LANTRONIX®

M110 Series
Cellular Modem
User Guide

Part Number PMD-00036
Revision A October 2019

Intellectual Property

Lantronix is a registered trademark of Lantronix, Inc. in the United States and other countries.

Patented: www.lantronix.com/legal/patents/. Additional patents pending.

Windows and *Internet Explorer* are registered trademarks of Microsoft Corporation. *Firefox* is a registered trademark of the Mozilla Foundation. *Chrome* is a trademark of Google Inc. All other trademarks and trade names are the property of their respective holders.

Warranty

For details on the Lantronix warranty policy, please go to our web site at www.lantronix.com/support/warranty/

Contacts

Lantronix, Inc.
7535 Irvine Center Drive, Suite 100
Irvine, CA 92618, USA
Toll Free: 800-526-8766
Phone: 949-453-3990
Fax: 949-453-3995

Technical Support
Online: www.lantronix.com/support

Sales Offices
For a current list of our domestic and international sales offices, go to the Lantronix web site at www.lantronix.com/about-us/contact/

Disclaimer

All information contained herein is provided “AS IS.” Lantronix undertakes no obligation to update the information in this publication. Lantronix does not make, and specifically disclaims, all warranties of any kind (express, implied or otherwise) regarding title, non-infringement, fitness, quality, accuracy, completeness, usefulness, suitability or performance of the information provided herein. Lantronix shall have no liability whatsoever to any user for any damages, losses and causes of action (whether in contract or in tort or otherwise) in connection with the user’s access or usage of any of the information or content contained herein. The information and specifications contained in this document are subject to change without notice.

Open Source Software

Some applications are Open Source software licensed under the Berkeley Software Distribution (BSD) license, the GNU General Public License (GPL) as published by the Free Software Foundation (FSF), or the Python Software Foundation (PSF) License Agreement for Python 2.7.3 (Python License). Lantronix grants you no right to receive source code to the Open Source software; however, in some cases, rights and access to source code for certain Open Source software may be available directly from Lantronix' licensors. Your use of each Open Source component or software is subject to the terms of the applicable license. The BSD license is available at http://opensource.org/licenses. The GNU General Public License is available at http://www.gnu.org/licenses/. The Python License is available at http://cmpt165.csil.sfu.ca/Python-Docs/license.html. Your use of each Open Source component or software is subject to the terms of the applicable license.

OPEN SOURCE SOFTWARE IS DISTRIBUTED WITHOUT ANY WARRANTY, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. SEE THE APPLICABLE LICENSE AGREEMENT FOR ADDITIONAL INFORMATION.

You may request a list of the open source components and the licenses that apply to them. Contact your regional Lantronix sales associate.
www.lantronix.com/about-us/contact/

Revision History

Date	Rev.	Comments
Sep., 2017	1.0	1.0 First release
Oct., 2017	1.1	1.1 RAM size and model list
Nov., 2017	1.2	1.2 Compatible models
Jun., 2018	1.3	1.3 Compatible models
Mar., 2019	1.4	1.4 Compatible models, Power, Accessories and Basic AT Command summary
October 2019	A	Initial Lantronix document. Added Lantronix document part number, Lantronix logo, branding, contact information, and links.

For the latest revision of this product document, please check our online documentation at www.lantronix.com/support/documentation.

Table of Contents

1 Safety Precautions

1.1 General precautions

The modem generates radio frequency (RF) power. When using the modem, precaution must be taken to ensure safety as well as compliance with all regulations that surround the use of RF equipment.

Do not use the modem in aircraft, hospitals and petrol stations or in places where using mobile cellular products or other RF equipment is prohibited, and make sure that the modem will not be interfering with nearby equipment such as pacemakers or medical equipment.

The antenna of the modem should be directed away from computers, office equipment, home appliance, etc., and always keep the modem at a minimally safe distance of 26.6cm or more from a human body.

Do not put the antenna inside metallic boxes or other containers.

1.2 Using the modem in vehicles

Check for any regulations or laws authorising the use of GSM, W-CDMA and LTE equipment in vehicles in the country before installing the modem.

Installation of the modem should be done by qualified personnel. Consult your vehicle dealer for any possible interference concerns related to the use of the modem.

Power consumption of the modem and related circuit should be taken into consideration when the modem is powered by the battery of the vehicle as the battery may deplete after an extended period.

