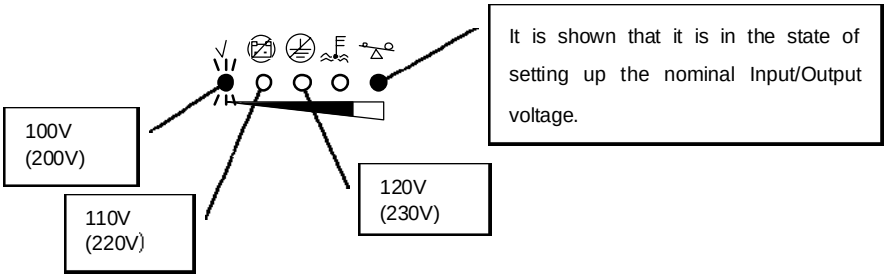
LED 1 ✓	LED 2	LED 3	LED 4	LED 5	Default	Contents
Flashing	Unlit	Unlit	Lit	Unlit	$	Alarm sounds ON
Unlit	Flashing	Unlit	Lit	Unlit		Alarm sounds OFF



(5) Nominal Input Voltage

Table 6

LED 1 ✓	LED 2	LED 3	LED 4	LED 5	Default	Contents
Flashing	Unlit	Unlit	Unlit	Lit	⇳	Nominal Input/Output voltage 100V(*200V)
Unlit	Flashing	Unlit	Unlit	Lit		Nominal Input/Output voltage 110V(*220V)
Unlit	Unlit	Flashing	Unlit	Lit		Nominal Input/Output voltage 120V(*230V)



* ( ) : DL9126 1500jHL

6. UPS Maintenance

This section explains how to:

- Care for the UPS and batteries
- Storing the UPS and Batteries
- When to Replace Batteries
- Replacing Batteries
- Testing New Batteries
- Recycling the Used Battery

6-1 UPS and Battery Care

For the best preventive maintenance, keep the area around the UPS clean and dust-free. If the atmosphere is very dusty, clean the outside of the system with a vacuum cleaner. For full battery life, keep the UPS at an ambient temperature of 25° C (77° F).

6-2 Storing the UPS and Batteries

If you store the UPS for a long period, recharge the battery every 12 months by plugging the UPS into a power outlet. The batteries charge to 80% capacity in approximately 2 hours. However, it is recommended that the batteries charge for 24 hours after long-term storage.

6-3 When to Replace Batteries

When the indicator illuminates, the batteries may need replacing. Conduct a self-test by pressing and holding the button for three seconds. If the indicator stays on, contact your service representative to order new batteries.

6-4 Replacing Batteries

WARNING

- Batteries can present a risk of electrical shock or burn from high short-circuit current. The following precautions should be observed: 1) Remove watches, rings, or other metal objects; 2) Use tools with insulated handles; 3) Do not lay tools or metal parts on top of batteries.
- ELECTRIC ENERGY HAZARD. Do not attempt to alter any battery wiring or connectors. Attempting to alter wiring can cause injury.

NOTE DO NOT DISCONNECT the batteries while the UPS is in Battery mode.

(1) How to Replacing Internal Batteries

Please Call your service representative ,when internal batteries replace.

(2) How to Replacing External Batteries

Use the following procedure to replace EBMs:

1. Unplug the EBM cable from the UPS and remove the EBM brackets.
2. Replace the EBM. See “Recycling the Used Battery” on page 24 for proper disposal.
3. Reinstall the EBM brackets.
4. Plug the new EBM into the UPS as shown in Figure 16.
5. For additional EBMs, plug the EBM cable of the second cabinet into the battery connector on the first EBM.

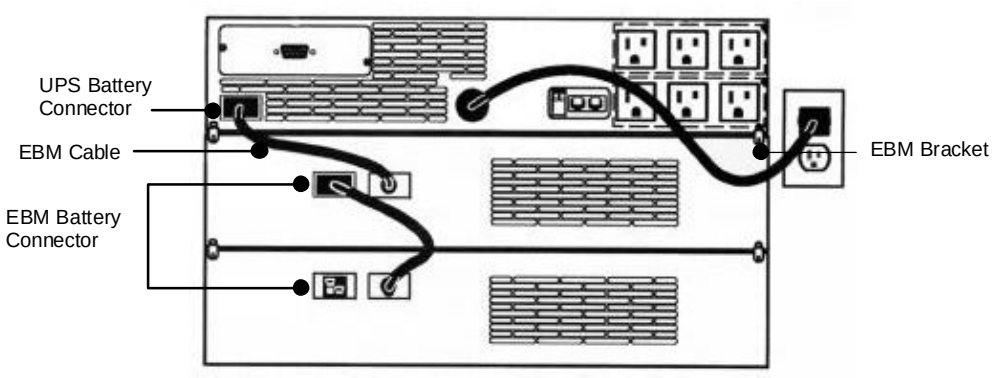


Figure 16 EBM Connections(100V Type)

6-5 Testing New Batteries

Press and hold the button for three seconds to initiate a self-test. After the test is finished, the indicator should turn off. If the indicator stays on, check the battery connections. Call your service representative if the problem persists.

6-6 Recycling the Used Battery

Contact your local recycling or hazardous waste center for information on proper disposal of the used battery.

WARNING

- Do not dispose of the battery or batteries in a fire. Batteries may explode. Proper disposal of batteries is required. Refer to your local codes for disposal requirements.
- Do not open or mutilate the battery or batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.

CAUTION

Do not discard the UPS or the UPS batteries in the trash. This product contains sealed, Lead-acid batteries and must be disposed of properly. For more information, contact your local recycling or hazardous waste center.

7. Additional UPS Features

This section describes:

- X-slot Module
- REPO (Remote Emergency Power Off)
- Remote ON/OFF
- Network Transient Protector
- Load Segments

7-1 X-slot Module

X-Slot modules allow the UPS to communicate in a variety of networking environments and with different types of devices. The Densei-Lambda 9126 is compatible with any X-Slot module, including:

Single-Port Module - has one serial communication port.

Isolated Single-Port Module - has one isolated serial communication port.

Network agent Card – has Ethernet and SNMP capabilities

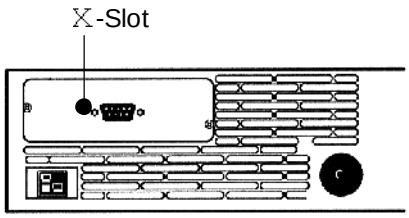


Figure 17 X-Slot Module

The Densei-Lambda 9126 is factory-installed with a Single-Port Module or USB Module, depending on the customer order.

To establish communication between the UPS and a computer, connect your computer to the UPS communication port using the supplied communication cable. When the communication cable is installed, power management software can exchange data with the UPS. The software polls the UPS for detailed information on the status of the power environment. If a power emergency occurs, the software initiates the saving of all data and an orderly shutdown of the equipment.
The cable pins are identified in Figure 18 and the pin functions are described in Table 7.

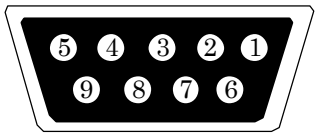


Figure 18 Communication Port

Table 7. Communication Port Pin Assignment

Pin Number	Signal Name	Function	Direction from the UPS
1	Low Batt	Low Battery relay contact	OUT
2	TxD	Transmit to external device	OUT
3	RxD/UPS Shutdown	Receive from external device/ Receive UPS Shut down Signal(10V ＋2V)	IN
4	DTR	PnP (Plug and Play) from external device (tied to Pin 6)	IN
5	GND	Signal Common(tied to chassis)	-
6	DSR	To external device (tied to Pin 4)	OUT
7	RTS/Internal Fault	PnP from external device (default) or Internal Fault relay contact (jumper-selectable)	IN/OUT
8	AC Fail	AC Fail relay contact	OUT
9	-	No Used	-

7-2 Internal Fault Relay Contact

You can enable the Internal Failure relay using the jumper on the single-port module. The jumper default is disabled. To enable the Internal Failure relay:

1. To prevent electrostatic discharge (ESD), place one hand on a metal surface such as the UPS rear panel.
2. Remove the single-port module on the UPS rear panel. Retain the screws (see Figure 19).

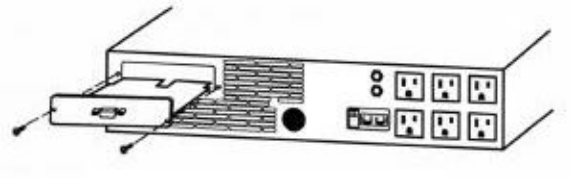


Figure 19 Removing the Single-Port Module

3. Move the J3 jumper to the AS/400 position to enable the Internal Fault relay as shown in Figure 20.

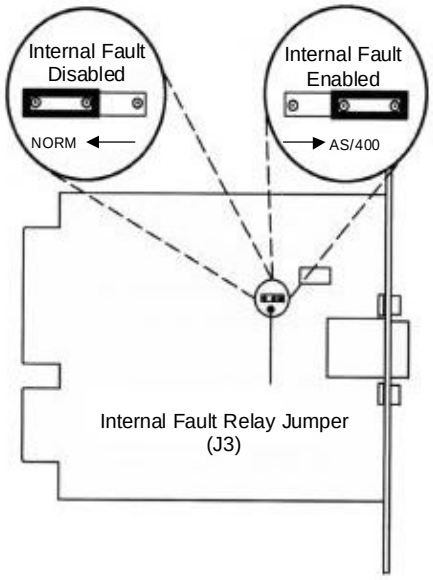


Figure 20 Internal Fault Relay Jumper

4. Align the single-port module with the slot guides and slide the module into the slot until it is firmly seated.
5. Secure the single-port module with the screws removed in Step 1.

7-3 Remote Emergency Power-Off (REPO)

The Densei-Lambda 9126 includes a REPO port that allows power to be switched off at the UPS output receptacles from a customer-supplied switch in a remote location.

The REPO feature shuts down the protected equipment immediately and does not follow the orderly shutdown procedure initiated by any power management software.

Any devices that are operating on battery power are also shut down immediately. When the REPO switch is re-opened, the equipment will not return to battery power until the UPS is manually restarted. If the Off ⏻ button is pressed after the REPO is activated, the UPS remains in Standby mode when restarted until the On | button is pressed.

WARNING

The REPO circuit is an IEC60950 safety extra low voltage (SELV) circuit. This circuit must be separated from any hazardous voltage circuits by reinforced insulation.

CAUTION

To ensure the UPS stops supplying power to the load during any mode of operation, the input power must be disconnected from the UPS when the emergency power-off function is activated.

NOTE The REPO function activates when the REPO contacts close.

Use the following procedure to install the REPO switch:

1. Verify that the UPS is off and unplugged.
2. Remove the REPO connector from the Rear Panel.
3. Connect isolated, normally-open, dry contacts (rated at 60 Vdc maximum, 30 Vac RMS maximum, and 20 mA maximum) across the REPO device to Pin 1 and Pin 2 (see Figure 21). Use stranded, non-shielded wiring, size 18-22 AWG (0.3 mm ^{2}-0.75 mm^2).
4. Connect the REPO connector to the REPO port on the rear panel of the UPS.

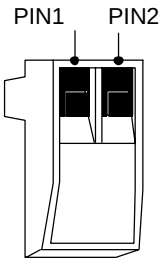


Figure 21. REPO Connector

5. Verify that the externally-connected REPO switch is off to enable power to the UPS output receptacles.
6. Plug in the UPS and start the UPS by pressing the On | button. Turn on the external REPO switch to test the REPO function.
7. Turn off the external REPO switch to test the REPO function.
8. Turn off the external REPO switch and restart the UPS.

7-3 Remote ON/OFF

The default is set as REPO port. Please refer to Chapter 5 "Configuration" to use Remote-ON/OFF function. By this function , The UPS can control in ON/OFF in customer's prepared remote SW. Then , the ON/OFF button of the front panel becomes invalid. The load segment control by Remote-ON/OFF function follow the setting of power management software. In the default, UPS is started by opening a port and that is stopped by closing a port. Please refer to "REPO" for the connection method of REPO connector.

NOTE Please insert the REPO connector to receptacle after the UPS is stopped, and the input power code pulled out from UPS, and connected SW to REPO connector is open. Please insert the REPO connector to receptacle after connected SW to REPO connector is open when it is necessary to connect the REPO connector in the UPS drive. (There is a possibility that the UPS stops.)

7-4 Network Transient Protector

The Network Transient Protector, shown in Figure 22, is located on the rear panel and has jacks labeled IN and OUT. This feature accommodates a single RJ-45 (10BaseT) network connector.

Low voltage models can also accommodate an RJ-11 telephone connector that provides protection for modems, fax machines, or other telecommunications equipment. As with most modem equipment, it is not advisable to use this jack in digital PBX (Private Branch Exchange) environments.

Connect the input connector of the equipment you are protecting to the jack labeled IN. Connect the output connector to the jack labeled OUT.

(The function of only this model : DL9126 1200/1500jL)

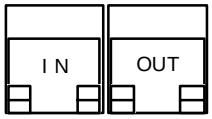


Figure 22 Network Transient Protector

7-5 Load Segments

Load segments are sets of receptacles that can be controlled by power management software, providing an orderly shutdown and startup of your equipment. For example, during a power outage, you can keep key pieces of equipment running while you turn off other equipment. This feature allows you to save battery power. See your power management software manual for details.

NOTE If the power management software is not used, the individual load segments cannot be controlled.

UPS has two load segments as shown in Figure 23

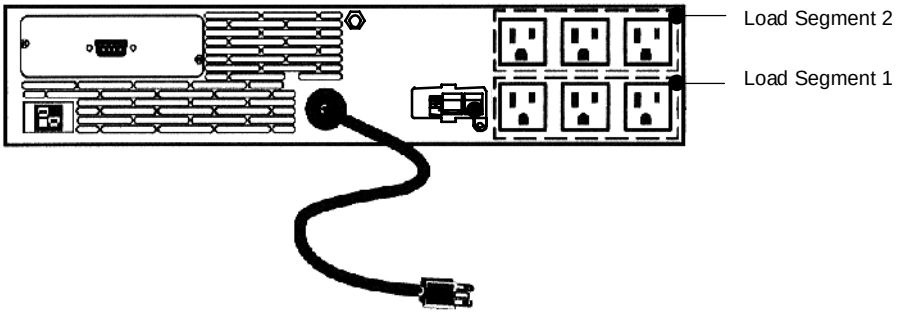


Figure 23 UPS Load Segments

8. Specification

This section provides the following specifications for the Densei-Lambda 9126 models:

- Model List
- Electrical input and output
- Weights and dimensions
- Environmental and safety
- Battery
- Accessory

Table 8. Model List

UPS Models	Standard Models	
	DL9126 1200jL DL9126 1500jL	DL9126 1500jHL

Table 9. Electrical Input and Output

Nominal Voltage	100V (Default) ・ 100,110,120V (Selectable)	200V (Default) ・ 200,220,230V (Selectable)
Voltage Range	80－131V	160－264V
Nominal Frequency	50／60Hz(Auto sensing)	
Noise Filter	MOVs and line filter for normal and common mode noise	
Connections	DL9126 1200jL: 6-ft,5-15P Power Cord DL9126 1500jL: 6-ft,5-20Ppower Cord	IEC320 input connector
Power Levels (Rated at nominal inputs)	DL9126 1200jL: 1200VA/875W DL9126 1500jL: 1500VA/1050W	1500VA/1050W
Regulation (Normal Mode)	Nominal output voltage 3%	
Voltage Waveform	Normal Mode : Sine Wave ; < 5% THD with Linear Load , < 10% Nonlinear Load and batteries reach 25% capacity	
Output Receptacles	(6)5-15R	(6)IEC320
Over Load	101～110% ・ 120s, 111～150% ・ 30s, 150%> ・ 300ms	

Table 10. Weight and Dimensions

Dimensions(W×D ×H)	432×494×87 mm (2U)
Weight	23kg

Table 11. Environmental and Safety

Operation Temperature	0℃～40℃ （Optional battery performance ，25℃）
Storage Temperature	-15℃～50℃ （Except battery module）
Relative Humidity	10～90％ （noncondensing）
Operation Altitude	Up to 1500meters above sea level
Audible Noise	Less than 45dBA (Normal mode typical load) Less than 50dBA (Battery mode）
Safety Standard	UL1778
EMI	VCCI (Class B)

Table 12. Internal Battery

Configuration	(4)12V,7.2Ah
Type	Sealed, maintenance free, valve regulated, lead acid
Battery Life Expectancy	5year
Charging	Internal battery: approximately 5 hours to 80% usable capacity at nominal line voltage after full load discharge

Table 13. Battery Run Times (in Minute)

Load	UPS Internal Battery	+1EBM	+2EBM
1500VA(1050W)	6	25	55
1200VA(875W)	7	30	60
1000VA(750W)	10	45	75
800VA(600W)	13	55	100
600VA(450W)	20	80	120
400VA(300W)	30	120	200

NOTE Battery times are approximate and vary depending on the load configuration and battery charge.

Table 14. Accessory

Accessory Name	Model name	note
Flange kid for Rack mount setup	DL9126-RM-KIT	
	DL9126-RM-KIT/B	/B : Black model
Pedestal kid for installing the UPS stands(Option)	DL9126-PD-KIT	
	DL9126-PD-KIT/B	/B : Black model

9. Troubleshooting

This section explains:

- UPS alarms and conditions
- How to silence an alarm

9-1 Audible Alarms and UPS Conditions

The UPS has an audible alarm feature to alert you of potential power problems. Use Table 15 to determine and resolve the UPS alarms and conditions.

NOTE Some alarms, such as the Overtemperature and Overload alarms, have to be. cleared by shutting down and restarting the UPS (see 34 for more information).

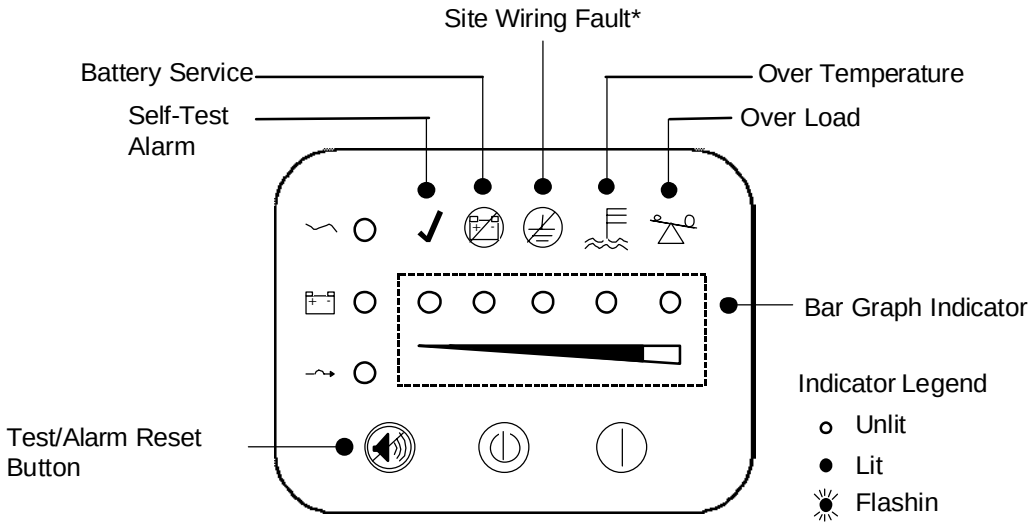


Figure 24 Alarm Indicators

9-2 Silencing an Audible Alarm

Silencing an Audible Alarm To silence the alarm for an existing fault, press the button. If UPS status changes, the alarm beeps, overriding the previous alarm silencing.

Table 15 Troubleshooting Guide

Alarm or Condition	Possible Cause	Action
The ⏦ indicator is not on; the UPS does not start	The power cord is not correctly connected	Check the power cord connections.
	The wall outlet is faulty	Have a qualified electrician test and repair the outlet..
	The battery is not connected correctly.	Check the battery connections. Call your service representative if the problem persists.
The ⏦ indicator is flashing; power is not available at the UPS output receptacles.	The UPS is in Standby mode.	Press the On | button to supply power to the connected equipment. Checked Remote ON/OFF or ,REPO signal
Input circuit breaker trips	Load Fault	Check the load. Disconnect faulty load equipment. Wait several minutes before resetting the UPS circuit breaker.
	UPS Internal Fault	Resetting the UPS circuit breaker. If Input breaker trips immediately, Call your service representative.
The UPS does not provide the expected backup time.	The batteries need charging or service.	Plug the UPS into a power outlet for 24 hours to charge the battery. After charging the battery, press and hold the 🔇 button for 3 seconds; then check the ⊘ indicator. If the ⊘ indicator is still on, see "UPS Maintenance" on page 22 to replace the battery.
Battery Intermittent audible Alarm	UPS on battery (see "Battery Mode" on Page 14 for more information).	The UPS is powering the equipment with battery power. Check the bar graph indicators for available battery capacity and prepare your equipment for shutdown.
Warning-Low Battery	3-minute battery warning.	3 minutes or less of battery power remains (depending on load configuration and battery charge). Prepare for a shutdown. Save your work and turn off your equipment.
Shutdown-Low Battery	Shutdown imminent	Prepare equipment for shutdown.
Bypass Continuous audible alarm	UPS is in Bypass mode.	The equipment is transferred to utility power; however, the utility power continues to be passively filtered by the UPS. Check for one of the following alarms: Over temperature, Overload, UPS Failure, or Battery Service.
Bypass	Bypass is not available. Input voltage is not within 12% of nominal or input frequency is not within 3% of nominal.	The UPS is receiving utility power that may be unstable or in brownout conditions. The UPS continues to supply power to your equipment. If conditions worsen, the UPS may switch to battery power.

Alarm or Condition	Possible Cause	Action
Service Battery	The battery may be fully discharged.	Plug the UPS into a power outlet for 24 hours to charge the battery. After charging the battery, press and hold the button for 3 seconds; then check the indicator. If the indicator is still on, see "UPS Maintenance" on page 22 to replace the battery.
	The battery is not connected correctly.	Check the battery connections. Call your service representative if the problem persists.
Overtemperature	UPS internal temperature is too high. The UPS switches to Bypass, allowing the UPS to cool.	Turn off and unplug the UPS. Clear vents and remove any heat sources. Ensure the airflow around the UPS is not restricted. Wait at least 5 minutes and restart the UPS. If the condition persists, contact your service representative.
OverLoad Continuous Audible alarm	Continuous audible alarm Power requirements exceed UPS capacity (101-110% for 2 minutes or 111-150% for 30 seconds) or the load is defective.	Turn off and unplug the UPS. Remove some of the equipment from the UPS. Wait at least 5 seconds until all LEDs are off and restart the UPS. You may need to obtain a larger capacity UPS.
UPS Failure	UPS internal Failure	Call your service representative
	PowerShare Mode	See "(5) PowerShare Mode" on Page15.

10. Service and Support

10-1 Warranty

The warranty is appended to equipment. Please keep it carefully after entering of the contents. The term of a warranty is for one year from a purchase day.

10-2 After service

If you have any questions or problems with the UPS, call your Local Distributor and ask for a UPS technical representative.

Please have the following information ready when you call the Local Distributor:

- Model Number
- Warranty Number (Serial Number)
- Date of failure or problem
- Symptoms of failure or problem
- Customer return address and contact information

3-2: TRAFFIC SIGNALS

The Instruction Manual of

A04-TYPE MULTI-PLAN SYSTEM TRAFFIC SIGNAL CONTROLLER

Kyosan Electric Mfg. Co., Ltd.

<Table of Contents>

Outline

1.1 General

"A04-Type Traffic Signal Controller" is designed/produced for mainly overseas use. That makes improving its maintainability and producing it at low cost possible.

This controller have the abilities to switch the indication time in response to traffic situation by setting control pattern and to control the signals in response to traffic characteristics.

The Controller consists of Control Unit, Power Supply Unit, Lamp Switch Unit, Junction and Manual Operation Unit in terms of functions.

1.2 Configuration

Components of the Controller are shown in the following table.

Table 1.1 Component devices

Item	Device	Quantity
Main unit	Cabinet Manual Operation Unit Control Unit Power Supply Unit Lamp Switch Unit Junction	1 unit
	Pushbutton for Manual Operation	As required
Accessories	Key for main door of cabinet Key for door of Manual Operation Unit Connection code Mounting metal fixture	1 unit
Spare units	Fuse (1.6A for control power) Fuse (5A for maintenance) Setting pins (for pin board)	2 pieces 2 pieces 3pins
Attached documents	Test Report Instruction Manual Operation Manual	3 copies As required 1 copy

2. Functions and Ability

2.1 Main characteristics

(1) Improvement of Reliability

High efficiency integration of circuit and semiconductor device of power consumption controls interior evolution of heat and improves the reliability.

(2) Improvement of Maintainability

Making each Units components joint plug-in or plug-in style improves the maintainability.

(3) Maintenance of Safety

This controller maintains safety by the danger prevention (G-G protection) function for the phase.

(4) Time Setting

Pin board of panel operating unit makes the time setting easier.

2.2 Specifications

(1)	Power Requirement	AC216 to 264V 50/60hz
(2)	Power Consumption	approximately 30VA (excluding lamps)
(3)	Ambient Temperature	–20 to +60℃
(4)	Relative Humidity	40 to 90%
(5)	Insulation Resistance	Between AC input terminals and Cabinet –10MΩ or more at DC500V (with arrester, etc., disconnected)
(6)	Insulation Voltage	Between AC input terminals and Cabinet –AC 1000V 1 minute(with arrester, etc., disconnected)
(7)	Shape	400 (W)×800 (H)×300(L) mm
(8)	Weight	approximately 70kg

2.3 Main Operations

2.3.1 Flashing Operation

Yellow signal in the major road side and red signal in the minor road side flash alternately. During Flashing Operation, Pedestrian Signal Lamps and Arrow Mark Lamps go out.

Flashing Operation works in the following cases:

- When the time was set by Time Switch.(pattern flashing)
- When the Flashing Switch on the Control Unit Panel is turned "ON". (manual flashing)
- When the indication time becomes abnormally long.(abnormal flashing)
- When green signals are indicated at the same time for crossing traffic flows.(abnormal flashing)

2.3.2 Manual Operation

When the Operation Switch in the Manual Operation Unit is set at "Manual," a signal indication is advanced by one step every time the Pushbutton for Manual Operation is pressed. Unless it is pressed, the indication in a current step can be continued.

2.3.3. Multi-Plan Operation

This Operation executes three kind of patterns different in indication time of specified steps (a maximum of 5 steps) in advance.

2.3.4. Regular Cycle Operation

This Operation repeats the specified pattern all day. Changeover of a pattern is controlled by the Pattern Switch on the Control Unit Panel. When Time Switch power is turned OFF or time table is not set, pattern1 (P1) takes Regular Cycle Operation.

2.4 Function and Ability of Each Units

2.4.1 Control Unit

This Unit consists of MCU Card, PDU Card and Time Switch. It displays and designates each Operation, and controls the lamp color and each Operation works like Figure 2.1 Operation flow according to the position of switch and signal situation.

(1) Indication function

Operation and control situation of the Controller is displayed on the monitor by the following pilot lamps.

① Step(1-16) Pilot Lamps
② Clock Pilot Lamp (CLOCK)
③ Abnormal Pilot Lamps (G-G·FAIL)
④ Manual Flashing Operation Pilot Lamp (FL)
⑤ Running Pattern Pilot Lamps (P1, P2, P3, F)

(2) Initial all red indication

When the main power is tuned ON, the power return after the power cut and operating Reset Button, starts normal Operation with first step after displaying red signal for 5 seconds to all phases. However when Flashing Switch is set to "ON", not performing all red display in first stage, immediately starts Flashing Operation.

(3) Operation in abnormal condition

① When green signal lamps are indicated at the same time for crossing traffic flows, the green signal lamps are once completely turned OFF in any operation mode, and then Flashing Operation is activated. In this case "G-G" on Abnormal Pilot Lamp is turned ON.

② Maximum time and minimum time of each step is observed, each step is maintained at least for a minimum time, but when the indication time takes the maximum time, Flashing Operation immediately starts. In this case "FAIL" on Abnormal Pilot Lamp is turned ON.

Step \ Monitoring time	Maximum time (sec.)	Minimum time (sec.)
Short step (PW, PR, Y, R)	35	0.95
Middle step	110	o.95
Long step (G)	110	8

③ If the cause of the abnormal is eliminated, Flashing Operation will be canceled by pushing the "RESET" button.

(4) Operation switching

Changeover of operation mode can be safely performed without turning OFF the Main Switch; when two or more operation modes conflict with each other, operation priority is given to Flashing Operation, Manual Operation and Independent Multi-Plan Operation. And also switching of each operation except for Flashing Operation and patterns can be continuously activated without skipping any step.

(5) Indication time and changeover of pattern

Indication time and changeover of pattern are set at the Control Unit Panel.

① Indication time

It is possible to set the indication time from 1 to 99 by second. An error is under ± 3% from a selected time.

It is also possible to set three patterns – P1, P2 and P3.

② Changeover of Pattern

"P1", "P2" and "P3" are switchable using the rotary switch (P.SEL) on the panel operator. Also, the switch is set at "AUT", the patterns are automatically switchable a maximum of 10 times a day.

(6) Phase data

Phase program, G-G program and Flashing Color Specification, all of them are set at diode matrix on the phase data substrate (PDU).

(7) Clock

Backup condenser makes it possible that clock circuitry in time switch works normally against the following kind of power cut.

- the power cut within 12 hours
- the power cut lasting within 30 minutes and repeating over 12 hours cycle

2.4.2 Power Supply Unit

The plug-in control power unit provides necessary electricity to each Operations.

(1) Input: AC216 to 254V 50/60Hz±5Hz per unit

(2) Output: a rated voltage of DC 5V±0.25V, a maximum rated current of 3A
a rated voltage of ±DC 12V±1V, a maximum rated current of 0.2A

(3) Dividing output: a rated voltage of 8 to 15V, a rated current of 10mA

(4) Protection circuitry:
① If the input voltage goes down under 80V, output voltage off will be turned off.
② It protects the interior against inputting an abnormal voltage of 150V half wave
③ It is operable within input 10ms of a moment power.
④ It protects excess voltage output. (up to 5V)
⑤ It protects the power against short circuit of the output terminal.

2.4.3 Lamp Switch Unit

This unit consists of 4 Plug-in Lamp Switch Unit (SSU), perceives the lamp colour driving signals and lights the lamps using the lamp switch element.

(1) This Unit can house a maximum of 6 Lamp Switch Elements (3 vehicles, 2 pedestrians 1 arrow) per 1 unit. It houses a maximum of 24 Lamp Switch Elements by 4 Units.

(2) Each Lamp Switch Element can supply a maximum current of 5A with power. It prevents external surge from

breaking into the controller side because input side is insulated electrically from output side by installing SSR. And it decreases making noise as little as possible by switching lamp power near OV.

(3) This unit consists of phase 1 to 4 from the top. The monitor lamps in front of it helps confirming the phase even with the lamp OFF.

2.4.4 Manual Operation Unit

(1) This Unit can be run by manual or automatic operation using the Operation Switch.

(2) When the Operation Switch in the Manual Operation Unit is set at "Manual," a signal indication is advanced by one step every time the Pushbutton for Manual Operation is pressed. Unless it is pressed the indication in a current step can be continued.

2.4.5 Junction

(1) This unit consists of the terminal board for line wire connection, Main Power Switch and Lamp Power Switch.

① The Type of the Main Power Switch is 30 A frame type with a normal-temperature rating of 30A. It can supply the Lamp Power Switch with a maximum current of 25A.

② The Lamp Power Switch is separately switchable regardless of other circuitry.

