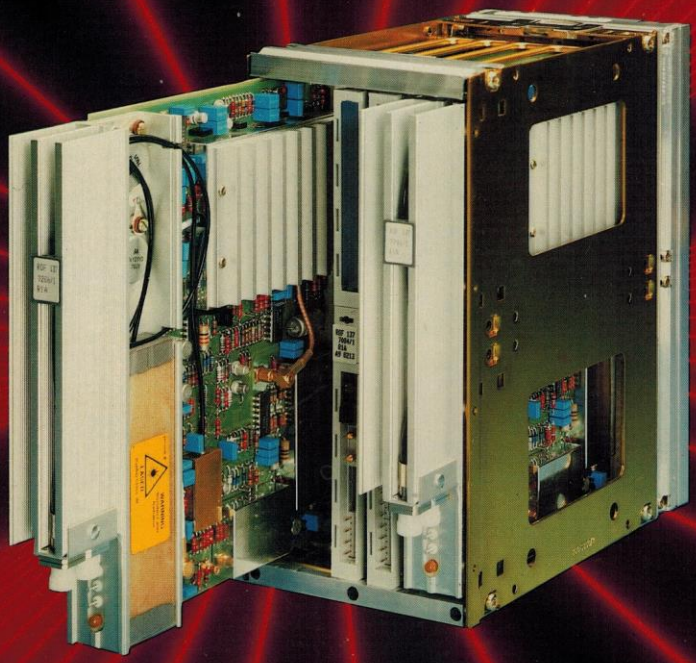
# Ericsson fibre optics



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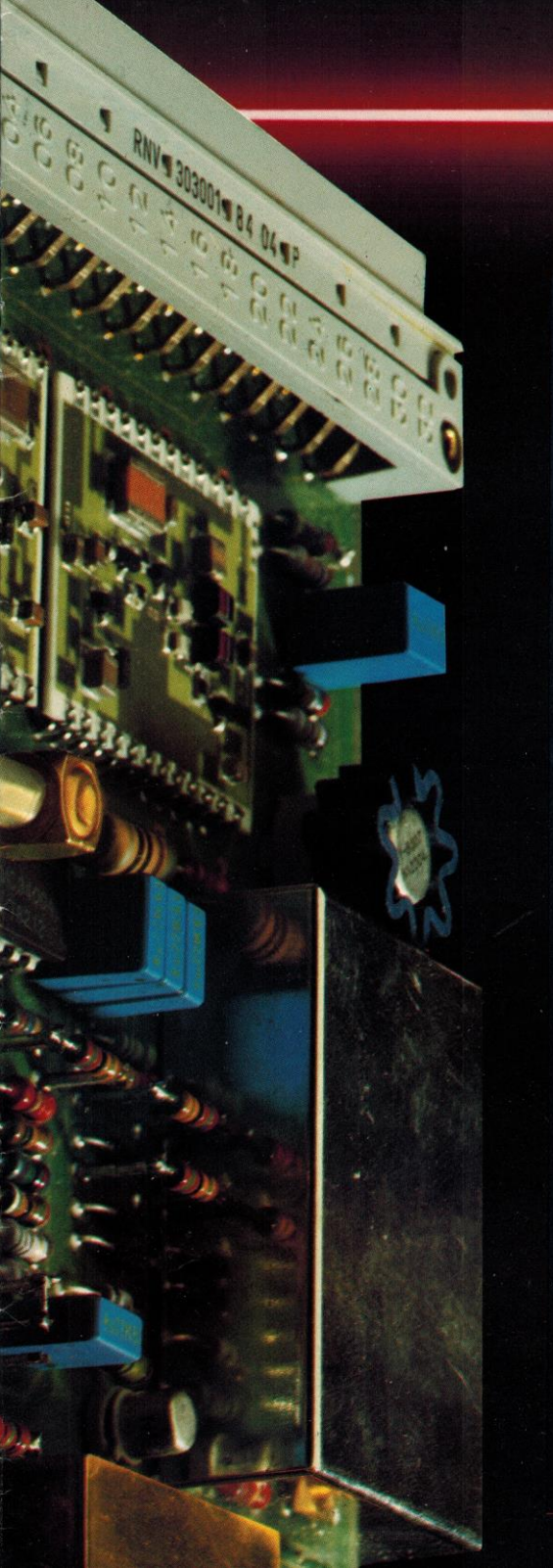


# Into the age of fibre optics

Ericsson's dynamic presence in the world of telecommunications has made itself known for more than a hundred years. With no more than a few years of our second century behind us we have already secured a leading position in the sphere of fibre optics.

