EPSON
EXCEED YOUR VISION

S1C31D01
Photoplethysmography (PPG) Demonstration Kit
Software Manual

SEIKO EPSON CORPORATION

Rev.1.0

Evaluation board/kit and Development tool important notice

1. This evaluation board/kit or development tool is designed for use for engineering evaluation, demonstration, or development purposes only. Do not use it for other purposes. It is not intended to meet the requirements of design for finished products.
2. This evaluation board/kit or development tool is intended for use by an electronics engineer and is not a consumer product. The user should use it properly and in a safe manner. Seiko Epson dose not assume any responsibility or liability of any kind of damage and/or fire coursed by the use of it. The user should cease to use it when any abnormal issue occurs even during proper and safe use.
3. The part used for this evaluation board/kit or development tool may be changed without any notice.

NOTICE

Table of Contents

1. Software Description

The C31D01_PpgRefBoard software samples the PPG sensor and 3D accelerometer LIS2DH's output values in certain cycles, and sends them to the Micro SD card in Data-logger. The recorded data on Micro SD card can be visualized by Excel PpgMvLog.xlsm. The following describes this software.

1.1 File Configuration

File name	Description
data_logger.c	Data-logger function file
data_logger.h	Data-logger header definition file
hr_func.c	Heart-rate function file
hr_func.h	Heart-rate header definition file
lis2dh.c	Three-axis accelerometer LIS2DH function file
lis2dh.h	Three-axis accelerometer LIS2DH header definition file
main.c	Main function file
mdc_disp.c	Memory display function file
mdc_disp.h	Memory display header definition file
meas_data.h	Measured data header definition file
source_code_pro_black_28_1bit.h	Memory display font header definition file
trigon_table.h	Trigonometric function header definition file

1.2 Module Description

This section describes the more uncommon functions and variables that need explanation.

File name: data_logger.c

Function name	Description
logData	logKind's data is recorded to Data-logger

addLogData	Add to the queue for the Data-logger record.
sendLogData	Output the content of the queue for the Data-logger record.
redLed	Red LED is controlled according to argument swOn. 0: Turns off, 1: Turns on.
greenLed	Green LED is controlled according to argument swOn. 0: Turns off, 1: Turns on.

File name: hr_func.c

Function name	Description
calcCcHr	The heart rate is calculated at intervals of the least peak of the cross-correlation value. The frame number of 1/4 widths of window also follows and it changes in the certain scope.
getMinMax	Obtains the maximum and minimum values of the raw data that are used to detect pulsation.
checkHeartBeatTiming	Returns 2 if the latest measured raw data is smaller than the threshold value to determine that it denotes systole, otherwise this function returns 1.
execFir	Processes the raw data through the FIR filter and stores the result to ccData.firRes.
calcCC	Process ccData.firRes through the square wave correlation filter and stores the obtained cross-correlation value to ccData.ccRes.
calcFftHr	Calculate heart rate from results of FFT.
selFftHr	The static or the moving state is judged from the average value of an acceleration sensor, and heart rate is calculated from the calculation result of FFT.
subMeanVal	It carries away from fftData.ar[] for average of argument inData[].
calcAcc2	The value in which the sum of squares of the each axis output of the acceleration sensor is divided by 256 is returned.
fft	Analyzes fftData.ar[] through FFT and assigns the results to fftData.ar[] and fftData.ai[].

hannWin	Applies the Hann window to fftData.ar[].
calcPower	Assigns the sum of squares of fftData.ar[] and fftData.ai[] to fftData.power[].
getPeaks	Searches peaks in fftData.power[] and returns the peak pointer values and magnitudes by assigning to an array.

File name: main.c

Function name	Description
privSeI2C_Init	Initializes the I2C Ch.0 settings. This function is based on the seI2C_Init function included in the se_i2c.[ch] peripheral library with the PPORT setting for I2C masked and the BRT setting modified.
PORT_IRQHandler	This is an interrupt handler called when SW2 or SW3 is pressed. When SW2 is pressed, it starts or stop measuring. When SW3 is pressed, it changes display mode.
T16_0_IRQHandler	T16 Ch.0 interrupt handler function. This function is called repeatedly every 20 msec. It obtains the pulse wave A/D converted values and record them to the Data-logger. The value of the acceleration sensor obtains the value once every 20 msec. that is five times every 20 msec.
T16_2_IRQHandler	T16 Ch.2 interrupt handler function. This function updates the FFT calculation, the logger output of the calculation result, and the display of the memory display.
ADC12A_IRQHandler	ADC12A interrupt handler function. This function stores the measurement result to measData.measuredVal when an A/D conversion has completed and sets measData.stage to 1 (measurement completed).

File name: mdc_disp.c

Function name	Description
val2Str4	Converts a positive integer val into a numeric character string of “digit” digits (up to four digits) and sets it to the return value dst. If zeroSup = 1, this function suppresses zeros in the number, otherwise it does not zero-suppress.
pmVal2Str4	It is different from val2Str4. When val is a negative value, it return a minus sign adding.
val2Str6	It is different from val2Str4. Up to six digits.

chooseHr	The static or the moving state is judged from the momentary value of an acceleration sensor, and heart rate is selected from the calculation result of FFT or cross-correlation result.
dispEpsonLogo	Displays an EPSON logo at the predetermined position on the memory display.
dispState	Displays the currently selected measurement conditions on the memory display.
dispCurrMode	Displays the currently selected display mode on the memory display.
dispInternalVal	Displays the decided internal values on the memory display.
dispHeartRate	Displays the heart rate at the predetermined position on the memory display if it has been calculated.
dispExerIntens	The value of the acceleration sensor is converted into relative exercise intensity and displays it on the memory display.
dispSwStat	The setting status of SW1-1 to SW1-4 is displayed on the memory display.
checkBeat	It is judged whether the heart has shrunk, and sets the value of mdcDisp.markType.
reDrawMdc	It re-draws in each display element of the memory display according to specification.
privSeMDC_Gfx_PutString	The character string is displayed at a position specified of the memory display.

