Compact Controller for Stand-by and Parallel Operating Gen-sets

Inteli New Technology
Modular Gen-set Controller

Single Parallel to Mains – SW configuration SPtM - GeCon

IG-NT, IG-NTC, IS-NT, IG-NT-BB,IG-NTC-BB, IS-NTC-BB

Software version IGS-NT-GeCon-LandBased, November 2013

ComAp
LEADER IN GEN–SET
COMMUNICATION SOLUTION

Reference guide

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General guidelines

What is described in this manual?

This manual describes Single parallel to Mains – GeCon-LandBased - „SPtM“ software configuration. The software configuration is designed for single set, parallel with mains applications.

What is the purpose of this manual?
This manual provides general information on how to configure and operate the controller.
This manual is intended for use by:

- Operators of gen-sets
- Gen-set control panel builders
- For everybody who is concerned with installation, operation and maintenance of the gen-set

!! Warnings !!

The NT controller can be remotely controlled. In the event that maintenance needs to be done to the gen-set, check the following to ensure that the engine cannot be started.

To be sure:

- Disconnect remote control via RS232 line
- Disconnect input REMOTE START/STOP

or

- Disconnect output STARTER and outputs GCB CLOSE/OPEN and MCB CLOSE/OPEN

The controller contains a large number of configurable setpoints, because of this it is impossible to describe all of its functions. These are subject to change from SW version to SW version. This manual only describes the product and is not guaranteed to be set for your application on arrival.

Text

ESC	(Capital letters in the frame) buttons on the front panel
Break Return	(Italic) set points
Generator protections	(Bold) Set point group
Cyan background	Valid for IS-NT only

Conformity declaration

CE

Following described machine complies with the appropriate basic safety and health requirement of the EC Low Voltage Directive No: 73/23 / EEC and EC Electromagnetic Compatibility Directive 89/336 / EEC based on its design and type, as brought into circulation by us.

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.

WARNING – VERY IMPORTANT !!!

Be aware that the binary outputs can change state during and after software reprogramming (before the controller is used again ensure that the proper configuration and setpoint settings are set in the controller).

Every time you want to disconnect following NT controller terminals:

- Mains voltage measuring and / or
- Binary output for MCB control and / or
- MCB feedback

Be aware that the MCB can be switched off and gen-set can start !!!

Switch the controller to MAN mode and disconnect the Binary outputs Starter and Fuel to avoid unexpected automatic start of gen-set and GCB closing.

!!! CAUTION !!!

Dangerous voltage

The terminals for voltage and current measurement should never be touched.
Properly connect the grounding terminals.
Do not disconnect the CT terminals for any reason.

Adjust set points

All setpoints are preadjusted to their typical values. But the set points in the "**Basic settings**" settings group **!!must!!** be adjusted before the first startup of the gen-set.

!!! WRONG ADJUSTMENT OF BASIC PARAMETERS CAN DESTROY THE GEN-SET !!!

The following instructions are for qualified personnel only. To avoid personal injury do not perform any action not specified in this User guide !!!

General description

Description of the controller system (with all options)

NT Family controllers are comprehensive AMF-controllers for single and multiple generating sets operating in stand-by or parallel modes.
NT Family controllers are equipped with a powerful graphic display showing icons, symbols and bar-graphs for intuitive operation, which sets, together with high functionality, new standards in Gen-set controls.
The controller automatically starts the gen-set, closes the Gen-set C.B. when all conditions are met, then stops the engine* (*sw GeCon opens GCB only, not stop the engine) on external signal or by pressing push buttons.
Parallel to the Mains operation is a standard feature. Isolated parallel and Power Management System support are optional. Forward and reverse synchronizing, Generator protections, Mains protection including vector shift, load and power factor control are the major functions provided. Interfacing to foreign synchronizers and load sharers is supported.
The key feature of the controller is its easy-to-use operation and installation. Predefined configurations for typical applications are available as well as user-defined configurations for special applications.

Comparing of IGS-NT-GeCon-LandBased 3.0 to the standard IGS-NT-2.6.4

- GeCon does not take care of Engine control
- GeCon is the generator controller – synchronize, load control, generator protections evaluation
- GeCon accepts external – “by hand” Engine and GCB control.
- GeCon can control the engine via Binary start/stop output signals only – see below. The independent Engine controller (e.g. ID-DCU) is expected.
- Synchronizing and unloading timeouts can be disabled by setpoint setting (or Force value function).
- Interface GeCon to engine controller is provided by I/O wires no by communication line.
- From ECU is possible read the information only

Available related documentation

PDF FILE	DESCRIPTION
InteliMonitor-2.7-Reference Guide	Reference Guide for monitoring tool
GenConfig-2.6-Reference Guide	Reference Guide for configuration tool
IGS-NT Communication Guide 11-2011	Communication guide for IG/IS-NT controllers. It contains information how to connect control unit and all communication features descriptions
IGS-NT-2.6 Installation Guide	Installation guide for IG/IS-NT controllers. It contains technical information about controler and extension modules
IGS-NT-2.6 Application Guide	Application guide for IG/IS-NT controllers. It refers to application and typical installation settings and sites structures
IGS-NT-2.6-Operator guide.pdf	Operator guide for IG/IS-NT

Functions

IGS-NT-GeCon-LandBased SPtM 3.0 is free and from version 3.0 works without IGS-NT-GeCon dongle!

OFF-MAN-AUT-TEST mode

OFF mode

Use OFF mode to block controller functions (even if is switched on). OFF mode is used for controller firmware or configuration change.
Binary outputs (e.g. GCB CLOSE/OPEN) are not energized, all closed Binary outputs are opened when controller is switched to OFF mode.
Gen-set cannot be started and operated from IG-NT-GeCon controller – no response for panell buttons and Binary input commands.
The MCB is closed permanently (*MCB Opens On* = GENRUN) **or is open or closed according to the mains is present or not** (*MCB Opens On* = MAINSFAIL).

Hint:
Switching to OFF mode is blocked on running engine to avoid accidental engine stop by mode change or by firmware or configuration programming.

MAN mode

Engine start can be activated from
- Engine controller (e.g. ID-MCU)
- GeCon panel – Start button
- GeCon BI: StartButton
- Remotely e.g. from InteliMonitor

GeCon BI: ReadyToLoad initiates GeCon "Running" state" - activates **Gener protect**: *Min stab time* a *Max stab time* within the generator electric protections are activated.
Gen-set is loaded/unloaded from
- GeCon panel – GCB button
- GeCon BI: GCBButton
- Remotely e.g. from InteliMonitor

GCB closing from controller can be blocked by BI: GCB disable.

AUT mode

Engine start is activated from GeCon BI: Load/Unload.
GeCon BI: ReadyToLoad initiates GeCon "Running" state" - activates **Gener protect**: *Min stab time* a *Max stab time* within the generator electric protections are activated.
- Gen-set starts synchronizing and is loaded/unloaded automatically.

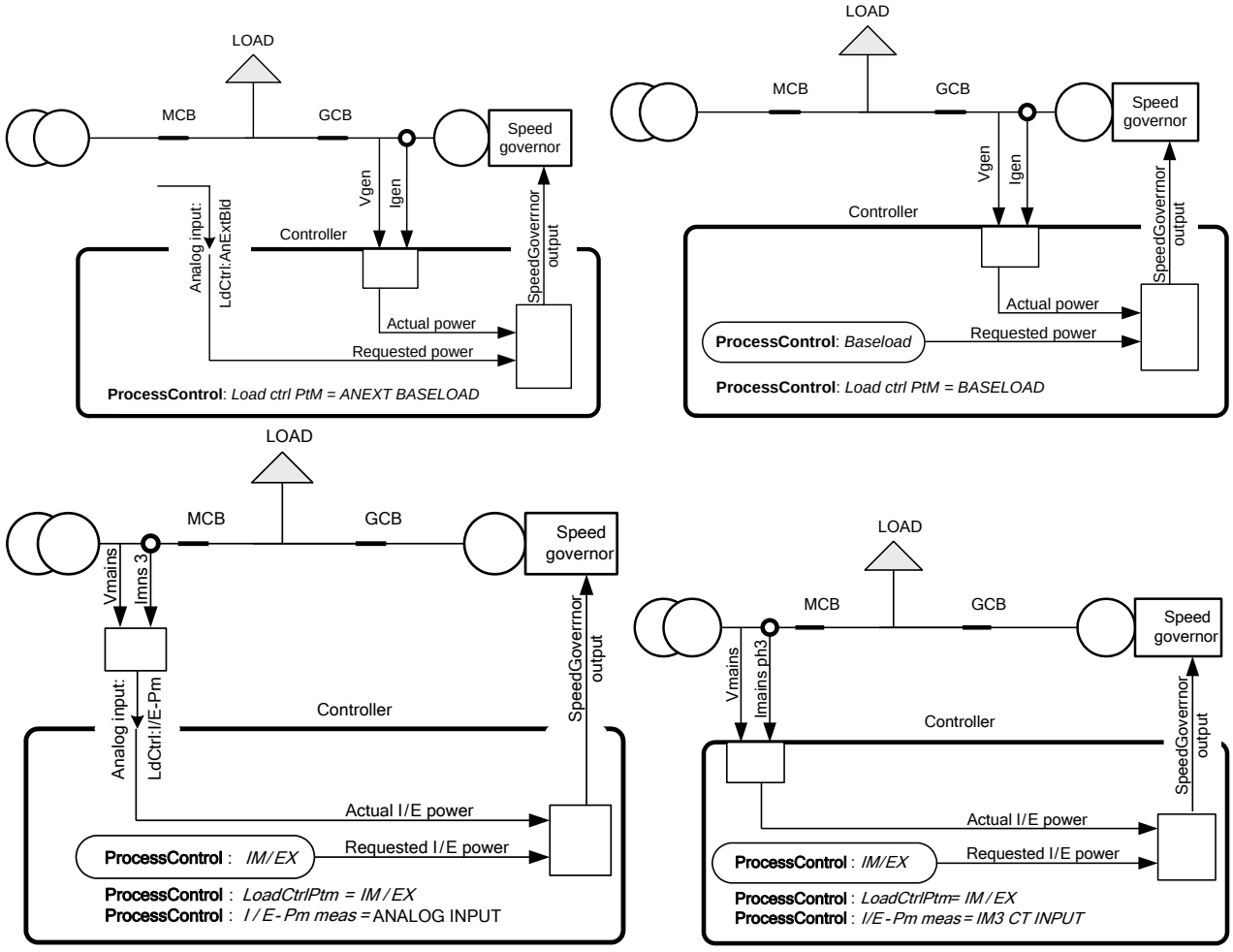
GeCon will stop engine started from MCU when BI Load/Unload is deactivated.

TEST mode

Use TEST mode for Gen-set start test if the Mains is OK or to transfer the load to the gen-set when Mains fail is announced in advance.
Hint:
The controller does not respond to GCB ON/OFF , STOP, START in *Return To mains* = ENABLED.
Engine automatically starts, when TEST mode is selected.
Engine can start automatically without warning when pressing FAULT RESET after shut down alarm.

Active Power control modes in Parallel to Mains

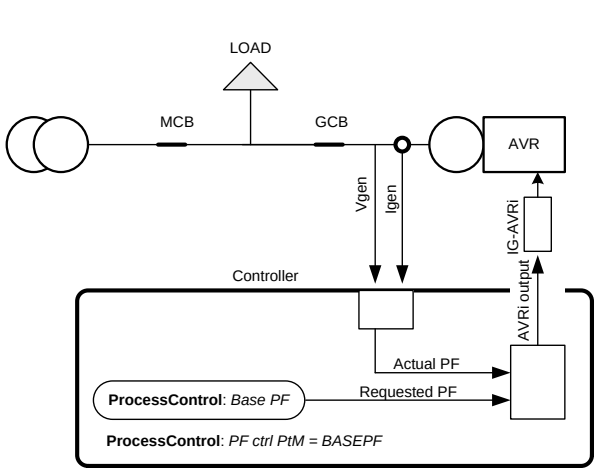
Mode	Function	Setpoints
Baseload	Genset power is constant - set by Baseload setpoint.	**ProcessControl**: *Load ctrl PtM=BASELOAD; Base load*
ANEXT Baseload	Gen-set power is set via Analog input.	**ProcessControl**: *Load ctrl ANEXT Baseload;* Analog input: LdCtrlAnextBld
Import / Export	Import/Export value is constant – I/E power is measured by controller.	**ProcessControl**: *Load ctrl PtM=IM/EX; Import load; I/E Pm-meas = IM3 CT INPUT*
ANEXT Import / Export	Import/Export value is constant – I/E power is measured via Analog input.	**ProcessControl**: *Load ctrl PtM=IM/EX; Import load; I/E Pm-meas = ANALOG INPUT* Analog input: LdCtrl:I/E-Pm
Peak shaving	Automatic gen-set start/stop based on object (load) consumption.	**ProcessControl**: *PeakLevelStart; PeakLevelStop; PeakAutS/S del*
Export limit	Limits export to the mains in the Baseload mode.	**ProcessControl**: *Export limit = ENABLE*

