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Product name	Description	Version
RTK-M300	RTK Fan-Less System	0.2

1. Introduction

LOCOSYS RTK-M300, a compact, rugged and industrial grade computer with Intel Atom® x5-E3930 processor dual core 1.3GHz, Aluminum top case with sheet metal, is designed for the harsh or need noiseless Ad-hoc network environment.

LOCOSYS RTK-M300 has advanced RTK (Real-time kinematic) receiver supports global GPS/Glonass/Beidou/Galileo/QZSS, L1+L5 Dual-frequency and multi-constellation RTK positioning solution. RTK-M300 adopt full frequency 4G-LTE communication board, Worldwide LTE, UMTS/HSPA+ and GSM/GPRS/EDGE coverage. It features 10/100/1000Mbps Ethernet data and voice connectivity. With external SIM socket, it allows user to access SIM card conveniently. RTK-M300 installs Win10 (or Linux) operating system, suitable for with LOCOSYS Firebird application software, provide user-friendly graphical operation interface, whether it is used for “Base station” management or “Rover” use.

Because of the fan-less compact design, certified (-30 ~ +70 degrees) high and low temperature test and (MIL-STD-810) military standard vibration test, provide fast and easy installation. It is especially for the RTK Base Station with limited room space to locate the computer system, but without compromising with its space to scarify its features. Whether as a RTK Base station or RTK Rover, it is very fast and convenient to use and install. RTK-M300 keeps the flexibility to meet different demands for telemetric monitor or surveying applications.

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2. Features

- Intel Atom® x5-E3930 processor dual core 1.3GHz compact and fan-less design.
- L1 + L5 Dual-frequency and multi-constellation heading and RTK positioning solution.
- Support GPS, GLONASS, BeiDou, GALILEO, QZSS satellite.
- Capable of SBAS (WAAS, EGNOS, MSAS, GAGAN).
- Support 135-channel GNSS.
- RTK Position Accuracy 1cm CEP.
- GNSS Position Accuracy 1.5m CEP
- Support 1/5Hz Default. (Option: Up to 10Hz update rate).
- 10/100/1000Mbps Ethernet.
- 1PPS high accuracy time pulse output.
- Operating temperature range -40 to +70°C.
- Wide range DC input from 9-36V (Option: AC100-240V Power adapter).
- Certified by CE/FCC/E13 mark.
- Passed Military standard (MIL-STD-810) vibration test.
- RTK Base station management or RTK Rover use.

3. Application

- Vehicle RTK positioning and navigation.
- Automotive navigation.
- Marine navigation.
- Fleet management.
- Autonomous Vehicle Guidance.
- Precision Agriculture.
- AGV Robotics.
- Structural / Land Monitoring.
- RTK Ad-hoc network.

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4. Product feature

GNSS feature	Description	
Frequency	GPS/QZSS: L1 C/A, L5C	GALILEO: E1, E5a
	GLONASS: L1OF	BEIDOU: B1I, B2a
Channels	Support 135 channels	
Update rate	1/5Hz (default) ; 10Hz (option)	
Sensitivity	Tracking	-165dBm (with external LNA)
	Cold start	-148dBm (with external LNA)
Acquisition Time	Cold start	28s (typical)
	RTK Convergence time	< 10s (typical; after 3D fix)
Position Accuracy (1)	Autonomous	< 1.5m CEP
	RTK (2)	0.01m + 1ppm (Horizontal)
Max. Altitude	< 18,000 m	
Max. Velocity	< 500 m/s	
Protocol Support	NMEA 0183 ver. 4.1	115200 bps (3), 8 data bits, no parity, 1 stop bits (default) 1Hz: GGA, GLL, RMC 0.2Hz: GSA, GSV
	Raw data	115200 bps, RTCM V3.3, message type 1005, 1074, 1084, 1094, 1114, 1124

Note 1: Open sky, dual band, demonstrated with a good external LNA.

Note 2: CEP, 24hr static.

Note 3: Both baud rate output message rate are configurable to be factory default.

