SOFTWARE MANUAL

RF POWER AMPLIFIER

CA1300BW1-5867R-SL

R&K Company Limited

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Revision History

Version	Date	Author(s)	Revision Note

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1. Control System

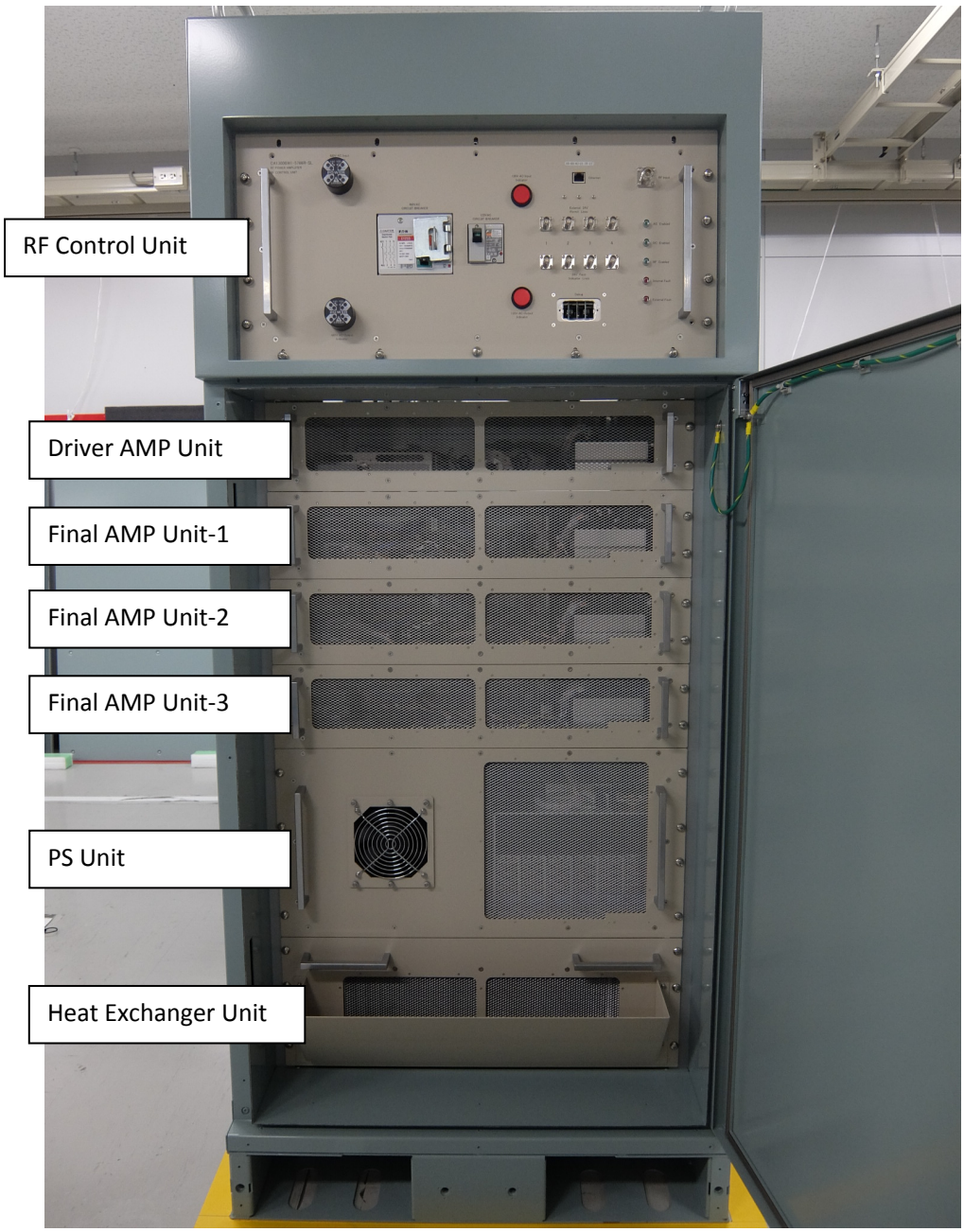
This manual covers the digital control system of CA1300BW1-5867R-SL.

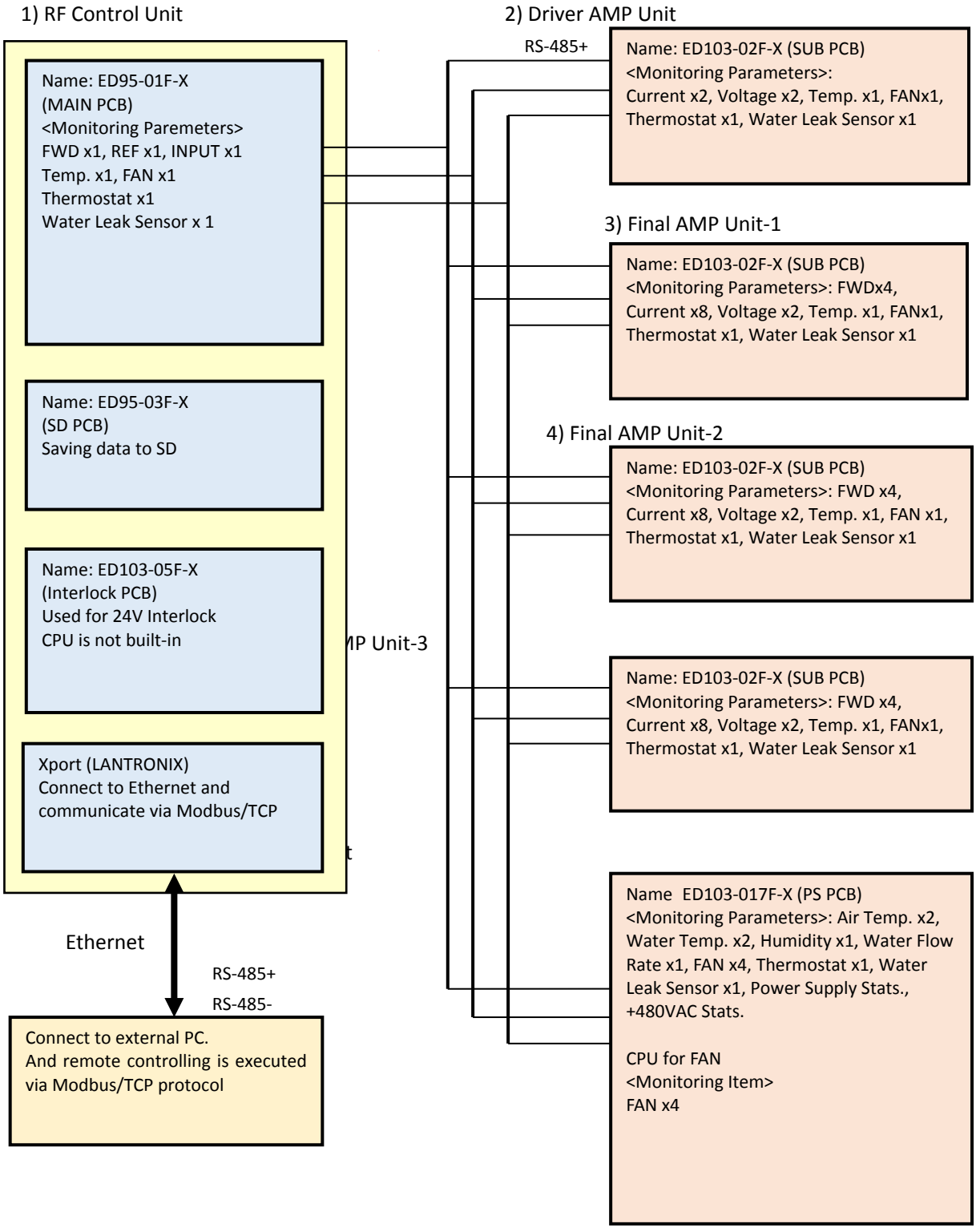
The product is a 1.3GHz Solid State Amplifier (SSA) system in a rack controlled by 6 CPUs which consist of 1 Main CPU, 4 Sub CPUs and 1 PS CPU.

1.1. Construction

This product consists of RF Control Unit, Driver Amplifier (AMP) Unit, Final AMP Unit-1, Final AMP Unit-2, Final AMP Unit-3, PS Unit and Heat Exchanger Unit.

Following are photos of the total system, a block diagram and photos of the control chassis and the individual chassis controlled by it.





ALM_IN signal is used as Hand Shake signal

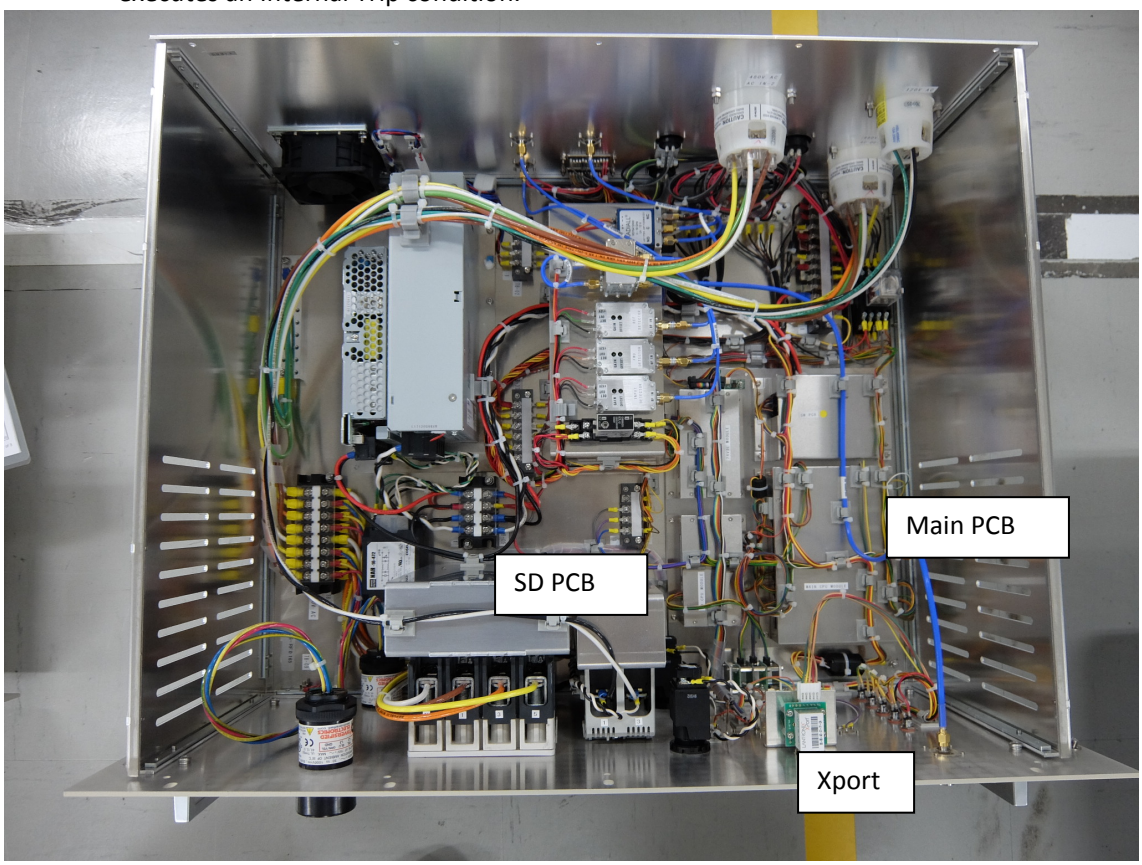
1) RF Control Unit

The Main Printed Circuit Board (PCB) and the Secure Digital (SD) PCB are built into the RF Control Unit. (There are sub PCBs in the other Units as described below.) The MAIN PCB controls all the systems.

Communication is performed by computer bus standard RS485. The SUB-PCB boards are daisy-chain-connected with the MAIN-PCB. Measurement data (power, voltage and current) is collected by each PCB via RS485 on each unit and saved to MODBUS register. The measurement can be remotely confirmed via MOBUS communication. MODBUS data is also saved in SD memory on the SD PCB.

The sub CPU analyses the data collected by the sub-PCB and determines if there should be a warning. It sends the information to the main PCB. The Main CPU executes the resulting action (e.g. the control unit fan rotation speed is <6300 rpm, warning code 503 will be set but the SSA will continue to operate).

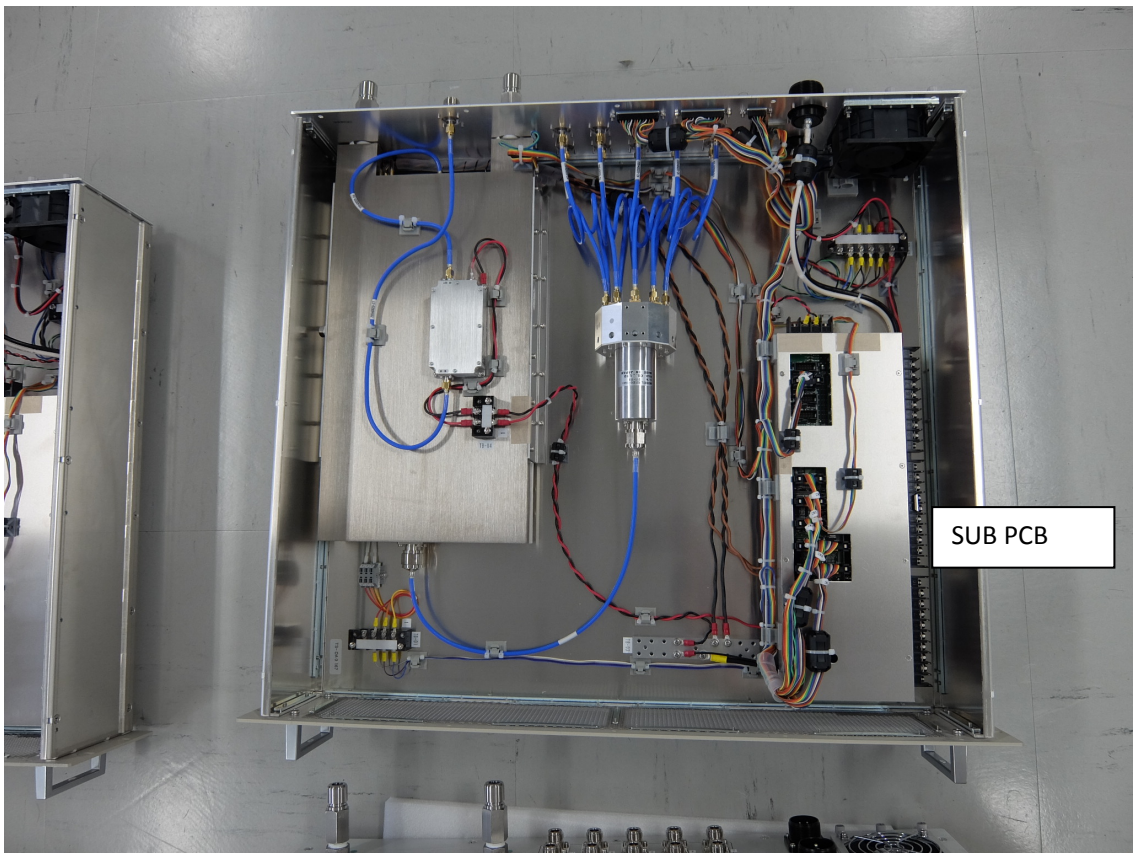
Thermostat and Water Leak Sensors are built into all the chassis in the SSA rack. The thermostat sensors are daisy-chain-connected with each other and the MAIN-PCB. The water leak sensors are daisy-chain-connected with each other and the MAIN-PCB. When the thermostat sensors detect above threshold conditions, they are interlocked to trip the SSA via hardware circuit and cause an Internal Fault condition. When the Leak Sensors detect above threshold condition the MAIN-CPU assess the condition and executes an Internal Trip condition.



2 Driver AMP Unit

A SUB-PCB is built into the Driver AMP Unit. An Analog-to-Digital (AD) converter, which has a CPU inside measures voltage and current, and an Integrated Circuit (IC) chip on the i2C Bus measures the temperature.

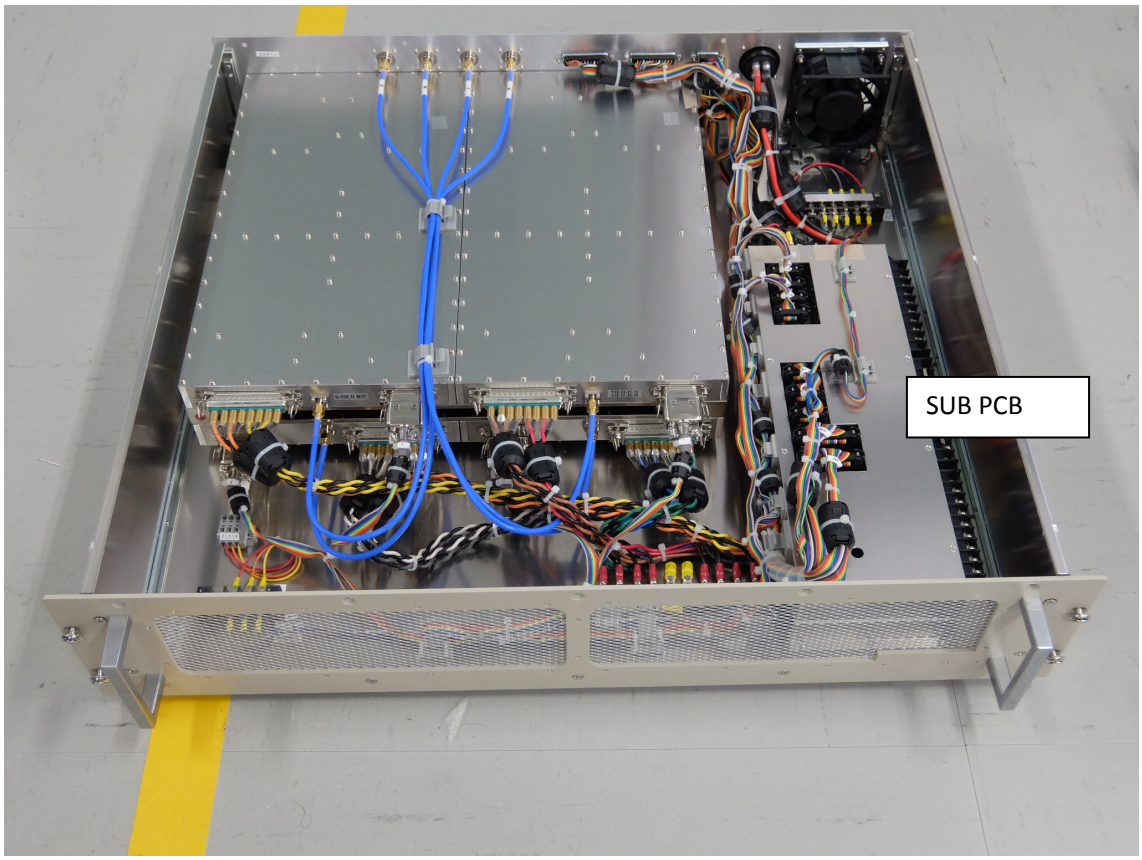
Data is submitted to the CPU on the MAIN PCB via RS485 communication. The CPU on the MAIN PCB confirms every <100 mS that the data is within the allowed margins.



3 Final AMP Unit-1

A SUB-PCB is built into the Final AMP Unit-1. An AD converter, which has a CPU inside measures voltage and current, and IC chip on the i2C Bus measures the temperature.

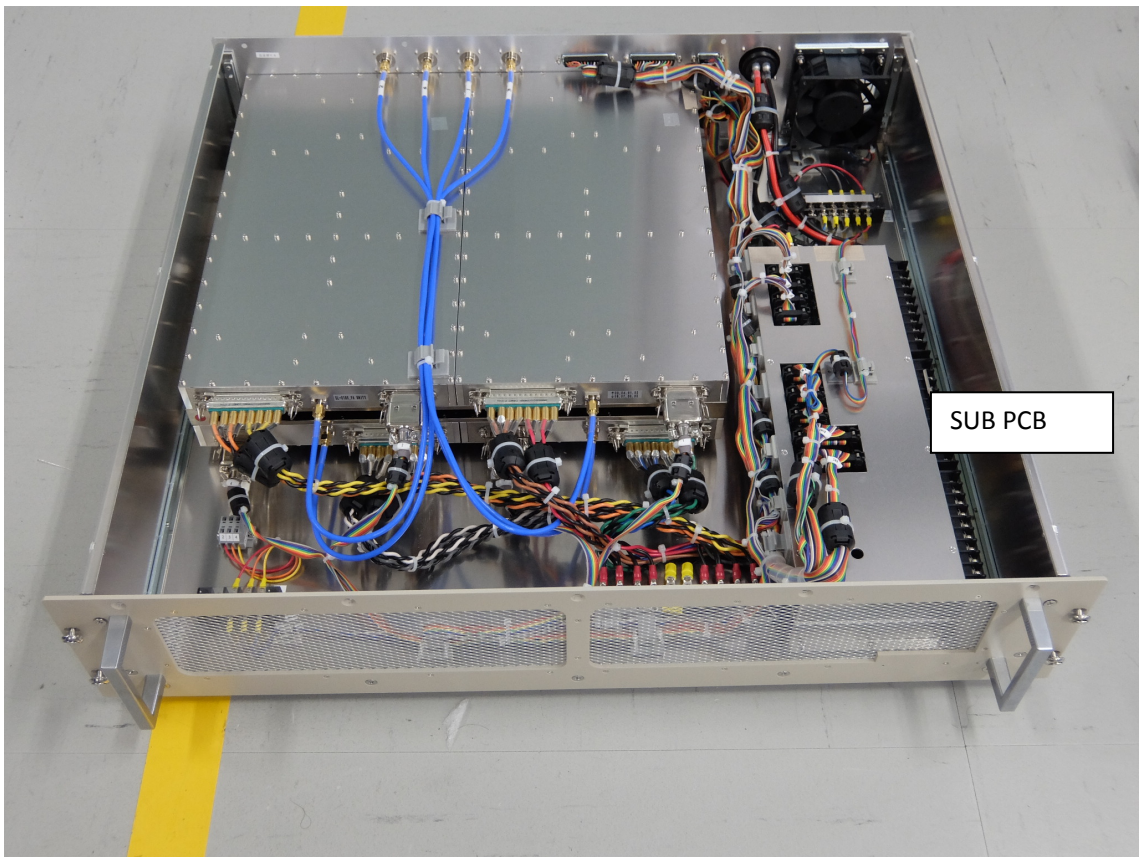
Data is submitted to the CPU on the MAIN PCB via RS485 communication. The CPU on the MAIN PCB confirms every <100 mS that the data is within the allowed margins.



4) Final AMP Unit-2

A SUB-PCB is built into the Final AMP Unit-2. An AD converter, which has a CPU inside measures voltage and current, and IC chip on the i2C Bus measures the temperature.

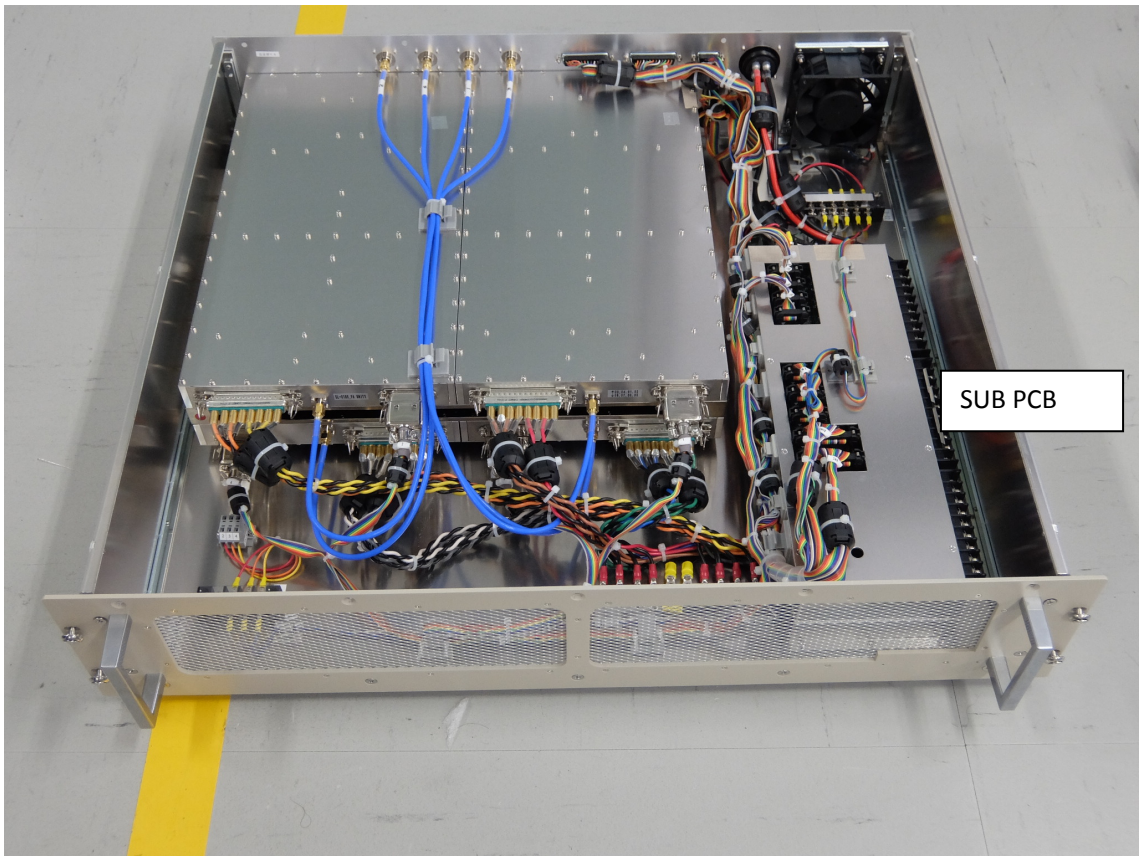
Data is submitted to the CPU on the MAIN PCB via RS485 communication. The CPU on the MAIN PCB confirms every <100 mS that the data is within the allowed margins.



5) Final AMP Unit-3

A SUB-PCB is built into the Final AMP Unit-3. An AD converter, which has a CPU inside measures voltage and current, and IC chip on the i2C Bus measures the temperature.

Data is submitted to the CPU on the MAIN PCB via RS485 communication. The CPU on the MAIN PCB confirms every <100 mS that the data is within the allowed margins.



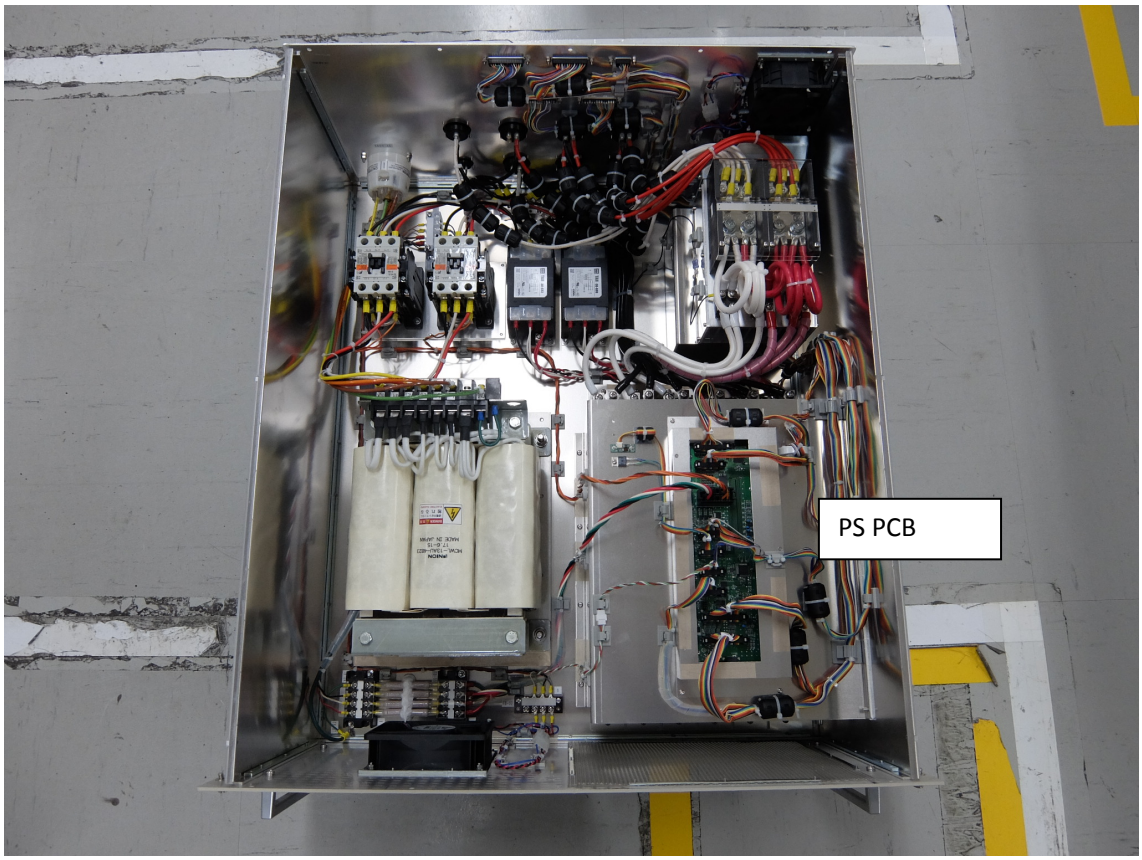
6) P.S. Unit

2 CPUs are built into one P.S.-Board in the P.S. Unit.

An AD converter on the P.S. board has a CPU inside which measures voltage, and an IC chip on the i2C Bus measures the temperature.

Another CPU on the P.S. board measures only the FAN rotation speed and submits data to the CPU in the AD converter via Universal Asynchronous Receiver/Transmitter (UART)

Data in the CPU in the AD converter on the P.S. board is submitted to the MAIN PCB via RS485 communication. The CPU on the MAIN PCB confirms every <100 mS that the data is within the allowed margins.



1.2. Control Interface

This product has a network interface.

Network Interface: Modbus/TCP

1.3. Monitoring System

The main CPU on the main PCB in the Control Module monitors and records the status of the Control Module, the Driver Amplifier (DA) Module, the three Final Amplifier (FA) Modules and the Power Supply (P.S.) Module. The recorded information can be confirmed via Modbus interface in real time. These data are also recorded to the SD card.

1.4. Protection Function

The CA1300BW1-5867R-SL has the following protection functions.

Error When an internal or external abnormal status occurs that adversely affects its continuous operation, the unit is automatically shut down and a fault signal (24 V indicator) as well as the applicable error code is generated.

Warning When an internal abnormal status occurs that warrants the operators attention, warning registers are set that can be confirmed via Modbus, but the operation of the unit continues without change.

2. Control System Construction and Functions

This section describes the construction and control function of each subsystem.

2.1. Control Construction

2.1.1. Controller Module

The RF Control Unit is operated by the MAIN CPU on the MAIN PCB. It polls each SUB-CPU to collect data which is measured by each SUB-CPU.

The MAIN CPU on the MAIN PCB controls the SSA by processing orders submitted from the control interface.

Table 1: Control System

Category	Type name	Number	Specification
Main PCB	ED95-01F-X	1	①CPU:PIC24EP256GU810 ②Input Port x16 ③Output Port x8 ④Open Collector Output Port x 8 ⑤LED Output Port x8 ⑥ADC Input Port (12bit) x 4 ⑦DAC Output Port (MCP4822) x 2 ⑧RS-485 (LTC2850) ⑨RX,TX ⑩Real Time Clock DS3232SN
SD PCB	ED95-03F-X	1	①CPU:PIC24FJ256GB106 ②EEPROM(24LC16B) ③SD-SLOT
Xport	Xport (LANTRONIX)	1	①Module to convert RX TX to Ethernet ②Modbus/TCP ③MAC address is displayed on the Front Panel
SUB PCB	ED103-02F-X	4	①CPU:PIC24HJ64GP206A ②Input Port x11 ③Output Port x2 ④ADC Input Port x14 ⑤RS-485 LTC2850
PS PCB	ED103-017F-X	1	①CPU:PIC24HJ64GP206A x 2 ②Input Port x13 ③Output Port x5 ④ADC Input Port x7 ⑤RS-485 LTC2850

2.1.2. Driver and Final Amplifier Units

The Driver and Final Amplifier Units are controlled by a SUB-CPU from manufacturer Microchip (PIC24HJ64GA206A). The SUB-CPU monitors and measures the internal status of the corresponding amplifier unit. The MAIN-CPU polls the SUB-CPUs in the Amplifier units and collects the measured parameters.

Table 2: Monitoring Parameters

Parameter	Resolution (bit)	Sampling rate (Kilo Samples per Second)	Note
Device current	12 bit	100	DA Unit, FA Unit
Drain Voltage	12 bit	100	DA Unit, FA Unit
Module Forward power	12 bit	100	FA Unit
Forward power	12 bit	100	RF Control Unit
Reflection power	12 bit	100	RF Control Unit
Input power	12 bit	100	RF Control Unit
Heat Sink temperature	12 bit	100	FA Unit, DA Unit
Heat Sink thermostat	1 bit	-	FA Unit, DA Unit
AC/DC Power Supply voltage	12 bit	100	DA Unit, FA Unit
AC/DC Power Supply alarm	1 bit	-	PS Unit
FAN speed (1/4 rpm)	12 bit	-	DA Unit, FA Unit, RF Control Unit, PS Unit
Humidity	12 bit	100	PS Unit
Water flow	12 bit	100	PS Unit
Water temperature	12 bit	100	PS Unit
Air temperature	12 bit	100	RF Control Unit, PS Unit
Heat Exchanger temperature	12 bit	100	PS Unit
480 VAC Phase Loss	12 bit	100	PS Unit
Air Thermostat	1 bit	-	RF Control Unit, PS Unit
Heat Exchanger Thermostat	1 bit	-	PS Unit

2.2. Control Interface

2.2.1. XPort Setting

The XPort module determines the communication protocols of the control system.

Settings of the Xport module are editable by the Lantronix “Device Installer.exe” program. The initial factory setting of the Xport is shown in Table 3.

Table 3: Unit1 Xport Setting

	Xport
IP Address	169.254.xxx.x
Subnet Mask	255.255.0.0
Default Gateway	0.0.0.0
DNS Server	0.0.0.0
CPU Performance Mode	High
Protocol	RS232
Flow Control	None
Baud Rate	230400bps
Data Bits	8
Parity	None
Stop Bits	1
Local Port	502
Remote Port	0
Remote Host	0.0.0.0

2.2.2. Communication protocol

Communication between the Model CA1300BW1-5766R-SL SSA (3.8 kW nominal) and the external control system is via Ethernet using Lantronix Xport hardware and Modbus/TCP protocol. The Xport settings are established using the Device Installer software. Port is 502

IP address of the first 254 SSAs as set at the factory is 169.254.150.XXX, where XXX is the serial number (i.e. IP address of serial number SL-0215 is 169.254.150.215, of SL-015 is 169.254.150.15).
For serial numbers greater than 254 the IP address is 169.254.151.XXX, where XXX is serial number minus 254 minus (I.e. for SL-0260 the IP address is 169.254.150.6).
For Model CA1300BW1-5867R-SL SSA (4.6 kW nominal) serial number SL-1001, the IP address is 169.254.152.1 (note the variation in the third set of numbers).

For special cases of model CA1300BW1-5766R-SL SSA (3.8 kW nominal) SL-9001, SL-9002 and SL-9003 IP address is as follows:
SL-9001 is 169.254.150.136 (same as SL-0136)
SL-9002 is 169.254.151.23
SL-9003 is 169.254.151.22

While the fixed IP address as described above is the Factory default, Dynamic Host Configuration Protocol (DHCP) IP address inquiry is supported by the SSA control system. This setting can be changed in the Lantronix XPort Device Manager software or Lantronix XPort web interface.

<Register Map>

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

- ◆ Definition: “Default” means: AC Enable, DC Disable (PS Output Control Voltage 700mV), RF Disable
- ◆ Reset Operation
  - ➢ Conditions: Internal Fault, External Fault
    When these conditions are detected, SSA operation goes to Default and the respective fault light(s) and registers will be activated
    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 “PS Output Control Voltage” command (Address 3) to the SSA via Modbus.
    4. Send the “RF Enable” command (Address 2) to the SSA via Modbus.