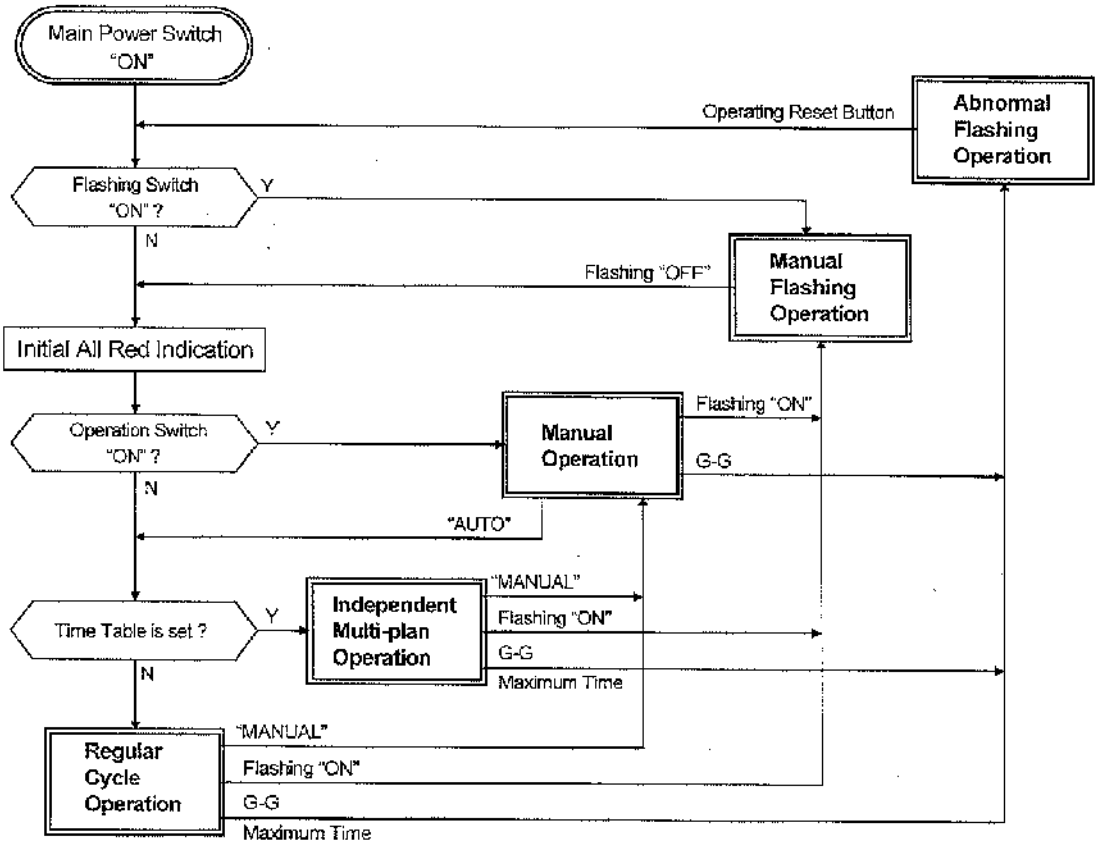


Fig.2.1 Operation flowchart

3. Cautions for Installation

3.1 Installation Location

(1) Install the equipment in locations and directions suitable to manually control the equipment for traffic signal control.

(2) Adjust locations and directions of the equipment so that the equipment will not obstruct traffic flows of pedestrians and vehicles.

(3) Select locations and directions of the equipment so that maintenance personnel can safely work for maintenance and inspections of the equipment.

3.2 Installation Method

(1) The Controller can be installed in a standalone or pole-mounted type. In the latter case, the Controller is mountable in either left or right side.

(2) When the Controller is mounted on a pole, be sure to rigidly mount the equipment using the attached mounting fittings.

(3) Install the equipment so that the door of the Controller can be opened and closed.

(4) Install a cable conduit securely on to the Controller.

3.3 Precautions for Installation

(1) Main Power Switch

Before beginning installation work, be sure to turn "OFF" the Main Power Switch.

CAUTION!! Working at it with the power on may lead to shock hazard and unexpected injury. In case of short, it leads to damage the equipment.

(2) Connection of wires

Screw the screw terminal tightly. In the case of the metal penetration system terminal, pull the electric wire a bit after interconnection and confirm it is connected tightly.

(3) Connection of wires to utility power lines

Connect power lines directly to upper terminals of the Main Power Switch. At that time, check that the lines carry AC240V and connect a grinding wire to the terminal with a mark "E", on the Switch.

(4) Connection of signal lamps

Do not incorrectly install the wiring to the input/output terminal board.

CAUTION!! Do not short the signal line and "COM" line because it may lead to give a serious damage to the Controller and wire.

Also Do not connect more than 7 signal lamps to an output terminal of a signal lamp.

(5) Grounding

Be sure to have a grounding resistance of 100Ω or less using the earth(E) terminal of the terminal board. Also ground all spare lines and messenger wires in the external line, using the E terminal, as far as possible. Such grinding will be very effective in reducing damages of lightning surges and noise troubles.

(6) Insulation test

Before beginning the insulation test, disconnect grounding wires in the grounding terminal and the housing, from the grounding main

(7) Operation test after installation

When a Controller is transported, connected wires and connectors may sometimes become loose in printed circuit boards, plugs, relays, units, etc., so be sure to check each connected part.

Before beginning the operation test, see next chapter "4. Precautions for Management".

4. Precautions for Management

4.1 Names and Explanations of Each Units

4.1.1 Controller Appearance and Interior Arrangement

Describes the outlook of the controller and the interior arrangement in Figure 4.1.

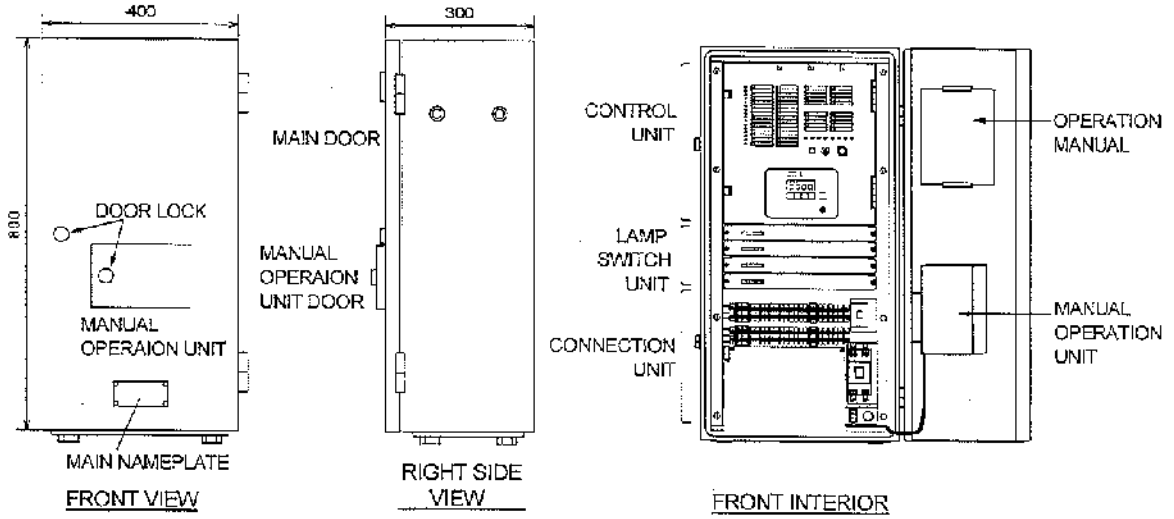


Fig.4.1 External & internal views of Controller

(1) Opening & closing of Main Door
and Manual Operation Unit Door

As for switching the main panels and manual operator panels, stick the key for traffic signals to the hole and turn right to unlock. Also If the panels are shut, they will be automatically locked. At that time push hard and listen to the sound " Click" to confirm that they are locked.

(2) Interior arrangement

Manual Operation Unit is on the main panels. Open the main panels and you'll see the controller, lamp switcher, and connection unit from the top. Describes the interior mounting figure in Figure 4.2. The main motherboard of the controller (MCU) and time switch are mounted on the back of the controller panel and the control power and phase data cards are mounted in the depth.

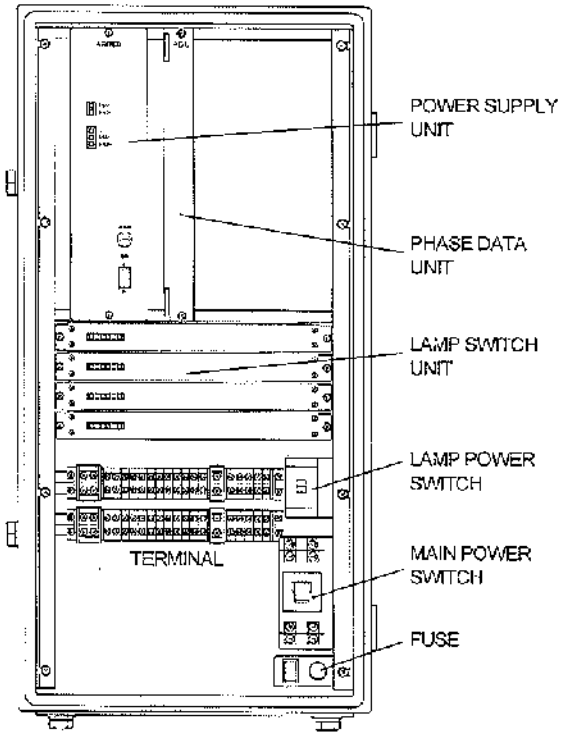


Fig.4.2 Interior arrangement

4.1.2 Control Unit

Describes the Control Unit Panel in Figure 4.3.

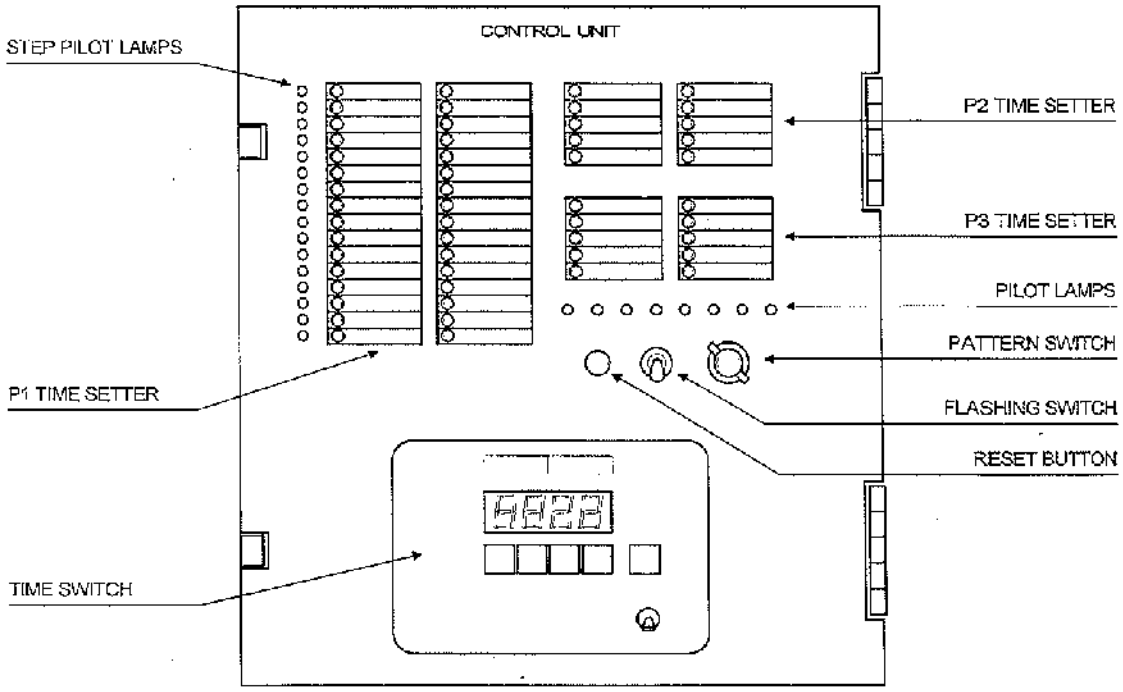


Fig.4.3 Control Unit Panel

(1) Each Switch

① Flashing Switch: It starts Flashing Operation immediately with the switch "ON" at any level. Also, if the switch is set at "OFF", it starts indicating the first step after indicating red signal for 5 seconds to all traffic flow.

CAUTION!! Be fully careful to the traffic flow for the operation at work. Consider the safety of driving vehicles and then switch it with all red signal.

② Reset Button: Only when each Abnormal Pilot Lamp lights up and the cause of it is disappeared, stored abnormal state can be reset by pushing this button. In that case, the indication of the first step starts after indicating red lights for 5 seconds to all traffic flow.

③ Pattern Switch Use this switch to change over a patterns. The pattern after switching is executed from the first step of the next cycle. If the switch is set at "AUT", Independent Multi-Plan Operation is actuated by Time Switch.

(2) Pilot Lamps

① Step Pilot lamps	A Step Pilot Lamp, related to a step of Controller operation, lights up.
② "CLOCK":	Continues blinking in 1-second intervals when the Controller is in operation.
③ "G-G":	Lights up when a simultaneous-green indication failure occurs in lamps for crossing traffic flows.
④ "FAIL":	Lights up when a failure occurs and a step in effect cannot be advanced even after passing a maximum monitoring time.
⑤ "FL":	Lights up when Flashing Operation is effected using Flashing Switch.
⑥ "P1":	Lights up when the pattern 1 (P1) is selected.
⑦ "P2":	Lights up when the pattern 2 (P2)is selected.
⑧ "P3":	Lights up when the pattern 3 (P3)is selected.
⑨ "F":	Lights up when pattern flashing is running.

(3) Time Switch

Describes the front and back of time switch in Figure 4.4

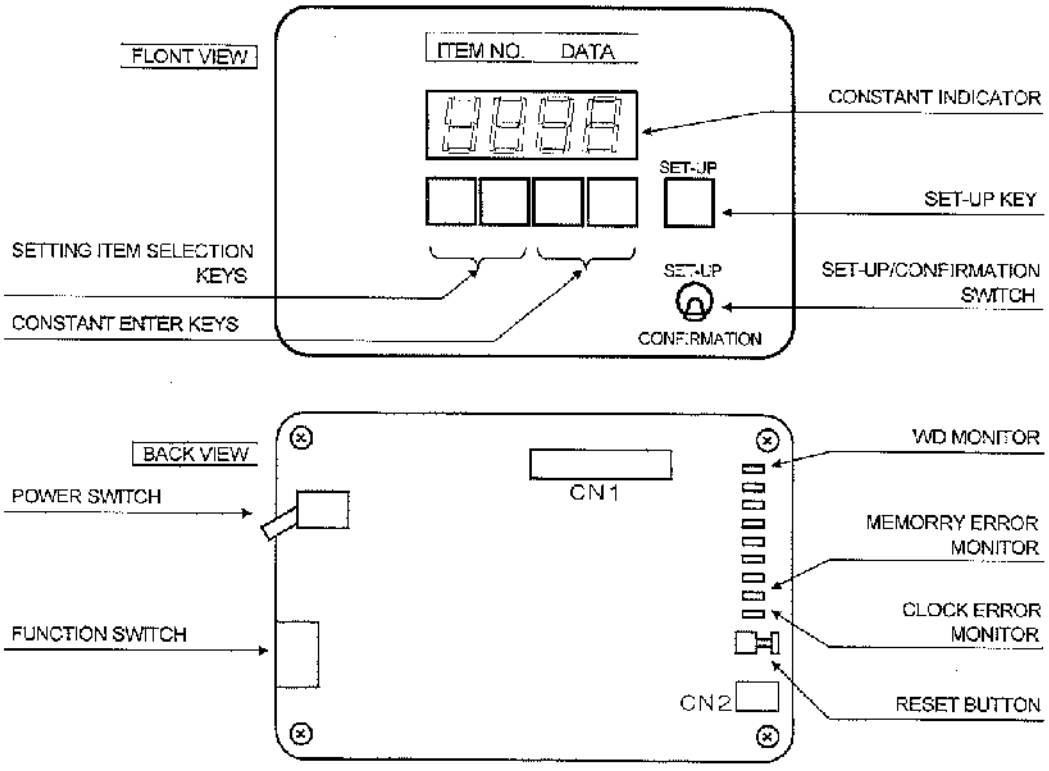


Fig.4.4 Time Switch

① Constant Indicator: Indicates present time with SET-UP/CONFIRMATION Switch "CONFIRMATION". If the switch is set at "SET-UP", 2 columns on the left side indicates setting items and 2 columns on the right side indicates setting constants. "- -" means no permission to enter.

② Setting Item Selection Keys:	This key is efficient only with Set-Up/Confirmation Switch "SET-UP" and selects setting items.
③ Constant Enter Keys:	This key is efficient with Set-Up/Confirmation Switch "SET-UP" and enters the constant by selected items on the left 2 columns. Enter "space" for unsetting and canceling.
④ Set-Up Key:	This key is efficient with Set-Up/Confirmation Switch "SET-UP" and confirms the constant entered by the Constant Enter Key.
⑤ Set-Up/Confirmation Switch:	Selects "SET-UP" mode or "CONFIRMATION" mode. Normally the switch is set at "CONFIRMATION". only in setting operation it is on " SET-UP" side. Also set the switch at "CONFIRMATION" quickly after setting operation.
⑥ Power Switch:	This is the main power supply switch in the Time Switch Unit. Normally the switch is kept set at "ON".
⑦ Reset Button:	This button resets CPU. Don't push it carelessly.
⑧ Function Switch:	Don't touch.
⑨ WD Monitor:	This flashes when CPU in time switch unit normally works.
⑩ Memory Error Monitor:	This monitor is turned on or flashes when memory error has occurred.
⑪ Clock Error Monitor:	This monitor is turned on when clock error has occurred. when the power is turned off for over 24 hours, it may have the clock error when the power is turned on again. Be sure to confirm it.

* The Pilot Lamps excluding ⑨~⑪ are unused.

4.1.3 Power Supply Unit

Describes the front panel of the control power unit in Figure 4.5.

(1) Power Switch

Setting the switch to "ON(接)" supplies each unit with control Power (+5V and +12V) and frequency division (100/120Hz) power.

CAUTION!! All the lamp lights are turned OFF with the Power Switch "OFF(断)". Be fully careful to the traffic flow when you operate at work.

(2) Pilot Lamp for Control Power

Lights up when +5V and 12V is normally provided.

(3) Check Terminal

This checks the voltages the control power(+5V and 12V).

(4) Fuse

Protects AC Input Unit, with a capacity of 1.6A. In exchanging, be sure to follow the rating. Spare fuses are in the spare Units furnishing items on the back of main panel.

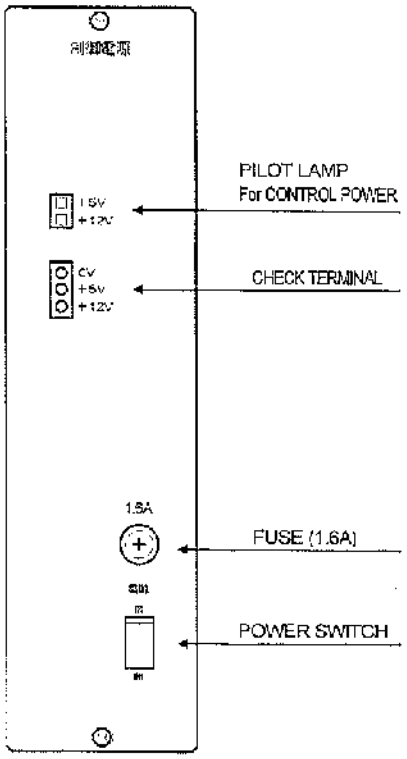


Fig.4.5 Power Supply Unit (Panel)

4.1.4 Lamp Switch Unit

This unit consists of the Lamp Switch Unit (SSU), phase 1 to 4 from the top. 3 vehicle lamps, 2 pedestrian lamps and 1 arrow mark lamp are mounted in 1 unit. The front monitor lamp indicates the signals for controlling the light color received from the Control Unit (MCU).

The phase can be confirmed with the Lamp Switch "OFF".

4.1.5 Manual Control Unit

This Unit is mounted in the small window of the front of the Controller. Describes the interior mounting figure in Figure 4.6.

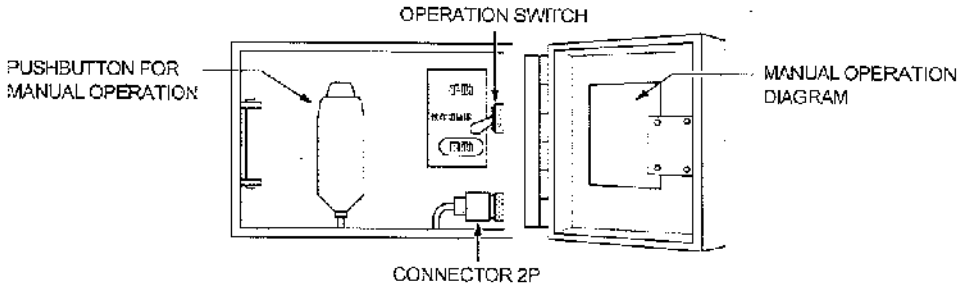


Fig.4.6 Manual Operation Unit

(1) Operation Switch

Normally the switch is set at " AUT". Except for the error and Manual Flashing, with the Operation Switch set to "Manual", signal indication can be advanced by one step every time the Pushbutton for Manual Operation is pressed. Be sure to set the Switch to "AUT" unless Manual Operation is effected.

(2) Push button for Manual Operation

it is used for the Manual Operation.

(3) Manual Operation Diagram

Describes how to manually operate the Controller.

4.1.6 Connection Unit

(1) Main Power Switch

Setting the switch to "ON" supplies the Controller with utility AC power (AC240V). The maximum current capacity is 30A including the external machines using the external connection terminals "AC1" and "AC2".

(2) Lamp Switch

Setting the switch to "ON" supplies signal lamps with power. Setting the switch to "OFF" turns OFF only signal lamps even when the Controller is in operation. However, as the lamp switcher unit and the control board are working with this switch "OFF". Be careful to the traffic flow for the operation at work.

(3) External Wire Terminal Boards

This is the connection terminal board for the signal lamps and applying to the wire of a maximum of 3.5 squares.

(4) Fuse

The maximum current capacity of the fuse is 5A..

4.2 Operation Details in Each Operation Mode

4.2.1 Power-up

① The switch in each Unit is set at as follows:

- Operation Switch (Manual Control Unit) : ON
- Flash Switch (Control Panel) : OFF
- Power Switch (Control Power Unit) : OFF (断)
- Lamp Switch : ON

② After making sure of the utility power wire is connected. the Main Power Switch is set to "ON".

③ After indicating the red signal to all the traffic flow for 5 seconds (Initial all red indication), the indication of the first step starts.

CAUTION!! Be sure to confirm " the present time" of the Time Switch. If the power has been turned off for two days, it is possible that the time error occurred. In this case, set the correct time again. Be careful for the traffic flow in the operation of the Main Power Switch.

4.2.2 Operation in Manual Flashing Mode

① Flashing Operation is given highest priority, than any other operation mode. By setting the Flashing Switch to "ON", the Flashing Operation is immediately actuated.

② In the Flashing Operation, the pedestrian and arrow lamps are turned off.

③ BY setting the Flashing Switch to "OFF", all red signals are indicated for 5 seconds and then signal lamps are normally operated from the first step.

CAUTION!! As for the operation at work, be fully careful for the traffic flow. Taking driving vehicle safety into consideration, do it in indicating all red signals if possible.

4.2.3 Operation in Manual Operation Mode

① Set the Operation Switch in the Manual Operation Unit to "Manual" for an operation mode other than Flashing Operation. Processing of the Controller stops at a step when the Switch was set to "Manual".

② Indicated signal can be advanced by one step every time the Manual Operation Pushbutton is pressed. Unless the Pushbutton is pressed, the Controller holds the same step permanently.

③ By setting the Operation Switch to "Auto", current step is advanced to next one after passing a setting time for the step when the Switch was set.

4.2.4 Operation in Regular Cycle Operation Mode

① Set the Pattern Switch of the Control Panel to "P1", "P2", or "P3" for an operation mode other than Flashing Operation. This Operation starts with the first step of the next cycle.

② Even if the Pattern Switch is set to "AUT". Regular Cycle Operation starts by pattern 1 (P1) when the Time Switch is set at off or Time Table is yet to set..

4.3 Phase Data

The phase data (Indication program, G-G program, Flashing color specification and so on) is set by the diode matrix mounted in the PDU Card of the Control Unit.

4.3.1 Planning of Indication

Describes the phase/step diagram and the setting example of matrix applying to it in Figure 4.7 and 4.8.

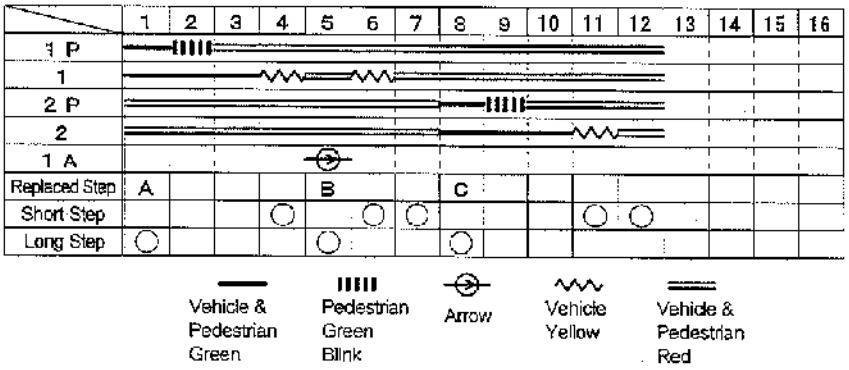


Fig.4.7 Phase/Step Diagram

For programming, connect diodes in each step 1 to 16 applying to each items on the left.

Each item's specification is as follows:

① 1G~4G ; Indicates Vehicle Green Lamps.
② 1Y~4Y ; Indicates Vehicle Yellow Lamps.
③ 1PG~4PG ; Indicates Pedestrian Green Lamps.
④ 1PW~4PW ; Indicates Pedestrian Green Blinks.
⑤ 1A~4A ; Indicates Arrow Mark Lamps.
⑥ ENS ; Indicates the final step.
⑦ SB1~SB3 ; Specifies the step replacing the indication time.
⑧ L35 ; Specifies the short steps.
⑨ M8 ; Specifies the long steps.
⑩ SD1, SD2 ; Unused.

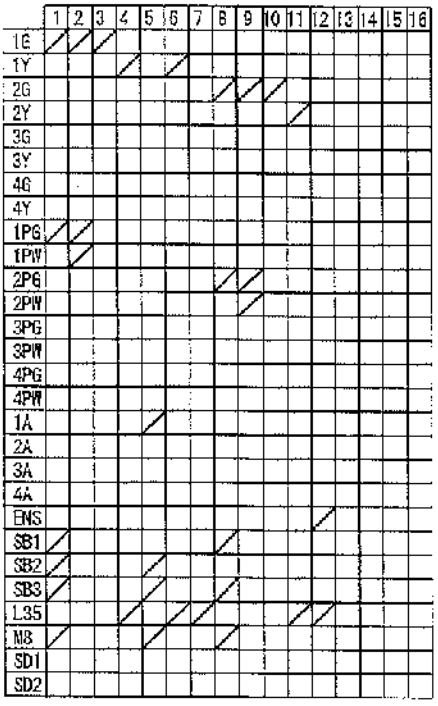


Fig.4.8 Phase Program Unit

(1) Lamp color (①~⑤)

Specifies the lamp color indicated in each step. If "G" or "Y" is not programmed, Red Lamp is specified.

Also, In the specification of the Pedestrian Green Blink, program both of "PG" and "PW".

(2) Final step (⑥)

Specify the final step.

(3) Step of "P2" and "P3". (⑦)

Specify the step of "P2" and "P3". A maximum of 5 steps (A to E) is replaceable by the specification. Program it according to the following Fig.4.9.

	STEPS P2 & P3				
	A	B	C	D	E
SB1	○		○		○
SB2	○	○			○
SB3	○	○	○	○	

Program in Mark ○

Fig.4.9 Assignment of steps for P2 & P3

(4) Monitoring Time (⑧, ⑨)

Specifies the short (0.95 to 35 sec.) and long (8 to 110 sec.) steps. If neither of them are specified, it is to be the medium step (0.95 to 110 sec.).

4.3.2 Method of Setting the G-G Program

Describes the setting example of G-G program in Figure 4.10 applying to the phase step figure in Figure 4.7. It specifies the combination of "blue phases" which are not allowed to indicate at the same time. It is possible to set a maximum of 6 combinations. The blue phase for G-G error to blue phase specified in "0-1" line is specified in "0-2" line. For example, when a vehicle green light (1G) on major road is turned on, pedestrian a green light is also turned on but a arrow mark light (1A) on the major road, vehicle green lights (2G) on the minor road and pedestrian green lights (2PG) crossing on the major road should be tuned off. Therefore "1A", "2G" or "2PG" in "1-2" line is specified in "1-2" line to "1G" in "1-1" line. This applies to "1PG", "1PG" as well as "1G" is specified in "1-1" line.

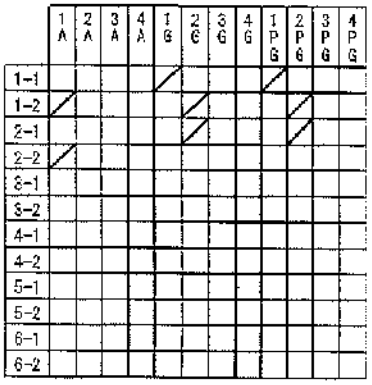


Fig.4.10 Program Unit

Using the same way as the above, you set all the combination. If "2G" to "1G" is set by G-G setting, it is same setting as "1G" to "2G" set by G-G setting. Omit the setting like this.

4.3.3 Method of Setting the Flashing Color

Describes the setting example of the flashing color in Figure 4.11 applying to phase step figure in Figure 4.7. Normally Vehicle Yellow light is set on the major road (1Y) and Vehicle red light is set on the minor road and it starts flashing with the red light (2R) on the minor road.

Flashing Operation starts with the light color specified in "F1".

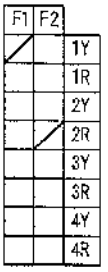


Fig.4.11 Flashing Color program

4.4 Setting of Panel Operation Unit

4.4.1 Method of Setting Indication Time

A setting pin for "10's digits" (a figure on the left side) and "1's digits" (a figure on the right side) in each indication seconds are inserted into the applying holes in the indication time setting machine of each pattern (P1, P2, P3).

However don't remove a setting pin for a running step (Step Pilot Lamp is turned on). It may cause Flashing Operation ("FAIL" pilot lamp is turned on).

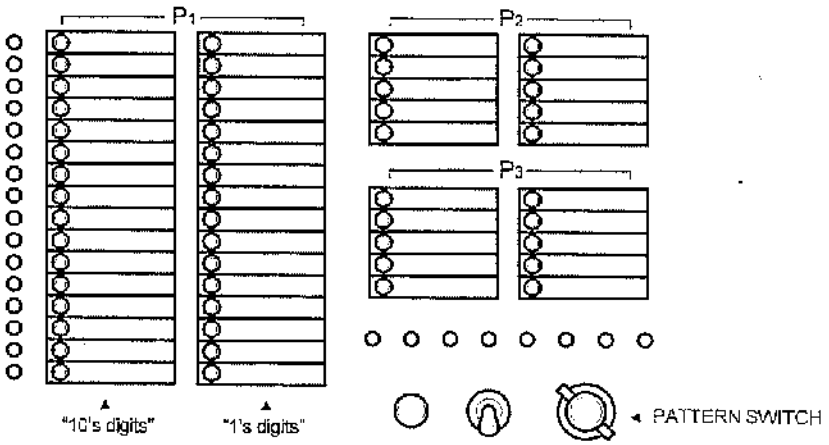


Fig.4.12 The Indication Time Setting

4.4.2 Method of Changeover of A Pattern

Selects the auto control (AUT), pattern 1 (P1), pattern 2 (P2), pattern 3 (P3) of time switch at the pattern switcher. After switching, the selected pattern works from the first step of the next cycle.

4.4.3 Method of Setting Time Switch

If you select "AUT" at the pattern switcher, the auto control of time switch (independent Multi-Plan Operation) works. However, if the power of time switch is off, the time table is unset or the clock error has occurred, the regular cycle Operation of pattern 1 (P1) works.

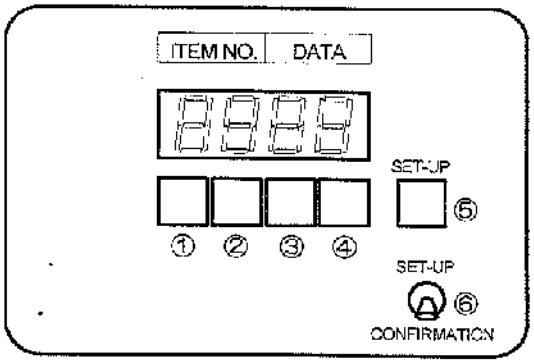


Fig.4.13 Time Switch Setting

(1) Set-up/CONFIRMATION switch⑥ is set at "set-up".

(2) Entering the setting item selection key ①and②, select the setting item number. Item number is specified in Table 4.1.

(3) Entering the Constant key③and④, enter the constant (time or pattern).

(4) If the entered constant is correct, confirms it by entering the setting key⑤.

(5) Repeats (3) to (5) as many times as you need.

(6) When you finish all the setting, return Set-up/CONFIRMATION key⑥ on "CONFIRMATION" side.

