SOFTWARE MANUAL

RF POWER AMPLIFIER

CA186BW3-7878R-LB

R&K Company Limited

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Revision History

Version	Date	Author(s)	Revision Note
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1.00	October 25, 2017	J.Aranami	1st release
1.01	November 10, 2017	J.Aranami	modify: Table17 Address 180 “Threshold(upper)” value modify: Table17 Address 315 “Error Operation” description modify: Table17 Address 319 “Error Operation” desctiption modify: 3.1 PLC Flowchart modify: Table 53 “Bad” → “Fault” additional: Table 54, 55
1.02	December 1, 2017	J.Aranami	exchange: 1.3←→1.4, 2.3←→2.4 additional: 2.1.1. “Design tool”, “Download cable” additional: 2.1.2. “Design tool”, “Download cable” additional: 2.2.1. “Design tool”, “Download cable” divide: table 17 register map ➔ table 17-1 Main status ➔ table 17-2 Control Unit ➔ table 17-3 SSA module_Driver ➔ table 17-4 SSA module_00 ➔ table 17-5 SSA module_01-30 ➔ table 17-6 Interlock status modify: Table17-2 Address 103 “see Table 20”→“see Table 21” modify: Table18, 19, 20, 21 “sample” → “example” modify: 2.4.3.1. (2) Information “Fault Status”→”Interlock Status”

Version	Date	Author(s)	Revision Note
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1. Function Overview

This product is controlled by programmable logic. You can read all status by controlling various functions.

1.1. Construction

This product is constructed with 1 controller module and 32 SSA modules.

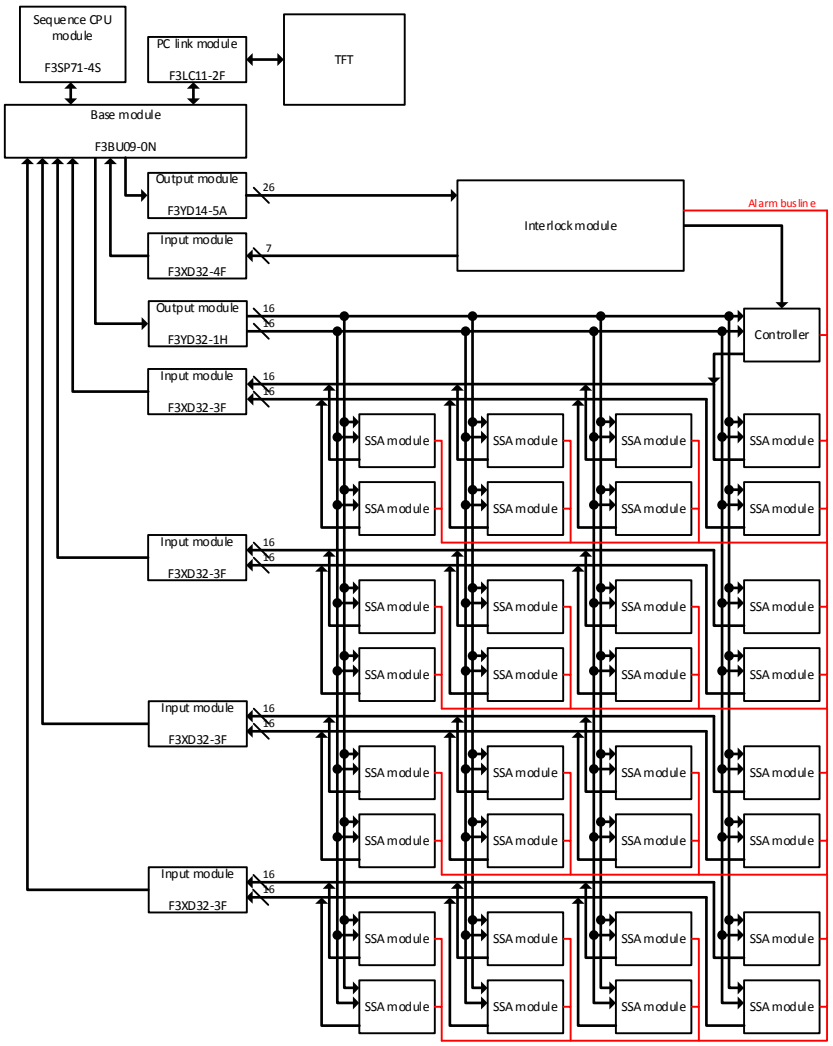

Fig. 1: Construction of Control System

FPGA Address 1: Controller module FPGA

FPGA Address 2: Solid State Amplifier_Driver module FPGA

FPGA Address 3: Solid State Amplifier_00 module FPGA

…

FPGA Address 33: Solid State Amplifier_30 module FPGA

1.2. Control Interface

This product has both human interface and network interface.

- Human Interface : Touch Screen
- Network Interface : Modbus/TCP

Modbus/TCP controls SSA by accessing register similar to “CA1300BW1-5766R-SL”.

1.3. Protection Function

This product has following protection function.

- Interlock：When abnormal status occurs internally or externally, it stops HPA and send fault signal
- Warning：When abnormal status occurs internally, warning is notified on control interface.

1.4. Monitoring System

The system monitors and collects each status of SSA. Collected status can be seen via control interface in real time. Collected status are also recorded to SD card.

2. Function Information

Information of each function is as following.

2.1. Control Construction

2.1.1. Controller Module

Controller module is controlled by PLC (FA-M3V) by Yokogawa Electric Corporation. It collects data which taken by SSA modules by polling

It controls SSA by processing orders from control interface

Table 1: PLC system

Category	Type name	Number	Specification
Base Module	F3BU09-0N	1	For power supply (F3PU20-0S), 9 slot (CPU+I/O).
Power Supply Module	F3PU20-0S	1	100-240 VAC, 5 VDC / 4.3 A rated output.
CPU Module	F3SP71-4S	1	Ladder 60K steps, basic instruction 0.00375us or logger, with network and Modbus/TCP slave (server) functions (USB2.0, Ethernet).
PC link Module	F3LC11-2F	1	115kbps maximum RS-422/RS-485 port For panel (GP-4301TM Module Type) communication.
I/O Module	F3YD08-6A	1	Output Module Send an instruction to Interlock board. Restart and Instruction Execution.
	F3XD32-4F	1	Input Module For receiving alarm signal
	F3YD32-1H	1	Output Module For FPGA data transmission
	F3XD32-3F	4	Input Module For receiving FPGA data

- Design tool

  WildField3 (R3.04) by Yokogawa Electric Corporation.
- Download cable

  PLC software can be updated via Ethernet

2.1.2. SSA Module

SSA modules are controlled by FPGA (Spartan 6) by Xilinx. It monitors and measures the internal status of SSA. Measured values are sent by polling of PLC. When measured value is abnormal, warning is sent to PLC.

Table 2: Monitoring Items

Parameter	Resolution	Sampling rate	Note
SSA Device current	12 bit	3MSPS	SSA module
SSA Drain Voltage	12 bit	3MSPS	SSA module
SSA Forward power	12 bit	3MSPS	SSA module
SSA Reflection power	12 bit	3MSPS	SSA module
60kW Forward power	12 bit	3MSPS	Controller unit
60kW Reflection power	12 bit	3MSPS	Controller unit
Input power	12 bit	3MSPS	Controller unit
Heat Sink temperature	12 bit	100kSPS	SSA module
Heat Sink thermostat	1 bit	-	SSA module
Transformer thermostat	1 bit	-	SSA module
AC/DC Power Supply current	12 bit	3MSPS	SSA module
AC/DC Power Supply voltage	12 bit	100kSPS	SSA module
AC/DC Power Supply alarm	1 bit	-	SSA module, Controller unit
FAN speed(1/4 rpm)	12 bit	-	SSA module, Controller unit
Humidity	12 bit	100kSPS	Controller unit
Water flow	12 bit	100kSPS	Controller unit
Water temperature	12 bit	100kSPS	Controller unit
Module temperature	12 bit	100kSPS	SSA module, Controller unit
Cabinet temperature	12 bit	100kSPS	Controller unit
Radial Combiner temperature	12 bit	100kSPS	Controller unit
Heat Exchanger temperature	12 bit	100kSPS	Controller unit
480 VAC voltage	12 bit	3MSPS	Controller unit

- Design tool
  ISE® WebPACK (Version 14.7) by Xilinx Inc.
- Download cable
  XUP USB-JTAG Programing Cable by DIGILENT Inc.

2.2. Control Interface

2.2.1. Human Machine Interface

HMI is controlled by touch screen by Pro-face (GP-4301TM). It communicates with PLC via PC link Modules.

Table 3: Specification of Touch Screen

Screen Size	5.7 inch
Screen Resolution	320×240 dot (QVGA)
Display Device	TFT color (16bit high color)
Internal Memory	8MByte

Touch screen displays HPA's data in one second cycle. By pressing menu button, voltage, current, and temperature of each unit can be shown in screen.

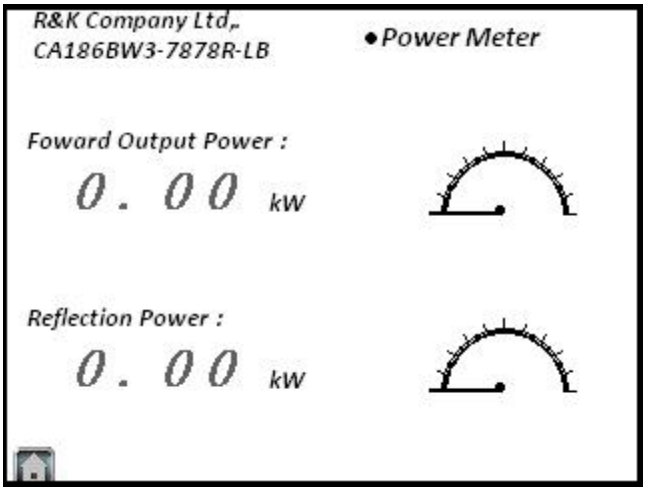

Fig. 2: Sample Display

- Design tool
  GP-Pro EX (V.4.06.200) by Pro-face (Schneider Electric Japan Holdings Ltd.)
- Download cable
  Touch screen software can be updated via USB

2.2.2. Network Interface

2.2.2.1 IP Address setting

For Network interface with external, XPort 1 is used. The setting of XPort 1 is editable. For updating of PLC, IP Address of PLC is used. IP Address setting of PLC and XPort2 are unable to edit. Please do not try to change them.

(1) Internal network system

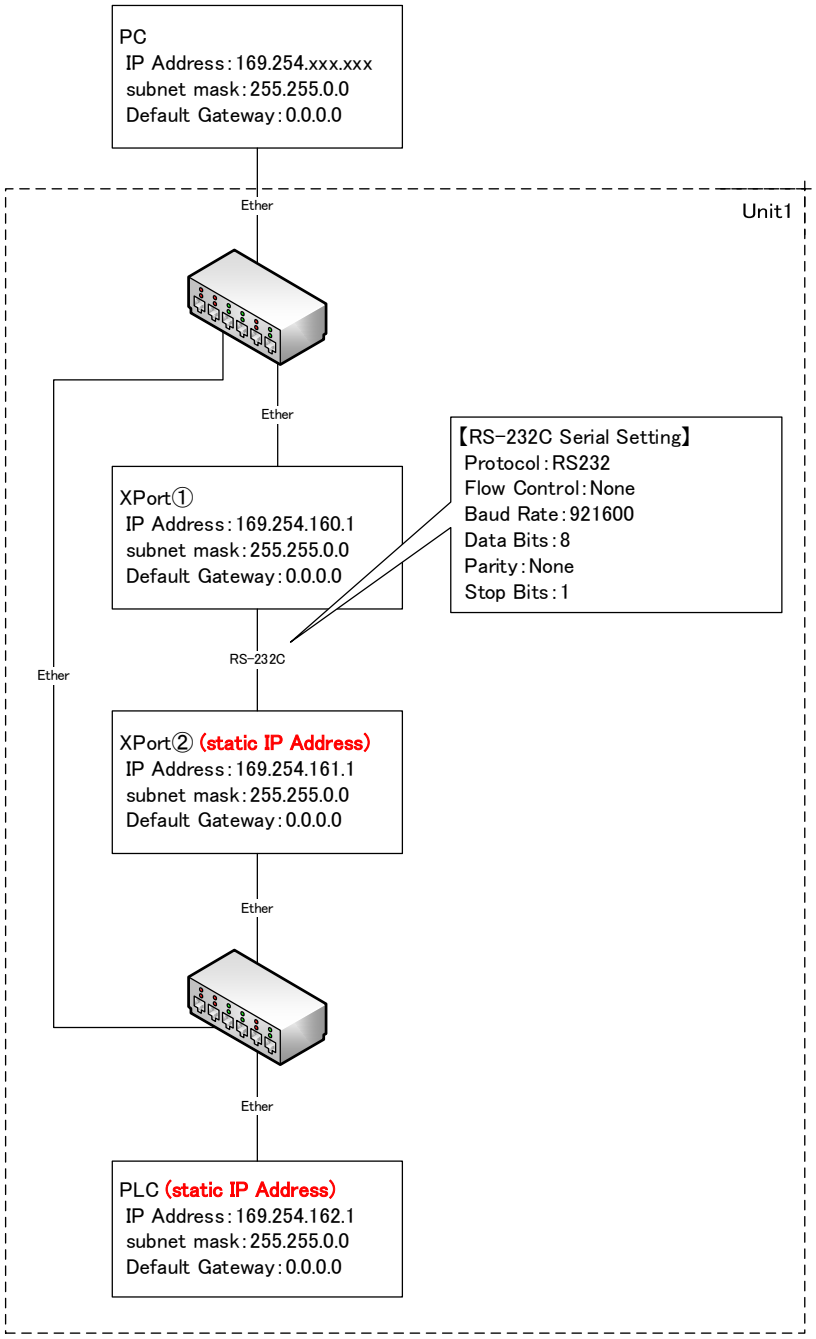

Fig. 3: Network system

(2) XPort setting

Setting of XPort is editable by “Device Installer.exe” of Lantronix. Please find following lists of initial setting of Xport.

Table 4: Unit1 XPort setting

	XPort1	XPort2
“Network” – “IP Configuration”		
IP Address	169.254.160.1	169.254.161.1
Subnet Mask	255.255.0.0	255.255.0.0
Default Gateway	0.0.0.0	0.0.0.0
DNS Server	0.0.0.0	0.0.0.0
“Server - “Advanced”		
CPU Performance Mode	High	High
“Serial Setting” – “Port Settings”		
Protocol	RS232	RS232
Flow Control	None	None
Baud Rate	921600	921600
Data Bits	8	8
Parity	None	None
Stop Bits	1	1
“Connection” – “Endpoint Configuration”		
Local Port	502	502
Remote Port	0	502
Remote Host	0.0.0.0	169.254.162.1

Table 5: Unit2 XPort setting

	XPort1	XPort2
“Network” – “IP Configuration”		
IP Address	169.254.160.2	169.254.161.2
Subnet Mask	255.255.0.0	255.255.0.0
Default Gateway	0.0.0.0	0.0.0.0
DNS Server	0.0.0.0	0.0.0.0
“Server” – “Advanced”		
CPU Performance Mode	High	High
“Serial Setting” – “Port Settings”		
Protocol	RS232	RS232
Flow Control	None	None
Baud Rate	921600	921600
Data Bits	8	8
Parity	None	None
Stop Bits	1	1
“Connection” – “Endpoint Configuration”		
Local Port	502	502
Remote Port	0	502
Remote Host	0.0.0.0	169.254.162.2

(3) PLC IP Address setting

IP Address setting of PLC is editable by “CPU Properties” – “SET UP” – “ETHERNET” of Wide Field3 tool of Yokogawa. If there is no problem with initial setting, please do not edit the setting of CPU Properties.

Please find following lists for initial setting of PLC’s IP Address.

Table 6: Unit1 PLC IP Address setting

	Unit1 PLC
“CPU Properties” – “SETUP” – “ETHERNET”	
IP Address	169.254.162.1
Subnet Mask	255.255.0.0
Default Gateway	0.0.0.0
DNS Server	0.0.0.0
“CPU Properties” – “SETUP” – “HIGHER-LEVEL_LINK_SERVICE”	
HLLINK_PROTOCOL_A	2 (=Modbus/TCP Slave)
HLLINK_DATA_FORMAT_A	1 (=Binary)
HLLINK_PROTOCOL_B	2 (=Modbus/TCP Slave)
HLLINK_DATA_FORMAT_B	1 (=Binary)
HLLINK_PROTECT	0 (=Disabled)

Table 7: Unit2 PLC IP Address setting

	Unit2 PLC
“CPU Properties” – “SETUP” – “ETHERNET”	
IP Address	169.254.162.2
Subnet Mask	255.255.0.0
Default Gateway	0.0.0.0
DNS Server	0.0.0.0
“CPU Properties” – “SETUP” – “HIGHER-LEVEL_LINK_SERVICE”	
HLLINK_PROTOCOL_A	2 (=Modbus/TCP Slave)
HLLINK_DATA_FORMAT_A	1 (=Binary)
HLLINK_PROTOCOL_B	2 (=Modbus/TCP Slave)
HLLINK_DATA_FORMAT_B	1 (=Binary)
HLLINK_PROTECT	0 (=Disabled)

2.2.2.2 Communication protocol

The Model CA186BW3-7878R-LB can be controlled with Lantronix Xport.

Xport is set up by Deviceinstaller.

IP address is assigned automatically. Port is 502.

Table 8: Modbus/TCP

Transaction Identifier	Protocol Identifier	Length	Unit Identifier
2byte 0xXXXX	2byte 0xXXXX	2byte 0xXXXX	1byte 0xXX

Response returns same one as received Header

(Transaction identifier, Protocol identifier, Unit identifier)

<Function Code>

Supports following Function Code.

<0x03 Read Holding Registers>

Read only.

One or continuous registers read is enabled. (125 max.)

1) Request

Table 9: Request packet format (0x03)

Transaction Identifier		Protocol Identifier		Length		Unit Identifier	Function	Starting Address		Quantity of Registers	
byte0	byte1	byte2	byte3	byte4	byte5	byte6	byte7	byte8	byte9	byte10	byte11
Hi	Lo	Hi	Lo	Hi	Lo	1 byte	1 byte	Hi	Lo	Hi	Lo
0xXX	0xXX	0xXX	0xXX	0x00	0x06	0xXX	0x03	0x00	0x02	0x00	0x03

2) Response

Table 10: Response packet format (0x03)

Transaction Identifier		Protocol Identifier		Length		Unit Identifier	Function	Byte court	Data 1		Data 2		Data 3	
byte0	byte1	byte2	byte3	bite4	byte5	byte6	byte7	byte8	byte9	byte10	byte11	byte12	byte13	byte14
Hi	Lo	Hi	Lo	Hi	Lo	1 byte	1 byte	1 byte	Hi	Lo	Hi	Lo	Hi	Lo
0xXX	0xXX	0xXX	0xXX	0x00	0x09	0xXX	0x03	0x06	0xXX	0xXX	0xXX	0xXX	0xXX	0xXX

3) Exception Response

Table 11: Exception response packet format (0x03)

Transaction Identifier		Protocol Identifier		Length		Unit Identifier	Function	Exception Code
byte0	byte1	byte2	byte3	byte4	byte5	byte6	byte7	byte8
Hi	Lo	Hi	Lo	Hi	Lo	1 byte	1 byte	1 byte
0xXX	0xXX	0xXX	0xXX	0x00	0x03	0xXX	0x83	0xXX

Table 12: Exception code (0x03)

Exception Code	MODBUS Name	Comments
0x01	Illegal Function Code	The function code is unknown by the server
0x02	Illegal Data Address	Address specification outside the range
0x03	Illegal Data Number	Specify the number outside the range
0x04	Processing abnormality	Write protect setting
0x0A	CPU number error	Unit ID designation other than 1 to 4
0x0B	Timeout	The CPU specified by the unit ID does not exist.

<0x06 Write Single Register>

Write only

One register rewriting is enabled

It is used to command below

- Power ON/OFF
- RF ON/OFF
- Voltage control setting of switching power supply
- Reset for warning clear
- Reboot
- Time setting

1) Request

Table 13: Request packet format (0x06)

Transaction Identifier		Protocol Identifier		Length		Unit Identifier	Function	Register Address		Register Value	
byte0	byte1	byte2	byte3	byte4	byte5	byte6	byte7	byte8	byte9	byte10	byte11
Hi	Lo	Hi	Lo	Hi	Lo	1 byte	1 byte	Hi	Lo	Hi	Lo
0xXX	0xXX	0xXX	0xXX	0x00	0x06	0xXX	0x06	0x00	0x02	0x01	0x03

2) Response

Table 14: Response packet format (0x06)

Transaction Identifier		Protocol Identifier		Length		Unit Identifier	Function	Register Address		Register Value	
byte0	byte1	byte2	byte3	byte4	byte5	byte6	byte7	byte8	byte9	byte10	byte11
Hi	Lo	Hi	Lo	Hi	Lo	1 byte	1 byte	Hi	Lo	Hi	Lo
0xXX	0xXX	0xXX	0xXX	0x00	0x08	0xXX	0x06	0x00	0x02	0x01	0x03

3) Exception Response

Table 15: Exception response packet format (0x06)

Transaction Identifier		Protocol Identifier		Length		Unit Identifier	Function	Exception Code
byte0	byte1	byte2	byte3	byte4	byte5	byte6	byte7	byte8
Hi	Lo	Hi	Lo	Hi	Lo	1 byte	1 byte	1 byte
0xXX	0xXX	0xXX	0xXX	0x00	0x03	0xXX	0x86	0xXX

Table 16: Exception code (0x06)

Exception Code	MODBUS Name	Comments
0x01	Illegal Function Code	The function code is unknown by the server
0x02	Illegal Data Address	Address specification outside the range
0x03	Illegal Data Number	Specify the number outside the range
0x04	Processing abnormality	Write protect setting
0x0A	CPU number error	Unit ID designation other than 1 to 4
0x0B	Timeout	The CPU specified by the unit ID does not exist.

<Register Map>

Below is the list of Register Map. Address offset is enabled.

- ◆ Definition: Default: AC Enable, DC Disable, RF Disable
- ◆ Reset Operation

➢ Default

When these errors are detected, SSA operation goes to Default: AC Enable, DC Disable and RF Disable.
To recover from this state:

1. Send the “Fault Reset” command (Address 4) to the SSA via Modbus.
2. Send the “DC Enable” command (Address 1) to the SSA via Modbus.
3. Send the “RF Enable” command (Address 2) to the SSA via Modbus.

➢ Remove Cause:

When errors are detected, SSA operation continues as before the error detection.
To remove these error:

1. Check what causing the error and remover or fix the error cause.
2. Send the “Fault Reset” command (Address 4) to the SSA via Modbus. SSA operation continues as before putting reset command.

