ComAp
The heart of smart control

InteliPro

Protection Relay for Parallel Applications

SW version 1.9.0

Global Guide

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1 Document information

1.1 Clarification of notation

Note: *This type of paragraph calls readers attention to a notice or related theme.*

IMPORTANT: This type of paragraph highlights a procedure, adjustment etc., which can cause a damage or improper function of the equipment if not performed correctly and may not be clear at first sight.

Example: This type of paragraph contains information that is used to illustrate how a specific function works.

1.2 About this guide

1.2.1 Installation and Operation Guide

The Installation and Operation Guide serves for the personnel, providing installation of the InteliPro unit. It contains wiring and setting instructions, needed for service and commissioning of the unit. It also contains introduction of the user interface and necessary procedures to perform setting and operating of the unit. Though InteliPro is very simple and intuitive for the operating personnel, we recommend keeping one copy of this manual available permanently at the installation site, where InteliPro unit is installed, to facilitate the necessary service and operation tasks.

For more information **see Introduction of Installation Guide on page 9**.

1.2.2 Application Guide

The Application Guide serves for the designers and engineers, who process the necessary documentation and implementation procedures on the installation site, where InteliPro is installed. It contains detailed description of InteliPro functionalities and their practical application.

For more information **see Introduction of Application Guide on page 30**.

1.2.3 Communication Brochure

The Communication Brochure gives specific tips for wiring and set-up of communication interface of InteliPro and preparing it for local or remote communication. For more details about communication of ComAp products, see the IL-NT, IA-NT, IC-NT Communication Guide published on ComAp download centre.

For more information **see Introduction of Communication Brochure on page 54**.

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Pay attention to the following recommendations and measures to increase the level of security of ComAp products and services.

Please note that possible cyber-attacks cannot be fully avoided by the below mentioned recommendations and set of measures already performed by ComAp, but by following them the cyber-attacks can be considerably reduced and thereby to reduce the risk of damage. ComAp does not take any responsibility for the actions of persons responsible for cyber-attacks, nor for any damage caused by the cyber-attack. However, ComAp is prepared to provide technical support to resolve problems arising from such actions, including but not limited to restoring settings prior to the cyber-attacks, backing up data, recommending other preventive measures against any further attacks.

Warning: Some forms of technical support may be provided against payment. There is no legal or factual entitlement for technical services provided in connection to resolving problems arising from cyber-attack or other unauthorized accesses to ComAp's Products or Services.

General security recommendations and set of measures

1. AccessCode

• Change the AccessCode BEFORE the device is connected to a network.

• Use a secure AccessCode – ideally a random string of 8 characters containing lowercase, uppercase letters and digits.

• For each device use a different AccessCode.

2. Password

• Change the password BEFORE the device enters a regular operation.

• Do not leave displays or PC tools unattended if an user, especially administrator, is logged in.

3. Controller Web interface

• The controller web interface at port TCP/80 is based on http, not https, and thus it is intended to be used only in closed private network infrastructures.

• Avoid exposing the port TCP/80 to the public Internet.

4. MODBUS/TCP

• The MODBUS/TCP protocol (port TCP/502) is an instrumentation protocol designed to exchange data between locally connected devices like sensors, I/O modules, controllers etc. From it's nature it does not contain any kind of security – neither encryption nor authentication. Thus it is intended to be used only in closed private network infrastructures.

• Avoid exposing the port TCP/502 to the public Internet.

5. SNMP

• The SNMP protocol (port UDP/161) version 1,2 is not encrypted. Thus it is intended to be used only in closed private network infrastructures.

• Avoid exposing the port UDP/161 to the public Internet.

1.4 Document history

Revision number	Related sw. version	Date	Author
2	1.9.0	17.9.2018	Petra Píclová
1	1.9.0	9.4.2018	Petra Píclová

1.5 Symbols in this manual

Symbol	Name	Symbol	Name	Symbol	Name	Symbol	Name
	3 x Phases		Connector - male		GSM		Resistive sensor RPTC
	Active current sensor		Contact		GSM modem		RS 232 male
	AirGate		Contactor		IG-AVRi		RS 232 female
	Alternating current		Controller simplified		IG-AVRi TRANS		Starter
	Analog modem		Current measuring		Jumper		Switch - manually operated
	Battery		Current measuring		Load		Transformer
	Binary output		Diode		Mains		USB type B male
	Breaker contact		Ethernet male		Mains		USB type B female
	Breaker contact		Ethernet female		Mobile provider		Voltage measuring
	Breaker		Fuel solenoid		Passive current sensor		Wifi / WAN / LAN
	Breaker		Fuse		Pick - up		
	Breaker		Fuse switch		Relay coil		
	Capacitor		Generator		Relay coil of slow-operating		
	Coil		Generator schematic		Resistor		
	Connector - female		Grounding		Resistor adjustable		

2 Introduction of Installation Guide

Congratulations to your purchase of ComAp InteliPro protection relay unit! InteliPro is a microprocessor-based door-mounted protective device, providing a comprehensive set of protective and supplementary functionalities. ComAp unique modular concept of HW extension modules, SW options and full configurability allow perfect solution for most of the generator-to-mains parallel applications.

2.1 General warnings

> **IMPORTANT: Be aware that the relay outputs can change state during and after the unit setting (before the unit is used again ensure that the proper setting is done)!!!**

> **IMPORTANT: Be aware that the devices connected to binary outputs of the unit may operate upon disconnection of power supply, measurement inputs and/or binary inputs!!!**

2.1.1 Dangerous voltage

In no case touch the terminals for voltage and current measurement!

Always connect grounding terminals!

In any case do not disconnect controller CT terminals!

2.1.2 Adjust the setpoints

All parameters are adjusted to their typical values. However the setpoints has to be checked and adjusted to their real values before the first starting of the gen-set.

The following instructions are for qualified personnel only. To avoid personal injury do not perform any action not specified in related guides for product.

> *Note: ComAp believes that all information provided herein is correct and reliable and reserves the right to update at any time. ComAp does not assume any responsibility for its use unless otherwise expressly undertaken.*

3 Installation data

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3.1 Package contents

The package contains:

▶ InteliPro unit

▶ Relay Card CT2-REL2 plug-in module (plugged in the unit)

▶ Mounting holders

▶ Terminal blocks

The package does not contain any communication module nor any extension module. The required module should be ordered separately.

3.2 Mounting

The unit is to be mounted onto the switchboard door. Requested cutout size is 175x115mm. Use the screw holders delivered with the unit to fix the controller into the door as described on pictures below.

3.3 Terminal diagram
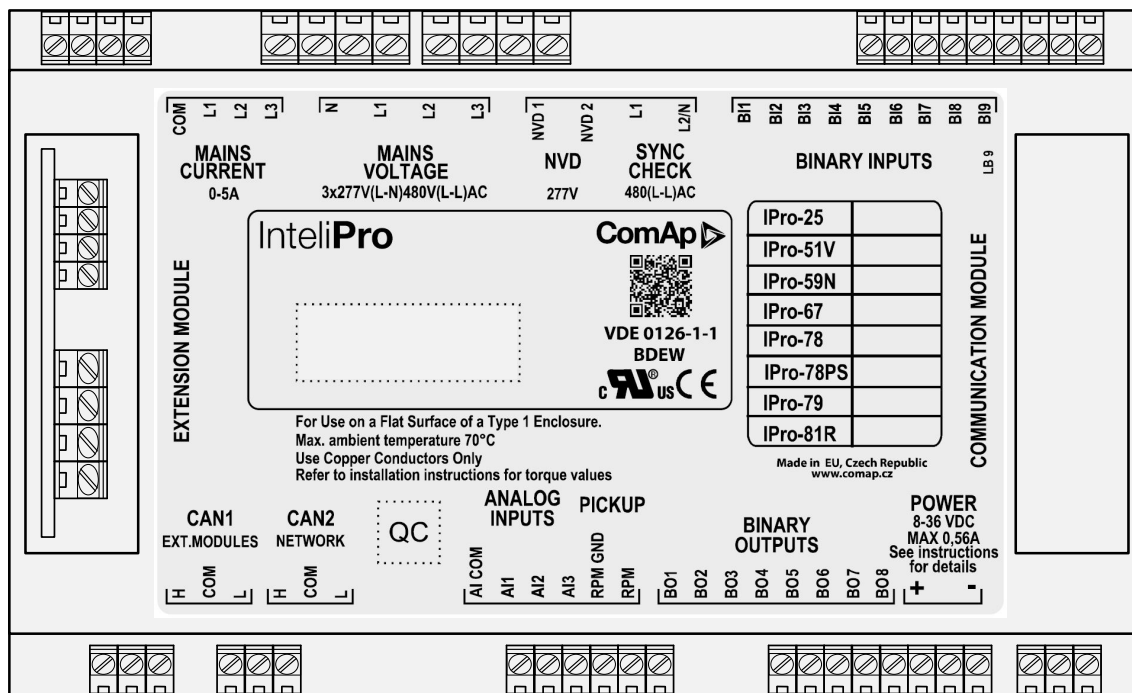
3.4 Voltage and current inputs

> IMPORTANT: Risk of personal injury due to electric shock when manipulating with voltage terminals under voltage! Be sure the terminals are not under voltage before touching it.

> IMPORTANT: Do not open secondary circuit of current transformers when primary circuit is closed!!! Open the primary circuit first!

Use 1.5 mm^2 cables for voltage connection and 2.5 mm^2 for current transformers connection.

Adjust nominal voltage, nominal current, CT ratio and PT ratio by appropriate setpoints in the Basic Settings group **Group: Basic Settings (page 85)**. Learn about how to view and change setpoints in the **User Interface (page 26)** chapter.

3.4.1 Low Voltage Measurement Wiring
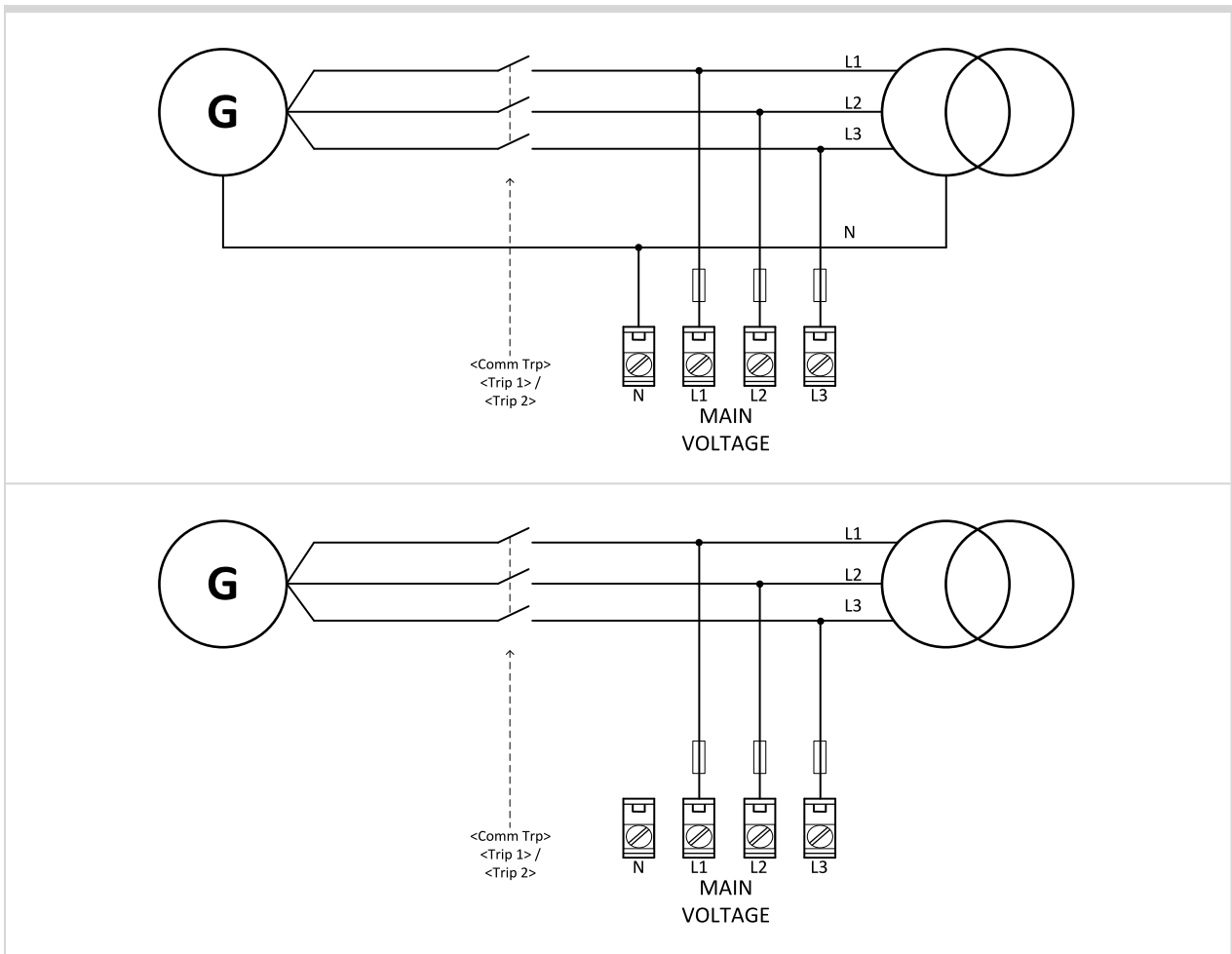
3.4.2 High Voltage Measurement Wiring - Two Voltage Transformers
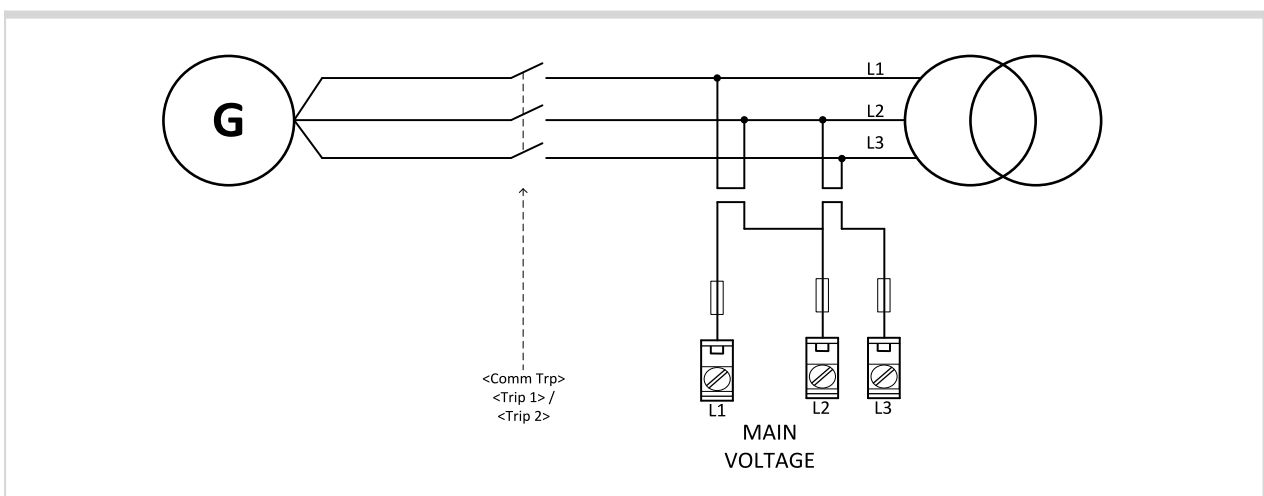
3.4.3 Current Measurement Wiring
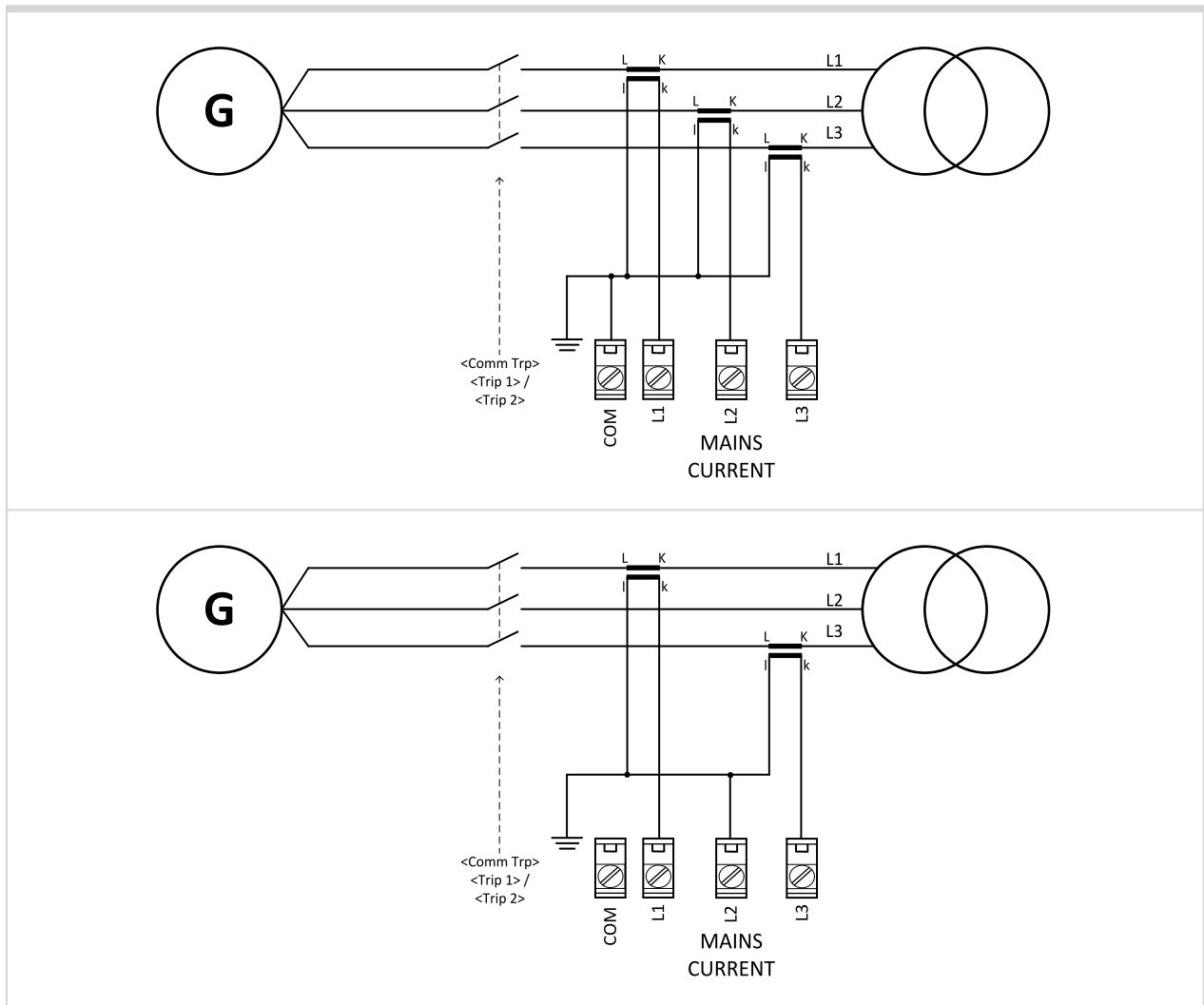
IMPORTANT: To assure accurate measurement of the mains current, we recommend direct metallic connection between COM terminal of Mains Current measurement and the minus "-" terminal of the unit power supply. The potential difference between those two points must not overreach 10 V.

3.4.4 NVD and Sync Check Wiring
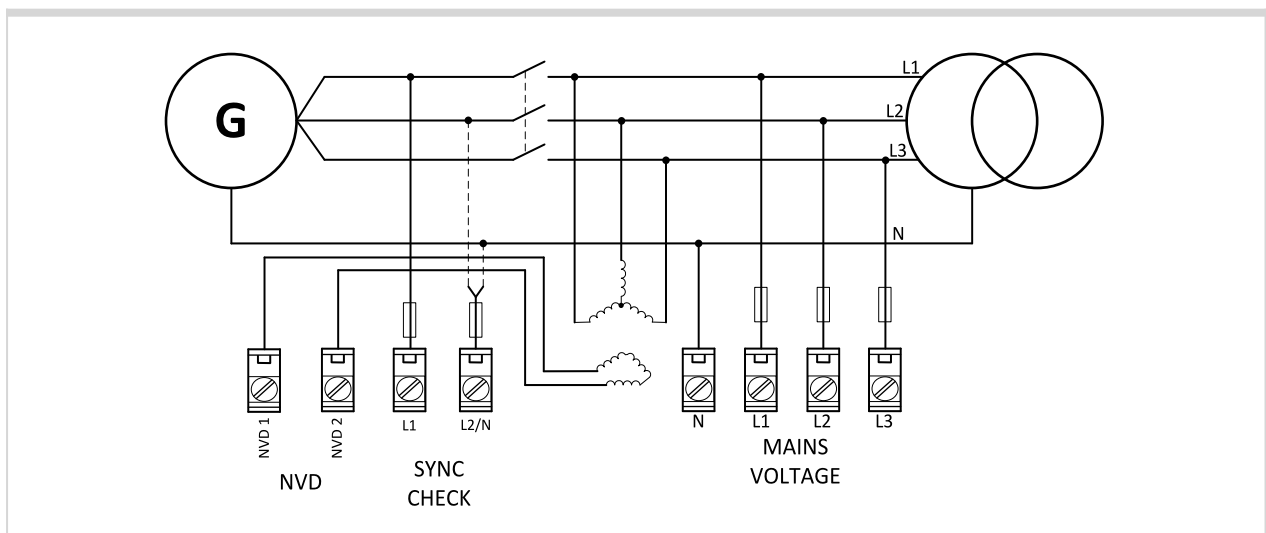
3.5 Complete measurement wiring scheme with voltage transformers

27, 59	Over/undervoltage
47	Voltage asymmetry
81H, 81L	Over/underfrequency
50	Instantaneous overcurrent
51	Time overcurrent
46	Current asymmetry
50N, 51N	Earth fault current
50GS, 51GS	Ground surge current
32	Directional power
50BF	Breaker failure protection
	Dynamic grid support
	QU protection
	Phase sequence supervision
	Auto fault reset
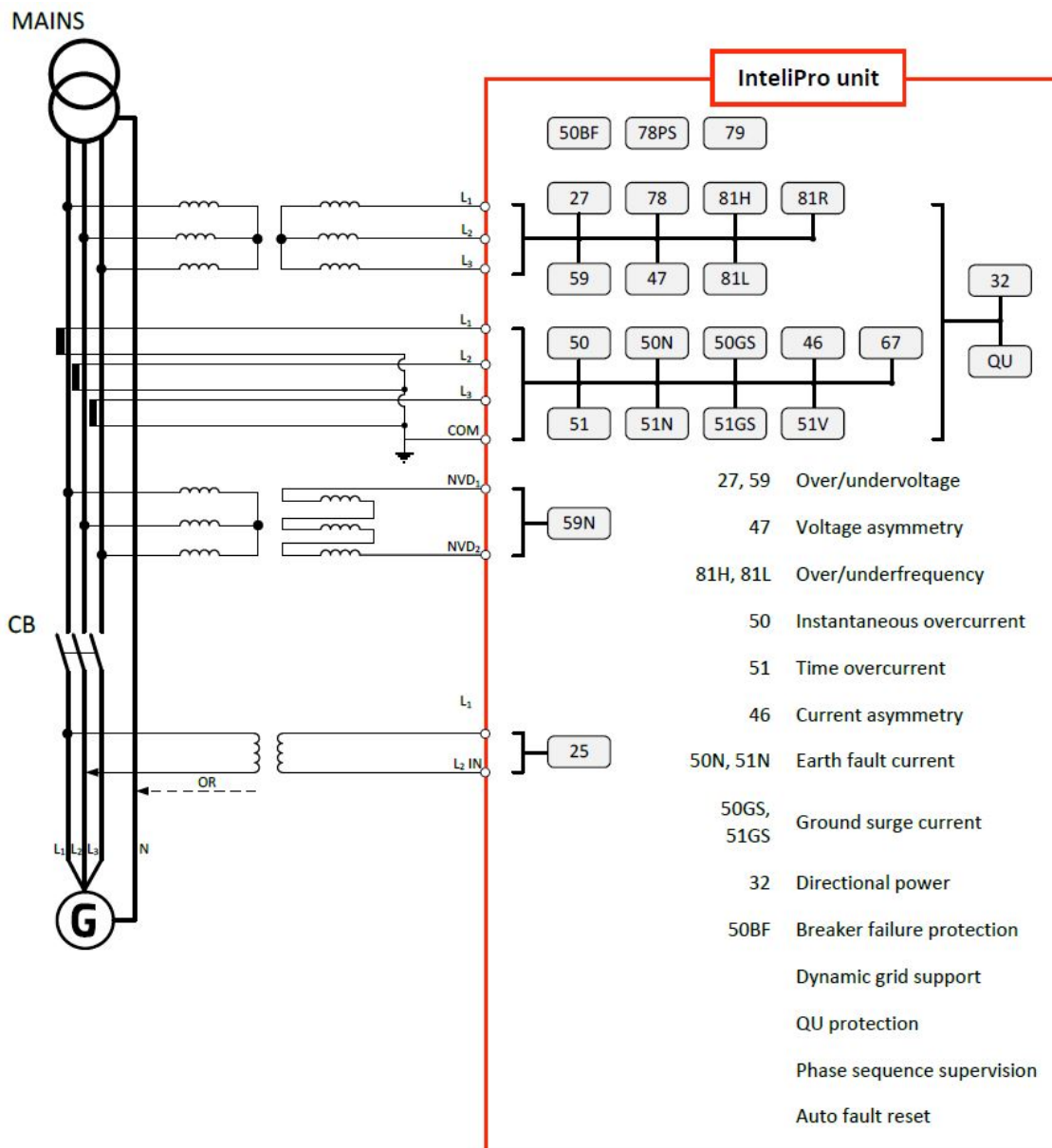
3.6 Complete measurement wiring scheme without voltage transformers
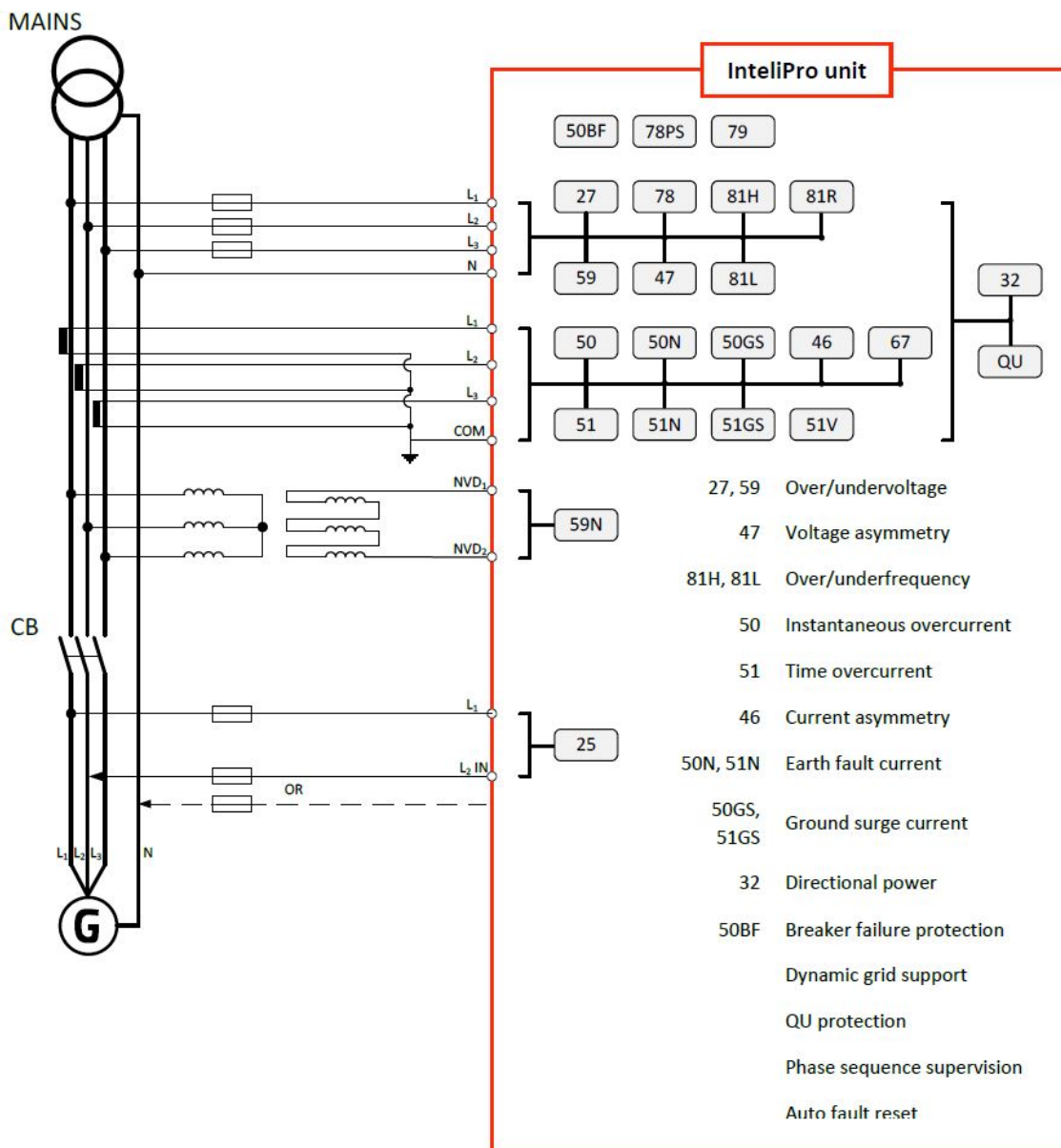
3.7 Binary inputs

The binary inputs of the unit are used to receive basic information about the installation site, its operational state and conditions. They can be also used for control of the unit operation, i.e. blocking of protective functions, induce tripping by binary signals or providing remote **Fault reset (page 33)** signal.

To wire the binary inputs correctly, please use the following picture. The black line is to be wired to the unit, the blue line indicates internal arrangement of the unit. Use min. 1 mm^2 cables for wiring of binary inputs.

Note: *The name and function or alarm type for each binary input have to be assigned during the configuration.*

BATTERY
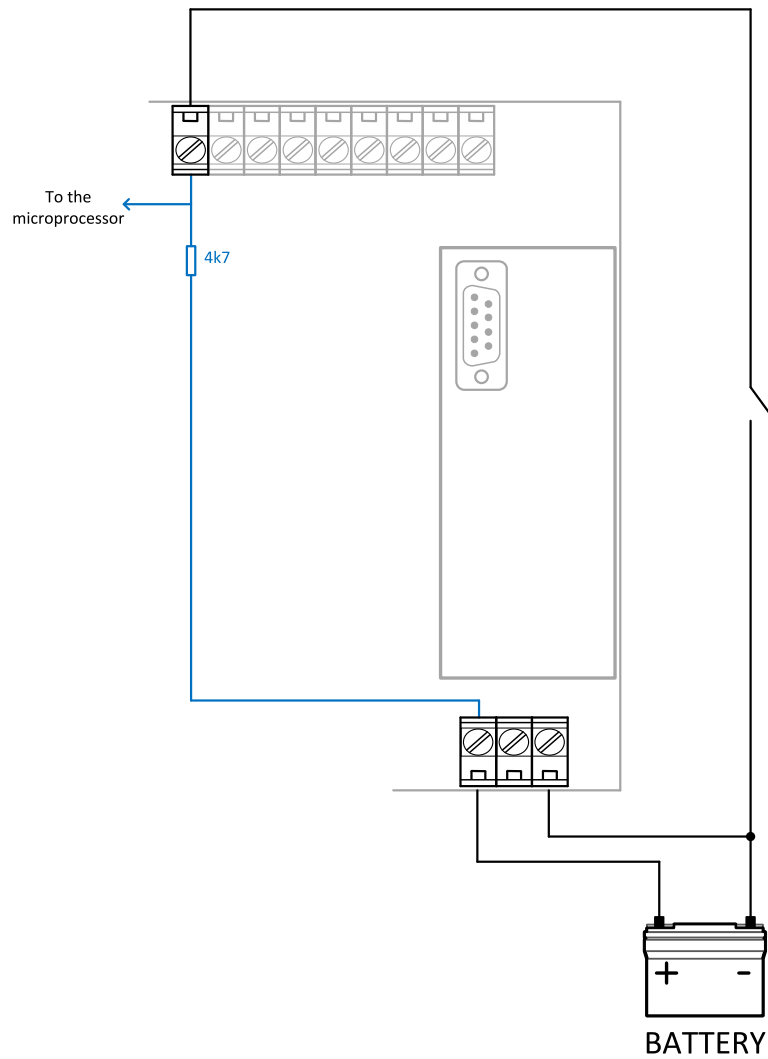
Image 3.1 Wiring of binary inputs

3.8 Binary outputs

Use min. 1 mm^2 cables for wiring of binary outputs. Use external relays as indicated on the schematic below for all outputs except those where low-current loads are connected (signalization etc..).

