Technical Description

MEW01760

Revision -

TLON, Network used for fire alarm system EBL512 G3

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Table of contents

1   Introduction

TLON is the name of the local network that connects a system of two or more EBL512 G3 control units. Up to 30 control units can be connected in a TLON network.

This document is intended to be used by planning engineers as well as service / commissioning engineers.

The TLON Technical description should be read in conjunction with the Operating Instructions TLON Manager V2.0.x MEW01361.

TLON was used for the older system EBL512 as well, however the focus of this document is to describe the network design of an EBL512 G3 system.

In a TLON network it is possible using components from third part manufacturers e.g. routers.

Note, Panasonic Eco Solutions Nordic AB cannot take responsibility for third part products. However all recommended products in this document have been tested in systems with maximum number of EBL512 G3 control units.
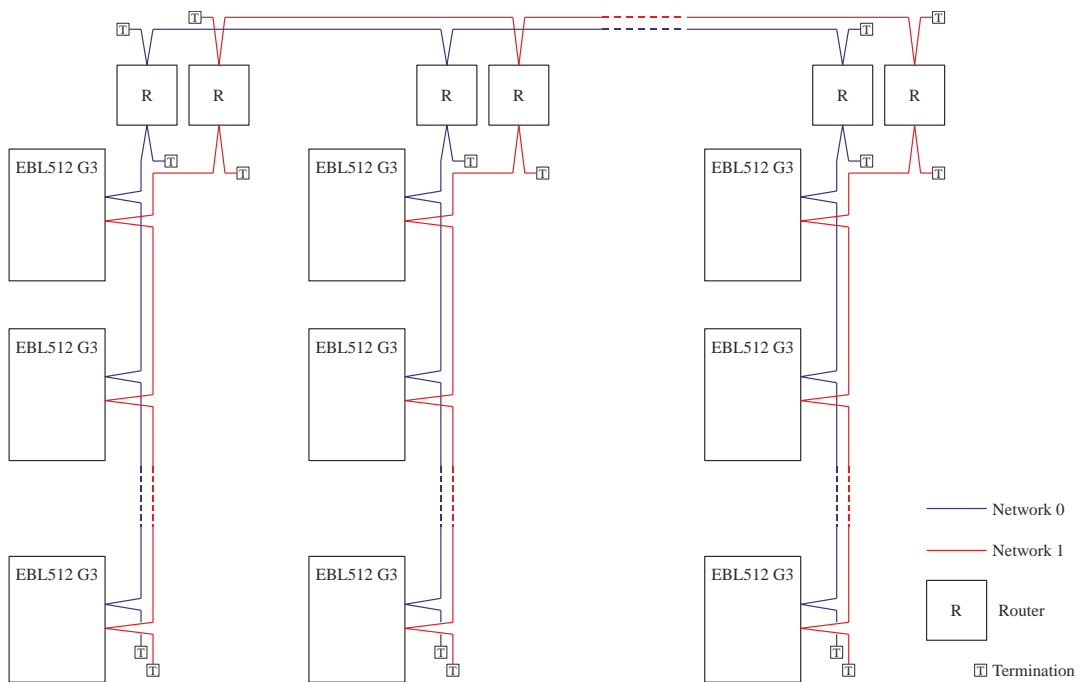
Figure 1. Example of a TLON network. Schematic drawing.

2   Definitions / Explanations

Unit:

> A physical device connected to the network, e.g. an EBL512 G3 unit – containing a TLON connection board 5090.

Channel:

> A physical structure of the network. Routers may subdivide the network into several channels. It can be useful for long distance network, longer than the max. length for one channel or for extra security reasons.

Router / Router in repeater mode:

> A router is able to forward all valid data based on its destination address. It is also possible configure a router in repeater mode. In this mode all valid data will be forwarded. It is recommendable to use routers in repeater mode because in a TLON Network all EBL512 G3 units share the same data, thus all messages are sent to all units in the TLON Network.