During the same short time-span fibre optics has emerged from the obscurity of initial research to assume the status of an established discipline.

The mature status of fibre optics as a transmission medium has been clearly demonstrated by the successful conquest of the single mode technology under field conditions.

Fibre and cable manufacture have successfully met requirements calling for something of a miracle. System engineering and component development have advanced the frontiers of current technology resulting in vast improvements of both reliability and performance.

Ericsson is proud of its leading role in this development. A role confirmed by the products and achievements exemplified on the following pages.

*Transceiver unit for a 565 Mbit/s single-mode system for transmission of 8000 telephone channels. Exceptional performance and compactness is achieved through advanced hybrid technology. The low input capacitance of the receiver which employs a Rifa-made PIN-FET hybrid enables very long repeater spans. This has been achieved through the skilful application of chip-and-wire bonding and the combined use of a thick-film and thin-film techniques.*

# Fibre optics at Ericsson

Optical fibre research at Ericsson began in the early seventies. Initially as basic research but once the basic know-how had been acquired the research effort was intensified and directed towards more specific products and applications.

By 1978/79 the development work in all spheres of the technology had reached the point where a successful field trial could be carried out.

In 1979 Ericsson acquired an interest in the Anaconda company in the USA. This acquisition brought considerable development and production resources into the Group and has strengthened the Ericsson presence in the USA and Latin America.

The name Anaconda was later dropped and the fibre-optic activities in the USA are now carried on under the name Ericsson Lightwave.

The successful field trial in 1978/79 boosted Ericsson's resolve to press on with the development efforts in all areas of the technology. By 1984 a full range of single-mode systems up to 565 Mbit/s operating at 1300 nm were in production. Today Ericsson's capability covers everything from components to nation-wide turn-key projects.

In the vital field of optical fibre cable the group includes production facilities both at Sieverts in Sweden and at Ericsson Lightwave in the USA.

Splicing has been brought to a state of near-perfection thanks to the fusion splicers from Sieverts.

An important role in the fibre optic program is being played by the department of fibre optics and line transmission in Stockholm, where the development effort is focused on optical fibre systems for telephony, data and video transmission.

Nevertheless the effort is not limited to transmission. Activities of rising importance are the

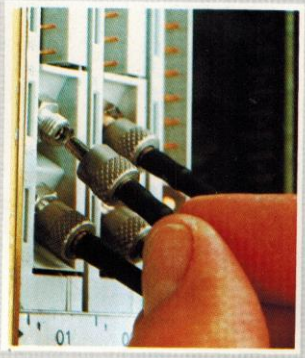
*The Ericsson joint box for optical fibre is made of stainless steel.*

*Optical fibre cable from Sieverts being installed in Mexico. The fibre optic cable offers a tremendous saving in weight and bulk. The weight of one km is about 100 kg as compared to more than 5000 kg for coaxial cable.*

work on Integrated Optics (IOC), Optical Sensors and Optical Character Recognition (OCR).

Ericsson's capability also covers components, connectors, optical by-pass switches, to say nothing of joint boxes, network material and installation techniques.

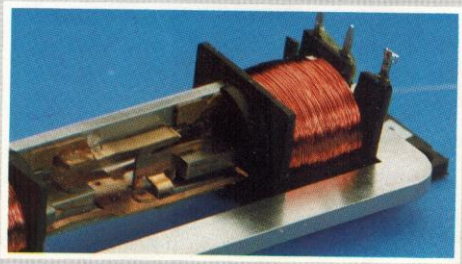
Add to this all the well-known Ericsson back-up services such as engineering assistance, installation support and operations training.



