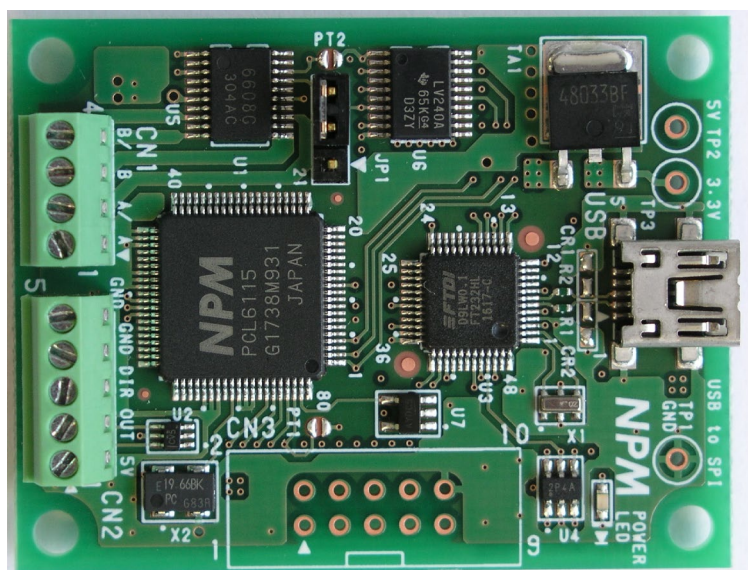


# PCL6115 Starter Kit

## PCL6115-EV

### User's Manual

### Hardware



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# 1. Preface

Thank you for considering our PCL6115-EV Starter Kit.

This manual describes specifications, functions of our PCL6115-EV Starter Kit and how to connect and use it.

In order to use this product safely, please read this manual thoroughly and keep it.

## 1.1 1.1 Cautions about this manual

Please consider contents of this section when handling this manual.

- 1) Copying all or any part of this manual without written approval is prohibited by copyright laws.
- 2) The specifications of these LSIs may be changed to improve performance or quality without prior notice.
- 3) Although this manual was produced with the utmost care, if you find any points that are unclear, wrong or have inadequate descriptions, please let us know.

## 1.2 Production warranty

### 1.2.1 Warranty period

The warranty period is one year from the date of the delivery to an assigned place.

### 1.2.2 Warranty scope

If defects are found in the product during the warranty period under normal use defined used only in method set forth in this manual, NPM will repair the product without charge or replace it with a new one at the direction of NPM.

The following cases are not covered by the warranty even during warranty period.

- 1) The products are modified or repaired by anyone other than NPM or a person authorized by NPM.
- 2) The defect results from dropping of the product after delivery or mishandling in transit.
- 3) Wearing of components, natural deterioration or fatigue
- 4) Causes arising from usage other than those described in this document.
- 5) The product has been subjected to natural disaster or force majeure such as fire, earthquake, lightning strike, wind, flood, salt, electrical surges, etc.
- 6) The defects or damage results from a cause that is not the fault of NPM.

When the product is purchased from a supplier other than NPM, please contact that supplier regarding the product warranty.

NPM will not provide on-site repair. If the product is defective, the product must be returned to the specified location for repair.

The warranty period of the repaired product is the same as the warranty period before the repair.

This warranty does not cover damages caused by product malfunction or damage to the product itself.

## 1.3 Notice

This document aims to describe details of the function of the product and does not warrant fitness for a particular purpose of the customers.

Examples of applications and circuit diagrams in this manual are included only for your reference. Please confirm the feature and the safety of device or equipment before use.

## 1.4 Confirmation

Please do not use this product in the following conditions. If you need to use the product in the following conditions, please contact our sales department before proceeding.

- 1) Any equipment that may require high reliability or safety, such as nuclear facility, electricity or gas supply system, transportation facilities, vehicle, various safety system, medical equipment, etc.
- 2) Any equipment that may directly affect human survival or property
- 3) Usage under conditions or circumstances that are not specified in the brochure, manual, etc.

When this product is used in any equipment where faults or malfunctions may directly affect human survival or property, please secure high reliability and security with redundancy design, etc.

## 2. Introduction

Thank you for considering PCL6115-EV starter kit.

This manual is the instruction manual of the hardware of this product.

By using PCL6115-EV Starter Kit, you can learn motor control functions using pulse control LSI PCL6115.

Please refer to the following manuals along with this manual.