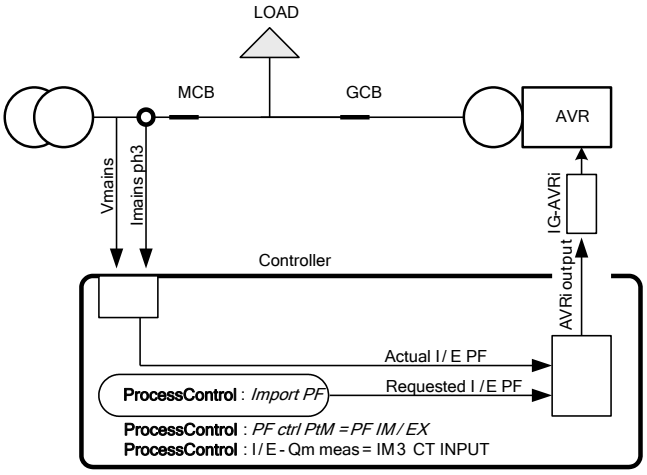


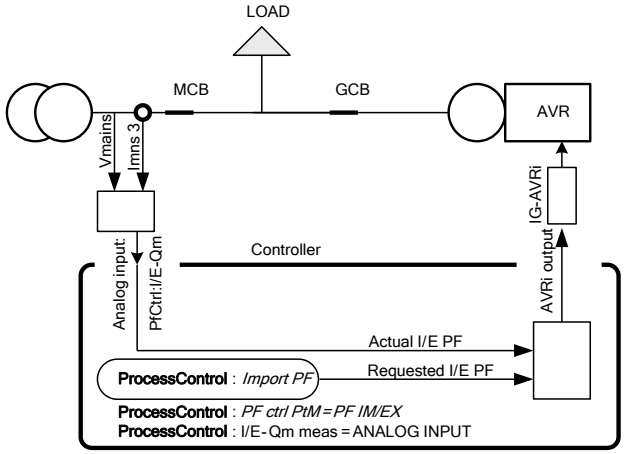
PF control modes in Parallel to Mains

Mode	Function	Setpoints
Base PF	Genset PF is constant – set by Base PF setpoint.	**ProcessControl**: *PF ctrl PtM=BASE PF; Base PF*
PF Import / Export	Constant Import/Export PF– I/E PF is measured by controller.	**ProcessControl**: *PF ctrl PtM=IM/EX; Import PF*; *I/E Qm-meas = IM3 CT input*

	Constant Import/Export PF– I/E PF is measured via Analog input.	**ProcessControl**: *PF ctrl PtM=IM/EX; Import PF*; *I/E Qm-meas = IM3 CT input* Analog input: PFctrl:I/E-Qm







Load shedding

Load shedding function is dedicated for tripping of non-essential load in case of high generator current, or drop of generator frequency above/below preadjusted limits, for preadjusted time.

All LOAD SHED outputs are activated (closed) to trip the unessential load when gen-set goes to island:

a) When GCB is closed after mains fail and gen-set starts in AUT mode.
b) When MCB opens from parallel to mains operation in AUT mode.
c) Before MCB is opened in MAN mode by button.

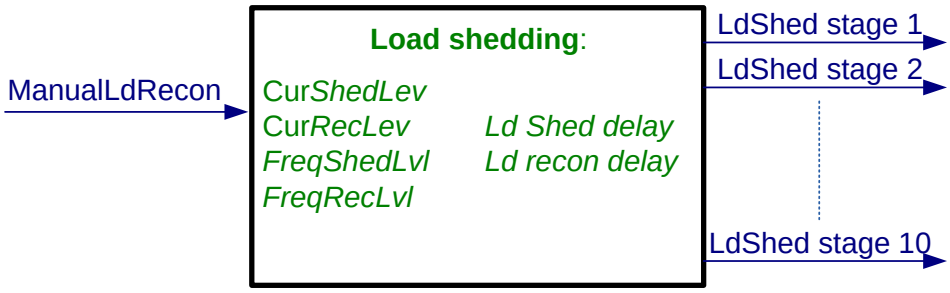
The load shedding function is active in all controller modes except OFF.

Load shedding has ten steps and each step is linked with its own Load shed x binary output. The non essential load tripping is based on generator current and generator frequency. There is only one level for current load shedding and one level for frequency load shedding for all 10 steps, as well for reconnection level and delay. Load shed can only move from one step to the following one.

If manual reconnection of the load is desired, the AutoLd recon setpoint needs to be disabled (*AutoLd recon* = DISABLED) and the MAN load recon binary input needs to be configured.

Rising edge on this input resets the controller to a lower stage, but only if the load is under the *CurRecLev* and above *FreqRecLev* at that moment.

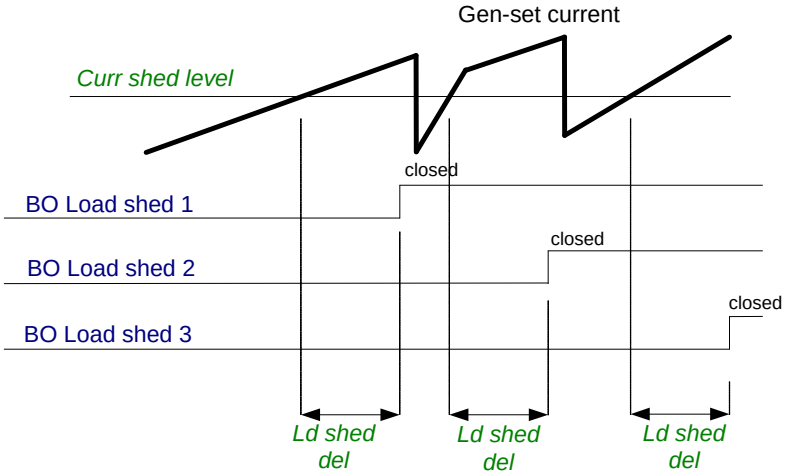
The current load shedding can be activated in case any of phase current exceeds the adjusted limit. The reconnection is able only in case all of the current values are below reconnection level.



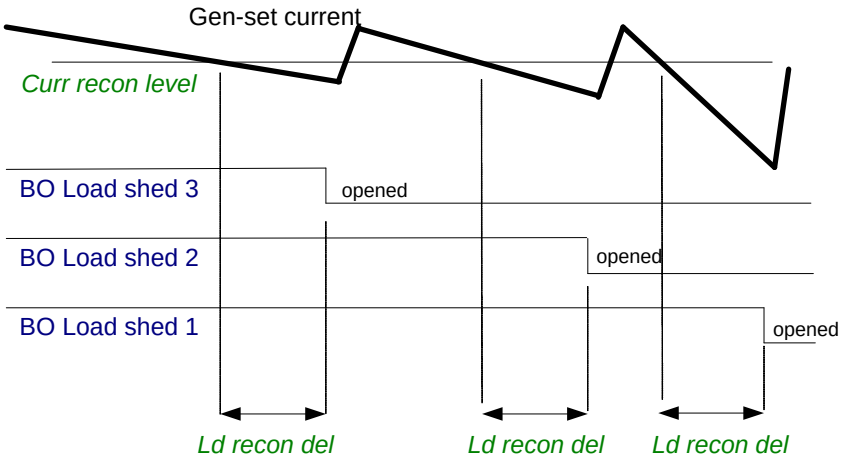
Hint:

If no Load Shedding outputs are configured, there is no record to history and no screen timer indication of the activity of this function.

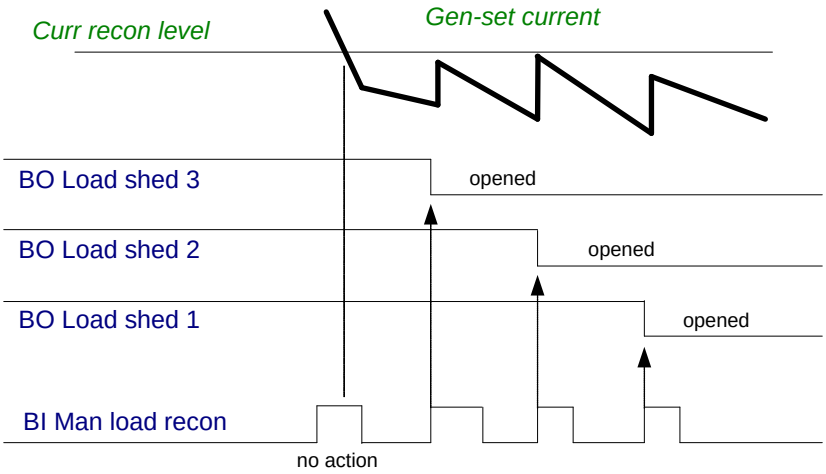
On the following pictures, the generator current load shedding is depicted. The current is evaluated from all 3 phases, each phase can activate the load shedding. On the picture, due to transparency, only 3 load shed outputs are depicted, not all 10.
The generator frequency based load shedding is in fact the same, but fall below preadjusted limit is watched, instead of exceeding of the limit as in case of current load shedding. Frequency is evaluated from phase 3.



Load reconnection – automatic -> *AutoLd recon* = ENABLED



Load reconnection – manual -> *AutoLd recon* = DISABLED



Test on load – SPtM

Affects the behavior in TEST mode. Before the activation of this function

1. adjust setpoint **AMF settings**: *ReturnTo mains* = DISABLED
2. adjust Process control: MFStart enable = YES.
3. switch controller to Test on load mode (see drawing below)

Gen-set starts and goes to load (synchronizes to the mains, closes GCB and opens MCB) automatically when this input is closed even if Mains is OK.
Gen-set stays running in parallel with mains during the soft load transfer from the mains to the gen-set until *Import power* = 0. When the load is bigger than *Nominal power*, MCB stays closed, BO WrnTstOnLdFail is closed and warning message is issued (WrnTstOnLdFail).

When the controller is switched from Test on load mode (and Mains is OK), it synchronizes MCB, stays running in parallel for *BreakerOverlap* time (soft load transfer), opens GCB, cools down and stops.
During the load transfer from the gen-set to the mains can be *BreakerOverlap* time shortened due to the influence of: *Load ramp*, *GCB open level*, *GCB open del* setpoints.

Hint:
It is possible to configure both binary inputs (Remote TEST and Test on load) to only one controller physical binary input internally.

Power derating

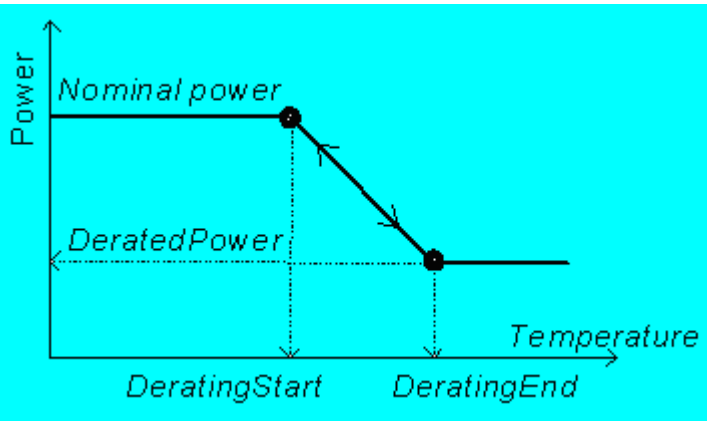
This function linearly **decreases genset nominal power** according to analog input value.
Gen-set power starts decreasing when temperature measured by Analog input PowerDeratingX exceeds *DeratingX strt* value.
Gen-set power is at *DeratedX pwr* value when temperature measured by Analog input Power deratingX is equal or higher than *DeratingX end* value.
Hint:
To use Power derating function configure at first Analog input PowerDeratingX to any IGS-NT or IS-AIN analog input terminal by GenConfig.

When Power derating function is active the generator overload protection is based on the Derated power! ! !

Derated power value **Pg derated** is visible in the controller measure screen.

When derating function is not active the Derating power is equal to Nominal power.

Example :
Nomin power = 200 kW, *Derating1 strt* = 70 °C, *Derating1 end* = 100 °C, *Derated1 pwr* = 70 %.
Genset is running at Nominal power 200 kW. When temperature reached 70 °C the genset power starts decreasing. When temperature reached 100 °C genset runs at 70 % of Nominal power = 140 kW. When temperature increased above *DeratingX end* temperature level, gen-set power stays at *DeratedX pwr* level 140 kW.



Temperature derating function decreases genset power depend on setpoints *DeratingX strt*, *DeratingX end* and *DeratedX pwr*.

Temperature derating starts at *DeratingX strt* temperature.

At *DeratingX end* temperature runs genset at *DeratedX pwr* level.

Above *DeratingX end* temperature Genset runs at constant *DeratedX pwr*.

Service time alarm

Engine protect: *Service time 1*
Service time 2
Service time 3
Service time 4
→ WrnServiceTime

Engine starting procedures

- Independent Engine controller (e.g. InteliDrive) is expected.
- Interface GeCon to InteliDrive is provided by single BI/BO wires (no communication line).
- GeCon does not directly control engine via Starter, Fuel, Ignition – only sends Start request and Stop requests, or level signal Remote S/S.
- GeCon does not measure RPM from pickup.

Engine stopping procedures

- Active Generator protection does not stop running engine.
- Only Slow Stop protection really stops the engine

Engine "running" conditions

- The additional condition to close GCB (start synchronizing) is GeCon **BI Ready to load** (coming from MCU) in both MAN, AUT modes.

PLC functions

- Note: For detailed PLC functions description see IGS-NT-2.6-Application guide.pdf

Group	PLC Block	IS-NT-GeCon LandBased 3.0	IG-NT-GeCon LandBased 3.0
Logical function	OR/AND	**100**	**32**
	XOR/RS	**100**	**32**
Comparators	Comp Hyst	16	4
	Comp Time	16	4
	Comp Win	16	4
Math operations	Math Fc	16	2
	Ext math Fc	8	2
	Interpol Fc	4	1
Regulators	PID Ana B	4	2
	PID Bin	4	2
Ramp functions	Ramp	4	2
	Up/Down	4	2
	Inc/Dec	2	2
	Mov Avg	2	1
Time functions	Timer	4	1
	Delay	**24**	8
Others	Ana Switch	16	2
	Force Hist	4	4
	Force Prot	4	4
	Jump	4	4
	Mux Const.	4	4
	Counter	4	1
	Decomp	4	4
	Convert	10	10

Multi language support

NT family controllers support up to five Languages that is possible to switch during controller duty. Every terminal (i.e. Remote display or PC-InteliMonitor) can be switched to different language. Use PC-GenConfig - Translator tool to translate texts to another language.
Default application archives contain all texts in English only.