  - ➢ Remove Cause: Warning
    When a warming is detected, a warning code will be set on Address 15 but the SSA operation continues.
    To remove the warning Code:
    1. Check the Error code in Table 5 and remove the cause.
    2. Send the “Fault Reset” command (Address 4) to the SSA via Modbus. SSA operation continues uninterrupted..

- ◆ Multiplier
  - ➢ 1
    The number shown on the Modbus is the actual performance value.
  - ➢ 0.1
    The actual performance value is **x 0.1**. The last number shown on the Modbus is actually the first number after the decimal point.

Table4: Register Map

Address	Address	Description	Function	Display Range	Multiplier	Unit	Permitted Raw Value	Threshold (Lower)	Threshold (Upper)	command /status	Error Code	Error Type	Error Operation	Reset Operation
1	0x0001	DC Enable/Disable	0x03,06	0 or 1	n/a	n/a	0 or 1	n/a	n/a	0: Disable 1: Enable	n/a	n/a	n/a	n/a
2	0x0002	RF Enable/Disable	0x03,06	0 or 1	n/a	n/a	0 or 1	n/a	n/a	0: Disable 1: Enable	n/a	n/a	n/a	n/a
3	0x0003	PS Output Control Voltage (see table 6)	0x03,06	0 – 4095	1	mV	700 - 2520	n/a	n/a	Operation Value	n/a	n/a	n/a	n/a
4	0x0004	Fault Reset	0x06	1	n/a	n/a	1, 2, 4	n/a	n/a	1: Internal 2: External 4: Warning	n/a	n/a	n/a	n/a
5	0x0005	X-Port Reboot	0x06	1	n/a	n/a	1	n/a	n/a	1: Reboot	n/a	n/a	n/a	n/a
6	0x0006	System Reboot	0x06	1	n/a	n/a	1	n/a	n/a	1: Reboot	n/a	n/a	n/a	n/a
7	0x0007	-	-	-	-	-	-	-	-	-	-	-	-	-
8	0x0008	-	-	-	-	-	-	-	-	-	-	-	-	-
9	0x0009	-	-	-	-	-	-	-	-	-	-	-	-	-
10	0x000a	AC Enabled (480VAC Breaker)	0x03	0 or 1	n/a	n/a	Read only	n/a	n/a	0: Disable 1: Enable	n/a	n/a	n/a	n/a
11	0x000b	DC Enabled	0x03	0 or 1	n/a	n/a	Read only	n/a	n/a	0: Disable 1: Enable	n/a	n/a	n/a	n/a
12	0x000c	RF Enabled	0x03	0 or 1	n/a	n/a	Read only	n/a	n/a	0: Disable 1: Enable	n/a	n/a	n/a	n/a
13	0x000d	Internal Fault Error Code	0x03	0 or 31 - 580	n/a	n/a	Read only	n/a	n/a	0: No Error 31 - 580: Error	See Error code list	Internal	DC: Disable RF: Disable	Default
Address	Address	Description	Function	Display Range	Multiplier	Unit	Permitted Raw Value	Threshold (Lower)	Threshold (Upper)	command /status	Error Code	Error Type	Error Operation	Reset Operation
14	0x000e	External Fault Error Code	0x03	0 or 511 - 525	n/a	n/a	Read only	n/a	n/a	0: No Error 511 - 525: Error	Fault1: 511 Fault2: 512	External	DC: Disable RF: Disable	Default

										(Bit)	Fault3: 514 Fault4: 518			
15	0x000f	Warning Code	0x03	0 or 1 - 503	n/a	n/a	Read only	n/a	n/a	0: No Error 1 - 503: Error	See Error code list	Warning	Notification Only	Remove Cause
16	0x0010	Input Drive Power (see Table 7)	0x03	0 - 3300	1	mV	Read only	0mV	2500mV	Operation Value	500	Internal	DC: Disable RF: Disable	Default
17	0x0011	Forward Power	0x03	0 - 4500	1	W	Read only	0W	5100W	Operation Value	501	Internal	DC: Disable RF: Disable	Default
18	0x0012	Reflected Power	0x03	0 - 4500	1	W	Read only	0W	500W	Operation Value	530	Internal	DC: Disable RF: Disable	Default
19	0x0013	-	-	-	-	-	-	-	-	-	-	-	-	-
20	0x0014	-	-	-	-	-	-	-	-	-	-	-	-	-
21	0x0015	-	-	-	-	-	-	-	-	-	-	-	-	-
22	0x0016	Control Unit Air Temperature	0x03	0 - 125.0	0.1	degC	Read only	+10.0degC	+60.0degC	Operation Value	550	Internal	DC: Disable RF: Disable	Default
23	0x0017	Control Unit Fan Rotation Speed	0x03	0 - 12000	1	rpm	Ready only	6300rpm	11700rpm	Operation Value	503	Warning	Notification Only	Remove Cause
24	0x0018	-	-	-	-	-	-	-	-	-	-	-	-	-
25	0x0019	Thermostat Status	0x03	0 or 1	n/a	n/a	Read only	n/a	n/a	0: OK 1: Alarm	560	Internal	DC: Disable RF: Disable	Default
26	0x001a	-	-	-	-	-	-	-	-	-	-	-	-	-
27	0x001b	-	-	-	-	-	-	-	-	-	-	-	-	-
28	0x001c	Water Leak Status	0x03	0 or 1	n/a	n/a	Read only	n/a	n/a	0: OK 1: Alarm	502	Internal	DC: Disable RF: Disable	Default
29	0x001d	-	-	-	-	-	-	-	-	-	-	-	-	-
30	0x001e	-	-	-	-	-	-	-	-	-	-	-	-	-
31	0x001f	-	-	-	-	-	-	-	-	-	-	-	-	-
32	0x0020	DA Unit-1 Current	0x03	0 - 20.0	0.1	A	Read only	+0.5A	+3.0A	Operation Value	001	Warning	Notification Only	Remove Cause
33	0x0021	-	-	-	-	-	-	-	-	-	-	-	-	-

Address	Address	Description	Function	Display Range	Multiplier	Unit	Permitted Raw Value	Threshold (Lower)	Threshold (Upper)	command /status	Error Code	Error Type	Error Operation	Reset Operation
34	0x0022	DA Unit-2 Current	0x03	0 - 20.0	0.1	A	Read only	0A	+11.5A	Operation Value	002	Warning	Notification Only	Remove Cause
35	0x0023	-	-	-	-	-	-	-	-	-	-	-	-	-
36	0x0024	-	-	-	-	-	-	-	-	-	-	-	-	-
37	0x0025	-	-	-	-	-	-	-	-	-	-	-	-	-
38	0x0026	-	-	-	-	-	-	-	-	-	-	-	-	-
39	0x0027	-	-	-	-	-	-	-	-	-	-	-	-	-
40	0x0028	-	-	-	-	-	-	-	-	-	-	-	-	-
41	0x0029	-	-	-	-	-	-	-	-	-	-	-	-	-
42	0x002a	-	-	-	-	-	-	-	-	-	-	-	-	-
43	0x002b	-	-	-	-	-	-	-	-	-	-	-	-	-
44	0x002c	DA Unit-1 Power Supply Voltage	0x03	0 - 100.0	0.1	V	Read only	+10.0V	+14.0V	Operation Value	021	Warning	Notification Only	Remove Cause
45	0x002d	DA Unit-2 Power Supply Voltage	0x03	0 - 100.0	0.1	V	Read only	+10.0V	+48.0V	Operation Value	022	Warning	Notification Only	Remove Cause
46	0x002e	DA Unit Heat Sink Temperature	0x03	0 - 125.0	0.1	degC	Read only	+10.0degC	+60.0degC	Operation Value	031	Internal	DC: Disable RF: Disable	Default
47	0x002f	DA Unit Fan Rotation Speed	0x03	0 - 12000	1	rpm	Read only	5250rpm	9750rpm	Operation Value	041	Warning	Notification Only	Remove Cause
48	0x0030	FA Unit1-1 Current	0x03	0 - 20.0	0.1	A	Read only	0A	+11.5A	Operation Value	101	Warning	Notification Only	Remove Cause
49	0x0031	FA Unit1-2 Current	0x03	0 - 20.0	0.1	A	Read only	0A	+11.5A	Operation Value	102	Warning	Notification Only	Remove Cause
50	0x0032	FA Unit1-3 Current	0x03	0 - 20.0	0.1	A	Read only	0A	+11.5A	Operation Value	103	Warning	Notification Only	Remove Cause
51	0x0033	FA Unit1-4 Current	0x03	0 - 20.0	0.1	A	Read only	0A	+11.5A	Operation Value	104	Warning	Notification Only	Remove Cause
52	0x0034	FA Unit1-5 Current	0x03	0 - 20.0	0.1	A	Read only	0A	+11.5A	Operation Value	105	Warning	Notification Only	Remove Cause
53	0x0035	FA Unit1-6 Current	0x03	0 - 20.0	0.1	A	Read only	0A	+11.5A	Operation Value	106	Warning	Notification Only	Remove Cause
54	0x0036	FA Unit1-7 Current	0x03	0 - 20.0	0.1	A	Read only	0A	+11.5A	Operation Value	107	Warning	Notification Only	Remove Cause
Address	Address	Description	Function	Display Range	Multiplier	Unit	Permitted Raw Value	Threshold (Lower)	Threshold (Upper)	command /status	Error Code	Error Type	Error Operation	Reset Operation
55	0x0037	FA Unit1-8 Current	0x03	0 - 20.0	0.1	A	Read only	0A	+11.5A	Operation Value	108	Warning	Notification Only	Remove Cause
56	0x0038	FA Unit-1-1 Module Power	0x03	0 - 900	1	W	Read only	0W	550W	Operation Value	111	Warning	Notification Only	Remove Cause
57	0x0039	FA Unit-1-2 Module Power	0x03	0 - 900	1	W	Read only	0W	550W	Operation Value	112	Warning	Notification Only	Remove Cause
58	0x003a	FA Unit-1-3 Module Power	0x03	0 - 900	1	W	Read only	0W	550W	Operation Value	113	Warning	Notification Only	Remove Cause
59	0x003b	FA Unit-1-4 Module Power	0x03	0 - 900	1	W	Read only	0W	550W	Operation Value	114	Warning	Notification Only	Remove Cause
60	0x003c	FA Unit1-1 Power Supply Voltage	0x03	0 - 100.0	0.1	V	Read only	+10.0V	+48.0V	Operation Value	121	Warning	Notification Only	Remove Cause
61	0x003d	FA Unit1-2 Power Supply	0x03	0 - 100.0	0.1	V	Read only	+10.0V	+48.0V	Operation Value	122	Warning	Notification	Remove Cause

		Voltage											Only	
62	0x003e	FA Unit1 Heat Sink Temperature	0x03	0 - 125.0	0.1	degC	Read only	+10.0degC	+60.0degC	Operation Value	131	Internal	DC: Disable RF: Disable	Default
63	0x003f	FA Unit1 Fan Rotation Speed	0x03	0 - 12000	1	rpm	Read only	5250rpm	9750rpm	Operation Value	141	Warning	Notification Only	Remove Cause
64	0x0040	FA Unit2-1 Current	0x03	0 - 20.0	0.1	A	Read only	0A	+11.5A	Operation Value	201	Warning	Notification Only	Remove Cause
65	0x0041	FA Unit2-2 Current	0x03	0 - 20.0	0.1	A	Read only	0A	+11.5A	Operation Value	202	Warning	Notification Only	Remove Cause
66	0x0042	FA Unit2-3 Current	0x03	0 - 20.0	0.1	A	Read only	0A	+11.5A	Operation Value	203	Warning	Notification Only	Remove Cause
67	0x0043	FA Unit2-4 Current	0x03	0 - 20.0	0.1	A	Read only	0A	+11.5A	Operation Value	204	Warning	Notification Only	Remove Cause
68	0x0044	FA Unit2-5 Current	0x03	0 - 20.0	0.1	A	Read only	0A	+11.5A	Operation Value	205	Warning	Notification Only	Remove Cause
69	0x0045	FA Unit2-6 Current	0x03	0 - 20.0	0.1	A	Read only	0A	+11.5A	Operation Value	206	Warning	Notification Only	Remove Cause
70	0x0046	FA Unit2-7 Current	0x03	0 - 20.0	0.1	A	Read only	0A	+11.5A	Operation Value	207	Warning	Notification Only	Remove Cause
71	0x0047	FA Unit2-8 Current	0x03	0 - 20.0	0.1	A	Read only	0A	+11.5A	Operation Value	208	Warning	Notification Only	Remove Cause
Address	Address	Description	Function	Display Range	Multiplier	Unit	Permitted Raw Value	Threshold (Lower)	Threshold (Upper)	command /status	Error Code	Error Type	Error Operation	Reset Operation
72	0x0048	FA Unit2-1 Module Power	0x03	0 - 900	1	W	Read only	0W	550W	Operation Value	211	Warning	Notification Only	Remove Cause
73	0x0049	FA Unit2-2 Module Power	0x03	0 - 900	1	W	Read only	0W	550W	Operation Value	212	Warning	Notification Only	Remove Cause
74	0x004a	FA Unit2-3 Module Power	0x03	0 - 900	1	W	Read only	0W	550W	Operation Value	213	Warning	Notification Only	Remove Cause
75	0x004b	FA Unit2-4 Module Power	0x03	0 - 900	1	W	Read only	0W	550W	Operation Value	214	Warning	Notification Only	Remove Cause
76	0x004c	FA Unit2-1 Power Supply Voltage	0x03	0 - 100.0	0.1	V	Read only	+10.0V	+48.0V	Operation Value	221	Warning	Notification Only	Remove Cause
77	0x004d	FA Unit2-2 Power Supply Voltage	0x03	0 - 100.0	0.1	V	Read only	+10.0V	+48.0V	Operation Value	222	Warning	Notification Only	Remove Cause
78	0x004e	FA Unit2 Heat Sink Temperature	0x03	0 - 125.0	0.1	degC	Read only	+10.0degC	+60.0degC	Operation Value	231	Internal	DC: Disable RF: Disable	Default
79	0x004f	FA Unit2 Fan Rotation Speed	0x03	0 - 12000	1	rpm	Read only	5250rpm	9750rpm	Operation Value	241	Warning	Notification Only	Remove Cause
80	0x0050	FA Unit3-1 Current	0x03	0 - 20.0	0.1	A	Read only	0A	+11.5A	Operation Value	301	Warning	Notification Only	Remove Cause
81	0x0051	FA Unit3-2 Current	0x03	0 - 20.0	0.1	A	Read only	0A	+11.5A	Operation Value	302	Warning	Notification Only	Remove Cause
82	0x0052	FA Unit3-3 Current	0x03	0 - 20.0	0.1	A	Read only	0A	+11.5A	Operation Value	303	Warning	Notification Only	Remove Cause
83	0x0053	FA Unit3-4 Current	0x03	0 - 20.0	0.1	A	Read only	0A	+11.5A	Operation Value	304	Warning	Notification Only	Remove Cause
84	0x0054	FA Unit3-5 Current	0x03	0 - 20.0	0.1	A	Read only	0A	+11.5A	Operation Value	305	Warning	Notification Only	Remove Cause
85	0x0055	FA Unit3-6 Current	0x03	0 - 20.0	0.1	A	Read only	0A	+11.5A	Operation Value	306	Warning	Notification Only	Remove Cause

86	0x0056	FA Unit3-7 Current	0x03	0 - 20.0	0.1	A	Read only	0A	+11.5A	Operation Value	307	Warning	Notification Only	Remove Cause
87	0x0057	FA Unit3-8 Current	0x03	0 - 20.0	0.1	A	Read only	0A	+11.5A	Operation Value	308	Warning	Notification Only	Remove Cause
88	0x0058	FA Unit3-1 Module Power	0x03	0 - 900	1	W	Read only	0W	550W	Operation Value	311	Warning	Notification Only	Remove Cause
Address	Address	Description	Function	Display Range	Multiplier	Unit	Permitted Raw Value	Threshold (Lower)	Threshold (Upper)	command /status	Error Code	Error Type	Error Operation	Reset Operation
89	0x0059	FA Unit3-2 Module Power	0x03	0 - 900	1	W	Read only	0W	550W	Operation Value	312	Warning	Notification Only	Remove Cause
90	0x005a	FA Unit3-3 Module Power	0x03	0 - 900	1	W	Read only	0W	550W	Operation Value	313	Warning	Notification Only	Remove Cause
91	0x005b	FA Unit3-4 Module Power	0x03	0 - 900	1	W	Read only	0W	550W	Operation Value	314	Warning	Notification Only	Remove Cause
92	0x005c	FA Unit3-1 Power Supply Voltage	0x03	0 - 100.0	0.1	V	Read only	+10.0V	+48.0V	Operation Value	321	Warning	Notification Only	Remove Cause
93	0x005d	FA Unit3-2 Power Supply Voltage	0x03	0 - 100.0	0.1	V	Read only	+10.0V	+48.0V	Operation Value	322	Warning	Notification Only	Remove Cause
94	0x005e	FA Unit3 Heat Sink Temperature	0x03	0 - 125.0	0.1	degC	Read only	+10.0degC	+60.0degC	Operation Value	331	Internal	DC: Disable RF: Disable	Default
95	0x005f	FA Unit3 Fan Rotation Speed	0x03	0 - 12000	1	rpm	Read only	5250rpm	9750rpm	Operation Value	341	Warning	Notification Only	Remove Cause
96	0x0060	480VAC Out Status	0x03	0 - 7	n/a	n/a	Read only	n/a	n/a	Bit0: L1	401	Internal	DC: Disable RF: Disable	Default
										Bit1: L2	402			
										Bit2: L3	403			
										ALL	580			
97	0x0061	PS Unit Power Supply Fault	0x03	0 - 6	1	pc(s)	Read only	n/a	n/a	Operation Value	n/a	n/a	n/a	n/a
98	0x0062	PS Unit Air Temperature	0x03	0 - 125.0	0.1	degC	Read only	+10.0degC	+60.0degC	Operation Value	404	Internal	DC: Disable RF: Disable	Default
99	0x0063	Heat Exchanger Inlet Air Temperature	0x03	0 - 125.0	0.1	degC	Read only	+10.0degC	+45.0degC	Operation Value	405	Internal	DC: Disable RF: Disable	Default
100	0x0064	Inlet LCW Temperature	0x03	0 - 70.0	0.1	degC	Read only	+22.0degC	+38.0degC	Operation Value	410	Internal	DC: Disable RF: Disable	Default
101	0x0065	Outlet LCW Temperature	0x03	0 - 70.0	0.1	degC	Read only	+22.0degC	+45.0degC	Operation Value	411	Internal	DC: Disable RF: Disable	Default
102	0x0066	Moisture	0x03	0 - 99.0	0.1	%	Read only	n/a	n/a	Operation Value	n/a	n/a	n/a	n/a
103	0x0067	Outlet LCW Flow Rate	0x03	0 - 80.0	0.1	L/min.	Read only	10.0L/min	30.0L/min	Operation Value	409	Internal	DC: Disable RF: Disable	Default
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Address	Address	Description	Function	Display Range	Multiplier	Unit	Permitted Raw Value	Threshold (Lower)	Threshold (Upper)	command /status	Error Code	Error Type	Error Operation	Reset Operation
104	0x0068	PS Unit Power Supply Fault Status	0x03	0 - 63 (3F)	n/a	n/a	Read only	n/a	n/a	Bit0: PS1	421	Warning	Notification Only	Remove Cause
										Bit1: PS2	422			
										Bit2: PS3	423			
										Bit3: PS4	424			
										Bit4: PS5	425			
										Bit5: PS6	426			

										Bit8: PS7	427			
										Bit9: PS8	428			
										Bit10: PS9	429			
										-	Over 3pcs Errors: 420	Internal	DC: Disable RF: Disable	Default
105	0x0069	Heat Exchanger Unit Fan1 Rotation Speed	0x03	0 - 12000	1	rpm	Read only	6300rpm	11700rpm	Operation Value	431	Warning	Notification Only	Remove Cause
106	0x006a	Heat Exchanger Unit Fan2 Rotation Speed	0x03	0 - 12000	1	rpm	Read only	6300rpm	11700rpm	Operation Value	432	Warning	Notification Only	Remove Cause
107	0x006b	Heat Exchanger Unit Fan3 Rotation Speed	0x03	0 - 12000	1	rpm	Read only	6300rpm	11700rpm	Operation Value	433	Warning	Notification Only	Remove Cause
108	0x006c	Heat Exchanger Unit Fan4 Rotation Speed	0x03	0 - 12000	1	rpm	Read only	6300rpm	11700rpm	Operation Value	434	Warning	Notification Only	Remove Cause
109	0x006d	PS Unit Fan1 Rotation Speed	0x03	0 - 12000	1	rpm	Read only	5250rpm	9750rpm	Operation Value	435	Warning	Notification Only	Remove Cause
110	0x006e	PS Unit Fan2 Rotation Speed	0x03	0 - 12000	1	rpm	Read only	5250rpm	9750rpm	Operation Value	436	Warning	Notification Only	Remove Cause
111	0x006f	PS Unit Fan3 Rotation Speed	0x03	0 - 12000	1	rpm	Read only	2590rpm	4810rpm	Operation Value	437	Warning	Notification Only	Remove Cause
112	0x0070	PS Unit Fan4 Rotation Speed	0x03	0 - 12000	1	rpm	Read only	5250rpm	9750rpm	Operation Value	438	Warning	Notification Only	Remove Cause
113	0x0071	Year for Calendar	0x03,06,10	15 - 99	1	Year	15 - 99	n/a	n/a	Operation Value	n/a	n/a	n/a	n/a
114	0x0072	Month for Calendar	0x03,06,10	1 - 12	1	Month	1 - 12	n/a	n/a	Operation Value	n/a	n/a	n/a	n/a
115	0x0073	Date for Calendar	0x03,06,10	1 - 31	1	Date	1 - 31	n/a	n/a	Operation Value	n/a	n/a	n/a	n/a
116	0x0074	Hour for Calendar	0x03,06,10	0 - 23	1	Hour	0 - 23	n/a	n/a	Operation Value	n/a	n/a	n/a	n/a
118	0x0076	Minute for Calendar	0x03,06,10	0 - 59	1	Minute	0 - 59	n/a	n/a	Operation Value	n/a	n/a	n/a	n/a
119	0x0077	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Address	Address	Description	Function	Display Range	Multiplier	Unit	Permitted Raw Value	Threshold (Lower)	Threshold (Upper)	command /status	Error Code	Error Type	Error Operation	Reset Operation
120	0x0078	Main Software Version	0x03	n/a	XXX	Version	Read only	n/a	n/a	Operation Value	n/a	n/a	n/a	n/a
121	0x0079	Main Software Version (Second Level Numbering)	0x03	n/a	XXX	Number	Read only	n/a	n/a	Operation Value	n/a	n/a	n/a	n/a
122	0x007a	SD Software Version	0x03	n/a	XXX	Version	Read only	n/a	n/a	Operation Value	n/a	n/a	n/a	n/a
123	0x007b	SD Software Version (Second Level Numbering)	0x03	n/a	XXX	Number	Read only	n/a	n/a	Operation Value	n/a	n/a	n/a	n/a
124	0x007c	Sub Software Version	0x03	n/a	XXX	Version	Read only	n/a	n/a	Operation Value	n/a	n/a	n/a	n/a
125	0x007d	Sub Software Version (Second Level Numbering)	0x03	n/a	XXX	Number	Read only	n/a	n/a	Operation Value	n/a	n/a	n/a	n/a
126	0x007e	PS Software Version	0x03	n/a	XXX	Version	Read only	n/a	n/a	Operation Value	n/a	n/a	n/a	n/a
127	0x007f	PS Software Version (Second Level Numbering)	0x03	n/a	XXX	Number	Read only	n/a	n/a	Operation Value	n/a	n/a	n/a	n/a
128	0x0080	Input Drive Power Upper Limit	0x03	0 - 3300	1	mV	Read only	n/a	2500mV	Operation Value	n/a	n/a	n/a	n/a
129	0x0081	Input Drive Power Lower Limit	0x03	0 - 3300	1	mV	Read only	0mV	n/a	Operation Value	n/a	n/a	n/a	n/a
130	0x0082	Forward Power Upper Limit	0x03	0 - 4500	1	W	Read only	n/a	4200W	Operation Value	n/a	n/a	n/a	n/a
131	0x0083	Forward Power Lower Limit	0x03	0 - 4500	1	W	Read only	0W	n/a	Operation Value	n/a	n/a	n/a	n/a
132	0x0084	Reflected Power Upper Limit	0x03	0 - 4500	1	W	Read only	n/a	500W	Operation Value	n/a	n/a	n/a	n/a
133	0x0085	Reflected Power Lower Limit	0x03	0 - 4500	1	W	Read only	0W	n/a	Operation Value	n/a	n/a	n/a	n/a

134	0x0086	Control Unit Air Temperature Upper Limit	0x03	0 - 125.0	0.1	degC	Read only	n/a	+60.0degC	Operation Value	n/a	n/a	n/a	n/a
135	0x0087	Control Unit Air Temperature Lower Limit	0x03	0 - 125.0	0.1	degC	Read only	+10.0degC	n/a	Operation Value	n/a	n/a	n/a	n/a
136	0x0088	Control Unit Fan Rotation Speed Upper Limit	0x03	0 - 12000	1	rpm	Read only	n/a	11700rpm	Operation Value	n/a	n/a	n/a	n/a
137	0x0089	Control Unit Fan Rotation Speed Lower Limit	0x03	0 - 12000	1	rpm	Read only	6300rpm	n/a	Operation Value	n/a	n/a	n/a	n/a
138	0x008a	DA Unit-1 Current Upper Limit	0x03	0 - 20.0	0.1	A	Read only	n/a	+3.0A	Operation Value	n/a	n/a	n/a	n/a
139	0x008b	DA Unit-1 Current Lower Limit	0x03	0 - 20.0	0.1	A	Read only	+0.5A	n/a	Operation Value	n/a	n/a	n/a	n/a
140	0x008c	DA Unit-2 Current Upper Limit	0x03	0 - 20.0	0.1	A	Read only	n/a	+11.5A	Operation Value	n/a	n/a	n/a	n/a
141	0x008d	DA Unit-2 Current Lower Limit	0x03	0 - 20.0	0.1	A	Read only	0A	n/a	Operation Value	n/a	n/a	n/a	n/a
142	0x008e	DA Unit-1 Power Supply Voltage Upper Limit	0x03	0 - 100.0	0.1	V	Read only	n/a	+14.0V	Operation Value	n/a	n/a	n/a	n/a
143	0x008f	DA Unit-1 Power Supply Voltage Lower Limit	0x03	0 - 100.0	0.1	V	Read only	+10.0V	n/a	Operation Value	n/a	n/a	n/a	n/a
Address	Address	Description	Function	Display Range	Multiplier	Unit	Permitted Raw Value	Threshold (Lower)	Threshold (Upper)	command /status	Error Code	Error Type	Error Operation	Reset Operation
144	0x0090	DA Unit-2 Power Supply Voltage Upper Limit	0x03	0 - 100.0	0.1	V	Read only	n/a	+48.0V	Operation Value	n/a	n/a	n/a	n/a
145	0x0091	DA Unit-2 Power Supply Voltage Lower Limit	0x03	0 - 100.0	0.1	V	Read only	+10.0V	n/a	Operation Value	n/a	n/a	n/a	n/a
146	0x0092	DA Unit Heat Sink Temperature Upper Limit	0x03	0 - 125.0	0.1	degC	Read only	n/a	+60.0degC	Operation Value	n/a	n/a	n/a	n/a
147	0x0093	DA Unit Heat Sink Temperature Lower Limit	0x03	0 - 125.0	0.1	degC	Read only	+10.0degC	n/a	Operation Value	n/a	n/a	n/a	n/a
148	0x0094	DA Unit Fan Rotation Speed Upper Limit	0x03	0 - 12000	1	rpm	Read only	n/a	9750rpm	Operation Value	n/a	n/a	n/a	n/a
149	0x0095	DA Unit Fan Rotation Speed Lower Limit	0x03	0 - 12000	1	rpm	Read only	5250rpm	n/a	Operation Value	n/a	n/a	n/a	n/a
150	0x0096	FA Unit1 Current Upper Limit	0x03	0 - 20.0	0.1	A	Read only	n/a	+11.5A	Operation Value	n/a	n/a	n/a	n/a
151	0x0097	FA Unit1 Current Lower Limit	0x03	0 - 20.0	0.1	A	Read only	0A	n/a	Operation Value	n/a	n/a	n/a	n/a
152	0x0098	FA Unit1 Module Power Upper Limit	0x03	0 - 900	1	W	Read only	n/a	550W	Operation Value	n/a	n/a	n/a	n/a
153	0x0099	FA Unit1 Module Power Lower Limit	0x03	0 - 900	1	W	Read only	0W	n/a	Operation Value	n/a	n/a	n/a	n/a
154	0x009a	FA Unit1 Power Supply Voltage Upper Limit	0x03	0 - 100.0	0.1	V	Read only	n/a	+48.0V	Operation Value	n/a	n/a	n/a	n/a
155	0x009b	FA Unit1 Power Supply Voltage Lower Limit	0x03	0 - 100.0	0.1	V	Read only	+10.0V	n/a	Operation Value	n/a	n/a	n/a	n/a
156	0x009c	FA Unit1 Heat Sink Temperature Upper Limit	0x03	0 - 125.0	0.1	degC	Read only	n/a	+60.0degC	Operation Value	n/a	n/a	n/a	n/a
157	0x009d	FA Unit1 Heat Sink Temperature Lower Limit	0x03	0 - 125.0	0.1	degC	Read only	+10.0degC	n/a	Operation Value	n/a	n/a	n/a	n/a
158	0x009e	FA Unit1 Fan Rotation Speed Upper Limit	0x03	0 - 12000	1	rpm	Read only	n/a	9750rpm	Operation Value	n/a	n/a	n/a	n/a
159	0x009f	FA Unit1 Fan Rotation Speed Lower Limit	0x03	0 - 12000	1	rpm	Read only	5250rpm	n/a	Operation Value	n/a	n/a	n/a	n/a
160	0x00a0	FA Unit2 Current Upper Limit	0x03	0 - 20.0	0.1	A	Read only	n/a	+11.5A	Operation Value	n/a	n/a	n/a	n/a
161	0x00a1	FA Unit2 Current Lower Limit	0x03	0 - 20.0	0.1	A	Read only	0A	n/a	Operation Value	n/a	n/a	n/a	n/a

162	0x00a2	FA Unit2 Module Power Upper Limit	0x03	0 - 900	1	W	Read only	n/a	550W	Operation Value	n/a	n/a	n/a	n/a
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Address	Address	Description	Function	Display Range	Multiplier	Unit	Permitted Raw Value	Threshold (Lower)	Threshold (Upper)	command /status	Error Code	Error Type	Error Operation	Reset Operation
163	0x00a3	FA Unit2 Module Power Lower Limit	0x03	0 - 900	1	W	Read only	0W	n/a	Operation Value	n/a	n/a	n/a	n/a
164	0x00a4	FA Unit2 Power Supply Voltage Upper Limit	0x03	0 - 100.0	0.1	V	Read only	n/a	+48.0V	Operation Value	n/a	n/a	n/a	n/a
165	0x00a5	FA Unit2 Power Supply Voltage Lower Limit	0x03	0 - 100.0	0.1	V	Read only	+10.0V	n/a	Operation Value	n/a	n/a	n/a	n/a
166	0x00a6	FA Unit2 Heat Sink Temperature Upper Limit	0x03	0 - 125.0	0.1	degC	Read only	n/a	+60.0degC	Operation Value	n/a	n/a	n/a	n/a
167	0x00a7	FA Unit2 Heat Sink Temperature Lower Limit	0x03	0 - 125.0	0.1	degC	Read only	+10.0degC	n/a	Operation Value	n/a	n/a	n/a	n/a
168	0x00a8	FA Unit2 Fan Rotation Speed Upper Limit	0x03	0 - 12000	1	rpm	Read only	n/a	9750rpm	Operation Value	n/a	n/a	n/a	n/a
169	0x00a9	FA Unit2 Fan Rotation Speed Lower Limit	0x03	0 - 12000	1	rpm	Read only	5250rpm	n/a	Operation Value	n/a	n/a	n/a	n/a
170	0x00aa	FA Unit3 Current Upper Limit	0x03	0 - 20.0	0.1	A	Read only	n/a	+11.5A	Operation Value	n/a	n/a	n/a	n/a
171	0x00ab	FA Unit3 Current Lower Limit	0x03	0 - 20.0	0.1	A	Read only	0A	n/a	Operation Value	n/a	n/a	n/a	n/a
172	0x00ac	FA Unit3 Module Power Upper Limit	0x03	0 - 900	1	W	Read only	n/a	550W	Operation Value	n/a	n/a	n/a	n/a
173	0x00ad	FA Unit3 Module Power Lower Limit	0x03	0 - 900	1	W	Read only	0W	n/a	Operation Value	n/a	n/a	n/a	n/a
174	0x00ae	FA Unit3 Power Supply Voltage Upper Limit	0x03	0 - 100.0	0.1	V	Read only	n/a	+48.0V	Operation Value	n/a	n/a	n/a	n/a
175	0x00af	FA Unit3 Power Supply Voltage Lower Limit	0x03	0 - 100.0	0.1	V	Read only	+10.0V	n/a	Operation Value	n/a	n/a	n/a	n/a
176	0x00b0	FA Unit3 Heat Sink Temperature Upper Limit	0x03	0 - 125.0	0.1	degC	Read only	n/a	+60.0degC	Operation Value	n/a	n/a	n/a	n/a
177	0x00b1	FA Unit3 Heat Sink Temperature Lower Limit	0x03	0 - 125.0	0.1	degC	Read only	+10.0degC	n/a	Operation Value	n/a	n/a	n/a	n/a
178	0x00b2	FA Unit3 Fan Rotation Speed Upper Limit	0x03	0 - 12000	1	rpm	Read only	n/a	9750rpm	Operation Value	n/a	n/a	n/a	n/a
179	0x00b3	FA Unit3 Fan Rotation Speed Lower Limit	0x03	0 - 12000	1	rpm	Read only	5250rpm	n/a	Operation Value	n/a	n/a	n/a	n/a
180	0x00b4	PS Unit Air Temperature Upper Limit	0x03	0 - 125.0	0.1	degC	Read only	n/a	+60.0degC	Operation Value	n/a	n/a	n/a	n/a
Address	Address	Description	Function	Display Range	Multiplier	Unit	Permitted Raw Value	Threshold (Lower)	Threshold (Upper)	command /status	Error Code	Error Type	Error Operation	Reset Operation
181	0x00b5	PS Unit Air Temperature Lower Limit	0x03	0 - 125.0	0.1	degC	Read only	+10.0degC	n/a	Operation Value	n/a	n/a	n/a	n/a
182	0x00b6	Heat Exchanger Inlet Air Temperature Upper Limit	0x03	0 - 125.0	0.1	degC	Read only	n/a	+45.0degC	Operation Value	n/a	n/a	n/a	n/a
183	0x00b7	Heat Exchanger Inlet Air Temperature Lower Limit	0x03	0 - 125.0	0.1	degC	Read only	+10.0degC	n/a	Operation Value	n/a	n/a	n/a	n/a
184	0x00b8	Outlet LCW Flow Rate Upper Limit	0x03	0 - 80.0	0.1	L/min.	Read only	n/a	30.0L/min	Operation Value	n/a	n/a	n/a	n/a

185	0x00b9	Outlet LCW Flow Rate Lower Limit	0x03	0 - 80.0	0.1	L/min.	Read only	10.0L/min	n/a	Operation Value	n/a	n/a	n/a	n/a
186	0x00ba	Inlet LCW Temperature Upper Limit	0x03	0 - 70.0	0.1	degC	Read only	n/a	+38.0degC	Operation Value	n/a	n/a	n/a	n/a
187	0x00bb	Inlet LCW Temperature Lower Limit	0x03	0 - 70.0	0.1	degC	Read only	+22.0degC	n/a	Operation Value	n/a	n/a	n/a	n/a
188	0x00bc	Outlet LCW Temperature Upper Limit	0x03	0 - 70.0	0.1	degC	Read only	n/a	+45.0degC	Operation Value	n/a	n/a	n/a	n/a
189	0x00bd	Outlet LCW Temperature Lower Limit	0x03	0 - 70.0	0.1	degC	Read only	+22.0degC	n/a	Operation Value	n/a	n/a	n/a	n/a
190	0x00be	Heat Exchanger Unit Fan Upper Limit	0x03	0 - 12000	1	rpm	Read only	n/a	11700rpm	Operation Value	n/a	n/a	n/a	n/a
191	0x00bf	Heat Exchanger Unit Fan Lower Limit	0x03	0 - 12000	1	rpm	Read only	6300rpm	n/a	Operation Value	n/a	n/a	n/a	n/a
192	0x00c0	PS Unit Fan1,2 Rotation speed Upper Limit	0x03	0 - 12000	1	rpm	Read only	n/a	9750rpm	Operation Value	n/a	n/a	n/a	n/a
193	0x00c1	PS Unit Fan1,2 Rotation speed Lower Limit	0x03	0 - 12000	1	rpm	Read only	5250rpm	n/a	Operation Value	n/a	n/a	n/a	n/a
194	0x00c2	PS Unit Fan3 Rotation speed Upper Limit	0x03	0 - 12000	1	rpm	Read only	n/a	4810rpm	Operation Value	n/a	n/a	n/a	n/a
195	0x00c3	PS Unit Fan3 Rotation speed Lower Limit	0x03	0 - 12000	1	rpm	Read only	2590rpm	n/a	Operation Value	n/a	n/a	n/a	n/a

Error codes

Below is the list of Error Codes.
The Factory set threshold values can be changed at user's discretion and risk.
A method to change the threshold values is listed on Appendix B (starts from p79) of this document.
In cases of registers 13, 14, or 15, the codes below are displayed if any errors have occurred.

