SROUT
Router Option Card for
Lon® Star Coupler RER 111

Technical Reference Manual

ABB Automation

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Contents:

1. Introduction

The router option card is designed to be used within the LON® Star Coupler RER 111. This device is not a "stand-alone" device.

The router option card connects two different communication channels and forwards LonTalk™ messages between them. One channel is the open collector bus of the RER 111 unit, while the other can be a fibre-optic type or a transformer-isolated twisted pair type channel with a speed of 78 kb/s or 1.25 Mb/s.

The router option card contains 9-pin D-type connector for the twisted pair interface and a pair of fibre-optic transceivers.

Two types of transceiver pairs are available:

- ST-type glass fibre-optic transceiver
- snap-in-type plastic fibre-optic transceiver

The router option card can be used for improving network performance by dividing a large communication network into smaller sub-groups of nodes, or it can be used as media converter to twisted pair media.

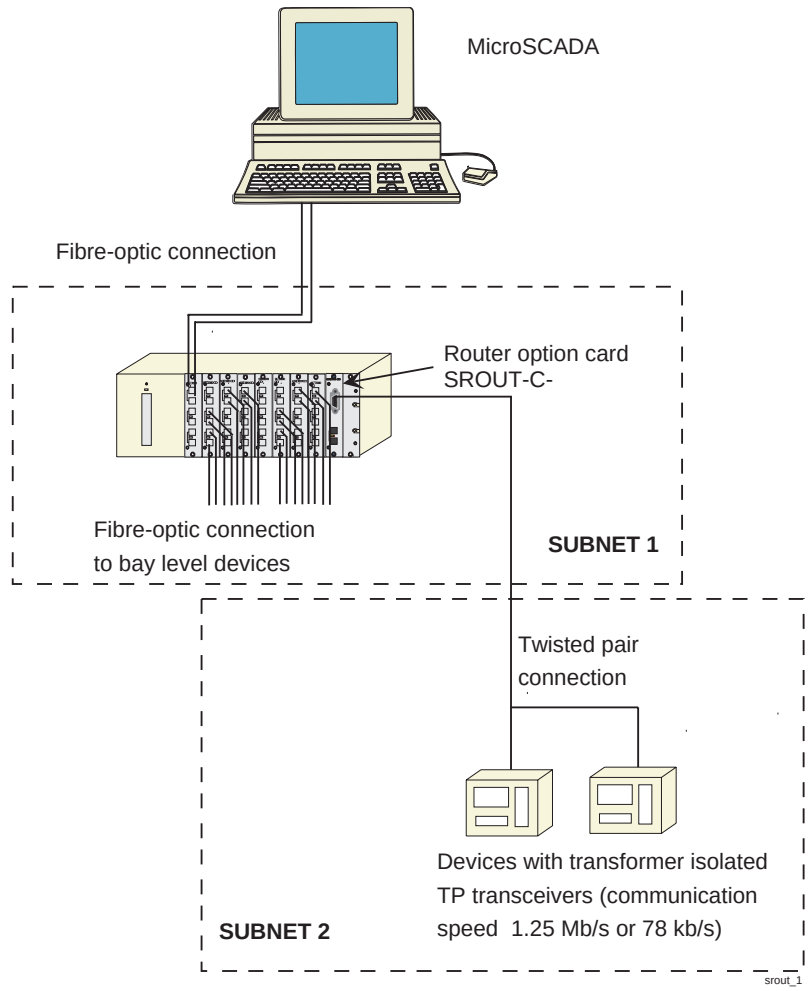

Fig. 1.-1 System structure when using two different media types.

