

Utility Distribution and Industrial Protection and Control

Overview

The series 220 compact protection and control relays are a cost-effective secure solution for line/feeder protection as well as backup or auxiliary protection and control for transformers, generators and motors in HV/MV systems.

The fit-for-purpose design allows plug-and-play engineering together with alternatives for customization of protection schemes and user-defined PLC logic. Full integration in the Automation Studio toolset allows simple configuration, programming and management, either in standalone or system applications.

By fully supporting multiple open communication standards, it is both future-proof and integration friendly.



Product Overview

TPU S220
Multifunction Relay

- I - Entry-level current relay
- R - Auto-reclosing and breaker failure added
- T - Sensitive earth-fault protection and directionality added
- U - Voltage functions added
- S - Full-function line/feeder relay including frequency functions, synchro-check and fault locator

TPU B220
Voltage and Frequency Relay

- U - Voltage load shedding relay
- F - Full-function including frequency load shedding

TPU M220
Motor Protection Relay

- I - Motor protection with current functions
- U - Full-function including voltage functions

Key Features

- Combined Protection, Control, Measurement and Recording
- Compliant with State-of-the-art Standards
- Multiple Communication Options
- IEC 61131-3 Logic and PLC Programming
- Watchdog and Self-monitoring
- Local and Web-based Interface
- Automation Studio Toolset for Engineering

Customer Benefits

- Economical and Secure P&C Solution
- Single Device Platform for all Products
- Easy to Specify, Configure, Troubleshoot and Maintain
- Easy to Integrate into Existing or New Systems
- IEC 61850 Option for Cost-effective Systems



Interfaces

Built-in and Web-based User Interface

The local interface includes a 20x4 alphanumeric LCD and keypad for relay information access and change of settings, relay operation status indicators, 8 programmable alarm LEDs and 4 programmable function keys.

Complementary to the local interface and Automation Studio toolset the relay provides an embedded webserver (available at the front or rear Ethernet ports) where all local operations are available as well as access to SOE, fault or disturbance records. This permits interacting with the device and associated power system locally or remotely without requiring external software tools.

Interoperability via Open Communication Protocols

The series 220 relays provide several alternative slave communication protocols such as DNP 3.0 or IEC 60870-5-103, made available at the rear panel serial ports (fiber option available). This allows integration into any system communication technology.

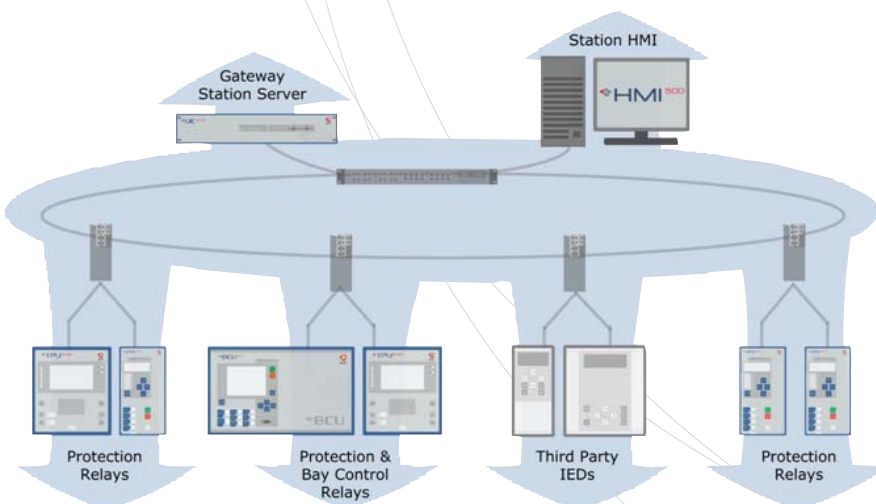
Ethernet or TCP/IP protocols are also available at the rear Ethernet interface (10/100 Mbps copper or fiber). General purpose protocols such as FTP are available together with remote control protocols at both front and rear Ethernet interfaces.