Table 4.1 – The setting item table of time switch

Item	Display (setting) content	Item	Display (setting) content
00	present time (h)		
01	present time (m)		
	(unused from 02 to 0F)		
10	start time (h) of switch 1	60	start time (h) of switch 6
11	start time (m) of switch 1	61	start time (m) of switch 6
12	execution pattern of switch 1	62	execution pattern of switch 6
	(unused from 13 to 1F)		(unused from 63 to 6F)
20	start time (h) of switch 2	70	start time (h) of switch 7
21	start time (m) of switch 2	71	start time (m) of switch 7
22	execution pattern of switch 2	72	execution pattern of switch 7
	(unused from 23 to 2F)		(unused from 73 to 7F)
30	start time (h) of switch 3	80	start time (h) of switch 8
31	start time (m) of switch 3	81	start time (m) of switch 8
32	execution pattern of switch 3	82	execution pattern of switch 8
	(unused from 33 to 3F)		(unused from 83 to 8F)
40	start time (h) of switch 4	90	start time (h) of switch 9
41	start time (m) of switch 4	91	start time (m) of switch 9
42	execution pattern of switch 4	92	execution pattern of switch 9
	(unused from 43 to 4F)		(unused from 93 to 9F)
50	start time (h) of switch 5	A0	start time (h) of switch 10
51	start time (m) of switch 5	A1	start time (m) of switch 10
52	execution pattern of switch 5	A2	execution pattern of switch 10
	(unused from 53 to 5F)		(unused from A3 to AF)

5. Cautions for Maintenance

5.1 Periodical Maintenance

Periodically maintain and inspect the Traffic Signal Controller so that normal functions are performed. Major inspection items are as follows.

INSPECTION ITEM	INSPECTION DETAIL	STANDARD	INSTRUMENT	INSPECTION CYCLE
Check of power supply	1) Measure input voltage of power supply. 2) Measure output voltage of power supply. 3) Fuse	1) AC216~264V 2) DC4.8~5.2V 3) Is capacity correct?	1) AC ammeter 2) DC voltmeter	1) Twice a year 2) Twice a year 3) Once a year
Green-green indication test	Check green-green indication detection function.	All vehicle green lamps and pedestrian signal lamps should immediately go out while actuating Flashing Operation and lighting up Pilot Lamps "G-G" and "Step & Pattern immediately before abnormal".		Twice a year
Abnormal length test	Check abnormal length detection function.	After passing regulated time, vehicle green lamps and pedestrian signal lamps should go out while actuating Flashing Operation. Pilot Lamps "FAIL" and "Step & Pattern immediately before abnormal" should light up.	Stop watch	Twice a year
Manual Operation test	1) Check manual operation. 2) Check green-blinking cycles.	1) Step upon changeover should be maintained without skipping or faulty advancing. At this time, Pilot Lamp "Pattern" should go out. 2) Ten blinking cycles should be within 5±1 seconds.	Stop watch	Once a year
Indication time test	Check number of seconds for set cycle.	Within ±5% of set cycle.	Stop watch	
Flashing Operation test	1) Check Flashing Operation. 2) Check Flashing cycle.	1) Flashing Operation should immediately be activated while lighting up Pilot Lamp "Flashing". 2) Ten blinking cycles should be within 10±2 seconds.	Stop watch	Once a year
Monitor Lamp test	Blinking of monitor lamp	Visually check for no Abnormals.	Stop watch	Once a year
Inspections on external and internal views	1) Check Abnormals, e.g. loose terminals & overheating. 2) Check for no panel deformation, loose mounting parts, etc. 3) Check for no soiling inside & outside of housing, peel of painting, rusting, nor deformation. 4) Loose connectors and connector bases. 5) Loose printed circuit boards. 6) Loose units, etc. 7) Check for no loose relays, color fading of contacts, nor abrasion.	1)~7) Visually check for no Abnormals.		

INSPECTION ITEM	INSPECTION DETAIL	STANDARD	INSTRUMENT	INSPECTION CYCLE
Inspection of spare parts		Supplement parts, if insufficient		
Independent Multi-plan Operation test (with Multi-plan Unit mounted)	1) Pattern automatic selection test. 2) Pattern manual selection test. 3) Test for correcting Time Switch time.	1) After a pattern is switched, changeover to a pattern indicated on Time Switch should be completed within a cycle. 2) Changeover to new pattern should be completed within a cycle from actuation of changing pattern. 3) Allowance of setting should be within ±5 min from set time.	Stop watch	

5.2 Precautions for Maintenance

(1) If you exchange the parts, units and print boards, be aware of the following things

① If you exchange the main board of controller or print board, turn the Control Power Switch "OFF".

CAUTION!! If you turn the Control Power Switch "OFF", the signal lamps will be turned OFF.

② When you exchange the Time Switch, turn the Power Switch of unit "OFF".

③ When you exchange the Lamp Switch Unit (SSU), turn the Lamp Switch "OFF".
Each Lamp Switch Unit is common, but the phase is changed by the mounted position.

CAUTION!! If you turn it "OFF", the signal lamps will be turned OFF.
Be fully aware of the traffic flow.

④ Before replacing a component part, be sure to check a new replacing part for complete conformity with the same circuit and the same specifications as those so far used.

(2) As for the maintenance of the goods for maintenance, be aware of the following things:

① Do not store in high temperature and high humidity, and direct sunlight.

② Do not store where there are static charges. Especially as for each kind of base board, be sure to take the measures to cope with static charges.

③ Keep it free from mechanical stress like giving shocks by dropping and bumping.

5.3 Maintenance in Occurrence of Troubles

5.3.1 Maintenance Process

(1) In the case of signal error, confirm the following items first.

- the name of the intersection
- unusual phenomena (ex. flashing light, light extinction, phase stop, double phases)

(2) After arrival of the spot, confirm the following items:

- the fixed position of the switches
- the lighting condition of the monitor lamps
- the condition of the fuses and breakers

(3) Check the power system. (AC input voltage, each kind of direct current voltage)

5.3.2 Tools and the Measuring Apparatus for Maintenance

(1) a set of tools (a driver, a nipper, a pair of cutting radio pliers, a soldering iron)

(2) a tester, an oscilloscope

(3) a key

5.3.3 Substrate and Unit for Maintenance

(1)	MB	: mother board
(2)	MCU	: main base board in the Controller
(3)	PDU	: phase data unit
(4)	PBO	: time switch
(5)	SSU unit	: lamp driving unit
(6)	Power Supply unit	: Control Power for A04 shaped Multi-Plan system controller

5.3.4 Replacement Unit

(1) Primary exchange unit (the items that maintenance men should household)

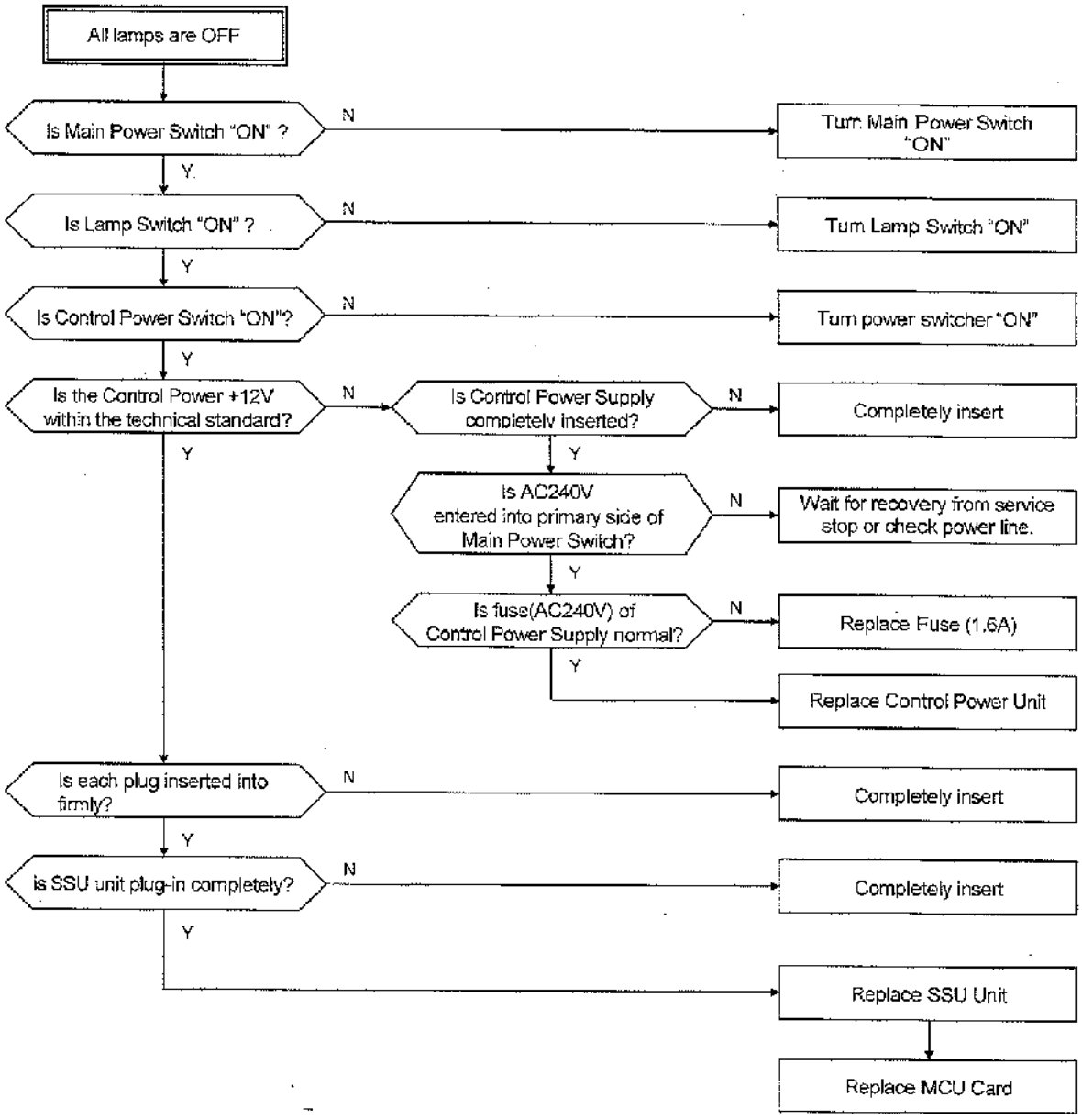
- Fuses
- ZNR
- Breakers
- PKG (MCU, PDU)
- Units (PBO, SSO, control power)
- Manual pushbuttons

(2) Secondary exchange unit (the items that maintenance men should household)

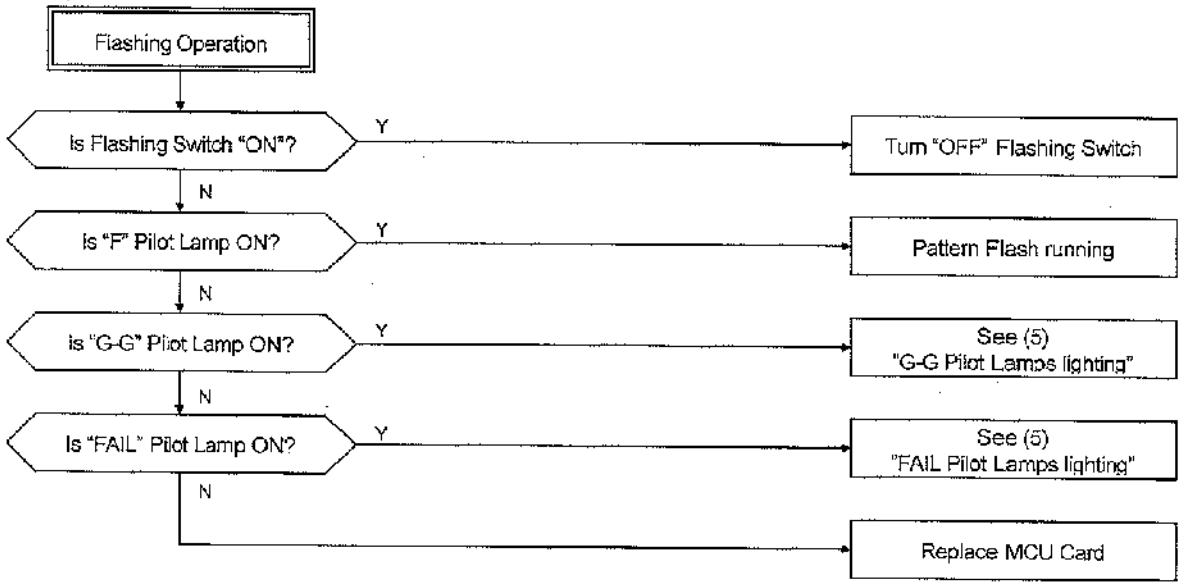
- PKG (MB)
- Controllers
- Flat cables

5.3.5 Flow Chart of Trouble Detection

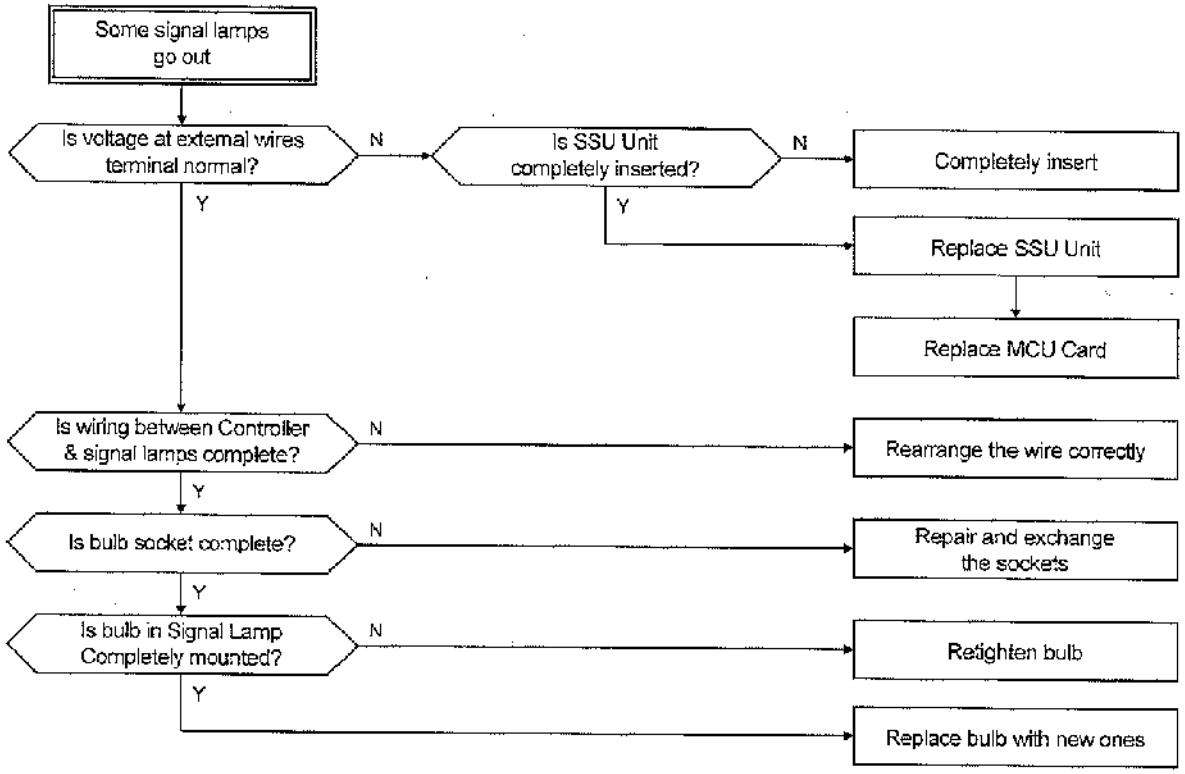
(1) Turning All Signal Lamps OFF



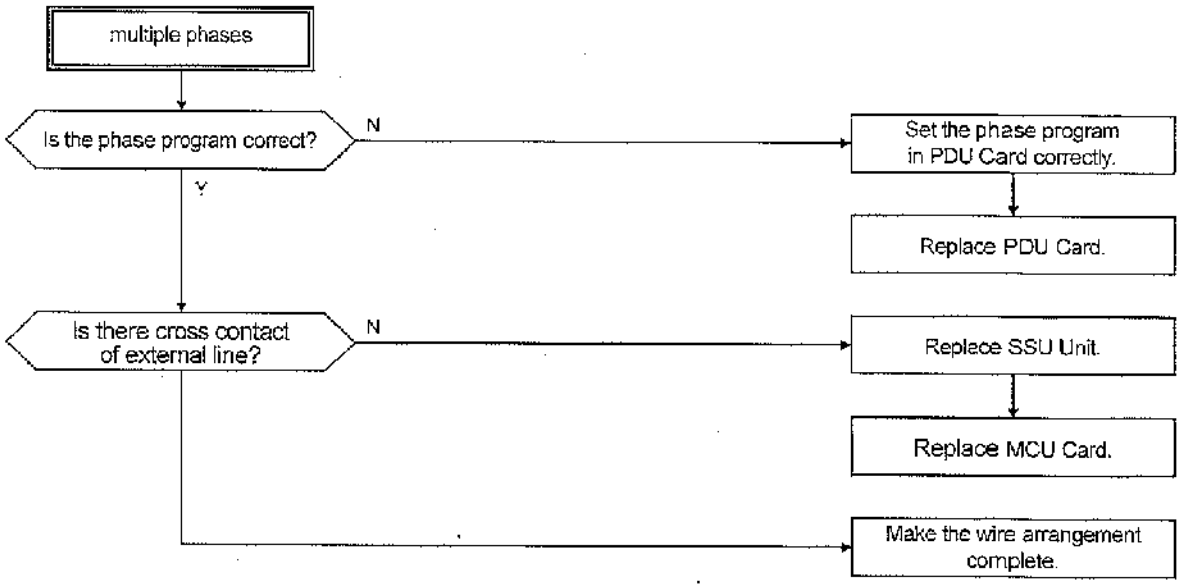
(2) Flash of the Signal Lamps



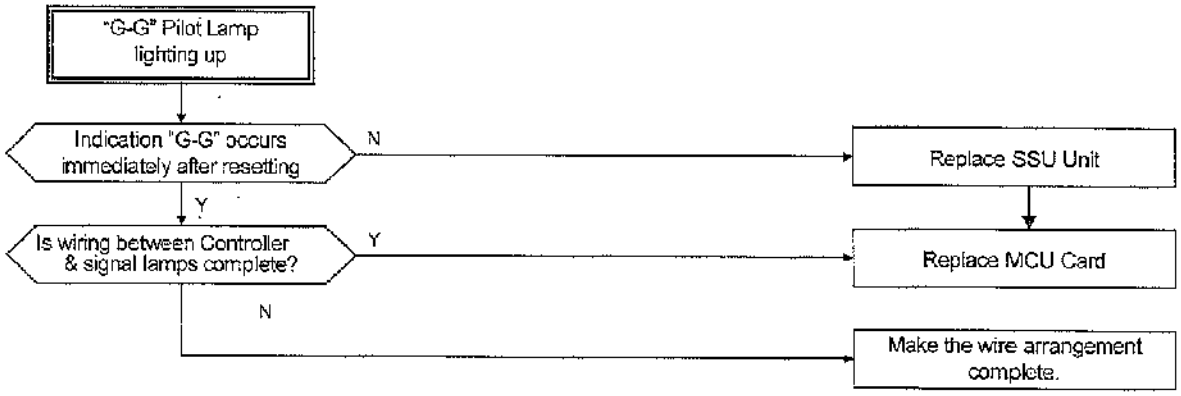
(3) Extinction of the Unit of signal lamps



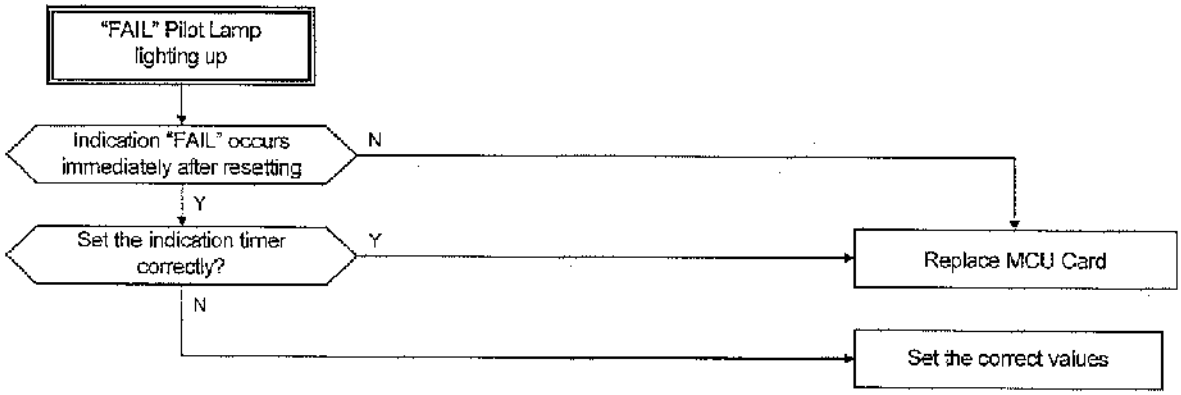
(4) Multiple Phases



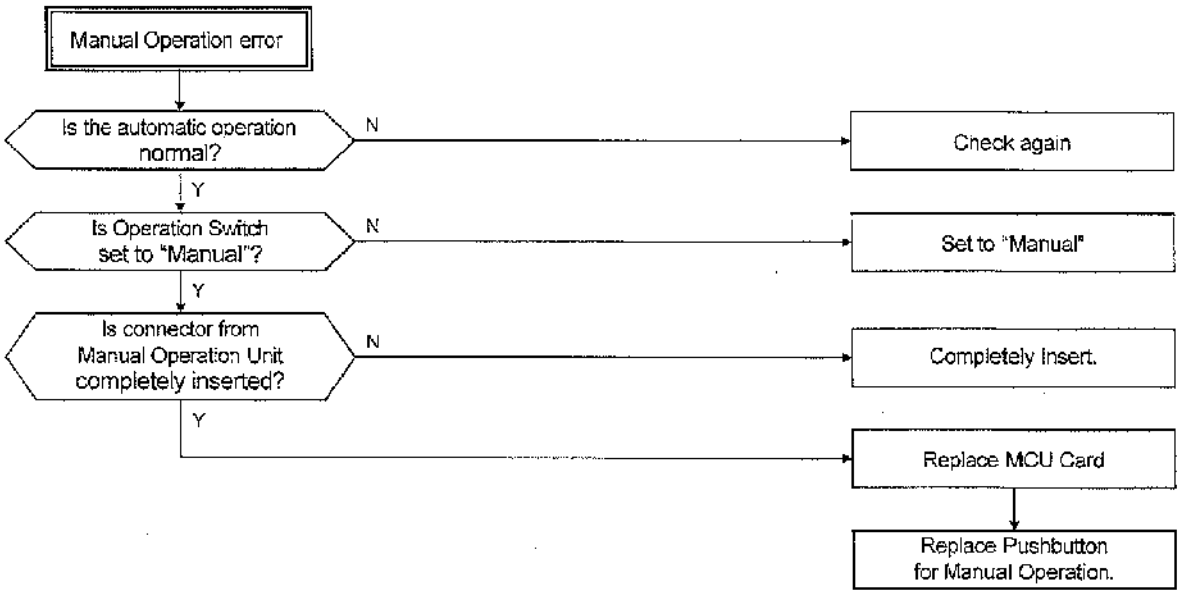
(5) "G-G" Pilot Lamp Lighting Up



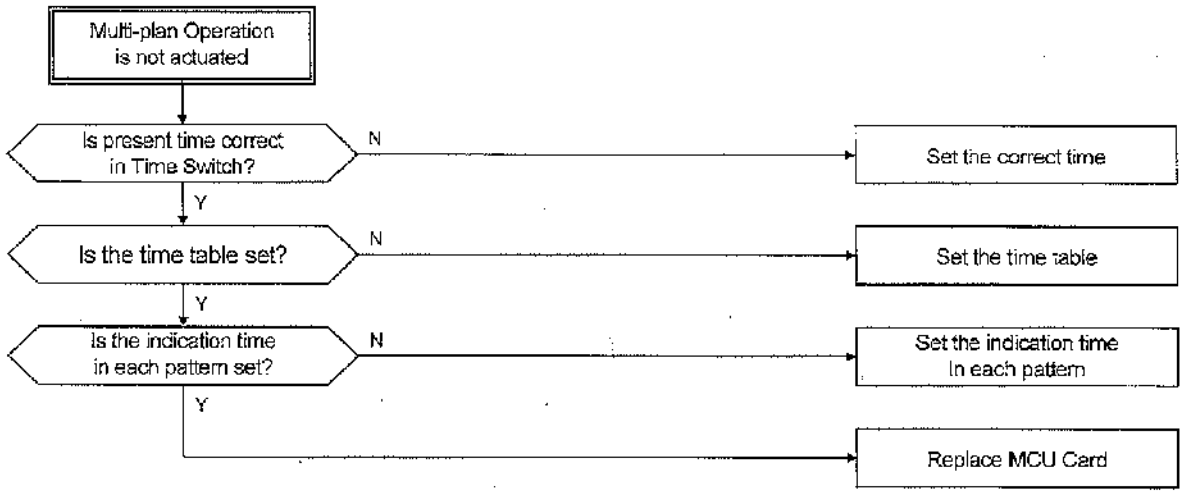
(6) "FAIL" Pilot Lamp Lighting Up



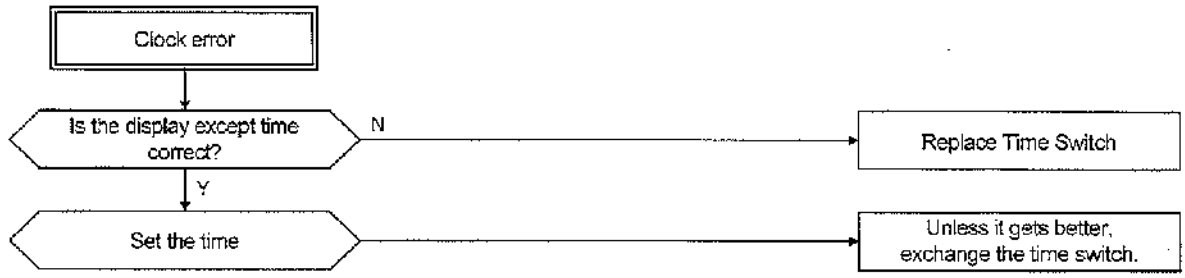
(6) Failure in Manual Operation



(7) Deactivation of Multi-Plan Operation



(8) Clock Error



KYOSAN

The instruction Manual of

A04-TYPE MULTI-PLAN SYSTEM

TRAFFIC SIGNAL CONTROLLER

Kyosan Electric Mfg. Co., Ltd.

SAFETY PRECAUTIONS

This "Instruction Manual" contains "installing, operating and maintaining" instructions and safeguards. Read the "Instruction Manual" before " contains "installing, operating and maintaining" the "A04-TYPE MULTI-PLAN SYSTEM TRAFFIC SIGNAL CONTROLLER" to ensure the equipment offers you maximum service and is used properly and safely. Keep the " A04-TYPE MULTI-PLAN SYSTEM TRAFFIC SIGNAL CONTROLLER" in a convenient location for future reference.

Never attempt any procedure on the " A04-TYPE MULTI-PLAN SYSTEM TRAFFIC SIGNAL CONTROLLER" that is not specifically described in the "Instruction Manual". Unauthorized operation can cause faults or accidents. Kyosan is not liable for any problems resulting from unauthorized operation of equipment.

In the safety signs affixed on the " A04-TYPE MULTI-PLAN SYSTEM TRAFFIC SIGNAL CONTROLLER", to make certain situations clear the following signal words are used:

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION

CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

NOTICE indicates information or a company policy that relates directly or indirectly to the safety of personnel or protection of property.

General safety signs indicates general instructions relative to safe work practices, reminders of proper safety procedures, or the location of safety equipment.

In the safety signs affixed on the " A04-TYPE MULTI-PLAN SYSTEM TRAFFIC SIGNAL CONTROLLER", to communicate different messages the following symbols are used:

A black image on a white square background means hazard alerting symbol. A symbol on the background indicates the type of hazard.

A blue circle means the mandatory action symbol. A symbol in the blue circle indicates the action mandated.

A red circular band with red diagonal slash on white background means prohibition symbol.

A symbol in the red circular band indicates the action prohibited.

A safety green image on a white background means information symbol.

A symbol on the background indicates the safety information.

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1.Outline

1.1 General

"A01-Type Traffic Signal Controller" is designed produced for mainly overseas use. That makes improving its maintainability and producing it at low possible.

This controller have the abilities to switch the indication time in response to traffic situation by setting control pattern and to control the signals in response to traffic characteristics.

The Controller consists of Control Unit, Power Unit, Lamp Switch Unit, Junction and Manual Operation Unit in terms of functions.

1.2 Configuration

Components of the Controller are shown in the following table.

Table 1.1 Component devices

Item	Device	Quantity
Main unit	Cabinet Manual Operation Unit Control Unit Power Supply Unit Lamp Switch Unit Junction	1 unit
	Pushbutton for Manual Operation	As required
Accessories	Key for main door of cabinet Key for door of Manual Operation Unit Connection code Mounting metal fixture	1 unit
Spare units	Fuse (3.15A for control power) Fuse (2A for IFU) Setting pins (for pin board)	2 pieces 2 pieces 3pins
Attached documents	Test Report Instruction Manual Operation Manual	3 copies As required 1 copy

2.Function and Ability

2.1 Main characteristics

(1) Improvement of Reliability

High efficiency integration of circuit and semiconductor device of power consumption controls interior evolution of heat and improves the reliability.

(2) Improvement of Maintainability

Making each Units components joint plug-in or plug-in style improves the maintainability.

(3) Maintenance of Safety

This controller maintains safety by the danger prevention (G-G protection) function for the phase.

(4) Time Setting

Pin board of panel operating unit makes the time setting easier.

2.2 Specifications

(1) Power Requirement	AC100V ±10% 50/60hz
(2) Power Consumption	approximately 70VA (excluding lamps)
(3) Ambient Temperature	-20 to +60℃
(4) Relative Humidity	40 to 90%
(5) Insulation Resistance	Between AC input terminals and Cabinet-10MΩ or more at DC500V (with arrester, etc., disconnected)
(6) Insulation Voltage	Between AC input terminals and Cabinet -AC 100V 1 minute (with arrester, etc., disconnected)
(7) Shape	400(W)×800(H)×300(L)mm
(8) Weight	approximately 70kg

2.3 Main Operation

2.3.1 Flashing Operation

Yellow signal in the major road side and red signal in the minor road side flash alternately. During Flashing Operation, Pedestrian Signal Lamps and Arrow Mark Lamps go out.

Flashing Operation works in the following cases:

- When the time was set by Time Switch.(pattern flashing)
- When the Flashing Switch on the Control Unit Panel is turned "ON". (manual flashing)
- When the indication time becomes abnormally long.(abnormal flashing)
- When green signal are indicated at the same time for crossing traffic flows.(abnormal flashing)

2.3.2 Manual operation

When the Operation Switch in the Manual Operation Unit is set at "Manual", a signal indication is advanced by one step every time the Pushbutton for Manual Operation is pressed. Unless it is pressed, the indication in a current step can be continued.

2.3.3 Multi-Plan Operation

This Operation executes three kind of patterns different in indication time of specified step (a maximum of 5 steps) in advance.

2.3.4 Regular Cycle Operation

This Operation repeats the specified pattern all day. Changeover of a pattern is controlled by the Pattern Switch on the Control Unit Panel. When Time Switch power is turned OFF or time table is not set, pattern 1 (P1) takes Regular Cycle Operation.

2.3.5 Interlocking Operation (Option)

This Operation can be activated by mounting an IFU Card.

- Function of Interlocking Master Unit
  Output periodic signals (A/B) to Interlocking Slave Unit.
- Function of Interlocking Slave Unit
  Receives periodic signals from Interlocking Master Unit and performs interlocking operations.

In an interlocking operation, the first step is to wait for a change from "A" to "B," the offset time in seconds, set at that time, is counted, and after counting, the phase advances to the next step (second step).

2.4 Function and Ability of Each Units

2.4.1 Control Unit

This Unit consists of MCU Card, PDU Card and Time Switch. It displays and designates each Operation, and controls the lamp color and each Operation works like Figure.2.1 Operation flow according to the position of switch and signal situation.

(1) Indication function

① Step (1-16) Pilot Lamps
② Clock Pilot Lamps (CLOCK)
③ Abnormal Pilot Lamps (G-G-FAIL)
④ Manual Flashing Operation Pilot Lamp (FL)
⑤ Running Pattern Pilot Lamps (P1,P2,P3,F)

(2) Initial all red indication

When the main power is turned ON, the power return after the power cut and operating Reset Button, starts normal Operation with first step after displaying red signal for 5 seconds to all phases. However when Flashing Switch is set to "ON", not performing all red display in first stage, immediately starts Flashing Operation.

(3) Operation in abnormal condition

① When green signal lamps are indicated at the same time for crossing traffic flows, the green signal lamps are once completely turned OFF in any operation mode, and then Flashing Operation is activated. In this case "G-G" on Abnormal Pilot Lamp is turned ON.