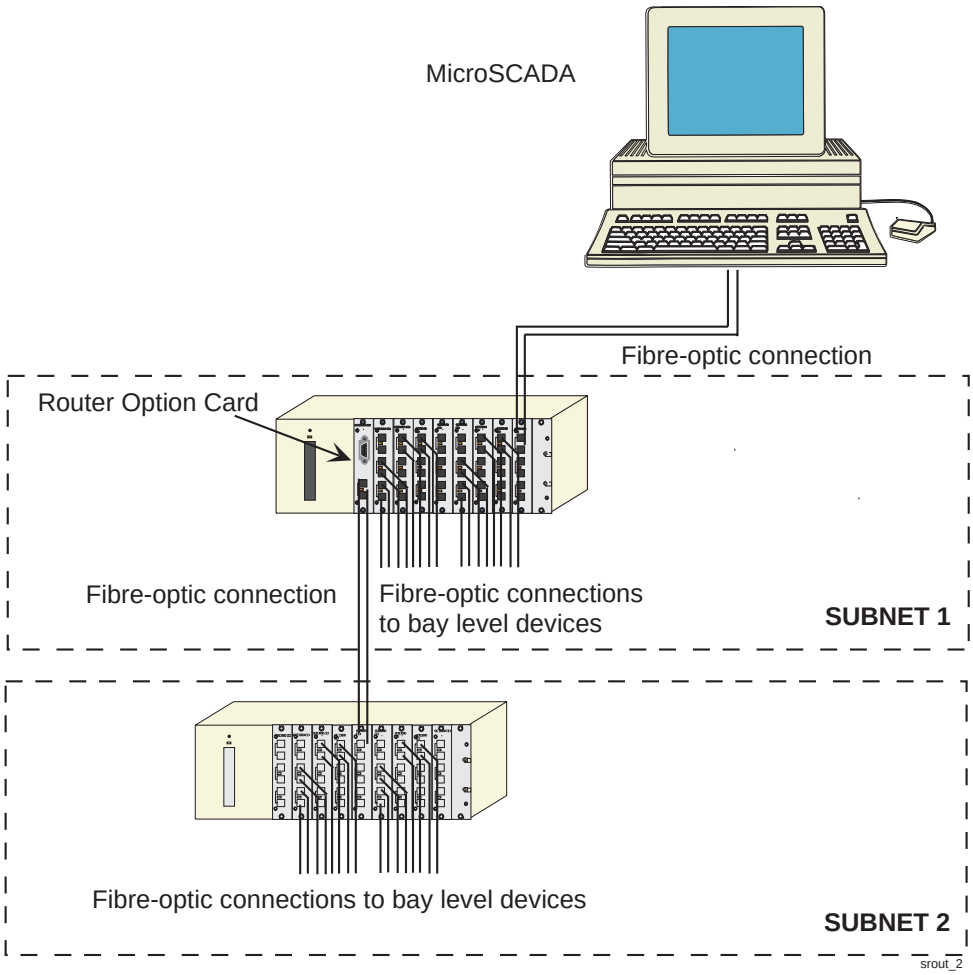

Fig. 1.-2 System structure when the fibre-optic interface is used to divide a large network in to two subnets.

The router option card can also be used as a network repeater to increase the number of LON Star Couplers in the network. Without a repeater, the maximum number of LON Star Couplers between any two nodes is three.

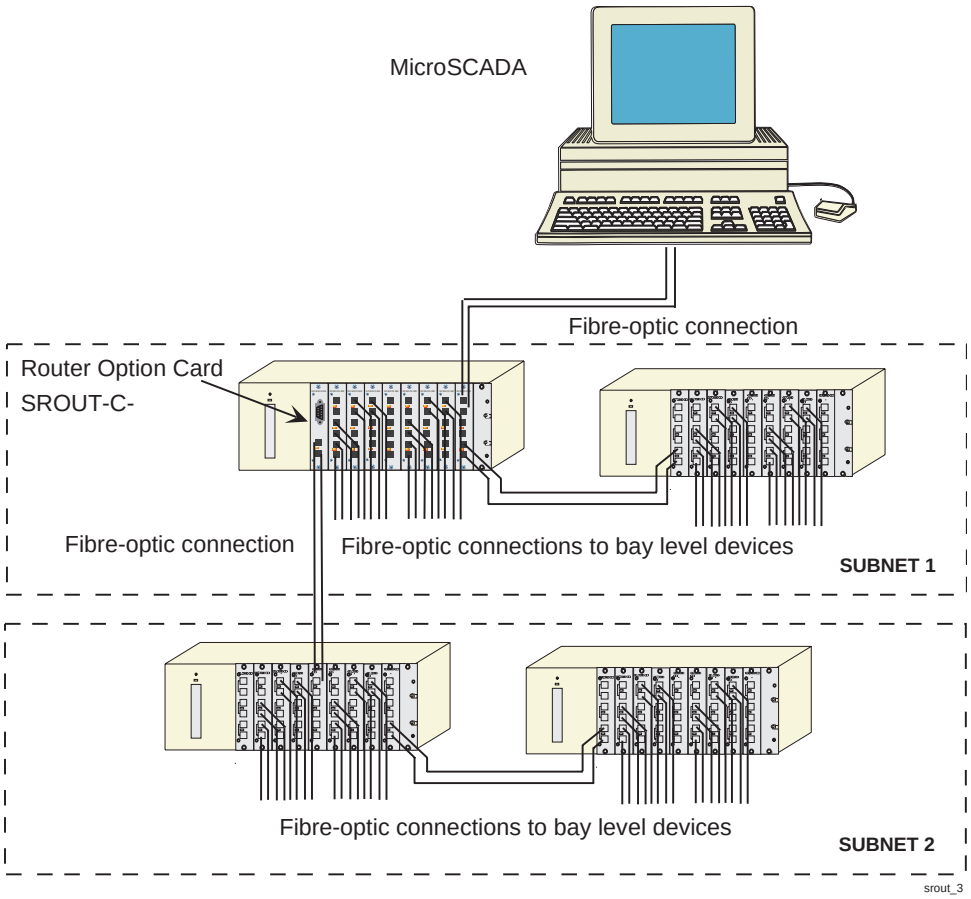

Fig. 1.-3 Router option card as a repeater between two groups of LON Star Couplers.