Clock Synchronization

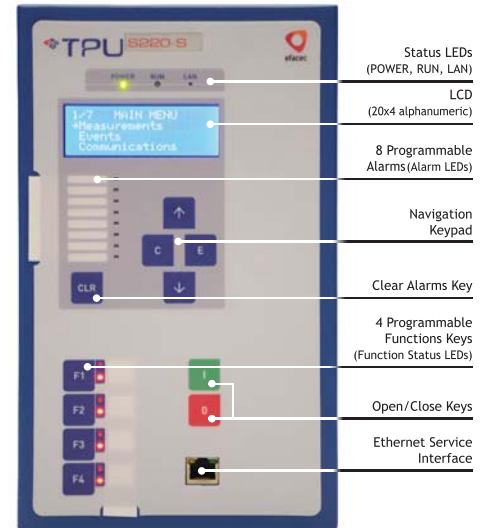
Real-time clock synchronization can be performed via SNTP, IRIG-B, by communication protocol or set at the local interface.

Open Design via IEC 61850

The optional IEC 61850 interface, fully compatible with compliant devices and tools, allows truly open design in cost-reduced system deployments. Fine-tuned communication performance with regard to GOOSE messaging allows distributed protection and control architectures to be deployed with full confidence and reliability. The series 220 function design is object oriented and in full accordance with the well-known IEC 61850 models.



IEC 61850 System Integration.



TPU S220-S Front Panel and Local User Interface.

Interfaces

User Interface	
4x20 Alphanumeric LCD	●
Programmable Alarm / Indication LEDs	●
Functional Keys	●
Relay Status LEDs	●
Integrated Webserver	●
Service Interface (Front Panel)	
10/100BASE-TX	●
Service Interface (Rear Panel)	
RS232/RS485	●
RS232/RS485, Glass Fiber or Plastic Fiber	○
10/100BASE-TX (Default Option) or 100BASE-FX	●
Time Synchronisation	
IRIG-B Input	○
SNTP Client	●
By Communication Protocol	●
Communication Protocols	
IEC 61850 Server and GOOSE	○
IEC 60870-5-104 (TCP/IP)	○
IEC 60870-5-103 (Serial)	○
IEC 60870-5-101 (Serial)	○
DNP 3.0 (Serial)	○
DNP 3.0 (TCP/IP)	○
MODBUS (Serial)	○
MODBUS (TCP/IP)	○
Others (Please Contact)	○

● - Base feature | ○ - Optional feature

Hardware

I/O and Construction

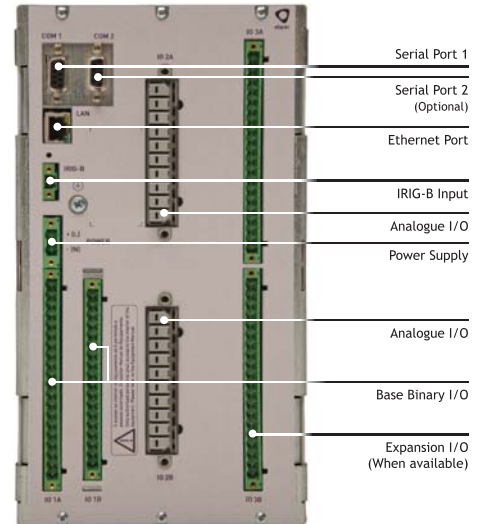
Flexible I/O configuration allows direct implementation of single, double, n-bits or pulse-counting points as well as multiple contact operation via single or double controls.

Standard analog current and voltage input configuration together with pre-designed configuration templates permit straightforward device I/O setup. Binary inputs are independent and analog input options are selectable with order. No additional measuring instruments or external control components are required for application to control cubicles.

Products are available in standard 1/4 or 1/3 19" size (optionally rack-mountable) supporting up to 32 binary I/O points, 2 DC analog inputs, 2 DC analog outputs, 6 RTD inputs and 8 AC analog inputs.

Internal watchdog, watchdog output and self-supervision of all hardware component, including memory, I/O boards and communication ports, and of all software modules, are included. Diagnostic information can be accessed through the webserver, toolset or communication interfaces. A test mode, suitable to validate device operation, can also be set.

To ensure operation reliability, secondary system supervision functions such as of CTs/VTs or trip circuits are included and may be used, together with self-diagnostics, not only for signaling and recording but also for trip blocking or user-defined logic.



TPU S220-S Rear Panel and Interfaces.