ECU interface customizing

The list of available ECU interfaces can be found in GenConfig / Modules / ECU list.
In sw GeCon is possible to configure the any ECU, but controller can read information only. Writing any information is not possible.

Protections and Alarm management

Protection groups

There are two groups of protections in the controller: fix and customer configurable.

		Setpoint group
Analog protections	Configurable/Fix	Analog protect
Generator protections	Configurable/Fix	Gener protect
Mains protections	Configurable/Fix	Mains protect
Fix protections	Fix	Gener protect, Mains protect, Analog protect

Protection types

Level	Protection types	Abbre viation	Gen-set action	Record
1	**History record**	Hst	None	History only
1	**Alarm only**	Al	None (Alarm disappears when becomes inactive and Fault Reset button is pressed.)	Alarmlist only
1	**Warning**	Wrn	None	Alarmlist and History
1	**AL indication**	ALI	None (Alarm disappears automatically, when becomes inactive.)	Alarmlist only
1	**A+H indication**	AHI	None	Alarmlist and History
2	**Low power**	LoP	Load is ramped-down to **Gener protect:** *Min power PtM*. After protection becomes inactive, the power limitation is automatically terminated (no fault reset necessary). Load is ramped down and up via the Load ramp setpoint.	Alarmlist and History
2	**Off load**	OfL	Controller opens GCB without soft unloading, gen-set runs 1 minute at Nominal RPM in AUT mode, in MAN mode it runs till operator intervene	Alarmlist and History
2	**Breaker Open**	BO	Controller opens GCB without soft unloading, gen-set state changes to Running.	Alarmlist and History
1	**Mains protection**	MP	Controller opens MCB or GCB, gen-set stays running.	History only
2	**Slow stop**	Stp	Soft unloading then the GCB opens, the gen-set state changes to Cooling and Stop.	Alarmlist and History
2	**Shutdown**	Sd	Controller opens GCB without soft unloading.	Alarmlist and History
X	**Sensor fail**	Fls	Can be indicated when Analog input value is ±6% out of sensor characteristic range. Fls can optionally activate corresponding (e.g. Sd) Analog input protection as well.	Alarmlist and History
2	**SdOverride**	SdO	Binary input with protection type SdOverride is included into the list of protections evaluated when the LBI: SdOverride is active	AlarmList and History

Default protections in SPTM

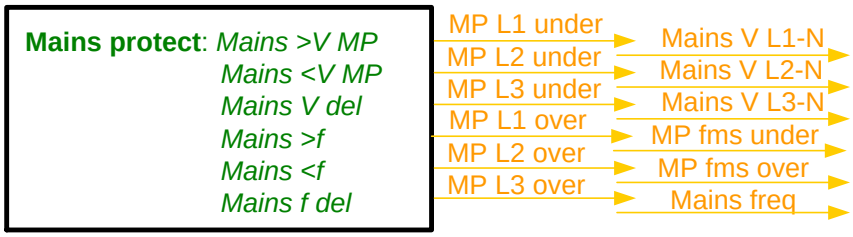
Fix – firmware based		
Generator:		Corresponding setpoints
IDMT overcurrent	BO	**Basic settings**: Nomin current; **Gener protect**: *2Inom del*
IDMT Active power	BO	**Gener protect**: *OverldStrtEval; 2POvrldStrtEvDel*
Shortcurrent	BO	**Gener protect**: *Ishort; Ishort del*
Generator voltage: Ug1>, Ug1<, Ug2>, Ug2<, Ug3>, Ug3<	BO	**Gener protect**: *Gen >V BO; Gen <V BO; Gen V del.*
Generator voltage: Ug1>>, Ug2>>, Ug3>>	Sd	**Gener protect**: *Gen >V Sd; Gen V del.*
Generator frequency: fg<, fg>	BO	**Gener protect**: *Gen >f; Gen <f; Gen V del*
Mains:		
Vector shift	MP	**Mains protect**: *VectorS prot; Vector S limit, VectorS CB sel*
Mains voltage	MP	**Mains protect**: *Mains >V MP; Mains <V MP; Mains V del*
Mains frequency	MP	**Mains protect**: *Mains >f; Mains <f; Mains f del*
Default - configurable		
Reverse power (UnivState 1)	BO	**Gener protect**: *Reverse power; ReversePwr del*
Batt <V, Batt >V (UnivState 2)	Wrn	**Analog protect**: *Batt >V; Batt <V; Batt V del*
EarthFaultCurr (UnivState 5)	BO	**Gener protect**: *EarthFaultCurr; EthCurr del*

Generator:	PROTECTION	CORESPONDING SETPOINTS
Generator:		
IDMT overcurrent	BO	**Basic settings**: *Nomin current*; **Gener protect**: *2Inom del*
IDMT Active power	BO	**Gener protect**: *OverldStrtEval; 2POvrldStrtEvDel*
Shortcurrent	BO	**Gener protect**: *Ishort; Ishort del*
Generator voltage: Ug1>, Ug1<, Ug2>, Ug2<, Ug3>, Ug3<	BO	**Gener protect**: *Gen >V BOC; Gen <V BOC; Gen V del.*
Generator frequency: fg<, fg>	BO	**Gener protect**: *Gen >f; Gen <f; Gen V del*
Mains:		
Vector shift	MP	**Mains protect**: *VectorS prot; VectorS CB sel; Vector S limit*
Mains voltage	MP	**Mains protect**: *Mains >V MP; Mains <V MP; Mains V del*
Mains frequency	MP	**Mains protect**: *Mains >f; Mains <f; Mains f del*
Rate of Change of Frequency	MP	**Mains protect**: *ROCOF df/dt, ROCOF Win*
Rate of Change of Frequency	MP	**Mains protect**: *ROCOF df/dt, ROCOF Win*
Default – configurable:		

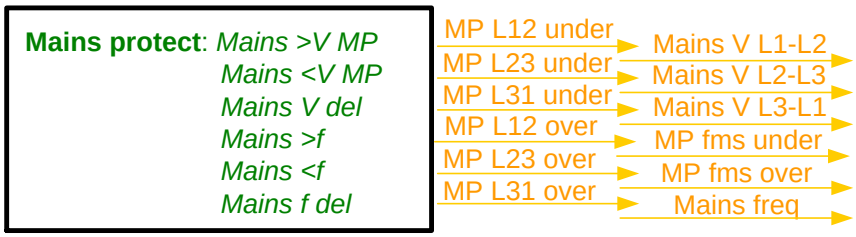
Reverse power (UnivState 1)	BO	**Gener protect**: *Reverse power; ReversePwr del*
Batt <V, Batt >V (UnivState 2)	Wrn	**Analog protect**: *Batt >V; Batt <V; Batt V del*
EarthFaultCurr (UnivState 5)	BO	**Gener protect**: *EarthFaultCurr; EthCurr del*
Gen Current unbalance	BO	**Gener protect**: *Gen I unbal; Gen I unb del*
Gen Voltage unbalance	BO	**Gener protect**: *Gen V unbal;Gen V unb del*
Mains Voltage unbalance	BO	**Mains protect:** *Mains V unbal; Mains Vunb del*

Mains voltage and frequency protections - limits and indications

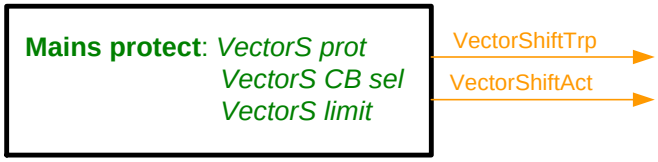
Basic settings:
VoltProtselect = PHASE-NEUTRAL



Basic settings:
VoltProtselect = PHASE-PHASE



Vector shift protection - limits and indications



Hint:
For more information about Vector Shift Protection see chapter *Setpoints / Mains protect* of this manual or chapter *Vector Shift Protection* of NPU User Guide 1.9.

Generator voltage and frequency protections - limits and indications

Basic settings:
VoltProtSelect = PHASE-NEUTRAL

Basic settings:
VoltProtSelect = PHASE-PHASE

Shutdown override

If the Binary input Sd override is closed, all* 2nd level protections are disabled to allow engine run in an emergency situation, e.g. sprinkler devices power supply.
All protections are shown in Alarmlist and recorded into History, but the controller doesn't stop the engine because of them. If the input is deactivated and some protections are still active or not yet reset, the controller starts to take these protections into account and consequently behaves based on them.
Hint:
All 2nd level protections are locked out, except of these:

- Emergency stop
- All inputs with configured protection type: SdOverride

Circuit breakers operation sequence, GCB/MCB fail detection

Related binary inputs:

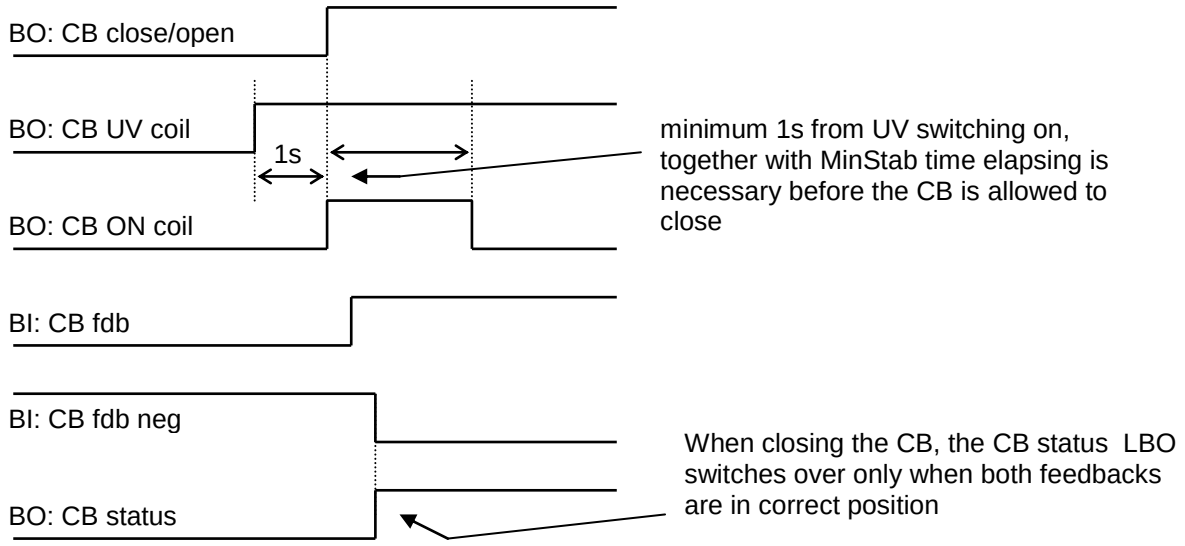
- CB fdb – CB feedback binary input
- CB fdb neg – negative CB feedback binary input. Used for increasing the reliability of CB status evaluated by the controller. In case that it is not configured, negative value of CB fdb is calculated internally within the controller.

Related binary outputs:

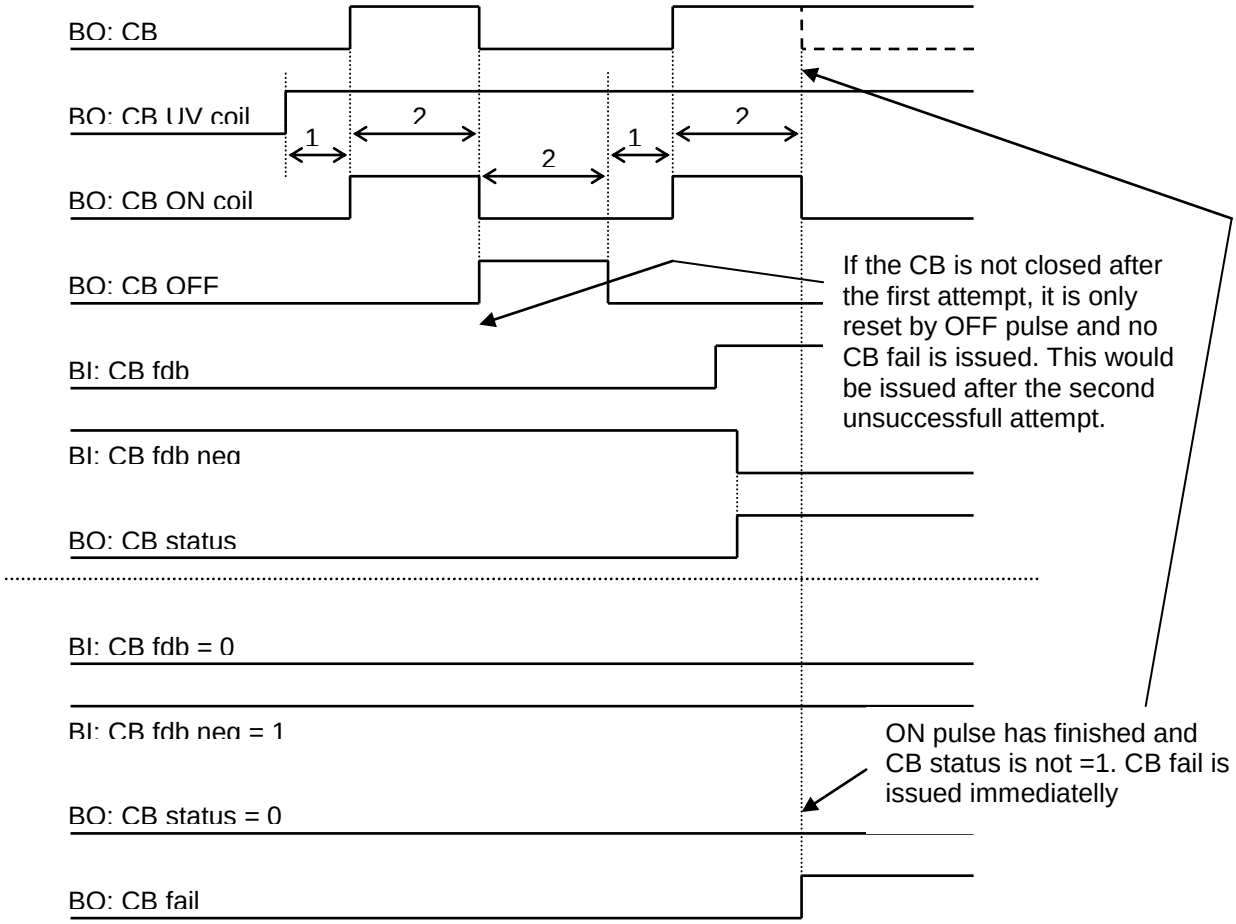
- CB close/open – output for circuit breaker. Equals to 1 during the time when CB is requested to be closed.
- CB ON coil – output for closing coil of the CB. 2s pulse (5s if synchronising is not provided by the particular CB) is used for closing the CB.
- CB OFF coil – output for opening coil of the CB. 2s pulse (5s if synchronising is not provided by the particular CB) is used for opening the CB.
- CB UV coil – output for undervoltage coil of the CB. Permanently active, 2s negative pulse (5s if synchronising is not provided by the particular CB) is used for CB opening request
- CB status – output indicating CB status as evaluated by the controller. This signal is used for lighting LEDs on the panel, switching the regulations, CB fail evaluation, etc.