2. Functions

The router option card has one 9-pin D-type connector for the twisted pair interface and one fibre-optic transceiver pair. There are two transceiver modules available for the twisted pair interface, either of which may be connected to the router core module RTR-10 via jumpers.

To enable the use of two different media, the router option card is divided into two sections, router side A and router side B. The open collector bus, connected to the mother board of the RER 111 unit, is directly connected to router side B. This connection cannot be changed. The communication speed in router side B must be 1.25 Mb/s. Router side A may be connected to either the fibre-optic transceiver or the transformer-isolated twisted pair transceiver with a communication speed of 78 kb/s or 1.25 Mb/s. When the fibre-optic transceiver is connected to router side A, the communication speed must be 1.25 Mb/s.

The router option card also contains a service switch. When this switch is pressed and released, the router generates a service pin message to both router sides. This service pin message is used by the network management device (e.g. higher level processors, PC, etc.) to install and configure the router option card. The two sides of the router option card must be configured separately.

The router option card also contains two service LEDs, one for each side of the router option card. These LEDs are blinking when the corresponding router side is unconfigured. After configuration of the router side, the LED is off.

Please note that for router side A, only one type of interfacing, that is, either the twisted pair interface or the fibre-optic interface, can be attached at the same time.

The RTR-10 core module also incorporates two simple collision detection circuits, one for each router side. Each circuit detects a collision if the transmitted data is in the '1' state whilst the received data is in the '0' state. The circuit is permanently active on router side B. On router side A, the circuit is active only when the fibre-optic interface is used.

The router option card has a self-supervision feature for continuous light reception. If the fibre-optic channel receives continuous light, the reception on the channel is cut off. The error is notified to the I/O module of RER 111 LON Star Coupler via the error line. Error reset is also notified. For information regarding the error line of the RER 111 Star Coupler, refer to the RER 111 manual 1MRS750104-MUM, chapter 4.1.

The indication LED of the fibre-optic receiver is continuously lit if continuous light is received.

2.1. Twisted pair interface

The twisted pair interface is transformer-isolated and has a communication speed of either 78 kb/s or 1.25 Mb/s. Jumpers are used to select the interface to be used. Physically, the interface is a 9-pin D-type female connector.

The twisted pair interface can only be attached to router side A.

A message received from the twisted pair interface is passed on to the open-collector bus on the mother board, through the RTR-10 core module. A message received from the open collector bus is sent to the twisted pair interface through the RTR-10 core module.

With this interface, network termination is available, either in an enabled or a disabled state. The required state is set by jumpers.

The router option card also contains a LED for the twisted pair interface. This LED flashes when a message is being sent or received by the twisted pair transceiver.

2.2. Fibre-optic interface

The router option card can be equipped with a fibre-optic transceiver pair with two different types of fibre-optic interfacing available. These types are not interchangeable and have to be defined by the user in the order. For ordering information, see chapter 8.

The router option card also contains a LED for the fibre-optic receiver. This LED flashes when a message is being received from the fibre-optic channel.

The fibre-optic interface can be connected to either router side A or router side B, or it may not be used at all. This is achieved by the use of jumpers.

If the fibre-optic interface is connected to router side A, then all messages are sent to the open collector bus through the RTR-10 core module and vice versa.

If the fibre-optic interface is connected to router side B, then all messages that are sent to the open collector bus from the twisted pair interface are also sent to the fibre-optic interface. Then any messages from the open collector bus are transmitted directly to the fibre-optic interface and also to the twisted pair interface through the RTR-10 core module.

Please note that the fibre-optic interface cannot be connected to both router sides at the same time.

2.3. RTR-10 core module

The Echelon RTR-10 core module contains the core electronics and firmware required to implement a router. The RTR-10 core module also contains the parameters needed for the communication with the LONWORKS® network (address information, etc.).

The task of the core module is to pass on messages between router sides. Router side B is permanently connected to the open collector bus from the mother board. The fibre-optic interface can also be connected to this side (providing that it is not already in use for router side A). Router side A can be user-defined as either a twisted pair or a fibre-optic interface.