Repeater:

> A repeater is a physical amplifier without own processing function. A repeater will forward all data without any buffering. The repeater may increase the collision rate. For this reason Repeaters shall only be used in a very restricted manner in a TLON Network. Note, do not mix up Repeaters with Router in repeater mode as described above.

LonWorks:

> A technology platform for implementing control network systems. (Registered trademark of Echelon Corporation)

TP/FT-10:

> Twisted pair cable topology.

Autonomous control units:

> A control unit which maintain full functionality autonomous and independently from other control units in the system. See also paragraph 3.3.1.

3   General description

3.1   General description of EBL512 G3.

EBL512 G3 is an intelligent, analog and addressable Control and In-dicating Equipment (control unit).

EBL512 G3 can be used as a stand-alone control unit or connected to a TLON Network, i.e. a "system" with up to 30 control units. Each control unit has access to all information.

There are two different types:

- EBL512 G3 type 5000 is with front and display and with or without printer.
- EBL512 G3 type 5001 is without front, display, printer or door. (A "grey box".). Type 5001 cannot be used stand-alone, it must be connected via the TLON Network to a system where at least one of the control units is of type 5000.

Figure 2. Left: The EBL512 G3 Control Unit 5000, with printer. Right: The EBL512 G3 Control Unit 5001.

3.1.1   TLON connection board 5090

The TLON connection board 5090 is a transformer coupled interface (FTT-10), which supports the LonWorks TP/FT-10 topology, between the control unit and the TLON Network.

On the EBL512 G3 control unit (5000 / 5001) main board, there are spaces and connectors for two TLON connection boards 5090. In a stand-alone control unit there are no TLON connection board mount-ed. When the control unit is connected to a system via the TLON

Network there may be one or two 5090 boards mounted, one if single TLON Network is used and two if redundant TLON Network is used. This is more explained in paragraphs 3.3.1 and 3.3.2.
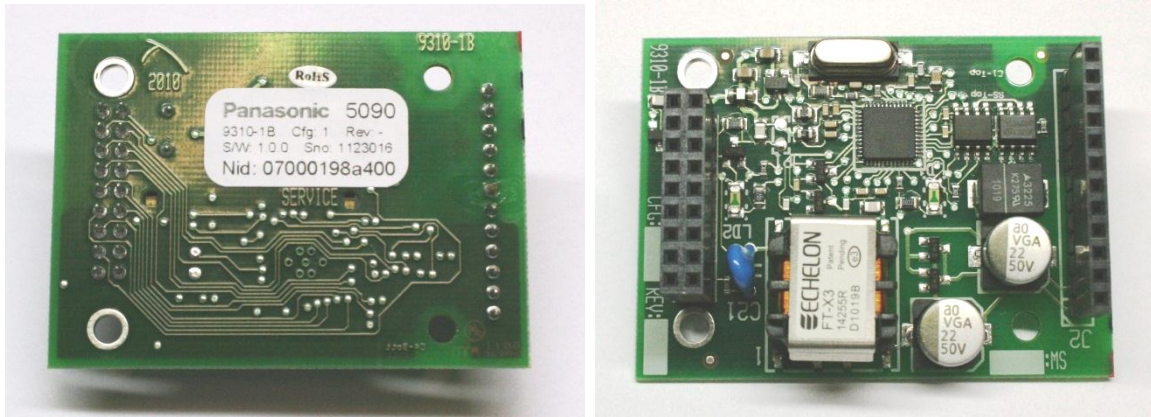

Figure 3. Left: Backside of the 5090 board, The unique Neuron ID number is printed at the label.   Right: Component side of the 5090 board.