Structure name: MEAS_DATA_ST (defined in the meas_data.h file)

Variable name	Description
raw20[]	Raw data of the pulse wave measurement results every 20 msec. The data range is 0 to 4,095 because it was converted by ADC12A.
raw100[]	Raw data of the pulse wave measurement results every 100 msec. The data range is 0 to 4,095 because it was converted by ADC12A.
acc2[]	Sum of squares of the accelerometer three-axis outputs (X^2 + Y^2 + Z^2) / 32.
accX, accY, accZ	Measured values of three-axis directions of the accelerometer LIS2DH.

avail20	Available data number of raw20[].
avail100	Available data number of raw100[].
measVal	Measured PPG sensor value.
dazzlingCount	Counter for dazzling data.
initCount	Count down timer for initialize.
skip1stCount	Counter to count the number of skips at the start of measurement.
ptr20	Pointer to raw20[]、firRes[]、ccRes[].
ptr100	Pointer to raw100[]、acc2[].
interval5	Counter to make interval of every 100 msec. from interval timer of every 20 msec.
stage	State flag of A/D converter. 0: Measuring, 1: Measurement end.
running	Measurement state flag. 0: Under suspension, 1: Measuring.
interm	The control information that specifies either intermittent drive or continuous drive. 0: Continuous drive, 1: Intermittent drive
highGain	The gain control information. 0: Low amplifier gain, 1: High amplifier gain.
lpf	The LPF control information. 0: LPF off, 1: LPF on
logRaw	Record cycle to Data-logger. 0: Every 20 msec., 1: Every 100 msec.
soundFlag	Sound effect flag. 0: Sound off, 1: Sound on. It always sets to '1'.
overRunTimes0	Over run counter for T16 Ch.0.
overRunTimes2	Over run counter for T16 Ch.2.

Structure name: CC_DATA_ST (defined in the hr_func.h file)

Variable name	Description
firRes[]	The value after being processed through the FIR filter. The filtering process makes the shaped width smaller than the value before being converted.
ccRes[]	The cross-correlation value calculated using the square pulse window.
hr	Heart rate in BPM (Beats Per Minute).
numFrame	The number of frames for 1/4 of the square pulse window width.
rawMinVal	The minimum value of the raw data.
rawMaxVal	The maximum value of the raw data.
rawRange	Raw data range (= maximum value - minimum value).
rawSystoleLevel	Threshold value to determine systole. If raw data is smaller than this value, it is determined as systole.
systoleCycleCounter	Systole cycle counter.
hrFromSystole	The heart rate calculated from the systole cycle. This is used to automatically adjust numFrame.
shlinking	Flag shown as systole.

Structure name: FFT_DATA_ST (defined in the hr_func.h file)

Variable name	Description
ar[],ai[]	Real and imaginary parts of the FFT output.
ppgMaxVal[]	FFT peak magnitude of the PPG sensor signal.
accMaxVal[]	FFT peak magnitude of the accelerometer signal.
ppgMaxPtr[]	FFT peak pointer value of the PPG sensor signal.
accMaxPtr[]	FFT peak pointer value of the accelerometer signal.

ppgMaxHr[]	Heart rate converted from ppgMaxPtr[].
samePeak[]	Flag that is set to 1 when the peak positions of the the PPG sensor and accelerometer are matched, or set to 0 otherwise.
statPpgMaxVal[]	The pointer value of the FFT peak of PPG at the static state. It is judged from the value of the acceleration.
statPpgMaxPtr	Pointer to statPpgMaxVal[].
hr	Heart rate in BPM (Beats Per Minute).
currStat	A status which judged from the acceleration value. 0: Static state. 1: Motion state.
checkPeakFrom	Beginning point of peak check.
checkPeakTo	End point of peak check.
power[]	Square of the accelerometer FFT power (RealPart^2 + ImaginaryPart^2).
ptrToHrCoef	Coefficient (= 2.34) to convert the pointer value into a heart rate.

Structure name: MDC_DISP_ST (defined in the mdc_disp.h file)

Variable name	Description
hrBuff[]	Buffer to store the obtained heart rate. The value is in BPM.
exIntBuff[]	Buffer to store the obtained exercise intensity. Arbitrary unit.
hr	Heart rate for display in BPM (Beats Per Minute).
exerIntens	Exercise intensity. Arbitrary unit.
lastHr	Last measured heart rate in BPM.
dispHrCounter	Counter to update the heart rate display.
dispExIntConer	Counter to update the exercise intensity display.
markType	Size of heart mark for display. 0: Small. 1: Large.

frmBuff[]	Frame buffer for memory display.
strDisp[]	Character string for display.
Mode	Display mode. 0: Normal mode. 1: Cross-Correlation mode. 2: Fast Fourier Transform mode. 3: Accelerometer mode.
updateFlag	Item to which display should be updated.
needUpdate	Full-screen update request flag. It is set when the display contents on the memory display have significantly changed.

Structure name: DATA_LOG _ST (defined in the data_logger.h file)

Variable name	Description
sendData[]	Data sent to Data-logger. It adds to sendBuff[] by calling the addLogData() function.
sendBuff[]	Transmission buffer of data sent to Data-logger.
sendLen	Number of character in sendData[].
rdBuffPtr	Data-logger transmission pointer to sendBuff[].
wrBuffPtr	Writing pointer to sendBuff[].
lastHrForDL	LastHr of structure MDC_DISP_ST is kept for the logger output.
Tick	Tick value of sampling timing.
bufOverFlowTimes	Over flow counter for sendBuff[].

1.3 Operation Procedures

(1) Double click on the Samples/WORKSPACE_IAR/Samples.eww to launch IAR Embedded Workbench IDE.

(2) Select [C31D01_PpgRefBoard – DebugFlash] from the workspace drop-down menu.

(3) Select [Download and Debug] from the [Project] menu to write the program to the flash memory.

(4) Execute Excel.
Double-click the Excel file PpgMvLog.xlsm to execute.

(5) Execute the sample software.

1. Select [Go] from the [Debug] menu to execute the program. The program can also be executed by the S5U1C31D01S1200 alone with an external battery connected, as it is written in the flash memory.

2. After "C31D01_PpgRefBoard" is executed, the collection of measurements recorded on micro SD card, and it can be operated by the command from Excel VBA.

1.4 How to Use PpgMvLog.xlsm

Figure 1-1 shows the appearance of PpgMvLog.xlsm.