(x: revision)

	Manual Name [Outline]	Document File name	Software File name	Document No.
Hardware Manual	PCL6115 Starter Kit User's Manual (Hardware)	PCL6115-EV _Hardware Manual _VerxE.pdf	—	TA600021-ENx/x (This document)
	PCL6115 Starter Kit User's Manual (Simple Manual)	PCL6115-EV _Simple Manual _VerxE.pdf	—	TA600020-ENx/x
Application Software Manual	PCL6115 Starter Kit User's Manual (Application Software) [Setting accel/decel pattern and register display]	PCL6115-EV _Application Manual _VerxE.pdf	PCL6115-EV _Application _VxxxJE.zip	TA600018-ENx/x
	PCL6115 Starter Kit User's Manual (Language File Creation Rule) [Multi-language]	PCL6115-EV _Application Language File Manual_VerxE.pdf	PCL6115-EV _Application Language File _VxxxE.zip	TA600007-ENx/x
	PCL6115 Starter Kit User's Manual (Sample program) [Check and add motion pattern on development environment]	PCL6115-EV _Application Sample Manual_VerxE.pdf	PCL6115-EV _Application Sample _VxxxE.zip	TA600022-ENx/x

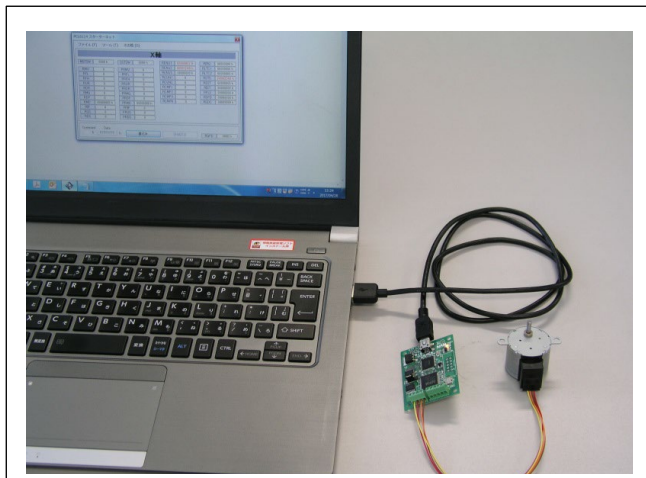
(x: revision)

	Manual Name [Outline]	Document File name	Software File name	Document No.
Motion Pattern Builder Manual	PCL6115 Starter Kit User's Manual (Motion Pattern Builder Application Software) [To describe function to perform axis control visually with a flowchart]	PCL6115-EV _Motion Builder Manual_VerxE.pdf	PCL6115-EV _Motion Builder _VxxxJE.zip	TA600023-ENx/x
	PCL6115 Starter Kit User's Manual (Motion Pattern Builder Language File Creation Rule) [Motion Pattern Builder in Multi-language]	PCL6115-EV _Motion Builder Language File Manual_VerxE.pdf	PCL6115-EV _Motion Builder Language File_VxxxE.zip	TA600008-ENx/x
	PCL6115 Starter Kit User's Manual (Motion Pattern Builder Sample Project) [Check and add motion pattern created by Motion Pattern Builder on development environment]	PCL6115-EV _Motion Builder Sample Manual_VerxE.pdf	PCL6115-EV _Motion Builder Sample_VxxxE.zip	TA600024-ENx/x
Reference	PCL6115/6125/6145 User's Manual		-	DA70152-0/xE

Please download application software and related materials from our NPM website.

## 2.1 Outline

This product can operate a stepping motor PFCU30-24V4GM(1/12) by connecting with PC using USB2.0 and controlling pulse control LSI PCL6115 from application software PCL6115EV.



## 2.2 Notes

- When unpacking PCL6115-EV starter kit packing box, please check that PCL6115-EV board and accessories are included.
- The board can be exchanged with a new product only when it has an initial failure.



## 2.3 About warranty

We cannot guarantee any trouble or malfunction at the time of use because this product is provided free of charge.



### 3. Specification

USB-Serial interface IC (FT232 HL [FTDI]) and pulse control LSI (PCL6115 [NPM]) are connected by the serial bus I/F specification.

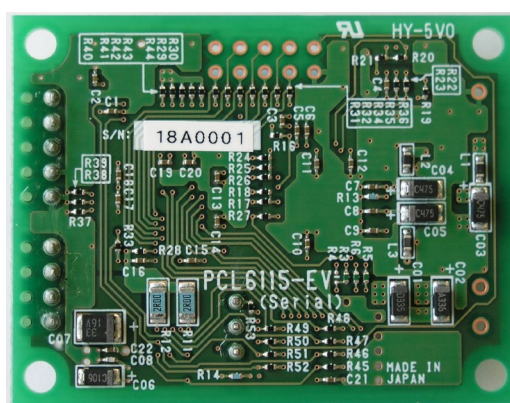
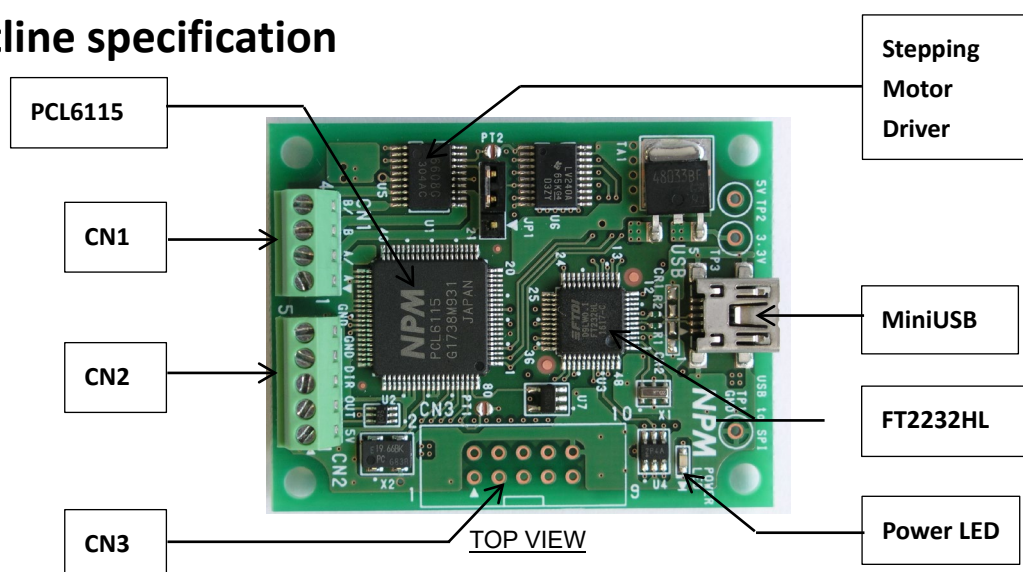
Connect the operation pulse output signal from OUT terminal of PCL6115 and the direction judgment output signal from DIR terminal to the CK terminal and CW/CCW terminal of the stepping motor driver IC (TB6608FNG[TOSHIBA]). It controls excitation mode, RESET, ENABLE and STBY by connecting the general output bit signal of PCL6115.