I/O Options	TPU S220					TPU B220		TPU M220	
	I	R	T	U	S	U	F	I	U
Chassis Version									
1/4 rack 19"	•	•	•			•	•	•	
1/3 rack 19"				•	•				•
Base AC Analogue Inputs									
Current inputs	4	4	4	4	4			4	4
4 th current input with high sensitivity			○	○	○				
Voltage inputs			1	4	4	4	4		4
Base I/O									
4 DI + 4 DO	•								
8 DI + 8 DO		•	•	•	•	•	•	•	•
Expansion I/O									
Type 1: 8 DI + 8 DO Expansion Card									
Type 2: 16 DO Expansion Card					○		○		
Type 3: 16 DI Expansion Card								○	
Type 4: 2 DC Analog Input + 2 DC Analog Output + 6 RTD Card									
Power Supply									
24V d.c. (19V to 60V)					○				
110/125/220V d.c. (88V to 300V)					○				
115/230V a.c. (80V to 265V)					○				
48/60/110/125V d.c. (38V to 150V)					○				

• - Base feature | ○ - Optional feature (one expansion card only)

Architecture

Field-Proven Protection Function Design

Drawing on the experience obtained with previous field-proven product families, 220 family protection algorithms have been significantly enhanced, with new and additional features included. A careful design of protection functions and device architecture provides an adequate balance between speed, sensitivity and accuracy.

Protection Stability and Dependability

Protection characteristics and algorithms were developed to guarantee stability during load and external faults while preserving dependability of operation for internal faults.

Several built-in functions and options enable the correct operation of the protection relay in high or medium voltage networks with grounded, low-impedance, isolated or compensated neutral. Inrush current detection prevents inadvertent tripping caused by the connection of a transformer.

Protection Function Overview

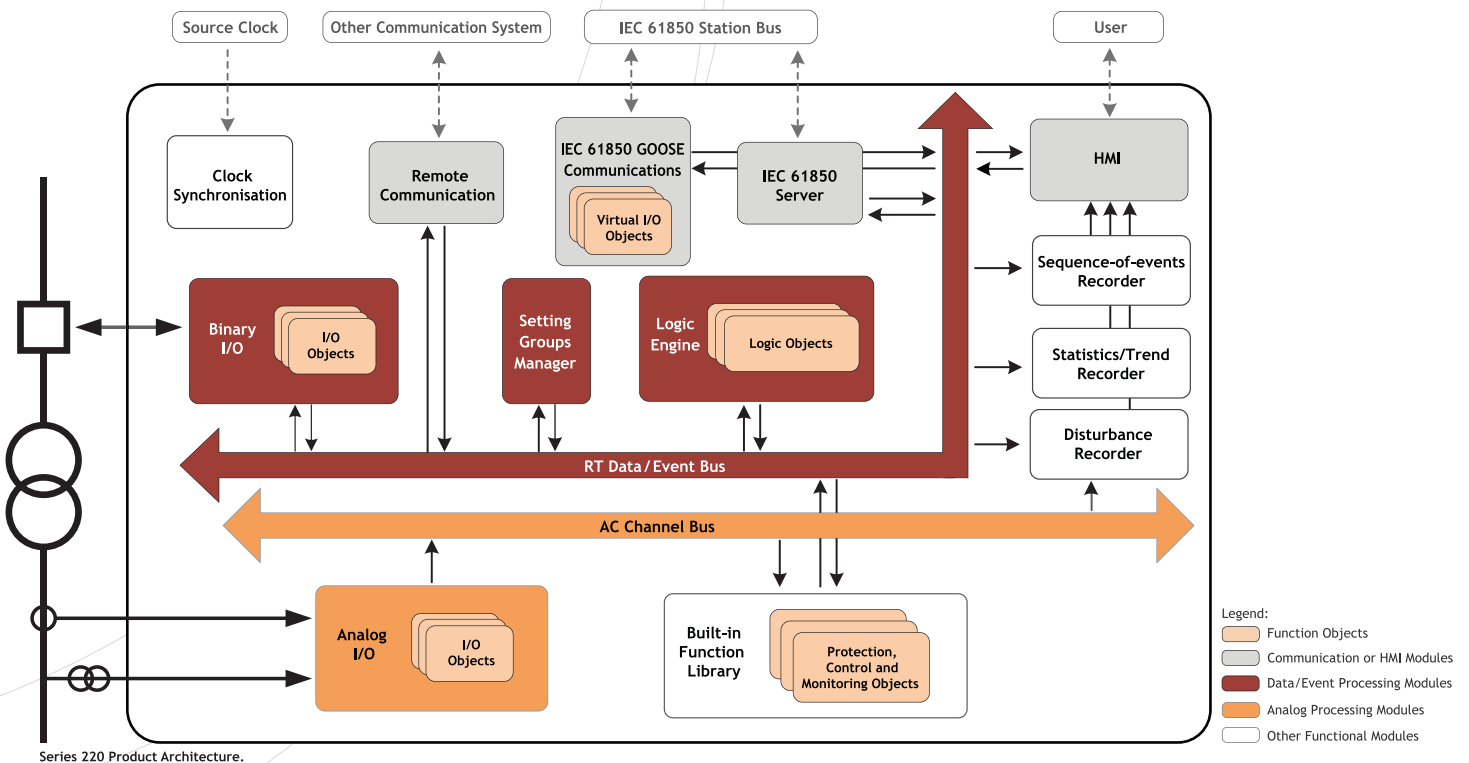
Several independent stages for main protection functions, enable versatile device applications, in a true full-scheme design.