② Maximum time and minimum time of each step is observed, each step is maintained at least for a minimum time , but when the indication time takes the maximum time, Flashing Operation immediately starts. In this case "FAIL" on Abnormal Pilot Lamp is turned ON.

Step \ Monitoring time	Maximum time (sec.)	Minimum time (sec.)
Short step (PW, PR, Y, R)	35	0.95
Middle step	110	0.95
Long step (G)	110	8

③ If the cause of the abnormal is eliminated, Flashing Operation will be canceled by pushing the "RESET" button.

(4) Operation switching

Changeover of operation mode can be safely performed without turning OFF the Main Switch; when two or more operation modes conflict with each other, operation priority is given to Flashing Operation, Manual Operation and Independent Multi-Plan Operation. And also switching of each operation except for Flashing Operation and patterns can be continuously activated without skipping any step.

(5) Indication time and changeover of pattern

Indication time and changeover of pattern are set at the Control Unit Panel.

① Indication time

It is possible to set the indication time from 1 to 99 by second. An error is under ±3% from a selected time. It is also possible to set three patterns -P1,P2 and P3.

② Changeover of Pattern

"P1", "P2" and "P3" are switchable using the rotary switch (P.SEL) on the panel operator. Also, the switch is set at "AUT", the patterns are automatically switchable a maximum of 10 time a day.

(6) Phase data

Phase program, G-G program and Flashing Color Specification, all of them are set at diode matrix on the phase data substrate (PDU).

(7) Clock

Backup capacitor makes it possible that clock circuitry in time switch works normally against the following kind of power cut.

- the power cut within 12 hours
- the power cut lasting within 30 minutes and repeating over 12 hours cycle

2.4.2 Power Supply Unit

The plug-in control power unit provides necessary electricity to each Operations.

(1) Input: AC100V ±10% 50/60hz ±5hz per unit

(2) Output: a rated voltage of DC5V±0.25V, a maximum rated current of 3A
a rated voltage of ±DC12V ±1V, a maximum rated current of 0.2A

(3) Dividing output: a rated voltage of 8 to 15V, a rated current of 10mA

(4) Protection circuitry:
① If the input voltage goes down under 80V, output voltage off will be turned off.
② It protects the interior against inputting an abnormal voltage of 150V half wave.
③ It is operable within input 10ms of a moment power.
④ It protects excess voltage output. (up to 5V)
⑤ It protects the power against short circuit of the output terminal.

2.4.3 Lamp Switch Unit

This unit consists of 4 Plug-in Lamp Switch Unit (SSU), perceives the lamp color driving signals and light the lamps using the lamp switch element.

(1) This Unit can house a maximum of 6 Lamp Switch Elements (3 vehicles, 2 pedestrians, 1 arrow) per 1 unit. It houses a maximum of 24 Lamp Switch Elements by 4 Units.

(2) Each Lamp Switch Element can supply a maximum current of 5A with power. It prevents external surge from breaking into the controller side because input side is insulated electrically from output side by installing SSR. And it decreases making noise as little as possible by switching lamp power near 0V.

(3) This unit consists of phase 1 to 4 from the top. The monitor lamps in front of it helps confirming the phase even with the OFF.

2.4.4 Manual Operation Unit

(1) This Unit can be run by manual or automatic operation using the Operation Switch.

(2) When the Operation Switch in the Manual Operation Unit set at "Manual," a signal indication is advanced by one step every time the Pushbutton for Manual Operation is pressed. Unless it is pressed the indication in a current step can be continued.

2.4.5 Junction

(1) This unit consists of the terminal board for line wire connection, Main Power Switch and Lamp Power Switch.

① The Type of the Main Power Switch is 30A frame type with a normal-temperature rating of 30A. It can supply the Lamp Power Switch with a maximum current of 25A.

② The Lamp Power Switch is separately switchable regardless of other circuitry.

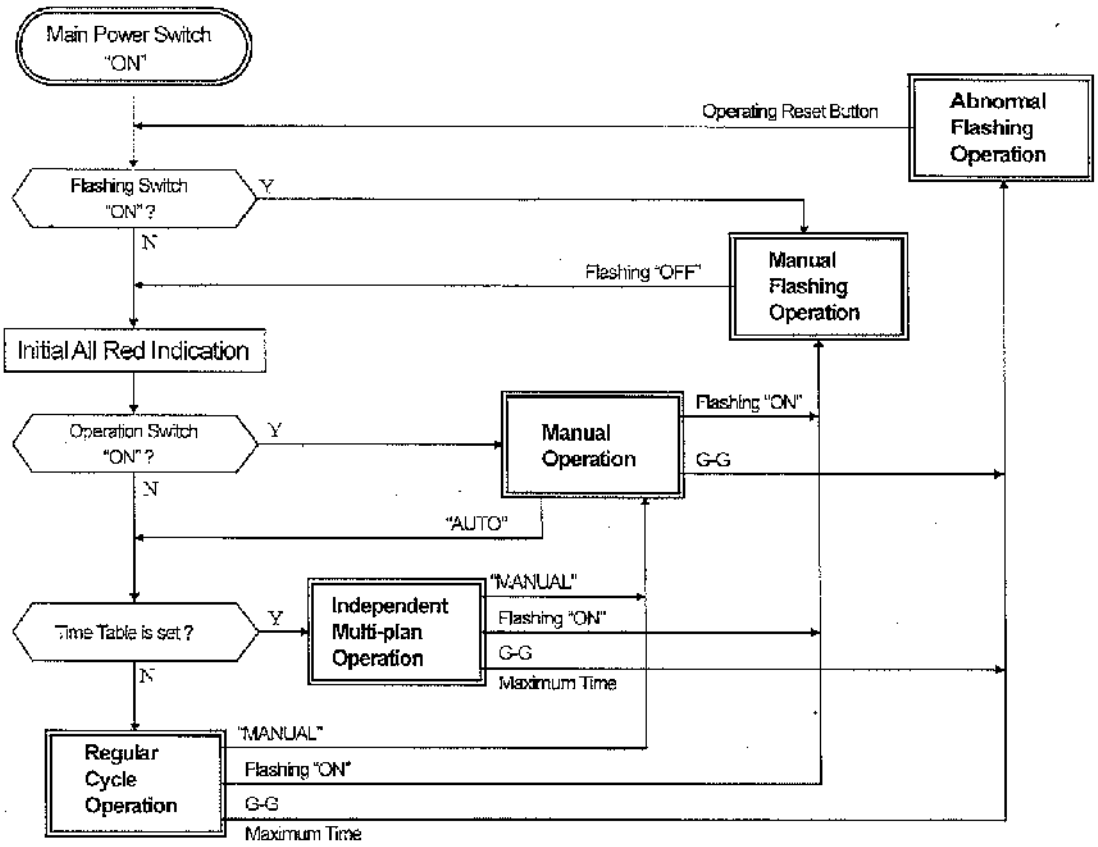


Figure.2.1 Operation Flowchart

3.Caution for Installation

3.1 Installation Location

(1) Install the equipment in locations and directions and suitable to manually control the equipment for traffic signal control.

(2) Adjust locations and direction of the equipment so that the equipment will not obstruct traffic flows of pedestrians and vehicles.

(3) Select locations and direction of the equipment so that maintenance personnel can safely work for maintenance and inspection of the equipment.

3.2 Installation Method

(1) The Controller can be installed in a standalone or pole-mounted type. In the latter case, the Controller is mountable in either left or right side.

(2) When the Controller is mounted on a pole, be sure to rigidly mount the equipment using the attached mounting fitting.

(3) Install the equipment so that the door of the Controller can be opened and closed.

(4) Install a cable conduit securely on to the Controller.

3.3 Precautions for Installation

(1) Main Power Switch

Before beginning installation work, be sure to turn "OFF" the Main Power Switch.

Working at it with the power on may lead to shock hazard and unexpected injury. In case of short, it leads to damage the equipment.

(2) Connection of wires

Screw the screw terminal tightly. In the case of the metal penetration system terminal, pull the electric wire a bit after interconnection and confirm it is connected tightly.

(3) Connection of wires to utility power lines

Connect power lines directly to upper terminals of Main Power Switch. At that time, check that the lines carry AC100V and connect a grinding wire to the terminal with a mark "E", on the Switch.

(4) Connection of signal lamps

Do not incorrectly install the wiring to the input/output terminal board.

Do not short the signal line and "COM" line because it may lead to give a serious damage to the Controller and wire.
Also do not connect more than 7 signal lamps to an output terminal of a signal lamp.

(5) Grounding

Be sure to have a grounding resistance of 100Ω or less using the earth(E) terminal of the terminal board. Also ground all spare lines and messenger wires in the external line, using the "E" terminal, as far as possible. Such grinding will be very effective in reducing damages of lightning surges and noise troubles.

(6) Insulation test

Before beginning the insulation test, disconnect grounding wires in the grounding terminal and the housing, from the grounding main.

(7) Operation test after installation

When a Controller is transported, connected wires and connectors may sometimes become loose in printed circuit boards, plugs, relays, units, etc., so be sure to check each connected part.

Before beginning the operation test, see next chapter "4. Precautions for Management".

4.Precautions for Management

4.1 Names and Explanation of Each Units

4.1.1 Controller Appearance and Interior Arrangement

Describes the outlook of the controller and the interior arrangement in Figure 4.1.

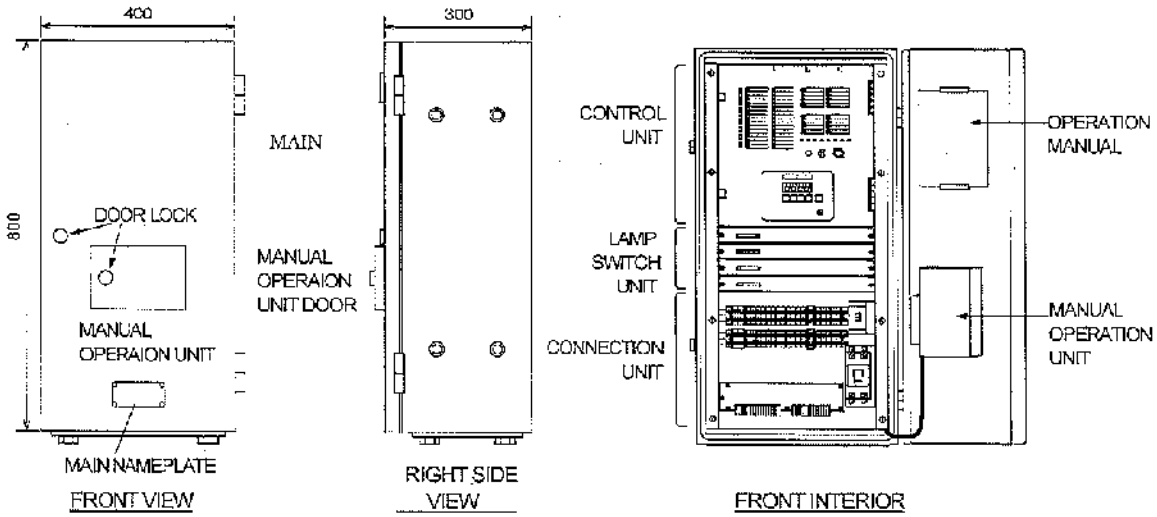


Figure 4.1 External & internal views of Controller

(1) Opening & closing of Main Door
and Manual Operation Unit Door

As for switching the main panels and manual operator panels, stick the key for traffic signals to the hole and turn right to unlock. Also if the panels are shut, they will be automatically locked. At that time push hard and listen to the second "Click" to confirm that they are locked.

(2) Interior arrangement

Manual Operation Unit is on the main panels.

Open the main panels and you'll see the controller, lamp switcher, and connection unit from the top.

Describes the interior mounting figure in Figure 4.2. The main motherboard of the controller (MCU) and time switch are mounted on the back of the controller panel and the control power and phase data cards are mounted in the depth.

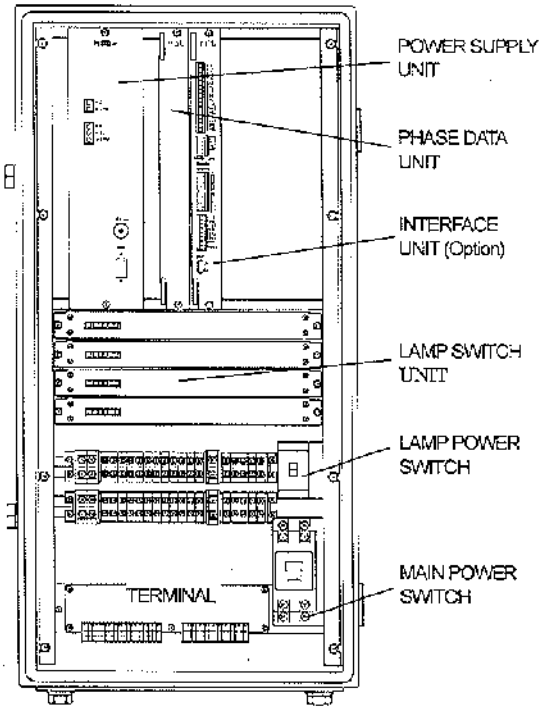


Figure 4.2 Interior arrangement

4.1.2 Control Unit

Figure 4.3 shows the front panel of the Control Unit.

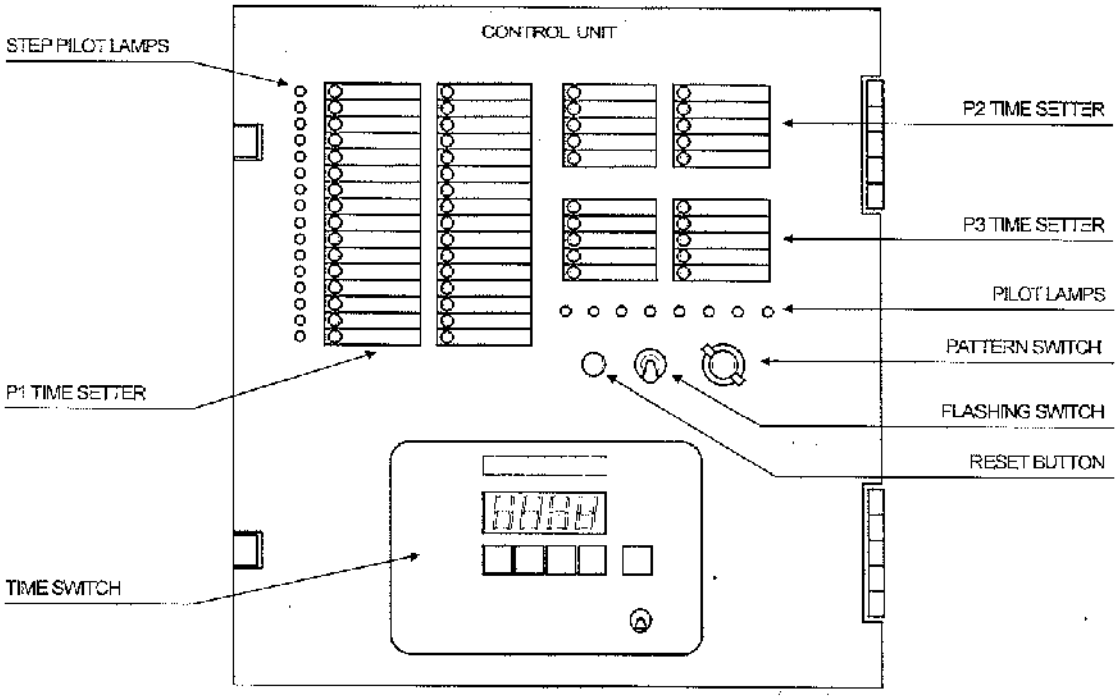


Figure 4.3. Control Unit Panel

(1) Each Switch

① Flashing Switch: It starts Flashing Operation immediately with the switch "ON" at any level. Also, if the switch is set at "OFF", it start indicating the first step after indicating red signal for 5 seconds to all traffic flow.

⚠ CAUTION Be fully careful to the traffic flow for the operation at work. Consider the safety to driving vehicles and then switch it with all red signals.

② Reset Button: Only when each Abnormal Pilot Lamp lights up and the cause of it is disappeared, stored abnormal state can be reset by pushing this button. In that case, the indication of the first step starts after indicating red lights for 5 seconds to all traffic flow.

③ Pattern Switch: Use this switch to change over a pattern. The pattern after switching is executed from the first step of the next cycle. If the switch is set at "AUT", independent Multi-Plan Operation is actuated by Time Switch.

(2) Pilot Lamps

① Step Pilot Lamps:	A Step Pilot Lamp, related to a step of Controller operation, lights up.
② "CLOCK":	Continues blinking in 1-second intervals when the Controller is in operation.
③ "G-G":	Lights up when a simultaneous-green indication failure occurs in lamps for crossing traffic flows.
④ "FAIL":	Lights up when a failure occurs and a step in effect cannot be advanced even after passing a maximum monitoring time.
⑤ "FL":	Lights up when Flashing Operation is effected using Flashing Switch.
⑥ "P1":	Lights up when the pattern 1 (P1) is selected.
⑦ "P2":	Lights up when the pattern 2 (P2) is selected.
⑧ "P3":	Lights up when the pattern 3 (P3) is selected.
⑨ "F":	Lights up when pattern flashing is running.

(3) Time Switch

Figure 4.4 shows the front and back panel of the Time Switch.

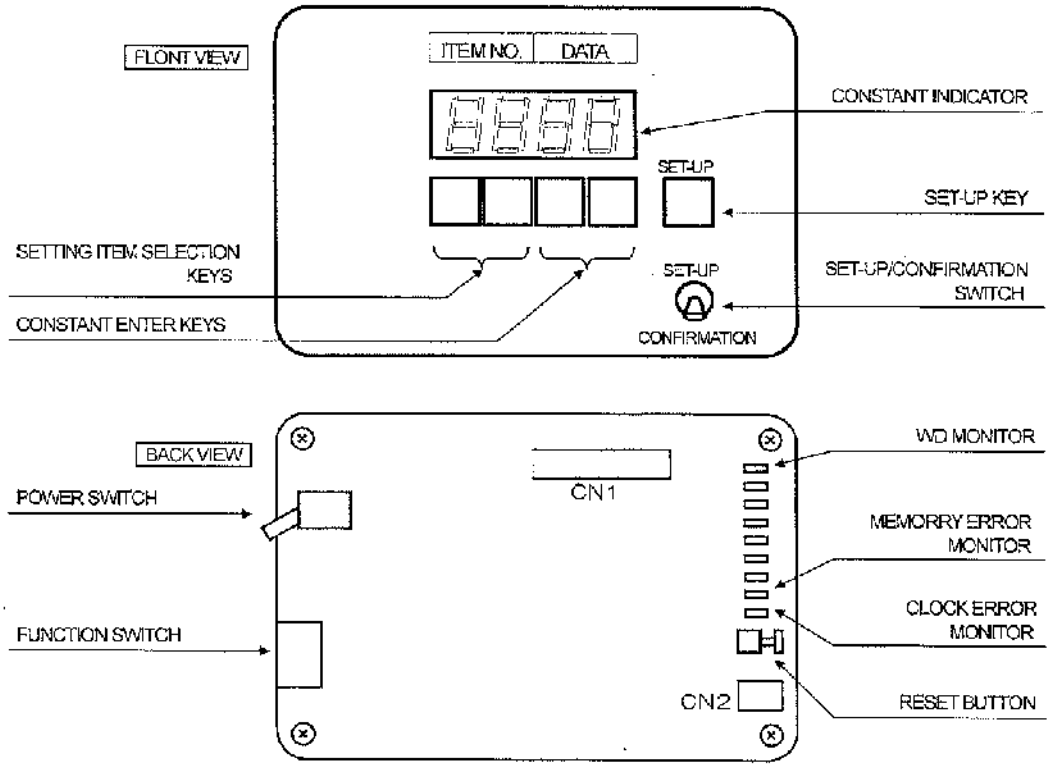


Figure 4.4. Time Switch

① Constant Indicator: Indicates present time with SET-UP/CONFIRMATION Switch "CONFIRMATION". If the switch is set at "SET-UP", 2 columns on the left side indicates setting items and 2 columns on the right side

indicates setting constants. "--"means no permission to enter.

② Setting Item Selection Keys: This key is efficient only with Set-Up/Confirmation Switch "SET-UP" and selects setting items.

③ Constant Enter Keys: This key is efficient with Set-Up/Confirmation Switch "SET-UP" and enters the constant by selected items on the left 2 columns. Enter "space" for unsetting and canceling.

④ Set-Up key: This key is efficient with Set-Up/Confirmation Switch "SET-UP" and confirms the constant entered by the Constant Enter Key.

⑤ Set-Up/Confirmation Switch: Selects "SET-UP" mode or "CONFIRMATION" mode. Normally the switch is set at "CONFIRMATION", only in setting operation it is on "SET-UP" side. Also set the switch at "CONFIRMATION" quickly after setting operation.

⑥ Power Switch: This is the main power supply switch in the Time Switch Unit. Normally the switch is kept set at "ON".

⑦ Reset Button: This button resets CPU. Don't push it carelessly.

⑧ Function Switch: Don't touch.

⑨ WD Monitor: This flashes when CPU in Time Switch Unit normally works.

⑩ Memory Error Monitor: This monitor is turned on or flashes when memory error has occurred.

⑪ Clock Error Monitor: This monitor is turned on when clock error has occurred. When the power is turned off for over 24 hours, it may have the clock error when the power is turned on again. Be sure to confirm it.

＊The Pilot Lamps excluding ⑨~⑪ are unused.

4.1.3 Power Supply Unit

Figure 4.5 shows the front panel of the Power Supply Unit.

(1) Power Switch

Setting the switch to "ON(接)" supplies each unit with Control Power(+5V and +12V) and frequency division (100/120hz) power.

CAUTION All the lamp lights are turned OFF with the Power Switch "OFF(断)". Be fully careful to the traffic flow when you operated at work.

(2) Pilot Lamp for Control Power

Light up when +5V and +12V is normally provided.

(3) Check Terminal

This Check Terminals the voltages the control power (+5V and +12V).

(4) Fuse

Protects AC input Unit, with a capacity of 3.15A. In exchanging, be sure to follow the rating. Spare fuses are in the spare Units

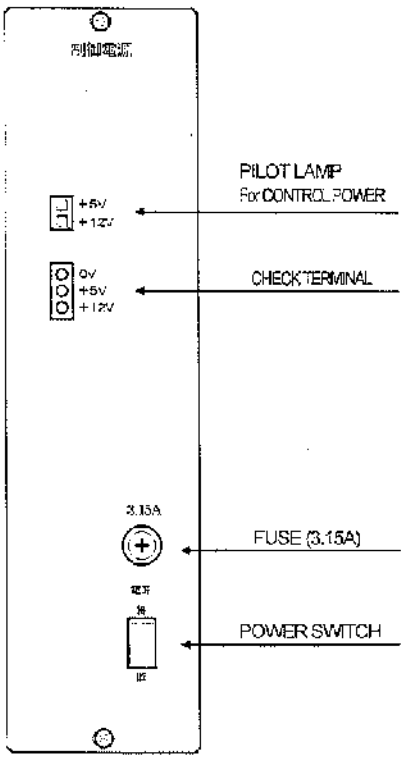


Figure 4.5 Power Supply Unit (Panel)

furnishing items on the back of main panel.

4.1.4 Interface Unit (IFU: Option)

Figure 4.6 shows the front panel of the IFU.

(1) Power Switch

Setting the switch to "ON (入)" supplies the unit with power.

CAUTION Before mounting or moving the unit, be sure to set the power switch to "OFF (切)."

(2) Detector Monitor

Not used in this controller.

(3) Pushbutton Activating Switch

Not used in this controller.

(4) Detector Activating Switch

Not used in this controller.

(5) Pushbutton Monitor

Not used in this controller.

(6) Synchronous Monitor

When the interlocking slave function is incorporated, any of these lamps lights when a periodic signal is received from the master unit.

When "A" signal is received, "SYNC (同期) 2" lights, and "B" signal received lights "SYNC (同期) 1."

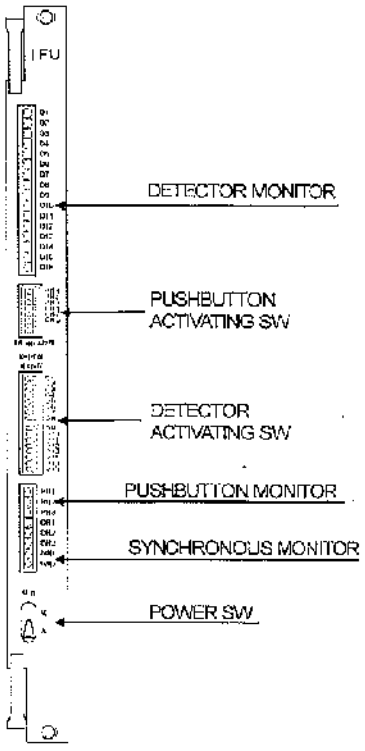


Figure 4.6 IFU Front Panel

4.1.5 Lamp Switch Unit

This unit consists of the Lamp Switch Unit (SSU), phase 1 to 4 from the top. 3 vehicle lamps, 2 pedestrian lamps and 1 arrow mark lamp are mounted in 1 unit. The front monitor lamp indicates the signals for controlling the light color received from the Control Unit (MCU).

The phase can be confirmed with the Lamp Switch "OFF".

4.1.6 Manual Control Unit

This Unit is mounted in the small window of the front of the Controller. Figure 4.7 shows the interior mounting.

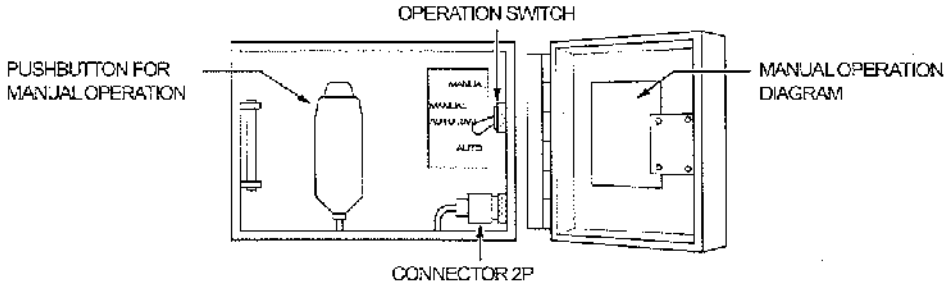


Figure 4.7. Manual Operation Unit

(1) Operation Switch

Normally the switch is set at "AUT". Except for the error and Manual Flashing, with the Operation Switch set to "MANUAL", signal indication can be advanced by one step every time the Pushbutton for Manual Operation is pressed. Be sure to set the Switch "AUT" unless Manual Operation effected.

(2) Push button for Manual Operation

It is used for the Manual Operation.

(3) Manual Operation Diagram

Describes how to manually operate the Controller

4.1.7 Connection Unit

(1) Main Power Switch

Setting the switch to "ON" supplies the Controller with utility AC power (AC100V). The maximum current capacity is 30A including the external machines using the external connection terminals "AC1" and "AC2".

(2) Lamp Switch

Setting the switch to "ON" supplies signal lamps with power. Setting the switch to "OFF" turns OFF only signal lamps even when the Controller is in operation. However, as the lamp switch unit and the control board are working this switch "OFF". Be careful to the traffic flow for the operation at work.

(3) External Wire Terminal Boards

This is the connection terminal board for the signal lamps and applying to the wire of a maximum of 3.5 mm^2.

(4) External Wire Terminal Board for Interlocking

This board is mounted in a controller with a interlocking function.

Terminals "A" and "B" function as periodic signal output terminals for a master unit.

Terminal "S1" and "S2" function as periodic signal receiving terminals for a slave unit.

The board is a plug-in type capable of connecting a wire with a maximum section of 2 mm^2.

4.2 Operation Details in Each Operation Mode

4.2.1 Power-up

① The switch in each Unit is set at as follows:

- Operation Switch (Manual Control Unit) : ON
- Flash Switch (Control Panel) : OFF
- Power Switch (Control Power Unit) : OFF (断)
- Lamp Switch : ON

② After making sure of the utility power wire is connected, the Main Power Switch is set to "ON".

③ After indicating the red signal to all the traffic flow for 5 seconds (Initial all red indication), the indication of the first step starts.

⚠ CAUTION Be sure to confirm "the present time" of the Time Switch. If the power has been turned off for two days, it is possible that the time error occurred. In this case, set the correct time again.
Be careful for the traffic flow in the operation of the Main Power Switch.

4.2.2 Operation in Manual Flashing Mode

① Flashing Operation is given highest priority, than any other operation mode. By setting the flashing Switch to "ON", the Flashing Operation is immediately actuated.

② In the Flashing Operation, the pedestrian and arrow lamps are turned off.

③ By setting the Flashing Switch to "OFF", all red signals are indicated for 5 seconds and then signal lamp are normally operated from the first step.

⚠ CAUTION As for the operation at work, be fully careful for the traffic flow. Taking driving vehicle safety into consideration, do it in indicating all red signals if possible.

4.2.3 Operation in Manual Operation Mode

① Set the Operation Switch in the Manual Operation Unit to "Manual" for an operation mode other than Flashing Operation. Processing of the Controller stops at a step when the Switch was set to "Manual".

② Indicated signal can be advanced by one step every time the Manual Operation Pushbutton is pressed. Unless the Pushbutton is pressed, the Controller holds the same step permanently.

③ By setting the Operation Switch to "Auto", current step is advanced to next one after passing a setting time for the step when the Switch was set.

4.2.4 Operation in Regular Cycle Operation Mode

① Set the Pattern Switch of the Control Panel to "P1", "P2", or "P3" for an operation mode other than Flashing Operation. This Operation starts with the first step of the next cycle.

② Even if the Pattern Switch is set to "AUT", Regular Cycle Operation starts by pattern 1 (P1) when the Time Switch is set at off or Time Table is yet to set.

4.3 Phase Data

The phase data (Indication program, G-G program, Flashing color specification and so on) is set by diode matrix mounted in the PDU Card of the Control Unit.

4.3.1 Planning of Indication

Describes the phase/step diagram and the setting example of matrix applying to it in Figure 4.8 and 4.9.

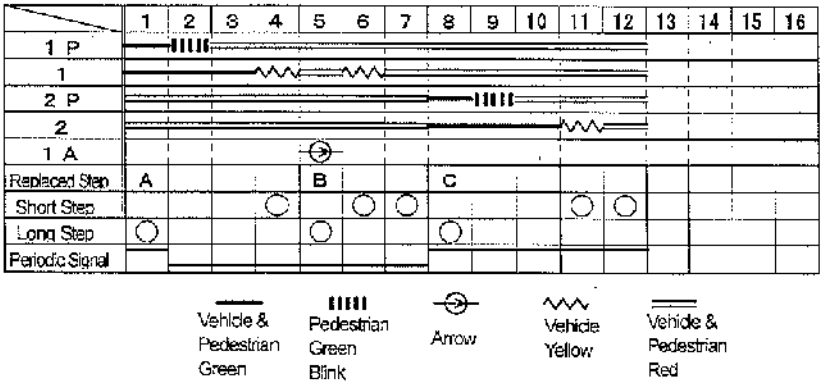


Figure 4.8 Phase/Step Diagram

For programming, connect diodes in each step 1 to 16 applying to each item on the left.

① 1G~4G :Indicates Vehicle Green Lamps.
② 1Y~4Y :Indicates Vehicle Yellow Lamps.
③ 1PG~4PG :Indicates Pedestrian Green Lamps.
④ 1PW~4PW :Indicates Pedestrian Green Blinks.
⑤ 1A~4A :Indicates Arrow Mark Lamps.
⑥ ENS :Indicates the final step.
⑦ SB1~SB3 :Specify the step replacing the indication time.
⑧ L35 :Specify the short steps.
⑨ M8 :Specify the long steps.
⑩ SD1,SD2 :Specify periodic signal outputs.

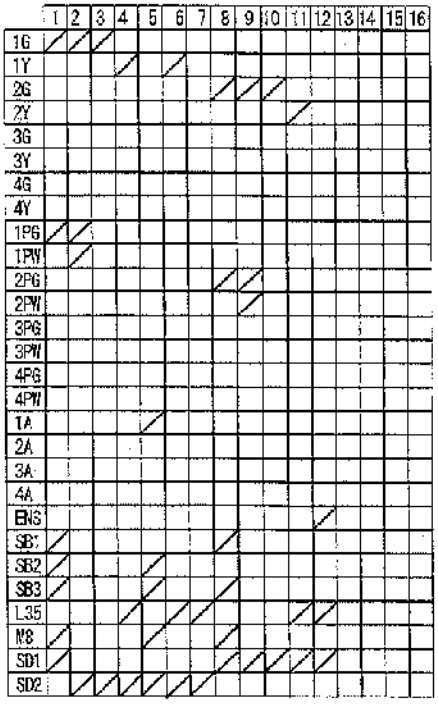


Figure 4.9 Phase Program Unit

(1) Lamp color(①~⑤)

Specifies the lamp color indicated in each step. If "G" or "Y" is not programmed, Red lamp is specified.