Error Code 0: No error
● - Default (RF Disable, DC Disable, AC Enable, Power Supply control voltage set to 700 mV)
○ - Error Code for Notification Only (Warning)

Table5: Error Code

Error Code	Error Name	Threshold	Internal Fault	External Fault	Warning
001	DA Unit-1 Current	<0.5A or >3.0A			○
002	DA Unit-2 Current	>11.5A			○
021	DA Unit-1 Power Supply Voltage	<+10.0V or >+14.0V			○
022	DA Unit-2 Power Supply Voltage	<+10.0V or >+48.0V			○
031	DA Unit Heat Sink Temperature	<10.0℃ or >60.0℃	●		
041	DA Unit Fan Rotation Speed	<5250rpm or >9750rpm			○
101	FA Unit1-1 Current	>11.5A			○
102	FA Unit1-2 Current	>11.5A			○
103	FA Unit1-3 Current	>11.5A			○
104	FA Unit1-4 Current	>11.5A			○
105	FA Unit1-5 Current	>11.5A			○
106	FA Unit1-6 Current	>11.5A			○
107	FA Unit1-7 Current	>11.5A			○
108	FA Unit1-8 Current	>11.5A			○
111	FA Unit1-1 Module Power	>550W			○
112	FA Unit1-2 Module Power	>550W			○
113	FA Unit1-3 Module Power	>550W			○
114	FA Unit1-4 Module Power	>550W			○
121	FA Unit1-1 Power Supply Voltage	<+10.0V or >+48.0V			○
Error Code	Error Name	Threshold	Internal Fault	External Fault	Warning
122	FA Unit1-2 Power Supply Voltage	<+10.0V or >+48.0V			○
131	FA Unit1 Heat Sink Temperature	<10.0℃ or >60.0℃	●		

141	FA Unit1 Fan Rotation Speed	<5250rpm or >9750rpm			○
201	FA Unit2-1 Current	>11.5A			○
202	FA Unit2-2 Current	>11.5A			○
203	FA Unit2-3 Current	>11.5A			○
204	FA Unit2-4 Current	>11.5A			○
205	FA Unit2-5 Current	>11.5A			○
206	FA Unit2-6 Current	>11.5A			○
207	FA Unit2-7 Current	>11.5A			○
208	FA Unit2-8 Current	>11.5A			○
211	FA Unit2-1 Module Power	>550W			○
212	FA Unit2-2 Module Power	>550W			○
213	FA Unit2-3 Module Power	>550W			○
214	FA Unit2-4 Module Power	>550W			○
221	FA Unit2-1 Power Supply Voltage	<+10.0V or >+48.0V			○
222	FA Unit2-2 Power Supply Voltage	<+10.0V or >+48.0V			○
231	FA Unit2 Heat Sink Temperature	<10.0℃ or >60.0℃	●		
241	FA Unit2 Fan Rotation Speed	<5250rpm or >9750rpm			○
301	FA Unit3-1 Current	>11.5A			○
302	FA Unit3-2 Current	>11.5A			○
303	FA Unit3-3 Current	>11.5A			○
304	FA Unit3-4 Current	>11.5A			○
Error Code	Error Name	Threshold	Internal Fault	External Fault	Warning
305	FA Unit3-5Current	>11.5A			○
306	FA Unit3-6 Current	>11.5A			○
307	FA Unit3-7 Current	>11.5A			○

308	FA Unit3-8 Current	>11.5A			○
311	FA Unit3-1 Module Power	>550W			○
312	FA Unit3-2 Module Power	>550W			○
313	FA Unit3-3 Module Power	>550W			○
314	FA Unit3-4 Module Power	>550W			○
321	FA Unit3-1 Power Supply Voltage	<+10.0V or >+48.0V			○
322	FA Unit3-2 Power Supply Voltage	<+10.0V or >+48.0V			○
331	FA Unit3 Heat Sink Temperature	<10.0℃ or >60.0℃	●		
341	FA Unit3 Fan Rotation Speed	<5250rpm or >9750rpm			○
401	480VAC L1 Status	L1 Fault	●		
402	480VAC L2 Status	L2 Fault	●		
403	480VAC L3 Status	L3 Fault	●		
404	PS Unit Air Temperature	<10℃ or >60℃	●		
405	Heat Exchanger Inlet Air Temperature	<10℃ or >45℃	●		
409	Outlet LCW Flow Rate	<13L/min or >30L/min	●		
410	Inlet LCW Temperature	<22℃ or >38℃	●		
411	Outlet LCW Temperature	<22℃ or >45℃	●		
420	PS Unit Power Supply Fault Status (Over Four Errors)	<=3 (No Error) or >=4 (Error)	●		
421	PS Unit Power Supply Fault Status (bit0 : PS1)	0 (No Error) or 1 (Error)			○
Error Code	Error Name	Threshold	Internal Fault	External Fault	Warning
422	PS Unit Power Supply Fault Status (bit1 : PS2)	0 (No Error) or 1 (Error)			○
423	PS Unit Power Supply Fault Status (bit2 : PS3)	0 (No Error) or 1 (Error)			○
424	PS Unit Power Supply Fault Status (bit3 : PS4)	0 (No Error) or 1 (Error)			○
425	PS Unit Power Supply Fault Status (bit4 : PS5)	0 (No Error) or 1 (Error)			○
426	PS Unit Power Supply Fault Status	0 (No Error) or 1 (Error)			○

	(bit5 : PS6)				
427	PS Unit Power Supply Fault Status (bit8 : PS7)	0 (No Error) or 1 (Error)			○
428	PS Unit Power Supply Fault Status (bit9 : PS8)	0 (No Error) or 1 (Error)			○
429	PS Unit Power Supply Fault Status (bit10 : PS9)	0 (No Error) or 1 (Error)			○
431	Heat Exchanger Unit Fan1 Rotation Speed	<6300rpm or >11700rpm			○
432	Heat Exchanger Unit Fan2 Rotation Speed	<6300rpm or >11700rpm			○
433	Heat Exchanger Unit Fan3 Rotation Speed	<6300rpm or >11700rpm			○
434	Heat Exchanger Unit Fan4 Rotation Speed	<6300rpm or >11700rpm			○
435	PS Unit Fan1 Rotation Speed	<5250rpm or >9750rpm			○
436	PS Unit Fan2 Rotation Speed	<5250rpm or >9750rpm			○
437	PS Unit Fan3 Rotation Speed	<2590rpm or >4810rpm			○
438	PS Unit Fan4 Rotation Speed	<5250rpm or >9750rpm			○
500	Input Drive Power	>2500mV	●		
501	Forward Power	>5100W	●		
Error Code	Error Name	Threshold	Internal Fault	External Fault	Warning
502	Water Leak Status	0 (No Error) or 1 (Error)	●		
503	Control Unit Fan Rotation Speed	<6300rpm or >11700rpm			○
511	External Fault No.1 24V Permit Line	0 (No Error) or 511 (Error)		●	
512	External Fault No.2 24V Permit Line	0 (No Error) or 512 (Error)		●	
514	External Fault No.3 24V Permit Line	0 (No Error) or 514 (Error)		●	
518	External Fault No.4 24V Permit Line	0 (No Error) or 518 (Error)		●	
530	Reflected Power	>500W	●		
550	Control Unit Air Temperature	<10℃ or >60℃	●		
560	Thermostat Status	0 (No Error) or 1 (Error)	●		
570	120VAC OFF or Reboot	Start of SSPA	●		

580	480VAC Status	All Phase Fault of 480VAC	•		

Table 6:

PS Drain Voltage to Control Voltage Conversion

	Voltage
48V	2520
47V	2460
46V	2410
45V	2370
44V	2310
43V	2260
42V	2210
41V	2150
40V	2100
39V	2050
38V	2000
37V	1940
36V	1890
35V	1840
34V	1780
33V	1730
32V	1680
31V	1630
30V	1570
29V	1520

Table 7:

Input Power (Drive) to ADC conversion

RF Input Power (Drive)	ADC Value Address 16
-10.0dBm (0.10mW)	228 mV
-9.5dBm (0.11mW)	248 mV
-9.0dBm (0.13mW)	267 mV
-8.5dBm (0.14mW)	290 mV
-8.0dBm (0.16mW)	314 mV
-7.5dBm (0.18mW)	340 mV
-7.0dBm (0.20mW)	364 mV
-6.5dBm (0.22mW)	394 mV
-6.0dBm (0.25mW)	424 mV
-5.5dBm (0.28mW)	455 mV
-5.0dBm (0.32mW)	488 mV
-4.5dBm (0.35mW)	524 mV
-4.0dBm (0.40mW)	562 mV
-3.5dBm (0.45mW)	600 mV
-3.0dBm (0.50mW)	640 mV
-2.5dBm (0.56mW)	684 mV
-2.0dBm (0.63mW)	731 mV
-1.5dBm (0.71mW)	778 mV
-1.0dBm (0.79mW)	830 mV
-0.5dBm (0.89mW)	883 mV

28V	1470
27V	1420
26V	1360
25V	1310
24V	1260
23V	1210
22V	1150
21V	1100
20V	1050
19V	1000
18V	940
17V	890
16V	840
15V	790
14V	730
13.5V	700

0dBm (1.00mW)	940 mV
+0.5dBm (1.12mW)	998 mV
+1.0dBm (1.26mW)	1064 mV
+1.5dBm (1.41mW)	1127 mV
+2.0dBm (1.58mW)	1196 mV
+2.5dBm (1.78mW)	1269 mV
+3.0dBm (2.00mW)	1346 mV
+3.5dBm (2.24mW)	1427 mV
+4.0dBm (2.51mW)	1510 mV
+4.5dBm (2.82mW)	1600 mV
+5.0dBm (3.16mW)	1694 mV
+5.5dBm (3.55mW)	1795 mV
+6.0dBm (4.00mW)	1904 mV
+6.5dBm (4.47mW)	2018 mV
+7.0dBm (5.01mW)	2138 mV
+7.5dBm (5.62mW)	2267 mV
+8.0dBm (6.31mW)	2408 mV
+8.3dBm (6.67mW)	2500 mV

Drain voltage range of this amplifier's power supply (see Table 6) is from 13.5 to 48V

Internal Conversion Method from the Detected Voltage at the Final Amplifier Stage to Wattage Scale (Just for Information)

There is voltage detectors after each final amplifier stage of the FA Unit. The detected voltage value is transmitted to the Analog-Digital Converter in the Sub CPU. And the Sub-CPU calculates to wattage scale based on the voltage value with the following method. The power values of the FA Units from each Sub CPU to the Main CPU are calculated in this method.

Calculation Method

There are two series of Tables and Equations.
For calculation of 10-100W power, Table 1 and Equation 1 are used.
For calculation of 100-600W power, Table 2 and Equation 2 are used.

Table

Table 8: Fwd Table A

#	0	1	2	3	4	5	6	7	8	9
Power (Watt)	10	20	30	40	50	60	70	80	90	100
Detected Voltage (mV)	214	286	358	405	505	548	591	634	677	722

Table 9: Fwd Table B

#	0	1	2	3	4	5	6	7	8	9	10
Power (Watt)	100	150	200	250	300	350	400	450	500	550	600
Detected Voltage (mV)	722	884	1022	1140	1247	1332	1424	1515	1593	1670	1740

Equation

Equation A

$$\text{Forward Power} = \frac{(\text{Detected Voltage} - \text{Lower Bound Voltage}) * 10}{(\text{Upper Bound Voltage} - \text{Lower Bound Voltage})} + \text{Lower Bound Power (Watt)}$$

Equation B

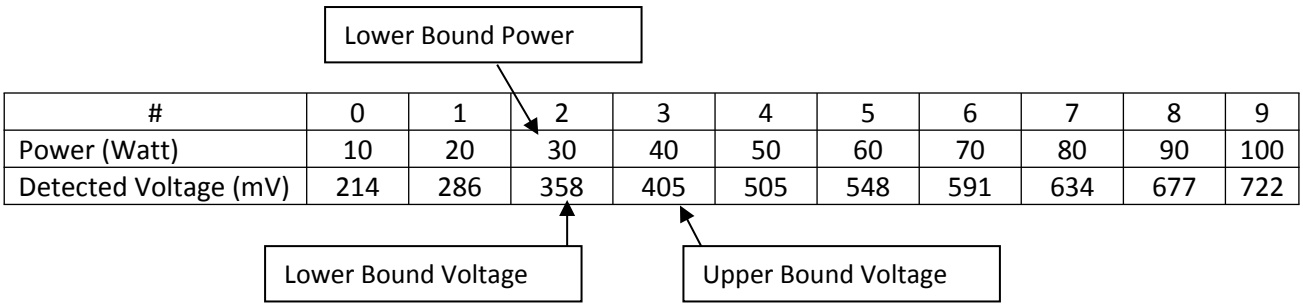
$$\text{Forward Power} = \frac{(\text{Detected Voltage} - \text{Lower Bound Voltage}) * 50}{(\text{Upper Bound Voltage} - \text{Lower Bound Voltage})} + \text{Lower Bound Power (Watt)}$$

Example/Explanation continues on next page.

Example/Explanation

Example 1

1. 375mV is detected
2. Sub CPU seeks what numbers 375mV is located between.
3. In this case, numbers are #2 and #3 of Fwd Table A because 375mV is bigger than 358mV and smaller than 405mV.
4. To fill up the Equation A, Sub CPU seeks Lower Bound Voltage, Upper Bound Voltage, and Lower Bound power of #2 and #3 from the table.
   In this case,
   Lower Bound Voltage = 358, Upper Bound Voltage = 405, Lower Bound Power = 30.

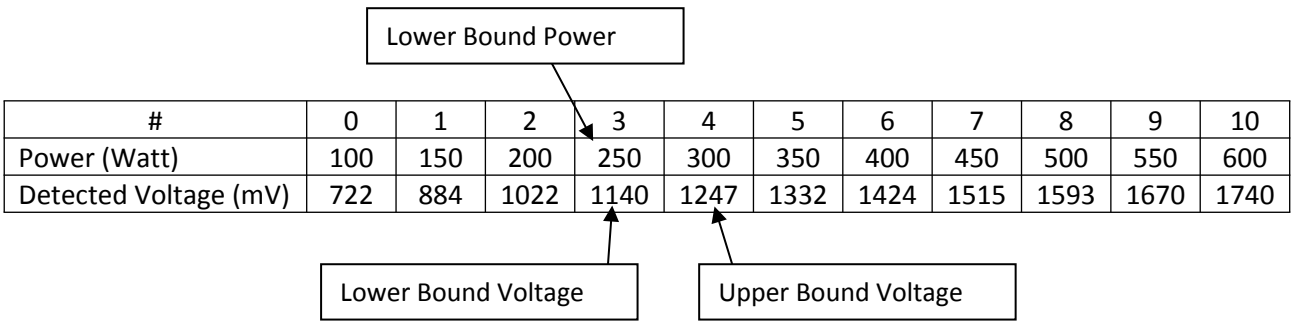


#	0	1	2	3	4	5	6	7	8	9
Power (Watt)	10	20	30	40	50	60	70	80	90	100
Detected Voltage (mV)	214	286	358	405	505	548	591	634	677	722

5. So, calculation is: Forward Power = ((375-358)*10 / (405-358)) + 30
   As the result, power is calculated as 34W (cut off after the decimal point)

Example 2

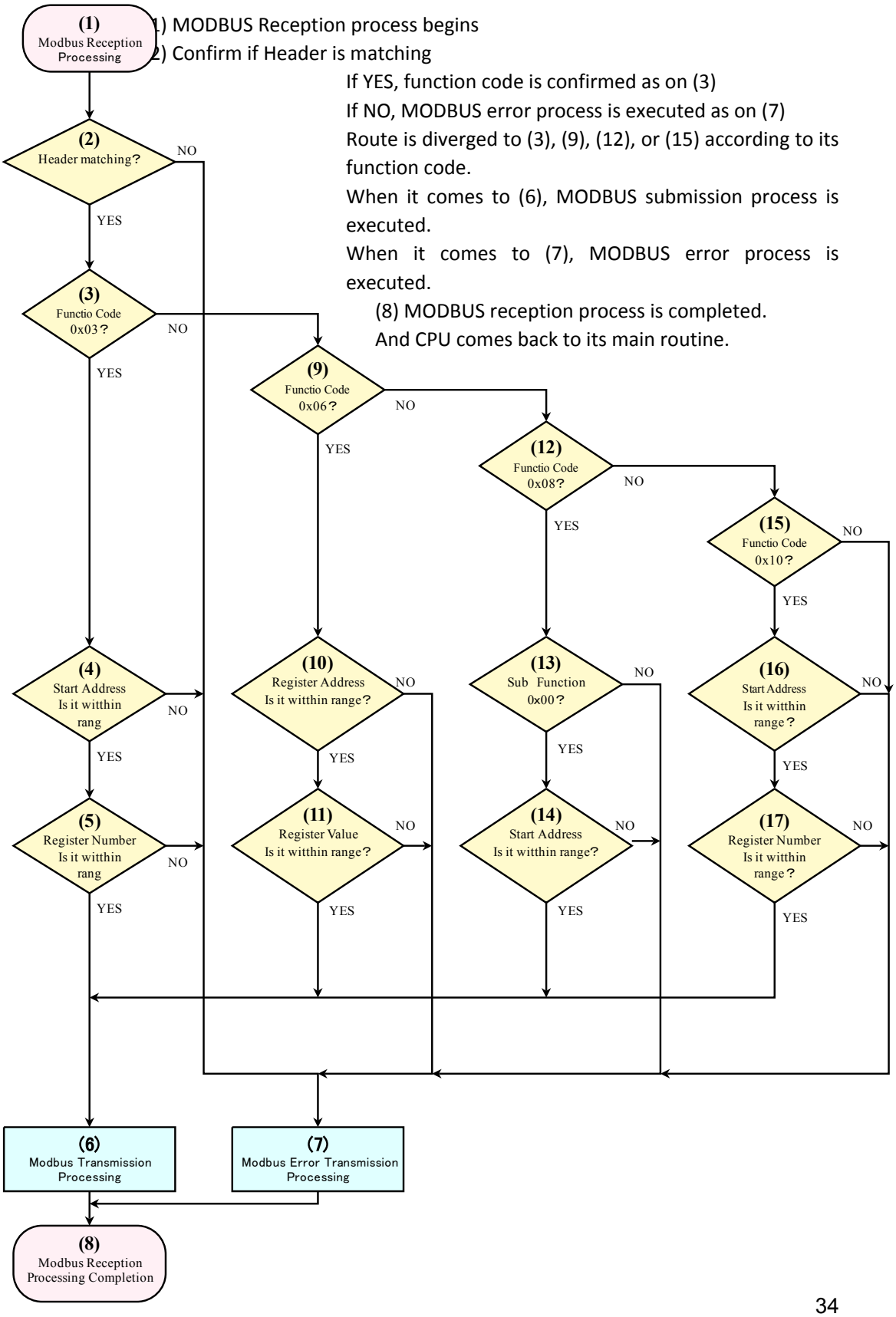
1. 1200mV is detected
2. Sub CPU seeks what numbers 1200mV is located between.
3. In this case, numbers are #3 and #4 of Fwd Table B because 1200mV is bigger than 1140mV and smaller than 1247mV.
4. To fill up the Equation B, Sub CPU seeks Lower Bound Voltage, Upper Bound Voltage, and Lower Bound power of #3 and #4 from the table.
   In this case,
   Lower Bound Voltage = 1140, Upper Bound Voltage = 1247, Lower Bound Power = 250.



#	0	1	2	3	4	5	6	7	8	9	10
Power (Watt)	100	150	200	250	300	350	400	450	500	550	600
Detected Voltage (mV)	722	884	1022	1140	1247	1332	1424	1515	1593	1670	1740

5. So, calculation is: Forward Power = ((1200-1140)*50 / (1247-1140)) + 250
   As the result, power is calculated as 278W (cut off after the decimal point)

2.2.3. MODBUS Reception Flow-Chart



1) MODBUS Reception process begins

2) Confirm if Header is matching

If YES, function code is confirmed as on (3)

If NO, MODBUS error process is executed as on (7)

Route is diverged to (3), (9), (12), or (15) according to its function code.

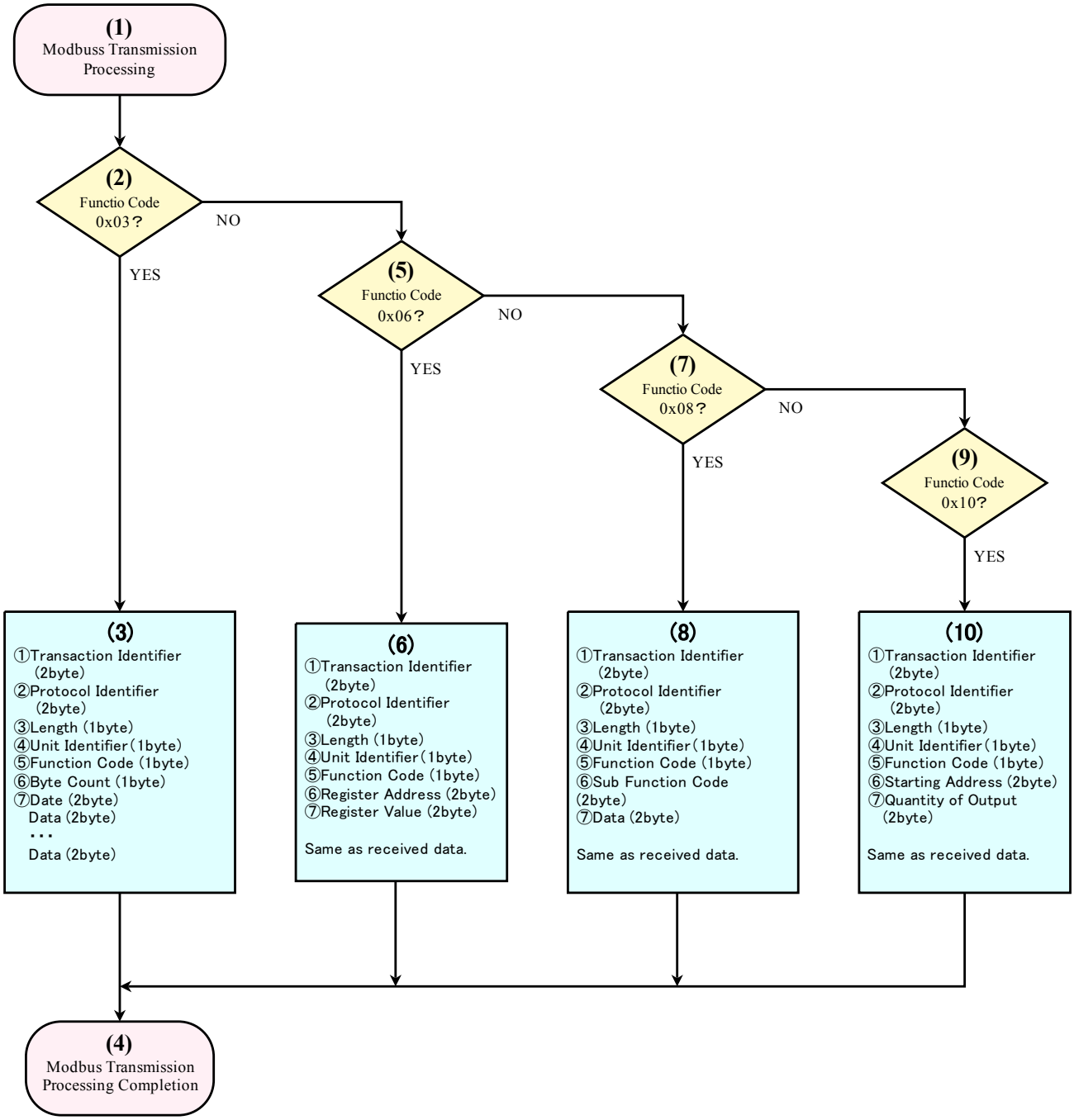
When it comes to (6), MODBUS submission process is executed.

When it comes to (7), MODBUS error process is executed.

(8) MODBUS reception process is completed.

And CPU comes back to its main routine.

2.2.4. MODBUS Transmission Flow-Chart



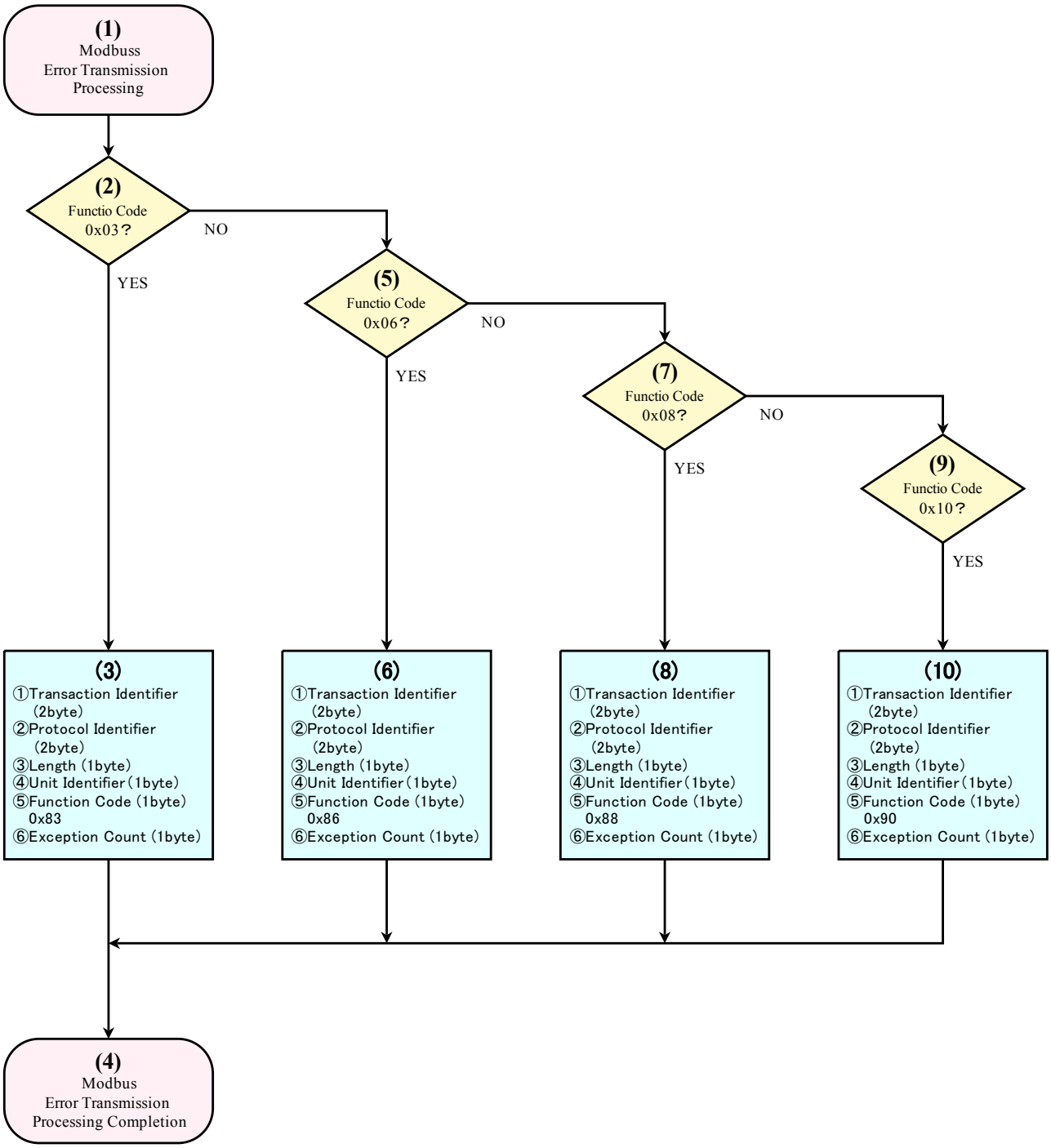
(1) MODBUS Transmission Process begins

Route is diverged to (2), (5), (7), or (9) according to its Function Code.

Process (3), (6), (8), or (10) is executed according to its Function Code.

(4) MODBUS submission process is completed.

2.2.5. MODBUS Error Process Flow-Chart



(1) MODBUS error process begins.

Route is diverged to (2), (5), (7), or (9) according to its Function Code.

Process (3), (6), (8), or (10) is executed according to its Function Code.

(4) MODBUS Error process is completed.

2.3. RS-485 Communication

After 120V is turned on to this product…

① Communication between MAIN PCB and SD PCB for clock synchronizing begins.
② Communication between MAIN PCB and each SUB PCB begins for transmitting threshold data.
③ Request for transmission of collected data is submitted from MAIN PCB to each SUB PCB.
④ Collected data is confirmed via MODBUS communication. And also, saved at SD memory.

Following 2.3.1~2.3.7 is detail of RS-485.

2.3.1. Serial Setting

Description of communication setting
To avoid error action, Check Sum is set

Table 10: Serial setting

Item	Value
Baud Rate	115200bps
bit value	8bit
Parity	None
Stop bit value	1bit
Check Sum	2byte

2.3.2. Clock setting of SD PCB

Clock setting is executed for time stamping at saving data to SD memory

① Clock setting of MAIN PCB is submitted to SD PCB

Table 11: clock data

Buffer	Item	Range
[0]	Year	15-99
[1]	Month	1-12
[2]	Date	1-31
[3]	Week	0-6
[4]	Hour	0-23
[5]	Minute	0-59
[6]	Second	0-59

② Clock inside CPU is synchronized based on received clock data at SD PCB.
③ The synchronized clock data is transferred to MAIN PCB.
④ After comparison of received data and above ① data, when difference is shorter than 1 min., OK command is submitted to SD PCB.
Clock setting is completed.
⑤ When difference is longer than 1min. at ④, process is re-started from ①.
In the case clock setting can not be completed in second time, clock setting is cancelled.

2.3.3. Transfer Request from Control Unit (MAIN PCB)

MAIN PCB submit transfer request to each SUB PCB and PS PCB (slave) as master.

Following is process of transfer request and format.

<Process>

① Confirmation of Hand Shake Line to be High

② Hand Shake Line is turned to Low

③ 0xff is submitted (Command of Transfer Start)

④ 0x40 + address is submitted (when address is 1, 0x41)

⑤ Hand Shake Line is turned to High

Table 12: Format

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Transfer Request		Spare		Address of each PCB			
0	1	0	0	0	0	0	1

Table 13: Transmission / Reception Code

Unit	Address	Code
DA Unit	0	0 40
FA Unit1	1	0 41
FA Unit2	2	0 42
FA Unit3	3	0 43
PS Unit	4	0 44

2.3.4. Response From Each Unit

The unit which received transfer request on its address replies transfer response and data.

Following is process of transfer response and format.

<Process>

① Confirmation of Hand Shake Line to be High.

② Hand Shake Line is turned to Low.

③ 0xff is submitted (Command of Transfer Start).

④ 0x80 + address is submitted (when address is 1, 0x81).

⑤ After 34 byte (17 data) of 8bit data is transferred, 2 byte check sum is transferred.

⑥ Hand Shake Line is turned to High.

Table 14: Format

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Transfer Response		Spare		Address of each PCB			
1	0	0	0	0	0	0	1

Table 15: Transmission Code

Unit	Address	Code
DA Unit	0	0 80
FA Unit1	1	0 81
FA Unit2	2	0 82
FA Unit3	3	0 83
PS Unit	4	0 84

To avoid existence of 0xff in data, 0xff is replaced to 0xfe.
Time for one transfer is
(1 / 115200) X 8 X 36 2.5ms

2.3.5. Communication Interval

Communication process of this product is as below:
DA Unit → FA Unit1 → FA Unit2 → FA Unit3 → PS Unit
This communication is executed once per 10ms. From taken 10 data, maximum 2 data and minimum 2 data is excepted and average of rest 6 data is though as measurement value.

2.3.6. Monitoring and Alarm

<DA Unit>
Monitoring Parameters are Current 2 points, Voltage 2 points, Temperature 1 point and Fan Speed 1 point.

Table 16: DA Unit Monitoring Parameter

Data No.	DA Unit	Measurement Interval		Lower Limit	Upper Limit	Error Code
0	DA-1 Current	1ms	ADC	0.5A	3A	001/Warning
1	-	-	-	-	-	-
2	DA-1 Current	1ms	ADC	0A	11.5A	002/Warning
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	-	-	-	-	-	-
11	-	-	-	-	-	-
12	DA-1 Voltage	1ms	ADC	+10V	+14V	021/Warning
13	DA-2 Voltage	1ms	ADC	+10V	+48V	022/Warning
14	DA Temperature	100ms	I2C	+10degC	+60degC	031/Fault
15	FAN Speed	1s	Counter	5250rpm	9750rpm	041/Warning
16	DA Alarm Code	-	-	-	-	001-041

<FA Unit 1>

Monitoring Parameters are Current 8 points, Power 4 points, Voltage 2 points, Temperature 1 point and Fan Speed 1 point.

Table 17: FA Unit1 Monitoring Parameter

Data No.	FA Unit	Measurement Interval		Lower Limit	Upper Limit	Error Code
0	FA1 Current1	1ms	ADC	0A	11.5A	101/Warning
1	FA1 Current2	1ms	ADC	0A	11.5A	102/Warning
2	FA1 Current3	1ms	ADC	0A	11.5A	103/Warning
3	FA1 Current4	1ms	ADC	0A	11.5A	104/Warning
4	FA1 Current5	1ms	ADC	0A	11.5A	105/Warning
5	FA1 Current6	1ms	ADC	0A	11.5A	106/Warning
6	FA1 Current7	1ms	ADC	0A	11.5A	107/Warning
7	FA1 Current8	1ms	ADC	0A	11.5A	108/Warning
8	FA1 FWD1	1ms	ADC	0W	550W	111/Warning
9	FA1 FWD2	1ms	ADC	0W	550W	112/Warning
10	FA1 FWD3	1ms	ADC	0W	550W	113/Warning
11	FA1 FWD4	1ms	ADC	0W	550W	114/Warning
12	FA1 Voltage 1	1ms	ADC	+10V	+48V	121/Warning
13	FA1 Voltage 2	1ms	ADC	+10V	+48V	122/Warning
14	FA1 Temperature	100ms	I2C	+10degC	+60degC	131/Fault
15	FA1 FAN Speed	1s	Counter	5250rpm	9750rpm	141/Warning
16	FA1 Alarm Code	-	-	-	-	101-141

<FA Unit2>

Monitoring Parameters are Current 8 points, Power 4 points, Voltage 2 points, Temperature 1 point and Fan Speed 1 point.