Possible CB sequences:

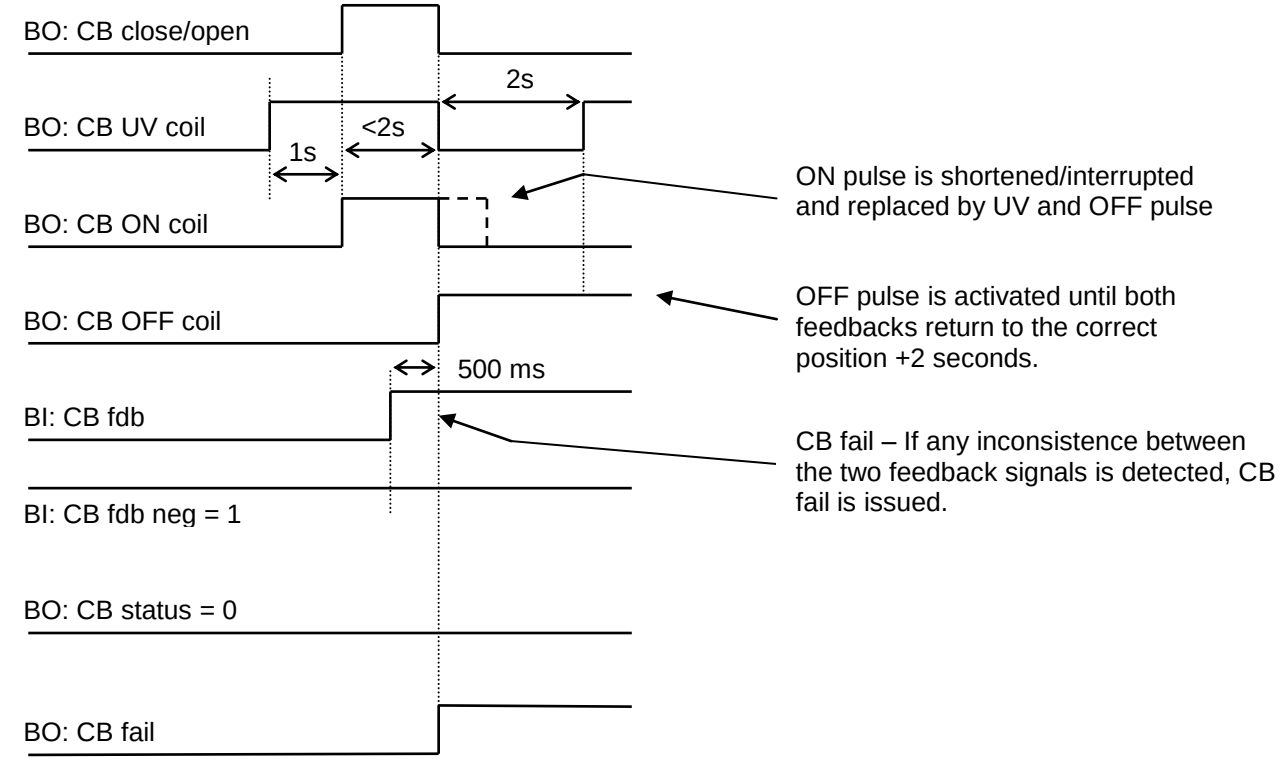
CB close command:



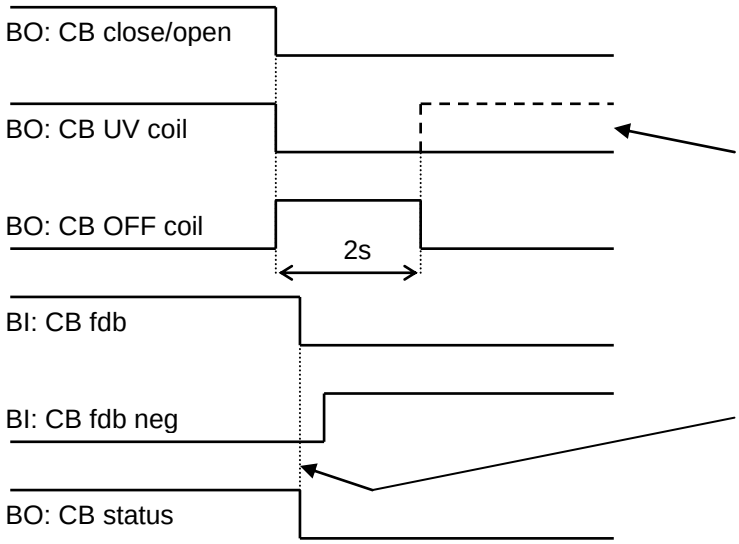
Repeated CB close command:



CB fail – fdb mismatch:



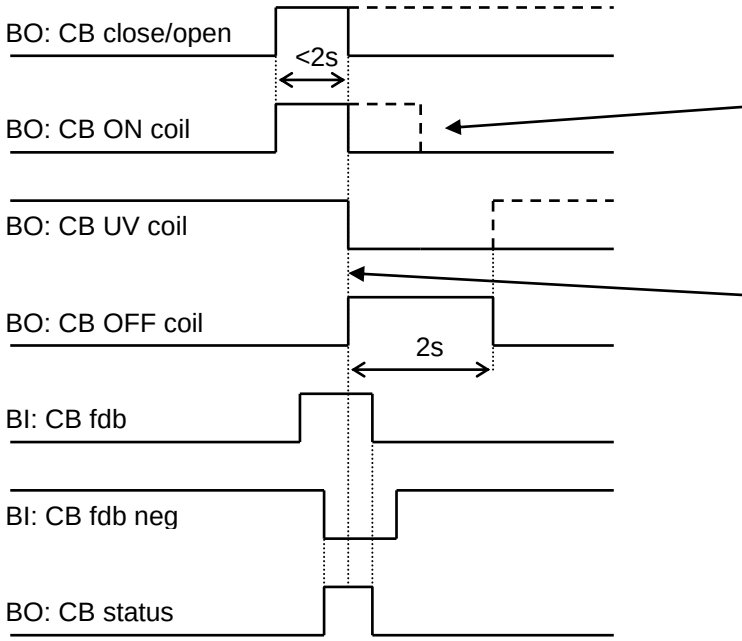
CB open command:



Further behavior of UV output depends on the system status. In case of transition to cooling stays off, if the Cb was opened manually and the engine keeps running, it activates again after timeout elapses.

During CB opening the CB status LBO is deactivated with change of the first feddback status

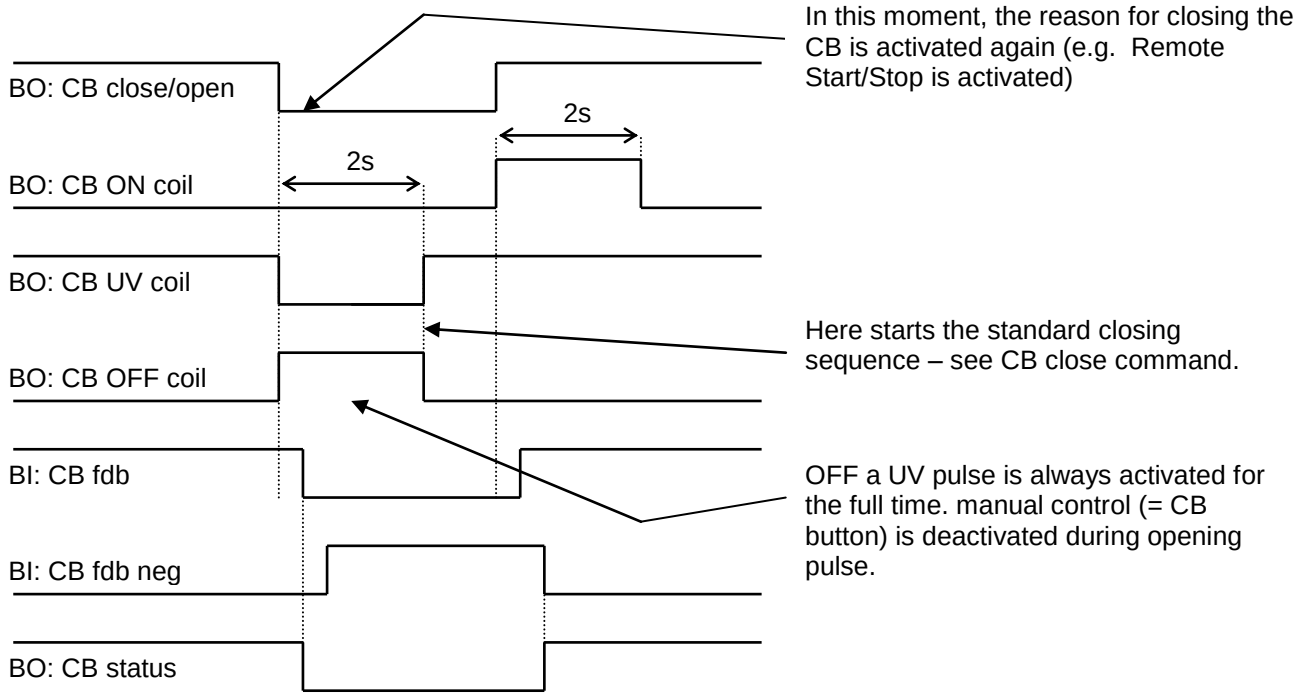
Transition closing -> opening (opening command is issued during closing pulse):



Closing pulse is shortened, opening sequence is started immediatelly

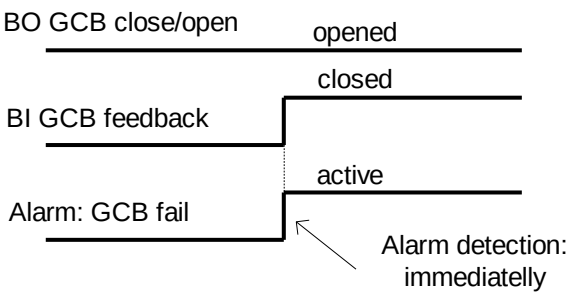
CB opening by protection or manual command (button pressed)

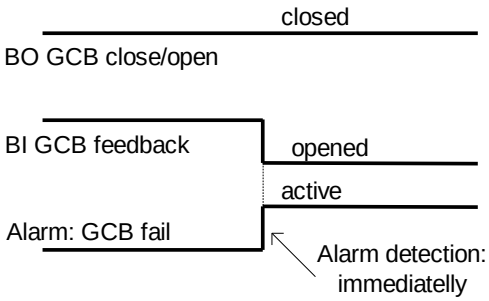
Transition opening -> closing (closing command is issued during opening pulse)



Other CB fail reasons:

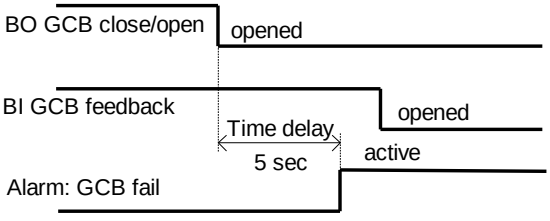
– When the BO CB close/open is in steady state and CB feedback is changed, the CB fail is detected immediately (no delay).





– When the BO CB close/open opens, there is 5 resp. 2 sec delay for the breaker to respond before a CB fail is detected. In such case, if CB OFF coil is used for opening the CB and CB fail occurs during opening the CB, the signal CB OFF coil is automatically extended until the breaker opening is detected (evaluated as CB status).

- 2 sec when the CB is used for synchronizing
- 5 sec in other cases



- In case that CB fail is detected after switching the controller on (CB is closed), the CB OFF coil output is activated immediately.

Gen-set operation states

Gen-set can operate in following states

Not ready	Gen-set is not ready to start
Stopped	No Running indication
Starting	Waiting for ReadyToLoad signal
Running	Waiting for GCB connection or start synchronizing
Soft load	Gen-set power is ramping up
Loaded	Gen-set is loaded
Soft unld	Gen-set power is ramping down
Stopping	Stopping procedure before the BI ReadyToLoad is opened.
Stopped	Stopped - initial state – waiting for engine start

External gen-set conditions :

MainsOper	Mains is present (MCB is closed, GCB is opened)
IslOper	Island operation (MCB is opened, GCB is closed)
Brks Off	GCB, MCB opened
Synchro	Gen-set is synchronizing (MCb is closed, GCB is opened)
ParalOper	Gen-set is in parallel with mains (MCB is closed, GCB is closed)

Inputs and Outputs

Virtual and physical modules

Number of I/O can be extended and project wiring can be reduced using the following extension and virtual modules.

