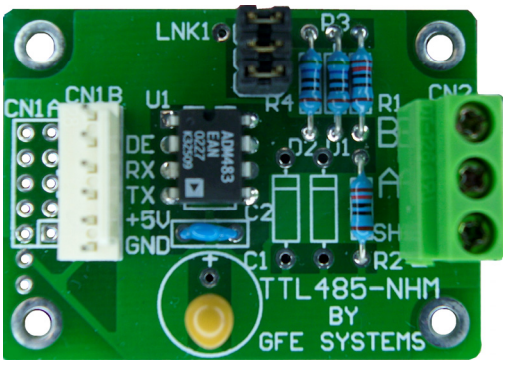
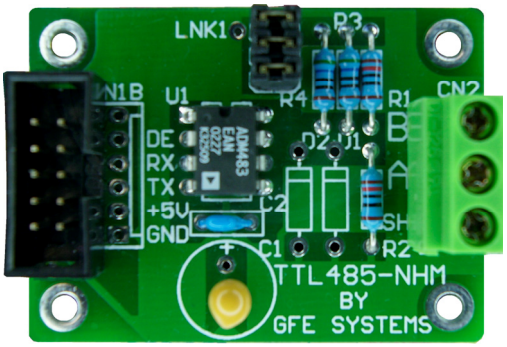
TTL-485-NHM
TTL to RS485 interface board.

Intended for use in OEM products requiring a wired connection to a small, medium speed network within an electrically noisy environment and/or long distance.

- **Single supply 5.0V +/- 10% @ 50mA.**
- **Up to 250kbps data rate.**
- **Maximum distance between end-nodes is 1200m.**
- **Up to 32 nodes per network.**
- **Small board size: 48mm x 36mm x 15mm.**
- **+/- 15KV ESD protection, HBM Pin A-B.**
- **Half-duplex operation.**
- **RS422 compatible.**
- **Suitable for multi-drop network.**
- **Designed for multi-point network.**
- **Crimp or IDC version.**
- **15VAC/400W TVS protection.**
- **On-board 120 ohm line terminator.**
- **On-board fail-safe receiver biasing.**





Description.

The TTL-485-NHM board provides a half-duplex multi-drop / multi-point serial link for a network between 2 and 32 Nodes. On board links are provided for enabling line termination (120 ohms) as well as bus fail-safe mode. Provision is made for connection of cable shield with current limiting (120 ohms).

The board can be supplied in one of two variations :-

CRIMP – 6 way Crimp style connector
IDC ----- 10 pin IDCC style connector

For situations requiring more protection against induced surge currents, 400W TVS diodes can be added.

The receiver TTL output requires a pull-up (> 10K) as it is put into a high-Z state whenever the driver is enabled.

GFE Systems
Suite 6, 250 Gore Street
Fitzroy, 3065
Melbourne, Australia.

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Connector Pin Description:

TTL 10way IDC (CN1A)	TTL 6way CRIMP (CN1B)	Description
2	1	Supply Ground
1	2	Supply +5Volts
3	3	TX (TTL input)
5	4	RX (TTL output)
7	5	DE (TTL input)
9	6	DE Loopback