3. Mechanical and electrical design

3.1. Block diagram

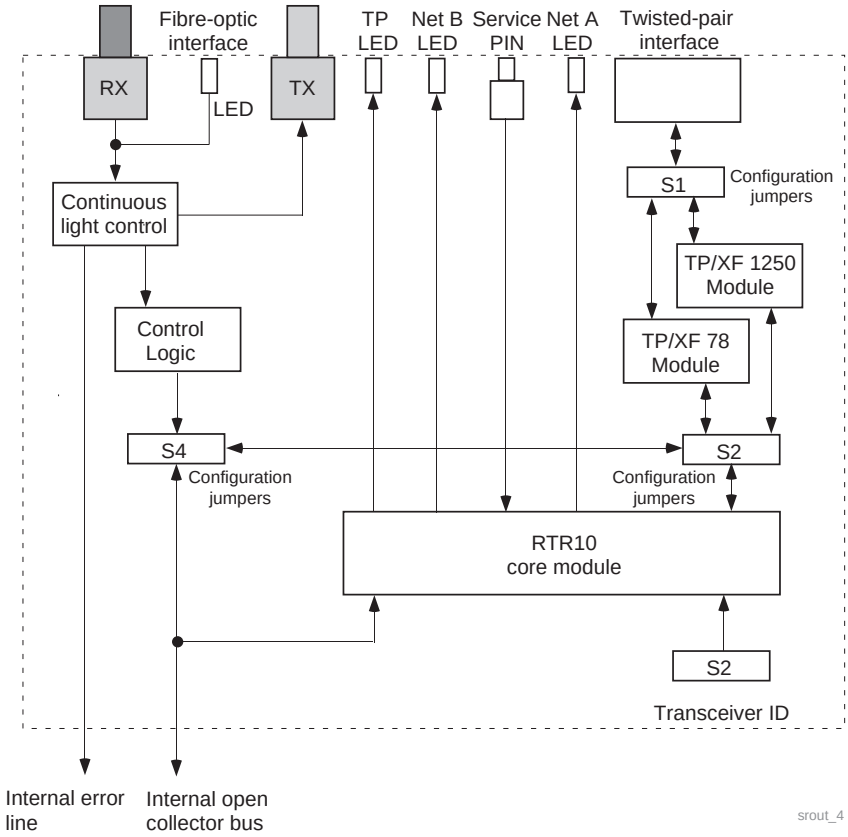

Fig. 3.1.-1 Block diagram of the router option card.

3.2. Mechanical structure

The router option card is built on a printed circuit board (PCB) of size 100 mm x 160 mm. The size of the front plate is 116.4 mm x 19.8 mm.

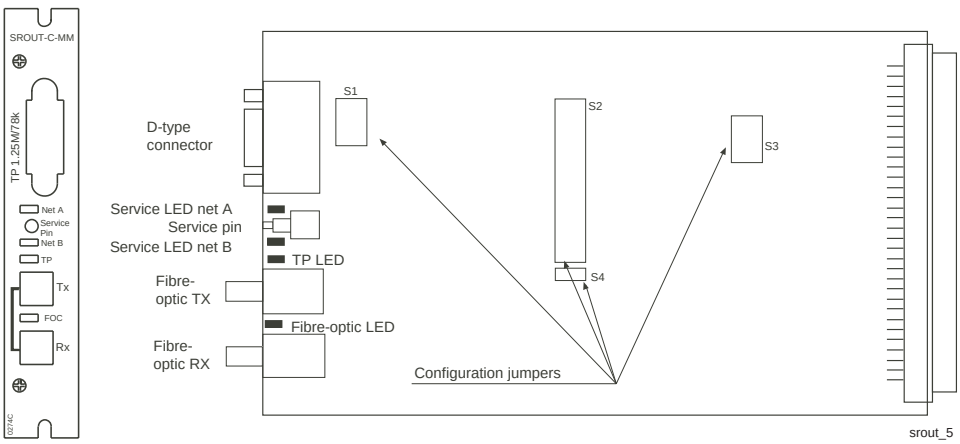

Fig. 3.2.-1 Mechanical structure of the router option card

4. Interfaces

4.1. General

The router option card has five separate interfaces:

- a 64-pin E1 card connector for the connection to the mother board of the RER 111 unit
- a fibre-optic transceiver pair
- a 9-pin D-type female connector for transformer-isolated twisted pair connection
- a service switch
- a 40-position SIMM connector for the RTR-10 core module.

4.2. Twisted pair interface

A 9-pin D-type female connector is used for the transformer-isolated twisted pair interface. In the picture below the connector is viewed from the outside, looking into it. The contacts are on top of the connector with pin 1 on the left hand side.

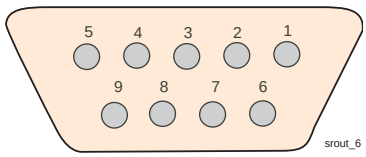

Fig. 4.2.-1 The 9-pin D-type female connector

Table 4.2.-1 The pin designations for the twisted pair interface

Pin	Signal	Description
1	Net A	Signal line
2	Net B	Signal line

For the communication cable specifications regarding the twisted pair network, refer to the document “Junction Box and Wiring Guidelines For Twisted Pair LONWORKS Networks”, August 1994. Echelon Corporation.

If a shielded cable is used, the protective shield should be connected to the casing of the D-type connector. The connector of the option card is earthed to the case of the RER 111 unit. Figure 4.2.-2 below illustrates the connection of the protective shield to the cable connector.

The cable connector has to be made of a conductive material.