5. Operation Specification

Parameter	Description
Operating Temperature Range	-40~70°C
Storage Temperature	-40~85°C

6. Specification

6.1 System

System	Description
CPU	Intel Atom® x5-E3930 processor dual core 1.3GHz

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Memory	1 x 204-pin DDR3L SO-DIMM socket support 1866MHz up to 8GB. (Default 4GB)
Communication	Worldwide 4G-LTE, UMTS/HSPA+ and GSM/GPRS/EDGE coverage ➢ LTE TDD: B1/B2/B3/B4/B5/B7/B8/B12/B13/B18/B19/B20/B25/B26/B28 ➢ LTE TDD: B38/B39/B40/B41 ➢ WCDMA: B1/B2/B4/B5/B6/B8/B19 ➢ GSM: B2/B3/B5/B8
Function	LOCOSYS RTK Base Station or Rover
I/O Interface-Front	1 x Power button 4 x LED indicators for Status (programmable), Storage. 1 x System reset button 2 x Type A USB 3.0 compliant host, supporting system boot up 1 x DB-15 VGA 1 x HDMI 1 x SIM card socket
I/O Interface-Rear	1 x 9~36VDC input with Ignition and 20W typical power consumption. 1 x RJ-45 with LEDs for 10/100/1000Mbps Ethernet 1 x Audio-in, 1 x Audio-out 1 x DB9 COM port
Expandable Storage	1 x 2.5” SSD SATA 3.0 1 x m-SATA
Operating System	Windows 10 Linux (By request)
Power Management	Selectable boot-up & shut-down voltage for low power protection HW design ready for 8-level delay time on/off at user's self configuration Power on/off ignition, software detectable Support S3, S4 suspend mode
Dimensions	185mm (W) x 120mm (D) x 45mm (H) (7.3" x 4.7" x 1.8") 1 kg (2.20 lbs)
Construction	Aluminum top case with sheet metal

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Environment	-40°C to 70°C (w/ industrial SSD) with air flow Storage temperatures: -40°C to 85°C Relative humidity: 10% to 90% (non-condensing) Vibration: Vibration (SSD): 2g @5~500 Hz Operating: MIL-STD-810F Storage: MIL-STD-810F, Method 514.5, Category 24, Integrity Test Shock (SSD): Operating: MIL-STD-810F, Method 516.5, Procedure I, Trucks and semi-trailers=20g Crash hazard: MIL-STD-810F, Method 516.5, Procedure V, Ground equipment=75g
Power Adapter	AC100-240V
Standards Certifications	CE approval FCC Class AE13 mark