Module name	BIN	BOUT	AIN	AOUT	Note
IGS-NT controller	x	x	x	x	Number of I/O depends on type.
IGS-PTM	8	8	4	1	Standard I/O extension module.
IS-AIN8	-	-	8	-	Standard I/O extension module.
IS-BIN16/8	16	8	-	-	Standard I/O extension module.
I-CB	x	x	x	x	Configurable communication bridge.
IGL-RA15	-	15	-	-	15 Green, Red, Yellow LED panel.
I-AOUT8	-	-	-	8	8 Analog outputs
VPIO	8	8	-	-	Virtual periphery I/O module.
SHBIN	8	-	-	-	SHared (virtual) Binary INput module
SHBOUT	-	8	-	-	SHared (virtual) Binary OUTput module
SHAIN	-	-	4	-	Shared (virtual) Analog INput module
SHAOUT	-	-	-	4	Shared (virtual) Analog OUTput module
PLC	x	x	x	x	Programmable (internal) logic module.

Maximum number of configured I/O modules

Module name	Maximum number	Note
IGS-PTM	4	Address of the module can be **only 1-4**. **Configuration** of this module **decrease** the **maximum number of IS-AIN8 and IS-BIN16/8 and I-AOUT8** which can be additionally configured to IGS-NT controller
IS-AIN8	10	In case there is connected any IGS-PTM (address 1-4) the maximum number of IS-AIN8 is reduced by this number
IS-BIN16/8	6	In case there is connected any IGS-PTM (address 1-4) the maximum number of IS-BIN16/8 is reduced by this number. In case, there is connected any IGL-RA15 module, then one IGL-RA15 means loose of possibility to configure 2 IS-BIN16/8
I-CB	1	Address of any I-CB module must be 1
IGL-RA15	4	Configuration of this module decrease the maximum number of IS-BIN16/8 which can be additionally configured to IGS-NT controller
I-AOUT8	4	Configuration of this module decrease the maximum number of IGS-PTM which can be additionally configured to IGS-NT controller
VPIO	4	
SHBIN	6	
SHBOUT	6	Take in account that each controller which has configured SHBOUT module should have configured this module with different address, otherwise there will be mismatch of SHBOUT modules on CAN line and Shared outputs will not work correctly
SHAIN	2	
SHAOUT	2	Take in account that each controller which has configured SHAOUT module should have configured this module with different address, otherwise there will be mismatch of SHAOUT modules on CAN line and Shared outputs will not work correctly

Hint:

For more details about Virtual peripherals (Shared and Internal virtual I/O periphery and PLC) see IGS-NT-Application guide-2.2.pdf.

Binary inputs – Control

AccessLock int

If the input is closed, no setpoints can be adjusted from the controller front panel.
Hint:
For IS-NT, this input is controlling the display #1, which is supposed to be attached to or close to the main module.
As the controller mode (OFF-MAN-AUT-TEST) is one of the setpoints, not even that can be changed.
The START, STOP, FAULT RESET and other control buttons are disabled as well.

AccessLock D#2

If the input is closed, no setpoints can be adjusted and no commands can be issued from IG/IS-Display #2.

AccessLock D#3

If the input is closed, no setpoints can be adjusted and no commands can be issued from IS-Display #3.

AccessLock ext

If the input is closed, no setpoints can be adjusted and no commands can be issued from any external terminal = via direct/modem/internet connection to the controller.
Hint:
Use these inputs to lock out the selected terminals for setpoint changes and commands. Such a terminal can only be used for monitoring.

Alt brightness

Active binary input switches controller display backlight to the alternative setting. Alternative intensity of the backlight can be set independently using the controller panel buttons.
Hint:
Input available in IG-NT/NTC and modifications only. For IG-Display and IS-Display modules, this binary input is located in the Power connector and its function is fixed (not configurable).

FaultResButton

Binary input has the same function as Fault reset button on the controller front panel. Take in account the setpoint **Basic settings**: *Local buttons* must be set to EXTBUTTONS or BOTH option, otherwise this input has no influence.

HornResButton

Binary input has the same function as Horn reset button on the controller front panel. Take in account the setpoint **Basic settings**: *Local buttons* must be set to EXTBUTTONS or BOTH option, otherwise this input has no influence.

StopButton

Binary input has the same function as Stop button on the controller front panel. It is active in MAN mode only. Take in account the setpoint **Basic settings**: *Local buttons* must be set to EXTBUTTONS or BOTH option, otherwise this input has no influence.

StartButton

Binary input has the same function as Start button on the controller front panel. It is active in MAN mode only. Take in account the setpoint **Basic settings**: *Local buttons* must be set to EXTBUTTONS or BOTH option, otherwise this input has no influence.

MCBButton

Binary input has the same function as MCB button on the controller front panel. It is active in MAN and TEST modes only. In TEST mode in some special cases only (see description TEST mode).

GCBButton

Binary input has the same function as GCB button on the controller front panel. It is active in MAN mode only. Take in account the setpoint **Basic settings**: *Local buttons* must be set to EXTBUTTONS or BOTH option, otherwise this input has no influence.

Hint:

All Binary inputs, which simulate controller front panel buttons, are edge (no level) sensitive, and they react on the rising edge only. Minimal input pulse duration is 0,2 seconds.

Remote OFF

If closed, the controller mode is forced to OFF. When opened controller is switched to previous mode.

Hint:

Use this input to block the engine start during service.

Remote MAN

Active binary input forces the controller mode to MAN.

Remote AUT

Active binary input forces the controller mode to AUT mode. When opened, controller is switched to original mode.

Hint:

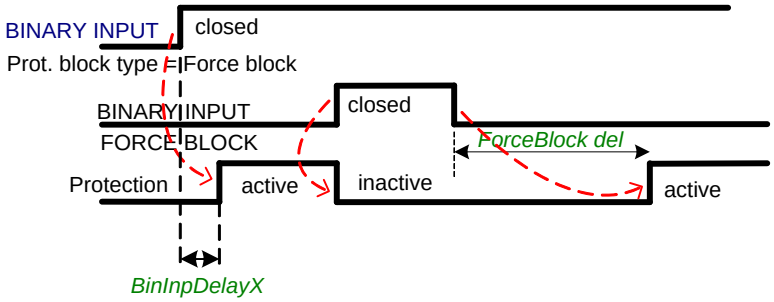
Use this input to switch the controller to automatic operation, e.g. using the external key switch.

Remote TEST

Active binary input forces the controller mode to TEST.

Force block 1 6

Three binary inputs for user-specific blocking of programmable protections. If the particular input is active, all the protections with the corresponding “Force block X” block type are blocked.



Force value 1 …16

If any of the particular 16 inputs is active, the Force value function on that corresponding channel gets active, forcing an alternative value to the selected setpoint. Force value function enables to change the setting of some setpoints by activation of binary input or PLC function. It is also possible that the forced setpoint value is based on Analogue input value (generally any analogue value in the controller).

IssueActCallC1…3

Rising edge on these binary inputs forces an active call to be issued via the corresponding channel.

Hint:

Can be used to send e.g. SMS in the case of a mains failure to report that the engine has successfully started (linked from the output Gen params OK) and later on to report that the engine has stopped again.

Load/Unload

If the input closes, the controller starts the engine (in AUT mode only). This input forces the gen-set parallel run with mains, as an AMF start usually is managed in different way.

In SPI / SPtM application (AUT mode) activates the start or stop sequence – start, synchronizing, loading ramp, parallel run / unloading ramp, GCB opening, cool-down, stop.

Emergency stop

If the input is activated, controller immediately trips the GCB. The BO: Stop pulse is not activated, binary output Remote S/S stays active (if engine was running). GeCon is considered as Generator controller, so is not supposed to stop in these cases engine. If this is required, the PLC inside the controller can be used, or copy of this input can be configured to physical binary output to signalize the active input into the engine controller.

Sd override

If the input is closed, all 2nd level protections are disabled to allow engine run in an emergency situation, e.g. sprinkler devices power supply.
All protections are shown in Alarmlist and recorded into History, but the controller doesn't stop the engine due to their occurence. If the input is deactivated and some protections are still active or not yet reset, the controller starts to take these protections into account and consequently stops the engine.
Hint:
All 2nd level protections are locked out, except of:Emergency stop

HotStandBy

The controller behaves like when switched to OFF mode if input is closed. Opens all binary outputs but the output terminals that are configured with inversion are closed.

Detection of "running engine" condition and subsequent alarm message "Sd Stop fail" is blocked. The controller shows "HotStndBy" state and the engine can not be started from GeCon panel. Generator current and power (energy) measurement is active in this mode, regardless of the actual state of the engine. After the binary input HotStandBy is open again, the controller recovers to previous mode and behaves according to the actual situation. Should the engine run and any of the conditions to start the engine was active, it will keep the engine running.
Function is active in any controller mode and activation of this input is written to history.

ManualLdRecon

The rising edge on this input switches the controller to the lower Load Shedding stage when **Load shedding:** *AutoLd recon* = DISABLED and the load is under **Load shedding:** *Ld recon level*.

TestOnLoad

Affects the behavior in TEST mode. Before the activation of this function

1. adjust setpoint **AMF settings**: *ReturnTo mains* = DISABLED
2. adjust Process control: MFStart enable = YES.
3. switch controller to Test on load mode (see drawing below)

Gen-set starts and goes to load (synchronizes to the mains, closes GCB and opens MCB) automatically when this input is closed even if Mains is OK.
Gen-set stays running in parallel with mains during the soft load transfer from the mains to the gen-set until *Import power* = 0. When the load is bigger than *Nominal power*, MCB stays closed, BO WrnTstOnLdFail is closed and warning message is issued (WrnTstOnLdFail).

When the controller is switched from Test on load mode (and Mains is OK), it synchronizes MCB, stays running in parallel for *BreakerOverlap* time (soft load transfer), opens GCB, cools down and stops.
During the load transfer from the gen-set to the mains can be *BreakerOverlap* time shortened due to the influence of: *Load ramp*, *GCB open level*, *GCB open del* setpoints.

Hint:

It is possible to configure both binary inputs (Remote TEST and Test on load) to only one controller physical binary input internally.

GCB disable

The input blocks the GCB closing, even if all other conditions for its closing are fulfilled. Valid in all modes. However GCB is blocked to be closed, the synchronization process starts and runs independently on this input state.

Hint:

If you want to lock out the GCB closing during synchronizing loop test, set **Sync/Load ctrl:** *Phase window* = 0. This allows the control loop to be tested while actual GCB closing is blocked.

Conditions for closing:

1) voltage only on generator side of GCB
2) voltage on both sides of GCB and all synchronizing conditions fulfilled.

MCB disable

The input blocks MCB closing, even if all other conditions for its closing are fulfilled. Valid in all modes.

Hint:

If you want to lock out the GCB (or MCB) closing during synchronizing loop test, set **Sync/Load ctrl:** *Phase window* = 0. This allows the control loop to be tested while actual GCB (or MCB) closing is blocked.

Conditions for closing:

1) voltage only on generator side of GCB (or MCB)
2) voltage on both sides of GCB (or MCB) and all synchronizing conditions fulfilled.

Startblocking

If this input is activated, start signal is not activated (Start pulse or Remote S/S signal)

Cyldifevalblk

If the signal is active, the protection based on the difference amongst cylinder temperatures is blocked. After signal deactivation, the protection is unblocked immediately.

ReadyToLoad

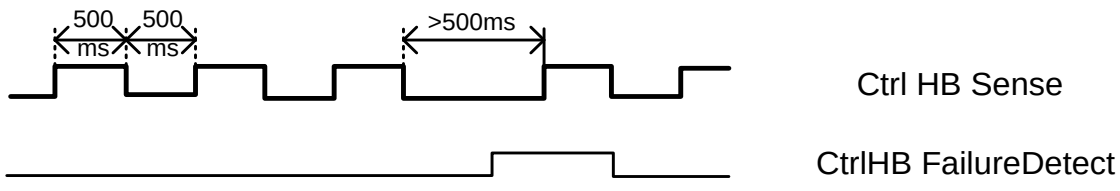
This signal is the essential one for right functionality of GeCon. As soon as this signal is active, GeCon starts to count down the MinStabTime, and when finished, starts to evaluate configured generator protection. Without activation of this input the GeCon will be 'sitting' in the Starting state and will not proceed into Running state. As soon as this signal is deactivated, GeCon proceed into state Stopping, until still condition is sensed (zero frequency measured). In case this signal is lost in Loaded state, the GCB is immediately opened.

ECU Stopped Eng

Engine stop was activated in ECU, not from controller. The controller reflects this situation and also goes to Stop to avoid an Underspeed alarm (and record in the Alarm list).

CtrlHB Sense

BI "CtrlHBeat sens" should be assigned to the output "CtrlHeartBeat" from the other controller. If input signal does not correspond to right form (log 1 / log 0 : 500 ms / 500 ms; +/- 100 ms), BO: "CtrlHBeat FD" (Controller Heart Beat Failure Detect) is activated. This BO can be used for primary controller blocking (switching to HotStndBy, disconnecting BO, ...) and mainly for disconnecting of BI "HotStndBy" of this controller. What means that the backup controller assumes engine control.