Also, in the specification of the Pedestrian Green Blink, program both of "G" and PW".

(2) Final step (⑥)

Specify the final step.

(3) Step of "P2" and "P3" (⑦)

Specify the step of "P2" and "P3". A maximum of 5 steps (A to E) is replaceable by the specification. Program it according to the following Figure 4.10.

	STEPS P2 & P3				
	A	B	C	D	E
SB1	○		○		○
SB2	○	○			○
SB3	○	○	○	○	

Program in Mark ○

Figure 4.10 Assignment of steps for P2 & P3

(4) Mounting Time (⑧,⑨)

Specifies the short (0.95 to 35 sec.) and long (8 to 110 sec.) steps. If neither of them are specified, it is to be the medium step (0.95 to 110 sec.).

4.3.2 Method of Setting the G-G program

Describes the setting example of G-G program in Figure 4.11 applying to the phase step figure in Figure 4.8. It specifies the combination of "blue phase" which are not allowed to indicate at the same time. It is possible to set a maximum of 6 combinations. The blue phase for G-G error to blue phase specified in "0-1" line is specified in "0-2" line. For example, when a vehicle green light (1G) on major road is turned on, pedestrian a green light (1PG) is also turned on but a arrow mark light (1A) on the major road, vehicle green light (2G) on the minor road and pedestrian green light (2PG) crossing on the major road should be turned off. Therefore "1A", "2G" or "2PG" in "1-2" line is specified in "1-2" line to "1G" in "1-1" line. This applies to "1PG". "1PG" as well as "1G" is specified in "1-1" line.

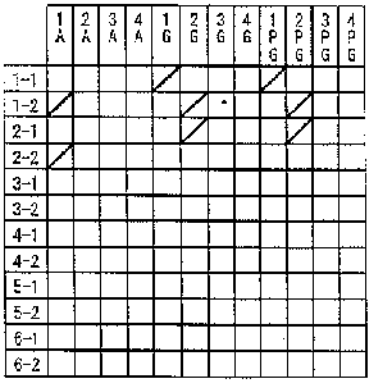


Figure 4.11 Program Unit

Using the same way as the above, you set all the combination. If "2G" to "1G" is set by G-G setting, it is same setting as "1G" to "2G" set by G-G setting. Omit the setting like this.

4.3.3 Method of Setting the Flashing Color

Describes the setting example of the flashing color in Figure 4.12 applying to phase step figure in Figure 4.8. Normally Vehicle Yellow light is set on the major road (1Y) and Vehicle red light is set on the minor road and it starts flashing with the red light (2R) on the minor road.

Flashing Operation starts with the light color specified in "F2".

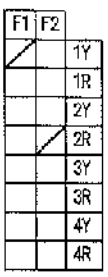


Figure 4.12 Flashing Color

4.3.4 Setting Method for Periodic Signal Output (⑩)

Set periodic signal (A or B signal) output when the controller is used as an interlocking master unit.

Setting SD1 generates "A" signal output in the set step. (1 and 8-12 in Fig. 4.8)

Setting SD2 generates "B" signal output in the set step. (2-7 in Fig. 4.8)

Complete setting for all steps to set periodic signal output. If a step is unset, a slave unit connected judges the unset step to be an error, and does not activate an interlocking operation.

4.4 Setting of Panel Operation Unit

4.4.1 Method of Setting Indication Time

A setting pin for "10's digits" (a figure on the left side) and "1's digits" (a figure on the right side) in each indication seconds are inserted into the applying holes in the indication time setting machine of each pattern (P1, P2, P3).

However don't remove a setting pin for a running step (Step Pilot Lamp is turned on). It may cause Flashing Operation ("FAIL" pilot lamp is turned on).

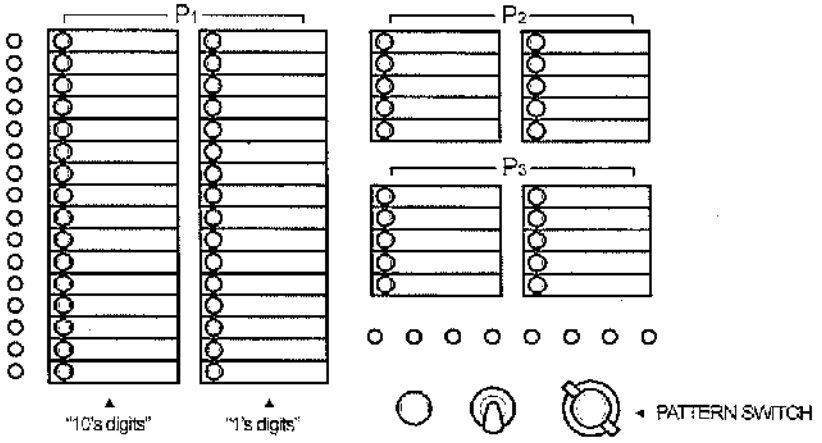


Figure 4.13 The Indication Time Setting

4.4.2 Method of Changeover of A Pattern

Selects the auto control (AUT), pattern 1 (P1), pattern 2 (P2), pattern 3 (P3) of time switch at the pattern switcher. After switching, the selected pattern works from the first step of the next cycle.

4.4.3 Method of Setting Time Switch

If you select "AUT" at the pattern switcher, the auto control of time switch (Independent Multi-Plan Operation) works. However, if the power of time switch is off, the time table is unset or the clock error has occurred, the regular cycle Operation of pattern 1 (P1) works.

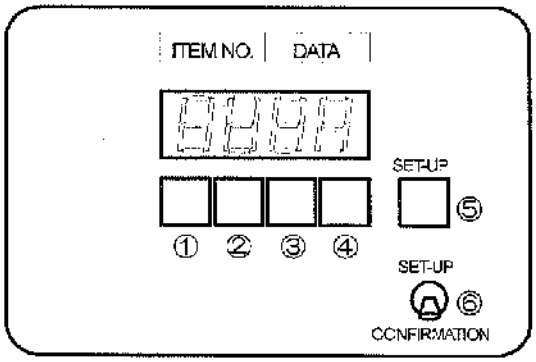


Figure 4.14 Time Switch Setting

(1) Set-up/CONFIRMATION switch ⑥ is set at "set-up".

(2) Entering the setting item selection key ① and ②, select the setting item number. Item number is specified Table 4.1.

(3) Entering the Constant key ③ and ④, enter the constant (time or pattern).

(4) If the entered constant is correct, confirms it by entering the setting key ⑤.

(5) Repeats (3) to (4) as many time as you need.

(6) When you finish all the setting, return Set-up/COMFIRMATION key ⑥ on "COMFIRMASION" side.

Table 4.1 – The setting item table of time switch

Item	Display (setting) content	Item	Display (setting) content
00	present time (h)	60	start time (h) of switch 6
01	present time (m)	61	start time (m) of switch 6
	(unused from 02 to 0F)	62	execution pattern of switch 6
10	start time (h) of switch 1		(unused from 63 to 6F)
11	start time (m) of switch 1	70	start time (h) of switch 7
12	execution pattern of switch 1	71	start time (m) of switch 7
	(unused from 13 to 1F)	72	execution pattern of switch 7
20	start time (h) of switch 2		(unused from 73 to 7F)
21	start time (m) of switch 2	80	start time (h) of switch 8
22	execution pattern of switch 2	81	start time (m) of switch 8
	(unused from 23 to 2F)	82	execution pattern of switch 8
30	start time (h) of switch 3		(unused from 83 to 8F)
31	start time (m) of switch 3	90	start time (h) of switch 9
32	execution pattern of switch 3	91	start time (m) of switch 9
	(unused from 33 to 3F)	92	execution pattern of switch 9
40	start time (h) of switch 4		(unused from 93 to 9F)
41	start time (m) of switch 4	A0	start time (h) of switch 10
42	execution pattern of switch 4	A1	start time (m) of switch 10
	(unused from 43 to 4F)	A2	execution pattern of switch 10
50	start time (h) of switch 5		(unused from A3 to AF)
51	start time (m) of switch 5	B0	Offset time (s)
52	execution pattern of switch 5		(unused from B1 to EF)
	(unused from 53 to 5F)	F0	Software version

※ Set offset seconds "B0" only for an interlocking slave unit.
When the number of seconds is set, the interlocking operation function is validated for through-day operations.

5.Cautions for Maintenance

5.1 Periodical Maintenance

Periodically maintenance and inspect the Traffic Signal Controller so that normal functions are performed. Major inspection items are as follows.

INSPECTION ITEM	INSPECTION DETAIL	STANDARD	INSTRUMENT	INSPECTION CYCLE
Check of power supply	1) Measure input voltage of power supply. 2) Measure output voltage of power supply. 3) Periodic signal voltage.	1) AC80~110V 2) DC4.8~5.2V 3) DC48V ±20% (Interlocking master unit : Between terminals A and B)	1) AC ammeter 2) DC voltmeter 3) DC voltmeter	1) Twice a year 2) Twice a year 3) Twice a year
Green-green Indication test	Check green-green Indication detection function.	All vehicle green lamps and pedestrian signal lamps should immediately go out while actuating Flashing Operation and lighting up Pilot Lamps "G-G" and "Step & Pattern immediately before abnormal".		Twice a year
Abnormal length test	Check abnormal length detection function.	After passing regulated time, vehicle green lamps and pedestrian signal lamps should go out while actuating Flashing Operation. Pilot Lamps "FAIL" and "Step & Pattern immediately before abnormal" should light up.	Stop watch	Twice a year
Manual Operation test	1) Check manual operation. 2) Check green-blinking cycles.	1) Step upon changeover should be maintained without skipping or faulty advancing. At this time, Pilot Lamp "Pattern" should go out. 2) Ten blinking cycles should be within 5±1 seconds.	Stop watch	Once a year
Indication time test	Check number of seconds for set cycle.	Within ±5% of set cycle.	Stop watch	
Flashing Operation test	1) Check Flashing Operation. 2) Check Flashing cycle.	1) Flashing Operation should Immediately be activated while lighting up Pilot Lamp "Flashing". 2) Ten blinking cycles should be within 10±2 seconds.	Stop watch	Once a year
Monitor Lamp test	Blinking of monitor lamp	Visually check for no Abnormal.	Stop watch	Once a year

INSPECTION ITEM	INSPECTION DETAIL	STANDARD	INSTRUMENT	INSPECTION CYCLE
Inspections on external and internal views	1) Check Abnormal, e.g. loose terminals & overheating. 2) Check for no panel deformation, loose mounting parts, etc. 3) Check for no soiling inside & outside of housing, peel of painting, rusting, nor deformation. 4) Loose connectors and connector bases. 5) Loose printed circuit boards. 6) Loose units. etc.	1)~7) Visually check for no Abnormal.		
Inspection of spare parts		Supplement parts, if insufficient		
Independent Multi-plan Operation test (with Multi-plan Unit mounted)	1) Pattern automatic selection test. 2) Pattern manual selection test. 3) Test for correcting Time Switch time.	1) After a pattern is switched, Changeover to a pattern indicated on Time Switch should be completed within a cycle. 2) Changeover to new pattern should be completed within a cycle from actuation of changing pattern. 3) Allowance of setting should be within ±5 min from set time.	Stop watch	

5.2 Precaution for Maintenance

(1) If you exchange the parts, units and print circuit board, be aware of the following things.

① If you exchange the main board of controller(MCU) or PDU Card, turn the Controller Power Switch "OFF".

⚠ CAUTION If you turn the Control Power Switch "OFF", the signal lamps will be turned "OFF".

② When you exchange the Time Switch, turn the Power Switch of unit "OFF".

③ When you exchange the Lamp Switch Unit (SSU), turn the Lamp Switch "OFF".
Each Lamp Switch Unit is common, but the phase is changed by the mounted position.

⚠ CAUTION If you turn it "OFF", the signal lamps will be turned OFF.
Be fully aware of the traffic flow.

④ Before replacing a component part, be sure to check a new replacing part for complete conformity with the same circuit and the same specifications as those so far used.

(2) As for the maintenance of the goods for maintenance, be aware of the following things.

① Do not store in high temperature and high humidity, and direct sunlight.

② Do not store where there are static charges. Especially as for each kind of base board, be sure to take the measures to cope with static charges.

③ Keep it free from mechanical stress like giving shocks by dropping and bumping.

5.3 Maintenance in Occurrence of Troubles

5.3.1 Maintenance Process

(1) In the case of signal error, confirm the following items first.

- The name of the intersection.
- Unusual phenomena. (ex. flashing light, light extinction, phase stop, double phases.)

(2) After arrival of the spot, confirm the following items.

- The fixed position of the switches.
- The lighting condition of the monitor lamps.
- The condition of the fuses and breakers.

(3) Check the power system. (AC input voltage, each kind of direct current voltage)

5.3.2 Tools and the Measuring Apparatus for Maintenance

(1) A set of tools. (A driver, a nipper, a pair of cutting radio pliers, a soldering iron)

(2) A tester, an oscilloscope.

(3) A key.

5.3.3 Substrate and Unit for Maintenance

(1) MB	:mother board
(2) MCU	:main base board in the Controller
(3) PDU	:phase data unit
(4) IFU	:interface unit
(5) PBO	:time switch
(6) SSU unit	:lamp driving unit
(7) Power Supply unit	:Control Power for A04-Type Multi-Plan system controller

5.3.4 Replacement Unit

(1) Primary exchange unit. (the items that maintenance men should household)

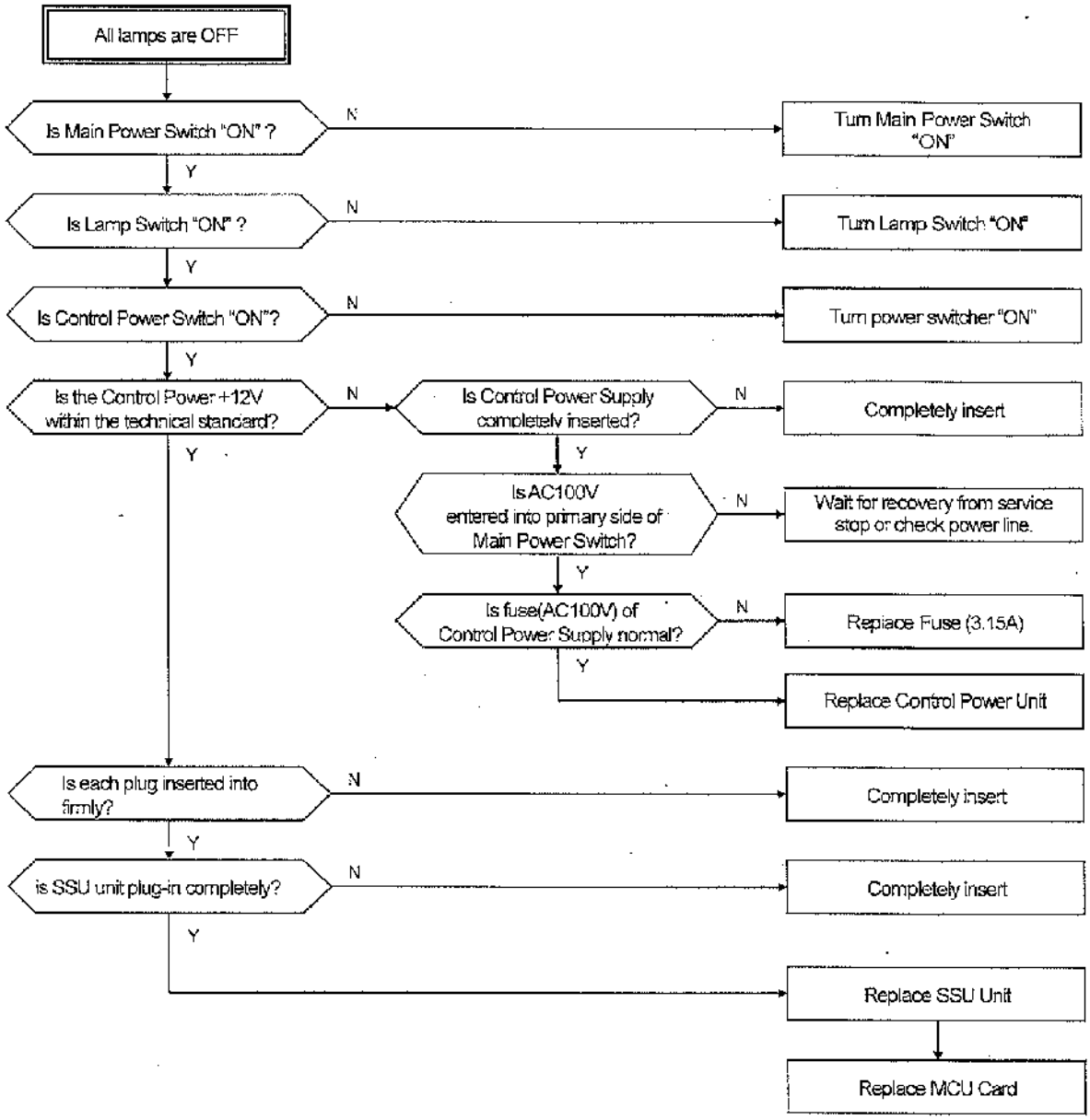
- Fuses
- ZNR
- Breakers
- PCB (MCU, PDU, IFU)
- Units (PBO, SSU, Power Supply)
- Manual pushbuttons

(2) Secondary exchange unit. (the items that maintenance men should household)

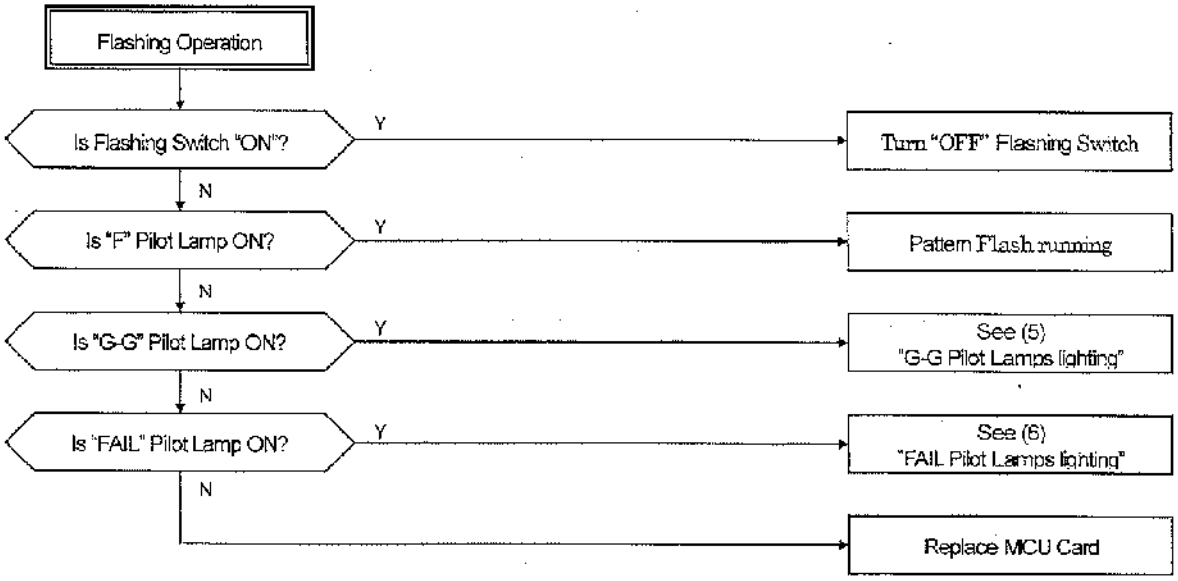
- PBC (MB)
- Controllers
- Flat cables

5.3.5 Flow Chart of Trouble Detection

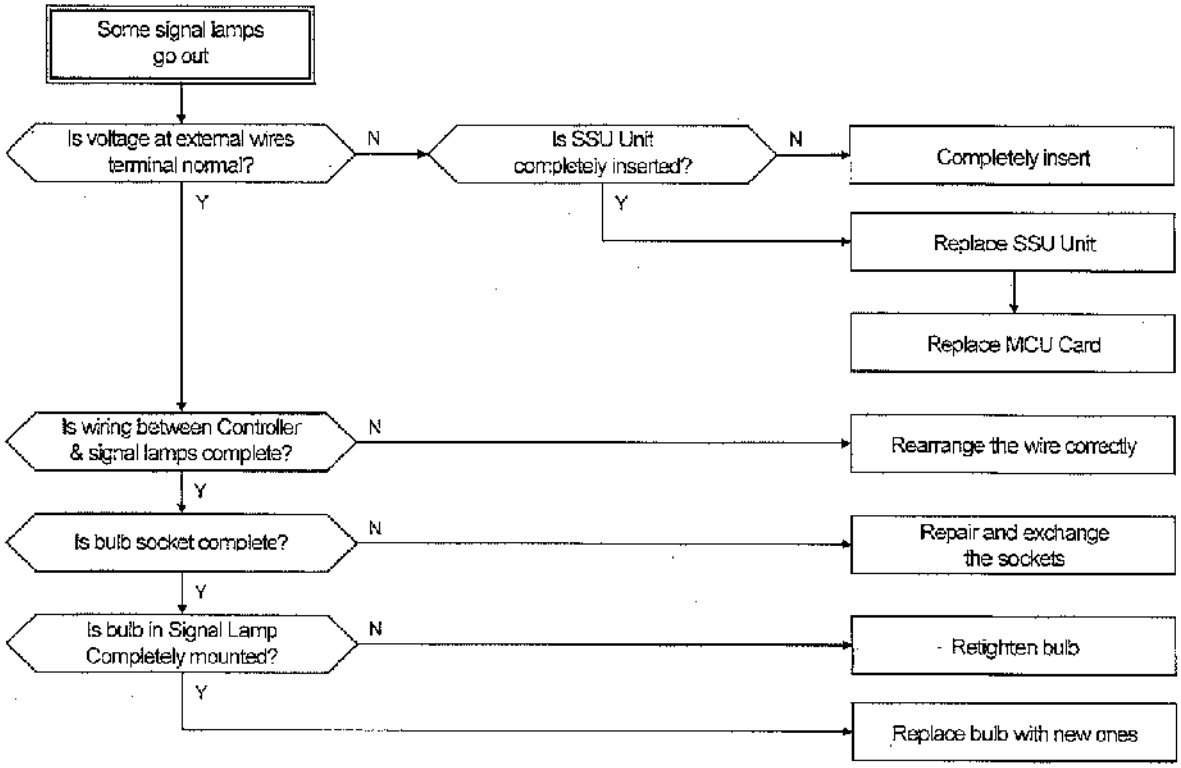
(1) Turning All Signal Lamps OFF



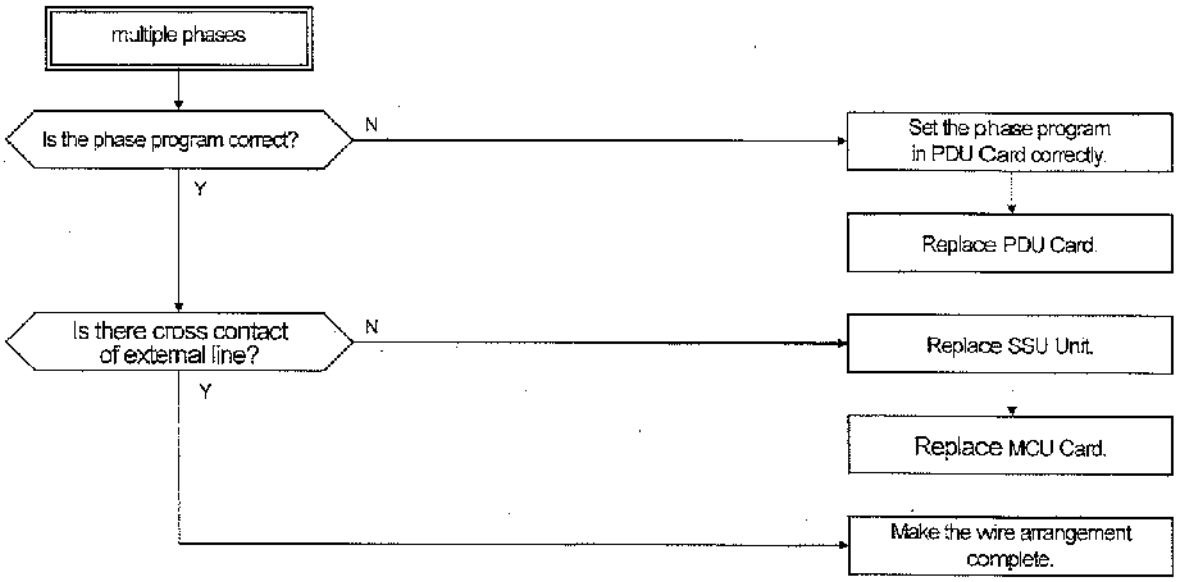
(2) Flash of the Signal Lamps



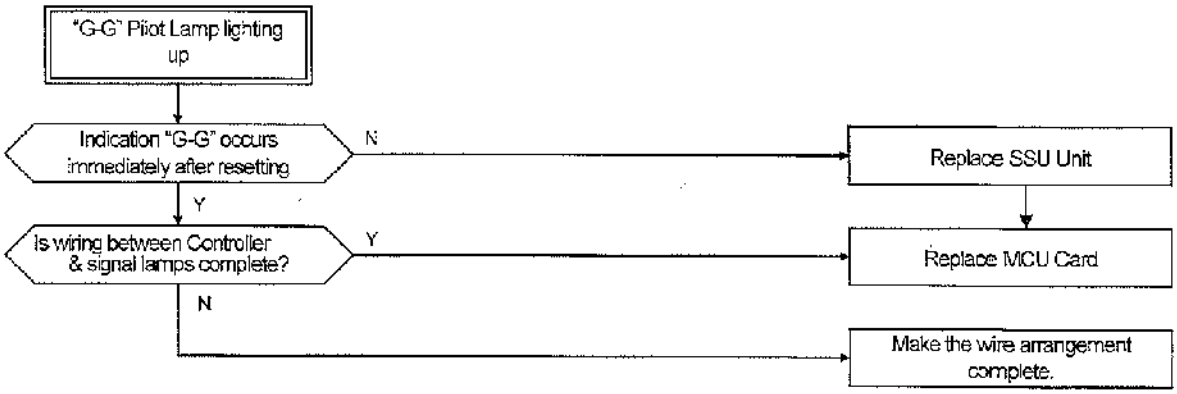
(3) Extinction of the Unit of Signal Lamps



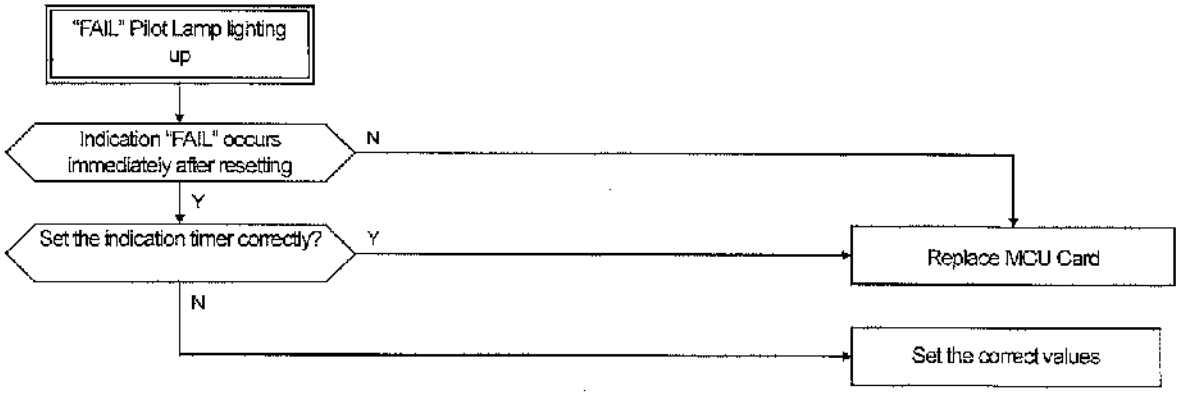
(4) Multiple Phases



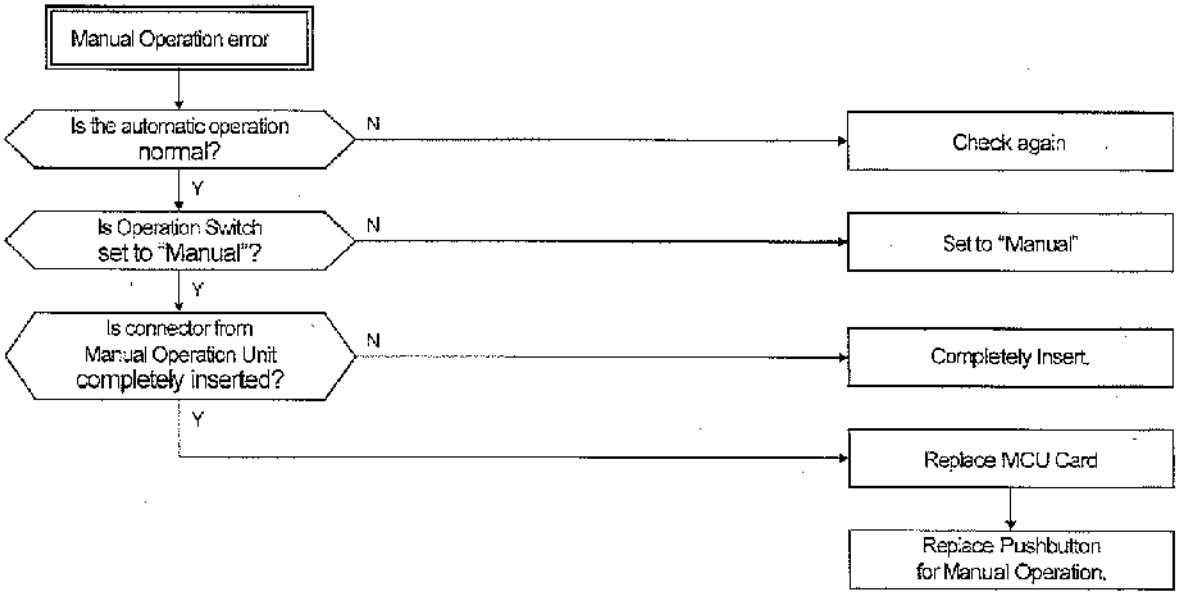
(5) "G-G" Pilot Lamp Lighting Up



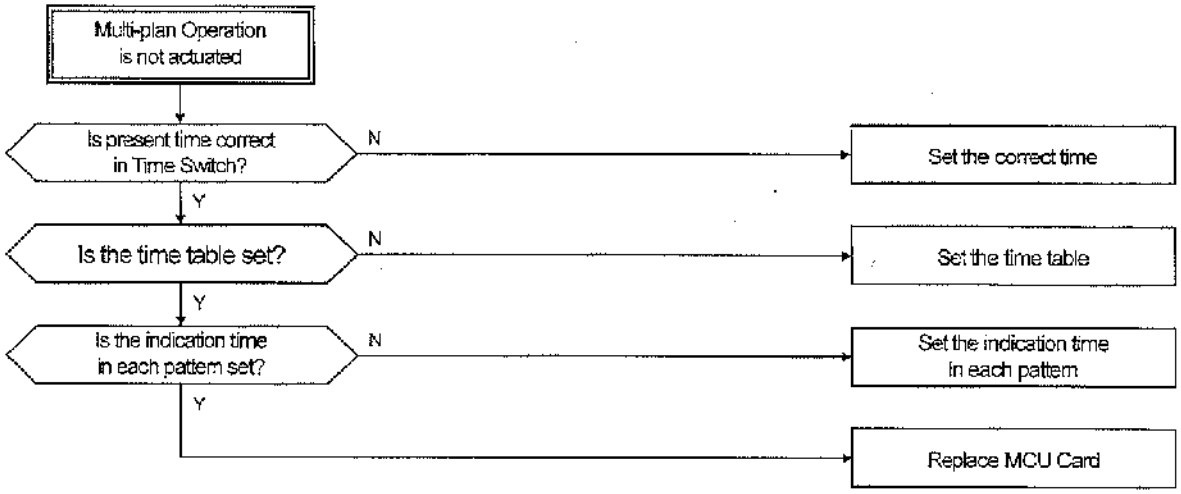
(6) "FAIL" Pilot Lamp Lighting Up



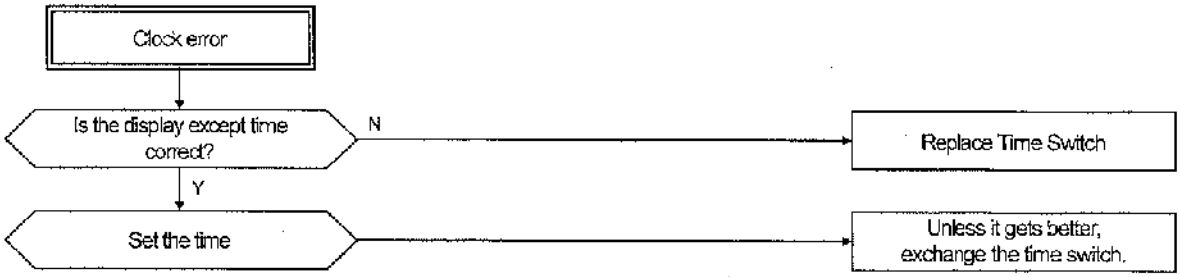
(7) Failure in Manual Operation



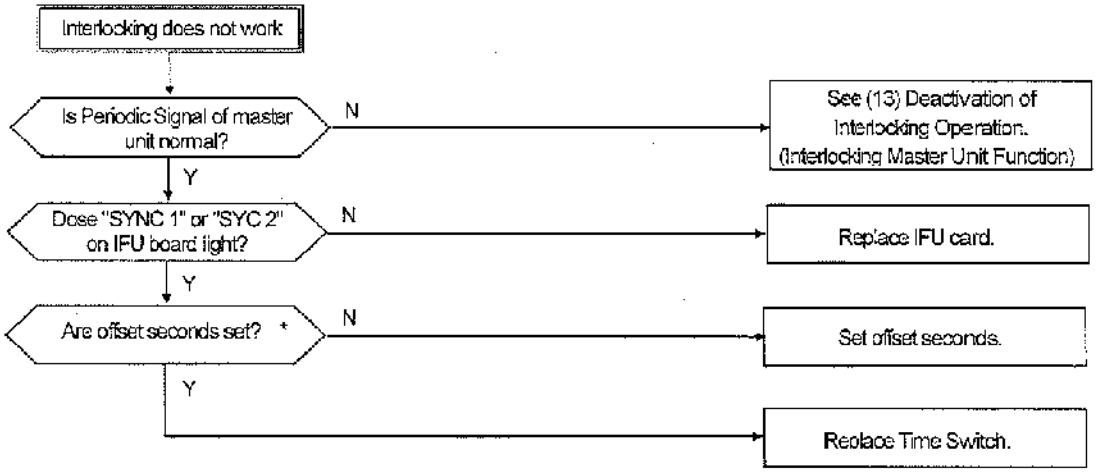
(8) Deactivation of Multi-Plan Operation



(9) Clock Error

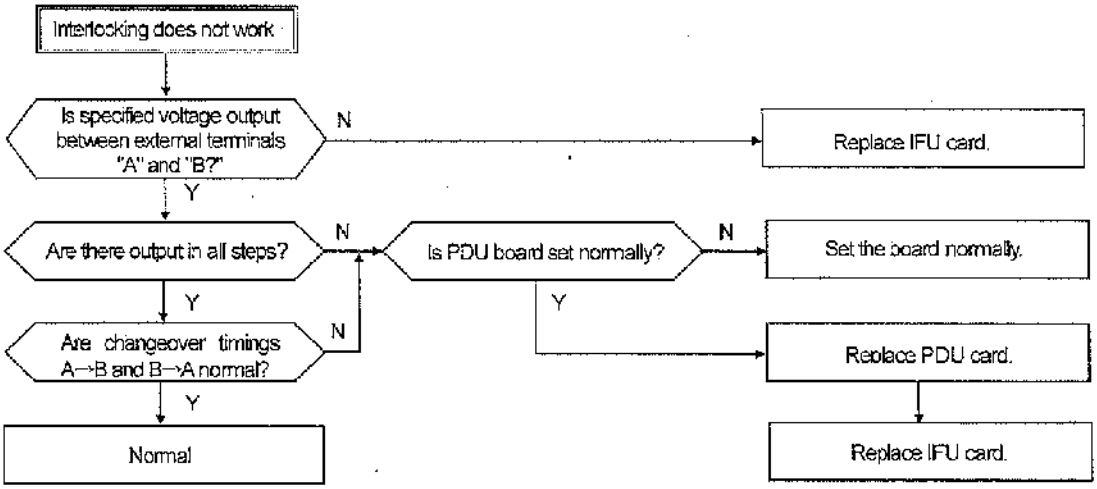


(10) Deactivation of Interlocking Operation (Interlocking Slave Unit Function)



* : Set the number of offset seconds in the range of 0 - 99 seconds, but not more than the cycle time of the master unit.