Note: *The function of each output has to be assigned during the configuration.*

IMPORTANT: Use suppression diodes on all relays and other inductive loads!
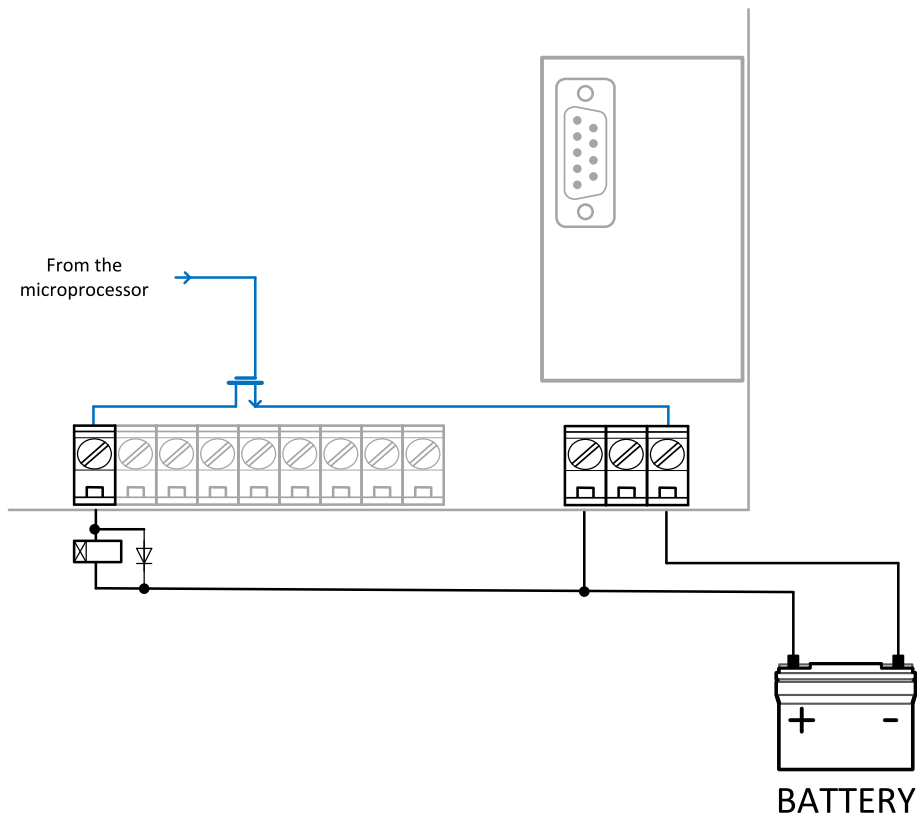
Image 3.2 Wiring of Binary outputs

3.9 Analog inputs

The analog inputs are designed for resistive automotive type sensors like VDO or DATCON. The sensors are connected either by one wire (the second pole is sensor body) or by two wires.

▶ In case of grounded sensors connect the AI COM terminal to the engine body as near from the sensors as possible.

▶ In case of isolated sensors connect the AI COM terminal to the negative power supply terminal of the controller as well as the opposite poles of the sensors.

Note: The fail sensor alarm is issued if the measured resistance is smaller than one half of the first (lowest) point of the sensor curve characteristic or is greater than 112,5% of the last (greatest) point of the sensor curve characteristic.
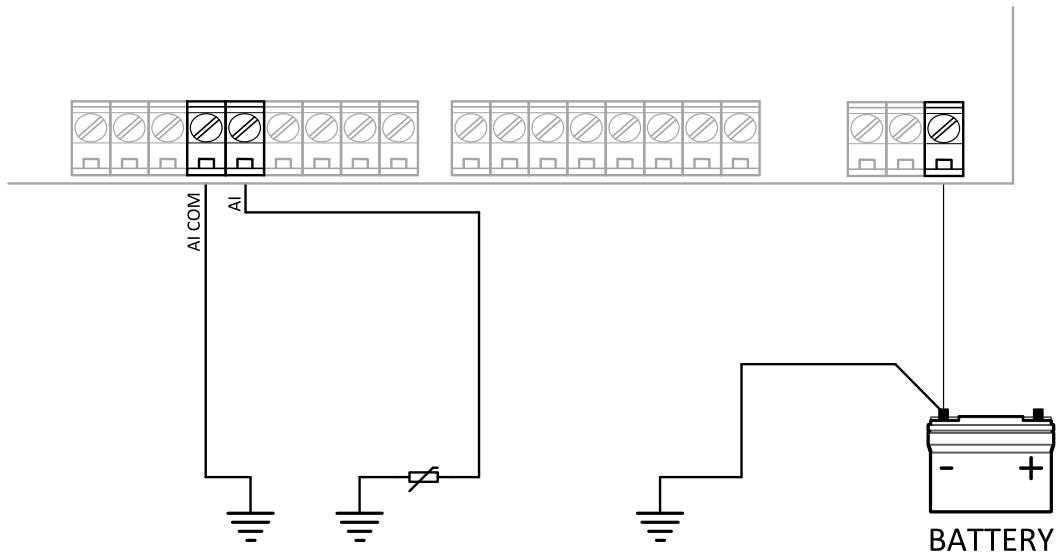
Image 3.3 Wiring of Analog inputs - Grounded sensors
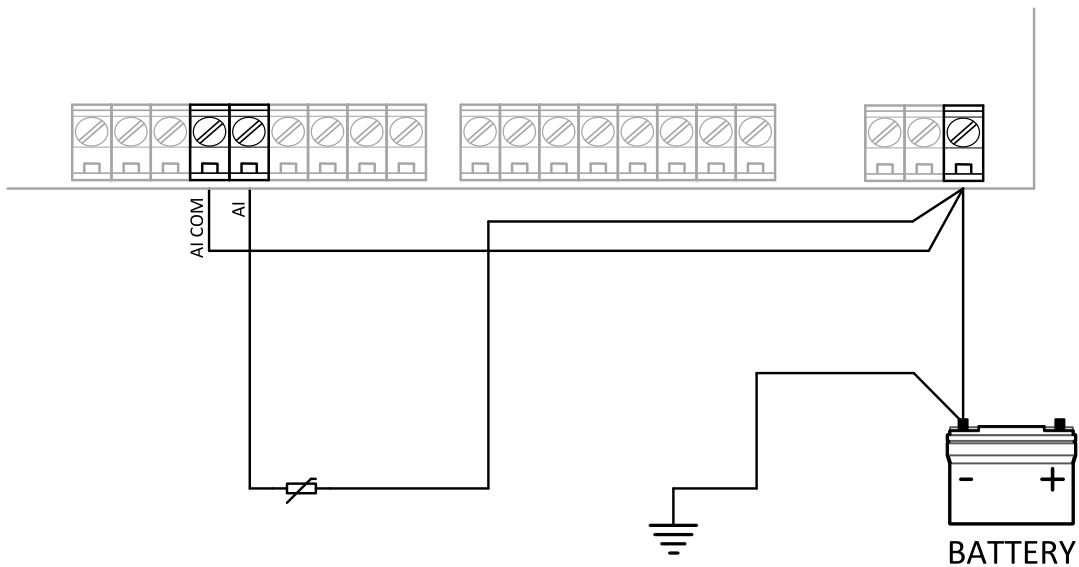
Image 3.4 Wiring of Analog inputs - Isolated sensors

3.9.1 Tristate inputs

Analog inputs can be used also as binary or tristate, i.e. for contact sensors without or with circuit check. The threshold level is 750Ω. In case of tristate, values lower than 10Ω and values over 2400Ω are evaluated as sensor failure (short or open circuit).
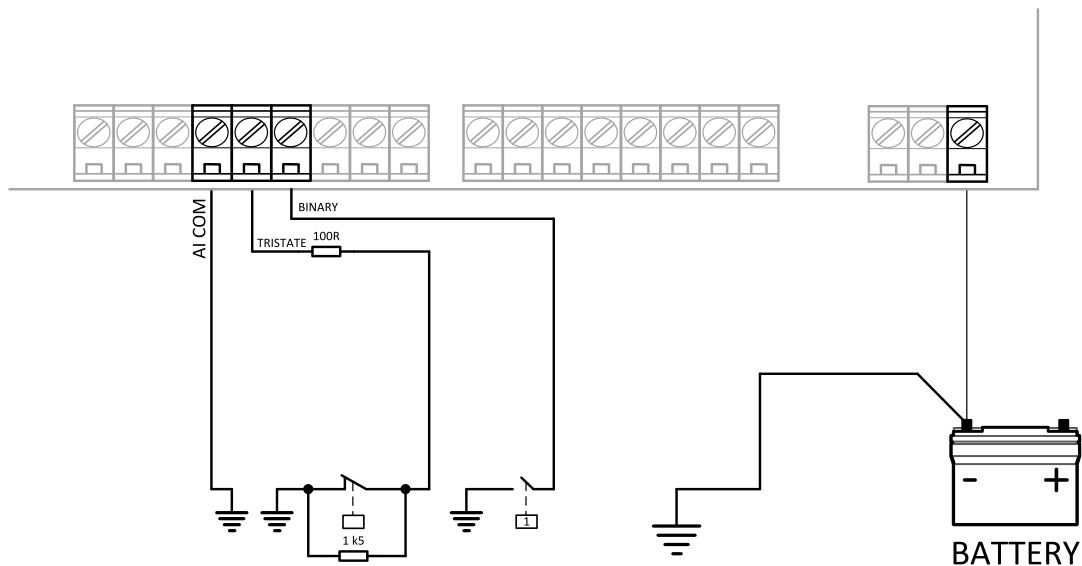
Image 3.5 Wiring of Analog inputs - Used as Binary or Tristate

Note: *The name, sensor characteristic and alarm types for each analog input have to be assigned during the configuration.*

3.10 Relay Card CT2-REL2 plug-in module

As a default, the unit is supplied with the plug-in module Relay Card CT2-REL2 plugged in the unit.

The module provides:

▶ 2 relay outputs allowing voltage-free output contacts

▶ 5 A current measurement input

▶ 50 mA current measurement input

It is possible to operate the unit also without the Relay Card CT2-REL2 if none of the above mentioned functions is requested for the application. In that case, it can be removed and the plug-in slot can be used for inserting another plug-in expansion module, e.g. IC-NT CT-BIO7 to expand the configurability of binary inputs/outputs.

3.10.1 Relay outputs

The relays on the Relay Card CT2-REL2 module provide a set of 2 NO contacts with possibility of configuration of any logical binary output. By default, the functions !Comm Trp and !Bak Comm Trp are configured to those outputs. To change the configuration of the relay outputs function, use the configuration tool in LiteEdit PC software.

3.10.2 Current inputs

The module Relay Card CT2-REL2 provides two current inputs for purpose of the **Earth Fault Current (ANSI 50N, ANSI 51N) (page 47)** and **Ground Surge Current (ANSI 50GS, ANSI 51GS) (page 47)** evaluation.

> **IMPORTANT: When wiring the current inputs, please make sure that the wires are connected to the correct current measurement input to prevent damage of the 50 mA input by excessive current!**

3.11 Power supply

The unit is designed for 8 - 36 VDC (typically 24V or 12V battery, battery charger or inverter) power supply. Use secured power supply voltage to assure operation of the InteliPro protection relay even during power supply outages! In case that no suitable DC supply circuits are available on-site, we recommend to use an appropriate inverter AC to 24 VDC. In case of need, ask ComAp technical support at support@comap-control.com for recommendations.

3.12 Recommended wiring

In the diagram below, see the typical wiring of the InteliPro unit inputs and outputs. The wiring is to be considered as an example for the default configuration and operation mode with 1 common trip output. The relay contacts of Relay Card CT2-REL2 module can be reconfigured to Trip 1 and Trip 2 outputs in case of operation with 2 trip outputs, as well as any inputs and outputs can be reconfigured to the particular needs of the application.

An OFF coil of a circuit breaker is to be wired to terminals RE11 and RE14 or to terminals RE21 and RE24 on extension module.
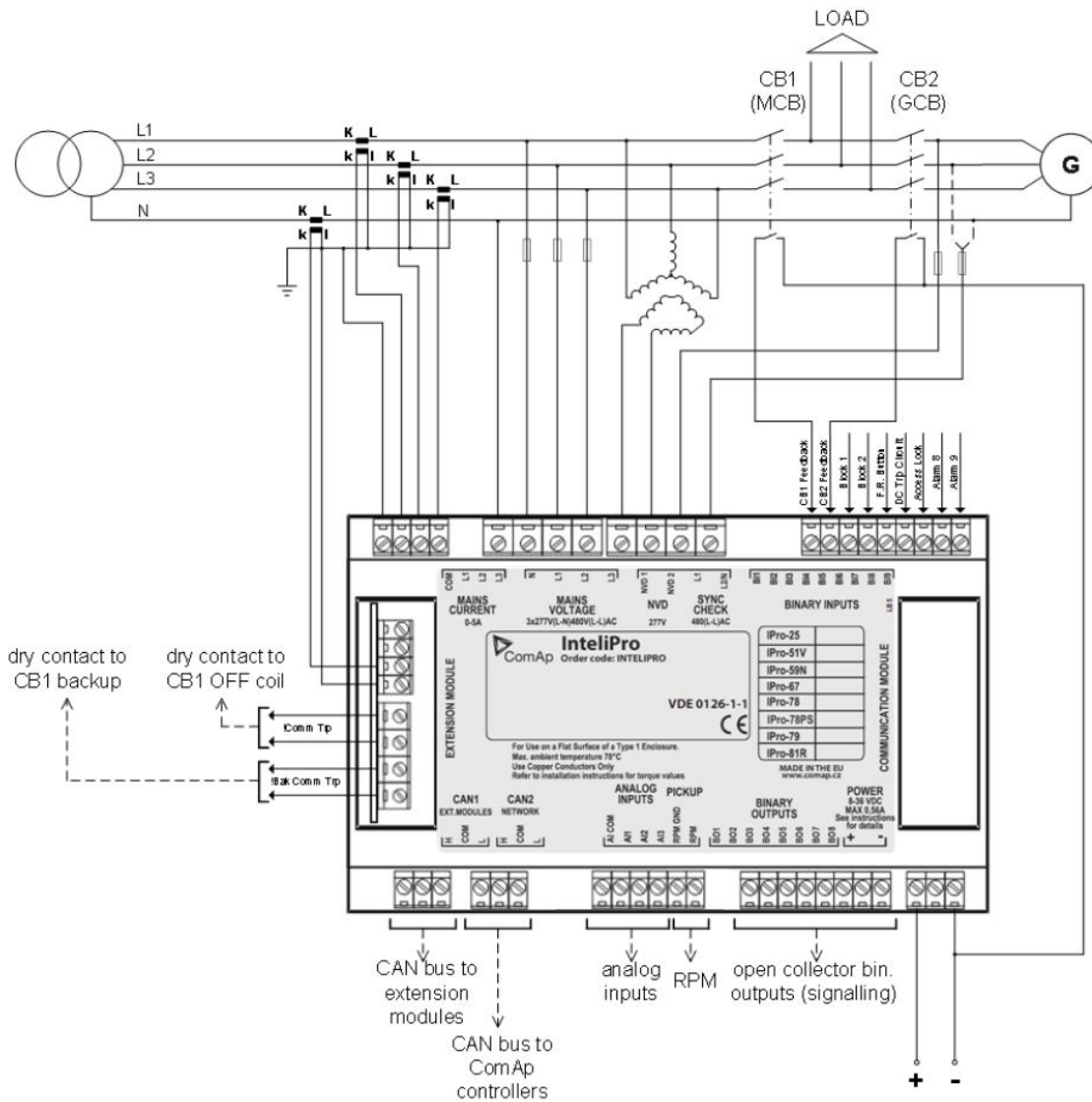
3.13 Configurability

One of the key features of InteliPro unit is high level of flexibility and adaptability of the system to the particular application. The way how to achieve this is the configuration. Use LiteEdit PC software to read the configuration from the controller or disk, view it, modify it and write the configuration to controller or disk. To work with InteliPro, LiteEdit version 4.6.8 or higher is necessary. Visit www.comap-control.com for download or update of this PC application and its manuals.

The firmware contains large number of binary inputs and outputs for different functions. Those that are required by operation of a particular application can be mapped to the physical terminals of the unit. One of main tasks of the configuration is this mapping of "logical" firmware input and output signals to the "physical" hardware inputs and outputs.

Configuration parts:

▶ Mapping of logical binary inputs (functions) assigning alarms to physical binary input terminals.

▶ Assigning the "normally closed" or "normally opened" functionality to the inputs.

▶ Mapping of logical binary outputs (functions) to physical binary output terminals.

▶ Assigning sensor characteristics and alarms to analog inputs.

- ▶ Assigning control values and output characteristics to analog outputs.
- ▶ Selecting of peripherial modules which are connected to the controller and doing the same as above for them.
- ▶ Changing language of the unit texts.

Note: Some of the logical binary outputs provide also the reversed functionality. Those LBOs are marked with exclamation mark "!" as the first character of their name.
*See more in the **Library of binary outputs (page 75)** chapter.*
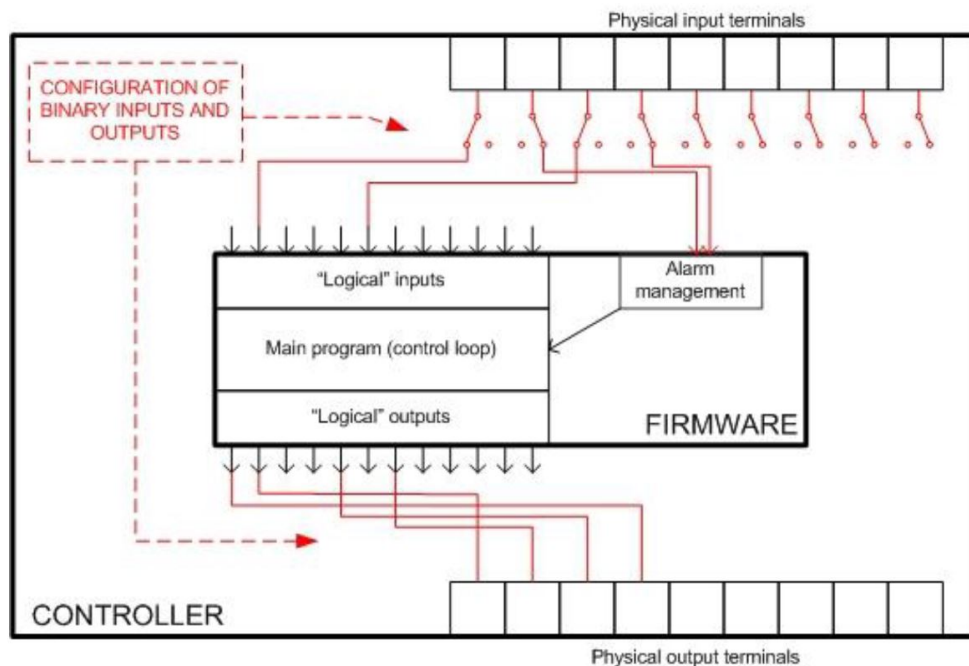
Image 3.6 Principle of Binary inputs and outputs configuration

The unit is delivered with a default configuration, which should fit to most standard applications. This default configuration can be changed only using PC and LiteEdit software. See LiteEditdocumentation for details.

Note: You need one of communication modules to connect the controller to a PC with LiteEdit. There is a special easy removable service module for cases, where there is no communication module permanently attached.

Once the configuration is modified, it can be stored in a file for later usage with another controller or for backup purposes. The file is called **archive** and has file extension "aic". An archive contains full image of the controller at the moment of saving (if the controller is online to the PC) except firmware, i.e. besides configuration there are also current adjustment of all setpoints, all measured values, copy of history log and copy of alarm list.

The archive can be simply used for **cloning** of InteliPro units, which means preparing units with identical configuration and settings.
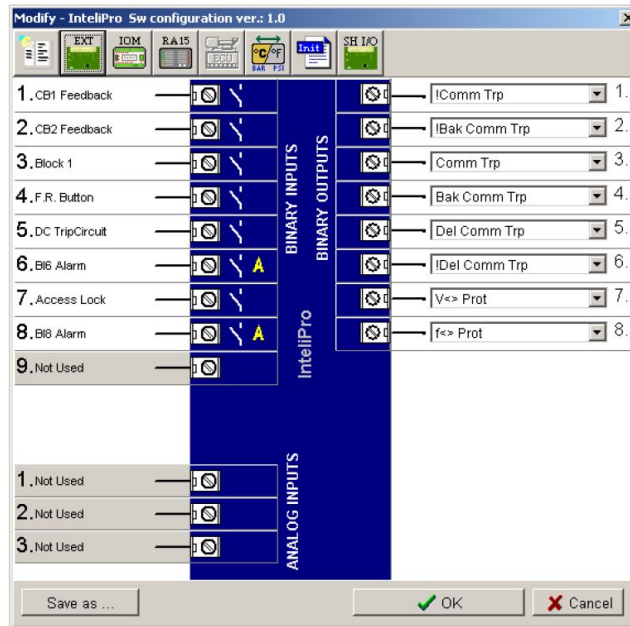
Image 3.7 Configuration window in LiteEdit

> **IMPORTANT: The firmware of this version is compatible only with the archive version 1.4. It is not possible to use for instance the archive version 1.3.**

3.14 System of optional functions

The unit offers wide range of protective functionalities. To allow flexibility of the protective functions at the particular application, some of the features are provided as SW options. These functions are unlocked by a software dongle, delivered by ComAp or its approved distributors. The SW dongle is a unique number generated according to the serial number of the unit and the selected protective functions. The functions are referred by their ANSI numbers, according to the following table:

IPro-25	Synch Check
IPro-32	Single phase reverse power
IPro-51V	Time over current with voltage control
IPro-59N	Neutral voltage displacement
IPro-67	Directional overcurrent
IPro-78	Vector shift
IPro-78PS	Pole Slip
IPro-79	AC reclosing relay
IPro-81R	Rate of change of frequency + rocof filter

The appropriate selection of InteliPro optional functions is to be marked on the rear side of the unit:

IPro-25	
IPro-51V	
IPro-59N	
IPro-67	
IPro-78	
IPro-78PS	
IPro-79	
IPro-81R	

For unlocking the desired functions or changing those functions that are already unlocked, contact your sales person for the appropriate SW dongle. The following information will be needed:

▶ Serial number of the unit

▶ List of requested functions to unlock

3.14.1 Entering the SW dongle

Once received the appropriate SW dongle relative to the unit serial number, go to the setpoint **IPro-SW Key (page 93)** and enter the numerical string, which you have obtained. Though it is more convenient to enter the SW dongle via LiteEdit PC software, it is also possible to enter it through the controller screen and pushbuttons.

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4 User Interface

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4.1 Front panel elements
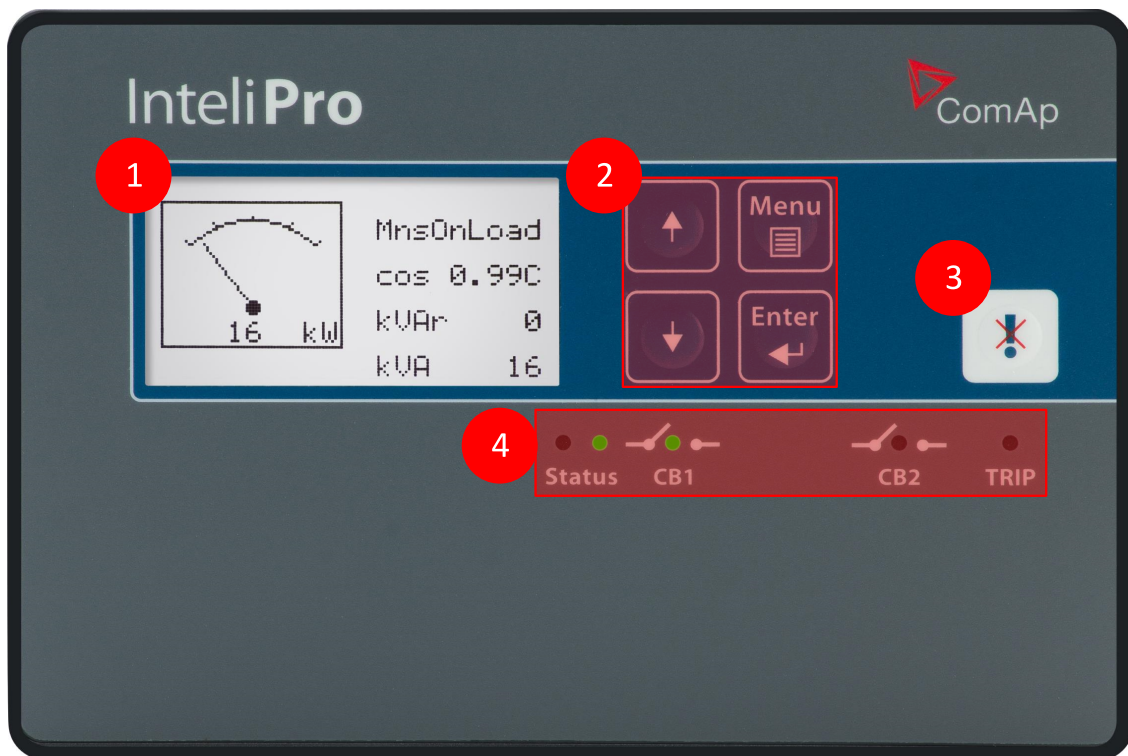
❶	128 x 64 pixels graphical
❷	Control and navigation push buttons
❸	Fault Reset button
❹	Signalization LEDs

4.1.1 General operation using buttons

▶ In the measurement screens, use the 🔼 and 🔽 buttons to browse through the measured values as displayed on the graphical display. See the chapter Measurement screens to get the basic orientation.

▶ Use the 📋 button to cycle through display of measurement screens, adjust setpoints and view the history table. For setpoints change, see the following chapter.

▶ To enter the init screen, change language or read the list of unlocked InteliPro options, push the [Enter] and [Menu] buttons at the same time. Together with the init screen display, the unit performs lamp test by simultaneous blinking of all LEDs.

▶ For confirmation of change any setpoint, use the [Enter] button.

4.1.2 Passwords
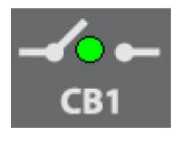
InteliPro provides 3 levels of password protection. The system of passwords allows to assign different levels of password to different personnel groups. After entering of the password of 1st or 2nd level, it is possible to change that password or the password of any of the lower levels. The password for the 1st (highest) level is set to zero "0" by default.
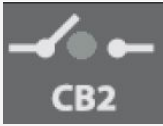
Entering the password

The password must be entered prior adjusting setpoints that are password-protected. Password is located in the first group of setpoints and the way how to enter or change password is similar to change of setpoints.

4.2 Signalization LEDs

There are 5 LEDs for indication of InteliPro status with the meaning indicated in the table below:

LED	State	Meaning
(red)	-	Status of the InteliPro unit - used in combination with green LED, see the table below.
(green)	-	Status of the InteliPro unit - used in combination with red LED, see the table below.
(green)	ON	CB1 feedback - activated - state "I".
	OFF	CB1 feedback - deactivated - state "0".
(green)	ON	CB2 feedback - activated - state "I".

LED	State	Meaning
CB2	OFF	CB2 feedback - deactivated - state "0".
TRIP (red)	ON	Indicates TRIP state, measured values are in fault conditions (out of limits).
TRIP (red)	blinking	Indicates TRIP state, measured values are in fault-free conditions (within limits). It is possible to terminate the TRIP state by any of the methods of of Fault Reset.
TRIP	OFF	The unit is not in TRIP state.

Status LED signalization				
Red	Green	State	Display reading	Meaning
OFF	OFF	Status		No power supply or PowerFail occured.
blink	OFF	Status	"Program Corrupted" or "System Error" or "System Error + Wrong config format"	Transient SW failure → Contact technical support with information abut the display message.
ON	OFF	Status	Normal reading	Wrong checksum of parameters → Check the complete settings of your unit and change any one of the parameters. If the state persists, contact technical support.
ON	ON	Status	Normal reading	Wrong checksum of "R" parameters → Contact technical support.

Status LED signalization				
Red	**Green**	**State**	**Display reading**	**Meaning**
blink	ON		Normal reading	Watchdog reset was performed → Save the archive, contact technical support and attach the archive.
OFF	ON		Normal reading	Normal operation of the unit.
blink	blink		Not initialized	Unit HW failure → Request repair of the unit.

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5 Introduction of Application Guide

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InteliPro protection relay provides high range of flexibility to the users and their applications. In the most common cases, one output for tripping is used. In this case, InteliPro provides the common trip output , which represents logical "OR" of all activated and pre-set protective functions of the unit. If needed, InteliPro also allows two circuit breakers to operate, where some protective functions are assigned to one of them and other functions to the other. In such case, the circuit breakers can provide backup for each other, so that in "fail to trip" situation the other circuit breaker opens under pre-set conditions to clear the first breaker failure.

Furthermore, InteliPro provides two independent blocking inputs and complex blocking conditions, which can be used to activate or deactivate any of the protective functions of the unit. All necessary inputs and outputs can be freely configured to any input or output of the unit. In case of outputs, any of the 2 relay outputs or 8 open-collector outputs can be selected.

In case that any of the configured protective functions is activated, InteliPro relay provides a Trip signal. This signal is provided in both positive and negative logic in order to follow the requirements of the application:

▶ Due to increased safety requirements, some protective relays require to use negative logic, assuring that loss off power supply always causes the relay to trip. I.e. the relay contacts are used, with fault-free position maintained in energized state. In case of power supply fail, the unit goes to "fault" indication position. The outputs using negative logic are marked with exclamation mark "!" as the first character of their name.

▶ In some applications, the negative logic is not a required functionality. The function of opening the circuit breaker in case of loss of power supply is not accepted as a safety point and the safety is assured by different means e.g. in the superior system or within the protection relays intertripping scheme. In such case, the outputs with positive logic (without the exclamation mark) can be used to signal the detected failure state.

In any case, it must be assured that the InteliPro relay has full control at opening the appropriate breaker by the trip command - i.e. in case of Trip state the unit receives the appropriate CB feedback, confirming its open position. The feedback must respond within preset time to the trip command. A special attention should be paid to opening of motorized circuit breakers, as it could take more than 2s on some types. In such cases it is necessary to use undervoltage coil for fast opening.

5.1 Operation mode with 1 common trip output

▶ This is the essential mode of operation of the protection relay InteliPro. In this case, CB1 circuit breaker or contactor is considered as the main connection device, protected by InteliPro. In the ComAp gen-set controllers, this breaker is called "Mains Circuit Breaker" = MCB.

▶ Second circuit breaker or contactor is not expected in the protection scheme, but there is still possibility to use the "backup trip" signal from InteliPro relay to operate any backup device, if present on the installation. As such device may be considered another circuit breaker in the line of mains-connection, CB1 undervoltage coil, or any device which serves as a backup in case of the CB1 fail.

▶ The **Comm Trp (page 77)** (or **!Comm Trp (page 77)**) output is used as the main signal to open the CB1 circuit breaker. InteliPro expects that in such case, the CB1 Feedback input deactivates as a result of the protection trip. Adjustable delay can be set by the setpoint **BackupTrp Del (page 91)**, to provide backup functionality for the CB1 breaker. If the feedback does not deactivate within this delay, the output **Bak Comm Trp (page 76)** activates (or **!Bak Comm Trp (page 76)** deactivates) immediately.

▶ Any function, which is activated and not blocked within the InteliPro unit activates the Comm Trp signal. Use the blocking conditions to control which protective functions will be used under the appropriate circumstances.

