FTR-120 Free Topology Repeater

1. Intent & Scope

This document describes the installation procedure for the FTR-120 Free Topology Repeater for use on LonWorks networks.

2. Description

The FTR-120 is a wall mount four-channel network repeater for use with the Echelon LonWorks network. A message received on any channel is rebroadcast on the other three channels. The FTR-120-1 has four FTT free topology channels and requires an external power supply.

FTR-120 Free Topology Repeater

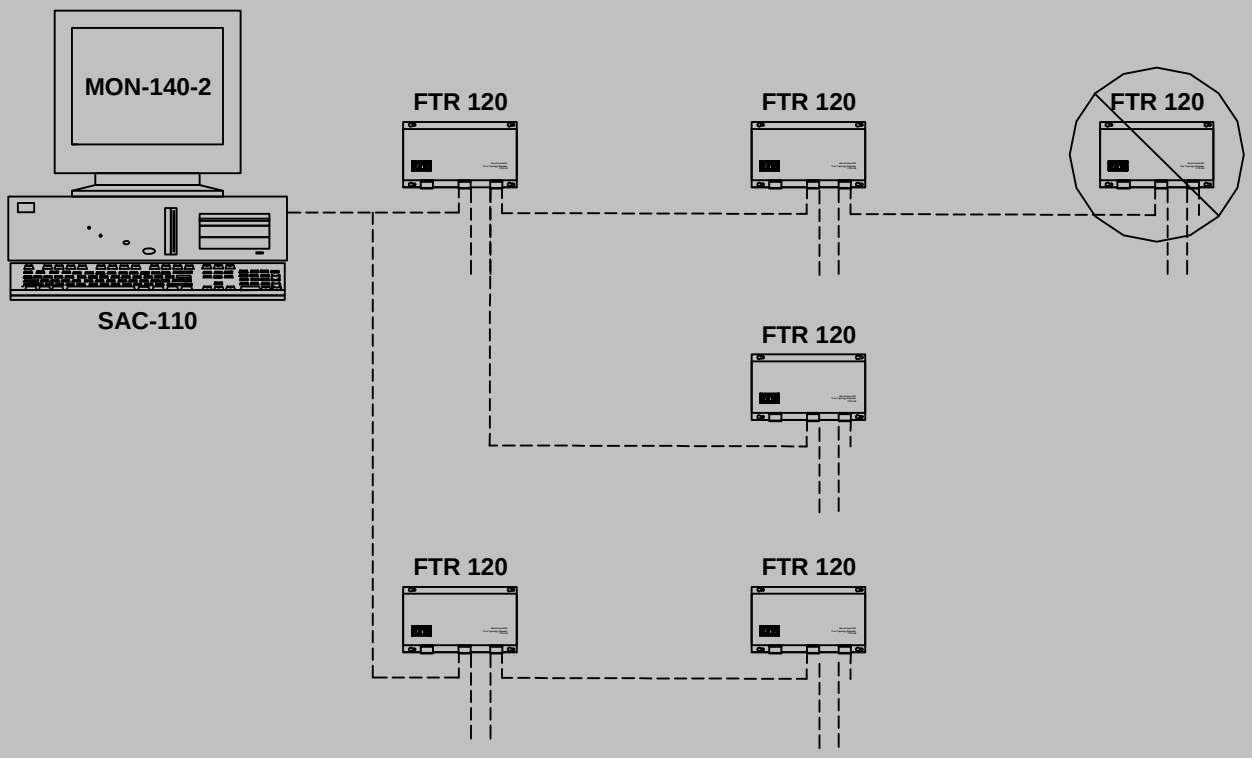
3. Free Topology Networks

The MicroComm DXI system uses Echelon LonWorks networks to transfer control and status information between its various components. The LonWorks Free topology network, used by the DXI system, is a long distance network that connects SAC computers with I/O card cages, and connects master stations and remote DIO modules to the SAC computers.

