ACVF DRIVES AND REMOTE MONITORING OF ESCALATORS

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ABSTRACT

Escalators and passenger conveyors have become essential in public transport systems to move passengers between different floor levels. The remote monitoring of escalators is the most efficient way to guarantee this service and is increasingly becoming a standard requirement in technical specifications. Down time is considerably reduced and the comfort of the passengers re-established as a result of the provision of rapid and precise information about what has caused a stoppage. A trend which parallels ecological awareness is the use of ACVF drives resulting in energy savings. This technology in use with lifts for some time, now finds acceptance for escalator drives.

1. ACVF DRIVES

Escalators equipped with ACVF drives lead to higher investment for the purchaser because of the

* additional price for the ACVF drive
* external control cabinet which is needed due to space, noise and heat reasons.

How can these be offset by advantages?

There are four advantages:

1.1 Reduced power consumption

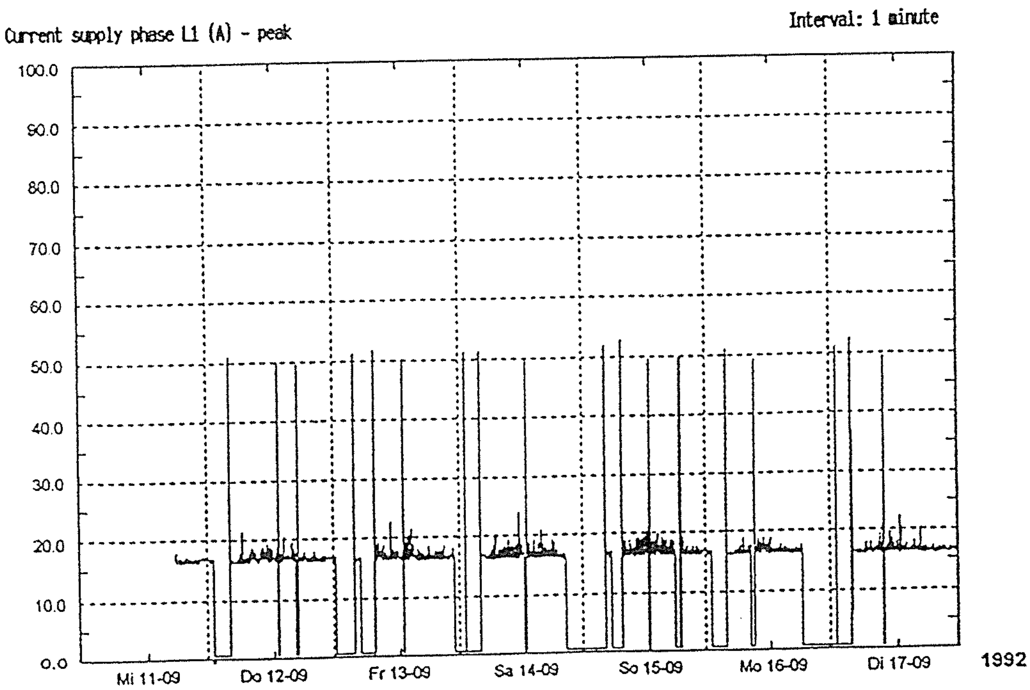
The ACVF becomes effective when the escalator (or passenger conveyor) changes to a reduced speed which is normally 1/3 of the nominal speed, i.e. 0.15 m/s and which is attained in an unloaded status according to a preset delay period.

The energy consumption of a unit running at nominal speed is the same with conventional drive or ACVF drive.

An absolute comparison of the energy consumption between the conventional and ACVF drive over a long period is not applicable since even on the same day of the week and at the same hour the number of transported people is not identical. However, it is certainly justified to extrapolate the measured energy difference between reduced and nominal speed for a period of 12 months.

A survey was conducted at an escalator installed in the Zürich Airport on the request of the Airport authority "FIG". Measurements were made both for current and power during a period of one week. It allowed for the calculation of the power factor cos φ (phase displacement between voltage and the current of the basewave) as well as an estimation of the mechanical stress of the escalator resulting from the number of starting currents.

The graph below shows the form of the current of phase L 1 of the escalators without AVCF:



From the form of current curve it can be deduced that the power factor is about cos φ = 0,85. Three starts average per day have been registered.

