PROTECTA
Electronics Co. Ltd

EuroProt

complex protection,

Technical information

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EUROPROT

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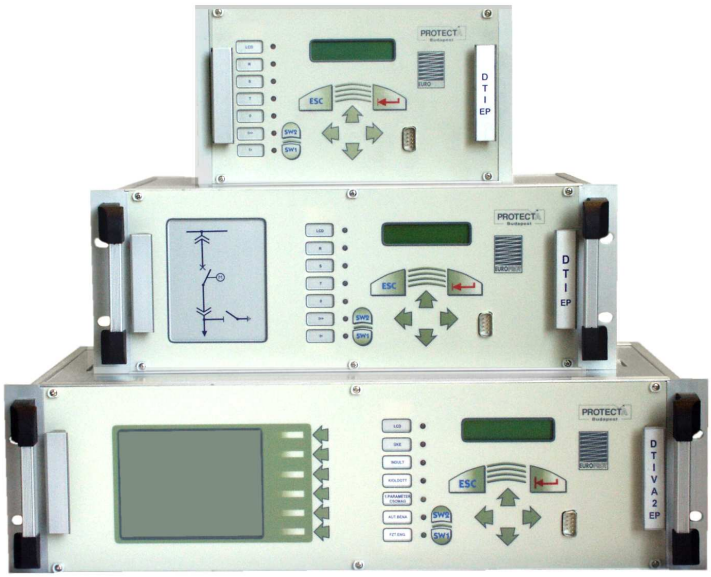
Contents



The versions of the EuroProt product family

The EuroProt device family

The EuroProt device family of Protecta Electronics Co. Ltd. has been designed to perform all protection and control functions of the electric power system. The devices of this product line can protect the power system elements of the medium and high voltage levels. They can be applied in power stations, substations and by industrial consumers as well.

The ***EuroProt*** type complex protection in respect of hardware and software is a modular device. The modules is assembled and configured according to the requirements, and then the software determines the functions.

This manual summarises the technical information, common to all devices of the EuroProt product line. The individual characteristics of the specific applications are described in the manuals of the device factory configurations.

Rear view of a EuroProt device

Design

The EuroProt devices are produced in two designs and in three sizes. All versions are mounted in standard 19" racks. The two designs are the relay panel mounted version and the cabinet or flash-mounted version. The sizes are determined by the number of applied modules. The table below show the size range of the EuroProt devices.

Cabinet mounted or flash-mounted design (mm)			
Width	Height	Depth	Front panel version[1]
269	132.5	201	a, b
376			a, b
483			a, b, c
Relay panel mounted design (mm)			
Width	Height	Depth	Front panel version[1]
277	250	250	a, b
384			a, b
490			a, b, c

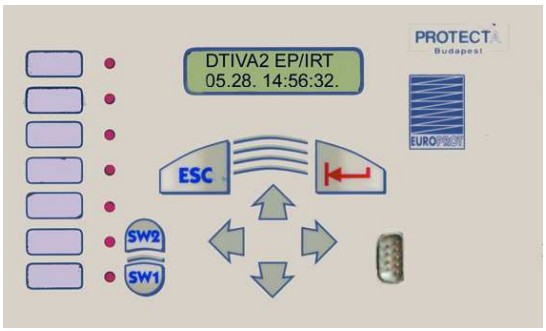
[1]See the front panel versions below

Connector types

Current connections[1]	Weidmüller STVS SB - SS
All other connections	Weidmüller SLA – BLA

[1]See the rightmost module (on the rear view) of the picture above.

The front panel versions



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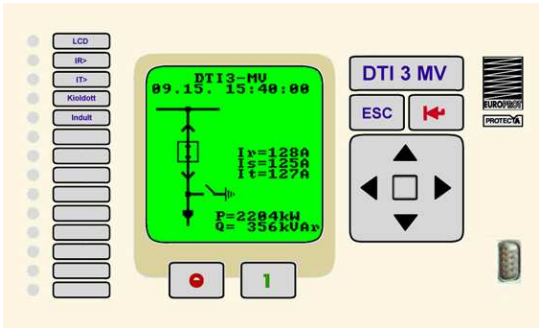