(11) Deactivation of Interlocking Operation (Interlocking Master Unit Function)



Operation Manual

of

TRAFFIC SIGNAL CONTROLLER

TYPE: CF4200

Carefully read this operation manual beforehand for proper machinery operation.

TSEC

Transportation Systems & Electric Co., Ltd.

Contents

1. Outline

1.1 General

The Traffic Signal Controller offered in this Manual is mainly designed for overseas use. The Traffic Signal Controller is designed so as to realize high reliability, stability, low power consumption, increase of maintainability and decrease of size by combining the exclusive LSI for traffic controlling equipment and high quality MPU.

Consequently, the Traffic Signal Controller can change time indication by preset controlling pattern in accordance with traffic conditions for weekdays, Saturday, holidays and special days. In other words, traffic signal control corresponding to the change of traffic characteristics is available by the Traffic Signal Controller.

The Traffic Signal Controller consists of *Control Unit*, *Power Supply Unit*, *Signal Light Switch Unit*, *Junction Unit* and *Manual Control Unit*.

1.2 Configuration

Components of the Traffic Signal Controller are shown in the following table.

Table 1-1 Components

Item	Device	Quantity
Main Unit	Cabinet Manual Operation Unit Control Unit Power Supply Unit Signal Light Switch Unit Junction Unit	1 unit
Accessories	Push Button for Manual Operation Key for Traffic Signal Controller Connection Cable Mounting Metal Fixture	1 unit
Spares	Fuse (3.15A for control power supply) Fuse (5A for maintenance)	2 pcs. 2 pcs.
Attached Documents	Test Report Operation Manual	As required

2. Function and Ability

2.1 Main Characteristics

1. Improvement of Reliability

High efficient integration of circuit and low power consumption semiconductor devices control interior evolution of heat causing faults and improve reliability.

2. Improvement of Maintainability

Making each unit component as connecter or plug-in style improves maintainability.

3. Improvement of Safety

The Traffic Signal Controller maintains safety of phase by the danger prevention (G-G protection) function.

4. Improvement of Time Accuracy

Quartz clock assures time accuracy.

5. Time Setting

Setting buttons of Control Panel enables easy time setting.

6. Watching Abnormality of Power Supply Unit

Backing up for instantaneous power failure for 10 ms or less is prepared. And abnormal signal output is not originated even for extraordinary voltage down.

2.2 Specifications

Table 2-1 Specifications

Input Power	90 to 110V AC, 50/60 Hz
Power Consumption	Approx. 50 VA (excl. signal light current)
Ambient Temperature	-20 to +60℃
Relative Humidity	40 to 90 %
Insulation Resistance	10 MΩ or more at 500 VDC between AC input terminal and the cabinet (Measured by disconnecting arrestor)
Insulation Voltage	1,000 VAC, 1 minute between AC input terminal and the cabinet (Measured by disconnecting arrestor).
Dimensions	400(W) x 800(H) x 300(D) mm
Weight	Approx. 70kg

2.3 Main Operation

2.3.1 Flashing Operation

"YELLOW" on the major road and "RED" on the minor road flash alternatively. During Flashing Operation, pedestrian signal lights and arrow signal lights turn off. Flashing Operation is carried out in the following situations:

* Flashing Operation Function is set on the Time Table (Function Flashing)
* Flashing Switch on the Control Unit is turned "ON" (Manual Flashing)
* "GREEN" are indicated to the 2 or more crossing traffic flows at the same time (G-G Confliction)
* Passing time of a step exceeds the prescribed value in Fail Safe Operation (Time Out)

2.3.2 Manual Operation

When the Operation Switch in the Manual Operation Unit is set to "Manual", signal indication proceeds step by step by pushing Manual Button. Unless Manual button is pushed, the indication on the current step continues.

2.3.3 Fail Safe Operation

This operation is directly controlled by the exclusive LSI without relying on the MPU. And the operation is carried out in the following situations:

* The clock works extraordinarily
* Multi-plan Operation Time Table is not set
* Pattern Changing Time Table is not set though the Multi-step Operation Time Table is set
* Passing time of a step exceeds the prescribe value in Multi-plan Operation

2.3.4 Multi-plan Operation

On Multi-plan Operation, the MPU selects the appropriate "Pattern" from Multi-plan Operation Time Table according to the "Program" from Pattern Changing Time Table. 10 patterns can be set in Multi-plan Operation Time Table, and 10 pattern-changings can be set in Pattern Changing Time Table.
This operation is carried out when both Multi-plan Operation Time Table and Pattern Changing Time Table are set.

2.4 Function and Ability of Each Unit

2.4.1 Control Unit

The Control Unit controls indication of each function, processing of input and output signals and signal lights. The main print circuit board (LPC Card) is installed on the back of the Control Unit Panel.

1. Indicating Function

The situations of operation are indicated by indicators and display as follows.

a) Executing item monitor lamp
b) Data indicator
c) In-operation indication lamp
d) Error indication lamp (MPU, G-G Confliction, Time Out)

2. Operations

Operations are carried out as the flow chart shown the Figure 2-1. The operation is relied on the position of switches and signal conditions.

a) Action when the Main Power is switched on or Reset Button is pushed

After the Main Power is switched on, power is recovered after power failure, or Reset Button is pushed, the Traffic Signal Controller confirms the position of FLASHING SWITCH on the Control Unit Panel. If the switch is “FLASH ON” side, Flashing Operation starts immediately. If not, each “RED” of all the traffic signal turns on for about 5 seconds (“Initial All Red Indication”).

Then, the Controller confirms the position of OPERATION SWITCH on the Manual Control Unit. If the switch is “MANUAL” side, Manual Operation starts. If not, Multi-plan Operation or Fail Safe Operation starts. “Which operation starts” is depends on the setting of 2 kinds of time table (see “2.3.4 Multi-plan Operation”).

b) Action in unusual status

i: If “GREEN” are indicated to the 2 or more crossing traffic flows at the same time, the Traffic Signal Controller forces to turn off all “GREEN” indication immediately, and starts Flashing Operation. In this case, the error monitor lamp, “G-G”, lights on.

ii: If passing time of a step exceeds the prescribed value in Fail Safe Operation, the Traffic Signal Controller forces to turn off all “GREEN” indication immediately, and starts Flashing Operation. In this case, the error monitor lamp, “TIME OUT”, lights on.

iii: After removal the causes of faults, Flashing Operation ends by pushing the Reset Button.

c) Operation change

Operation change is carried out safely without switching off the power supply. The priority of operations is classified from Flashing Operation, Manual Operation, Multi-plan Operation and Fail Safe Operation. Each operation except Flashing Operation is carried out in order and continuously without skipping the current steps.

3. Setting of Step, Pattern and Pattern-changing

The each step duration and pattern can be set at the Control Unit Panel.

a) Step

Duration of step can be set from one second to 99 seconds. The accuracy is ± 3 % of the set value.

b) Pattern and Pattern-changing

10 patterns (P1 – P9, PA) can be set on the Multi-plan Operation Time Table. A pattern consists of durations of each step.

10 pattern-changings can be set on the Pattern Changing Time Table. A pattern-changing consists of applicable patterns and its starting time.

Totally seven Kinds of Day type are available (Weekdays, Saturday, holidays and four special days). Each Kind of Day type can have 10 pattern-changings.

4. Pattern for Fail Safe Operation

The pattern for Fail Safe Operation is set as Pattern 0 (P0) and it is changeable. However, P0 is not selectable at Multi-plan Operation.

5. Watching of Step duration

Watching of the maximum duration and the minimum duration of each step is available. There are 3 types of step, Short, Middle and Long. The type of each step is set before shipment, and is depends on what kind of signal indicates on the step. For example, YELLOW step is Short step, Vehicle GREEN step is Long step.

If passing time of a step exceeds the prescribed value in Multi-plan Operation, operation is changed to Fail Safe Operation. If in Fail Safe Operation, the exclusive LSI detects Time Out error and starts Flashing Operation.

Table 2-2 Type of Steps and Watching Duration

Monitoring time / Step	Maximum time (sec.)	Minimum time (sec.)
Short step	10	0.95
Middle step	110	0.95
Long step	110	6

6. Signal Light Phase Plan

The Signal Light Phase Plan is set as “Signal Phase Data”. It is set before shipment and not-changeable. The maximum number of step is 30 and the maximum connectable Signal Light Switch Circuits are 24.

7. Clock and Calendar

The clock for controlling date and time operates correctly by back-up condenser even for the following power failures.

* Power failure continuing within 12 hours
* Power failure within 30 minutes occurring repeatedly over 12 hour cycle

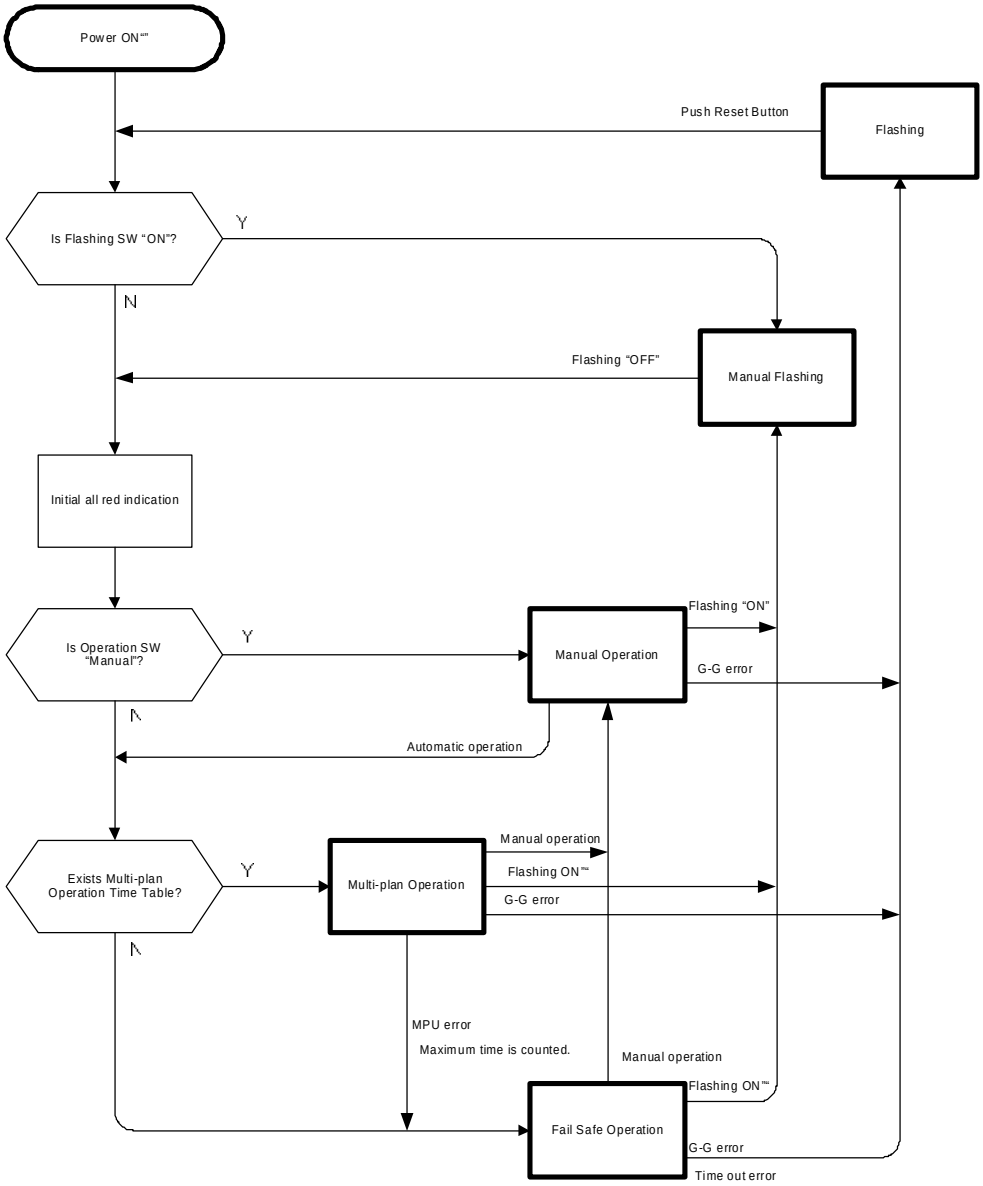


Figure 2-1 Flow Chart of Operations

2.4.2 Power Supply Unit

The Control Power Supply Unit is plug-in type and supplies necessary power stably.

1. Input 90 to 110 VAC, 50/60 Hz ± 5Hz, single phase
2. Output Rating voltage 5 ± 0.25 VDC, maximum rated current 3 A
   Rating voltage 12 ± 1 VDC, maximum rated current 0.2 A
3. Protection circuit:
   a) If the input voltage goes down to 80 VAC or less, the output is turned off.
   b) It protects the interior circuit against an abnormal input voltage over 150 V, half wave.
   c) It protects the operation for instantaneous power failure of 10 ms or less.
   d) It protects over voltage output for 5V DC circuit.
   e) It protects the Power Supply Unit against short circuit at the output terminal.

2.4.3 Signal Light Switch Unit

This unit consists of Signal Light Switch Units (SSU) and receives traffic signal light driving signal and lights the signal lights by the light switch elements.

1. This unit equips with 6 Light Switch Elements (for 3 vehicles, 2 pedestrians and 1 arrow) per unit.
2. It is plug-in type and maximally 4 units can be equipped. In other words, 24 Light Switch Units can be equipped maximally. The most upper shelf equips with the unit for phase 1 and the lowest shelf equips with the unit for phase 4.
3. Since monitor lamps for signal lights are prepared on the front panel, each phase can be confirmed even when signal lights are extinguished.
4. The maximum current for a signal switch element is 5A.
5. The input side and output side of the signal switch element are electrically isolated because solid state relays (SSR) are adopted and they prevent external surge. Also they decrease noise as low as possible when switching on and off the large current by switching the power for signal lights at near 0 volt.

2.4.4 Manual Control Unit

1. The following operations are carried out by the Operation Mode Selection SW.
   a) Manual Operation
   b) Automatic Operation
2. Manual Button only works when the Operation Mode Selection SW is turned to “MANUAL“ side.
   Signal indication precedes step by step every pushing Manual Button. Unless it is pushed, the indication in the current step continues.

2.4.5 Junction Unit

1. Terminals and Power Supply Switches are installed in the Junction Unit.
   a) Main Power Supply Switch is 30 A frame with rated current of 30 A at normal temperature and maximally 25 A can be flowed to the Signal Light Switch. (Maximally 20 signal lights are connectable.)
   b) The Signal Light Power Supply Switch can switch on and off the Signal Light Power Supply independently from other circuits.

3. Caution for Installation

3.1 Installation Location

1. Install the equipment convenient to execute Manual Operation for both location wise and direction wise.
2. Select the location and direction of the equipment so as not to disturb traffic flow of pedestrians and vehicles.
3. Select the location and direction of the equipment so that maintenance personnel can execute maintenance and inspection safely.

3.2 Installation Method

1. The Traffic Signal Controller can be installed as stand alone type or as pole-mounting type.
2. When the Traffic Signal Controller is mounted on a pole, mount it rigidly using the attached fittings for mounting.
3. Install the Traffic Signal Controller so that the door can be opened and closed freely.
4. Install cable conduits securely to the Traffic Signal Controller.

3.3 Caution for Installation

1. Main Power Switch

Before beginning installation work, be sure to turn “OFF” the Main Power Switch.

CAUTION

Working with the electric power “ON”, it may cause an electric shock or an unexpected injury. In case of a short circuit, the Traffic Signal Controller may be damaged.

2. Connection of Wires

Fix wires tightly to the terminal. In case of the metal penetration type terminal, pull the wire slightly after connecting it to the terminal to confirm that the wire is tightly connected.

3. Connection of Commercial Power Line

Connect the power line directly to the upper terminal of the Main Power Switch. Confirm the power supply voltage and connect the earth wire to the terminal marked “E” on the upper side of the Switch.

4. Connection of Signal Light Wires

Connect the wires carefully to the input terminals for Signal Lights at the terminal board.

CAUTION

Do not cause a short circuit between the power line and “COM” line because it may cause a serious damage to the Traffic Signal Controller and the wire.
Further, do not connect more than 7 wires for Signal Lights to an output terminal of Signal Light.

5. Grounding

Be sure that the earth resistance is 100Ω or less using the earth terminal (“E”) of the terminal board. Also, ground all the spare lines and messenger wires of the external cable etc. using “E” terminal. Such grounding is very effective in reducing damages by lightning and noise.

6. Insulation Test

Before starting the insulation test, disconnect earth wires from the grounding terminal.

7. Operation Test after Installation

During transportation of the Traffic Signal Controller, print circuit boards, connectors, relays, each unit may become loose, so be sure to check each connected part before installation.

Before confirming operation, see the next chapter, “4. Caution for Operation”.

4. Caution for Operation

4.1 Names and Explanation of Each Unit

4.1.1 Outlook and Inner Arrangement

The outlook and inner arrangement are shown in Figure 4-1.

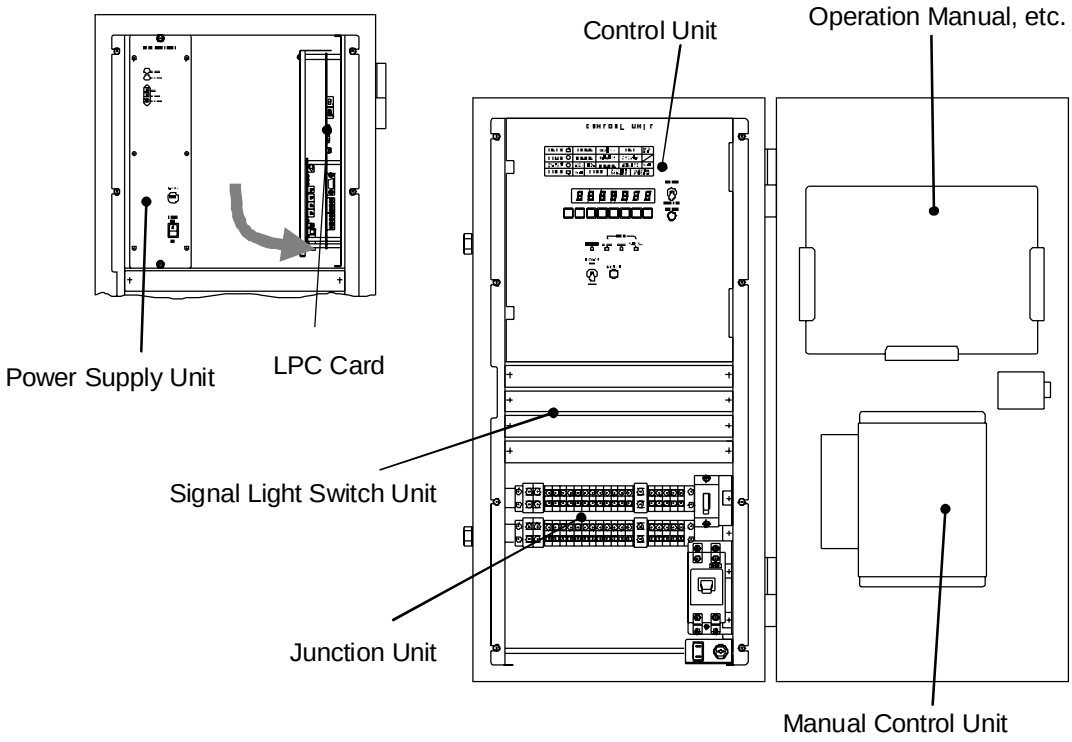


Figure 4-1 Outlook and Inner Arrangement of Traffic Signal Controller

1. Opening and Closing of Main Door

As for opening and closing the Main Door and door of the Manual Control Unit, use the key for Traffic Signal Controller. For unlocking, turning them clockwise. The doors are automatically locked when they are closed. Confirm the click sound by closing the door strongly.

2. Interior Arrangement

The Manual Control Unit is located at the back of the Main Door.

The Control Unit, Signal Light Switch Unit and Junction Unit are arranged from the top in the Traffic Signal Controller.

The interior arrangement is shown in the figure above. LPC Card is installed at the back space of the Control Panel, and the Control Power Supply is installed at the left part of the back space.

4.1.2 Control Unit

Figure 4-2 shows the front panel of the Control Unit.

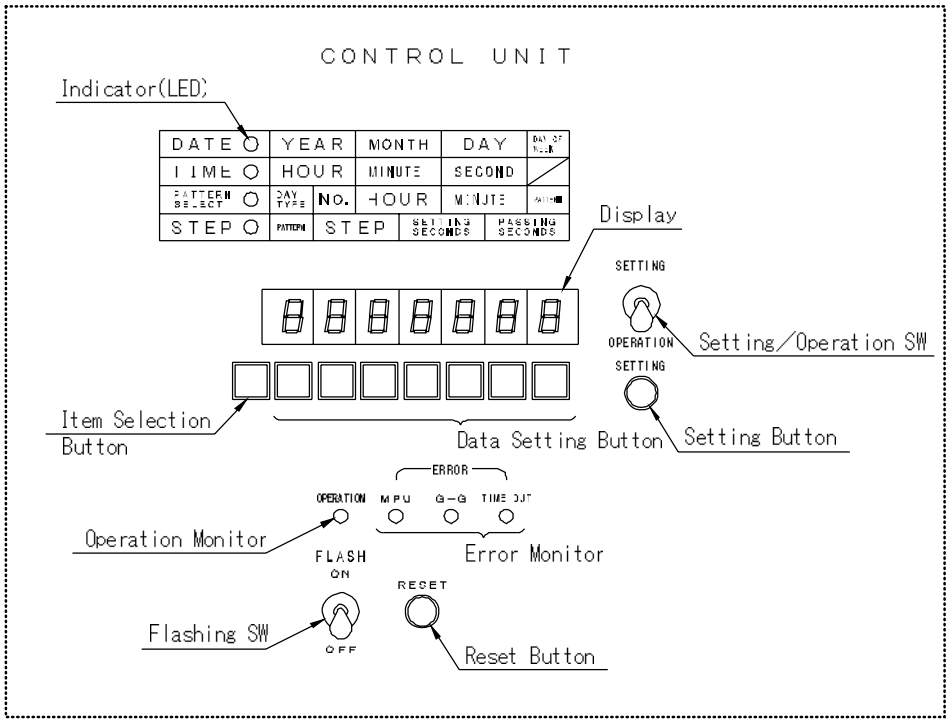


Figure 4-2 Control Unit Panel

1. Switches and Buttons

a) Setting/Operation Switch

It is necessary to turn Setting/Operation SW to “SETTING” side at each parameter setting. “Date”, “Time” and “Step Duration” are displayed immediately after the change and “Pattern Change” is carried out from the first step of the next cycle.

b) Flashing Switch

Flashing Operation starts immediately after Flashing SW is turned “ON” at any operation level. If the Switch is turned “OFF”, “Initial All Red Indication” starts.

CAUTION

Be fully careful to the traffic flow for this operation.
Consider the safety of driving vehicles and switch it during all red signal indication period.

c) Setting Button

It is only effective when the Setting/Operation SW is turned to “SETTING” side. Set each data finally to the value set by the Data Setting Button for inputting and changing. Adding that, set the above mentioned value by the setting button. If the number display lights continuously after it has flashed once when the button is pushed, it means the setting is effectively done. If the indication continues flashing, the setting is invalid. In this case input again by confirming the input value already executed.

d) Reset Button

Even when the “Error Monitor” is lighting, error is canceled by pushing this button if the cause of the error is already removed. In the case G-G error and timer error are removed, “Initial All Red Indication” starts.

e) Data Setting Button

It is used for inputting Data from the Control Unit Panel. It is only effective when Setting/Operation SW is turned to “Operation” side.

f) Item Selection Button

It changes the indication item to indicate on the Data Display or item to set the Data. Each time the Button is pushed, the indication of the Item Selection Indicator also changes relatively to the button operation.

2. Monitoring Items

a) Item Selection Indicator

The Item Selection Indicator corresponding to the indication on the Data Display turns ON. When the main power is turned on, the executing operation is indicated and each time when the item change key is pushed, indication changes from “Date” to “Executing Condition” in order.

b) Operation Monitor

Red color LED lights in Multi-plan Operation. In other operation stage, the Monitor flashes.

c) Error Monitor

It lights at the errors of MPU, G-G and TIME OUT.

d) Data Display

The present values of each Data or executing operation (passed period in seconds) are indicated in relation to the Item Selection Indicator.

4.1.3 LPC Card

Figure4-3 shows the side view of the LPC Card.

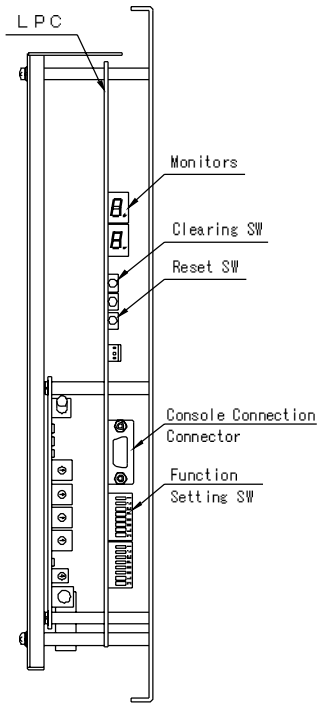


Figure 4-3 LPC Card (Side View)

1. Switches

a) Clearing Switch (Pushbutton SW, white)

It is used for clearing all the data already set. Push the Reset Switch at the same time when the Clearing SW is being pushed.

b) Reset Switch (Pushbutton SW, red)

It is used for resetting MPU.

2. Indicators

WD	It flashes if MPU operation is normal. If abnormal, it lights on continuously or lights off.
Error of Date and Time	Lights when date or time is incorrect or abnormal.
Synchronized	Lights when the interlocking signal synchronizes with master signal.
Proceeding of Step	Lights when a step is proceeding to the next step.
G-G test	Flashes when G-G test is being executed.
PG 1 to 3	Each of them indicates the page of ROM under execution.
Step Indicator	The executing step is indicated when the MPU is in error and controlling is executed by the exclusive LSI.

4.1.4 Power Supply Unit

Figure 4-4 shows the front panel of the Power Supply Unit.

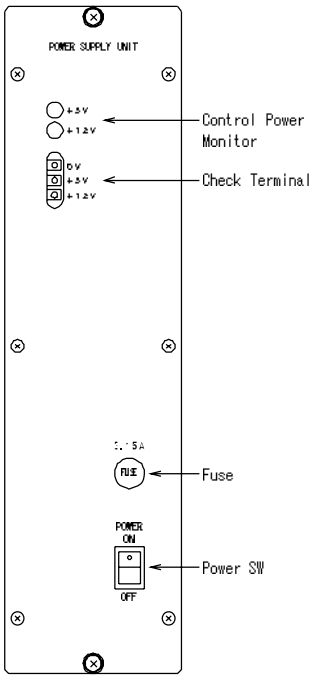


Figure 4-4 Front Panel of the Power Supply Unit

1. Power Switch

Setting the switch “ON”, the Power Supply Unit supplies Control Power (+5V), and Signal Light Switch Unit Power (+12V)

CAUTION

All the signal lights turn OFF when the Control Power Switch is turned OFF.
Be fully careful to the traffic flow when operating the Power Switch.

2. Control Power Monitoring Lamp

This lamp lights when the Power Switch is turned ON and +5V and +12V are supplied normally.

3. Check Terminal

+5V and +12V of Control Power can be checked by this terminal.

4. Fuse

It is for AC input and the capacity is 3.15A. When changing the fuse, use the correct one. The spare fuses are prepared in the back space of the main door.

4.1.5 Signal Light Switch Unit

It composes of Signal Light Switch Units (SSU) and the unit 1 (for the indication1), unit 2 (for the indication 2), unit 3 (for the indication 3) and unit 4 (for the indication 4) are installed from the top to bottom in order. One unit consists of Signal Light Switch Unit (for 3 vehicle signals, 2 pedestrian signals and 1 arrow signal) as a standard.

The Monitor Lamp installed at the front indicates the color indication signal received from the LPC Card and indication condition can be confirmed even extinguishing the signal lights by switching off the Signal Light Switch Unit.

4.1.6 Manual Control Unit

This Unit is mounted at the front of the Traffic Signal Controller.

Figure 4-5 shows the interior of the Manual Control Unit.