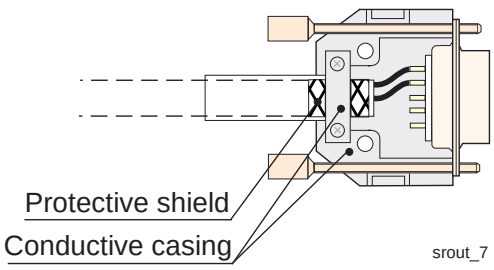

Fig. 4.2.-2 Protective shield connection of the twisted pair cable.

4.3. Fibre-optic interface

For more information regarding fibre-optic cables and the fibre-optic connection of option cards, refer to the RER 111 manual 1MRS750104-MUM, chapter 6.2.

4.4. Service switch

The service switch is used to produce a service-pin message. This message can be used by the network management device (e.g. higher level processors, PC etc.) to install and configure the router option card. When this switch is pressed and released, the router generates a service pin message to both router sides.

The router sides must be installed and configured separately.

5. Installation, configuration and programming

5.1. Installation

As the router option card is not intended for "stand-alone" use, it has to be installed in the RER 111 unit. It can be placed in any of the 9 slots available.

The maximum number of router option cards in one RER 111 unit is limited to 2.

To install the router option card in the RER 111 unit:

1 **Remove the strain screws on the blank plate or the front plate of the option card installed.**

2 **Lift off the blank plate or pull the required option card out of the casing.**

3 **Replace the old option card with a new one (the component side facing away from the power supply).**

4 **Push the option card into the unit until the front plate is flush with the rack.**

5 **Tighten the option card or the blank plate to the case with the strain screws.**

Notice! Do not touch the fibre-optic transceiver.
Do not remove dust shields from transceivers not in use.

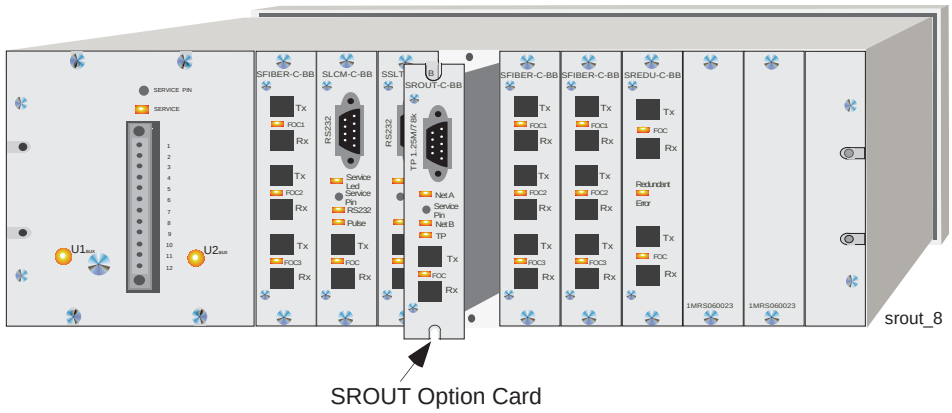

Fig. 5.1.-1 Installation of router option card in the RER 111 unit.

5.2. Configuration of router option card

5.2.1. Configuration instructions

The router option card has 4 individual sets of jumpers. These are used to specify the transceiver type for router side A, the use of termination in the twisted pair network and the use of the fibre-optic transceiver pair.

Jumper groups S1, S2 and S3 are used together to select whether router side A is connected to the fibre-optic transceiver pair or the twisted pair transceiver, and which one of the transformer-isolated transceivers is to be used.

Jumper S4 is used to connect the fibre-optic transceiver pair to router side B.

The figure below shows the required jumper settings of jumper groups S1, S2, S3 and S4 for each transceiver mode and the corresponding transceiver ID.

Router side A can be set to be a TP/XF-78 interface, i.e. 78 kb/s speed, a TP/XF-1250 interface, i.e. 1.25 Mb/s speed, or a fibre-optic interface

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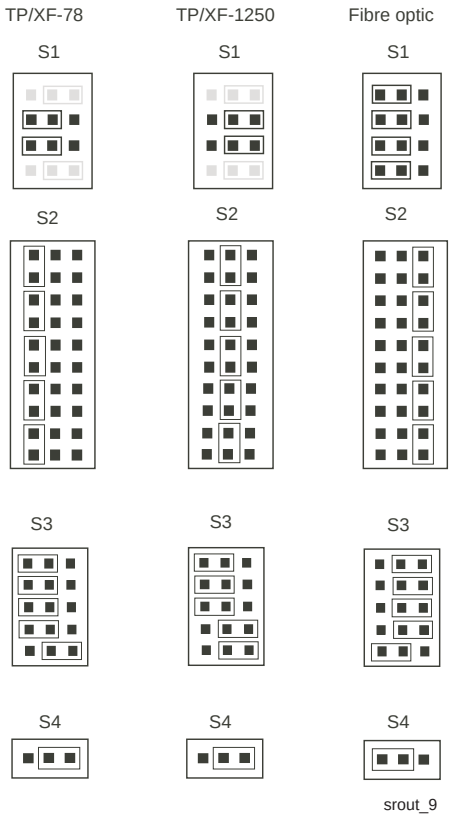

Fig. 5.2.1.-1 Jumper groups S1, S2, S3 and S4 used for selecting the transceiver for router side A.