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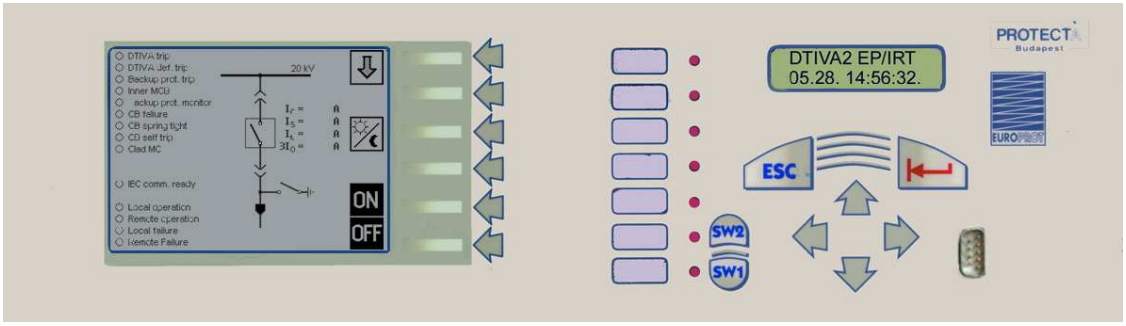


c

Versions of the front panel

The available hardware modules

The ***EuroProt*** type complex protection devices are compiled of hardware modules. All EuroProt devices must contain the following hardware modules:

HW module	Function
CPU	Central processing unit containing: - the main processor with the additional electronic elements, - the signal processor performing the protections functions, - additional signal processor for the communication and SCADA functions, - integrated disturbance recorder and event recorder.
T	Power supply unit.

The usual modules for most devices:

HW module	Function
CT	Analogue input module with current transformers;
VT	Analogue input module with voltage transformers;
R	Output module with relays;
O	Digital input module with optical couplers.

Optional modules to be applied according to the requirements:

HW module	Function
OX	Optically isolated communication modules for large distant data communication
M_A	Module for checking the CB operating circuits;
ZI	Independent disturbance recorder module;
TA	4…20 mA signal transmitter module;
AnInp	4…20 mA signal receiver module;
Pt100	Pt100 signal input module;
xx	Special module for the SCADA system, produced by other firms.

Power supply module

Power supply	Nominal voltage[1]	Operating range	Stored energy[1]
	24 V DC	±20% DC	0, 10, 20, 60, 100 ms
	48 V DC	±20% DC	0, 10, 20, 60, 100 ms
	110 V DC	±20% DC/AC	0, 10, 20, 60, 100 ms
	220 V DC	±20% DC/AC	0, 10, 20, 60, 100 ms
	110/220 V DC	88 – 264V	0, 10, 20, 60, 100, 200 ms
	100 V AC	-20, +10% AC	0, 10, 20, 60, 100 ms
	230 V AC	-20, +10% AC	0, 10, 20, 60, 100 ms

[1] Options, to be selected at ordering stage

Analogue input modules

Current transformer inputs

Current inputs	Nominal current	Inom [1]	1 A / 5 A [1]
	Nominal frequency		50 Hz
	CT thermal ratings	continuous	4 * Inom
		1 s	100 * Inom
	CT dynamical ratings	10 ms	250 * Inom
	Consumption	Inom = 1 A	<0.02 VA
		Inom = 5 A	<0.1 VA
	Nominal current Inom [2]		0.1A or 0.5A[2]
	Nominal frequency		50 Hz
	CT thermal ratings	continuous	4 * Inom
		1 s	100 * Inom
	CT dynamical ratings	10 ms	250 * Inom
	Consumption	Inom = 0.1 A	<0.02 VA
		Inom = 0.5 A	<0.1 VA
	Nominal current	Inom [2]	0.025A or 0.05A[2]
	Nominal frequency		50 Hz
	CT thermal ratings	continuous	4 * Inom
		1 s	100 * Inom
	CT dynamical ratings	10 ms	250 * Inom
	Consumption	Inom = 0.025 A	<0.02 VA
		Inom = 0.05 A	<0.1 VA

[1]Can be changed by soldering

Voltage transformer inputs

Voltage inputs	Nominal Voltage Unom [1]		100/√3V / 200 √3V	
	Nominal frequency		50 Hz	
	VT thermal ratings	continuous	2 * Unom	
	Consumption		<0.7 W	

[1] Options, to be selected at the ordering stage

Binary input modules

Binary inputs	Nominal Voltage	Unom[1]	24 V / 48 V / 110 V / 220V DC
	Consumption		<0.4 W