The free topology network provides reliable communications and wiring flexibility over long distances. When the distances to be covered are too great for a single network segment (a segment is a portion of a network connected by one or more cables that are electrically connected) a free topology repeater is used to extend the network wiring to the required length.

With the recommended 22 ga Echelon LonWorks approved cable, each free topology network segment is restricted to a maximum length of 400 metres (1300 feet) between devices, with a maximum total cable length of 500 metres (1600 feet) for each segment. In addition a maximum of 64 devices are allowed per segment. In very large facilities, it may be necessary to extend the network segment even farther by installing additional repeaters. Note: A maximum of two FTRs can be in series between a SAC computer and a communication point in the network. Repeaters can be connected in parallel to create larger distribution networks

Warning: more than two FTRs in series may cause LonWorks network problems.



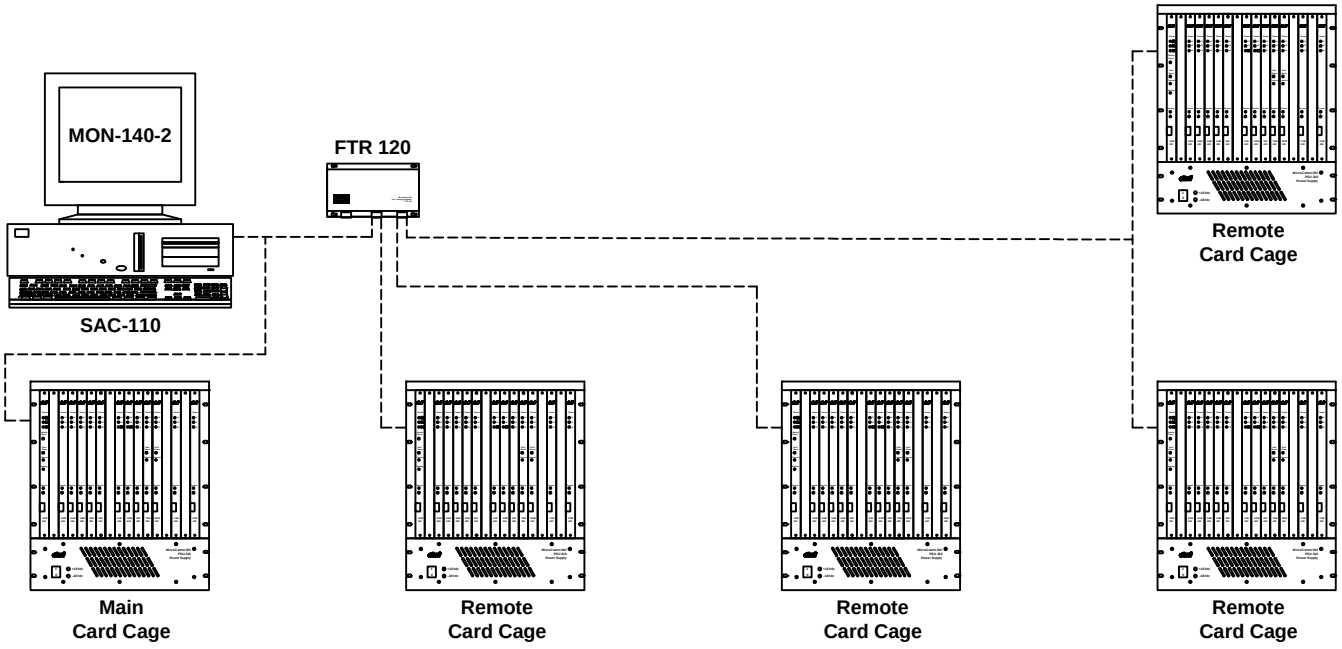
Only 2 Repeaters can be Connected in Series

3.1 Network Configuration

Free topology network wiring can be installed with almost any combination of "tap-offs", "tee-taps" and "star" connections, with the exception that the network should not form a complete loop at any point. The other restrictions are that the limits for the total node-to-node cable length and the number of nodes per network segment are not exceeded.