The jumper group S1 is used for selecting the transceiver type to be used (jumpers J2 and J3) and to control the network termination. The following figure shows how to enable and disable network termination using jumpers J1 and J4.

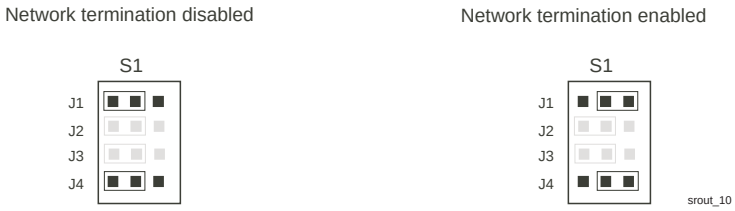

Fig. 5.2.1.-2 Jumper group S1 showing the selection of the TP/XF-78 transceiver, with network termination disabled and enabled.

Jumper group S4 is used to connect the fibre-optic interface to router side B, i.e. the open collector bus. Note that the fibre-optic interface can be connected to router side B only when it is not connected to router side A, i.e. when a twisted pair interface is in use.

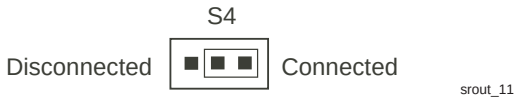

Fig. 5.2.1.-3 Jumper group S4 for connecting the fibre-optic interface to router side B.

5.2.2. Default settings:

Table 5.2.2-1 The default settings of the jumpers

Jumper	Default
Groups S1, S2 and S3	Router side A is a 78 kb/s transformer-isolated twisted pair interface
Group S4	The fibre-optic interface is connected to router side B, the open collector bus
J1, J4/group S1	Network termination is enabled

5.3. Programming of the router option card

There are two Neuron chips on the RTR-10 core module. These two Neuron chips serve one router side each. All configuration programming relating to one router side is stored within the corresponding Neuron chip's EEPROM memory. The router option card is programmed by sending network management commands e.g. by using a network management program on a PC. The LON Network Tool (LNT), for example, can be used to program the router option card.

All communication parameters relating to the twisted pair interface are automatically set when the twisted pair interface is chosen for side A. These communication parameters vary according to the transceiver ID chosen for this interface with jumper group S3.

The transceiver ID for the fibre-optic mode for router side A is a CUSTOM-required mode. The communication parameters are NOT automatically set, but have to be set by the user. Please refer to Appendix A, table 3, for the proper settings.

The transceiver ID for router side B is also a CUSTOM-required mode. For this side, the manufacturer has given default values for the communication parameters.

The router option card can be programmed and installed in the network through the open collector bus, which makes it possible to install router side B. To install and configure router side A, "far side escape codes" with configuration messages must be used.

The network address for both router sides must be programmed for the router option card on initialisation. By default router side A has the network address:

- subnet 1, node 121

and router side B has the network address:

- subnet 1, node 120.

Once the router option card has been programmed, the fibre-optic mode can be configured for router side A, if required. To enable this, the communication parameters must be set from router side B. In the fibre-optic mode, the following items must be programmed for router side A, for example, by using LNT:

- communication speed
- communication port mode, i.e. single-ended, direct mode.
- other parameters related to communication on the LONWORKS network, i.e. parameters in the configuration structure.

Note! If a parameter value has to be changed, extreme care should be taken, because all parameters are stored in EEPROM memory in the RTR-10 core module and incorrect settings may cause severe damage to the RTR-10 core module, or even destroy it completely.

Note! For more information about the programming of the RTR-10 core module, see LONWORKS ® Router User's Guide (078-0018-01C).

5.3.1. Programming the router by using the LON Network Tool (LNT)

A Before starting the configuration, connect a PC with the LNT program to the system.

B Start the LON Network Tool program (globe icon)

1 Configure the management node selecting (Tools → NetAgent → Configure…)

2 Give an address to the management node: subnet 1, node 127.

3 Save the NetAgent configuration.

C Add the router card by dragging the router icon from the Device types window to the Devices window. After releasing the mouse button you can give an address to the router card, for example, subnet 1, node 120.

D Install the router as follows:

1 Select (Configuration → Install Nodes…)

2 Activate the router in the Install Nodes window and press the Start button.

You don't have to specify the Neuron Id of the node.

E Next the LNT program will ask you to press the service pin of the device.

F After installing the router, close the Install Nodes window.

Now the router is logically installed in the system, but it is not programmed. The router operates as a repeater and it will pass on all messages regardless of the addresses of the messages.