#### 3.1 Specification summary

Item	Specification
Pulse control LSI	U1: PCL6115[NPM] <ul style="list-style-type: none"> <li>• 80 pin QFP(14 mm × 14 mm) 0.5 mm pitch</li> <li>• Single voltage power supply 3.3V · Serial bus I/F(SPI)</li> <li>• Positioning control range -2,147,483,648 ~ +2,147,483,647</li> <li>• Linear accel/decel, S-curve accel/decel</li> </ul>
PCL6115 clock	X2: Crystal oscillator(SG-8002LB-19.6608M-PCB[EPSON])
Pulse output I/F	U2: IC(SN74LVC2G07DCKT[TI]) <ul style="list-style-type: none"> <li>• 6 pin SC70 · OUT/DIR terminal signal output of PCL6115</li> <li>• Open-Drain output, Low-level Output current 24 mA</li> </ul>
USB-Serial I/F	U3: FT232HL[FTDI] <ul style="list-style-type: none"> <li>• 48pin LQFP-48(9 mm × 9 mm) 0.5 mm pitch</li> </ul>
FT232HL clock	X1: Crystal oscillator (CSTCE12M0G15L99-R0[murata]) 12MHz
Memory	U4: EEPROM (93LC56B[MICROCHIP]) <ul style="list-style-type: none"> <li>• 128 × 16 bit, I2C I/F · Customized FTDI device</li> </ul>
Stepping motor driver	U5: IC (TB6608FNG [TOSHIBA]) <ul style="list-style-type: none"> <li>• 20 pin SSOP(7 mm × 4.4 mm) 0.65 mm pitch</li> <li>• Bipolar constant current drive</li> <li>• Micro-step([2phase], 1-2phase, W1-2phase, 2W1-2phase)</li> <li>• Accessory stepping motor PFCU30-24V4GM(1/12) Weight 75g Winding resistance 30Ω, speed Max 375 pps(1-2phase), torque 100mN·m</li> </ul>
Buffer I/F	U6: IC(SN74LVC240APWG4[TI]) <ul style="list-style-type: none"> <li>• 20 pin SSOP( 7mm × 4.4 mm) 0.65 mm pitch</li> <li>• OUT/DIR terminal signal output of PCL6115, and terminals signals P3 to P7 to driver IC</li> </ul>
Reset	U7: IC (PST883A290NR [MITSUMI]) <ul style="list-style-type: none"> <li>• 5 pin SOT-25A Power on reset</li> </ul>
Voltage power supply 3.3 V	TA1: IC(TA48033F[TOSHIBA]) <ul style="list-style-type: none"> <li>• HSOP-3-P-2.30D 3.3 V MAX 1 A</li> </ul>
Terminal block for motor	CN1: 790-1102[RS Pro]

Terminal block for pulse	CN2: 790-1105[RS Pro]
I/O connector	CN3: +EL/-EL/SD/ORG/ALM/EA/EB input signals, BSY output signal
Mini USB I/F connector	USB: UB-M5BR-G14-4S [JST] · Accessory MiniUSB cable(AB-10H) A-miniB type 1m]
LED	Power: SML-D12Y8WT86[ROHM](Yellow) · Lit by power supply via USB
External diameters	40 mm (H) × 52 mm (W) × 12 mm (D)
Power supply	Supply 5 V from mini USB connector MAX: 500 mA
Current consumption	MAX: 380 mA (When stepping motor connected, speed 1 pps)
Usage environment	· Storage temperature: 0°C ~ 50°C · Storage humidity: 10% ~ 90% (No condensation)

