
PRODUCT DESCRIPTION

# EuroProt+ DVEZ

## IED-EP+/DVEZ

## BAY CONTROL UNIT

PROTECTA HUNGARY

# EUROPROT+ DVEZ

## BAY CONTROL UNIT

## OVERVIEW

The **DVEZ** product type is a member of the **EuroProt+** numerical protection relay, made by Protecta Co. Ltd. The **EuroProt+** complex protection in respect of hardware and software is a modular device. The modules are assembled and configured according to the requirements, and then the software determines the functions.

The **DVEZ** products are configured for bay control unit applications on the transmission and distribution network.

### GENERAL FEATURES

- Native IEC 61850 IED with Edition 1 & 2 compatibility
- Module layouts with options 42 or 84 HP wide rack size (height: 3U)
- The pre-defined factory configuration can be customized to the user's specification with the powerful EuroCAP tool
- Flexible protection and control functionality to meet special customer requirements
- Different HMI Types: advanced HMI with color touchscreen and black-and-white display with 4 tactile push buttons. An embedded web server and extended measuring, control and monitoring functions are also available for both types
- User configurable LCD user screens, which can display SLDs (Single Line Diagrams) with switchgear position indication and control as well as setting values, measurement values, event and fault information (timestamp, function block, fault phase, fault current...)
- 8 setting groups available as default. The number of setting groups can be up to 20 as user's requirement
- Enhanced breaker monitoring and control
- High capacity disturbance recorder (DRE) and event logging in non-volatile memory:
  - DRE can store more than 64 records
  - Each DRE recording can be configured up to 32 analogue and 64 digital signal channels with duration up to 10s and sampling rate up to 2kHz
  - Event recorder can store more than 10,000 events
  - The records can be read out from IED in the standard COMTRADE file format (IEEE Std C37.111) via exist communication connection (such as IEC61850) or even examined on-line. Every single record stored in 3 files with the same name and the following extensions: .dat, .cfg, .inf
- Several mounting methods: Rack; Flush mounting; Semi-flush mounting; Wall mounting; Wall-mounting with terminals; Flush mounting with IP54 rated cover.
- Wide range of communication protocols:
  - Ethernet-based communication protocol: IEC61850, DNP3.0 TCP, IEC60870-5-104, Modbus TCP
  - Serial communication protocol: DNP3.0, IEC60870-5-101, IEC60870-5-103, MODBUS, SPA
- Legacy network based protocols via 100Base-FX and 10/100Base-TX (RJ45)
- Optional communication ports: Fiber Ethernet (MM/ST, SM/FC), RJ45, Serial POF, Serial glass fiber, RS-485/422
- Handling several communication protocols simultaneously
- Built-in self-monitoring to detect internal hardware or software errors
- Time synchronization protocol: NTP/SNTP, Minute pulse, Legacy protocol, IRIG-B
- Integrated advanced cyber security - Conformity with the Cyber Security requirements in accordance with NERC-CIP, IEEE 1686, BDEW Whitepaper and IEC 62351-8 standard and recommendation. Passwords are required when logging into the device for: access, control, setting, manage,...

## APPLICATION

The **DVEZ IEDs** (intelligent electronic devices) are used for bay control unit applications in transmission and distribution networks. They provide full control for any type of switchgear (including the interlocking functions) and other substation applications. The **DVEZ** factory configurations implement the basic functionality, but customers can add optional functions to increase the functionality of the device.

### OPTIONAL FUNCTIONS

- Breaker failure protection
- Synchrocheck
- Automatic reclosing function for HV/MV networks
- Automatic voltage regulator (AVR) / tap change control
- Remote binary signal transmission
- Voltage protection functions

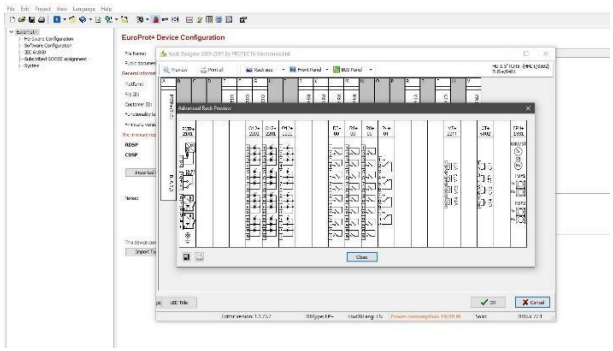
- Thermal protection
- Load shedding functions
- Monitor transformer temperature via analog input module (AIC) or RTD input module (Pt100/Ni100, Pt250/Ni250…)
- The analog output module (ATO) transmits current or voltage signals. This module can be used in wide ranges in unipolar and bipolar mode

## EUROCAP CONFIGURATION TOOL

The EuroCAP configuration tool, which is available free of charge, offers a user-friendly and flexible application for protection, control and measurement functions to ensure that the IED-EP+ devices are fully customisable.

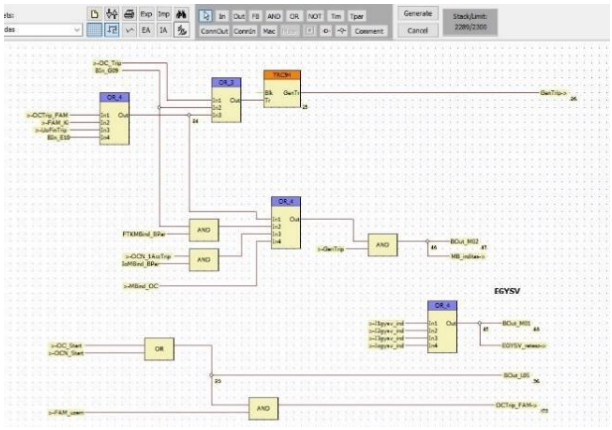
- **HW configuration**

  - View the exciting hardware configuration of the IED including card information and slot position
  - Modify (add or change) certain HW modules
  - Digital and analogue I/O signal definition



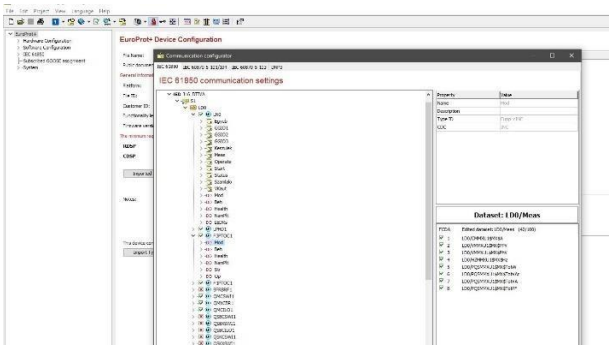
- **Logic editor**

  - Create/manage logical sheets
  - Factory pre-configured logical schemes to speed up the commissioning process



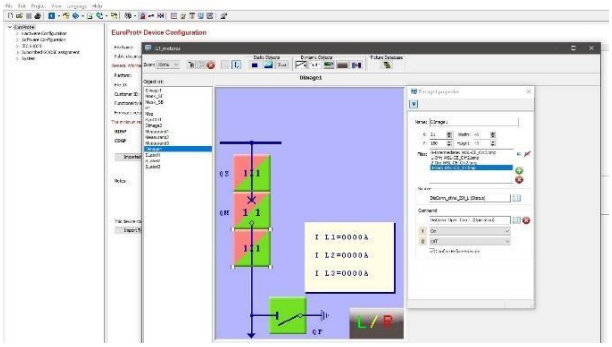
- **Communication configurator**

  - Set up IEC 61850, 101-104, 103, DNP3 communication protocols
  - Configure dataset, report and goose control block properties for IEC 61850 horizontal and vertical communication
  - GOOSE configuration between IEDs



- **LCD configurator (available with color TFT displays)**

  - Create/modify user screens with Single Line Diagrams, measuring or status values
  - Icon library for effective configuration Own, user-defined symbols can be created as well



- **Feedback documentation**

Automatic documentation of the configured IED, which can contain the actual connection assignment, online measurements, all recorded event channels, all recorded disturbance channels, LED assignment, Logical sheets and the relevant communication settings and collect the protection, control and monitoring parameters.