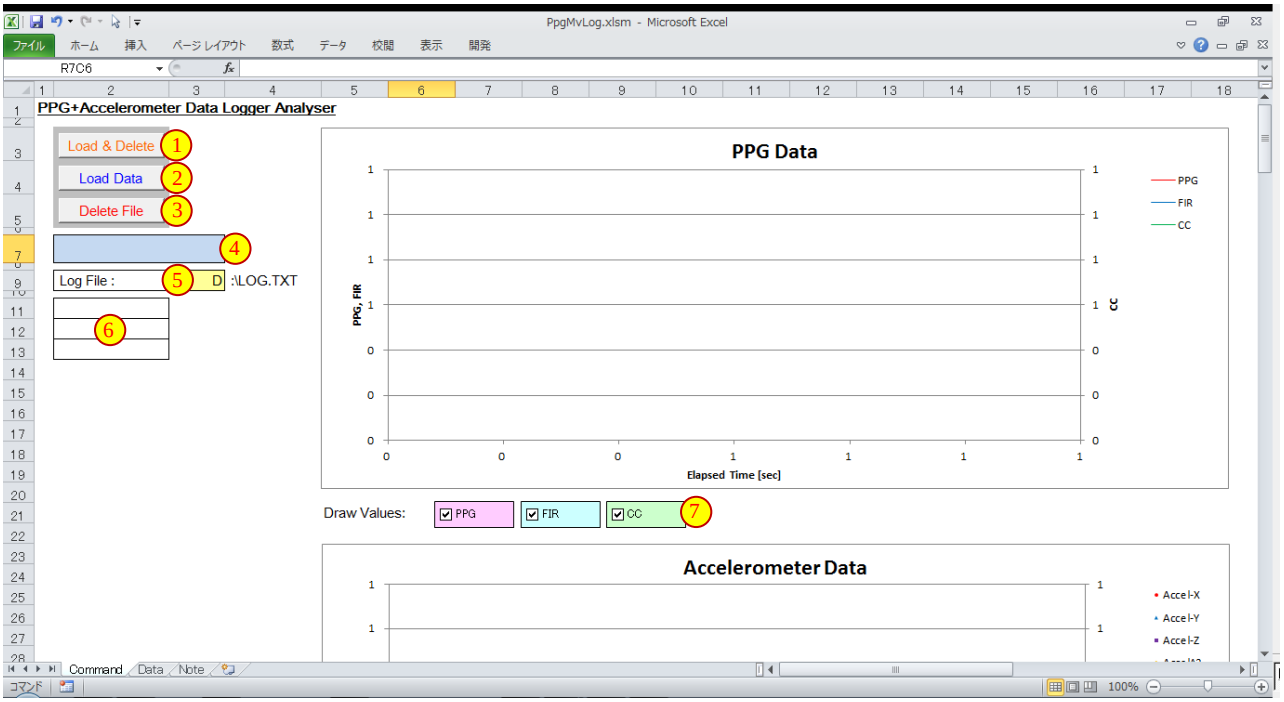


Figure 1-1 Appearance of PpgMvLog.xlsm

①	Load & Delete Button	Read data from micro SD card, and delete log file.
②	Load Button	Read data from micro SD card.
③	Delete Button	Delete log file in micro SD card
④	Status Indicator	It displays message of status.
⑤	Assign disk drive	Assign data drive of micro SD card.
⑥	Data Attributes	It displays data attributes. (Drive mode , Amplifier Gain, LPF)
⑦	Draw Element	Specify plot elements of each graphics.

Note1） The filter actually used depends on the combination of first and second filter selections.

1.5 Outline of Sample Program Operations

The sample program performs the following processing:

(1) Initializes the following peripherals/functions to be used:
- initializes the variables,
- enables OSC1(32.768kHz) to start oscillating,
- switches the system clock to IOSC(20MHz internal oscillator),
- sets the interrupt levels and clears the interrupt flags,
- initializes the memory display to clear the display,
- initializes PPORT, T16 Ch0, Ch2, Ch7, UART3, I2C, LIS2DH, and SNDA,
- assigns the ADC12A ports to the pins and initializes ADC12A,
- assigns the buzzer ports to the pins,
- initializes PPORT used for changing the AFE circuit configuration, and
- outputs 'H' from P24 to turn PPG_VDD off.

(2) Obtains the on/off status of SW1-1 to SW1-4 and updates the memory display to the initial screen.

(3) Starts T16 Ch.0 and Ch.2.

(4) Puts the CPU into HALT mode to wait for a PPORT interrupt.

(5) When a PORT interrupt has occurred by processing SW3, the sample program shifts the display mode.

(6) When a PPORT interrupt has occurred by pressing SW2, the sample program changes the AFE circuit configuration according to the setting, and performs the following processing:
When measurement is in halt state,
- turns PPG_VDD on to start measurement,
- configures the T16 Ch.0 to set the data sampling cycle, and
- issues a SW status display update request.

When the measurement is underway,
- turns PPG_VDD off to terminate the measurement,
- configures the T16 Ch.0 to set the SW1 status detection cycle,
- issues a SW status display update request, and
- the red LED shown while recording to the Data-logger is turned off.

(7) In intermittent drive mode, the T16_0_IRQHandler function turns the LED on and triggers ADC12A to initiate an A/D conversion after the predefined delay time has elapsed. It obtains the A/D conversion result and then turns the LED off.
In continuous drive mode, the function triggers ADC12A and obtains the A/D conversion result without a delay time inserted. After that, the sample program obtains the accelerometer LIS2DH output values, calculates the heart rate, and updates the display, periodically.

2. Switch and Display

2.1 Function of Push Switch and LED Display

Table 2-1 shows the function of push switch and the LED display.

Table 2-1 Function of Push Switch

Push Switch	Function
SW2	Start or stop measuring
SW3	Shift display mode

Table 2-2 LED display

LED	Status
Red LED	Recording to Data-logger
Green LED	State of dazzle

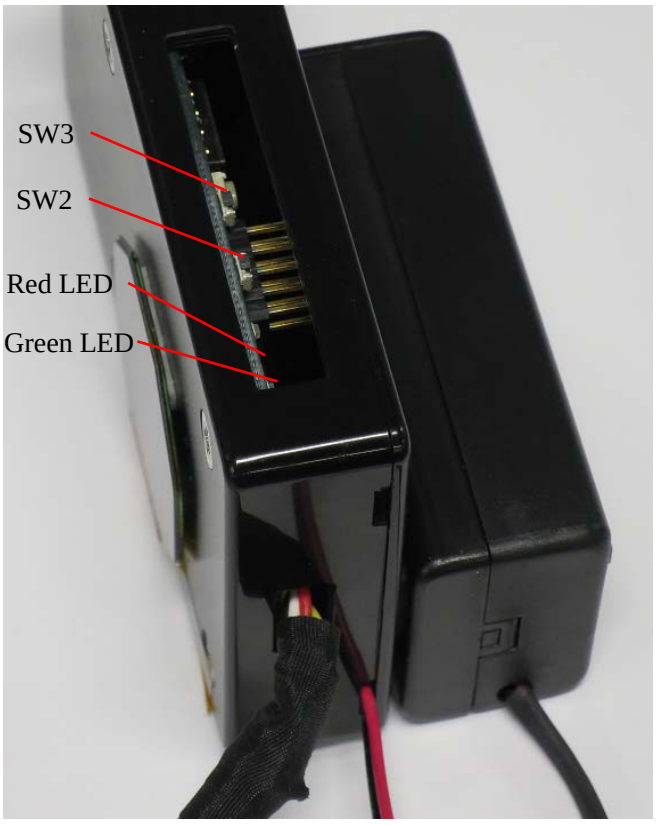


Figure 2-1 Push Switch and LED

2.2 Function of DIP Switch and Data Log Mode

Table 2-3 shows the function of the DIP switch.