GenStandby

Controller is automatically forced into the AUT mode as soon as this BI is activated. Controller does not send the start signal to engine controller, engine is supposed to be started externally. GeCon waits till the BI:ReadyToLoad is activated, then starts with MinStabTime count down, synchronization, etc. As soon as the ReadyToLoad signal is activated the behaviour is the same as in AUT mode with activated BI: Sys start/stop, BUT set with activated BI: GenStandby is excluded from power management. As soon as the BI: GenStandby is deactivated, controller is forced into the mode, where was originally and behaves based on the sensing signals.

GCB close/open

The output controls the generator circuit breaker. It is intended for contactors – provides a continual active signal if GCB should be closed.

Gen sync

Active input initiates the synchronization process, but the GCB close command is not send automatically. It is up to operator to close GCB by GCB I/O button on GeCon front panel, or use BI: GCB Button, or close GCB externally. The In Sync condition is signalized by BO: InSynchronism. As soon as the BI: Gen sync is deactivated, the synchronization process is terminated. This input is taken in account in MAN mode only.

Gen unload

Active input initiates the soft unload of the generator. The load is ramped towards the zero load, GCB open command is not initiated – it is up to operator. In case there is no other genset available to take the load, there is no influence of this input activation. Working in MAN mode only.

Sync disable

Active input disables synchronization process. Working in both MAN and AUT mode.
SyncEna=synchronisation is enabled, SyncDis – synchronisation is disabled.

SpeedReqReset

If this input is active the speed governor output of controller is reset to it's default value, given by setpoint: **Nominal Speed.**

ExtValue1up …Extvalue4up

Active binary input causes increasing of the corresponding *ExtValueX* value. The rate of change is given by the setpoint *ExtValueX rate*. If the *ExtValueX* reaches the *ExtValueXHiLim*, the further input request is ignored.

ExtValue1down …ExtValue4down

Active binary input causes decreasing of the corresponding *ExtValueX* value. The rate of change is given by the setpoint *ExtValueX rate*. If the *ExtValueX* reaches the *ExtValueXLoLim*, the further input request is ignored.

ExtValue1reset … ExtValue4reset

Active binary input causes *ExtValueX* to be reset and held at its default value, given by the setpoint *ExtValueXdeflt*.
Hint:
These inputs, if configured, do not block the external set commands (in contrast to *ExtValueX up* / *ExtValueX down* inputs). However, if the reset input is activated, the corresponding *ExtValueX* is reset to its default (*ExtValueXdeflt*) value. This default value is kept in *ExtValueX* until the reset input is deactivated, and the external set commands received meanwhile are ignored.

PulseCounter 1

PulseCounter 2

PulseCounter 3

PulseCounter 4

The inputs are linked with corresponding counters, which integrate the pulses sensed at these inputs. Each rising edge of the signal at input increases the internal counter value.

Hint:

Pulse width (both high/low levels) must be at least 120 ms in order to be correctly sensed!
Conversion ratio can be selected using the setpoints *ConvCoefPulseX*. The converted values are visible in statistics – values *PulseCounter X*. These values can be reset using Statistics window in InteliMonitor.

Timer block 1 … 16

Sixteen blocking inputs for particular timer module channels. The input can lock out its assigned channel – if this input is active, the channel won't activate its output (Timer active X) to e.g. start the engine.

Lang sel int A … Lang sel int C

Set of binary inputs for forcing alternative languages. This set of inputs is switching the controller's internal terminal – for IG-based controllers the front panel, for IS-based controllers the IS-Display with address #1.

Encoding of binary inputs' combinations:

Language index ->	given by display setting	1	2	3	4	5	6	7
Lang sel int A	0	1	0	1	0	1	0	1
Lang sel int B	0	0	1	1	0	0	1	1
Lang sel int C	0	0	0	0	1	1	1	1

Hint:

Warning – each language change causes the restart of the respective display (not the whole controller), so the display's control panel won't react until the restart has finished (~ 5s).
Value 0 in the table denotes that the corresponding input is not active or not configured.
If more than 7 languages are present in the controller, it is not possible to force languages with index higher than 7 using these binary inputs.
The reaction on BI combination change is 1s delayed not to react on transient combinations if a rotary selector switch is used.

Lang sel D#2 A

Lang sel D#2 B

Lang sel D#2 C

Set of binary inputs for forcing alternative languages. This set of inputs is switching the controller's external terminal with address #2 – for IG-based controllers the IG-Display, for IS-based controllers the IS-Display with address #2.

Encoding of binary inputs' combinations:

Language index ->	given by display setting	1	2	3	4	5	6	7
Lang sel D#2 A	0	1	0	1	0	1	0	1
Lang sel D#2 B	0	0	1	1	0	0	1	1
Lang sel D#2 C	0	0	0	0	1	1	1	1

Hint:

Warning – each language change causes the restart of the respective display (not the whole controller), so the display's control panel won't react until the restart has finished (~ 5s).
Value 0 in the table denotes that the corresponding input is not active or not configured.
If more than 7 languages are present in the controller, it is not possible to force languages with index higher than 7 using these binary inputs.

The reaction on BI combination change is 1s delayed not to react on transient combinations if a rotary selector switch is used.

Lang sel D#3 A

Lang sel D#3 B

Lang sel D#3 C

Set of binary inputs for forcing alternative languages. This set of inputs is switching the IS-Display with address #3.

Encoding of binary inputs' combinations:

Language index ->	given by display setting	1	2	3	4	5	6	7
Lang sel D#3 A	0	1	0	1	0	1	0	1
Lang sel D#3 B	0	0	1	1	0	0	1	1
Lang sel D#3 C	0	0	0	0	1	1	1	1

Hint:

Warning – each language change causes the restart of the respective display (not the whole controller), so the display's control panel won't react until the restart has finished (~ 5s).
Value 0 in the table denotes that the corresponding input is not active or not configured.
If more than 7 languages are present in the controller, it is not possible to force languages with index higher than 7 using these binary inputs.
The reaction on BI combination change is 1s delayed not to react on transient combinations if a rotary selector switch is used.

Binary inputs – Status information

GCB feedback

Generator Circuit Breaker positive feedback input (closed if GCB is closed). This is a primary source for the controller about the status of the GCB.

GCB fdb neg

Generator Circuit Breaker negative feedback input (closed if GCB is open). Additional signal, can be used if both positive and negative feedback signals are available from the breaker.

Hint:

If both feedbacks are used and there is a mismatch between these signals, longer than 500 ms, a GCB fail alarm is activated.

MCB feedback

Mains Circuit Breaker positive feedback input (closed if MCB is closed). This is a primary source for the controller about the status of the MCB.

Hint:

The controller decides based on this signal whether the gen-set is running in mains parallel or island operation.

MCB fdb neg

Mains Circuit Breaker negative feedback input (closed if MCB is open). Additional signal, can be used if both positive and negative feedback signals are available from the breaker.

Hint:

If both feedbacks are used and there is a mismatch between these signals, longer than 500 ms, a MCB fail alarm is activated.

NeutralCB fdb

Use this input to detect, whether the Neutral circuit breaker is open or closed. See also setpoint *Neutral cont* and binary output Neutral CB C/O.

Binary outputs – Breaker control

GCB close/open

The output controls the generator circuit breaker. It is intended for contactors – provides a continual active signal if GCB should be closed.

GCB ON coil

The pulse output for GCB closing. If GCB synchronizing is enabled, the pulse length is 2s, if not, pulse length is 5s.

Hint:

ON coil can only be closed if UV coil is already active for at least 1s and MinStab time has elapsed.

GCB OFF coil

The pulse output for GCB opening. If GCB synchronizing is enabled, the pulse length is 2s, if not, pulse length is 5s.

GCB UV coil

GCB undervoltage coil. Output is closed if generator values are within limits and GCB is ready to be closed. It is opened if GCB should be open, and then closed again if generator electric values are in limits. If GCB synchronizing is enabled, the opening pulse length is 2s, if not, pulse length is 5s.

Hint:

UV coil automatically opens and OFF coil closes if GCB is closed spontaneously, not from controller's activity. This state lasts until the GCB status has been deactivated.
The only exception is during synchronization state, as an external device is allowed to close the GCB.

GCB status

Indicates breaker state expected by controller (based on gen-set state, controller commands and breaker feedback). Can be used for external indication of breaker status according to controller's information.

MCB status

Indicates breaker state expected by controller (based on gen-set state, controller commands and breaker feedback). Can be used for external indication of breaker status according to controller's information.

MCB close/open

The output controls the mains circuit breaker. It is intended for contactors – provides a continual active signal if MCB should be closed.

Hint:

Use binary output inversion (in GenConfig during configuration) to achieve that closed output = breaker opened.

MCB ON coil

The pulse output for MCB closing. If MCB synchronizing is enabled, the pulse length is 2s, if not, pulse length is 5s.

Hint:

ON coil can only be closed if UV coil is already active for at least 1s.

MCB OFF coil

The pulse output for MCB opening. If MCB synchronizing is enabled, the pulse length is 2s, if not, pulse length is 5s.

MCB UV coil

MCB undervoltage coil. Output is closed if mains values are within limits and MCB is ready to be closed. It is opened if MCB should be open, and then closed again if mains electric values are in limits. If MCB synchronizing is enabled, the opening pulse length is 2s, if not, pulse length is 5s.

Neutral CB C/O

Neutral circuit breaker close /open output controls the generator Neutral circuit breaker. It is intended for contactors – provides a continual active signal if NCB should be closed. See also setpoint Neutral cont.

LdShed stage 1

LdShed stage 2

LdShed stage 3

LdShed stage 4

LdShed stage 5

LdShed stage 6

Load shedding outputs for partial load switching.

Binary outputs – Control loops

AVR up

AVR dn

Binary outputs for Volt / PF control by motorized or electronic potentiometer.

Speed up

Speed dn

Binary outputs for Synchronizing and Load control. Outputs can be used instead of analog Speed governor output for older engine types. Minimum pulse duration is 0,15 sec. Maximum pulse duration is 10,0 sec.

Hint:

When Speed governor output stays near to the limit value (*SpeedGovLowLim*+0,2 V or *SpeedGovHiLim*-0,2 V) for more than 2 sec, the "Wrn SpdRegLim" message is displayed in the Alarm list and recorded to History.
When AVRi output stays on <2% or >98% for more than 2 sec, the "Wrn VoltRegLim" is displayed in the Alarm list and recorded to History.
Corresponding warning is blocked when Binary outputs Speed Up, Speed Dn or AVR up, AVR dn are configured to a physical BO or VPIO.
It is not recommended to process these signals via the internal PLC, as the precise signal timing would be distorted.

RemoteControl 1 – 8

These outputs are controlled remotely from InteliMonitor or other tool. The user selects the requested state of these outputs via the buttons in this program.

Hint:

Outputs can be used to switch on/off some auxiliary devices in the control panel.

Binary outputs – Status information

Ready for load

The output closes when the engine is running, no 2nd level protection is active and the GCB is already closed or is able to be closed (i.e. all generator parameters are within limits).

Stand-by ready

The output closes when the engine is ready for AUT mode, no 2nd level protection active.

Gen-set active

The output closes together with Prestart output and opens together with achieving “still engine” condition after the stop command. If the start sequence finishes with Start fail, the output opens after the last unsuccessful start attempt.

Hint:

The output also closes if the engine begins to rotate spontaneously. It stays closed until “still engine” condition is achieved.

Operational

The output is closed when no protection is active and the gen-set is ready for operation or is currently in operation.

Not ready

The output is closed, if following conditions are fulfilled:
- The controller in OFF mode or
- Any 2nd level alarm is active or not yet reset

Starting

The output closes together with Prestart output and opens with transition from Idle to Running state or with Start fail output activation. During crank pauses, the output stays closed.

Running

The output closes with transition from Starting to Running state. It opens with transition to Cooling state or if any 2nd level protection gets active. It stays closed if the engine is loaded.

ForwardSynchro

The output is closed during forward synchronizing and opens when GCB status gets active (= GCB was closed). The output can be used for external synchronizing module control.

Soft load

The output is closed during gen-set soft loading state – the gen-set power is ramping up, i.e. since GCB was closed until the end of the ramp.

Loaded

The output is closed when gen-set is loaded – GCB is closed and no load ramp is active.

Soft unload

The output is closed during gen-set soft unloading state – gen-set power is ramping down.

Stopping

The output closes after the command to stop has been issued. It opens if “still engine” conditions are fulfilled. The output also closes if the engine begins to rotate spontaneously. It stays closed until “still engine” condition is achieved.

Stopped

The output is closed when GeCon is in initial state – waiting for engine start.

Off mode

The output is closed, if OFF mode is selected.

MAN mode

The output is closed, if MAN mode is selected.

Aut mode

The output is closed, if AUT mode is selected.

Test mode

The output is closed if TEST mode is selected

Start pulse

One sec pulse is generated when engine start is requested

OFF mode	Inactive
MAN mode	Activated by panel START button or BI:StartButton when no 2nd level protection is active.
AUT mode	Activated when BI Sys start/stop is closed – depends also on Power management function setting.

Stop pulse

1s pulse for engine stop command, intended for ECU connection.

OFF mode	Inactive
MAN mode	Activated by STOP button or BI:StopButton.
AUT mode	Activated when BI Sys start/stop is opened - depends on Power management function setting as well.

Remote S/S

Level signal, which is active, when engine should be running. In MAN mode this signal is activated by START button or by BI:Start Button, signal is deactivated by STOP button or by BI:StopButton activation. In AUT mode the signal is controlled by BI: Load/Unload and by Power management adjustment.

GenParams OK

The output is copy of generator status LED on controller front panel. The output is closed if gen-set is running and all generator electric values are in limits and no 2nd level alarm is active (when only 1st level alarm is active, the output is closed).

Hint:

Use this output for switching on/off auxiliary device (e.g. cooling pump) driven from generator voltage independently on the GCB status.