- **Offline Parameter Set Editor**

  - View, set, compare and save the setting of the IED parameters
  - Import existing parameter settings into the Offline parameter set editor from the IED
  - Import/Export parameters in xlsx format
  - Generate and save parameters in RIO format for relay tester. The XRIO files can be downloadable from website

## PROTECTION & CONTROL FUNCTIONS

- **Pre-defined configuration variants**

The number and the functionality of the members of each product type are put together according to the application philosophy, keeping in mind the possible main usages. The available configurations of the DVEZ type are listed in the table below.

| VARIANT | MAIN APPLICATION |
|---|---|
| E1-BCU | Bay control unit with optional binary I/O, RTD, AIC or ATO modules only |
| E2-BCU | Special bay control unit with analogue measurements (CT, VT) |

The protection and control functions of the DVEZ configurations as table below.

| THE IMPLEMENTED PROTECTION & CONTROL FUNCTIONS | IEC | ANSI | E1-BCU | E2-BCU |
|---|---|---|---|---|
| Circuit breaker control (included interlocking function) | | | ✓ | ✓ |
| Disconnector control (included interlocking function) | | | ✓ | ✓ |
| Voltage measurement | | | | ✓* |
| Current measurement | | | | ✓* |
| Line measurement | | | | ✓* |
| Average and maximum measurement | | | | ✓* |
| Fuse failure protection (VTS supervision) | | 60 | | ✓* |
| Current unbalance protection | | 60 | | ✓* |
| Breaker failure protection | | 50BF | | Op. |
| Synchro check | | 25 | | Op. |
| Automatic reclosing function | 0 → 1 | 79 | | Op. |
| Automatic voltage regulator (AVR) / tap change control | | 90 | | Op. |
| Remote binary transmission | | | Op. | Op. |
| Remote binary communication | | | Op. | Op. |
| Circuit breaker wear | | | | ✓* |
| Definite time overvoltage protection | U >,U >> | 59 | | Op. |
| Residual overvoltage protection | Uo >,Uo | 59N | | Op. |
| Definite time undervoltage protection | U <,U << | 27 | | Op. |
| Overfrequency protection | f >, f >> | 81O | | Op. |
| Underfrequency protection | f <, f << | 81U | | Op. |
| Rate of change of frequency protection | df/dt | 81R | | Op. |
| Load shedding | | | | Op. |
| Thermal protection | T> | 49 | | Op. |
| Trip circuit supervision (TCS) | | 74 | ✓ | ✓ |
| Lockout trip logic function | | 86/94 | 1 | ✓ |

- Op.: Optional
- ✓*: If the HW permits, then basic

- **Circuit breaker control function block (CB1Pol)**

The Circuit breaker control function block can be used to integrate the circuit breaker control of the EuroProt+ device into the station control system and to apply active scheme screens of the local LCD of the device. Up to 32 Circuit breaker control function blocks can be configured.

The Circuit breaker control function block receives remote commands from the SCADA system and local commands from the local LCD of the device, performs the prescribed checking and transmits the commands to the circuit breaker. It processes the status signals received from the circuit breaker and offers them to the status display of the local LCD and to the SCADA system.

**Main features:**

- Local (LCD of the device) and Remote (SCADA) operation modes can be enabled or disabled individually.
- The signals and commands of the synchro check/synchro switch function block can be integrated into the operation of the function block.
- Interlocking functions can be programmed by the user applying the inputs “EnaOff” (enabled trip command) and “EnaOn” (enabled close command), using the graphic equation editor.
- Programmed conditions can be used to temporarily disable the operation of the function block using the graphic equation editor.
- The function block supports the control models prescribed by the IEC 61850 standard.
- All necessary timing tasks are performed within the function block:
  - Time limitation to execute a command
  - Command pulse duration
  - Filtering the intermediate state of the circuit breaker
  - Checking the synchro check and synchro switch times
  - Controlling the individual steps of the manual commands
- Sending trip and close commands to the circuit breaker (to be combined with the trip commands of the protection functions and with the close command of the automatic reclosing function; the protection functions and the automatic reclosing function directly give commands to the CB). The combination is made graphically using the graphic equation editor
- Operation counter
- Event reporting

The Circuit breaker control function block has binary input signals. The conditions are defined by the user applying the graphic equation editor. The signals of the circuit breaker control are seen in the binary input status list.

- **Disconnector control function (DisConn)**

The Disconnector control function block can be used to integrate the disconnector or earthing switch control of the EuroProt+ device into the station control system and to apply active scheme screens of the local LCD of the device. Up to 32 Disconnector control function blocks can be configured.

The disconnector control function block receives remote commands from the SCADA system and local commands from the local LCD of the device, performs the prescribed checking and transmits the commands to the disconnector. It processes the status signals received from the disconnector and offers them to the status display of the local LCD and to the SCADA system.

**Main features:**

- Local (LCD of the device) and Remote (SCADA) operation modes can be enabled or disabled individually.
- Interlocking functions can be programmed by the user applying the inputs “EnaOff” (enabled trip command) and “EnaOn” (enabled close command), using the graphic equation editor.
- Programmed conditions can be used to temporarily disable the operation of the function block using the graphic equation editor.
- The function block supports the control models prescribed by the IEC 61850 standard.
- All necessary timing tasks are performed within the function block:
  - Time limitation to execute a command
  - Command pulse duration
  - Filtering the intermediate state of the disconnector
  - Controlling the individual steps of the manual commands
- Sending trip and close commands to the disconnector
- Operation counter
- Event reporting

The Disconnector control function block has binary input signals. The conditions are defined by the user applying the graphic equation editor. The signals of the disconnector control are seen in the binary input status list.

- **Thermal protection (49)**

Basically, thermal protection measures the three sampled phase currents. RMS values are calculated and the temperature calculation is based on the highest RMS value of the phase currents. The temperature calculation is based on the step-by-step solution of the thermal differential equation. This method yields “over temperature”, meaning the temperature above the ambient temperature. Accordingly, the temperature of the protected object is the sum of the calculated “over temperature” and the ambient temperature.

If the calculated temperature (calculated “over temperature” + ambient temperature) is above the threshold values, alarm, trip and restart blocking status signals are generated.

- **Definite time overvoltage protection (59)**

The definite time overvoltage protection function measures three voltages. The measured values of the characteristic

quantity are the RMS values of the basic Fourier components of the phase voltages. The Fourier calculation inputs are the sampled values of the three phase voltages (UL1, UL2, UL3), and the outputs are the basic Fourier components of the analyzed voltages (UL1Four, UL2Four, UL3Four). They are not part of the 59 function; they belong to the preparatory phase.

The function generates start signals for the phases individually. The general start signal is generated if the voltage in any of the three measured voltages is above the level defined by parameter setting value. The function generates a trip command only if the definite time delay has expired and the parameter selection requires a trip command as well.

The overvoltage protection function has a binary input signal, which serves the purpose of disabling the function. The conditions of disabling are defined by the user, applying the graphic equation editor.

- **Definite time undervoltage protection (27)**

The definite time undervoltage protection function measures the RMS values of the fundamental Fourier component of three phase voltages. The Fourier calculation inputs are the sampled values of the three phase voltages (UL1, UL2, UL3), and the outputs are the basic Fourier components of the analyzed voltages (UL1Four, UL2Four, UL3Four). They are not part of the TUV27 function; they belong to the preparatory phase.

The function generates start signals for the phases individually. The general start signal is generated if the voltage is below the preset starting level parameter setting value and above the defined blocking level. The function generates a trip command only if the definite time delay has expired and the parameter selection requires a trip command as well.

The operation mode can be chosen by the type selection parameter. The function can be disabled, and can be set to “1 out of 3”, “2 out of 3”, and “All”.

The overvoltage protection function has a binary input signal, which serves the purpose of disabling the function. The conditions of disabling are defined by the user, applying the graphic equation editor.

- **Residual definite time overvoltage protection function (59N)**

The residual definite time overvoltage protection function operates according to definite time characteristics, using the RMS values of the fundamental Fourier component of the zero sequence voltage (UN=3Uo). The Fourier calculation inputs are the sampled values of the residual or neutral voltage (UN=3Uo) and the outputs are the RMS value of the basic Fourier components of those.

The function generates start signal if the residual voltage is above the level defined by parameter setting value. The function generates a trip command only if the definite time delay has expired and the parameter selection requires a trip command as well.

The residual overvoltage protection function has a binary input signal, which serves the purpose of disabling the function. The conditions of disabling are defined by the user, applying the graphic equation editor.

- **Over-frequency protection (81O)**

The deviation of the frequency from the rated system frequency indicates unbalance between the generated power and the load demand. If the available generation is large compared to the consumption by the load connected to the power system, then the system frequency is above the rated value. The over-frequency protection function is usually applied to decrease generation to control the system frequency. Another possible application is the detection of unintended island operation of distributed generation and some consumers. In the island, there is low probability that the power generated is the same as consumption; accordingly, the detection of high frequency can be one of the indication of island operation.

The over-frequency protection function generates a start signal if at least five measured frequency values are above the preset level. Time delay can also be set.

The function can be enabled/disabled by a parameter.

The over-frequency protection function has a binary input signal. The conditions of the input signal are defined by the user, applying the graphic equation editor. The signal can block the under-frequency protection function.

