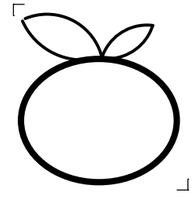
Rev	Date	Name	Description
XA1	24Apr2020	WA2DFI	Initial Drawing
XA2	26Apr2020	WA2DFI	Added Build property for LD, changed RM-3100 to sockets
XA3	29Apr2020	WA2DFI	Added LD interrupt capabiity; auto addressing
XA4	3May2020	WA2DFI	Changed interrupt jumper to 3-pin
XA5	4May2020	WA2DFI	Change PU, add capacitance
XA6	7May2020	WA2DFI	Remove AS3935 lighning detector; rename to MagneoPiHat
XA7	26May2020	WA2DFI	Fix pins on MagI2C
XA8	28May2020	WA2DFI	Fix J10 property.
XA9	31May2020	WA2DFI	Update layout, J1 p/n
XB1	20Aug2020	WA2DFI	Add C5, D2, R2, C6, C19. Change C16 to 220uF. Change U1 to ULDO Reg.
XB2	25Aug2020	WA2DFI	Change D2 BAT54 to 0603. Renumber.
XC1	9Sep2020	WA2DFI	Add 0-ohm option connecting GPIO5 to the 9615 enable pin
XC2	23Sep2020	WA2DFI	Change R7 from 100 ohm 1/2W to 220 ohm 1/4W
XD1	11Oct2020	WA2DFI	Swap U7-2 and U7-3. Rotate J6 and substitute latch-up version; add HamSCI and NSF logos. R19 & R21 change to 0.1W

Pg	Contents
1	Cover
2	MagnetoPiHat Placement, addressing and build options
3	MagnetoPiHat Schematic



Design by Scotty Cowling WA2DFI

Zephyr Engineering Inc.

Title: TangerineSDR MagnetoPiHat

Size: C | Document Number: <Doc> | Rev: XD1

Date: Sunday, October 11, 2020 | Sheet 1 of 3

The MagnetoPiHat can operate in three different modes:
1. STANDALONE TEST
2. LOCAL
3. REMOTE

In normal operation, a pair of MagnetoPiHat boards are used, one in LOCAL mode and the other in REMOTE MODE. The PNI sensor module is plugged into the REMOTE, and J5/J6 are empty on the LOCAL unit. Jumper the LOCAL and REMOTE units as shown below.
STANDALONE TEST mode is only used to test the communicatiuons and power connections. DATA OBTAINED IN STANDALONE TEST MODE WHERE THE MAGNETOMETER IS LOCATED INDOORS IS NOT TO BE TRUSTED.

STANDALONE TEST MODE (I2C ADDRESSES set to LOCAL)

The STANDALONE TEST mode is used to test the Magnetometer module and is NOT INTENDED to be used to collect data. In order to get accurate readings, the Magnetometer module MUST BE LOCATED OUTSIDE, AWAY FROM ALL ELECTRICAL AND MAGNETIC SOURCES.

Configuration: Single MagnetoPiHat plugged onto RPi I/O expansion header
RM-3100 Magnetometer board plugged into J1/J8
Addresses automatically set to "local"
JMP2 pins: none
JMP4 pins: none

LOCAL MODE (I2C ADDRESSES set to LOCAL)

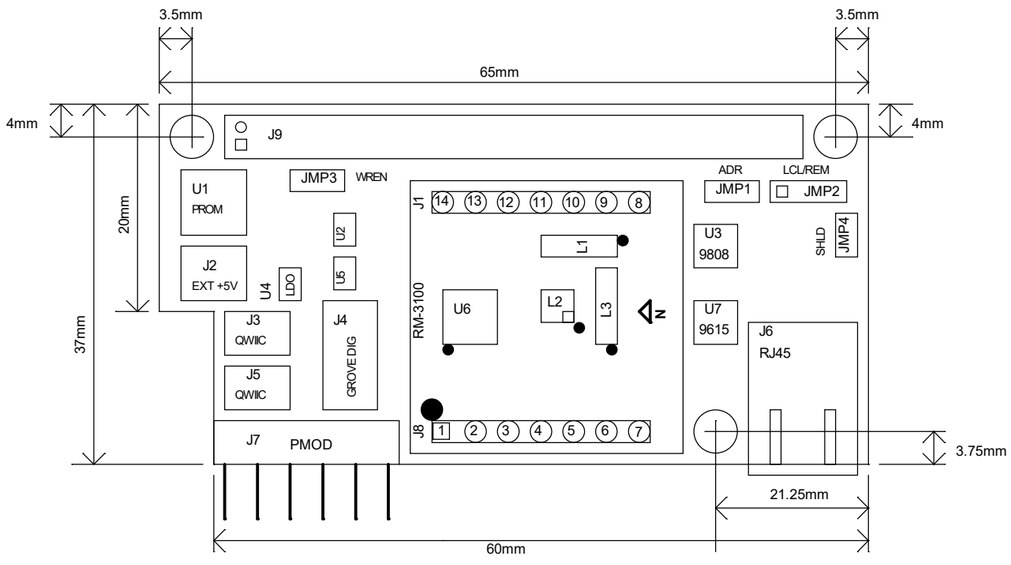
Configuration: Single MagnetoPiHat plugged onto RPi I/O expansion header
No RM-3100 Magnetometer board plugged into J1/J8
Addresses automatically set to "local"
JMP2 pins: 1-2
JMP4 pins: 1-2