Table 17-1: Register map – Main status

Address	Address (Hex)	Description	Unit	Function	Permitted Raw Value	Threshold (Lower)	Threshold (Upper)	Convert to Engineering units	command /status	Error Type	Error Operation	Reset Operation
1	0x0001	DC Enable/Disable	n/a	0x06	0 or 1	n/a	n/a	n/a	0 : Disable 1 : Enable	n/a	n/a	n/a
2	0x0002	RF Enable/Disable	n/a	0x06	0 or 1	n/a	n/a	n/a	0 : Disable 1 : Enable	n/a	n/a	n/a
3	0x0003	PS Output Control Voltage	mV	0x06	700 - 2500	700	2500	Value*1	Operation Value	n/a	n/a	n/a
4	0x0004	Fault Reset	n/a	0x06	0 or 1 or 2 or 4	n/a	n/a	n/a	1 : Internal Interlock Reset 2 : External Interlock Reset 4 : Warning Reset	n/a	n/a	n/a
5	0x0005	X-Port Reboot	n/a	0x06	0 or 1	n/a	n/a	n/a	1 : X-Port Reboot	n/a	n/a	n/a
6	0x0006	System Reboot	n/a	0x06	0 or 1	n/a	n/a	n/a	1 : System Reboot	n/a	n/a	n/a
7	0x0007	Pulse Mode	n/a	0x06	0 or 1	n/a	n/a	n/a	0 : Disable 1 : Enable	n/a	n/a	n/a
8	0x0008	APD/ATT Switch	n/a	0x06	0 or 1	n/a	n/a	n/a	0 : APD 1 : ATT	n/a	n/a	n/a
9	0x0009	-	-	-	-	-	-	-	-	-	-	-
10	0x000A	AC Enabled (480VAC Breaker)	n/a	0x03	0 or 1	n/a	n/a	n/a	0 : Disable 1 : Enable	n/a	n/a	n/a
11	0x000B	DC Enabled	n/a	0x03	0 or 1	n/a	n/a	n/a	0 : Disable 1 : Enable	n/a	n/a	n/a
12	0x000C	RF Enabled	n/a	0x03	0 or 1	n/a	n/a	n/a	0 : Disable 1 : Enable	n/a	n/a	n/a
13	0x000D	Internal Fault	n/a	0x03	0 or 1	n/a	n/a	n/a	0 : Fault 1 : OK	Interlock	RF/DC: Disable	Default
14	0x000E	External Fault	n/a	0x03	0 or 1	n/a	n/a	n/a	0 : Fault 1 : OK	Interlock	RF/DC: Disable	Default

Address	Address (Hex)	Description	Unit	Function	Permitted Raw Value	Threshold (Lower)	Threshold (Upper)	Convert to Engineering units	command /status	Error Type	Error Operation	Reset Operation
15	0x000F	Warning	n/a	0x03	0 or 1	n/a	n/a	n/a	0 : Fault 1 : OK	Warning	Notification Only	Remove Cause
16	0x0010	Year for Calendar	Year	0x03	0-99	n/a	n/a	Value*1	n/a	n/a	n/a	n/a
17	0x0011	Month for Calendar	Month	0x03	1-12	n/a	n/a	Value*1	n/a	n/a	n/a	n/a
18	0x0012	Date for Calendar	Date	0x03	1-31	n/a	n/a	Value*1	n/a	n/a	n/a	n/a
19	0x0013	Hour for Calendar	Hour	0x03	0-23	n/a	n/a	Value*1	n/a	n/a	n/a	n/a
20	0x0014	Minute for Calendar	Minute	0x03	0-59	n/a	n/a	Value*1	n/a	n/a	n/a	n/a
21	0x0015	Second for Calendar	Second	0x03	0-59	n/a	n/a	Value*1	n/a	n/a	n/a	n/a
22	0x0016	Wire-Check Status	n/a	0x03	0 or 1	n/a	n/a	n/a	0 : Incomplete 1 : Complete	n/a	n/a	n/a
23	0x0017	Configuration in Progress	n/a	0x03	0 or 1	n/a	n/a	n/a	2^0 : Control Unit 2^1 : Driver module 2^2 : SSA module 0:in progress 1:Done	n/a	n/a	n/a
24	0x0018	APD/ATT Status	n/a	0x03	0 or 1	n/a	n/a	n/a	0 : APD 1 : ATT	n/a	n/a	n/a
25	0x0019	-	-	-	-	-	-	-	-	-	-	-
26	0x001A	-	-	-	-	-	-	-	-	-	-	-
27	0x001B	-	-	-	-	-	-	-	-	-	-	-
28	0x001C	-	-	-	-	-	-	-	-	-	-	-
29	0x001D	-	-	-	-	-	-	-	-	-	-	-
30	0x001E	Forward Power Alarm Limit (max.)	kW	0x06	0 – 2260	n/a	63 kW	“see Table 18”	n/a	n/a	n/a	n/a
31	0x001F	Reflection Power Alarm Limit (max.)	kW	0x06	0 - 730	n/a	6 kW	“see Table 19”	n/a	n/a	n/a	n/a
32	0x0020	LCW Outlet Temperature Limit (max.)	degC	0x06	1001-2065	0 degC	50 degC	25+(Value-1638)/25.5	n/a	n/a	n/a	n/a
33	0x0021	LCW Flow Rate Limit (min.)	L/min	0x06	1154-1775	65 L/min	100 L/min	Value*1/17.745	n/a	n/a	n/a	n/a
34	0x0022	-	-	-	-	-	-	-	-	-	-	-
35	0x0023	PS Output Control Voltage	mV	0x03	0 - 2500	n/a	2500	Value*1	n/a	n/a	n/a	n/a
36	0x0024	Forward Power Alarm Limit (max.)	kW	0x03	0 – 63	n/a	63 kW	Value*1	n/a	n/a	n/a	n/a
37	0x0025	Reflection Power Alarm Limit (max.)	kW	0x03	0 – 6	n/a	6 kW	Value*1	n/a	n/a	n/a	n/a
38	0x0026	LCW Outlet Temperature Limit (max.)	degC	0x03	0 – 50	0 degC	50 degC	Value*1	n/a	n/a	n/a	n/a
39	0x0027	LCW Flow Rate Limit (min.)	L/min	0x03	65 - 100	65 L/min	100 L/min	Value*1	n/a	n/a	n/a	n/a
…	…	-	-	-	-	-	-	-	-	-	-	-
93	0x005D	Year for Calendar	Year	0x06	15-99	15	99	Value*1	n/a	n/a	n/a	n/a

	Address	Address (Hex)	Description	Unit	Function	Permitted Raw Value	Threshold (Lower)	Threshold (Upper)	Convert to Engineering units	command /status	Error Type	Error Operation	Reset Operation
94	0x005E	Month for Calendar	Month	0x06	1-12	1	12	Value*1	n/a	n/a	n/a	n/a	
95	0x005F	Date for Calendar	Date	0x06	1-31	1	31	Value*1	n/a	n/a	n/a	n/a	
96	0x0060	Hour for Calendar	Hour	0x06	0-23	0	23	Value*1	n/a	n/a	n/a	n/a	
97	0x0061	Minute for Calendar	Minute	0x06	0-59	0	59	Value*1	n/a	n/a	n/a	n/a	
98	0x0062	Second for Calendar	Second	0x06	0-59	0	59	Value*1	n/a	n/a	n/a	n/a	
99	0x0063	-	-	-	-	-	-	-	-	-	-	-	

Table 17-2: Register map – Control Unit

Address	Address (Hex)	Description	Unit	Function	Permitted Raw Value	Threshold (Lower)	Threshold (Upper)	Convert to Engineering units	command /status	Error Type	Error Operation	Reset Operation
100	0x0064	480VAC_1 U-V	VAC	0x03	0 -570	432 VAC	528 VAC		n/a	Interlock	RF/DC: Disable	Default
101	0x0065	480VAC_2 V-W	VAC	0x03	0 -570	432 VAC	528 VAC		n/a	Interlock	RF/DC: Disable	Default
102	0x0066	480VAC_3 U-W	VAC	0x03	0 -570	432 VAC	528 VAC		n/a	Interlock	RF/DC: Disable	Default
103	0x0067	Input Drive Power	dBm	0x03	0 to 1287	n/a	0 dBm	“see Table 21”	n/a	Interlock	RF/DC: Disable	Default
104	0x0068	Forward Power	kW	0x03	0 – 2370	n/a	63 kW	“see Table 18”	n/a	Interlock	RF/DC: Disable	Default
105	0x0069	Reflected Power	kW	0x03	0 - 2258	n/a	6 kW	“see Table 19”	n/a	Interlock	RF/DC: Disable	Default
106	0x006A	Humidity Rate	%	0x03	0-755	n/a	n/a	Value/7.548	n/a	n/a	n/a	n/a
107	0x006B	LCW Flow Rate	L/min	0x03	0-1775	65 L/min	n/a	Value/17.745	n/a	Interlock	RF/DC: Disable	Default
108	0x006C	-	-	-	-	-	-	-	-	-	-	-
109	0x006D	-	-	-	-	-	-	-	-	-	-	-
110	0x006E	System Rack Air Temperature	degC	0x03	1000-4060	n/a	50 degC	25+(Value-1638)/25.5	n/a	Interlock	RF/DC: Disable	Default
111	0x006F	LCW Inlet Temperature	degC	0x03	1000-4060	22 degC	34 degC	25+(Value-1638)/25.5	n/a	Interlock	RF/DC: Disable	Default
112	0x0070	LCW Outlet Temperature	degC	0x03	1000-4060	n/a	45 degC	25+(Value-1638)/25.5	n/a	Interlock	RF/DC: Disable	Default
113	0x0071	Heat Exchanger_1 Temperature	degC	0x03	1000-4060	n/a	50 degC	25+(Value-1638)/25.5	n/a	Interlock	RF/DC: Disable	Default
114	0x0072	Heat Exchanger_2 Temperature	degC	0x03	1000-4060	n/a	50 degC	25+(Value-1638)/25.5	n/a	Interlock	RF/DC: Disable	Default
115	0x0073	Control Unit Air Temperature	degC	0x03	1000-4060	n/a	50 degC	25+(Value-1638)/25.5	n/a	Interlock	RF/DC: Disable	Default
116	0x0074	Radial Combiner Temperature	degC	0x03	1000-4060	n/a	70 degC	25+(Value-1638)/25.5	n/a	Interlock	RF/DC: Disable	Default
…	…	-	-	-	-	-	-	-	-	-	-	-

Address	Address (Hex)	Description	Unit	Function	Permitted Raw Value	Threshold (Lower)	Threshold (Upper)	Convert to Engineering units	command /status		Error Type	Error Operation	Reset Operation
126	0x007E	Control Unit I/O_1 Warning monitor	n/a	0x03	n/a	n/a	n/a	n/a	2^0: Heat Exchanger_1 FAN_1 Rotation Speed 2^1 : Heat Exchanger_1 FAN_2 Rotation Speed 2^2 : Heat Exchanger_1 FAN_3 Rotation Speed 2^3 : Heat Exchanger_1 FAN_4 Rotation Speed 2^4 : Heat Exchanger_1 FAN_5 Rotation Speed 2^5: Heat Exchanger_1 FAN_6 Rotation Speed 2^6: Heat Exchanger_1 FAN_7 Rotation Speed	0:Fault 1:OK	Warning	Notification Only	Remove Cause
127	0x007F	Control Unit I/O_2 Warning monitor	n/a	0x03	n/a	n/a	n/a	n/a	2^0: Heat Exchanger_1 FAN_8 Rotation Speed 2^1 : Heat Exchanger_2 FAN_1 Rotation Speed 2^2 : Heat Exchanger_2 FAN_2 Rotation Speed 2^3 : Heat Exchanger_2 FAN_3 Rotation Speed 2^4 : Heat Exchanger_2 FAN_4 Rotation Speed 2^5 : Heat Exchanger_2 FAN_5 Rotation Speed 2^6 : Heat Exchanger_2 FAN_6 Rotation Speed	0:Fault 1:OK	Warning	Notification Only	Remove Cause
128	0x0080	Control Unit I/O_3 Warning monitor	n/a	0x03	n/a	n/a	n/a	n/a	2^0: Heat Exchanger_2 FAN_7 Rotation Speed 2^1 : Heat Exchanger_2 FAN_8 Rotation Speed 2^2 : Control Unit FAN_1 Rotation Speed 2^3 : Control Unit FAN_2 Rotation Speed 2^4 : Thermostat (FAN PS Transformer) 2^5 : FAN PS Alarm (PS1 or PS2 or PS3) 2^6 : -	0:Fault 1:OK	Warning	Notification Only	Remove Cause
129	0x0081	-	-	-		-	-	-	-		-	-	-
130	0x0082	-	-	-	-	-	-	-	-		-	-	-

Address	Address (Hex)	Description	Unit	Function	Permitted Raw Value	Threshold (Lower)	Threshold (Upper)	Convert to Engineering units	command /status	Error Type	Error Operation	Reset Operation
131	0x0083	Heat Exchanger_1 FAN Rotation Speed_1	rpm	0x03	0 - 4075	5980 rpm	n/a	Value*4	n/a	Warning	Notification Only	Remove Cause
132	0x0084	Heat Exchanger_1 FAN Rotation Speed_2	rpm	0x03	0 – 4075	5980 rpm	n/a	Value*4	n/a	Warning	Notification Only	Remove Cause
133	0x0085	Heat Exchanger_1 FAN Rotation Speed_3	rpm	0x03	0 – 4075	5980 rpm	n/a	Value*4	n/a	Warning	Notification Only	Remove Cause
134	0x0086	Heat Exchanger_1 FAN Rotation Speed_4	rpm	0x03	0 – 4075	5980 rpm	n/a	Value*4	n/a	Warning	Notification Only	Remove Cause
135	0x0087	Heat Exchanger_1 FAN Rotation Speed_5	rpm	0x03	0 – 4075	5980 rpm	n/a	Value*4	n/a	Warning	Notification Only	Remove Cause
136	0x0088	Heat Exchanger_1 FAN Rotation Speed_6	rpm	0x03	0 – 4075	5980 rpm	n/a	Value*4	n/a	Warning	Notification Only	Remove Cause
137	0x0089	Heat Exchanger_1 FAN Rotation Speed_7	rpm	0x03	0 – 4075	5980 rpm	n/a	Value*4	n/a	Warning	Notification Only	Remove Cause
138	0x008A	Heat Exchanger_1 FAN Rotation Speed_8	rpm	0x03	0 – 4075	5980 rpm	n/a	Value*4	n/a	Warning	Notification Only	Remove Cause
139	0x008B	Heat Exchanger_2 FAN Rotation Speed_1	rpm	0x03	0 – 4075	5980 rpm	n/a	Value*4	n/a	Warning	Notification Only	Remove Cause
140	0x008C	Heat Exchanger_2 FAN Rotation Speed_2	rpm	0x03	0 – 4075	5980 rpm	n/a	Value*4	n/a	Warning	Notification Only	Remove Cause
141	0x008D	Heat Exchanger_2 FAN Rotation Speed_3	rpm	0x03	0 – 4075	5980 rpm	n/a	Value*4	n/a	Warning	Notification Only	Remove Cause
142	0x008E	Heat Exchanger_2 FAN Rotation Speed_4	rpm	0x03	0 – 4075	5980 rpm	n/a	Value*4	n/a	Warning	Notification Only	Remove Cause
143	0x008F	Heat Exchanger_2 FAN Rotation Speed_5	rpm	0x03	0 – 4075	5980 rpm	n/a	Value*4	n/a	Warning	Notification Only	Remove Cause
144	0x0090	Heat Exchanger_2 FAN Rotation Speed_6	rpm	0x03	0 – 4075	5980 rpm	n/a	Value*4	n/a	Warning	Notification Only	Remove Cause
145	0x0091	Heat Exchanger_2 FAN Rotation Speed_7	rpm	0x03	0 – 4075	5980 rpm	n/a	Value*4	n/a	Warning	Notification Only	Remove Cause
146	0x0092	Heat Exchanger_2 FAN Rotation Speed_8	rpm	0x03	0 – 4075	5980 rpm	n/a	Value*4	n/a	Warning	Notification Only	Remove Cause
147	0x0093	Control Unit FAN Rotation Speed_1	rpm	0x03	0 – 4075	5304 rpm	n/a	Value*4	n/a	Warning	Notification Only	Remove Cause

Address	Address (Hex)	Description	Unit	Function	Permitted Raw Value	Threshold (Lower)	Threshold (Upper)	Convert to Engineering units	command /status		Error Type	Error Operation	Reset Operation
148	0x0094	Control Unit FAN Rotation Speed_2	rpm	0x03	0 - 4075	5304 rpm	n/a	Value*4	n/a		Warning	Notification Only	Remove Cause
…	…	-	-	-	-	-	-	-	-		-	-	-
180	0x00B4	VSWR Over	n/a	0x03	0 or 1	n/a	> 10%	n/a	0 : Over 1 : Below		n/a	n/a	n/a
…	…	-	-	-	-	-	-	-	-		-	-	-
190	0x00BE	Communication Wire Error_1 Warning monitor	n/a	0x03	n/a	n/a	n/a	n/a	2^0 : SSA module - Driver 2^1 : SSA module - 00 2^2 : SSA module - 01 2^3 : SSA module - 02 … 2^14: SSA module - 13 2^15: SSA module – 14	0:Fault 1:OK	Warning	Notification Only	Remove Cause (Must be system rebooted)
191	0x00BF	Communication Wire Error_2 Warning monitor	n/a	0x03	n/a	n/a	n/a	n/a	2^0 : SSA module - 15 2^1 : SSA module - 16 … 2^12: SSA module – 27 2^13: SSA module - 28 2^14: SSA module - 29 2^15: SSA module - 30	0:Fault 1:OK	Warning	Notification Only	Remove Cause (Must be system rebooted)
192	0x00C0	-	-	-	-	-	-	-	-		-	-	-
193	0x00C1	-	-	-	-	-	-	-	-		-	-	-
194	0x00C2	FPGA Response Error_1 Warning monitor	n/a	0x03	n/a	n/a	n/a	n/a	2^0 : SSA module - Driver 2^1 : SSA module - 00 2^2 : SSA module - 01 2^3 : SSA module - 02 … 2^13: SSA module - 12 2^14: SSA module - 13 2^15: SSA module – 14	0:Fault 1:OK	Warning	Notification Only	Remove Cause (Must be system rebooted)
195	0x00C3	FPGA Response Error_2 Warning monitor	n/a	0x03	n/a	n/a	n/a	n/a	2^0 : SSA module - 15 2^1 : SSA module - 16 2^2 : SSA module - 17 2^3 : SSA module - 18 … 2^13: SSA module - 28 2^14: SSA module - 29 2^15: SSA module - 30	0:Fault 1:OK	Warning	Notification Only	Remove Cause (Must be system rebooted)
196	0x00C4	-	-	-	-	-	-	-	-		-	-	-
197	0x00C5	PLC Software Version	n/a	0x03	0.00 - 31.99	n/a	n/a	Value[11:7] + Value[6:0]/100	n/a		n/a	n/a	n/a

Address	Address (Hex)	Description	Unit	Function	Permitted Raw Value	Threshold (Lower)	Threshold (Upper)	Convert to Engineering units	command /status	Error Type	Error Operation	Reset Operation
198	0x00C6	TFT Display Software Version	n/a	0x03	0.00 - 31.99	n/a	n/a	Value[11:7] + Value[6:0]/100	n/a	n/a	n/a	n/a
199	0x00C7	Control Unit FPGA Software Version	n/a	0x03	0.00 - 31.99	n/a	n/a	Value[11:7] + Value[6:0]/100	n/a	n/a	n/a	n/a

Table 17-3: Register map – SSA module_Driver

Address	Address (Hex)	Description	Unit	Function	Permitted Raw Value	Threshold (Lower)	Threshold (Upper)	Convert to Engineering units	command /status	Error Type	Error Operation	Reset Operation
200	0x00C8	-	-	-	-	-	-		-	-	-	-
201	0x00C9	-	-	-	-	-	-		-	-	-	-
202	0x00CA	SSA module - Driver Device_1 Drain Current	A	0x03	0 – 2830	n/a	2.0 A	Value*1.0602 /1000	n/a	Warning	Notification Only	Remove Cause
203	0x00CB	SSA module – Driver Device_2 Drain Current	A	0x03	0 – 2830	n/a	1.5 A	Value*1.0602 /1000	n/a	Warning	Notification Only	Remove Cause
204	0x00CC	SSA module – Driver PS_1 DC Output Current	A	0x03	0 – 3280	n/a	2.2 A	Value*1.0602 /1000	n/a	Warning	Notification Only	Remove Cause
205	0x00CD	SSA module – Driver PS_2 DC Output Current	A	0x03	0 – 2830	n/a	2.0 A	Value*1.0602 /1000	n/a	Warning	Notification Only	Remove Cause
206	0x00CE	-	-	-	-	-	-	-	-	-	-	
207	0x00CF	-	-	-	-	-	-	-	-	-	-	
208	0x00D0	-	-	-	-	-	-	-	-	-	-	
209	0x00D1	SSA module - Driver Hi A/D Warning Monitor	n/a	0x03	n/a	n/a	n/a	n/a	2^0 : - 2^1 : - 2^2 : Gain Amplifier Drain Current 2^3 : Driver Amplifier Drain Current 2^4 : P.S.1 DC Output Current 2^5 : P.S.2 DC Output Current 2^6 : - 2^7 : - 0:Fault 1:OK	Warning	Notification Only	Remove Cause
210	0x00D2	SSA module - Driver GAIN AMP Drain Voltage	VDC	0x03	0 – 2640	10 VDC	14 VDC	Value/176	n/a	Warning	Notification Only	Remove Cause
211	0x00D3	SSA module - Driver Driver AMP Drain Voltage	VDC	0x03	0 – 3606	43 VDC	50 VDC	Value*0.01719	n/a	Warning	Notification Only	Remove Cause

Address	Address (Hex)	Description	Unit	Function	Permitted Raw Value	Threshold (Lower)	Threshold (Upper)	Convert to Engineering units	command /status		Error Type	Error Operation	Reset Operation
212	0x00D4	SSA module – Driver PS_1 DC Output Voltage	VDC	0x03	0 – 2640	10 VDC	14 VDC	Value/176	n/a		Warning	Notification Only	Remove Cause
213	0x00D5	SSA module – Driver PS_2 DC Output Voltage	VDC	0x03	0 – 3606	43 VDC	50 VDC	Value*0.01719	n/a		Warning	Notification Only	Remove Cause
214	0x00D6	-	-	-	-	-	-	-	-		-	-	-
215	0x00D7	SSA module - Driver LCW Heat Sink Temperature	degC	0x03	1000-4060	n/a	52 degC	25+(Value-1638)/25.5	n/a		Warning	Notification Only	Remove Cause
216	0x00D8	SSA module – Driver Air Temperature	degC	0x03	1000-4060	n/a	50 degC	25+(Value-1638)/25.5	n/a		Warning	Notification Only	Remove Cause
217	0x00D9	-	-	-	-	-	-		-		-	-	-
218	0x00DA	-	-	-	-	-	-	-	-		-	-	-
219	0x00DB	SSA module - Driver Lo A/D Warning Monitor	n/a	0x03	n/a	n/a	n/a	n/a	2^0 : Gain Amplifier Drain Voltage 2^1 : Driver Amplifier Drain Voltage 2^2 : PS_1 DC Output Voltage 2^3 : PS_2 DC Output Voltage 2^4 : - 2^5 : LCW Heat Sink Temperature 2^6 : SSA Module Air Temperature 2^7 : -	0:Fault 1:OK	Warning	Notification Only	Remove Cause
220	0x00DC	SSA module - Driver Sub Circuit Breaker Status	n/a	0x03	0 or 1	n/a	n/a	n/a	0 : OFF 1 : ON		n/a	n/a	n/a
221	0x00DD	-	-	-	-	-	-	-	-		-	-	-
222	0x00DE	-	-	-	-	-	-	-	-		-	-	-
223	0x00DF	SSA module – Driver I/O_1 Interlock Monitor	n/a	0x003	n/a	n/a	n/a	n/a	2^0 : Thermostat (Heat Sink) 2^1 : - 2^2 : - 2^3 : - 2^4 : - 2^5 : - 2^6 : -	0:Fault 1:OK	Interlock	RF/DC: Disable	Default
224	0x00E0	-	-	-	-	-	-	-	-		-	-	-
225	0x00E1	-	-	-	-	-	-	-	-		-	-	-

Address	Address (Hex)	Description	Unit	Function	Permitted Raw Value	Threshold (Lower)	Threshold (Upper)	Convert to Engineering units	command /status		Error Type	Error Operation	Reset Operation
226	0x00E2	SSA module - Driver I/O_1 Warning Monitor	n/a	0x03	n/a	n/a	n/a	n/a	2^0 : - 2^1 : Thermostat (Transformer) 2^2 : - 2^3 : - 2^4 : - 2^5 : - 2^6 : -	0:Fault 1:OK	Warning	SSR off	Remove Cause
227	0x00E3	SSA module - Driver I/O_2 Warning Monitor	n/a	0x03	n/a	n/a	n/a	n/a	2^0 :FAN_1 Rotation Speed (Transformer) 2^3 :FAN_2 Rotation Speed (Transformer) 2^2 :FAN_ Rotation Speed (SSA) 2^3 : - 2^4 : - 2^5 : - 2^6 : -	0:Fault 1:OK	Warning	Notification Only	Remove Cause
228	0x00E4	-	-	-	-	-	-	-	-		-	-	-
229	0x00E5	SSA module - Driver Power ON/OFF Monitor	n/a	0x03	0 or 1	n/a	n/a	n/a	0 : OFF 1 : ON		n/a	n/a	n/a
…	…	-	-	-	-	-	-	-	-		-	-	-
238	0x00EE	Transformer Unit_01 FAN Rotation Speed_1-	rpm	0x03	0 – 4075	6080 rpm	n/a	Value*4	n/a		Warning	Notification Only	Remove Cause
239	0x00EF	Transformer Unit_01 FAN Rotation Speed_2-	rpm	0x03	0 – 4075	6080 rpm	n/a	Value*4	n/a		Warning	Notification Only	Remove Cause
240	0x00F0	SSA module - Driver FAN Rotation Speed	rpm	0x03	0 – 4075	5304 rpm	n/a	Value*4	n/a		Warning	Notification Only	Remove Cause
…	…	-	-	-	-	-	-	-	-		-	-	-
299	0x012B	SSA module - Driver FPGA Ver.	n/a	0x03	0.00 - 31.99	n/a	n/a	Value[11:7] + Value[6:0]/100	n/a		n/a	n/a	n/a

Table 17-4: Register map – SSA module_00

Address	Address (Hex)	Description	Unit	Function	Permitted Raw Value	Threshold (Lower)	Threshold (Upper)	Convert to Engineering units	command /status		Error Type	Error Operation	Reset Operation
300	0x012C	SSA module_00 Forward Output Power	kW	0x03	0-3.6	n/a	n/a	“see Table 20”	n/a		n/a	n/a	n/a
301	0x012D	SSA module_00 Reflect Power	kW	0x03	0-3.6	n/a	n/a	“see Table 20”	n/a		n/a	n/a	n/a
302	0x012E	SSA module_00 Device_1 Drain Current	A	0x03	0 – 3694	n/a	50 A	Value*16.2439 /1000	n/a		Warning	Notification Only	Remove Cause
303	0x012F	SSA module_00 Device_2 Drain Current	A	0x03	0 – 3694	n/a	50 A	Value*16.2439 /1000	n/a		Warning	Notification Only	Remove Cause
304	0x0130	SSA module_00 PS_1 DC Output Current	A	0x03	0 – 3694	n/a	44 A	Value*16.2439 /1000	n/a		Warning	Power Supply 1 off	Remove Cause
305	0x0131	SSA module_00 PS_2 DC Output Current	A	0x03	0 – 3694	n/a	44 A	Value*16.2439 /1000	n/a		Warning	Power Supply 2 off	Remove Cause
306	0x0132	SSA module_00 PS_3 DC Output Current	A	0x03	0 – 3694	n/a	44 A	Value*16.2439 /1000	n/a		Warning	Power Supply 3 off	Remove Cause
307	0x0133	-	-	-	-	-	-	-	-		-	-	-
308	0x0134	-	-	-	-	-	-	-	-		-	-	-
309	0x0135	SSA module_00 Hi A/D Warning Monitor	n/a	0x03	n/a	n/a	n/a	n/a	2^0 : - 2^1 : - 2^2 : Device_1 Drain Current 2^3 : Device_2 Drain Current 2^4 :PS_1 DC Output Current 2^5 : PS_2 DC Output Current 2^6 : PS_3 DC Output Current 2^7 : -	0:Fault 1:OK	Warning	Device Current: Notification Only PS Current: Power Supply off	Remove Cause
310	0x0136	SSA module_00 Drain Voltage	VDC	0x03	0 – 3606	15 VDC	50 VDC	Value*0.01719	n/a		Warning	Notification Only	Remove Cause
311	0x0137	-	-	-	-	-	-	-	-		-	-	-
312	0x0138	SSA module_00 PS_1 DC Output Voltage	VDC	0x03	0 – 3606	15 VDC	50 VDC	Value*0.01719	n/a		Warning	Notification Only	Remove Cause
313	0x0139	SSA module_00 PS_2 DC Output Voltage	VDC	0x03	0 – 3606	15 VDC	50 VDC	Value*0.01719	n/a		Warning	Notification Only	Remove Cause