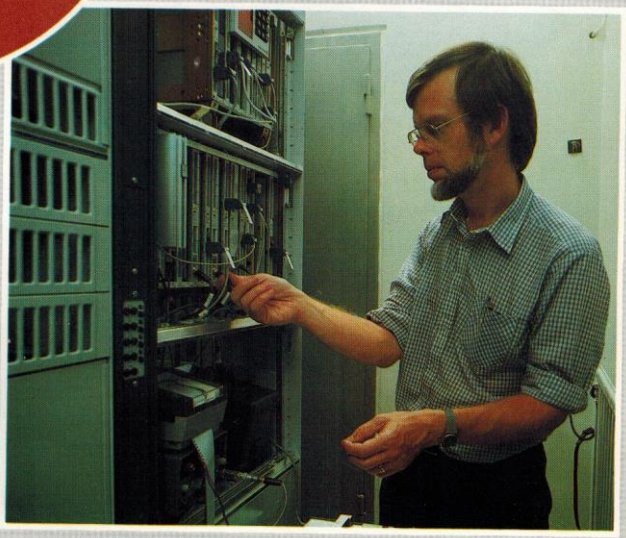
*The Ericsson connector represents a breakthrough by offering low and repeatable loss under field conditions.*

*The reliable fusion splicers from Sieverts are available in both single-mode and multi-mode versions.*

*Advanced PIN-FET hybrid made by Rifa for a 565 Mbit/s single-mode transceiver unit.*



*The Ericsson optical by-pass switch gives added flexibility to optical fibre systems and projects.*

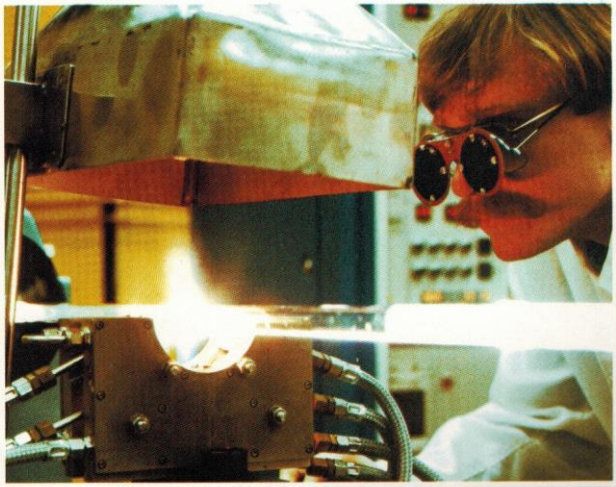


*Installation of 140 Mbit/s single-mode system in Stockholm, Sweden. The system operates over Sieverts single-mode fibre and error-free operation over 54 km has been demonstrated.*

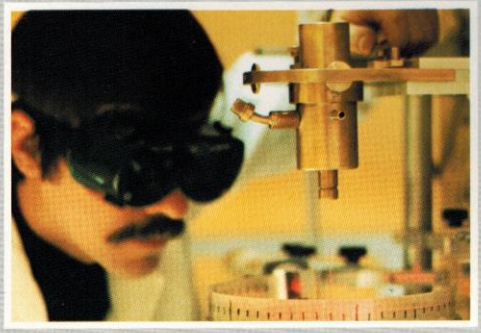
SIEVERTS

ERICSSON LIGHTWAVE

# Fibre and cable



*Sieverts has secured total control of the quality of the fibres by manufacturing their own preforms.*



*Every meter of fibre is continuously measured and tested during production.*

Successful implementation of optical fibre transmission depends to a large extent on the quality of the fibre itself. At Ericsson we have secured control of this vital factor by manufacturing both fibre and cable within the Ericsson Group.