REMOTE MODE (I2C ADDRESSES set to REMOTE)

Configuration: Single MagnetoPiHat at end of CAT5 cable
RM-3100 Magnetometer board plugged into J1/J8
Addresses automatically set to "remote"
JMP2 pins: 2-3
JMP4 pins: none

I2C ADDRESS TABLE

	LOCAL Board	REMOTE Board
	These addresses are used to address the parts on the LOCAL board when the MagentometerPiHat is plugged onto an RPi expansion header or JMP1 is installed.	These addresses are used to address the parts on the REMOTE board when the MagentometerPiHat is not plugged onto an RPi expansion header and JMP4 is not installed. The REMOTE board must be connected to the LOCAL board with CAT5 cable.
PNI MAGIC2 ASIC	**0x22 (test only)**	**0x23**
MCP9808 TEMP SENSOR	**0x18**	**0x19**



See https://github.com/raspberrypi/hats for outline details

BUILD OPTIONS

The following components are not installed from the factory. To enable the functions below, install the named components.

Extended remote option R9	To extend the LOCAL/REMOTE distance 50% by using two conductors in the CAT5 cable for power, install a zero-ohm 0402 resistor at R6. This will disable the remote REM_DRDY_IRQn interrupt to the RPi. If you add this option, remove JMP3 to insure that pins 2-3 NEVER get jumpered. This will prevent destruction of Q1.
Power option JMP1, J2	To power the MagnetoPiHat in LOCAL or STANDALONE TEST mode without plugging into a RPi (or with another SBC that has an incompatible expansion header pinout), install 2-pin 0.1" headers at JMP1 and J2. Power the board by connecting +5V to J2 (mind polarity!) and jumper JMP1 to LOCAL/STANDALONE TEST mode. This option is not used in REMOTE mode.
Grove option J4	To communicate with the MagnetoPiHat in LOCAL or STANDALONE TEST mode without plugging into a RPi (or with another SBC that has an incompatible expansion header pinout), install a 4-pin Grove connector at J4. Connect the I2C port to the board by connecting a 4-wire cable between connector J4 and the I2C port on the SBC. This option is not used in REMOTE mode.
QWIIC option J3, J5	To communicate with the MagnetoPiHat in LOCAL or STANDALONE TEST mode without plugging into a RPi (or with another SBC that has an incompatible expansion header pinout), install one or both 4-pin QWIIC connectors at J3 and/or J5. Connect the I2C port to the board by connecting a 4-wire QWICC cable between connector J3/J5 and the I2C port on the SBC. You can use the second QWIIC connector as a pass-through connection. This option is not used in REMOTE mode.
PMOD option J7	To communicate with the MagnetoPiHat in LOCAL or STANDALONE TEST mode without plugging into a RPi (or with another SBC that has an incompatible expansion header pinout), install a 12-pin PMOD connector at J7. Plug the MagnetoPIHat into a PMOD connector on the SBC. This option is not used in REMOTE mode.
Onboard Mag option C15,C17, R10-R16, L1-L2, U6	To install the magnetometer components directly to the board (instead of using a plug-in module on J1/J8), install the following parts: C15, C17, R10-R16, L1-L3, U6. Once you do this DO NOT install a magnetometer module on J1/J8.
Additional +5V capacitance C7	To add additional capacitance on the +5V rail to help with transient response, install a 220uF 6.3V 1206 capacitor at C7.
Remote Enable R23	Install this 0402 zero-ohm resistor to allow the RPi GPIO5 (pin 29) to disable (GPIO5 low) or enable (GPIO5 high) the 9615 I2C extender under program control..

JUMPER FUNCTIONS

JMP1
Place JMP1 to shift I2C addresses to their local values.
If the MagnetoPi Hat is plugged directly onto the RPi, addresses are shifted automatically and JMP1 is ignored.

JMP2
PLACE JMP2 pins 1-2 to enable the RPi interrupt from the remote on the CAT5 cable
PLACE JMP2 pins 2-3 to enable remote DRDY to drive the CAT5 cable
Do not place JMP2 in STANDALONE mode.