### 3.2 Outline specification



BOTTOM VIEW

## 3.3 Connector pin assignment

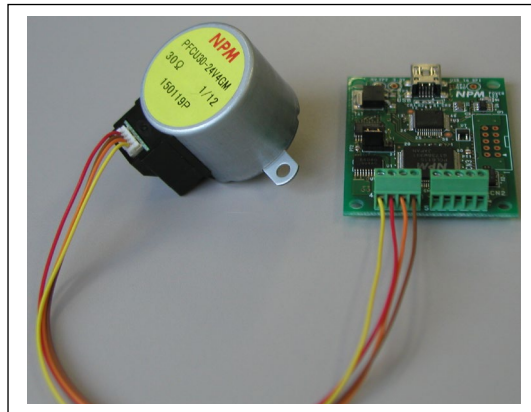
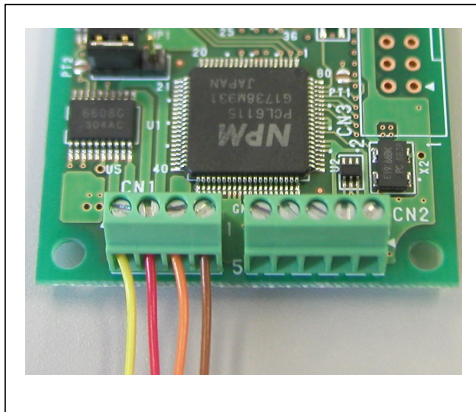
### 3.3.1 CN1

Terminal block for stepping motor 790-1102[RS Pro]

Terminal block for stepping motor 790-1102[RS Pro]

Terminal No.	Terminal Symbol	Terminal Name	Note
1	A	A phase 1	Motor cable color (Brown)
2	/A	A phase 2	Motor cable color (Orange)
3	B	B phase 1	Motor cable color (Red)
4	/B	B phase 2	Motor cable color (Yellow)

Accessory stepping motor PFCU30-24V4GM (1/12) is connected to CN1.

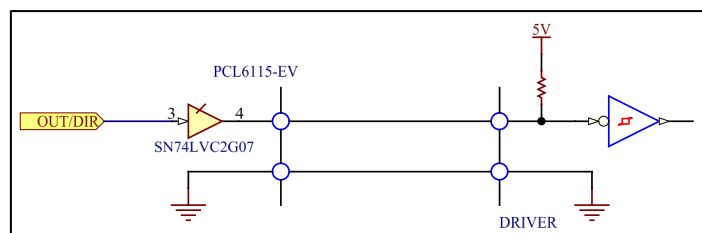


### 3.3.2 3.3.2 CN2

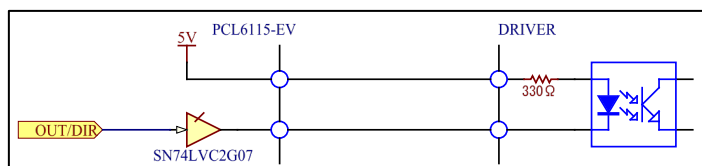
Terminal block for Clock/Direction output signal 790-1105 [RS Pro]

Terminal No.	Terminal Symbol	Terminal Name	Note
1	5V	5V Power	Power Supply
2	OUT	OUT signal	Clock signal (Open-Drain)
3	DIR	DIR signal	Direction signal (Open-Drain)
4	GND	GND Power	Power Supply Ground
5	GND	GND Power	Power Supply Ground

[Driver side TTL input]



[Driver side Photocoupler input]



Refer to "3.8 External driver connection."

### 3.3.3 3.3.3 CN3

+EL/-EL/SD/ORG/ALM/EA/EB input signals, BSY output signal Connector(not mounted)

Terminal No.	Terminal Symbol	Terminal Name	Note
1	5V	5V Power	Power Supply
2	+EL	+EL signal	End limit (+) direction
3	-EL	-EL signal	End limit (-) direction
4	SD	SD signal	Deceleration (Deceleration stop)
5	ORG	ORG signal	Origin input signal
6	ALM	ALM signal	Alarm input signal
7	EA	EA signal	(+) direction encoder
8	EB	EB signal	(-) direction encoder
9	BSY	BSY signal	Operations status monitor output signal
10	GND	GND Power	Power Supply Ground

+EL/-EL/SD/ORG/ALM/EA/EB input signals are pulled up to 5 V power supply with 10 k $\Omega$  and connected directly to each terminal of PCL6115. BSY output signal is 3.3V level output (output current 8 mA).