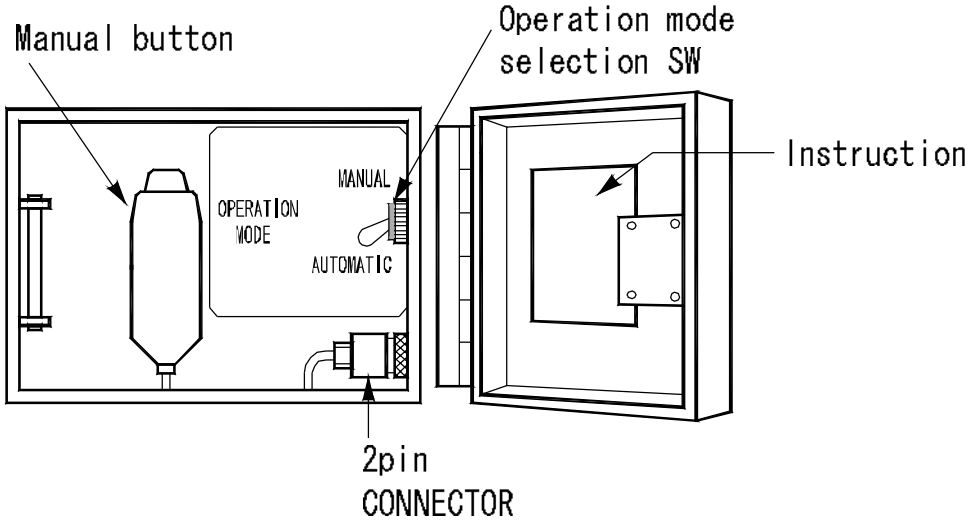


Figure 4-5 Manual Control Unit

1. Operation Mode Selection Switch

Normally the switch is set to “AUTOMATIC” side. Except for error or Manual Flashing Operation, when the Operation Mode Selection SW is turned to “Manual” side, the proceeding of step immediately stops and keep the step until Manual Button is pushed. The step can proceed step by step when the Manual Button is pushed.

Be sure to turn the Switch to “AUTOMATIC” side after finishing the Manual Operation.

2. Manual Button

It is used for Manual Operation.

3. Instruction

It describes how to operate the Traffic Signal Controller manually.

4.1.7 Junction Unit

Figure 4-6 shows the inner arrangement of the Junction Unit.

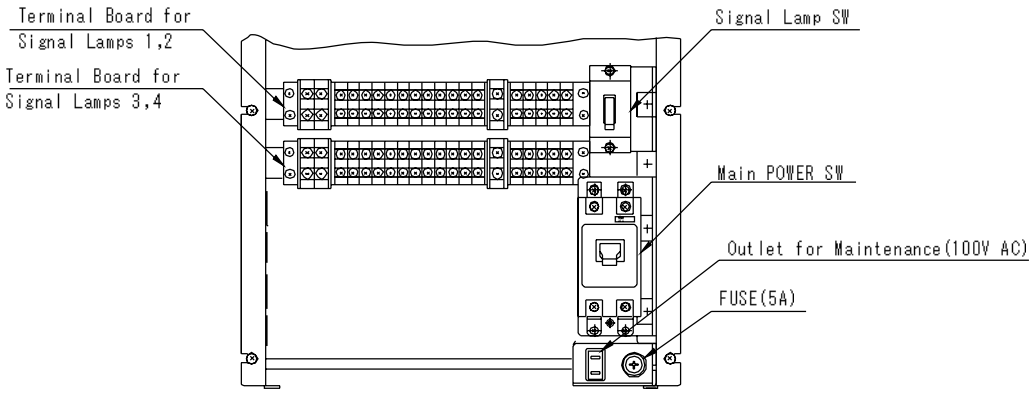


Figure 4-6 Inner Arrangement of Junction Unit

1. Main Power SW

Setting the switch “ON”, the commercial AC power (100v) is supplied to the Traffic Signal Controller. In the case AC power is supplied to the external equipment as Detectors etc. by utilizing the external connection terminals as AC1 and AC2, etc., power is not supplied when the switch is turned to “OFF” side. The maximum current capacity is 30A including the current of the Traffic Signal Controller itself.

2. Signal Light SW

When the switch is turned “ON”, signal lights light. Even though this switch is turned “OFF”, the Signal Light SW (SSU) and the Control Board continue working, be fully careful to the traffic flow when turning the Signal Light SW “ON”.

3. Terminal Board

The upper two Terminal Boards are for the Signal Lights and for wires up to 3.5 mm square connectable by screws.

4. Outlet for Maintenance and Fuse

Use the outlet for maintenance when AC power is necessary for maintenance work. When AC power is necessary, turn the Main Power Switch “ON”.

The fuse capacity is 5A.

4.2 Operation in Each Situation

4.2.1 Power On

1. Set each switch in each Unit as follows:
   * Operation Mode Selection SW (in Manual Control Unit) "AUTOMATIC" side
   * Flashing SW (on the Control Unit Panel) "OFF" side
   * Power SW (in Power Supply Unit) "OFF" side
   * Signal Light SW "OFF" side
2. After confirming that the power wires are correctly connected, set the Main Power SW "ON".
3. After indicating all red signal lights to all the traffic flows (Initial All Red Indication) for 5 seconds, the First Step starts.

CAUTION

Be sure to confirm the "Date" and "Time". If the commercial power has not been supplied for more than two days, date and time errors may occur.
In this case reset date and time again.
Be fully careful to the traffic flows in the operation of the Main Power Switch.

4.2.2 Manual Flashing Operation

Manual Flashing Operation is given with the highest priority than any other operation modes by setting the Flashing Switch "ON" and the indication of Data Display of the Control Panel extinguishes.

1. During the Manual Flashing Operation, pedestrian lights and arrow lights light off.
2. By setting the Flashing Switch "OFF", all the red signals turn on for 5 seconds, and then signal lights correctly operate from the first step.

CAUTION

As for the operation, be fully careful to the traffic flow.
Taking the driving vehicles into consideration, exec
operation during the indication of all red signal period.

4.2.3 Manual Operation

1. Set the Operation Mode Selection Switch on the Manual Control Unit to “MANUAL” side during the operation other than Flashing Operation. The step Indication executed at the moment when the switch turned is held.
2. The Signal Step proceeds step by step every time when the Manual Button is pushed. Unless the button is pushed, the Traffic Signal Controller holds the same step.
3. By setting back the Operation Mode Selection Switch to “AUTOMATIC”, the current step changes to Fail Safe Operation after the period given to the current step passes and a selected operation is executed from the next cycle.

4.2.4 Other Operations

As for Flashing, Fail Safe Operation and Multi-plan Operation, they are automatically selected and executed in accordance to the functional setting and operation conditions of the Traffic Signal Controller.

4.3 Setting and Adjusting

4.3.1 Planning of Indication and Setting of Fail Safe Operation Period

1. Setting Method

The setting is executed into the flash memory in the LPC Card at our factory. Since the flash memory can erase and rewrite data, ROM is not required. The data is preserved semi-permanently even electric power is not supplied.

CAUTION

In the case indication data is rewritten using the exclusive Console, Signal Lights extinguish as a general rule.

2. Phase Data

The following Data are included in the Phase Data. The exclusive software is necessary for preparing Phase Data.

a) Phase Data

Signal light output, pattern of Fail Safe Operation, type of step for watching duration, etc.

b) Controlling Data

Flag for distinguishing power supply frequency etc.

4.3.2 Setting of G-G and Flashing Color

1. Setting Method

G-G and Flashing Color are set at our factory. G-G setting is written in the flash memory of the LPC Card together with Phase Data.

2. G-G Detection

G-G setting is written in the flash memory with a complete data different from the conventional diode matrix method using hardware.

The confirmation of signal color for G-G detection is executed by the outputs for Signal Lights.

4.3.3 Changing of 50/60 Hz

As the Frequency Data is stored in the Phase Data, rewriting of the Phase Data is necessary when frequency must be changed.

4.4 Setting from the Control Unit Panel

Date, Time, Pattern, Pattern-changing and Step duration can be set and confirmed from the Control Unit Panel.

Each setting method is explained below.

For setting and confirmation, the Setting/Operation SW shall be set to “SETTING” side and the switch shall certainly be returned to ”OPERATION” side.

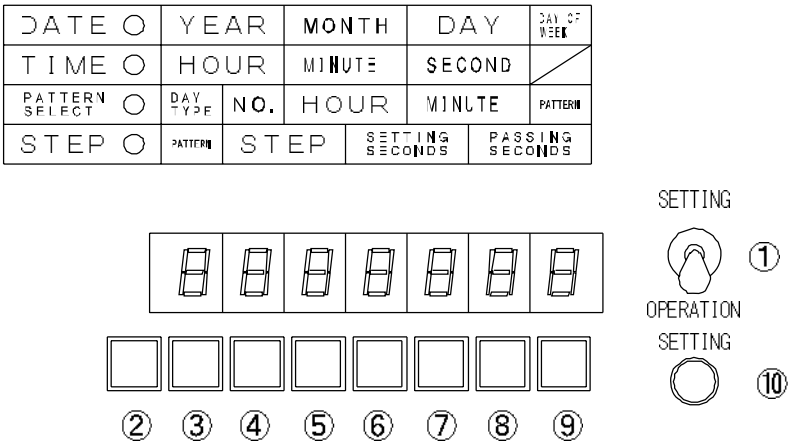


Figure 4-7 Panel Control Unit

4.4.1 Setting of Date

1. Push the Item Selection Button (No. 2) until “DATE” is selected.
2. Push the Item Selection Buttons (No. 3 and 4) and input “Year” (lower 2 digits of the Christian year).
3. Push the Item Selection Buttons (No. 5 and 6) and input “Month”.
4. Push the Item Selection Buttons (No. 7 and 8) and input “Date”.
5. Push the Item Selection Button (No. 9) and input a “Day of Week”. Each day of the week is as shown below.
   1:Mon, 2:Tue, 3: Wed, 4: Thu 5: Fri, 6:Sat, 7:Sun
6. Finally push the Item Selection Button (No.10) and fix the input values.

4.4.2 Setting of Time

1. Push the Item Selection Button (No. 2) until “TIME” is selected.
2. Push the Item Selection Buttons (No. 3 and 4) and input “Hour”.
3. Push the Item Selection Buttons (No. 5 and 6) and input “Minute”.
4. Finally push the Item Selection Button (No.10) and fix the input values.

4.4.3 Setting of Pattern

1. Push the Item Selection Button (No. 2) until “PATTERN SELECT” is selected.
2. Push the Item Selection Buttons (No. 3 and 4) and select “Kind of Day”.
   1: Weekdays 2: Saturday 3: Holidays
   4: Special day 1 5: Special day 2 6: Special day 3 7: Special day 4
3. Push the Item Selection Button (No. 4) and select “Number of Pattern-changing”.
4. Push the Item Selection Buttons (No. 5 and 6) and input “Hour”.
5. Push the Item Selection Buttons (No. 7 and 8) and input “Minute”.
6. Push the Item Selection Button (No.9) and select “Pattern”.
7. Finally push the Item Selection Button (No.10) and fix the input values.

4.4.4 Setting of Step Duration

1. Push the Item Selection Button (No. 2) until “STEP” is selected.
2. Push the Item Selection Button (No. 3) and select “Pattern”.
3. Push the Item Selection Buttons (No. 4 and No. 5 buttons and select “Step”.
4. Push the Item Selection Buttons (No. 6 and 7) and input “Step duration”.
5. Finally push the Item Selection Button (No.10) and fix the input values.

*1: The Data set for the Pattern 0 (Pattern of Fail Safe Operation) can be simply copied as Pattern 1 to A by using following action.

a) Push No. 3 button and select “Pattern” for copying the Data.

b) With the Data Setting Button (No. 9) of the most right side pushed (indicated as “CP” when this button is pushed), push No.10 button.

Caution: If this operation is executed for the pattern already set, the new content is set over the pattern already set.

*2: Erasing Function of Pattern

The Data set to each Pattern except Pattern 0 can be erased altogether by using following action.

1. Push the Item Selection Button (No. 3) and select the “Pattern” to erase.
2. Push the Item Selection Buttons (No.8 and 9) simultaneously (indicated as “CL” when these buttons are pushed) push No.10 button.

5. Cautions for Maintenance

5.1 Periodic Maintenance

Execute periodic maintenance so as to keep the essential functions for long time. The principal inspection items are as follows.

Table 5-1 Periodic Maintenance (1)

	No.	Inspection Item	Inspection Subject	Inspection Point	Measuring Equipment	Countermeasure against Defect
Appearance	1	Number	Spares	Number	Visual confirmation	Supplement Amend
	2	Damage	Cabinet	Burned, transformed, broken, cracked, etc.	Visual confirmation	Repair
	3	Rust at painted part	Cabinet Pipe	Coming off of paint, scratch, rust, etc.	Visual confirmation	Repair
	4	Rust at plated part	Cabinet Pipe	Coming off of the plated part, rust, scratch, blurring, etc.	Visual confirmation	Repair
Structure	5	Parts and fitting condition	Equipment	Chassis, transformation of card, loosening of fixed part Using up, weakening, damage of part, etc.	Visual confirmation	Repair
	6	Connector	Do.	Fixing condition of connectors for chassis and pushbutton	Visual confirmation	Repair
	7	Wiring	Do.	Wiring condition to the terminals Exposure and damage of wire core	Visual confirmation	Repair
	8	Terminal	Equipment	Fixing condition Loosening of fixed terminal	Visual confirmation	Repair
Operating condition	9	Monitoring	Monitor lamps in the Traffic Signal Controller	Indication corresponding to the operation of the Traffic Signal Controller	Visual confirmation	Repair
	10	Flashing Operation	Flashing Operation	Operation when Flashing SW is turned “ON” and “OFF”. Initial all red signals’ lighting period: 5 sec. Flashing cycle error: within 2 sec./10 terms	Visual confirmation Stop watch	Repair

Table 5-2 Periodic Maintenance (2)

	No.	Inspection Item	Inspection Subject	Inspection Point	Measuring Equipment	Countermeasure against Defect
Operating condition	11	Manual Operation	Manual Operation	Operation when the Operation Mode Selection SW turned to "AUTO" and "MANUAL". Flashing cycle error of green signal for pedestrians: within 1 sec./10 terms	Visual confirmation	Repair
	12	Fail Safe Operation	Fail Safe operation	Operates in accordance with the Fail Safe Operation time table (P0). Error: Within 3%of the cycle	Visual confirmation Stop watch	Repair
	13	Multi-plan Operation	Multi-plan Operation	Operates in accordance with the Multi-plan Operation time table. Error: Within 3%of the cycle	Visual confirmation Stop watch	Repair
	14	Input Voltage	Voltage at the input terminal Polarity	AC1-AC2: 90 to 110 V AC	Tester	Repair
	15	NFB	Temperature raise at the terminal, etc.	Appropriateness to the number of signal lights	Visual confirmation	Tightening of screw Repair
	16	Output voltage	Voltage for Power Supply Unit	+5V DC: 4.75 to 5.25 V +12V DC: 11.4 to 12.6 V	Tester	Repair
	17	Non -contact relay	SSU	Signal Lamp voltage Leakage current	Tester	Repair
	18	Arrester	ZNR etc.	Burned Appearance	Visual confirmation	Change
	19	Earth resistance	Between Traffic Signal Controller and earth	Type D	Earth resistance meter	Repair
Others		Cleaning	Cabinet	Removal of dust inside the cabinet Prevention of moisture Removal of unnecessary goods	Visual confirmation	

5.2 Caution for Maintenance

1. If you change parts, units and print circuit board, be aware of the following matters.
   a) If you change the main board of the Traffic Signal Controller (LPC card), turn the “Power Switch” of the Power Supply Unit “OFF”.

CAUTION

If you turn the Power SW of the Power Supply Unit “OFF”, the signal light turn “OFF”. Be fully careful to the traffic flow.

   b) When you change IFU cards, turn the switch of each card “OFF”.
   c) When you change Light Switch Unit (SSU), turn the Light Switch “OFF”. Even all units are replaceable each other, lamp indication differs depending on the position where the unit is installed.

CAUTION

If you turn it “OFF”, the signal lights turn “OFF”. Be fully careful to the traffic flow in operating the Light Switch.

   d) Before replacing a component part, be sure to check that the newly replacing part is as same circuit or same specification as one being used.

2. As for the storage of the maintenance parts, be aware of the following matters.
   a) Do not store the goods in high temperature, high humidity and under direct sunlight.
   b) Do not store the good in the place where static electricity may originate. As for print circuit boards, wrap them with aluminum foil so as not to be affected by the static electricity.
   c) Keep component parts from mechanical stress by dropping them or giving shocks

5.3 Maintenance in Occurrence of Trouble

5.3.1 Maintenance Process

1. In the case of signal error, confirm the following items first.
   * The name of intersection
   * Unusual phenomena (ex. flashing, extinction of light, proceeding stop of phase, double indication of phases)
2. After arriving at the site, confirm the following items.
   * The position of the switches
   * The lighting condition of the monitor lamps
   * The condition of fuses and breakers
3. Check the power system (AC input voltage, all kinds of DC voltage)

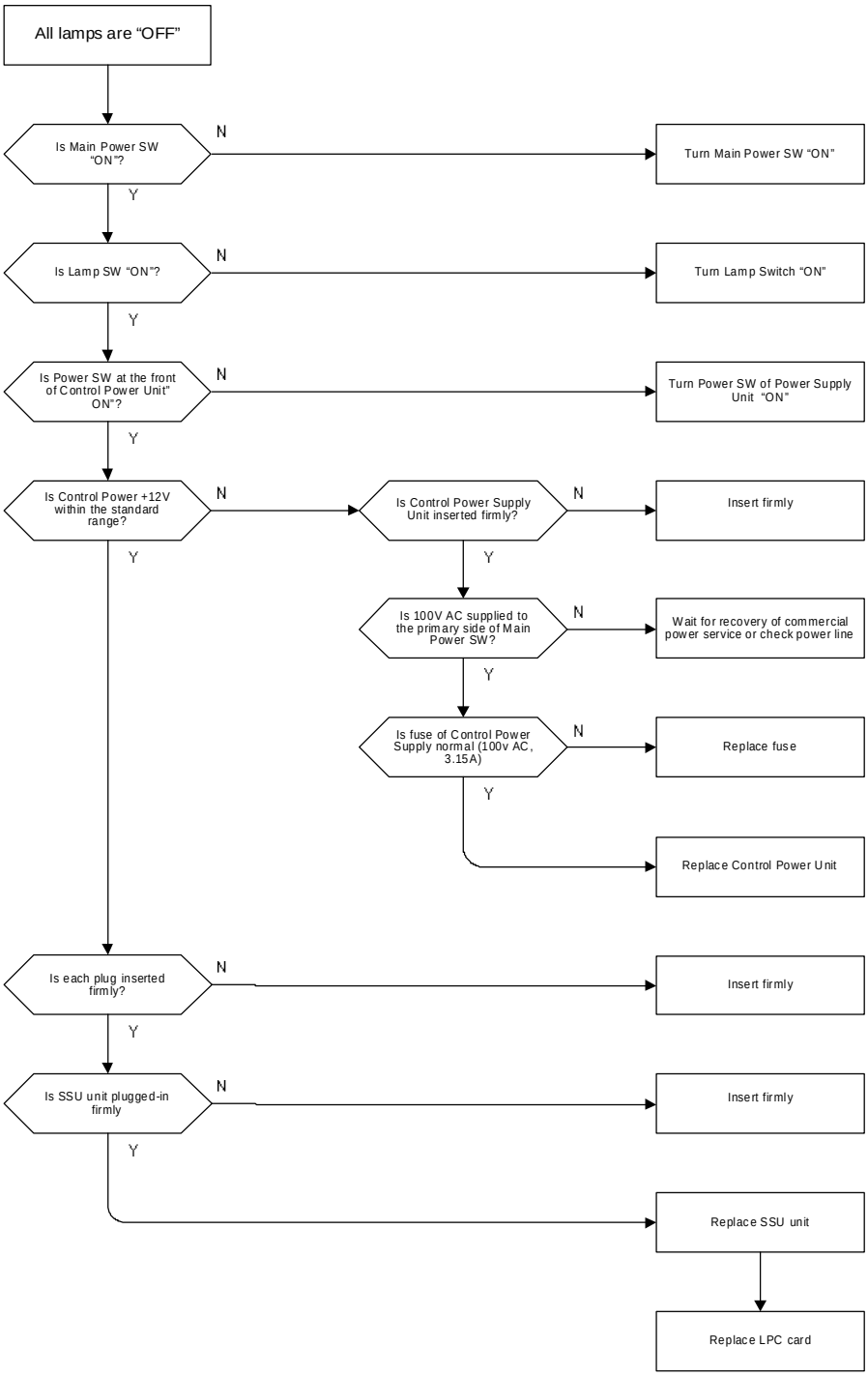
5.3.2 Tools and Measuring Apparatus for Maintenance

The tools and measuring equipment are as shown below.

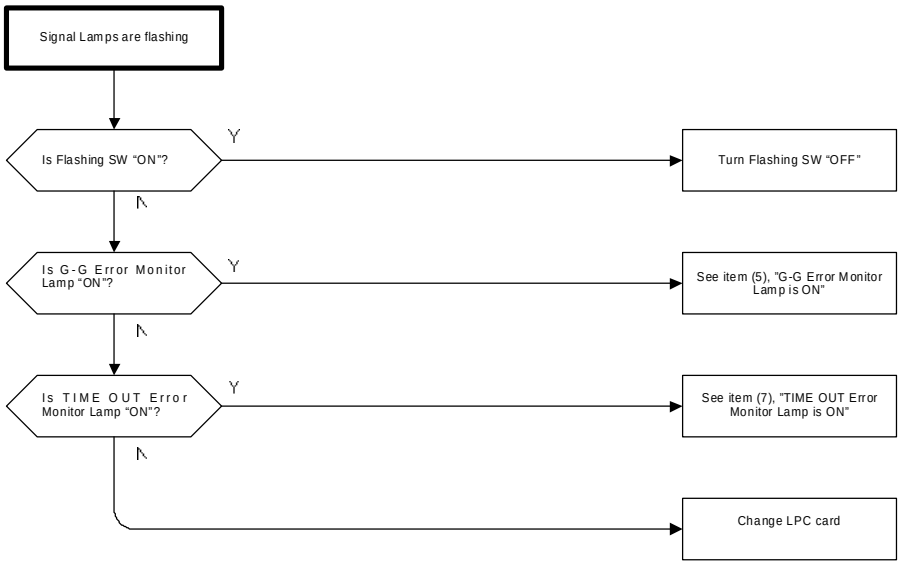
1. A set of tools (screw drivers, nipper, cutting pliers)
2. Tester
3. Stop Watch
4. Key for Traffic Signal Controller

5.3.3 Flow Chart of Trouble Detection

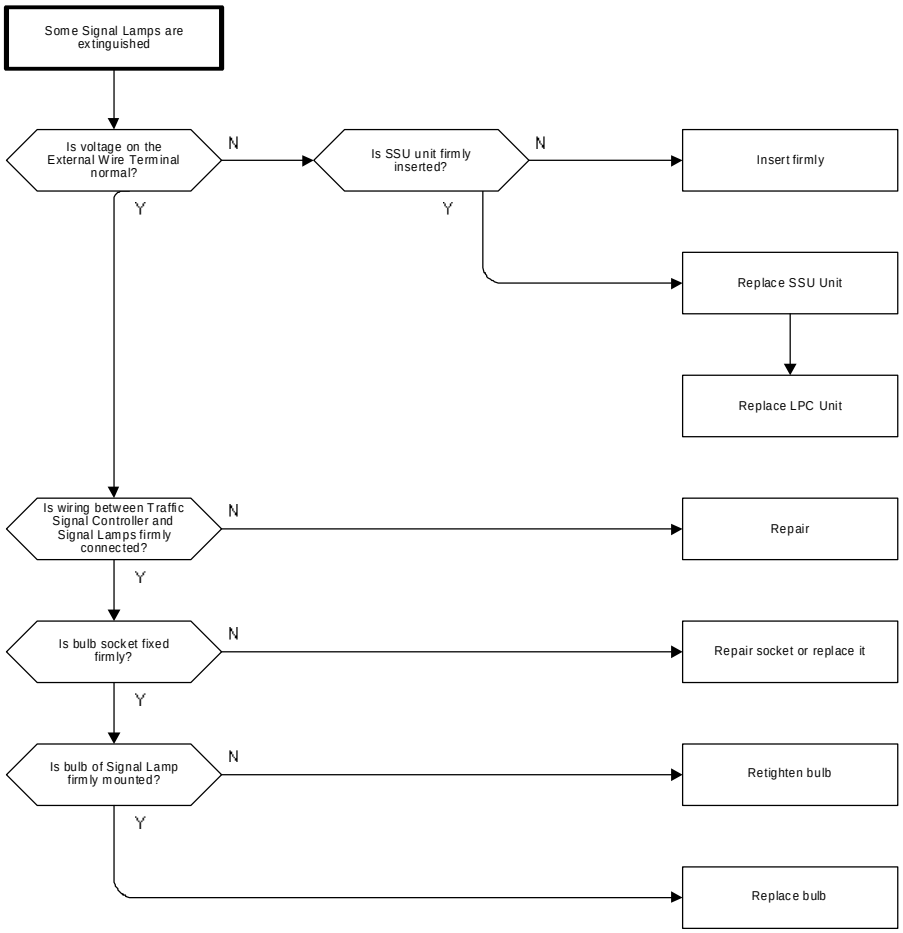
1. Turning All Signal Lights “OFF”



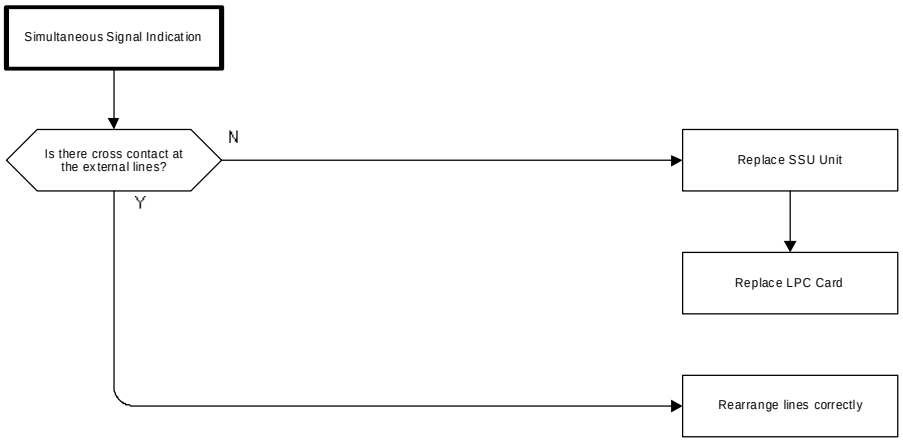
2. Flashing of Signal Lights



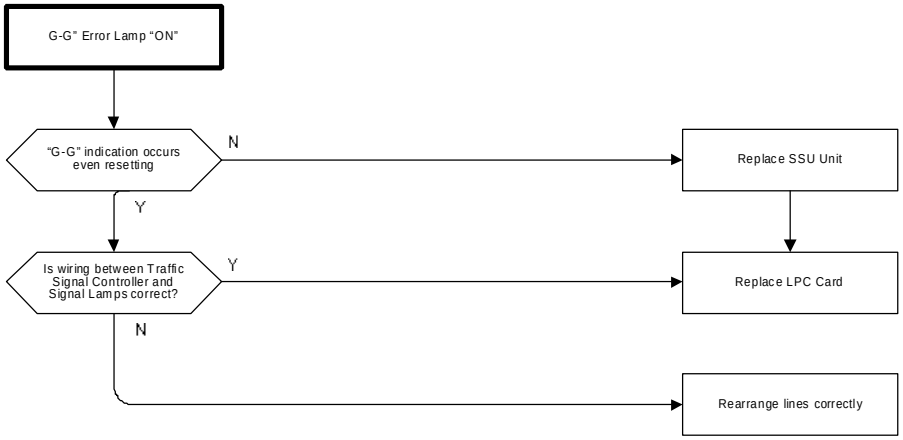
3. Partial Extinction of Signal Lights



4. Simultaneous Signal Indication



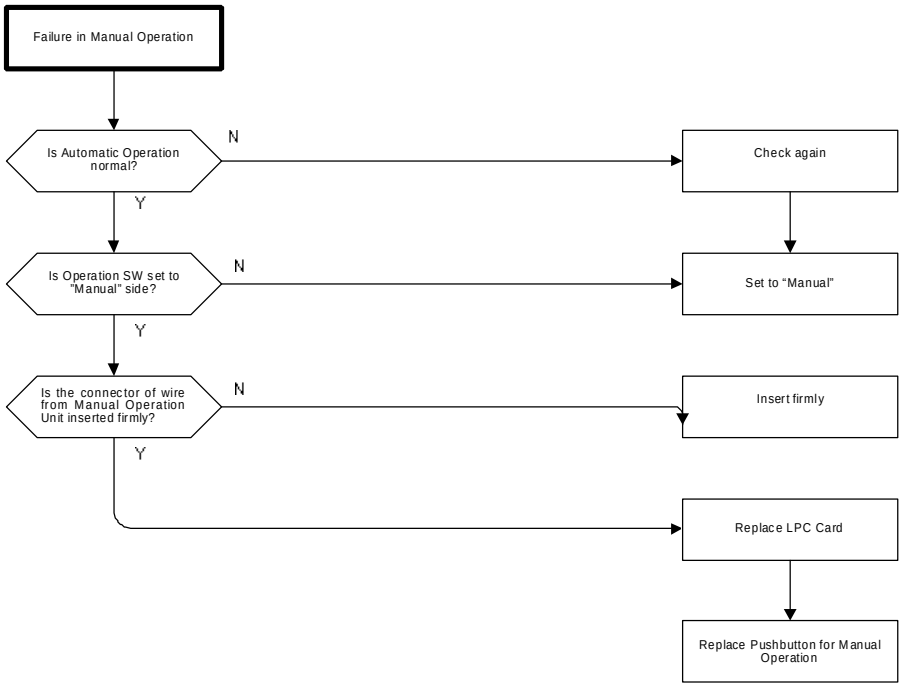
5. G-G Error Lamp “ON”



6. MPU Error Lamp “ON”

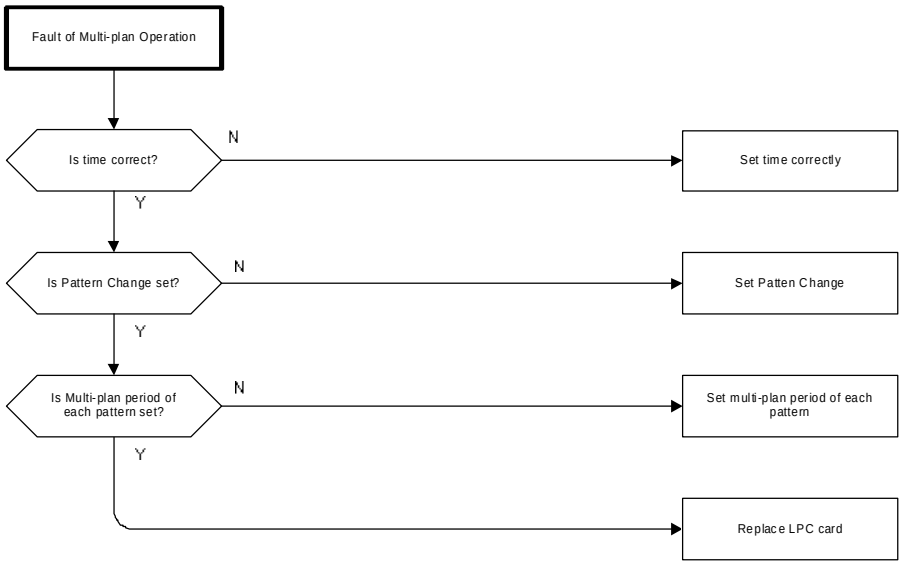
7. TIME OUT Error Lamp ”ON”