- **Underfrequency protection (81U)**

The deviation of the frequency from the rated system frequency indicates unbalance between the generated power and the load demand. If the available generation is small compared to the consumption by the load connected to the power system, then the system frequency is below the rated value. The under-frequency protection function is usually applied to increase generation or for load shedding to control the system frequency. Another possible application is the detection of unintended island operation of distributed generation and some consumers. In the island, there is low probability that the power generated is the same as consumption; accordingly, the detection of low frequency can be one of the indications of island operation. Accurate frequency measurement is also the criterion for the synchro-check and synchro- switch functions.

The under-frequency protection function generates a start signal if at least five measured frequency values are below the setting value.Time delay can also be set.

The function can be enabled/disabled by a parameter.

The under-frequency protection function has a binary input signal. The conditions of the input signal are defined by the user, applying the graphic equation editor. The signal can block the under-frequency protection function.

- **Rate of change of frequency protection (81R)**

The deviation of the frequency from the rated system frequency indicates unbalance between the generated power and the load demand. If the available generation is large

compared to the consumption by the load connected to the power system, then the system frequency is above the rated value, and if it is small, the frequency is below the rated value. If the unbalance is large, then the frequency changes rapidly. The rate of change of frequency protection function is usually applied to reset the balance between generation and consumption to control the system frequency. Another possible application is the detection of unintended island operation of distributed generation and some consumers. In the island, there is low probability that the power generated is the same as consumption; accordingly, the detection of a high rate of change of frequency can be an indication of island operation.

The rate of change of frequency protection function generates a start signal if the df/dt value is above the setting value. The rate of change of frequency is calculated as the difference of the frequency at the present sampling and at three periods earlier. Time delay can also be set.

The function can be enabled/disabled by a parameter.

The rate of change of frequency protection function has a binary input signal. The conditions of the input signal are defined by the user, applying the graphic equation editor. The signal can block the rate of change of frequency protection function.

- **Current unbalance function (60)**

The current unbalance protection function (60) can be applied to detect unexpected asymmetry in current measurement. The applied method selects maximum and minimum phase currents (RMS value of the fundamental Fourier components). If the difference between them is above the setting limit, the function generates a start signal. It is a necessary precondition of start signal generation that the maximum of the currents be above 10 % of the rated current and below 150% of the rated current. The Fourier calculation modules calculate the RMS value of the basic Fourier current components of the phase currents individually. They are not part of the VCB60 function; they belong to the preparatory phase.

The decision logic module combines the status signals to generate the starting signal and the trip command of the function. The trip command is generated after the defined time delay if trip command is enabled by the Boolean parameter setting.

The function can be disabled by parameter setting, and by an input signal programmed by the user with the graphic programming tool.

- **Breaker failure protection (50BF)**

After a protection function generates a trip command, it is expected that the circuit breaker opens and the fault current drops below the pre-defined normal level. If not, then an additional trip command must be generated for all backup circuit breakers to clear the fault. At the same time, if required, a repeated trip command can be generated to the circuit breakers which are a priori expected to open. The breaker failure protection function can be applied to perform this task.

The starting signal of the breaker failure protection function is usually the trip command of any other protection function. Dedicated timer starts at the rising edge of the general start signal for the backup trip command. During the running time of the timer the function optionally monitors the currents, the closed state of the circuit breakers or both, according to the user's choice. The selection is made using an enumerated parameter.

If current supervision is selected by the user then the current limit values must be set correctly. The binary input indicating the status of the circuit breaker has no meaning.

If contact supervision is selected by the user then the current limit values have no meaning. The binary input indicating the status of the circuit breaker must be programmed correctly using the graphic equation editor.

If the parameter selection is "Current/Contact", the current parameters and the status signal must be set correctly. The breaker failure protection function resets only if all conditions for faultless state are fulfilled.

If at the end of the running time of the backup timer the currents do not drop below the pre- defined level, and/or the monitored circuit breaker is still in closed position, then a backup trip command is generated.

The pulse duration of the trip command is not shorter than the time defined by setting the parameter Pulse length.

The breaker failure protection function can be disabled by setting the enabling parameter to "Off".

Dynamic blocking (inhibition) is possible using the binary input Block. The conditions are to be programmed by the user, using the graphic equation editor.

- **Synchro check (25)**

Several problems can occur in the electric power system if the circuit breaker closes and connects two systems operating asynchronously. The high current surge can cause damage in the interconnecting elements, the accelerating forces can overstress the shafts of rotating machines or, at last, the actions taken by the protective system can result in the unwanted separation of parts of the electric power system. To prevent such problems, this function checks whether the systems to be interconnected are operating synchronously. If yes, then the close command is transmitted to the circuit breaker. In case of asynchronous operation, the close command is delayed to wait for the appropriate vector position of the voltage vectors on both sides of the circuit breaker. If the conditions for safe closing cannot be fulfilled within an expected time, then closing is declined.

There are three modes of operation:

- Energizing check:
  - Dead bus, live line,
  - Live bus, dead line,
  - Any Energizing Case (including Dead bus, dead line).
- Synchro check (Live line, live bus)
- Synchro switch (Live line, live bus)

The function can be started by the switching request signals

initiated both the automatic reclosing and the manual closing. The binary input signals are defined by the user, applying the graphic equation editor.

Blocking signal of the function are defined by the user, applying the graphic equation editor. Blocking signal of the voltage transformer supervision function for all voltage sources are defined by the user, applying the graphic equation editor.

Signal to interrupt (cancel) the automatic or the manual switching procedure are defined by the user, applying the graphic equation editor.

- **Auto-reclose protection (79)**

The automatic reclosing function can realize up to four shots of reclosing. The dead time can be set individually for each reclosing and separately for earth faults and for multi-phase faults. All shots are of three phase reclosing. The starting signal of the cycles can be generated by any combination of the protection functions or external signals of the binary inputs.

The automatic reclosing function is triggered if as a consequence of a fault a protection function generates a trip command to the circuit breaker and the protection function resets because the fault current drops to zero or the circuit breaker's auxiliary contact signals open state. According to the preset parameter values, either of these two conditions starts counting the dead time, at the end of which the automatic reclosing function generates a close command automatically. If the fault still exits or reappears, then within the "Reclaim time" the protection functions picks up again and the subsequent cycle is started. If the fault still exists at the end of the last cycle, the automatic reclosing function trips and generates the signal for final trip. If no pickup is detected within this time, then the automatic reclosing cycle resets and a new fault will start the procedure with the first cycle again.

At the moment of generating the close command, the circuit breaker must be ready for operation, which is signaled via the binary input "CB Ready". The preset parameter value "CB Supervision time" decides how long the automatic reclosing function is allowed to wait at the end of the dead time for this signal. If the signal is not received during this dead time extension, then the automatic reclosing function terminates.

Depending on binary parameter settings, the automatic reclosing function block can accelerate trip commands of the individual reclosing cycles. This function needs user-programmed graphic equations to generate the accelerated trip command. The automatic reclosing function can be blocked by a binary input. The conditions are defined by the user applying the graphic equation editor

- **Automatic tap-changer controller (90)**

One criterion for power quality is to keep the voltage of selected points of the networks within the prescribed limits. The most common mode of voltage regulation is the application of transformers with on-load tap changers. When the transformer is connected to different taps, its turns ratio changes and supposing constant primary voltage, the secondary voltage can be increased or decreased as required.

Voltage control can take the actual load state of the transformer and the network into consideration. As a result, the voltage of a defined remote point of the network is controlled assuring that neither consumer near the busbar nor consumers at the far ends of the network get voltages out of the required range.

The voltage control function can be performed automatically or, in manual mode of operation, the personnel of the substation can set the network voltage according to special requirements.

The automatic tap changer controller function can be applied to perform this task. The automatic tap changer controller function receives the following analog inputs:

- UL1L2 Line-to-line voltage of the controlled secondary side of the transformer
- IL1L2 Difference of the selected line currents of the secondary side of the transformer for voltage drop compensation
- IHV Maximum of the phase currents of the primary side of the transformer for limitation purposes

The parameter "U Correction" permits fine tuning of the measured voltage.

The function performs the following internal checks before control operation (see Figure below):

- If the voltage of the controlled side UL1L2 is above the value set by the parameter "U High Limit", then control to increase the voltage is disabled.
- If the voltage of the controlled side UL1L2 is below the value set by the parameter "U Low Limit", then control to decrease the voltage is disabled.
- If the voltage of the controlled side UL1L2 is below the value set by the parameter "U Low Block", then the transformer is considered to be de-energized and automatic control is completely disabled.
- If the current of the supply side IHV is above the limit set by the parameter "I Overload", then both automatic and manual controls are completely disabled. This is to protect the switches inside the tap changer

There are two modes for Automatic tap-changer controller function:

- Automatic control mode
- Manual control mode

- **Trip circuit supervision (74)**

The trip circuit supervision is utilized for checking the integrity of the circuit between the trip coil and the tripping output of the protection device.