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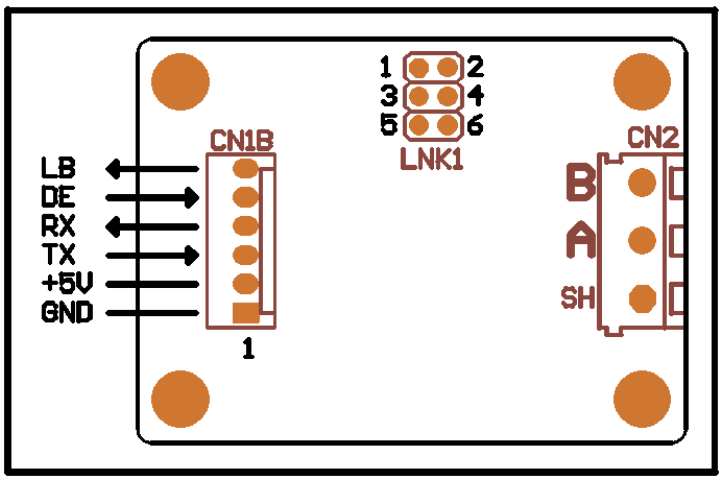
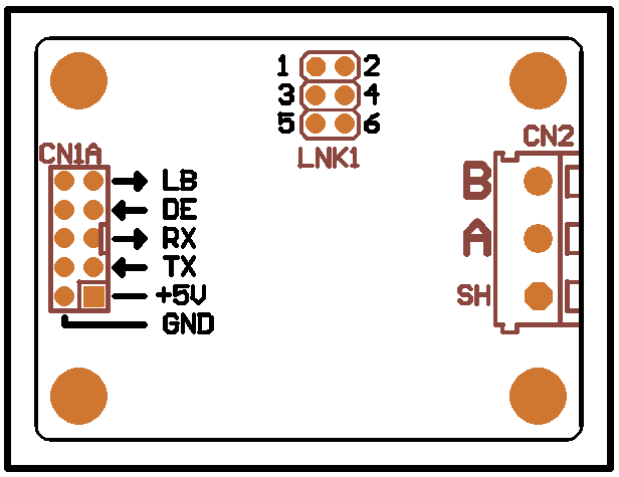
NETWORK 3way TERMINAL STRIP (CN2)	Description
1	B line
2	A line
3	Shield





Link Configuration:

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LINK1	Description
1-2 , 3-4 , 5-6	FAIL-SAFE
5-6	LINE TERMINATOR

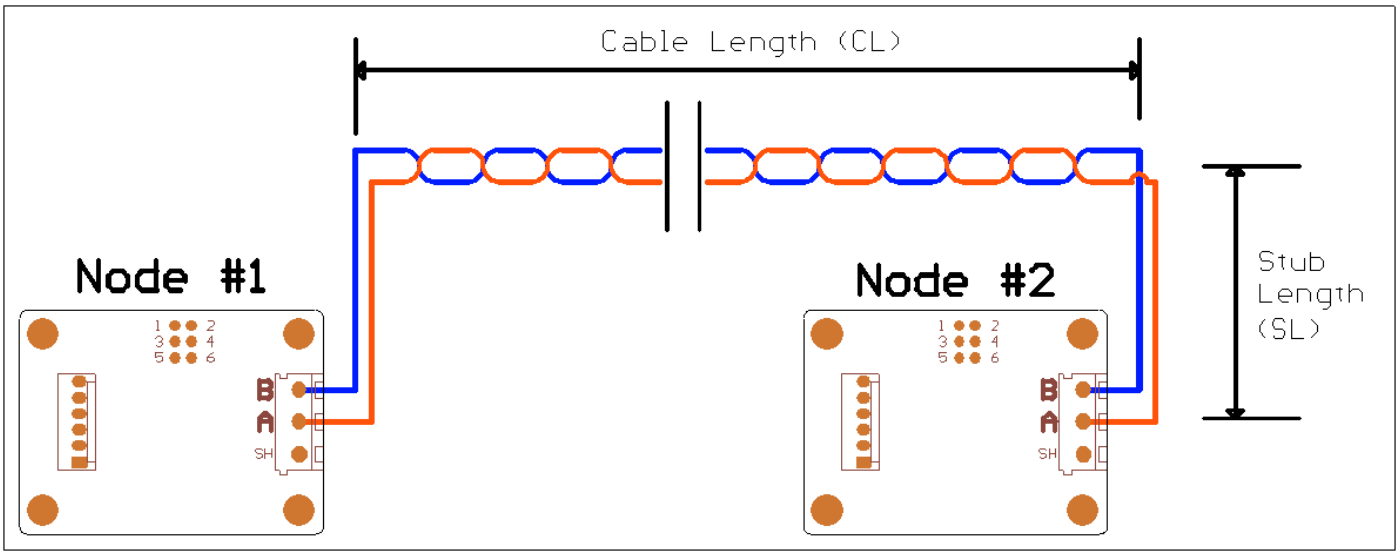
V+ to GND	-0.3V to +5.5Vdc
RS485 signals	–7V to +12V
Operating Current	5 to 50mA
Operating Temperature Range	0° C to 85°C
Storage Temperature Range	0° C to 85°C