3.2   TLON manager

Since units share the same communication media, physically attaching units to TLON is not enough for them to communicate. Units in a data network needs to be given network configuration information, such as network addresses, to enable them to understand with whom they should share data. With TLON, this network configuration information is defined and loaded by the network installation tool TLON Manager. Besides this, TLON Manager downloads the control unit number to each unit connected to TLON. With the TLON Manager the user just defines the network, there is no need to know the specific network addresses or the bindings between the units, TLON Manager generates this information automatically. TLON Manager also has functions for diagnostics to detect failures at a network level. More information about TLON Manager is to be find in Operating Instructions TLON Manager V2.0.x.

3.3   Single or redundant TLON Network

3.3.1   Single TLON Network

In this case all communication occurs on a single TLON Network, called Network 0. In case of a network fault (i.e. open circuit or short circuit) the control units in the system can´t share information any longer. This may adversely affect the function of the system and violates the EN 54-2 standard unless all units in the system are autonomous control units, i.e.:

-      All control units shall be of type 5000, i.e. including front panel.

- The alarm points and their "belonging" outputs shall be connected to the same control unit.

- If fire alarm routing equipment ("Fire brigade tx" output) shall be used, each control unit in the system shall be able to activate a fire alarm routing equipment independent of the other control units.

In all other cases and for highest security, a redundant TLON Network shall be used.

3.3.2   Redundant TLON network

Normally the communication occurs on Network 0. In case of a network fault on Network 0 (i.e. open circuit or short circuit) is detected, the control units in the system start using Network 1. Note that Network 1 always is supervised to detect network faults even when the communication occurs on Network 0.

3.4   Routers

In a TLON network it is possible to use routers. These units increases the maximum cable length and achieves an isolation between the channels of the TLON network.

A router is able to forward all valid data based on its destination address. It is also possible configure a router in repeater mode. In this mode all valid data will be forwarded. it is recommendable to use routers in repeater mode because in a TLON Network all EBL512 G3 units share the same data, thus all messages are sent to all units.

A router has to be configured with the TLON Manager tool for more information see chapter "Add a Router" in the Operating Instructions TLON Manager V2.0.x MEW01361.

4　　　　Network design

4.1　　　General rules

When planning the installation of a fire alarm system great carefulness must be taken, especially for the network design. Mistakes, e.g. using wrong type of cables or too long cables, may lead to problems which often are time consuming and expensive to solve afterwards.

The most important rules are:

- The cable shall be of correct type and the maximum length shall not be exceeded. See section 4.2

- A correct wiring of a TLON network. See section 4.3.

- Separate TLON communication wires from high voltage power cables Follow the national regulations for fire alarm installations with regard to cable placement.

- If routers are used keep in mind that these are vital components in the fire alarm system and shall be powered with an EN 54-4 approved power supply. See section 4.4.

4.2　　　Network cable length and cable selection

The cable type used for TLON shall be Belden 7703 NH 1 pair 22 AWG or equivalent.

The cable length is ≤ 900 meter.

Belden 7703 NH is a twisted pair and shielded cable, suitable for data transmission.

The shield shall be grounded in each control unit and each router if used.

Note that cables usually used for the COM-loop, e.g. ELQYB 2 x 1 or similar, shall not be used for TLON.

4.3　　　The doubly terminated bus topology

The transceivers used in a TLON network are the FTT-10A twisted pair transceivers. The FTT-10A transceiver is transformer isolated and operates at a data rate of 78 kbps, they support the TP/FT-10 topology.

It is strongly recommended to wire the TLON network in the doubly terminated bus topology fashion show in the figure below.

Two terminations are required one at each end of the bus. The termination is a resistor, $R = 105\Omega\pm1\%$ 1/8W.

The EBL512 G3 control unit supports that both incoming and outgoing wires are connected in the control unit. In that way the control units are stringed together in a daisy-chain fashion.