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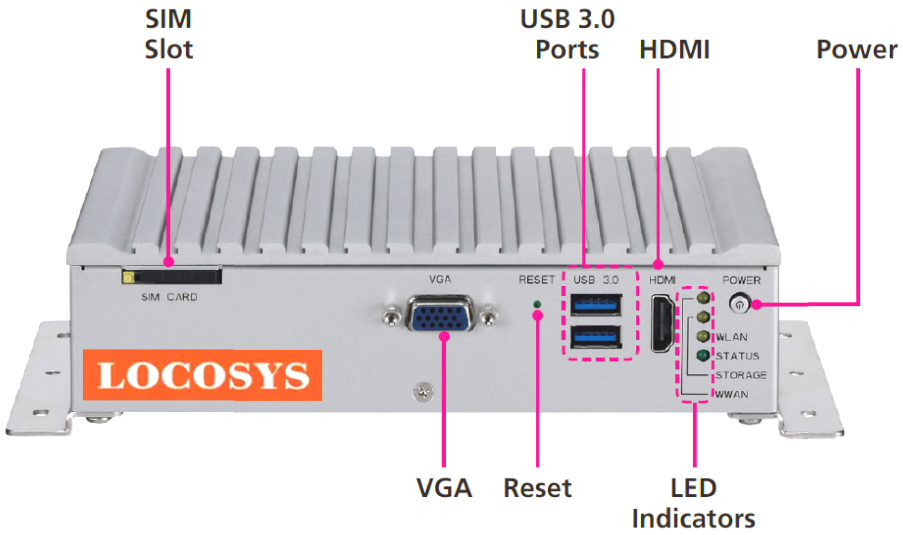
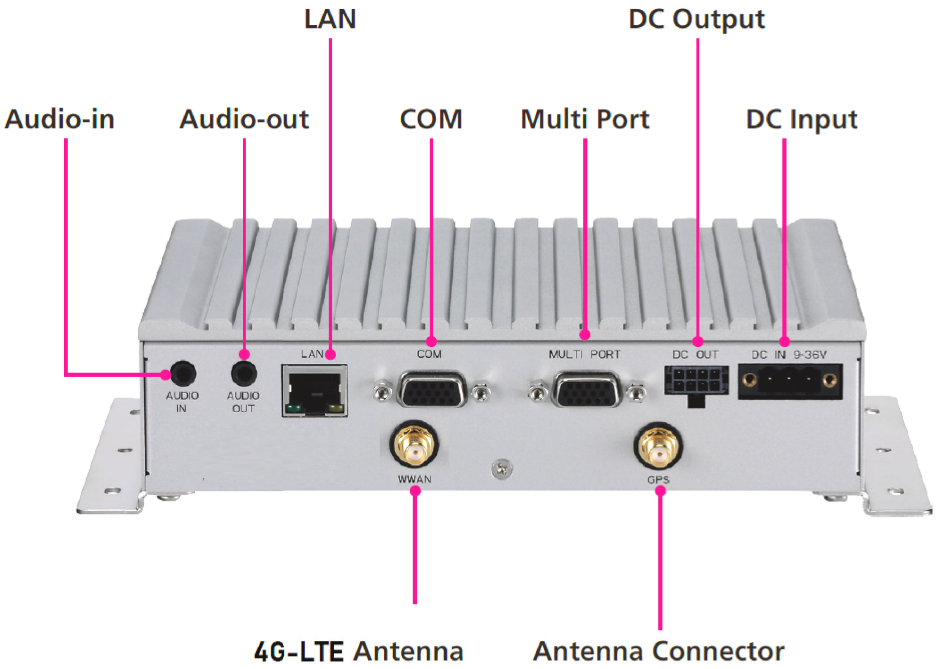
6.2 I/O view



Front View



Rear View

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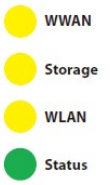
6.3 Power and LED states

LED Indicators
Connector number: 5



Power Button
Connector number: 6

LED	Description
WWAN	Blinking: Active
Storage	Light On: HDD/SSD Active
WLAN	Blinking: Active
Status	Programmable. Power On: Green

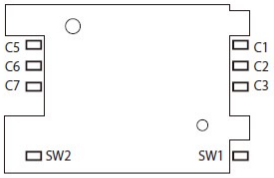
1 x R/B Bi-color LED	
LED Status	**Description**
Off	Power off
Blue	Power good
Red	Power fail

When the ignition is from "low" to "high", the system will turn on automatically. When the ignition is "high", press the power button to turn on/off the system.

When the ignition is from "high" to "low", the system will turn off automatically. When the ignition is "low", pressing the power button will not turn on the system.

6.4 SIM Slot

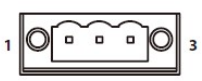
SIM Card Slot



Pin	Definition	Pin	Definition
C1	UIM_PWR	C2	UIM_RST
C3	UIM_CLK	C5	GND
C6	NC	C7	UIM_DATA
SW1	SIM2_DET#	SW2	GND

6.5 DC Power input

DC Power Input



Pin	Definition
1	GND_IN
2	V_IN
3	IGNITION

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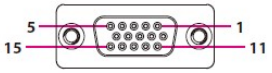
6.6 VGA port

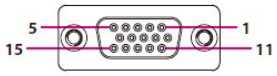
VGA Connector



Pin	Definition	Pin	Definition
1	DIRECTION	2	RXD3_R
3	GPIO1	4	GPIO4
5	GND	6	1PPS
7	TXD3_R	8	CAN1_L
9	GPIO3	10	GND
11	ODOMETER	12	CAN1_H
13	GPIO2	14	GPIO5
15	GND		