This is realized by injecting a small DC current (around 1-5 mA) into the trip circuit. If the circuit is intact, the current flows, causing an active signal to the opto coupler input of the trip contact.

The state of the input is shown on the devices' binary input listing among the other binary inputs, and it can be handled like any other of them (it can be added to the user logic, etc.)

- **Lockout trip logic (86/94)**

The lockout version of the simplified trip logic function operates according to the functionality required by the IEC 61850 standard for the "Trip logic logical node". Its output can be set to lockout and be reset externally.

This simplified software module can be applied if only three-phase trip commands are required, that is, phase selectivity is not applied.

The function receives the trip requirements of the protective functions implemented in the device and combines the binary signals and parameters to the outputs of the device.

The operation can be normal or lockout. In normal mode, the output remains energized at least for a given pulse time and drops off as soon as the trip input drops off. The aim of this decision logic is to define a minimal impulse duration even if the protection functions detect a very shorttime fault.

In lockout mode the output stays active until the function gets a reset signal on its reset input.

The trip requirements and the reset signal are programmed by the user, using the graphic equation editor.

## MEASUREMENT FUNCTIONS

- **Measurement functions**

  Based on the hardware inputs the measurements listed in table below are available.

| Measurement functions | E1-BCU | E2-BCU |
|---|---|---|
| Current (I1, I2, I3, I4, Iseq (I0, I1, I2)) | | X |
| Voltage (U1, U2, U3, U4, U12, U23, U31, Useq (U0, U1, U2)) and frequency | | X |
| Power (P, Q, S, pf) and Energy (E+, E-, Eq+, Eq-) | | X |
| Circuit breaker wear | X | X |
| Supervised trip contacts (TCS) | X | X |

*The measurement functions of the DVEZ configuration*

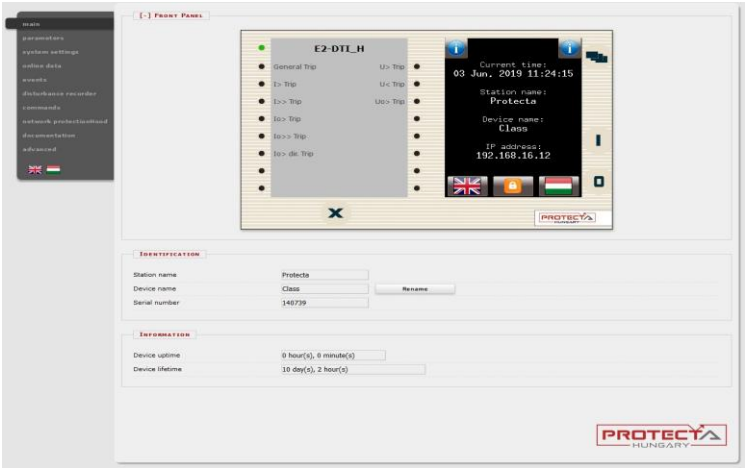
- **Monitoring functions**

  The **DVEZ** product type can monitor and detect current and voltage harmonics and short duration system disturbances such as:

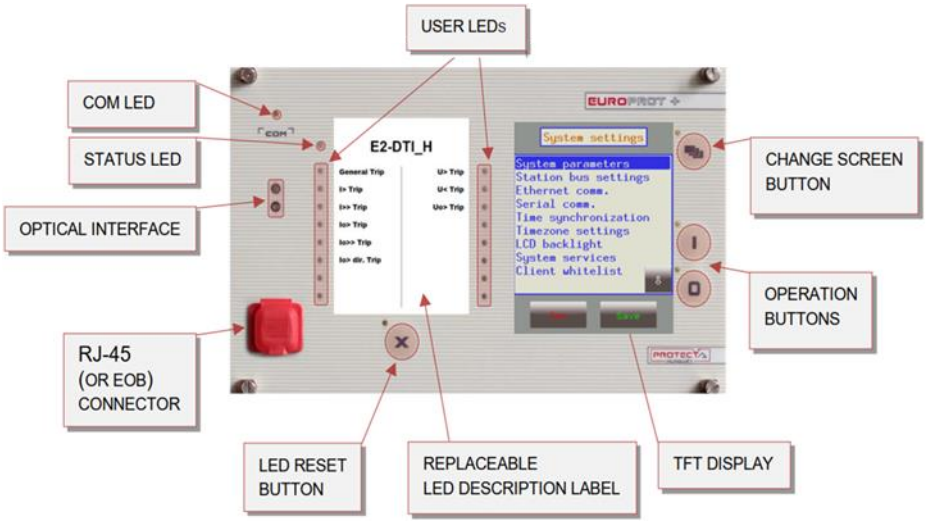
  - Harmonics contents of each voltage and current channel (order 1$^{st}$ to order 19$^{th}$)
  - Current total demand distortion (TDD)
  - Voltage total harmonic distortion (THD)
  - Sags (Dips), Swells and Interrupts

## HMI AND COMMUNICATION TASKS

- **Embedded WEB-server:** Allows remote access via Ethernet port of device
  - Firmware upgrade possibility
  - Modification of user parameters
  - Events list and disturbance records
  - Password management
  - Online data measurement
  - Commands
  - Administrative tasks




- **Front panel TFT display handling:** the interactive menu set is available through the TFT and the touchscreen interface.
- **User keys:** capacitive touch keys on front panel




- **Communication:**
  - The built-in 5-port Ethernet switch allows EuroProt+ to connect to IP/Ethernet-based network. The following Ethernet ports are available:
    - Station bus (100Base-FX Ethernet) SBW
    - Redundant station bus (100Base-FX Ethernet) SBR
    - Process bus (100Base-FX Ethernet)
    - EOB or EOB2 (Ethernet Over Board) or RJ-4 Ethern user interface on front panel
    - Optional 10/100Base-T port via RJ-45 connector
  - PRP/HSR seamless redundancy for Ethernet networking (100Base-FX Ethernet; 10/100Base-TX Ethernet)
  - Redundancy RJ-45 for Ethernet networking (10/100Base-TX Ethernet)
  - Other communication:
    - RS422/RS485 interfaces (galvanic interface to support legacy or other serial protocols, ASIF)
    - Plastic or glass fiber interfaces to support legacy protocols, ASIF
    - Proprietary process bus communication controller on COM+ module

## FUNCTIONAL PARAMETERS

| | |
|---|---|
| **Circuit breaker control function block (CB1Pol)** | |
| ControlModel | Direct normal, Direct enhanced, SBO enhanced |
| Forced check | If true, then the check function cannot be neglected by the check attribute defined by the IEC 61850 standard |
| Max.Operating time | 10-1000ms in 1ms steps |
| Pulse length | 50-500ms in 1ms steps |
| Max.Intermediate time | 20-30000ms in 1ms steps |
| Max.SynChk time | 10-5000ms in 1ms steps |
| Max.SynSW time | 0-60000ms in 1ms steps |
| SBO Timeout | 1000-20000ms in 1ms steps |
| **Disconnector control function (DisConn)** | |
| ControlModel | Direct normal, Direct enhanced, SBO enhanced |
| Type of switch | N/A ,Load break, Disconnector, Earthing Switch, HS Earthing Switch |
| Forced check | If true, then the check function cannot be neglected by the check attribute defined by the IEC 61850 standard |
| Max.Operating time | 10-20000ms in 1ms steps |
| Pulse length | 50-30000ms in 1ms steps |
| Max.Intermediate time | 20-30000ms in 1ms steps |
| SBO Timeout | 1000-20000ms in 1ms steps |
| **Thermal protection (49)** | |
| Operation | Off, Pulsed, Locked |
| Alarm Temperature | 60-200deg in 1deg steps |
| Trip Temperature | 60-200deg in 1deg steps |
| Rated Temperature | 60-200deg in 1deg steps |
| Base Temperature | 0-40deg in 1deg steps |
| Unlock Temperature | 20-200deg in 1deg steps |
| Ambient Temperature | 0-40deg in 1deg steps |
| Startup Term | 0-60% in 1% steps |
| Rated Load Current | 20-150% in 1% steps |
| Time Constan | 1-999min in 1min step |
| **Definite time overvoltage protection (59)** | |
| Operation | Off, On |
| Start Voltage | 30-130% in 1% steps |
| Reset Ratio | 1-10% in 1% steps |
| Time Delay | 0-60000ms in 1ms steps |
| **Definite time undervoltage protection (27)** | |
| Operation | Off, 1 out of 3, 2 out of 3, All |
| Start Voltage | 30-130% in 1% steps |
| Block Voltage | 0-20% in 1% steps |
| Reset Ratio | 1-10% in 1% steps |
| Time Delay | 50-60000ms in 1ms steps |
| **Residual time overcurrent protection (51N/51Ns)** | |
| Operation | Off, DefiniteTime, IEC Inv,IEC VeryInv, IEC ExtInv,IEC LongInv, |