1.3 Protecting your modem

To ensure error-free usage, please install and operate the modem with care and comply with the following;

Do not expose the modem in extreme conditions such as high humidity/rain, high temperatures, direct sunlight, caustic/harsh chemicals, dust, or water.

Do not try to disassemble or modify the modem as there is no user serviceable parts inside and warranty will void in case of tampering.

Do not drop, hit, shake the modem or place in extreme vibration.

Do not pull the power supply cable. Attach or detach it by holding the connector after switching off the supply.

Install and connect the modem in accordance with this user manual. Failure to do so will void the warranty.

2 M110 Series Compatible Modems

Model name	Territories or Operator(s)	Cellular type [1]	Bands [2]	Fallback mode [1]	Band(s) [2]	Location services	Planned / Obtained certifications [3]	Planned / Made FCS [4]	Order code
M111	World excl. Japan, Koreas	2G [λ1]	5/8/3/2	×	N/A	×	CE [6]	Aug. '18	M111
M112	China	NB-IoT	5/8/3				CCC, SRRC, CTA	*TBD*	M112#358
	World		28/20/5/8/3				*TBD*		M112
M113	World	Dual mode LTE-M1 / NB-IoT	12[a]/28/13/20/ 26[b]/8/3[c]/4/25[d]/1/ TDD 39 (LTE-M1 only)				ISED; FCC [7], PTCRB, Verizon Wireless, AT&T Wireless; IFT; RCM, Telstra; JRF, JPA, NTT docomo; KC, SK telecom; CCC, SRRC, CTA	Sep. '18	M113-N
M114	EMEA	LTE cat. 1	20/3/7	2G [λ3]	5/8/3/2		CE [6]	Jan. '19	M113
					8/3			Jun. '18	M114#37K##38
	Verizon Wireless		13/4	×	N/A		FCC [7], Verizon Wireless	*TBD*	M114#4D
	AT&T Wireless, T-Mobile USA, Sprint		12[a]/5/4/2	3G	5/2		ISED; FCC [7], PTCRB, AT&T Wireless		M114#245C#25
	Asia Pacific		28/8/3		1		RCM; NCC	Oct. '18	M114#38S#1
	NTT docomo		19/1	×	N/A		JRF, JPA	*TBD*	M114#1J
M115	EMEA; S. Asia; S.-E. Asia	3G	8/1	2G [λ2]	8/3		*TBD*		M115#02
	Japan		5/8/3/1		5/8/3/2		JRF, JPA		M115#05
	World						*TBD*		M115
M113G	World	Type and bands identical to M113's		×	N/A	GNSS [5]	*TBD*	Jan. '20	M113G-N

Please consult us regarding the models or features shown in grey, which are subject to MOQ and other considerations

[1] *Uplink / Downlink maximum data rates*
- *2G: [λ1] 42.8 / 85.6; or 236.8 / [λ2] 236.8; or [λ3] 296 kbps*
- *NB-IoT: 62.5 / 27.2 kbps*
- *LTE-M1: 375 / 375 kbps*
- *LTE cat. 1: 5.2 / 10.3 Mbps*
- *3G: 5.76 / 7.2 Mbps*

[2] *Ranked by increasing frequencies*
[a] *incl. North America's ("NorAm's") B17*
[b] *incl. KDDI's B18 as well as NorAm's B5, the latter incl. NTT docomo's B19, itself incl. Japan's B6 (3G)*
[c] *incl. Japan's B9*
[d] *incl. NorAm's B2*

[3] *Besides MIL-STD-810G*
[4] *First customer shipment [date of]*
[5] *Concurrent GPS, Galileo and either GLONASS or Beidou*
[6] *Based on compliance with RED; EN 60950-1; etc.*
[7] *Also Class I Division 2 for use in explosive atmospheres as a factory option subject to MOQ and other considerations*

09 October 2019

3 Product Features

The M110 series cellular modem is designed for M2M applications operating in tough environmental condition, with the Lantronix mPack application software (refer to the M110 Commands Guide), which makes the modem suitable for industrial equipment such as electricity meters, PLC, lifts, vending machines, etc.

3.1 Hardware

Casing:	Extruded aluminum	
Dimensions:	60x60x21.7 (mm)	
Weight:	89 g (approx.)	
Temperature;	Operating:	-30 °C – +70 °C
	Storage:	-40 °C – +85 °C
MCU Memory;	Flash:	256 kB
	RAM:	128 kB

3.2 Power

Power supply:	8 – 32 Vdc with Slow Start in 4-pin Micro-Fit
Last Gasp (optional):	Last for approximately 5 SMS messages, backed up by two industrial grade super caps.