ABSOLUTE MAXIMUM RATINGS (1)

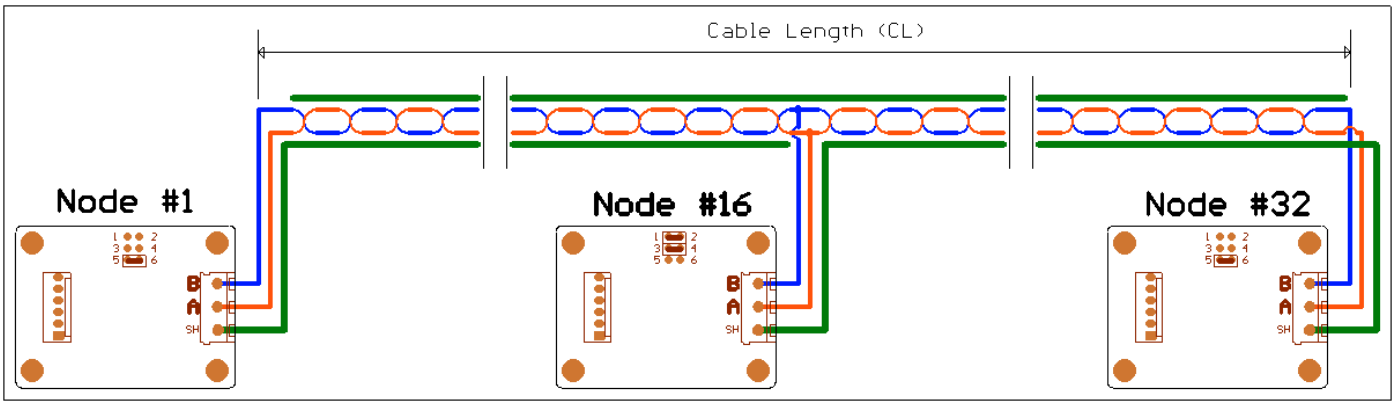
NOTE:: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. Exposure to absolute maximum conditions for extended periods may affect unit reliability.

Network configurations:

The following is an example of a very simple network consisting of only 2 nodes. This would be suitable for situations requiring the reliable transfer of data between 2 stations that are separated by less than 12m or the bitrate is less than 25Kbps.



The following is an example of a more complex network consisting of the maximum of 32 nodes. This would be suitable for situations requiring reliable communication between a master station and many slave stations. All nodes are wired in a daisy-chain with the 2 end nodes terminated with 120ohms using link 5-6 in order to minimize the signal reflections within the cable. Receiver fail-safe links 1-2 and 3-4 may be installed at the master node for those cases where all drivers are disabled for more than a few bit lengths.



Stub length:

The RS485 standard requires the use of a daisy-chain topology where there is one continuous cable joining all the nodes together. There will be occasions where a joiner cable is used to connect the RS485 board to the network cable. This joiner cable should have a stub length no greater than 5 meters otherwise excessive line reflections may be observed which will degrade high speed performance.

Cabling:

The maximum cable length (max CL) is determined by a combination of length (in meters) and the data rate (in bits per second) given by the equation :-

Max CL = 100,000,000 / Data Rate

Example #1

Data rate = 250,000 Bps, therefore max CL = 400 meters.

