LANTRONIX®

M110 Series Cellular Modem User Guide

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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.
September 2022	B	Updates to Part Numbers and Accessories

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	M111F00FS
M113	World	Dual mode LTE-M1 / NB-IoT	LTE CAT M1 / NB1 MODULE, LTE BANDS 2, 3, 4, 5, 8, 12, 13, 20, 25, 28				ISED; FCC [7], PTCRB, Verizon Wireless, AT&T Wireless; IFT; RCM, Telstra; JRF, JPA, NTT docomo; KC, SK telecom; CCC, SRRC, CTA	Sep. '18	M113F00FS
				2G [λ3]	5/8/3/2		CE [6]	Jan. '19	M113F002S
M114	EMEA	LTE cat. 1	20/3/7		8/3			Jun. '18	MM114F002S
	Verizon Wireless		13/4	×	N/A		FCC [7], Verizon Wireless	*TBD*	M114F001S
	AT&T Wireless, T-Mobile USA, Sprint		12[a]/5/4/2	3G	5/2		ISED; FCC [7], PTCRB, AT&T Wireless		M114F000S
	Asia Pacific		28/8/3		1		RCM; NCC	Oct. '18	M114F003S
	NTT docomo		19/1	×	N/A		JRF, JPA	*TBD*	M114F005S
M115	World						*TBD*		F00FS

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*

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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

Specification	Description
Casing	Extruded aluminium
Dimensions	60 x 60 x 21.7 (mm)
Weight	89 g (approximately)
Temperature	Operating: -30°C ~ +70°C Storage: -40°C ~ +85°C
MCU Memory	Flash: 256 kB RAM: 128 kB

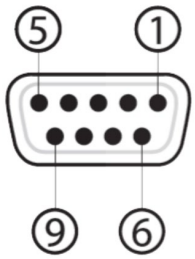
3.2 Power

Specification	Description
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)

Model	@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

Interface	Type	Note
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	n/a
I/Os	Analog input (x2) or Digital input (x2)	0V – 48 Vdc Open collector; 200 mA; 50 Vdc max.
Cellular antenna	SMA connector	n/a
SIM interface	2FF SIM 1.8 V/3.0 V	n/a
LED indicators	Two (2) – amber, green	n/a

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
- Configure via: Terminal program, SMS, and Telnet

For information about working with the mPACK software, refer to *M110 Series mPACK Software Command Reference*. This is available for download from the M110 series product page at: https://www.lantronix.com/products/m110-series-modems/.

4 Accessories

Part number	Description
	Power supply/Power cable
P22E0	12V1.25A switching power adapter, with 2pin Molex connector. Euro plug AC cable.
P22E2	12V1.25A switching power adapter, with 2pin Molex connector. USA plug AC cable.
P22E3	12V1.25A switching power adapter, with 2pin Molex connector. Australia & NZ plug AC cable.
P22E4	12V1.25A switching power adapter, with 2pin Molex connector. UK/HK plug AC cable.
KDC42	ACC-CA10 SPARE CABLE (4-PIN) WITH POWER FUSE HS CODE: 8544 4211
	Serial and USB cable
KS990	RS232 CABLE DB9P/M TO DB9P/F L=1000MM
KUCA1	USB 2.0 A/M to USB Type C/M black cable, L=800mm
	Antennae
A31M0	JCG017L, Single LTE Antenna, Adhesive remote antenna with 3000mm RG174 cable, SMA male
A31H0	Single LTE Antenna, ultrawideband I-Bar antenna, 3000mm Cable with SMA male, Adhesive mount.
A32M0	Two in one LTE, 2*LTE antenna, 2*3000mm RG174 cable, SMA male
A32H0	Two in one LTE, 2*LTE antenna, 2*3000mm cable, SMA male, adhesive mount
	Miscellaneous
BR350	ACC-DIN DIN CLIP HS CODE: 8517 7091
SC485	RS232 to RS485 converter