[1] Options, to be selected at the ordering stage

Rated voltage	Un	24V DC	48V DC	110V DC	220V DC
Operating voltage at rated temperature	0.7*Un ±5%	17V ±5%DC	34V ±5%DC	77V ±5%DC	154V ±5%DC
Operating voltage in the temperature range of –25°C+55°C	0.7*Un ±20%	17V ±20%DC	34V ±20%DC	77V ±20%DC	154V ±20%DC
Minimal drop-off difference of the input voltage in the temperature range of –25°C+55°C	0.04*Un	1V	2V	4.4V	8.8V
RMS value of the power frequency voltage on the input, not generating operation		10V AC	22V AC	50V AC	100V AC
Steady state impedance on operating voltage (min.)		12.4kΩ	27kΩ	60kΩ	150kΩ
Steady state impedance on drop-off voltage (max)		0.24kΩ	0.6kΩ	2kΩ	4kΩ

Output relay modules

Output relays	Output contact rated voltage	Uk	250V DC
	Output contact rated continuous load current	Ik	8A DC
	Output contact making current		16A DC
	Output contact breaking current L/R= 40ms load, at 220V		0,2A DC
	Output contact breaking current conductive load, at 220V		0,25A DC
	Insulation test surge voltage		5 kV 1,2/50 µs
	50 Hz power frequency insulation test 1 min		2kV RMS
	Rated coil voltage	Un	18V DC
	Operating voltage in the temperature range of –20°C+50°C	0,5 - 0,83Un	9V-15V DC
	Minimal drop-off difference of the input voltage in the temperature range of –20°C+50°C	0,27Un	5V

Output relays (increased breaking capacity)	Output contact rated voltage	Uk	250V DC
	Output contact rated continuous load current	Ik	8A DC
	Output contact making current		16A DC
	Output contact breaking current L/R= 40ms load, at 220V		4A DC
	Output contact breaking current conductive load, at 220V		4A DC
	Insulation test surge voltage		5 kV 1,2/50 µs
	50 Hz power frequency insulation test 1 min		2kV RMS
	Rated coil voltage	Un	18V DC
	Operating voltage in the temperature range of –20°C+50°C	0,5 - 0,83Un	9V-15V DC
	Minimal drop-off difference of the input voltage in the temperature range of –20°C+50°C	0,27Un	5V

Analogue signal transmitter modules

Analogue signal transmitter	Output current range	I	0..20/4..20/ 0..6 mA	0..6/±6 mA	4..20/0.. 20 mA
	Output current resolution		12 bits, 1 in 4096		
	Accuracy		±1%		
	Max load resistance	Ri	1kΩ	2kΩ	1kΩ
	Settling time to 0,5%	ts	<10ms		
	Power supply voltage	Ups	220/110/48 V DC [4]	(Internal PS)	
	Power supply voltage range		Ups±10%		
	Signal transmission time	tt	100 ms		

[4]This module type needs independent power supply input

Fibre optic communication modules

OX module	Optical code	Manchester
	Optical frequency	10 MHz
	Communication speed	1.2 Mbit/s
	Optical sending element	Laser diode
	"Single" mode (SM) cable application	
	Wave length	1300 or 1550 nm
	Optical power	> -7 dBm
	Optical receiver	InGaAs diode
	Receiver sensitivity	< -35 dBm
	Optical connector	FC PC
	Fibre optic cable internal diameter	μ nm
	Maximal distance	>100 km
	"Multi" mode (MM) cable application	
	Wave length	850 nm
	Optical power	> -15 dBm
	Optical receiver	InGaAs diode
	Receiver sensitivity	< -30 dBm
	Optical connector	ST
	Fibre optic cable internal diameter	50 or 62.5 μm
	Maximal distance	2-4 km

Communication with the CPU modules

FO communication with the CPU module	Communication speed	Max. 38400 Baud
	Plastic fibre optic cable application	
	Wave length	660 nm
	Optical power	> -16 dBm
	Optical receiver	InGaAs diode
	Receiver sensitivity	< -21 dBm
	Optical connector	POF
	Fibre optic cable diameter	1 mm
	Maximal distance	>60 m
	"Multi" mode (MM) cable application	
	Wave length	820 nm
	Optical power	> -15 dBm
	Optical receiver	InGaAs diode
	Receiver sensitivity	< -24 dBm
	Optical connector	ST
	Fibre optic cable internal diameter	50 or 62.5 μm
	Maximal distance	2 km
	Ethernet	
	Connector	RJ45