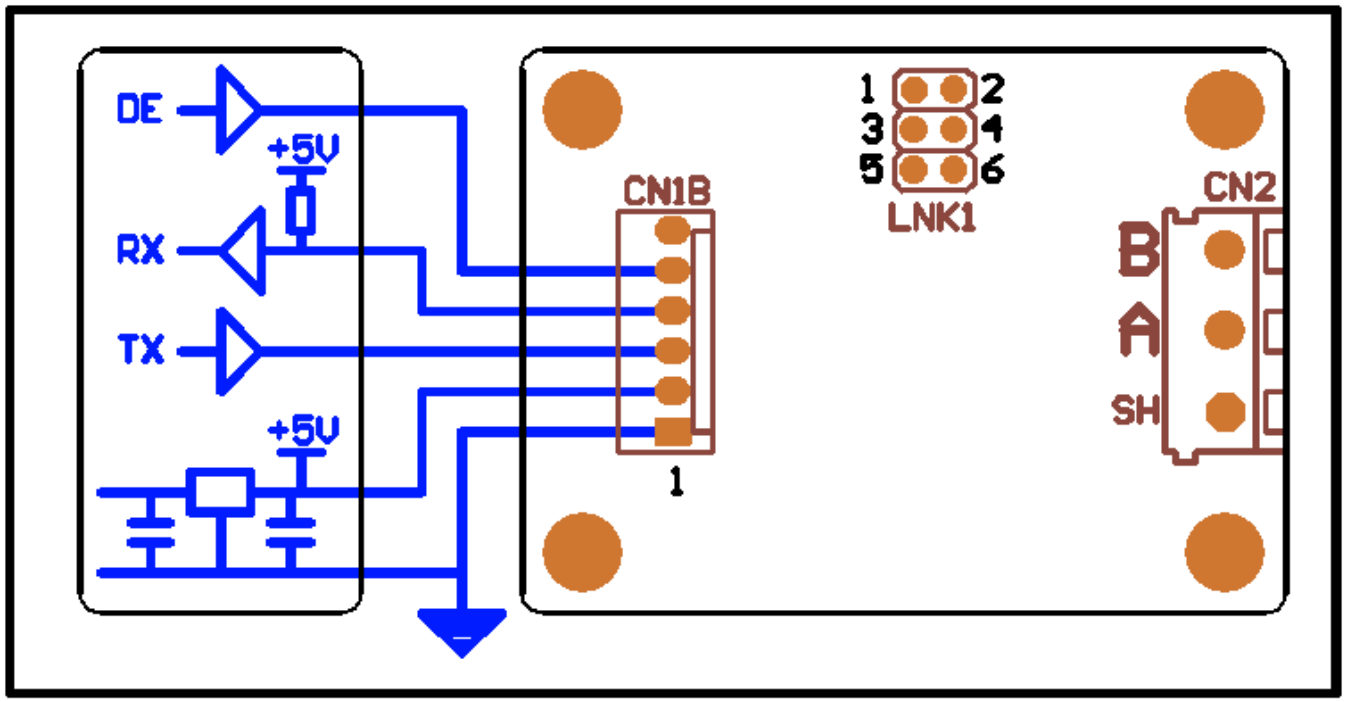
Example #2

CL = 1200 meters, therefore max Data Rate = 83,333 bps.

The cable should have a characteristic impedance of 120 ohms and a capacitance of no more than 50pF/meter. Unshielded cable may be used, however, a twisted pair needs to be allocated for the shield connection if needed. The ubiquitous CAT-5 UTP network grade cable will work well in most cases.

Typical circuit connection:

The following shows a typical connection to a controller board. A well regulated +5V supply is required as well as a pull-up resistor on the RX line. Most micro-controllers have an internal pull-up resistor on certain ports.