Table 2-3 Function of DIP Switch

Switch	OFF	ON
SW1-1	LOG_RAW100 mode	LOG_RAW20 mode
SW1-2	C: Continuous drive	I: Intermittent drive
SW1-3	-: LPF off	F: LPF on
SW1-4	L: Low amplifier gain	H: High amplifier gain

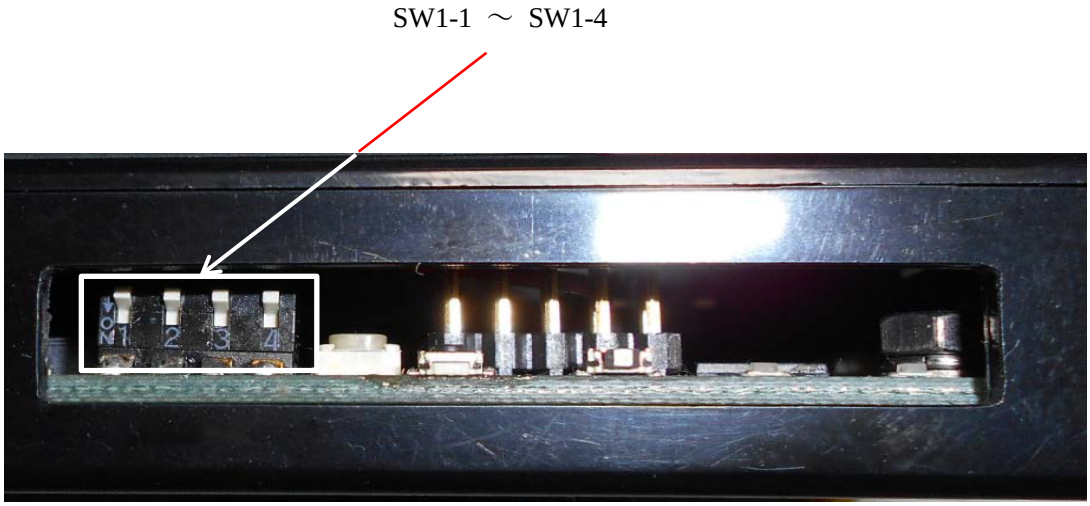


Figure 2-2 DIP Switch

On the data log mode, the recording duration changes as follows:

LOG_RAW20 mode

20ms × 100,000 = 2,000s = 0h33m20s

The following calculation results are recorded:

- The FIR filter.
- The square wave cross-correlation filter.

LOG_RAW100 mode

100ms × 100,000 = 10,000s = 2h46m40s

The following calculation results are not recorded:

- The FIR filter.
- The square wave cross-correlation filter.

2.3 Transition and Display Information on each Display Mode

The display mode shifts as follows by pushing SW3.

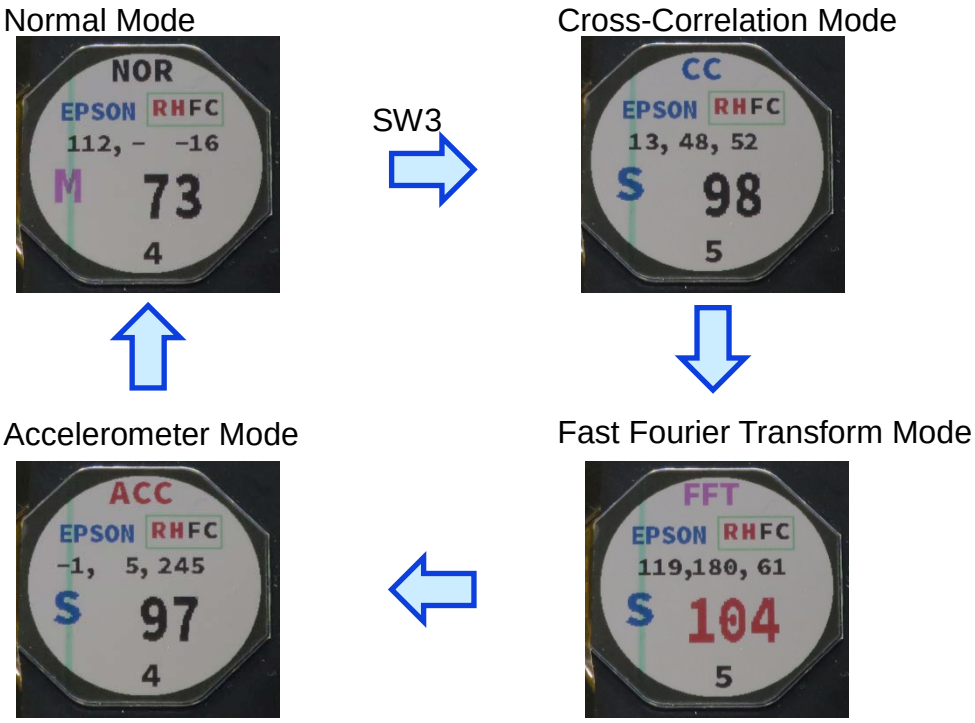


Figure 2-3 Shift of Display Mode

Display information is as follows:

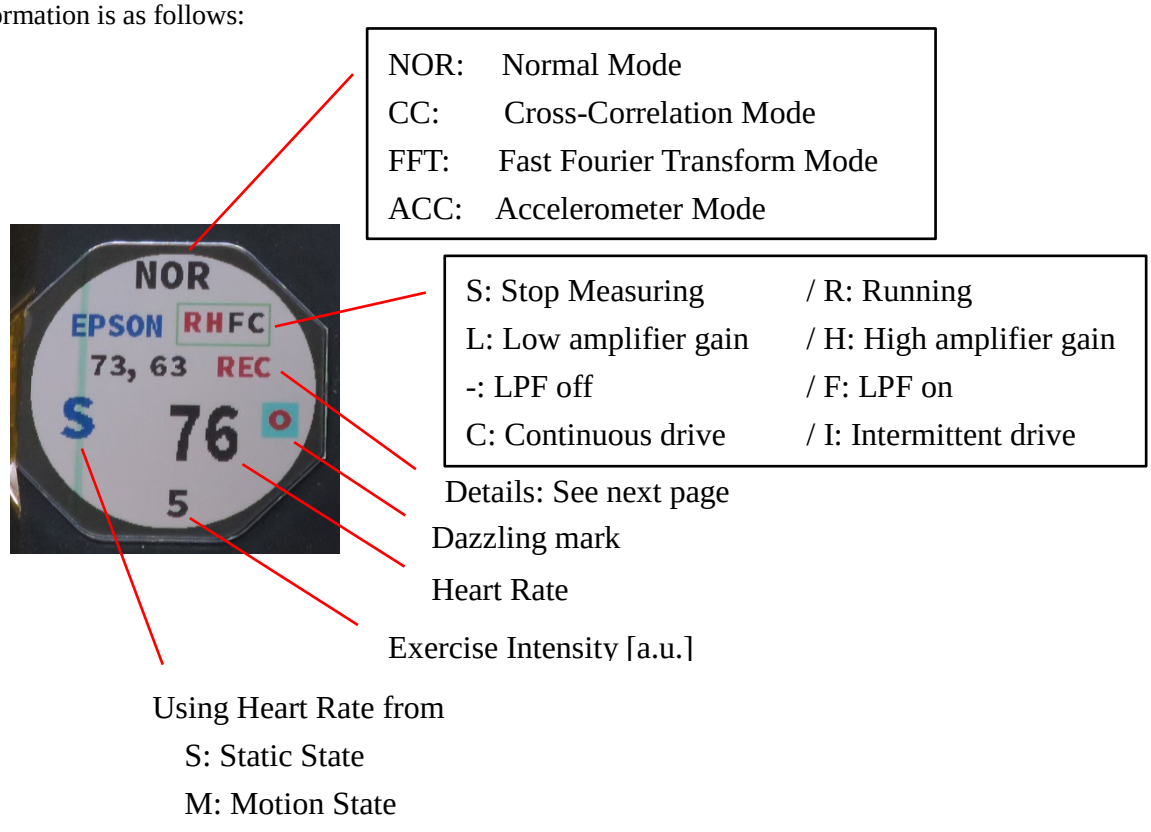


Figure 2-4 Display Information

The content of the display of detailed information changes in the display mode. It is as follows:

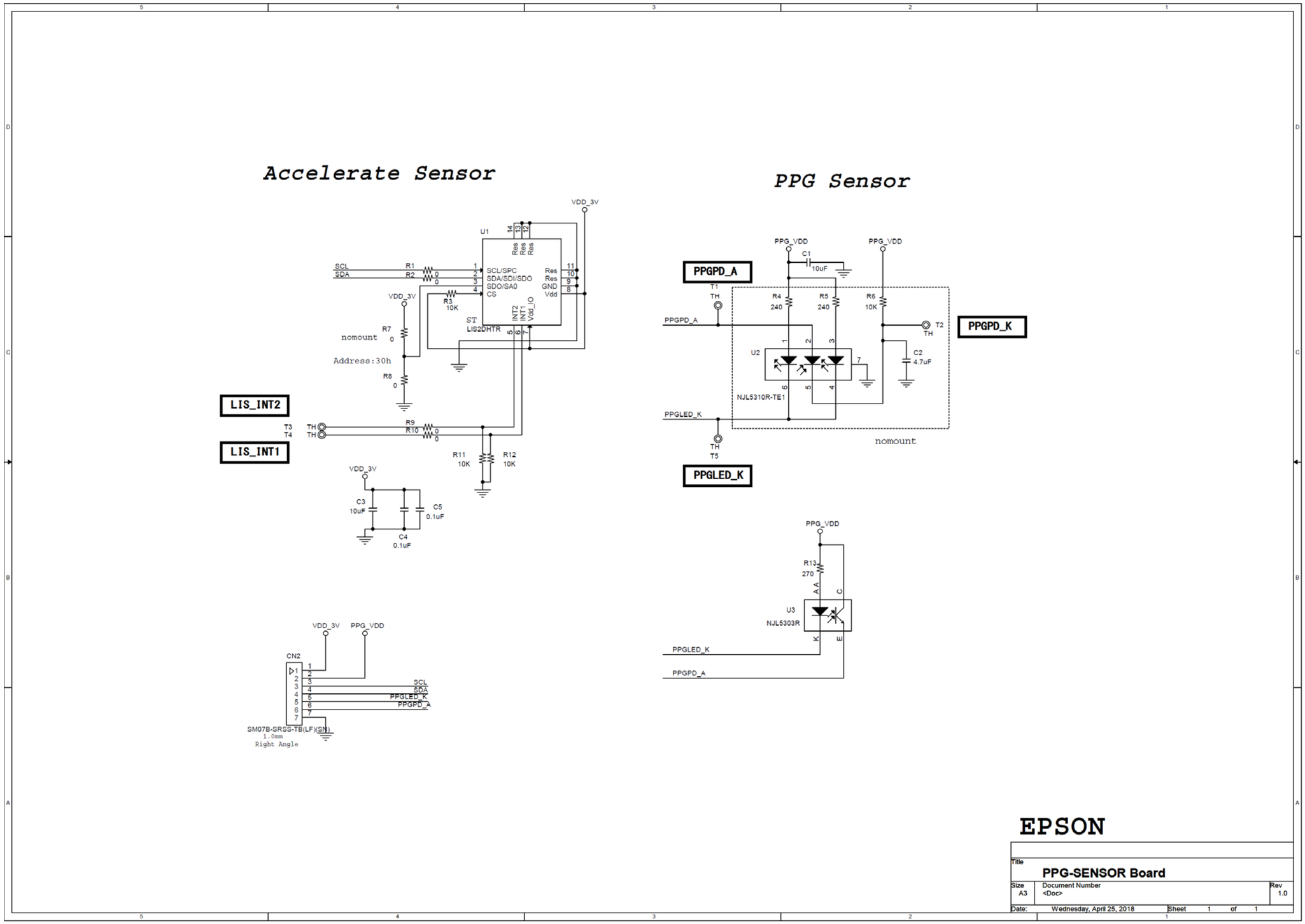
NOR: Normal Mode
"ccData.hr", "fftData.hr", "measData.skip1stCount / 10" or "REC"