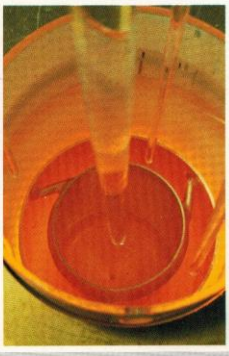
At their Opto-center in Stockholm, Sieverts has established a fibre and cable production unit which takes advantage not only of Sieverts' long experience in cable manufacture, but also the technological competence available within the Group. A broad range of fibres are manufactured including multi-mode and single-mode fibres for telecommunications as well as for industrial applications.

To obtain total control of the quality of the fibres, Sieverts also manufactures the raw-materials.

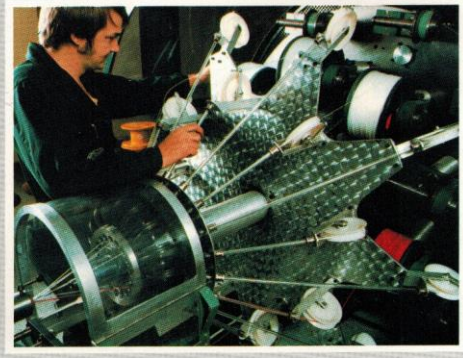
Optical fibre production calls for exacting precision and extreme cleanliness throughout the manufacturing process. Every meter of fibre is continuously measured and tested during production and the finished fibre is carefully checked as to tensile strength and transmission properties.

Production of single-mode fibres with a core diameter of

*Assembly of optical fibres into cables is made in precision machinery manufactured within the Ericsson Group.*



*Heated crucible for fibre production.*

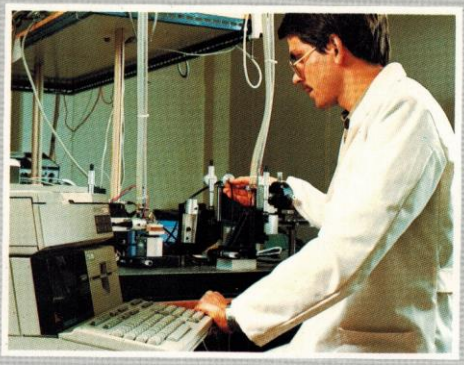


dulation of light under the influence of electrical control signals. Current projects in this field include the development of Electro-optical Directional Couplers (EDC) and Interferometer Modulators in lithium niobate ($LiNbO_3$) with in-diffused titanium waveguides. In these components the light is switched from a number of inputs to any desired output by means of electrical control signals applied to metal electrodes. Very high switching rates can be attained and Ericsson has demonstrated modulation rates in excess of 6 Gbit/s in a travelling wave directional coupler. An interesting application of this device is external modulation of laser diodes in high speed systems.

Interferometer Modulators in lithium niobate will find application e.g. in a Mach Zehnder interferometer sensor currently under development at Ericsson. This type of fibre sensor can be made extremely sensitive resolving equivalent length changes orders of magnitude below the radius of an atom and still transmit this information passively over several kilometers.

The width and depth of Ericsson's technological capability can be exemplified by further glimpses from current programs. Optical character Recognition (OCR) is a field where our optical know-how has been successfully applied resulting in a first-class product. The same is valid for WDM-filters and couplers which are devices of increasing importance due to the use of fibre-optics in the subscriber part of the network.

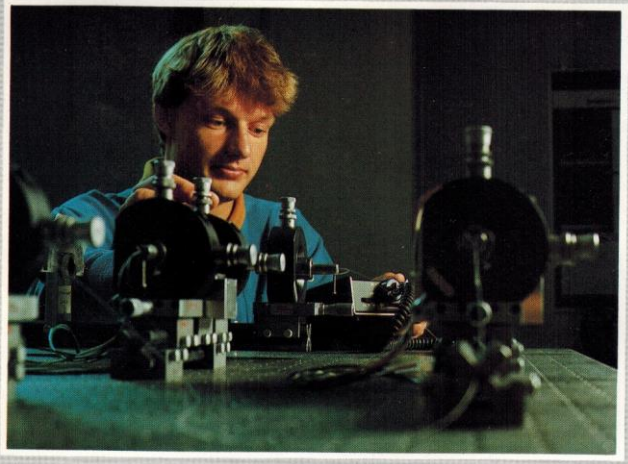
Rifa, the Ericsson component house, is not only a major supplier of quality components for a wide range of Ericsson products. Rifa is also a supplier of opto-electric components and houses an important centre of research and development in this field. The performance of high speed fibre-optic transmission systems in terms of speed, repeater span, reliability and cost depends to a very large extent on the quality and characteristics of the opto-electric components.