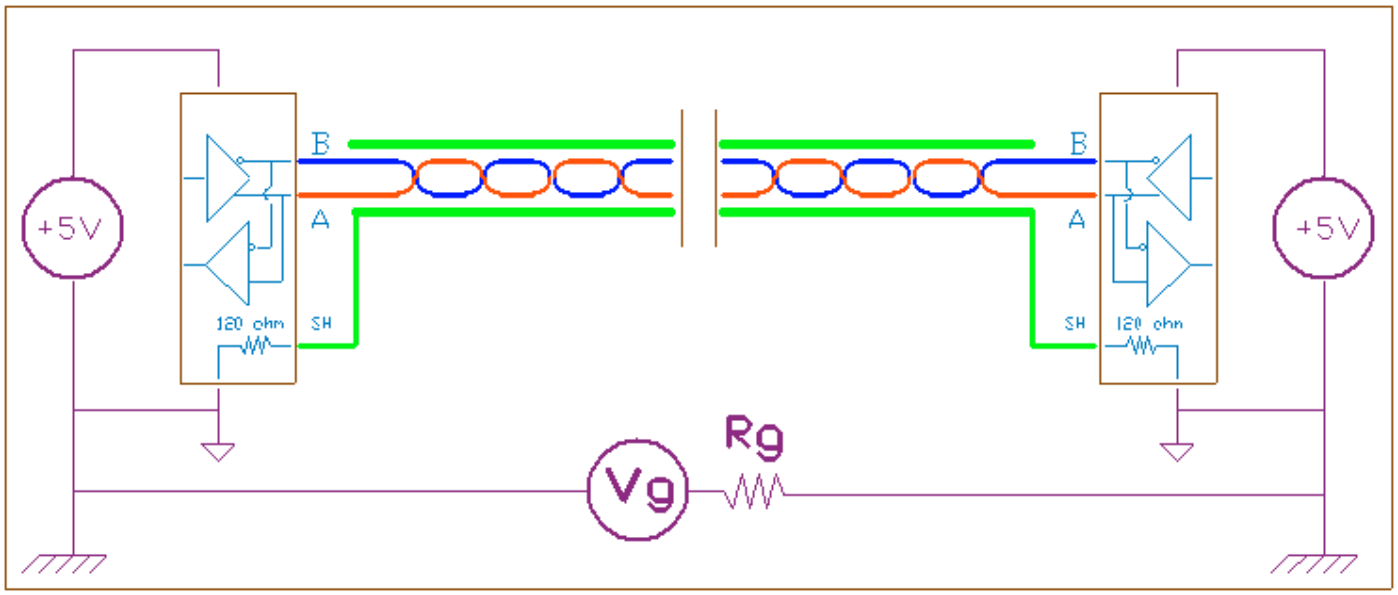


Earth/Ground loops:

If two or more nodes have their signal common connection earthed, a so called ground loop will be formed. While this may increase the noise on the network, the main problem would be that the common mode voltage may exceed the TIA/EIA-485 standard of –7V/+12V relative to signal common. Ground loops are usually broken by using a combination of transformers and opto-isolators. This board uses a simpler and cheaper method to reduce ground loop effects, namely, a shield connection.

Shield connection:

The shield connection is used to reduce the detrimental effects of ground loops.



Vg represents the ground potential between two nodes and Rg represents the ground resistance.
A common mode voltage is generated due to the voltage sources and the resistive divider formed by Rg and Rin of the receiver, typically 12K per receiver. This common mode voltage must not exceed the TIA/EIA 485 standard of –7V/+12V relative to circuit/signal common. Utilizing the shield connection will reduce the common voltage using the built-in 120 ohm current limiting resistors.
Using a spare twisted pair from an unshielded cable will also work.