R = Termination resistor 105Ω±1% 1/8W.
L = Cable length = 1400 meter. The cable shall be Belden 7703 NH 1 pair 22 AWG or equivalent.
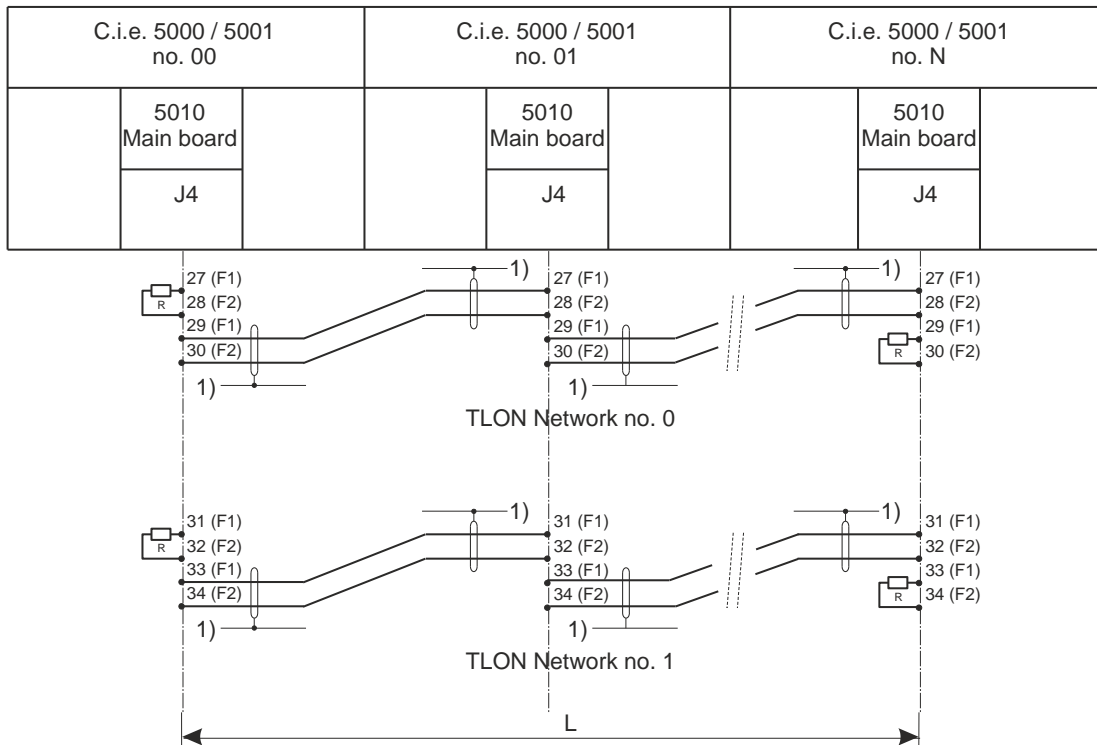
1) Screen shall be connected to the earth point of the control unit.

Figure 4. The doubly terminated bus topology.

It is true that the TP/FT-10 support free topology, e.g. one control unit in the center and the others connected in a star. This may be used if absolutely necessary during special circumstances. Note that in this case the maximum total wire length, for the prescribed cable type, is reduced to 500 meter. Furthermore only one termination resistor shall be used in the center of the net R = 52,3Ω±1% 1/8W.

4.4 Routers

In a TLON network it is possible to use routers.

A router adds a channel to the TLON network, which extends the maximum cable length. It is possible to add multiple routers depending on the distance needed.

With a router it is possible to interface different communication media to TLON, e.g. fiber optic cable.

Since the channels connected to a router are isolated a failure on one channel does not affect the other channel. E.g. if a single TLON network only consists of one channel and a short circuit occurs, this will affect every control unit in the network. The control units will still work stand-alone but no communication will occur between them. Fault messages will be generated in all control units. Instead, if there are more than one channel, the short circuit will only effect the communication between the control units in the actual channel, the communication between control units in other channels are not affected. Naturally fault messages will be generated in every control unit.

If there are more than one channel in the TLON network it may be more easy to locate and service faults on the network e.g. disturbances etc. If routers are used, only messages with a valid CRC code will be forward between the channels.