5.2 Operation mode with 2 trip outputs

▶ In some cases, the protection relay is requested to operate two circuit breakers. Usually, one of them is considered as the main circuit breaker, with most of the functions configured to operate this circuit breaker. As mentioned above, this breaker often corresponds to the "Mains Circuit Breaker" = MCB as used in ComAp controllers.

▶ The second circuit breaker can be from the point of view of the protection relay considered as a supplementary contactor in the power connection scheme. It can provide back-up functionality in case that the CB1 does not trip on command, or can be operated individually by selected protective functions. It can, but does not necessarily have to correspond to the "Generator Circuit breaker" = GCB as used in the ComAp controllers applications. In such case, e.g. NVD function is the most often case, when GCB (CB2) is tripped instead of MCB (CB1).

▶ In case that 2 circuit breakers are controlled by InteliPro unit, it is possible to freely assign, swap or configure the functionalities of both circuit breakers and provide appropriate back-up function of the breakers by the "Priority switching" functionality. It is not practical to use the Comm Trp output in this case. To distinguish between the 2 breakers, outputs Trp 1 and Trp 2 are available.

▶ For each protective function in InteliPro, it is possible to assign either Trip 1 or Trip 2 function, none of them, or both. The setpoint xxx Trp BO (e.g.**I> T Trp BO [Trp 1 / Trp 2 / Trp 1+2 / None] (page 102)**) in the appropriate group of protection setting is used for this assignment. By this setting, the output Trp 1 or 2 will then contain only those functions which were assigned to it.

▶ Trip 1 output is internally interconnected with CB1 operation, i.e. in case of activation of Trp 1, the CB1 Feedback is expected to be deactivated. The same applies for Trip 2: in case of activation of Trp 2, the CB2 Feedback is expected to be deactivated.

5.3 Priority switching

Priority switching feature allows using the circuit breakers CB1 and CB2 as a backup to the other one. To clearly understand this, it is necessary first to understand the possibility of assignment of any of the operated two circuit breakers to the appropriate protective function (**see Operation mode with 2 trip outputs on page 31**).

Though both of the breakers are equivalent and fully assignable within the InteliPro relay, the most common application for generator-to-mains connection is as follows:

▶ CB1 is considered as the main contactor of the generator to the mains. In ComAp products, this breaker is called "Mains Circuit Breaker" = MCB.

▶ CB2 is considered as a supplementary contactor on the power connection between generator and mains. There can be specific protection functions assigned to trip CB2 only and it can provide back-up functionality to the CB1. It can, but does not necessarily have to correspond to the "Generator Circuit breaker" = GCB as used in the ComAp products.

▶ Please note, that as both circuit breakers are equivalent, it is also possible to assign CB2 as the main one and CB1 as the backup, or provide a symmetrical backup of both breakers "one to each other".

Depending on setting the setpoint **Prio Switching [DISABLED / CB1 -> CB2 / CB1 <- CB2 / CB1 <-> CB2] (page 92)**, the following backup function is provided:

DISABLED	No CB backup is provided.
CB1 -> CB2	CB1 is considered as the primary contactor. If the CB1 Feedback is not deactivated within preset period after Trp 1, the output Trp 2 is issued immediately to trip CB2 as backup. Bak Trp 1 is issued at the same time.
CB1 <- CB2	CB2 is considered as the primary contactor. If the CB2 Feedback is not deactivated within preset period after Trp 2, the output Trp 1 is issued immediately to trip CB1 as backup. Bak Trp 2 is issued at the same time.
CB1 <-> CB2	Both CBs provide a backup switching for each other. If the CB1 Feedback doesn't deactivate in preset period, CB2 is tripped, if the CB2 Feedback doesn't come in preset period, CB1 is tripped.

5.4 TRIP and Fault Reset description

5.4.1 TRIP

TRIP may be considered as event or status of the unit:

TRIP event

▶ Starts in the moment of terminating the count-down of any protective function with delay, or in the moment of activation of any immediate protective function.

▶ As a result of the trip event, are e.g. the following consequences:

● Immediate activation of output Comm Trp and deactivation of output !Comm Trp

● LED TRIP goes to red

● History record is created.

TRIP status

- ▶ Starts at the moment of TRIP event

- ▶ During this status, the **Comm Trp (page 77)** and **!Comm Trp (page 77)** outputs keep in the fault position

- ▶ During this status, it is not possible to perform Fault reset

- ▶ TRIP status is active until a successful Fault reset. This may not be done before all measured and evaluated values are within preset limits.

- ▶ If during the TRIP status, caused by some value, another value overreached its limits for TRIP evaluation, this second overreach is not considered as TRIP. It does not cause a second TRIP event. However, as a consequence of this, the TRIP duration may be prolonged until the moment when both (all) values are within limits.

5.4.2 Fault reset

Fault reset is an event, caused by either of the following reasons:

- ▶ Fault reset [⚡] button is pressed.

- ▶ Input **F.R. Button (page 74)** is activated.

- ▶ Automatic fault reset is performed according to the setting of **Auto FR [DISABLED / ON DEACT / CB1+CB2=0 / NOFAULT+DEL] (page 92)**.

- ▶ By activation or deactivation of **Block 1, Block 2 (page 73)**.

The reasons mentioned above are a trigger to provide Fault reset, however, it is successfully done only in case that the TRIP status is activated and all evaluated values have returned back into limits. If the TRIP status is not activated, or it is activated, but any of the values is still out of limits, Fault reset is not done and any of the mentioned triggers is forgotten. I.e., the unit may not be „provisionally" fault-reset.

By a successful Fault reset, the TRIP status is terminated.

5.5 Interconnection to IG/IS-NT controllers

It is possible to interconnect InteliPro unit with IG-NT and IS-NT controllers on the CAN2 bus. Refer to the chapter **CAN bus and RS485 (page 55)** for the details on wiring the CAN2 bus. The most frequent applications of this function are as follows:

- ▶ Transmitting analog values like active and reactive power, measured voltage or current from the point of connection to the mains via InteliPro to the NT controllers. Technology of shared peripheries is used to transmit up to 4 analog values. The transmitted values can then be processed by the controllers to allow the requested operation of the gen-sets (e.g. load and PF control).

- ▶ Transmitting binary signal from the point of connection to the grid to the controllers. Technology of shared peripheries is used to transmit up to 8 binary signals. Typically, the state of breaker feedbacks or other InteliPro binary inputs can be used to provide inputs to the gen-set control processes. Another application is to use InteliPro as a communication interface that allows e.g. setting the remote control switches via remote communication. The state of the switches can then be transferred to the controllers to reduce power to the value requested by the external system or provide other signals relevant to the site operation.

- ▶ Remote monitoring of the complete site including the InteliPromains protection and gen-set controllers through the CAN2 bus and ComAp standard monitoring modules and tools (I-LB+, InternetBridge-NT, InteliMonitor).

5.6 Shared peripheries

The function is compatible with IG/IS-NT controllers. CAN2 interconnection between the gen-set controllers and InteliPro is necessary to allow this feature. Use the LiteEdit configuration window to configure the appropriate binary and analog values to be transmitted from InteliPro via the CAN2 communication. In the Configuration window, click the � button. The following window opens:
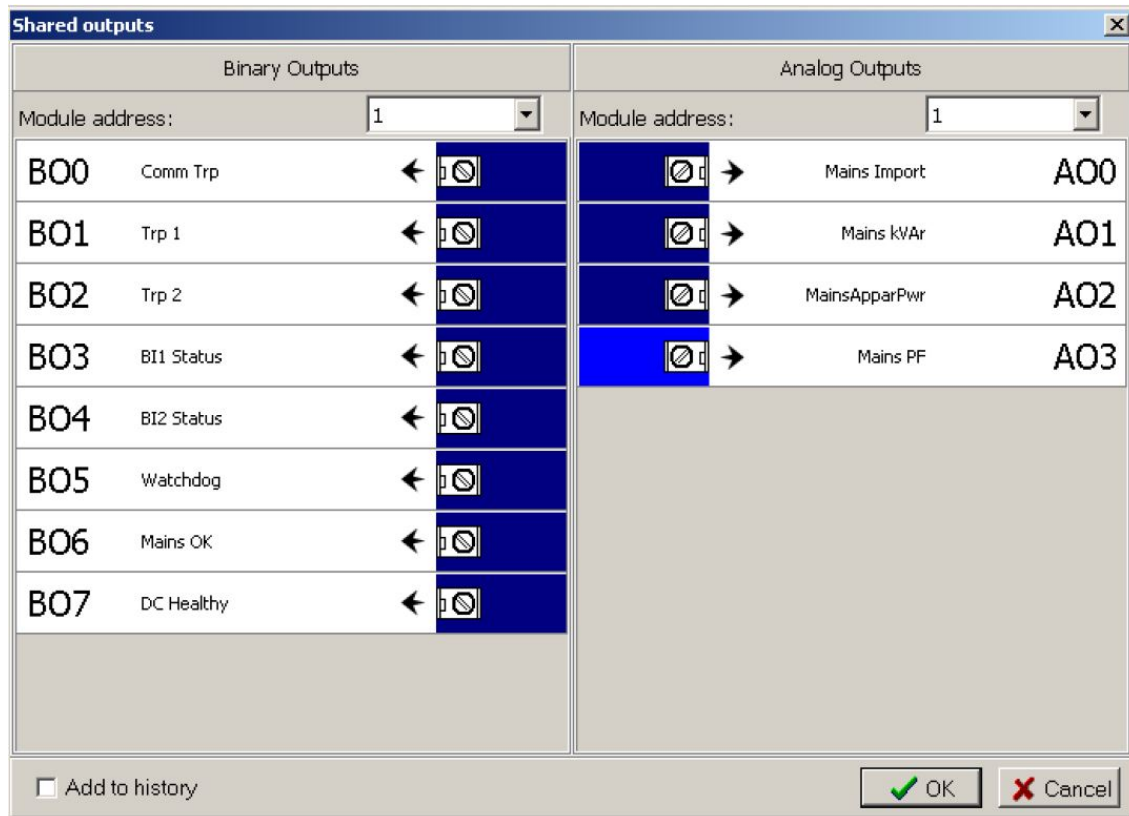
Using the "Module address" selection box to adjust the address of the shared peripheries module and avoid collision with other module already present on CAN2 bus. Click on the appropriate Binary output or Analog output in the list to set-up the value to be transmitted via CAN2 bus to the gen-set controllers. The transmitted values are received by the IG/IS-NT controllers connected via the CAN2 bus. See more about configuring shared peripheries (Shared and Internal virtual I/O periphery and PLC) in IGS-NT-Application guide.

The shared binary and analog outputs can be used for communicating out the binary statuses of CBs, trips of the particular protective functions or transmitting the value of mains import in kW, kVAr or kVA and further processing e.g. for the gen-set control or visualization of the site.

5.7 Remote opening/closing of circuit breakers

InteliPro offers the users the possibility to manually control – open/close a circuit breaker. The breaker can operated either by binary input or via PC software - LiteEdit and InteliMonitor allow the user to click either on "Open" or "Close" button and InteliPro will issue a signal (activate binary output) to open or close the circuit breaker. There are two dedicated binary inputs – CB1 open and CB1 close; for detailed description see Library of binary inputs and three binary outputs – CB1 ON Man, CB1 OFF Man, CB1 UV Coil to operate the circuit breaker; for detailed description see the Library of binary outputs.
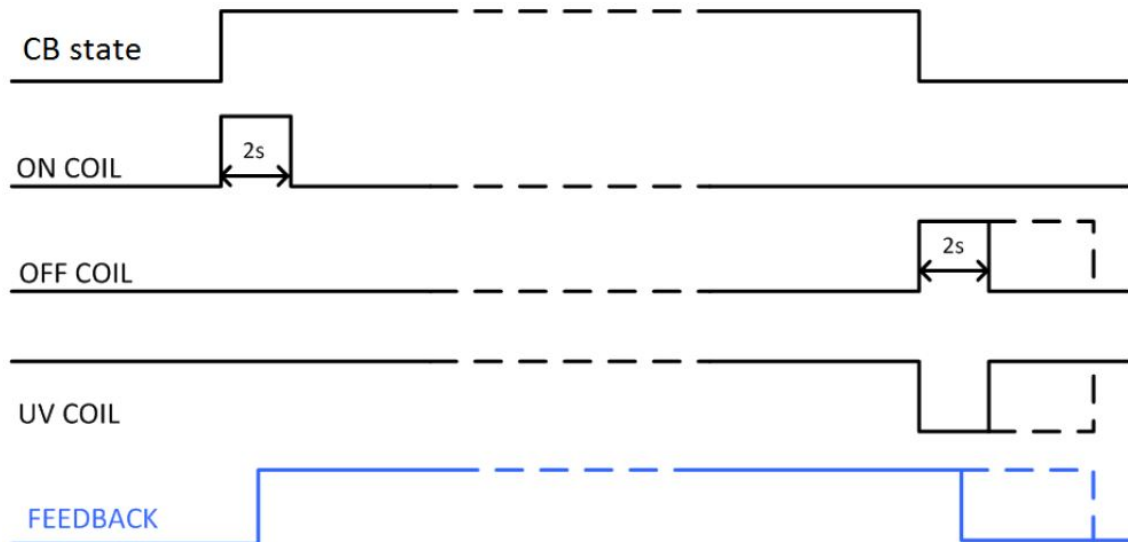
The buttons are password protected and are enabled only upon entering correct password.

Opening of the circuit breaker is possible under any conditions, closing only if all of the following conditions are fulfilled:

▶ The circuit breaker has been manually opened before.

▶ InteliPro is not in TRIP state.

▶ All mains parameters are within limits.

It may happen that after opening the breaker the unit is reset or some changes in configuration are done. It is important that even if all mains parameters are within limits the breaker remains open because it was manually opened and it is a wanted state. The breaker can close only after the input CB1 close is active or if the button ▮ in InteliMonitor or LiteEdit is pressed. There is no automatic operation of the controller if configuration is change towards remote/manual operation.

There will be an event created in the Alarm list and History when the circuit breaker is manually opened.

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6 Protective functions

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6.1 The concept

InteliPro is a compact electronic protective relay, providing complete list of protective functions. Each of the functions works as an autonomous protective stage, with its independent activation, setting of the limits and assigning of the **Trp 2 (page 83)** and/or **Trp 1 (page 82)** output and Block 1 and/or Block 2 input (**Block 1, Block 2 (page 73)**). Besides that, each activated protective function activates the **Comm Trp (page 77)** output as described above. These settings are done in the setpoints menu, using the appropriate group of setpoints, assigned to its function. E.g. setting of overcurrent limit, delay, and trip outputs is done in the setpoint **Group: I> (page 101)**.

6.1.1 How to set up trip outputs

To assign the appropriate trip outputs, which are operated by a particular protective stage, find the setpoint group, which contains the setting of this protective stage. E.g. for overcurrent, go to the setpoint **Group: I> (page 101)**. In the setpoint group find the setpoint xxx Trp BO, where "xxx" is the abbreviation of the protective stage. It is possible to use the following setting:

▶ None: neither Trp 1 nor Trp 2 is activated in case of this protective stage trip. In such case, only the Comm Trp output contains information about trip by this protection stage.

▶ Trp 1: binary output Trp 1 is activated in case of this protection stage trip.

▶ Trp 2: binary output Trp 2 is activated in case of this protection stage trip.

▶ Trp 1+2: both binary output Trp 1 and Trp 2 are activated in case of this protection stage trip.

▶ In all cases, the Comm Trp output contains information about trip from all activated protection stages.

6.1.2 How to set up blocking conditions

New version of LiteEdit allows setting of InteliPro blocking conditions for individual functions in "Blocking conditions" matrix. It provides simple enabling and disabling of functions either in all cases or only under specific conditions. It also provides option of blocking particular functions by binary input or blocking if not in parallel to mains operation.

> **IMPORTANT: This feature replaces the selection of disable/enable option in InteliPro "General" group of setpoints, as well as selection of blocking binary inputs for selected functions.**

Description

The functions to be blocked are located in the very left column called "Protection". Functions can be added by pressing [+] button and removed by pressing [-] button. After selecting desired function, the "Setting" column offers selection for Disable or Enable the function. The third, "Blocking conditions" column, provides list of functions to create the logic matrix. It offers list of functions, as well as binary inputs for blocking (Block 1, Block 2) and operation in parallel (Parallel). Setting if the protection selected in the first column should be

enabled, or disabled resp., by activation or deactivation of the function selected in the third column, can be distinguished by ticking off the box "NOT".

Blocking conditions can be also added by pressing [+] button and removed by pressing [-] button.

Help hints describing the set blocking conditions are available for each function upon placing cursor on the particular box.

> **IMPORTANT: Blocking conditions can be saved as a part of an archive and uploaded to another unit with equal sw version. Blocking conditions cannot be transferred from older to newer InteliProsw version, due to possible inconsistency in the range of available functions.**
> **The speed of saving settings depends on the speed of the communication channel with the controller. If GPRS is used, uploading blocking conditions can last longer, therefore do not interrupt the process until uploading progress bar is shown.**

In order to e.g. activate only one adjustable pickup used within a multiple-stages protective function, set the pickup limit of the other one to zero. E.g. InteliPro allows setting 2 stages of overvoltage protection. To use only V> and block the V>> stage, set the pickup limit V>> to 0V. In general, setting of any pickup limit of any protective function blocks this protection stage.

If activation of one functionality (e.g. f<>) is conditional to other (e.g QU Protection), the activation is triggered by limit violation of f<> and the condition lasts until Fault reset is performed.

It is possible, that in your unit, some optional protective functions are not activated. In such case, the function is permanently blocked and even the setpoints related to it are not visible. In case that this protection is requested, please consult your sales representative regarding the options unlocking.

6.2 Protective functions in detail

6.2.1 Overvoltage, Undervoltage (ANSI 59, 27)

The RMS value of measured voltage is compared with the preset limit of overvoltage or undervoltage. When any of the preset limits is over/underexceeded, the output U Sig moves to fault-indicating position immediately. If the voltage of the given phase keeps out of limits for the delay of the appropriate stage, TRIP is issued. As the voltage returns back within limits in all measured phases, the U Sig output stop to signal the fault state immediately, regardless of whether TRIP was issued or not or Fault reset was performed or not.

Both overvoltage and undervoltage protective stages provide possibility of setting 2 levels with independent delay assigned to each level.

In order to prevent from unwanted voltage oscillation around the overvoltage, respective undervoltage limits, there is a possibility to set up voltage hysteresis. The principle is shown in the pictures below. After overvoltage situation, voltage must decrease under the hysteresis limit to clear the fault. After undervoltage situation, voltage must exceed the hysteresis limit to clear the fault.
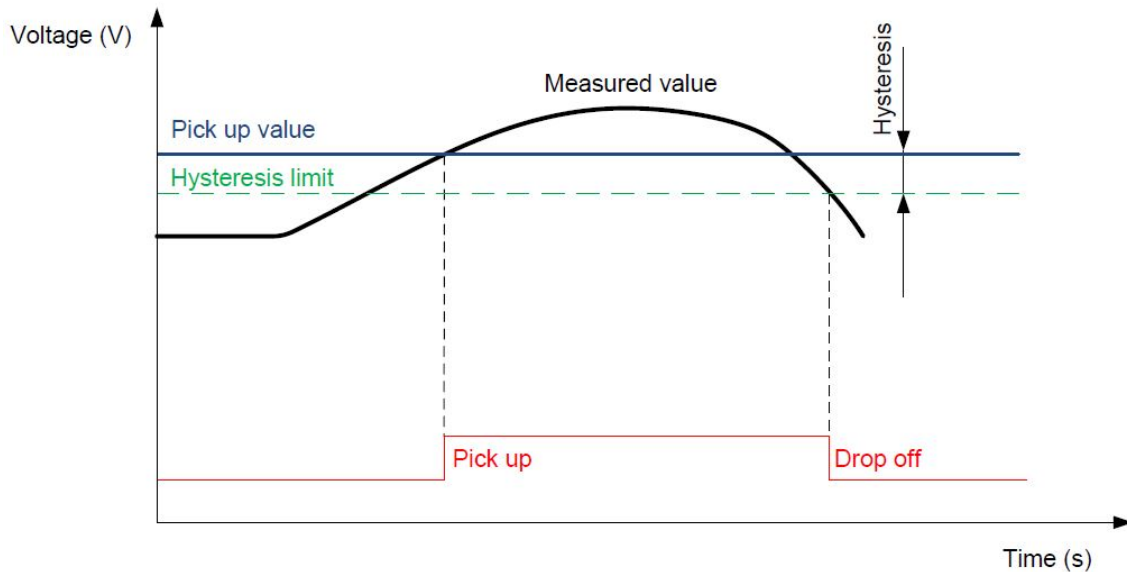
Image 6.1 Voltage hysteresis for overvoltage
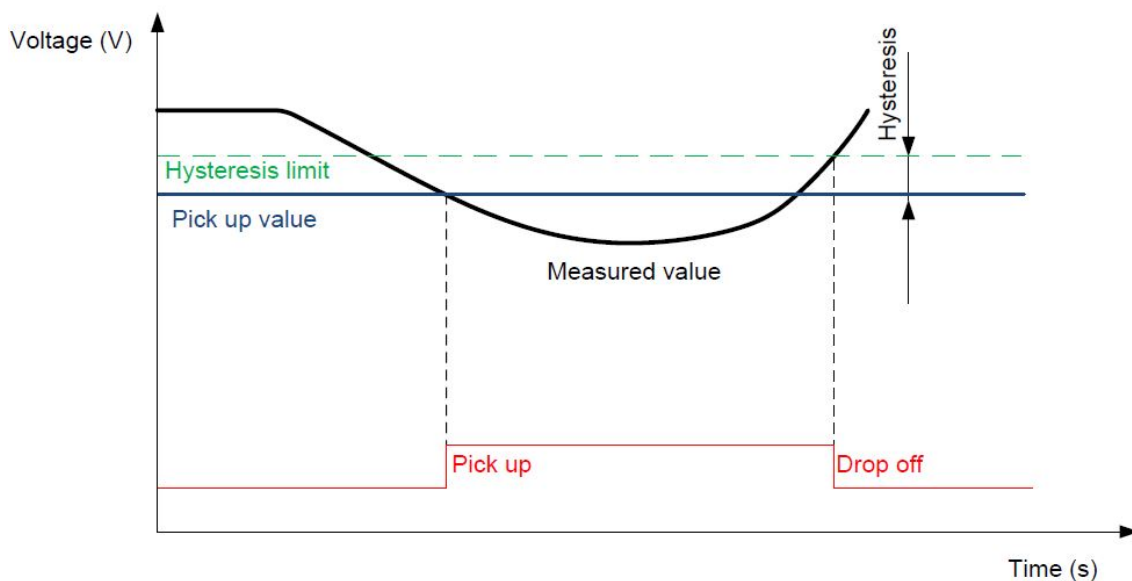
Image 6.2 Voltage hysteresis for undervoltage

6.2.2 Overfrequency, Underfrequency (ANSI 81 H, L)

The frequency value measured on phase L1 is compared with the preset limit of overfrequency or underfrequency. When any of the preset limits is over/underreached, the output f Sig moves to faultindicating position immediately. If the frequency keeps out of limits for the delay of the appropriate stage, TRIP is issued. As the frequency returns back within limits, the f Sig output stops to signal the fault state immediately, regardless of whether TRIP was issued or not or Fault reset was performed or not.

Both overfrequency and underfrequency protective stages provide possibility of setting 2 levels with independent delay assigned to each level.

In order to prevent from unwanted frequency oscillation around the overfrequency, respective underfrequency limits, there is a possibility to set up frequency hysteresis. The principle is shown in the pictures below. After

overfrequency situation, frequency must decrease under the hysteresis limit to clear the fault. After underfrequency situation, frequency must exceed the hysteresis limit to clear the fault.
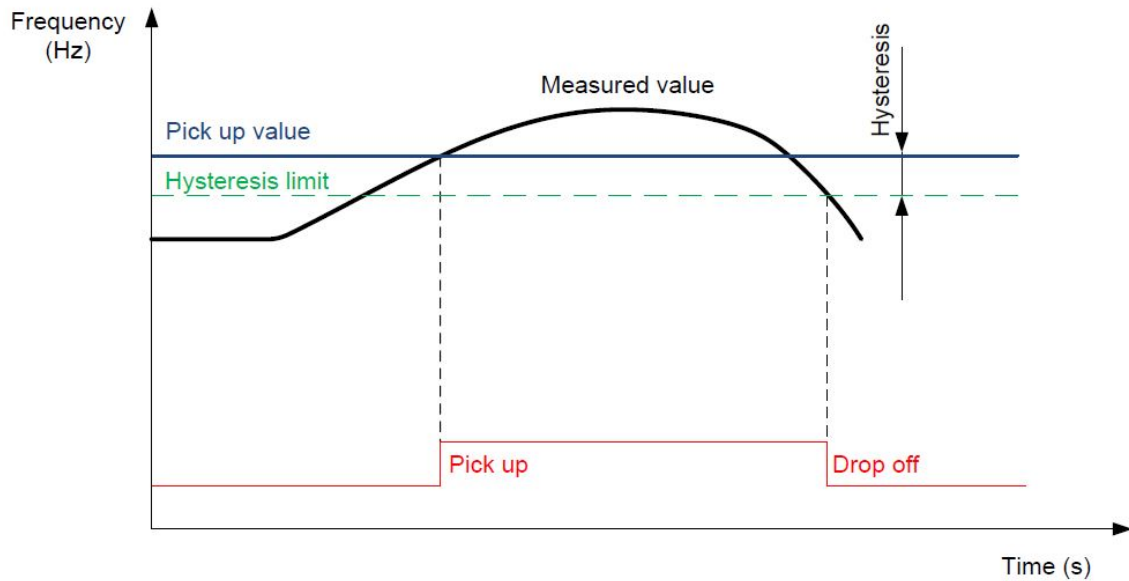
Image 6.3 Frequency hysteresis for overfrequency
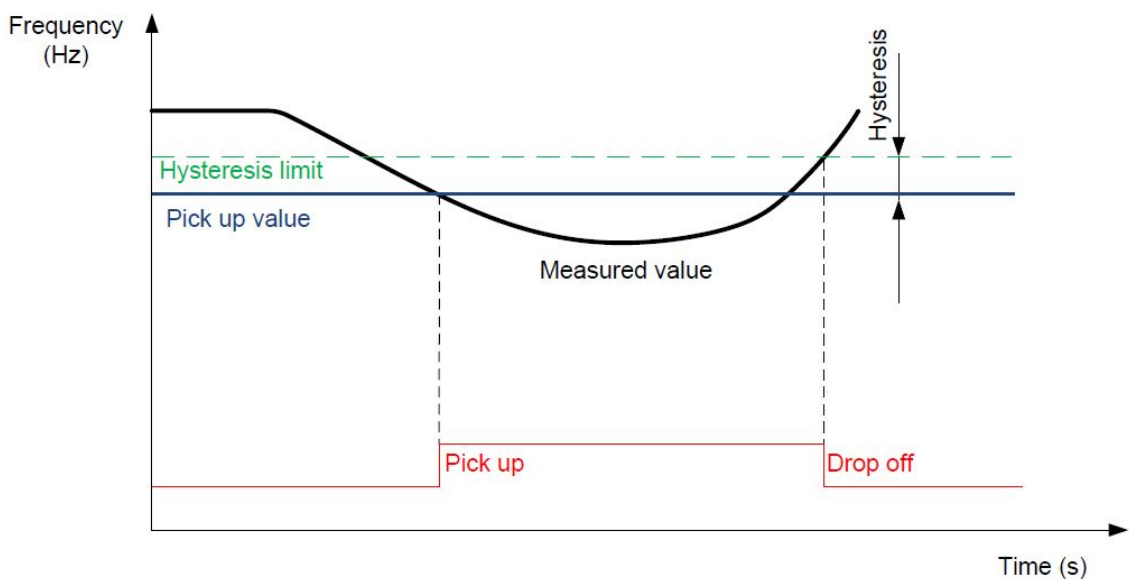
Image 6.4 Frequency hysteresis for underfrequency

6.2.3 Voltage unbalance (ANSI 47)

The voltage unbalance is evaluated in case that amplitude difference between any 2 phases overreaches the preset limit V Unb: V Unb. It refers to the amplitude unbalance of the measured voltage.

6.2.4 Floating average overvoltage

The floating average overvoltage protection provides continuous 10 minutes long measurement of either phase-to-neutral or phase-to-phase voltage (depending on the Voltage Setup parameter setting). In case that the measured voltage exceeds the set limit, an immediate trip is issued.

6.2.5 "Loss of mains" protections

InteliPro provides two different methods for fast evaluation of loss of mains (LOM), into which the generator operates:

▶ Vector shift

▶ Rate Of Change Of Frequency

The loss-of-mains protections setpoints are in **Group: LOM (page 99)**.

6.2.6 Vector shift

Vector shift is one of the LOM protections. It provides very fast detection of mains failure (in units or tens of ms), based on the principle of shift of the synchronous generator displacement angle. The displacement angle is an angle between magnetic field of a rotor and the rotating magnetic field of the stator winding and relates strongly to the load of the generator. In case that this load changes, the displacement angle immediately changes by a "jump". Compared to the frequency decrease, which probably also occurs, this jump is an immediate phenomena and is detected as a shift of the measured voltage sine curve - Vector shift or Vector jump. Depending on the preset limit in degrees [°], it allows immediate disconnection of very fast failures and thus prevention of severe damages which could not be prevented within the delay of frequency or voltage protections.
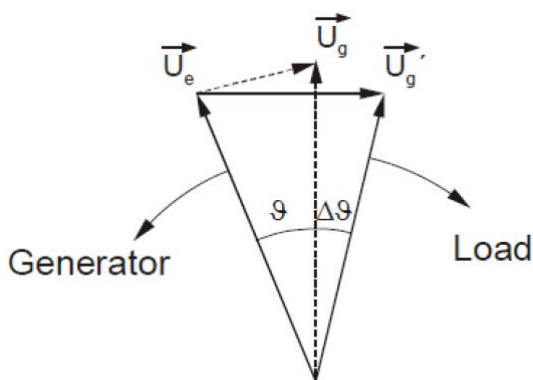
Image 6.5 At mains failure   Image 6.6 Measuring principle
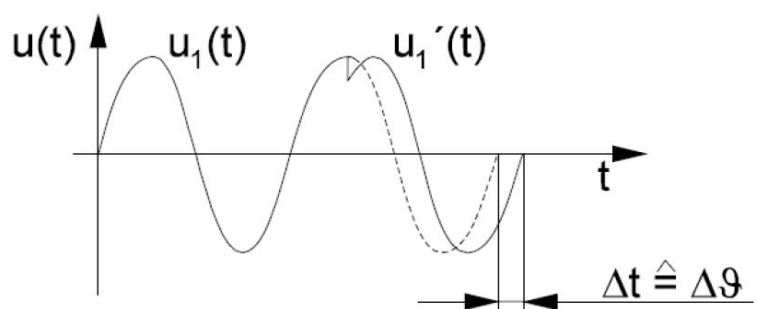
Vector shift reaction times are usually requested up to 30ms. Typical setting is shown e.g. in G59/3 standard (see below).