Address	Address (Hex)	Description	Unit	Function	Permitted Raw Value	Threshold (Lower)	Threshold (Upper)	Convert to Engineering units	command /status		Error Type	Error Operation	Reset Operation
314	0x013A	SSA module_00 PS_3 DC Output Voltage	VDC	0x03	0 – 3606	15 VDC	50 VDC	Value*0.01719	n/a		Warning	Notification Only	Remove Cause
315	0x013B	SSA module_00 LCW Heat Sink Temperature	degC	0x03	1000 - 4060	n/a	52 degC	25+(Value-1638)/25.5	n/a		Warning	Reduce P.S. Control Voltage	Remove Cause
316	0x013C	SSA module_00 SSA Module Air Temperature	degC	0x03	1000 - 4060	n/a	50 degC	25+(Value-1638)/25.5	n/a		Warning	Notification Only	Remove Cause
317	0x013D		-	-	-	-	-	-	-		-	-	-
318	0x013E		-	-	-	-	-	-	-		-	-	-
319	0x013F	SSA module_00 Lo A/D Warning Monitor	n/a	0x03	n/a	n/a	n/a	n/a	2^0 : SSA Drain Voltage 2^1 :- 2^2 : PS_1 DC Output Voltage 2^3 : PS_2 DC Output Voltage 2^4 : PS_3 DC Output Voltage 2^5 : LCW Heat Sink Temperature 2^6 : SSA Module Air Temperature 2^7 : -	0:Fault 1:OK	Warning	LCW H.S. Temp: Reduce P.S. Control Voltage Others: Notification Only	Remove Cause
320	0x0140	SSA module_00 Sub Circuit Breaker Status	n/a	0x03	0 or 1	n/a	n/a	n/a	0 : ON 1 : OFF		n/a	n/a	n/a
321	0x0141	-	-	-	-	-	-	-	-		-	-	-
322	0x0142	-	-	-	-	-	-	-	-		-	-	-
323	0x0143	SSA module_00 I/O_1 Interlock Monitor	n/a	0x03	n/a	n/a	n/a	n/a	2^0 : Thermostat (Heat Sink) 2^1 : - 2^2 : - 2^3 : - 2^4 : - 2^5 : - 2^6 : -	0:Fault 1:OK	Interlock	RF/DC: Disable	Default
324	0x0144	-	-	-	-	-	-	-	-		-	-	-
325	0x0145	-	-	-	-	-	-	-	-		-	-	-

Address	Address (Hex)	Description	Unit	Function	Permitted Raw Value	Threshold (Lower)	Threshold (Upper)	Convert to Engineering units	command /status		Error Type	Error Operation	Reset Operation
326	0x0146	SSA module_00 I/O_1 Warning Monitor	n/a	0x03	n/a	n/a	n/a	n/a	2^0 : - 2^1 :Thermostat (Transformer) 2^2 : PS_1 Alarm 2^3 : PS_2 Alarm 2^4 : PS_3 Alarm 2^5 : - 2^6 : -	0:Fault 1:OK	Warning	Thermostat: SSR off PS Alarm: Power Supply off	Remove Cause
327	0x0147	SSA module_00 I/O_2 Warning Monitor	n/a	0x03	n/a	n/a	n/a	n/a	2^0 :FAN_1 Rotation Speed (Transformer) 2^1 :FAN_2 Rotation Speed (Transformer) 2^2 :FAN_ Rotation Speed (SSA) 2^3 :- 2^4 : - 2^5 : - 2^6 : -	0:Fault 1:OK	Warning	Notification Only	Remove Cause
328	0x0148	-	-	-	-	-	-	-	-		-	-	-
329	0x0149	SSA Module_00 Power ON/OFF Monitor	n/a	0x03	0 or 1	n/a	n/a	n/a	0 : OFF 1 : ON		n/a	n/a	n/a
…	…	-	-	-	-	-	-	-	-		-	-	-
338	0x0152	SSA module_00 FAN Rotation Speed_1 (Transformer)	rpm	0x03	0 – 4075	6080 rpm	n/a	Value*4	n/a		Warning	Notification Only	Remove Cause
339	0x0153	SSA module_00 FAN Rotation Speed_2 (Transformer)	rpm	0x03	0 – 4075	6080 rpm	n/a	Value*4	n/a		Warning	Notification Only	Remove Cause
340	0x0154	SSA module_00 FAN Rotation Speed	rpm	0x03	0 – 4075	5304 rpm	n/a	Value*4	n/a		Warning	Notification Only	Remove Cause
…	…	-	-	-	-	-	-		-		-	-	
349	0x015D	SSA module_00 FPGA Version	n/a	0x03	0.00 - 31.99	n/a	n/a	Value[11:7] + Value[6:0]/100	n/a		n/a	n/a	n/a

Table 17-5: Register map – SSA module_01 - 30

Address	Address (Hex)	Description	Unit	Function	Permitted Raw value	Threshold (Lower)	Threshold (Upper)	Convert to Engineering units	command / status	Error Type	Error Operation	Reset Operation
350-399	0x015E-0x018F	SSA Module_00 is as same as Address pattern of SSA Module_01 *SSA_1-30	-	0x03	-	-	-	-	-	-	-	-
400-449	0x0190-0x01C1	SSA Module_02	-	0x03	-	-	-	-	-	-	-	-
450-499	0x01C2-0x01F3	SSA Module_03	-	0x03	-	-	-	-	-	-	-	-
500-549	0x01F4-0x0225	SSA Module_04	-	0x03	-	-	-	-	-	-	-	-
550-599	0x0226-0x0257	SSA Module_05	-	0x03	-	-	-	-	-	-	-	-
600-649	0x0258-0x0289	SSA Module_06	-	0x03	-	-	-	-	-	-	-	-
650-699	0x028A-0x02BB	SSA Module_07	-	0x03	-	-	-	-	-	-	-	-
700-749	0x02BC-0x02ED	SSA Module_08	-	0x03	-	-	-	-	-	-	-	-
750-799	0x02EE-0x031F	SSA Module_09	-	0x03	-	-	-	-	-	-	-	-
800-849	0x0320-0x0351	SSA Module_10	-	0x03	-	-	-	-	-	-	-	-
850-899	0x0352-0x0383	SSA Module_11	-	0x03	-	-	-	-	-	-	-	-
900-949	0x0384-0x03B5	SSA Module_12	-	0x03	-	-	-	-	-	-	-	-
950-999	0x03B6-0x03E7	SSA Module_13	-	0x03	-	-	-	-	-	-	-	-
1000-1049	0x03E8-0x0419	SSA Module_14	-	0x03	-	-	-	-	-	-	-	-
1050-1099	0x041A-0x044B	SSA Module_15	-	0x03	-	-	-	-	-	-	-	-
1100-1149	0x044C-0x047D	SSA Module_16	-	0x03	-	-	-	-	-	-	-	-
1150-1199	0x047E-0x04AF	SSA Module_17	-	0x03	-	-	-	-	-	-	-	-
1200-1249	0x04B0-0x04E1	SSA Module_18	-	0x03	-	-	-	-	-	-	-	-
1250-1299	0x04E2-0x0513	SSA Module_19	-	0x03	-	-	-	-	-	-	-	-
1300-1349	0x0514-0x0545	SSA Module_20	-	0x03	-	-	-	-	-	-	-	-
1350-1399	0x0546-0x0577	SSA Module_21	-	0x03	-	-	-	-	-	-	-	-
1400-1449	0x0578-0x05A9	SSA Module_22	-	0x03	-	-	-	-	-	-	-	-
1450-1499	0x05AA-0x05DB	SSA Module_23	-	0x03	-	-	-	-	-	-	-	-
1500-1549	0x05DC-0x060D	SSA Module_24	-	0x03	-	-	-	-	-	-	-	-
1550-1599	0x060E-0x063F	SSA Module_25	-	0x03	-	-	-	-	-	-	-	-
1600-1649	0x0640-0x0671	SSA Module_26	-	0x03	-	-	-	-	-	-	-	-
1650-1699	0x0672-0x06A3	SSA Module_27	-	0x03	-	-	-	-	-	-	-	-
1700-1749	0x06A4-0x06D5	SSA Module_28	-	0x03	-	-	-	-	-	-	-	-
1750-1799	0x06D6-0x0707	SSA Module_29	-	0x03	-	-	-	-	-	-	-	-
1800-1849	0x0708-0x0739	SSA Module_30	-	0x03	-	-	-	-	-	-	-	-

Address	Address (Hex)	Description	Unit	Function	Permitted Raw value	Threshold (Lower)	Threshold (Upper)	Convert to Engineering units	command / status	Error Type	Error Operation	Reset Operation
…	-	-	-	-	-	-	-	-	-	-	-	-

Table 17-6: Register map – Interlock status

Address	Address (Hex)	Description	Unit	Function	Permitted Raw value	Threshold (Lower)	Threshold (Upper)	Convert to Engineering units	command / status	Error Type	Error Operation	Reset Operation
4000	0x0FA0	External Fault 1	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK	Interlock	RF/DC: Disable	Default
4001	0x0FA1	External Fault 2	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK	Interlock	RF/DC: Disable	Default
4002	0x0FA2	External Fault 3	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK	Interlock	RF/DC: Disable	Default
4003	0x0FA3	External Fault 4	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK	Interlock	RF/DC: Disable	Default
4004	0x0FA4	External Fault 5	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK	Interlock	RF/DC: Disable	Default
4005	0x0FA5	External Fault 6	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK	Interlock	RF/DC: Disable	Default
4006	0x0FA6	Internal Fault	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK	Interlock	RF/DC: Disable	Default
4007	0x0FA7	480 VAC 1 (U-V)	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK	Interlock	RF/DC: Disable	Default
4008	0x0FA8	480 VAC 2 (V-W)	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK	Interlock	RF/DC: Disable	Default
4009	0x0FA9	480 VAC 3 (U-W)	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK	Interlock	RF/DC: Disable	Default
4010	0x0FAA	RF Input Power	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK	Interlock	RF/DC: Disable	Default
4011	0x0FAB	Forward Power	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK	Interlock	RF/DC: Disable	Default
4012	0x0FAC	Reflection Power	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK	Interlock	RF/DC: Disable	Default
4013	0x0FAD	-	-	-	-	-	-	-	-	-	-	-
4014	0x0FAE	LCW Flow Rate	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK	Interlock	RF/DC: Disable	Default
4015	0x0FAF	System Rack Air Temperature	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK	Interlock	RF/DC: Disable	Default
4016	0x0FB0	LCW Inlet Temperature	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK	Interlock	RF/DC: Disable	Default
4017	0x0FB1	LCW Outlet Temperature	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault	Interlock	RF/DC: Disable	Default

Address	Address (Hex)	Description	Unit	Function	Permitted Raw value	Threshold (Lower)	Threshold (Upper)	Convert to Engineering units	command / status		Error Type	Error Operation	Reset Operation
									1 : OK				
4018	0x0FB2	Heat Exchanger 1 Air Temperature	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK		Interlock	RF/DC: Disable	Default
4019	0x0FB3	Heat Exchanger 2 Air Temperature	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK		Interlock	RF/DC: Disable	Default
4020	0x0FB4	Control Unit Air Temperature	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK		Interlock	RF/DC: Disable	Default
4021	0x0FB5	Radial Combiner Temperature	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK		Interlock	RF/DC: Disable	Default
4022	0x0FB6	-	-	-	-	-	-	-	-		-	-	-
4023	0x0FB7	Control Unit Sub Circuit Breaker (FAN P.S.)	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK		Interlock	RF/DC: Disable	Default
4024	0x0FB8	-	-	-	-	-	-	-	-		-	-	-
4025	0x0FB9	Thermostat (FAN P.S. Transformer)	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK		Interlock	RF/DC: Disable	Default
4026	0x0FBA	LCW Leak sensor	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK		Interlock	RF/DC: Disable	Default
4027	0x0FBB	Alarm Bus-line	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK		Interlock	RF/DC: Disable	Default
4028-4031	0x0FBC-0x0FBF	-	-	-	-	-	-	-	-		-	-	-
4032	0x0FC0	FAN P.S. Alarm	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK		Interlock	RF/DC: Disable	Default
4033	0x0FC1	Communication Wire Error (Control Unit FPGA)	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK		Interlock	RF/DC: Disable	Default
4034	0x0FC2	FPGA Error (Control Unit FPGA)	n/a	0x03	n/a	n/a	n/a	n/a	0 : Fault 1 : OK		Interlock	RF/DC: Disable	Default
4035	0x0FC3	Heat Sink Thermostat (SSA module_Driver, module_00-14)	n/a	0x03	n/a	n/a	n/a	n/a	2^0 : SSA module - Driver 2^1 : SSA module - 00 2^2 : SSA module - 01 2^3 : SSA module - 02 … 2^13: SSA module - 12 2^14: SSA module - 13 2^15: SSA module – 14	0: Fault 1: OK	Interlock	RF/DC: Disable	Default
4036	0x0FC4	Heat Sink Thermostat (SSA module_15-31)	n/a	0x03	n/a	n/a	n/a	n/a	2^0 : SSA module - 15 2^1 : SSA module - 16 2^2 : SSA module - 17 2^3 : SSA module - 18 …	0: Fault 1: OK	Interlock	RF/DC: Disable	Default

Address	Address (Hex)	Description	Unit	Function	Permitted Raw value	Threshold (Lower)	Threshold (Upper)	Convert to Engineering units	command / status		Error Type	Error Operation	Reset Operation
									2^13: SSA module - 28 2^14: SSA module - 29 2^15: SSA module - 30				

Table 18: Lookup table of Forward RF power (example for reference)

RF Power (W)	Raw Value
70000	2370
68000	2334
66000	2298
64000	2262
62000	2225
60000	2188
58000	2150
56000	2112
54000	2073
52000	2033
50000	1992
48000	1956
46000	1914
44000	1872
42000	1829
40000	1785
38000	1740
36000	1693
34000	1645
32000	1597
30000	1548
28000	1500
26000	1446
24000	1391
22000	1335
20000	1275
18000	1212
16000	1146
14000	1074
12000	999
10000	919
7500	804
5000	662

RF Power (W)	Raw Value
2000	428
1000	307
500	219
200	141
0	0 to 140

P (W) = slope * (Raw-value – Raw-value(LUT lower)) + offset

slope = RF Power(LUT upper) – RF Power(LUT lower) / Raw Value(LUT upper) – Raw Value(LUT lower)
offset = RF Power(LUT lower)

[Calculation example]
When Raw-Value is “1515”.

RF Power (W)	Raw Value	Description
30000	1548	Upper of LUT
P (W)	1515	for example
28000	1500	Lower of LUT

P (W) = ((30000 – 28000) / (1548 – 1500)) * (1515 – 1500) + 28000
= 28625

Table 19: Lookup table of Reflection RF power (example for reference)

RF Power (W)	Raw Value
70000	2258
68000	2223
66000	2188
64000	2153
62000	2118
60000	2083
58000	2047
56000	2011

RF Power (W)	Raw Value
70000	2258
68000	2223
66000	2188
54000	1975
52000	1938
50000	1900
48000	1862
46000	1822
44000	1782
42000	1741
40000	1699
38000	1656
36000	1611
34000	1566
32000	1519
30000	1471
28000	1421
26000	1370
24000	1318
22000	1263
20000	1205
18000	1144
16000	1083
14000	1014
12000	941
10000	863
7500	750
5000	615
2000	386
1000	267
500	180
200	115
0	0 to 114

Table 20: Lookup table of SSA RF power (example for reference)

RF Power (W)	Raw Value
3131	2865
3029	2773
2928	2680
2826	2588
2724	2496
2621	2404
2496	2312
2376	2183
2051	2057
1978	1943
1768	1843
1687	1763
1519	1690
1437	1603
1334	1549
1262	1473
1198	1405
1134	1337
1077	1277
925	1216
849	1133
787	1065
711	982
639	904
552	808
479	728
388	629
284	515
220	398
154	254
78	89

Table 21: Lookup table of Input RF power (example for reference)

RF Power (dBm)	Raw Value
10	1287
5	1173
0	1063
-5	954
-10	847
-15	740
-20	632
-25	525
-30	419
-35	317
-40	225
-45	152

P (dBm) = slope * (Raw-value – Raw-value(LUT lower)) + offset

slope = RF Power(LUT upper) – RF Power(LUT lower) / Raw Value(LUT upper) – Raw Value(LUT lower)

offset = RF Power(LUT lower)

[Calculation example]

When Raw-Value is “1000”.

RF Power (dBm)	Raw Value	Description
0	1063	Upper of LUT
P (dBm)	1000	for example
-5	954	Lower of LUT

P (dBm) = ((0 + 5) / (1063 – 954)) * (1000 – 954) - 5

= -2.89

2.3. Protection Function

2.3.1. Interlock Operation

Interlock Control works only with hardware without software. There are two types of Interlock; one is “Internal Interlock” to be activated by a failure caused inside SSPA, and the other is “External Interlock” to be activated by a failure caused outside SSPA. Error type of both is shown as “Interlock” in Register Map. If Interlock occurs (Fault status), both DC Enable and RF Enable change to Disable status.

Interlock Control sets 24V Fault output to lower than 5VDC and shuts the PS control voltage down promptly. Those status can be seen via control interface. Fault information is latched, and also resettable by interlock reset command.

Table 22: 24 V Fault State Definitions

OK(No Fault) State Voltage	24 VDC nominal	Range 10.0 – 31.2 VDC
OK(No Fault) State Current	Minimum 4.8 mA @10 VDC	Maximum 5.5 mA @31.2 VDC
Fault State	< 5 VDC	< 2.27 mA

2.3.2. Warning Operation

In the SSA module, values are set for monitoring items such as current, voltage, temperature, etc. When the measured value exceeds the current value, the warning is notified. (However, the following case are excluded.)

For PS OFF case, PS voltage indicates OK. This is due to the fact that the Circuit Breaker is OFF and therefore 0V is expected, or otherwise, due to the fact that PS is OFF by self-monitoring function and PS alarm indicates Fault.

There are multiple types of Warning; warning which stops and doesn’t stop SSA Module, warning which decreases voltage of Power Supply down to 75%. Error type of all is shown as “Warning”. If Warning occurs (Fault status) with a certain module, only that module will perform Error Operation.

These status can be seen via control interface. Fault information is latched, and also resettable by warning reset command.

2.4. Monitoring System

2.4.1. Measurement

RF, Current, Temperature, Flow Rate, Humidity and more monitored contents are converted to voltage and read by A/D Converter in Voltage. The rotation speed of FAN is calculated by monitoring the period of the pulse signal. Other High / Low signals such as thermostat and water leakage are monitored as they are. After power supplied, these monitored items will be periodically monitored without interruption. The measured data will be averaged and notified to the PLC.

However, when it is in Pulse Mode, monitoring is performed in synchronization with the rising edge of the trigger.

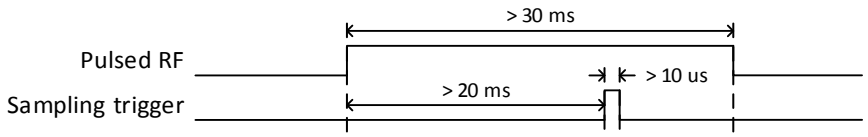

Fig. 4: recommended pulse width and trigger timing

Although the minimum operation pulse width of SSA is 1 ms, some measurements may not be able to obtain accurate values due to the influence of averaging. Figure 4 shows the recommended pulse width and trigger timing.

2.4.2. Collection / Transmission

PLC controls SSA modules by (1) issuing orders and performing setting to SSA modules (writing sequence) and (2) reading measured value and status of SSA (reading sequence).

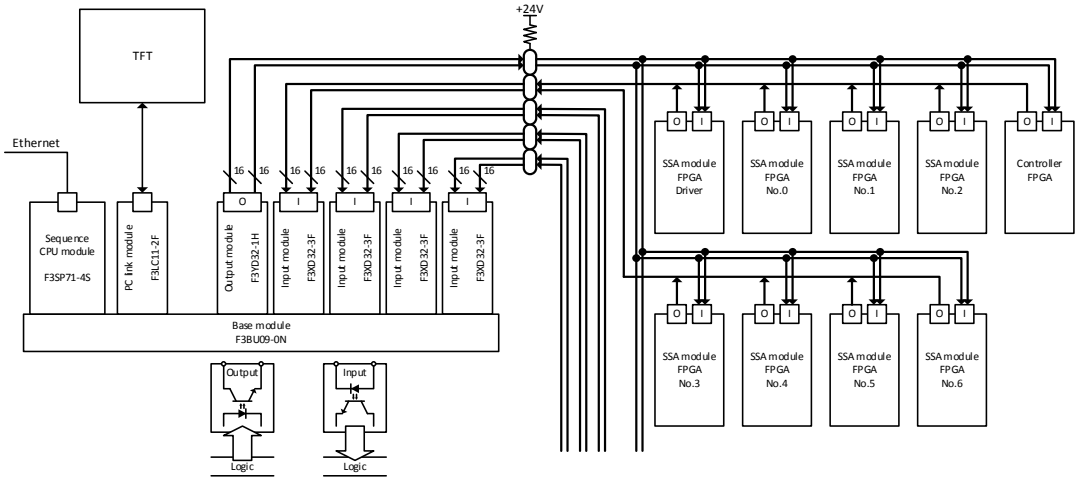

Fig. 5: PLC – SSA module Connection

SSA modules' signal wires of input (READ PORT) is 32bit and output (WRITE Port) is 16 bit. And both wires communicate via photo coupler

PLC accesses register to all the SSA modules at the same time. Then, SSA modules on designated addresses start instructed command or replying.

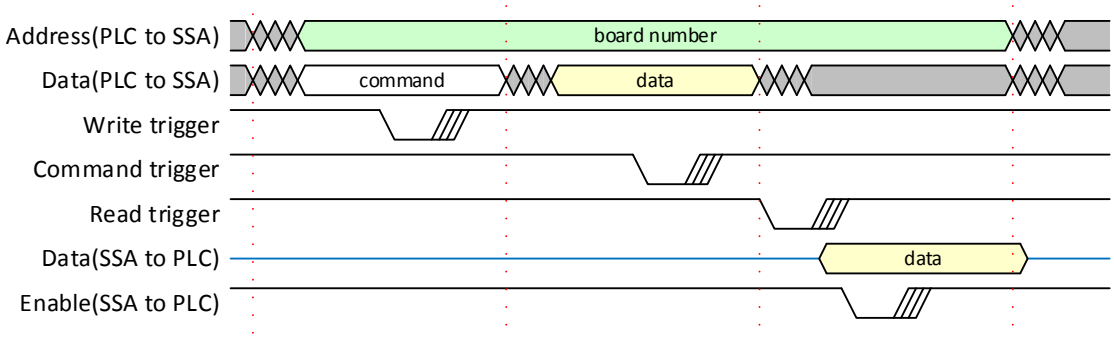

Fig. 6: Writing Sequence

PLC does write action for setting and/or commanding to SSA modules. (See Fig. 6)
PLC accesses to SSA modules by setting write enable after setting address signals, data signals, and data enable.

PLC can access to all SSA modules at the same time by one write action.

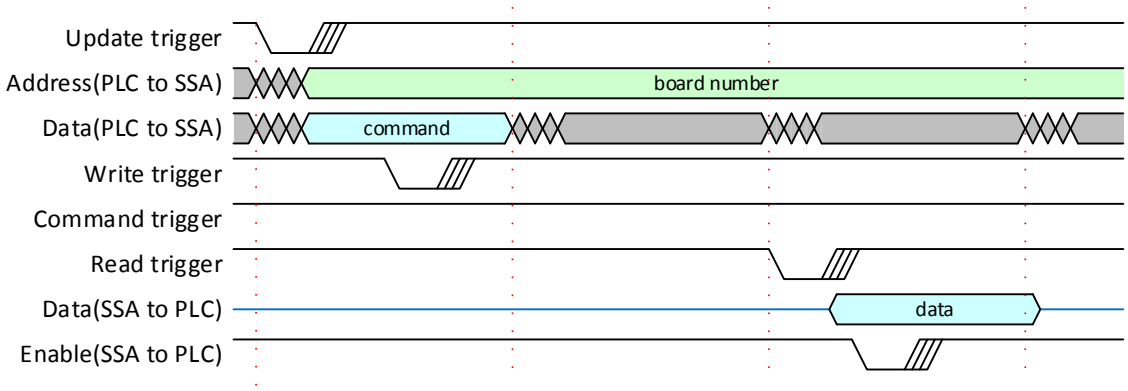

Fig. 7: Reading Sequence

PLC does read action for reading status from SSA modules. (See Fig. 7)
PLC accesses to SSA modules by setting read enable after setting address signals, data signals, and data enable.

PLC can access to 8 SSA modules at the same time by one read action
Update Trigger is provided by PLC in 620 ms period.

2.4.3. Display / Recording

Collected data is shown on touch screen and recorded to SD card at the same time. (Recorded data is used when a fault occurs.)

2.4.3.1. Display design and Operation manual

Screen displayed and operating manual are as the followings.

(1) Configuration

Configuration Display is displayed after inputting power into the SSA.

It will automatically switch to Information Display after completing all the FPGA Configurations – FPGA_1 (Control Unit), FPGA_2 (SSA Module_Driver), and FPGA_3-33(SSA Module_0-30).

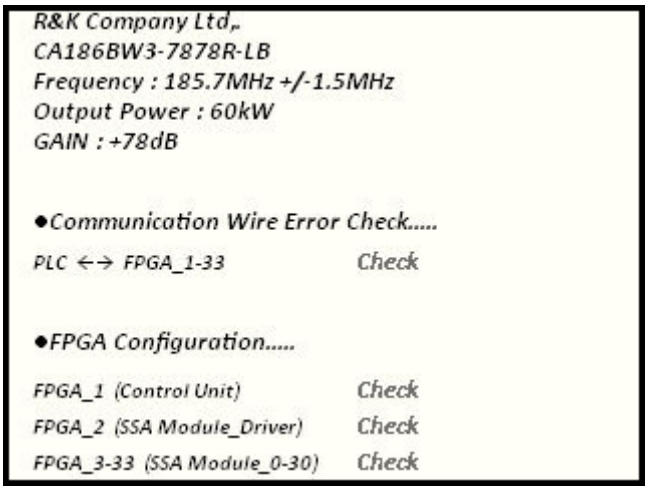

Fig. 8: Screenshot (Power ON)

Table 23: Display contents

No.	parameter	description
1	PLC <--> FPGA_1-33	----: FPGA Communication Wire Error Check is incomplete.
		Check： FPGA Communication Wire Error Check is completed.
2	FPGA_1 (Control Unit)	---- ： FPGA Configuration is incomplete.
		Check： FPGA Configuration is completed.
3	FPGA_2 (SSA Module_Driver)	---- ： FPGA Configuration is incomplete.
		Check： FPGA Configuration is completed.
4	FPGA_3-33 (SSA Module_0-30)	---- ： FPGA Configuration is incomplete.
		Check： FPGA Configuration is completed.

(2) Information Display

This is the screen image of Information Display.

During the normal operation, this is displayed after all the FPGA Configurations are completed.

By pressing the button of each item, the selected item will be displayed.