A router is able to forward all valid data based on its destination address and can use one of following routing algorithms: configured router, learning router and bridge. However it is also possible configure a router in repeater mode. In this mode all valid data (i.e. data packages with correct CRC codes) will be forwarded. It is recommendable to use routers in repeater mode because in a TLON Network all EBL512 G3 units share the same data, thus all messages are sent to all units.

4.5   Repeaters

The repeater increases the maximum cable length. A repeater is a physical amplifier without own processing function. It physically extends the channel and assures that the required signal level is kept throughout the extension. A repeater will transparently forward all data packets without any buffering.

A repeater does not have to be configured in the network with TLON manager.

The repeater will impose an extra delay on the channel that could conflict with the media access timing used by the LonTalk protocol. The extra delay results in a higher probability for packet collisions, especially for a busy channel.

A router described in the previous chapter does not increase the collision rate. Because of this routers shall always be the first choice in a TLON Network.

Note! The repeater may increase the collision rate. For this reason Repeaters shall be avoided in a TLON Network, especially in large networks. However they may be used in a restricted manner:

> No more than one repeater shall be in the path between two control units in the TLON network.

4.6   To power the router/repeater

Since the routers/repeaters are vital components in the TLON network a battery backed up and monitored power source shall be used e.g. the 24V output of the EBL512 G3 control units or the external power supply 3366.
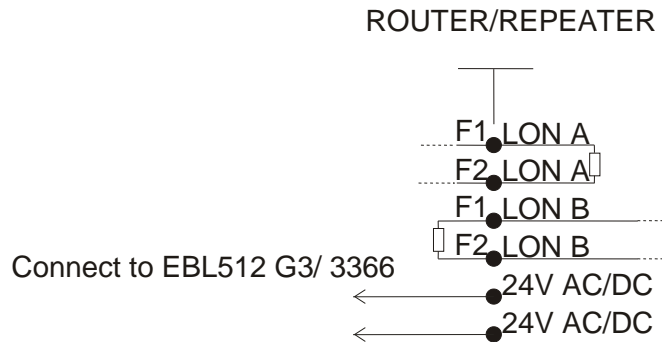
ROUTER/REPEATER

F1 LON A
F2 LON A
F1 LON B
F2 LON B
Connect to EBL512 G3/ 3366   24V AC/DC
24V AC/DC

Figure 5. It is recommended to use the 24V output of EBL512 or external power supply 3366 to power the router/repeater.

4.7   Termination

Often the router/repeater is placed in the end of the bus. In this case the termination resistor ($R = 105\Omega \pm 1\%$ 1/8W) shall be placed as shown in *Figure 5*. Note, is some cases the termination resistor is built in and selectable by a dip switch, refer to the manual of the router/repeater.

4.8   The two channels network

A TLON network that consists of two channels is achieved with one router. The router connect the two channels. Multiple routers connecting same two channels is called looping topologies. Looping topologies may cause an endless looping of forwarded messages and shall on that account not be used.
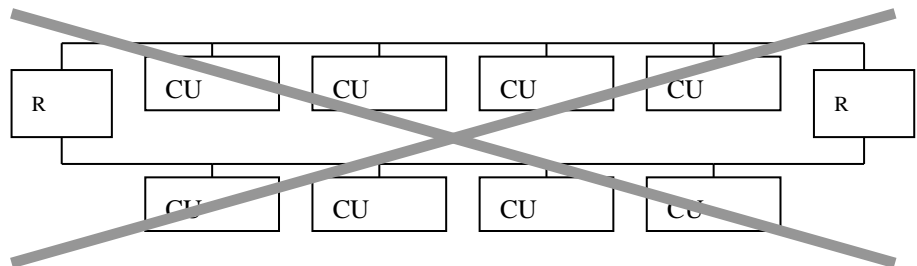
| R | CU | CU | CU | CU | R |

| CU | CU | CU | CU |

Figure 6. Looping topologies shall not be used. Schematic drawing.