Four phase and earth-fault overcurrent stages, with cold-load pickup and optional directionality, provide correct fault discrimination and adequate coordination options.

Two distinct voltage blocks of each type, and five distinct frequency blocks of each type enable full-function load shedding or other applications.

Specific motor protection functions extend the use of this product family, covering loss of load, phase unbalance, locked rotor or excessive number of starts, among other operation failures. Thermal overload function is provided for both line and motor applications.

Four independent setting groups are available for each function, and can be interchanged by user command or logic condition dependent on system operation.



Features

Functions		TPU S220					TPU B220		TPU M220		
Protection	ANSI	I	R	T	U	S	U	F	I	U	IEC 61850
Phase Overcurrent	50/51	•	•	•	•	•			•	•	PTOC
Directional Phase Overcurrent	67				•	•					RDIR
Earth-Fault Overcurrent	50N/51N	•	•	•	•	•			•	•	PTOC
Directional Earth-Fault Overcurrent	67N			•	•	•					RDIR
Cold Load Pickup		•	•	•	•	•			•	•	
Blocking Scheme Logic	68	•	•	•	•	•			•	•	
Thermal Overload	49	•	•	•	•	•					PTTR
Negative Sequence Overcurrent / Phase Balance	46		•	•	•	•			•	•	PTOC
Directional Negative Sequence Overcurrent	67				•	•					RDIR
Switch-onto-Fault	50HS		•	•	•	•					RSOF/PIOC
Directional Earth-Fault Overcurrent for Non-Earthed Systems	32N			•	•	•					PSDE
Directional Power	32				•	•					PDOC
Phase Undervoltage	27				•	•	•	•		•	PTUV
Phase Overvoltage	59				•	•	•	•		•	PTOV
Residual Overvoltage	59N			•	•	•	•	•		•	PTOV
Negative Sequence Overvoltage / Phase Balance	47				•	•	•	•		•	PTOV
Underfrequency	81					•		•		•	PTUF
Overfrequency	81					•		•		•	PTOF
Frequency Rate-of-Change	81					•		•		•	PFRC
Motor Thermal Overload	49M								•	•	PTTR
Locked Rotor	51LR								•	•	PMSS
Excessive Start Time / Load Jam	48								•	•	PMSS
Limitation of Number of Starts / Time between Starts	66								•	•	PMRI
Undercurrent / Loss of Load	37								•	•	PTUC
Underpower / Loss of Load	37									•	PDUP
Over / Under Power Factor	55									•	POPF/PUPF