Type tests

Electrical type tests		
Electrostatic discharge tests	IEC 60255-22-2 : 1989, level 4	EN 61000-4-2 Class 4
Radiated electromagnetic field	IEC 60255-22-3 : 1989	EN 61000-4-3 Class 3
Electrical fast transient (Burst) test	IEC 60255-22-4	EN 61000-4-4 Class 4
Surge test	IEC 60255-22-5	EN 61000-4-5 Class 4
Conductive radio disturbances	IEC 60255-22-6	EN 61000-4-6 Class 3
Power frequency disturbances	IEC 60255-22-7 Class A	
Power frequency magnetic fields		EN 61000-4-8 : Class 4
DC supply interruption	IEC 60255-11 0.1s/100% at 220 V	EN 61000-4-11
1 MHz burst disturbance test	IEC 60255-22-1 : 1988 IEEE C37.90.1 : 1989	EN 61000-4-12 Class III
Disturbance test for mains frequency changes		EN 61000-4-28
Disturbance test for short voltage dips and voltage variations of the DC input port		EN 61000-4-29
Insulation tests	IEC 60255-5: 1994 Class 3	
Impulse voltage test	IEC 255-5 : 1994 5 kV 0.5J	

Mechanical stress tests		
Vibration test:	IEC 60255-21-1 : 1988, Class 1	
Shock test:	IEC 60255-21-2 : 1988, Class 1	
Seismic test:	IEC 60255-21-3 : 1993, Class 1	
Climatic tests	IEC 68-2-30 : 1980	

Protection	IEC 529 IP Front side Rear side	 IP 50/(54)[1] IP 20

[1] Option, to be selected at ordering stage

Operating temperature range	-10°C …+55°C	
Storage temperature range	-40°C …+70°C	
Humidity range	≤75% (annual mean)	

Characteristics of the integrated disturbance recorder

Max. number of records	With cyclic overwriting	10
Storage capacity of a record		64 kByte
Storage requirements	Analogue sample	2 byte
	8 binary samples	1 byte
Sampling rate		1 ms
Approximate time span of a record	Using 8 analogue samples and 32 binary samples	3.2 s
Starting	Programmed with PROTLOG equations	Binary signal level / Binary signal rising edge
Factory settings	Pre-fault time	200 ms
	Post-fault time	200 ms
Data format		Protecta ".zav"
Data export format		COMTRADE
Data transfer		"Protect for Windows" software
Evaluation		"Zirert" software (or any COMTRADE evaluation software)

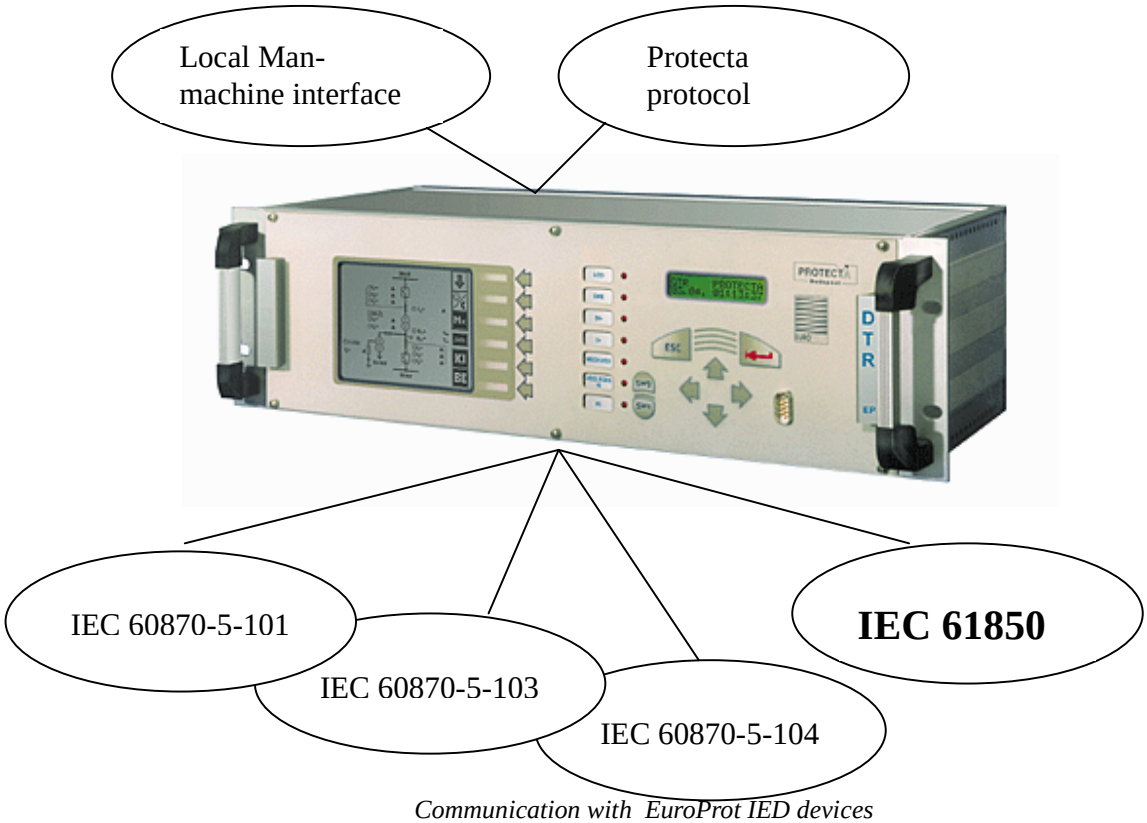
Characteristics of the integrated event recorder