Table 18: FA Unit2 Monitoring Parameter

Data No.	FA Unit	Measurement Interval		Lower Limit	Upper Limit	Error Code
0	FA2 Current1	1ms	ADC	0A	11.5A	201/Warning
1	FA2 Current2	1ms	ADC	0A	11.5A	202/Warning
2	FA2 Current3	1ms	ADC	0A	11.5A	203/Warning
3	FA2 Current4	1ms	ADC	0A	11.5A	204/Warning
4	FA2 Current5	1ms	ADC	0A	11.5A	205/Warning
5	FA2 Current6	1ms	ADC	0A	11.5A	206/Warning
6	FA2 Current7	1ms	ADC	0A	11.5A	207/Warning
7	FA2 Current8	1ms	ADC	0A	11.5A	208/Warning
8	FA2 FWD1	1ms	ADC	0W	550W	211/Warning
9	FA2 FWD2	1ms	ADC	0W	550W	212/Warning
10	FA2 FWD3	1ms	ADC	0W	550W	213/Warning
11	FA2 FWD4	1ms	ADC	0W	550W	214/Warning
12	FA2 Voltage 1	1ms	ADC	+10V	+48V	221/Warning
13	FA2 Voltage 2	1ms	ADC	+10V	+48V	222/Warning
14	FA2 Temperature	100ms	I2C	+10degC	+60degC	231/Fault
15	FA2 FAN Speed	1s	Counter	5250rpm	9750rpm	241/Warning
16	FA2 Alarm Code	-	-	-	-	201-241

<FA Unit 3>

Monitoring Parameters are Current 8 points, Power 4 points, Voltage 2 points, Temperature 1 point and Fan Speed 1 point.

Table 19: FA Unit3 Monitoring Parameter

Data No.	FA Unit	Measurement Interval		Lower Limit	Upper Limit	Error Code
0	FA3 Current1	1ms	ADC	0A	11.5A	301/Warning
1	FA3 Current2	1ms	ADC	0A	11.5A	302/Warning
2	FA3 Current3	1ms	ADC	0A	11.5A	303/Warning
3	FA3 Current4	1ms	ADC	0A	11.5A	304/Warning
4	FA3 Current5	1ms	ADC	0A	11.5A	305/Warning
5	FA3 Current6	1ms	ADC	0A	11.5A	306/Warning
6	FA3 Current7	1ms	ADC	0A	11.5A	307/Warning
7	FA3 Current8	1ms	ADC	0A	11.5A	308/Warning
8	FA3 FWD1	1ms	ADC	0W	550W	311/Warning
9	FA3 FWD2	1ms	ADC	0W	550W	312/Warning
10	FA3 FWD3	1ms	ADC	0W	550W	313/Warning
11	FA2 FWD4	1ms	ADC	0W	550W	314/Warning
12	FA3 Voltage 1	1ms	ADC	+10V	+48V	321/Warning
13	FA3 Voltage 2	1ms	ADC	+10V	+48V	322/Warning
14	FA3 Temperature	100ms	I2C	+10degC	+60degC	331/Fault
15	FA3 FAN Speed	1s	Counter	5250	9750	341/Warning
16	FA3 Alarm Code	-	-	-	-	301-341

PS Unit

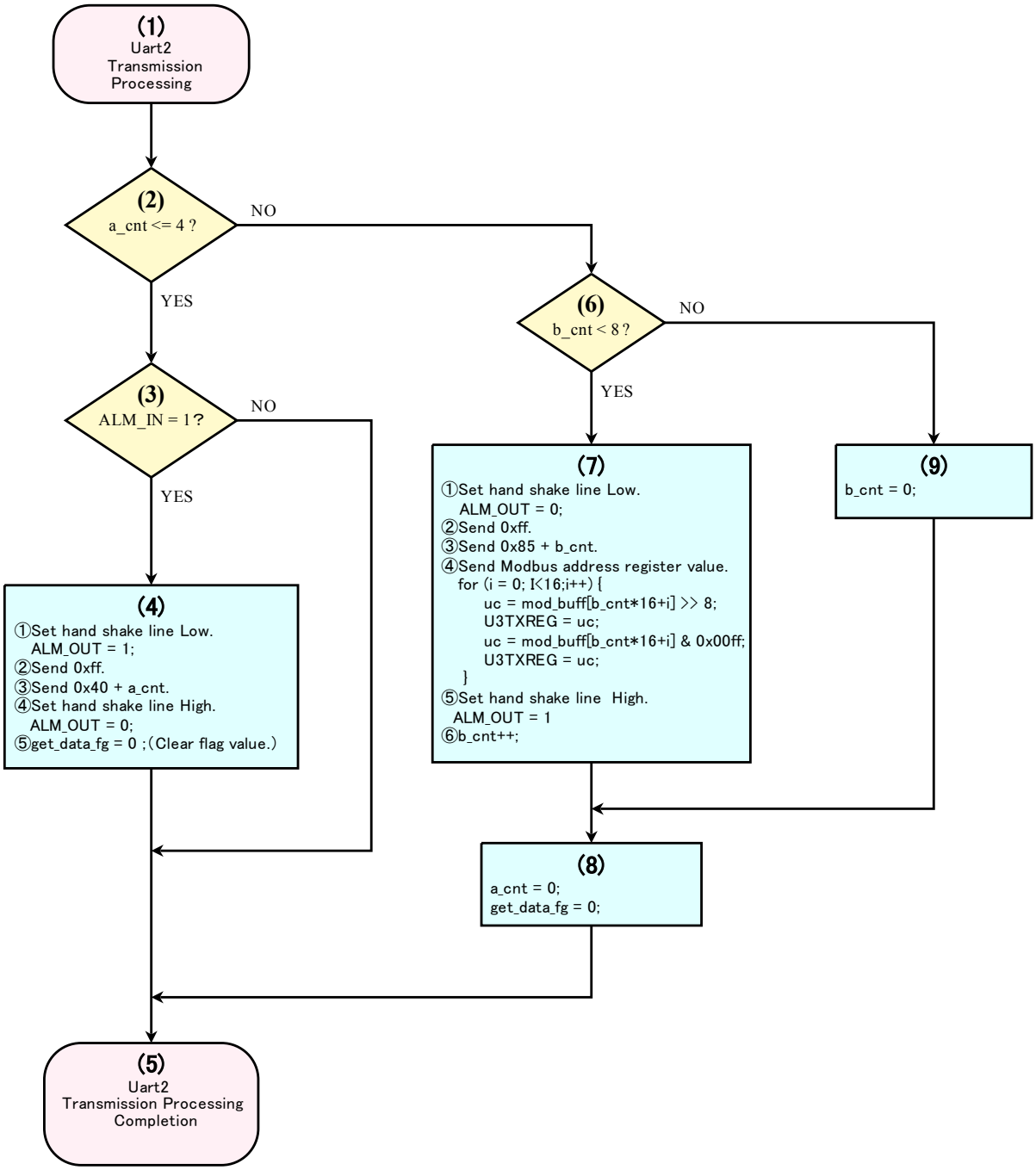
Monitoring Parameters of PS PCB and alarm threshold.

Monitoring Parameters are Phase loss 3 points, Temperature 4 points, Moisture 1 point, Water Flow Rate 1 point, PS status 1 point, and Fan Speed 8 points (4 of 8 Fans are EX FAN = Heat Exchanger's FAN).

Table 20: PS Unit Monitoring Parameter

Data No.	PS Unit	Measurement Interval		Lower Limit	Upper Limit	Cord
0	AC Loss Status	1ms	ADC	-	-	401-403/Fault
1	-	-	-	-	-	-
2	PS Temperature	100ms	I2C	+10degC	+60degC	404/Fault
3	Ex Temperature	100ms	I2C	+10degC	+45degC	405/Fault
4	Water Temp Inlet	1ms	ADC	+22degC	+38degC	410/Fault
5	Water Temp Outlet	1ms	ADC	+22degC	+45degC	411/Fault
6	Moisture	1ms	ADC	0%	99%	Read Only
7	Water Flow	1ms	ADC	10L/min	30L/min	409/Fault
8	PS Status	1ms	Port		>=3 1 or 2	420/Fault 421-426/Warning
9	Ex FAN1	1s	Counter	6300rpm	11700rpm	431/Warning
10	Ex FAN2	1s	Counter	6300rpm	11700rpm	432/Warning
11	Ex FAN3	1s	Counter	6300rpm	11700rpm	433/Warning
12	Ex FAN4	1s	Counter	6300rpm	11700rpm	434/Warning
13	PS FAN1	1s	Counter	5250rpm	9750rpm	435/Warning
14	PS FAN2	1s	Counter	5250rpm	9750rpm	436/Warning
15	PS FAN3	1s	Counter	2590rpm	4810rpm	437/Warning
16	PS FAN4	1s	Counter	5250rpm	9750rpm	438/Warning
17	PS Alarm Code	-	-	-	-	401-438

2.3.7. UART2 (RS-485) Transmission Flow-Chart



(1) UART2 (RS-485) Transmission Processing begins
(2) Confirm if a_cnt (address of SUB PCB) is lower than 4 or not.
If YES, confirm ALM_IN (Hand Shake Lint) is High as on (3)
If NO, confirm b_cnt is lower than 8 or not as on (6)

(3) In the case ALM_IN is High, (4) would be processed.
If ALM_IN is not High, UART2 transmission processing is completed as on (5).

(6) Confirm if b_cnt (address of SUB PCB) is lower than 8 or not.
If YES, (7) would be processed.
If NO, b_cnt=0 as on (9), and (7) would be ignored.

(8) is executed.
(5) Uart2 Transmission Processing is completed

3. RF Control Unit

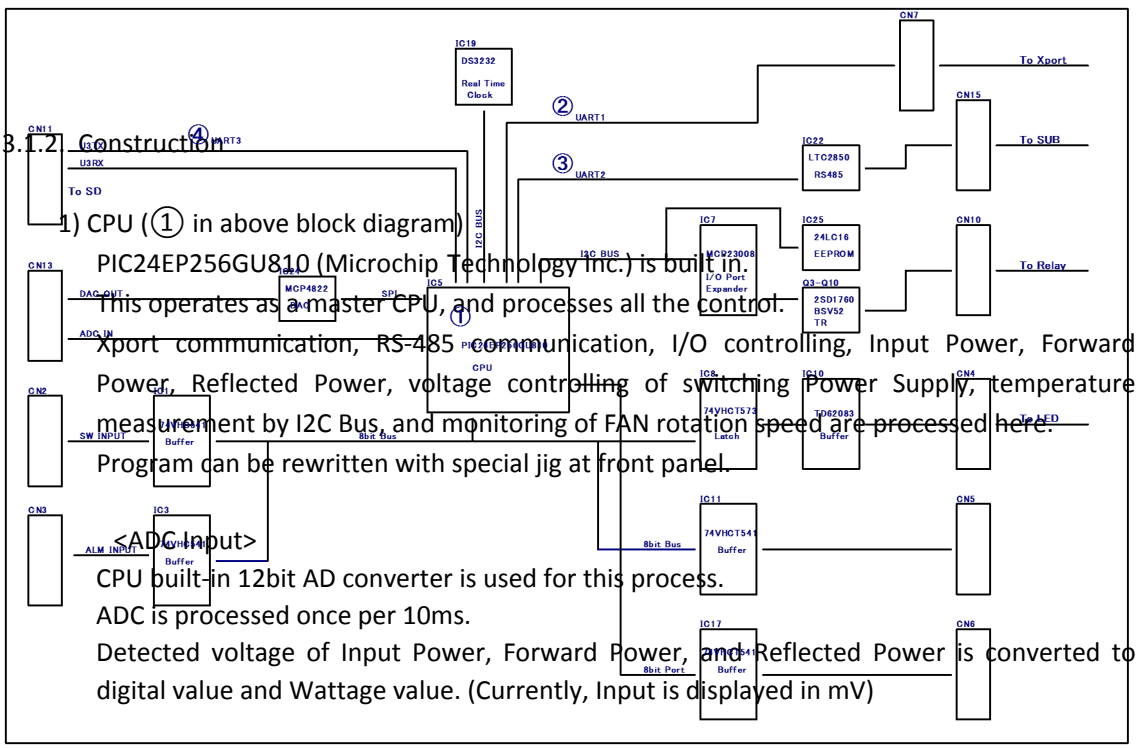
Description of Main and SD PCB in the control unit.

3.1. Main PCB

Description of Main PCB

3.1.1. Block Diagram

3.1.2. Construction



1) CPU (① in above block diagram)

PIC24EP256GU810 (Microchip Technology Inc.) is built in.

This operates as a master CPU, and processes all the control.

Xport communication, RS-485 communication, I/O controlling, Input Power, Forward Power, Reflected Power, voltage controlling of switching Power Supply, temperature measurement by I2C Bus, and monitoring of FAN rotation speed are processed here.

Program can be rewritten with special jig at front panel.

<ADC Input>

CPU built-in 12bit AD converter is used for this process.

ADC is processed once per 10ms.

Detected voltage of Input Power, Forward Power, and Reflected Power is converted to digital value and Wattage value. (Currently, Input is displayed in mV)

Table 21

Item	Description	Error Code
Input Drive Power Over	Fault at over 2500mV	500
Forward Power Over	Fault at over 5100W	501
Reflected Power Over	Fault at over 500W	530

2) Ethernet connection (② in above block diagram)

By using Xport (LANTRONIX), serial signal of UART 1 is exchanged to Ethernet signal.
Operation which is same to MODBUS/TCP is available.
Serial Port RX, TX of Main CPU and Serial Port RX, TX of Xport are cross connected.

3) RS-485 (③ in above block diagram)

LTC2850 (Linear Technology) is used.
UART2 is converted to RS-485.
RS485 communication with each SUB PCB is processed and monitoring data is collected.

4) UART3 (④ in above block diagram)

UART3 is Cross connected with UART1 at SD PCB
Collected MODBUS data at MAIN PCB is transferred to SD PCB 8 times per second.

5) Debug

A connector port is on the front panel of the RF Control Unit for Rewrite/Debug of each PCB.

6) DAC output

MPC4822 (Microchip Technology Inc.) is used.
12bitDAC 2 channel output operated with SPI
It is used for setting of control voltage of switching power supply.
Setting of it is processed at address 0x0003.

7) I2C bus

2 system I2C bus is used.
Operation clock of I2C bus is 100kHz.
Following is address of each IC.

Table 22

Item	Address	Description
MCP23008	0x40	Used as output port
DS1731	0x90	Temperature Sensor DS1731 is installed out of PCB

Table 23

Item	Address	Description
DS3232	0xd0	Clock which has calendar function

<I/O Expander>

This is used as output on this product.
This is connected to CN10.

<Temp. Sensor>

Temperature inside the control unit is monitored by DS-1731.
When measured value is out of threshold, internal fault occurs.

<Clock which has calendar function>

For time stamping of SD memory and file, clock which has calendar function is built in.
Clock data is BCD (binary).

Table 24
i.e.) 2016, June 14th, 17:20:00

Item	Binary	Description	
Year	0x16	Year: 2016	0x00-0x99 is maximum
Month	0x06	Month: June	0x01-0x12 is maximum
Date	0x14	Date: 14th	0x01-0x31 is maximum
Hour	0x17	Hour: 17	0x00-0x23 is maximum
Minute	0x20	Minute: 20	0x00-0x59 is maximum
Second	0x00	Second: 00	0x00-0x59 is maximum

IC for the clock is backed up with lithium battery.
When power is turned onto Main-CPU, I2C bus accesses to clock IC and clock data is read onto CPU.
Real-Time-Clock inside CPU is set to this time setting.

After the setting of Real-Time-Clock, communication with SD PCB is processed by RS-485 and SD PCB's Real-Time-Clocks are set.

3.1.3. Monitoring of measurement data and error processing

There are three kind of error: Internal Fault, External Fault, and Warning.

Table 25: Internal Fault

Item	Description	Error Code
DA Unit Temp.	Abnormal Temperature inside DA Unit	031
FA Unit1 Temp.	Abnormal Temperature inside FA Unit1	131
FA Unit2 Temp.	Abnormal Temperature inside FA Unit2	231
FA Unit3 Temp.	Abnormal Temperature inside FA Unit3	331
AC Phase Loss	Phase Loss	401-403
PS Unit Air Temp.	Abnormal Temperature inside PS Unit	404
Heat Exchanger Temp.	Abnormal Temperature inside Heat Exchanger	405
LCW Flow	Abnormal Water Flow Rate	409
LCW Inlet Temp.	Abnormal Temperature of Incoming water	410
LCW Outlet Temp.	Abnormal Temperature of Outgoing water	411
PS Fault	Abnormality of more than 4 switching power supply	420
Input Power Over	Over RF input power	500
Forward Power	Over RF output power	501
Water Leak	Abnormality is detected by Water Leak Sensor	502
Reflected Power	Over Reflected RF power	530
RF Control Unit Temp.	Abnormal Temperature inside Control Unit	550
Thermostat	Abnormality is detected by Thermostat	560
120VAC OFF, Reboot	Status when AC120V is turned on	570
480VAC Status	Status when AC480V is not provided	580

When Internal Fault occurs

1 BNC+24V output gets to 0V.
2 RF is Disabled.
3 LED of RF Enable is turned off.
4 Control voltage setting of switching power supply is set at 700.
5 DC is Disabled.
6 LED of DC Enable is turned off.
7 Internal Fault LED is turned on.
8 On Modbus address 0x000d, Fault Code appears.
9 This Fault can be reset only via MODBUS.

To release only Internal Fault, command is 0x01.

When AC120V power is turned on, status is Error Code 570

Table 26: External Fault

Item	BNC1	BNC2	BNC3	BNC4	Error Code
External Fault1	✓				511
External Fault1		✓			512
External Fault2	✓	✓			513
External Fault1			✓		514
External Fault2	✓		✓		515
External Fault2		✓	✓		516
External Fault3	✓	✓	✓		517
External Fault1				✓	518
External Fault2	✓			✓	519
External Fault2		✓		✓	520
External Fault3	✓	✓		✓	521
External Fault2			✓	✓	522
External Fault3	✓		✓	✓	523
External Fault3		✓	✓	✓	524
External Fault4	✓	✓	✓	✓	525

When any External Fault occurs

1 BNC+24V output gets to 0V.
2 RF is Disabled.
3 LED of RF Enable is turned off.
4 Control voltage setting of switching power supply is set at 700.
5 DC is Disabled.
6 LED of DC Enable is turned off.
7 External Fault LED is turned on.
8 On Modbus address 0x000e, Fault Code appears.
9 This Fault can be reset only via MODBUS.

To release only External Fault, command is 0x02.

<Warning>

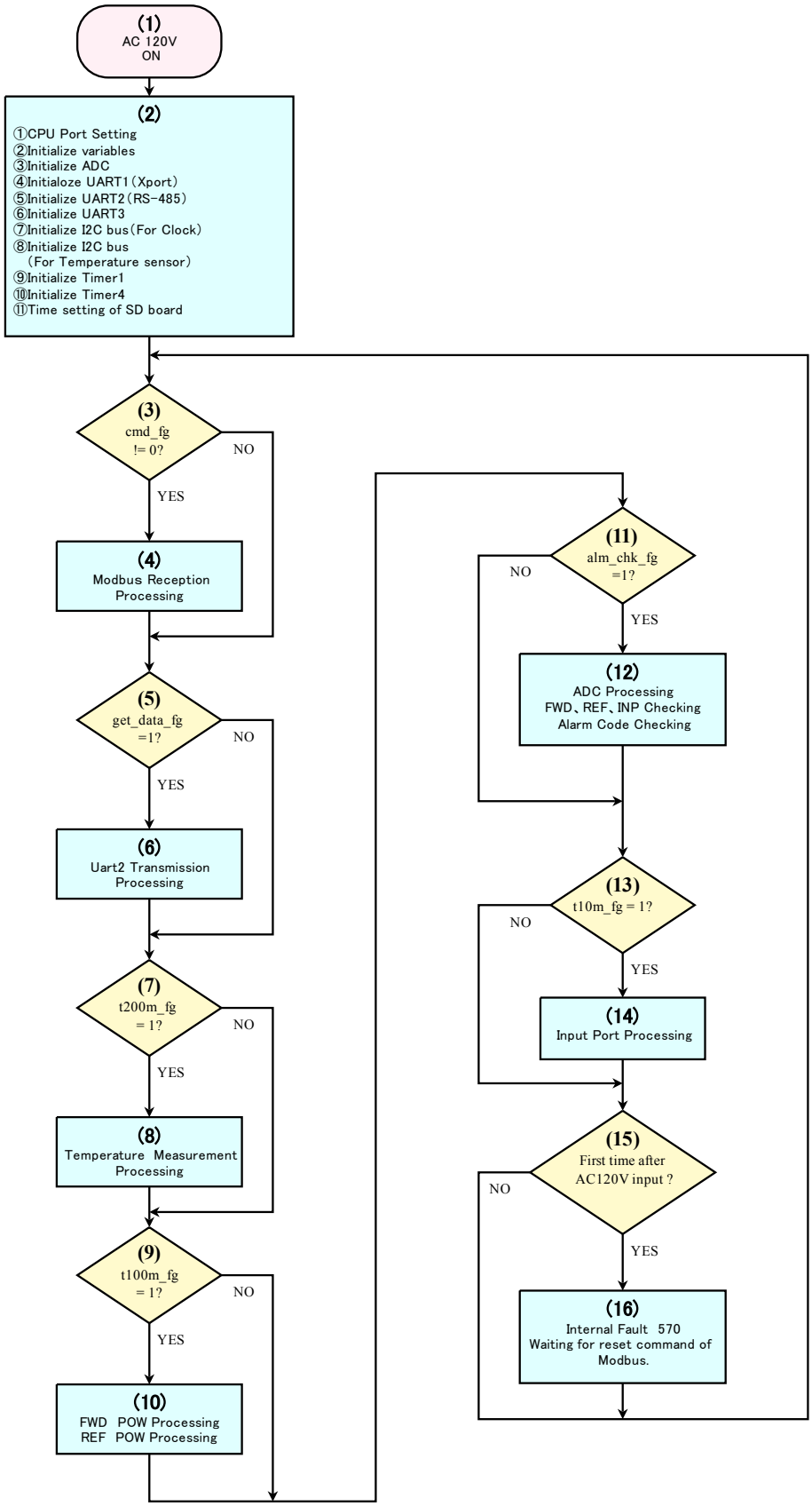
When monitoring items inside FA (FWD1-4, Current, Voltage and FAN speed) are out of threshold, warning code appears on MODBUS address 0x000f.

No operation is limited by these Warning occurrence.

Warning Code can be released by reset via MODBUS

Release of Warning is 0x04

3.1.4. Main Module Flow-Chart



(1) When AC120V is turned on, 5V is supplied to MAIN PCB, and CPU starts its operation.

(2) CPU starts its initialization.
After completion of initialization, CPU repeats process from (3) to (16)
This is Main Routine

(3) Confirm the flag if MODBUS command is received or not.
If YES, (4) Modbus Reception Processing is executed.
If NO, (4) is ignored.

(5) Confirm if transmission needs to be executed or not.
If YES, (6) Uart2 Transmission Processing is executed.
If NO, (6) is ignored.

(7) Confirm the flag of temperature measurement per 200ms
If YES, (8) Temperature Measurement Processing is executed.
If NO, (8) is ignored.

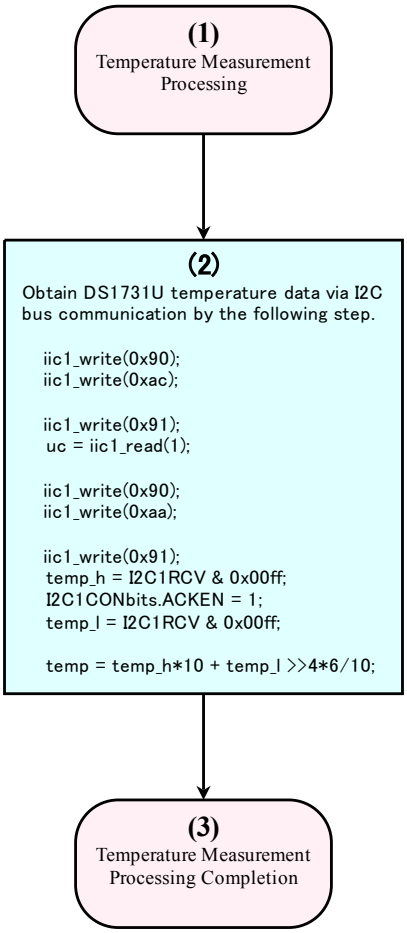
(9) Confirm the flag of convert FWD REF value to W per 100ms
IF YES, (10) FWD POW Processing/REF POW Processing is executed.
FWD REF value is to be converted to W value.
If NO, (10) is ignored.

(11) Confirm the flag of alarm check.
If YES, (12) ADC Processing/FWD, REF, INP Checking/Alarm Code Checking is executed.
If NO, (12) is ignored.

(13) Confirm the flag of input port check per 100ms
If YES, (14) Input Port Processing is executed.
If NO, (14) is ignored.

(15) Confirm if the routine is the first one after input of 120V power.
If YES, Internal Fault 570 occurs.
If NO, flow chart is restarted from (3).

3.1.5. Temperature Measurement Processing Flow-Chart

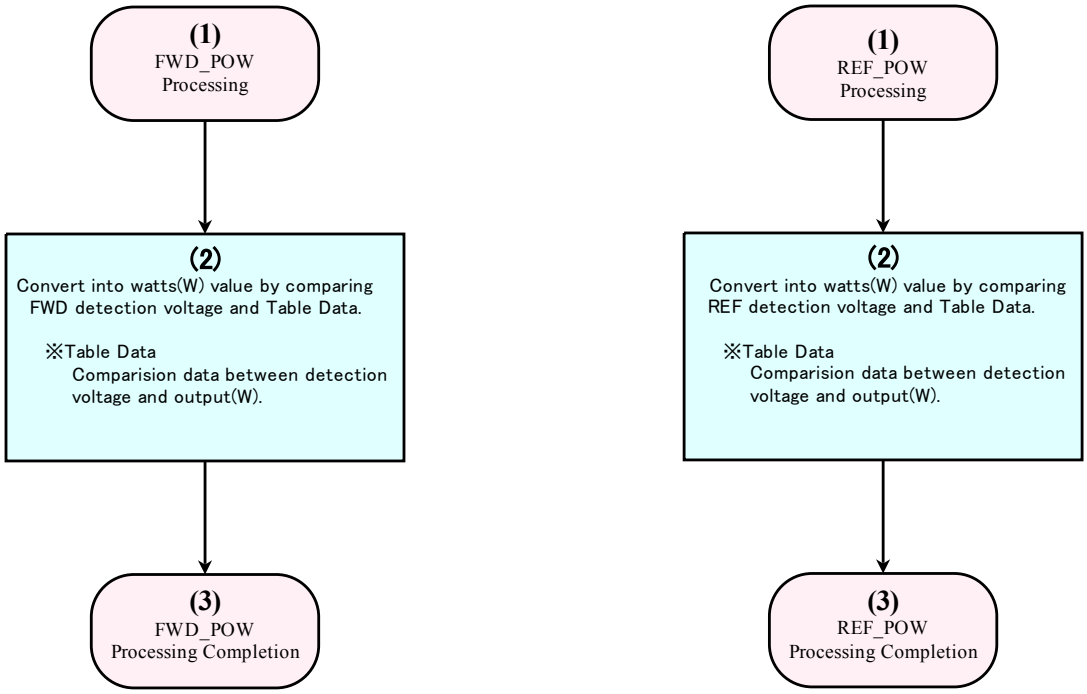


(1) Temperature Measurement Processing begins

Item (2) is executed. And measurement value is read.
I2C Bus communication is executed.

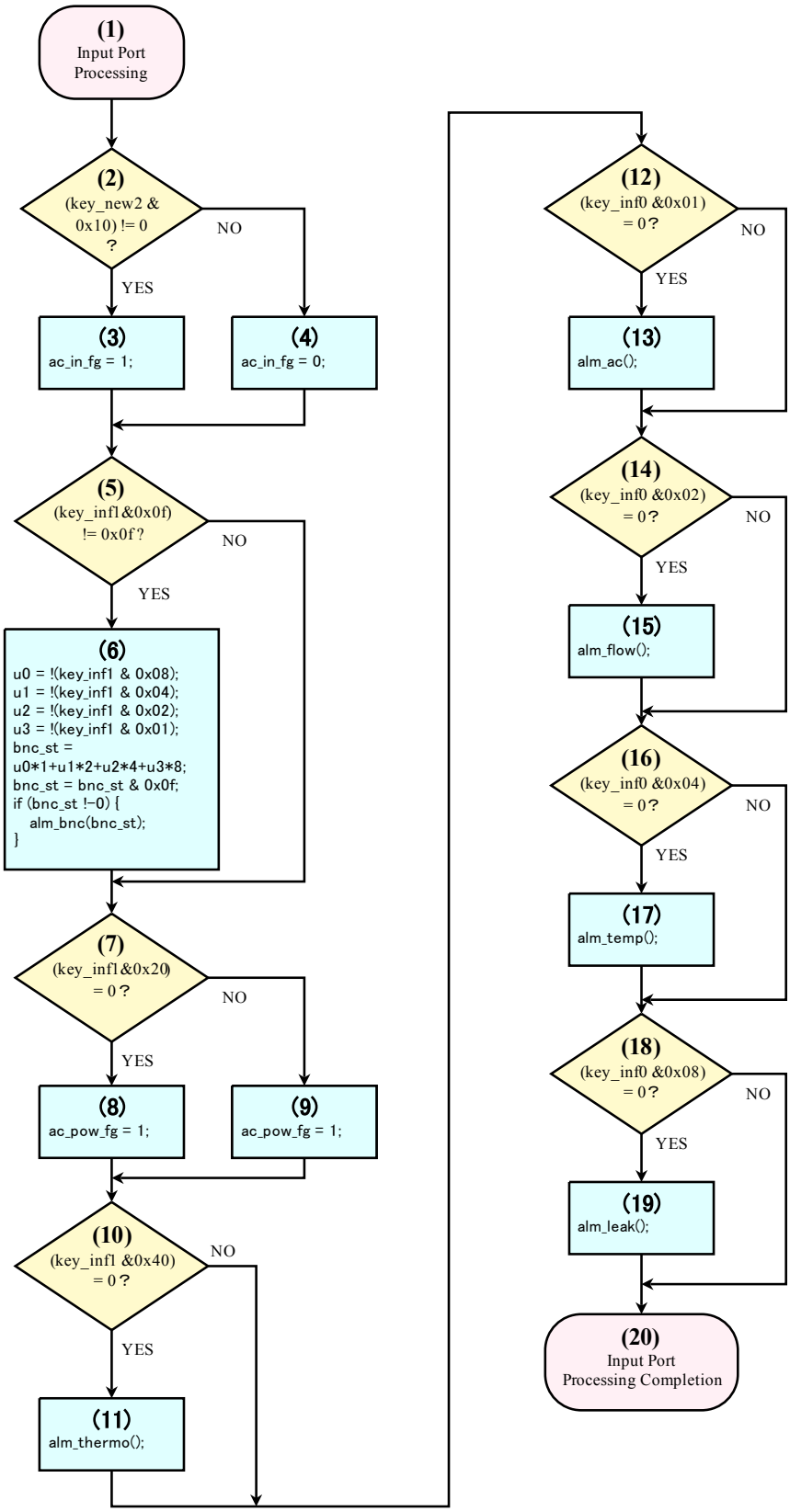
(3) Temperature Measurement Processing is completed.

3.1.6. Forward and Reflection power processing flow-chart



By using conversion table, both FWD and REF is converted to W (wattage) value.

3.1.7. Input Port Processing Flow-Chart



(1) Input Port Processing begins
(2) Confirm if (key_new2 & 0x10) is 0 or not. (if 480V breaker is ON or not)
If YES, ac_in_fg = 1 (480V is ON).
If NO, ac_in_fg = 0 (480V is OFF).

(5) Confirm if there is 1 on (key_inf1 & 0x0f) result to inspect 4 BNCs status of External +24V.
If YES, alm_bnc(bnc_st); is executed.
If NO, (6) is ignored.

(7) Confirm if (key_inf1 & 0x20) is 0 or not.
Whether AC480V is input or not is checked by monitoring direct signal from PS PCB.
If YES, (8) ac_pow_fg = 1 (AC480 is input).
If NO, (9) ac_pow_fg = 0 (AC480 is not input).

(10) Confirm if (key_inf1 & 0x40) is 0 or not for checking alarm status of Thermostat
If YES, (11) alm_thermo(); is executed.
If No, (11) is ignored.

(12) Confirm if (key_inf0 & 0x01) is 0 or not for checking existence of AC Phase Loss by direct signal from PS PCB.
If YES, (13) alm_ac(); is executed. (Status: AC Phase Loss)
If NO, (13) is ignored.

(14) Confirm if (key_inf0 & 0x02) is 0 or not. When water flow rate is abnormal, alarm is executed from PS PCB by direct signal.
If YES, (15)alm_flow(); is executed.
If NO, (15) is ignored.

(16) Confirm if (key_inf0 & 0x04) is 0 or not. When temperature is abnormal, alarm is executed from PS PCB by direct signal.
If YES, (17)alm_temp(); is executed.
If NO, (17) is ignored.

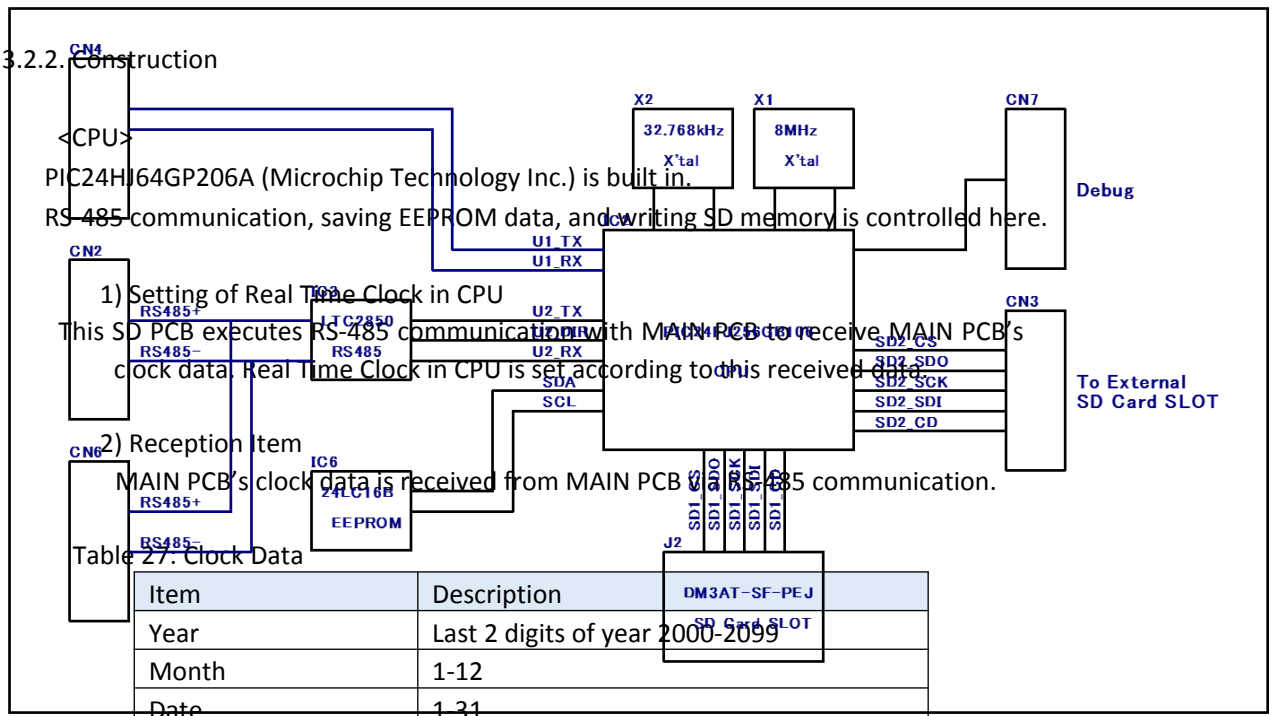
(18) Confirm if (key_inf0 & 0x08) is 0 or not. Water leak status is shown on MODBUS.
If YES, (19)alm_leak(); is executed.
If NO, (19) is ignored.

(20) Input Port Processing is completed.

3.2. SD PCB

SD PCB saves collected data by RS-485 reception to the SD memory.

3.2.1. Block Diagram



3.2.2. Construction

<CPU>

PIC24HJ64GP206A (Microchip Technology Inc.) is built in.

RS-485 communication, saving EEPROM data, and writing SD memory is controlled here.

1) Setting of Real Time Clock in CPU

This SD PCB executes RS-485 communication with MAIN PCB to receive MAIN PCB's clock data. Real Time Clock in CPU is set according to this received data.