• - Base feature

Functions	ANSI	TPU S220					TPU B220		TPU M220		IEC 61850
		I	R	T	U	S	U	F	I	U	
Control and Supervision											
Three-Phase Trip Logic	94	•	•	•	•	•			•	•	PTRC
Automatic Reclosing	79		•	•	•	•					PREC
Synchronism and Voltage Check	25					•					RSYN
Circuit Breaker Failure	51BF		•	•	•	•			•	•	RBRF
Trip Circuit Supervision	74TC		•	•	•	•			•	•	STRC
Voltage Load Shedding					•	•	•	•			GAPC
Frequency Load Shedding						•		•			GAPC
Circuit Breaker Close Lock / Lockout	86	•	•	•	•	•	•	•	•	•	RCBL
Fuse Failure / VT Supervision					•	•	•	•		•	RVTS
CT Supervision		•	•	•	•	•			•	•	RCTS
Broken Conductor Check	46BC		•	•	•	•					RBCD
Circuit Breaker Control / Supervision	52	•	•	•	•	•	•	•	•	•	CSWI/XCBR
Distributed Automation		•	•	•	•	•	•	•	•	•	GGIO
Programmable Automation (IEC 61131-3)		•	•	•	•	•	•	•	•	•	GAPC
Monitoring, Measurement and Metering											
Three-Phase Accurate Measurements		•	•	•	•	•	•	•	•	•	MMXU/MSQJ
Metering					•	•				•	MMTR
Temperature Monitoring (requires Type 3 Expansion Card)	26								○	○	STMP
Speed Monitoring (requires Type 3 Expansion Card)	14								○	○	PZSU
Fault Locator	21FL					•					RFLO
Self-Tests and Watchdog		•	•	•	•	•	•	•	•	•	
Recording and Reporting											
Current Disturbance Recorder		•	•	•	•	•			•	•	RDRE
Voltage Disturbance Recorder				•	•	•	•	•		•	RDRE
Chronological Event Log / SOE		•	•	•	•	•	•	•	•	•	
Load Diagram / Statistical Trend Recorder					•	•				•	
Fault Report		•	•	•	•	•	•	•	•	•	

• - Base feature | ○ - Optional feature



Application Overview

The series 220 products provide a cost-effective solution for line/feeder, transformer or motor protection and control applications. These compact relays can be used standalone or system integrated, as main protection or as backup in more complex schemes. The availability of several device models, with pre-defined and fit-for-purpose function sets and configuration ensures adequacy to each user application.

Product and Life-cycle Support

The openness of series 220 family and the support throughout the system life-cycle allow stepwise investment strategies. Together with future-proof technology Efacec provides a full range of services from training and support to engineering and maintenance that ensures you have the best solution for your requirements.



Application Description

<p>TPU S220</p> <ul style="list-style-type: none"> Line / feeder protection Transformer backup protection General backup protection 	<p>TPU S220 - I</p> <ul style="list-style-type: none"> Basic overcurrent version <ul style="list-style-type: none"> Overcurrent and earth-fault Thermal overload <p>TPU S220 - R</p> <ul style="list-style-type: none"> Overcurrent protection with built-in recloser <ul style="list-style-type: none"> TPU S220-I plus: <ul style="list-style-type: none"> Auto-reclosing Negative sequence overcurrent <p>TPU S220 - T</p> <ul style="list-style-type: none"> Overcurrent protection with earth-fault protection enhancements <ul style="list-style-type: none"> TPU S220-R plus: <ul style="list-style-type: none"> Sensitive earth-fault Directional earth-fault Ground overvoltage <p>TPU S220 - U</p> <ul style="list-style-type: none"> Overcurrent with directionality and voltage measurements <ul style="list-style-type: none"> TPU S220-T plus: <ul style="list-style-type: none"> Directional phase overcurrent Voltage protection <p>TPU S220 - S</p> <ul style="list-style-type: none"> Complete version <ul style="list-style-type: none"> TPU S220-U plus: <ul style="list-style-type: none"> Synchronism check Frequency protection Fault locator
<p>TPU B220</p> <ul style="list-style-type: none"> Voltage and frequency relay Load shedding and restoration 	<p>TPU B220 - U</p> <ul style="list-style-type: none"> Basic version <ul style="list-style-type: none"> Voltage protection Voltage load shedding and restoration <p>TPU B220 - F</p> <ul style="list-style-type: none"> Complete version <ul style="list-style-type: none"> TPU B220-U plus: <ul style="list-style-type: none"> Frequency protection Frequency load shedding and restoration
<p>TPU M220</p> <ul style="list-style-type: none"> Motor protection 	<p>TPU M220 - I</p> <ul style="list-style-type: none"> Motor protection with current measurements <ul style="list-style-type: none"> Basic version: <ul style="list-style-type: none"> Over and under- current protection Locked rotor / load jam Number of starts / time between starts <p>TPU M220 - U</p> <ul style="list-style-type: none"> Motor protection with current and voltage measurements <ul style="list-style-type: none"> TPU M220-I plus: <ul style="list-style-type: none"> Voltage and frequency protection Underpower and power factor protection