MainsParams OK

The output is copy of mains status LED on controller front panel. The output is closed if mains electric values are in limits.

In synchronism

The output closes during synchronizing if all matching conditions are fulfilled. It opens if corresponding breaker is closed (xCB status output get active).

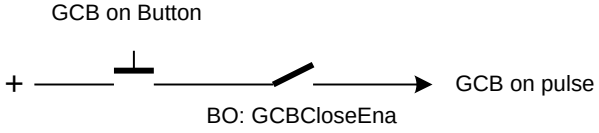
Hint:

Synchronizing matching conditions:

- Slip frequency < 0,25 Hz
- Gen to Mains/Bus voltage phase shift within **Sync/Load ctrl:***Phase window*
- Gen and Mains/Bus voltages within **Sync/Load ctrl:***Voltage window*
- **Sync/Load ctrl:***Dwell time* elapsed

GCBCloseEna

The output can be used for safe “by hand” GCB closing. The output activity is based on condition “In synchronism” OR “Dead bus” (any bus phase voltage is below 15 VAC). Output is opened when GCB is closed.



StartButnEcho

StopButnEcho

FaultButnEcho

HornButnEcho

MCBButnEcho

GCBButnEcho

These outputs are active for 1s if the corresponding button is pressed or binary input gets active or remote command is issued (from PC software, SMS, ...).

CtrlHeartBeat

The output signalizes watchdog reset. In a healthy state it flashes at 500ms : 500ms rate. It stops flashing when the unit reset occurs and the new controller start-up fails.

Logical 0

Constant value that can be configured to any output.

Logical 1

Constant value that can be configured to any output.

TimerAct 1-4

TimerAct 5-8

TimerAct 9-12

TimerAct 13-16

These outputs are active if at least one of their assigned timer module channels gets active. Timer module channels are organized into groups of four.

TimerActiveCom

This output is a logical OR (Com = Common) of the outputs TimerAct 1-4, 5-8, 9-12, 13-16. It gets active if any timer module channel is active.

kWh pulse

The output generates 1 sec pulse in case that the kWh value increases.

Binary outputs – Fixed protection outputs

Horn

The output closes if any alarm comes up. It opens if FAULT RESET or HORN RESET is pressed or if *Horn timeout* has elapsed. The output closes again if a new fault comes up.

Alarm

The output closes if any alarm comes up. It opens if FAULT RESET is pressed. The output closes again if a new fault comes up.

NewAlarm

The output generates 1 second pulse in case there is a record into the controller's Alarm list.

NewECUAlarm

The output generates 1 second pulse in case there is a record into the controller's ECU Alarm list (Controller displays ECU Alarm list only when some ECU is configured).

Common Wrn

The output closes if any "Warning"-type alarm appears. The output opens, if no "Warning"-type alarm is active and FAULT RESET has been pressed.

Common Sd

The output closes if any "Shutdown"-type alarm appears. The output opens, if no "Shutdown"-type alarm is active and FAULT RESET has been pressed.

Common SdO

The output closes if any "Shutdown override"-type alarm appears. The output opens, if no "Shutdown override"-type alarm is active and FAULT RESET has been pressed.

Common Stp

The output closes if any "Slow stop"-type alarm appears. The output opens, if no "Slow stop"-type alarm is active and FAULT RESET has been pressed.

Common Fls

The output closes if any "Fail sensor"-type alarm appears. The output opens, if no "Fail sensor"-type alarm is active and FAULT RESET has been pressed.

Common OfL

The output closes if any "Off load"-type alarm appears. The output opens, if no "Off load"-type alarm is active. No FAULT RESET needed.

Common LoP

The output closes if any "Low power"-type alarm appears. The output opens, if no "Low power"-type alarm is active. No FAULT RESET needed.

Common BO

The output closes if any "Breaker Open"-type alarm appears. The output opens, if no "Breaker"-type alarm is active and FAULT RESET has been pressed.

Common Al

The output closes if any "Alarm only"-type alarm appears. The output opens, if no "Alarm only"-type alarm is active and FAULT RESET has been pressed.

Common Hst

The output closes if any "History record"-type alarm appears. The output opens after 1s.

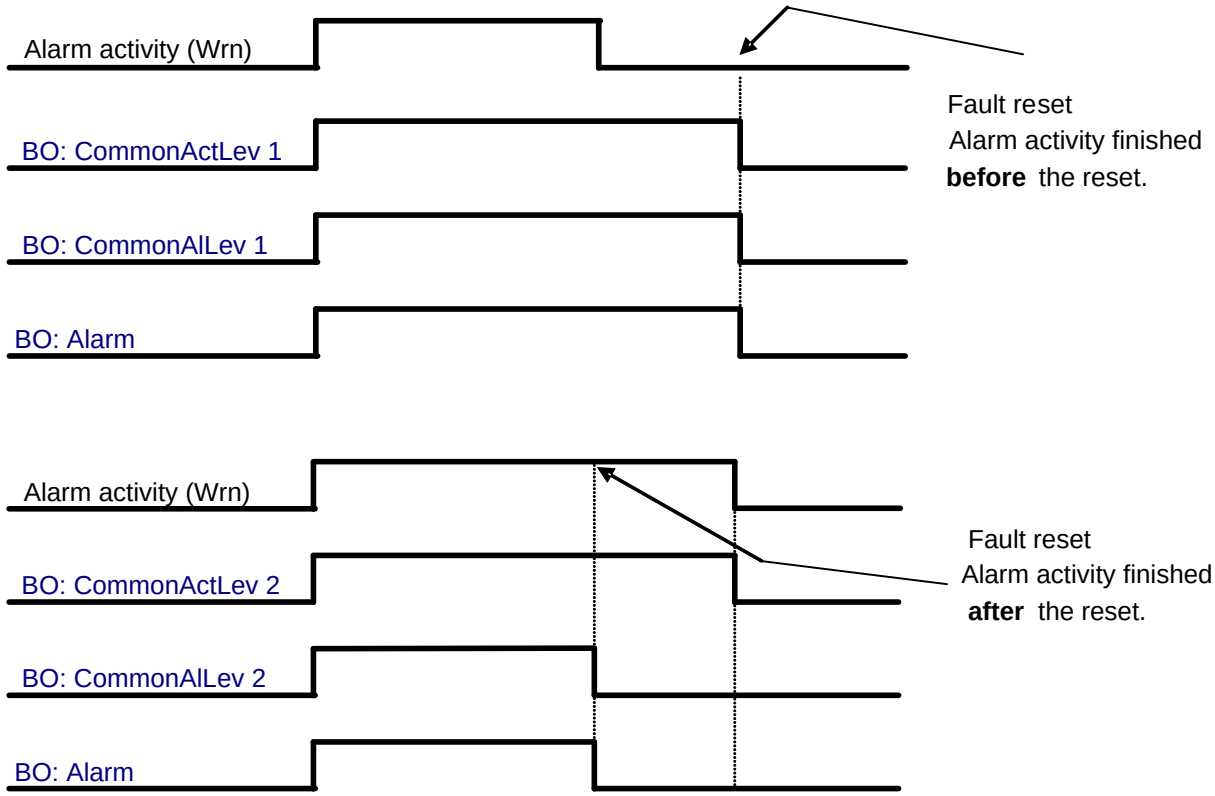
CommonActLev 1

The output is a logical OR of Common Al and Common Wrn outputs.

CommonAlLev 1

The output is active if at least one of the 1st level alarms (Al, Wrn) is active or not yet confirmed.
Hint:

See picture below with signal behaviour description. The same behaviour like for “Warning”-type alarm would be for “Alarm only”.
The same behaviour, but with signals CommonActLev 2 and CommonAlLev 2 would be for “BreakerOpen”, “Slow stop” and “Shutdown”-type alarms



CommonActLev 2

The output is a logical OR of Common BO, Common Stp and Common Sd outputs.

CommonAlLev 2

The output is active if at least one of the 2nd level alarms (BO, Stp, Sd) is active or not yet confirmed.

Alarm flashing

If any alarm comes up, the output starts periodic closing/opening with period 1s/1s. It opens and stays open if FAULT RESET is pressed.

Horn flashing

If any alarm comes up, the output starts periodic closing/opening with period 1s/1s. It opens and stays open if FAULT RESET or HORN RESET is pressed or if *Horn timeout* has elapsed.

Vgen <>

The output closes if the generator over/under voltage alarm activates.

Vmains <>

The output closes if the mains over/under voltage alarm activates.

VectorShiftTrp

The output closes if the Vector shift protection gets active and the controller actually trips the selected breaker. The output stays closed for 3s, then opens again.

VectorShiftAct

The output closes if the Vector shift protection gets active. It stays closed for 3s, then opens again. This output is activated regardless of the activity of the input Sd Override.

Overcurrent

The output closes if the generator IDMT Overcurrent or Shortcurrent alarm activates. The output opens, if none of these alarms is active and FAULT RESET has been pressed.

TCylDiffer

Output is activated when engine cylinder temperatures difference warning is active.

ECU comm error

Output closes if there is an error in the communication with ECU. It doesn't matter how the ECU is connected – J1939 link or RS232 line.

PeriphCommErr

Output closes if there is an error in the communication with any peripheral unit (e.g. IS-AIN8, IGS-PTM, ...).

CtrlHBeat FD

BI "CtrlHBeat Sense" should be assigned to the output "CtrlHeartBeat" from the other controller. If input signal does not correspond to right form (log 1 / log 0 : 500 ms / 500 ms; +/- 100 ms), BO: "CtrlHBeat FD" (Fail Detect) is activated. This BO can be used for primary controller blocking (switching to HotStandBy, disconnecting BO, ...) and mainly for disconnecting of BI "HotStandBy" of this controller. What means that the backup controller assumes engine control.

Derate1 act

Output is active in case the Derating 1 function is active

Derate 2 act

Output is active in case the Derating 1 function is active

Binary outputs – Configurable prog. states

ECU

SHBinCfGErr

Shared Binary module configuration error – i.e. more than one source was configured (is on the CAN2 bus).

SHAinCfgErr

Shared Analog module configuration error – i.e. more than one source was configured (is on the CAN2 bus).

PLC State 1 .. 4

PLC state indication.

ECUDiagBlocked

Output is active when **Basic setting**: *ECU diag* = DISABLED.

WrongConfig

Wrong configuratio indication.

RTC battery flat

Batt volt

Indication of battery voltage protection based on **Analog protection**: *Batt >V*, *Batt <V*, *Batt V del*.

EarthFaultCurr

Indication of Earth fault current protection based on **Gener protect**: *EarthFaultCurr* and *EthFltCurr del*.

GenV unbal

Output indicates active generator voltage unbalance protection.

GenI unbal

Output indicates active generator current unbalance protection.

Mains V unbal [%]

Threshold for mains voltage unbalance alarm in % of nominal voltage. The voltage unbalance is calculated as a maximum difference between phase voltages.
Step: 1%
Range: 0 – 200% of *MainsNomV* or *MainsNomVph-ph* respectively

Dongle incomp

Incompatible dongle indication.

Emergency stop

Activity of Emergency stop (from Binary input Emergency stop) indication.
Hint:
Any Binary output alarm indication that follows the corresponding internal state is activated with alarm and stays active until alarm reason disappears and the Fault reset (panel button or remote) is activated.

CAN2 bus empty

The output closes if the controller doesn't "see" any other controllers on the CAN2 bus. The output activation can be blocked by setpoint **Basic settings**:CAN2empt*Detect* (So it should be DISABLED for single applications.)

WrnServiceTime

The output closes when at least one of gen-set Service count down timers *Service time X* has reached zero. To reset the output (and the related Wrn alarm), it is necessary to set again a non-zero value to the corresponding setpoint.

WrnCylTemp1-32

Output is activated in case any of the configured temperature activates the Average cylinder temperature deviation protection

Wrn GCB fail

Output closes when GCB fail is detected.

Wrn MCB fail

Output closes when MCB fail is detected.

Stp GCB fail

Stop of the engine is initiated in case the GCB fail is indicated in AUT mode.

WrnRSync fail

The output is closed when the reverse synchronization is not succesfull

Wrn Sync fail

The output is closed when the alarm Sync timeout is active.

WrnSpdRegLim

Output indicates the controller Speed governor output is on limit.

WrnVoltRegLim

Output indicates the controller AVRi output is on limit.
Hint:
When Speed governor output stays near to the limit value (*SpeedGovLowLim*+0,2 V or *SpeedGovHiLim*-0,2 V) for more than 2 sec, the "Wrn SpdRegLim" message is displayed in the Alarm list and recorded to History. When AVRi output stays on <2% or >98% for more than 2 sec, the "Wrn VoltRegLim" is displayed in the Alarm list and recorded to History.

Generator Voltage and Frequency alarms indication

Basic settings: *FixVoltProtSel* = PHASE-NEUTRAL

Binary output name	Protection type	Based on setpoint
BO L1 under	BreakerOpen	Gener protect: *Gen <V BO, Gen V del*
BO L2 under		
BO L3 under		
BO L1 over	BreakerOpen	Gener protect: *Gen >V BO, Gen V del*
BO L2 over		
BO L3 over		
Sd L1 over	Shut-down	Gener protect: *Gen >V SD* Gener protect: *Gen V del*
Sd L2 over		
Sd L3 over		
Gen V L1-N	BreakerOpen Shut-down	Gener protect: *Gen <V BO* Gener protect: *Gen >V BO* Gener protect: *Gen >V SD* Gener protect: *Gen V del*
Gen V L2-N		
Gen V L3-N		

Basic settings: *FixVoltProtSel* = PHASE-PHASE

Binary output name	Protection type	Based on setpoint
BO L12 under	BreakerOpen	Gener protect: *Gen <V BO* Gener protect: *Gen V del*
BO L23 under		
BO L31 under		
BO L12 over	BreakerOpen	Gener protect: *Gen >V BO* Gener protect: *Gen V del*
BO L23 over		
BO L31 over		
Sd L12 over	Shut-down	Gener protect: *Gen >V SD* Gener protect: *Gen V del*
Sd L23 over		
Sd L31 over		
Gen V L1-L2	BreakerOpen Shut-down	Gener protect: *Gen <V BO* Gener protect: *Gen >V BO* Gener protect: *Gen >V SD* Gener protect: *Gen V del*
Gen V L2-L3		
Gen V L3-L1		

BO fgen under	BreakerOpen	**Generator protect**: *Gen <f* and *Gen f del*.
BO fgen over		**Generator protect**: *Gen >f* and *Gen f del*.
Gen freq		**Generator protect**: *Gen >f*, *Gen <f* and *Gen f del*.