Next you can program the router to operate as intended. Figure 1.-2, for example, illustrates a system with two subnets and one router option card. Now we program the router in the system so that it only forwards messages that are sent to another subnet (e.g. if node X in subnet 1 sends a message to node Y in

the same subnet, the message will not be passed on to subnet 2. But if node X in subnet 1 sends a message to node Z in subnet 2, the message will naturally be passed on to subnet 2). This is done by changing the routing algorithms of the router.

G Activate router 001/120 in the Devices window.

1 Press the right mouse button in it to open a menu.

2 Select edit from this menu and press the Interface… button in the Edit Node window.

The default router algorithm is a repeater.

3 Change the algorithm to Configured.

The configured routing algorithm enables two buttons at the bottom of this window. The routers in this system either forwards or drops messages depending on the destination subnet. Therefore you have to set the *forwarding flags* in the routing table.

4 Press the Subnets button in the Router Information window and you will get an empty routing table.

The router has two sides and so the routing table has two sides too: *this side* and the *far side*. A check-mark in a box indicates that a message addressed to the subnet should be forwarded. So, when subnet 1 has a check in the *this side* box, for example, messages addressed to subnet 1 will be passed through the router from *this side* to the *far side*.

In the example system in figure 1.-2, *this side* is an open-collector bus on the mother board and the *far side* is a fibre-optic interface. Which side is which depends on where the management node is connected. In this system, the management node is connected to the open-collector bus of the router.

5 Now put a check-mark on subnet 2 on the *this side* routing table and on subnet 1 on the *far side* routing table.

6 Press the OK buttons to close the Routing Tables – Subnets, the Router Information and the Edit Node windows.

Next you have to verify that the Neuron chip structures are right on both router sides:

7 Select Network → Single Node → Edit Structures from the pulldown menu.

8 Give the address 1/120 in the Select Target window and press OK.

You will get the Neuron Structures, Near Side window.

9 Press the Router Other Side button.

You will see now Neuron Structures, Far Side parameters.

In this case the far side (router side A) is the fibre-optic interface. Thereby it is important that the configuration structure parameters are as mentioned in the Appendix A, Table 3 of this manual.

Especially check the following values and change them if needed:

comm_type: *Single-ended*

comm_pin_dir: *Direct-mode – single-ended*

channel type: *custom* (behind the **Select Channel Type** button)

comm_clock: *0* (behind the **Bit Rate** button)

input_clock: *5* (behind the **Bit Rate** button)

10 Press the Router Other Side button.

Remember, in this case the parameters mentioned above must be same on the both router sides. So check the parameters in this window, too.

11 If you made changes in the 'Near Side' or 'Far Side' window, press the Write button to write the parameter values to the router.

12 Press the Close button to close the Neuron Structures, Near Side window.

Now you have made the settings for the proper router configuration.

Next you have to download these changes to make them take effect.

H Select Configuration → Download to Network… from the pulldown menu.

1 Activate the router (001/120) in the Download Configuration window and press the Start button.

When the download is completed, the router starts to operate as intended.

You can verify that the routing table is correct by making a query through the router. Send, for example, a **Query Status** message to a node in subnet 2. Because the management node is connected to subnet 1, the Query Status message goes through the router. If you get an answer, the routing table is correct.

6. Technical data

Interfaces

Transformer-isolated twisted pair interface	9-pin D-type female connector
Communication speed	78 kb/s or 1.25 Mb/s
Max. number of router option cards in one RER 111 unit	2
Fibre-optic interface	glass fibre with ST-type connectors
	plastic fibre with snap-in-type connectors
Communication speed	1.25 Mb/s
Connection to mother board	64-pin E1 connector

Power source

From the mother board	+8 VDC

Power consumption

SROUT-C-MM option card	<1.4 W
SROUT-C-BB option card	<1.4 W

Size

E1 card	100 mm x 160 mm
Front plate	116.4 mm x 19.8 mm

Disturbance tests

High frequency interference test according to IEC 60255-22-1	
- common mode	2.5 kV, 1 Mhz
- differential mode	1.0 kV, 1 Mhz
Fast transient test according to IEC 61000-4-4 and IEC 60255-22-4, cl. 4	4 kV
Electrostatic discharge test according to IEC 61000-4-2 and IEC 60255-22-2, class III	
- contact discharge	6 kV
- air discharge	8 kV

Environmental conditions

Specified ambient service temperature range	-10...+55°C
Transport and storage temperature range	-40...+70°C

Climatic environmental tests

Dry heat test according to IEC 60068-2-2	+55°C
Dry cold test according to IEC 60068-2-1	-10°C
Damp heat test according to IEC 60068-2-30	RH = 93%, 55°C, 6 cycles

7. Maintenance and service

7.1. Self-diagnostics

7.1.1. Fibre-optic receiver LED

The receiver LED flashes when a message is being received from the fibre-optic channel.

If the LED is continuously lit, the channel is heavily loaded or there is a malfunctioning device sending continuous light.