| | |
|---|---|
| | ANSI Inv, ANSI ModInv, ANSI VeryInv, ANSI ExtInv, ANSI LongInv, ANSI LongVeryInv, ANSI LongExtInv |
| Start current | |
| In = 1A or 5A | 5-3000% in 1% steps |
| In = 200mA or 1A | 5-3000% in 1% steps |
| Time Multiplier | 0.05-999 in 0.01 steps |
| Minimum time delay for the inverse char. | 40-60000ms in 1ms steps |
| Definite time delay for definite type char. | 40-60000ms in 1ms steps |
| Reset time delay for the inverse char. | 60-60000ms in 1ms steps |
| **Definite time overvoltage protection (59)** | |
| Operation | Off, On |
| Start Voltage | 30-130% in 1% steps |
| Reset Ratio | 1-10% in 1% steps |
| Time Delay | 0-60000ms in 1ms steps |
| **Residual overvoltage protection (59N)** | |
| Operation | Off, On |
| Start Voltage | 2-60% in 1% steps |
| Time Delay | 0-60000ms in 1ms steps |
| **Overfrequency protection (81O)<br>Undefrequency protection (81U)** | |
| Operation | Off, On |
| Start signal only | False, True |
| Start frequency | 40-70Hz in 0.01Hz steps |
| Time Delay | 0-60000ms in 1ms steps |
| Voltage limit | 0.3-1.0 Un |
| **Rate of change of frequency protection (81R)** | |
| Operation | Off, On |
| Start signal only | False, True |
| Start df/dt | -5.00-5.00Hz/s in 0.01Hz/s steps |
| Time Delay | 0-60000ms in 1ms steps |
| **Breaker failure protection (50BF)** | |
| Operation | Off, Current, Contact, Current/Contact |
| Retrip | Off, On |
| Start Ph Current | 20-200% in 1% steps |
| Start Res Current | 10-200% in 1% steps |
| Retrip Time Delay | 0-1000ms in 1ms steps |
| Backup Time Delay | 100-60000ms in 1ms steps |
| Pulse Duration | 0-60000ms in 1ms steps |
| **Current unbalance protection (60)** | |
| Operation | Off, On |
| Start Signal Only | False, True |
| Start Current Diff | 10-90% in 1% steps |
| Time Delay | 100-60000ms in 1ms steps |
| **Synchrocheck (25)** | |

| | |
|---|---|
| Voltage Select | L1-N, L2-N, L3-N, L1-L2, L2-L3, L3-L1 |
| Voltage Select | Off, On, ByPass |
| SynSW Auto | Off, On |
| Energizing Auto | Off, DeadBus LiveLine, LiveBus DeadLine, Any energ case |
| Operation Man | Off, On, ByPass |
| SynSW Man | Off, On |
| Energizing Man | Off,DeadBus LiveLine, LiveBus DeadLine, Any energ case |
| U Live | 60-110% in 1% steps |
| U Dead | 10-60% in 1% steps |
| Udiff Syncheck auto | 5-30% in 1% steps |
| Udiff SynSW auto | 5-30% in 1% steps |
| MaxPhaseDiff auto | 5-80º in 1º steps |
| Udiff SynCheck Man | 5-30% in 1% steps |
| Udiff SynSW Man | 5-30% in 1% steps |
| MaxPhaseDiff Man | 5-80º in 1º steps |
| FrDiff SynCheck Auto | 0.02-0.5Hz in 0.02Hz steps |
| FrDiff SynSW Auto | 0.10-1.00Hz in 0.2Hz steps |
| FrDiff SynCheck Man | 0.02-0.5Hz in 0.02Hz steps |
| FrDiff SynSW Man | 0.10-1.00Hz in 0.2Hz steps |
| Breaker Time | 0-500ms in 1ms steps |
| Close Pulse | 10-60000ms in 1ms steps |
| Max Switch Time | 100-60000ms in 1ms steps |
| **Auto-reclose (79)** | |
| Operation | Off, On |
| EarthFault RecCycle | Disabled, 1. Enabled, 1.2. Enabled, 1.2.3. Enabled, 1.2.3.4. Enabled |
| PhaseFault RecCycle | Disabled, 1. Enabled, 1.2. Enabled, 1.2.3. Enabled, 1.2.3.4. Enabled |
| Reclosing Started by | Trip reset, CB open |
| 1. Dead Time Ph | 0-100000ms in 10ms steps |
| 2. Dead Time Ph | 10-100000ms in 10ms steps |
| 3. Dead Time Ph | 10-100000ms in 10ms steps |
| 4. Dead Time Ph | 10-100000ms in 10ms steps |
| 1. Dead Time EF | 0-100000ms in 10ms steps |
| 2. Dead Time EF | 10-100000ms in 10ms steps |
| 3. Dead Time EF | 10-100000ms in 10ms steps |
| 4. Dead Time EF | 10-100000ms in 10ms steps |
| Reclaim Time | 100-300000ms in 10ms steps |
| Close Command Time | 10-10000ms in 10ms steps |
| Dynamic Blocking Time | 10-100000ms in 10ms steps |
| Block after Man Close | 0-100000ms in 10ms steps |
| Action Time | 0-20000ms in 10ms steps |
| Start Signal Max Time | 0-10000ms in 10ms steps |
| DeadTime Max Delay | 0-100000ms in 10ms steps |
| CB Supervision Time | 10-100000ms in 10ms steps |
| SynCheck Max Time | 500-100000ms in 10ms steps |
| SynCheck Max Time | 500-100000ms in 10ms steps |
| CB State Monitoring | False, True |
| Accelerate 1.Trip | False, True |
| Accelerate 2.Trip | False, True |
| Accelerate 3.Trip | False, True |

| | |
|---|---|
| Accelerate 4.Trip | False, True |
| **Lockout trip logic (86/94)** | |
| Operation<br>Min pulse duration | Off, On, Lockout<br>50-60000ms in 1ms steps |

| **Disturbance recorder** | |
|---|---|
| Operation<br>Resolution<br>Prefault<br>PostFault<br>Max Recording Time | Off, On<br>1/1.2 kHz; 2/2.4kHz<br>100-1000ms in 1ms steps<br>100-10000ms in 1ms steps<br>500-10000ms in 1ms steps |

## TECHNICAL DATA

| HARDWARE | |
|---|---|
| **Analog Inputs (Current & Voltage Input Modules)** | |
| Rated current In | 1A or 5A (selectable) |
| Rated voltage Vn | 110V (± 10%) |
| Rated frequency | 50Hz or 60Hz |
| Overload rating | |
| Current inputs | 20A continuous, 175A for 10s, 500A for 1s, 1200A for 10ms |
| Voltage inputs | 250V continuous, 275V for 1s |
| Burden | |
| Phase current inputs | 0.01VA at In = 1A, 0.25VA at In = 5A |
| Voltage inputs | 0.61VA at 200V, 0.2VA at 100V |
| **Power Supply** | |
| Rated auxiliary voltage | 24/48/60VDC (Operative range: 19.2 - 72VDC)<br>110/220VDC (Operative range: 88 - 264VDC or 80-250VAC) |
| Power consumption | 20W, 25W, 30W, 60W (Depend on type of power supply module) |
| **Binary Inputs** | |
| Input circuit DC voltage | 24VDC (Thermal withstand voltage: 72VDC)<br>48VDC (Thermal withstand voltage: 100VDC)<br>110VDC (Thermal withstand voltage: 250VDC)<br>220VDC (Thermal withstand voltage: 320VDC) |
| Pickup voltage | 0.8Un |
| Drop voltage | 0.64Un |
| Power consumption | max. 1.6 mA per channel at 220VDC<br>max. 1.8 mA per channel at 110VDC<br>max. 2 mA per channel at 48VDC<br>max. 3 mA per channel at 24VDC |
| **Binary Outputs** | |
| Rated voltage | 250VAC/DC |
| Continuous carry | 8A |
| Maximum switching voltage | 400VAC |
| Breaking capacity | 0.2A at 220VDC, 0.3A at 110VDC (L/R=40ms)<br>2000VA max |
| Short time carrying capacity | 35A for 1s |
| Operating time | Typically 10ms |
| **Trip Contacts** | |
| Rated voltage | 24VDC/48VDC/110VDC/220VDC |
| Continuous carry | 8A |
| Thermal withstand voltage | 72VDC (Rated voltage: 24VDC or 48VDC)<br>150VDC (Rated voltage: 110VDC)<br>242VDC (Rated voltage: 220VDC) |
| Breaking capacity | 4A (L/R=40ms) |
| Making capacity | 30A for 0.5s |
| Operating time | With pre-trip 0.5 ms, without pre-trip typically 10 ms |