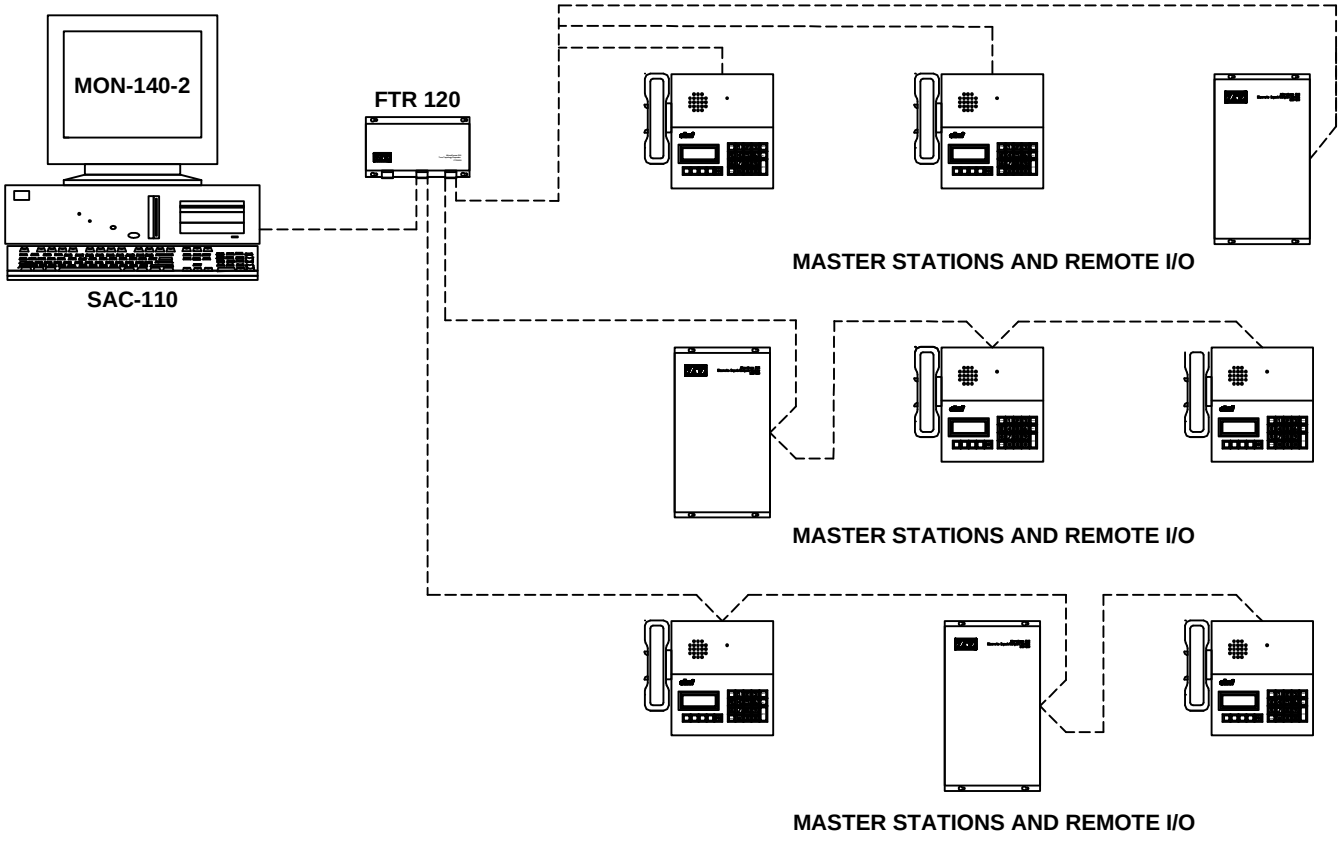
In a MicroComm DXI system, there are usually two LonWorks networks connected to each SAC computer -- the Card Cage Network and the Remote I/O Network. Each network can have its own FTRs to extend it as necessary.

The following diagram shows a typical wiring layout of a card cage network that uses a free topology repeater.