4.9   The backbone architecture

If a TLON network consists of more than two channels, it may be convenient using the so-called backbone architecture. Since a short circuit on the backbone will affect the communications between all channels extra carefulness shall be taken with regard to cable placement of the backbone.

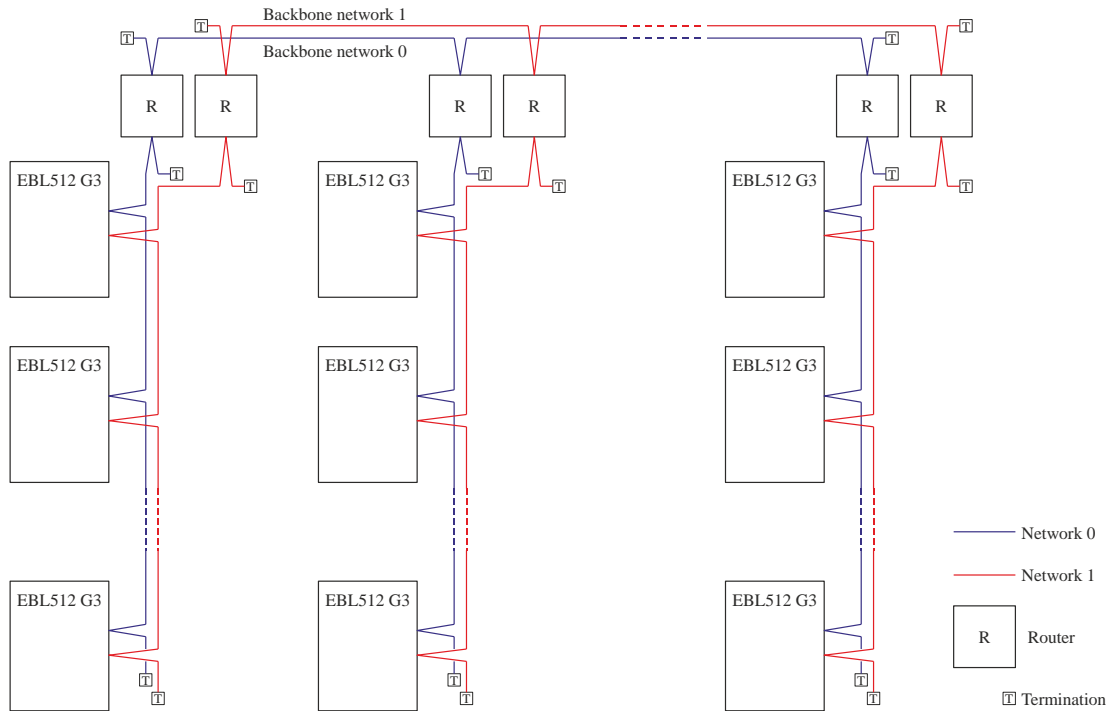A backbone net may preferably consist of a fiber optic channel, see 4.11.

Figure 7. A backbone net. Schematic drawing.

4.10   **TLON via TCP/IP**

With a LonWorks Internet server (e.g. i.LON 600) it is possible using internet (or any IP-based LAN or WAN) as a pathway for TLON.

The transition from TP/FT-10 to IP-network opens the opportunity to use the large range of infrastructure products e.g. fiber optic converters.