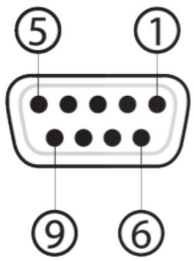
Power consumption table (mA)

	@8 V	@12 V	@32 V
M111			
GSM900 Call (PCL 5, RS-232)	220	138	52
GSM1800 Call (PCL 0, RS-232)	155	108	41
GPRS900 2Tx@gamma 3 (RS-232)	405	258	100
GPRS1800 2Tx@gamma 3 (RS-232)	288	182	72
Stand-by (RS-232 & USB connected)	54	37	15
Stand-by (RS-232 connected)	54	37	15
M113			
LTE in communication mode (Tx Max, RS-232)	125	100	45
Stand-by (RS-232 & USB connected)	54	37	15
Stand-by (RS-232 connected)	54	37	15
M114			
GSM900 (PCL 5, RS-232)	225	140	54
GSM1800 (PCL 0, RS-232)	160	110	43
GPRS900 4Tx@gamma 3 (RS-232)	412	262	103
GPRS1800 4Tx@gamma 3 (RS-232)	294	187	74
W-CDMA in communication mode (band 1, Tx max, RS-232)	426	235	107
HSDPA in communication mode (band 1, Tx max, RS-232)	460	292	115
LTE in communication mode (Tx Max, RS-232)	376	220	95
Stand-by (RS-232 & USB connected)	54	37	15
Stand-by (RS-232 connected)	54	37	15

3.3 Interfaces

RS-232: DB-9 socket;

1. DCD
2. Rx
3. Tx
4. DTR
5. Ground
6. DSR
7. RTS
8. CTS
9. RI



USB:	Type-C connector	
I/Os;	Analogue input (x2): or Digital input/output (x2):	0 V – 48 Vdc Open collector; 200 mA; 50 Vdc max.
Cellular antenna:	SMA connector	
SIM interface:	2FF SIM 1.8 V/3.0 V	
LED indicators:	Two (amber, green)	

3.4 Lantronix application software (mPack)

- Dial-up connection
- TCP/UDP permanent client/server or on-demand
- Network connectivity watchdog
- Configurable text and recipients upon the Last Gasp
- DOTA via user's HTTP server or D2Sphere
- Configure via: Terminal program, SMS and Telnet

Refer to the M110 series user documentation, *M110 Series mPACK Software Command Reference,* for more information about working with the mPACK software. M110 series documentation is available at:
https://www.lantronix.com/products/m110-series-modems/#tab-docs-downloads

4 Accessories

Part number	Description
Power supply/Power cable	
ACC-PS20	4-pin Micro-Fit, 1.2 A power adapter with Euro plug 2-pin - Europe
ACC-PS21	4-pin Micro-Fit, 1.2 A power adapter with NEMA plug 3-pin - U.S./Europe/Taiwan/Japan
ACC-PS22	4-pin Micro-Fit, 1.2 A power adapter with AS3112 plug 3-pin - Australia/New Zealand/China
ACC-PS23	4-pin Micro-Fit, 1.2 A power adapter with BS1363 plug 3-pin - U.K./Ireland
ACC-CA10	4-pin Micro-Fit (M) to stripped wire with 2.5 A fuse in 1 m length
Serial and USB cable	
ACC-CA07	DB9(M) to DB9(M) cable
ACC-CA56	USB Type-C cable
Antennae	
ACC-A31	SISO, 2G, 3G and 4G, 698 – 960 MHz & 1710 – 2690 MHz, 3 m cable
ACC-A31H	SISO, 2G, 3G, 4G and GPS, 698 – 960 MHz & 1710 – 2700 MHz, 3 m cable
ACC-A32	MIMO, 2G, 3G and 4G, 698 – 960 MHz & 1710 – 2690 MHz, 3 m cable
ACC-A32H	MIMO, 2G, 3G and 4G, 698 – 960 MHz & 1710 – 2690 MHz, 3 m cable – High efficiency
Miscellaneous	
ACC-DIN	Metal DIN Rail clip
Snap-cap	Converter: RS-232 DB-9 port into an isolated, half/full-duplex (switchable) 5-pin RS-485 port