### 3.3.4 USB

Mini USB Connector UB-M5BR-G14-4S[JST]

Terminal No.	Terminal Symbol	Terminal Name	Note
1	VBus	5V Power	Power Supply
2	-Data(D-)	- Data	
3	+Data(D+)	+ Data	
4	NC		
5	GND	GND Power	Power Supply Ground

## 3.4 Jumper setting

### 3.4.1 JP1

Vref setting jumper Connector XJ8B-0311[OMRON], Short-circuit socket XJ8A-0241[OMRON]

Short-circuit No.	Terminal Name	Note
1-2	No current down	When stopped, a current of about 250 mA always flows.
2-3	Automatic current down	When stopped, a current of about 125 mA flows. (Default setting)

### 3.4.2 PT1

Solder the part of PT1 (short) or remove solder (open)

PT1	Name	Note
Short	+EL/-EL positive logic	+EL/-EL inputs make the input logic positive logic.
Open	+EL/-EL negative logic	+EL/-EL inputs make the input logic negative logic. (Default setting)

### 3.4.3 PT2

Solder the part of PT2 (short) or remove solder (open)

PT2	Name	Note
Short	DCY_L	Current decay mode setting "L"
Open	DCY_H	Current decay mode setting "H" (Default setting)

## 3.5 Stepper motor driver IC interface

### 3.5.1 Output pulse specification

OUT and DIR output signals of PCL6115 are connected to CK and CW/CCW input signals of the stepping motor driver IC (TB6608FNG).

OUT(CK)	DIR(CW/CCW)	Motor rotation direction
	L	CW (Output shaft clockwise direction)
	H	CCW (Output shaft counterclockwise direction)

The output pulse specification (PMD2 to 0) of the environment setting 1 register (RENV1) of PCL6115 is 0x02.

### 3.5.2 3.5.2 Excitation setting method

P3 and P4 general-purpose output signals of PCL6115 are connected to M2 and M1 input signals of stepping motor driver IC (TB6608FNG). The following shows the maximum speed and movement amount of one rotation when connecting to the stepping motor PFCU30-24V4GM (1/12).

P4(M1)	P3(M2)	Excitation mode	Max speed	Movement amount per rotation
L	H	1-2 phase	375 pps	576
H	L	W1-2 phase	750 pps	1152
L	L	2W1-2 phase	1500 pps	2304

The default setting is 2W1-2 phase excitation mode. The setting contents can be checked with sub status (SSTSW) of PCL6115.

### 3.5.3 Action mode

P5, P6, and P7 general-purpose output signals of PCL6115 are connected to STBY, RESET and ENABLE input signals of stepping motor driver IC (TB6608FNG).

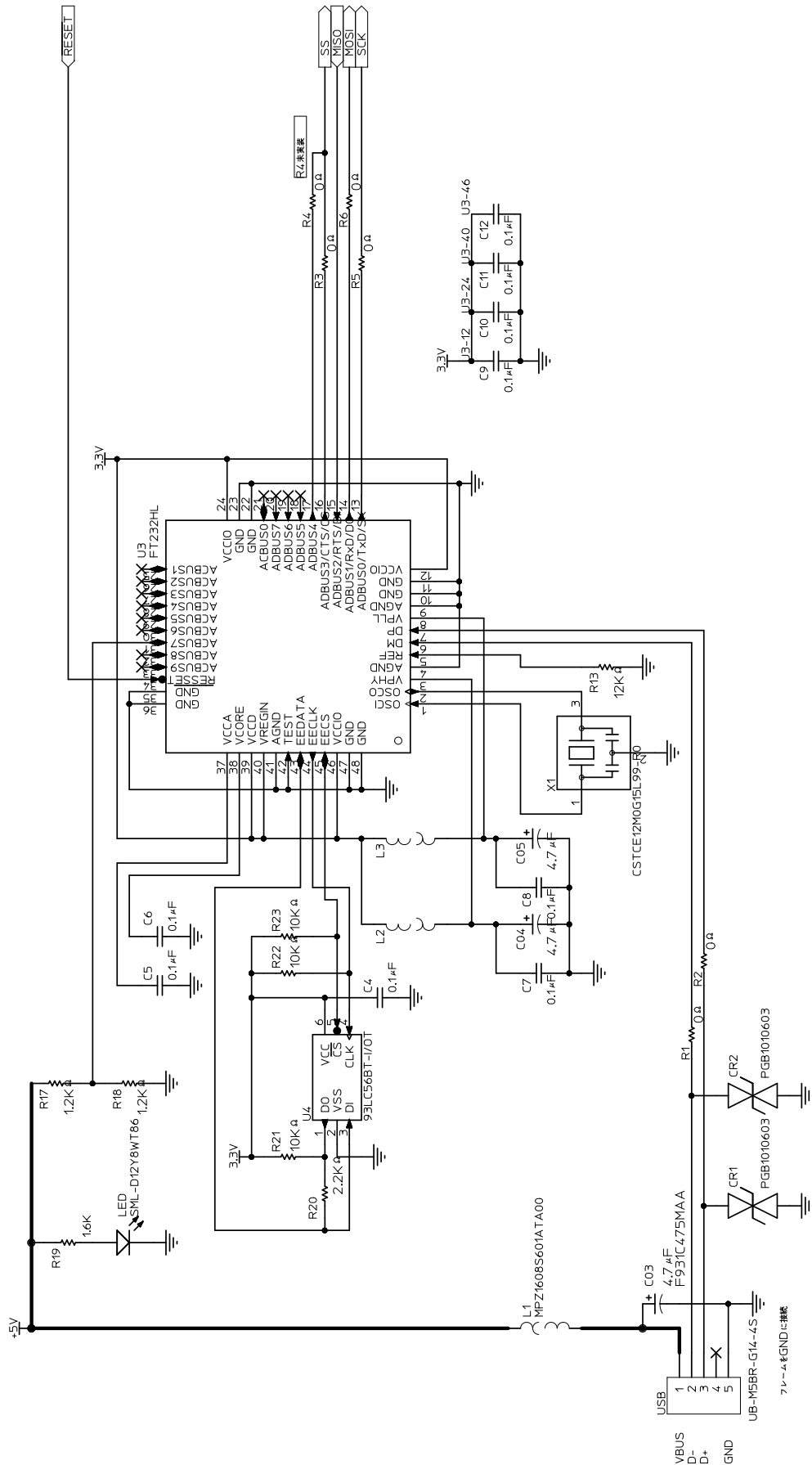
P6(RESET)	P7(ENABLE)	P5(STBY)	Operation mode
L	L	L	Operable mode
H	L	L	Initial mode (MO output [EZ input] Low level)
x	H	L	Enable standby mode (Output OFF, Hi-impedance)
x	x	H	Standby mode (Output OFF, Hi-impedance)