Time stamp resolution	1 ms
Number of stored events	300
Max number of binary signals in an event	63

Communication with EuroProt-IED multifunctional intelligent devices

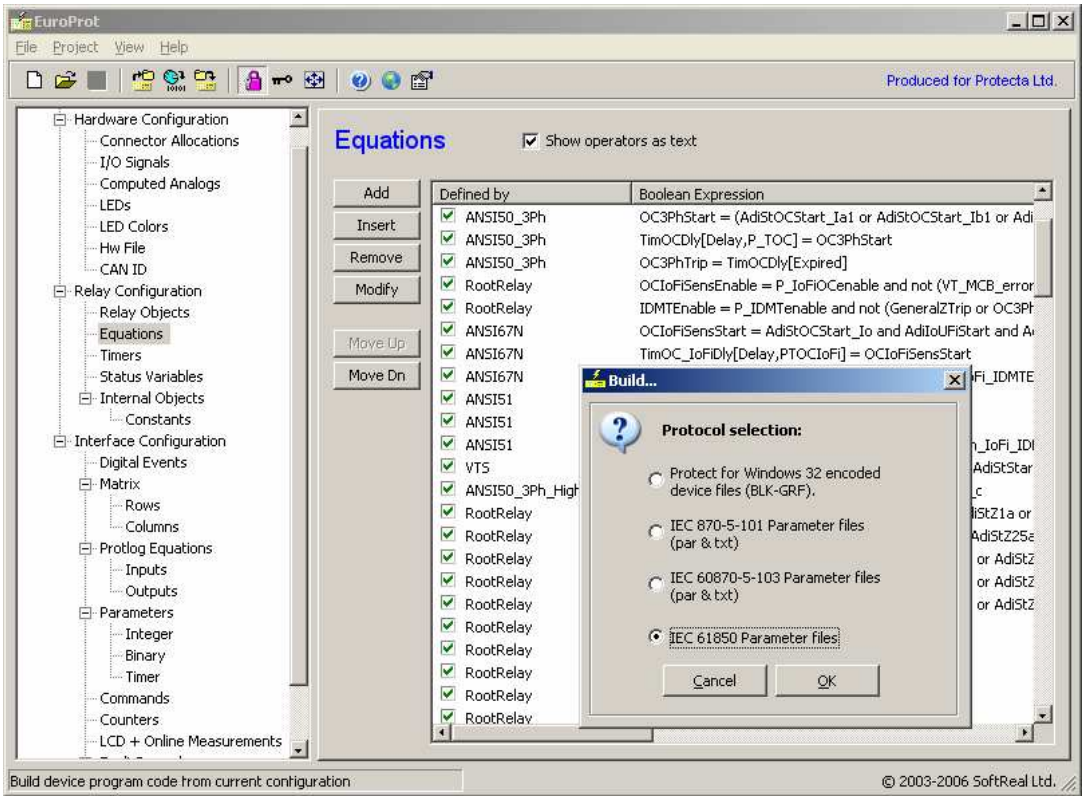
The intelligent multifunctional EuroProt devices made by Protecta - parallel to the development in the power system protection and the microprocessor technology - keep pace with the development of the communication technology as well. Following the first data exchange with computers using Protecta communication protocol, the international communication standards (IEC 60870-5-101, IEC 60870-5-103, IEC 60870-5-104) have been realised in quick sequence after each other, and as an example for co-operation with devices of other manufacturers, the ABB SPA protocol has been applied too. As the result of the latest development activities, the EuroProt – IED (intelligent electronic devices) can be involved in the communication system according to the international IEC 61850 standard. (See Fig. 1)

Meeting the requirements of the IEC 61850 standard means that the EuroProt – IED devices can participate in the information exchange of the devices from other manufacturers, applying this international standard.



Communication with EuroProt IED devices

The Fig. below shows one step of the factory configuration procedure for the EuroProt multifunctional intelligent devices: the protocol selection.