JMP3
Place JMP3 to enable writes to the on-board RPi Hat eeprom. Normally users will never do this.

JMP4
Place JMP4 to connect the J6 (CAT5) shield to logic ground.
Place JMP4 on the local board only in a LOCAL/REMOTE setup.

Design by Scotty Cowling WA2DFI

Zephyr Engineering Inc.
Title: TangerineSDR MagnetoPiHat Layout
Size: C | Document Number: <Doc> | Rev: XD1
Date: Sunday, October 11, 2020 | Sheet 2 of 3

RPi Expansion

J9
HDR_20X2_SMT_N2_10mm

3P3V_PI
PROM_SDA
RMT_EN
5P0V_PI
REM_DRDY_IRQn
LCL_DRDY_IRQn
PROM_SCL

PTC1
750mA
24V
290 mOhm

5P0V

3P3V

R3
10K
1%

JMP1
1x2_0.100_vert_JMP - DNI
Build = DNI

ADDR

JUMPER FOR LOCAL/STANDALONE
REMOVE JUMPER FOR REMOTE

RPi CONNECTION AUTO
SWITCHES ADDRS

R2
4K7
1%

R1
4K7
1%

R4
3K9
1%

R6
3K9
1%

U1
CAT24C32WI-GT3

R5
1K
1%

C1
100nF
16V

WREN

JMP3
1x2_0.100_vert_JMP

LOCAL/STND ADR: 0x22
REMOTE ADR: 0x23

J8
HDR_RM3100_1_7

J1
HDR_RM3100_8_14

LCL_DRDY

R8
10K
1%

C2
100nF
16V

PNI-RM3100MAG

780uA

JUMPER 1-2 FOR LOCAL
JUMPER 2-3 FOR REMOTE
NO JUMPER FOR STANDALONE

JMP2
1x3_0.100_vert_JMP

LOC / RMT

R7
220R
0.25W
1%

U2
74LVC1G07

500uA

U5
74LVC1G06

500uA

Q1
IRLML6244TRPbF

GROVE DIGITAL

J4
Grove_1x4_0.100_vert - DNI
Build = DNI

QUIIC

J3
QWIIC_1x4_1mm_ra - DNI
Build = DNI

QUIIC

J5
QWIIC_1x4_1mm_ra - DNI
Build = DNI

EXT 5V

J2
1x2_0.100_vert_ramp - DNI

PMOD

J7
Conn_HDR_RA_PMOD - DNI
Build = DNI

U6
PNI-MAGI2C_13156 - DNI
Build = DNI

C17
100nF - DNI
16V
Build = DNI

C15
10uF - DNI
6.3V
Build = DNI

R12
33K - DNI
1%
Build = DNI

R11 121R - DNI 1% Build = DNI
R10 121R - DNI 1% Build = DNI
R14 121R - DNI 1% Build = DNI
R13 121R - DNI 1% Build = DNI
R15 121R - DNI 1% Build = DNI
R16 121R - DNI 1% Build = DNI

L1
SEN_XY-f_13104 - DNI
Build = DNI

L3
SEN_XY-f_13104 - DNI
Build = DNI

L2
SEN-Z-f 13101 - DNI
Build = DNI

U4
MIC5301-3.3YD5

Load ~2.3mA

C3
100nF
16V

C4
1uF
16V

C8
100nF
16V

C5
100nF
16V

C6
10uF
6.3V

Vdropout=4mV@25mA

MH3
2.75mm

MH4
2.75mm

U3
MCP9808T-E/MS

400uA

C9
100nF
16V

LOCAL/STND ADR: 0x18
REMOTE ADR: 0x19

SCL
SDA
LOCALn

D1
Schottky
40V
200mA

C14
100nF
16V

C10
100nF
16V

16uA

91mA

11.4mA

U7
PCA9615DPJ

ENABLE

R23
0R - DNI
Build = DNI

C16
100nF
16V

C18
22uF
10V

R20
390R
1%

R18
390R
1%

R21
100R
0.1W
5%

R9
0R - DNI
Build = DNI

R22
390R
1%

R17
390R
1%

R19
100R
5%
0.1W

REMOTE CABLE

J6
RJ45_SH-RA-NoLED-up

DSCL+
DSCL-
DSDA+
LD_TRIGn
CAB_5V
DSDA-
SH

JMP4
1x2_0.100_vert_JMP

SH GND

FB1
MMZ2012R601ATD25
200 mOhm

C11
100nF
16V

C12
1nF
16V

C13
220uF
6.3V

C7
220uF-DNI
6.3V
Build = DNI

Design by Scotty Cowling WA2DFI

Zephyr Engineering Inc.	Title: TangerineSDR MagnetoPiHat	
Size: C	Document Number: <Doc>	Rev: XD1
Date: Sunday, October 11, 2020	Sheet 3 of 3	