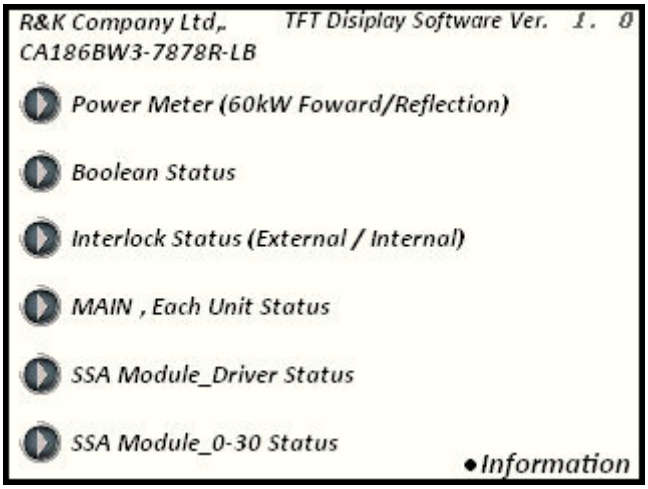

Fig. 9: Screenshot (Menu)

Table 24: Display contents

No.	parameter	description
1	Power Meter (60kW Forward/Reflection)	By pressing the button, it switches to Power Meter Display.
2	Boolean Status	By pressing the button, it switches to Boolean Status Display.
3	Interlock Status (External/Internal)	By pressing the button, it switches to Interlock Status (External/Internal) Display.
4	MAIN, Each Unit Status	By pressing the button, it switches to MAIN, Each Unit Status Display.
5	SSA Module_Driver Status	By pressing the button, it switches to SSA Module_Driver Status Display.
6	SSA Module_0-30 Status	By pressing the button, it switches to SSA Module_0-30 Status Display.

(3) Power Meter Display

This is the screen image of Power Meter Display.

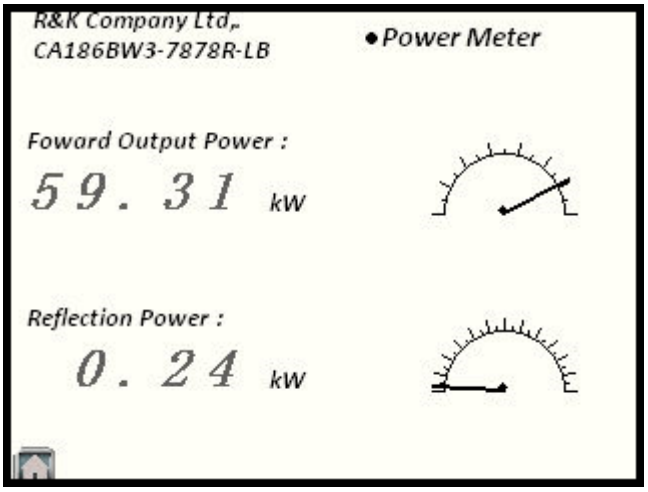

Fig. 10: Screenshot (During normal operation, Po=60kW)

Table 25: Display contents

No.	parameter	description
1	Forward Output Power	It displays Forward Output Power value in kilowatt (kW).
2	Reflection Power	It displays Reflection Power value in kilowatt (kW).
3	Home button	By pressing the button, it switches to Information Display.

(4) Boolean Status Display – page 1

This is the screen image of Boolean Status_1 Display.

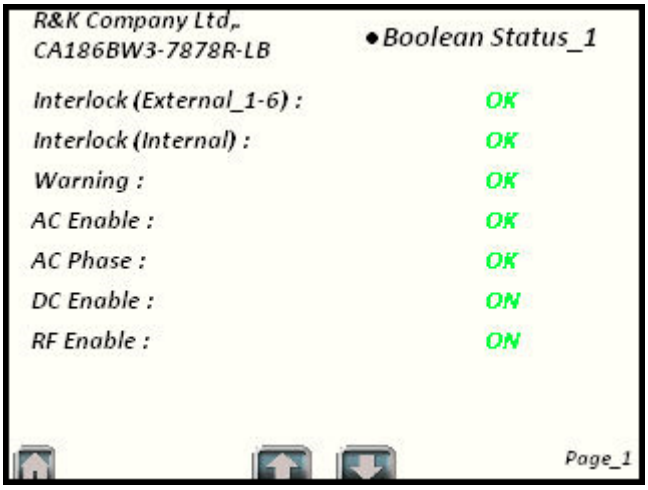

Fig. 11: Screenshot (During normal operation, Po=60kW)

Table 26: Display contents

No.	parameter	description
1	Interlock (External_1-6)	It displays the Interlock (External_1-6) status (OK/fault). When this status is fault, it automatically switches to Interlock Status_1 Display.
2	Interlock (Internal)	It displays the Interlock (Internal) status (OK/fault). When this status is fault, it automatically switches to Interlock Status_2 Display.
3	Warning	It displays the Warning status (OK/fault). When this status is fault, it automatically switches to status screen of module where the warning occurred.
4	AC Enable	It displays the AC Enable status (OK/fault).
5	AC Phase	It displays the AC Phase status (OK/fault).
6	DC Enable	It displays the DC Enable status (ON/OFF).
7	RF Enable	It displays the RF Enable status (ON/OFF).
8	Home button 	By pressing the button, it switches to Information Display.
9	Page up button 	By pressing the button, it switches to Boolean Status_4 Display.
10	Page down button 	By pressing the button, it switches to Boolean Status_2 Display.

(5) Boolean Status Display – page 2

This is the screen image of Boolean Status_2 Display.

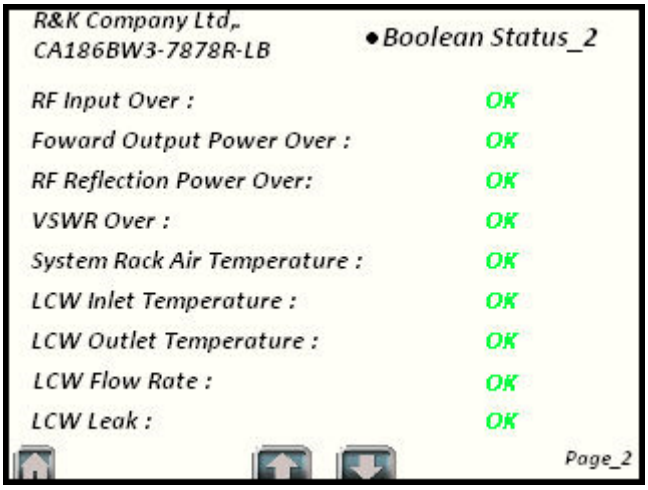

Fig. 12: Screenshot (During normal operation, Po=60kW)

Table 27: Display contents

No.	parameter	description
1	RF Input Over	It displays the RF Input Over status (OK/fault).
2	Forward Output Power Over	It displays the Forward Output Power Over status (OK/fault).
3	RF Reflection Power Over	It displays the RF Reflection Power Over status (OK/fault).
4	VSWR Over	It displays the VSWR Over status (OK/fault).
5	System Rock Air Temperature	It displays the System Rock Air Temperature status (OK/fault).
6	LCW Inlet Temperature	It displays the LCW Inlet Temperature status (OK/fault).
7	LCW Outlet Temperature	It displays the LCW Outlet Temperature status (OK/fault).
8	LCW Flow Rate	It displays the LCW Flow Rate status (OK/fault).
9	LCW Leak	It displays the LCW Leak status (OK/fault).
10	Home button 	By pressing the button, it switches to Information Display.
11	Page up button 	By pressing the button, it switches to Boolean Status_1 Display.
12	Page down button 	By pressing the button, it switches to Boolean Status_3 Display.

(6) Boolean Status Display – page 3

This is the screen image of Boolean Status_3 Display.

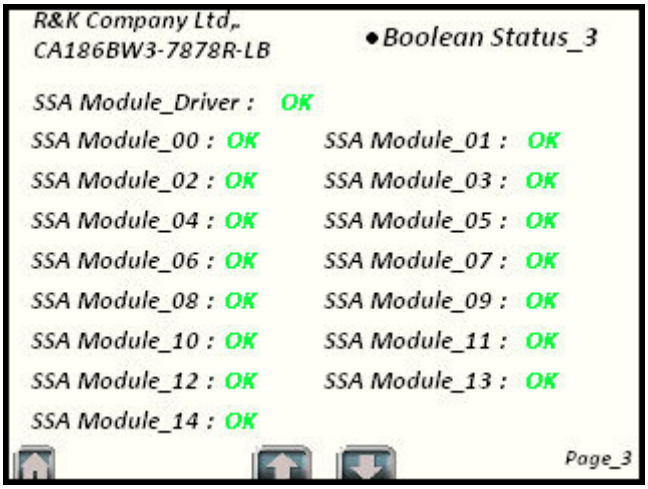

Fig. 13: Screenshot (During normal operation, Po=60kW)

Table 28: Display contents

No.	parameter	description
1	SSA Module_Driver	It displays the P.S. Remote (SSA Module_Driver) status (OK/fault).
2	SSA Module_00	It displays the P.S. Remote (SSA Module_00) status (OK/fault).
3	SSA Module_01	It displays the P.S. Remote (SSA Module_01) status (OK/fault).
4	SSA Module_02	It displays the P.S. Remote (SSA Module_02) status (OK/fault).
5	SSA Module_03	It displays the P.S. Remote (SSA Module_03) status (OK/fault).
6	SSA Module_04	It displays the P.S. Remote (SSA Module_04) status (OK/fault).
7	SSA Module_05	It displays the P.S. Remote (SSA Module_05) status (OK/fault)
8	SSA Module_06	It displays the P.S. Remote (SSA Module_06) status (OK/fault)..
9	SSA Module_07	It displays the P.S. Remote (SSA Module_07) status (OK/fault).
10	SSA Module_08	It displays the P.S. Remote (SSA Module_08) status (OK/fault).
11	SSA Module_09	It displays the P.S. Remote (SSA Module_09) status (OK/fault).
12	SSA Module_10	It displays the P.S. Remote (SSA Module_10) status (OK/fault).
13	SSA Module_11	It displays the P.S. Remote (SSA Module_11) status (OK/fault).
14	SSA Module_12	It displays the P.S. Remote (SSA Module_12) status (OK/fault).
15	SSA Module_13	It displays the P.S. Remote (SSA Module_13) status (OK/fault).
16	SSA Module_14	It displays the P.S. Remote (SSA Module_14) status (OK/fault).
17	Home button	By pressing the button, it switches to Information Display.
18	Page up button	By pressing the button, it switches to Boolean Status_2 Display.

19	Page down button 	By pressing the button, it switches to Boolean Status_4 Display.

(7) Boolean Status Display – page 4

This is the image of Boolean Status_4 Display.

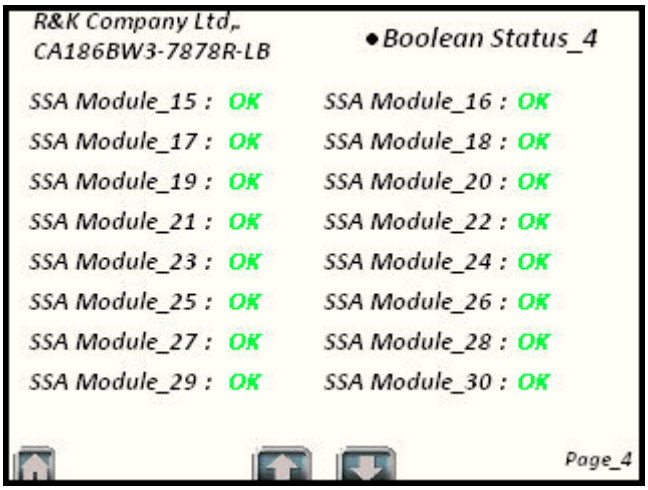

Fig. 14: Screenshot (During normal operation, Po=60kW)

Table 29: Display contents

No.	parameter	description
1	SSA Module_15	It displays the P.S. Remote (SSA Module_15) status (OK/fault).
2	SSA Module_16	It displays the P.S. Remote (SSA Module_16) status (OK/fault).
3	SSA Module_17	It displays the P.S. Remote (SSA Module_17) status (OK/fault).
4	SSA Module_18	It displays the P.S. Remote (SSA Module_18) status (OK/fault).
5	SSA Module_19	It displays the P.S. Remote (SSA Module_19) status (OK/fault).
6	SSA Module_20	It displays the P.S. Remote (SSA Module_20) status (OK/fault).
7	SSA Module_21	It displays the P.S. Remote (SSA Module_21) status (OK/fault).
8	SSA Module_22	It displays the P.S. Remote (SSA Module_22) status (OK/fault).
9	SSA Module_23	It displays the P.S. Remote (SSA Module_23) status (OK/fault).
10	SSA Module_24	It displays the P.S. Remote (SSA Module_24) status (OK/fault).
11	SSA Module_25	It displays the P.S. Remote (SSA Module_25) status (OK/fault).
12	SSA Module_26	It displays the P.S. Remote (SSA Module_26) status (OK/fault).
13	SSA Module_27	It displays the P.S. Remote (SSA Module_27) status (OK/fault).
14	SSA Module_28	It displays the P.S. Remote (SSA Module_28) status (OK/fault).
15	SSA Module_29	It displays the P.S. Remote (SSA Module_29) status (OK/fault).
16	SSA Module_30	It displays the P.S. Remote (SSA Module_30) status (OK/fault).
17	Home button 	By pressing the button, it switches to Information Display.
18	Page up button 	By pressing the button, it switches to Boolean Status_3 Display.

19	Page down button 	By pressing the button, it switches to Boolean Status_1 Display.

(8) Interlock Status Display – page 1

This is the screen image of External Interlock Status_1 Display.

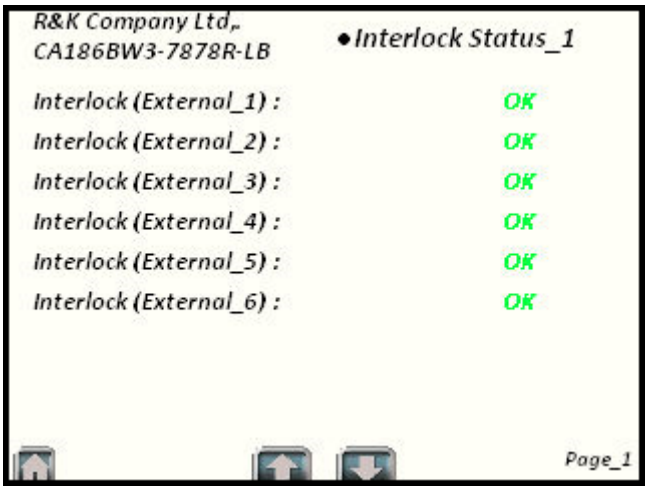

Fig. 15: Screenshot (During normal operation, Po=60kW)

Table 30: Display contents

No.	parameter	description
1	Interlock(External Fault_1)	It displays the Interlock (External Fault_1) status (OK/fault).
2	Interlock(External Fault_2)	It displays the Interlock (External Fault_2) status (OK/fault).
3	Interlock(External Fault_3)	It displays the Interlock (External Fault_3) status (OK/fault).
4	Interlock(External Fault_4)	It displays the Interlock (External Fault_4) status (OK/fault).
5	Interlock(External Fault_5)	It displays the Interlock (External Fault_5) status (OK/fault).
6	Interlock(External Fault_6)	It displays the Interlock (External Fault_6) status (OK/fault).
7	Home button 	By pressing the button, it switches to Information Display.
8	Page up button 	By pressing the button, it switches to Interlock Status_6 Display.
9	Page down button 	By pressing the button, it switches to Interlock Status_2 Display.

(9) Interlock Status Display – page 2

This is the screen image of Internal Interlock Status_2 Display.

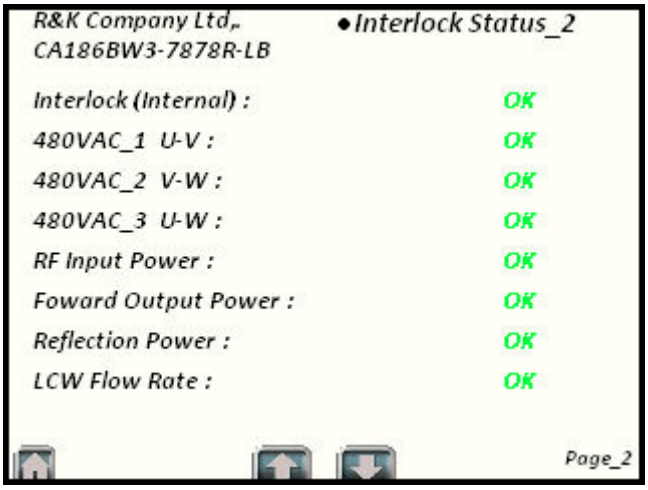

Fig. 16: Screenshot (During normal operation, Po=60kW)

Table 31: Display contents

No.	parameter	description
1	Internal Fault or 120VAC Boot-up	It displays the Interlock (Internal) status (OK/fault).
2	480VAC_1 U-V	It displays the 480VAC_1 U-V status (OK/fault).
3	480VAC_1 V-W	It displays the 480VAC_2 V-W status (OK/fault).
4	480VAC_1 U-W	It displays the 480VAC_3 U-W status (OK/fault).
5	RF Input Power	It displays the RF Input Power status (OK/fault).
6	Forward Output Power	It displays the Forward Output Power status (OK/fault).
7	Reflection Power	It displays the Reflection Power status (OK/fault).
8	LCW Flow Rate	It displays the LCW Flow Rate status (OK/fault).
9	Home button 	By pressing the button, it switches to Information Display.
10	Page up button 	By pressing the button, it switches to Interlock Status_1 Display.
11	Page down button 	By pressing the button, it switches to Interlock Status_3 Display.

(10) Interlock Status Display – page 3

This is the screen image of Internal Interlock Status_3 Display.

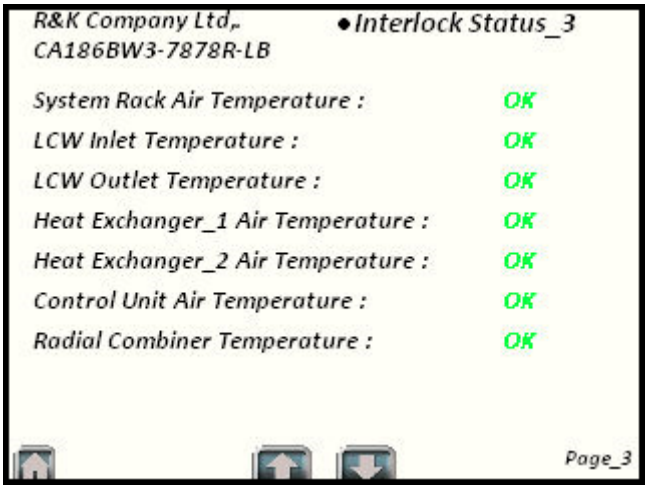

Fig. 17: Screenshot (During normal operation, Po=60kW)

Table 32: Display contents

No.	parameter	description
1	System Rock Air Temperature	It displays the System Rock Air Temperature status (OK/fault).
2	LCW Inlet Temperature	It displays the LCW Inlet Temperature status (OK/fault).
3	LCW Outlet Temperature	It displays the LCW Outlet Temperature status (OK/fault).
4	Heat Exchanger_1 Air Temperature	It displays the Heat Exchanger_1 Air Temperature status (OK/fault).
5	Heat Exchanger_2 Air Temperature	It displays the Heat Exchanger_2 Air Temperature status (OK/fault).
6	Control Unit Air Temperature	It displays the Control Unit Air Temperature status (OK/fault).
7	Radial Combiner Temperature	It displays the Radial Combiner Temperature status (OK/fault).
8	Home button 	By pressing the button, it switches to Information Display.
9	Page up button 	By pressing the button, it switches to Interlock Status_2 Display.
10	Page down button 	By pressing the button, it switches to Interlock Status_4 Display.

(11) Interlock Status Display – page 4

This is the screen image of Internal Interlock Status_4 Display.

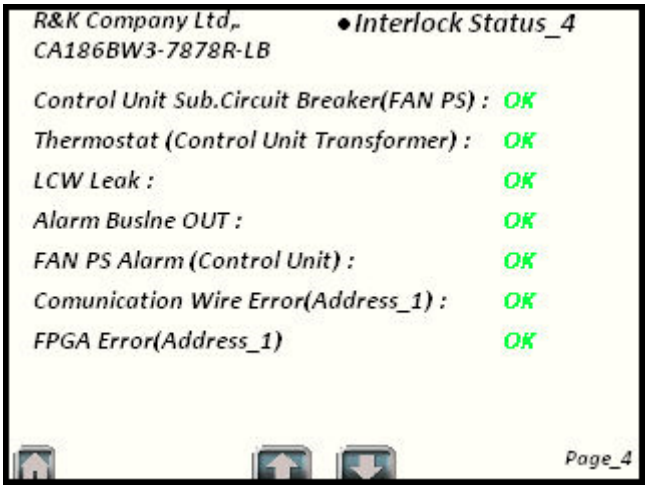

Fig. 18: Screenshot (During normal operation, Po=60kW)

Table 33: Display contents

No.	parameter	description
1	Control Unit Sub.Circuit Breaker (FAN PS)	It displays the Control Unit Sub.Circuit Breaker (FAN PS) status (OK/fault).
2	Thermostat (Control Unit Transformer)	It displays the Thermostat (Control Unit Transformer) status (OK/fault).
3	LCW Leak	It displays the LCW Leak status (OK/fault).
4	Alarm Busline OUT	It displays the Alarm Busline OUT status (OK/fault).
5	FAN PS Alarm (Control Unit)	It displays the FAN PS Alarm (Control Unit) status (OK/fault).
6	Communication Wire Error (Address_1)	It displays the Communication Wire Error (Address 1) status (OK/fault).
7	FPGA Error Address_1	It displays the FPGA Error Address_1 status (OK/fault).
8	Home button 	By pressing the button, it switches to Information Display.
9	Page up button 	By pressing the button, it switches to Interlock Status_3 Display.
10	Page down button 	By pressing the button, it switches to Interlock Status_5 Display.

(12) Interlock Status Display – page 5

This is the screen image of Internal Interlock Status_5 Display.

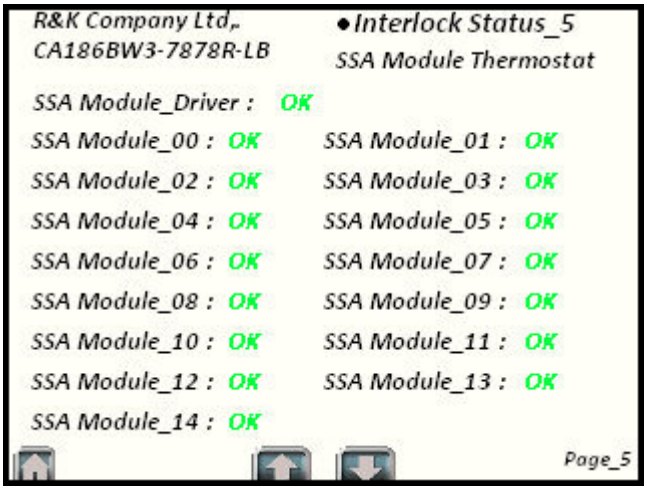

Fig. 19: Screenshot（During normal operation, Po=60kW）

Table 34: Display contents

No.	parameter	description
1	SSA Module_Driver	It displays the Thermostat on H.Sink (SSA Module Driver) status (OK/fault).
2	SSA Module_00	It displays the Thermostat on H.Sink (SSA Module_00) status (OK/fault).
3	SSA Module_01	It displays the Thermostat on H.Sink (SSA Module_01) status (OK/fault).
4	SSA Module_02	It displays the Thermostat on H.Sink (SSA Module_02) status (OK/fault).
5	SSA Module_03	It displays the Thermostat on H.Sink (SSA Module_03) status (OK/fault).
6	SSA Module_04	It displays the Thermostat on H.Sink (SSA Module_04) status (OK/fault).
7	SSA Module_05	It displays the Thermostat on H.Sink (SSA Module_05) status (OK/fault).
8	SSA Module_06	It displays the Thermostat on H.Sink (SSA Module_06) status (OK/fault).
9	SSA Module_07	It displays the Thermostat on H.Sink (SSA Module_07) status (OK/fault).
10	SSA Module_08	It displays the Thermostat on H.Sink (SSA Module_08) status (OK/fault).
11	SSA Module_09	It displays the Thermostat on H.Sink (SSA Module_09) status (OK/fault).
12	SSA Module_10	It displays the Thermostat on H.Sink (SSA Module_10) status (OK/fault).
13	SSA Module_11	It displays the Thermostat on H.Sink (SSA Module_11) status (OK/fault).
14	SSA Module_12	It displays the Thermostat on H.Sink (SSA Module_12) status (OK/fault).
15	SSA Module_13	It displays the Thermostat on H.Sink (SSA Module_13) status (OK/fault).
16	SSA Module_14	It displays the Thermostat on H.Sink (SSA Module_14) status (OK/fault).
17	Home button	By pressing the button, it switches to Information Display.
18	Page up button	By pressing the button, it switches to Interlock Status_4 Display.

19	Page down button 	By pressing the button, it switches to Interlock Status_6 Display.

(13) Interlock Status Display – page 6

This is the screen image of Internal Interlock Status_6 Display.

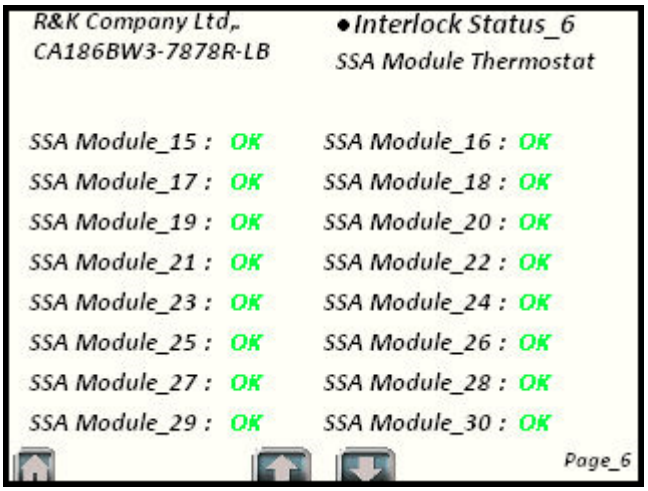

Fig. 20: Screenshot（During normal operation, Po=60kW）

Table 35: Display contents

No.	parameter	description
1	SSA Module_15	It displays the Thermostat on H.Sink (SSA Module_15) status (OK/fault).
2	SSA Module_16	It displays the Thermostat on H.Sink (SSA Module_16) status (OK/fault).
3	SSA Module_17	It displays the Thermostat on H.Sink (SSA Module_17) status (OK/fault).
4	SSA Module_18	It displays the Thermostat on H.Sink (SSA Module_18) status (OK/fault).
5	SSA Module_19	It displays the Thermostat on H.Sink (SSA Module_19) status (OK/fault).
6	SSA Module_20	It displays the Thermostat on H.Sink (SSA Module_20) status (OK/fault).
7	SSA Module_21	It displays the Thermostat on H.Sink (SSA Module_21) status (OK/fault).
8	SSA Module_22	It displays the Thermostat on H.Sink (SSA Module_22) status (OK/fault).
9	SSA Module_23	It displays the Thermostat on H.Sink (SSA Module_23) status (OK/fault).

