

MuLOGIC
LLM-336S/R.ETH

**LEASED LINE MODEM FOR
ETHERNET BRIDGING
(HARDWARE REV2.2/2.3)**

User Guide
Issue 2.2
May 2023

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LLM-336/Eth Leased Line Modem for Ethernet Bridging

Compliances

Public Leased line operation

- 2-wire operation (A2O, A2S): ES 203 021
- 4-wire operation (A4O, A4S): ES 203 021

CE Compliance

- EMC: Directive 2004/108/EC (EN 55022, EN55024)
- Safety: Directive 2006/95/EC (EN 60950)

The LLM-336 complies with EMC directive 2004/108/EC and is classified for use in Residential areas. Test standard: EN 55022 Class B.
The LLM-336 also complies with the Immunity standard for ITE equipment EN 55024 with the applicable test levels increased to levels compatible with Industrial standards (ref. EN 61000-6-2).

Important note:

This user guide applies to LLM-336.Eth modems with hardware revisions 2.2 or 2.3.
Modems with hardware revision 2.2 are marked “H/W: rev2.2” or “2.3” on the serial number label.

About this user guide

Although this user guide was written with greatest possible care, omissions and errors cannot be precluded. MuLogic accepts no liability for any inaccuracies that may be found.

However if you have comments or suggestions about this guide, please contact us in order to help us to improve our product documentation.

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1 Introduction



LLM-336S.Eth / LLM-336R.Eth

The MuLogic LLM-336.Eth is a voiceband modem for connecting Ethernet products over copper wire or analogue leased lines. The modem offers a transparent link for Ethernet packets regardless of the higher-level protocol.

The LLM-336.Eth was designed for industrial applications: it can be powered from low voltage AC or DC power sources and operates within a temperature range of -25..+60°C.

The LLM-336S.Eth has a rugged steel housing.
The LLM-336R.Eth is a card set consisting of the modem card and the interface card that can be fit in the 19" UCF-16.3 card frame.

Features

- No configuration, very easy set-up, almost "plug and play".
- Automatic learning Ethernet bridge.
- Protocol independent.
- No routing configuration required.
- 10/100baseT Auto-MDI/MDIX Ethernet interface.
- V.34 modem for line rates between 9600 bit/s and 33.6 kbit/s.
- Operates over analogue leased lines (2 wire and 4 wire)
- Operates over "dry" copper wire and conditioned copper lines.
- Isolated supply voltage (ac and dc) for industrial environments.
- 11-36 Vdc or 18-60Vdc/22-30Vac supply voltage.
- Extended temperature range from -25°C to $+60^{\circ}\text{C}$.

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Hardware Details and Installation



Fig. 1 LLM-336S.Eth – LLM-336R.Eth Front panel

Front panel LED Indicators

The LED indicators of the LLM-336 display the real-time status of the modem and the key interface signals. In case a communication problem occurs, these LEDs can help you determine the cause of the problem.

LED	Description
PWR	Indicates that the modem is powered on and functions correctly.
DSR	DSR on, indicates that the modem is ready for normal operation. Off indicates that modem is in configure mode.
DTR	Follows the state of the LNK LED at the rear panel. This LED is on when the Ethernet port is connected correctly to the HUB, switch or PC.
TxD	Flashes when the modem sends Ethernet frames towards the remote modem.
RxD	Flashes when the modem receives Ethernet frames from the remote modem.
RTS	This LED flashes when the bridge circuit sends Ethernet frames to the modem.
CTS	The CTS LED indicates the state of the modem's data buffer. It will go off when the modem buffers are full and data from the bridge circuit is blocked.
DCD	Indicates that a valid connection is made with the remote modem.

Rear panel layout

The rear panel of the LLM-336.Eth contains LEDs for the Ethernet port and connectors for the modem line, Ethernet cable and power cable.



Fig 2. Rear Panel

Rear panel LED Indicators

LED	Description
FDX	Ethernet port in Full-duplex mode.
COL	Collision detected on connected LAN.
100M	Ethernet port operates at 100Mbps.
Rx/Tx	Flashes when data is transmitted via the Ethernet port.
LNK	Ethernet connected (HUB, Switch or PC).

Configuration Switches

Modem card

The dipswitches of the LLM-336 modem card can be accessed by removing the card from the housing or card frame. Release the front panel screws and gently remove the card from the housing or card frame. The position of the switches is shown below.

