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Power supply module for MPPC

C11204-01

Command Reference

Be sure to read the operation manual carefully before this board is used.
If operated differently from the standard procedure in the manual,
a serious accident may occur.
Keep this manual for future reference.

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INTRODUCTION

This document describes the commands specification for C11204-01.
C11204-01 is communicated in UART communication protocol.
By using the communication command, you can make voltage control and parameter setting of C11204-01.

1. COMMUNICATION SPECIFICATION

1-1. UART communication specifications

UART communication specifications for C11204-01 are as follows:

Baud rate	: 38400[bps]
Data bit	: 8
Parity bit	: Even
Stop bit	: 1
Flow control	: None
Data order	: LSB

1-2. The basic steps of communication

When C11204-01 receives the command from the host, perform a process according to the command type. There is always a response to the command. Also by analyzing the contents of the command response the exchange of data between the host and C11204-01 is performed.
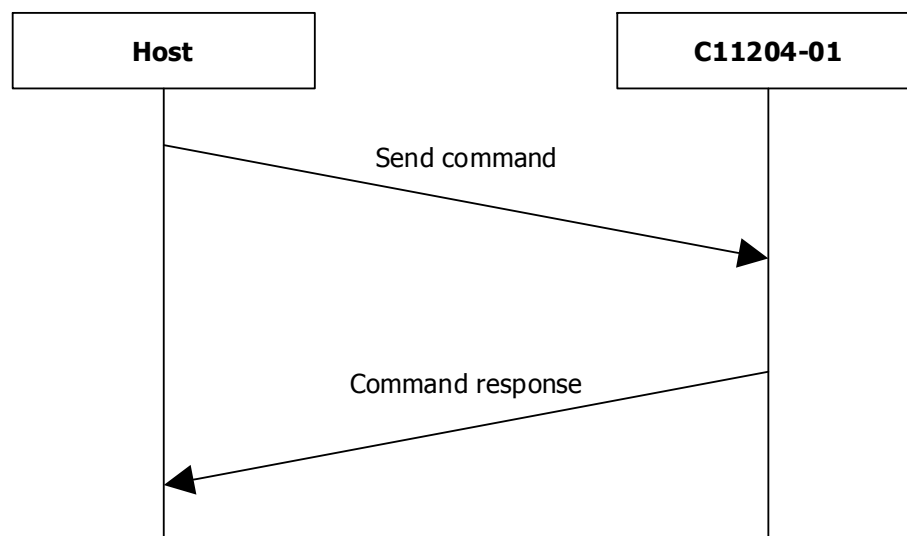

Figure1.The basic steps for communication between the C11204-01 and the host

2. OVERVIEW OF COMMUNICATION COMMANDS

The command character code is ASCII. For the ASCII code characters, refer to the standards published on web or document. Follow the specified format to create communication commands.

2-1. Send command format

Header and delimiter of the command is STX and CR
The checksum is the sum of the STX from ETX.

Symbol	Size(Byte)	Description
STX	1	Start of text (0x02)Fixed
Command	3	Type of command
Data	0–24	The data length is fixed for each command
ETX	1	End of text (0x03)Fixed
Check Sum	2	Checksum
Delimiter	1	Delimiter (0x0D)Fixed

Example)"Get the monitor information and status" send command

Command name

ASCII code	STX	H	P	O	ETX	E	C	CR
Byte data	0x02	0x48	0x50	0x4f	0x03	0x45	0x43	0x0D

2-2. Response command format

Symbol	Size(Byte)	Description
STX	1	Start of text (0x02)Fixed
Command	3	Command the type of response
Data	0–43	The data length is fixed for each command
ETX	1	End of text (0x03)Fixed
Check Sum	2	Checksum
Delimiter	1	Delimiter (0x0D)Fixed

Example)"Get the monitor information and status" response command

		Command			Status				Reserve			
ASCII code	STX	h	p	o	0	0	0	9	B	D	8	7
Byte data	0x02	0x68	0x70	0x6f	0x30	0x30	0x30	0x39	0x42	0x44	0x38	0x37