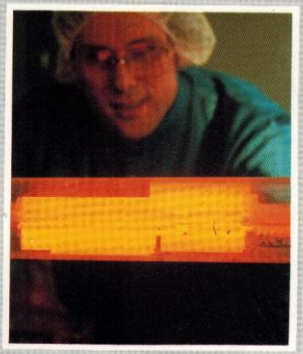


*Opto-electric components, both in-house and others are subjected to exhaustive tests and measurements.*

For this reason Rifa directs considerable efforts and resources towards the further development of Laser diodes, PIN-diodes etc. including the 1550 nm transmission window.

The development work on integrated optics also involves Rifa, especially in respect of production techniques.





*Rifa is an important centre of research and development in the field of opto-electric components.*

*Development of a Mach Zehnder interferometer utilizing integrated optics to achieve a robust field deployable fibre sensor.*

# Optical fibre line systems

Ericsson's long-standing commitment to the sector of long distance transmission is too well known to need any lengthy introduction.

The latest range of optical fibre line systems covers systems from 2 Mbit/s through 565 Mbit/s all based on state-of-the-art technology.

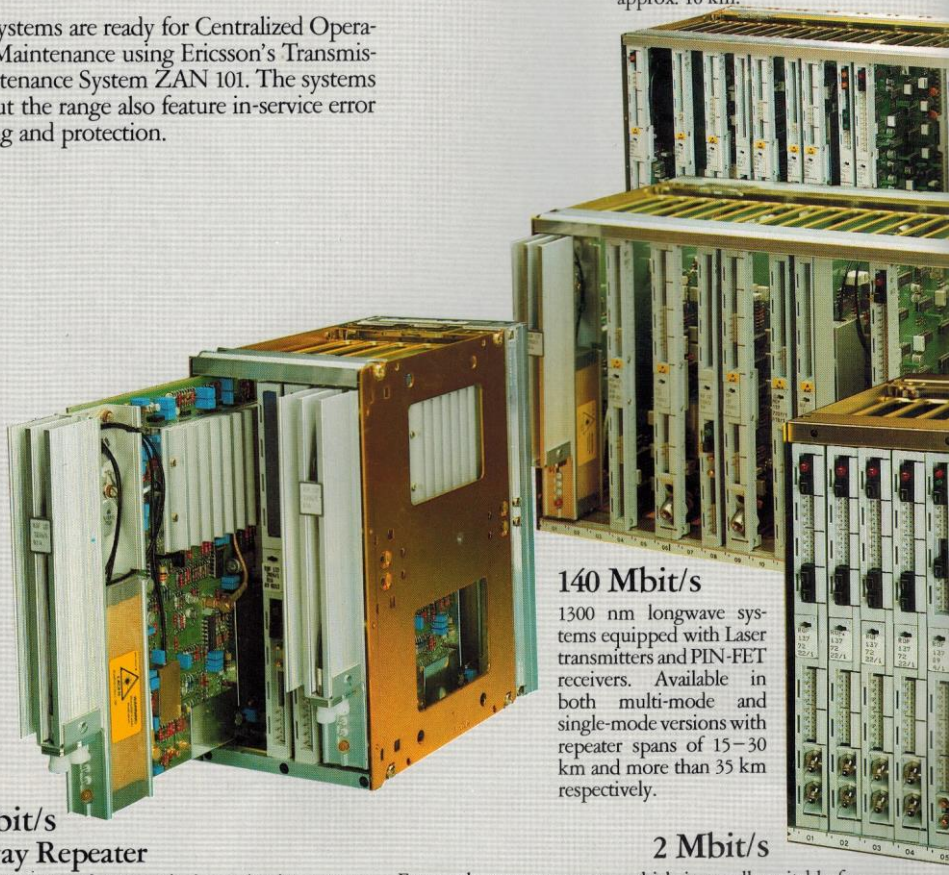
The mechanical design which owes its origin to the highly successful AXE exchanges combines rigidity and flexibility with ease of installation.