The initial setting is the operable mode.

The setting contents can be checked with sub status (SSTSW) of PCL6115.

### 3.6 Circuit diagram

#### 3.6.1 Circuit No.1



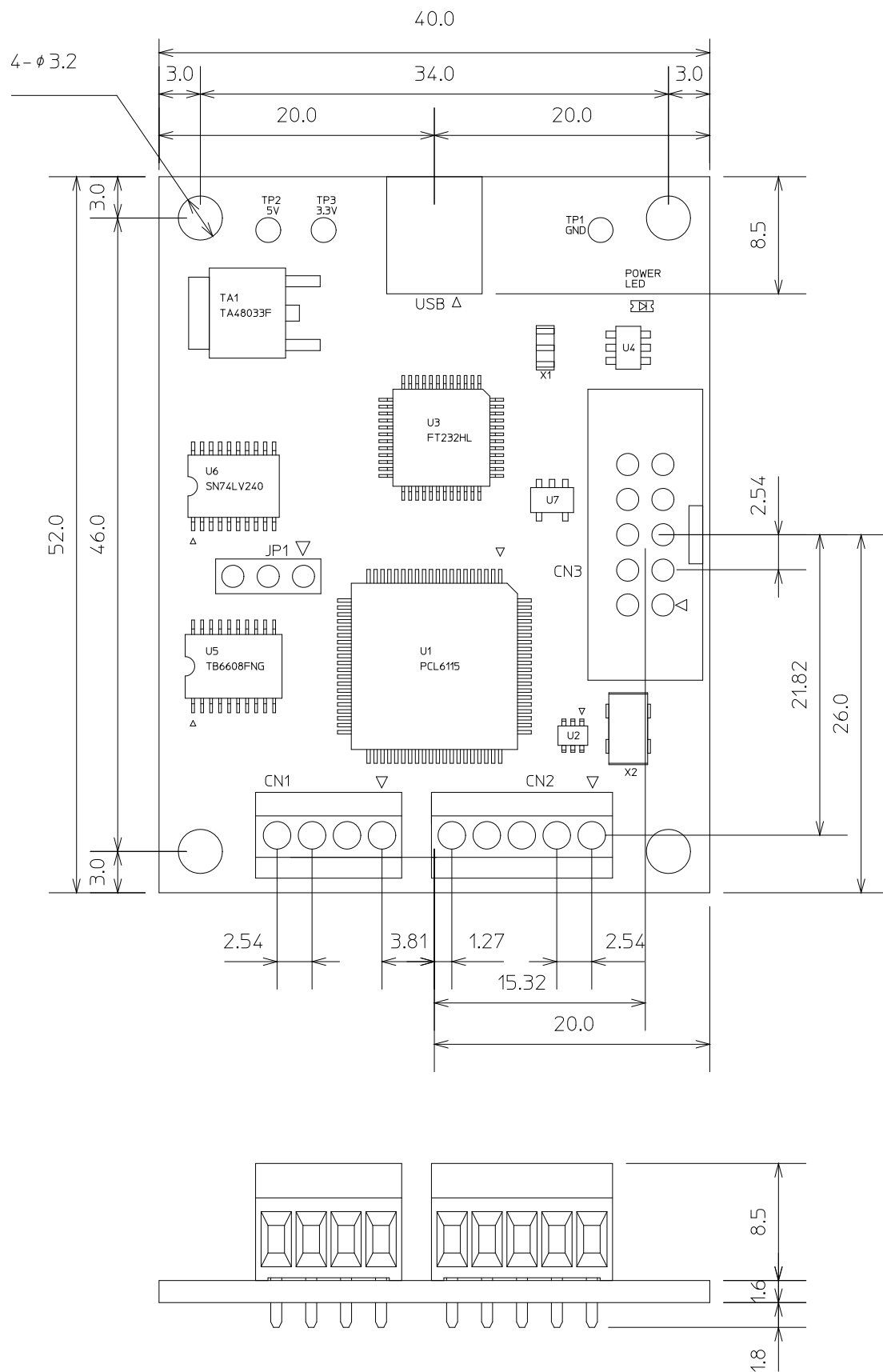




### 3.6.3 Parts List

No.	Part Name	Manufacture	Model	Pieces	Part No.	Remark
1	LSI	NPM	PCL6115	1	U1	
2	IC	TI	SN74LVC2G07DCKT	1	U2	
3	LSI	FTDI	FT232HL	1	U3	
4	EEPROM	Microchip	93LC56BT-I/OT	1	U4	
5	Driver IC	TOSHIBA	TB6608FNG	1	U5	
6	IC	TI	SN74LV240APWR	1	U6	
7	Reset IC	MITSUMI	PST883A290NR	1	U7	
8	Oscillator	MURATA	CSTCE12M0G15L99-R0	1	X1	
9	Oscillator	EPSON	SG-8002LB-19.6608M-PC B	1	X2	
10	Regulator	TOSHIBA	TA48033BF	1	TA1	
11	EMC Part	TDK	MPZ1608S601ATA00	3	L1,L2,L3	
12	LED	ROHM	SML-D12Y8WT86	1	LED1	
13	Jumper	OMRON	XJ8B-0311	1	JP1	
14	Socket	OMRON	XJ8A-0241	1		
15	PULSE-GUARD	Littelfuse	PGB1010603	2	CR1,CR2	Not mounted
16	Check Pin	Mac8	LC-2-S White	2	TP2,TP3	Not mounted
17	Check Pin	Mac8	LC-2-S Black	1	TP1	Not mounted
18	Resistor	KOA	RK73Z1ETTP	2	R1,R2	
19	Resistor	KOA	RK73B1ETTP102J	2	R16,R17	
20	Resistor	KOA	RK73B1ETTP222J	1	R18	