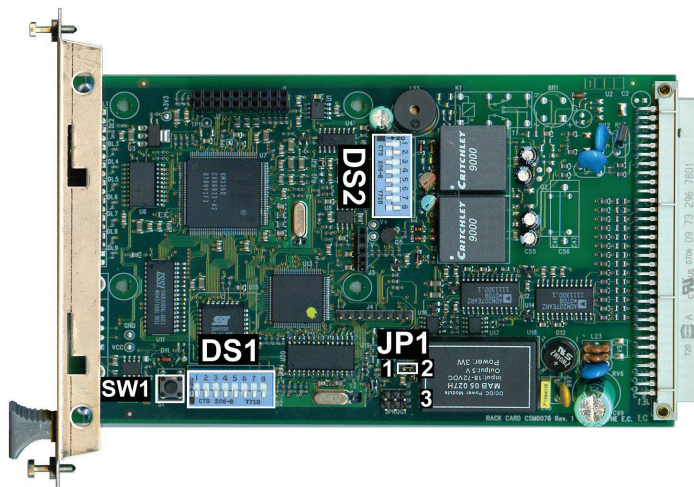


Fig. 3 Switches. LLM-336.Eth modem module

DS1, Dip-switch 1

DS1	ON	OFF
1 .. 4	See table 2, maximum modem line rates	
5	<i>Reserved (keep at On)</i>	<i>Reserved(keep at On)</i>
6	<i>Reserved (keep at Off)</i>	<i>Reserved(keep at Off)</i>
7	<i>Reserved (keep at Off)</i>	<i>Reserved(keep at Off)</i>
8	<i>Reserved (keep at Off)</i>	<i>Reserved(keep at Off)</i>

Table 1. Dipswitch 1

Note: unless stated otherwise, DS1.5 must remain in the ON position. In this mode, the LLM-336.Eth Rev2.2 is compatible with older LLM-336.Eth modems in non-compressed mode.

Maximum Line Data Rates		DS1.1	DS1.2	DS1.3	DS1.4
0	33.6 kbit/s – V.34 mode	Off	Off	Off	Off
1	31.2 kbit/s – V.34 mode	On	Off	Off	Off
2	28.8 kbit/s – V.34 mode	Off	On	Off	Off
3	26.4 kbit/s – V.34 mode	On	On	Off	Off
4	24.0 kbit/s – V.34 mode	Off	Off	On	Off
5	21.6 kbit/s – V.34 mode	On	Off	On	Off
6	19.2 kbit/s – V.34 mode	Off	On	On	Off
7	16.8 kbit/s – V.34 mode	On	On	On	Off
8	14.4 kbit/s – V.34 mode	Off	Off	Off	On
9	12.0 kbit/s – V.34 mode	On	Off	Off	On
10	9.6 kbit/s – V.34 mode	Off	On	Off	On
11	7.2 kbit/s – V.34 mode	On	On	Off	On
12	4.8 kbit/s – V.34 mode	Off	Off	On	On
13	14.4 kbit/s – V.32bis mode	On	Off	On	On
14	12.0 kbit/s – V.32bis mode	Off	On	On	On
15	9.6 kbit/s – V.32bis mode	On	On	On	On

Table 2. Maximum modem line rates

Note:

1. The “maximum modem line rate” sets the limit of the data rate. It can be used in occasions where the line conditions are not stable. Setting a lower rate will result in a more reliable connection. If the line quality does not allow for the maximum data rate set, then the modems will automatically connect at a lower data rate.

DS2, Dip-switch 2

DS2	ON	OFF
1	4-wire operation	2-wire operation
2	2-wire operation	4-wire operation
3	4-wire Rx line terminated with 600 Ω	2-wire operation
4	4-wire operation	2-wire operation
5	<i>Reserved</i>	<i>Reserved (keep Off)</i>
6	<i>Reserved</i>	<i>Reserved (keep Off)</i>
7	Originate mode	Answer mode (note 1)
8	Monitor speaker on	Monitor speaker off

Line type	DS2.1	DS2.2	DS2.3	DS2.4	DS2.5	DS2.6
2-wire line	Off	On	Off	Off	Off	Off
4-wire line	On	Off	On	On	Off	Off

Table 3. Line connection modes

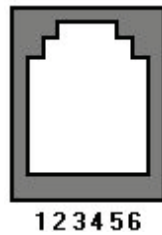
Note 1.