2) Reception Item

MAIN PCB's clock data is received from MAIN PCB via RS-485 communication.

Table 27. Clock Data

Item	Description
Year	Last 2 digits of year 2000-2099
Month	1-12
Date	1-31
Week	Sunday: 0 ~ Saturday: 6
Hour	0-23
Minute	0-59
Second	0-59

3) CPU setting

Real Time Clock of CPU is set to clock data.

32.768 kHz external oscillator is used for frequency of clock.

<EEPROM>

24LC16B (Microchip Technology Inc.) is used.

EEPROM is operated by I2C bus.

Data of file system is saved on this.

Initialization of EEPROM

When EEPROM is initialized by I2C bus, written data is collected.

Table 28: Status

Item	Description
Year	Last 2 digits of year 2000-2099
Month	1-12
Date	1-31
File No	1-60
Mode	1: overwrite 2: Create a new file

When there is any difference between reception date data and EEPROM date data, +1 is added on file No. (if file No. is 3, changed to file No. 4)

<RS-485>

LTC2850 (Linear Technology) is built in to convert UART to RS-485.

3.2.3. Reception of Data

On the PCB, by communication (reception) of UART, monitoring data on MODBUS is saved on buffer. Reception is executed eight times per second.

Table 29:

Name	Modbus Address
00	0x0000 – 0x000f
10	0x0010 – 0x001f
20	0x0020 – 0x002f
30	0x0030 – 0x003f
40	0x0040 – 0x004f
50	0x0050 – 0x005f
60	0x0060 – 0x006f
70	0x0070 – 0x007f

3.2.4. Data to be saved on SD

Data to be saved on SD is saved on designated buffer with time stamp.

Table 30: Data Format

Byte	0	1	2	3	4	5	6
Time Stump	0xff	Year 0x16	Mon 0x05	Date 0x11	Hour 0x14	Min 0x10	Sec 0x30

Byte	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2Byte		2Byte		2Byte		2Byte		2Byte		2Byte		2Byte		2Byte	
00	D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
10	D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
20	D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
30	D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
40	D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
50	D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
60	D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
70	D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15

Byte	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	2Byte		2Byte		2Byte		2Byte		2Byte		2Byte		2Byte		2Byte	
00	D16	D17	D18	D19	D20	D21	D22	D23	D24	D25	D26	D27	D28	D29	D30	D31
10	D16	D17	D18	D19	D20	D21	D22	D23	D24	D25	D26	D27	D28	D29	D30	D31
20	D16	D17	D18	D19	D20	D21	D22	D23	D24	D25	D26	D27	D28	D29	D30	D31
30	D16	D17	D18	D19	D20	D21	D22	D23	D24	D25	D26	D27	D28	D29	D30	D31
40	D16	D17	D18	D19	D20	D21	D22	D23	D24	D25	D26	D27	D28	D29	D30	D31
50	D16	D17	D18	D19	D20	D21	D22	D23	D24	D25	D26	D27	D28	D29	D30	D31
60	D16	D17	D18	D19	D20	D21	D22	D23	D24	D25	D26	D27	D28	D29	D30	D31
70	D16	D17	D18	D19	D20	D21	D22	D23	D24	D25	D26	D27	D28	D29	D30	D31

Data for 1 second is 263 Byte.

1) Writing Sequence (1 second data)

1 Buffer for SD writing is double buffer (A and B) of 1024 Byte.
2 Above data is continuously written. When data becomes 512 byte, buffer is changed to B.
3 Buffer data of A is written onto SD memory.
4 Same as ②, when data of buffer B becomes 512 byte, buffer is changed to A.
5 Buffer data of B is written onto SD memory.
6 Sequence ②~⑤ are repeated.

2) Writing Sequence (1 minute data)

Only the peak value of 1 second data in 60 second is saved. (Maximum value of 60 data)
Data is collected once per minute.
Writing sequence is same with ①~⑥ of 1 second data.

3.2.5. File System

1) Format of SD memory

This product is compatible with format of FAT16 and FAT32.

Because data of SD memory is binary, it cannot be read by text editor. Please use binary editor.

2) Saving of 1 second data

All data (263 byte) is saved onto SD memory per second.
Date of clock with calendar and date of saving file are compared at power input. If those date are same, saving data is written on the last file. If those aren't same, new file is created.
File is named as DATA00xtxt ~ DATA59.txt. (60 kinds)

For the first day, file is named as DATA00.txt. From next day, naming continues to DATA01.txt~.
After the naming of DATA59.txt, next file is not DATA60.txt, but DATA00.txt by overwriting old data.
Therefore, saved 1 second data is for recent 60 days.
Data volume of this data for per day is: 263 X 60 X 60 X 24 22723200 byte (21.7MB)

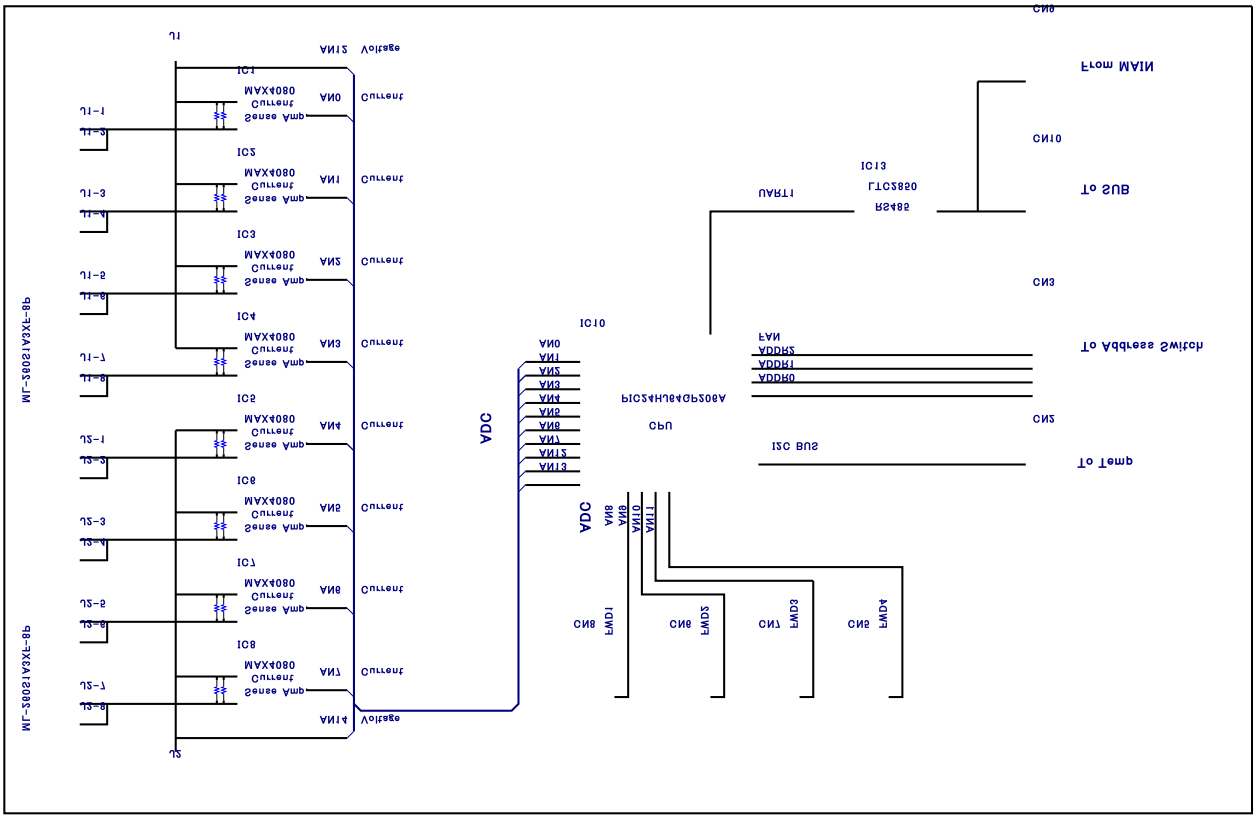
3) Saving of 1 minute data
One file is created for each month. And all data is saved on the file per minute for 10 years.
Name of 1 minute data file is year+month.txt. i.e.) Data for 2016, July is 201607.txt.
New file is created each month.
Differ from 1 second data, no data is overwritten.

4. Amp Unit

This product is consisted of Driver Amp Unit, Final Amp Unit1, Final Amp Unit2, and Final Amp Unit3.

SUB PCB is built inside of each Unit. It monitors current, voltage, and FAN rotation speed.

4.1. Block Diagram



4.2. Construction

<CPU>

PIC24HJ64GP206A is built in (Microchip Technology Inc.).

Monitoring contents are Current, Voltage, Temperature, FAN rotation speed.

12bit ADC is used for Current and Voltage

Monitored data is submit to Main PCB via RS-485 per second.

<Current Sensor>

MAX4080SASA (Maxim Integrated) is used.

Each current of FET inside AMP is measured.

DC voltage is converted digitally by ADC of CPU.

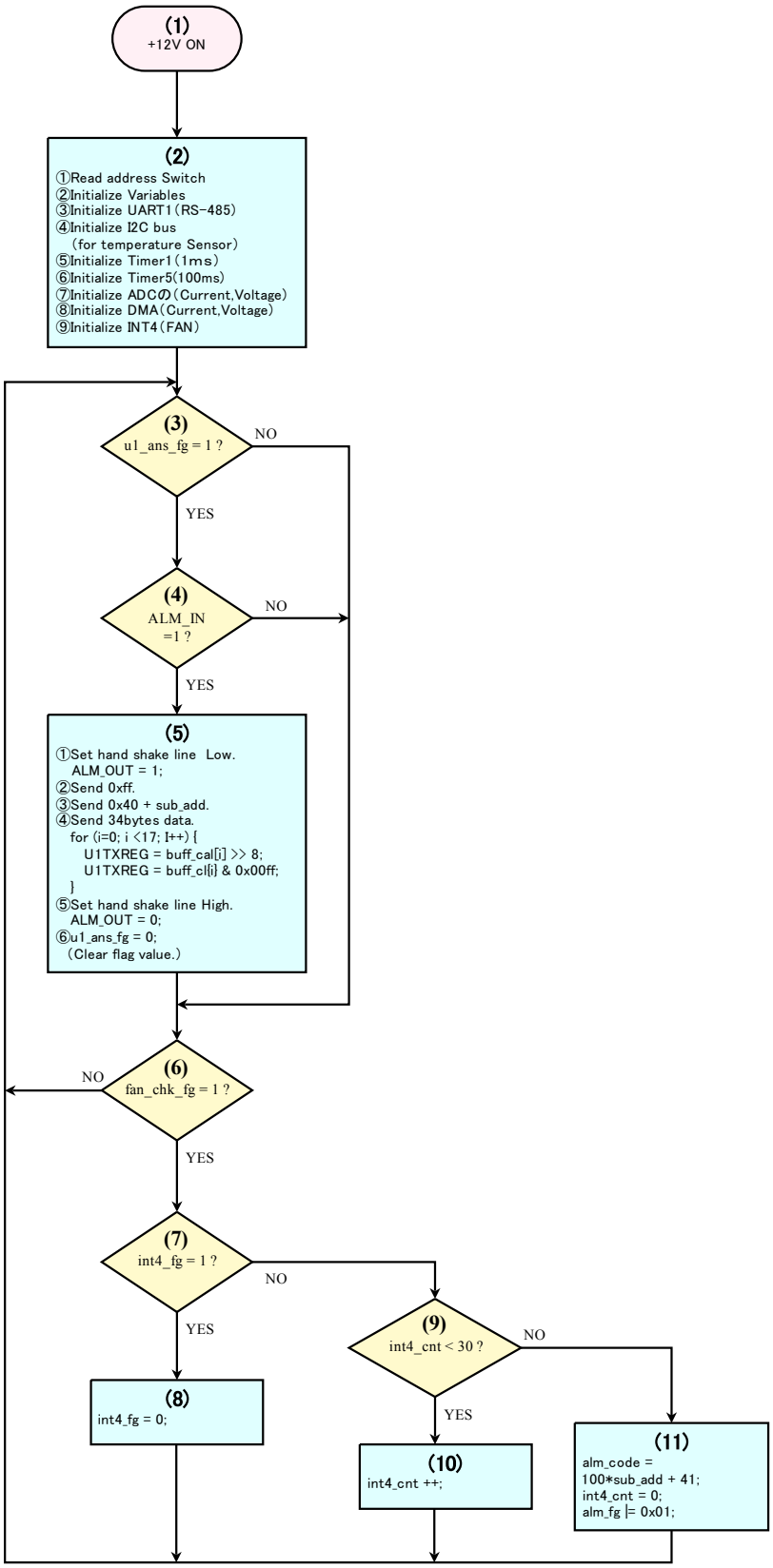
<RS-485>

LTC2850 (Linear Technology) is used.

UART is converted to RS-485.

4.3. Flow-Chart

4.3.1. Main Module Flow-Chart



(1) When +12V is supplied from Main PCB, CPU on SUB PCB starts its operation.

(2) Inside of CPU is initialized.

(3) Confirm if u1_ans_fg is 1 or not.
u1_ans_fg expresses if there is request for transmission from MAIN PCB.
If YES, confirm if (4) ALM_IN is 1 or not next.
If NO, (4) and (5) are ignored.

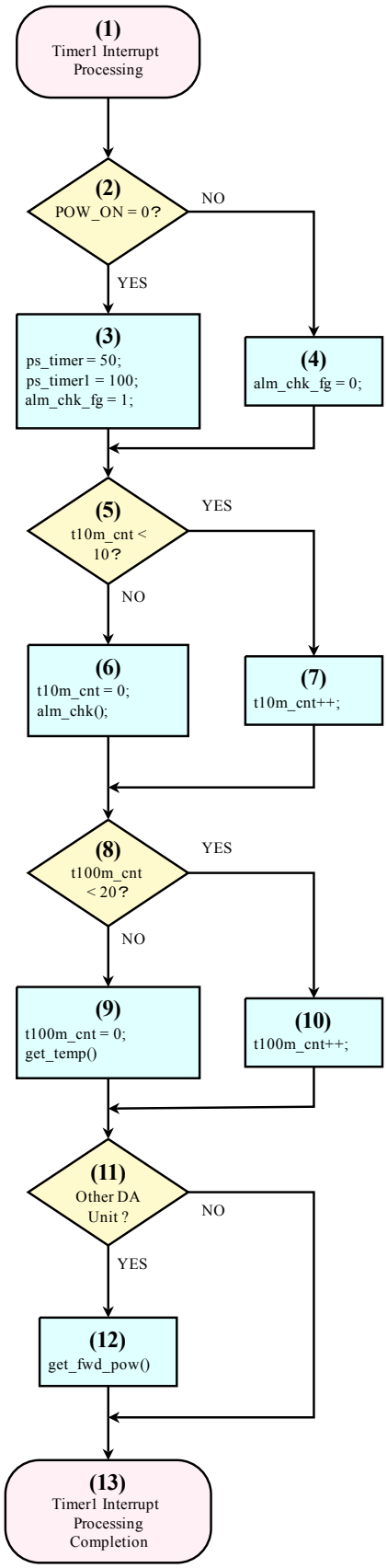
(4) ALM_IN is used as Hand shake Line for this product.
At High status, it becomes 1.
If YES, (5) sequence is executed.
If NO, (5) is ignored.

(6) Confirm if fan_chk_fg is 1 or not.
If YES, FAN is monitored and (7) int4_fg status is confirmed.
If NO, (7) is ignored.

(7) When interrupt of INT4 occurs, int4_fg = 1;.
If YES, (8) int4_fg = 0; is executed.
If NO, confirm if (9) int4_cnt is lower than 30.

(9) If there is no interrupt of INT4 in 3 seconds, FAN alarm occurs.

4.3.2. Timer 1 Module Flow-Chart



(1) Timer 1 Interrupt Processing begins.

(2) Confirm if POW_ON signal from MAIN PCB is 0 or not at input port.
If YES, (3) is executed.
If NO, (4) alm_chk_fg=0; is executed.

(5) Confirm if t10m_cnt is lower than 10 or not.
It is a routine to count 10ms
If NO, (6) is executed.
If YES, (7) t10m_cnt++; is executed.

(8) Confirm if t100m_cnt is lower than 20 or not.
It is a routine to count 200ms.
If NO, (9) is executed.
If YES, (10) t100m_cnt++; is executed.

(11) Diverge route according to amp kind: DA or others.
*When SUB_Address is 0, DA Unit.
If YES (NOT DA unit), (12) is executed.
If NO (DA Unit), (12) is ignored.

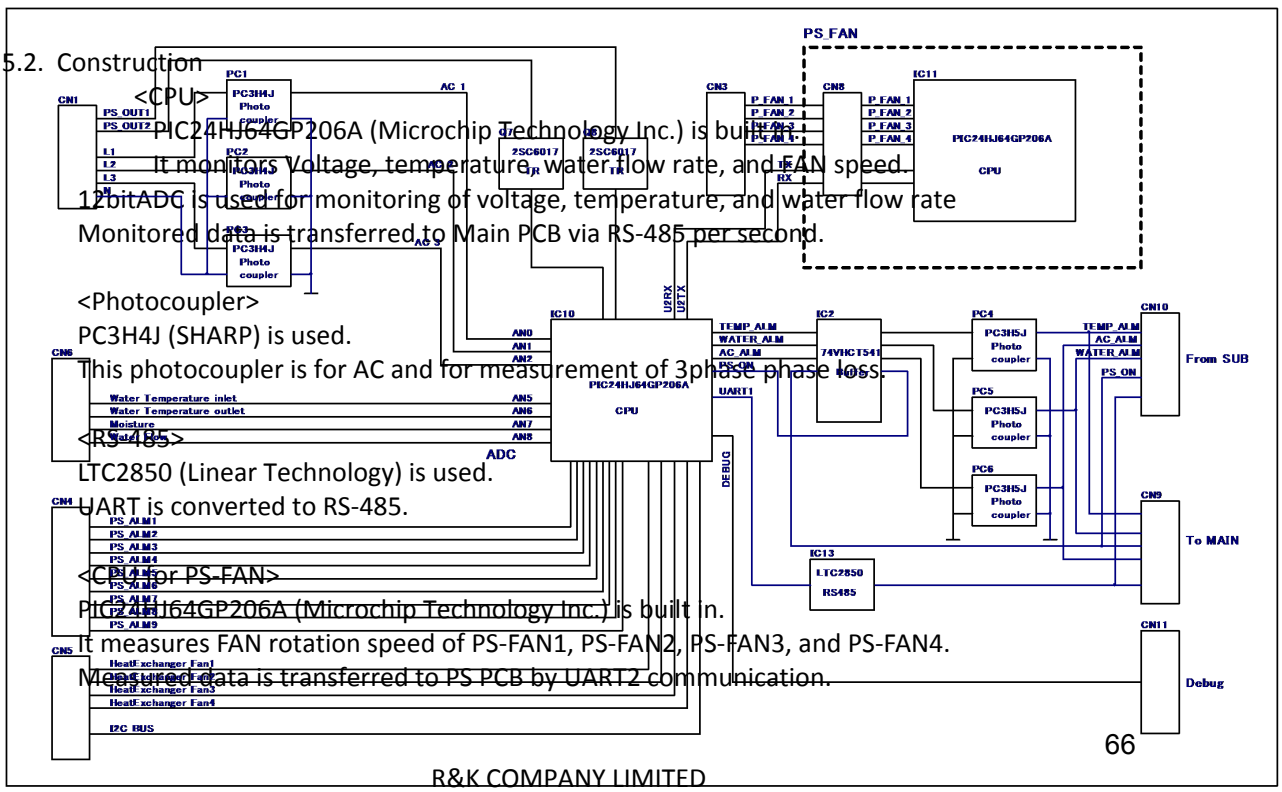
(13) Timer 1 Interrupt Processing is completed.

5. PS Unit

PS Unit is consisted of Power Supply transformer, magnet conductor, switching power supply (48V x 9pcs). And PS PCB is built in to control them.

Voltage, temperature, water flow rate, and FAN speed is monitored and the data is transferred to Main PCB via RS-485.

5.1. Block Diagram



5.2. Construction

<CPU>

PIC24HJ64GP206A (Microchip Technology Inc.) is built in.

It monitors Voltage, temperature, water flow rate, and FAN speed.

12bitADC is used for monitoring of voltage, temperature, and water flow rate

Monitored data is transferred to Main PCB via RS-485 per second.

<Photocoupler>

PC3H4J (SHARP) is used.

This photocoupler is for AC and for measurement of 3phase phase loss.

<RS-485>

LTC2850 (Linear Technology) is used.

UART is converted to RS-485.

<CPU for PS-FAN>

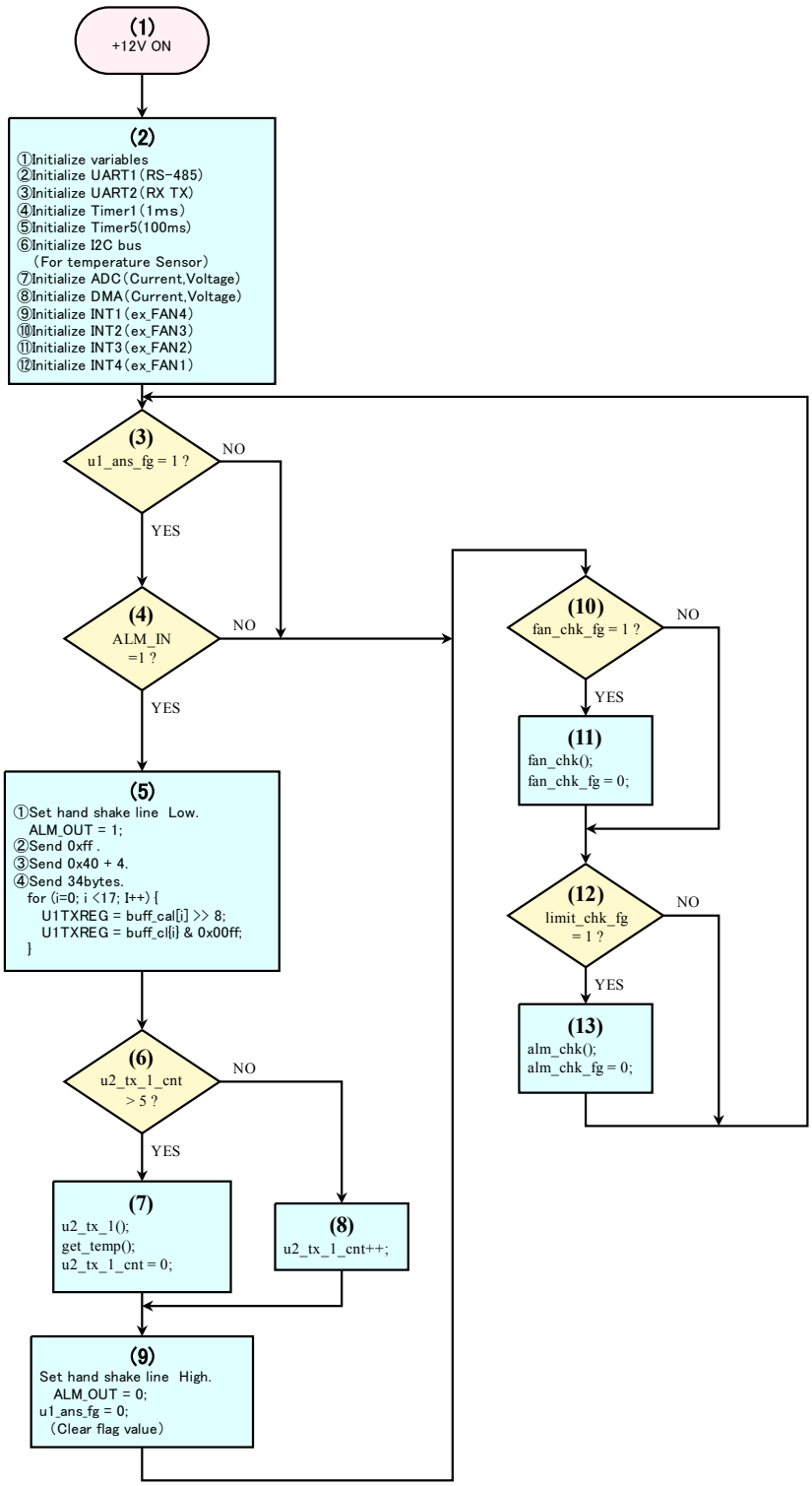
PIC24HJ64GP206A (Microchip Technology Inc.) is built in.

It measures FAN rotation speed of PS-FAN1, PS-FAN2, PS-FAN3, and PS-FAN4.

Measured data is transferred to PS PCB by UART2 communication.

5.3. Flow-Chart

5.3.1. Main Module Flow-Chart



(1) When +12V is supplied from Main PCB, CPU on PS PCB starts its operation.

(2) Inside of CPU is initialized

(3) Confirm if u1_ans_fg is 1 or not.
u1_ans_fg expresses if there is request for transmission from MAIN PCB.
If YES, confirm if (4)ALM_IN is 1 or not next.
If NO, (4) is ignored.

(4) ALM_IN is used as Hand Shake Line for this product.
At High status, it becomes 1.
If YES, (5) sequence is executed.
If NO, (5) is ignored.

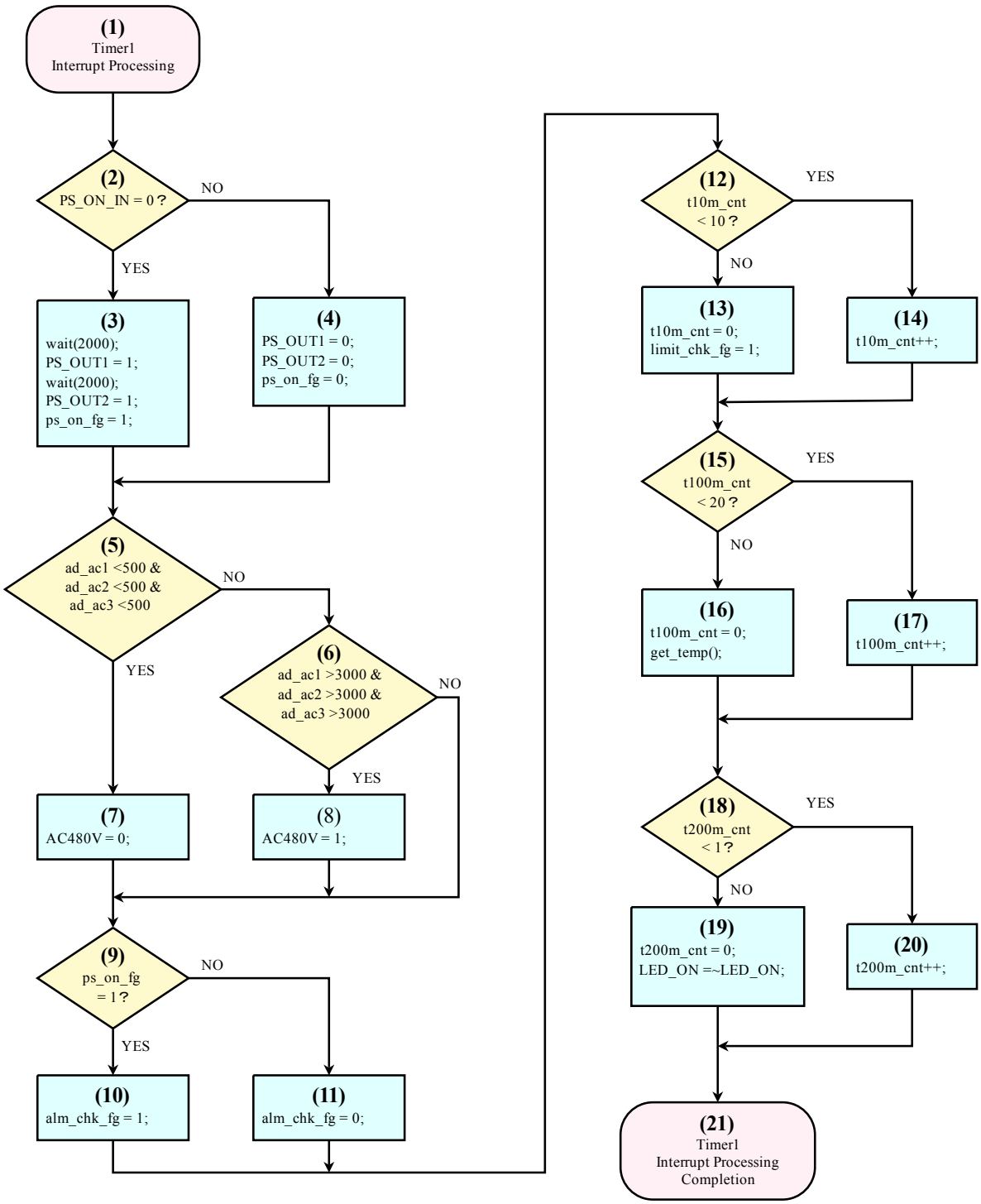
(6) Confirm if u2_tx_1_cnt is higher than 5 or not.
If YES, (7) sequence is executed.
If NO, (8) u2_tx_1_cnt++; is executed.

(9) sequence is executed to complete data transfer to MAIN PCB.

(10) Confirm if fan_chk_fg is 1 or not.
Fan_chk_fg becomes 1 at interrupt of Timer5 (100ms).
If YES, (11) sequence is executed.
If NO, (11) is ignored.

(12) Confirm if limit_chk_fg is 1 or not.
Limit_chk_fg becomes 1 per 10ms by Timer1.
If YES, (13) sequence is executed.
If NO, (13) is ignored.

5.3.2. Timer 1 Module Flow-Chart



(1) Timer1 Interrupt Processing begins.

(2) Confirm if PS_ON_IN is 0 or not.
It is a direct signal to turn the magnet conductor on from MAIN PCB.
If YES, (3) sequence is executed. 2 magnet conductors are turned on with short time-rug.
If NO, (4) sequence is executed. 2 magnet conductors are turned off.

(5) Each phase of AC3 phases is converted to DC and AC value is read.
Confirm if AD value of each phase is lower than 500mV.
If YES, it means three 480V phases are in normal status. (480V is supplied)
Then, (7) AC480V=0 is executed.
If NO, (6) sequence is executed.

(6) Confirm if all AD value is higher than 3000mV.
If YES, it means 480V is not supplied. Then, (8) AC480V=1; is executed.
If NO, (8) is ignored.

(9) Confirm if ps_on_fg is 1 or not.
If YES, (10) alm_chk_fg = 1; is executed.
If NO, (11) alm_chk_fg = 0; is executed.

(12) Confirm if t10m_cnt is lower than 10. *It is a routine to count 10ms.
If NO, (13) is executed.
If YES, (14) is executed.

(15) Confirm if t100m_cnt is lower than 20. *It is a routine to count 200ms.
If NO, (16) is executed to measure temperature.
If YES, (17) t100m_cnt++; is executed.

(18) Confirm if t200m_cnt is lower than 1. *It is a routine to count 400ms.
If NO, (19) LED_ON = ~LED_ON; is executed.
If YES, (20) t200m_cnt++; is executed.

(21) Timer1 Interrupt Processing is completed.

APPENDIX A.

Modbus/TCP Parameters

Table 31: Modbus/TCP Header Parameters

Transaction Identifier	Protocol Identifier	Length	Unit Identifier	Function	Starting Address	Quantity of Registers
2bytes 0xXXXX	2bytes 0xXXXX	2bytes 0xXXXX	1byte 0xXX	1byte 0xXX	2bytes 0xXX	2bytes 0xXX
Header						

The data sent by the external control system as “Request” and the data responded by the Main CPU as “Response” have same parameter on their header.

<Function Code>

The function cod field of the message will contain one byte that tells the slave what kind of action to take. Following is the table of the function codes which are used for CA1300BW1-5867R-SL.

Table 32

CODE	FUNCTION
0x03	Read Holding Registers
0x06	Write Single Register
0x08	Diagnostics
0x10	Request packet format

◆0x03 Read Holding Registers

This function is a type of Read-Only.

The readable data by this function at once is only one or continuous parameters (125 at max.) on the register map.

1) An Example of Request from a Control System.

Table 33: Request Data Format (0x03)

Transaction Identifier		Protocol Identifier		Length		Unit Identifier	Function	Starting Address		Quantity of Registers	
byte0	byte1	byte2	byte3	byte4	byte5	byte6	byte7	byte 8	byte 9	byte1 0	byte1 1
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) An Example of Response from the Main CPU for a Usual Situation

Table 34: Response Data 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	byte1 0	byte1 1	byte1 2	byte1 3	byte1 4
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) An Example of Response from the Main CPU for an Exceptional Situation

Table 35: Exceptional Response Data Format (0x03)

Transaction Identifier		Protocol Identifier		Length		Unit Identifier	Function	Code of Exception
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 36: Code of Exception (0x03)

Code of Exception	MODBUS Name	Comments
0x01	Illegal Function Code	The function code is unknown by the server
0x02	Illegal Data Address	Dependent on the request
0x03	Illegal Data Value	Dependent on the request
0x04	Server Failure	The server failed during the exaction

◆0x06 Write Single Register

This function is a type of Write-Only.

The writable data by this function at once is only one of the register map.
Following is a list of writable data.

Power ON/OFF
RF ON/OFF
Voltage control setting of switching power supply
Reset for alarm clear (Clear latched faults)
Reboot
Time setting

1) An Example of Request from a Control System.

Table 37: Request Data 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) An Example of Response from the Main CPU for a Usual Situation

Table 38: Response Data 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) An Example of Response from the Main CPU for an Exceptional Situation

Table 39: Exceptional response Data format (0x06)

Transaction Identifier		Protocol Identifier		Length		Unit Identifier	Function	Code of Exception
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 40: Code of Exception (0x06)

Code of Exception	MODBUS Name	Comments
0x01	Illegal Function Code	The function code is unknown by the server
0x02	Illegal Data Address	Dependent on the request
0x03	Illegal Data Value	Dependent on the request

0x04	Server Failure	The server failed during the exaction
0x05	No Action	Command has been received with no action

◆0x08 Diagnostics

This function code is used for confirming the normality of the Modbus communication. When Requested data and Responded data are exact same, the communication is recognized as normal.

Sub-function Code should be 0x0000. A user can put any numbers on Data (byte 10 and 11).

1) An Example of Request from a Control System

Table 41: Request Data Format (0x08)

Transaction Identifier		Protocol Identifier		Length		Unit Identifier	Function	Sub-Function Code		Data	
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	0x06		0xXX	0x08	0x00	0x00	0xXX	0xXX

Table 42: Sub-Function Code (0x08)

Sub-Function Code	Name
0x00	Return Query Data

2) An Example of Response from the Main CPU for a Usual Situation

Table 43: Response Data Format (0x08)

Transaction Identifier		Protocol Identifier		Length		Unit Identifier	Function	Sub-Function Code		Data	
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	0x06		0xXX	0x08	0x00	0x00	0xXX	0xXX

3) An Example of Response from the Main CPU for an Exceptional Situation

Table 44: Exceptional response Data Format (0x08)

Transaction Identifier		Protocol Identifier		Length		Unit Identifier	Function	Code of Exception
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	0x88	0xXX

Table 45: Code of Exception (0x08)

Code of Exception	MODBUS Name	Comments

0x01	Illegal Function Code	The function code is unknown by the server
0x03	Illegal Data Value	Dependent on the request
0x04	Server Failure	The server failed during the exaction

◆0x10 Write Multiple Registers

This function is a type of Write-Only.

The writable data by this function at once is only one or continuous parameters on the register map.

This function is only used for setting the calendar of the product.