The Laser versions are equipped with thermo-electric stabilization of the Laser for high reliability.

All systems are ready for Centralized Operation and Maintenance using Ericsson's Transmission Maintenance System ZAN 101. The systems throughout the range also feature in-service error monitoring and protection.

## 140 Mbit/s

850 nm shortwave Laser/APD system. Intended for graded index fibre which permits repeater spans of approx. 10 km.



## 140 Mbit/s

1300 nm longwave systems equipped with Laser transmitters and PIN-FET receivers. Available in both multi-mode and single-mode versions with repeater spans of 15–30 km and more than 35 km respectively.

## 565 Mbit/s
## Two-way Repeater

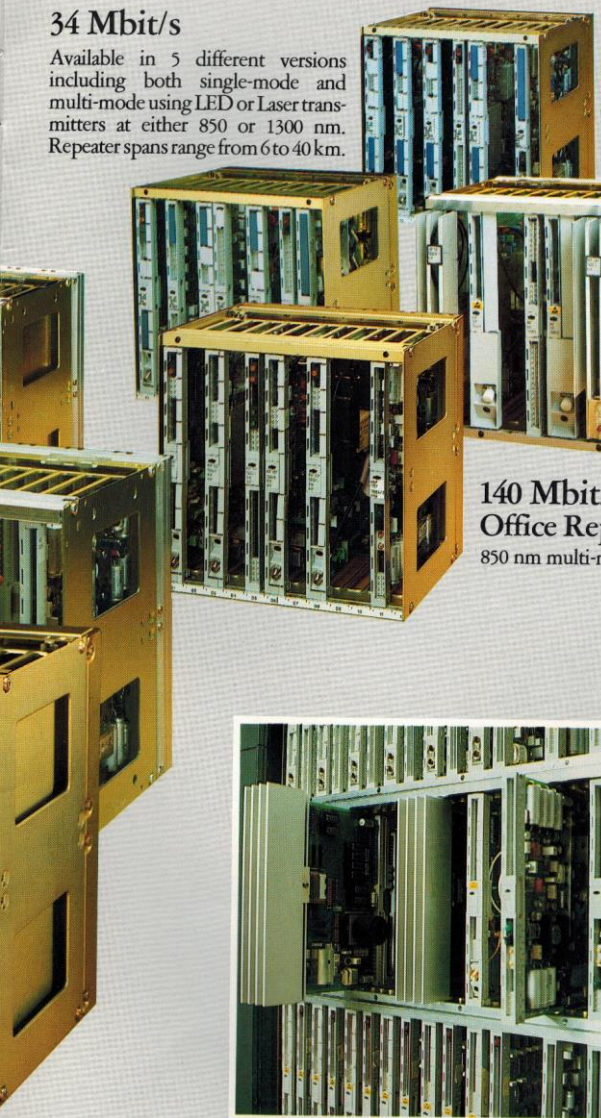
High capacity system for 8064 telephone circuits. 1300 nm Laser transmitter and PIN-FET receiver. Intended for single-mode fibre which permits repeater spans in excess of 30 km. The transceiver is made extremely compact through the use of advanced in-house hybrids.

## 2 Mbit/s

Extremely compact system which is equally suitable for industrial, telecom and defence applications. The smallest BYB magazine terminates 4 systems. Both 850 nm and 1300 nm versions are available both using LED transmitters and PIN receivers. The repeater spans are approx. 10 km and 20 km respectively.

## 34 Mbit/s

Available in 5 different versions including both single-mode and multi-mode using LED or Laser transmitters at either 850 or 1300 nm. Repeater spans range from 6 to 40 km.



### 34 Mbit/s Office Repeater

### 140 Mbit/s Office Repeater

1300 nm single-mode version.