Card Cage Network

The following diagram shows the typical wiring layout for the remote I/O network.



Remote I/O Network

3.2 Network Cabling

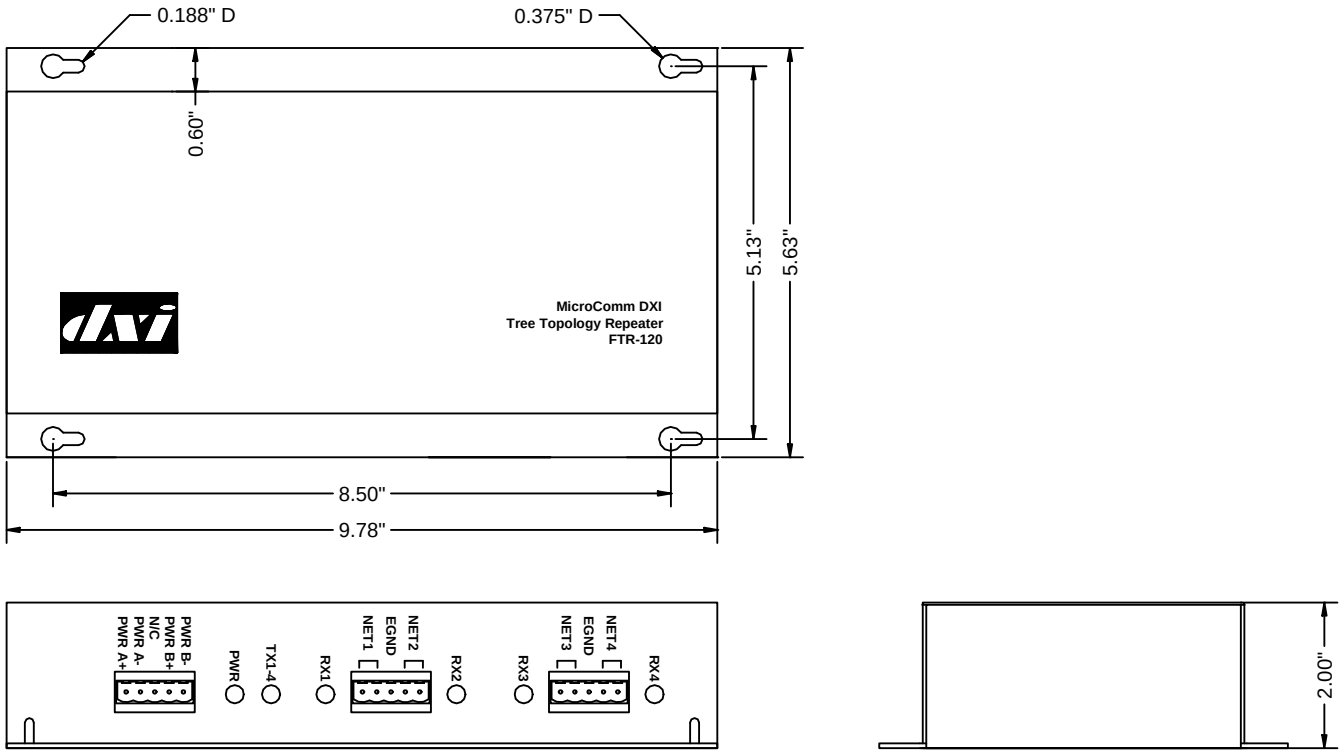
Free topology network connections should be made with a level 4 or 5 Echelon LonWorks 22 Ga. unshielded twisted pair. As an alternative Belden 85102 or 8471 16 Ga. cables can be used, or for limited runs of 250 metres node-to-node or 400 metres of total cable length, category 5 cables can be used. Please consult the factory before using any other type of cable.

4. Installation

4.1 Mechanical Installation

Mount the unit on the wall using four #6 mounting screws. The unit can be mounted horizontally with the terminal blocks facing down or vertically with the terminal blocks on the right side.