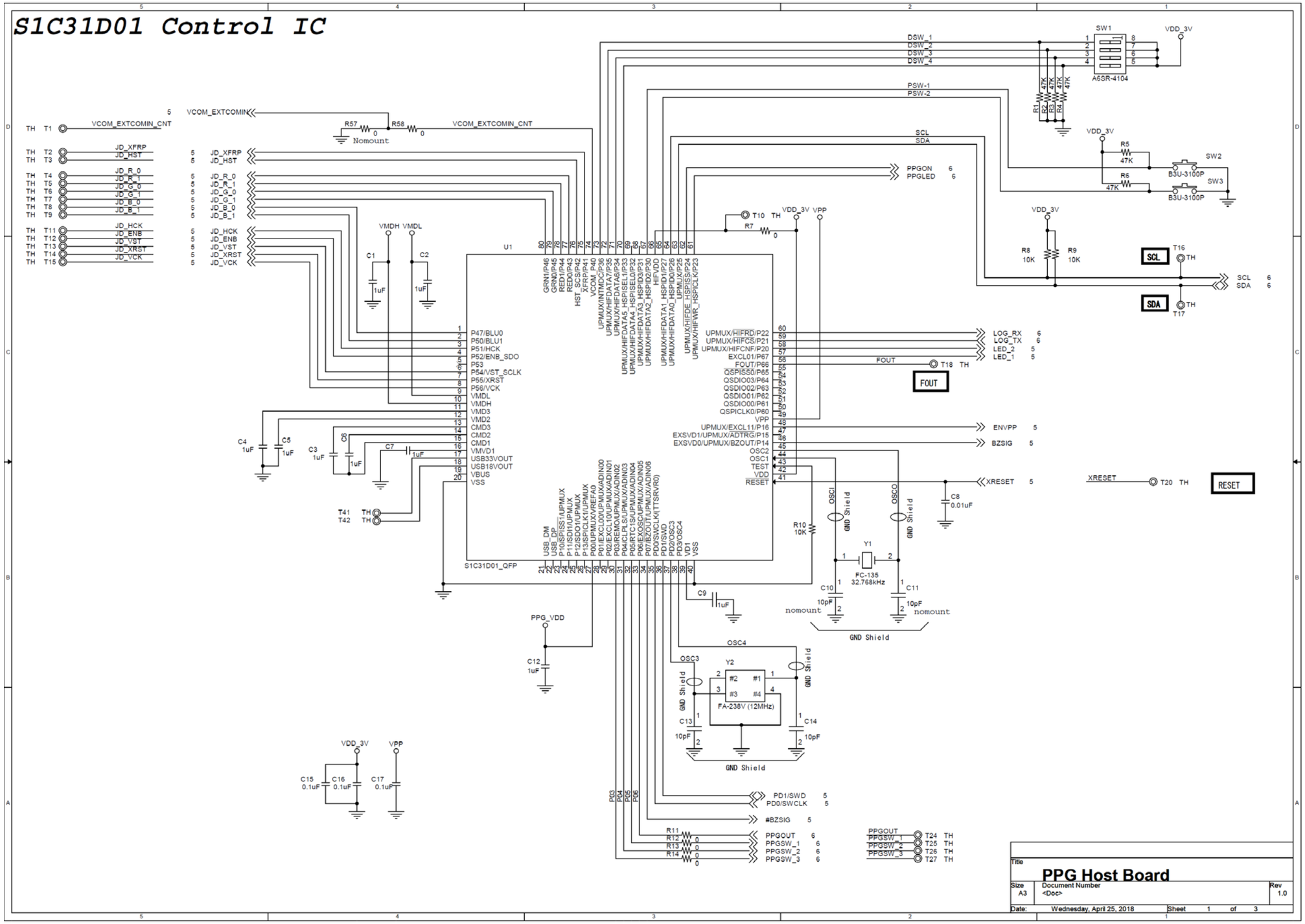
CC: Cross-Correlation Mode
"ccData.numFrame", "ccData.systoleCycleCounter", "ccData.hrFromSystole"

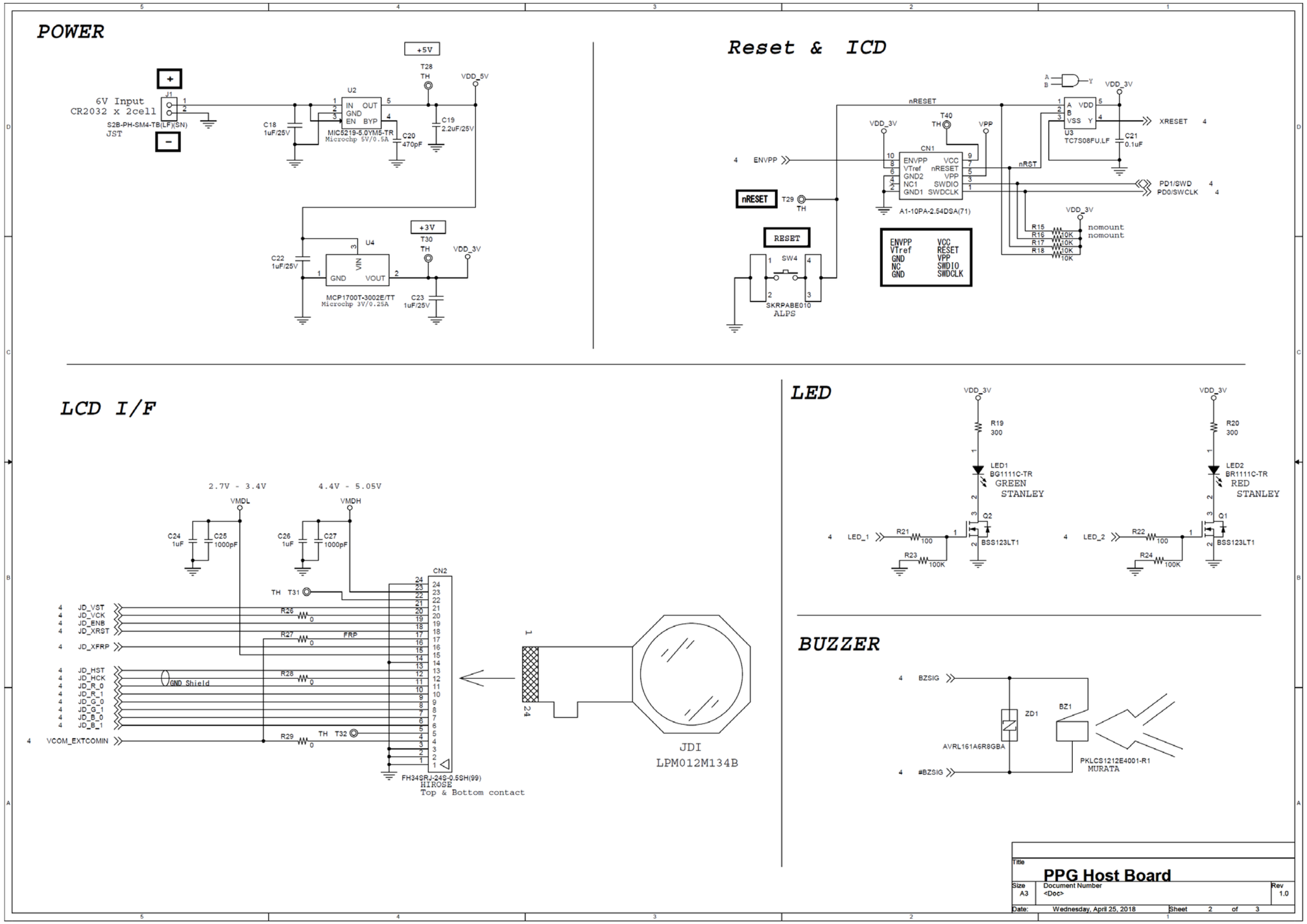
FFT: Fast Foulier Transform Mode
"fftData.ppgMaxHr[0-2]"