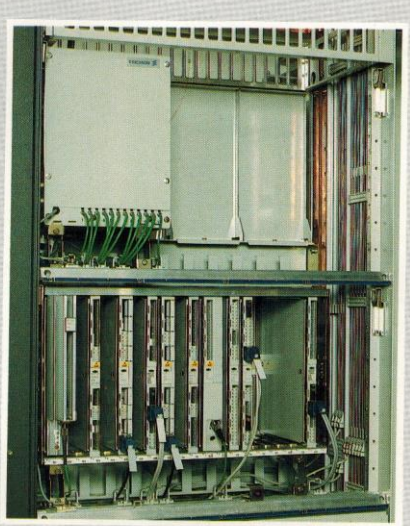
### 140 Mbit/s Office Repeater

850 nm multi-mode version.



### 565 Mbit/s

Line muldex for use in conjunction with 565 Mbit/s two-way repeater. Available with either 45/565 Mbit/s or 140/565 Mbit/s multiplexer. Fits BYB bays or 23″ racks.



### 140 Mbit/s

140 Mbit/s single-mode system in BYB bay (covers removed) showing also cable terminating box for optical cable.

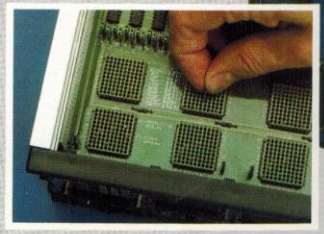
# Fibre optics for data, industrial and defence applications

The introduction of optical fibre transmission represents a break-through in many applications where interference has hitherto been a problem. Fibre optics also enable a level of security against interception which is unmatched by conventional transmission media.

Ericsson is offering a potent range of optical fibre systems covering a wide spectrum of industrial, commercial and defence applications. In terms of bandwidth the range stretches from a single-channel telephone link to broadband video trunk systems. The range of data transmission systems starts at single-channel data modems running through data multiplexers and data acquisition systems with an almost unlimited versatility.


## Multichannel data modem

The ZAT 16/19.2 is a high performance fibre-optic data modem which will permit two-way transmission of 16 data channels at rates from 300 up to 19200 bps (V24/ V^.8 RS 232-C). Thanks to a unique strap field at the electrical interface almost any combination of pinnings are accepted thus eliminating the need for special interface cables or on-site soldering.



## Information integrity link

Unlike conventional cables optical fibre has no electromagnetic leakage field which can be "tapped". Unauthorized access to optically transmitted information can only be obtained by direct access to the light flow inside the fibre. The Information Integrity Link prevents tapping and interception by giving alarm if any attempt is made to tamper with the cable. This is made possible by a special alarm circuit in combination with an ingenious method of modulation.

## Fibre-optic field splice

Low loss V-groove splice designed for fast and easy field assembly. No fusion splicer needed – only simple tools.

## Fibre-optic distribution box

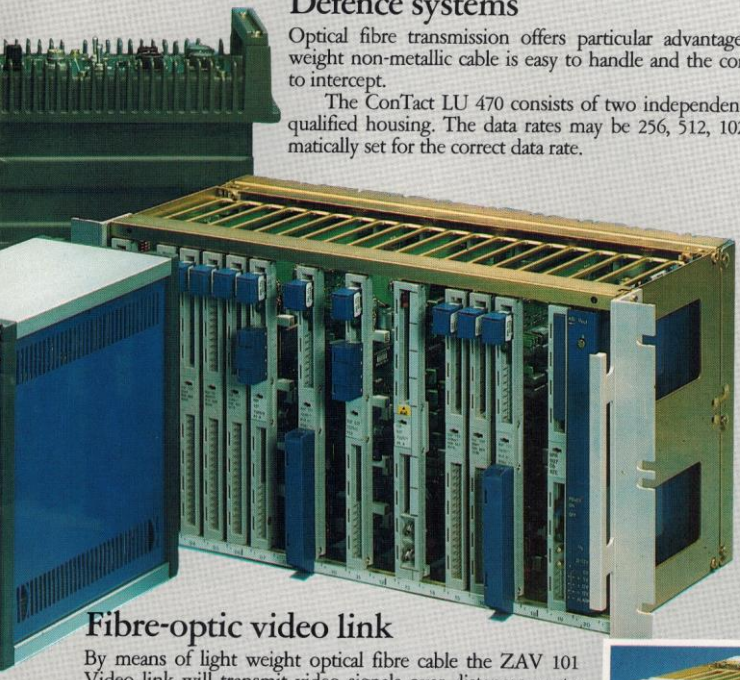
Compact distribution box in 19" rack mount design. Fitted with several alternative cable inlets and up to 16 fibre outlets for fibre-optic connectors or pigtails. Suitable for either fusion splices or V-groove splices.