| | |
|---|---|
| **Analog input module (AIC)** | |
| Measurement method<br>Measurement ranges<br>Relative accuracy | 2 wire inputs<br>± 20 mA, typical 0÷20 mA, 4÷20 mA<br>± 0.5 % ± 1 digit |
| **RTD input module** | |
| Measurement method<br>Sensor type<br><br>Measurement ranges<br>Accuracy | 2, 3 or 4 wire configuration<br>Pt100/Ni100, Ni120/Ni120US, Pt250/Ni250, Pt1000/Ni1000, Cu10, Service-Ohm(60 Ω … 1.6 kΩ)<br>$-50^0$C ÷ $+150^0$C<br>± 0.5 % ± 1 digit |
| **Analog output module (ATO)** | |
| Channel number<br>Output type<br>Maximum load<br>Output ranges | 2 or 4 channel<br>2 wire<br>500 Ω<br>± 20 mA, typical 0÷20 mA, 4÷20 mA |
| **Mechanical Design** | |
| Installation<br>Case<br>Protection class | Flush mounting<br>42 or 84 HP (height:3U)<br>IP4x from front side, IP2x from rear side<br>IP54 Rated mounting kit |
| **Key & LED** | |
| Device keys<br>Capacitive touch key LEDS<br>Number of configurable LED<br>Device status LED | Capacitive touch keys<br>4 pcs yellow, 3 mm circular LEDs indicating touch key actions<br>16<br>1 piece three-color, 3 mm circular LED<br>Green: normal device operation<br>Yellow: device is in warning state<br>Red: device is in error state |
| **Local Interface** | |
| Service port on front panel | 10/100-Base-T interface with RJ-45 type connector |
| **System Interface** | |
| 10/100-Base-TX<br>100Base-FX<br><br><br><br><br>Serial Interface | IP56 rated with RJ-45 connector<br>MM/ST 1300 nm, 50/62.5/125 µm connector, (up to 2 km) fiber<br>MM/LC 1300 nm, 50/62.5/125 µm connector, (up to 2 km) fiber<br>SM/FC 1550 nm, 9/125 µm connector, (up to 120 km), with max. 32 dB link attenuation<br>SM/FC 1550 nm, 9/125 µm connector, (up to 50 km), with max. 27 dB link attenuation<br>Plastic optical fiber (ASIF-POF)<br>Glass with ST connector (ASIF-GS)<br>Galvanic RS485/422 (ASIF-G) |
| **PROTECTION & CONTROL FUNCTIONS** | |
| **Circuit breaker control function block (CB1Pol)** | |

| | |
|---|---|
| Operate time accuracy | ±5% or ±15 ms, whichever is greater |
| **Disconnector control function (DisConn)** | |
| Operate time accuracy | ±5% or ±15 ms, whichever is greater |
| **Thermal protection (49)** | |
| Operate time at I>1.2*Itrip accuracy | <3 % or <+ 20 ms |
| **Definite time overvoltage protection (59)** | |
| Pick-up starting accuracy | < ± 0,5 % |
| Reset time | |
| U> → Un | 60 ms |
| U> → 0 | 50 ms |
| Operate time accuracy | < ± 20 ms |
| Minimum operate time | 50 ms |
| **Definite time undervoltage protection (27)** | |
| Pick-up starting accuracy | < ± 0,5 % |
| Reset time | |
| U> → Un | 50 ms |
| U> → 0 | 40 ms |
| Operate time accuracy | < ± 20 ms |
| Minimum operate time | 50 ms |
| **Residual overvoltage protection (59N)** | |
| Pick-up starting accuracy | |
| 2 – 8 % | < ± 2 % |
| 8 – 60 % | < ± 1.5 % |
| Reset time | |
| U> → Un | 60 ms |
| U> → 0 | 50 ms |
| Operate time | 50 ms |
| Operate time accurracy | < ± 20 ms |
| **Overfrequency protection (81O)**<br>**Undefrequency protection (81U)** | |

| | |
|---|---|
| Min. operate voltage | 0.1 Un |
| Operate range | 40 - 60 Hz (50 Hz system)<br>50 - 70 Hz (60 Hz system) |
| Effective range | 45 - 55 Hz (50 Hz system)<br>55 - 65 Hz (60 Hz system) |
| Accuracy | ± 3 mHz |
| Minimum operate time | 93ms (50 Hz system)<br>73ms Hz (60 Hz system) |
| Minimum operate time accuracy | ± 32 ms (50 Hz system)<br>± 27 ms (60 Hz system) |
| Accuracy when time delay: | |
| 140 – 60000 ms | ± 4 ms |
| <140 ms (50 Hz system) | ± 32 ms |
| <140 ms (60 Hz system) | ± 27 ms |
| Reset frequency | [Start freq.] – 101 mHz, accuracy: ± 1 mHz |
| Reset time | 98 ms (50 Hz)<br>85 ms (60 Hz) |
| Reset time accuracy | ± 6 ms |
| **Rate of change of frequency protection (81R)** | |
| Min. operate voltage | 0.1 Un |
| Operate range | ± 10 Hz/s, accuracy: ± 50 mHz/s |
| Effective range | ± 5 Hz/s, accuracy: ± 15 mHz/s |
| Minimum operate time | 191 ms (50 Hz system), accuracy: ± 40 ms<br>159 ms (60 Hz system), accuracy: ± 39 ms<br>200 – 60000 ms (50 Hz), accuracy: ± 2 ms |
| Time delay (at 0.2 Hz/s) | ± 1 mHz |
| Reset ratio (drop/pick in absolute values) | 0.92 (>0.5 Hz/s), accuracy: -0.03<br>0.999 (<0.5 Hz/s), accuracy: -0.072 |
| Reset time | 187 ms (50Hz), accuracy: ±44ms<br>157 ms (60Hz), accuracy: ±38 ms |
| **Breaker failure protection (50BF)** | |
| Pick-up starting accuracy | <2 % |
| Operating time accuracy | ±5% or ±15 ms, whichever is greater |
| Retrip time | approx. 15 ms |
| Reset ratio | 0.9 |
| Current reset time | 16-25ms |
| **Current unbalance protection (60)** | |
| Pick-up starting accuracy at In | Pick-up starting accuracy at In |
| Reset ratio | 0.95 |
| Operate time | 70 ms |
| **Synchrocheck (25)** | |
| Rated Voltage Un | 100/200V, parameter setting |
| Voltage effective range | 10-110 % of Un, accuracy: ±1% of Un |
| Frequency | 47.5 – 52.5 Hz, accuracy: ±10 mHz |
| Phase angle accuracy | ±3 ° |
| Operate time | Setting value, accuracy: ±3 ms |
| Reset time | <50 ms |
| Reset ratio | 0.95 Un |