10	SSA Module_24	It displays the Thermostat on H.Sink (SSA Module_24) status (OK/fault).
10	SSA Module_25	It displays the Thermostat on H.Sink (SSA Module_25) status (OK/fault).
11	SSA Module_26	It displays the Thermostat on H.Sink (SSA Module_26) status (OK/fault).
12	SSA Module_27	It displays the Thermostat on H.Sink (SSA Module_27) status (OK/fault).
13	SSA Module_28	It displays the Thermostat on H.Sink (SSA Module_28) status (OK/fault).
14	SSA Module_29	It displays the Thermostat on H.Sink (SSA Module_29) status (OK/fault).
15	SSA Module_30	It displays the Thermostat on H.Sink (SSA Module_30) status (OK/fault).
16	Home button	By pressing the button, it switches to Information Display.
17	Page up button	By pressing the button, it switches to Interlock Status_5 Display.
18	Page down button	By pressing the button, it switches to Interlock Status_1 Display.

(14) Main Status Display – page 1

This is the screen image of MAIN Status_1 Display.

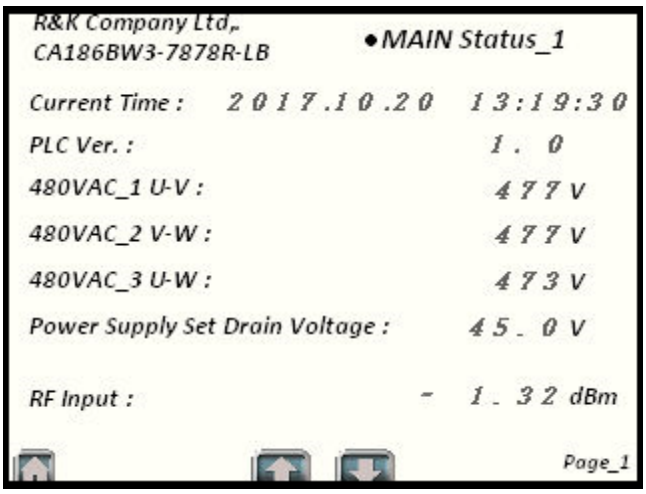

Fig. 21: Screenshot (During normal operation, Po=60kW)

Table 36: Display contents

No.	parameter	description
1	Current Time	It displays the current time.

2	PLC Ver.	PLC Version Information
3	480VAC_1 U-V	It displays the 480VAC_1 U-V value in volt (V).
4	480VAC_2 V-W	It displays the 480VAC_2 V-W value in volt (V).
5	480VAC_3 U-W	It displays the 480VAC_3 U-W value in volt (V).
6	Power Supply Set Drain Voltage	It displays the Power Supply Set Drain Voltage value in volt (V).
7	RF Input	It displays the RF Input value (dBm).
8	Home button 	By pressing the button, it switches to Information Display.
9	Page up button 	By pressing the button, it switches to MAIN Status_8 Display.
10	Page down button 	By pressing the button, it switches to MAIN Status_2 Display.

(15) Main Status Display – page 2

This is the screen image of MAIN Status_2 Display.

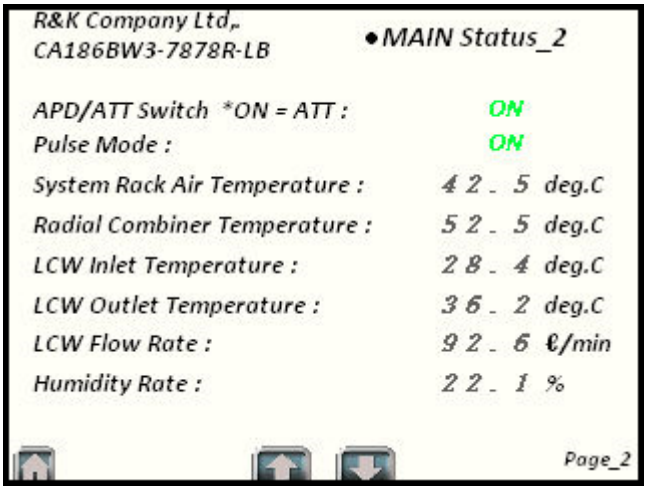

Fig. 22: Screenshot (During normal operation, Po=60kW)

Table 37: Display contents

No.	parameter	description
1	APD/ATT Switch *ON = ATT	It displays the APD/ATT Switch status (ON/OFF).
2	Pulse Mode	It displays the Pulse Mode status (ON/OFF).
3	System Rock Air Temperature	It displays the System Rock Air Temperature value (deg.C).
4	Radial Combiner Temperature	It displays the Radial Combiner Temperature value (deg.C).
5	LCW Inlet Temperature	It displays the LCW Inlet Temperature value (deg. C).
6	LCW Outlet Temperature	It displays the LCW Outlet Temperature value (deg. C).
7	LCW Flow Rate	It displays the LCW Flow Rate value (ℓ/min).
8	Humidity Rate	It displays the Humidity value (%).
9	Home button 	By pressing the button, it switches to Information Display.
10	Page up button 	By pressing the button, it switches to MAIN Status_1 Display.
11	Page down button 	By pressing the button, it switches to MAIN Status_3 Display.

(16) Main Status Display – page 3

This is the screen image of MAIN Status_3 Control Unit Display.

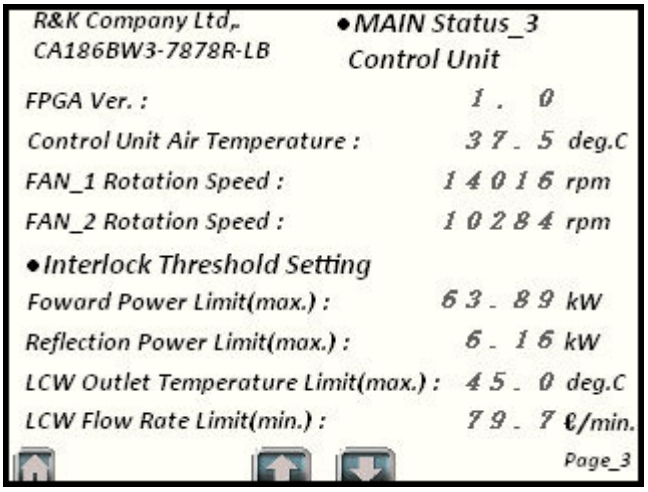

Fig. 23: Screenshot (During normal operation, Po=60kW)

Table 38: Display contents

No.	parameter	description
1	FPGA Ver.	It displays the FPGA Version Information.
2	Control Unit Air Temperature	It displays the Control Unit Air Temperature value (deg.C).
3	FAN_1 Rotation Speed	It displays the FAN_1 Rotation Speed value (rpm).
4	FAN_2 Rotation Speed	It displays the FAN_2 Rotation Speed value (rpm).
5	Forward Power Limit (max)	It displays the Forward Power Limit (max).
6	Reflection Power Limit (max)	It displays Reflection Power Limit (max).
7	LCW Outlet Temperature Limit (max)	It displays LCW Outlet Temperature Limit (max).
8	LCW Outlet Temperature Limit (max)	It displays LCW Outlet Temperature Limit (max).
9	Home button 	By pressing the button, it switches to Information Display.
10	Page up button 	By pressing the button, it switches to MAIN Status_2 Display.
11	Page down button 	By pressing the button, it switches to MAIN Status_4 Display.

(17) Main Status Display – page 4

This is the screen image of MAIN Status_4 Heat Exchanger_1 Unit Display.

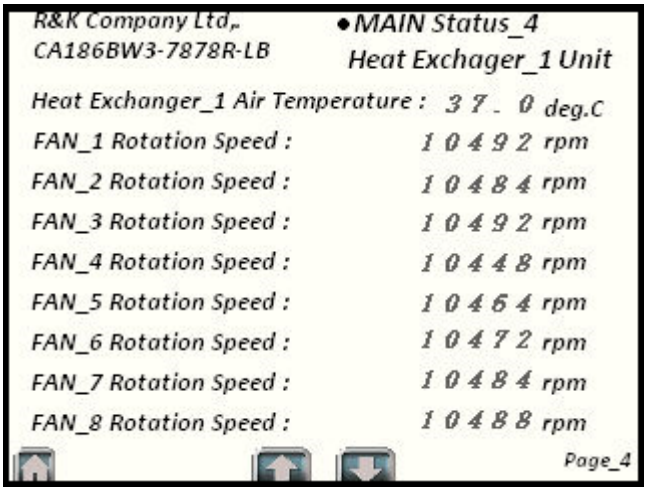

Fig. 24: Screenshot (During normal operation, Po=60kW)

Table 39: Display contents

No.	parameter	description
1	Hear Exchanger_1 Air Temperature	It displays the Hear Exchanger_1 Air Temperature value (deg.C).
2	FAN_1 Rotation Speed	It displays the FAN_1 Rotation Speed value (rpm).
3	FAN_2 Rotation Speed	It displays the FAN_2 Rotation Speed value (rpm).
4	FAN_3 Rotation Speed	It displays the FAN_3 Rotation Speed value (rpm).
5	FAN_4 Rotation Speed	It displays the FAN_4 Rotation Speed value (rpm).
6	FAN_5 Rotation Speed	It displays the FAN_5 Rotation Speed value (rpm).
7	FAN_6 Rotation Speed	It displays the FAN_6 Rotation Speed value (rpm).
8	FAN_7 Rotation Speed	It displays the FAN_7 Rotation Speed value (rpm).
9	FAN_8 Rotation Speed	It displays the FAN_8 Rotation Speed value (rpm).
10	Home button 	By pressing the button, it switches to Information Display.
11	Page up button 	By pressing the button, it switches to MAIN Status_3 Display.
12	Page down button 	By pressing the button, it switches to MAIN Status_5 Display.

(18) Main Status Display – page 5

This is the screen image of MAIN Status_5 Heat Exchanger_2 Unit Display.

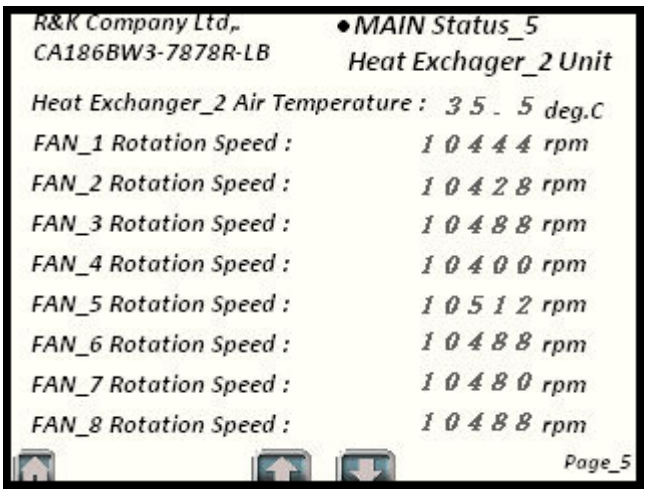

Fig. 25: Screenshot (During normal operation, Po=60kW)

Table 40: Display contents

No.	parameter	description
1	Hear Exchanger_2 Air Temperature	It displays the Hear Exchanger_1 Air Temperature value (deg.C).
2	FAN_1 Rotation Speed	It displays the FAN_1 Rotation Speed value (rpm).
3	FAN_2 Rotation Speed	It displays the FAN_2 Rotation Speed value (rpm).
4	FAN_3 Rotation Speed	It displays the FAN_3 Rotation Speed value (rpm).
5	FAN_4 Rotation Speed	It displays the FAN_4 Rotation Speed value (rpm).
6	FAN_5 Rotation Speed	It displays the FAN_5 Rotation Speed value (rpm).
7	FAN_6 Rotation Speed	It displays the FAN_6 Rotation Speed value (rpm).
8	FAN_7 Rotation Speed	It displays the FAN_7 Rotation Speed value (rpm).
9	FAN_8 Rotation Speed	It displays the FAN_8 Rotation Speed value (rpm).
10	Home button 	By pressing the button, it switches to Information Display.
11	Page up button 	By pressing the button, it switches to MAIN Status_4 Display.
12	Page down button 	By pressing the button, it switches to MAIN Status_6 Display.

(19) Main Status Display – page 6

This is the screen image of MAIN Status_6 Control Unit Display.

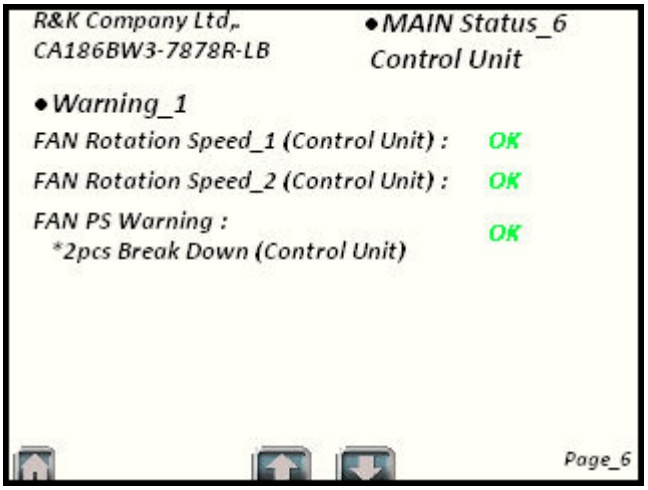

Fig. 26: Screenshot (During normal operation, Po=60kW)

Table 41: Display contents

No.	parameter	description
1	FAN Rotation Speed_1 (Control Unit)	It displays the FAN Rotation Speed_1 (Control Unit) status (OK/fault).
2	FAN Rotation Speed_2 (Control Unit)	It displays the FAN Rotation Speed_2 (Control Unit) status (OK/fault).
3	FAN PS Warning *2pcs Break Down (Control Unit)	It displays the FAN PS Warning (Control Unit) status (OK/Fault). (see table 58)
4	Home button	By pressing the button, it switches to Information Display.
5	Page up button	By pressing the button, it switches to MAIN Status_5 Display.
6	Page down button	By pressing the button, it switches to MAIN Status_7 Display.

(20) Main Status Display – page 7

This is the screen image of MAIN Status_7 Heat Exchanger_1 Display.

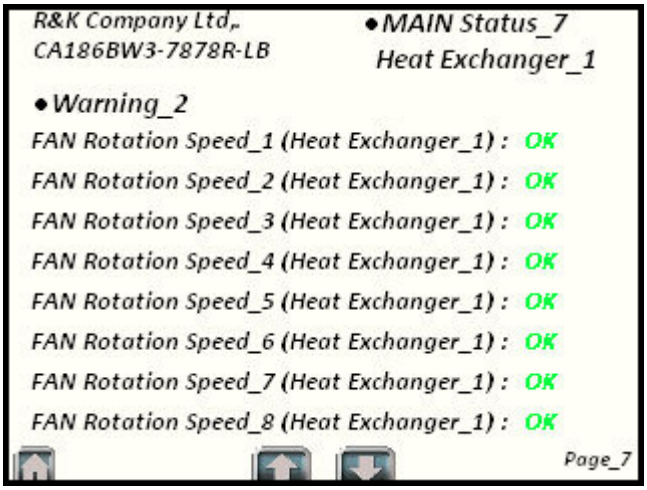

Fig. 27: Screenshot (During normal operation, Po=60kW)

Table 42: Display contents

No.	parameter	description
1	FAN Rotation Speed_1 (Heat Exchanger_1)	It displays the FAN Rotation Speed_1 (Heat Exchanger_1) status (OK/fault).
2	FAN Rotation Speed_2 (Heat Exchanger_1)	It displays the FAN Rotation Speed_2 (Heat Exchanger_1) status (OK/fault).
3	FAN Rotation Speed_3 (Heat Exchanger_1)	It displays the FAN Rotation Speed_3 (Heat Exchanger_1) status (OK/fault).
4	FAN Rotation Speed_4 (Heat Exchanger_1)	It displays the FAN Rotation Speed_4 (Heat Exchanger_1) status (OK/fault).
5	FAN Rotation Speed_5 (Heat Exchanger_1)	It displays the FAN Rotation Speed_5 (Heat Exchanger_1) status (OK/fault).
6	FAN Rotation Speed_6 (Heat Exchanger_1)	It displays the FAN Rotation Speed_6 (Heat Exchanger_1) status (OK/fault).
7	FAN Rotation Speed_7 (Heat Exchanger_1)	It displays the FAN Rotation Speed_7 (Heat Exchanger_1) status (OK/fault).
8	FAN Rotation Speed_8 (Heat Exchanger_1)	It displays the FAN Rotation Speed_8 (Heat Exchanger_1) status (OK/fault).
9	Home button 	By pressing the button, it switches to Information Display.
10	Page up button 	By pressing the button, it switches to MAIN Status_6 Display.
11	Page down button 	By pressing the button, it switches to MAIN Status_8 Display.

(21) Main Status Display – page 8

This is the screen image of MAIN Status_8 Heat Exchanger_2 Display.

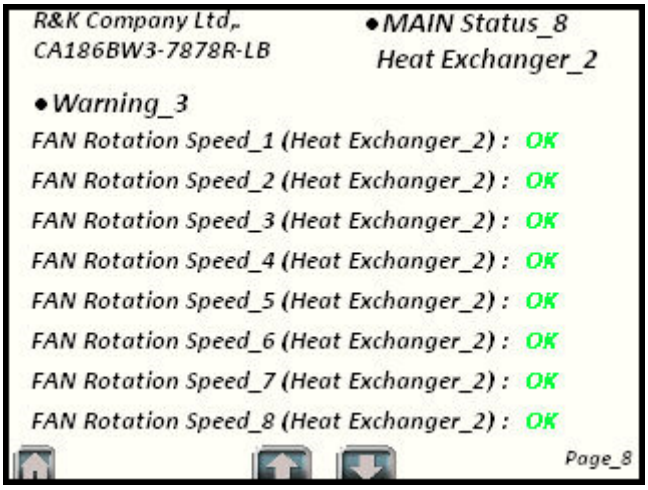

Fig. 28: Screenshot (During normal operation, Po=60kW)

Table 43: Display contents

No.	parameter	description
1	FAN Rotation Speed_1 (Heat Exchanger_2)	It displays the FAN Rotation Speed_1 (Heat Exchanger_2) status (OK/fault).
2	FAN Rotation Speed_2 (Heat Exchanger_2)	It displays the FAN Rotation Speed_2 (Heat Exchanger_2) status (OK/fault).
3	FAN Rotation Speed_3 (Heat Exchanger_2)	It displays the FAN Rotation Speed_3 (Heat Exchanger_2) status (OK/fault).
4	FAN Rotation Speed_4 (Heat Exchanger_2)	It displays the FAN Rotation Speed_4 (Heat Exchanger_2) status (OK/fault).
5	FAN Rotation Speed_5 (Heat Exchanger_2)	It displays the FAN Rotation Speed_5 (Heat Exchanger_2) status (OK/fault).
6	FAN Rotation Speed_6 (Heat Exchanger_2)	It displays the FAN Rotation Speed_6 (Heat Exchanger_2) status (OK/fault).
7	FAN Rotation Speed_7 (Heat Exchanger_2)	It displays the FAN Rotation Speed_7 (Heat Exchanger_2) status (OK/fault).
8	FAN Rotation Speed_8 (Heat Exchanger_2)	It displays the FAN Rotation Speed_8 (Heat Exchanger_2) status (OK/fault).
9	Home button 	By pressing the button, it switches to Information Display.
10	Page up button 	By pressing the button, it switches to MAIN Status_7 Display.
11	Page down button 	By pressing the button, it switches to MAIN Status_1 Display.

(22) SSA Module_Driver Display – page 1

This is the screen image of SSA Module_Driver Status_1 Display.

When Communication wire error or FPGA Response error occurs, the contents of display are fixed data (all 0, OK).

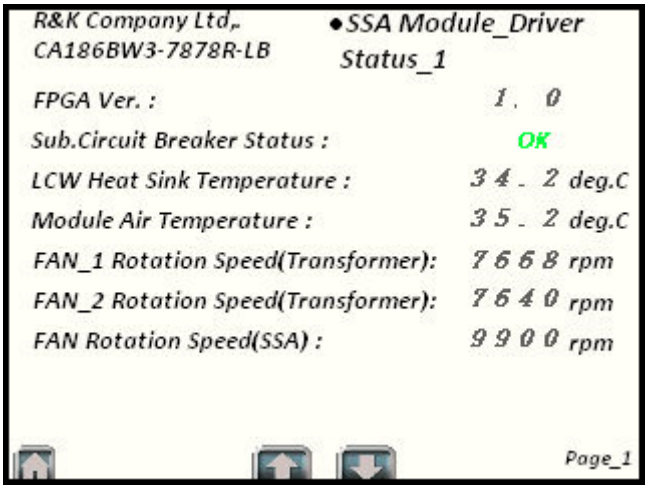

Fig. 29: Screenshot (During normal operation, Po=60kW)

Table 44: Display contents

No.	parameter	description
1	FPGA Ver.	It displays the FPGA Version Information.
2	Sub.Circuit Breaker Status	It displays the Sub Circuit Breaker Status (OK/fault).
3	LCW Heat Sink Temperature	It displays the LCW Heat Sink Temperature value (deg.C).
4	Module Air Temperature	It displays the Module Air Temperature value (deg.C).
5	FAN_1 Rotation Speed (Transformer)	It displays the FAN_1 Rotation Speed (Transformer) value (rpm).
6	FAN_2 Rotation Speed (Transformer)	It displays the FAN_2 Rotation Speed (Transformer) value (rpm).
7	FAN Rotation Speed(SSA)	It displays the FAN Rotation Speed (SSA) value (rpm).
8	Home button 	By pressing the button, it switches to Information Display.
9	Page up button 	By pressing the button, it switches to SSA Module_Driver Status_4 Display.
10	Page down button 	By pressing the button, it switches to SSA Module_Driver Status_2 Display.

(23) SSA Module_Driver Display – page 2

This is the screen image of SSA Module_Driver Status_2 Display.

When Communication wire error or FPGA Response error occurs, the contents of display are fixed data (all 0).

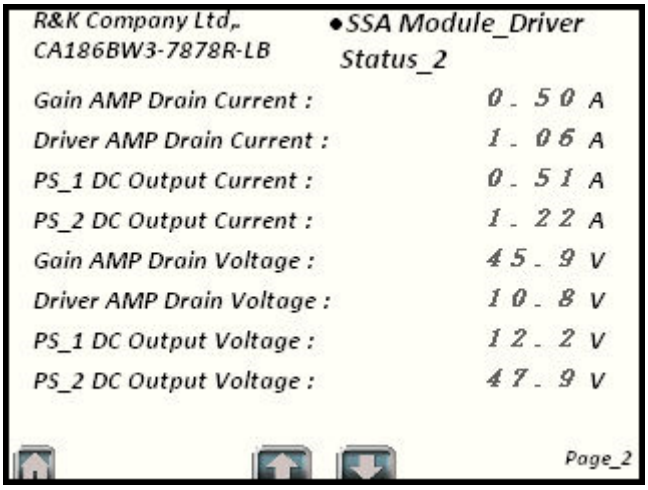

Fig. 30: Screenshot (During normal operation, Po=60kW)

Table 45: Display contents

No.	parameter	description
1	Gain AMP Drain Current	It displays the Gain Amplifier Drain Current value (A).
2	Driver AMP Drain Current	It displays the Driver Amplifier Drain Current value (A).
3	PS_1 DC Output Current	It displays the Power Supply_1 DC Output Current value (A).
4	PS_2 DC Output Current	It displays the Power Supply_2 DC Output Current value (A).
5	Gain AMP Drain Voltage	It displays the Gain Amplifier Drain Voltage value (A).
6	Driver AMP Drain Voltage	It displays the Driver Amplifier Drain Voltage value (A).
7	PS_1 DC Output Voltage	It displays the Power Supply_1 DC Output Voltage value (A).
8	PS_2 DC Output Voltage	It displays the Power Supply_2 DC Output Voltage value (A).
9	Home button 	By pressing the button, it switches to Information Display.
10	Page up button 	By pressing the button, it switches to SSA Module_Driver Status_1 Display.
11	Page down button 	By pressing the button, it switches to SSA Module_Driver

		Status_3 Display.

(24) SSA Module_Driver Display – page 3

This is the screen image of SSA Module_Driver Status_3 Display.

When Communication wire error or FPGA Response error occurs, the contents of display are fixed data (OK).

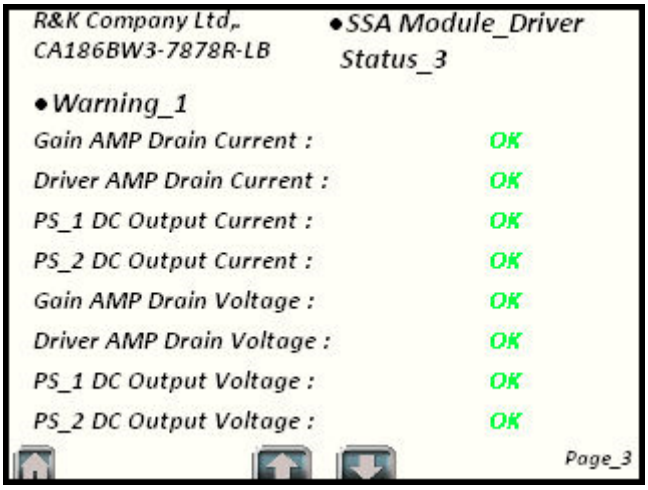

Fig. 31: Screenshot (During normal operation, Po=60kW)

Table 46: Display contents

No.	parameter	description
1	Gain AMP Drain Current	It displays the Gain Amplifier Drain Current status (OK/fault).
2	Driver AMP Drain Current	It displays the Driver Amplifier Drain Current status (OK/fault).
3	PS_1 DC Output Current	It displays the Power Supply_1 DC Output Current status (OK/fault).
4	PS_2 DC Output Current	It displays the Power Supply_2 DC Output Current status (OK/fault).
5	Gain AMP Drain Voltage	It displays the Gain Amplifier Drain Voltage status (OK/fault).
6	Driver AMP Drain Voltage	It displays the Driver Amplifier Drain Voltage status (OK/fault).
7	PS_1 DC Output Voltage	It displays the Power Supply_1 DC Output Voltage status (OK/fault).
8	PS_2 DC Output Voltage	It displays the Power Supply_2 DC Output Voltage status (OK/fault).
9	Home button 	By pressing the button, it switches to Information Display.
10	Page up button 	By pressing the button, it switches to SSA Module_Driver Status_2 Display.