6.2.7 Rate Of Change Of Frequency (df/dt, ROCOF, ANSI 81R)

ROCOF is second most frequently requested method of LOM detection. In principle, the method uses similar evaluation method like Vector shift, but the physical phenomena detected is different. It calculates the change of speed of the generator, caused by sudden change in its load, together with unintentional islanding situation (loss of mains), which is normally capable of keeping the frequency on a stable level. The frequency change is expressed as tangent in time [Hz/s]:
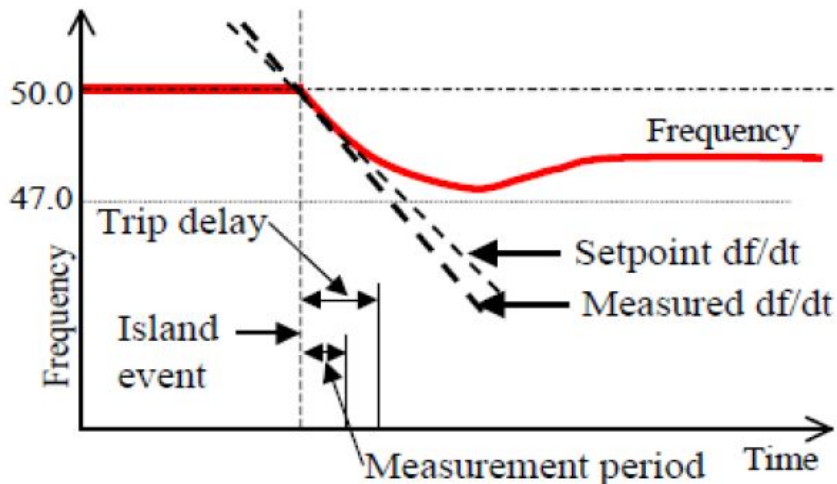
Image 6.7 RoCoF detection - negative df/dt
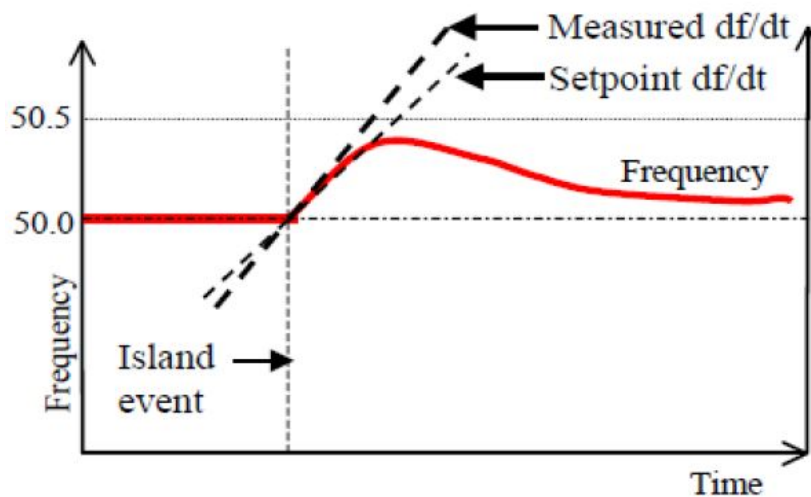
Image 6.8 RoCoF detection - positive df/dt

In case that absolute value of this tangent overreaches a pre-set pickup limit, the protection trips. It is a fast protection, similar to Vector shift, however, unlike Vector shift, which detects immediate phenomena, the tangent calculation requires a certain time for evaluation. In ComAp protection relays, the evaluation time for ROCOF protection can be adjusted by setpoint **ROCOF [Hz/s] (page 99)** filt in number of sine curve cycles being taken into evaluation from 1 to tens of cycles (each having 20ms, if frequency is 50Hz). This allows setting up the ratio between the evaluation speed and sensitivity to nuisance trips. Protection tripping delay **ROCOF Del [s] (page 100)** is available in addition to that. It defines time for which ROCOF value has to be above the ROCOF tripping limit before actual tripping.

6.2.8 Overcurrent: definite-time, IDMT and with voltage control

InteliPro provides three types of mains-overcurrent with different setting of the protection delay:

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Definite time overcurrent (ANSI 50)

The trip is issued in a given delay after the current in any phase exceeds pre-set pickup limit. The setting is done using the setpoints in the **Group: I> (page 101)**.

IDMT overcurrent (ANSI 51)

The IDMT (inverse definite minimum time) overcurrent protection evaluates the true RMS value of the current independently in any of the 3 phases (is activated if the overcurrent is detected in only one phase). This protection provides delayed overcurrent trip, where the delay is based on the current magnitude. The setting is done using the setpoints in the **Group: I> T (page 101)**.

The relation between the time and current is set by the following curve:
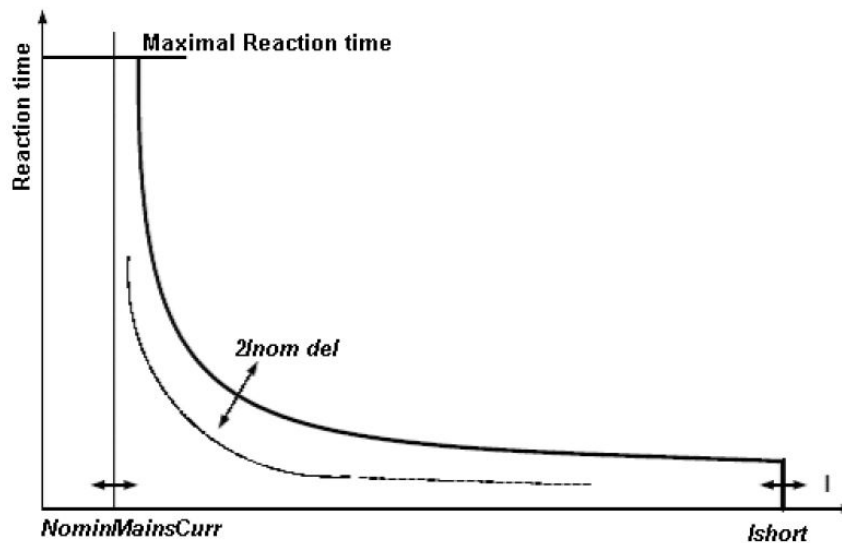
Tripping

The trip time can be calculated from the following formula:

$$t(I) = \left(\frac{A}{M^P - 1} + B\right)$$

where   t(I) is the trip time

p, A and B are constants which determine the final shape of the curve

M is the ratio of measured current value and pickup current (pickup is the nominal current)

The trip delay, respectively the curve shape is to be prescribed by the DNO, based on the calculations of short-circuit conditions in the point of the generator connection. The grid protections are coordinated and allow for isolating the faults by the protections which are located closer to the short-circuit area. This way, the discrimination of the breakdown point is done by the short-circuit current magnitude allowing the generator to ride-through a distant faults and contribute to recover the mains voltage after the fault is disconnected.

InteliPro offers pre-set curves according to ANSI and IEC standards, and one "IDMT" curve.

The shape of the IDMT curve can be selected using the parameter I> T: I> T Curve.

The curves can have the following shapes:
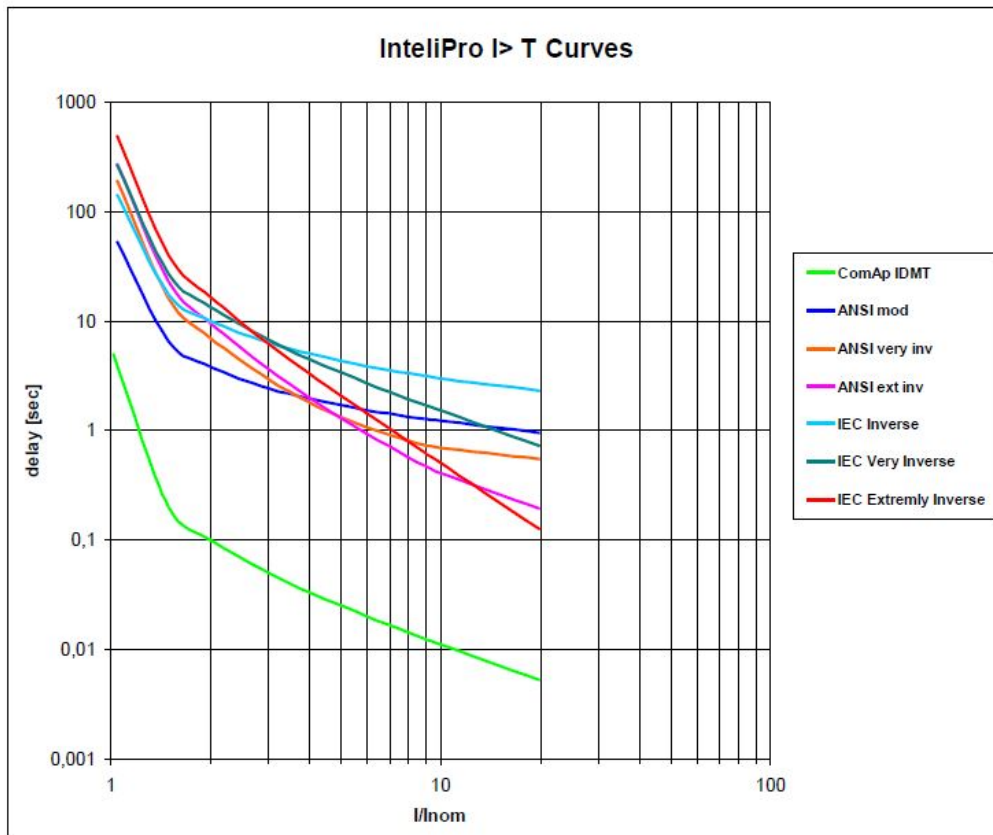
List of the used constants for curve shape determination:

▶ ANSI

Characteristic	A	B	p	t_r*	p**
Moderately inverse	0,0515	0,1140	0,02	4,85	2
Very inverse	19,61	0,491	2	21,6	2
Extremely inverse	28,2	0,1217	2	29,1	2

▶ IEC

Characteristic	A	B	p	t_r*	p**
Moderately inverse	0,14	0	0,02	9,7	2
Very inverse	13,5	0	1	43,2	2
Extremely inverse	50	0	2	58,2	2

▶ IDMT

Characteristic	A	B	p	t_r*	p**
IDMT	1	0	1	2,5	1

If the option IDMT is selected, then the trip time formula can be simplified as follows:

$$\text{Reaction time} = \frac{2Inom\ del*NominMainsCurr}{Mains\ current - NominMainsCurr}$$

In this case the I> T Del equals to the reaction time for 200% overcurrent (when mains current = 2* NominMainsCurr).

Resetting

The IDMT protection provides also the mechanism of time-dependent resetting curves after the current decreases to or below the nominal current. This mechanism respects the cooling characteristics of the protected device. See the picture below for the complete curves shape including the reset characteristics:
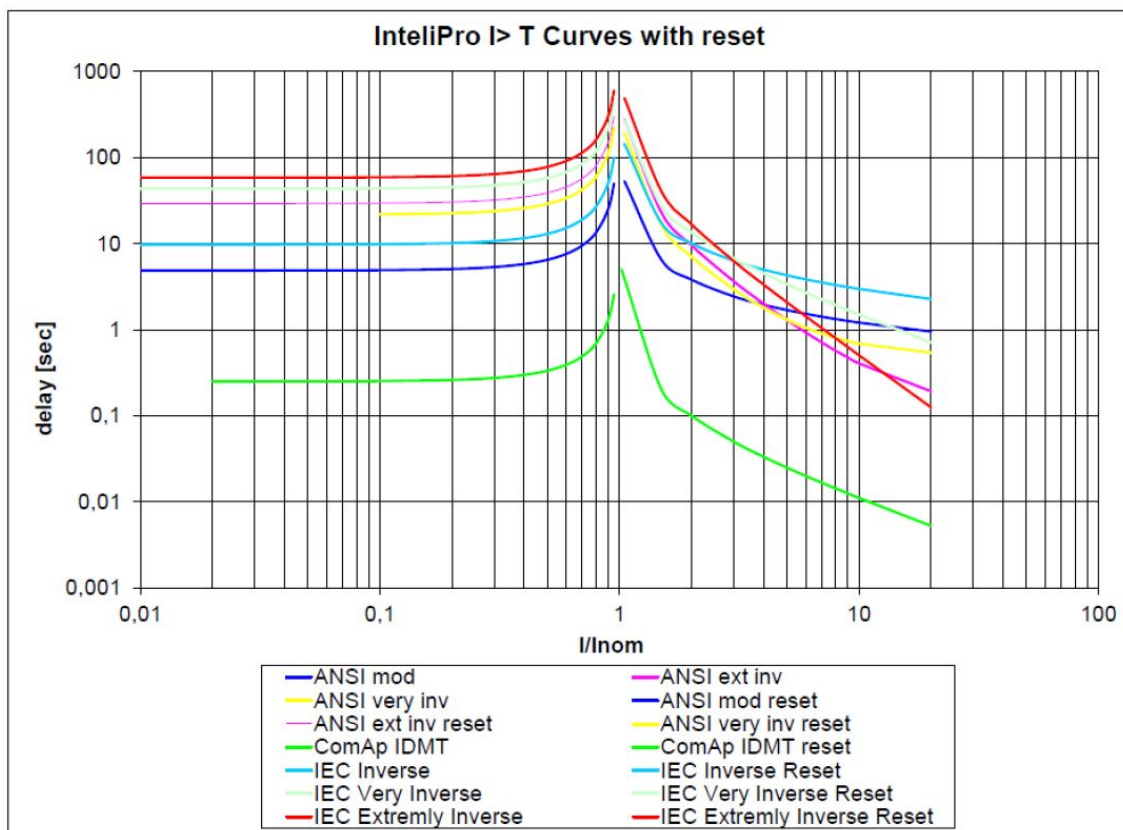
The reset time can be calculated from the following formula:

$$t(I) = -T_{dial} \cdot \frac{t_r}{\left(\dfrac{I}{I_{nom}}\right)^P - 1}$$

where t(I) is the reset time after tripping

      T_{dial} is multiplier (I>T Del in IDMT curve)

      I is the measured current value pickup current

      I_n nominal current (pickup current)

      t_r and p are constants which determine the final shape of the curve (values to be found in the tables with other constants above)

The IDMT tripping curve and resetting curve depends on the conditions to which InteliPro was exposed, as the unit requires some time to recover after being subjected to overcurrent. The reset time does not depend on the magnitude of the overcurrent, but it depends on how long the overcurrent (I>In) was present before the circuit breaker was opened.

The provided ANSI51 curve shapes are multiplied by the time multiplier, set by the setpoint **I> T Del [s] (page 101)**. This way, the final shape of the tripping curve is calculated. See the example of the ANSI Moderately Inverse curve multiplied by various time multipliers:
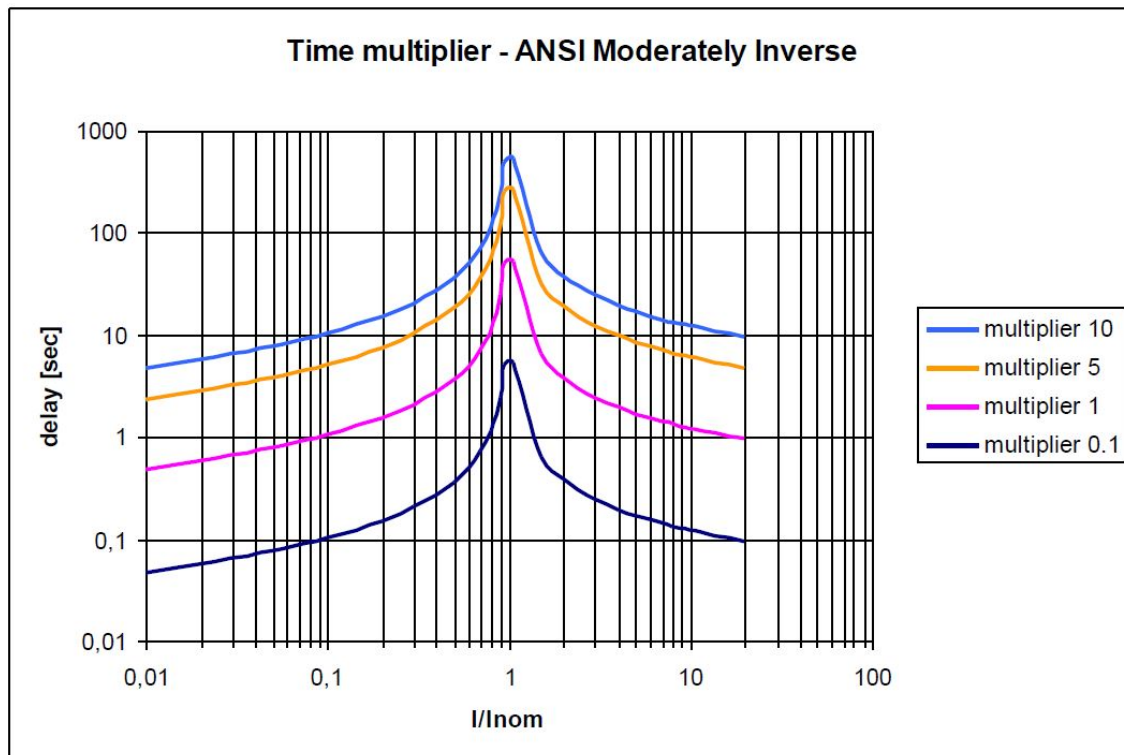
IMPORTANT: Please note that InteliPro current measurement inputs range is 5A with over-range up to 9A. This range provides possibility of ANSI 51 curves calculation up to cca 2x In case that 5A CT secondary current is used. To allow evaluation of higher currents and appropriate delays according to the mentioned curves, we recommend using lower secondary rating of the current transformers (typically 1A) and then setting the current ratio accordingly. Please note, that this solution though decreases the accuracy of the measurement, which is designed for the 5A CT output.

Time overcurrent with voltage control and restraint (ANSI 51V)

The voltage control of time overcurrent assures that the protection is blocked in case that the measured voltage is above the level set by the setpoint **I> V Control [%Un] (page 103)**.

The voltage restraint function is a modification of the IDMT overcurrent protection. It uses the same mechanism of the delay calculation according to the IDMT trip curve, but the delay is further adjusted according to the measured voltage:
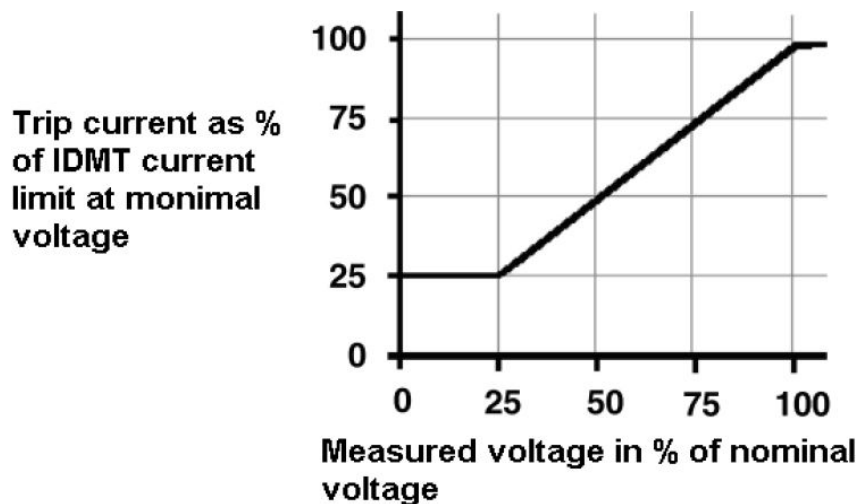
This protection functionality uses the fact that voltage in the point of short-circuit drops to zero or very low values and with growing distance from the fault, it increases up to the mains nominal voltage value. Thus, increased sensitivity to short-circuits localization and protection coordination is provided. The setting is done using the setpoints in the **Group: I> V (page 102)**.

Earth Fault Current (ANSI 50N, ANSI 51N)

For the earth fault current protection, the 5 A current measurement input, located on the plug-in module Relay Card CT2-REL2 is used. The protection stage allows setting up instantaneous neutral overcurrent or IDMT overcurrent, similar to the mains overcurrent protective functions. The setting is done using the setpoints **Group: EFC (page 105)**.

Ground Surge Current (ANSI 50GS, ANSI 51GS)

The function is intended for detection of non-zero current used to indicate earth faults by sensitive ground sensors. The function enables very sensitive measurement in level up to 50 mA, so it is applicable e.g. for Hall sensors measurement. Please note, that due to very low measurement range, it must be assured that the current will not overreach 120mA, what is the thermal capacity of the input.

For the ground surge current protection, the 50 mA current measurement input, located on the plug-in module Relay Card CT2-REL2 is used. The protection stage allows to set up instantaneous ground surge overcurrent (ANSI 50GS) or IDMT overcurrent (ANSI 51GS), similar to the mains overcurrent protective functions. The setting of the 50GS/51GS function is done using the **Group: IGS (page 106)**. Unlike the mains current or earth fault current protections, the limit setting is done directly in mA.

Current unbalance (ANSI 46)

The current unbalance protection is used to avoid unbalanced load in the point of mains connection. The setting is done using the setpoints in the setpoint **Group: I Unb (page 103)**. The units of I Unb are in percent of current nominal value.

Directional overcurrent (DOC, ANSI 67)

DOC is sensitive for location of the fault with relation to the measurement point. This way, directional protection is capable to detect whether the fault happened "in front of it" or "behind". Directional overcurrent protection, applied in the point of generator connection to mains, is considered a loss of mains protection, however it does not substitute the traditional loss of mains protections like Vector shift or ROCOF. The typical application is a

generator running in parallel to mains with its own load consumption (e.g. peak shaving, soft transfer stand-by, or other applications). The generator is usually used to support the local consumption with no export to the mains. In case of mains transition into an island mode, the generators, running in parallel with the islanded area, would start to supply its complete consumption, generating current in opposite direction. DOC protection is used to avoid this situation, and trip the generator from the islanded mains, combining the overcurrent protection together with its directional character. Compared to the "reverse power protection", DOC protection detects also reactive currents from the given angle zone, what allows better sensitivity for tripping.

The following image shows the conditions of activation of Directional Overcurrent protection in InteliPro – i.e. critical angles between voltage and current, given the voltage is placed at the 0°angle:
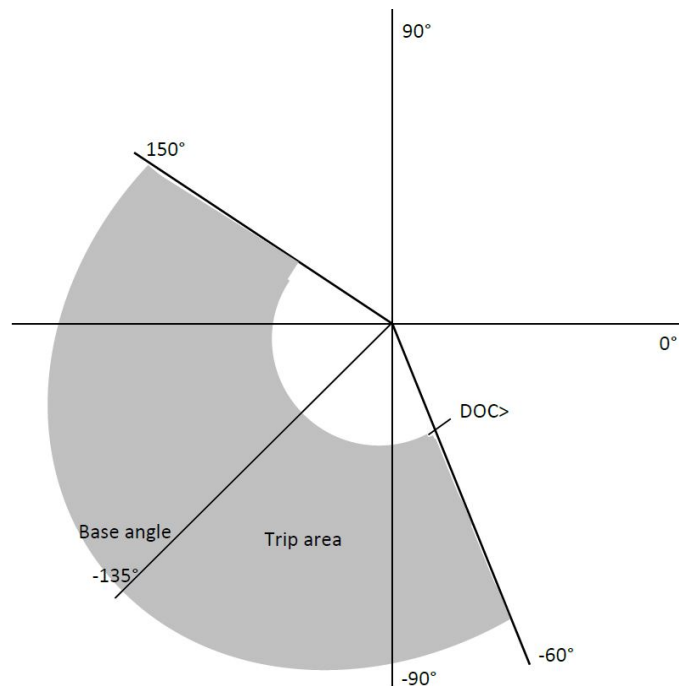
The setting is done using the setpoints in the **Group: DOC (page 104)**. The unit allows top test the functionality of the directional overcurrent protection by setting the setpoint DOC Test to ENABLED. In such case, the **DOC Test [DISABLED / ENABLED] (page 105)** shows the sensing of the protection regardless of the other protection enabling/disabling conditions in order to allow full quadrant range test of this protection stage.

Neutral Voltage Displacement (NVD, ANSI 59N)

NVD protective function is used in medium or high voltage systems with isolated or indirectly grounded zero-point. Under healthy conditions of the system, the sum of the three phase-to-earth voltages should balance to zero. When an earth-fault occurs, it does not cause a short-circuit, because of the isolation of the system in the zero point. However, the fault provides connection of one phase with earth what represents hazard for the system safety (ground-fault in any other phase would then mean a phase-to phase short-circuit, phase-to-ground voltage of the other phases may fluctuate to multiples of its nominal, providing increased stress to the isolation system, etc). One of the effects of the fault is a rise in the neutral voltage, so called neutral voltage displacement. This neutral voltage displacement is measured in a specific "open-delta" connection of voltage transformers, as shown in the chapter Voltage and current inputs. In some cases, it is required to clear the fault by tripping the appropriate circuit breaker. However, the NVD protection itself does not allow detecting the location of a fault and for this reason it is sometimes used only for providing an earth-fault alarm.

A specific function is provided incase that mains failure is detected by an external device e.g. for purpose of redundancy: If the external device indicates a mains failure state and activates the input Ext Mf Relay, the NVD

trip outputs are blocked. To unblock the NVD protection, it is necessary not only to deactivate the Ext Mf Relay input, but also to deactivate the feedback of the circuit breaker, which is operated by the NVD protection stage.

It is possible to set whether the NVD contributes to the common trip of the relay or uses its own separate output for signalization of the NVD alarm. The setting is done using the setpoints in the group NVD.

Directional power (ANSI 32)

InteliPro provides two stages of power protections, both of them allowing setting of either overreaching the preset limit or underreaching it. This way, all of the following protections are realized:

▶ Mains reverse power (protection of unintentional export)

▶ Generator reverse power (protection of motoric operation)

▶ Minimum import underreaching (timely trip in case of unintentional export approaching)

The setting is done using the setpoints in the **Group: P (page 109)**.

Directional reactive power (ANSI 32Q/40)

InteliPro provides two stages of reactive power protection, both of them allowing setting of either overreaching the preset limit or underreaching it. This way, all of the following protections are realized:

▶ Excessive reactive power import from mains

▶ Excessive reactive power export to mains

The setting is done using setpoints in the **Group: Q (page 111)**.

Power Factor (ANSI 55)

InteliPro provides inductive (current is lagging voltage) and capacitive (current is leading voltage) power factor evaluation. In case the value of the measured power factor falls below the set limit, trip output is activated accordingly.

The power factor evaluation is based on the phase difference between current and voltage.

The setting is done using the setpoints in the **Group: PF (page 112)**.

Single phase reverse power protection

InteliPro provides two stages of single phase reverse power protection, both of them allowing setting of either overreaching the preset limit or underreaching it. This way, all of the following protections are realized:

▶ Excessive single phase power import from mains

▶ Excessive single phase power export to mains

InteliPro evaluates the protection separately in all three phases. In other words three separate protections are evaluated, one in each phase.

The setting is done using setpoints in the **Group: P 1Ph (page 110)**.

Synchro check (ANSI 25)

This function checks state of synchronism at both sides of the circuit breaker. It is used as a supplementary function to automatic reconnection of the other functions to assure that the synchronous conditions are met before the circuit breaker closes back by the protection relay, or is unblocked to be closed by some other device. In InteliPro, either L1-L2 phase-to-phase voltage or L1-N phase-to-neutral voltage is measured on the generator side of the circuit breaker and compared with the corresponding measured mains voltage. Whether phase-to-phase or phase-to-neutral voltage is used is decided by the setpoint **Voltage Setup [Ph To N / Ph To Ph] (page 87)**. Synchronous conditions are evaluated based on the pre-set window of voltage, frequency and angle match as set in the setpoint **Group: Sync Check (page 113)**.

AC reclosing (ANSI 79)

The automatic reclosing mechanism is generally used in situation, where temporary nature of the failure is expected. The protection relay trips the breaker according to the standard protection settings. As soon as the trip conditions disappear, i.e. the protection senses fault-free situation, the tripping output deactivates and after a reclosing delay, the reclosing output issues a signal to automatically reclose the breaker. There may be several reclosure attempts done in case of unsuccessful reclosing cycle. The setting is done using the setpoints in the **Group: AC Reclosing (page 115)**.

Pole Slip (ANSI 78PS)

The protection against pole slip ensures immediate disconnection of a generator running in parallel-to-mains in case that the load angle of the generator, which determines its loading, exceeds preset limit. The protection prevents from high overcurrents and mechanical stresses that occur when e.g. the load within the supplied area plummet significantly.

The setting is done using the setpoints in the group **Group: Pole Slip (page 116)**.

For pole slip protection evaluation of the RPM input is necessary, thus RPM input wire must be connected to the appropriate connectors and nominal revolutions per minute must be set in the setpoint **Nominal RPM [-] (page 117)**. Also, number of the engine´s flywheel teeth must be set in the setpoint **Gear Teeth [-] (page 116)**. The load angle limit is set in the setpoint **Pole Slip Lim [°] (page 117)**.

> *Note: For the RPM input **shielded cable** must be used!*
> *The function is active only in parallel operation, thus all CBs must be closed. For correct operation the mains voltage frequency and also the generator voltage frequency must be measured and synch check wires connected. InteliPro must be switched on before the engine starts running.*

Pole Slip protection requires generator voltage detection using Sync Check terminals. Single Phase-Neutral or Phase-Phase generator voltage is used for initial protection calibration. Use parameter Voltage Setup to determine what voltage is connected to the Sync Check terminals.

If Pole Slip protection is enabled in controller and PoleSlip protection is not blocked by a blocking condition, CB2 feedback function has to be configured with a binary input. CB2 feedback input has to be linked with generator circuit breaker feedback. CB2 feedback has to be deactivated when the Pole Slip protection trips. Trp PS Disable alarm is issued, if the CB2 feedback is not deactivated by the Pole Slip trip.

If it is not configured, protection Trp PS Disable is activated, because CB2 feedback is necessary for the Pole Slip protection evaluation. Alarm Trp PS Disable has the same effect like actual Trp Pole Slip, it means that these LBO signals are activated:

▶ CommTrp and other trip indication signals

▶ Pole Slip Prot

▶ Trp1/Trp2, activation of Trp 1/Trp 2 depends on LOM Trp BO setting
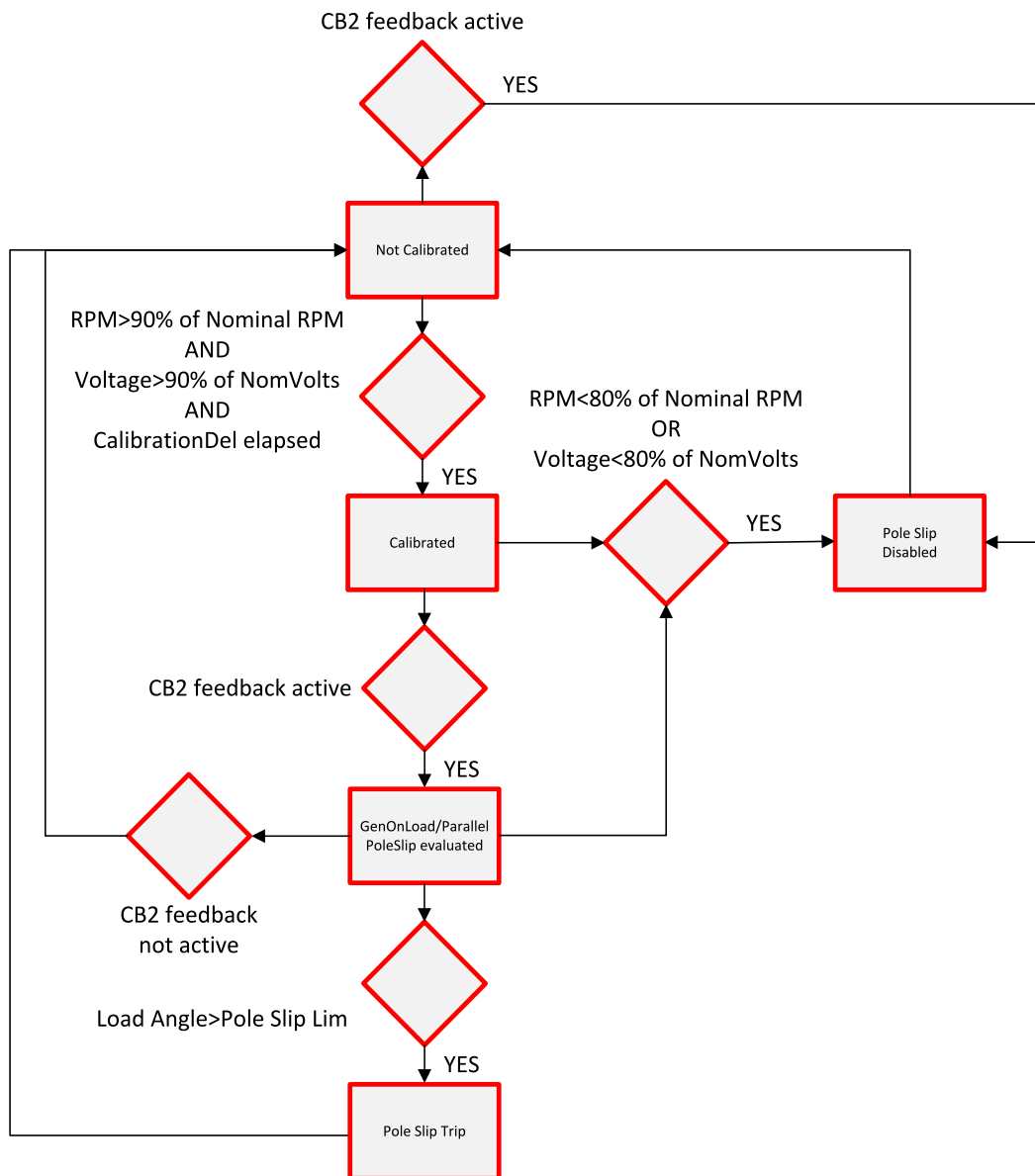
Image 6.9 Pole Slip Diagram

Pole Slip Disabled means:

▶ Trp PS Disable alarm is issued

▶ CommTrp and other trip indication signals are activated

▶ Pole Slip Prot signal is activated

▶ Trp1/Trp2 is activated, activation of Trp 1/Trp 2 depends on LOM Trp BO setting

Pole Slip Trip means:

▶ Trp Pole Slip alarm is issued

▶ CommTrp and other trip indication signals are activated

▶ Pole Slip Prot signal is activated

▶ Trp1/Trp2 is activated, activation of Trp 1/Trp 2 depends on LOM Trp BO setting

Dynamic grid support

Dynamic grid support function is used to support balanced status of the grid by retaining the connection of the generator to mains even during large voltage drops. The relay will not trip immediately in case of undervoltage, instead it will compare the measured voltage with the preset red curve. The shape of the curve is determined by voltage levels in setpoints **V Lim 1, V Lim 2, V Lim 3 [% Un] (page 96)**, and time delays in setpoints **Delay 1, Delay 2, Delay 3 [s] (page 96)**.