1) An Example of Request from a Control System

Table 46: Request Data Format (0x10)

Transaction Identifier		Protocol Identifier		Length		Unit Identifier	Function	Starting Address		Quantity of Output	
byte0	byte1	byte2	byte3	byte4	byte5	byte6	byte7	byte8	byte9	byte10	byte11
Hi	Lo	Hi	Lo	2 byte		1 byte	1 byte	Hi	Lo	Hi	Lo
0xXX	0xXX	0xXX	0xXX	0x02*(N+3)+1		0xXX	0x10	0x00	0xXX	0x00	0xXX

Table 47

Byte Counter	Data 1		Data---		Data N	
byte12	byte13	byte14			byte13+N	byte14+N
1 byte	Hi	Lo	Hi	Lo	Hi	Lo
0x02*N	0xXX	0xXX	0xXX	0xXX	0xXX	0xXX

2) An Example of Response from the Main CPU for a Usual Situation

Table 48: Response Data Format (0x10)

Transaction Identifier		Protocol Identifier		Length		Unit Identifier	Function	Starting Address		Quantity of Output	
byte0	byte1	byte2	byte3	byte4	byte5	byte6	byte7	byte8	byte9	byte10	byte11
Hi	Lo	Hi	Lo	2 byte		1 byte	1 byte	Hi	Lo	Hi	Lo
0xXX	0xXX	0xXX	0xXX	0x06		0xXX	0x10	0x00	0xXX	0x00	0xXX

3) An Example of Response from the Main CPU for an Exceptional Situation

Table 49: Exceptional Response Data Format (0x10)

Transaction Identifier		Protocol Identifier		Length		Unit Identifier	Function	Code of Exception
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	0x90	0xXX

Table 50: Code of Exception (0x10)

Code of Exception	MODBUS Name	Comments
0x01	Illegal Function Code	The function code is unknown by the server
0x02	Illegal Data Address	Dependent on the request
0x03	Illegal Data Value	Dependent on the request
0x04	Server Failure	The server failed during the exaction

APPENDIX B

How to Change Threshold Value of CA1300BW1-5867R-SL

According to a parameter item, placement of the software to rewrite differs.
For the detail please refer to the following list and Table 51.

No. 1-10: Main CPU only
No. 11-22: Main CPU and SUB CPU of DA
No. 23-32: Main CPU and SUB CPU of FA1
No. 33-42: Main CPU and SUB CPU of FA2
No. 43-52: Main CPU and SUB CPU of FA3
No. 53-68: Main CPU and SUB CPU of PS

Attention: All the designated parameter items HAVE TO be changed. Please confirm.

About how to change each parameter, please refer to following pages.
Main CPU: page 82 - 90
DA/FA CPU: page 91 - 97
PS CPU: page 98 - 106

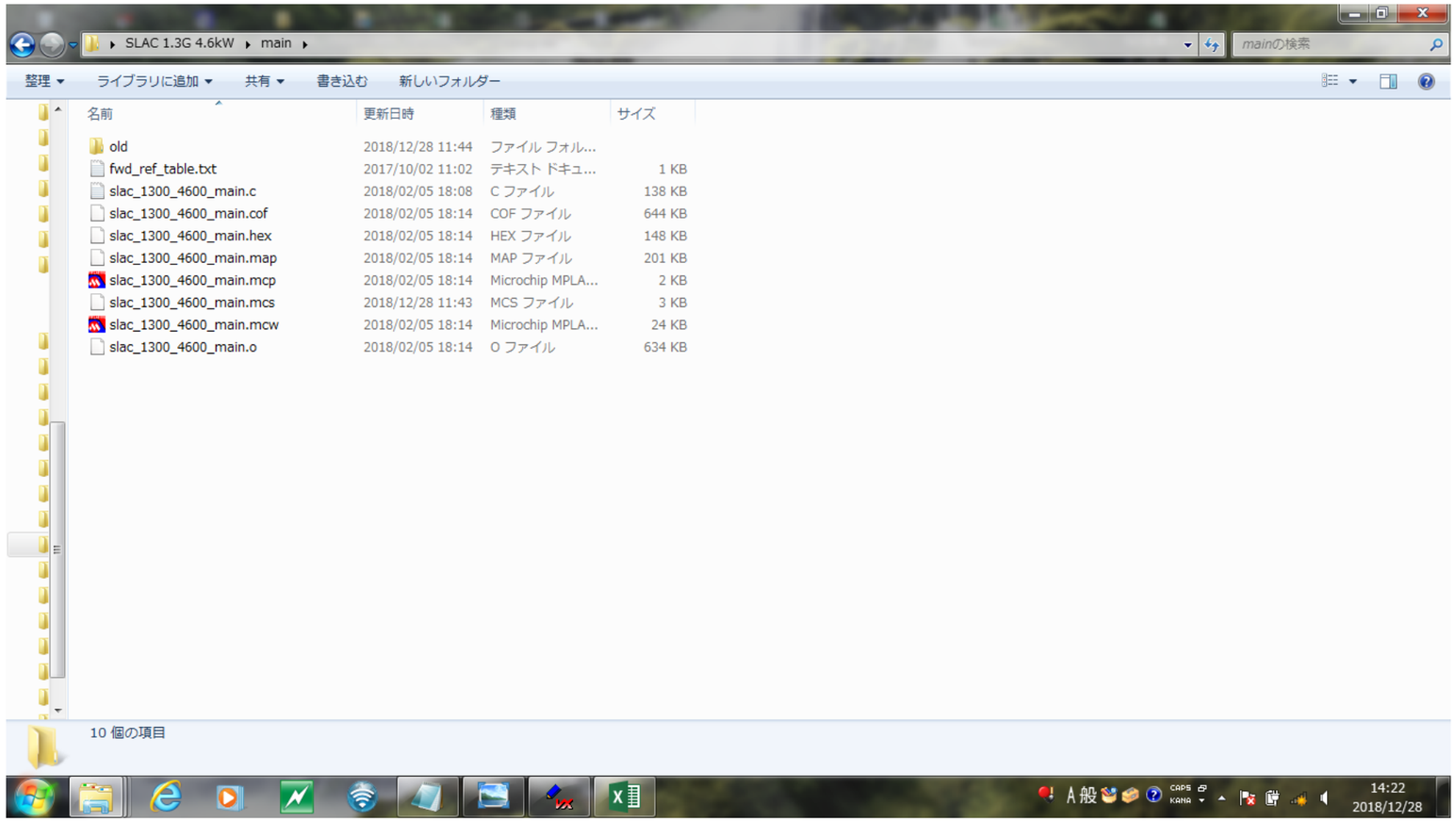
Table 51 Placement to change: ca1300bw1_5867r_sl_main.c *Limit value for "lower" parameter is minimum, and "upper" is maximum number.

	Main CPU			DA CPU		FA CPU		PS CPU	
No.	Line	Limit*	Description	Line	Limit*	Line	Limit* (FA1-FA3)	Line	Limit*
1	4973	mod_buff[128] = 2500;	input upper						
2	4974	mod_buff[129] = 0;	input lower						
3	4975	mod_buff[130] = 4300;	fwd upper						
4	4976	mod_buff[131] = 0;	fwd lower						
5	4977	mod_buff[132] = 500;	ref upper						
6	4978	mod_buff[133] = 0;	ref lower						
7	4979	mod_buff[134] = 600;	rf control temp upper						
8	4980	mod_buff[135] = 100;	rf control temp lower						
9	4981	mod_buff[136] = 11700;	fan1 upper						
10	4982	mod_buff[137] = 6300;	fan1 lower						
11	4983	mod_buff[138] = 30;	da1 current upper	1193	spec[1] = 30;				
12	4984	mod_buff[139] = 5;	da1 current lower	1194	spec[2] = 5;				
13	4985	mod_buff[140] = 115;	da2 current upper	1195	spec[3] = 115;				
14	4986	mod_buff[141] = 0;	da2 current lower	1196	spec[4] = 0;				
15	4987	mod_buff[142] = 140;	da1 voltage upper	1197	spec[5] = 140;				
16	4988	mod_buff[143] = 100;	da1 voltage lower	1198	spec[6] = 100;				
17	4989	mod_buff[144] = 480;	da2 voltage upper	1199	spec[7] = 480;				
18	4990	mod_buff[145] = 100;	da2 voltage lower	1200	spec[8] = 100;				
19	4991	mod_buff[146] = 600;	da unit temp upper	1201	spec[9] = 600;				
20	4992	mod_buff[147] = 100;	da unit temp lower	1202	spec[10] = 100;				
21	4993	mod_buff[148] = 9750;	fan2 upper	1203	spec[11] = 9750;				
22	4994	mod_buff[149] = 5250;	fan2 lower	1204	spec[12] = 5250;				
23	4995	mod_buff[150] = 115;	fa1 current upper			1207	spec[1] = 115;		
24	4996	mod_buff[151] = 0;	fa1 current lower			1208	spec[2] = 0;		
25	4997	mod_buff[152] = 550;	fa1 module pow upper			1209	spec[3] = 550;		
26	4998	mod_buff[153] = 0;	fa1 module pow lower			1210	spec[4] = 0;		
27	4999	mod_buff[154] = 480;	fa1 voltage upper			1211	spec[5] = 480;		
28	5000	mod_buff[155] = 100;	fa1 voltage lower			1212	spec[6] = 100;		
29	5001	mod_buff[156] = 600;	fa1 unit temp upper			1213	spec[7] = 600;		
30	5002	mod_buff[157] = 100;	fa1 unit temp lower			1214	spec[8] = 100;		
31	5003	mod_buff[158] = 9750;	fa1 fan2 upper			1215	spec[9] = 9750;		
32	5004	mod_buff[159] = 5250;	fa1 fan2 lower			1216	spec[10] = 5250;		
33	5005	mod_buff[160] = 115;	fa2 current upper			1207	spec[1] = 115;		
	Main CPU			DA CPU		FA CPU		PS CPU	
34	5006	mod_buff[161] = 0;	fa2 current lower			1208	spec[2] = 0;		
35	5007	mod_buff[162] = 550;	fa2 module pow upper			1209	spec[3] = 550;		
36	5008	mod_buff[163] = 0;	fa2 module pow lower			1210	spec[4] = 0;		
37	5009	mod_buff[164] = 480;	fa2 voltage upper			1211	spec[5] = 480;		
38	5010	mod_buff[165] = 100;	fa2 voltage lower			1212	spec[6] = 100;		
39	5011	mod_buff[166] = 600;	fa2 unit temp upper			1213	spec[7] = 600;		
40	5012	mod_buff[167] = 100;	fa2 unit temp lower			1214	spec[8] = 100;		
41	5013	mod_buff[168] = 9750;	fa2 fan2 upper			1215	spec[9] = 9750;		
42	5014	mod_buff[169] = 5250;	fa2 fan2 lower			1216	spec[10] = 5250;		
43	5015	mod_buff[170] = 115;	fa3 current upper			1207	spec[1] = 115;		
44	5016	mod_buff[171] = 0;	fa3 current lower			1208	spec[2] = 0;		
45	5017	mod_buff[172] = 550;	fa3 module pow upper			1209	spec[3] = 550;		
46	5018	mod_buff[173] = 0;	fa3 module pow lower			1210	spec[4] = 0;		

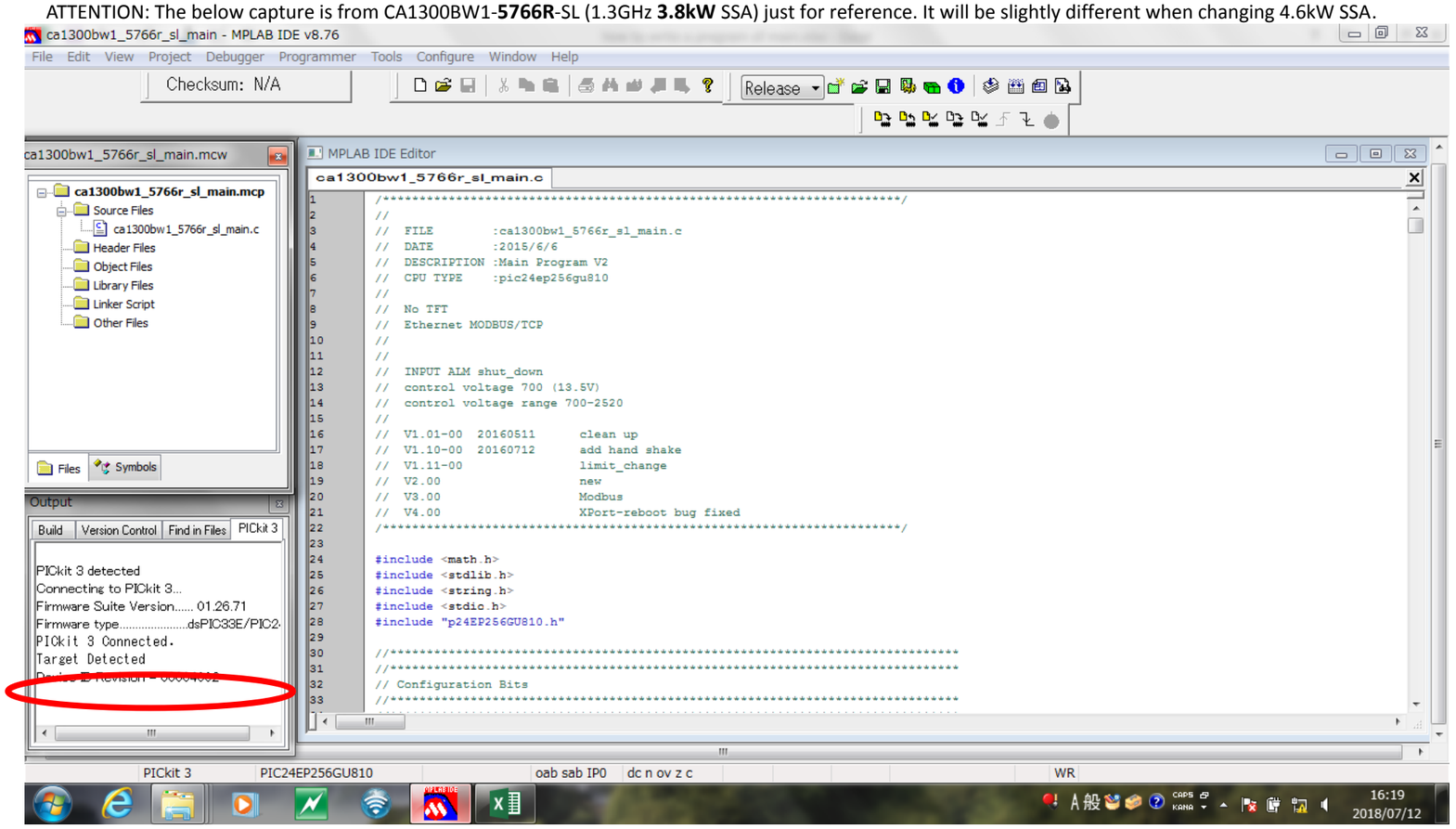
47	5019	mod_buff[174] = 480;	fa3 voltage upper			1211	spec[5] = 480;		
48	5020	mod_buff[175] = 100;	fa3 voltage lower			1212	spec[6] = 100;		
49	5021	mod_buff[176] = 600;	fa3 unit temp upper			1213	spec[7] = 600;		
50	5022	mod_buff[177] = 100;	fa3 unit temp lower			1214	spec[8] = 100;		
51	5023	mod_buff[178] = 9750;	fa3 fan2 upper			1215	spec[9] = 9750;		
52	5024	mod_buff[179] = 5250;	fa3 fan2 lower			1216	spec[10] = 5250;		
53	5025	mod_buff[180] = 600;	ps unit temp upper					1513	spec[1] = 600;
54	5026	mod_buff[181] = 100;	ps unit temp lower					1514	spec[2] = 100;
55	5027	mod_buff[182] = 450;	heat exchanger temp upper					1515	spec[3] = 450;
56	5028	mod_buff[183] = 100;	heat exchanger temp lower					1516	spec[4] = 100;
57	5029	mod_buff[184] = 300;	water flow upper					1517	spec[5] = 300;
58	5030	mod_buff[185] = 100;	water flow lower					1518	spec[6] = 130;
59	5031	mod_buff[186] = 380;	lcw inlet temp upper					1519	spec[7] = 380;
60	5032	mod_buff[187] = 220;	lcw inlet temp lower					1520	spec[8] = 220;
61	5033	mod_buff[188] = 450;	lcw outlet temp upper					1521	spec[9] = 450;
62	5034	mod_buff[189] = 220;	lcw outlet temp lower					1522	spec[10] = 220;
63	5035	mod_buff[190] = 11700;	fan1 upper					1523	spec[11] = 11700;
64	5036	mod_buff[191] = 6300;	fan1 lower					1524	spec[12] = 6300;
65	5037	mod_buff[192] = 9750;	fan2 upper					1525	spec[13] = 9750;
66	5038	mod_buff[193] = 5250;	fan2 lower					1526	spec[14] = 5250;
67	5039	mod_buff[194] = 4810;	fan3 upper					1527	spec[15] = 4810;
68	5040	mod_buff[195] = 2590;	fan3 lower					1528	spec[16] = 2590;

How to Modify Threshold Parameters of Main CPU

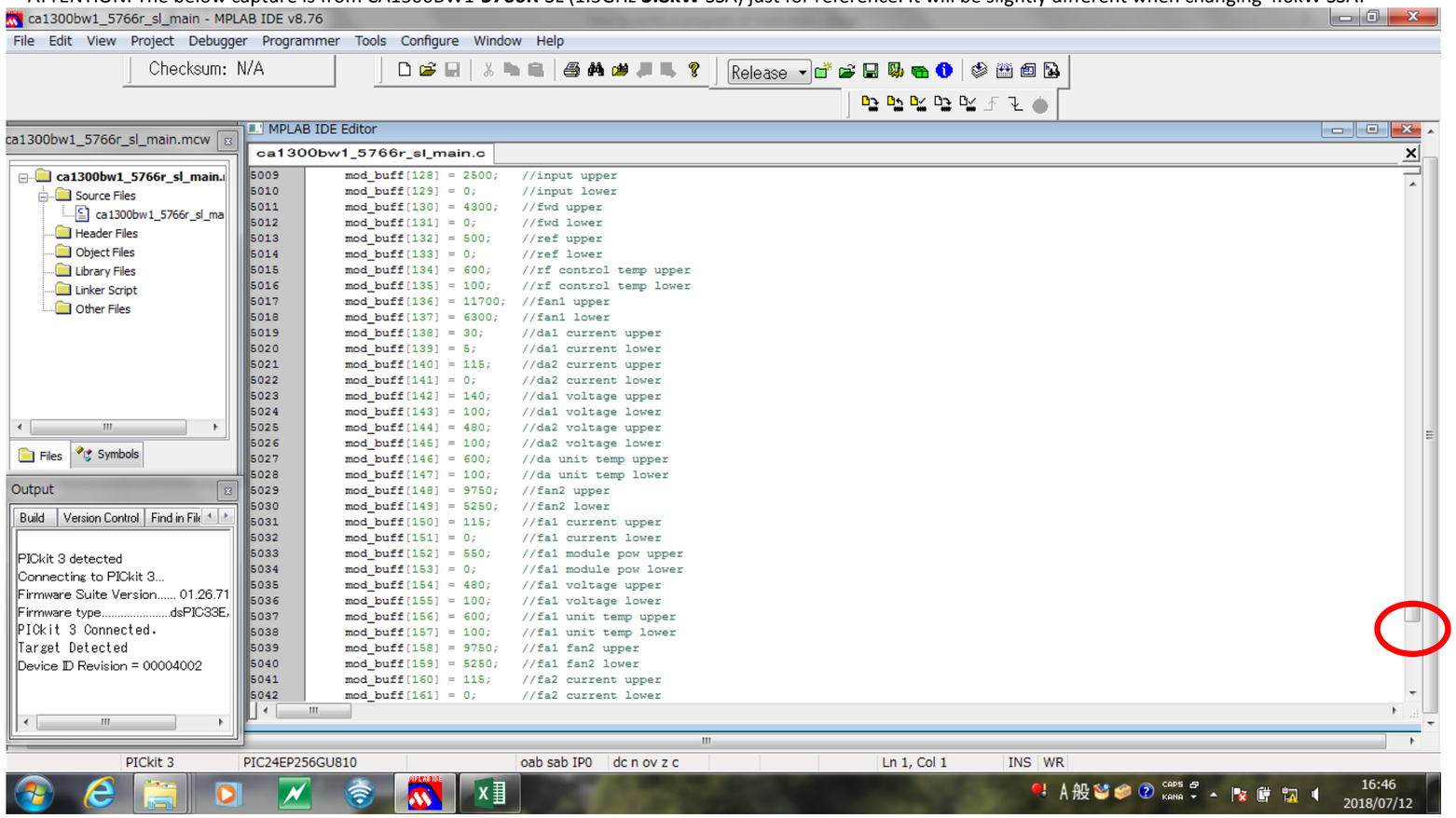
①Remove the DEBUG cover at the front panel of the control unit, so you can connect a jig cable to the leftmost connector.
②Connect the other end of the jig cable to Pickit 3.
③Connect a USB cable between the Pickit 3 and your PC.
④Open up the SLAC 1.3G 4.6kW folder on your PC.
⑤Open up the main folder in the 4.6kW folder.
⑥Turn AC120V power of the SSA on.
⑦Double-click "slac_1300_4600_main.mcp" in the main folder. (as shown in the below capture)


SLAC 1.3G 4.6kW ▸ main ▸
mainの検索
整理
ライブラリに追加
共有
書き込む
新しいフォルダー
名前
更新日時
種類
サイズ
old 2018/12/28 11:44 ファイル フォル...
fwd_ref_table.txt 2017/10/02 11:02 テキスト ドキュ... 1 KB
slac_1300_4600_main.c 2018/02/05 18:08 C ファイル 138 KB
slac_1300_4600_main.cof 2018/02/05 18:14 COF ファイル 644 KB
slac_1300_4600_main.hex 2018/02/05 18:14 HEX ファイル 148 KB
slac_1300_4600_main.map 2018/02/05 18:14 MAP ファイル 201 KB
slac_1300_4600_main.mcp 2018/02/05 18:14 Microchip MPLA... 2 KB
slac_1300_4600_main.mcs 2018/12/28 11:43 MCS ファイル 3 KB
slac_1300_4600_main.mcw 2018/02/05 18:14 Microchip MPLA... 24 KB
slac_1300_4600_main.o 2018/02/05 18:14 O ファイル 634 KB
10 個の項目
14:22
2018/12/28

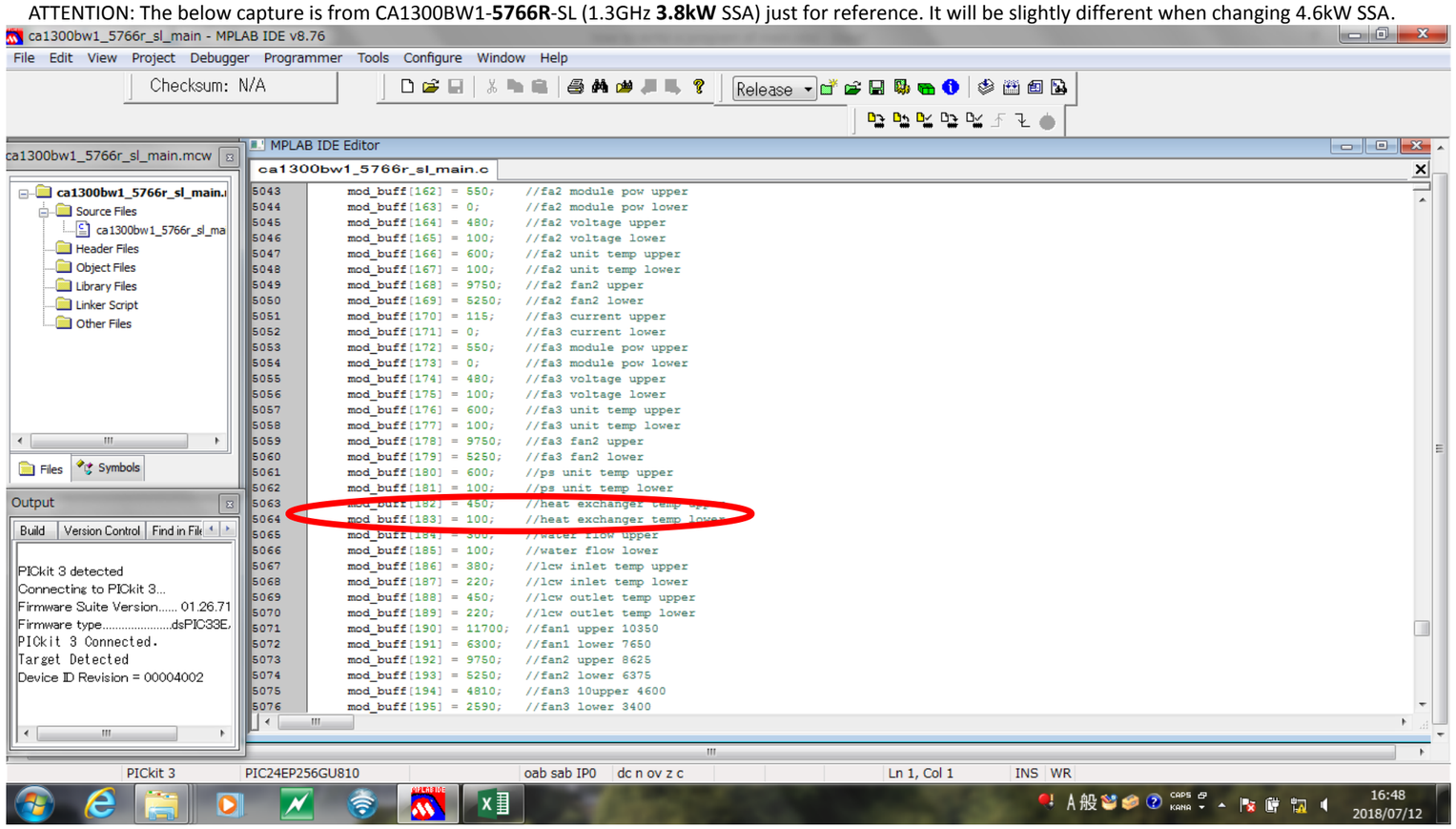
⑧MPLAB IDE starts its application. (confirm its version is Ver8.76)
⑨Confirm Device ID Revision is showing on the red circled place on the below capture.
ATTENTION: The below capture is from CA1300BW1-**5766R**-SL (1.3GHz **3.8kW** SSA) just for reference. It will be slightly different when changing 4.6kW SSA.



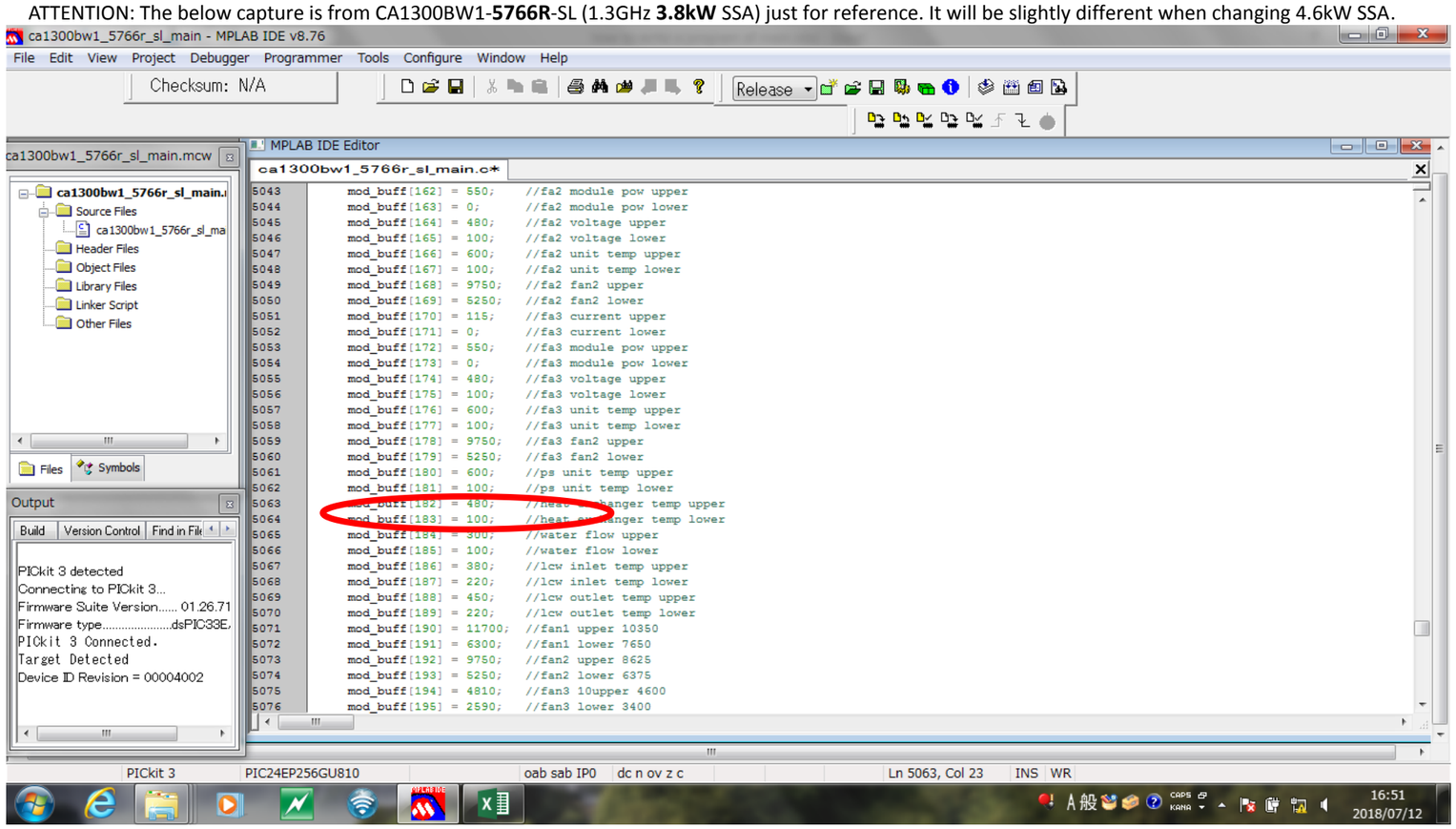
⑩Threshold parameters are listed from Line 4973 (modbus address: 128) to Line 5040 (modbus address: 195).
You can see rough placement of Line 4973 (modbus address: 128) in the below capture. (refer to the red circle)
For the Line vs Modbus address table, please refer to page 80 – 81 (Table 51) of this document.
ATTENTION: The below capture is from CA1300BW1-**5766R**-SL (1.3GHz **3.8kW** SSA) just for reference. It will be slightly different when changing 4.6kW SSA.



⑪<EXAMPLE> How to change the threshold parameter of Temperature of the Heat Exchanger from 45 degC to 48 degC.
Temperature of the Heat Exchanger of CA1300BW1-5867R-SL (1.3GHz 4.6W) is listed on Line 5027 (modbus address 182).
For the Line vs Modbus address table, please refer to page 80 – 81 (Table 51) of this document.
ATTENTION: The below capture is from CA1300BW1-**5766R**-SL (1.3GHz **3.8kW** SSA) just for reference. It will be slightly different when changing 4.6kW SSA.

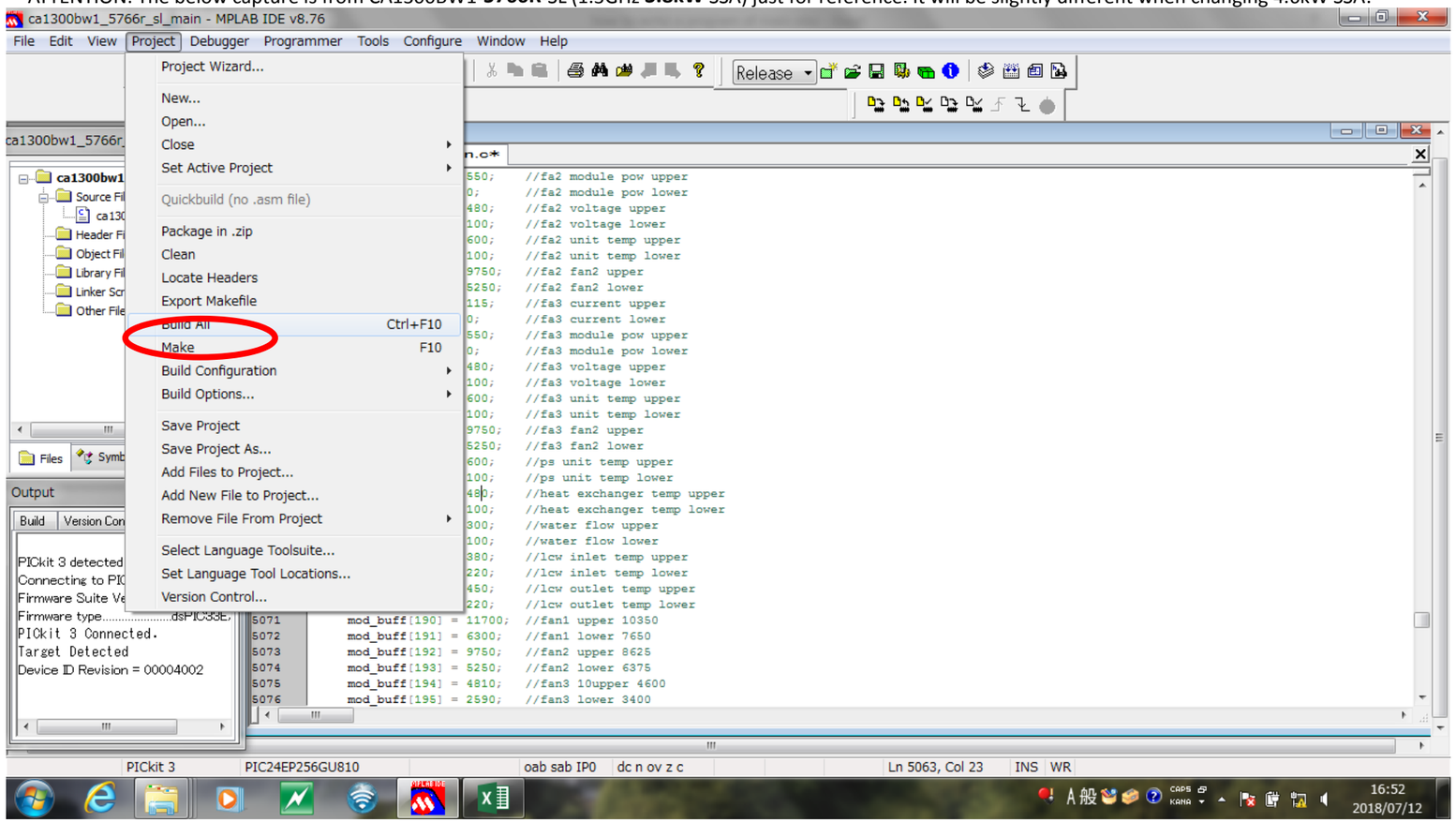


⑫Temperature of the Heat Exchanger is listed on Line 5027 (modbus address: 182).
⑬450 means 45.0 degC. To change it to 48.0 degC, change the number from 450 to 480. (About the difference between listed numbers vs actual data, please refer to table 51)
⑭Threshold parameter is changed as the below capture.
ATTENTION: The below capture is from CA1300BW1-**5766R**-SL (1.3GHz **3.8kW** SSA) just for reference. It will be slightly different when changing 4.6kW SSA.