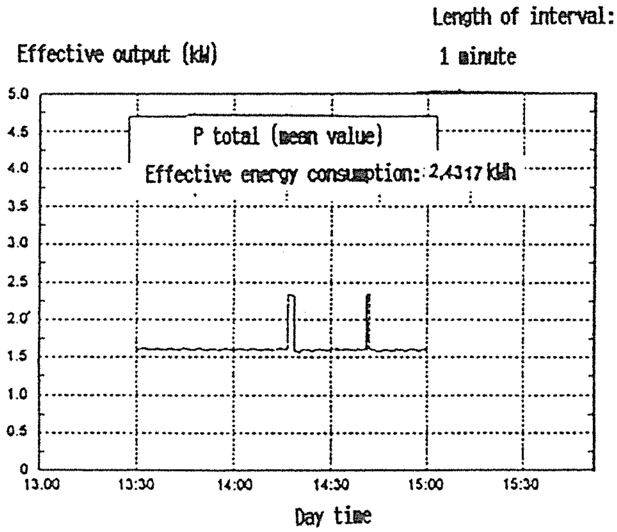
Then, the power was measured over a period of 1,5 hours in the modes

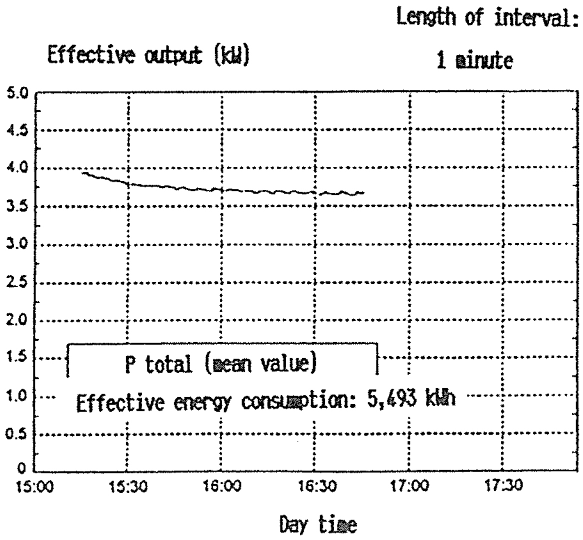
* escalator conventional drive - nominal speed without load

* escalator with ACVF - reduced speed

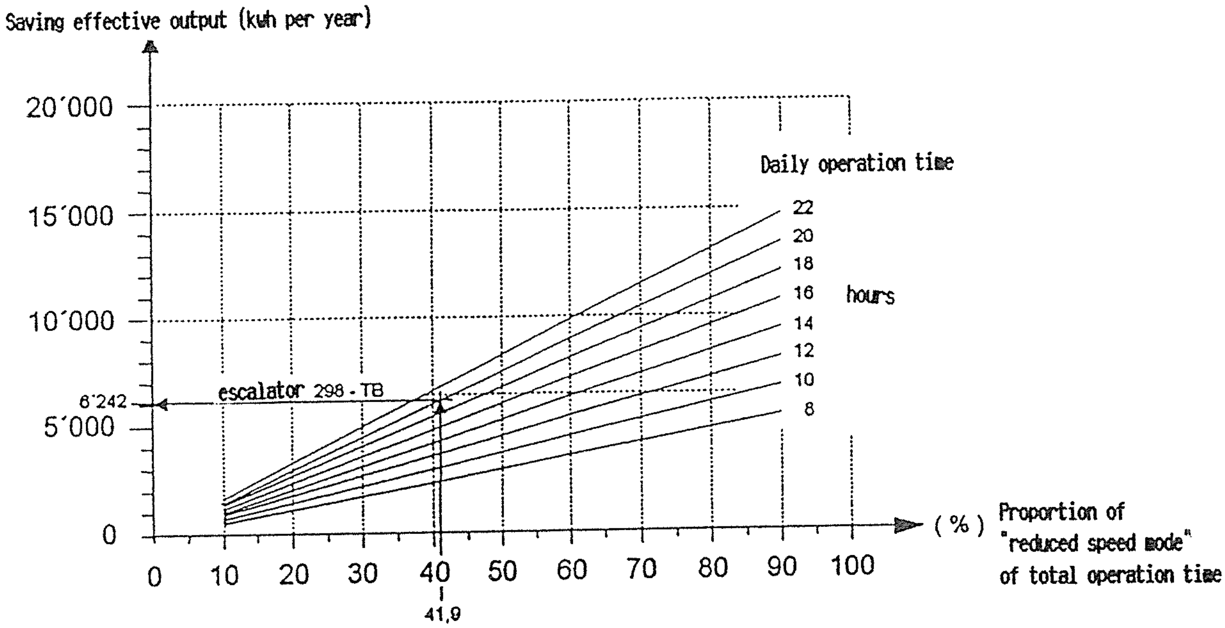
The time during which the escalator was running at reduced speed was registered over a long period. It showed that more than 8 hours of reduced speed occurs during a 20 hour daily service.