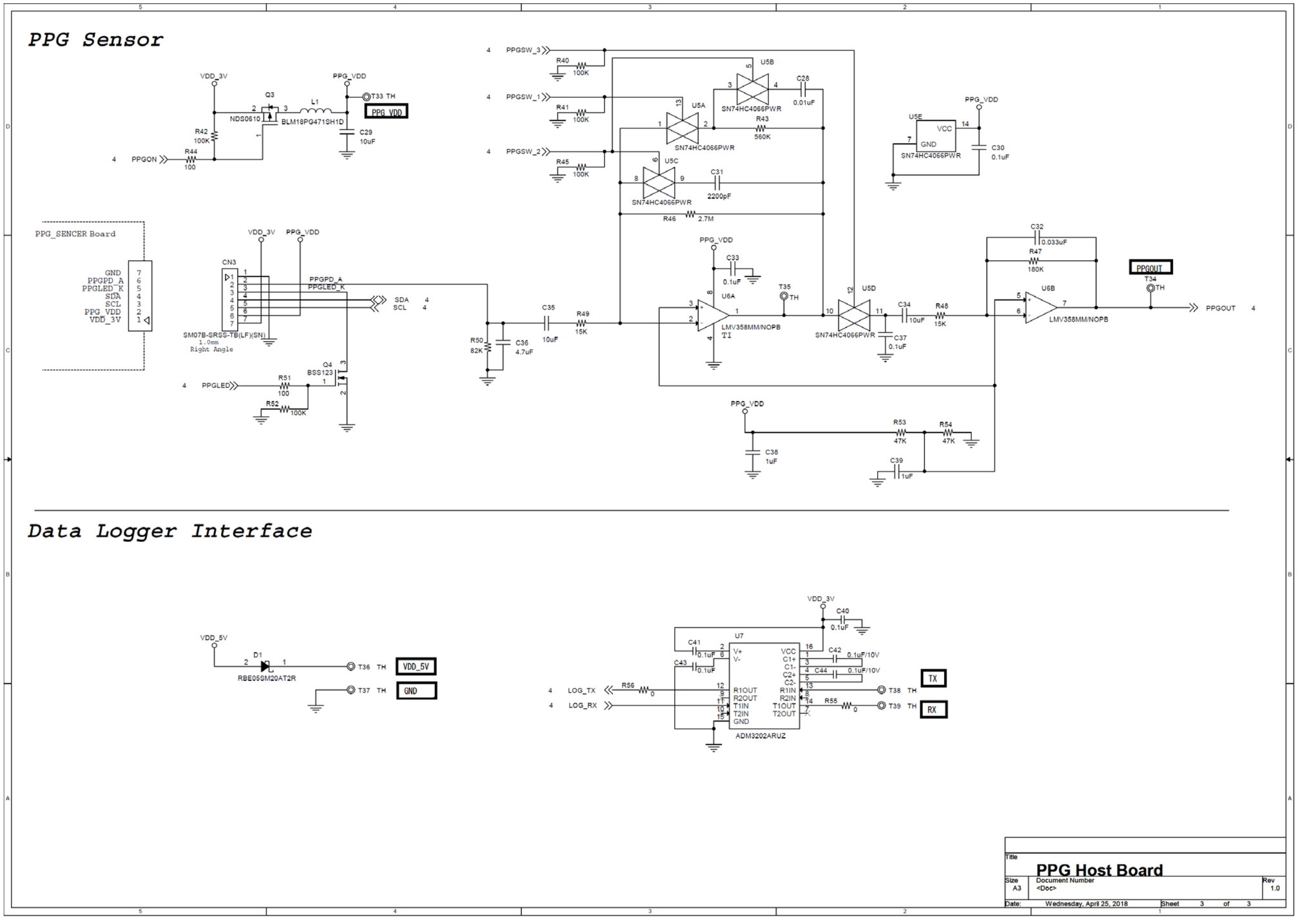
ACC: Accelerometer Mode
"measData.accX", "measData.accY", "measData.accZ"

Appendix-A Circuit Diagram




S1C31D01 Control IC
VCOM_EXTCOMIN
VCOM_EXTCOMIN_CNT
R57 0 Nomount
R58 0
JD_XFRP
JD_HST
JD_R_0
JD_R_1
JD_G_0
JD_G_1
JD_B_0
JD_B_1
JD_HCK
JD_ENB
JD_VST
JD_XRST
JD_VCK
VMDH VMDL
C1 1uF
C2 1uF
U1
S1C31D01_QFP
C4 1uF
C5 1uF
C3 1uF
C6 1uF
C7 1uF
T41 TH
T42 TH
C9 1uF
PPG_VDD
C12 1uF
DSW_1
DSW_2
DSW_3
DSW_4
SW1
A6SR-4104
VDD_3V
R1 47K
R2 47K
R3 47K
R4 47K
PSW-1
PSW-2
SCL
SDA
PPGON 6
PPGLED 6
R5 47K
R6 47K
SW2 B3U-3100P
SW3 B3U-3100P
R8 10K
R9 10K
T16 TH
T17 TH
SCL 6
SDA 6
T10 TH
R7 0
VPP
FOUT
T18 TH
LOG_RX 6
LOG_TX 6
LED_2 5
LED_1 5
ENVPP 5
BZSIG 5
XRESET 5
T20 TH
RESET
C8 0.01uF
R10 10K
Y1 FC-135 32.768kHz
C10 10pF nomount
C11 10pF nomount
GND Shield
OSC4
OSC3
Y2 FA-238V (12MHz)
C13 10pF
C14 10pF
C15 0.1uF
C16 0.1uF
C17 0.1uF
PD1/SWD 5
PD0/SWCLK 5
#BZSIG 5
R11 0
R12 0
R13 0
R14 0
PPGOUT 6
PPGSW_1 6
PPGSW_2 6
PPGSW_3 6
T24 TH
T25 TH
T26 TH
T27 TH
Title
PPG Host Board
Size A3
Document Number <Doc>
Rev 1.0
Date: Wednesday, April 25, 2018
Sheet 1 of 3