5 LED Status Indicator

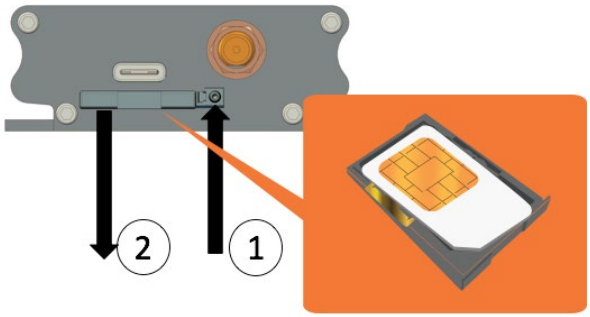
The modem operation status is indicated by two LEDs, which are located on the front side described in the below table.

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 *7.3 Received Signal Strength*.

6 Hardware Installation

6.1 Inserting SIM card:

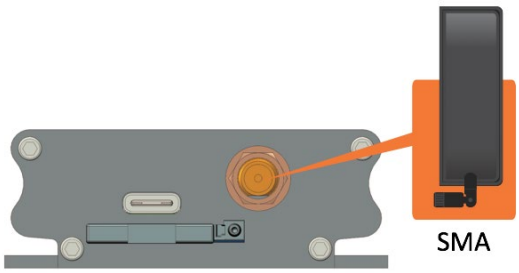


(1) Eject the SIM tray by pushing the eject button inwards.

(2) Pull the SIM tray out.

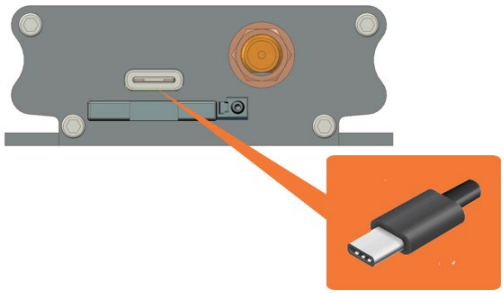
Place the mini-SIM card on the tray with SIM chip facing up, then push the tray back in place carefully.

6.2 Connecting cellular antenna:

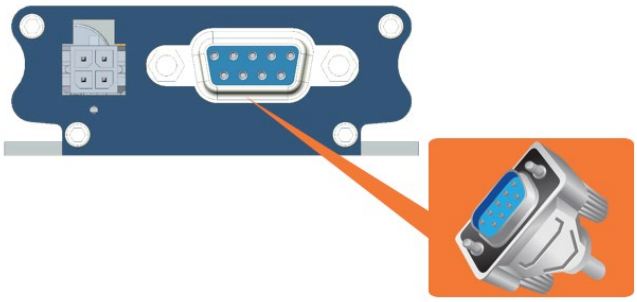


Screw (clockwise) the SMA antenna onto the SMA connector.

6.3 Connecting USB Type-C cable

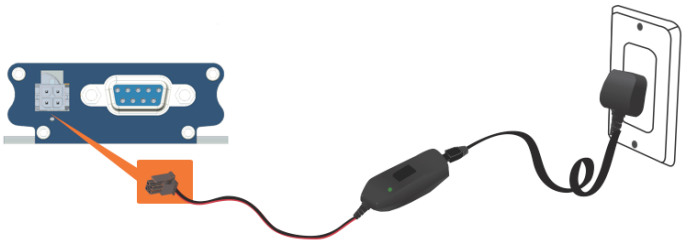


6.4 Connecting RS-232 DB-9 serial cable



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 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 respond in the following 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 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:0,3	Registration denied
+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

Lantronix offers many resources to support our customers and products at http://www.lantronix.com/technical-support.

For example, you can browse the knowledge base, open a support issue, find firmware downloads, view tutorials, and more. At this site you can also find FAQs, product bulletins, warranty information, extended support services, and product documentation.

To submit a support request, please use the Lantronix Technical Support portal at https://ltrxdev.atlassian.net/wiki/spaces/LTRXTS/overview (registration required).

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