The two graphs below clearly indicate that the true power is reduced by 56 % from 5,49 KWh to 2,43 KWh at reduced speed.





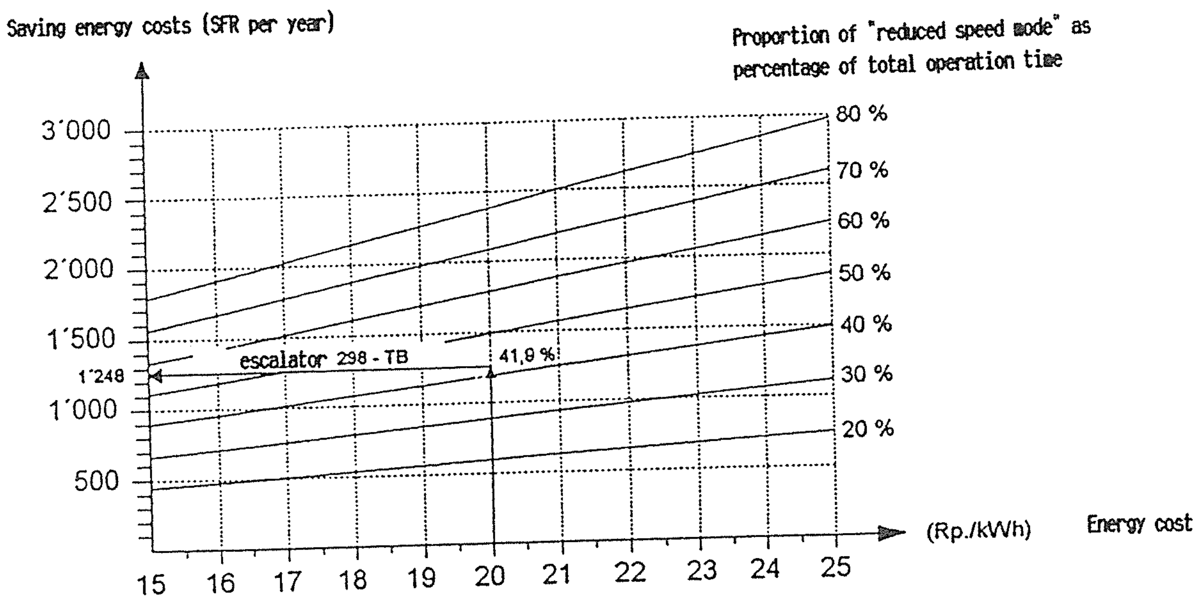
The saving through the reduction of true energy consumption extrapolated over a period of 12 months can be best seen from the next graph. Over 6000 KWh per year can thus easily be saved.



A relation between total number of service hours and percent of reduced speed is evident.

Cost saving will certainly vary from country to country depending on the price of electricity.

How cost saving, percent of reduced speed and electricity costs are interrelated, can be seen on the graph shown below.



1.2 Improvement of the cos φ

Current peaks are reduced by up to 80 % bringing the cos φ to 1.

1.3 Reduction of wear and tear

Due to the considerably lower speed in the "reduced speed" mode, all moving parts, i.e. rollers, chains, handrails, motor and gear box, etc., have an extended service life compared to escalators with conventional drive systems.

In addition, the absence of starting current peaks contributes to longer life as well.

1.4 "In use" visualization

The last advantage which, however, cannot be quantified in monetary terms, is the fact that passengers realize that escalators running in energy saving mode with ACVF are in operation and can be boarded. This is often not the case when escalators with conventional drive are stopped by traditional, intermittent service mode.