7.1.2. TP/XF LED

The TP/XF LED flashes when a message is being sent or received by the twisted pair transceiver.

7.1.3. Service LEDs

The are two service LEDs, one for each router side.

If the service LED is off, the Neuron Chip of the corresponding router side is in the configured state.

If the service LED is flashing, the Neuron Chip of the corresponding router side is in the unconfigured state.

If the service LED is continuously on, then the network interface has detected a hardware failure.

7.2. Service and spare parts

If a fault occurs in the router option card, the faulty option card should be replaced with a new one. For ordering information please see chapter 8.

8. Ordering information

When ordering please state the following:

1. Quantity
2. Type of fibre-optic transceivers

Type designation

Router option card	Type Designation
Router option card with ST-type glass fibre-optic transceivers	SROUT-C-MM
Router option card with snap-in-type plastic fibre-optic transceivers	SROUT-C-BB

Example:

2 pcs — Number of cards
SROUT-C-MM — Card identification
Two router option cards with ST type glass fibre-optic transceiver pair.

Document revisions:

Date	Revision	Author	Description
21.11.1996	A	T. Peltoniemi	Original version
29.12.1999	B1	M. Kiikkala	Update version (Q4/99)
24.02.2000	B2	M. Kiikkala	References to SMA-transceiver option removed

Appendix A

Default values of communication parameters and routing tables for the router option card, sides A and B.

These default values are set during manufacturing and they are stored in EEPROM memory of the Neuron chip. Configuration structure values may be read and written over the LONWORKS network using Read Memory and Write Memory network management messages addressed to the router option card (for more details see LONWORKS Technology Device Data chapter A6: The configuration structure).

Table 1: Configuration structure fields and values programmed for router option card side A (TP/XF-78 interface) during manufacturing

Field of a structure	Value	Offset	/ # of bits	Remarks
channel_id	0x0000	0x0016	/ 16	
location	0	0x02	/ 6*8	set during installation
comm_clock	4	0x08	/ 5	= input_clock / 8: 78kbit/s
input_clock	5		/ 3	= 10 Mhz
comm_type	5	0x09	/ 3	= differential
comm_pin_dir	0x0C		/ 5	= dir.mode - differential
preamble_length	6	0x0A	/ 8	= 240 µs
packet_cycle	4	0x0B	/ 8	= 4 ms
beta2_control	0	0x0C	/ 8	
xmit_interpacket	0	0x0D	/ 8	
recv_interpacket	0	0x0E	/ 8	
node_priority	0	0x0F	/ 8	= no priority slot allocated
channel_priorities	30	0x10	/ 8	number of priority slots
collision_detect	0	0x11	/ 1	= disabled
bit_sync_threshold	0		/ 2	= number of bits: 4
filter	1		/ 2	
hysteresis	2		/ 3	
cd_to_end_packet	0	0x12	/ 6	
cd_tail	0		/ 1	
cd_preamble	0		/ 1	
non_group_timer	0	0x18	/ 4	= 128 ms
nm_auth	0		/ 1	= no authentication
preemption timeout	5		/ 3	= 10 sec

.

Table 2: Default routing parameter values for router option card side A (TP/XF-78 interface).

Routing algorithm:	Repeater
Router mode:	Normal

Table 3: Configuration structure fields and values programmed for router option card side B (open collector bus) during manufacturing

Field of a structure	Value	Offset	/ # of bits	Remarks
channel_id	0x0000	0x0016	/ 16	
location	0	0x02	/ 6*8	set during installation
comm_clock	0	0x08	/ 5	= input_clock / 8: 1,25Mb/s
input_clock	5		/ 3	= 10 Mhz
comm_type	1	0x09	/ 3	= single_ended
comm_pin_dir	0x0E		/ 5	= dir.mode - single_ended
preamble_length	6	0x0A	/ 8	= 240 µs
packet_cycle	4	0x0B	/ 8	= 4 ms
beta2_control	0	0x0C	/ 8	
xmit_interpacket	0	0x0D	/ 8	
recv_interpacket	0	0x0E	/ 8	
node_priority	0	0x0F	/ 8	= no priority slot allocated
channel_priorities	30	0x10	/ 8	number of priority slots
collision_detect	1	0x11	/ 1	= enabled
bit_sync_threshold	0		/ 2	= number of bits: 4
filter	0		/ 2	
hysteresis	0		/ 3	
cd_to_end_packet	1	0x12	/ 6	
cd_tail	1		/ 1	
cd_preamble	0		/ 1	
non_group_timer	0	0x18	/ 4	= 128 ms
nm_auth	0		/ 1	= no authentication
preemption timeout	5		/ 3	= 10 sec

When the fibre-optic interface is connected to router side A, these values must be used for router option card side A, too.

Table 4. Default routing parameter values for router option card side B (open collector bus).

Routing algorithm:	Repeater
Router mode:	Normal

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