One modem must work in **originate mode** and the other in **answer mode**.



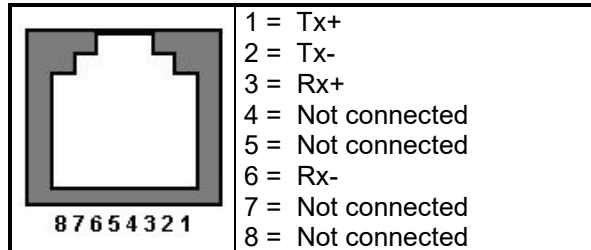
Fig 4. Rear Panel

Line Connector



- 1 = Not connected
- 2 = 4-wire transmit signal a (output)
- 3 = 4-wire receive signal a (input) / 2-wire receive-transmit a
- 4 = 4-wire receive signal b (input) / 2-wire receive-transmit b
- 5 = 4-wire transmit signal b (output)
- 6 = Not connected

Ethernet Connector



- 1 = Tx+
- 2 = Tx-
- 3 = Rx+
- 4 = Not connected
- 5 = Not connected
- 6 = Rx-
- 7 = Not connected
- 8 = Not connected

Note: The Ethernet port is of type 10/100baseT Auto-MDI/MDI. It will automatically adapt to the connected Ethernet port.

Power connectors

The operating power of the LLM-336.Eth is supplied at either of the 2 screw terminal connectors (see fig. 4). The remaining power connector can be used for linking the power to another device. The operating voltage range depends on the model.

LLM-336.Eth/Vr1: 11-36Vdc, 20-26Vac

LLM-336.Eth/Vr2: 18-60Vdc, 22-30Vac

Note: The power input of the LLM-336 is not polarised. You can connect DC power in either direction.

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3 Operation

Quick set up

The LLM-336.Eth is shipped from the factory in the following mode:

- All line rates from 4800 up to 33k6 bit/s enabled
- No data compression

If shipped as pair, the modems are configured for 2-wire operation where one modem is set to Originate mode and the other to Answer mode. This means that both modems can be connected back-to-back by means of the supplied RJ-11 cable.

Changing 2-wire to 4-wire operation

For changing from 2-wire to 4 wire operation put DS2.2 to OFF and DS2.1, DS2.3 and DS2.4 to ON. (Refer to Table 3. Line connection modes)

Selecting Originate or Answer mode

To connect two modems together, one modem must operate in Originate mode and the other in Answer mode. (Refer to Table 3. Line connection modes)

Changing Maximum Data Rate

Under normal conditions, the modem automatically evaluates the line quality and adapts the maximum data to achieve the best possible throughput.

However, on some very long unconditioned copper lines, the rate selected may not be optimal. (In this case usually a too high rate is selected). In order to force the modem to work at a defined maximum data rate, change the position of DS1.1..DS1.4.

(Refer to Table 2, Maximum modem line rates)

Note: *The maximum rate needs only to be selected at one modem of the pair. The other modem will automatically follow the maximum data rate.*

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Technical Specifications

Modem

**Modulation mode
and data rates**

- Modulation type: ITU-T V.34
- Max. modem data rate: 33.6 kbit/s.

Line connection

- Conditioned or unconditioned analogue leased lines
- Dry copper wire cables
- 2 wire and 4 wire operation
- Line impedance: 600 Ohms
- RJ-11 connector

Ethernet Interface

- Type: Remote Bridge
- 10/100baseT Auto-MDI/MDIX port
- Frame size: max. 1536 bytes
- Frame buffer capacity: 256 frames
- Address filter: automatic learning and ageing
- Ageing time: 300 seconds
- Connection type: 10baseT or 100baseT UTP

Data Throughput

- Throughput at 33,6 kbit/s modem rate: 3,9 kbyte/s
- Latency (throughput delay) at 33,6 kbit/s modem rate: 45 ms

Power supply

LLM-336.Eth/VR1

- 11-36 Vdc or 20-26 Vac
- Power consumption: 4,5 W max.

LLM-336.Eth/VR2

- 18-60 Vdc or 22-30 Vac
 - Power consumption: 4,1 W max.
-

General

Dimensions and weight

- 95x145x30 mm LxWxH, Weight: 975 gr.

Temperature range

- -25 ..+60°C, Humidity: 5..95%