## Single-channel telephone link

## Defence systems

Optical fibre transmission offers particular advantages in defence applications. The light-weight non-metallic cable is easy to handle and the communication link is almost impossible to intercept.

The ConTact LU 470 consists of two independent systems housed in a rugged 19″ MIL qualified housing. The data rates may be 256, 512, 1024 or 2048 kbit/s and the link is automatically set for the correct data rate.



## Fibre-optic data multiplexer

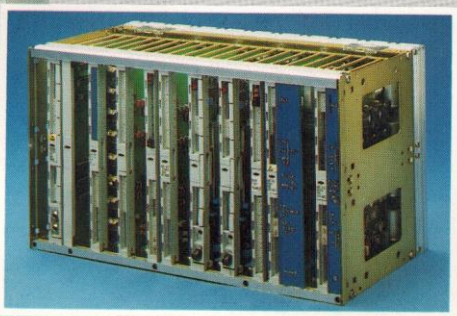
The micro-processor controlled data multiplexer ZAH 001 is a highly versatile system for data acquisition and remote control.

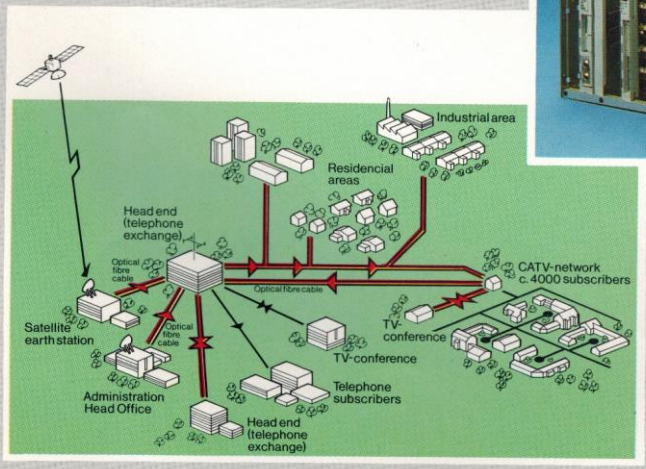
## 280 Mbit/s fibre-optic CATV system

ZAV 280/4 is a fibre-optic CATV trunk system for digital transmission of high quality video and audio signals. It carries 4TV and 6 stereo audio channels on one multi-mode or single-mode fibre over distances of 5 to 35 km.

## Fibre-optic video link

By means of light weight optical fibre cable the ZAV 101 Video link will transmit video signals over distances up to 8 km. Typical applications are surveillance and monitoring in industrial environments such as road and rail traffic, entrance control, production lines etc.






## Fibre-optic CATV

The use of advanced digital picture coding equipment in conjunction with optical fibre transmission results in improved performance of CATV-networks. Initially fibre optics is most attractive at trunk and primary levels. As costs go down in the future fibre optics will be used closer and closer to the subscriber's premises, developing into an all fibre digital broadband network for telephony, data and video.

# Field experience

*Fibre optics installed by Anaconda plays an important role at Walt Disney's famous Epcot Center.*

Ericsson's long history includes an important chapter on field experience. Experience which covers every aspect of installation and commissioning in all corners of the globe. This unique world-wide experience naturally embraces a series of optical fibre projects successfully concluded both in Europe, the USA, Latin America and the Middle East.