5 LED Status Indicator

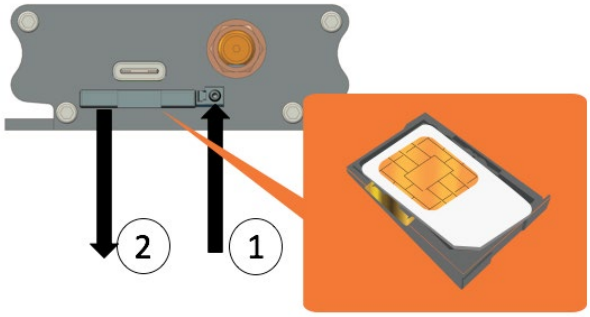
The modem operation status is indicated by two LEDs, which are located on the front side described in the below table.

LED State	Amber LED	Green LED
ON	**Solid** Cellular connection established	**Solid** Good CSQ > 10
	Blinking Cellular connection established & data transfer in process	**Slow blinking** No signal, or, CSQ < 4 or = 99
		Fast blinking Marginal, CSQ is 4 – 9
OFF	No cellular connection	No power

For further description on CSQ, refer to section **8.3 Received Signal Strength**.

6 Hardware Installation

6.1 Inserting SIM card:

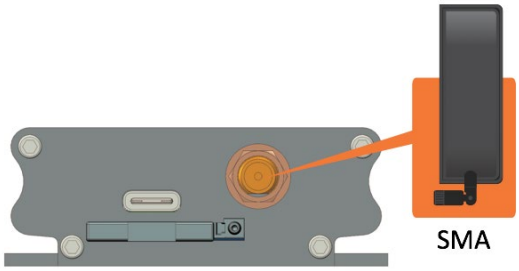


(1) Eject the SIM tray by pushing the eject button inwards.

(2) Pull the SIM tray out.

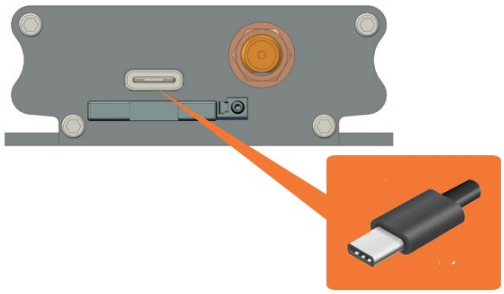
Place the mini-SIM card on the tray with SIM chip facing up, then push the tray back in place carefully.

6.2 Connecting cellular antenna:

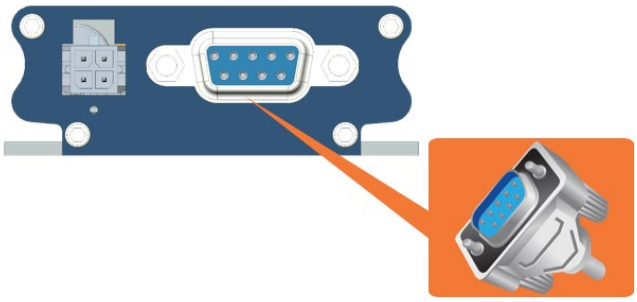


Screw (clockwise) the SMA antenna onto the SMA connector.

6.3 Connecting USB Type-C cable

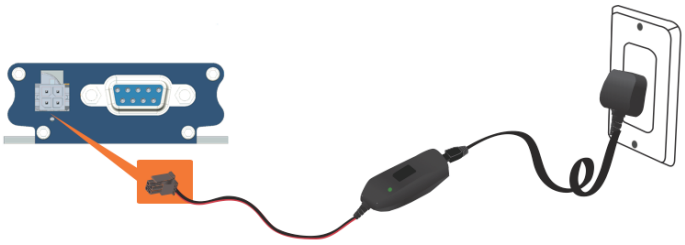


6.4 Connecting RS-232 DB-9 serial cable



Connect the RS-232 DB-9 serial cable and secure the connection by tightening both thumb knobs on the connector.

6.5 Powering the modem



Connect the 4-pin Micro-Fit connector power supply to the modem as shown above.

7 Communication with the Modem

After all the above setup, communications between the terminal equipment and the modem can now be tested, AT commands can be sent to the modem using a terminal program (i.e. Tera Term) installed on computer for configuring the modem.