21	Resistor	KOA	RK73B1ETTP472J	1	R19	
22	Resistor	KOA	RK73B1ETTP103J	33	R20-R52	
23	Resistor	KOA	RK73H2BTDD2R00F	2	R11,R12	
24	Resistor	KOA	RK73H1ETDD1202F	1	R13	
25	Resistor	KOA	RK73H1ETDD1002F	1	R14	
26	Capacitor	MURATA	GRM155B31E104KA87D	25	C1-C25	
27	Capacitor	Nichicon	F931D335MAA	1	C01	
28	Capacitor	Nichicon	F931A336MAA	1	C02	
29	Capacitor	Nichicon	F931C475MAA	4	C03-C06	
30	Capacitor	Nichicon	F931C106MAA	1	C07	
31	Capacitor	Nichicon	F931C336MBA	1	C08	
32	Capacitor	MURATA	GRM1552C1H221JA01D	1	C09	
33	Connector	JST	UB-M5BR-G14-4S	1	USB	
34	Terminal Block	RS Pro	790-1102	1	CN1	
35	Terminal Block	RS Pro	790-1105	1	CN2	
36	Connector	JAE	PS-10-PE-D4T1-B1E	1	CN3	Not mounted

### 3.7 External dimensions



Unit: mm

## 3.8 External driver connection

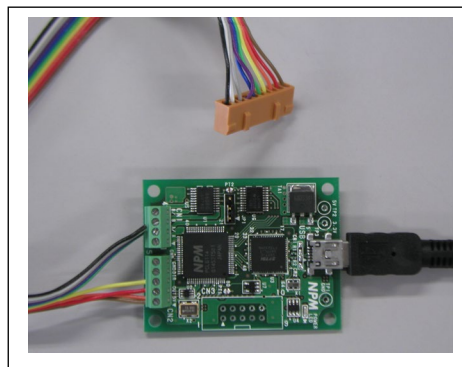
You can connect to an external driver using CN2 connector (clock, direction output signal) of PCL6115-EV and operate with application software.

[Products connected]

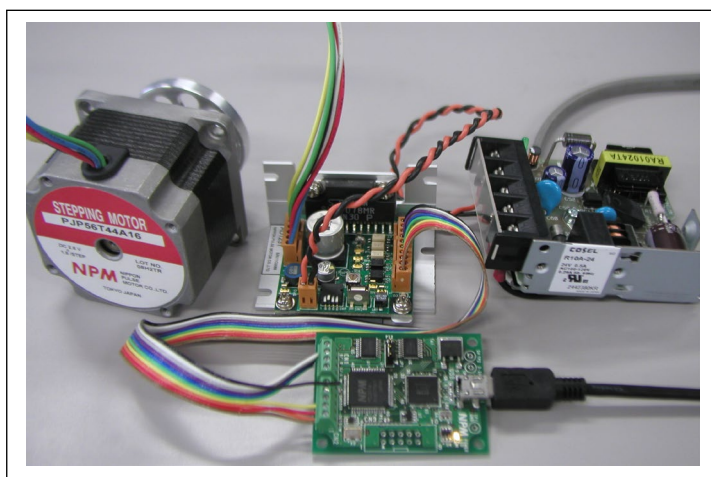
Driver: AD1231 [NPM] (Unipolar constant current drive, micro step excitation)