The following diagram depicts the physical dimensions and layout of the FTR-120.



FTR-120 Physical Layout

4.2 Power Supply Requirements

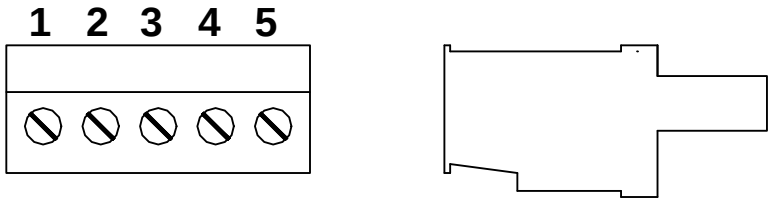
The power supply voltage at the FTR-120-1 terminals must be between +10.8 Vdc and +26.4 Vdc (either a 12 Vdc ± 10 % or 24 Vdc ±10% power supply can be used). The maximum current required by the unit is 100 mA. A +12 Vdc wall adapter, capable of supplying at least 100 mA of current, is a suitable power supply.

Note: If the input voltage exceeds 36 Vdc the unit can be damaged.

The FTR is protected by a ¼ amp mini fuse (Littlefuse part number 273.25). The location of the fuse is shown on the top view of the PCB shown in Section 6.

4.3 Cable Connections

The field wiring to the FTR is made with pluggable five position terminal blocks. The terminal block pins are numbered from left to right as shown in the following diagram.



Five Position Terminal Block

4.4 FTR-120-1 Four FTT Channels

The FTR-120-1 uses three identical five position terminal blocks. The power supply is connected to one of the terminal blocks while the other two terminal blocks each have two FTT channels. The wiring pinouts for the four FTT channel FTR are given in the following three tables.

Pin Number	Description
TB3-1	(PWR A+) Power A+ positive supply connection
TB3-2	(PWR A-) Power A- negative supply connection
TB3-3	N/C
TB3-4	(PWR B+) Power B+ positive supply connection
TB3-5	(PWR B-) Power B- negative supply connection

Power Supply Connection

Pin Number	Description
TB2-1	(NET 1) Network channel 1 connection
TB2-2	(NET 1) Network channel 1 connection
TB2-3	EGND
TB2-4	(NET 2) Network channel 2 connection
TB2-5	(NET 2) Network channel 2 connection

Network Connections

Pin Number	Description
TB1-1	(NET 3) Network channel 3 connection
TB1-2	(NET 3) Network channel 3 connection
TB1-3	EGND
TB1-4	(NET 4) Network channel 4 connection
TB1-5	(NET 4) Network channel 4 connection

Network Connections

Power A+ and Power A- are the power supply inputs. Connect the positive lead of the power supply to the terminal block Power A+ and the negative lead of the power supply to the terminal block Power A-.

If a redundant (backup) power supply is required it is connected to the Power B+ and Power B- terminals. Connect the positive lead of the redundant power supply to the terminal block Power B+ and the negative lead of the redundant power supply to the terminal block Power B-.

Networks 1-4 are the network connections. Network 1 is the channel 1 network connection. Connect the first network twisted pair to the terminal block NET 1 positions. The wiring is polarity independent so it does not matter which wire of the pair is connected to which position on the terminal block. Connect the rest of the network twisted pairs to the other channels. Leave any unused channels unconnected.

The terminals labeled EGND should be connected to an earth ground.

5. Status Indicators

There are six status LED's on the unit:

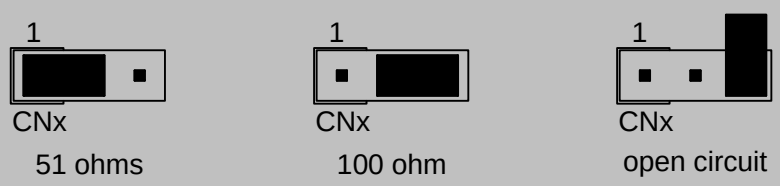
PWR	Power indicator. It is on if power is being supplied to the unit.
TX1-4	Transmit indicator. It flashes whenever the repeater transmits a message.
RX1	Receive channel 1 indicator. It flashes whenever a message is received on channel 1.
RX2	Receive channel 2 indicator. It flashes whenever a message is received on channel 2.
RX3	Receive channel 3 indicator. It flashes whenever a message is received on channel 3.
RX4	Receive channel 4 indicator. It flashes whenever a message is received on channel 4.