2. REMOTE MONITORING OF ESCALATORS

Normally, it is not possible to see from one place all escalators or passenger conveyors installed in a building.

However, through a monitoring system the service personnel can supervise all units from a control room. The evaluation of the data collected there facilitates the elimination of malfunctions and considerably increases the availability of the units.

For this purpose Schindler has developed two different systems:

- Servitel alarm system
- MICONIC-F LOBBY

2.1 Servitel Alarm System

Servitel is a remote monitoring system developed by Schindler for supervising operating conditions of lifts, escalators, and passenger conveyors. It consists of several modules connected with the day and night service center through the public telephone network.

There are two possibilities to connect escalators to Servitel:

2.1.1 Servitel with P-module

This is a compact system designed for easy retrofitting of escalators already installed and provided with relay control.

- **P-module:** This module is connected to the escalator. Up to 6 operating conditions are transmitted to a T-module:
  - Direction UP
  - Direction DOWN
  - Safety circuit interrupted
  - Emergency stop actuated
  - Power supply interrupted
  - Maintenance operation

- **T-module:** Can service up to 10 P-modules and transmit the data of the single P-modules through a telephone line to the alarm center.

- **PZEN Center:** The alarm center is equipped with a PC and a multitasking operation system. A telephone modem (TZ-module) is connected to the PC.
  The operating conditions of the individual escalators are shown on the video terminal and statistically evaluated. This statistical data may e.g. be used for optimizing the maintenance intervals. Furthermore, it is possible that the client installs an alarm center of his own.

2.1.2 Servitel through "data concentrator"

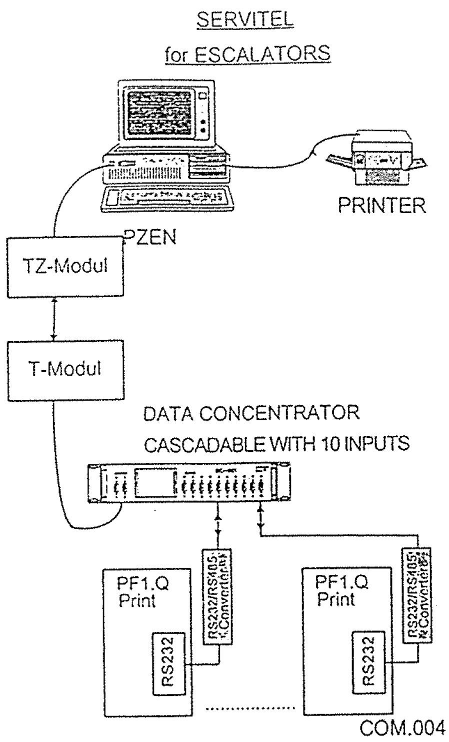
The control unit of the escalator control system PF1.Q (print) is connected through a serial interface with the "data concentrator" servicing up to 10 escalators.

The following indications and commands are supplied by the control unit through a serial interface:

- Operating conditions: Direction, maintenance operation, etc.

- Indications of malfunctions: Emergency stop, approx. 40 different interruptions of the safety circuit, etc.

This data is transmitted to the "data concentrator" which communicates it directly (without P-module) to the connected T-module. Further data flow from the T-module to the alarm center as described in Chapter No. 2.1.1.



2.2 MICONIC-F LOBBY

This is a remote monitoring and control system providing one data processing unit per building or station. The data transmitted to and from the units connected (escalators and passenger conveyors) are there processed through an on-line system. The specific data and parameters of the single units are managed through the video terminal.

2.2.1 Indications and commands

The following indications and commands are supplied by the control unit through a serial interface:

- Operating conditions: Direction, maintenance operation, etc.

- Indications of malfunctions: Emergency stop, approx. 40 different interruptions of the safety circuit, etc.

- Warnings: Lubrication system nearly empty, etc.
- Operation parameters: Time set for automatic operation, etc.
- Commands: Change of operating conditions: start, stop. In this case a passenger detecting system (video camera or light curtain) is indispensable.

2.2.2 Set-up of the communication system

A serial interface (RS 232) of the control unit serves for transmitting and receiving indications and commands.