Output voltage monitor				Output current monitor				MPPC temperature monitor						
9	B	3	7	0	0	1	0	B	8	4	4	ETX	9	2	CR
0x39	0x42	0x33	0x37	0x30	0x30	0x31	0x30	0x42	0x38	0x34	0x34	0x03	0x39	0x32	0x0D

2-3. Checksum

Checksum is an error detection code.
When creating a command on the transmit side, take a sum of data from [STX] to [ETX] of the command and place the2 byte in [CHECK SUM].
The command will fail unless the checksum on the transmit side matches the checksum of the C11204-01 side during UART communication.

Example) Checksum calculation

Checksum calculation range

ASCII code	STX	H	P	O	ETX	E	C	CR
Byte data	0x02	0x48	0x50	0x4F	0x03	0x45	0x43	0x0D

$$0x02 + 0x48 + 0x50 + 0x4F + 0x03 = 0xEC$$

The sum of the STX from ETX is 0xEC. If checksum have more than three orders of magnitude, put the value of the lower 2Byte.

2-4. Error reply

If the command does not work for some reason, C11204-01 performs the error response to the host.

■Command response

Item	STX	Command	Error code	ETX	Check sum	CR
Size(Byte)	1	3	4	1	2	1
ASCII code	0x02	"hxx"	"0000–FFFF"	0x03	-	0x0D

Error code	Error description	Description
0001	UART communication error	Parity error, overrun error, framing error. This indicates that an error has occurred either.
0002	Timeout error	This indicates that the CR has not been received within 1000ms of receiving the STX. The received packet is discarded.
0003	Syntax error	The beginning of the received command is other than STX, which indicates that the length of the command or 256byte.
0004	Checksum error	This indicates that the checksum does not match
0005	Command error	This indicates that it is an undefined command
0006	Parameter error	This indicates that the codes other than ASCII code(0–F) is in the parameter.
0007	Parameter size error	This indicates that the data length of the parameter is outside the specified length.

If the command has been successfully processed, command will return a response to lower case. For command response for each command, please refer to the "4.Command detail".

3. UNIT CONVERSION TABLE

The monitor value and the set value for this product are communicated by hexadecimal integer.
When converting unit V and °C, it is necessary to multiply the transform coefficients.

■Unit conversion table

Function	Data range(Hexadecimal)	Data range(Decimal)	Conversion factor(digit→)	Unit
Output voltage monitor	0000–FFFF	0–65535	1.812×10^{-3}	V
Output current monitor	0000-0400	0–1024	4.980×10^{-3}	mA
MPPC temperature monitor	0000-FFFF	0–65535	$(\text{digit} \times 1.907 \times 10^{-5} - 1.035)/(-5.5 \times 10^{-3})$	°C
Secondly high temp side coefficient $\Delta T'1$	FC18–03E8	-1000–1000	1.507×10^{-3}	mV/°C^2
Secondly low temp side coefficient $\Delta T'2$	FC18–03E8	-1000–1000	1.507×10^{-3}	mV/°C^2
Primary high temp side coefficient $\Delta T1$	0000–FFFF	0–65535	5.225×10^{-2}	mV/°C
Primary low temp side coefficient $\Delta T2$	0000–FFFF	0–65535	5.225×10^{-2}	mV/°C
Reference voltage Vb	0000–FFFF	0–65535	1.812×10^{-3}	V
Reference temperature Tb	0000–FFFF	0–65535	$(\text{digit} \times 1.907 \times 10^{-5} - 1.035)/(-5.5 \times 10^{-3})$	°C

Example 1) if you want to convert to unit of V
    1-1) Convert a hexadecimal number to decimal $9B38_{(16)} \rightarrow 39736_{(10)}$
    1-2) Multiply by the conversion factor $39736 \times 1.812 \times 10^{-3} \fallingdotseq 72.001[V]$