6.7 COM port

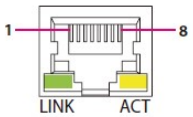
COM Connector



Pin	Definition	Pin	Definition
1	RXD_R_D	2	TXD2_R
3	RXD1_R	4	RS485B_-
5	GND	6	TXD_R_D
7	TXD_R_B	8	TXD1_R
9	RS485A_+	10	GND
11	RXD_R_D	12	RXD2_R
13	RS485A_-	14	RS485B_+
15	GND		

6.8 LAN port

LAN Port



Pin	Definition	Pin	Definition
1	MDI0P	2	MDI0N
3	MDI1P	4	MDI2P
5	MDI2N	6	MDI1N
7	MDI3P	8	MDI3N
9	LED2-	10	LED2+
11	LED1-	12	LED1+

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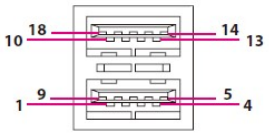
6.9 USB 3.0 port

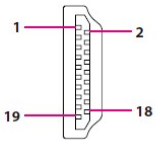
USB 3.0 Ports



Pin	Definition	Pin	Definition
1	5V	2	USB_0N
3	USB_0P	4	GND
5	USB3_TX0_N	6	USB3_TX0_P
7	GND	8	USB3_RX0_N
9	USB3_RX0_P	10	5V
11	USB_1N	12	USB_1P
13	GND	14	USB3_TX1_N
15	USB3_TX1_P	16	GND
17	USB3_RX1_N	18	USB3_RX1_P

6.10 HDMI port

HDMI



Pin	Definition	Pin	Definition
1	HDMI_TX2P_L	2	GND
3	HDMI_TX2N_L	4	HDMI_TX1P_L
5	GND	6	HDMI_TX1N_L
7	HDMI_TX0P_L	8	GND
9	HDMI_TX0N_L	10	HDMI_CLK_P_L
11	GND	12	HDMI_CLK_N_L
13	NC	14	NC
15	HDMI_SCL	16	HDMI_SDA
17	GND	18	HDMI_P5V
19	HDMI_HPD		

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7. Software interface

7.1. NMEA output message

Table 7.1-1 NMEA output message

NMEA record	Description
GGA	Global positioning system fixed data
GLL	Geographic position - latitude/longitude
GSA	GNSS DOP and active satellites
GSV	GNSS satellites in view
RMC	Recommended minimum specific GNSS data

- **GGA--- Global Positioning System Fixed Data**

Table7.1-2 contains the values for the following example:

$GNGGA,091250.000,2503.71250,N,12138.74514,E,1,32,0.55,119.0,M,17.2,M,,*7E

Table 7.1- 2 GGA Data Format

Name	Example	Units	Description
Message ID	$GNGGA		GGA protocol header
UTC Time	091250.000		hhmmss.sss
Latitude	2503.71250		ddmm.mmmmm
N/S indicator	N		N=north or S=south
Longitude	12138.74514		dddmm.mmmmm
E/W Indicator	E		E=east or W=west
Position Fix Indicator	1		See Table 7.1-3
Satellites Used	32		Number of satellites in view
HDOP	0.55		Horizontal Dilution of Precision (meters)
MSL Altitude	119.0	meters	Antenna Altitude above/below mean-sea-level (geoid) (in meters)
Units	M	meters	Units of antenna altitude, meters
Geoidal Separation	17.2	meters	
Units	M	meters	Units of geoidal separation, meters
Age of diff. GNSS data		second	Null fields when DGPS is not used
Diff. Ref. Station ID			Differential reference station ID, 0000-1023
Checksum	*7E		Checksum
<CR> <LF>			End of message termination

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Table 7.1-3 Position Fix Indicators

Value	Description
0	No position fix
1	Autonomous GNSS fix
2	Differential GNSS fix
4	RTK fixed
5	RTK float
6	Estimated/Dead reckoning fix

● GLL--- Geographic Position – Latitude/Longitude

Table 7.1-4 contains the values for the following example:

$GNGLL,2503.71193,N,12138.74582,E,094450.000,A,A*47

Table 7.1-4 GLL Data Format

Name	Example	Units	Description
Message ID	$GNGLL		GLL protocol header
Latitude	2503.71193		ddmm.mmmmm
N/S indicator	N		N=north or S=south
Longitude	12138.74582		dddmm.mmmmm
E/W indicator	E		E=east or W=west
UTC Time	094450.000		hhmmss.sss
Status	A		A=data valid or V=data not valid
Mode	A		N = No position fix A = Autonomous GNSS fix D = Differential GNSS fix R = RTK fixed F = RTK float E = Estimated/Dead reckoning fix
Checksum	*47		
<CR> <LF>			End of message termination

● GSA---GNSS DOP and Active Satellites

Table 7.1-5 contains the values for the following example:

$GNGSA,A,3,11,195,194,199,08,07,01,27,16,09,23,,1.19,0.64,1.00,1*3F

$GNGSA,A,3,87,81,76,,,,,,,,,1.19,0.64,1.00,2*0F

$GNGSA,A,3,,,,,,,,,,,,,1.19,0.64,1.00,3*09

$GNGSA,A,3,34,24,12,07,11,10,08,38,25,09,13,16,1.19,0.64,1.00,4*02

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Table 7.1-5 GSA Data Format

Name	Example	Units	Description
Message ID	$GNGSA		GSA protocol header
Mode 1	A		See Table 7.1-6
Mode 2	3		See Table 7.1-7
ID of satellite used	11		SV on Channel 1
ID of satellite used	195		SV on Channel 2
….			….
ID of satellite used			SV on Channel 12
PDOP	1.19		Position Dilution of Precision
HDOP	0.64		Horizontal Dilution of Precision
VDOP	1.00		Vertical Dilution of Precision
GNSS system ID	4		See Table 7.1-8
Checksum	*3F		
<CR> <LF>			End of message termination

Table 7.1-6 Mode 1

Value	Description
M	Manually set to operate in 2D or 3D mode
A	Automatically switching between 2D or 3D mode

Table 7.1-7 Mode 2

Value	Description
1	No position fix
2	2D fix
3	3D fix

Table 7.1-8 GNSS system ID

Value	Description
1	GPS
2	GLONASS
3	GALILEO
4	BEIDOU
6	IRNSS

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● GSV---GNSS Satellites in View

Table 7.1-9 contains the values for the following example:

$GPGSV,3,1,09,8,71,268,47,27,63,18,49,11,44,191,46,4,41,237,46,1*54

$GPGSV,3,2,09,16,38,42,42,9,32,279,39,26,22,70,38,31,15,131,36,1*56

$GPGSV,3,3,09,7,15,320,40,1*6B

$GPGSV,1,1,04,8,71,268,50,27,63,18,49,9,32,279,43,26,22,70,42,8*6C

$GLGSV,2,1,05,82,63,47,47,83,56,182,36,80,47,9,42,79,33,85,45,1*71

$GLGSV,2,2,05,81,15,27,37,1*71

$GAGSV,1,1,04,08,48,300,43,03,47,025,45,13,36,309,42,05,06,061,34,7*79

$GAGSV,1,1,04,08,48,300,43,03,47,025,47,13,36,309,43,05,06,061,33,1*7B

$GBGSV,5,1,17,12,80,182,47,24,64,5,51,7,58,355,44,3,57,205,45,1*7C

$GBGSV,5,2,17,1,54,141,44,34,52,211,49,9,48,230,45,10,47,316,42,1*79

$GBGSV,5,3,17,26,44,100,47,16,39,207,43,4,38,117,41,2,37,240,41,1*77

$GBGSV,5,4,17,39,37,210,43,6,36,198,41,38,27,173,41,25,18,317,42,1*4E

$GBGSV,5,5,17,35,16,39,40,1*7F

$GBGSV,1,1,02,24,64,5,50,26,44,100,43,4*77

Table 7.1-9 GSV Data Format

Name	Example	Units	Description
Message ID	$GPGSV		GSV protocol header GP=GPS/QZSS, GL=GLONSS, GA=GALILEO, GB=BEIDOU, GI=IRNSS.
Total number of messages	3		Range 1 to 9
Message number	1		Range 1 to 9
Satellites in view	09		
Satellite ID	8		Channel 1
Elevation	71	degrees	Channel 1 (Range 00 to 90)
Azimuth	268	degrees	Channel 1 (Range 000 to 359)
SNR (C/No)	47	dB-Hz	Channel 1 (Range 00 to 99, null when not tracking)
….			….
Satellite ID	4		Channel 4 (Range 01 to 196)
Elevation	41	degrees	Channel 4 (Range 00 to 90)
Azimuth	237	degrees	Channel 4 (Range 000 to 359)
SNR (C/No)	46	dB-Hz	Channel 4 (Range 00 to 99, null when not tracking)
Signal ID	1		GPS/QZSS: L1 C/A=1, L5Q=8 GLONASS: L1 C/A=1 GALILEO: E1=7, E5a=1 BEIDOU: B1=1, B2a=4