If the measured voltage falls below the red curve, a trip is issued. The time delay after which the protection starts to follow the curve from the beginning can be set in the setpoint **Reset Time [s] (page 96)**.
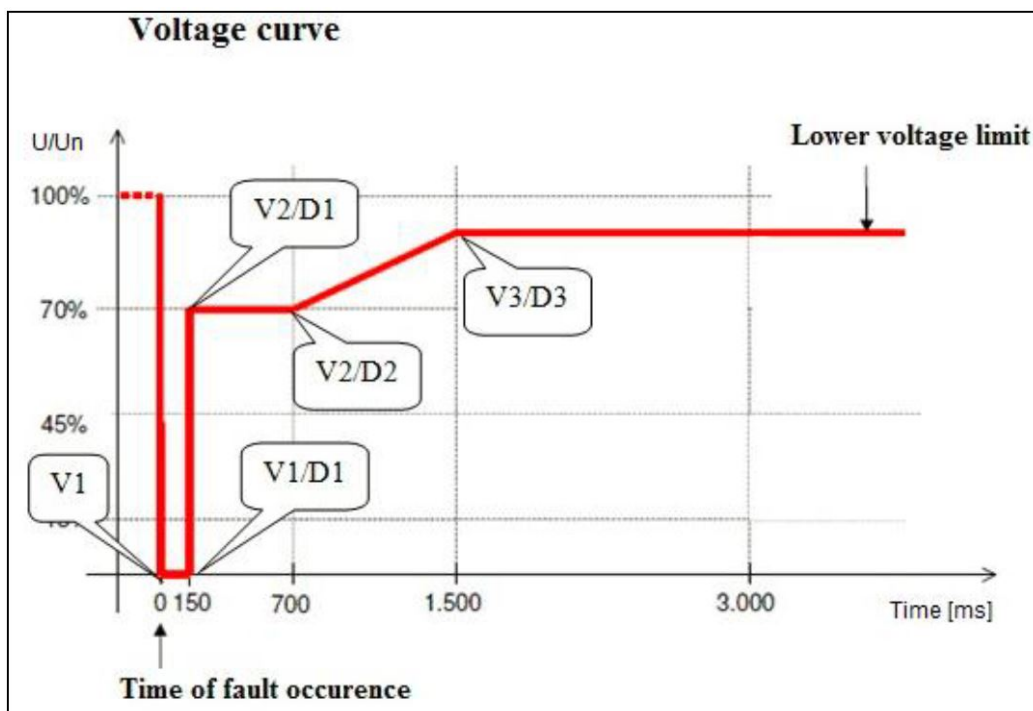
QU (undervoltage dependent directional reactive power) protection

QU, or undervoltage dependent directional reactive power protection is used to disconnect a power supply from the mains in case that the grid balance is threatened. This is achieved by evaluation of more variables – this function evaluates combination of mains voltage, current and reactive power at the decoupling point and only if all of the following conditions are fulfilled, the protection will activate:

1. Voltages in all three phases drops below the setpoint V< .

2. Currents in one phase exceed the set threshold (setpoint I Min).

3. The amount of produced reactive power violates the threshold (determined by the setpoint Q Min).

As soon as all the above conditions are met, the protection will activate and issue a trip to open the GCB (QU Gen Prot) with a time delay 1 (QU Del 1). In case of no response (CB Feedback will not deactivate), second trip

(QU Mns Prot) is issued in order to separate the generator from the network after time delay 2 (QU Del 2) by the MCB.

If the voltage returns back and exceed the set limit (Rst V<), the protection trip state will be deactivated and fault can be reset.

The conventional fault reset applies, which determines the time after the function will be reactivated since the condition of voltage return above 95% Un in all three phases and frequency returns to the range of 47,50 Hz and 50,05 Hz.

⏶ **back to Overcurrent: definite-time, IDMT and with voltage control**

7 Introduction of Communication Brochure

InteliPro provides the possibility of interconnecting it with technology on-site by RS485 communication and especially with other ComAp units, the CAN2 connection is possible in order to transmit data from InteliPro to them via the communication line. CAN1 communication line is used to interconnect the extension modules of InteliPro. For wiring of CAN bus communication, the following rules are to be maintained:

▶ Maximal length of the CAN bus depends on the communication speed. For the speed of 250kbps, which is used on the CAN1 bus (extension modules) and CAN2 bus if it is switched to 32C mode the maximal length is 200m. If the CAN2 bus is switched to 8C mode by the setpoint Comms settings: CAN Bus Mode, the speed is 50kbps and the maximal length is 800m.

▶ The bus must be wired in linear form with termination resistors at both ends. No nodes except on the controller terminals are allowed. Use cable with following parameters:

Cable type	Shielded twisted pair
Impedance	120Ω
Propagation velocity	>= 75% (delay <= 4.4 ns/m)
Wire crosscut	>= 0.25mm^2
Attenuation (@1MHz)	<= 2dB/100m
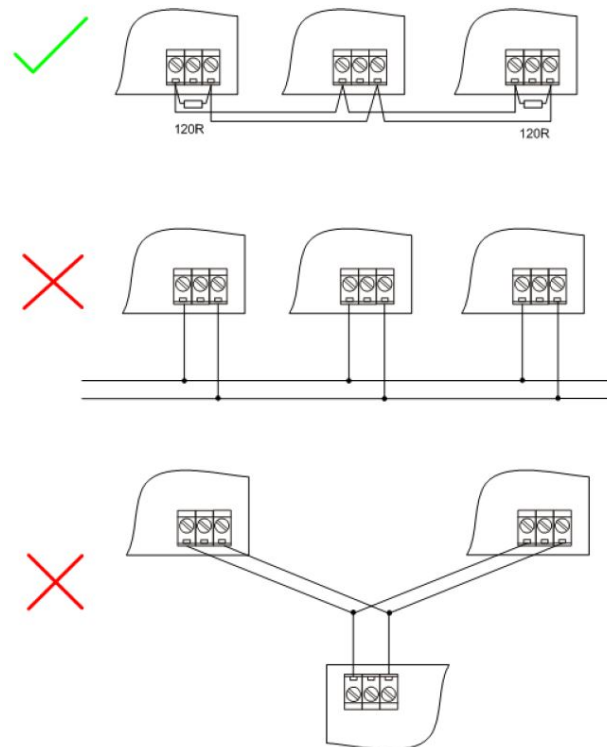
Image 7.1 CAN bus topology

Note: *See the web page www.can-cia.org for information about CAN bus, specifications etc.*

8 CAN bus and RS485

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8.1 Recommended CAN/RS485 connection

8.1.1 CAN bus connection

The bus has to be terminated by 120 Ohm resistors at both ends. External units can be connected on the CAN bus line in any order, but keeping line arrangement (no tails, no star) is necessary. Standard maximum bus length is 200m for 32C CAN BUS MODE and 900m for 8C CAN BUS MODE. Shielded cable must be used, shielding has to be connected to PE on one side (controller side).

▶ For shorter distances (all network components within one room) – **Picture 1 (page 56)**. Interconnect H and L; shielding connect to PE on controller side

▶ For longer distances (connection between rooms within one building) – **Picture 2 (page 56)**. Interconnect H, L, COM; shielding connect to PE in one point

▶ In case of surge hazard (connection out of building in case of storm etc.) – **Picture 3 (page 57)**. We recommend to use following protections:

  ● Phoenix Contact (www.phoenixcontact.com): PT 5-HF-12DC-ST with PT2x2-BE (base element)

  ● Saltek (www.saltek.cz): DM-012/2 R DJ

Recommended data cables: BELDEN (www.belden.com)

▶ For shorter distances: 3105A Paired - EIA Industrial RS-485 PLTC/CM (1x2 conductors)

▶ For longer distances: 3106A Paired - EIA Industrial RS-485 PLTC/CM (1x2+1 conductors)

▶ In case of surge hazard: 3106A Paired - EIA Industrial RS-485 PLTC/CM (1x2+1 conductors)

8.1.2 RS485 connection

The line has to be terminated by 120 Ohm resistors at both ends. External units can be connected on the RS485 line in any order, but keeping line arrangement (no tails, no star) is necessary. Standard maximum link length is 1000m. Shielded cable has to be used, shielding has to be connected to PE on one side (controller side).

▶ For shorter distances (all network components within one room) – **Picture 1 (page 56)** interconnect A and B; shielding connect to PE on controller side

▶ For longer distances (connection between rooms within one building) – **Picture 2 (page 56)** interconnect A, B, COM; shielding connect to PE in one point

▶ In case of surge hazard (connection out of building in case of storm etc.) – **Picture 3 (page 57)** We recommend to use following protections:

  ● Phoenix Contact (www.phoenixcontact.com): PT 5-HF-5DC-ST with PT2x2-BE (base element) (or MT-RS485-TTL)

  ● Saltek (www.saltek.cz): DM-006/2 R DJ

Recommended data cables: BELDEN (www.belden.com)

▶ For shorter distances: 3105A Paired - EIA Industrial RS-485 PLTC/CM (1x2 conductors)

▶ For shorter distances: 3105A Paired - EIA Industrial RS-485 PLTC/CM (1x2 conductors)

▶ In case of surge hazard: 3106A Paired - EIA Industrial RS-485 PLTC/CM (1x2+1 conductors)

8.1.3 Picture 1

Shorter distances (all network components within one room).
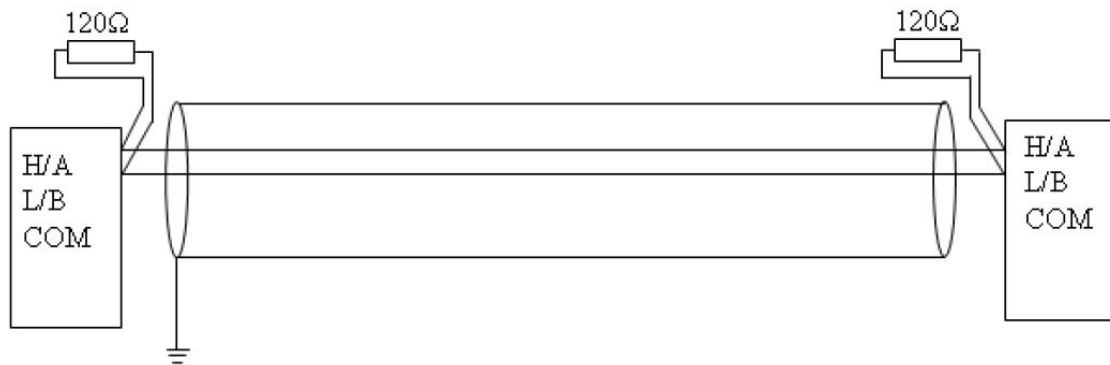
8.1.4 Picture 2

Longer distances (connection between rooms within one building).
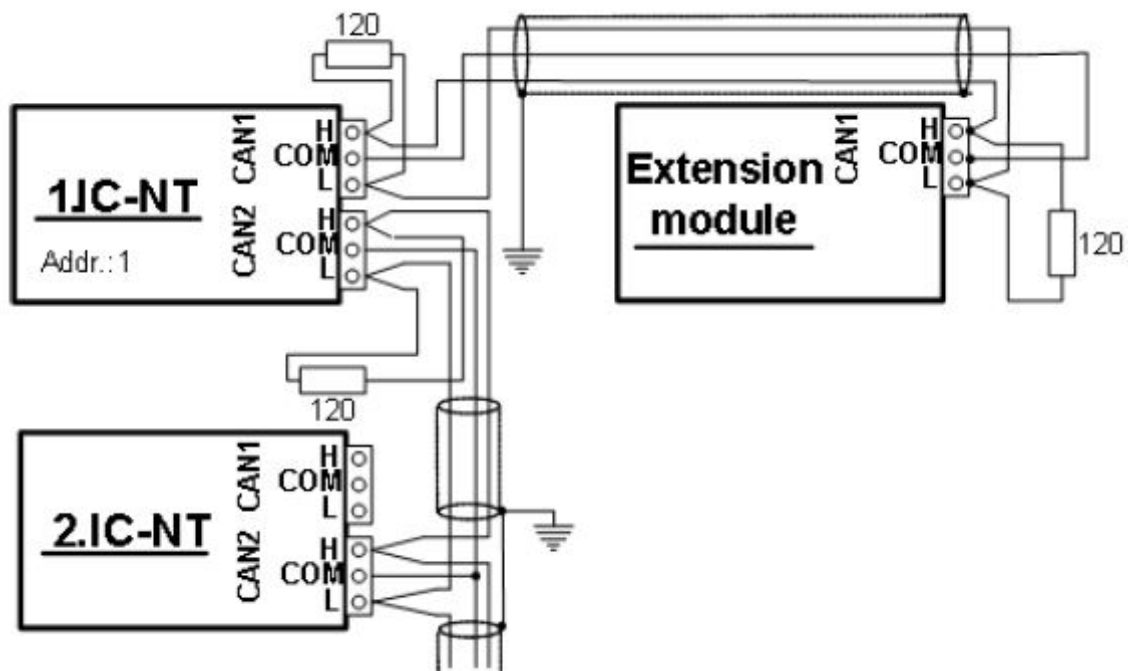
8.1.5 Picture 3

Surge hazard (connection out of building in case of storm etc.).
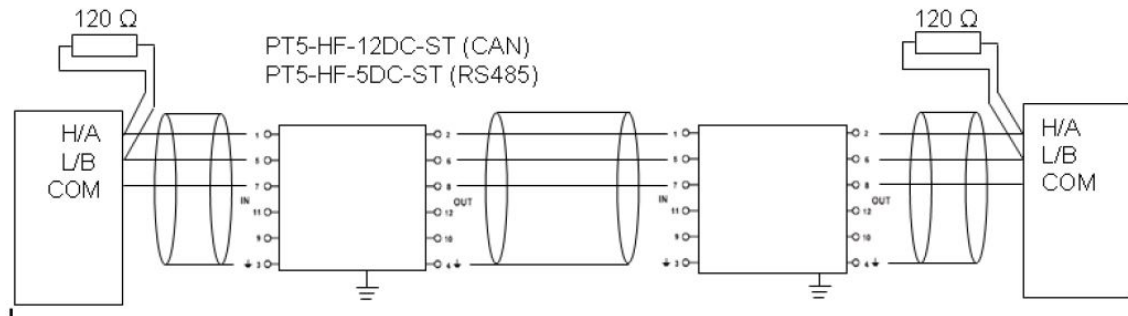
▲ **back to CAN bus and RS485**

9 Communication modules

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Communication module enables connection of a remote computer or other remote device such as PLC to InteliPro. The module is to be plugged-in into the slot in the rear side of InteliPro. The slot is accessible after slot cover is removed.
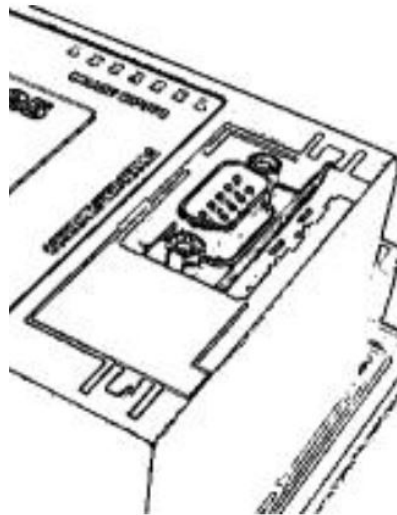
Image 9.1 Slot for Communication Modules

Note: The modules are compatible with ComAp IL-NT and IC-NT controllers.

9.1 IL-NT-232

This module contains a RS232 port with all modem signals connected internally to the COM1 of the controller. DB9M connector is used on the RS232 side.

GND 5
DTR 4
TxD 3
RxD 2
DCD 1
9 RI
8 CTS
7 RTS
6 DSR

PIN 1: Data Carrier Detect
PIN 2: Receive Data
PIN 3: Transmit Data
PIN 4: Data Terminal Ready
PIN 5: Signal Ground
PIN 6: Data Set Ready
PIN 7: Request to Send
PIN 8: Clear to Send
PIN 9: Ring Indicator
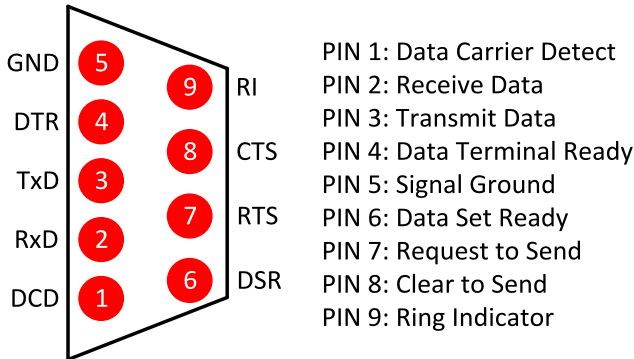
Image 9.2 Pinout and Cable wiring

DB9M — 2, 3, 5 crossed to DB9M — 2, 3, 5

To controller RS232 port

To PC COM port
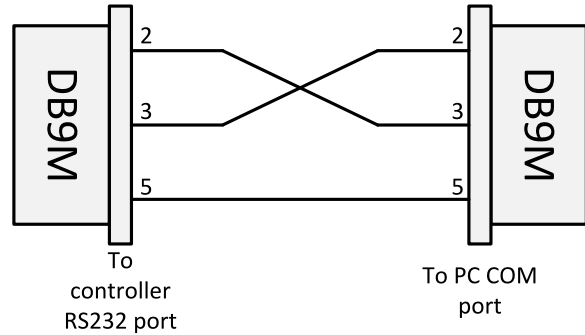
Image 9.3 Serial "Cross-wired" Cable

9.2 IL-NT-RS232-485

The IL-NT-232-485 is a dual port module with RS232 and RS485 interfaces at independent COM channels. The RS232 is connected to COM1 and RS485 to COM2.

RS485 balancing resistor jumpers

RS232 COM1

Boot jumper

RS485 120R terminator jumper

B (RxTx -)
GND
A (RxTx +)

RS485 COM2

RS485 internal wiring

+5V
Balancing resistor
A
Terminator
GND
Balancing resistor
B

GALVANIC SEPARATION

A
GND
B
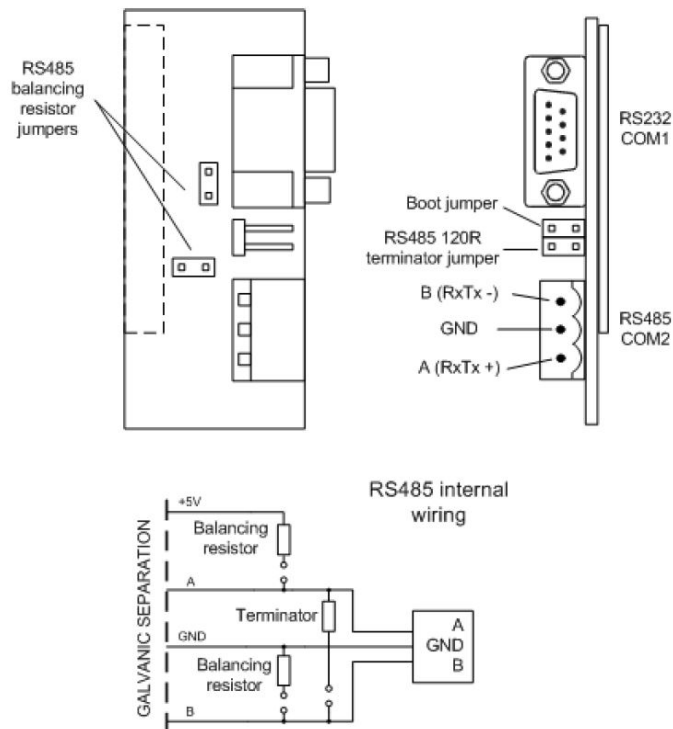
Image 9.4 IL-NT-RS232-485 Module

9.3 IL-NT-S-USB

This module contains USB slave port connected internally to the COM1 of the controller and is designed as an easy removable service module.

This module requires a FTDI USB Serial converter driver installed in the PC. The driver creates a virtual serial port (COM) in the PC, which must be used in LiteEdit as communication port when a connection is being opened.

Note: The FTDI driver is installed together with LiteEdit.

Note: When the USB cable from the controller is plugged-in first time into different USB ports on the PC including USB hubs, it can be recognized as new hardware and the drivers are installed again with different number of the virtual serial port.

> IMPORTANT: Use shielded USB cable only!

9.4 IL-NT-AIO

IL-NT-AIO is an extension plug-in module with four configurable analog inputs for the sensors (in the range 0-2400 ohm; 0/4-20mA; 0-4VDC) and one configurable analog output for the sensor (in the range 0/4-20mA; 0-4,5VDC; PWM 5V/500Hz). The setting of IL-NT-AIO can be done via LiteEdit through some of the supported communication modules.
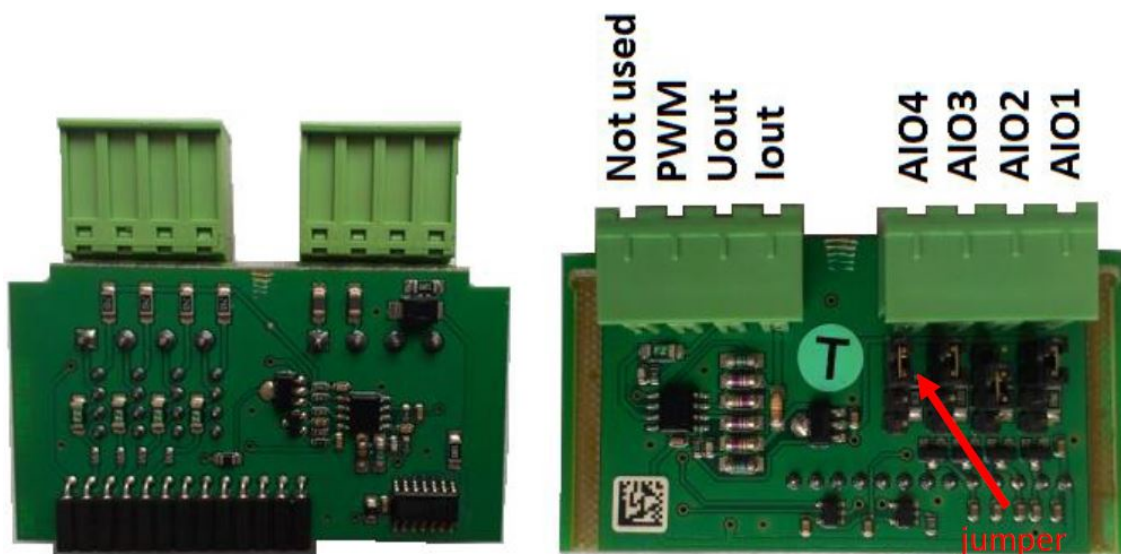
The type of analog input is selectable by jumper. Each analog input has its own line of jumper position. The top position (closest to green connector on the picture above) is for resistive input, central position for voltage input and lowest position is for current input.

AI1 – AI4	2600 Ohm / 4V / 20 mA
Iout	0 – 20 mA (max 22mA) max 100 Ohm load
Uout	0 – 4,5V (max 10mA)
PWM	PWM 5V / 15mA / 500 Hz
Not used	Do not connect!

9.4.1 How to set up the IL-NT-AIO module in LiteEdit

In LiteEdit click on the Modify configuration button ![wrench icon] in the upper toolbar.

In the window Modify, click on the button Extension Plug-in modules ![EXT icon] under which you can set extension modules.

Choose IL-NT-AIO option from the drop-down list.
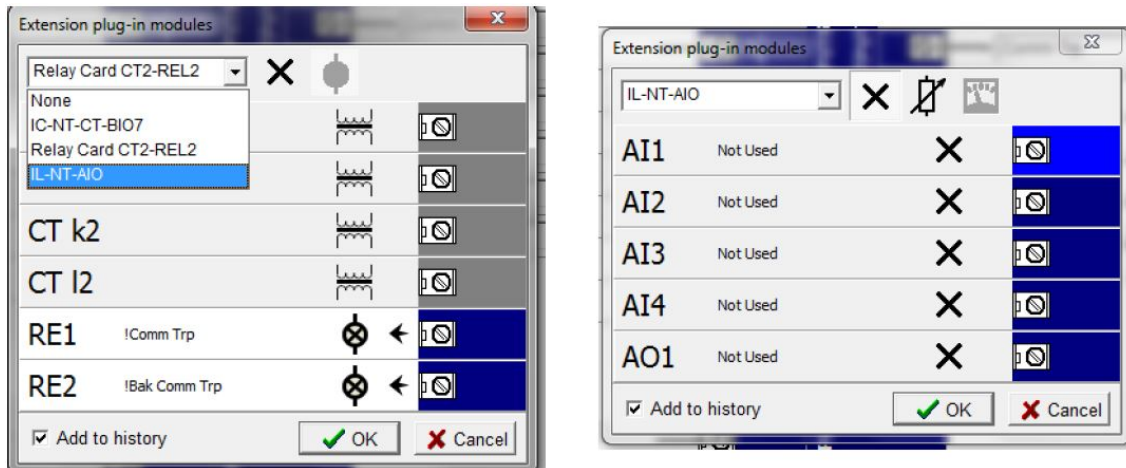
After double-clicking on one of the four analog inputs, type of the input and its behaviour can be defined (Not used, Alarm, or Monitoring).
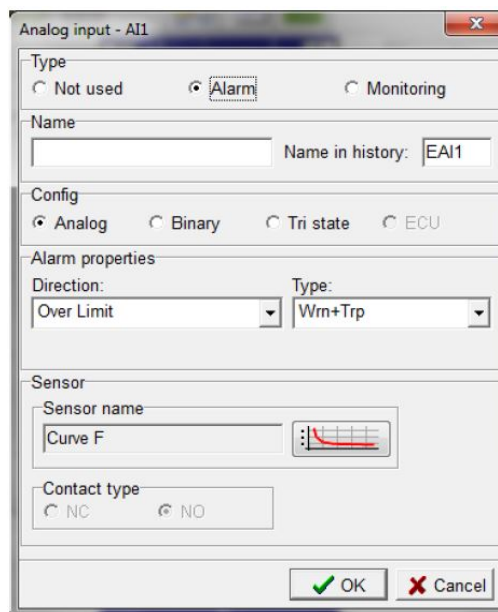
In case Alarm type is chosen, the input configuration can be defined. In case Binary or Tri state is chosen, alarm type and contact type can be configured. For analog configuration, type of the alarm and conditions of the alarm activation can be set up. It is also possible to define the operating curve of the sensor. The curve can be saved and loaded later.
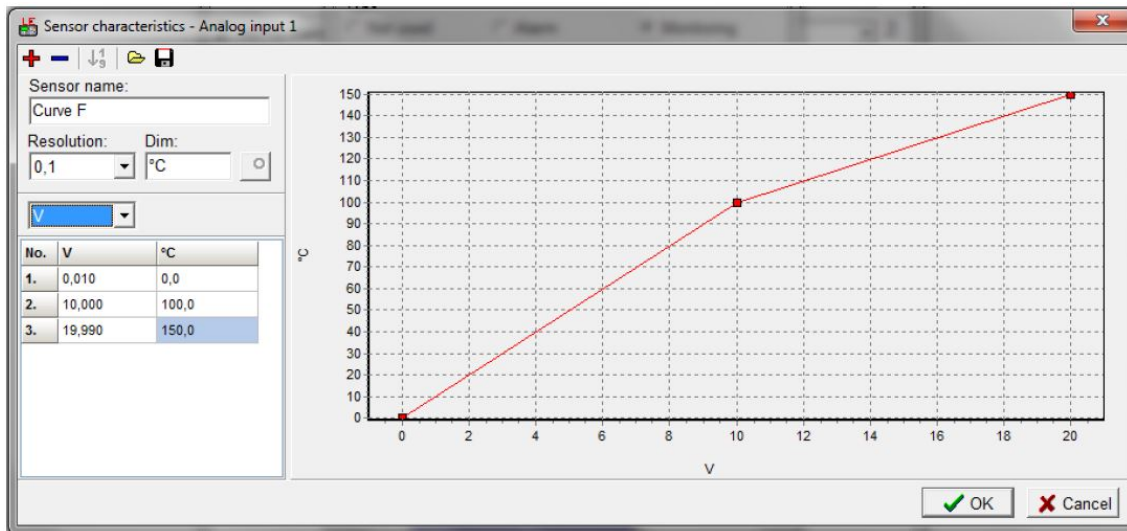
In case Monitoring type is chosen, an input configuration can be defined. In case of Binary or Tri state, contact type can be configured. For analog configuration, the operating curve of the sensor can be defined.