Example 2) If you enter a reference voltage to 70.123[V]
    2-1) Divide by the conversion factor $70.123 \div 1.812 \times 10^{-3} \fallingdotseq 38699$
                               (Truncate the decimal point)
    2-2) Convert a decimal number to hexadecimal $38699_{(10)} \rightarrow 972B_{(16)}$

4. COMMAND DETAIL

It shows the format of each command.
Response command and Send command are one-to-one correspondence

■Command list

No	Command name	Function
1	HST	Temperature correction factor setting
2	HRT	Temperature correction factor read
3	HPO	Get the monitor information and status
4	HGS	Get status
5	HGV	Get output voltage
6	HGC	Get output current
7	HGT	Get MPPC temperature
8	HOF	High voltage output OFF
9	HON	High voltage output ON
10	HRE	Power supply reset
11	HCM	Switching the temperature compensation mode
12	HBV	Reference voltage temporary setting

4-1. Temperature correction factor setting

■Send command

Item	STX	Command	Secondly high temperature side coefficient ΔT'1	Secondly low temperature side coefficient ΔT'2	Primary high temperature side coefficient ΔT1	Primary low temperature side coefficient ΔT2
Size(Byte)	1	3	4	4	4	4
ASCII code	0x02	"HST"	"FC18–03E8"	"FC18–03E8"	"0000–FFFF"	"0000–FFFF"

Reference voltage Vb	Reference temperature Tb	ETX	Check sum	CR
4	4	1	2	1
"0000–FFFF"	"0000–FFFF"	0x03	-	0x0D

[Commentary]

This command sets the temperature correction factor and reference voltage and reference temperature to C11204-01.

By setting the parameters, you can make the temperature compensation of the output voltage.

Setting parameters that you will be saved even when the power is turned off.

Please refer to "C11204-01 Operation Manual" for more information on each parameter.

For unit conversion value for each setting, please refer to the "3. UNIT CONVERSION TABLE ".

[Command example]

$\triangle$T'1 = 0[mV/°C 2] $\rightarrow$ 0 ÷ 1.507×10^{-3} = 0$_{(10)}$ $\rightarrow$ 0000$_{(16)}$

$\triangle$T'2 = 0[mV/°C 2] $\rightarrow$ 0 ÷ 1.507×10^{-3} = 0$_{(10)}$ $\rightarrow$ 0000$_{(16)}$

$\triangle$T1 = 56[mV/°C] $\rightarrow$ 56 ÷ 5.225×10^{-2} = 1072$_{(10)}$ $\rightarrow$ 0430$_{(16)}$

$\triangle$T2 = 56[mV/°C] $\rightarrow$ 56 ÷ 5.225×10^{-2} = 1072$_{(10)}$ $\rightarrow$ 0430$_{(16)}$

Vb = 60[V] $\rightarrow$ 60 ÷ 1.812×10^{-3} = 33113$_{(10)}$ $\rightarrow$ 8159$_{(16)}$

Tb = 25[°C] $\rightarrow$ (1.035 + (25 × -5.5×10^{-3})) ÷ 1.907×10^{-5} = 47063$_{(10)}$ $\rightarrow$ B7D7$_{(16)}$

		Command		$\triangle$T'1				$\triangle$T'2				$\triangle$T1		
ASCII code	STX	H	S	T	0	0	0	0	0	0	0	0	0	4	3	0
Byte data	0x02	0x48	0x53	0x54	0x30	0x30	0x30	0x30	0x30	0x30	0x30	0x30	0x30	0x34	0x33	0x30

$\triangle$T2				Vb				Tb						
0	4	3	0	8	1	5	9	B	7	D	7	ETX	C	D	CR
0x30	0x34	0x33	0x30	0x38	0x31	0x35	0x39	0x42	0x37	0x44	0x37	0x03	0x43	0x44	0x0D

■Response command

Item	STX	Command	ETX	Check sum	CR
Size(Byte)	1	3	1	2	1
ASCII code	0x02	"hst"	0x03	-	0x0D

[Commentary]

Return the response command.