POWER
6V Input
CR2032 x 2cell
S2B-PH-SM4-TB(LF)(SN)
JST
J1
C18
1uF/25V
U2
IN OUT
GND
EN BYP
MIC5219-5.0YM5-TR
Microchip 5V/0.5A
C20
470pF
C19
2.2uF/25V
+5V
T28
TH
VDD_5V
U4
VIN
GND VOUT
MCP1700T-3002E/TT
Microchip 3V/0.25A
C22
1uF/25V
C23
1uF/25V
+3V
T30
VDD_3V
Reset & ICD
nRESET
VDD_3V
T40
VPP
CN1
ENVPP VCC
VTref nRESET
GND2 VPP
NC1 SWDIO
GND1 SWDCLK
A1-10PA-2.54DSA(71)
ENVPP
nRESET
T29
RESET
SW4
SKRPABE010
ALPS
ENVPP VCC
VTref RESET
GND VPP
NC SWDIO
GND SWDCLK
U3
TC7S08FU,LF
C21
0.1uF
XRESET
nRST
PD1/SWD
PD0/SWCLK
R15
R16
R17
R18
10K
nomount
LCD I/F
2.7V - 3.4V
4.4V - 5.05V
VMDL
VMDH
C24
1uF
C25
1000pF
C26
1uF
C27
1000pF
CN2
TH T31
JD_VST
JD_VCK
JD_ENB
JD_XRST
JD_XFRP
JD_HST
JD_HCK
JD_R_0
JD_R_1
JD_G_0
JD_G_1
JD_B_0
JD_B_1
VCOM_EXTCOMIN
R26
R27
R28
R29
FRP
GND Shield
TH T32
FH34SRJ-24S-0.5SH(99)
HIROSE
Top & Bottom contact
JDI
LPM012M134B
LED
R19
300
R20
300
LED1
BG1111C-TR
GREEN
STANLEY
LED2
BR1111C-TR
RED
STANLEY
Q2
Q1
BSS123LT1
LED_1
LED_2
R21
R22
100
R23
R24
100K
BUZZER
BZSIG
#BZSIG
ZD1
AVRL161A6R8GBA
BZ1
PKLCS1212E4001-R1
MURATA
Title
PPG Host Board
Size
A3
Document Number
<Doc>
Rev
1.0
Date:
Wednesday, April 25, 2018
Sheet
2
of
3


PPG Sensor
VDD_3V
PPG_VDD
T33 TH
PPG_VDD
Q3
NDS0610
L1
BLM18PG471SH1D
C29
10uF
R42
100K
R44
100
PPGON
PPGSW_3
PPGSW_1
PPGSW_2
R40
100K
R41
100K
R45
100K
U5B
SN74HC4066PWR
C28
0.01uF
U5A
R43
560K
U5C
C31
2200pF
R46
2.7M
U5E
VCC
GND
SN74HC4066PWR
C30
0.1uF
PPG_SENCER Board
GND
PPGPD_A
PPGLED_K
SDA
SCL
PPG_VDD
VDD_3V
CN3
SM07B-SRSS-TB(LF)(SN)
1.0mm
Right Angle
PPGPD_A
PPGLED_K
SDA
SCL
Q4
BSS123
PPGLED
R51
100
R52
100K
C35
10uF
R49
15K
R50
82K
C36
4.7uF
C33
0.1uF
T35
TH
U6A
LMV358MM/NOPB
TI
U5D
SN74HC4066PWR
C34
10uF
R48
15K
C37
0.1uF
C32
0.033uF
R47
180K
U6B
LMV358MM/NOPB
PPGOUT
T34
TH
PPGOUT
C38
1uF
R53
47K
R54
47K
C39
1uF
Data Logger Interface
VDD_5V
D1
RBE05SM20AT2R
T36 TH
VDD_5V
T37 TH
GND
VDD_3V
C40
0.1uF
U7
C41
0.1uF
C43
0.1uF
V+
V-
VCC
C1+
C1-
C2+
C2-
C42
0.1uF/10V
C44
0.1uF/10V
LOG_TX
LOG_RX
R56
0
R1OUT
R2OUT
T1IN
T2IN
GND
R1IN
R2IN
T1OUT
T2OUT
R55
0
T38 TH
TX
T39 TH
RX
ADM3202ARUZ
Title
PPG Host Board
Size
A3
Document Number
<Doc>
Rev
1.0
Date:
Wednesday, April 25, 2018
Sheet
3
of
3

Revision History

Attachment-1

Rev. No.	Date	Page	Category	Contents
Rev 1.0	2018/ 4/27	All	new	

EPSON

International Sales Operations

America

Epson America, Inc.

Headquarter:
3840 Kilroy Airport Way
Long Beach, California 90806-2452 USA
Phone: +1-562-290-4677

San Jose Office:
214 Devcon Drive
San Jose, CA 95112 USA
Phone: +1-800-228-3964 or +1-408-922-0200

Europe

Epson Europe Electronics GmbH
Riesstrasse 15, 80992 Munich,
Germany
Phone: +49-89-14005-0 FAX: +49-89-14005-110

Asia

Epson (China) Co., Ltd.
4th Floor, Tower 1 of China Central Place, 81 Jianguo Road, Chaoyang District, Beijing 100025 China
Phone: +86-10-8522-1199 FAX: +86-10-8522-1120

Shanghai Branch
Room 1701 & 1704, 17 Floor, Greenland Center II,
562 Dong An Road, Xu Hui District, Shanghai, China
Phone: +86-21-5330-4888 FAX: +86-21-5423-4677

Shenzhen Branch
Room 804-805, 8 Floor, Tower 2, Ali Center,No.3331
Keyuan South RD(Shenzhen bay), Nanshan District, Shenzhen 518054, China
Phone: +86-10-3299-0588 FAX: +86-10-3299-0560

Epson Taiwan Technology & Trading Ltd.
15F, No.100, Songren Rd, Sinyi Dist, Taipei City 110. Taiwan
Phone: +886-2-8786-6688

Epson Singapore Pte., Ltd.
1 HarbourFront Place,
#03-02 HarbourFront Tower One, Singapore 098633
Phone: +65-6586-5500 FAX: +65-6271-3182

Seiko Epson Corp.
Korea Office
19F, KLI 63 Bldg, 60 Yoido-dong,
Youngdeungpo-Ku, Seoul 150-763, Korea
Phone: +82-2-784-6027 FAX: +82-2-767-3677

Seiko Epson Corp.
Sales & Marketing Division

Device Sales & Marketing Department
421-8, Hino, Hino-shi, Tokyo 191-8501, Japan
Phone: +81-42-587-5816 FAX: +81-42-587-5116

Document Code: 413650500
First Issue April 2018