9.5 IB-Lite

IB-Lite is a plug-in module with Ethernet 10/100 Mbit interface in RJ45 connector. The module is internally connected to both COM1 and COM2 serial channels and provides an interface for connecting a PC with LiteEdit or InteliMonitor through Ethernet/internet network, for sending active e-mails and for integration of the controller into a building management (Modbus/TCP protocol).
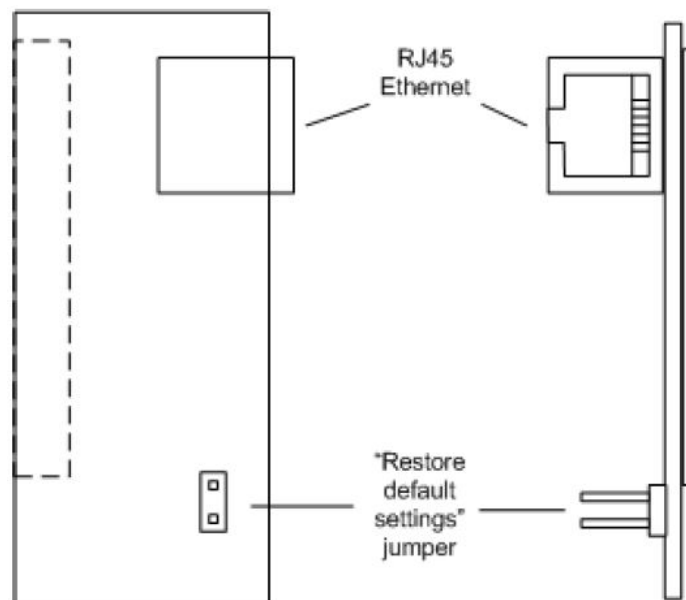
Image 9.5 IB-Lite Module

Use Ethernet UTP cable with RJ45 connector for connection of the module into your ethernet network. The module can be also connected directly to a PC using cross-wired UTP cable.
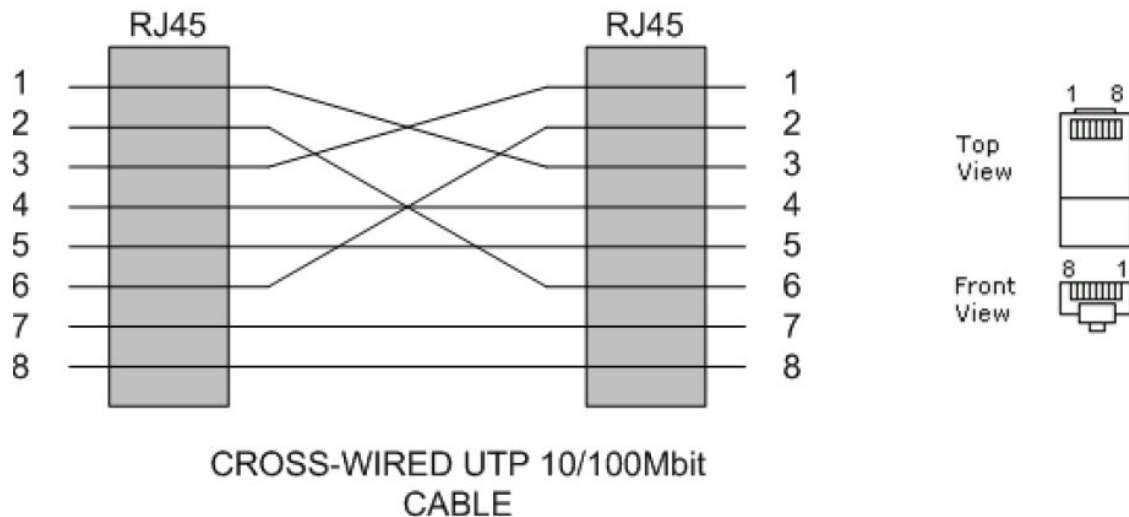
Image 9.6 Cross-wired UTP 10/100Mbit Cable

Note: Please note that for correct operation of IB-Lite interface, the setpoint COM1 Mode must be set to the DIRECT position!

Note: For communication using Modbus TCP protocol via IB-Lite module, the recommended setting is:
COM1 Mode: DIRECT
COM2 Mode: MODBUS
ModbusComSpeed: 57600

9.5.1 How to set up the IB-Lite module

There are three possibilities of connection:

▶ **Direct connection between PC and IB-Lite (page 63)**

▶ **Connection of IB-Lite to Ethernet/Internet by using dynamic IP and AirGate (page 64)**

▶ **Connection of IB-Lite to Ethernet by using static IP or to Internet by using public static IP (page 66)**

Direct connection between PC and IB-Lite

1. Turn on the controller.

2. Set up local network in your PC at:

   ▶ IP Address: 192.168.1.10

   ▶ Network Mask: 255.255.255.0

   ▶ Gateway IP: 192.168.1.1

   ▶ Check the "Comms Settings" directly on the controller:

   • Press ⬛ button. Choose "Comms Settings" by using of arrows ⬆ ⬇ and press ⏎.

   • Check "IBLite IP Addr" – should be 192.168.1.254 as default. If the IP is different change it with ⏎, ⬆ and ⬇ buttons to the correct one. **"IBLite DHCP" and "AirGate" has to be DISABLED.**

Note: "Comms Settings" of controller can be as well changed by using of LiteEdit software via IL-NT RS232, IL-NT RS232-485 or IL-NT S-USB communication modules.

> **IMPORTANT: Disconnect power source from the controller before exchanging the communication module!**

3. Connect the IB-Lite and PC via UTP cable (it is recommended to use the crossed cable).

Image 9.7 Controller Display: Comms Settings

4. For connection with controller use LiteEdit or InteliMonitor software or just a web browser and insert IP Address 192.168.1.254 (default IP) into the address bar which will allow you access to embedded SCADA WebServer.
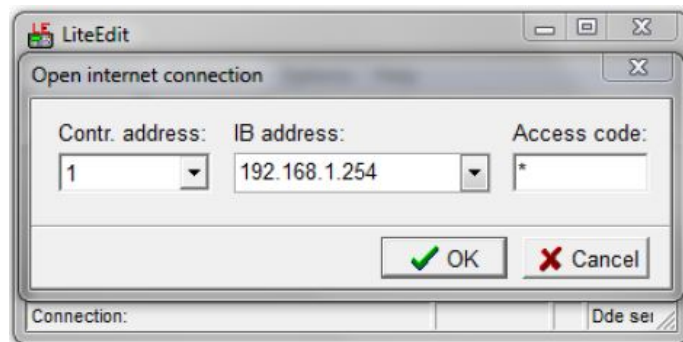
Image 9.8 Controller Display: Comms Settings

Connection of IB-Lite to Ethernet/Internet by using dynamic IP and AirGate

Note: Use this possibility when you have not assigned static Ethernet IP address from your IT department or static public IP from your internet provider.

1. Turn on the controller.
2. Setup "Comms Settings" directly on the controller:
   ► Press [Menu] button. Choose "Comms Settings" by using of arrows [↑] [↓] and press [Enter].
   ► Setup "IBLite DHCP" and "AirGate" as ENABLED.
   ► Setup. "AirGate IP" as "airgate.comap-control.com".

   Note: "Comms Settings" of controller can be as well changed by using of LiteEdit software via IL-NT RS232, IL-NT RS232-485 or IL-NT S-USB communication modules.

> **IMPORTANT: Disconnect power source from the controller before exchanging the communication module!**

3. Connect the IB-Lite to the router (or Internet/Ethernet socket) via UTP cable.

   ▶ Wait a while (or turn the controller off and on).

   ▶ Check the "AirGate ID": Press few times 🔼 button on the basic controller display until you see GSM/Modem status screen. Remember the AirGate ID.
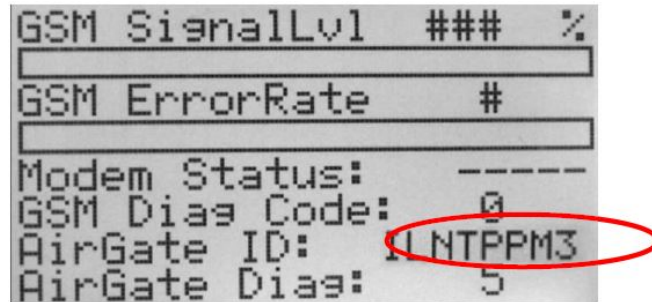
Image 9.9 Controller Display - GSM/Modem status screen

Table of AirGate Diagnostic Codes

0	Waiting for connection to AirGate Server
1	Controller registered, waiting for authorization
2	Not possible to register, controller blacklisted
3	Not possible to register, server has no more kapacity
4	Not possible to register, other reason
5	Controller registered and authorized

4. For connection with controller use LiteEdit or InteliMonitor software or just a web browser with your WebSupervisor account (websupervisor.comap.cz). Connect to the controller via AirGate, type in the AirGate ID and use "airgate.comap.cz" as an AirGate address (AirGate Server).
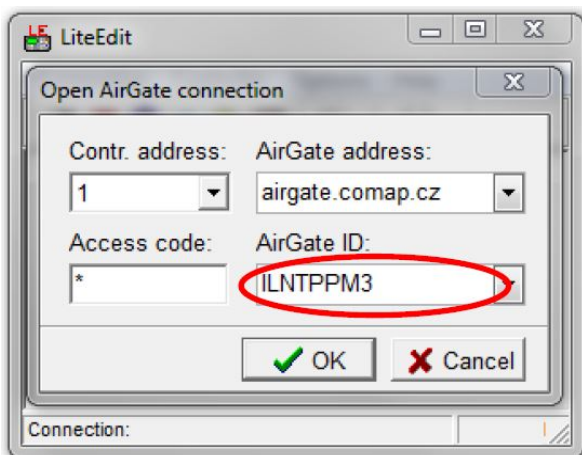
Image 9.10 LiteEdit: AirGate Connection   Image 9.11 WebSupervisor: AirGate Connection

Connection of IB-Lite to Ethernet by using static IP or to Internet by using public static IP

Note: Use this possibility when your IT department has a Static Ethernet IP at your disposal or when the Static Public IP from your internet provider is available.

1. Turn on the controller.

2. Setup "Comms Settings" directly on the controller:

   ▶ Press ▣ button. Choose "Comms Settings" by using of arrows ⬆⬇ and press ↵.

   ▶ Setup items of "IBLite IP Addr", "IBLite NetMask" and "IBLite GateIP" according to information from your IT department (internal network) or internet provider (public network). "IBLite DHCP" and "AirGate" has to be DISABLED.

   Note: "Comms Settings" of controller can be as well changed by using LiteEdit software via IL-NT RS232, IL-NT RS232-485 or IL-NT S-USB communication modules.

   > **IMPORTANT: Disconnect power source from the controller before exchanging the communication module!**

3. Connect the IB-Lite to the router via UTP cable.

4. For connection with controller use LiteEdit or InteliMonitor software or just a web browser with your WebSupervisor account (websupervisor.comap.cz) or simply embedded SCADA WebServer with putting of public IP Address ("IBLite IP Addr") into the address bar.

Note: For more detail about communication of ComAp products, see the IL-NT, IA-NT, IC-NT Communication Guide as published on ComAp download centre.

🔺 **back to Communication modules**

10 Technical data

Power supply

Power supply range	8-36 V DC
Power supply drop-out immunity	50 ms (from min. 10 V)
Power consumption	cca 200 mA/8 V; 50 mA/36 V
Peak power consumption (LT)	cca 0,56 A/8 V; 1,8 A/36 V
Backup battery type	CR 1225
Estimated backup battery lifetime	10 years

Operating conditions

Operating conditions	-20... 70 °C
Operating temperature (LT version)	-40... 70 °C
Operating humidity	95 % non-condensing (IEC/EN 60068-2-30)
Protection degree (front panel)	IP65
Vibration	5-25 Hz, +/- 1.6 mm; 25-100 Hz, a = 4 g
Shocks	a_{max} 200m/s^2
Storage temperature	-30... 80 °C
Intended use according to UL 508 standard	InteliPro is intended for use with switchgear and associated equipment as per the category for Protective relays – NRGU

Physical dimensions

Dimensions	185 × 125 × 60 mm (W×H×D)
Mounting cutout size	175 × 115 mm (W×H)

Standard conformity

Electromagnetic compatibility	EN 61000-6-1, EN 61000-6-2, EN 61000-6-3, EN 61000-6-4
Low voltage directive	EN 61010-1:95 +A1:97

Binary inputs

Number of binary inputs	9
Galvanic insulation	Not insulated
Common pole	Positive, V_s = 8-36 V DC
Closed contact voltage	<2 V
Open contact voltage	4 V - V_s
Input resistance	4.2 kOhm

Binary outputs

Number of binary outputs	8
Galvanic insulation	Not insulated
Type	Transistor, switching to negative supply terminal
Operating voltage	8-36 V DC
Switching current	500 mA (suppression diodes required for inductive loads)

Analog inputs

Number of analog inputs	3
Galvanic insulation	Not insulated
Electrical range	0-2500 ohm
Resolution	10 bits, 4 digits
Supported sensor types	Predefined: VDO 10 Bar, VDO Temperature, VDO Fuel level User defined: 10 points non-linear sensors can be defined by the user
Precision	1% from the range

Mains measurements

Measurement inputs	3 ph mains voltage, 3 ph mains current
Measurement type	True RMS
Voltage range	480 VPh-Ph (277 V Ph-N)
Max. measured voltage	340 VPh-N 588 VPh-Ph
Voltage accuracy	1% of nominal voltage at 20 °C and 50 or 60 Hz; 1,5 % on the complete frequency and temperature range
Current range	5 A
Max. measured current	9 A
Max. allowed current	12 A continuous, 50 A/1 s
Current accuracy	2 % of nominal current at CT Ratio = 50 A / 5 A or higher
CT input burden	<0.5 VA
Frequency range	30-70 Hz, measured from L3
Frequency accuracy	0.05 Hz

> **IMPORTANT: To assure accurate measurement of the mains current, we recommend direct metallic connection between COM terminal of Mains Current measurement and the minus "-" terminal of the unit power supply. The potential difference between those two points must not overreach 10 V.**

NVD and Sync Check measurement

Measurement inputs	NVD voltage, Sync Check
Measurement type	True RMS
Voltage range	NVD: 277 V Sync Check: 480 V

Min. measured voltage	Sync Check: 30 V
Max. measured voltage	NVD: 340 V
	Sync Check: 589 V
Voltage accuracy	1 % of nominal voltage at 20 °C and 50 or 60 Hz; 1.5 % on the complete frequency and temperature range. For accurate NVD measurement it is necessary that voltage with identical frequency is connected to the Mains Voltage terminals all the time.

Remote communication interface

RS232	Optional using the plug-in module IL-NT-RS232, D-SUB9M socket
RS485	Optional using the plug-in module IL-NT-RS232-485, plug-in terminal block
Baud rate	Depending on selected mode (up to 57600 bps)
USB	Optional using the plug-in module IL-NT-S-USB
Ethernet	Optional using the plug-in module IB-Lite

Extesion modules interface

Type	CAN bus
Galvanic insulation	Insulated, 500 V
Baud rate	250 kbps
Bus length	max. 200 m
Termination resistor	120 Ohm, built-in, jumper activated

Interface to other controllers

Type	CAN bus, available in MINT type only
Galvanic insulation	Insulated, 500 V
Baud rate	250 kbps
Bus length	max. 200 m
Termination resistor	120 Ohm, built-in, jumper activated

Relay Card CT2-REL2

Relay contacts (terminals RE11, RE14 and RE21, RE24)	
Number of relay outputs	2
Type	Dry contacts
Operating voltage	250 VAC
Max switched voltage/current	250 V/10 A
Current measurement inputs	2 x 1ph current measurement
Measurement type	True RMS
Number of current inputs	2
Input 1 (CT k1, I1):	
Current range	50 mA

Max. measured current	90 mA
Max. allowed current	120 mA
Current accuracy	2% of nominal current
Input 2 (CT k2, I2):	
Current range	5 A
Max. measured current	9 A
Max. allowed current	12 A continuous, 50 A/1 s
Current accuracy	2% from the range
CT input burden	<0.5 VA

Note: The module is delivered as a default part of the InteliPro unit.

Recommended CAN cables

Belden 3082A DeviceBus for Allen-Bradley DeviceNet
Belden 3083A DeviceBus for Allen-Bradley DeviceNet
Belden 3084A DeviceBus for Allen-Bradley DeviceNet
Belden 3085A DeviceBus for Allen-Bradley DeviceNet
Belden 3086A DeviceBus for Honneywell SDS
Belden 3087A DeviceBus for Honneywell SDS
Lapp Cable Unitronic Bus DeviceNet Trunk Cable
Lapp Cable Unitronic Bus DeviceNet Drop Cable
Lapp Cable Unitronic Bus CAN
Lapp Cable Unitronic-FD Bus P CAN UL/CSA

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11 Appendix

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11.1 ControllerObjects

11.1.1 Library of binary inputs

Binary alarm and functional input configuration items

Binary Alarm configuration items

Check this radio button to configure an alarm on a binary signal

Input name

Select the alarm type according to the table below

Select whether the alarm activates on opening (NC) or at closing (NO)

Functional input configuration items

Check this radio button to configure a function on a binary signal

Input function

Select whether the function activates on opening (NC) or at closing (NO)

⬆ **back to Library of binary inputs**

Alarm

If the input is closed (or opened), the configured binary alarm is activated.

Setting	Explanation
Warning	No trip, in case of activation, warning appears in the alarm list
Comm Trp	Only Comm Trp output is activated in case of binary alarm
Trp 1	Trp 1 output is activated in case of binary alarm
Trp 2	Trp 2 output is activated in case of binary alarm
Trp 1+2	Both Trp 1 and Trp 2 outputs are activated in case of binary alarm

Access Lock

If the input is closed, no setpoints can be adjusted from controller front panel.

Note: Access lock does not protect setpoints from LiteEdit. To avoid unqualified changes the selected setpoints can be password protected.

Block 1, Block 2

These inputs are used to disable a certain protection stage. To allow disabling/enabling the protection stage by these inputs, assign them to this protection stage by setpoint Block BI. Enabling the connected protection is delayed by time given by setpoint ProtActiv Del . **Please note that the Block inputs trigger immediate fault reset in the moment of their activation and deactivation.**

CB1 close

Binary input CB1 close is used to remotely closen circuit breaker via InteliPro. As soon as this input is activated, the binary output CB1 ON Man will be activated.

CB1 Feedback

This input indicates, whether the circuit breaker CB1 is open or closed. It is expected that this breaker opens in case of **Comm Trp Del (page 91)** and **Trp1 Del [s] (page 91)** activation. If it is configured in the unit and it does not open, CB1 fail is indicated.

In general, this breaker corresponds to the "Mains Circuit Breaker" = MCB in the ComAp controllers applications. Together with CB2 it indicates, whether the installation is in "parallel to mains" state (both CB1 Feedback and CB2 Feedback are closed) or in island mode (one or both of CB1 Feedback or CB2 Feedback are open).

CB1 open

Binary input CB1 open is used to remotely open circuit breaker via InteliPro. As soon as this input is activated, the binary output CB1 OFF Man will be activated.

CB2 Feedback

This input indicates, whether the circuit breaker CB2 is open or closed. It is expected that this breaker opens in case of Trp 2 activation. If it is configured in the unit and it does not open, CB2 fail is indicated.

This breaker can, but does not necessarily have to correspond to the "Generator Circuit breaker" = GCB as used in the ComAp controllers applications. In such case, together with CB1 it indicates, whether the installation is in "parallel to mains" state (both CB1 Feedback and CB2 Feedback are closed) or in island mode (one or both of CB1 Feedback or CB2 Feedback are open).

CtrlHBeat sens

This input is used to control if an appropriate controller is working. This input is wired to the output CtrlHBeat of some controller. In case there is no signal coming from this controller, the binary output CtrlHBeat FD is activated.

DC TripCircuit

Evaluation of DC trip circuit state. When the input closes, history record is made and a message "Wrn DCTripCirc" appears in the Alarmlist.

Ext MF Relay

The input serves for reading the state of external mains failure relay for the purpose of controlling the **Group: NVD (page 108)**. Its activation means that the external relay has detected a mains failure. If the input is active, NVD trip outputs are blocked. To unblock the NVD protection, it is necessary not only to deactivate the Ext MF Relay input, but also to deactivate the feedback of the circuit breaker, which is operated by the NVD protection stage. If the input changes its state, history record is made. There is no Alarmlist record or trip protection connected with this input. See description of this lockout in **Neutral Voltage Displacement (NVD, ANSI 59N) (page 48)** chapter.

F.R. Button

Activation of this binary input causes **Fault reset (page 33)**. The input has the same effect as pushing the Fault Reset ⚡ button . If permanently activated, every 100ms an impulse to reset the fault is sent internally within the unit.

🔺 **back to Library of binary inputs**

11.1.2 Library of binary outputs

Some binary output signals are provided in both positive and negative logic in order to follow the requirements of the application:

▶ Due to increased safety requirements, some protective relays require that negative logic is used, assuring that loss off power supply always causes the relay to trip. I.e. the relay contacts are used, with fault-free position maintained in energized state. In case of power supply fail, the unit goes to "fault" indication position. The outputs using negative logic are marked with exclamation mark "!" as the first character of their name.

▶ In some applications, the negative logic is not a required functionality. The function of opening the circuit breaker in case of loss of power supply is not accepted as a safety point and the safety is assured by different means e.g. in the superior system or within the protection relays intertripping scheme. In such case, the outputs with positive logic (without the exclamation mark) can be used to signal the detected failure state.

AC Reclosing

Binary output related to ANSI 79 AC Reclosing. The output closes AR Delay after power-up of the unit. The output opens immediately when the appropriate trip event appears. The trip, which is considered for the reclosing function is selected by the setpoint AC Reclosing: Rec Initiate. The output closes again with the pre-set delay after the trip state terminates.

AIx Wrn/Trp Sig, IOM AIxWrn/Trp Sig

The outputs are activated in the moment when the appropriate protection threshold is exceeded without any delay. The outputs stay active all the dime when faulty condition last. The outputs deactivate when the AI value gets back within limits. Fault reset has no effect on these outputs.

AL AIx Wrn/Trp, AL IOM AIx Wrn/Trp

The outputs are available to indicate warning or trip, caused by any of the analog inputs on InteliPro unit, or on IOM extension module, where "x" marks the number of the analog input. The output is activated in the moment when the appropriate AI warning/trip event is issued and stays activated until the alarm message disappears from the alarm list.

AL Aux Volt

The output activates in case of the Warning-type alarm of the power supply over- or undervoltage.

AL Common Fls

The output activates in case of any sensor-fail on the analog inputs.

AL Common Wrn

The output activates in case of any Warning-type alarm.

Avg V Prot

The output activates in case that average overvoltage protection is activated.

Bak Comm Trp

Output for back-up CB trip contact. Closes if Comm Trp is active and CB1 Feedback doesn't deactivate within BackupTrip del. Resets automatically when AutoFaultReset function is activated, otherwise has to be reset manually using Fault Reset 🔆 button. If any of the CB1 Feedback, Bak Comm Trp or !Bak Comm Trp outputs is not configured on any physical input or output, this function is blocked.

!Bak Comm Trp

Inverted polarity of the Bak Comm Trp signal.

Bak Trp 1

Output for back-up CB1 trip contact. Closes if TRP 1 is active and CB1 Feedback doesn't deactivate within BackupTrip Del. Resets automatically when AutoFaultReset function is activated, otherwise has to be reset manually using Fault Reset 🔆 button. If any of the CB1 Feedback, Bak Trp 1 or !Bak Trp 1 outputs is not configured on any physical input or output, this function is blocked.

!Bak Trp 1

Inverted polarity of the Bak Trp 1 signal.

Bak Trp 2

Output for back-up CB2 trip contact. Closes if TRP 2 is active and CB2 Feedback doesn't deactivate within BackupTrip Del. Resets automatically when AutoFaultReset function is activated, otherwise has to be reset manually using Fault Reset 🔆 button. If any of the CB2 Feedback, Bak Trp 2 or !Bak Trp 2 outputs is not configured on any physical input or output, this function is blocked.

!Bak Trp 2

Inverted polarity of the Bak Trp 2 signal.

Blx Status, IOM Blx Status

The outputs correspond to the status of the physical inputs of the unit or the IG-IOM or IGS-PTM extension module respectively.

Cap PF Prot

Separate output for capacitive power factor protection. Active if the capacitive power factor protection is active or not acknowledged by Fault Reset.

CB1 OFF Man

Binary output CB1 OFF MAN provides pulse for opening coils of the circuit breaker. The pulse lasts until the CB feedback deactivates, but its minimum length is 2 seconds.

CB1 ON Man

Binary output CB1 ON MAN provides 2 seconds long pulse for closing coils of the circuit breaker.

CB1 Protection

The output is normally energized for the complete duration of the unit operation. It de-energizes immediately after CB1 Feedback goes from activated position to zero. It keeps de-activated for Basic settings: CB1 Prot Timer.

CB1 UV Coil

The CB1 UV Coil output is used for control of undervoltage coils of circuit breakers and is active the whole time when gen-set is running (circuit breaker is closed) or the controller is switched on, and deactivates for the time determined by the length of the CB OFF Man output activation.

CB2 Protection

The output is normally energized for the complete duration of the unit operation. It de-energizes immediately after CB2 Feedback goes from activated position to zero. It keeps de-activated for Basic settings: CB2 Prot Timer.

Comm Trp

Common output of all built-in protections, activates whenever any of protections trips. Resets automatically when **Auto FR [DISABLED / ON DEACT / CB1+CB2=0 / NOFAULT+DEL] (page 92)** is activated, otherwise has to be reset manually using the Fault Reset button.

!Comm Trp

Inverted polarity of the Comm Trp signal.

Common Alarm

The output closes in case any alarm comes up. The output opens if Fault Reset button is pressed.

Ctrl HeartBeat

The output provides alternating signal with rate 500 ms active / 500 ms inactive while the unit is in operation. If the output does not provide the signal it may indicate that the unit is switched off, damaged, the firmware is incorrect or missing, or Watchdog is activated.

CtrlHBeat FD

Output for signalization of the Heartbeat feedback. The output is activated in case there is no Heartbeat signal from an appropriate controller coming to the binary input CTRLHBEAT SENS (PAGE 74).

DC Healthy

The output is closed all the time when auxiliary voltage is within the limits (Aux protect: Aux >V and Aux protect: Aux <V). The output opens when Aux voltage is failed or out of setpoint limits.

Del Comm Trp

Common output for all protections producing delayed pulse of defined length (see Comm Trp Del and Comm Trp Len).

!Del Comm Trp

Inverted polarity of the Del Comm Trp signal.

DOC Prot

Separate output for directional overcurrent protection.

DOC Sig

Signalling of directional overcurrent protection. Activates immediately in the moment of fault conditions (does not wait until delay times out). Deactivates in the moment when the measured values are back in limits. Fault reset has no effect on this output.

DOC Test

Test output for directional overcurrent protection. When the setpoint DOC Test is set to ENABLED, the directional overcurrent protection activates this output even if standard activating conditions are not fulfilled. This is to allow full quadrant range test of this protection – this output stays active all the time the protection senses the corresponding quadrant and magnitude of the current. **Activating DOC test does blocks the regular function of the ANSI 67 directional overcurrent protection stage!**

Dyn Volt Prot

The output activates in case that the dynamic voltage protection is activated.

EFC Prot

Separate output for earth fault current (ANSI 50N and 51N) protection.

EFC >Sig

Signaling of earth fault over current condition according the setting in EFC group. Activates immediately in the moment of fault conditions (does not wait until delay times out). Deactivates in the moment when the measured values are back in limits. Fault reset has no effect on this output.

f Sig

Signalling output of "out of limit" frequency according to the setting in f<> group.

Activates immediately in the moment of fault conditions (does not wait until delay times out). Deactivates in the moment when the measured values are back in limits. Fault reset has no effect on this output.

f<> Prot

Separate output for frequency protection stages. It is active if any of the frequency protection stages (underfrequency, overfrequency) is active or not acknowledged by Fault Reset.

f< Prot

Separate output for underfrequency protection. Active if the underfrequency protection is active or not acknowledged by Fault Reset.

f> Prot

Separate output for overfrequency protection. Active if the overfrequency protection is active or not acknowledged by Fault Reset.

I Unb Prot

Separate output for current unbalance protection.

I Unb Sig

Signalling of current unbalance according to the setting in I Unb group. Activates immediately in the moment of fault conditions (does not wait until delay times out). Deactivates in the moment when the measured values are back in limits. Fault reset has no effect on this output.

IGS Prot

Separate output for ground surge current (ANSI 50GS and 51GS) protection.

IGS > Sig

Signalling of ground surge protection according the setting in IGS group. Activates immediately in the moment of fault conditions (does not wait until delay times out). Deactivates in the moment when the measured values are back in limits. Fault reset has no effect on this output.

Ind PF Prot

Separate output for inductive power factor protection. Active if the inductive power factor protection is active or not acknowledged by Fault Reset.

I> Prot

Separate output for overcurrent (ANSI 50 and 51) protection.

I> Sig

Signalling of overcurrent protections stages according to the setting in I>, I> T and I> V group. Activates immediately in the moment of fault conditions (does not wait until delay times out). Deactivates in the moment when the measured values are back in limits. Fault reset has no effect on this output.

LOM Sig

Signalling of protection stages Vector Shift or ROCOF according to the setting in LOM group.

Activates immediately in the moment when fault conditions are detected. Deactivates after LOM Trip Del has elapsed. Fault reset has no effect on this output.

Mains OK

This output indicates that the mains is healthy. The output is closed while all mains electrical parameters are in limits. The output deactivates immediately as soon as any of the mains protections is activated. As soon as all mains parameters are in limits again, the output closes immediately.

Mains Pwr 1 - 8

Eight logical binary outputs activated if limits set in appropriate setpoints "Mains Pwr 1-8" in the group "P" are violated.

Mains Pwr 1

Mains Pwr 2

Mains Pwr 3

Mains Pwr 4

Mains Pwr 5

Mains Pwr 6

Mains Pwr 7

Mains Pwr 8

MaxParTime

Separate output of the short term parallel protection closes after the timer MaxParallTime has elapsed and both CB1 Feedback and CB2 Feedback remain closed.

!MaxParTime

Separate output for inverted signal of short term parallel protection.

NVD Sig

Signalling of neutral voltage displacement conditions according the setting in NVD group. Activates immediately in the moment of fault conditions (does not wait until delay times out). Deactivates in the moment when the measured values are back in limits. Fault reset has no effect on this output.

NVD> Prot

Separate output for 1st stage of neutral voltage displacement protection.

!NVD> Prot

Separate output for inverted signal of 1st stage of Neutral Voltage Displacement protection.

NVD>> Prot

Separate output for 2nd stage neutral voltage displacement protection.

!NVD>>Prot

Separate output for inverted signal of 2nd stage of Neutral Voltage Displacement protection.

P 1Ph Prot

Separate output for mains single phase reverse power protection.

P 1Ph Sig

Signalling of out off limit single phase power according the setting in P 1Ph group. Activates immediately in the moment of fault conditions (does not wait until delay times out). Deactivates in the moment when the measured values are back in limits. Fault reset has no effect on this output.

P Prot

Separate output for mains reverse power protection.

P Sig

Signaling of out off limit power according the setting in P group. Activates immediately in the moment of fault conditions (does not wait until delay times out). Deactivates in the moment when the measured values are back in limits. Fault reset has no effect on this output.

PF Prot

Separate output for power factor protection. It is active if any of the protections: inductive or capacitive power factor is active or not acknowledged by Fault Reset.

PF Sig

Signalling output of "out of limit" power factor according to the setting in PF group. Activates immediately at the moment of fault conditions (does not wait until delay times out). Deactivates in the moment when the measured values are back in limits. Fault reset has no effect on this output.

PhaseRot Prot

Separate output for phase sequence protection.

Pole Slip Prot

The output activates in case that the pole slip protection is activated.

PS Disable

PS Disable signal is linked with protection Trp PS Disable and indicates its activity (presence in alarm list).

Q Prot

Separate output for mains directional reactive power protection.

Q Sig

Signalling of out off limit reactive power according the setting in Q group. Activates immediately in the moment of fault conditions (does not wait until delay times out). Deactivates in the moment when the measured values are back in limits. Fault reset has no effect on this output.

QU Gen Prot

Separate output for the "QU" protection to open the GCB.

QU Mns Prot

Separate output for the "QU" protection to open the MCB.

RemoteControl1 - 8

Eight logical binary outputs, controlled via communication:

RemoteControl1

RemoteControl2

RemoteControl3

RemoteControl4

RemoteControl5

RemoteControl6

RemoteControl7

RemoteControl8

ROCOF Prot

Separate output for ROCOF protection.

Self-Test

This input indicates normal operation of the unit.

Sync Check

Binary output related to ANSI 25 Synchro check. The output is active in either of the following cases:
- ▶ Voltage, frequency and phase condition are met and dwell time is over according to the setting in Sync Check group.
- ▶ Connection to dead line or bus are enabled and the voltage is under Dead Voltage limit for the dwell time.

Trp 1

Trip output assignable to different protection stages by setpoint xxx Trp BO (e.g. V Trp BO). It activates whenever any assigned protection trips. It resets automatically when AutoFaultReset function is activated otherwise has to be reset manually using Fault Reset ⚡ button. This output is expected to trip the CB1 breaker, i.e. deactivation of the CB1 Feedback signal is expected after Trip 1.

!Trp 1

Inverted polarity of the Trp 1 signal.

Trp 2

Trip output assignable to different protection stages by setpoint xxx Trp BO (e.g. V Trp BO). It activates whenever any assigned protection trips. It resets automatically when AutoFaultReset function is activated otherwise has to be reset manually using Fault Reset [ ] button. This output is expected to trip the CB2 breaker, i.e. deactivation of the CB2 Feedback signal is expected after Trip 2.

!Trp 2

Inverted polarity of the Trp 2 signal.

U Sig

Signalling output of "out of limit" voltage according to the setting in V<> group.

Activates immediately in the moment of fault conditions (does not wait until delay times out). Deactivates in the moment when the measured values are back in limits. Fault reset has no effect on this output.