7.1 Communications test

- Connection between the terminal equipment and the modem can be made using two types of cables;

  RS-232 DB-9 Serial cable
  or
  USB Type-C cable

- Configuration of the RS-232 port on the terminal equipment/program should initially be;

Baud-rate:	115,200 bps
Data bits:	8
Parity:	None
Stop Bits:	1
Flow control:	None

- To see if the communications between the terminal program and the modem was established, enter:

  AT

  and modem will respond with:

  OK

7.2 Echo Function

The default echo setting is off/disabled (**ATE0**), to enable the echo function, either;

- Enable “Local echo’ in terminal program
  or
- Enable the modem echo function (enter **ATE1**)

In M2M application, it is highly recommended to disable the modem echo function (enter **ATE0**) to avoid unnecessary traffic between DTE and DCE.

In terminal program, if respond is not displayed after an AT command is entered, recheck the above setting.

If communications cannot be established with the modem, check;

- The RS-232 physical connection
- The RS-232 configuration

After the communications between the both has been established, refer to below AT commands for start using the modem.

AT Command	Description
AT+CGMI	To check the module manufacturer identification
AT+CPIN=XXXX	To enter a PIN code (if required) (XXXX is actual PIN)
AT+CSQ	To verify the received signal strength
AT+CREG?	To verify the network registration status
ATD<phone number>;	To initiate a voice call
ATH	To end the above voice call

7.3 Received Signal Strength

The modem can only establish a call or data session when the received signal strength is sufficient. In terminal window, enter AT+CSQ to see the received signal strength, then the modem will response in the below format;

+CSQ: <RSSI>,<BER>
or
<RSSI>,<BEP>
or
<RSSI>,<ECN0>
or
<RSSI>,<RSRQ>

where;

<RSSI> : Received Signal Strength Indication
<BER> : channel Bit Error Rate (GPRS)
<BEP> : channel Bit Error Pattern (EGPRS)
<ECN0> : Energy per Chip Noise ratio (UMTS)
<RSRQ> : Reference Signal Received Quality (LTE)

For SMS, voice and data operation, please refer to the below table for sufficient RSSI levels;

RSSI Level	Description
6 to 8	SMS/Voice
10 to 12	SMS/Voice/Data
13 to 31	All of above, to maximum RSSI level
99	Not measurable

7.4 Network Registration

To verify network registration, first ensure the SIM card has been provisioned.

If the model has embedded SIM, first ensure the modem has been activated by the network provider.

To see the network registration status, in terminal program, enter:

AT+CREG?

and refer to the below responses of network registration status;

Response	Description
+CREG: 0,0	Not registered
+CREG: 0,1	Registered on home network
+CREG: 0,2	Not registered and attempting
+CREG: 0,5	Registered on network when roaming

If it is not registered on the network, check the following;

- If the antenna was attached properly
- The received signal strength (refer to section 8.2)
- If the SIM card was provisioned

7.5 PIN Code

To verify, in terminal program, enter:

AT+CPIN?

and refer to the below responses of PIN code status;

Response	Description
+CPIN: READY	PIN code has been entered correctly or not required
+CPIN: SIM PIN	PIN code has not been entered or entered incorrectly

7.6 Basic AT command summary

Below table is a summary of basic AT commands, for the full set of commands, refer to M110 Commands Guide.

Feature	AT Command	Response	Description
Check network registration	AT+CREG?	+CREG: 0,0	Not registered
		+CREG: 0,1	Registered on home network
		+CREG: 0,2	Not registered and attempting
		+CREG: 0,5	Registered on network and roaming
Enter PIN code & status	AT+CPIN=XXXX	OK	PIN code accepted
		*+CME ERROR: 16	Incorrect PIN code
	AT+CPIN?	Ready	SIM is ready to use
Receive a voice call	ATA	OK	Answer the call
Initiate a voice call	ATD<phone number>;	OK	Communication established
		*+CME ERROR: 11	PIN code not entered (with +CMEE=1 mode)
Hang up	ATH	OK	End the call
Store settings in EEPROM	AT&W	OK	Configuration settings are stored in non-volatile memory

*AT+CMEE=1 to enable +CME error result code, otherwise only 'error' will be displayed instead.

XXXX is the actual PIN code, if required.

8 Technical Support

For additional resources about Lantronix products, please visit the Lantronix Support website:

https://www.lantronix.com/support/