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			IRNSS: L6=1
Checksum	*54		
<CR> <LF>			End of message termination

● RMC---Recommended Minimum Specific GNSS Data

Table 7.1-10 contains the values for the following example:

$GNRMC,070143.000,A,2503.71317,N,12138.74533,E,0.002,70.50,130220,,,A,V*01

Table 7.1-10 RMC Data Format

Name	Example	Units	Description
Message ID	$GNRMC		RMC protocol header
UTC Time	070143.000		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	2503.7117		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12138.74533		dddmm.mmmmm
E/W Indicator	E		E=east or W=west
Speed over ground	0.002	knots	True
Course over ground	70.50	degrees	
Date	130220		ddmmyy
Magnetic variation		degrees	
Variation sense			E=east or W=west
Mode	A		N = No position fix A = Autonomous GNSS fix D = Differential GNSS fix R = RTK fixed F = RTK float E = Estimated/Dead reckoning fix
Navigational status indicator	V		S = Safe C = Caution U = Unsafe V = Void
Checksum	*01		
<CR> <LF>			End of message termination

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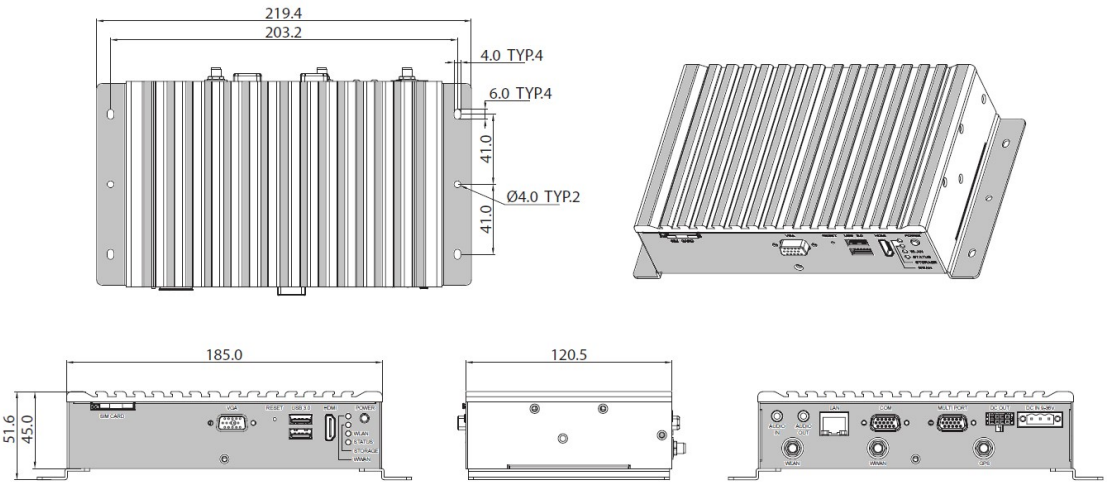
8. Dimension Information



RTK-M300

9. Driver and Software Download

Please link to LOCOSYS company website and click RTK-M300 product icon
https://www.locosystech.com/en/index.html

10. Packing Material Information

Standard industrial grade carton.

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Document change list

Revision 0.1

- Draft release on August 11, 2021.

Revision 0.2 (October 18, 2021)

- Revised update rate from 5Hz to 1Hz and 1Hz to 0.2Hz in the section 4.
- Revised the GSA default output from 1Hz to 0.2Hz in the section 4.
- Removed the VTG and HDT default output in the section 4.
- Removed the description of VTG and HDT in the section 7.1.

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