Protocol selection in the factory configuration process of the EuroProt IED devices

This brochure summarises the possibilities of communication with EuroProt intelligent multifunctional protective devices.

Local man-machine interface

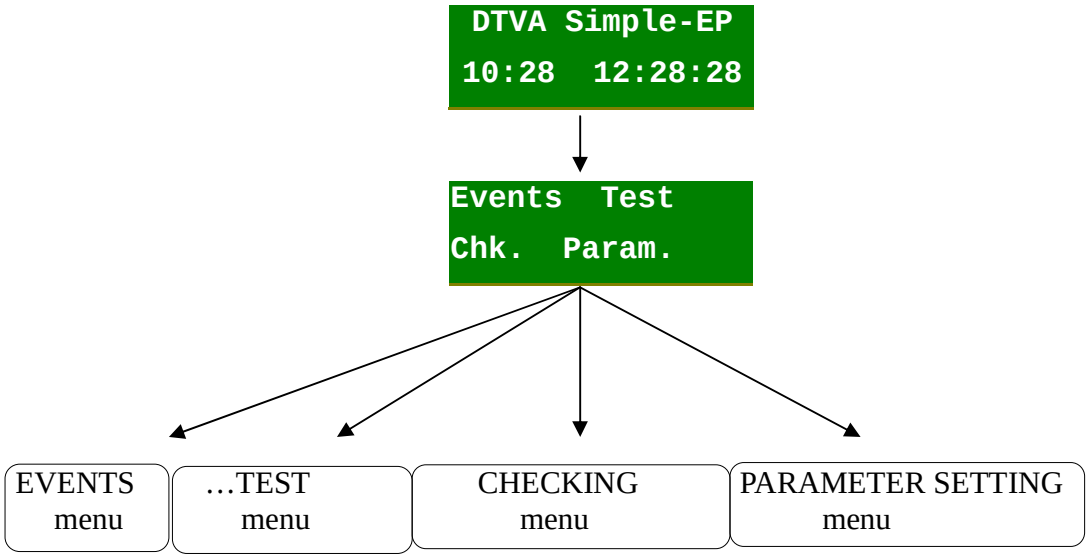
Tasks of the local man-machine interface:

- Parameter setting,
- Parameter supervision,
- Displaying on-line measured values one-by-one,
- Request of the stored event log,
- Displaying messages.

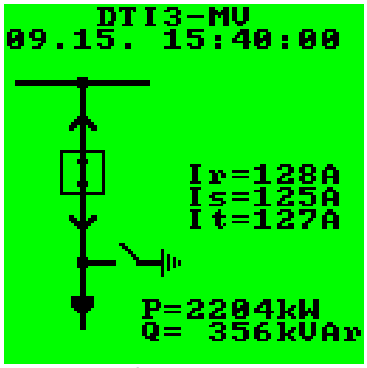
The local man-machine interface is located on the front side of the device (see Fig.1); it consists of an alphanumeric or graphic display, of eight push-buttons and of fourteen LED-

s. The configuration of the front side can be extended with a large graphic display as well, which provides additional six programmable push-buttons too.

The alphanumeric display and its menu system are shown on Fig.3, the small graphic LCD on Fig.4. The front cover of this brochure shows a device, which is configured with a large graphic display and six additional push-buttons.



The alpha-numeric display and the associated menu system (in a possible configuration)



*The 128*128 pixel LCD display (in a possible configuration)*

	Version 1	Version 2	Version 3
2*16 character alpha-numeric display	√		√
128*128 pixel graphic display		√	
320*240 pixel graphic display			√

The possible combinations of the displays

Operation with computers using Windows operating system

The operation of the device is more convenient if additionally to the local man-machine interface a serial connector or an Ethernet interface is used as well, which connects the device to a computer running under Windows operating system, and using the „**Protect for Windows**" operating software. The protocol of this communication is the own protocol, developed by Protecta.

The various types of the physical interfaces are summarised in Table below.