U Unb Sig

Signalling output of voltage unbalance according to the setting of V Unb group.

Activates immediately in the moment of fault conditions (does not wait until delay times out). Deactivates in the moment when the measured values are back in limits. Fault reset has no effect on this output.

U<> Prot

Separate output for voltage protection stages. It is active if any of the protections: undervoltage or overvoltage is active or not acknowledged by **Fault reset (page 33)**.

U< Prot

Separate output for undervoltage protection. Active if the undervoltage protection is active or not acknowledged by Fault Reset.

U> Prot

Separate output for overvoltage protection. Active if the overvoltage protection is active or not acknowledged by Fault Reset.

V Unb Prot

Separate output for voltage unbalance protection.

VectorS Prot

Separate output for vector shift protection.

V>Neg

Separate output for negative sequence overvoltage protection.

V<Pos

Separate output for positive sequence undervoltage protection.

Watchdog

This output is activated when Watchdog event occurs. The alarm message "Wrn Watchdog" is displayed and the output Watchdog stays opened after the controller's restart due to watchdog reset of the controller until the Fault Reset 🔲 button is pushed.

!Watchdog

Inverted Watchdog signal.

⏶ **back to Library of binary outputs**

11.1.3 Library of setpoints

Password protection

Each setpoint can be protected by password against unauthorized change. The password protection can be assigned to the setpoints during the configuration procedure. See also LiteEdit help to learn about working with password in LiteEdit.

Group: Basic Settings

ControllerName

User defined name, used for InteliPro identification. ControllerName is max 14 characters long and has to be entered manually using LiteEdit software.

Default setting	InteliPro

Mains CT Ratio [A/5A]

Mains current transformers ratio.

Step	1 A/5A
Range	1 – 25000 A/5A
Default setting	400 A/5A

Mains CT Polar [FORWARD / REVERSE]

In case the current transformers are wired with an opposite polarity and the change of the wiring is not possible the user can switch the sign to the "right" (opposite) polarity in order to have the correct direction. This will influence the sign of all variables related to current measurement.

FORWARD	does not have any effect on the measured current, use in case of correct wiring
REVERSE	the sign of the measured current will be switched, use in case of opposite wiring
Default setting	FORWARD

EF CT Ratio [A/5A]

Current transformer ratio for **Earth Fault Current (ANSI 50N, ANSI 51N) (page 47)**.

Step	1 A/5A
Range	1 – 8000 A/5A
Default setting	400 A/5A

Mains PT Ratio [V/V]

Mains potential (voltage) transformers ratio.

Step	0.01 V/V
Range	0.01 - 500,00 V/V
Default setting	1.00 V/V

Gen PT Ratio [V/V]

Generator potential (voltage) transformer ratio.

Step	0.1 V/V
Range	0.1 - 500.0 V/V
Default setting	1.0 V/V

NomVolts Ph-N [V]

Nominal mains voltage (phase to neutral).

Step	1 V
Range	80 - 23094 V
Default setting	231 V

Note: If the value of NomVolts Ph-N is changed, the value of NomVolts Ph-Ph is automatically recalculated and stored in NomVolts Ph-Ph setpoint.

NomVolts Ph-Ph [V]

Nominal mains voltage (phase to phase).

Step	1 V
Range	80 - 40000 V
Default setting	400 V

Note: If the value of NomVolts Ph-Ph is changed, value of NomVolts Ph-N is automatically recalculated and stored in NomVolts Ph-N setpoint.

Nominal Freq [Hz]

Nominal mains frequency.

Step	1 Hz
Range	45 - 65 Hz
Default setting	50 Hz

Nominal Power [kW]

Nominal power of the protected mains feeder.

Step	1 kW
Range	0 - 32000 kW
Default setting	200 kW

NominMainsCurr [A]

Nominal mains feeder current. Serves for Ishort and Earth Fault current protections' evaluation.

Step	1 A
Range	0 - 32000 A
Default setting	288 A

Voltage Setup [Ph To N / Ph To Ph]

Method of voltage evaluation. Setting of this setpoint indicates, whether the voltage protections and control functions are calculated from phase-to-neutral or phase-to-phase voltage.

Ph To N	protection is based on phase-to-neutral voltage evaluation
Ph To Ph	protection is based on phase-to-phase voltage evaluation
Default setting	Ph To N

Note: Setting of this setpoint influences evaluation methods of the following protection stages:
- Sync Check (ANSI 25)
- Time Over Current With Voltage Control (ANSI 51V)
- Over Voltage (ANSI 59)
- Under Voltage (ANSI 27)
- Volt (Un)Balance (ANSI 47)
- Pole Slip (ANSI 78PS)

CB1 Prot Timer [s]

Setting of the CB1 Protection timer. For this time after CB1 Feedback de-energization, the output CB1 Protection keeps in de-energized state to prevent premature breaker closing. After this time it goes back to energized state.

Step	1 s
Range	1 - 60 s
0 = OFF	CB1 protection function is disabled
Default setting	0 s

CB2 Prot Timer [s]

Setting of the CB2 Protection timer. For this time after CB2 Feedback de-energization, the output CB2 Protection keeps in de-energized state to prevent premature breaker closing. After this time it goes back to energized state.

Step	1 s
Range	1 - 60 s
0 = OFF	CB2 protection function is disabled
Default setting	0 s

Start Trip [DISABLED / ENABLED]

InteliPro supports start into the TRIP state after re-connection of the power supply if the setpoint Start Trip is set to ENABLED. The unit goes to TRIP state immediately after the auxiliary power is restored. If all values are within their limits, it is possible to perform Fault Reset when the FR Del time is up. If there is a fault present, it must be cleared first, then the Fault Reset performed and only then the outputs are set to fault-free state.

If disabled, the unit will after power supply restoration return to fault-free state.

DISABLED	function is disabled
ENABLED	function is enabled
Default	DISABLED

⏶ **back to Library of setpoints**

Group: Comms Settings

Contr. Addr

Unit identification address number. In case of connection to CAN bus together with other ComAp controllers, different address than that of the controllers has to be entered.

Range	1 - 32
Default setting	1

COM1 Mode [DIRECT / MODEM / MODBUS]

Switch, defining what protocol/mode of communication is used on the plug-in communication module.

DIRECT	InteliPro (LiteEdit) communication protocol
MODEM	Analog or GSM modem
MODBUS	InteliPro Modbus protocol
Default setting	DIRECT

Note: For a module, providing 2 communication channels, this switch defines the communication on the first channel (RS232 in case of IL-NT RS232-485).

COM2 Mode [DIRECT / MODEM / MODBUS]

Switch, defining what protocol/mode of communication is used on the second communication channel of a plug-in communication module.

DIRECT	InteliPro (LiteEdit) communication protocol
MODEM	Analog or GSM modem
MODBUS	InteliProModbus protocol
Default setting	DIRECT

Note: For a module, providing 2 communication channels, this switch defines the communication on the second channel (RS485in case of IL-NT RS232-485).

ModemIniString

Auxiliary modem initialization string – executed after the default modem initialization string in case of modem communication.

ModbusComSpeed [9600 / 19200 / 38400 / 57600 bps]

Adjusting of the speed of Modbus communication

Default setting	9600 bps

CAN Bus Mode [32C / 8C]

CAN bus speed selection. Use this setpoint in case that you operate InteliPro together with other ComAp contollers connected via CAN bus.

32C	High speed CAN (250 kbps) applicable up to 32 controllers, CAN bus length limited up to 200 meters.
8C	Low speed CAN (50 kbps) applicable up to 8 controllers, CAN bus length limited up to 900 meters.
Default setting	32C

IBLite IP Addr

IP address of IB-Lite module.

IBLite NetMask

IB-Lite network mask.

IBLite GateIP

IP address of gateway for IB-Lite.

IBLite DHCP

Automatic IP address assignment through DHCP server.

IP Addr Mode

FIXED or AUTOMATIC mode of IP address assignment.

ComAp Port

Port for ComAp communication over IB-Lite or IL-NT-GPRS module.

APN Name

Name of APN access point for GPRS network.

APN UserName

User name for APN access point.

APN UserPass

User password for APN access point.

Note: All 3 setpoints above shall be provided by GSM/GPRS operator.

AirGate

Communication mode of internet connection.

Note: You should disable AirGate mode in case you would like to use standard internet connection using IP address.

AirGate IP

IP address of AirGate server (used in AirGate mode).

SMTP UserName

User name or name of e-mail account for verification of e-mail sender on SMTP server. If parameter left empty, no verification is expected. Works for IB-Lite only.

SMTP UserPass

User password of e-mail account for verification of e-mail sender on SMTP server. If parameter left empty, no verification is expected. Works for IB-Lite only.

SMTP Server IP

IP address of SMTP server. Works for IB-Lite only.

Contr MailBox

E-mail address used as "Sender" of alarm e-mails from IB-Lite.

Note: If SMTP server requires verification of sender, e-mail address has to be registered to SMTP server and setpoints "SMTP UserName" and "SMTP UserPass" has to be setted to correct values.

Time Zone

List of time zones used for time reference.

DNS IP Address

IP address of Domain Name Server.

⏏ **back to Library of setpoints**

Group: General

This group contains general setting of the unit and its protective functions.

ProtActiv Del [s]

Common delay to activate for the protection stages set to PARALLEL after **CB1 Feedback (page 73)** and **CB2 Feedback (page 73)** inputs are closed. The delay applies in case of deactivation of **Block 1, Block 2 (page 73)** inputs at the protection stages that are blocked by these inputs.

Step	0.1 s
Range	0 - 30 s
Default setting	2.0 s

BackupTrp Del

Time period reserved for circuit breaker opening. If trip event occurs and the appropriate CB Feedback does not deactivate within this period, the breaker is considered as "failed to open". Bak Com Trp output is activated and in case that the functionality of CB backup are set-up, the appropriate actions are taken.

Step	0.01 s
Range	0.00 - 10.00 s
Default setting	2.00 s

Comm Trp Del

Delay for Del Comm Trp output.

Step	0.1 s
Range	0.0 - 20.0 s
Default setting	0.0 s

Comm Trp Len

Length of pulse on Del Comm Trp output after Comm Trp Del.

Step	0.1 s
Range	0.0 - 20.0 s
Default setting	1.0 s

Trp1 Del [s]

Output Trp 1 activation delay.

Step	0.1 s
Range	0.0 - 20.0 s
Default setting	0.0 s

Trp2 Del [s]

Output Trp 2 activation delay.

Step	0.1 s
Range	0.0 - 20.0 s
Default setting	0.0 s

Auto FR [DISABLED / ON DEACT / CB1+CB2=0 / NOFAULT+DEL]

Setting of automatic fault reset functionality.

DISABLED	AutoFaultReset is disabled
ON DEACT	If at least one of the inputs CB1 Feedback or CB2 Feedback is deactivated, AutoFaultReset is issued immediately
CB1+CB2=0	If both CB1 Feedback and CB2 Feedback are deactivated, AutoFaultReset is issued immediately
NOFAULT+DEL	AutoFaultReset is issued in the moment when the measured values are within their limits (no fault condition) no alarm is active plus the delay adjusted by AutoFR Del parameter. The timeout starts after the last protection deactivation. The NOFAULT+DEL option is the only method, which is not dependent on the state of CB1 Feedback or CB2 Feedback binary inputs.
Default setting	DISABLED

Auto FR Del [s]

Delay for activation of automatic fault reset function in the mode NOFLT+DEL.

Step	1 s
Range	0 - 3600 s
Default setting	10 s

Prio Switching [DISABLED / CB1 -> CB2 / CB1 <- CB2 / CB1 <-> CB2]

Setpoint indicates the method for **Priority switching (page 32)**:

DISABLED	no method of priority switching is applied
CB1 -> CB2	CB1 is considered as the primary switch. If the feedback doesn't come in preset period, Bak Trp 1 is issued and at the same time Trp 2 is issued.
CB1 <- CB2	CB2 is considered as the primary switch. If the feedback doesn't come in preset period, Bak Trp 2 is issued and at the same time Trp 1 is issued
CB1 <-> CB2	both CBs provide a backup switching for one another. If the CB1 feedback doesn't come in preset period, Bak Trp 1 is issued and at the same time Trp 2 is issued, if the CB2 feedback doesn't come in preset period, Bak Trp 2 is issued and at the same time Trp 1 is issued.
Default setting	DISABLED

IPro-SW Key

Software key unlocking the requested **System of optional functions (page 24)** of InteliPro.

Default setting	empty

Note: This setpoint is not overwritten after FW upgrade. The setpoint is not visible on InteliPro display in reading mode to avoid confusion of the user. It is possible to edit this setpoint through InteliPro display and pushbuttons - in this mode it becomes visible. It is however advisable to use LiteEdit for filling-in the SW Key.

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Group: Aux V<>

Aux >V [V]

Warning level for battery overvoltage.

Step	0.1 V
Range	Aux <V – 40 V
Default setting	36 V

Aux <V [V]

Warning level for low battery voltage.

Step	0.1 V
Range	8 – Aux >V V
Default setting	18 V

Aux V Del [s]

Delay for battery voltage warnings.

Step	1 s
Range	0 - 600 s
Default setting	5 s

 back to Library of setpoints

Group: V<>

V>, V>>, V<, V<< [V]

Threshold of 1st and 2nd stage overvoltage and 1st and 2nd stage undervoltage protection respectively.

Step	1 V
Range	1 - 34000 V
0 = OFF	the appropriate stage of voltage protection is disabled
Default setting	V> 253 V V>> 265 V V< 200 V V<< 184 V

V> Del, V>> Del, V< Del, V<< Del [s]

Delay of the appropriate stage of the voltage protection.

Step	0.01 s
Range	0.00 - 600.00 s
Default setting	V> Del 1.00 s V>> Del 0.50 s V< Del 2.50 s V<< Del 0.50 s

Rst V [+/- 0% V<> , +/- 4% V<>, 95%NomVol]

Threshold for voltage measurement hysteresis.

Options	+/- 0% V<>	no voltage hysteresis is applied
	+/- 4% V<>	increase/decrease of the undervoltage/overvoltage limit by 4% of the limit value
	95%NomVol>	reset value set to 95 % of the nominal voltage
Default setting	+/- 0% V<>	

Avg V > [V]

Treshold of the 10 minutes floating average overvoltage.

Step	1 V
Range	0 - 34000 V
0 = OFF	the appropriate stage of voltage protection is disabled
Default setting	0

V Trp BO [Trp 1 / Trp 2 / Trp 1+2 / None]

Selection of trip binary output for voltage protections.

Default setting	None

🔺 **back to Library of setpoints**

Group: V Unb

V Unb [%Un]

Threshold of the voltage unbalance (amplitude asymmetry). The value corresponds to the maximum difference between highest and lowest RMS phase voltage of the 3-phase system.

Step	1 % of nominal voltage
Range	0 - 150 % of the nominal voltage
0 % = OFF	the amplitude voltage asymmetry is disabled
Default setting	20%

V< Pos [%Un]

Undervoltage limit of the positive sequence.

Step	0.1 %Un
Range	0.0 - 100.0 % Un
Default setting	1.0 % Un

V> Neg [%Un]

Overvoltage limit of the negative sequence.

Step	0.1 %Un
Range	0.0 - 100.0 % Un
Default setting	1.0 % Un

V Unb Del [s]

Delay of the voltage unbalance (amplitude asymmetry) protection.

Step	0.01 s
Range	0.00 - 600.00 s
Default setting	5.00 s

V Unb Trp BO [Trp 1 / Trp 2 / Trp 1+2 / None]

Selection of trip binary output for voltage asymmetry protection.

Default setting	None

PhaseRotation [CW / CCW / ANY]

Direction of correct phase rotation.

CW	clockwise
CCW	counter-clockwise
ANY	The protection is blocked, any phase rotation is possible
Default setting	CW

Ph Rot Trp BO [Trp 1 / Trp 2 / Trp 1+2 / None]

Selection of trip binary output for phase rotation protection.

Default setting	None

⏏ **back to Library of setpoints**

Group: Dyn Volt

V Lim 1, V Lim 2, V Lim 3 [% Un]

Voltage limits determining the Dyn Volt Prot curve.

Step	1 %Un	
Range	0 - 100 %Un	
Default setting	V Lim 1	30%Un
	V Lim 2	70%Un
	V Lim 3	90%Un

Delay 1, Delay 2, Delay 3 [s]

Time delays determining the Dyn Volt Prot curve.

Step	0.01 s	
Range	0.01 - 10.00 s	
Default setting	Delay 1	0.15 s
	Delay 2	0.70 s
	Delay 3	1.50 s

Reset Time [s]

Time delay after which the protection starts to follow the curve from the beginning.

Step	0.01 s
Range	0.00..10.00 s
Default setting	2.00 s

DynVoltTrpBO [Trp 1 / Trp 2 / Trp 1+2 / None]

Selection of trip binary output for Dynamic Voltage protection.

Default setting	None

🔺 **back to Library of setpoints**

Group: QU

V< [%Un]

Threshold for voltage measurement

Step	1 %Un
Range	80 – 90 %Un
Default setting	85 %Un

Rst V< [%Un]

Threshold for voltage measurement hysteresis

Step	1 %Un
Range	90 – 100 %Un
Default setting	95 %Un

I Min [%In]

Threshold for current measurement

Step	1 %In
Range	2 – 20 %In
Default setting	10 %In

Q Min [%S]

Threshold for the reactive power measurement

Step	0,1 %S
Range	<-10,0;10,0> %S
Default setting	5,0 %S

QU Del 1 [s]

Time delay for opening the GCB (CB1).

Step	0.01 s
Range	0.00 - 1.00 s
Default setting	0.50 s

QU Del 2 [s]

Time delay for opening the MCB (CB2)

Step	0.01 s
Range	1.00 - 2.00 s
Default setting	1.50 s

QU Trp Gen [Trp 1 / Trp 2 / Trp 1+2 / None]

Selection of trip binary output for QU protection

Default	None

QU Trp Mns [Trp 1 / Trp 2 / Trp 1+2 / None]

Selection of trip binary output for QU protection

Default	None

🔺 **back to Library of setpoints**

Group: f<>

f>, f>>, f<, f<< [Hz]

Threshold of 1st and 2nd stage overfrequency and 1st and 2nd stage underfrequency protection respectively.

Step	0.01 Hz	
Range	0.00 - 70.00 Hz	
0 = OFF	the appropriate stage of frequency protection is disabled	
Default setting	f>	51.5 Hz
	f>>	52 Hz
	f<	47.5 Hz
	f<<	47 Hz

f> del, f>> del, f< del, f<< del [s]

Delay of the appropriate stage of the frequency protection.

Step	0.01 s	
Range	0.00 - 600.00 s	
Default setting	f> Del	90.00 s
	f>> Del	0.50 s
	f< Del	20.00 s
	f<< Del	0.50 s

Rst f< [100% f< / +0,2% f< / 47,5 Hz]

Thresholds for frequency measurement hysteresis.

Options	100% f<	the threshold is set to the underfrequency limit
	+0.2% f<	increase of the underfrequency limit by 0,2% of the limit value
	47.5 Hz	reset value set to 47.5 Hz
Default setting	100% f<	

Rst f> [100% f> / -0,2% f> / 50,05 Hz]

Thresholds for frequency measurement hysteresis.

Options	100% f>	the threshold is set to the overfrequency limit
	+0.2% f>	decrease of the overfrequency limit by 0.2% of the limit value
	50.05 Hz	reset value set to 50.05 Hz
Default setting	100% f>	

f Trp BO [Trp 1 / Trp 2 / Trp 1+2 / None]

Selection of trip binary output for frequency protections.

Default setting	None

⏶ **back to Library of setpoints**

Group: LOM

Vs Lim [°]

Threshold for activating the Vector shift protection.

Step	1°
Range	1 - 50°
0° = OFF	the Vector shift protection is disabled
Default setting	10°

ROCOF [Hz/s]

Threshold for activating the Rate of change of frequency (ROCOF) protection.

Step	0.01 Hz/s
Range	0.00 - 10.0. Hz/s
0 = OFF	the ROCOF protection is disabled
Default setting	0 Hz/s

ROCOF filt [-]

Determinates number of periods considered for evaluating ROCOF protection. Higher number means lower sensitivity and longer evaluation time. Lower number means increased sensitivity and shorter evaluation time.

Step	1
Range	1 - 100
Default setting	5

ROCOF Del [s]

When ROCOF value is above the ROCOF threshold, trip is delayed based on ROCOF Del setting. ROCOF protection trips only in case that ROCOF value is above the ROCOF threshold for the ROCOF Del time.

Use the default ROCOF Del setting to 0,00s in case that ROCOF protection should trip immediately as soon as ROCOF value above the ROCOF threshold is detected.

Step	0.01 s
Range	0.00 - 10.00 s
Default setting	0.00 s

LOM Init Del [s]

Delay for what the Loss of Mains (LOM, i.e. Vector shift and ROCOF) protection is disabled after applying valid measured voltage (stepping into the operational area of voltage and frequency).

Step	0.01 s
Range	0.00 - 600.00 s
Default setting	3.00 s

LOM Trip Del [s]

Duration of Loss of Mains (LOM, i.e. Vector shift and ROCOF) protection trip. After this delay, the fault is considered as terminated and Fault reset is possible. In case of automatic fault reset, the timer is started.

Step	0.01 s
Range	1 - 3600.00 s
Default setting	3.00 s

LOM Trp BO [Trp 1 / Trp 2 / Trp 1+2 / None]

Selection of trip binary output for loss of mains protections.

Default setting	None

⏶ **back to Library of setpoints**

Group: I>

I>, I>> [%In]

1st and 2nd threshold for short current evaluation. The level is in percentage of NominMainsCurr.

Step	1 %
Range	0 - 1000 %
0 = OFF	the short current protection is disabled
Default setting	200 %

I> Del , I>> Del [s]

Delay for short current protection.

Step	0.01 s
Range	0.00 - 10.00 s
Default setting	0.00 s

I Trp BO [Trp 1 / Trp 2 / Trp 1+2 / None]

Selection of trip binary output for overcurrent protection.

Default setting	None

🔺 **back to Library of setpoints**

Group: I> T

I> T Del [s]

IDMT curve shape selection for ANSI 51 time-overcurrent protection. I> T Del is the reaction time of IDMT protection for 200% overcurrent (when mains current = 2* NominMainsCurr).

Step	0.1 s
Range	0.1 - 20.00 s
Default setting	1.0 s

I> T Curve

Selection of which curve will be used for ANSI 51: Time Over Current protection.

IDMT	parametric curve, given by the I> T Del and NominMainsCurr parameters as described in the chapter time-overcurrent protection.
Mod Inv	moderately inverse curve according to ANSI standard
Very Inv	very inverse curve according to ANSI standard
Ext Inv	extremely inverse curve according to ANSI standard
IECInv	moderately inverse curve according to IEC standard
IECVerInv	very inverse curve according to IEC standard
IECExtInv	extremely inverse curve according to ANSI standard
Default setting	IDMT

I> T Trp BO [Trp 1 / Trp 2 / Trp 1+2 / None]

Selection of trip binary output for time overcurrent protection.

Default setting	None

⬆ **back to Library of setpoints**

Group: I> V

I> V Del [s]

IDMT curve shape selection for ANSI 51V time-overcurrent protection with voltage control. I> V Del is the reaction time of IDMT protection for 200% overcurrent when mains current = 2* NominMainsCurr and nominal voltage.

Step	0.1 s
Range	0.1 - 20.00 s
Default setting	1.0 s

I> V Curve

Selection of which curve will be used for ANSI 51V: Time Over Current with voltage control protection.

IDMT	parametric curve, given by the I> T Del and NominMainsCurr parameters as described in the chapter time-overcurrent protection.
Mod Inv	moderately inverse curve according to ANSI standard
Very Inv	very inverse curve according to ANSI standard
Ext Inv	extremely inverse curve according to ANSI standard
IECInv	moderately inverse curve according to IEC standard
IECVerInv	very inverse curve according to IEC standard
IECExtInv	extremely inverse curve according to ANSI standard
Default setting	IDMT

I> V Control [%Un]

The voltage control is applied to the time overcurrent stage under this level. I.e. the overcurrent protection is blocked if the voltage is higher then this setpoint.

Step	0.1 %
Range	1.0 - 200.0 %
200 = OFF	the voltage control of overcurrent protection is disabled
Default setting	200 %

I> V Restraint [DISABLED / ENABLED]

Enabling or disabling voltage restraint of time overcurrent protection. I.e. the overcurrent protection threshold is changed according to the voltage level.

DISABLED	protection disabled
ENABLED	protection enabled
Default setting	DISABLED

I> V Trp BO [Trp 1 / Trp 2 / Trp 1+2 / None]

Selection of trip binary output for time overcurrent protection with voltage control.

Default setting	None

⬥ **back to Library of setpoints**

Group: I Unb

I Unb [%In]

Threshold of current unballance protection. Protection is evaluated as maximum difference between any of the phase currents and the average value of phase currents.

Step	1 %
Range	0 - 200 %
Default setting	50 %

IMinDiffEval [%In]

Minimum limit of measured current in % of nominal current, that the current unballance is enabled from. The value is evaluated as an average value of all phase currents.

Step	1 %
Range	0 - 100 % of NominalMainsCurr
Default setting	50 %

I Unb Del [s]

Delay of current unbalance protection.

Step	0.1 %
Range	0.0 - 600 s
Default setting	5.0 s

I> V Trp BO [Trp 1 / Trp 2 / Trp 1+2 / None]

Selection of trip binary output for current unballance protection.

Default setting	None

🔺 **back to Library of setpoints**

Group: DOC

NominGenCurr [A]

Nominal current of the generator(s) connected to the mains feeder, protected by the InteliPro unit. Serves for directional overcurrent protection evaluation.

Step	1 A
Range	1 - 32000 A
Default setting	288 A

DOC> [%In]

Threshold for directional overcurrent evaluation as the % level of NominGenCurr.

Step	1 %
Range	0 - 150 %
0 = OFF	the directional overcurrent protection is disabled
Default setting	50 %

DOC> Del [s]

Delay for directional overcurrent.

Step	0.1 %
Range	0.0 - 30 s
Default setting	5.0 s

DOC Test [DISABLED / ENABLED]

Enables/disables the testing mode of directional overcurrent protection. When ENABLED, the output DOC TEST shows the sensing of the protection regardless of other protection enabling/disabling conditions. **Activating DOC test blocks the regular function of the ANSI 67 directional overcurrent protection stage!**

DISABLED	protection test disabled
ENABLED	protection test enabled Enabling the DOC test does blocks the regular function of the ANSI 67 directional overcurrent protection stage!
Default setting	DISABLED

DOC Trp BO [Trp 1 / Trp 2 / Trp 1+2 / None]

Selection of trip binary output for directional overcurrent protection.

Default setting	None

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Group: EFC

EFC> Lim [%In]

Threshold for ANSI 50N earth fault instantaneous overcurrent protection indicated in % of NominMainsCurr.

Step	1 %
Range	0 - 300 %
0 = OFF	the earth fault overcurrent protection is disabled
Default setting	30 %

EFC> Del [s]

Delay for ANSI 50N earth fault instantaneous overcurrent protection.

Step	0.1 s
Range	0.0 - 600 s
Default setting	10 s

EFC> T Lim [%In]

Limit value for ANSI 51N - earth fault time overcurrent IDMT curve. It shifts the curve in current direction. Level is indicated in % of NominMainsCurr.

Step	1 %
Range	0 - 300 %
0 = OFF	the earth fault time-overcurrent overcurrent protection is disabled
Default setting	10 %

EFC> T Del [s]

IDMT curve shape selection. EFC> T Del is the reaction time of IDMT protection for 200% overcurrent (when EarthFaultCurrent = 2 * EFC> T Lim * NominMainsCurr).

Step	0.1 s
Range	0.1 - 20.00 s
Default setting	1.0 s

EFC> T Curve

Selection of which curve will be used for ANSI 51N: time earth fault overcurrent.

IDMT	parametric curve, given by the EFC> T Del and EFC> T Lim parameters as described in the chapter time earth fault overcurrent protection.
Mod Inv	moderately inverse curve according to ANSI standard
Very Inv	very inverse curve according to ANSI standard
Ext Inv	extremely inverse curve according to ANSI standard
IECInv	moderately inverse curve according to IEC standard
IECVerInv	very inverse curve according to IEC standard
IECExtInv	extremely inverse curve according to ANSI standard
Default setting	IDMT

EFC Trp BO [Trp 1 / Trp 2 / Trp 1+2 / None]

Selection of trip binary output for earth fault overcurrent protection.

Default setting	None

EFCAutoFR Func [DEFAULT / MANUAL]

Setting of the parameter affects AutoFaultReset function use with the EFC protection.

DEFAULT	AutoFaultReset of the EFC protection works according to Auto FR setting
MANUAL	AutoFaultReset does not work with the EFC protection, alarm reset has to be done manually using Fault reset button or binary input
Default setting	DEFAULT

⬥ back to Library of setpoints

Group: IGS

IGS> Lim [mA]

Threshold for ANSI 50GS – ground surge instantaneous overcurrent protection. Level in 0,1 mA.

Step	0.1 mA
Range	0.0 - 100.0 mA
0 = OFF	the ANSI 50GS – ground surge instantaneous overcurrent protection is disabled
Default setting	0 mA

IGS> Del [s]

Delay for ground surge overcurrent protection.

Step	0.1 s
Range	0.0 - 600.0 s
Default setting	10 s

IGS> T Lim [mA]

Limit value for ANSI 51GS – ground surge time-overcurrent IDMT curve. It shifts the curve in current direction. Level is indicated in % of NominMainsCurr.

Step	0.1 mA
Range	0.0 - 50.0 mA
0 = OFF	the ground surge time-overcurrent overcurrent protection is disabled
Default setting	0 mA

IGS> T Del [s]

IDMT curve shape selection. IGS> T Del is the reaction time of IDMT protection for 100 mA ground surge current.

Step	0.1 s
Range	0.1 - 20.00 s
Default setting	1.0 s

IGS> T Curve

Selection of which curve will be used for ANSI 51GS: ground surge overcurrent.

IDMT	parametric curve, given by the IGS> T Del and IGS> T Lim parameters as described in the chapter ground surge time-overcurrent protection.
Mod Inv	moderately inverse curve according to ANSI standard
Very Inv	very inverse curve according to ANSI standard
Ext Inv	extremely inverse curve according to ANSI standard
IECInv	moderately inverse curve according to IEC standard
IECVerInv	very inverse curve according to IEC standard
IECExtInv	extremely inverse curve according to ANSI standard
Default setting	IDMT

IGS Trp BO [Trp 1 / Trp 2 / Trp 1+2 / None]

Selection of trip binary output for ground surge overcurrent protection.

Default setting	None

⏏ **back to Library of setpoints**

Group: NVD

NVD> [V]

Threshold for neutral voltage displacement evaluation.

Step	1 V
Range	0 - 150 V
0 = OFF	the ANSI 59N - neutral voltage displacement protection is disabled
Default setting	33 V

NVD> Del [s]

Delay for neutral voltage displacement protection.

Step	1 s
Range	0 - 300 s
Default setting	60 s

NVD>> [V]

Step	1 V
Range	0 - 500 V
Default setting	50 V

NVD>> Del [s]

Step	1 s
Range	0 - 300 s
Default setting	1 s

Rst NVD

Threshold for NVD measurement hysteresis.

Options	+/- 0%
	+/- 4%
Default	+/- 0%

NVD Trp BO [Trp 1 / Trp 2 / Trp 1+2 / None]

Selection of trip binary output for neutral voltage displacement protection.

Default setting	None

⏶ **back to Library of setpoints**

Group: P

P>, P>> [%Pn]

Threshold for first or second directional power protection stage respectively, indicated in % of NominMainsPwr. Positive value of power means that the power flows in the direction from mains into the feeder.

Step	0.01 %
Range	-300.00 - 300.00 %
Default setting P>	110.00 %
Default setting P>>	120.00 %

P> Del, P>> Del [s]

Delay for first or second stage of directional power protection stage respectively.

Step	0.01 s
Range	0.00 - 150.00 s
Default setting	5.00 s

P> Direction, P>> Direction [UNDER / OVER]

Setting of the direction of evaluation of mains-reverse power first or second protection stage respectively.