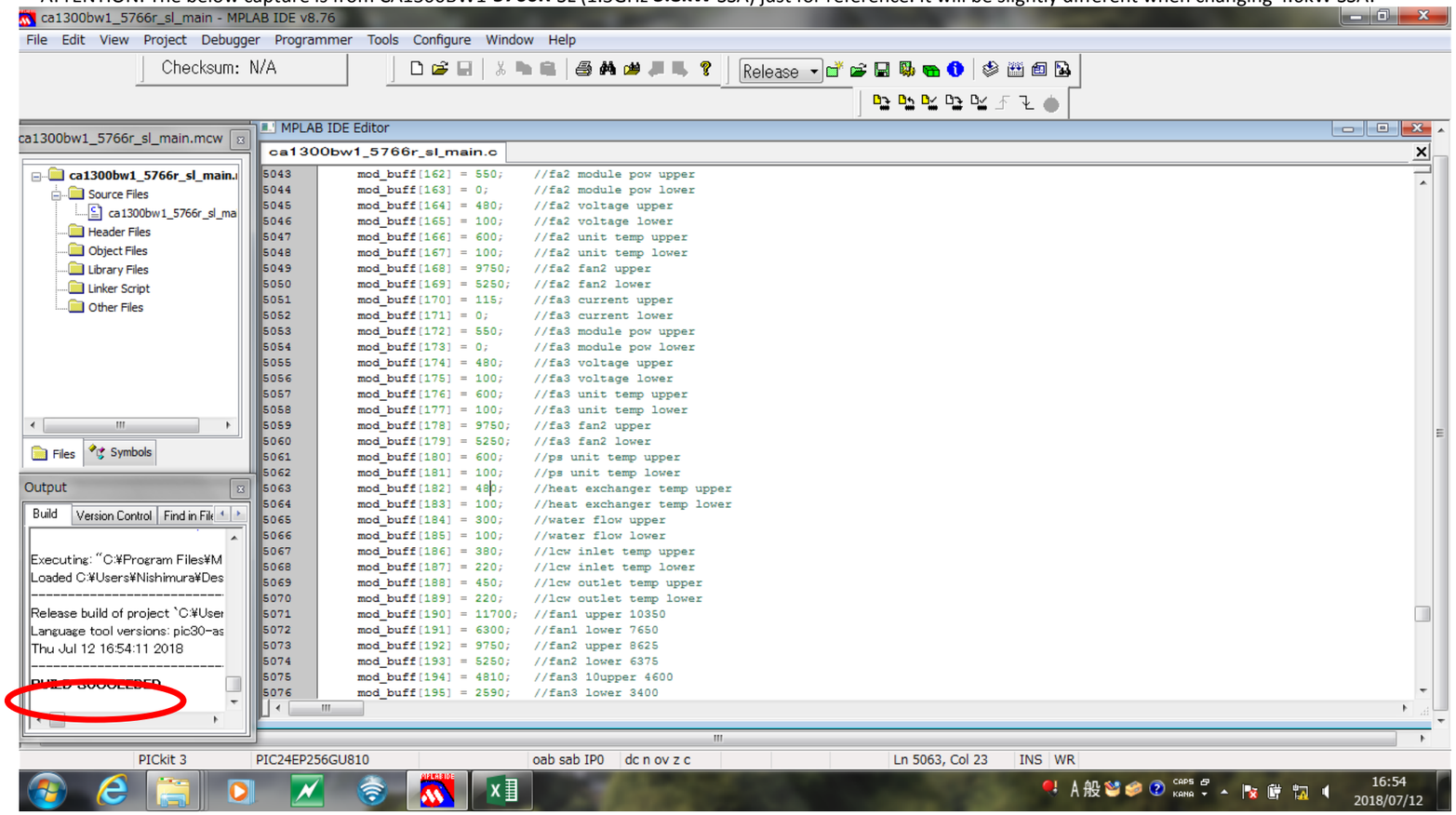
⑮Click on "Build All" under "Project" as the below capture.

ATTENTION: The below capture is from CA1300BW1-**5766R**-SL (1.3GHz **3.8kW** SSA) just for reference. It will be slightly different when changing 4.6kW SSA.



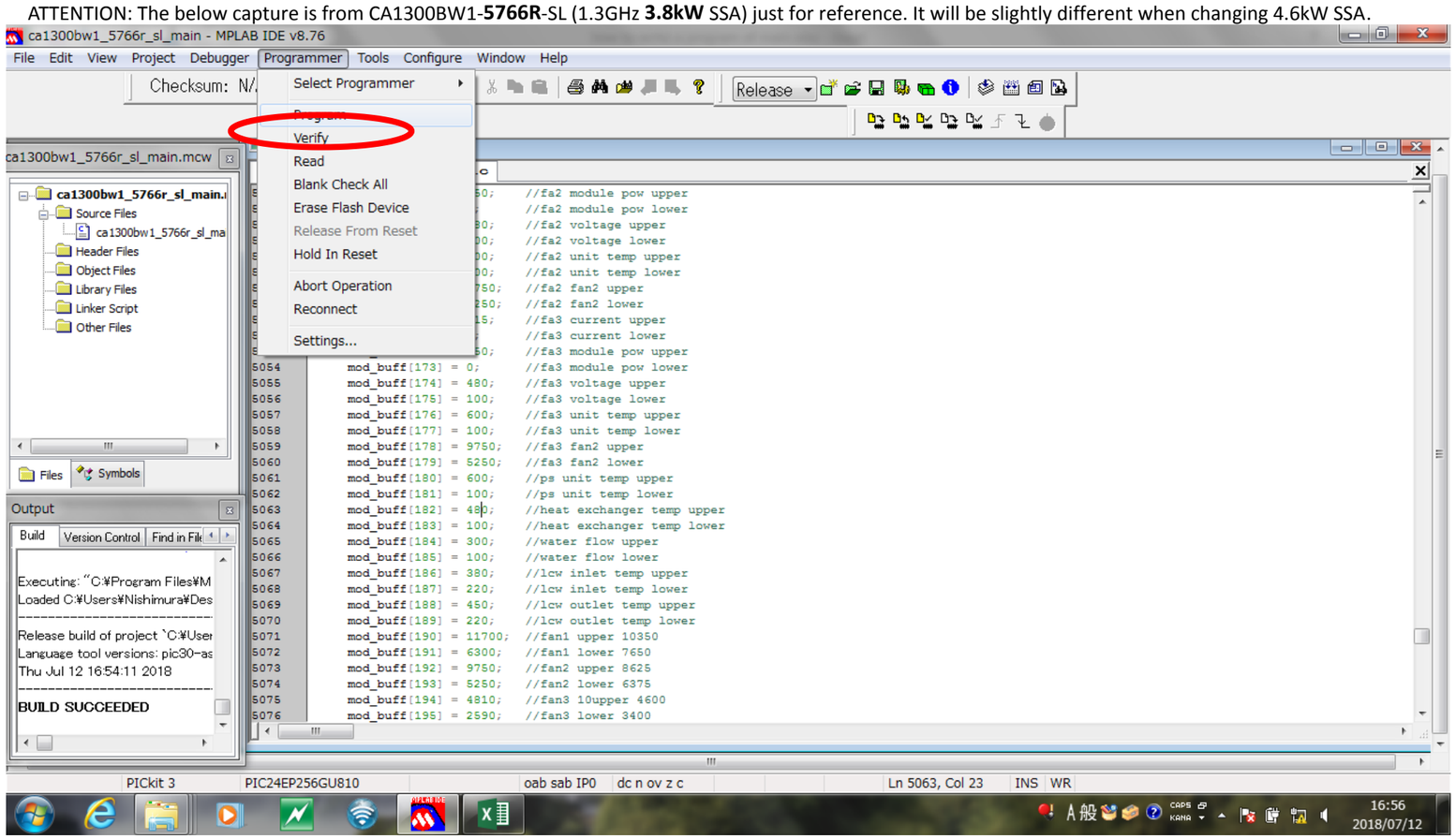
⑯Confirm “BUILD SUCCEEDED” is showing as on the below capture.

ATTENTION: The below capture is from CA1300BW1-**5766R**-SL (1.3GHz **3.8kW** SSA) just for reference. It will be slightly different when changing 4.6kW SSA.

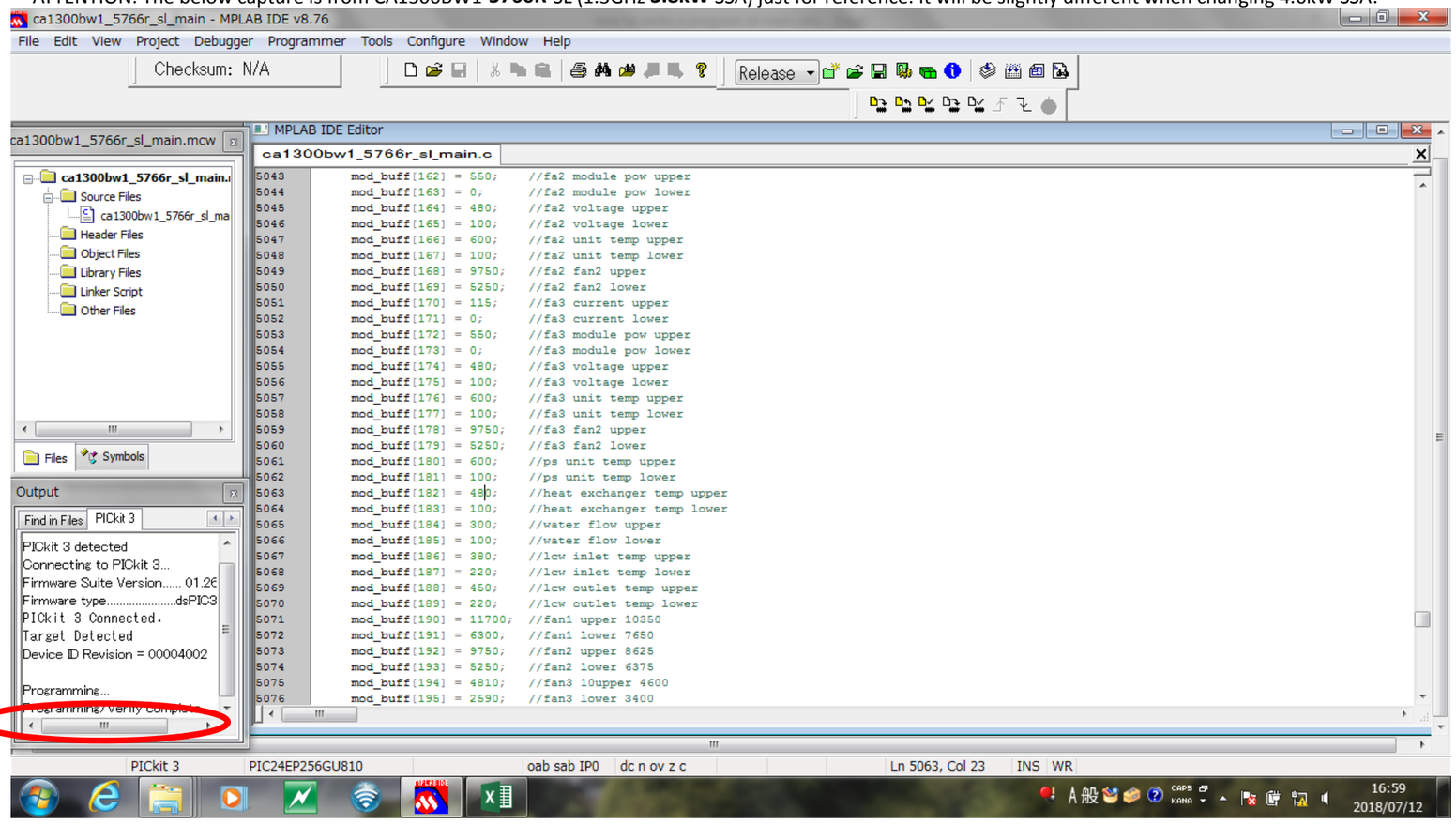


⑰Click on "Program" under "Programmer" as the below capture.

ATTENTION: The below capture is from CA1300BW1-**5766R**-SL (1.3GHz **3.8kW** SSA) just for reference. It will be slightly different when changing 4.6kW SSA.

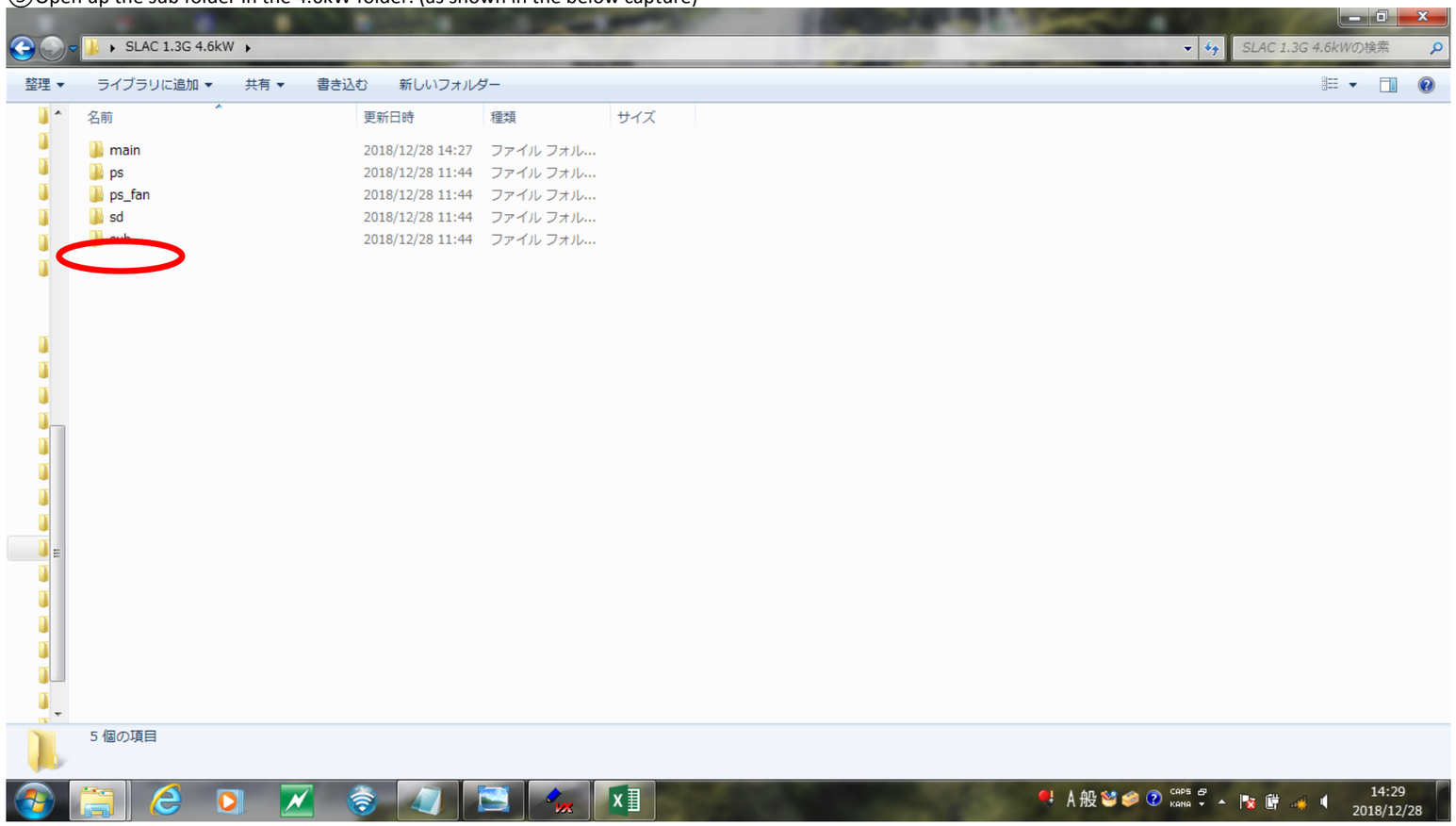


⑱Modification is completed if you see "Programing/Verify complete" as the below capture.
Attention: PS CPU has to be modified also. Please don't forget. (for Heat Exchanger case)
For the detailed information of what part of the software has to be modified, please refer to Table 51.
⑲Close MPLAB IDE, then remove the jig cable.
⑳Turn the AC120V power of SSA off.
ATTENTION: The below capture is from CA1300BW1-**5766R**-SL (1.3GHz **3.8kW** SSA) just for reference. It will be slightly different when changing 4.6kW SSA.

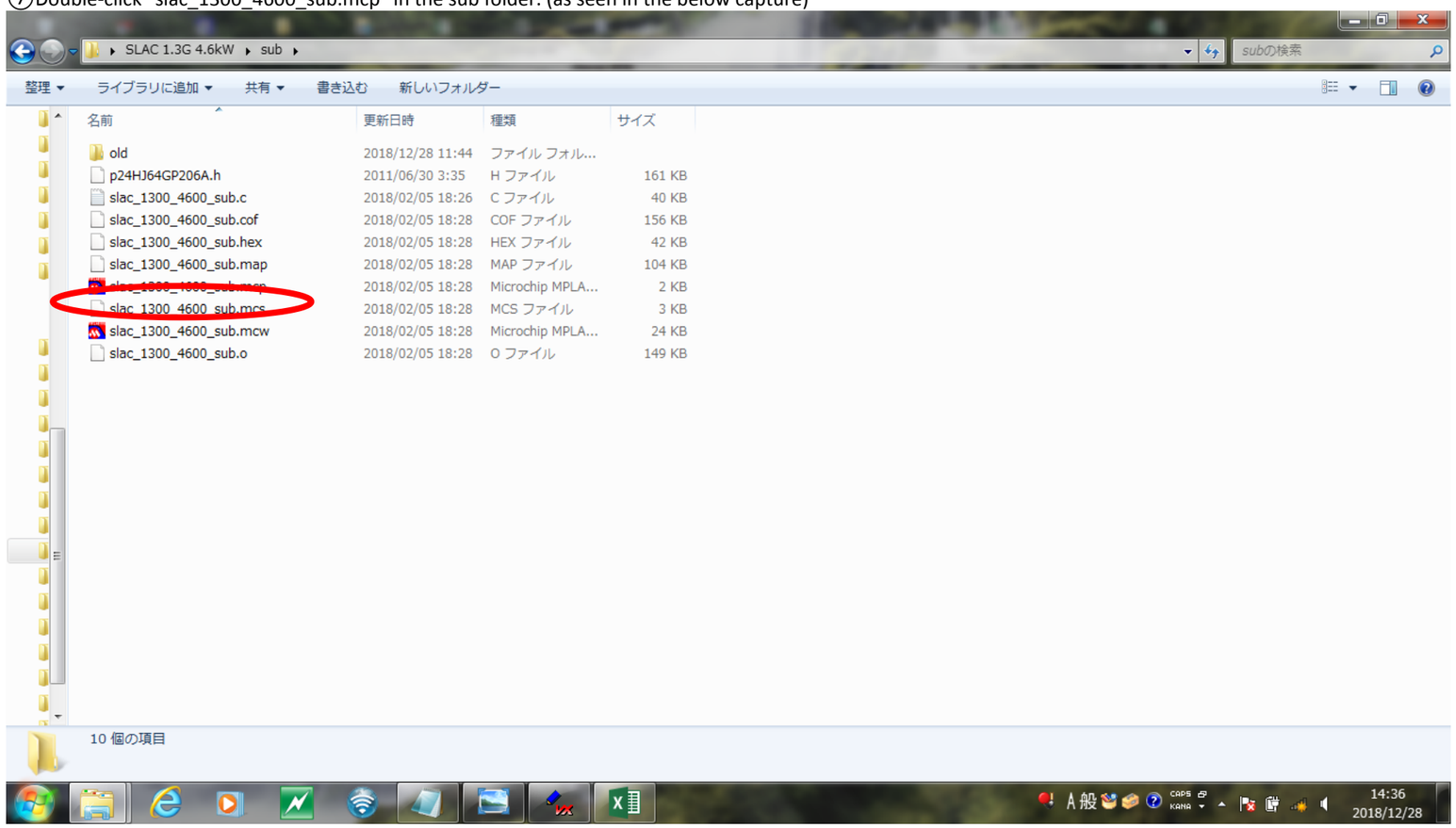


How to Modify Threshold Parameters of DA/FA CPU

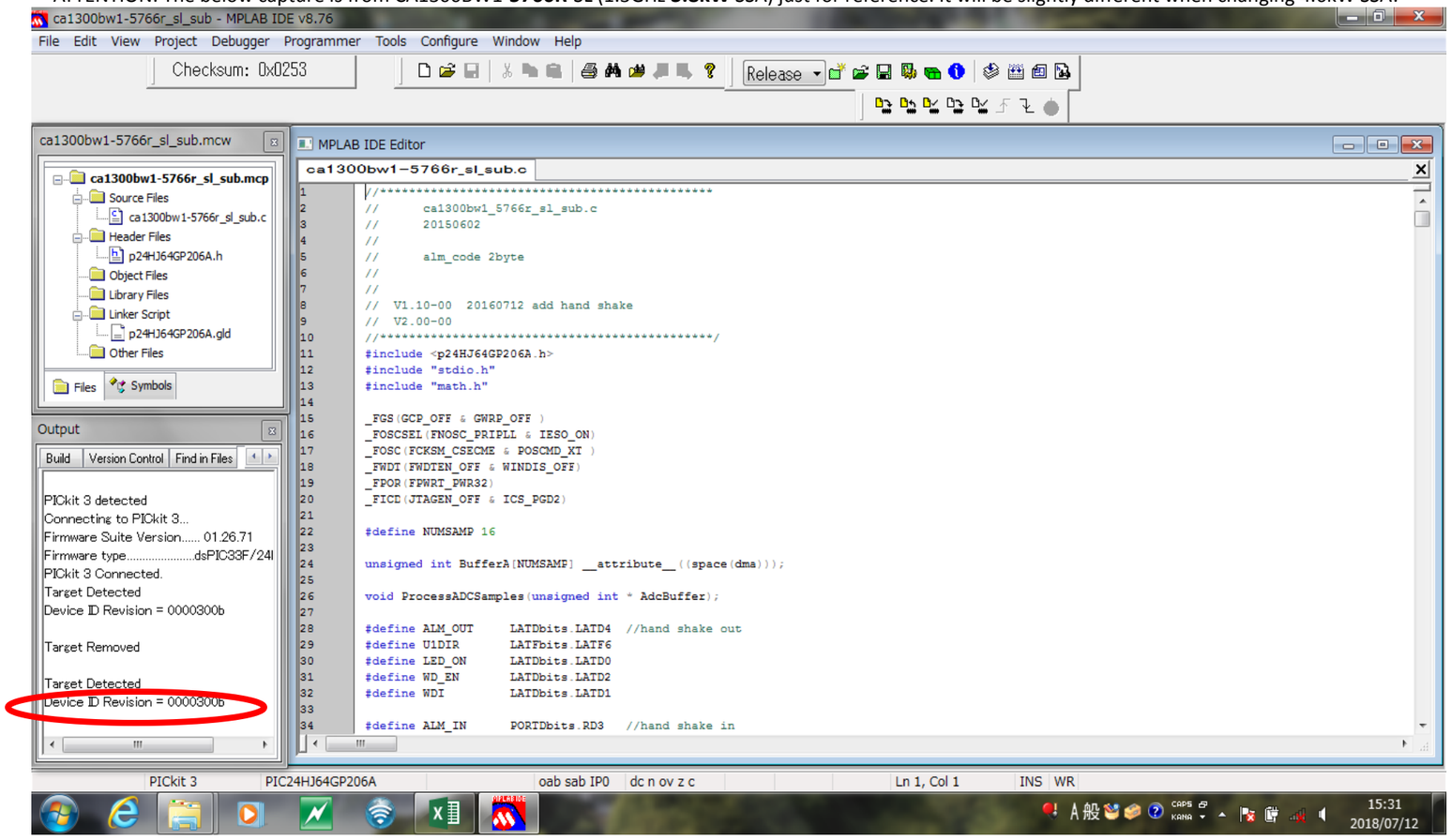
①Connect the jig cable to the DEBUG terminal (D-SUB 9pin) at the rear panel of the DA/FA unit.
②Connect the other end of the jig cable to a Pickit 3.
③Connect a USB cable between the Pickit 3 and your PC.
④Open up the SLAC 1.3G 4.6kW folder on your PC.
⑤Open up the sub folder in the 4.6kW folder. (as shown in the below capture)



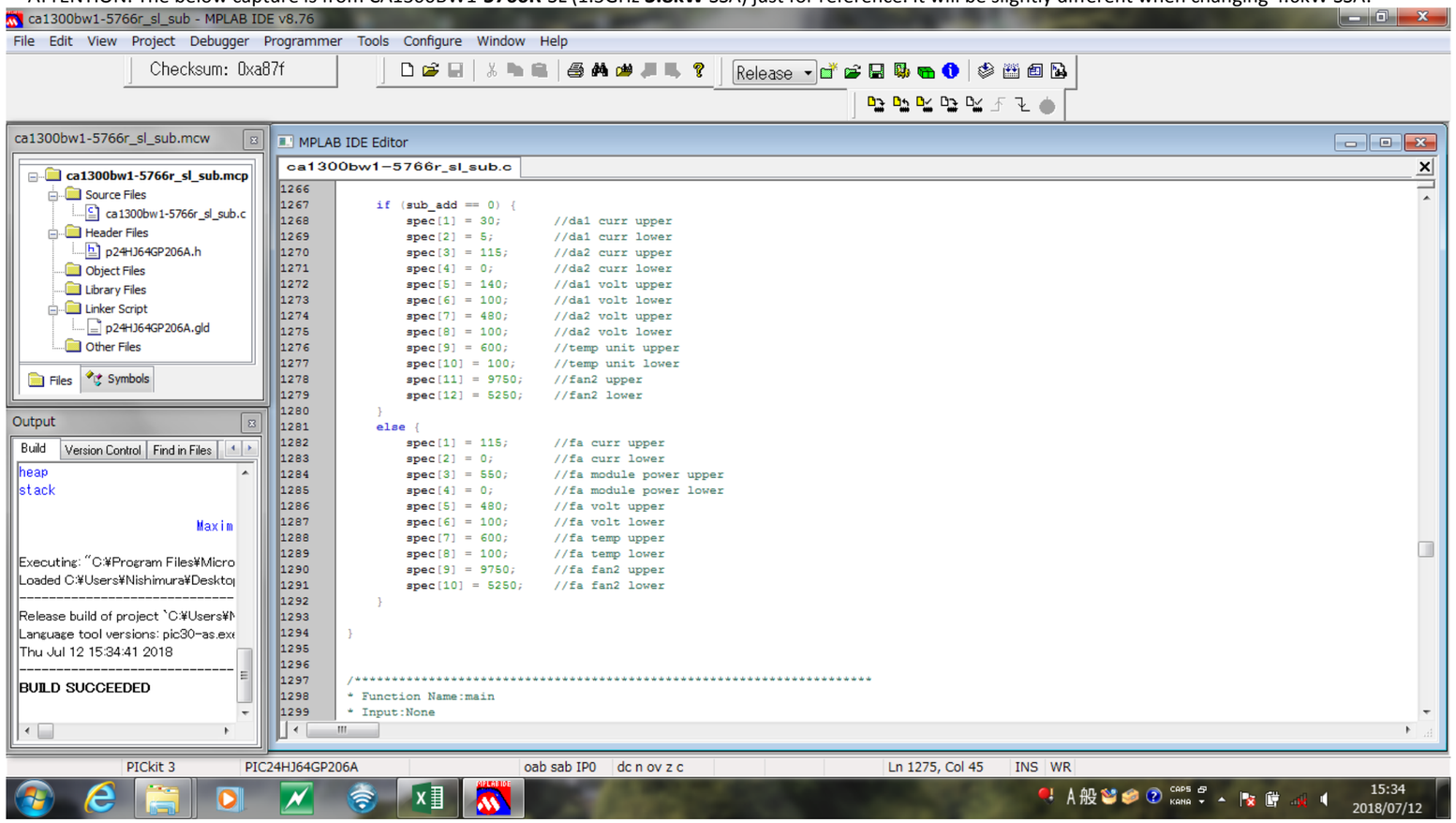
⑥Turn AC120V power of the SSA on.
⑦Double-click "slac_1300_4600_sub.mcp" in the sub folder. (as seen in the below capture)



⑧MPLAB IDE starts its application. (confirm its version is Ver8.76)
⑨Confirm Device ID Revision is showing on the red circled place on the below capture.
ATTENTION: The below capture is from CA1300BW1-**5766R**-SL (1.3GHz **3.8kW** SSA) just for reference. It will be slightly different when changing 4.6kW SSA.

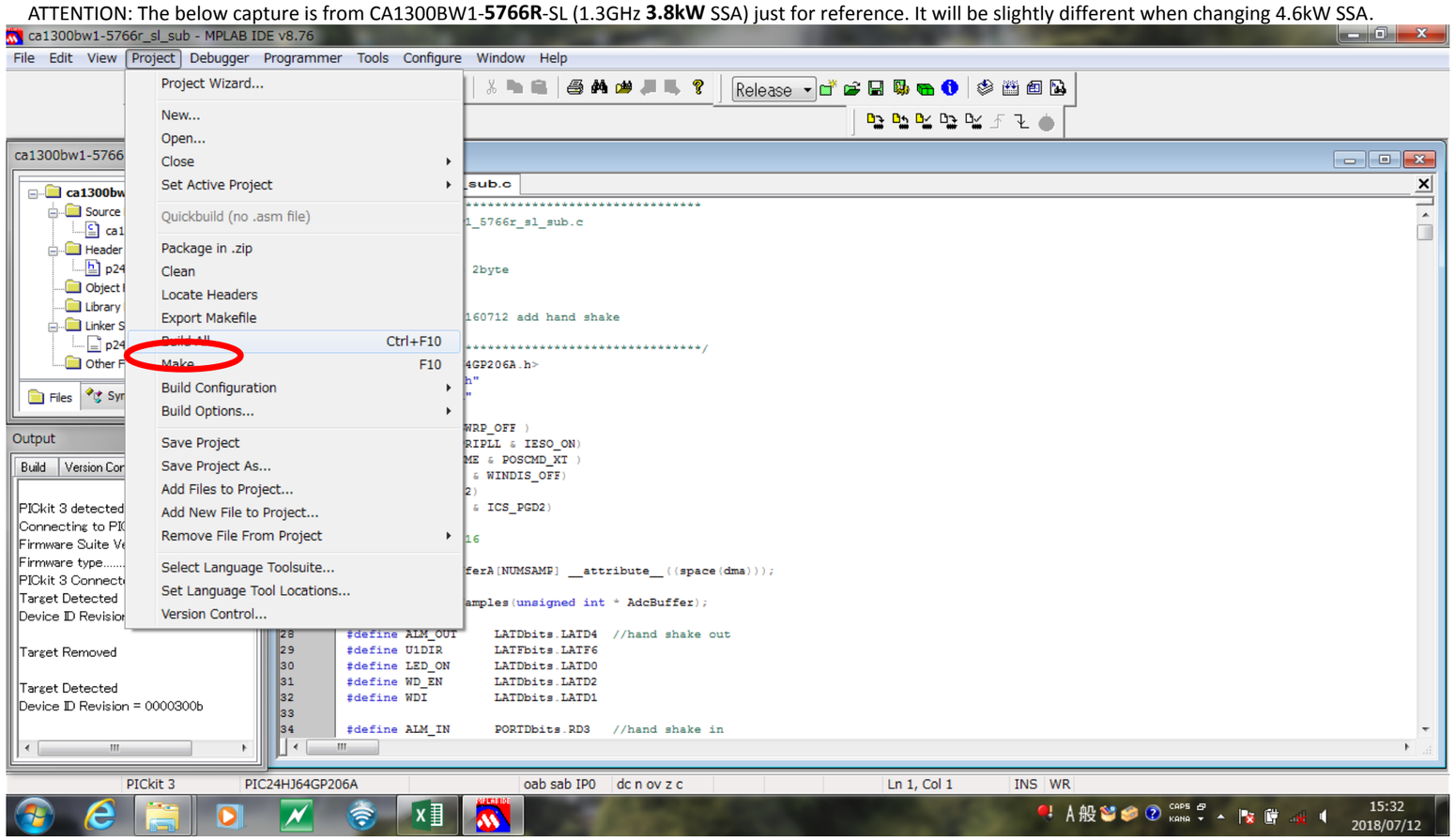


⑩Threshold parameters of DA are listed from Line 1193 (modbus address: 1) to Line 1204 (modbus address: 12).
Threshold parameters of FA are listed from Line 1207 (modbus address: 1) to Line 1216 (modbus address: 10).
⑪Change the number corresponding to the changing parameter. (refer to Table 51)
ATTENTION: The below capture is from CA1300BW1-**5766R**-SL (1.3GHz **3.8kW** SSA) just for reference. It will be slightly different when changing 4.6kW SSA.



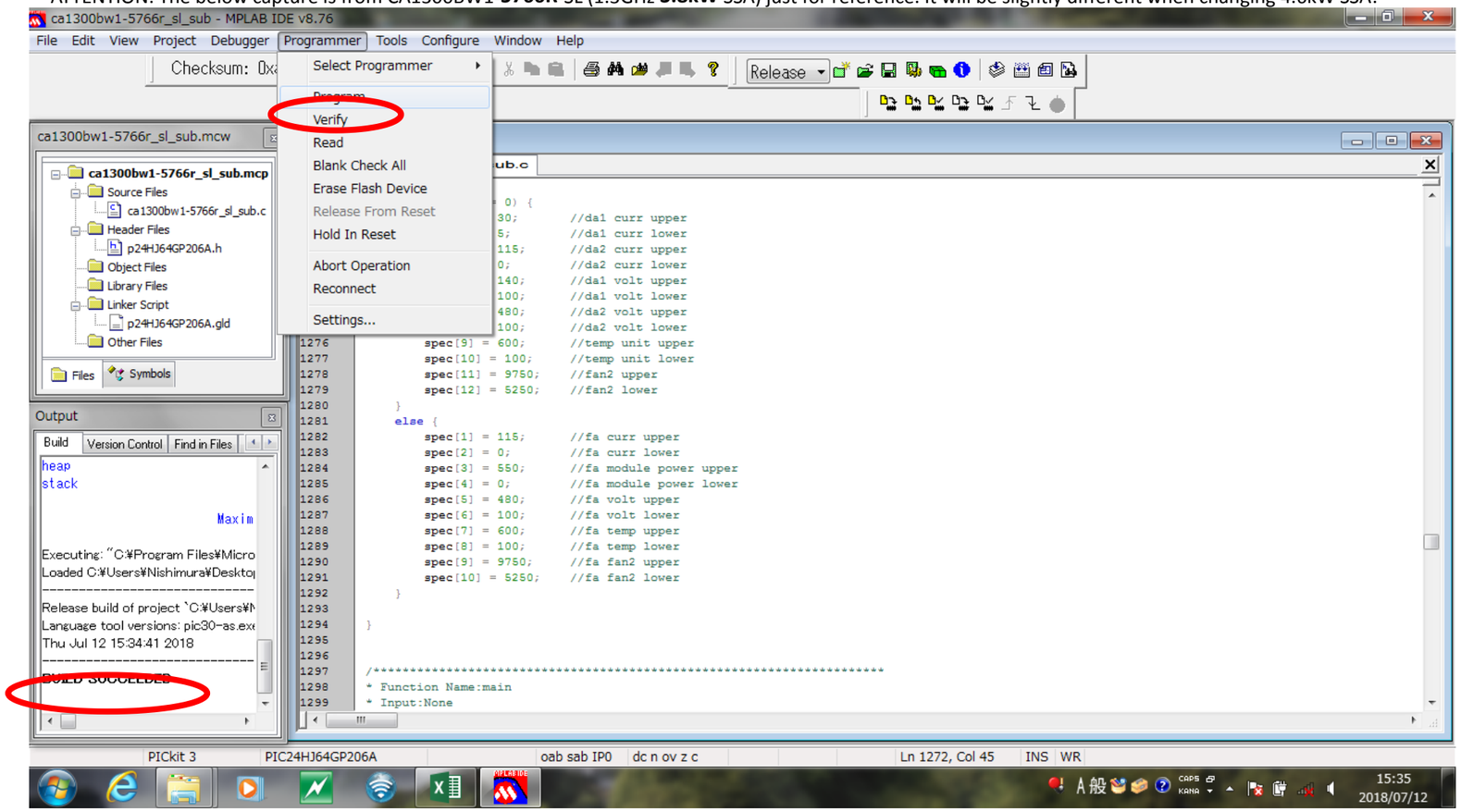
⑫Click on "Build All" under "Project" as the below capture.

ATTENTION: The below capture is from CA1300BW1-**5766R**-SL (1.3GHz **3.8kW** SSA) just for reference. It will be slightly different when changing 4.6kW SSA.