4-2. Temperature correction factor read

■Send command

Item	STX	Command	ETX	Check sum	CR
Size(Byte)	1	3	1	2	1
ASCII code	0x02	"HRT"	0x03	-	0x0D

[Commentary]

It is the command to read the temperature correction factor and reference voltage and reference temperature, which is set to C11204-01.

■Response command

Item	STX	Command	Secondly high temperature side coefficient ΔT'1	Secondly low temperature side coefficient ΔT'2	Primary high temperature side coefficient ΔT1	Primary low temperature side coefficient ΔT2
Size(Byte)	1	3	4	4	4	4
ASCII code	0x02	"hrt"	"FC18−03E8"	"FC18−03E8"	"0000−FFFF"	"0000−FFFF"

Reference voltage Vb	Reference temperature Tb	ETX	Check sum	CR
4	4	1	2	1
"0000−FFFF"	"0000−FFFF"	0x03	-	0x0D

[Commentary]

It returns the temperature correction factor and reference voltage and reference temperature that is set to C11204-01.

Please refer to "C11204-01 Operation Manual" for more information on each parameter.

For unit conversion value for each setting, please refer to the "3. UNIT CONVERSION TABLE ".

4-3. Get the monitor information and status

■Send command

Item	STX	Command	ETX	Check sum	CR
Size(Byte)	1	3	1	2	1
ASCII code	0x02	"HPO"	0x03	-	0x0D

[Commentary]
  This command is used to get the monitor information and status.

■Response command

Item	STX	Command	Status	Reserve	Output voltage
Size(Byte)	1	3	4	4	4
ASCII code	0x02	"hpo"	"0000–FFFF"	"0000–FFFF"	"0000–FFFF"

Output current	MPPC temperature	ETX	Check sum	CR
4	4	1	2	1
"0000–03FF"	"0000–FFFF"	0x03	-	0x0D

[Commentary]
  Returns monitor information and status.
  For unit conversion value for each setting, please refer to the "3. UNIT CONVERSION TABLE ".

4-4. Get status

■Send command

Item	STX	Command	ETX	Check sum	CR
Size(Byte)	1	3	1	2	1
ASCII code	0x02	"HGS"	0x03	-	0x0D

[Commentary]

This command is used to get the status.

■Response command

Item	STX	Command	Status	ETX	Check sum	CR
Size(Byte)	1	3	4	1	2	1
ASCII code	0x02	"hgs"	"0000–FFFF"	0x03	-	0x0D

[Commentary]

Return status.

For more information about the contents of the status, please refer to the book "5. STATUS LIST".

[Command example]

ASCII code	STX	h	g	s	0	0	4	9	ETX	1	4	CR
Byte data	0x02	0x68	0x67	0x73	0x30	0x30	0x34	0x39	0x03	0x31	0x34	0x0D

Status:$0049_{(16)} \rightarrow$ 0000 0000 0100 $1001_{(2)}$

bit0:1 (High voltage output : ON)
bit1:0 (Overcurrent protection : Not working)
bit2:0 (Output current value : Within specification)
bit3:1 (Temperature sensor connect : Connect)
bit4:0 (Operating temperature limit : Within specification)
bit5:0 (Reserve 5)
bit6:1 (Temperature correction : Effectiveness)
bit7:0 (Reserve 7)
bit8:0 (Reserve 8)
bit9:0 (Reserve 9)
bit10:0 (Reserve 10)
bit11:0 (Reserve 11)
bit12:0 (Reserve 12)
bit13:0 (Reserve 13)
bit14:1 (Reserve 14)
bit15:0 (Reserve 15)

4-5. Get output voltage

■Send command

Item	STX	Command	ETX	Check sum	CR
Size(Byte)	1	3	1	2	1
ASCII code	0x02	"HGV"	0x03	-	0x0D

[Commentary]
  This command is used to get the output voltage.