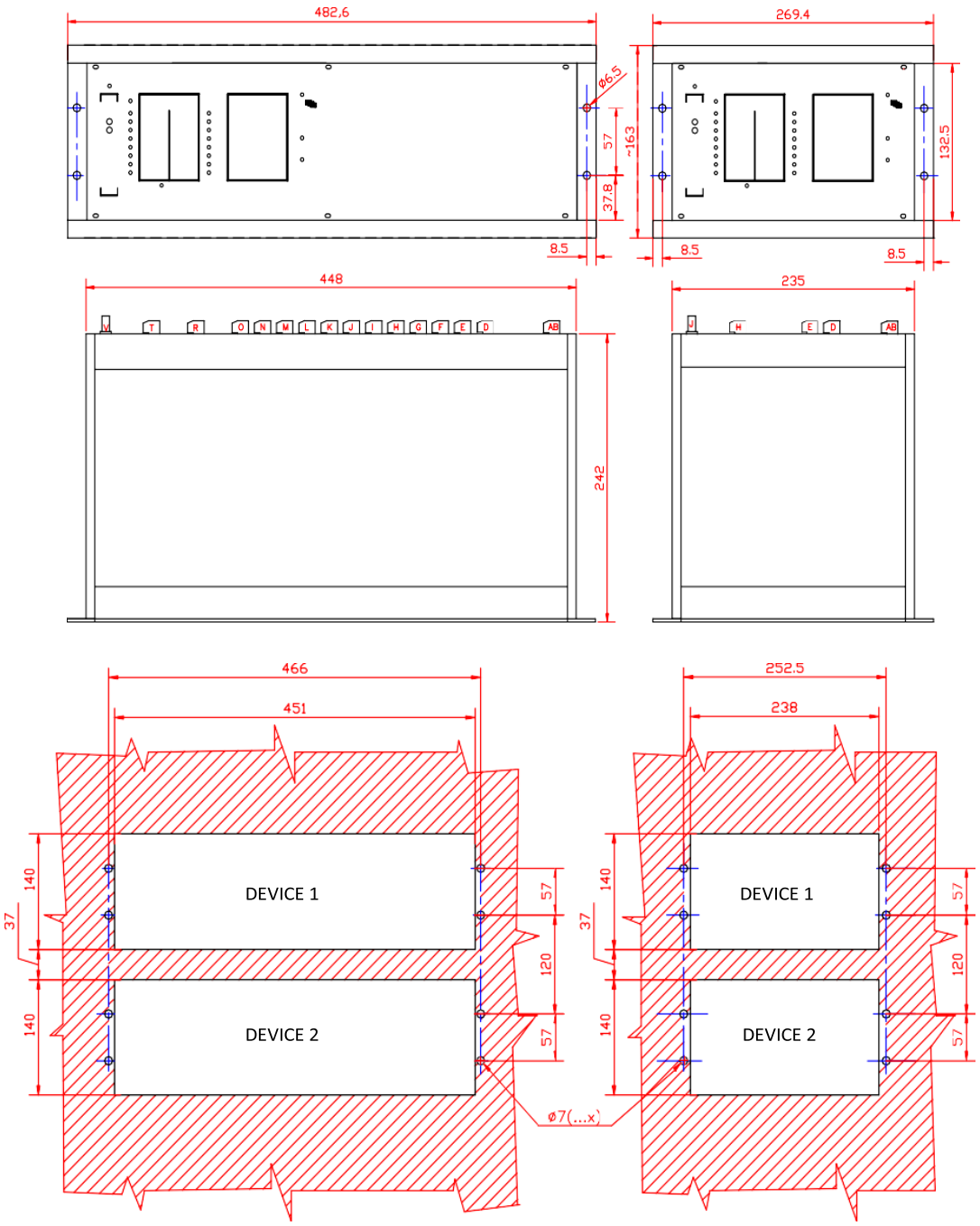
| | |
|---|---|
| **Auto-reclose (79)** | |
| Operating time accuracy | ±1% of setting value or ±30 ms |
| **Automatic tap-changer controller function (90)** | |
| Voltage measurement<br>Definite time delay accuracy<br>Inverse and “2powerN” time delay accuracy<br>12 % < U < 25%<br>25 % < U < 50% | 50 % < U < 130 %, accuracy: <1%<br><2% or ±20 ms, whichever is greater<br><br><5%<br><2% or ±20 ms, whichever is greater |
| **Lockout trip logic (86/94)** | |
| Pulse time | <3 ms |
| **MEASUREMENT FUNCTION** | |
| **Current**<br>With CT+/5151; CT+/5153 (Channel 1-3)<br>With CT+/1500<br>**Voltage**<br>With VT+/2211<br>**Power (P,Q,S, PF)**<br>With CT+/5151; CT+/5153 (Channel 1-3)<br>With CT+/1500<br>**Frequency** | <br>Range: 0.05 – 20 In, accuracy: ±0.5%, ±1 digit<br>Range: 0.02 – 2 In, accuracy: ±0.2%, ±1 digit<br><br>Range: 0.05 – 1.5 Un, accuracy: ±0.5%, ±1 digit<br><br>Range: 0.05 – 20 In, accuracy: ±0.5%, ±1 digit<br>Range: 0.02 – 2 In, accuracy: ±0.2%, ±1 digit<br><br>Range: 40 – 60 Hz (50Hz system); accuracy: ±2mHz<br>Range: 50 – 70 Hz (60Hz system); accuracy: ±2mHz |

## ENVIRONMENTAL PERFORMANCE

| | | |
|---|---|---|
| **Atmospheric Environment** | | |
| Temperature | IEC 60068-2-1<br>IEC 60068-2-2<br>IEC 60068-2-14 | Storage temperature: - 40 ºC … + 70 ºC<br>Operation temperature: - 20 ºC … + 55 ºC |
| Humidity | IEC 60255-1<br>IEC 60068-2-78<br>IEC 60068-2-30 | Humidity: 10 % ... 93 % |
| Enclosure protection | IEC 60529 | IP41 from front side, IP2x from rear side<br>IP54 Rated mounting kit |
| **Mechanical Environment** | | |
| Vibration | IEC 60255-21-1 | Class I |
| Shock and bump | IEC 60255-21-2 | Class I |
| Seismic | IEC 60255-21-3 | Class I |
| **Electrical Environment** | | |
| Dielectric withstand | IEC 60255-27 | Test levels: 2 kV AC 50 Hz (0.705 kV DC for transducer inputs) |
| High voltage impulse | IEC 60255-27 | Test levels: 5 kV (1 kV for transducer and temperature measuring inputs) |
| Insulation resistance | IEC 60255-27 | Insulation resistance > 15 GΩ |
| Voltage dips, interruptions, variations and ripple on dc supply | IEC 60255-26 | Voltage dips: 40 % (200 ms), 70 % (500ms), 80 % (5000 ms) |
| Thermal short time | IEC 60255-27 | |
| **Electromagnetic Environment** | | |
| Electrostatic discharge | IEC 61000-4-2<br>IEC 60255-26 | Test voltages: 15 kV air discharge, 8 kV contact discharge |
| Radiated radio frequency electromagnetic field immunity | IEC 61000-4-3<br>IEC 60255-26 | Test field strength: 10 V/m |
| Electrical fast transient | IEC 61000-4-4<br>IEC 60255-26 | Test voltage: 4 kV, 5kHz |
| Surge immunity | IEC 61000-4-5<br>IEC 60255-26 | Test voltages: 4 kV line-to-earth, 2 kV line-to-line |
| Immunity to conducted disturbances, induced by radio-frequency fields | IEC 61000-4-6<br>IEC 60255-26 | Frequency sweep: 150kHz…80 MHz<br>Spot frequencies: 27 MHz, 68 MHz<br>Test voltage: 10 V |
| Power frequency magnetic field immunity | IEC 61000-4-8<br>IEC 60255-26 | Test field field strength: 100 A/m continuous, 1000 A/m for 3 s |
| Damped oscillatory wave immunity | IEC 61000-4-18<br>IEC 60255-26 | Test frequency: 100 kHz, 1 MHz<br>Test voltage: 2.5 kV in common mode, 1 kV in differential mode |