11	Page down button	By pressing the button, it switches to SSA Module_Driver Status_4 Display.

(25) SSA Module_Driver Display – page 4

This is the screen image of SSA Module_Driver Status_4 Display.

When Communication wire error or FPGA Response error occurs, the contents of display are fixed data (OK).

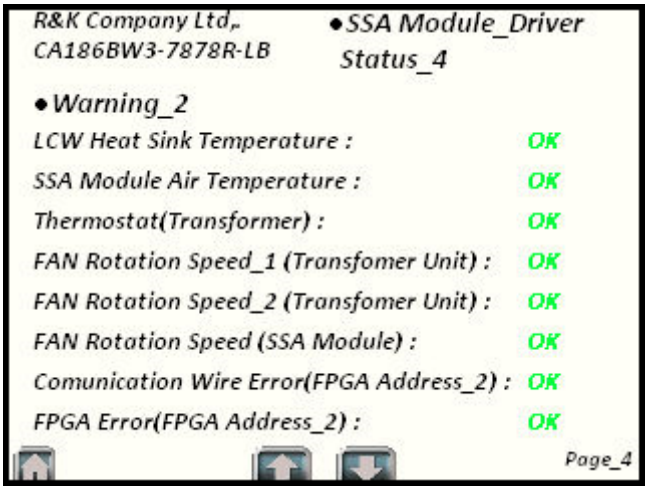

Fig. 32: Screenshot (During normal operation, Po=60kW)

Table 47: Display contents

No.	parameter	description
1	LCW Heat Sink Temperature	It displays the LCW Heat Sink Temperature status (OK/fault).
2	SSA Module Air Temperature	It displays the SSA Module Air Temperature status (OK/fault).
3	Thermostat(Transformer)	It displays the Thermostat (Transformer) status (OK/fault).
4	FAN Rotation Speed_1 (Transformer Unit)	It displays the FAN Rotation Speed_1 (Transformer Unit) status (OK/fault).
5	FAN Rotation Speed_2 (Transformer Unit)	It displays the FAN Rotation Speed_2 (Transformer Unit) status (OK/fault).
6	FAN Rotation Speed (SSA Module)	It displays the FAN Rotation Speed (SSA Module) status (OK/fault).
7	Communication Wire Error (Address_2)	It displays the Communication Wire Error (FPGA Address 2) status (OK/fault).
8	FPGA Error Address_2	It displays the FPGA Error (FPGA Address_2) status (OK/fault).
9	Home button	By pressing the button, it switches to Information Display.
10	Page up button	By pressing the button, it switches to SSA Module_Driver

		Status_3 Display.
11	Page down button	By pressing the button, it switches to SSA Module_Driver Status_1 Display.

(26) SSA Module_0 Display – page 1

This is the screen image of SSA Module_0 Status_1 Display.

When Communication wire error or FPGA Response error occurs, the contents of display are fixed data (all 0, OK).

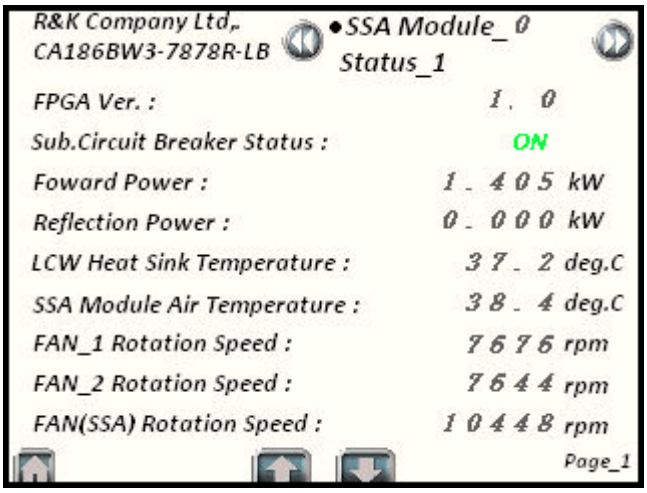

Fig. 33: Screenshot (During normal operation, Po=60kW)

Table 48: Display contents

No.	parameter	description
1	FPGA Ver.	FPGA Version Information
2	Sub.Circuit Breaker Status	It displays the Sub Circuit Breaker Status (OK/fault).
3	Forward Power	It displays the Forward Power value (kW).
4	Reflection Power	It displays the Reflection Power value (kW).
5	LCW Heat Sink Temperature	It displays the LCW Heat Sink Temperature value (deg.C).
6	SSA Module Air Temperature	It displays the SSA Module Air Temperature value (deg.C).
7	FAN_1 Rotation Speed	It displays the FAN_1 Rotation Speed value (rpm).
8	FAN_2 Rotation Speed	It displays the FAN_2 Rotation Speed value (rpm).
9	FAN(SSA) Rotation Speed	It displays the FAN (SSA) Rotation Speed status (rpm).
10	Home button	By pressing the button, it switches to Information Display.
11	Page up button	By pressing the button, it switches to SSA Module_0 Status_5 Display.
12	Page down button	By pressing the button, it switches to SSA Module_0 Status_2 Display.

13	Left button	By pressing the button, it switches to SSA Module_1 Status_1 Display.
14	Right button	By pressing the button, it switches to SSA Module_30 Status_1 Display.

(27) SSA Module_0 Display – page 2

This is the screen image of SSA Module_0 Status_2 Display.

When Communication wire error or FPGA Response error occurs, the contents of display are fixed data (all 0).

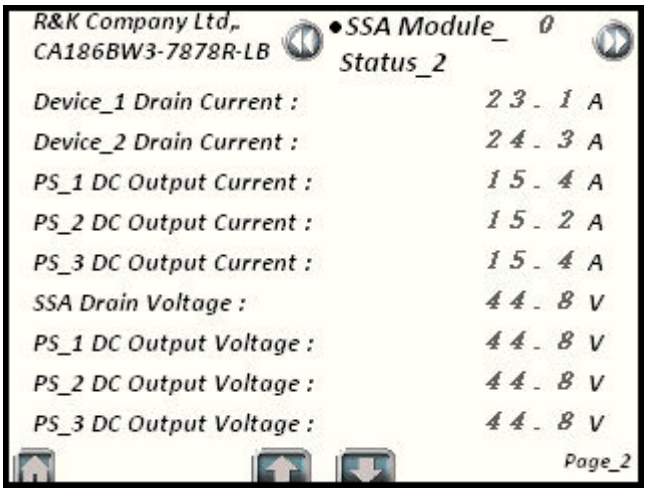

Fig. 34: Screenshot (During normal operation, Po=60kW)

Table 49: Display contents

No.	parameter	description
1	Device_1 Drain Current	It displays the Device_1 Drain Current value (A).
2	Device_2 Drain Current	It displays the Device_2 Drain Current value (A).
3	PS_1 DC Output Current	It displays the Power Supply_1 DC Output Current value (A).
4	PS_2 DC Output Current	It displays the Power Supply_2 DC Output Current value (A).
5	PS_3 DC Output Current	It displays the Power Supply_3 DC Output Current value (A).
6	SSA Drain Voltage	It displays the SSA Drain Voltage value (A).
7	PS_1 DC Output Voltage	It displays the Power Supply_1 DC Output Voltage value (A).
8	PS_2 DC Output Voltage	It displays the Power Supply_2 DC Output Voltage value (A).
9	PS_3 DC Output Voltage	It displays the Power Supply_3 DC Output Voltage value

		(A).
10	Home button	By pressing the button, it switches to Information Display.
11	Page up button	By pressing the button, it switches to SSA Module_0 Status_1 Display.
12	Page down button	By pressing the button, it switches to SSA Module_0 Status_3 Display.
13	Left button	By pressing the button, it switches to SSA Module_1 Status_2 Display.
14	Right button	By pressing the button, it switches to SSA Module_30 Status_2 Display.

(28) SSA Module_0 Display – page 3

This is the screen image of SSA Module_0 Status_3 Display.

When Communication wire error or FPGA Response error occurs, the contents of display are fixed data (OK).

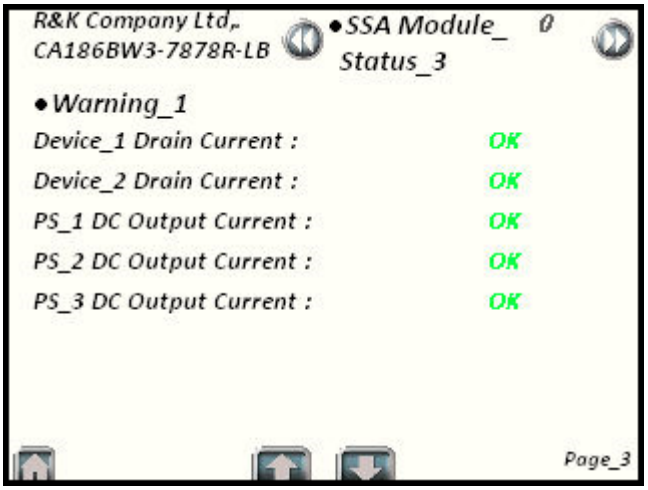

Fig. 35: Screenshot (During normal operation, Po=60kW)

Table 50: Display contents

No.	parameter	description
1	Device_1 Drain Current	It displays the Device_1 Drain Current status (OK/fault).
2	Device_2 Drain Current	It displays the Device_2 Drain Current status (OK/fault).
3	PS_1 DC Output Current	It displays the PS_1 DC Output Current status (OK/fault).
4	PS_2 DC Output Current	It displays the PS_2 DC Output Current status (OK/fault).
5	PS_3 DC Output Current	It displays the PS_3 DC Output Current status (OK/fault).
6	Home button	By pressing the button, it switches to Information Display.

7	Page up button 	By pressing the button, it switches to SSA Module_0 Status_2 Display.
8	Page down button 	By pressing the button, it switches to SSA Module_0 Status_4 Display.
9	Left button 	By pressing the button, it switches to SSA Module_1 Status_3 Display.
10	Right button 	By pressing the button, it switches to SSA Module_30 Status_3 Display.

(29) SSA Module_0 Display – page 4

This is the screen image of SSA Module_0 Status_4 Display.

When Communication wire error or FPGA Response error occurs, the contents of display are fixed data (OK).

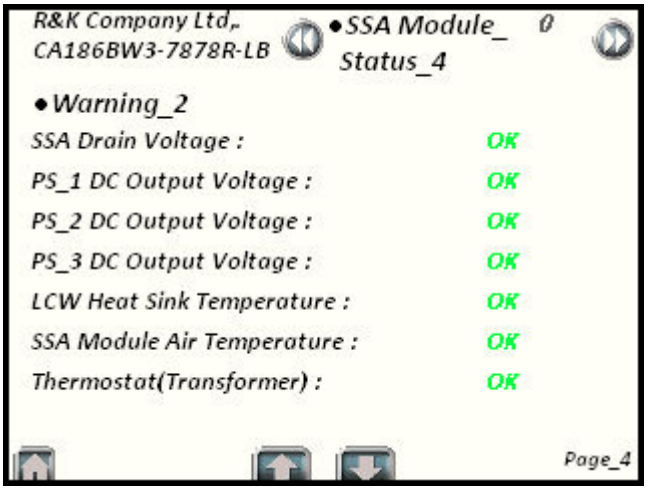

Fig. 36: Screenshot (During normal operation, Po=60kW)

Table 51: Display contents

No.	parameter	description
1	SSA Drain Voltage	It displays the SSA Drain Voltage status (OK/fault).
2	PS_1 DC Output Voltage	It displays the PS_1 DC Output Voltage status (OK/fault).
3	PS_2 DC Output Voltage	It displays the PS_2 DC Output Voltage status (OK/fault).
4	PS_3 DC Output Voltage	It displays the PS_3 DC Output Voltage status (OK/fault).
5	LCW Heat Sink Temperature	It displays the Heat Sink Temperature status (OK/fault).
6	SSA Module Air Temperature	It displays the SSA Module Air Temperature status (OK/fault).
7	Thermostat(Transformer)	It displays the Thermostat (Transformer) status (OK/fault).
8	Home button 	By pressing the button, it switches to Information Display.
9	Page up button 	By pressing the button, it switches to SSA Module_0 Status_3 Display.
10	Page down button 	By pressing the button, it switches to SSA Module_0 Status_5 Display.
11	Left button 	By pressing the button, it switches to SSA Module_1 Status_4 Display.
12	Right button 	By pressing the button, it switches to SSA Module_30 Status_4 Display.

(30) SSA Module_0 Display – page 5

This is the screen image of SSA Module_0 Status_5 Display.

When Communication wire error or FPGA Response error occurs, the contents of display are fixed data (OK).

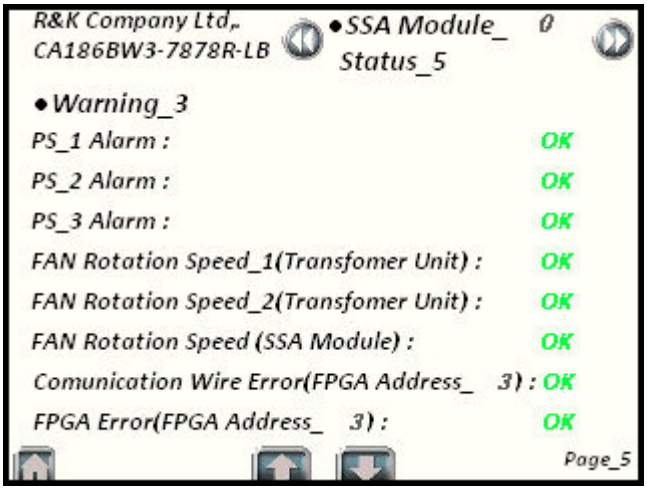

Fig. 37: Screenshot (During normal operation, Po=60kW)

Table 52: Display contents

No.	parameter	description
1	PS_1 Alarm	It displays the PS_1 Alarm status (OK/fault).
2	PS_2 Alarm	It displays the PS_2 Alarm status (OK/fault).
3	PS_3 Alarm	It displays the PS_3 Alarm status (OK/fault).
4	FAN Rotation Speed_1 (Transformer Unit)	It displays the FAN Rotation Speed_1 (Transformer Unit) status (OK/fault).
5	FAN Rotation Speed_2 (Transformer Unit)	It displays the FAN Rotation Speed_2 (Transformer Unit) status (OK/fault).
6	FAN Rotation Speed (SSA Module)	It displays the FAN Rotation Speed (SSA Module) status (OK/fault).
7	Communication Wire Error (FPGA Address_3)	It displays the Communication Wire Error (FPGA Address_3) status (OK/fault).
8	FPGA Error (FPGA Address_3)	It displays the FPGA Response Error (FPGA Address_3) status (OK/fault).
9	Home button	By pressing the button, it switches to Information Display.
10	Page up button	By pressing the button, it switches to SSA Module_0 Status_4 Display.
11	Page down button	By pressing the button, it switches to SSA Module_0 Status_1 Display.
12	Left button	By pressing the button, it switches to SSA Module_1 Status_5 Display.
13	Right button	By pressing the button, it switches to SSA Module_30 Status_5 Display.

(31) SSA Module_1-30 Display – page 1

SSA Module_1 to SSA Module_30 are the same as SSA Module_0 display format.

This is the screen image of SSA Module_1 Status_1 Display.

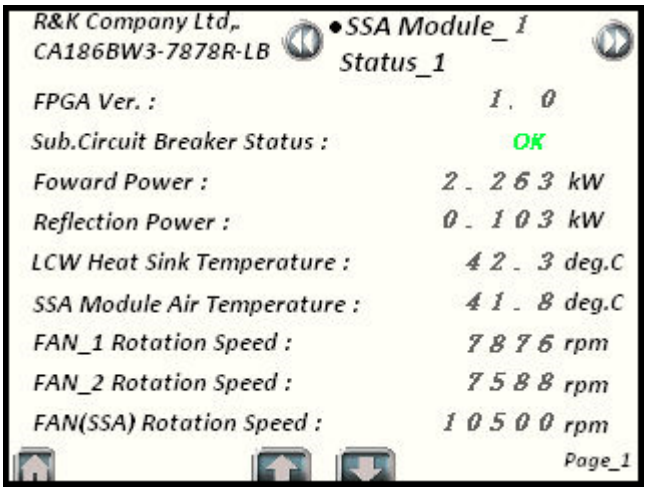

Fig. 38: Screenshot (During normal operation, Po=60kW)

Table 53: Display contents

No.	parameter	description
1	FPGA Ver.	FPGA Version Information
2	Sub.Circuit Breaker Status	It displays the Sub Circuit Breaker Status (OK/fault).
3	Forward Power	It displays the Forward Power value (kW).
4	Reflection Power	It displays the Reflection Power value (kW).
5	LCW Heat Sink Temperature	It displays the LCW Heat Sink Temperature value (deg.C).
6	SSA Module Air Temperature	It displays the SSA Module Air Temperature value (deg.C).
7	FAN_1 Rotation Speed	It displays the FAN_1 Rotation Speed value (rpm).
8	FAN_2 Rotation Speed	It displays the FAN_2 Rotation Speed value (rpm).
9	FAN(SSA) Rotation Speed	It displays the FAN (SSA) Rotation Speed status (rpm).
10	Home button 	By pressing the button, it switches to Information Display.
11	Page up button 	By pressing the button, it switches to SSA Module_1 Status_5 Display.
12	Page down button 	By pressing the button, it switches to SSA Module_1 Status_2 Display.
13	Left button 	By pressing the button, it switches to SSA Module_2 Status_1 Display.
14	Right button 	By pressing the button, it switches to SSA Module_0

		Status_1 Display.

(32) SSA Module_1-30 Display – page 2

SSA Module_1 to SSA Module_30 are the same as SSA Module_0 display format.

This is the screen image of SSA Module_1 Status_2 Display.

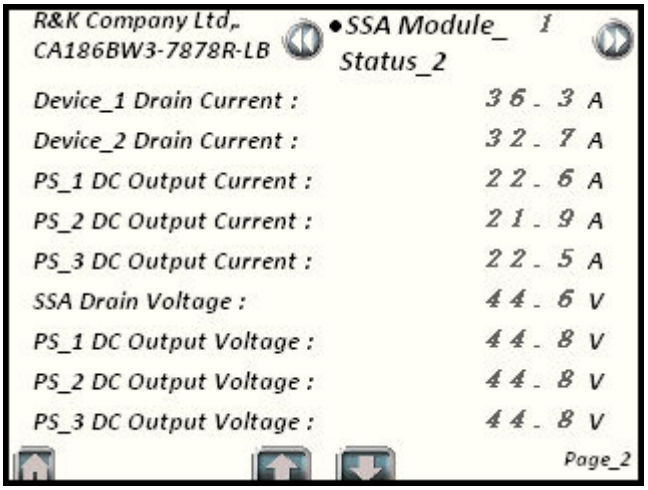

Fig. 39: Screenshot (During normal operation, Po=60kW)

Table 54: Display contents

No.	parameter	description
1	Device_1 Drain Current	It displays the Device_1 Drain Current value (A).
2	Device_2 Drain Current	It displays the Device_2 Drain Current value (A).
3	PS_1 DC Output Current	It displays the Power Supply_1 DC Output Current value (A).
4	PS_2 DC Output Current	It displays the Power Supply_2 DC Output Current value (A).
5	PS_3 DC Output Current	It displays the Power Supply_3 DC Output Current value (A).
6	SSA Drain Voltage	It displays the SSA Drain Voltage value (A).
7	PS_1 DC Output Voltage	It displays the Power Supply_1 DC Output Voltage value (A).
8	PS_2 DC Output Voltage	It displays the Power Supply_2 DC Output Voltage value (A).
9	PS_3 DC Output Voltage	It displays the Power Supply_3 DC Output Voltage value (A).
10	Home button	By pressing the button, it switches to Information Display.
11	Page up button	By pressing the button, it switches to SSA Module_1

		Status_1 Display.
12	Page down button	By pressing the button, it switches to SSA Module_1 Status_3 Display.
13	Left button	By pressing the button, it switches to SSA Module_2 Status_2 Display.
14	Right button	By pressing the button, it switches to SSA Module_0 Status_2 Display.

(33) SSA Module_1-30 Display – page 3

SSA Module_1 to SSA Module_30 are the same as SSA Module_0 display format.

This is the screen image of SSA Module_1 Status_3 Display.

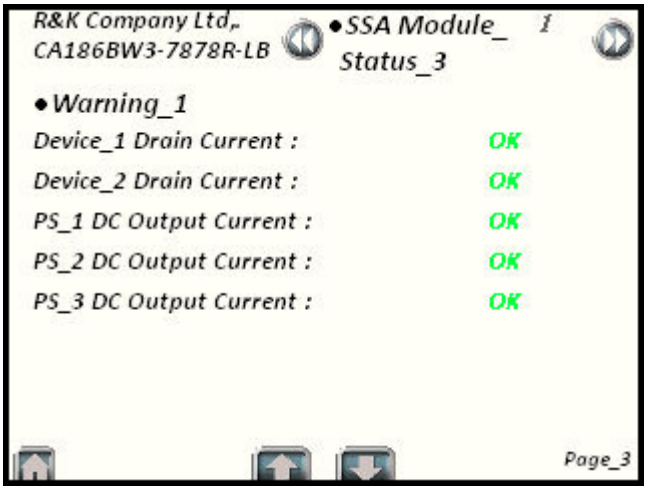

Fig. 40: Screenshot (During normal operation, Po=60kW)

Table 55: Display contents

No.	parameter	description
1	Device_1 Drain Current	It displays the Device_1 Drain Current status (OK/fault).
2	Device_2 Drain Current	It displays the Device_2 Drain Current status (OK/fault).
3	PS_1 DC Output Current	It displays the PS_1 DC Output Current status (OK/fault).
4	PS_2 DC Output Current	It displays the PS_2 DC Output Current status (OK/fault).
5	PS_3 DC Output Current	It displays the PS_3 DC Output Current status (OK/fault).
6	Home button	By pressing the button, it switches to Information Display.
7	Page up button	By pressing the button, it switches to SSA Module_1 Status_2 Display.
8	Page down button	By pressing the button, it switches to SSA Module_1 Status_4 Display.

9	Left button 	By pressing the button, it switches to SSA Module_2 Status_3 Display.
10	Right button 	By pressing the button, it switches to SSA Module_0 Status_3 Display.

(34) SSA Module_1-30 Display – page 4

SSA Module_1 to SSA Module_30 are the same as SSA Module_0 display format.

This is the screen image of SSA Module_1 Status_4 Display.

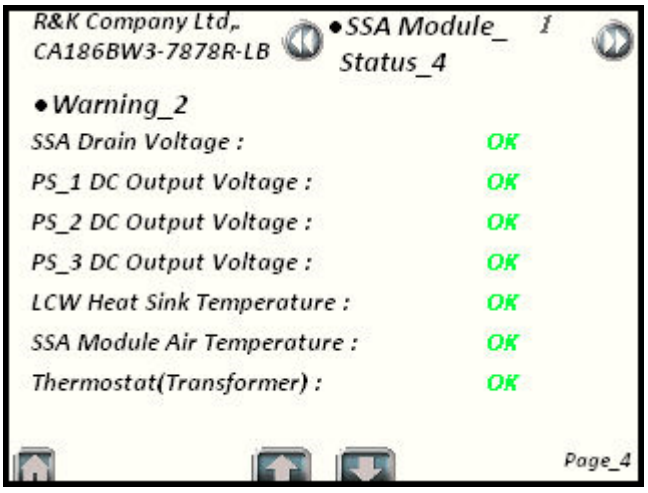

Fig. 41: Screenshot (During normal operation, Po=60kW)

Table 56: Display contents

No.	parameter	description
1	SSA Drain Voltage	It displays the SSA Drain Voltage status (OK/fault).
2	PS_1 DC Output Voltage	It displays the PS_1 DC Output Voltage status (OK/fault).
3	PS_2 DC Output Voltage	It displays the PS_2 DC Output Voltage status (OK/fault).
4	PS_3 DC Output Voltage	It displays the PS_3 DC Output Voltage status (OK/fault).
5	LCW Heat Sink Temperature	It displays the Heat Sink Temperature status (OK/fault).
6	SSA Module Air Temperature	It displays the SSA Module Air Temperature status (OK/fault).
7	Thermostat(Transformer)	It displays the Thermostat (Transformer) status (OK/fault).
8	Home button	By pressing the button, it switches to Information Display.
9	Page up button	By pressing the button, it switches to SSA Module_1 Status_3 Display.
10	Page down button	By pressing the button, it switches to SSA Module_1 Status_5 Display.
11	Left button	By pressing the button, it switches to SSA Module_2 Status_4 Display.
12	Right button	By pressing the button, it switches to SSA Module_0 Status_4 Display.

(35) SSA Module_1-30 Display – page 4

SSA Module_1 to SSA Module_30 are the same as SSA Module_0 display format.

This is the screen image of SSA Module_1 Status_4 Display.

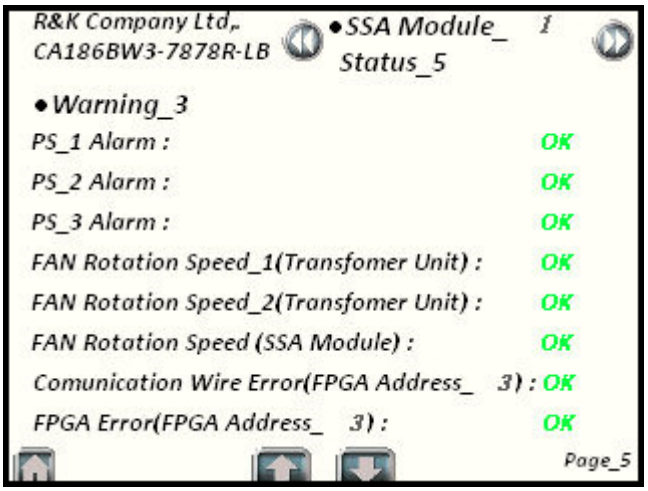

Fig. 42: Screenshot (During normal operation, Po=60kW)

Table 57: Display contents

No.	parameter	description
1	PS_1 Alarm	It displays the PS_1 Alarm status (OK/fault).
2	PS_2 Alarm	It displays the PS_2 Alarm status (OK/fault).
3	PS_3 Alarm	It displays the PS_3 Alarm status (OK/fault).
4	FAN Rotation Speed_1 (Transformer Unit)	It displays the FAN Rotation Speed_1 (Transformer Unit) status (OK/fault).
5	FAN Rotation Speed_2 (Transformer Unit)	It displays the FAN Rotation Speed_2 (Transformer Unit) status (OK/fault).
6	FAN Rotation Speed (SSA Module)	It displays the FAN Rotation Speed (SSA Module) status (OK/fault).
7	Communication Wire Error (FPGA Address_3)	It displays the Communication Wire Error (FPGA Address_3) status (OK/fault).
8	FPGA Error (FPGA Address_3)	It displays the FPGA Response Error (FPGA Address_3) status (OK/fault).
9	Home button 	By pressing the button, it switches to Information Display.
10	Page up button 	By pressing the button, it switches to SSA Module_1 Status_4 Display.
11	Page down button 	By pressing the button, it switches to SSA Module_1 Status_1 Display.
12	Left button 	By pressing the button, it switches to SSA Module_2 Status_5 Display.
13	Right button 	By pressing the button, it switches to SSA Module_0 Status_5 Display.