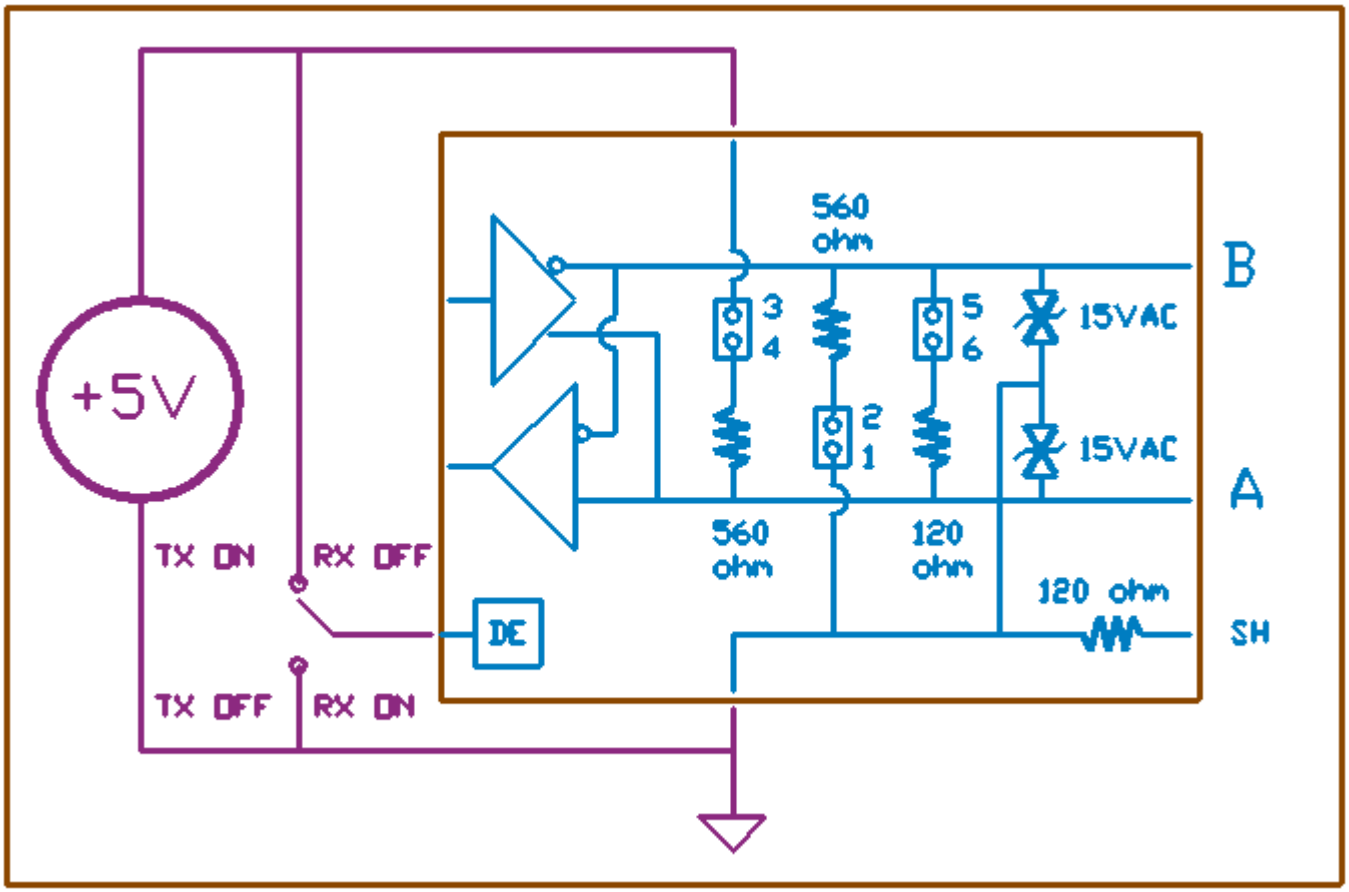
If Earth loops are too severe resulting in the common mode voltage exceeding the –7V/+12V limit, then a fully isolated RS-485 link will be required.

Network interface:

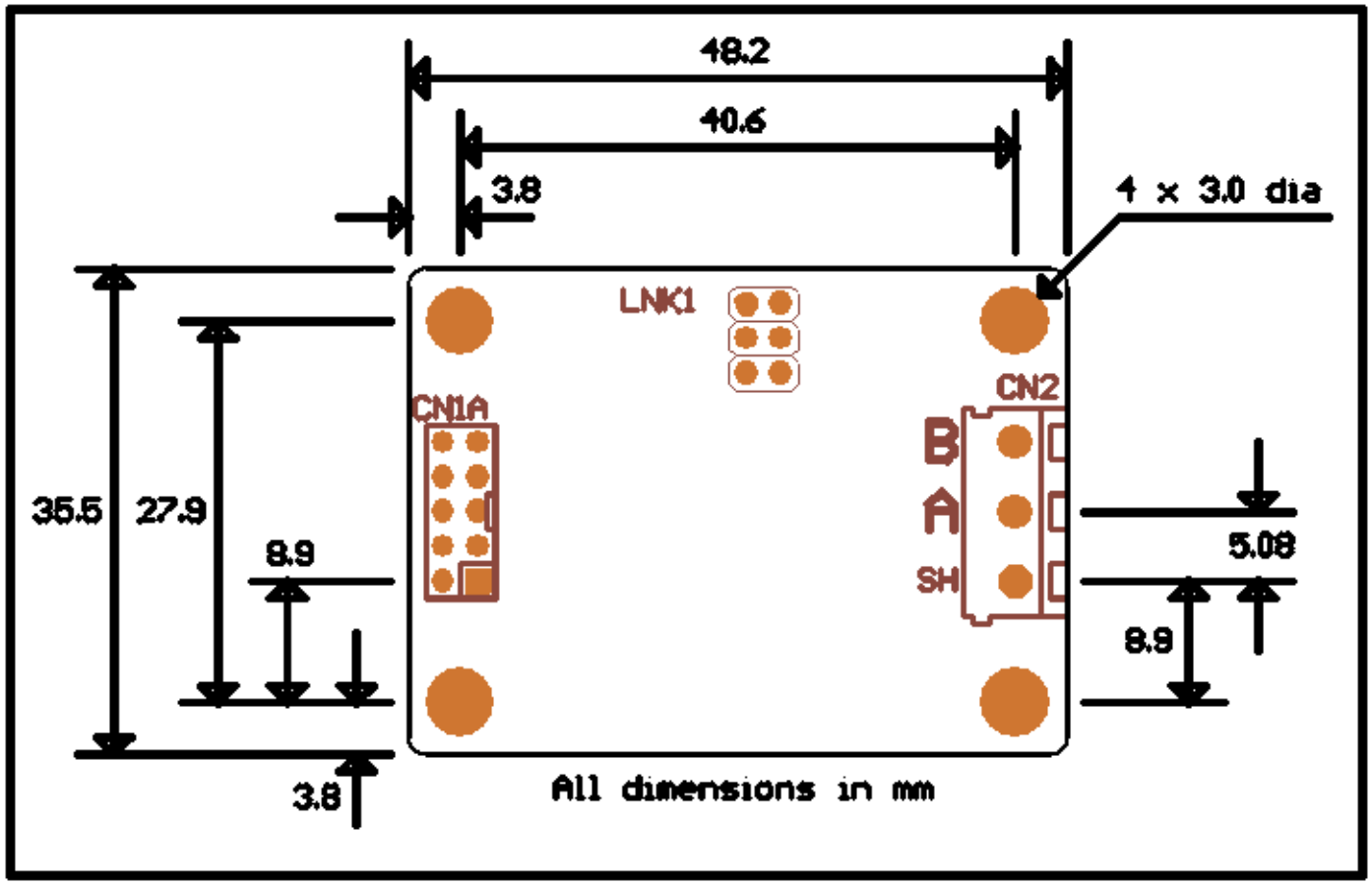
The board incorporates a pair of 15VAC/400W Transient Voltage Suppressors to give some measure of protection against induced voltage spikes on the line.