Stepping motor: PJP56T44A16 [NPM] (2 phase hybrid type, 1.8 degrees/pulse)

Power supply: 24V

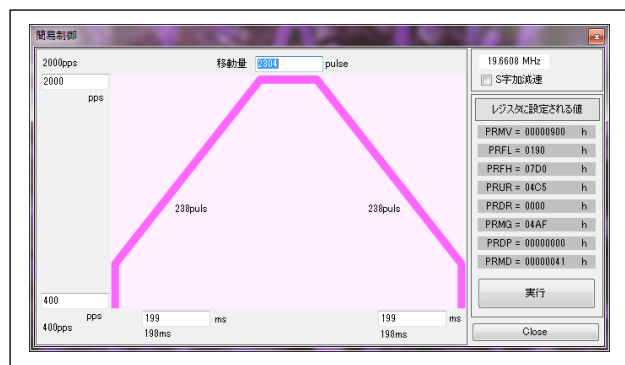
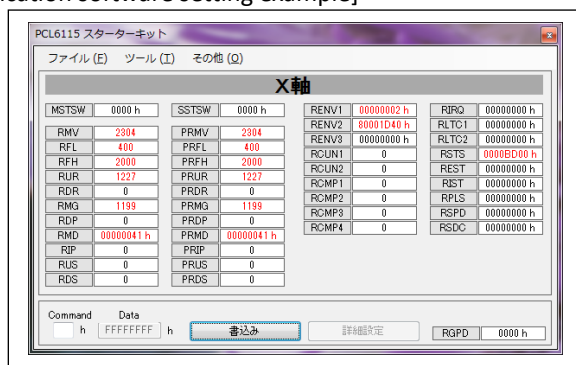


[Connection example]



Do not connect a stepping motor PFCU30-24V4GM (1/12) (accessory).

[Application software setting example]



The output pulse specification (PMD2 to 0) of the environment setting 1 register (RENV1) of PCL6115 is 0x03.

The setting value of PRMV is 3200 (200 pulses per rotation, 1/16 micro step).

## 4. Accessories

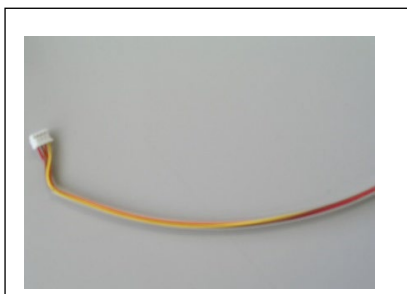
### 4.1 Stepping motor

PFCU30-24V4GM (1/12)[NPM] (1 piece)



### 4.2 Lead wire for motor

PFCU30 lead wire (E000016-885A) [NPM] 0.2m (1 piece)



CAUTION: When inserting the connector into the motor, do not insert it obliquely or do not overload it. After inserting the connector, please do not pull strongly the harness or overload it.

### 4.3 USB cable

Mini USB cable (AB-10H) A-miniB type 1m (1 piece)



# 4.4 Simple user's manual

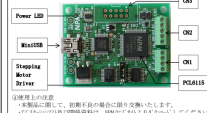
**NPM** 最新ユーザーマニュアル Ver.1.02 (2016.02)

本書は、下記でPCソフトウェアをインストールし、ソフトウェアインストールプログラムのインストールを完了させた後、PCL115を起動し、ステップモーター PFCU30-24V6GM(112)を動作させることができます。

①PCL115のスタートアップの特徴

②ハードウェア仕様

③部品配置図



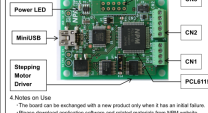
**NPM** Simple User's Manual Ver.1.02 (2016.02)

**PCL115 EV Starter Kit**

1. PCL115 EV Starter Kit Features


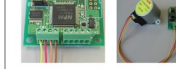
2. Hardware Specifications

3. Parts Layout




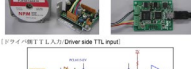
4. Notes on Use

【付属品】(1)ケーブル (Connect the accessory stepping motor)





端子番号	端子記号	ケーブルの色
1	A	1. Green
2	B	2. Orange
3	C	3. Red
4	D	4. Yellow


【例】(内蔵) (2)ケーブル (Example: Connect an external stepping motor)

①ドライブ側TTL入力 (Driver side TTL input)



②ドライブ側フォトインタラプター (Driver side Photocoupler input)



## Revision

Revision	Date	Contents
First	March 19, 2018	Initial Release.
Second	Jun 25, 2018	Page 10 Corrected because a picture and letters are overlapped.
Third	December 13, 2018	Changed Operation speed to 1500 pps 3.1 Specification summary 3.5.2 Excitation setting method
4th	July 16, 2019	Changed Document No. Added the manual list.
5th	July 16, 2024	TA600021-EN0/1 Page 9 Refer to "2-8. External driver connection" → Refer to " <b>3-8</b> . External driver connection"  Corrected spelling mistakes



Information  
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