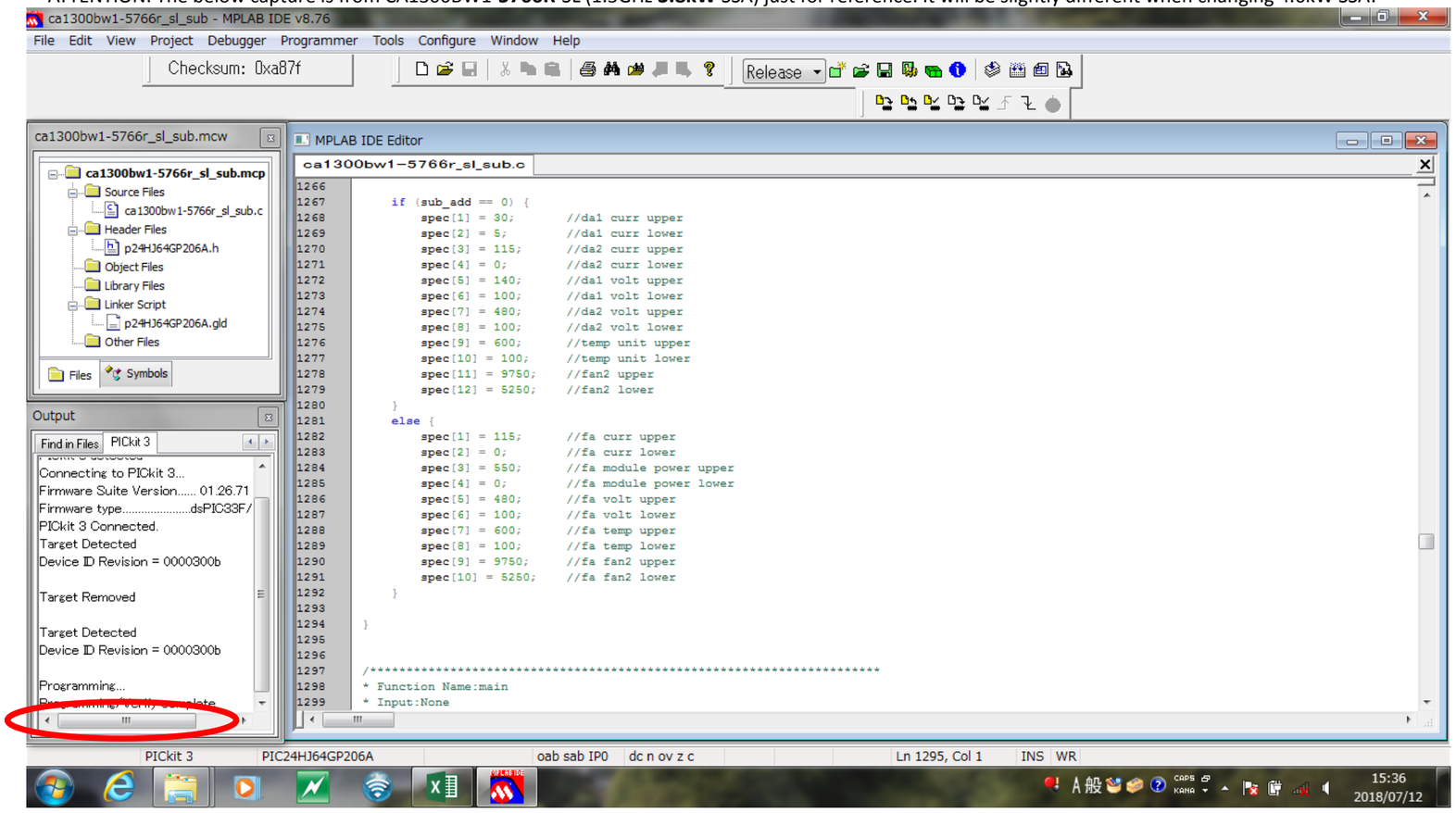


⑬Confirm “BUILD SUCCEEDED” is showing as on the below capture. Then, Click on "Program" under "Programmer" as the below capture.

ATTENTION: The below capture is from CA1300BW1-**5766R**-SL (1.3GHz **3.8kW** SSA) just for reference. It will be slightly different when changing 4.6kW SSA.

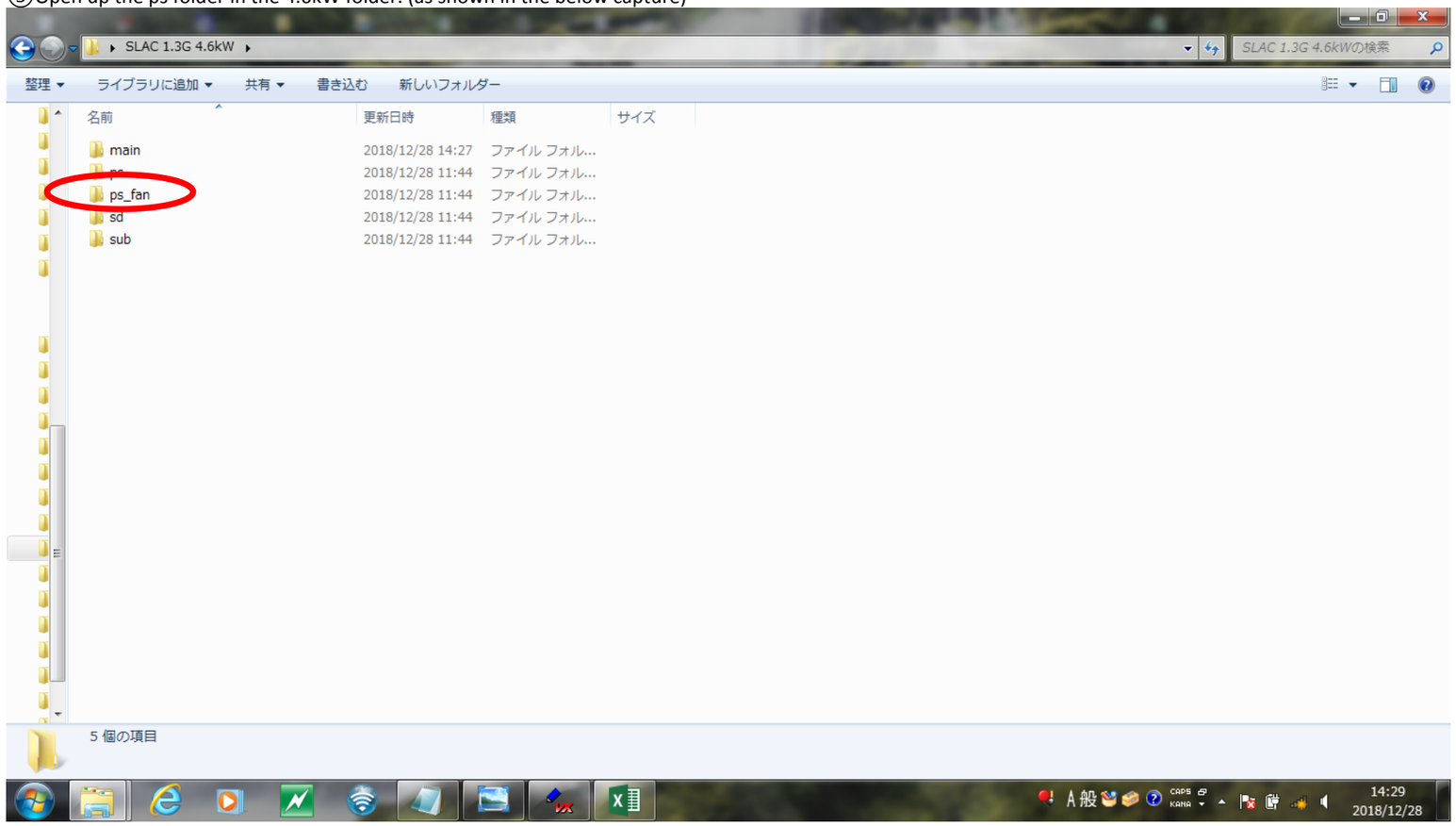


⑭Modification is completed if you see "Programing/Verify complete" as the below capture.
⑮Close MPLAB IDE, then remove the jig cable.
⑯Turn the AC120V power of SSA off.
ATTENTION: The below capture is from CA1300BW1-**5766R**-SL (1.3GHz **3.8kW** SSA) just for reference. It will be slightly different when changing 4.6kW SSA.

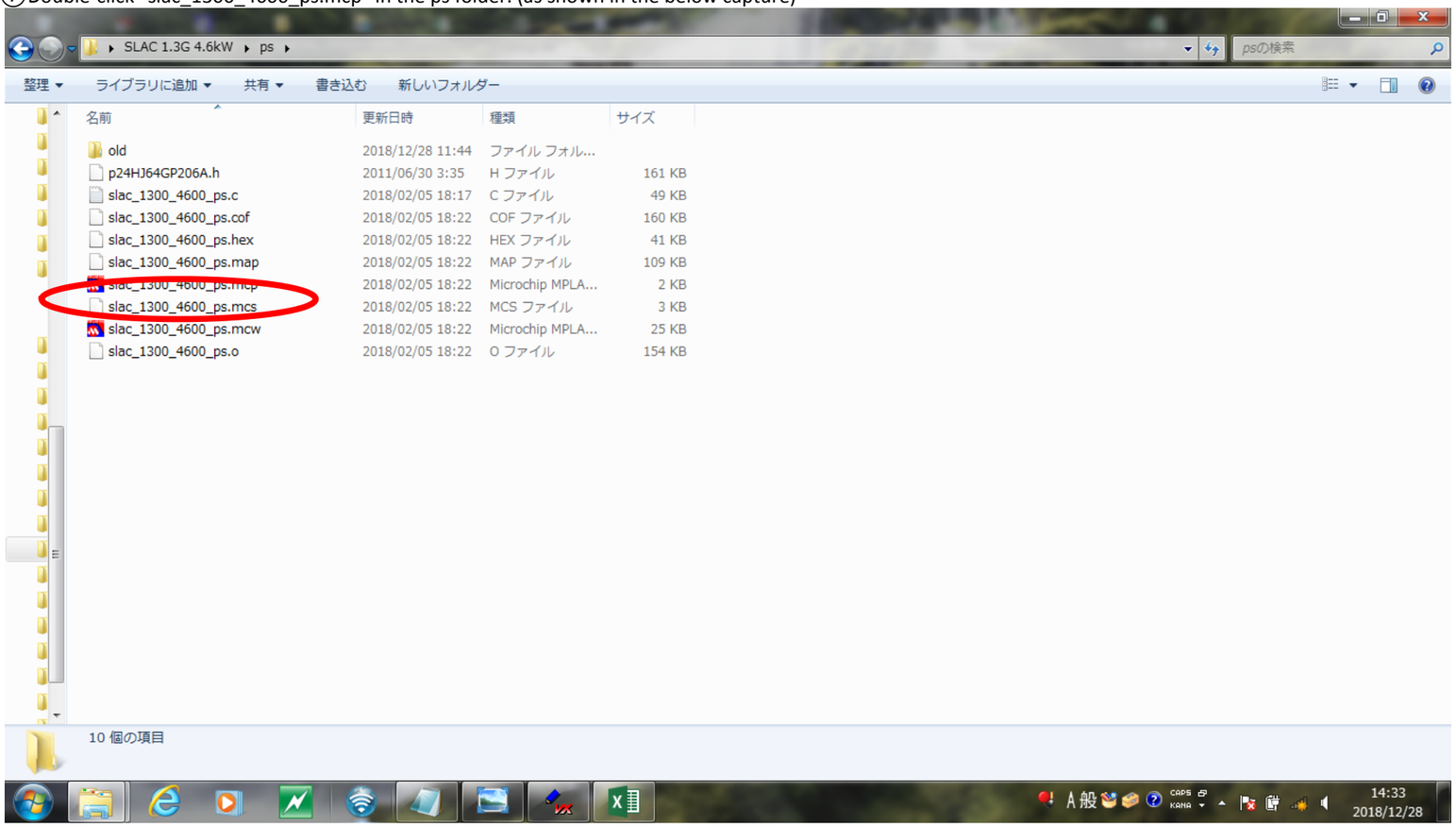


How to Modify Threshold Parameters of PS CPU

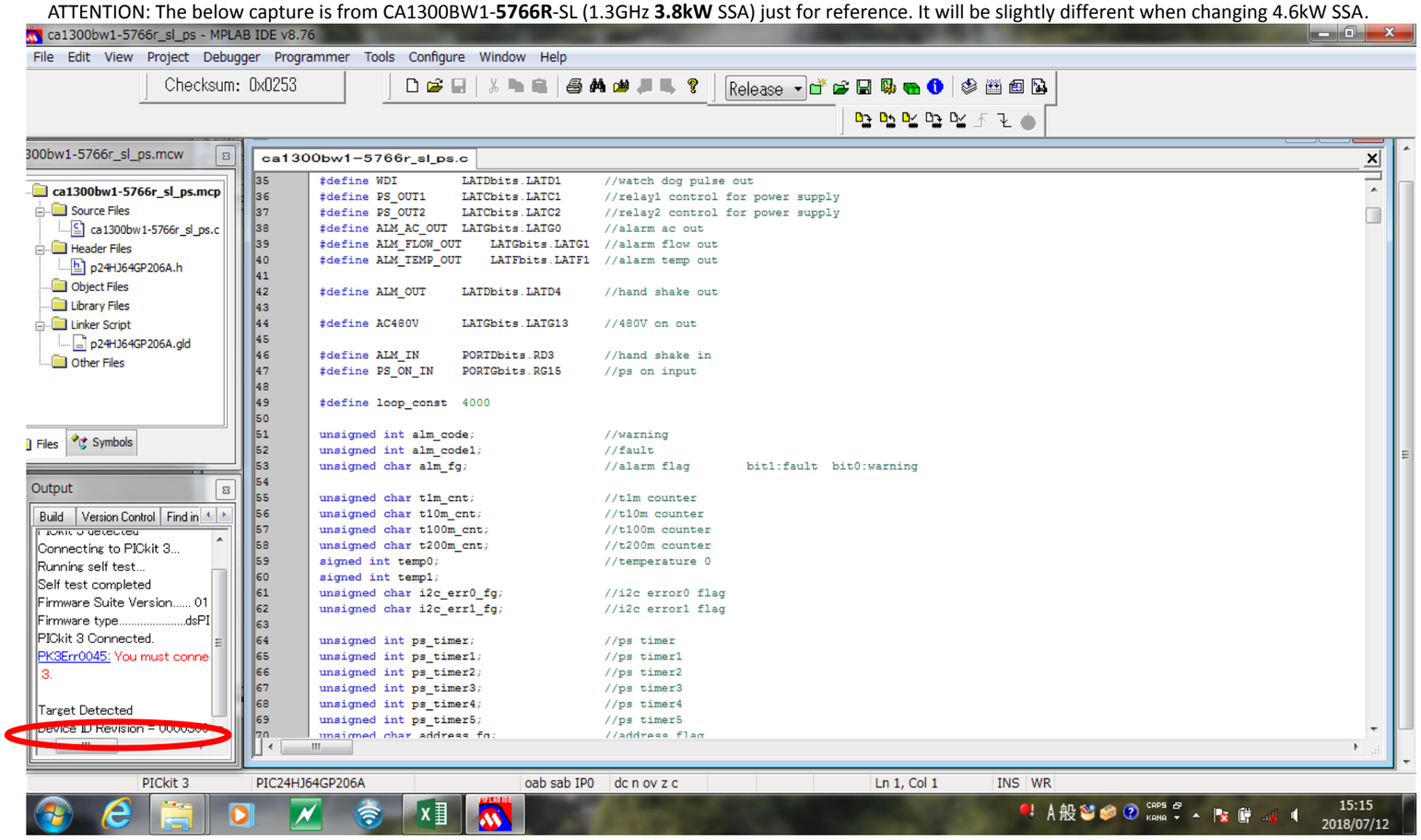
①Connect the jig cable to the DEBUG terminal (D-SUB 9pin) at the rear panel of the PS unit.
②Connect the other end of the jig cable to a Pickit 3.
③Connect a USB cable between the Pickit 3 and your PC.
④Open up the SLAC 1.3G 4.6kW folder on your PC.
⑤Open up the ps folder in the 4.6kW folder. (as shown in the below capture)



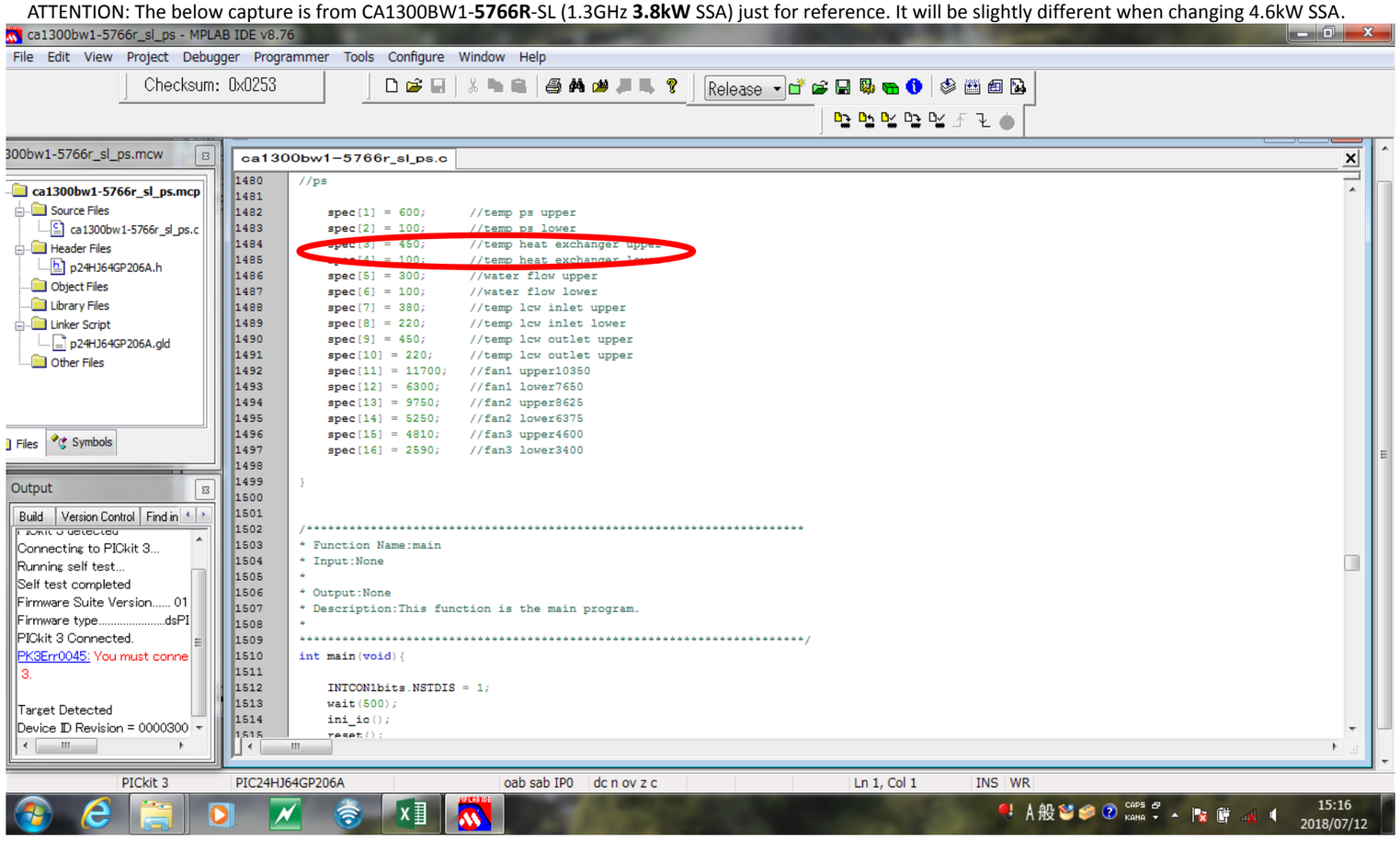
⑥Turn AC120V power of the SSA on.
⑦Double-click "slac_1300_4600_ps.mcp" in the ps folder. (as shown in the below capture)



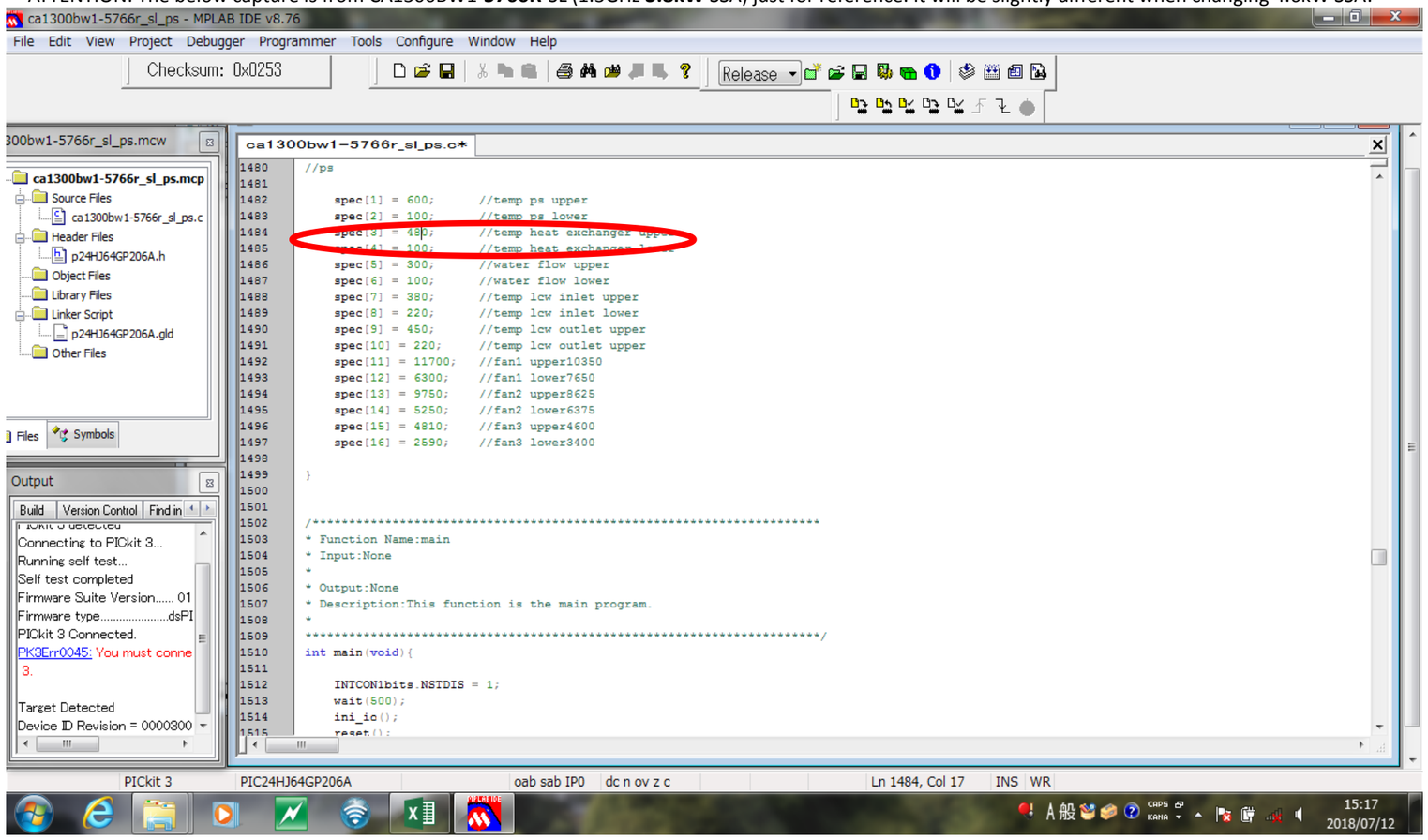
⑧MPLAB IDE starts its application. (confirm its version is Ver8.76)
⑨Confirm Device ID Revision is showing on the red circled place on the below capture.
ATTENTION: The below capture is from CA1300BW1-**5766R**-SL (1.3GHz **3.8kW** SSA) just for reference. It will be slightly different when changing 4.6kW SSA.



⑩Threshold parameters are listed from Line 1513 (modbus address: 1) to Line 1528 (modbus address: 16).
For the Line vs Modbus address table, please refer to page 80 – 81 (Table 51) of this document.
ATTENTION: The below capture is from CA1300BW1-**5766R**-SL (1.3GHz **3.8kW** SSA) just for reference. It will be slightly different when changing 4.6kW SSA.

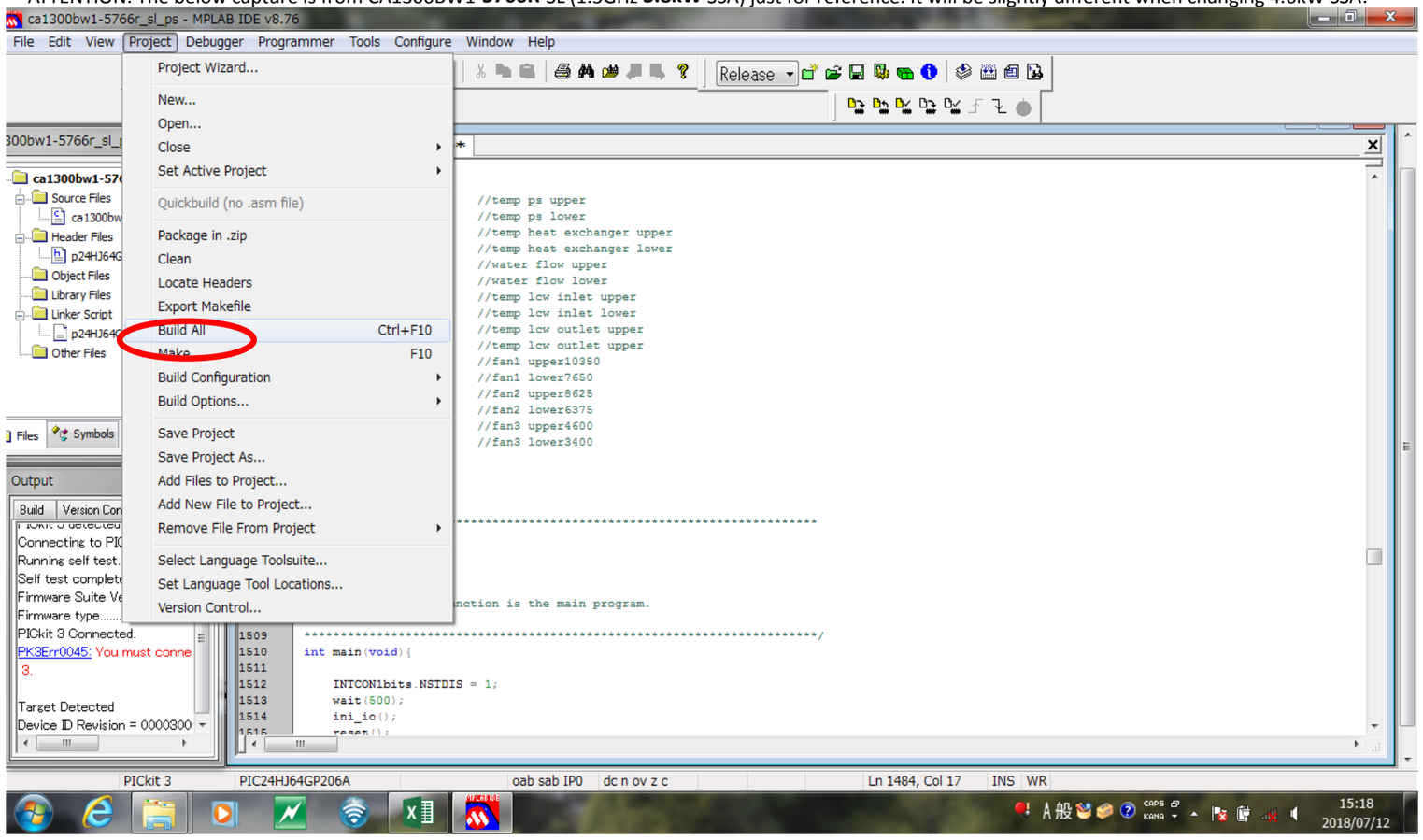


⑪ <EXAMPLE> How to change the threshold parameter of Temperature of the Heat Exchanger from 45 degC to 48 degC.
⑫Temperature of the Heat Exchanger is listed on Line 1515 (modbus address: 3).
⑬450 means 45.0 degC. To change it to 48.0 degC, change the number from 450 to 480. (About the difference between listed numbers vs actual data, please refer to table 51)
⑭Threshold parameter is changed as the below capture.
ATTENTION: The below capture is from CA1300BW1-**5766R**-SL (1.3GHz **3.8kW** SSA) just for reference. It will be slightly different when changing 4.6kW SSA.



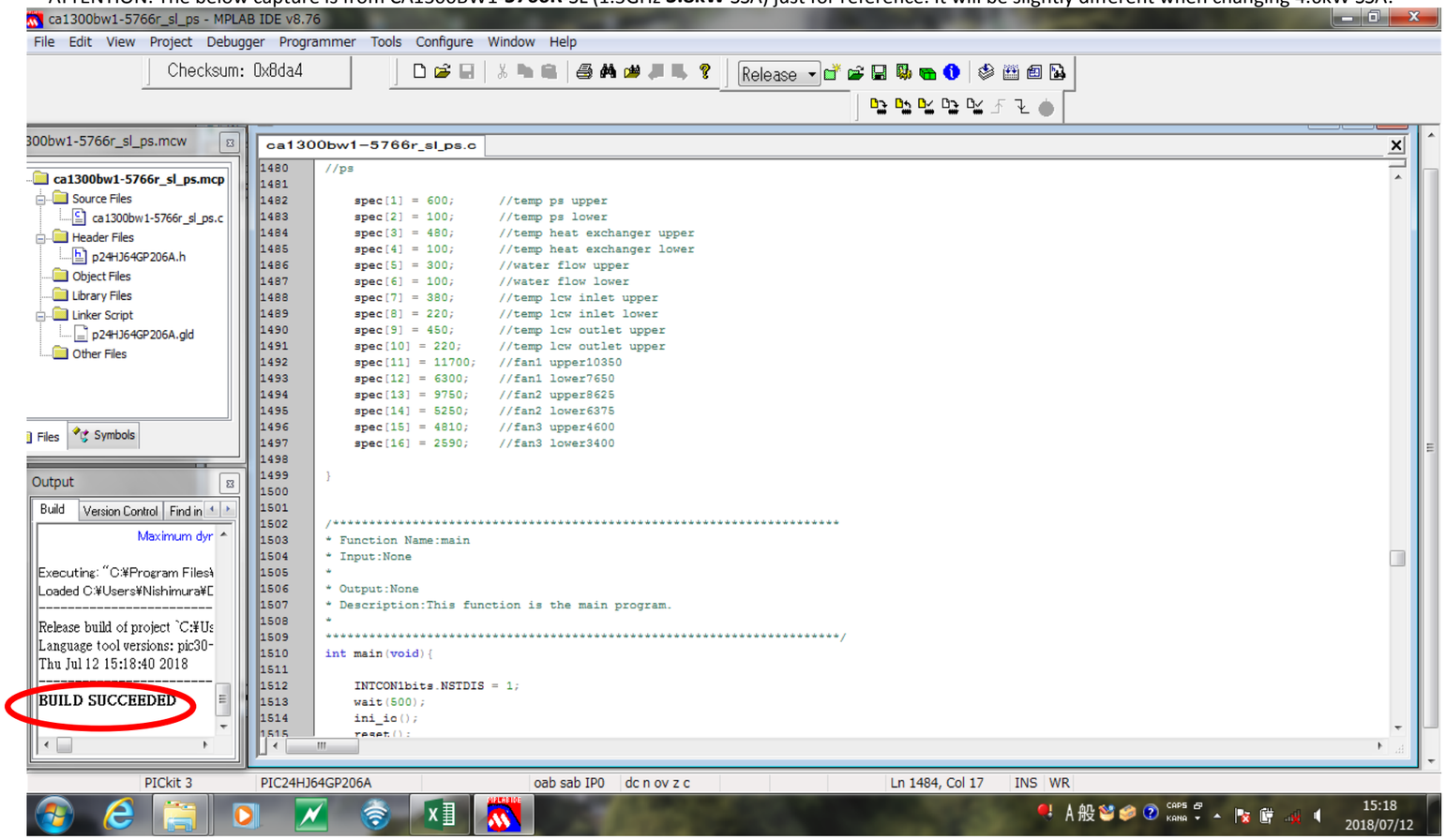
⑮Click on "Build All" under "Project" as the below capture.

ATTENTION: The below capture is from CA1300BW1-**5766R**-SL (1.3GHz **3.8kW** SSA) just for reference. It will be slightly different when changing 4.6kW SSA.



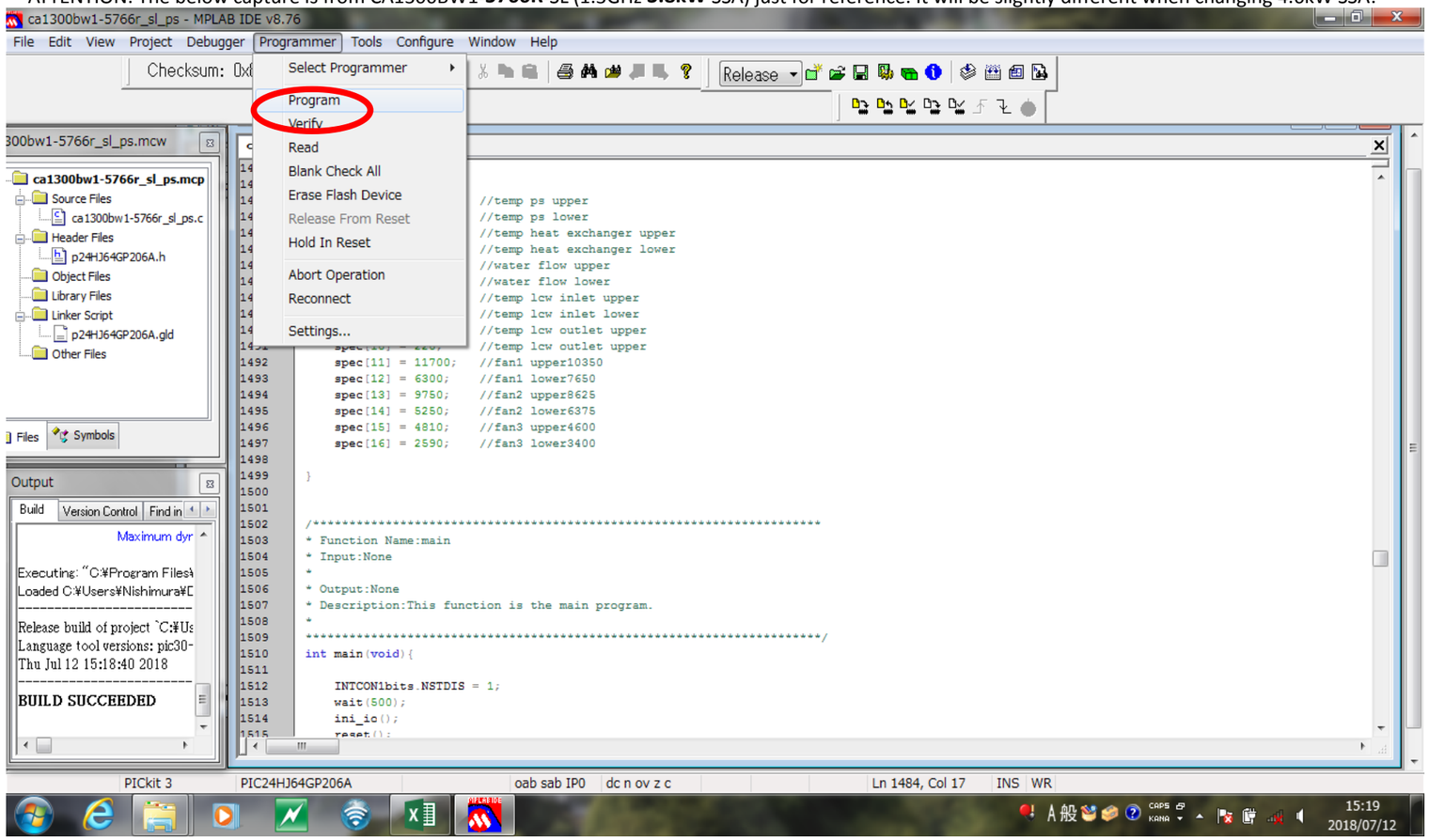
⑯Confirm “BUILD SUCCEEDED” is showing as on the below capture.

ATTENTION: The below capture is from CA1300BW1-**5766R**-SL (1.3GHz **3.8kW** SSA) just for reference. It will be slightly different when changing 4.6kW SSA.



⑰Click on "Program" under "Programmer" as the below capture.

ATTENTION: The below capture is from CA1300BW1-**5766R**-SL (1.3GHz **3.8kW** SSA) just for reference. It will be slightly different when changing 4.6kW SSA.



⑱Modification is completed if you see "Programing/Verify complete" as the below capture.
Attention: Main CPU has to be modified also. Please don't forget. (for Heat Exchanger case)
For the detailed information of what part of the software has to be modified, please refer to Table 51.
⑲Close MPLAB IDE, then remove the jig cable.
⑳Turn the AC120V power of SSA off.
ATTENTION: The below capture is from CA1300BW1-**5766R**-SL (1.3GHz **3.8kW** SSA) just for reference. It will be slightly different when changing 4.6kW SSA.