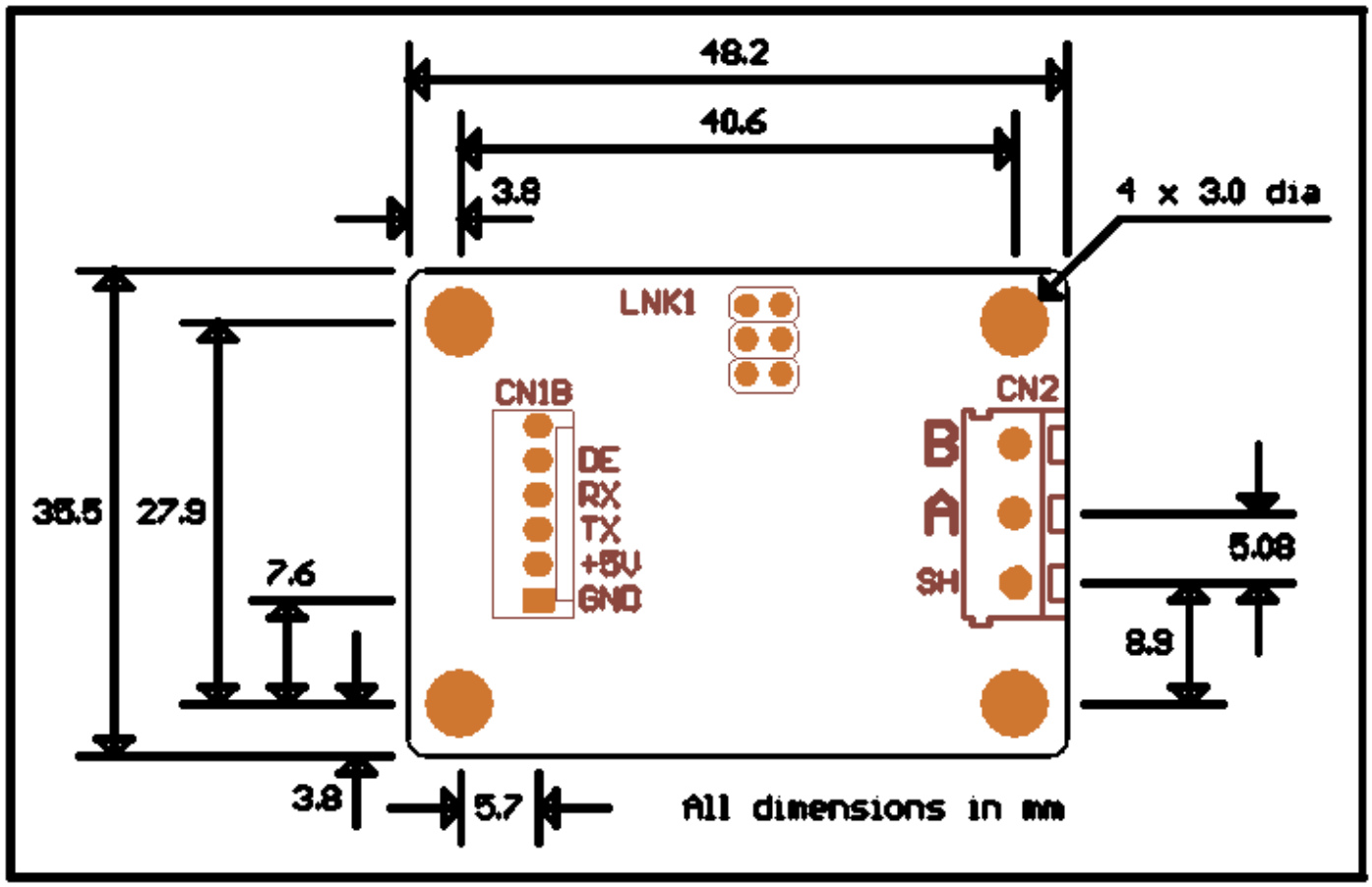
Links 5-6 enable the on-board 120 ohm line terminator which must only be used on those nodes that are at the very end of a very long line (up to 1200m).

Links 1-2 and 3-4 enable the on-board Fail-Safe mode which must only be used on one node. This will generally be the master node and is used to bias the line in an idle condition in case all drivers are disabled.



Dimensions:


48.2
40.6
3.8
4 x 3.0 dia
LNK1
CN1A
CN2
B
A
SH
35.5
27.9
8.9
5.08
8.9
3.8
All dimensions in mm


48.2
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4 x 3.0 dia
LNK1
CN1B
DE
RX
TX
+5V
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B
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7.6
5.08
8.9
3.8
5.7
All dimensions in mm

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