6. Network Terminations

The FTR is capable of providing network termination if desired. As shipped, each channel of the FTR has a 51-ohm network termination resistor across it. This is the standard network termination required for FTT networks. If no termination, or 100-ohm network termination is required, the housing top must be removed using a Robertson #0 (square headed) screwdriver. Once the top has been removed, moving the shorting jumpers on CN1, CN2, CN3, or CN4 can change the network termination.

Note: Free topology networks require one 51-ohm termination resistor somewhere along each segment. As shipped, the FTR-120 repeater printed circuit board has jumpers inserted so that each port contains an internal 51-ohm terminating resistor. If a single FTR-120 is used in a free topology network segment, no external terminating resistor is required. If multiple FTR-120s are installed on a single network, terminations have to be removed on all but one FTR on the segment. By moving the jumper associated with a port the terminating resistor can be changed to 100-ohm or by removing the jumper (or placing it sideways across only one pin) the termination becomes an open circuit.

The following figure shows the jumper position for the 3 possible terminations



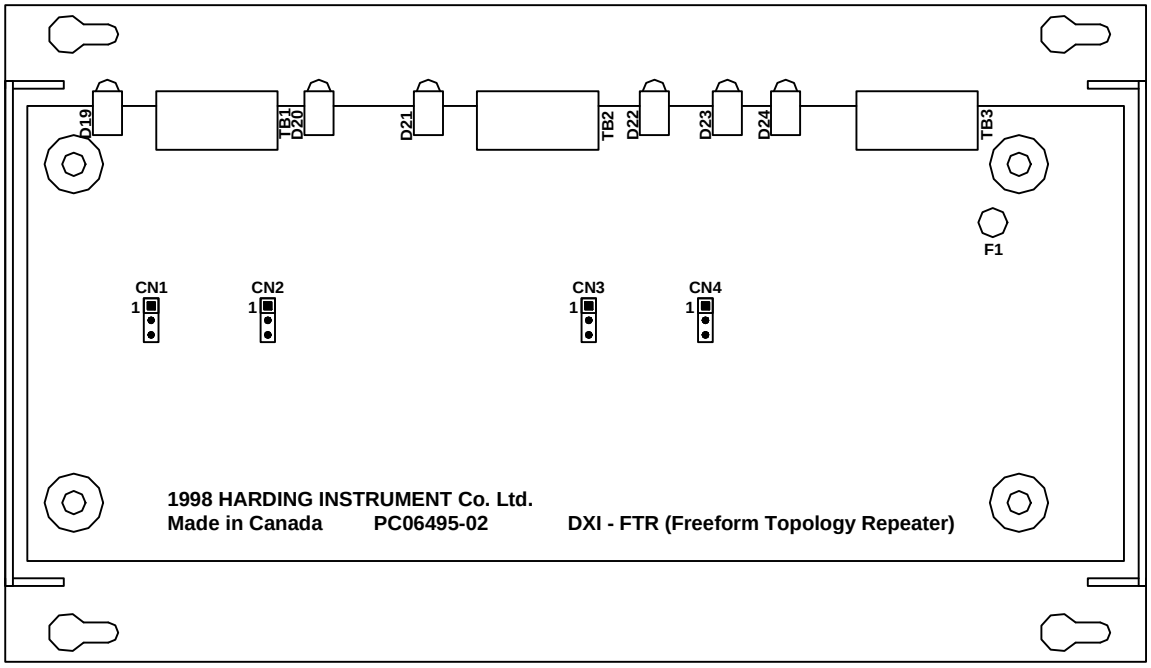
Jumper Position for Various Terminations

The following table gives the jumper positions for the various terminations.