	Version a	Version b	Version c
RS232 connector on the front panel of the device	√	√	√
A pair of fibre optic connectors on the rear side of the CPU module	√	√	√
RJ45 connector		√	√
RJ45 connector with RJ/ST converter module			√

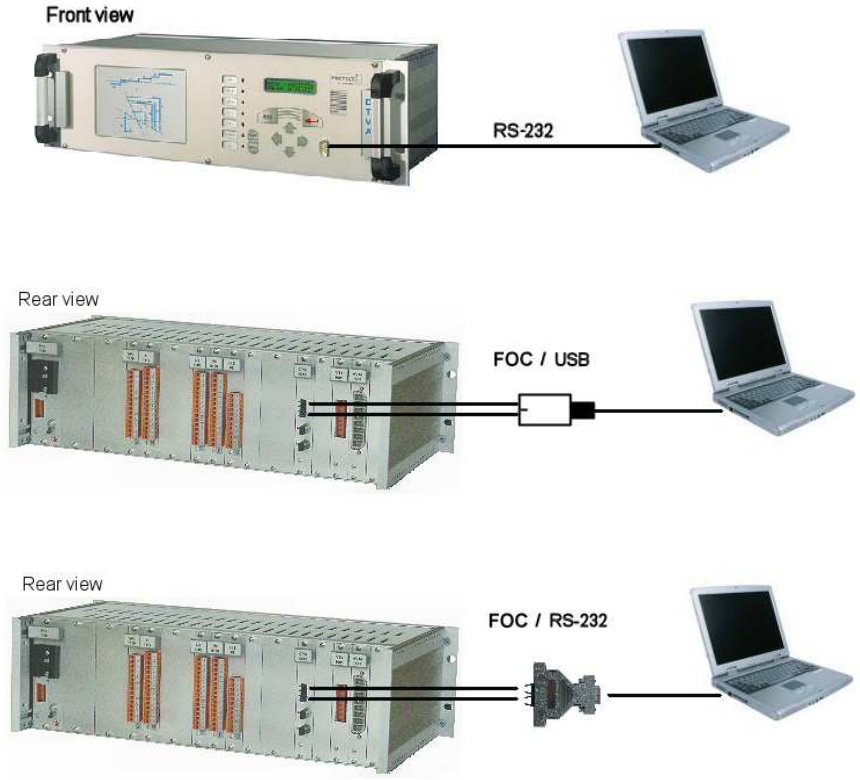
The versions of the serial connectors

The RS232 interface provides direct interconnection to a computer. When this is used, a large amount of information can be displayed on the screen of the computer, enabling easy survey of the measured and acquired data, and assures convenient operation of the device. This connection enables all services, which are available on the local man-machine interface as well.

DB9P	socket		DB9P	socket
1	DCD	⟷	7	RTS
2	RX	⟷	3	TX
3	TX	⟷	2	RX
4	DTR	⟷	6,8 connected	DSR,CTS
5	GND	⟷	5	GND
6,8 connected	DSR,CTS	⟷	4	DTR
7	RTS	⟷	1	DCD
9	RI	⟷	9	RI

Specification of the serial cable

In the harsh environment of a substation the fibre optic data communication is preferred rather than the conventional serial cable. The fibre optic cable interface is located on the rear side of the CPU module, accessed from the rear side of the device. For this kind of connection Protecta provides an RS232 / fibre optic converter, which can be connected to the serial interface of a computer. Another possibility is the fibre optic / USB converter, produced by Protecta as well. This method can be used with computers equipped with USB port.

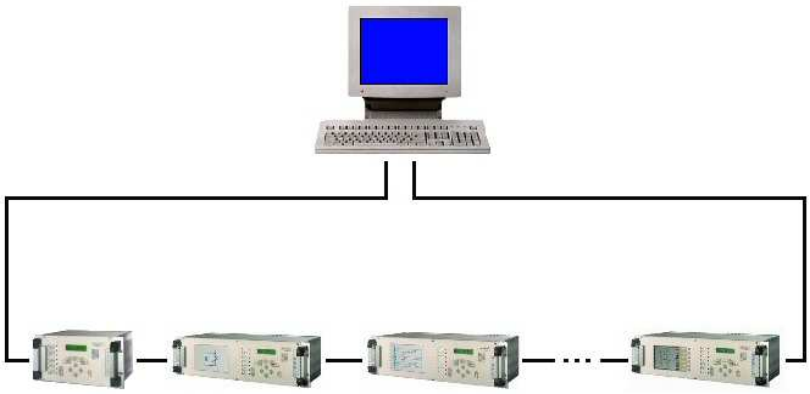


Communication with a supervising computer

Using fibre optic communication media, not only the basic operation functions can be realised as they are mentioned above, but this is the way of uploading and evaluation of disturbance recorder records, and this connection provides possibility to upgrade the programs of the processors, stored in the flash memory of the CPU module. The picture of the withdrawn CPU module is shown on Figure below.