■Response command

Item	STX	Command	Output voltage	ETX	Check sum	CR
Size(Byte)	1	3	4	1	2	1
ASCII code	0x02	"hgv"	"0000−FFFF"	0x03	-	0x0D

[Commentary]
  Return output voltage.

[Command example]

ASCII code	STX	h	g	v	8	1	5	9	ETX	2	1	CR
Byte data	0x02	0x68	0x67	0x76	0x38	0x31	0x35	0x39	0x03	0x32	0x31	0x0D

$8159_{(16)} \rightarrow 33113_{(10)}$

$33113 \times 1.812 \times 10^{-3} \fallingdotseq 60.000[V]$

4-6. Get output current

■Send command

Item	STX	Command	ETX	Check sum	CR
Size(Byte)	1	3	1	2	1
ASCII code	0x02	"HGC"	0x03	-	0x0D

[Commentary]
This command is used to get the output current.

■Response command

Item	STX	Command	Output current	ETX	Check sum	CR
Size(Byte)	1	3	4	1	2	1
ASCII code	0x02	"hgc"	"0000–FFFF"	0x03	-	0x0D

[Commentary]
  Return output current.

[Command example]

ASCII code	STX	h	g	c	0	0	1	4	ETX	F	C	CR
Byte data	0x02	0x68	0x67	0x63	0x30	0x30	0x31	0x34	0x03	0x46	0x43	0x0D

$0014_{(16)} \rightarrow 20_{(10)}$
$20 \times 4.980 \times 10^{-3} \fallingdotseq 0.1[mA]$

4-7. Get MPPC temperature

■Send command

Item	STX	Command	ETX	Check sum	CR
Size(Byte)	1	3	1	2	1
ASCII code	0x02	"HGT"	0x03	-	0x0D

[Commentary]
  This command is used to get the MPPC temperature.

■Response command

Item	STX	Command	MPPC temperature	ETX	Check sum	CR
Size(Byte)	1	3	4	1	2	1
ASCII code	0x02	"hgt"	"0000–FFFF"	0x03	-	0x0D

[Commentary]
  Return MPPC temperature.

[Command example]

ASCII code	STX	h	g	t	B	7	0	1	ETX	2	2	CR
Byte data	0x02	0x68	0x67	0x74	0x42	0x37	0x30	0x31	0x03	0x32	0x32	0x0D

$B701_{16)} \rightarrow 46849_{(10)}$

$(46849 \times 1.907 \times 10^{-5} - 1.035)/(-5.5 \times 10^{-3}) \fallingdotseq 25.743[°C]$

4-8. High voltage output OFF

■Send command

Item	STX	Command	ETX	Check sum	CR
Size(Byte)	1	3	1	2	1
ASCII code	0x02	"HOF"	0x03	-	0x0D

[Commentary]

This command is used to turn OFF the high voltage output of the C11204-01.

When you want to operate it again, you send a command of "4.9 High voltage output ON", or reboot a power supply.

■Response command

Item	STX	Command	ETX	Check sum	CR
Size(Byte)	1	3	1	2	1
ASCII code	0x02	"hof"	0x03	-	0x0D

[Commentary]

Return the response command.

4-9. High voltage output ON

■Send command

Item	STX	Command	ETX	Check sum	CR
Size(Byte)	1	3	1	2	1
ASCII code	0x02	"HON"	0x03	-	0x0D

[Commentary]

This command is used to turn ON the high voltage output of the C11204-01.

■Response command

Item	STX	Command	ETX	Check sum	CR
Size(Byte)	1	3	1	2	1
ASCII code	0x02	"hon"	0x03	-	0x0D

[Commentary]

Return the response command.

4-10. Power supply reset

■Send command

Item	STX	Command	ETX	Check sum	CR
Size(Byte)	1	3	1	2	1
ASCII code	0x02	"HRE"	0x03	-	0x0D

[Commentary]
  This command will reset the power.