## DIMENSION AND PANEL CUT-OUT

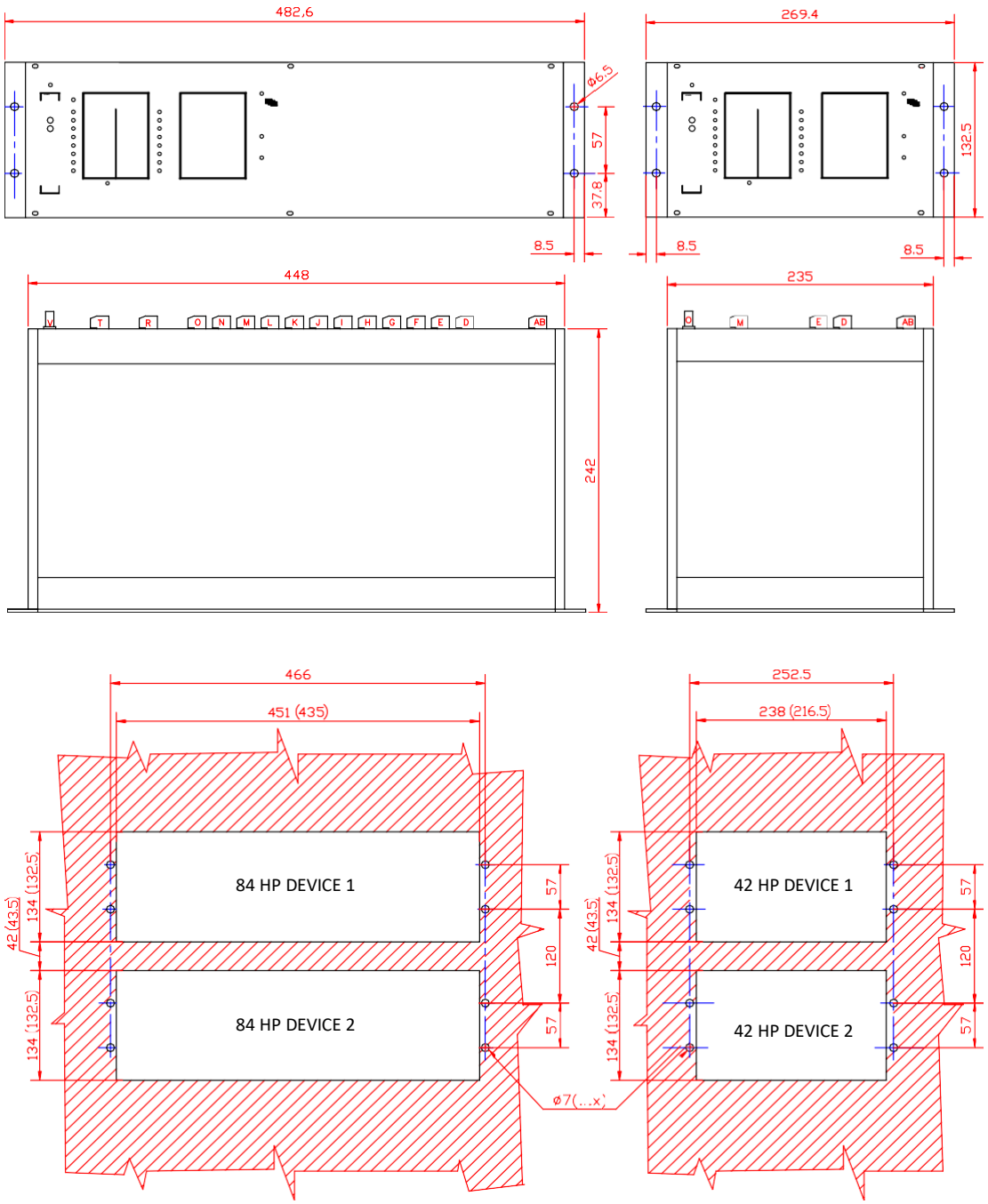
- **Flush mounting**




*Dimension and panel cut-out for DVEZ devices (Flush mounting type)*

- **Rack mounting**

When rack mounting is used the devices do not have a cover profile fit on. So it is possible to mount them in a 19" rack.




*Dimension and panel cut-out for DVEZ devices (Rack mounting type)*

Note that rack mounting type devices can also be mounted in a cut-out (e.g. on a switchgear door). It is possible to mount them from the front or from the back of the cut-out. The dimensions for rack mounting cut-outs are in the figure below. Dimensions in brackets are applicable in case of mounting from the back.

## HARDWARE CONFIGURATION

- **I/O configuration**

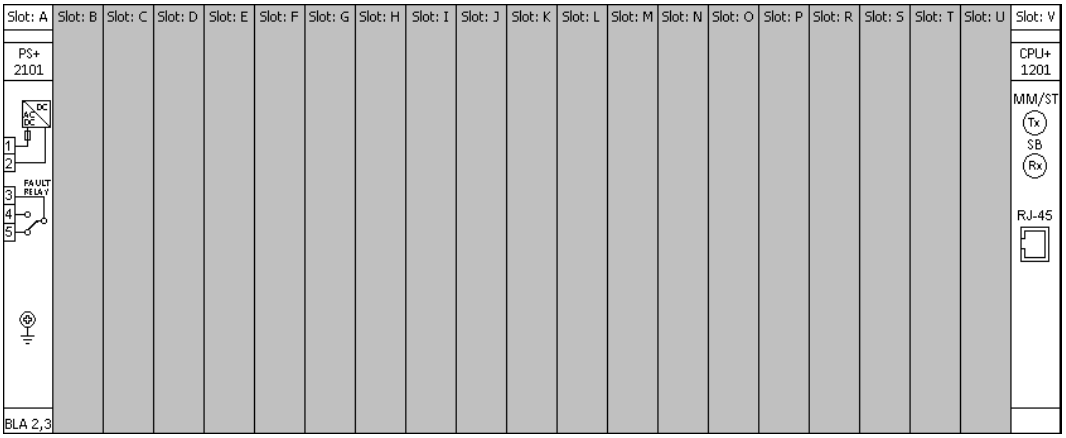
  The standard number of inputs and outputs of each variant are listed in the table below.

| Hardware configuration | E1-BCU | E2-BCU |
|---|---|---|
| Current inputs (4th channel can be sensitive) | - | 4 |
| Voltage inputs | - | 4 |
| Binary inputs | 12* | 12* |
| Binary outputs | 8* | 8* |
| RTD inputs | Op. | Op. |
| Analog inputs (AIC) | Op. | Op. |
| Analog outputs (ATO) | Op. | Op. |

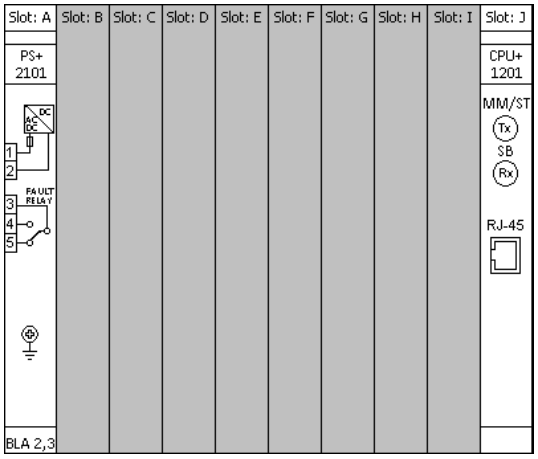
The maximum number of inputs and outputs of each variant are listed in the table below.

| Hardware configuration | E1-BCU | E2-BCU |
|---|---|---|
| Binary inputs (Max.) | 192 | 176 |
| Binary outputs (Max.) | 96 | 80 |

- **Module arrangement**
  - **E1-BCU Variant**

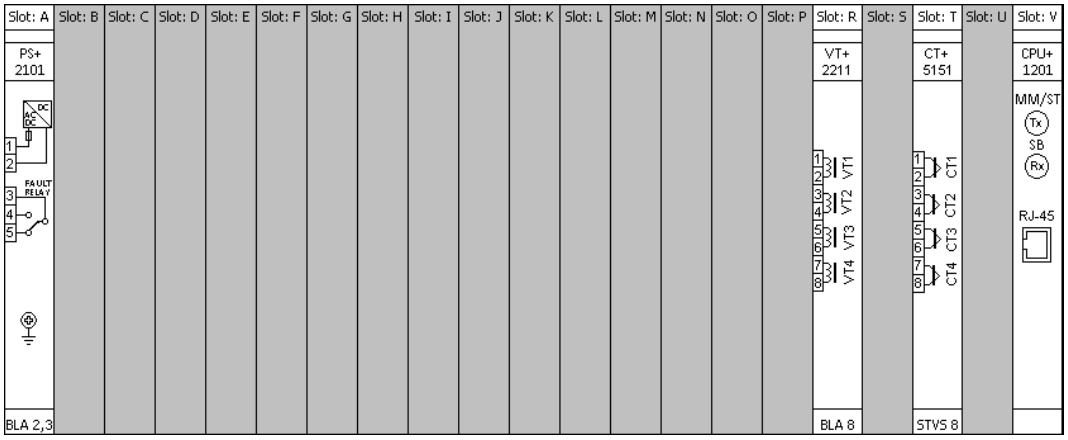



*Basic module arrangement of the E1-BCU configuration (84TE, rear view)*

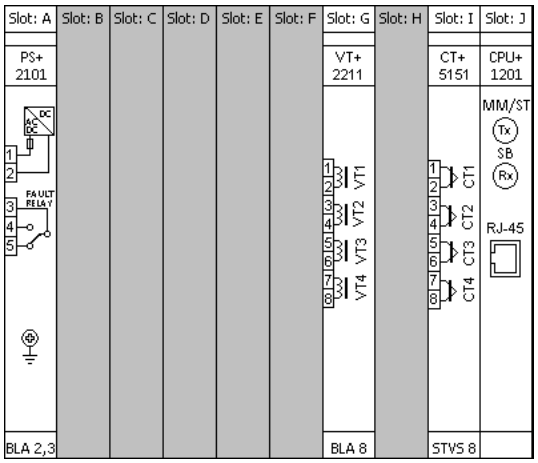



*Basic module arrangement of the E1-BCU configuration (42TE, rear view)*

- **E2-BCU Variant**




*Basic module arrangement of the E2-BCU configuration (84TE, rear view)*




*Basic module arrangement of the E2-BCU configuration (42TE, rear view)*

## CONTACT

For more information, please refer to the **DVEZ** configuration description document or contact us:

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