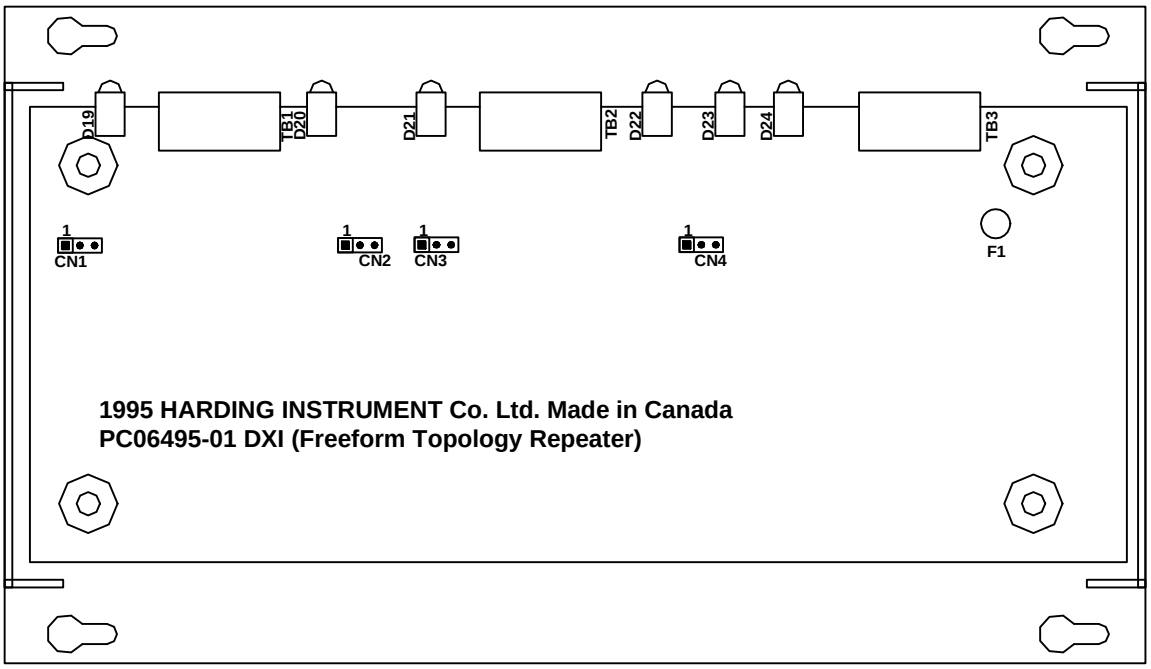
Channel	No Termination	51R Termination	100R Termination
Channel 1	CN4 No Jumper	CN4 - 1&2	CN4 - 2&3
Channel 2	CN3 No Jumper	CN3 - 1&2	CN3 - 2&3
Channel 3	CN2 No Jumper	CN2 - 1&2	CN2 - 2&3
Channel 4	CN1 No Jumper	CN1 - 1&2	CN1 - 2&3

Note the header number CN1 is associated with Channel 4, CN2 is associated with Channel 3, CN3 is associated with Channel 2 and CN4 is associated with Channel 1.

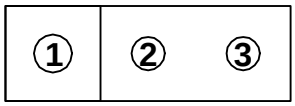
The following diagrams depict the location and pin configuration of the network termination shorting jumpers. The earlier versions of the FTP-120 (pre 1998) used printed circuit board (PCB) PC06495-01, while the most recent version uses PCB PC06495-02.