8. Failure in Manual Operation

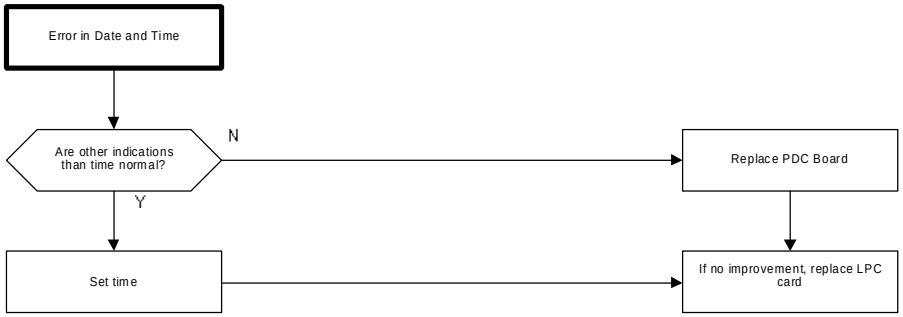


9. Failure in Fail Safe Operation

10. Fault of Multi-plan Operation

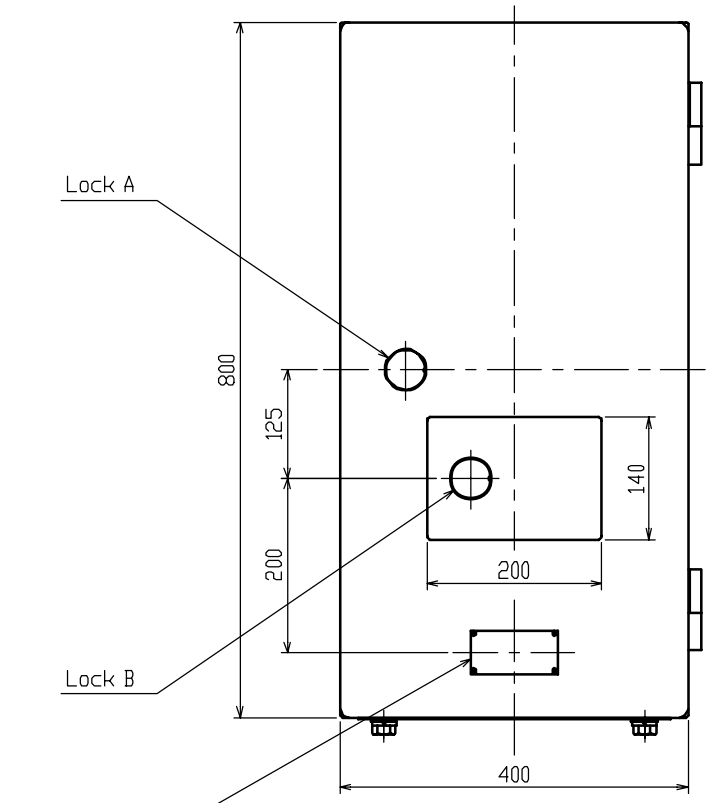


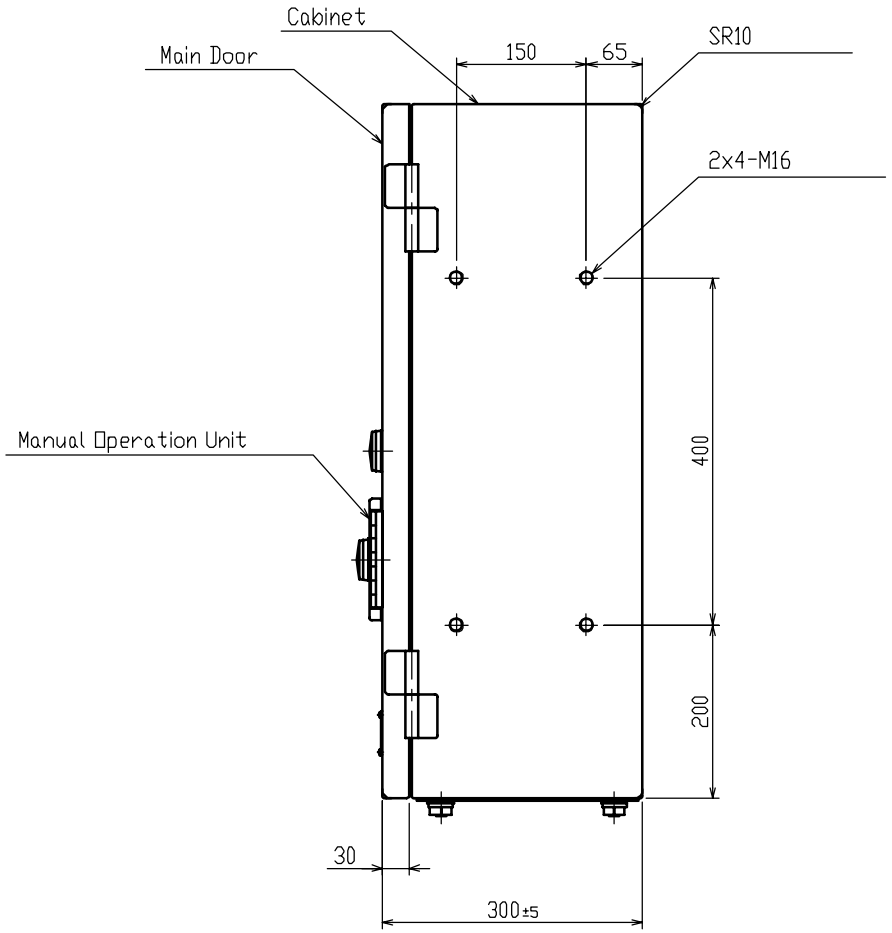
11. Error in Date and Time

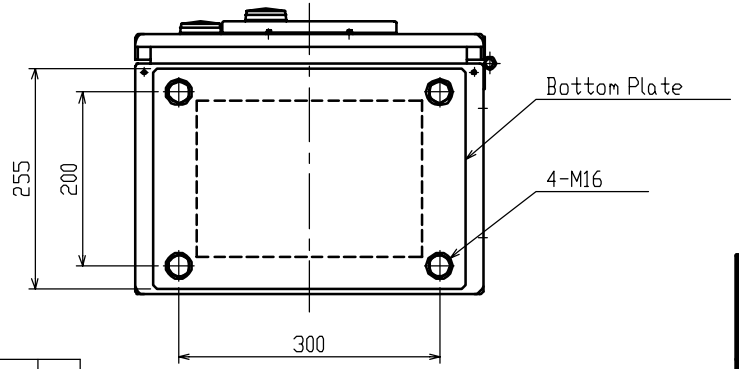


NO.	PARTS NAME	STANDARD · DRAWING NO.	MATERIAL	QTY	DESCRIPTION

NO.	PARTS NAME	STANDARD · DRAWING NO.	MATERIAL	QTY	DESCRIPTION







THIRD ANGLE PROJECTION	SCALE 1:6	UNIT mm	DATE 2006	05	18
APPROVED BY	CHECKED BY	DESIGNED BY	DRAWN BY		

TSEC TRANSPORTATION SYSTEMS & ELECTRIC CO., LTD JAPAN

TITLE: OUTWARD DRAWING of TRAFFIC SIGNAL CONTROLLER

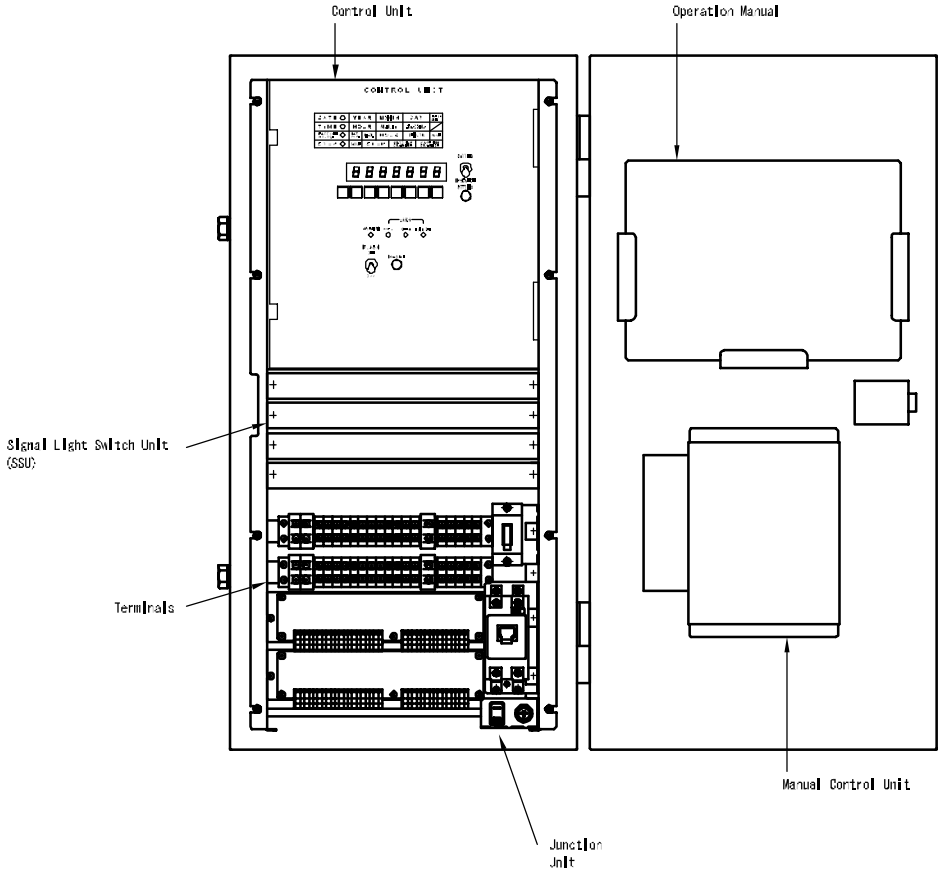
DWG. NO. CF4200A-001A

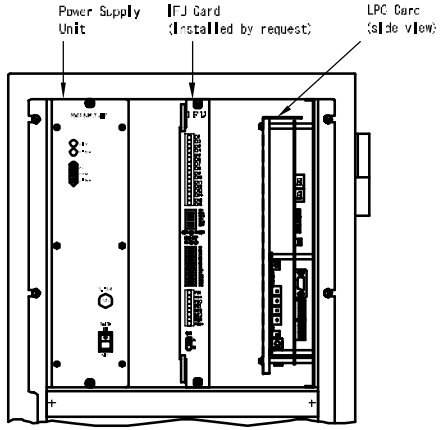
A060518

LTR	REVISION RECORD	DATE	DSGN	APKVD

NO.	PARTS NAME	STANDARD · DRAWING NO.	MATERIAL	QTY	DESCRIPTION

NO.	PARTS NAME	STANDARD · DRAWING NO.	MATERIAL	QTY	DESCRIPTION





3-221

A060518

LTR	REVISION RECORD	DATE	DSGN	APKVD

THIRD ANGLE PROJECTION	SCALE 1:6	UNIT mm	DATE 2006.05.18
APPROVED BY	CHECKED BY	DESIGNED BY	DRAWN BY

TSEC TRANSPORTATION SYSTEMS & ELECTRIC CO., LTD JAPAN

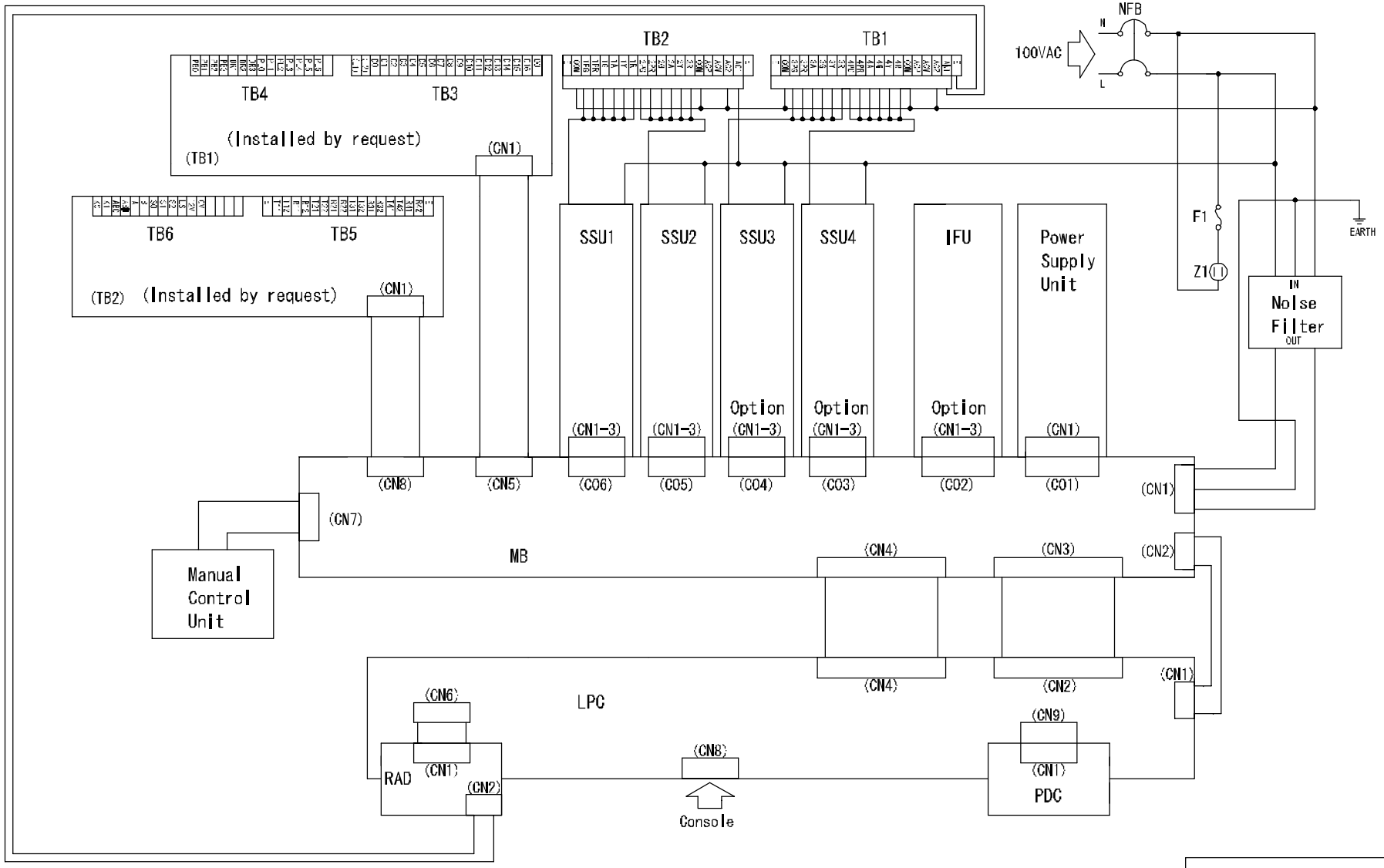
TITLE

INWARD DRAWING of TRAFFIC SIGNAL CONTROLLER

DWG. NO. CF4200A-002A

NO.	PARTS NAME	STANDARD · DRAWING NO.	MATERIAL	QTY	DESCRIPTION

NO.	PARTS NAME	STANDARD · DRAWING NO.	MATERIAL	QTY	DESCRIPTION



THIRD ANGLE PROJECTION	SCALE	UNIT	DATE
APPROVED BY	CHECKED BY	DESIGNED BY	DRAWN BY
Otomo	Sampei	Kishi	

TSEC TRANSPORTATION SYSTEMS & ELECTRIC CO., LTD. JAPAN

TITLE: BLOCK DIAGRAM of TRAFFIC SIGNAL CONTROLLER

DWG. NO: CF4200A-081A

LTR	REVISION RECORD	Ver.#	DATE	DSGN	APPVD

A060519

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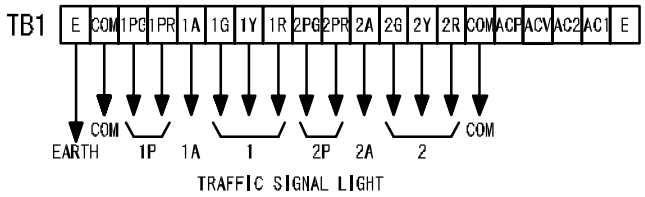
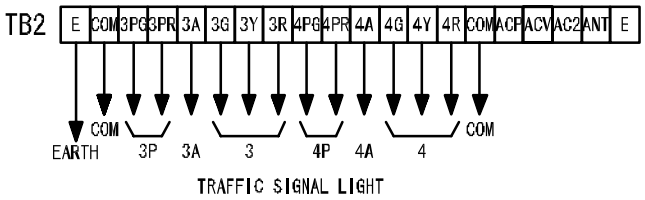
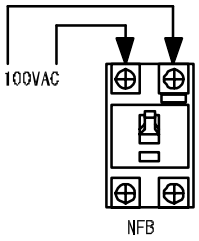
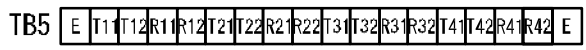
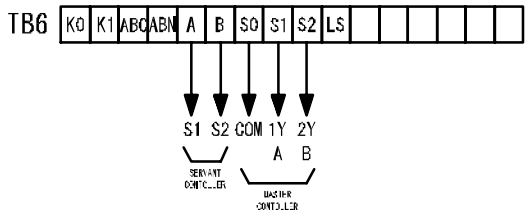








(Installed by request)



(Installed by request)

LTR	REVISION RECORD	Ver.*	DATE	DSGN	APRVD

THIRD ANGLE PROJECTION	SCALE	UNIT	DATE
APPROVED BY	CHECKED BY	DESIGNED BY	DRAWN BY
OTOMO	SAMPEI	KISHI	

A060519

TSEC TRANSPORTATION SYSTEMS & ELECTRIC CO., LTD. JAPAN

TITLE: CONNECTING of TRAFFIC SIGNAL CONTROLLER

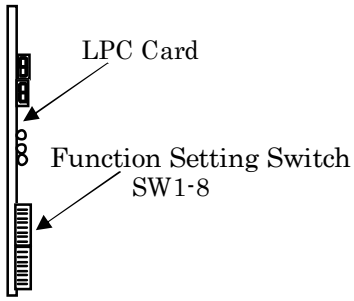
DWG. NO: CF4200A-802A

“RENDO”(Interlocked) Operation

Traffic signal controller interlock master traffic signal controller by electrical signal. So that platoons of vehicles can proceed through a continuous series of green light.

Setting procedure of “RENDO”(Interlocked) Operation

Set “RENDO”(Interlocked) Operation according to the following steps.



<1st step>

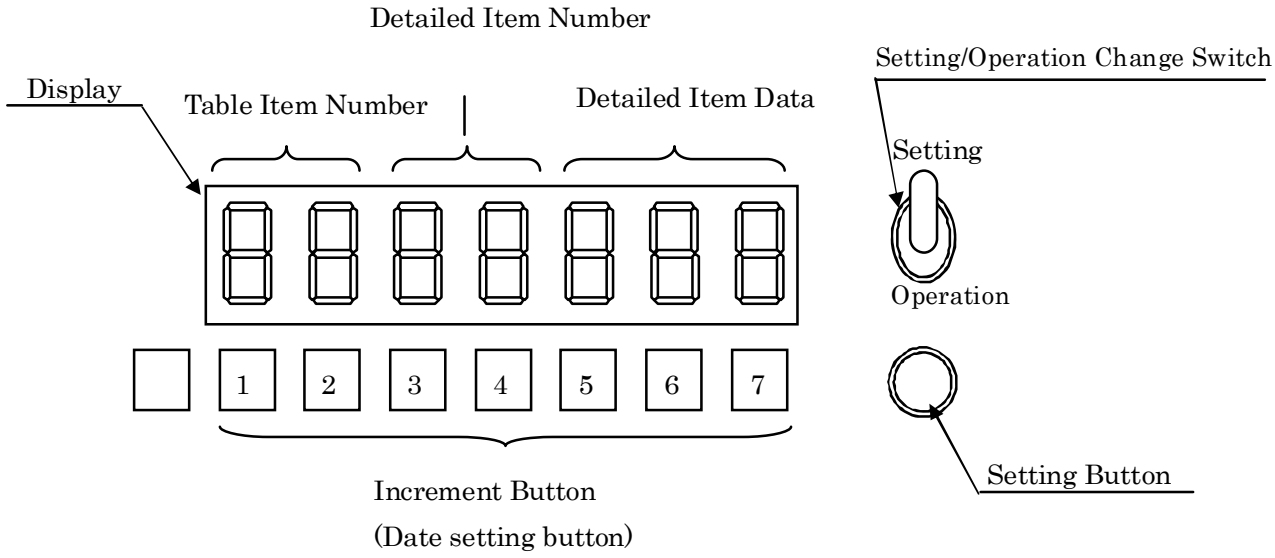
Start-up method of “Table Setting Mode”

(1) Make function setting switch (SW1-8) on the LPC Card “ON”

(2) In order to set Table Setting Mode, select “Setting” side of Setting/Operation Change Switch.

<2nd step>

Table Setting Method



1st Table Setting for TIME SETTING

(1) Set Table Item Number to “65” (Time setting of “RENDO”(Interlocked) Operation) by pushing Increment Button NO.1&NO.2.

(2) Set Detailed Item Number to the corresponding figures indicated in table (a)to(g) by pushing Increment Button NO.3 & NO.4.

(3) Set Detailed Item Data to the corresponding figures indicated in table (a)to(g) by pushing Increment Button NO.5 & NO.6 & NO.7.

(4) Push "Setting Button" in oder to finalize the above figures.

(5) Repeat the same precedures ((1)to(4)) for all kind of day and all start and end time.
(refer to setting example)

Tables of setting item for Time Setting of "RENDO"(Interlocked) Operation

(a) Week Day

Item			Detailed item number	Detailed item data
1	Start time	Hour	01	00 to 23
		Minute	02	00 to 59
	End time	Hour	03	00 to 23
		Minute	04	00 to 59
2	Start time	Hour	05	00 to 23
		Minute	06	00 to 59
	End time	Hour	07	00 to 23
		Minute	08	00 to 59
3	Start time	Hour	09	00 to 23
		Minute	10	00 to 59
	End time	Hour	11	00 to 23
		Minute	12	00 to 59
4	Start time	Hour	13	00 to 23
		Minute	14	00 to 59
	End time	Hour	15	00 to 23
		Minute	16	00 to 59

(b) Saturday

Item			Detailed item number	Detailed item data
1	Start time	Hour	17	00 to 23
		Minute	18	00 to 59
	End time	Hour	19	00 to 23
		Minute	20	00 to 59
2	Start time	Hour	21	00 to 23
		Minute	22	00 to 59
	End time	Hour	23	00 to 23
		Minute	24	00 to 59
3	Start time	Hour	25	00 to 23
		Minute	26	00 to 59
	End time	Hour	27	00 to 23
		Minute	28	00 to 59
4	Start time	Hour	29	00 to 23
		Minute	30	00 to 59
	End time	Hour	31	00 to 23
		Minute	32	00 to 59

(c) Holiday

Item			Detailed item number	Detailed item data
1	Start time	Hour	33	00 to 23
		Minute	34	00 to 59
	End time	Hour	35	00 to 23
		Minute	36	00 to 59
2	Start time	Hour	37	00 to 23
		Minute	38	00 to 59
	End time	Hour	39	00 to 23
		Minute	40	00 to 59
3	Start time	Hour	41	00 to 23
		Minute	42	00 to 59
	End time	Hour	43	00 to 23
		Minute	44	00 to 59
4	Start time	Hour	45	00 to 23
		Minute	46	00 to 59
	End time	Hour	47	00 to 23
		Minute	48	00 to 59

(d) Special Day1

Item			Detailed item number	Detailed item data
1	Start time	Hour	49	00 to 23
		Minute	50	00 to 59
	End time	Hour	51	00 to 23
		Minute	52	00 to 59
2	Start time	Hour	53	00 to 23
		Minute	54	00 to 59
	End time	Hour	55	00 to 23
		Minute	56	00 to 59
3	Start time	Hour	57	00 to 23
		Minute	58	00 to 59
	End time	Hour	59	00 to 23
		Minute	60	00 to 59
4	Start time	Hour	61	00 to 23
		Minute	62	00 to 59
	End time	Hour	63	00 to 23
		Minute	64	00 to 59

(e) Special Day2

Item			Detailed item number	Detailed item data
1	Start time	Hour	65	00 to 23
		Minute	66	00 to 59
	End time	Hour	67	00 to 23
		Minute	68	00 to 59
2	Start time	Hour	69	00 to 23
		Minute	70	00 to 59
	End time	Hour	71	00 to 23
		Minute	72	00 to 59
3	Start time	Hour	73	00 to 23
		Minute	74	00 to 59
	End time	Hour	75	00 to 23
		Minute	76	00 to 59
4	Start time	Hour	77	00 to 23
		Minute	78	00 to 59
	End time	Hour	79	00 to 23
		Minute	80	00 to 59

(f) Special Day3

Item			Detailed item number	Detailed item data
1	Start time	Hour	81	00 to 23
		Minute	82	00 to 59
	End time	Hour	83	00 to 23
		Minute	84	00 to 59
2	Start time	Hour	85	00 to 23
		Minute	86	00 to 59
	End time	Hour	87	00 to 23
		Minute	88	00 to 59
3	Start time	Hour	89	00 to 23
		Minute	90	00 to 59
	End time	Hour	91	00 to 23
		Minute	92	00 to 59
4	Start time	Hour	93	00 to 23
		Minute	94	00 to 59
	End time	Hour	95	00 to 23
		Minute	96	00 to 59

(g) Special day4

Item			Detailed item number	Detailed item data
1	Start time	Hour	97	00 to 23
		Minute	98	00 to 59
	End time	Hour	99	00 to 23
		Minute	A0	00 to 59
2	Start time	Hour	A1	00 to 23
		Minute	A2	00 to 59
	End time	Hour	A3	00 to 23
		Minute	A4	00 to 59
3	Start time	Hour	A5	00 to 23
		Minute	A6	00 to 59
	End time	Hour	A7	00 to 23
		Minute	A8	00 to 59
4	Start time	Hour	A9	00 to 23
		Minute	B0	00 to 59
	End time	Hour	B1	00 to 23
		Minute	B2	00 to 59

<3rd step>

2nd Table Setting for "KO"(SERVANT) SETTING

(1) Set Table Item Number to "87" ("KO"(Servant) setting of "RENDO"(Interlocked) Operation) by pushing Increment Button NO.1&NO.2.

(2) Set Detailed Item Number to the corresponding figures indicated by pushing Increment Button NO.3 & NO.4.

(3) Set Detailed Item Data to the corresponding figures indicated by pushing Increment Button NO.5 & NO.6 & NO.7.

(4) Push "Setting Button" in oder to finalize.

Tables of setting item for "KO"(Servant) Setting of "RENDO"(Interlocked) Operation

Item		Detailed item number	Detailed item data
Cycle "RENDO"(Interlocked) Signal		01	1:AB type Interconnect Signal (normal condition) 2:Y type Interconnect Signal
"RENDO"(Interlocked) sub-cycle operation		02	1: 1/1 period (normal condition) 2: 1/2 period 3: 2/3 period
Threshold value of "RENDO" (Interlocked) sub-cycle operation		03	0 to 254, or blank(normal condition) In case of "blank" , the "RENDO" (Interlocked) operation is done. (not sub-cycle) When the threshold value of "RENDO" (Interlocked) sub-cycle operation is more than the cycle of master controller, this becomes "RENDO" (Interlocked) cycle operation.(not sub-cycle)
Synchronized Step (S1)		04	1 to 30, or blank. In case of "blank" , Synchronized Step isn't designate.
Synchronized Step (S2)		05	1 to 30, or blank. In case of "blank" , Synchronized Step isn't designate.
Watch time of cycle signal		06	0 to 255. (255:normal condition) When "RENDO" (Interlocked) cycle signal isn't received within watch time of cycle signal, the "RENDO" (Interlocked) operation ends.
Pattern1	(S1)Offset	07	0 to 254, or blank. Offset time is set. In case of "blank" , the "RENDO" (Interlocked) operation isn't done.
	(S2)Offset	08	
Pattern2	(S1)Offset	09	
	(S2)Offset	10	
Pattern3	(S1)Offset	11	
	(S2)Offset	12	
Pattern4	(S1)Offset	13	
	(S2)Offset	14	
Pattern5	(S1)Offset	15	
	(S2)Offset	16	
Pattern6	(S1)Offset	17	
	(S2)Offset	18	
Pattern7	(S1)Offset	19	
	(S2)Offset	20	
Pattern8	(S1)Offset	21	
	(S2)Offset	22	
Pattern9	(S1)Offset	23	
	(S2)Offset	24	
PatternA	(S1)Offset	25	
	(S2)Offset	26	

<4th step>

Operation Mode

(1) After the 3rd step, switch the Setting/Operation Change Switch to "Operation" side. Consquently, Display indication also changes to figures of operation mode at the time.

(2) Finally, set the function setting switch(sw1-8) "OFF".

<<Setting example>>

Condition:

(1) Running time in "RENDO" (Interlocked) Operation is from 07:00 to 20:00 except special day.

(2) Cycle "RENDO" (Interlocked) Signal : "1"(AB type)

(3) "RENDO" (Interlocked) sub-cycle operation : "1"(1/1 period)

(4) Threshold value of "RENDO" (Interlocked) sub-cycle operation : "blank"(not sub-cycle)

(5) Synchronized Step: "1step" (s1) and "9step"(s2)

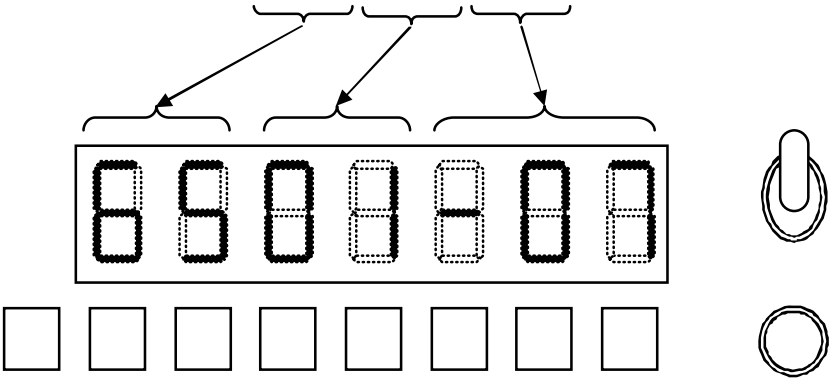
(6) Watch time of cycle signal : "255"(max)

(7) Offset time : "0"second for all pattern

Set figures as follows according to two table setting mode.

1st table< TIME SETTING >

		Table item number	Detailed item number	Detailed item data
(1)	Set the hour of the weekday start time.	65	01	07
(2)	Set the minute of the weekday start time.	65	02	00
(3)	Set the hour of the weekday end time.	65	03	20
(4)	Set the minute of the weekday end time.	65	04	00
(5)	Set the hour of the Saturday start time.	65	17	07
(6)	Set the minute of the Saturday start time.	65	18	00
(7)	Set the hour of the Saturday end time.	65	19	20
(8)	Set the minute of the Saturday end time.	65	20	00
(9)	Set the hour of the Holiday start time.	65	33	07
(10)	Set the minute of the Holiday start time.	65	34	00
(11)	Set the hour of the Holiday end time.	65	35	20
(12)	Set the minute of the Holiday end time.	65	36	00

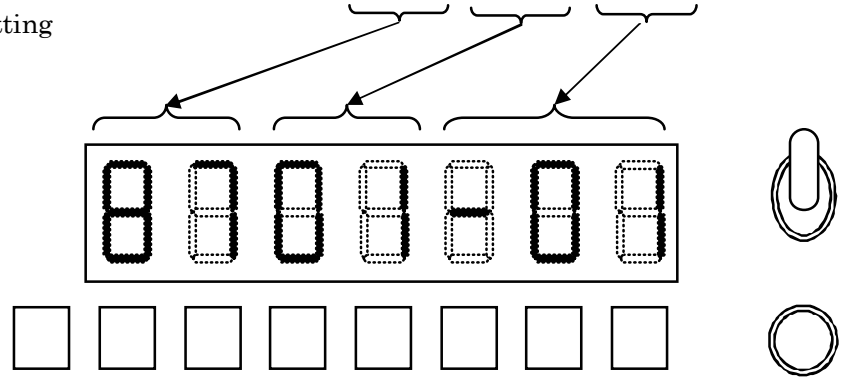


Setting example of Interlocked Operation at time setting

2nd Table <"KO"(SERVANT) SETTING>

Item			Table item number	Detailed item number	Detailed item data
(1)	Cycle "RENDO" (Interlocked) Signal		87	01	1
(2)	"RENDO" (Interlocked) sub-cycle operation		87	02	1
(3)	Threshold value of "RENDO" (Interlocked) sub-cycle operation		87	03	---
(4)	Synchronized Step (S1)		87	04	1
(5)	Synchronized Step (S2)		87	05	9
(6)	Watch time of cycle signal		87	06	255
(7)	Pattern1	(S1)Offset	87	07	0
		(S2)Offset	87	08	0
(8)	Pattern2	(S1)Offset	87	09	0
		(S2)Offset	87	10	0
(9)	Pattern3	(S1)Offset	87	11	0
		(S2)Offset	87	12	0
(10)	Pattern4	(S1)Offset	87	13	0
		(S2)Offset	87	14	0
(11)	Pattern5	(S1)Offset	87	15	0
		(S2)Offset	87	16	0
(12)	Pattern6	(S1)Offset	87	17	0
		(S2)Offset	87	18	0
(13)	Pattern7	(S1)Offset	87	19	0
		(S2)Offset	87	20	0
(14)	Pattern8	(S1)Offset	87	21	0
		(S2)Offset	87	22	0
(15)	Pattern9	(S1)Offset	87	23	0
		(S2)Offset	87	24	0
(16)	PatternA	(S1)Offset	87	25	0
		(S2)Offset	87	26	0

"-- " is no setting



Setting example of "RENDO" (Interlocked) Operation at "KO"(servant) setting