■Response command

Item	STX	Command	ETX	Check sum	CR
Size(Byte)	1	3	1	2	1
ASCII code	0x02	"hre"	0x03	-	0x0D

[Commentary]
  Return the response command.

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4-11. Switching the temperature compensation mode

■Send command

Item	STX	Command	Mode	ETX	Check sum	CR
Size(Byte)	1	3	1	1	2	1
ASCII code	0x02	"HCM"	"0" or "1"	0x03	-	0x0D

[Commentary]

This command switches the Enable or Disable of temperature correction function.

0: Disable

1: Enable

In the case of 1, output voltage is determined by each setting parameter and value of the temperature sensor. Please refer to "C11204-01 Operation Manual" for the calculation method.

In the case of 0, it is decided only by a reference voltage. Each temperature coefficient is calculated as 0.

■Response command

Item	STX	Command	ETX	Check sum	CR
Size(Byte)	1	3	1	2	1
ASCII code	0x02	"hcm"	0x03	-	0x0D

[Commentary]

Return the response command.

4-12. Reference voltage temporary setting

■Send command

Item	STX	Command	Reference voltage Vb	ETX	Check sum	CR
Size(Byte)	1	3	4	1	2	1
ASCII code	0x02	"HBV"	"0000–FFFF"	0x03	-	0x0D

[Commentary]
This command sets the reference voltage temporarily.
When you use this command temperature correction mode automatically switches to Disabled (0). Also voltage set by the reference voltage is output.
When you use the reset command (4.10 power reset) or turn off the power, the value set by this command will be erased.

■Response command

Item	STX	Command	ETX	Check sum	CR
Size(Byte)	1	3	1	2	1
ASCII code	0x02	"hbv"	0x03	-	0x0D

[Commentary]
  Return the response command.

5. STATUS LIST

The status can be obtained by the HPO command, HGS command.

■Status list

Bit	Status	0	1
0	High voltage output	OFF	ON
1	Overcurrent protection	Not working	Working protection
2	Output current value	Within specification	Outside specification
3	Temperature sensor connect	Disconnect	Connect
4	Operating temperature limit	Within specification	Outside specification
5	Reserve 5	-	-
6	Temperature correction	Invalid	Effectiveness
7	Reserve 7	-	-
8	Reserve 8	-	-
9	Reserve 9	-	-
10	Reserve 10	-	-
11	Reserve 11	-	-
12	Reserve 12	-	-
13	Reserve 13	-	-
14	Reserve 14	-	-
15	Reserve 15	-	-

5-1. High voltage output

This is condition of the high voltage output.
0: OFF
1: ON
High voltage is output immediately after the power is turned on.

5-2. Overcurrent protection

This is the condition of overcurrent protection.
0: Not working
1: Working protection
The threshold of the default is 3mA. When current load of 3mA exceeded more than 4 seconds, the output voltage becomes 0V. When you want to output the high voltage again, please send a reset command or reboot the C11204-01.

5-3. Output current value

This is the condition of current monitor.
0: Value is less than 2mA
1: Value is more than 2mA

5-4. Temperature sensor connect

This is the condition of temperature sensor connection.
0: Temperature sensor is connected and operating temperature is -30 to 100 degree.
1: Temperature sensor is unconnected or operating temperature departs from -30 to 100 degree.
If temperature departs from the operating temperature limit greatly, the temperature compensation becomes OFF forcibly.

5-5. Operating temperature limit

This is the condition of operating temperature.
0: Operating temperature is 0 to 50 degree
1: Operating temperature departs from 0 to 50 degree
If temperature departs from the operating temperature limit greatly, the temperature compensation becomes OFF forcibly.

5-6. Temperature correction

This is the condition of temperature correction mode.
0: Disable temperature correction
1: Enable temperature correction

In the case of 1, output voltage is determined by each setting parameter and value of the temperature sensor. In the case of 0, it is decided only by a reference voltage.
If you want to switch the mode, please refer to the "4.11 Switching the temperature compensation mode " in this document.