Top View of PCB PC06495-02 Showing Location of CN1, CN2, CN3, CN4 and Fuse F1



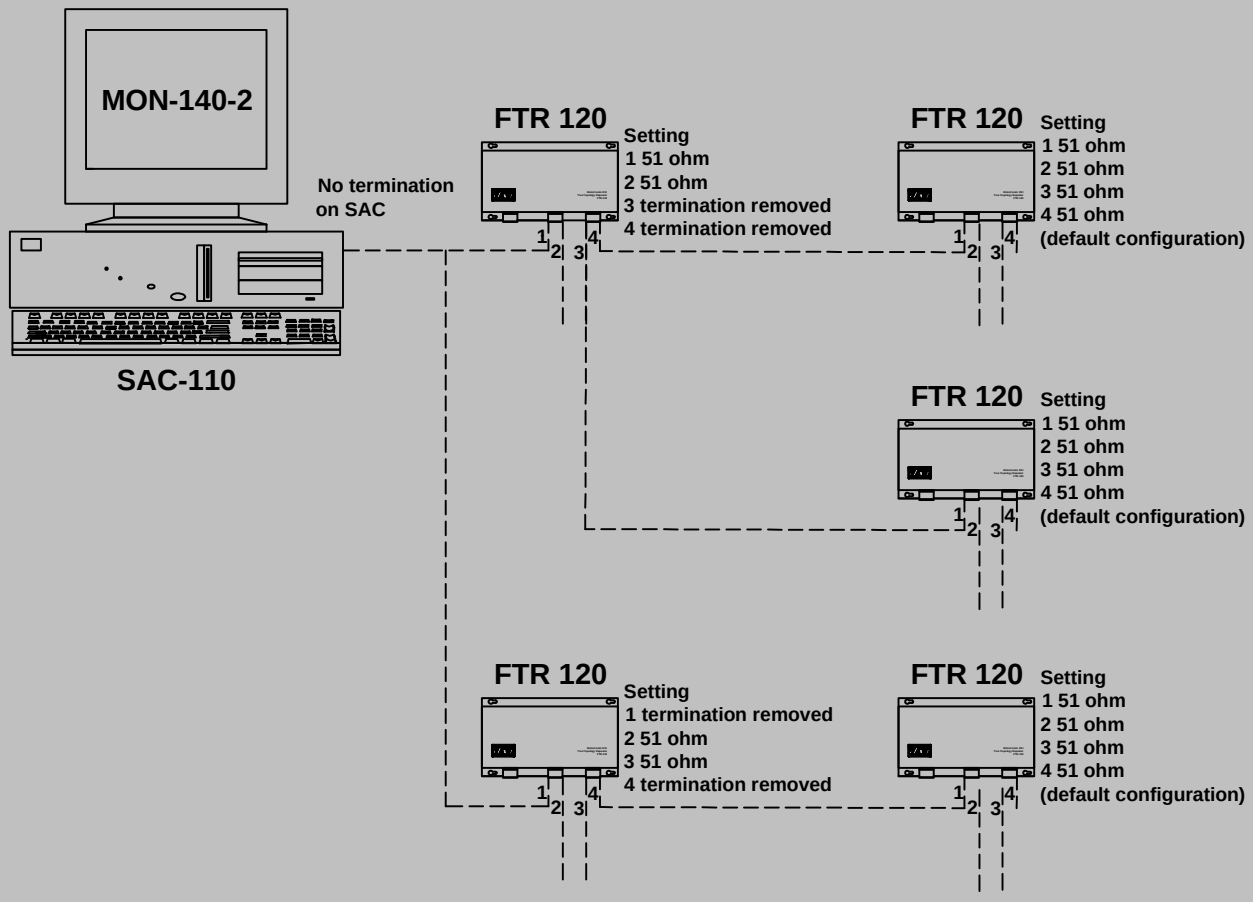
Top View of PCB PC06495-01 Showing Location of CN1, CN2, CN3, CN4 and Fuse F1



Jumper Pins on PCB

Warning: LonWorks network problems may occur if the network is not terminated properly!

The FTR-120s are shipped from the factory with the jumpers set to provide a 51-ohm termination. When you connect up a network with several FTRs each segment of the network should have one and only one 51 ohm terminating resistor. The jumpers must either be removed or set to the appropriate terminating resistance value. The following partial example shows one possible terminating scheme.



Only one 51-ohm termination per segment (One method to terminate this example)