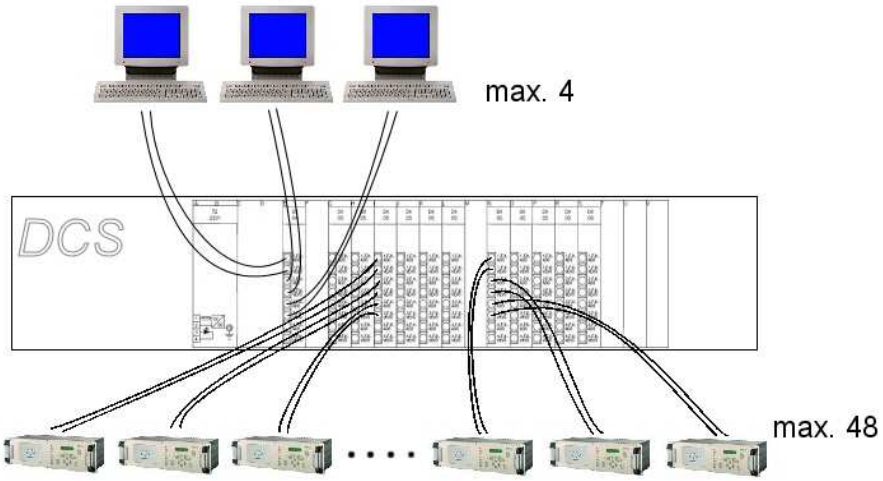
A CPU module with fibre optic connectors for plastic cables

Using the fibre optic interface several (max.20) devices can be connected in a loop. Based on the internal address, these devices can be accessed one-by-one by the supervising computer. The construction of a fibre optic loop is shown on Figure below.



Operation of the EuroPro- IED devices in a fibre optic loop

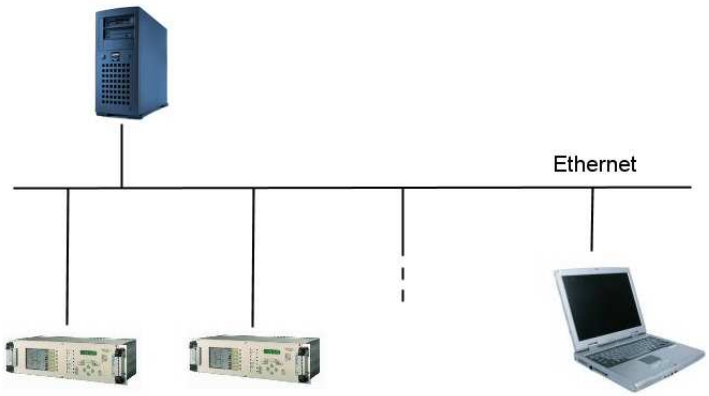
When using the DCS type star coupler produced by Protecta, a higher reliability can be achieved as compared to the communication using fibre optic loop. With this method the failure of the individual devices does not influence the communication with the healthy devices. The application of the DCS star coupler is shown on Fig. 8.



EuroProt-IED devices with DCS type star coupler

If an Ethernet network is available, then the devices equipped with RJ45 connectors can be connected to this network too. The RJ45 version of the CPU module is shown on Figure below, the connection to an Ethernet bus is drawn on Figure below. The cabling in substation environment is preferred with STP (shielded) twisted wires instead of UTP (unshielded) cables.

The RJ45 connectors version of the CPU module



EuroProt-IED devices in the Ethernet network

If the selected housing of the devices enables extension, then the application of the RJ45/ST converter module provides long distance fibre optic cable connection as well.

The EuroProt-IED multifunctional device in the substation monitoring and supervising system

In the EuroProt-IED multifunctional device a dedicated processor provides substation monitoring and supervising functions (data acquisition, control functions, interlocking, etc.) as well. This functionality is involved in the substation system by a dedicated serial connection. The connector for this purpose is located on the rear side of the CPU module. The physical connection possibilities are summarised in Table 3.

	Version A	Version B	Version C	Version D	Version E
A pair of fibre optic connectors on the rear side of the CPU module	√				
Dual fibre optic connectors on the rear side of the CPU module		√			
Multimode glass fibre optic connectors (See Fig. 11)			√		
RJ45 network connector (See Fig. 9)				√	√
RJ45 network connector with RJ/ST converter module					√

The physical connection possibilities

Multimode glass fibre optic cable connection

The realised protocols of the communication for supervisory and control purposes are summarised by physical connectors in Table 4.

Protocol	IEC 60870-5-			ABB-SPA	IEC 61850
Physical connectors	101	103	104		
A pair of fibre optic connectors on the rear side of the CPU module	√	√		√	
Dual fibre optic connectors on the rear side of the CPU module	√	√		√	
Multimode glass fibre optic connectors	√	√		√	
RJ45 network connector			√		√

The available communication protocols