UNDER	if the power is less then the value of the pre-set limit, the protection trips.
OVER	if the power is higher then the value of the pre-set limit, the protection trips.
Default setting	OVER

> **Example:** An example of setting of directional power protection is shown on the following case. There is a feeder of nominal power 200 kW. The protection is supposed to trip when the power flows from the generator to the mains, exceeds the value by 100 kW (50 % of nominal power of the protected feeder) and flows for a period of 10 seconds. The setpoints will be adjusted as follows:
> P> - 50 % (minus sign due to the power flow to the mains)
> P> Del 10 s
> P> Direction OVER (the protection must trip when the power exceeds 50 % of the nominal power).

P Trp BO [Trp 1 / Trp 2 / Trp 1+2 / None]

Selection of trip binary output for directional power protection.

Default setting	None

Mains Pwr 1…8 [%Pn]

Eight setpoints assignable to percentage of nominal active power value which activate appropriate binary output in case the measured value exceeds the set limit.

Range	0-100%
Step	1%
Default	0%
0 = OFF	

Filter Delay [s]

To avoid hunting of the binary outputs activation and deactivation, adjustable time delay can be assigned to the measured values. Only if the disturbance lasts longer than the pre-set delay, the thresholds set in "Mains Pwr 1...8" setpoints will be violated.

Range	0-300.0
Step	0.1
Default	5.0

⏶ **back to Library of setpoints**

Group: P 1Ph

P 1Ph>, P 1Ph>> [%Pn]

Threshold for first or second single phase reverse power protection stage respectively, indicated in % of **Nominal Power [kW] (page 86)**. Negative value of the setpoint means power flows in the direction from feeder to mains.

Step	0.01 %
Range	-100.00 - 100.00 %
Default setting	-5.00 %

P 1Ph> Del, P 1Ph>> Del [s]

Delay for first or second stage of single phase reverse power protection stage respectively.

Step	0,01 s
Range	0.00 - 150.00 s
Default setting	5.00 s

P 1Ph> Direction, P 1Ph>> Direction [UNDER / OVER]

Setting of the direction of evaluation of mains power first or second protection stage respectively.

UNDER	if mains single phase power is lower than the threshold value, the protection trips
OVER	if mains single phase power is higher than the threshold value, the protection trips
Default setting	UNDER

P 1Ph Trp BO [Trp 1 / Trp 2 / Trp 1+2 / None]

Selection of trip binary output for single phase reverse power protection.

Default setting	None

🔺 **back to Library of setpoints**

Group: Q

Q>, Q>> [%Pn]

Threshold for first or second directional reactive power protection stage respectively, indicated in % of **Nominal Power [kW] (page 86)**. Positive value of the setpoint means that reactive power flows in the direction from mains into the feeder.

Step	0.01 %
Range	-300.00 - 300.00 %
Default setting	10.00 %

Q> Del, Q>> Del [s]

Delay for first or second stage of directional reactive power protection stage respectively.

Step	0.01 s
Range	0.00 - 150.00 s
Default setting	5.00 s

Q> Direction, Q>> Direction [UNDER / OVER]

Setting of the direction of evaluation of mains reactive power first or second protection stage respectively.

UNDER	if mains reactive power is lower than the threshold value, the protection trips
OVER	if mains reactive power is higher than the threshold value, the protection trips
Default setting	OVER

Q Trp BO [Trp 1 / Trp 2 / Trp 1+2 / None]

Selection of trip binary output for directional reactive power protection.

Default setting	None

🔺 **back to Library of setpoints**

Group: PF

Ind PF limit [-]

Adjustable limit for inductive (current is lagging voltage) power factor evaluation. Trip is issued if the measured value falls below the pre-set limit.

Step	0.01
Range	0 - 1.00
Default setting	0.95

Ind PF Del [s]

Delay for TRIP activation after the inductive power factor limit is violated.

Step	0.1 s
Range	0 - 300.0 s
Default setting	1 s

Cap PF limit [-]

Adjustable limit for capacitive (current is leading voltage) power factor evaluation. Trip is issued if the measured value falls below the pre-set limit.

Step	0.01
Range	0 - 1.00
Default setting	0.95

Cap PF Del [s]

Delay for TRIP activation after the capacitive power factor limit is violated.

Step	0.1 s
Range	0 - 300.0 s
Default setting	1 s

PF Trp BO [Trp 1 / Trp 2 / Trp 1+2 / None]

Selection of trip binary output for power factor protection.

Default setting	None

⏶ **back to Library of setpoints**

Group: Sync Check

Upper V Lim [%Un]

Defines upper limit for the measured voltage, used to enable the Sync Check function. If the voltage is above this limit, it is never evaluated as "in synchronism".

Step	0.1 %
Range	100.0 - 120 % of nominal voltage
Default setting	105.0 %

Lower V Lim [%Un]

Defines lower limit for the measured voltage, used to enable the Sync Check function. If the voltage is under this limit, it is never evaluated as "in synchronism".

Step	0.1 %
Range	70.0 - 100.0 % of nominal voltage
Default setting	95.0 %

Voltage Window [%Un]

Maximum difference between mains and bus voltage measured on the Sync Check input, to be considered as "synchronous" conditions.

Step	0.1 %
Range	0.0 - 100.0 % of nominal voltage
Default setting	2.0 %

Phase Window [°]

Maximum angle between mains and bus voltage measured on the Sync Check input, to be considered as "synchronous" conditions.

Step	1°
Range	0 - 90°
Default setting	10°

Freq Window [Hz]

Maximum frequency difference between mains and bus voltage measured on the Sync Check input, to be considered as "synchronous" conditions.

Step	0.01 Hz
Range	0.01 - 5.00 Hz
Default setting	0.20 Hz

Dwell Time [s]

Minimum time that the mains and bus voltage have to stay within the Voltage Window, Phase Window and Freq Window to be considered as synchronous.

Step	0.1 s
Range	0.0 - 25.0 s
Default setting	2.0 s

DeadVm HotVsc [ENABLED / DISABLED]

Enabling/disabling the synchro-check function of closing "dead" mains to "hot" bus.

ENABLED	situation of dead mains (mains voltage below Dead V Lim) and live bus (Sync Check voltage within limits) is considered as "synchronous" state
DISABLED	situation of dead mains and live bus is not considered as "synchronous" state
Default setting	DISABLED

HotVm DeadVsc [ENABLED / DISABLED]

Enabling/disabling the synchro-check function of closing "live" mains to "dead" bus.

ENABLED	situation of live mains (mains voltage within limits) and dead bus (Sync Check voltage below Dead V Lim) is considered as "synchronous" state
DISABLED	situation of live mains and dead bus is not considered as "synchronous" state
Default setting	DISABLED

DeadVm DeadVsc [ENABLED / DISABLED]

Enabling/disabling the synchro-check function of closing "dead" mains to "dead" bus.

ENABLED	situation of dead mains (mains voltage below Dead V Lim) and dead bus (Sync Check voltage below Dead V Lim) is considered as "synchronous" state
DISABLED	situation of dead mains and dead bus is not considered as "synchronous" state
Default setting	DISABLED

Block By AR [ENABLED / DISABLED]

If enabled, the synchro-check will not evaluate synchronous state until the AC Reclosing output is activated after the trip termination.

ENABLED	The binary output will activate only after the AC Reclosing output is activated
DISABLED	The binary output activates regardless of the state of the AC Reclosing output
Default setting	DISABLED

Dead V Lim [%Un]

Threshold for evaluating the mains or bus voltage as "dead".

Step	0.1 % of nominal voltage
Range	0.0 - 50.0 %
Default setting	20.0 %

Dead T Del [s]

If the mains or bus voltage stays under the Dead V Lim threshold for longer than tis time, the voltage is considered as "dead".

Step	0.1 s
Range	0.0 - 150.0 s
Default setting	5.0 s

SynC Trp BO [Trp 1 / Trp 2 / Trp 1+2 / None]

Selection of trip binary output for synchro check protection.

Default setting	None

Note: In case of setting to None, the sync check function has no influence on trip outputs. If any trip output is selected, then deactivation of that trip output is blocked while the synchronous conditions are not evaluated. When the synchronous conditions are met, the deactivation of the trip output is no longer blocked.

🔺 **back to Library of setpoints**

Group: AC Reclosing

AR Delay [s]

Delay for activating the AC Reclosing binary output after fault reset.

Step	0.01 s
Range	0.00 - 600.00 s
Default setting	10.00 s

Rec Initiate [Common / Trp 1 / Trp 2]

Selection of which output is considered as a trigger for the AC reclosing function. Deactivation of this output initiates the counter of AR Delay for reconnecting by the AC Reclosing output.

Common Trp	the output Comm Trp is considered the trigger for AC reclosing counter
Trp 1	the output Trp 1 is considered the trigger for AC reclosing counter
Trp 2	the output Trp 2 is considered the trigger for AC reclosing counter
Default setting	Comm Trp

No.AC Reclose [-]

Setpoint for setting number of allowed AC Reclose actions. If the pre-set number is exceeded, trip is issued and the relay stays in TRIP stays until fault reset is performed.

Step	1
Range	0 - 50
0 = OFF	
Default setting	48

AC Rec Timer [s]

Timer for setting a time interval for the No.AC Reclose setpoint. If the No.AC Reclose reaches its set limit within the time interval set in AC Rec Timer, warning "No.AC Rec" will be displayed and shown in Alarm list and History, the unit will stop reclosing and stays in trip state until fault reset is performed.

When the fault reset is performed, the **AC Rec Timer** will reset and the countdown will start from zero at the moment when first AC Reclose is performed.

If the number of AC recloses does not reach its limit within the set period, the **AC Rec Timer** buffer and the **No.AC Reclose** setpoint will reset and starts from zero at the moment of next AC Reclose.

Step	1 s
Range	0 - 65535
0 = OFF	
Default setting	65535

AC Rec FR Del [s]

If configured, setpoint **AC Rec FR Del** allows to set longer time delay (independent on the regular FR Del) for fault reset when the trip is issued after the last AC Reclose action to allow the personnel to check the situation. Fault reset can be then performed after pre-set time is up.

Step	1 s
Range	0 - 65535
0 = OFF	
Default setting	0

⏶ **back to Library of setpoints**

Group: Pole Slip

Gear Teeth [-]

Number of teeth on the engine's (generator's) flywheel for the pick-up sensor

Step	1 [-]
Range	1 - 500
Default setting	256

Nominal RPM [-]

Number of the machine nominal revolutions per minute.

Step	1 [-]
Range	100 - 4000
Default setting	1500

Pole Slip Lim [°]

The load angle limit setting

Step	1°
Range	60 - 180
Default setting	100

CalibrationDel [s]

Pole slip protection calibration delay. Delay count down starts as soon as both engine RPM and generator voltage are above 90% of the nominal settings (**Nominal RPM [-] (page 117)** and **NomVolts Ph-N [V] (page 86)**).

Step	0.1
Range	0.0 - 20.0 s
Default setting	0.0 s

PS Trp BO [Trp 1 / Trp 2 / Trp 1+2 / None]

Selection of trip binary output for pole slip protection.

Default setting	None

⬖ **back to Library of setpoints**

Group: MaxParallTime

MaxParallTime [s]

Timer of the maximum parallel time protection.

Step	0.1 s
Range	0.1 - 1800.0 s
Default setting	300.0 s

MaxPT Trp BO [Trp 1 / Trp 2 / Trp 1+2 / None]

Selection of trip binary output for maximum parallel time protection.

Default setting	None

⬖ **back to Library of setpoints**

Group: CU Analog In

Setpoints in this group are used for protection on DC analog inputs of the unit.

CU AI1 Wrn, CU AI2 Wrn, CU AI3 Wrn

Level of warning type of protection assigned to analog input 1, 2 or 3 of the unit respectively. The step, decimals, range and units are given by configuration of the appropriate output.

CU AI1 Trp, CU AI2 Trp, CU AI3 Trp

Level of trip assigned to analog input 1, 2 or 3 of the unit respectively. The step, decimals, range and units are given by configuration of the appropriate output.

CU AI1 Del, CU AI2 Del, CU AI3 Del [s]

Delay of protections assigned to analog input 1, 2 or 3 of the unit respectively. It is the same for warning alarm and trip.

Step	1 s
Range	0 - 600 s
Default setting	5 s

CU AI1 BlockBI, CU AI2 BlockBI, CU AI3 BlockBI [Block 1 / Block 2 / Block 1+2 / None]

Selection of blocking binary input for protections assigned to analog input 1, 2 or 3 of the unit respectively.

Default setting	None

🔺 **back to Library of setpoints**

Group: IOM Analog In

Setpoints in this group are used for protection on DC analog inputs of the extension module IG-IOM or IGS-PTM.

IOM AI1 Wrn, IOM AI2 Wrn, IOM AI3 Wrn, IOM AI4 Wrn

Level of warning type of protection assigned to analog input 1, 2, 3 or 4 of the extension module IG-IOM or IGS-PTM. The step, decimals, range and units are given by configuration of the appropriate output.

IOM AI1 Trp, IOM AI2 Trp, IOM AI3 Trp, IOM AI4 Trp

Level of trip assigned to analog input 1, 2, 3 or 4 of the extension module IG-IOM or IGS-PTM respectively. The step, decimals, range and units are given by configuration of the appropriate output.

IOM AI1 Del, IOM AI2 Del, IOM AI3 Del, IOM AI4 Del [s]

Delay of protections assigned to analog input 1, 2, 3 or 4 of the extension module IG-IOM or IGS-PTM respectively. It is the same for warning alarm and trip.

Step	1 s
Range	0 - 600 s
Default setting	5 s

IOM AI1 BlockBI, IOM AI2 BlockBI, IOM AI3 BlockBI, IOM AI4 BlockBI [Block 1 / Block 2 / Block 1+2 / None]

Selection of blocking binary input for protections assigned to analog input 1, 2, 3 or 4 of the extension module IG-IOM or IGS-PTM respectively.

Default setting	None

 🔺 **back to Library of setpoints**

Group: SMS/E-Mail

Wrn Alarm Msg [OFF/ ON]

Enables or disables active calls, SMS or e-mail mesages to the selected phone, mobile or e-mail address when a warning alarm occurs.

Default setting	OFF

Trp Alarm Msg [OFF/ ON]

Enables or disables active calls, SMS or e-mail mesages to the selected phone, mobile or e-mail address when trip occurs.

Default setting	OFF

TelNo/Addr Ch1, TelNo/Addr Ch2

2 possibilities of enetring phone number or e-mail to which the message will be sent in case that warning or trip occurs.

 🔺 **back to Library of setpoints**

Group: Date/Time

TimeStamp Per [min]

Time interval for history record. Time base is based on number of minutes since midnight. History records are only made in parallel, if CB1 Feedback and CB2 Feedback are configured and closed, activation delay elapsed and if there is at least one unblocked protection. If CB1 Feedback and CB2 Feedback are not configured, history records are made in case that there is at least one unblocked protection.

Step	1 min
Range	0 - 240 min
0 = OFF	TimeStamp event is disabled
Default setting	30 min

#SummerTimeMod [DISABLED / WINTER / SUMMER, WINTER-S, SUMMER-S]

DISABLED	Automatic switching between summer and wintertime is disabled.
WINTER (SUMMER)	Automatic switching between summer and wintertime is enabled and it is set to winter (summer) season.
WINTER-S (SUMMER-S)	Modification for southern hemisphere.
Default setting	DISABLED

Note: In case of interconnection of InteliPro with other ComAp units on the CAN2 bus, the setpoint is automatically synchronized within the interconnected group.

#Time [HHMMSS]

Real time clock adjustment.

Note: In case of interconnection of InteliPro with other ComAp units on the CAN2 bus, the setpoint is automatically synchronized within the interconnected group.

#Date [DDMMYY]

Actual date adjustment

Note: In case of interconnection of InteliPro with other ComAp units on the CAN2 bus, the setpoint is automatically synchronized within the interconnected group.

🔺 **back to Library of setpoints**

Group: Sensors Spec

AI1Calibration, AI2Calibration, AI3Calibration, IOM AI1 Calibr, IOM AI2 Calibr, IOM AI3 Calibr, IOM AI4 Calibr

The value for calibration of the appropriate analog input of the unit or extension module IG-IOM or IGS-PTM. This value is added to the output of analog input curve.

🔺 **back to Library of setpoints**

11.1.4 List of Values

Mains Measured

Mains Freq	Hz	Mains freqeuency
VmL1N	V	L1-neutral voltage
VmL2N	V	L2-neutral voltage
VmL3N	V	L3-neutral voltage
VmL1L2	V	L1-L2 voltage
VmL2L3	V	L2-L3 voltage
VmL3L1	V	L3-L1 voltage
Avg V1	V	Averge voltage of L1-N or L1-L2 (depending on the Voltage Setup parameter setting)
Avg V2	V	Averge voltage of L2-N or L2-L3 (depending on the Voltage Setup parameter setting)
Avg V3	V	Averge voltage of L3-N or L3-L1 (depending on the Voltage Setup parameter setting)
V positive	V	Voltage of positive sequence
V negative	V	Voltage of negative sequence
Im1	A	Current in phase 1
Im2	A	Current in phase 2
Im3	A	Current in phase 3
Angle U1I1	°	Phase angle in phase 1
Angle U2I2	°	Phase angle in phase 2
Angle U3I3	°	Phase angle in phase 3
EarthFaultCurr	A	Earth fault current
GrndShortCurr	mA	Ground surge current from CT2 REL2 plug-in mo

Mains Power

Mains Pwr	kW	filtered measured mains active power
Mains Pwr Raw	kW	measured mains active power
MP L1	kW	active poewr in phase 1
MP L2	kW	active poewr in phase 2
MP L3	kW	active poewr in phase 3
Mains kVAr	kVar	mains reactive power
MQ L1	kVar	reactive power in phase 1
MQ L2	kVar	reactive power in phase 2
MQ L3	kVar	reactive power in phase 3
MainsApparPwr	kVA	mains apparent power
MS L1	kVA	apparent power in phase 1
MS L2	kVA	apparent power in phase 2

MS L3	kVA	apparent power in phase 3
Mains PF	-	Mains power factor
MPfL1	-	power factor of phase 1
MPfL2	-	power factor of phase 2
MPfL3	-	power factor of phase 3
Mains Ld Char	-	Mains load character
M Ld Char 1	-	load character of phase 1
M Ld Char 2	-	load character of phase 2
M Ld Char 3	-	load character of phase 3

LOM

MaxVectorShift	°	Maximal value of vector shift
Act ROCOF	Hz/s	actual value of Rate of Change of Frequency
Max ROCOF	Hz/s	Maximal value of Rate of Change of Frequency

NVD

NVD	V	neutral voltage displacement

Sync Check

Vsc Freq	Hz	Measured frequency of Vsc voltage
Vsc	V	Voltage between L2 and L3 on mains terminals
Slip Freq	Hz	Measured frequency slip between frequency of main three phase voltage and voltage on L2-L3 of the mains terminals
Angle	°	Shift angle between generator and mains voltage in phase 1

Pole Slip

RPM	RPM	Value of RPM evaluated from magnetic pickup
LoadAngle	°	Load angle
LoadAngMxTrip	°	Maximal pole slip detected before pole slip tripping. It is available only after pole slip trip. The value is recorded to history as LdAT.

Controller I/O

Aux Volts	V	Auxiliary power voltage
CU AI1	-	Analog input 1 of controller
CU AI2	-	Analog input 2 of controller
CU AI3	-	Analog input 3 of controller
Bin Inputs	-	Binary value with reading from binary input terminals on controller
Bin Outputs	-	Binary value set on binary output terminals on controller
GSM SignalLvl	%	GSM signal strength
GSM ErrorRate	-	Error rate of the GSM signal

GSM Diag Code	-	GSM diagnosis
AirGate Diag	-	AirGate diagnosis
AirGate ID	-	Unique number for AirGate communication
Modem Status	-	Modem status
RemoteControl	-	Remote control

Extension I/O

IOM AI1	U4	Analog from IOM or PTM module connected via CAN
IOM AI2	U5	Analog from IOM or PTM module connected via CAN
IOM AI3	U6	Analog from IOM or PTM module connected via CAN
IOM AI4	U7	Analog from IOM or PTM module connected via CAN
AIO AI1	U8	Analog input from AIO
AIO AI2	U9	Analog input from AIO
AIO AI3	U10	Analog input from AIO
AIO AI4	U11	Analog input from AIO
IOM Bin Inp	-	8bits binary value from binary inputs of IOM or PTM module connected via CAN
Relay Card CT2	-	Relay output
RA Bin Out	-	15bits binary value send to RA15 module connected via CAN
IOM Bin Out	-	8bits binary value send to binary outputs of IOM or PTM module connected via CAN
SharedBOut	-	8bits binary value contains binaries send to shared periphery
SharedAout 1	-	Analog value sends to shared periphery
SharedAout 2	-	Analog value sends to shared periphery
SharedAout 3	-	Analog value sends to shared periphery
SharedAout 4	-	Analog value sends to shared periphery

Statistics

kWh I	kWh	active power import
kVArh I	kVArh	reactive power import
kWh E	kWh	active power export
kVArh E	kVArh	reactive power export

Date/Time

Time	-	Time
Date	-	Date

InteliPro Info

Breaker State
FW Version
FW Branch
IOM SW Ver.
PasswordDecode
CAN16
CAN32
Options

⬆ **back to List of Values**

11.1.5 List of EMC tests

Test description	Compliant to	Test conditions/ level
Electrical disturbance test (1MHz burst immunity)	IEC 60255-22-1 IEC 61000-4-18 IEEE C37.90.1	f = 1MHz U= ±0,25, ±0,5, ±1kV
Electrostatic discharge tests	IEC 60255-22-2 IEC 61000-4-2	Test voltage: U= ± 2, ±4, ±6kV contact discharge U= ± 2, ±4, ±8kV air discharge
Radiated electromagnetic field immunity test	IEC 60255-22-3 IEC 61000-4-3 IEEE C37.90.2	Field intensity: 10V/m Scan spectrum: 80 – 1000MHz, 1,4 – 2,7GHz (80% AM 1kHz)
Electrical fast transient/burst immunity test	IEC 60255-22-4 IEC 61000-4-4 IEEE C37.90.1	f = 5kHz U= ± 2kV
Surge immunity tests	IEC 60255-22-5 IEC 61000-4-5	U= ± 0,5, ± 1kV
Immunity to conducted disturbances induced by radio –frequency fields	IEC 60255-22-6 IEC 61000-4-6 IEEE C37.90.2	Test voltage: U= 10V Scan spectrum: 0,15 – 80MHz (mod.80% AM / 1kHz) Spot frequencies: 27MHz, 68MHz
Power frequency magnetic field immunity tests	IEC 61000-4-8	Magnetic field intensity: 30/300 A/m
Voltage dips, short interruptions and voltage variations on dc input power port	IEC 60255-11 IEC 61000-4-29	Test level: 0% Ut Duration [ms]: 5, 10, 20, 50, 100, 200
Electromagnetic emission tests	CISPR 22 IEC 60255-25	Class A f = 30 – 1000 MHz f = 0,15 – 30 MHz
Vibration tests (sinusoidal)	IEC 60255-21-1 IEC 60068-2-6	2÷25Hz / ±1,6mm / 1 octave per minute 25÷100Hz / 4,0g / 1 octave per minute
Shock and bump tests	IEC 60255-21-2 EN 60068-2-27	A=200m/s2; T=11ms; half sinus; 3 shocks in all axis both directions (18 altogether)
Environmental testing	IEC 60068-2-1	Cold: -30°C
Environmental testing	IEC 60068-2-2	Dry heat: +70°C
Environmental testing	IEC 60068-2-3 IEC 60068-2-30	Cyclic damp heat + humidity Temperature cycle: 20-55-20°C Humidity: 97%
Isolation rated voltage	IEC 60255-5	Overvoltage category III

Test description	Compliant to	Test conditions/ level
Electrical disturbance test (1MHz burst immunity)	IEC 60255-22-1 IEC 61000-4-18 IEEE C37.90.1	f = 1MHz U= ±0,25, ±0,5, ±1kV
Electrostatic discharge tests	IEC 60255-22-2 IEC 61000-4-2	Test voltage: U= ± 2, ±4, ±6kV contact discharge U= ± 2, ±4, ±8kV air discharge
Radiated electromagnetic field immunity test	IEC 60255-22-3 IEC 61000-4-3 IEEE C37.90.2	Field intensity: 10V/m Scan spectrum: 80 – 1000MHz, 1,4 – 2,7GHz (80% AM 1kHz)
Electrical fast transient/burst immunity test	IEC 60255-22-4 IEC 61000-4-4 IEEE C37.90.1	f = 5kHz U= ± 2kV
Surge immunity tests	IEC 60255-22-5 IEC 61000-4-5	U= ± 0,5, ± 1kV
Immunity to conducted disturbances induced by radio –frequency fields	IEC 60255-22-6 IEC 61000-4-6 IEEE C37.90.2	Test voltage: U= 10V Scan spectrum: 0,15 – 80MHz (mod.80% AM / 1kHz) Spot frequencies: 27MHz, 68MHz
Power frequency magnetic field immunity tests	IEC 61000-4-8	Magnetic field intensity: 30/300 A/m
Voltage dips, short interruptions and voltage variations on dc input power port	IEC 60255-11 IEC 61000-4-29	Test level: 0% Ut Duration [ms]: 5, 10, 20, 50, 100, 200
Electromagnetic emission tests	CISPR 22 IEC 60255-25	Class A f = 30 – 1000 MHz f = 0,15 – 30 MHz
Vibration tests (sinusoidal)	IEC 60255-21-1 IEC 60068-2-6	2÷25Hz / ±1,6mm / 1 octave per minute 25÷100Hz / 4,0g / 1 octave per minute
Shock and bump tests	IEC 60255-21-2 EN 60068-2-27	A=200m/s2; T=11ms; half sinus; 3 shocks in all axis both directions (18 altogether)
Environmental testing	IEC 60068-2-1	Cold: -30°C
Environmental testing	IEC 60068-2-2	Dry heat: +70°C
Environmental testing	IEC 60068-2-3 IEC 60068-2-30	Cyclic damp heat + humidity Temperature cycle: 20-55-20°C Humidity: 97%
Isolation rated voltage	IEC 60255-5	Overvoltage category III

🔺 **back to ControllerObjects**

11.2 Alarms

11.2.1 Library of alarm messages

ActCallCH1Fail	error during sending an SMS to a number stated in the setpoint SMS/E-mail -> TelNo/Addr Ch1
ActCallCH2Fail	error during sending an SMS to a number stated in the setpoint SMS/E-mail -> TelNo/Addr Ch2
Low BackupBatt	Backup battery is low
Wrn Aux Volt	over or undervoltage of the power supply
M L1 neg	phase sequence is correct, L1 is in antiphase
M L2 neg	phase sequence is correct, L2 is in antiphase
M L3 neg	phase sequence is correct, L3 is in antiphase
M ph opposed	opposed phase sequence
M ph+L1 neg	phase sequence is opposite, L1 is in antiphase
M ph+L2 neg	phase sequence is opposite, L2 is in antiphase
M ph+L3 neg	phase sequence is opposite, L3 is in antiphase
Trp Vm1>	trip due to exceeding of the first stage overvoltage in phase 1
Trp Vm1>>	trip due to exceeding of the second stage overvoltage in phase 1
Trp Vm1<	trip due to exceeding of the first stage undervoltage in phase 1
Trp Vm1<<	trip due to exceeding of the first stage undervoltage in phase 1
Trp Vm2>	trip due to exceeding of the first stage overvoltage in phase 2
Trp Vm2>>	trip due to exceeding of the second stage overvoltage in phase 2
Trp Vm2<	trip due to exceeding of the first stage undervoltage in phase 2
Trp Vm2<<	trip due to exceeding of the first stage undervoltage in phase 2
Trp Vm3>	trip due to exceeding of the first stage overvoltage in phase 3
Trp Vm3>>	trip due to exceeding of the second stage overvoltage in phase 3
Trp Vm3<	trip due to exceeding of the first stage undervoltage in phase 3
Trp Vm3<<	trip due to exceeding of the first stage undervoltage in phase 3
Trp Vm12>	trip due to exceeding of the first stage overvoltage between phases 1 and 2
Trp Vm12>>	trip due to exceeding of the second stage overvoltage between phases 1 and 2
Trp Vm12<	trip due to exceeding of the first stage undervoltage between phases 1 and 2
Trp Vm12<<	trip due to exceeding of the first stage undervoltage between phases 1 and 2
Trp Vm23>	trip due to exceeding of the first stage overvoltage between phases 2 and 3
Trp Vm23>>	trip due to exceeding of the second stage overvoltage between phases 2 and 3
Trp Vm23<	trip due to exceeding of the first stage undervoltage between phases 2 and 3
Trp Vm23<<	trip due to exceeding of the first stage undervoltage between phases 2 and 3
Trp Vm31>	trip due to exceeding of the first stage overvoltage between phases 3 and 1
Trp Vm31>>	trip due to exceeding of the second stage overvoltage between phases 3 and 1
Trp Vm31<	trip due to exceeding of the first stage undervoltage between phases 3 and 1

Trp Vm31<<	trip due to exceeding of the first stage undervoltage between phases 3 and 1
Trp V Unb	trip due to voltage unbalance
Trp V Neg Seq	trip due to exceeding of overvoltage limit of negative sequence
Trp V Pos Seq	trip due to exceeding of undervoltage limit of positive sequence
Trp fm>	trip due to exceeding of the first stage overfrequency
Trp fm>>	trip due to exceeding of the second stage overfrequency
Trp fm<	trip due to exceeding of the first stage underfrequency
Trp fm<<	trip due to exceeding of the second stage underfrequency
Wrn DCTripCirc	evaluation of DC trip circuit state when the input closed
Trp VectorShft	trip due to activation of vector shift protection
Trp ROCOF	trip due to activation of rate of change of frequency protection
Trp DirOC L1	trip due to exceeding of the directional overcurrent limit in phase 1
Trp DirOC L2	trip due to exceeding of the directional overcurrent limit in phase 2
Trp DirOC L3	trip due to exceeding of the directional overcurrent limit in phase 3
Trp NVD>	trip due to exceeding of the first stage of neutral voltage displacement
Trp NVD>>	trip due to exceeding of the second stage of neutral voltage displacement
Wrn DirOC Test	indication during activation of directional overcurrent test
Trp EFC>	trip due to exceeding of earth fault current limit
Trp IGS>	trip due to exceeding of ground surge instantaneous overcurrent limit
Trp I>	trip due to exceeding of first stage overcurrent limit
Trp I>>	trip due to exceeding of second stage overcurrent limit
Trp I> T	trip due to activation of time-overcurrent protection
Trp I> V	trip due to activation of time-overcurrent protection with voltage control
Trp EFC> T	trip due to activation of earth fault time-overcurrent protection
Trp IGS> T	trip due to activation of ground surge time-overcurrent protection
Wrn Watchdog	watchdog event occurred
Trp I Unb	trip due to current unbalance
Trp MaxParTime	trip due to the parallel conditions has stayed longer then allowed
Trp P>	trip due to the first stage of directional power limit
Trp P>>	trip due to exceeding of the second stage directional power limit
Trp Vm1 Avg >	trip due to exceeding of the floating average overvoltage limit in phase 1
Trp Vm2 Avg >	trip due to exceeding of the floating average overvoltage limit in phase 2
Trp Vm3 Avg >	trip due to exceeding of the floating average overvoltage limit in phase 3
Trp Pole Slip	trip due to pole slip protection activation
Trp Dyn Volt	trip due to activation of dynamic voltage protection
Trp QU Gen	trip of the GCB due to QU protection activation
Trp QU Mns	trip of the MCB due to QU protection activation
Sd IOM Fail	error of IOM connection to InteliPro
Wrn RA Fail	error of RA15 connection to InteliPro

Wrn BadPwrCfg	a controller with different setting of units of power is connected to CAN
Trp PS Disable	pole slip calibration failure due to engine RPM or generator voltage drop below 80% of the nominal settings (**Nominal RPM [-] (page 117)** and **NomVolts Ph-N [V] (page 86)**)
Wrn PS Fail	disturbance on RPM input
Trp cap PF	trip due to activation of capacitive PF limit protection
Trp ind PF	trip due to activation of inductive PF limit protection
No.AC Rec	trip due to reaching the No.AC Reclose limit
Wrn MCBmanOpen	Remote / manual opening of CB

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