3. Flowchart

3.1. PLC Flowchart

- Operational Sequence List

(These commands can be executed independently of whether the RF and DC are Disabled or Enabled)

A) DC Enable/Disable

B) RF Enable/Disable

C) P.S. Output Control Voltage

D) Fault Reset

1. Internal Interlock Reset
2. External Interlock Reset
3. Warning Reset

E) System Reboot

F) Xport Reboot

G) Read Status

- Change Parameter List

(These commands will only be executed when the RF and DC Disabled)

A) Forward Power Maximum Limit

B) Reflection Power Maximum Limit

C) Outlet LCW Temperature Maximum Limit

D) LCW Flow Rate Minimum Limit

E) Pulse Mode

F) Calendar

G) APD/ATT select

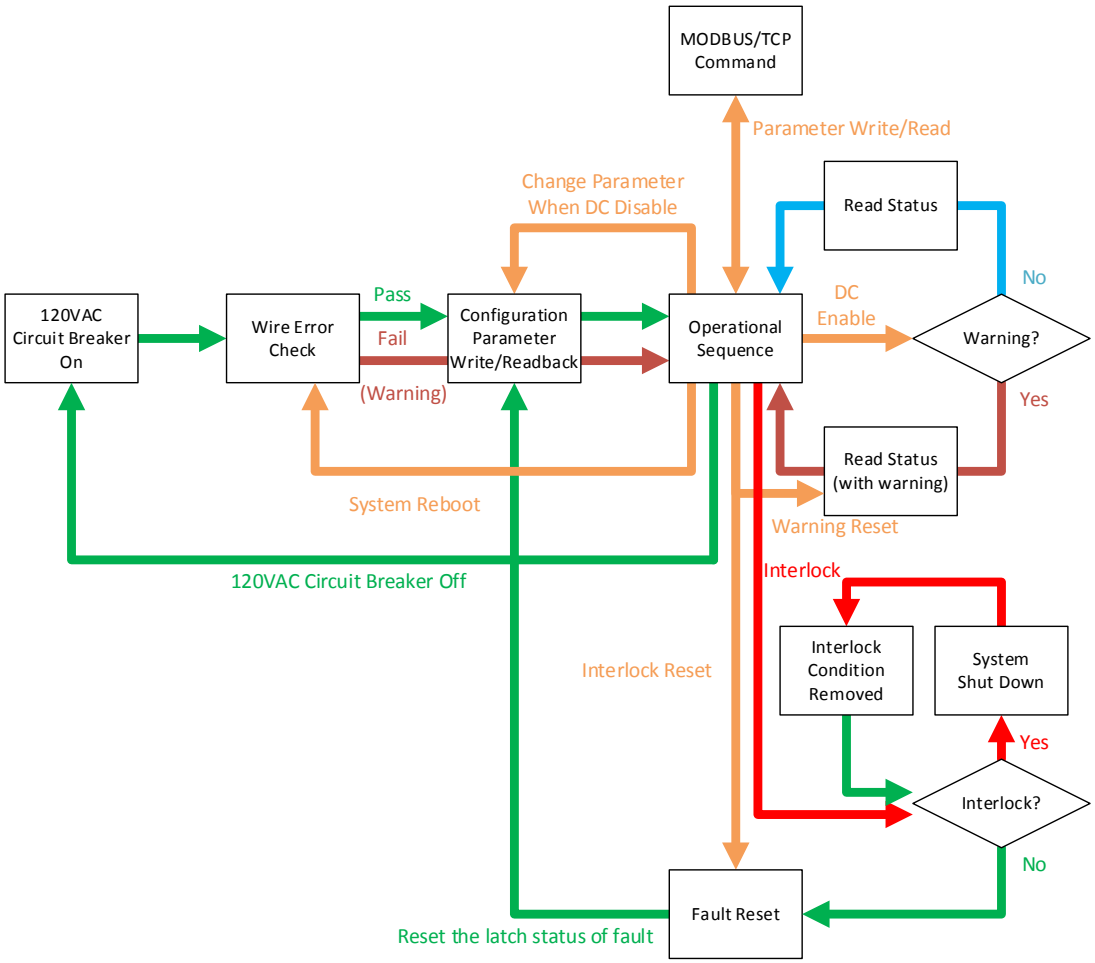

Fig. 43: System flowchart

3.1.1. Boot up / Reboot

① 120VAC Circuit Breaker On
② Self-Test
③ Configuration Parameter Write/Read-back
④ Operational Sequence

System will be initialized by changing the 120VAC Circuit Breaker status from Off to On. Before the SSA becomes operable, PLC automatically performs the communication cable test and sets parameters to the Passed SSA modules. For the Failed SSA module, it will be processed as Warning without setting a parameter.
When receiving the reboot command, the system will be initialized from Self-Test again.
[note] Internal Interlock and Alarm Busline go to active state after activation. Start using after Internal Interlock reset.

3.1.2. Change parameter

① Operational Sequence
② Modbus/TCP command
③ Configuration Parameter Write/Read-back
④ Operational Sequence

To change parameters from Modbus/TCP, DC must be in Disable state. Any parameter change issued during the operation (DC is in Enable state) are ignored.

3.1.3. Interlock

① Operational Sequence
② Interlock status happened
③ System shut-down
④ Interlock Condition Removed
⑤ Interlock Reset

When Interlock occurs, the system shuts down. Interlock information will be latched even after the factor of Interlock is removed. Interlock information is released by the Interlock Reset command but the Fault Reset command is ignored when the factor of Interlock still exists.

3.1.4. Warning

① Operational Sequence
② DC Enable command
③ Read Status
④ Warning status happened
⑤ Read Status with warning

⑥ Operational Sequence

⑦ Warning Reset

⑧ Read Status

When Warning occurs, the warning information can be read on Warning Monitor via Modbus/TCP. The SSA module continues to operate, but when a warning such as Thermostat (Transformer). occurs, the SSA module stops.

3.2. FPGA Flowchart

3.2.1. Controller Unit

- Standby

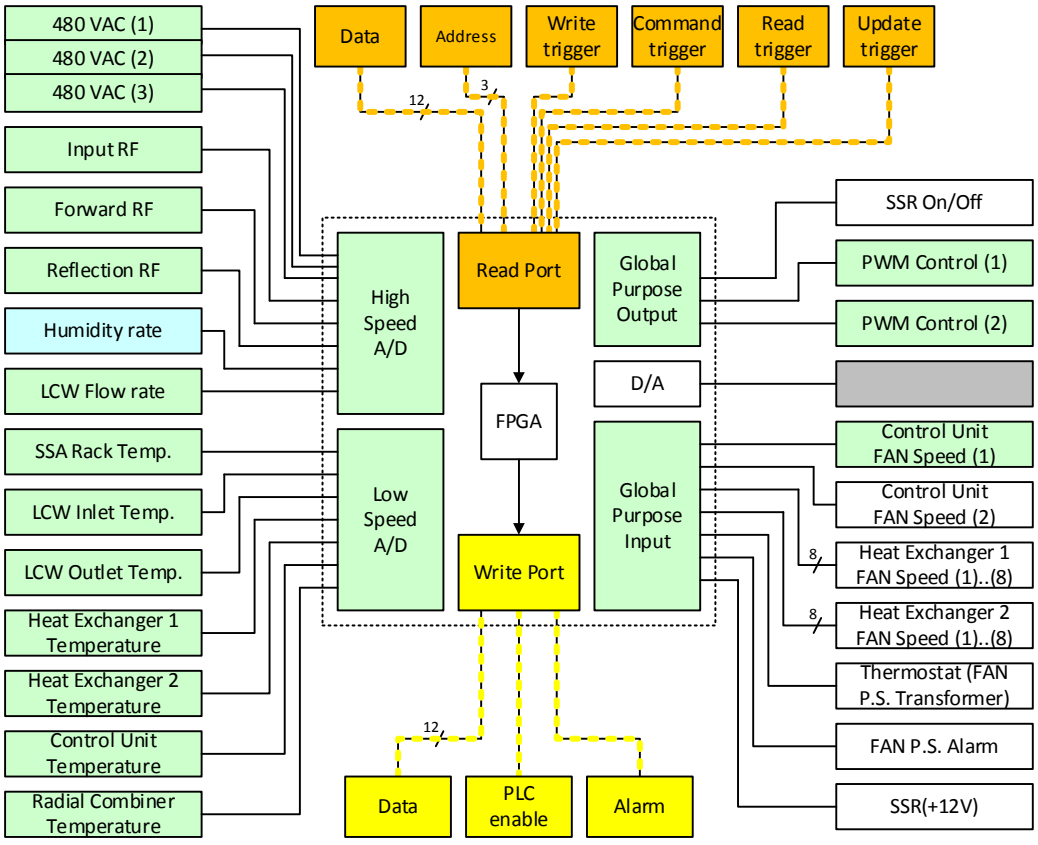

Fig. 44: Controller FPGA (Standby)

① Self-Test

② Configuration parameter

③ Start monitoring and FAN control

When receiving the communication cable test from the PLC to the Read Port after turning on the power, it sends the communication cable test from Write Port to PLC. Then, it receives each parameter setting from PLC, starts each status monitoring by High Speed A/D, Low Speed A/D, Global Purpose Input, and performs FAN speed control by PWM Control.

- SSR on

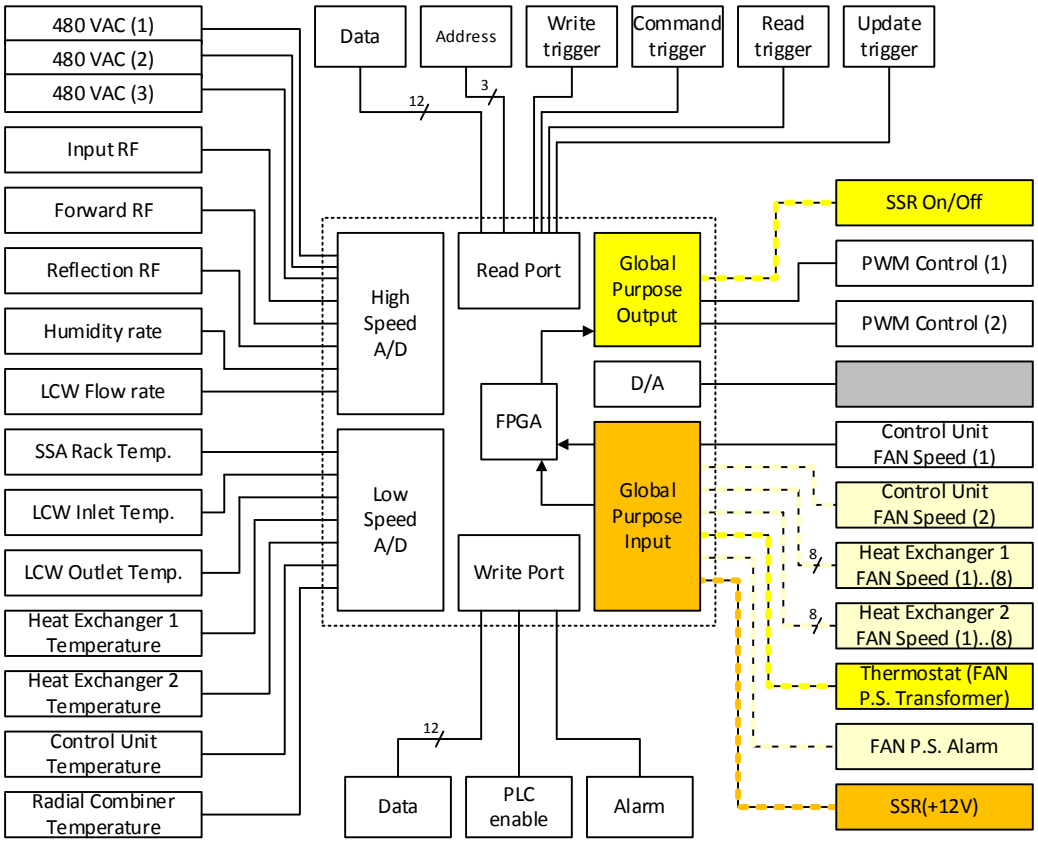

Fig. 45: Controller FPGA (SSR On)

① SSR (+12V) enable

② SSR On / Start monitoring (thermostat)

③ Start monitoring

When SSR (+12V) becomes enable, it turns ON the Solid State Relay and start monitoring Thermostat (FAN P.S. Transformer) status. After the SSR becomes ON status, it starts monitoring each FAN Speed.

- SSR off

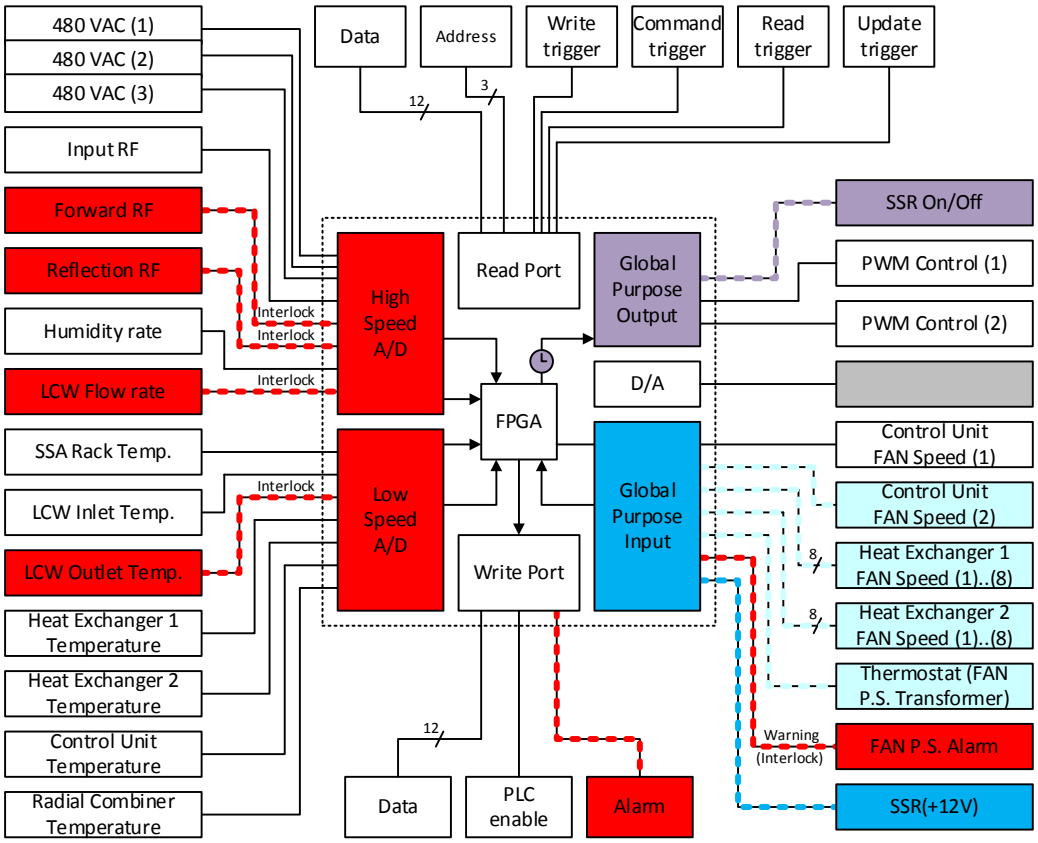

Fig. 46: Controller FPGA (SSR Off)

① SSR (+12V) disable / Interlock status happened

② SSR Off

③ Stop monitoring (FAN Speed)

When SSR (+12V) or Interlock status occurs, it turns Solid State Relay OFF. If it was in Interlock state, Alarm Busline also gets enabled. After SSR becomes OFF status, it stops monitoring each FAN Speed and Thermostat (FAN P.S. Transformer). When Interlock status occurs, the fault information is kept as latched. That information is not reset in Interlock status, but can be reset after the Interlock status is released.

Table 58: FAN PS Alarm condition

P.S. 1	Good	Fault	Good	Fault	Good	Fault	Good	Fault
P.S. 2	Good	Good	Fault	Fault	Good	Good	Fault	Fault
P.S. 3	Good	Good	Good	Good	Fault	Fault	Fault	Fault
P.S. Alarm	Good	Warning						Interlock

- Notification

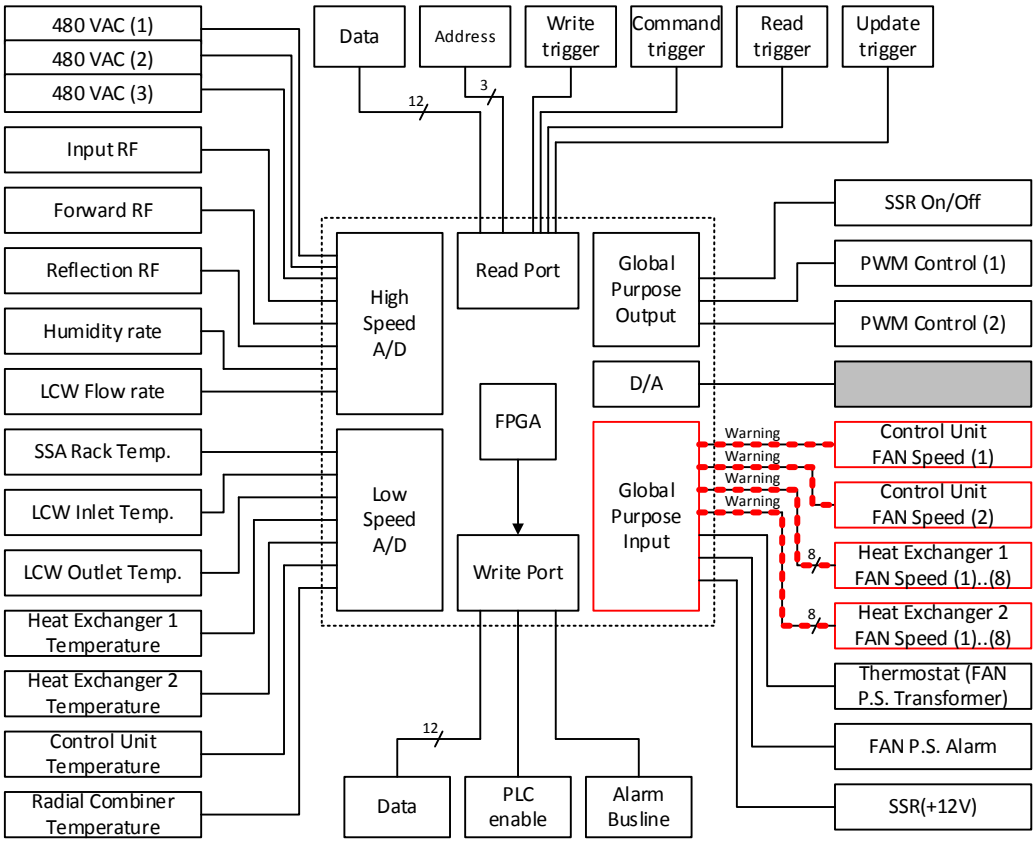

Fig. 47: Controller FPGA (Notification only)

① Warning status happened

② Notification

The SSA module continues to operate.

3.2.2. SSA module_Driver

- Standby

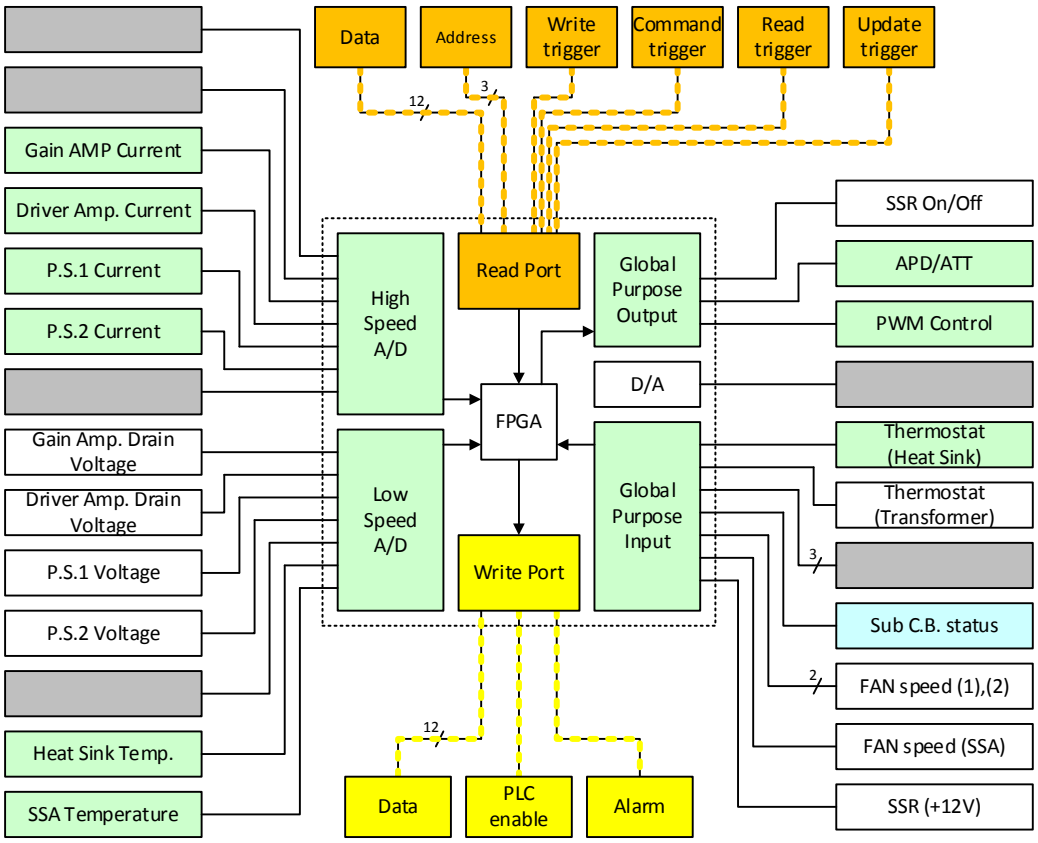

Fig. 48: SSA module_Driver FPGA (Standby)

① Self-Test

② Configuration parameter

③ Start monitoring and FAN control

When receiving the communication cable test from PLC to Read Port after turning on the power, it sends the communication cable test from Write Port to PLC. Then, it receives each parameter setting from PLC, starts monitoring each status of Amplifier Current, Power Supply Current, Temperature, Thermostat (Heat Sink), and perform FAN speed control by PWM Control.

- SSR On

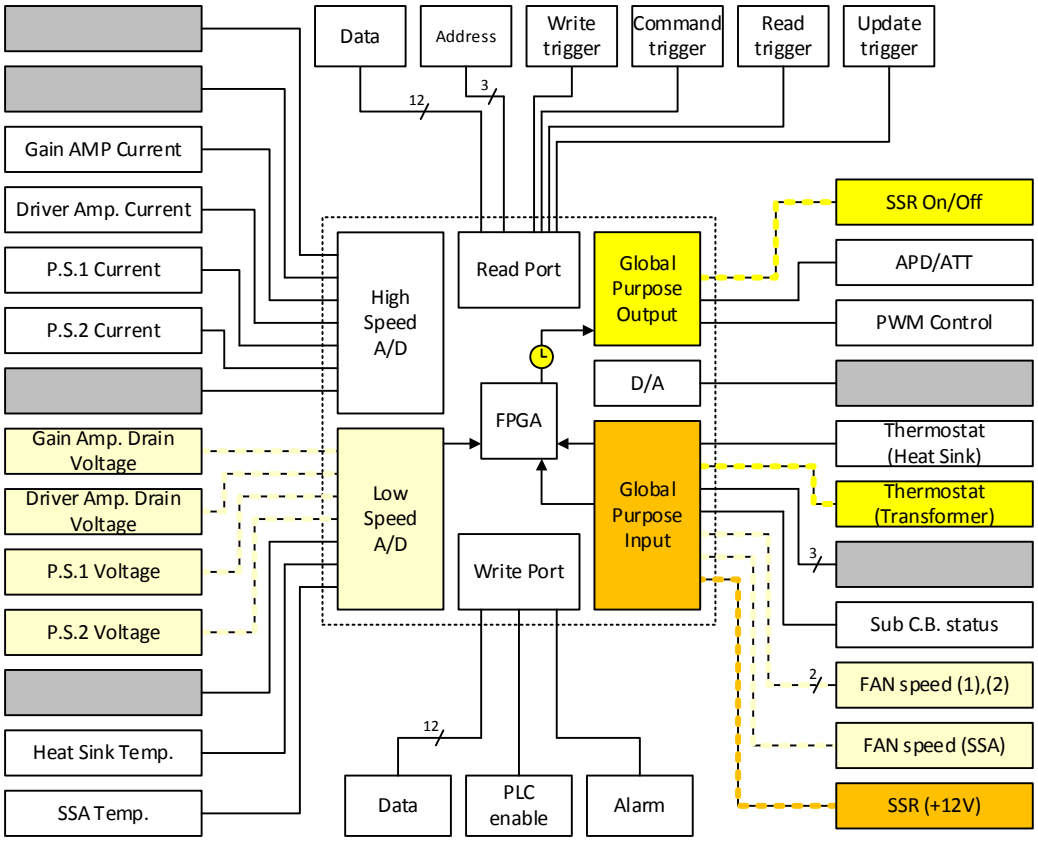

Fig. 49: SSA module_Driver FPGA (SSR On)

① SSR (+12V) enable

② SSR On / Start monitoring (thermostat)

③ Start monitoring

When SSR (+12V) is enabled, Solid State Relay is turned ON and start monitoring Thermostat (Transformer) status. Monitoring of each FAN Speed, Amplifier Voltage, and Power Supply Voltage is started after Solid State Relay is turned ON.