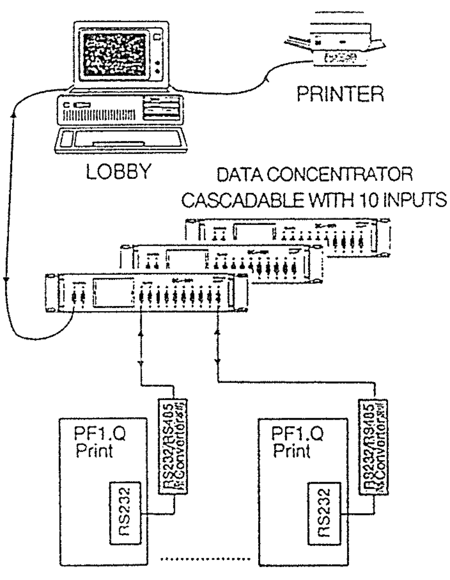
For larger distances an "RS232/RS485 converter" must be used.

The indications from the single units are collected by "data concentrators" connected in series and transmitted to the data processing system.

2.2.3 Data processing system

This is a personal computer with a multitasking operating system where the data of up to 4 x 30 escalators can be managed.

MICONIC F
LOBBY



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The system supplies:

- Communication software for control (through an on-line system)
- Visual display of operating conditions
- Print-out of malfunctions with indication of date and hour (through printer)
- Statistics: Type and number of malfunctions, operation hours, degree of availability
- Specific data of the unit: Year of construction, type, rise, time set for automatic operation, stopping distance, etc.
  Example: COM.005 and COM.006
- Special requirements of the client as per order: Translation (standard: English, French, German or Spanish)

PARAMETERS

AUTOMATIK TIME:	60 SEC
LUBRICATION PAUSE INTERVALL:	24 H
LUBRICATION TIME:	5 MIN
BRAKING DISTANCE:	30 CM

SPEED

OPERATING:	0,50 M/SEC
MAX:	0,60 M/SEC
MIN:	0,33 M/SEC

COM.005

TECHNICAL DATA

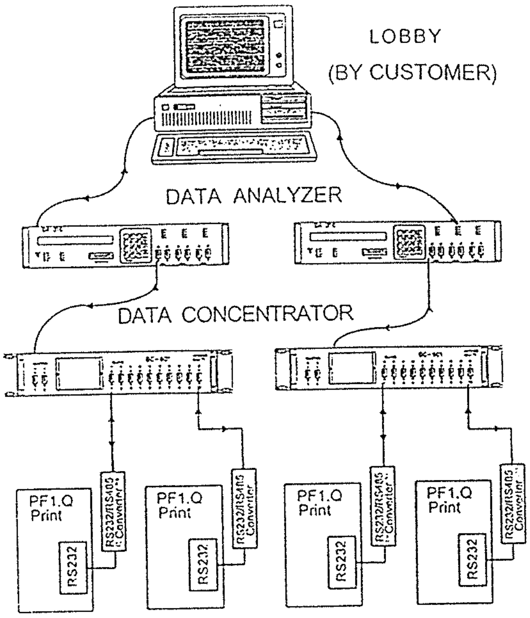
RK 74895
SGT 30-100 M-W
RISE: 6030 MM
BUILD IN: 1991
MICONIC F
POWER 15KW

COM.006

2.2.4
Communication system connected with the client's control center

Data processing in the client's control center. In this case a "data analyzer" providing compliance with the client's print-out is indispensable. The analyzer is connected with the "data concentrator" and can manage up to 10 units.
Reference installation: Metro Marseille

MICONIC F
COMMUNICATIONS SYSTEM (APPLICATIONS)



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AUTHOR BIOGRAPHICAL DETAILS:

Dr. Michael Lichtenberg, born in Berlin 1943

Studied first construction engineering and then law at the University in Graz, Austria. After he graduated he started to work in the High Court for a period of six months, before he changed direction and joined Austria's biggest semi-private enterprise, Steyr-Daimler-Puch.

Shortly after he became export sales manager for the cross country vehicle division in the Graz factory.

In 1981 he took residence in Vienna where he started to work for Schindler Lifts and Escalators Ltd. He is now the Executive Director for Export and Marketing for the escalator division.