Note, since most national regulations for fire alarm installations request dedicated network wiring, great carefulness must be taken when choosing an IP-network as a pathway for TLON and shall be used for autonomous control units only. Panasonic Eco Solutions Nordic AB cannot take responsibility for IP-based communication since it is dependent on the infrastructure of the IP-network.
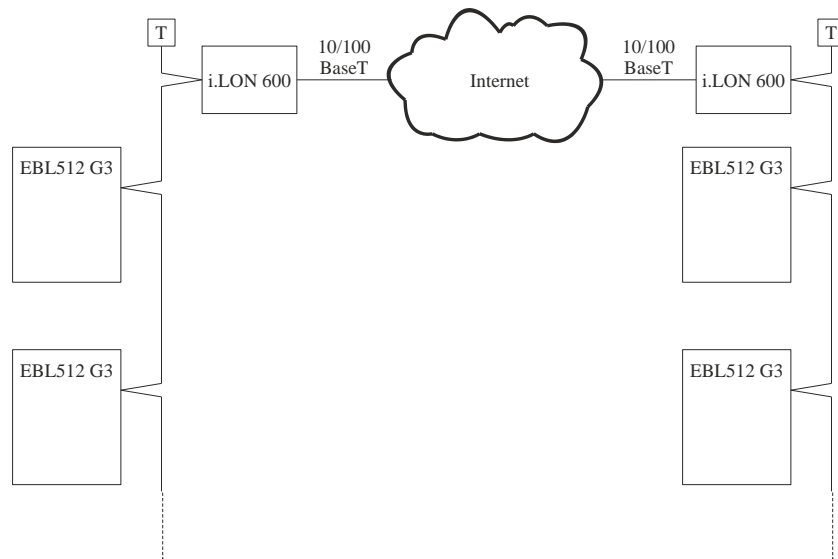
Figure 8. TLON via TCP/IP. Schematic drawing.

4.11   Fiber optic network

4.11.1   The Fiber Optic router for LonWorks TP/FT-10

With a Fiber Optic to TP/FT-10 router it is possible to connect an TP/FT-10 channel to a fiber optic channel.

In this case EBL512 G3 control units are connected to twisted pair (TP/FT-10) channels. With a Fiber Optic to TP/FT-10 router the TP/FT-10 channel is connected to the fiber optic channel. The topology is the same as in the section 4.9; in this case, the fiber optic channel is the backbone net. If many Fiber Optic to TP/FT-10 router are used, the optical fiber are stringed together via the routers in a daisy-chain fashion.

Refer to the manual of the Fiber Optic to TP/FT-10 router about supported optical fiber types, connectors, maximum length, termination of the optical fiber, etc.

4.11.2   The Fiber Optic repeater for LonWorks TP/FT-10

Unfortunately a lot of third part Fiber Optic to TP/FT-10 routers have become obsolete. However there are still Fiber Optic to TP/FT-10 repeaters on the market.

Note! A fiber optic repeater has the same disadvantages as repeaters in general (see paragraph 4.5) For this reason fiber optic repeaters shall only be used in a restricted manner in a TLON Network.

When two or more fiber optic repeaters are connected together they form a physical repeater link.

- No more than one repeater link shall be in the path between two control units in the TLON network.
- The delay the repeater link causes shall not exceed 36μs. The delay depends on the number of optical repeaters in the link and the total length of the fiber optic cable. Refer to the manual of the fiber optic repeater.

5   Recommended products

For correct installation in the TLON-network, refer to the manual of each of the products below.

5.1   Router

Loytech, LS33CB, L-Switch CEA-709 Router 2 x TP/FT-10.

A-Side TP/FT-10

B-Side TP/FT-10

12- 35 VDC

See paragraph 4.4

5.2   LonWorks/IP Server

Echelon, i.LON 600, LonWorks/IP Server.

Connects a TP/FT-10 to a IP-network.

24V AC/DC

See paragraph 4.10

5.3   Fiber optic repeater

Westermo, LRW-102, Fiber optic repeater for TP/FT-10

Connects a TP/FT-10 channel to a LonWorks fiber optic channel.

Available with 1310nm Multi Mode or 1310nm Single Mode

12 – 48 VDC

Note! Shall be used in a restricted manner, see paragraph 4.11.2

6 Revision history

The changes in conjunction with the latest revision are, when possible, written with red font colour in the document.

This is the original version, no revisions.