- SSR Off

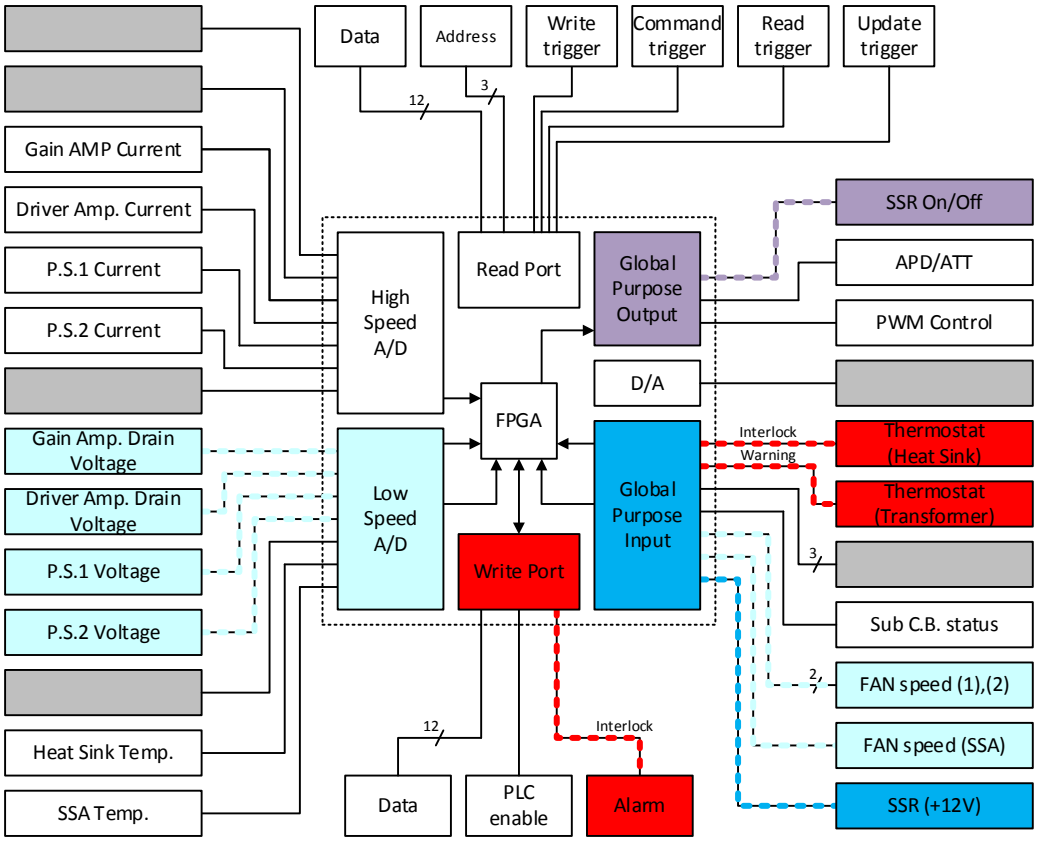

Fig. 50: SSA module_Driver FPGA (SSR Off)

① SSR (+12V) disable / Interlock / Warning status happened

② SSR Off

③ Stop monitoring (FAN Speed and Thermostat)

When SSR (+12V) disable status occurs or Thermostat (Transformer) (warning) occurs or Thermostat (Heat Sink) (Interlock) occurs or Alarm Busline (Interlock) becomes active, Solid State Relay is turned OFF. If it was in Interlock state, Alarm Busline also gets enabled. Monitoring of each FAN Speed, Thermostat (Transformer), Amplifier Voltage, and Power Supply Voltage are stopped after Solid State Relay is turned OFF. When Interlock status occurs, the fault information is kept as latched. That information is not reset in Interlock status, but can be reset after the Interlock status is released. When Warning status occurs, that information is Latched even after Warning status is released.

- Notification

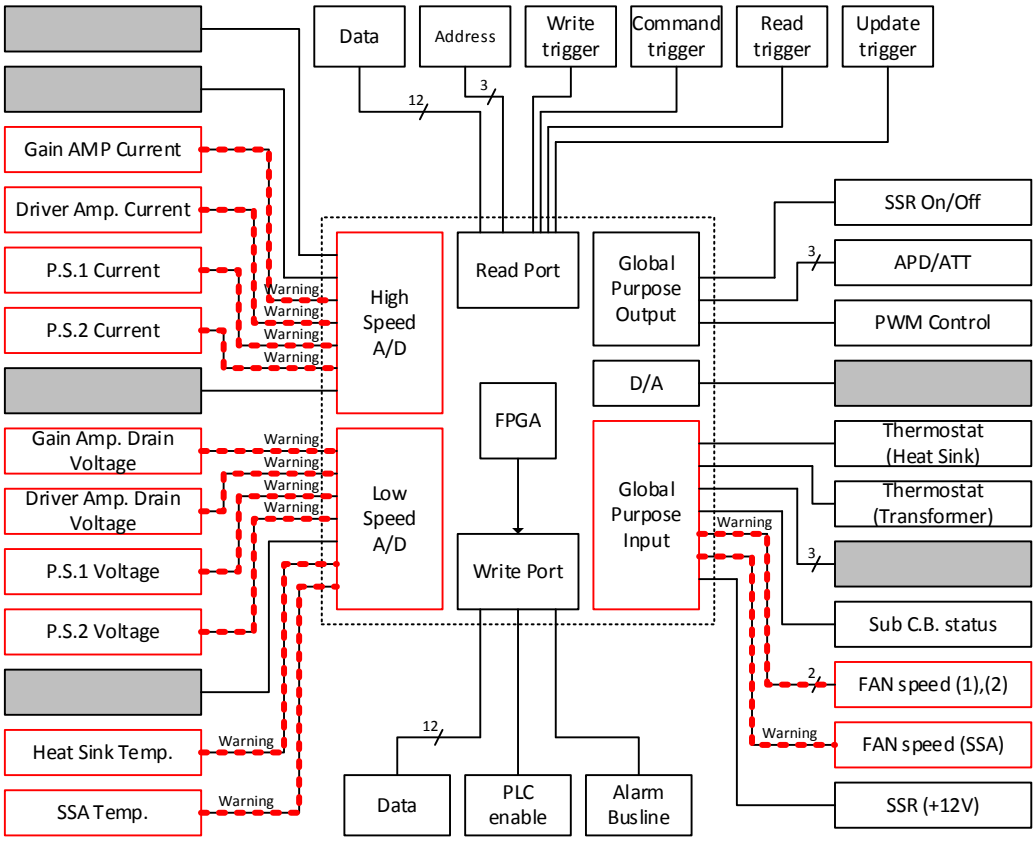

Fig. 51: SSA module_Driver FPGA (Notification only)

① Warning status happened

② Notification

The SSA module continues to operate.

3.2.3. SSA module_00 - 30

- Standby

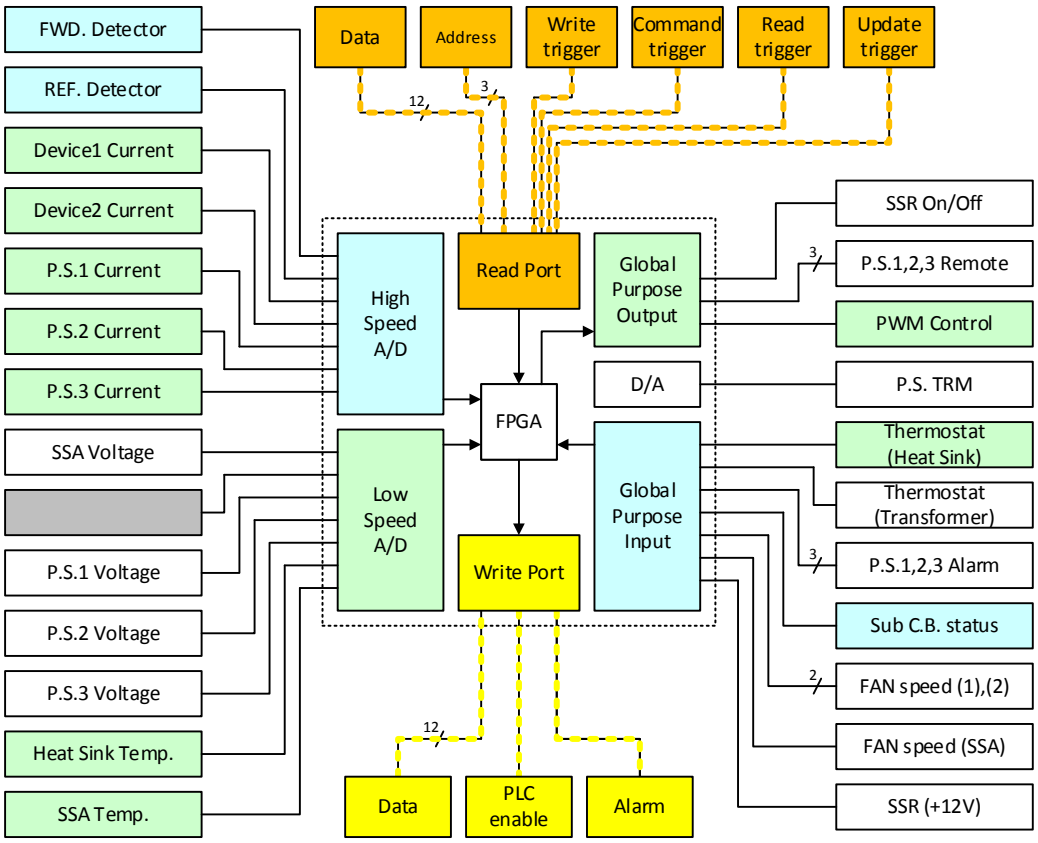

Fig. 52: SSA module_00 - 30 FPGA (Standby)

① Self-Test

② Configuration parameter

③ Start monitoring and FAN control

When receiving the communication cable test from the PLC to the Read Port after turning on the power, it sends the communication cable test from Write Port to PLC. Then, it receives each parameter setting from PLC, starts each status monitoring of Devices Current, Power Supplies Current, Heat Sink Temperature, Thermostat (Heat Sink), and performs FAN speed control by PWM Control.

- SSR On

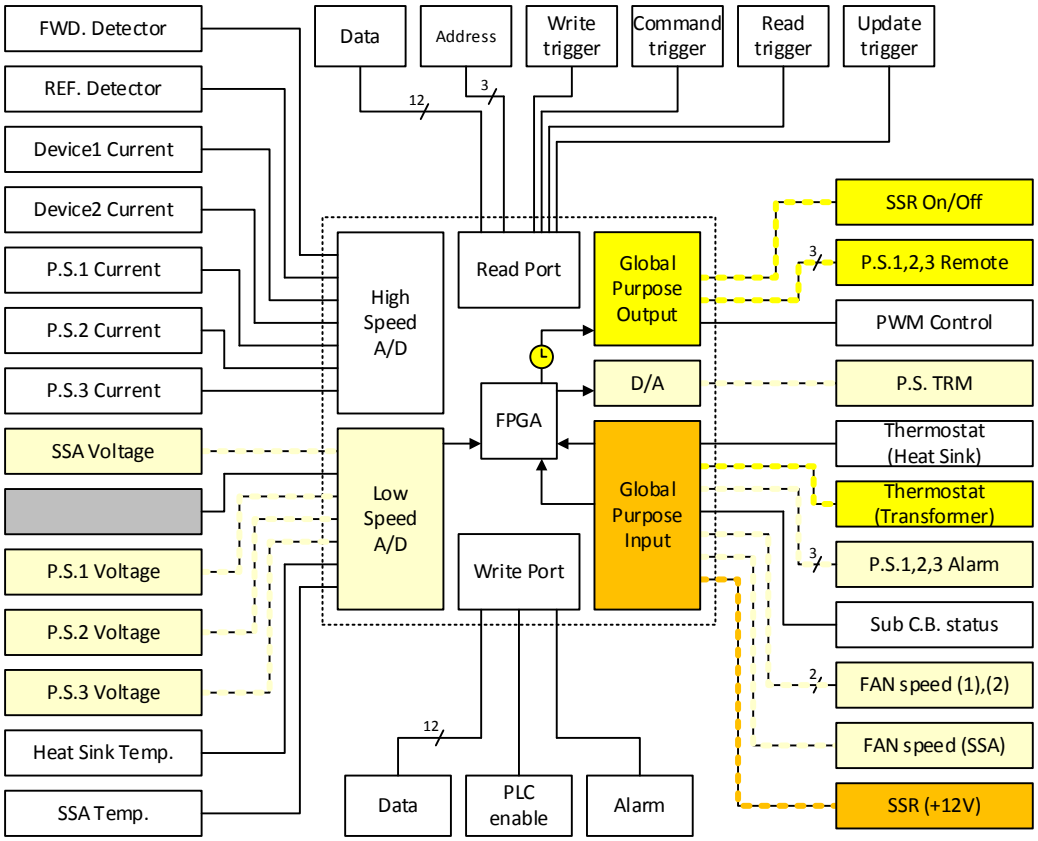

Fig. 53: SSA module_00 - 30 FPGA (SSR On)

① SSR (+12V) enable

② SSR On / Start monitoring (thermostat)

③ Start monitoring / Step up P.S. TRM voltage

When SSR (+12V) is enabled, Power Supplies Remote and Solid State Relay are turned ON and start monitoring Thermostat (Trans.) status. Monitoring of each FAN Speed, Amplifier Voltage, Power Supplies Voltage, and Power Supplies Alarm is started after Power Supplies Remote and Solid State Relay are turned ON. Then voltage of Power Supply TRM is increased gradually.

- SSR Off

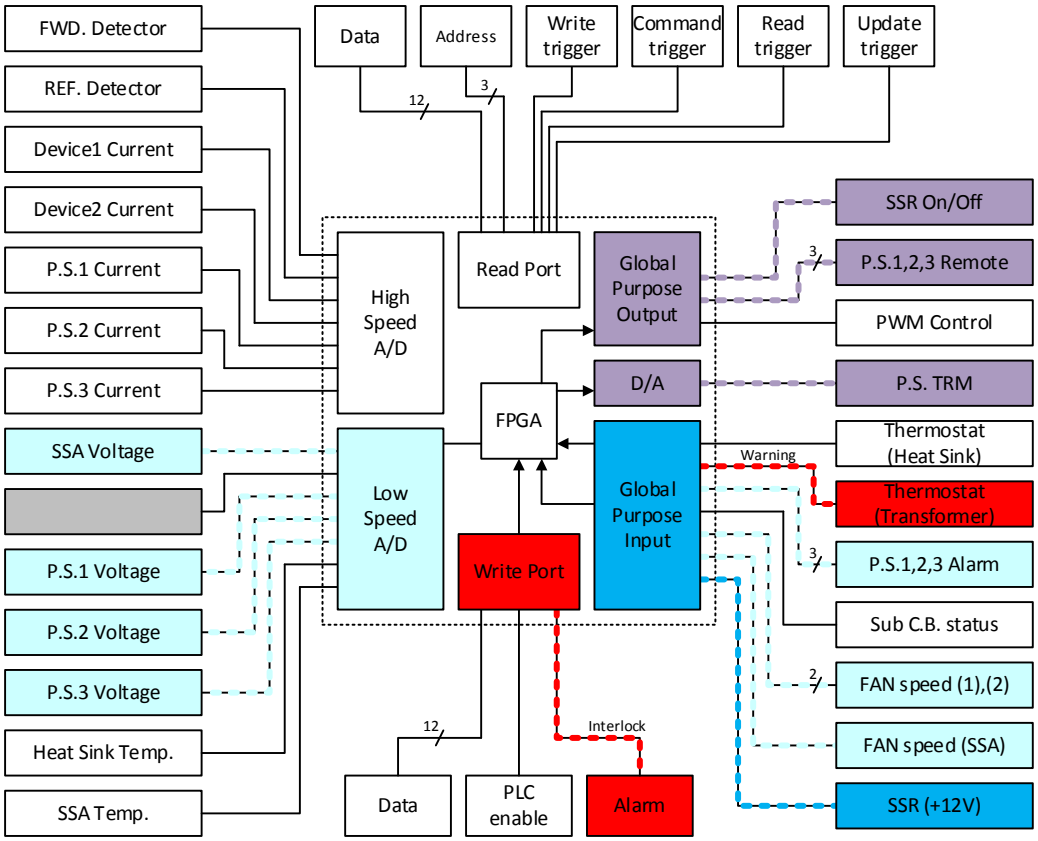

Fig. 54: SSA module_00 - 30 FPGA (SSR Off)

① SSR (+12V) disable / Interlock / Warning status happened

② SSR Off and P.S. Remote off and P.S.TRM shut off

③ Stop monitoring (FAN Speed and Thermostat) / Shut off P.S. TRM voltage

When SSR (+12V) disable status occurs or Thermostat (Transformer) (warning) occurs or Alarm Busline (Interlock) becomes active, Power Supplies Remote and Solid State Relay are turned OFF. Monitoring of each FAN Speed, Thermostat (Trans.), Amplifier Voltage, Power Supplies Voltage, and Power Supplies Alarm are stopped after Power Supplies Remote and Solid State Relay are turned OFF. Then, voltage of Power Supply TRM is decreased to +0V. When Warning status occurs, that information is Latched even after Warning status is released.

- P.S. Remote off

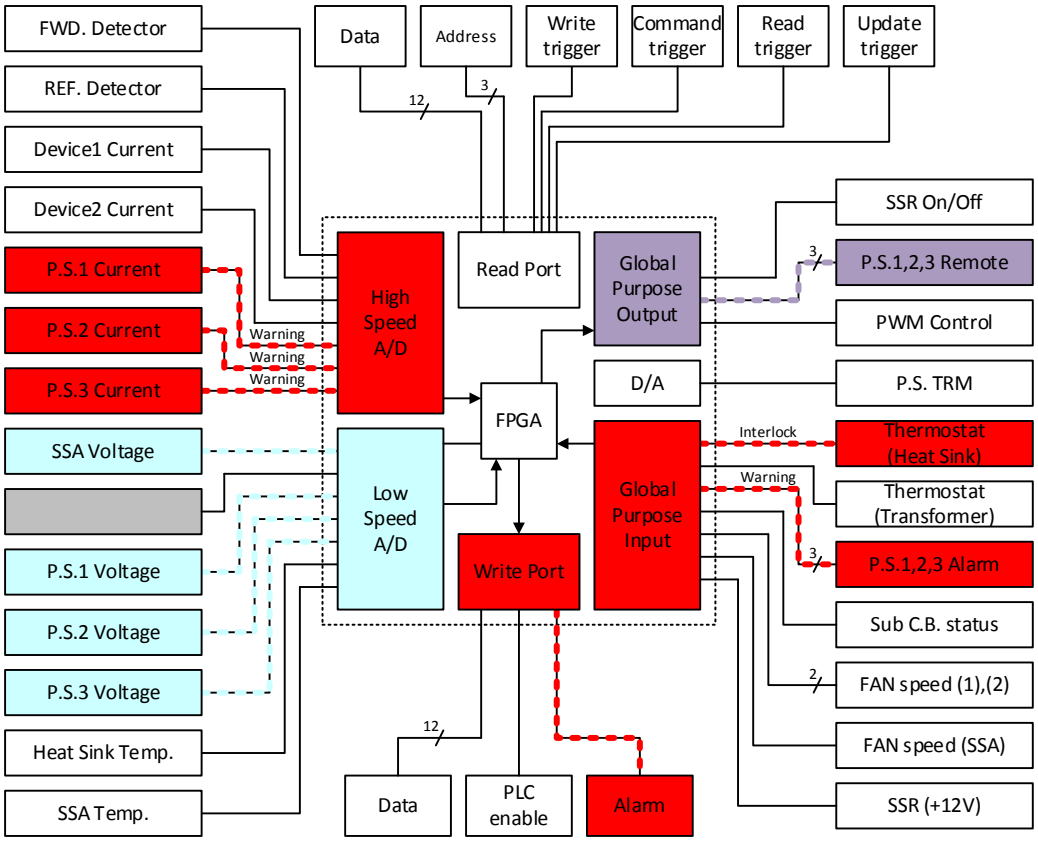

Fig. 55: SSA module_00 - 30 FPGA (P.S. Remote off)

① Interlock / Warning status happened

② P.S. Remote disable

When Warning of Power Supplies Alarm, Power Supplies Current, or Thermostat (Heat Sink) (Interlock) occurs, Power Supplies Remote is turned OFF. Monitoring of Amplifier Voltage, Power Supplies Voltage, and Power Supplies Alarm are stopped after Power Supplies Remote is turned OFF. When Interlock status occurs, active the Alarm Busline and the fault information is kept as latched. That information is not reset in Interlock status, but can be reset after the Interlock status is released. When Warning status occurs, that information is Latched even after Warning status is released.

Table 59: Interlock / Warning status

P.S.1 Alarm or Current	Good	Fault	Good	Fault	Good	…	Fault	-
P.S.2 Alarm or Current	Good	Good	Fault	Fault	Good	…	Fault	-
P.S.3 Alarm or Current	Good	Good	Good	Good	Fault	…	Fault	-
Thermostat(H.Sink)	Good	Good	Good	Good	Good	Good	Good	Fault
Interlock / Warning	-	Warning						Interlock

- Notification

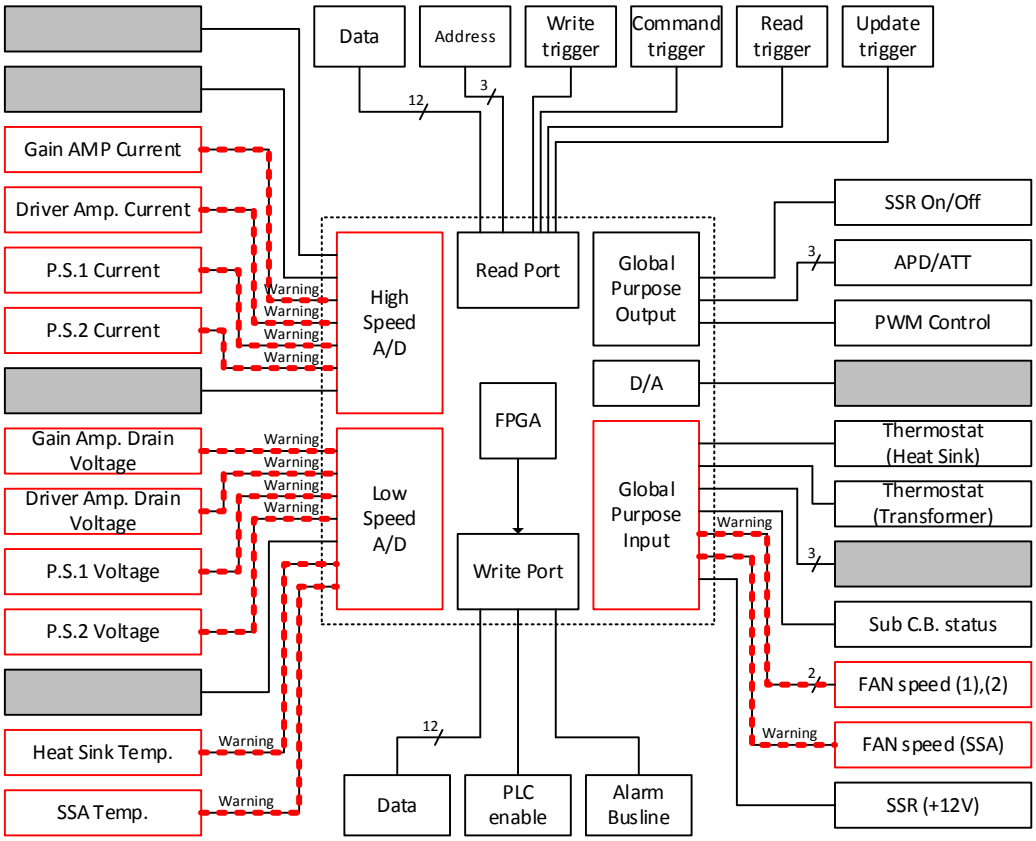

Fig. 56: SSA module_Driver FPGA (Notification only)

① Warning status happened

② Notification

The SSA module continues to operate.

Table 60: Error operation of SSA modules

Input / Output	SSR(+12V) ON / OFF	Interlock (Alarm busline)	SSA module 00 Thermo(Trans.)	SSA module 00 Thermo(H.Sink)	SSA module 00 H.Sink Temp.	SSA module 00 P.S. 1 Alarm	SSA module 00 P.S. 2 Alarm	SSA module 00 P.S. 3 Alarm	SSA module 00 P.S. 1 Current	SSA module 00 P.S. 2 Current	SSA module 00 P.S. 3 Current	SSA module 00 other warnings
SSA module 00 Solid State Relay	ON / OFF	OFF	OFF	- *1	-	-	-	-	-	-	-	-
SSA module 00 P.S. 1 Remote	ON / OFF	OFF	OFF	OFF	-	OFF	-	-	OFF	-	-	-
SSA module 00 P.S. 2 Remote	ON / OFF	OFF	OFF	OFF	-	-	OFF	-	-	OFF	-	-
SSA module 00 P.S. 3 Remote	ON / OFF	OFF	OFF	OFF	-	-	-	OFF	-	-	OFF	-
SSA module 00 P.S. TRM	Set / Reset control voltage	Reset control voltage	Reset control voltage	-	Reduce control voltage	-	-	-	-	-	-	-
SSA module 01 Solid State Relay	ON / OFF	OFF	-	-	-	-	-	-	-	-	-	-
SSA module 01 P.S. 1 Remote	ON / OFF	OFF	-	-	-	-	-	-	-	-	-	-
SSA module 01 P.S. 2 Remote	ON / OFF	OFF	-	-	-	-	-	-	-	-	-	-
SSA module 01 P.S. 3 Remote	ON / OFF	OFF	-	-	-	-	-	-	-	-	-	-
SSA module 01 P.S. TRM	Set / Reset control voltage	Reset control voltage	-	-	-	-	-	-	-	-	-	-
…												
SSA module 30 Solid State Relay	ON / OFF	OFF	-	-	-	-	-	-	-	-	-	-
SSA module 30 P.S. 1 Remote	ON / OFF	OFF	-	-	-	-	-	-	-	-	-	-
SSA module 30 P.S. 2 Remote	ON / OFF	OFF	-	-	-	-	-	-	-	-	-	-
SSA module 30 P.S. 3 Remote	ON / OFF	OFF	-	-	-	-	-	-	-	-	-	-
SSA module 30 P.S. TRM	Set / Reset control voltage	Reset control voltage	-	-	-	-	-	-	-	-	-	-

*1 Transition to interlock operation.