Mains Voltage and Frequency alarms indication

Binary output name	Protection type	Based on setpoint
MP L1 under	BreakerOpen	**Mains protect**: *Mains <V MP, Mains V del*
MP L2 under		

MP L3 under		
MP L1 over	BreakerOpen	**Mains protect**: *Mains >V MP, Mains V del*
MP L2 over		
MP L3 over		

Binary output name	Protection type	Based on setpoint
MP L12 under	Mains Protection	**Mains protect**: *Mains <V MP* and *Mains V del*.
MP L23 under		
MP L31 under		
MP L12 over	Mains Protection	**Mains protect**: *Mains >V MP* and *Mains V del.*
MP L23 over		
MP L31 over		
Mains V L1-L2	Mains Protection	**Mains protect**: *Mains <V MP,* **Mains protect**: *Mains >V MP* and *Mains V del*
Mains V L2-L3		
Mains V L3-L1		
Mains V L1-N	Mains Protection	**Mains protect**: *Mains <V MP,* **Mains protect**: *Mains >V MP* and *Mains V del*
Mains V L2-N		
Mains V L3-N		

MP fmns under	Mains Protection	Mains protect: *Mains >f*, Mains protect: *Mains <f*, Mains protect: *Mains f del*.
MP fmns over		
Mains freq		

Hint:
L1-N, L2-N, L3-N alarm indications are active when **Basic settings**: *FixVoltProtSel* = PHASE-NEUTRAL.
L1-L2, L2-L3, L3-L1 alarm indications are active when **Basic settings**: *FixVoltProtSel* = PHASE-PHASE.

OfL StartBlck

Output indicates wrong setpoints setting that disables the engine start or taking the load. E.g. **ProcessControl**: *Island enable; ParallelEnable; Synchro enable; MF start enable.*

Binary output name	Protection type	Based on setpoint
BO IDMT	BreakerOpen	Generator protect: *2Inom del*.
BO ShortCurr	BreakerOpen	Generator protect: *Ishort* and *Ishort del*.
BO Overload	BreakerOpen	Generator protect: *OverldStrtEval* Generator protect: *2POverldStEvDel*
BO NCB fail	BreakerOpen	x

LdCtrl:AnExBld

External requested gen-set power value.

- Configure LdCtrl:AnExtBld to selected analog input
- Configure Analog input range
- Adjust **ProcessControl:** *Load ctrl PTM* = ANEXT BASELOAD

LdCtrl:AnExI/E

External requested mains import/export power value.

- Configure input LdCtrl:AnExI/E to selected analog input
- Configure Analog input range
- Adjust **ProcessControl**: *Load ctrl PtM* to *ANEXT IM/EX*.

PFCtrl:AnExBPF

External requested gen-set power factor value.

- Configure PFCtrl:AnExBPF to selected analog input
- Configure Analog input range
- Adjust ProcessControl: PF ctrl PTM = ANEXT BASEPF

PFCtrl:AnExI/E

External requested mains import/export power factor value.

Example:
In the following table corresponding current values on analog input and power factor values are noticed:

Ic [mA] Primary curve values	PF + Load Character Requested PF value	PF Converted curve value*
-20	0,60 L	0,60
-10	0,80 L	0,80
0	1,00 R	1,00
10	0,80 C	1,20
20	0,80 C	1,20

* Values 0.6 – 0.99 correspond to lagging PF, 1.01 – 1.20 correspond to leading PF.

- Configure input PFCtrl:AnExI/E to selected analog input
- Configure Analog input range
- Adjust ProcessControl: PF ctrl PtM to ANEXT PF-IM/EX.

LdCtrl:I/E-Pm

Mains import/export active power measured from an external transducer.

- Configure LdCtrl:I/E-Pm to selected analog input
- Configure Analog input range
- Adjust **ProcessControl:** *I/E-Pm meas* = ANALOG INPUT

PFCtrl:I/E-Qm

Mains import/export reactive power value from an external transducer.

- Configure PFCtrl:I/E-Qm to selected analog input
- Configure Analog input range
- Adjust **ProcessControl:** *I/E-Qm meas* = ANALOG INPUT

LCD brightness

Analog input for external LCD brightness setting (e.g. via potentiometer). Keyboard LCD brightness setting and binary input Alt brightness do not work when input is configured. Expected value is in the range 0 to 100%.

Hint:

In IG-NT/EE and modifications, this input controls the backlight of the built-in display. For optionally attached IG-Display module, this input has no meaning.
In IS-NT and modifications, this input controls the backlight of the IS-Display with address #1. For optional displays with addresses #2 and #3, this input has no meaning.

PowerDerating1

Analog input for Power derating function, channel 1.

PowerDerating2

Analog input for Power derating function, channel 2.

LdCtrl:TByPwr

Input to measure water temperature for temperature by generator power control.

Cyl temp 1-32

Analogue input for Cylinder temperature monitoring.

Cold Temp 1-4

In case in the system there is a special thermocouple measuring the “cold end” of the cylinder temperatures evaluation configure this function on that input.

Analog outputs

The IS-NT has one analog output available. It is possible to configure any value available in the controller using GenConfig.

If the output range 4 to 20 mA is needed, the limits for analog output should be set according to an example in the following table:

Requested power range	Controller analog output setting
0 – 1000 kW	Low limit: -250 kW High limit: 1000 kW
Low – *High* kW	Low limit: *Low* - (*High* – *Low*)/4 kW High limit: *High* kW

This setting ensures that 0 kW (Low kW) will correspond to 4 mA.

Setpoints

Password protection

Any setpoint can be password protected - 7 levels of protection are available. There can be up to 8 users defined (including the Admin – highest password level), each one with different access rights (levels of protection). Every user has it’s own password. The password is a four-digit number. Only setpoints protected by the protection level that is covered by currently logged-in user’s access rights can be modified.
If a user logs in from a particular terminal (e.g. the controller front panel), this does not unlock the other terminals for him, e.g. InteliMonitor connected directly or via modem.
Setpoints opened from front panel are automatically closed 15 minutes (return to measurement screens) after the last setpoint change or when wrong value of password is set.
System administrator (User 0 – always present in the system) can reset the password for any other user. The controller programming (configuration) requires the highest - password 7 level, so only administrator and other defines users with this highest level are able to modify the controller configuration or firmware.

ProcessControl

Base load [kW – MW*]

Required gen-set power when *Load ctrl PtM* = BASELOAD.

Step: 0,1 kW / 1 kW / 0,01 MW*
Range: 0,1 kW - *Nomin power**
Note:
The actual setpoint units and range depend on setting of the Power format (see GenConfig manual).

Hint:
If the setpoint *Base load* is set to lower value than the one given by setpoint **Generator protect**: *Min power PtM*, the gen-set power is limited to **Generator protect**: *Min power PtM*.

Base PF [ ]

Requested power factor value when *PF ctrl PtM* = BASEPF. Value bigger than 1.00 means capacitive PF (leading) load character.
Step: 0.01
Range: 0.60 to 1.20

Import load [kW – MW*]

Requested power from / to mains when *LoadCtrl PtM* = IMP/EXP or when Export protection function is active i.e. *Export limit* = ENABLED.
Step: 0,1 kW / 1 kW / 0,01 MW*
Range: -320,00 MW to +320,00 MW*
Note:
The actual setpoint units and range depend on setting of the Power format (see GenConfig manual).

Import PF [ ]

Requested power factor of the mains when *PF ctrl PtM* = PF-IM/EX. Value bigger than 1.00 means capacitive PF (leading) load character.
Step: 0.01
Range: 0.60 to 1.20

Load ctrl PtM [BASELOAD / IM/EX / ANEXT BASELOAD / ANEXT IM/EX / T BY PWR] (FV)

Load ctrl PtM selects control mode for parallel to mains operation.
BASELOAD Gen-set is loaded at preadjusted level **ProcessControl:** *Base load*.
IM/EX Gen-set is loaded according to imported/exported power from/to mains to achieve **ProcessControl:** *Import load*.
ANEXT BASELOAD Gen-set is loaded according to the requested value given by an external device via Analog input LdCtrl:AnExBld.
ANEXT IM/EX Gen-set is loaded according to imported/exported power from/to mains to achieve the requested value given by an external device via Analog input LdCtrl:AnExI/E.
T BY PWR Gen-set power is changed to keep required temperature, measured via an analog input.
Force value possibility: Yes
Hint:
For “digital” external load control select mode ANEXT BASELOAD and as the source for LdCtrl:AnExBld select value *ExtValue1-4*. This value can be set using a command transmitted e.g. over CAN bus or ModBus.

PF ctrl PtM [BASEPF / PF-IM/EX ANEXT BASEPF / ANEXT PF-IM/EX] (FV)

PF ctrl PtM selects control mode of power factor for parallel to mains operation.
BASEPF Gen-set power factor is kept at the level given by **Process control**:*Base PF.*
PF-IM/EX Gen-set power factor is controlled according to imported/exported reactive power from/to mains to achieve **ProcessControl**: *Import PF*.
ANEXT BASEPF Gen-set power factor is kept at the level given by an external device via Analog input PFCtrl:AnExBPF.
ANEXT PF-IM/EX Gen-set power factor is controlled according to imported/exported reactive power from/to mains to achieve the requested value given by an external device via Analog input PFCtrl:AnExI/E.
Force value possibility: Yes

I/E-Pm meas [NONE / IM3 CT INPUT / ANALOG INPUT]

Import / Export measurement selection when one of power I/E modes selected.

NONE	No source for I/E active power measurement available. If selected, power control defaults to Baseload (BASELOAD, ANEXT BASELOAD, T BY PWR).
IM3 CT INPUT	Mains I/E active power (Pm) is measured and calculated from controller's Im3 current terminal. The value is multiplied by 3 to estimate the aggregate mains power.
ANALOG INPUT	Mains I/E active power is measured by an external device and the controller measures this value via analog input LdCtrl:I/E-Pm.

Hint:

Earth fault current protection may be used only if *I/E-Pm meas* = ANALOG INPUT or NONE.

I/E-Qm meas [NONE / IM3 CT INPUT / ANALOG INPUT]

Import / Export measurement selection when one of PF I/E modes selected.

NONE	No source for I/E reactive power measurement available. If selected, power factor control defaults to BasePF (BASEPF, ANEXT BASEPF).
IM3 CT INPUT	Mains I/E reactive power (Qm) is measured and calculated from controller's Im3 current terminal. The value is multiplied by 3 to estimate the aggregate mains reactive power.
ANALOG INPUT	Mains I/E reactive power is measured by an external device and the controller measures this value via analog input PFCtrl:I/E-Qm.

Hint:

Earth fault current protection may be used only if *I/E-Qm meas* = ANALOG INPUT or NONE.

If I/E-Pm meas is set to IM3 CT INPUT, then I/E-Qm meas should be logically set to IM3 CT INPUT as well, because IM3 CT INPUT is common input for both parameters.

PeakLevelStart [kW – MW*] (FV)

Load consumption level the gen-set has to stop at. Function is inactive when *PeakAutS/Sdel* = OFF. Genset start is *PeakAutS/Sdel* delayed after the consumption of the Load exceeds the *PeakLevelStar*t limit.

Step: 0,1 kW / 1 kW / 0,01 MW*
Range: *PeakLevelStop* to 320,00 MW*
Force value possibility: Yes

**Note:*

The actual setpoint units and range depend on setting of the Power format (see GenConfig manual).

PeakLevelStop [kW – MW*] (FV)

Load consumption level the gen-set has to start at. Genset stop is *PeakAutS/Sdel* delayed after *PeakLevelStop* limit is reached. Load consumption (P factory) is calculated (not directly measured) as a sum of gen-set (Act power) and mains (P mains) active power.

Step: 0,1 kW / 1 kW / 0,01 MW*
Range: 0,00 to *PeakLevelStart* MW*
Force value possibility: Yes

**Note:*

The actual setpoint units and range depend on setting of the Power format (see GenConfig manual).

PeakAutS/S del [s] (FV)

Delay for automatic Peak start/stop function. Set OFF to disable Peak aut start function.

Step: 1s
Range: OFF, 1 – 3200 s
Force value possibility: Yes

Export limit [DISABLED / ENABLED] (FV)

Protection against power export to the mains. The function limits gen-set requested power to hold import power higher or equal to the setpoint *Import Load.*

Force value possibility: Yes

Derating1 strt [X] (FV)

Derating2 strt [X] (FV)

The starting values for the power derating function. The gen-set nominal power is decreased according to the adjusted curve.
The setpoint actual physical dimension is given by the related analog input and the value assigned to it.
Step: 1 X
Range: ± 32000 X
Force value possibility: Yes

Hint:

DeratingX strt unit [X] depends on DeratingPowerX analog input unit.It can be e.g.°C in case of temperature derating function.

Derating1 end [X] (FV)

Derating2 end [X] (FV)

Ending value for power limitation – at this value the gen-set power is limited to *DeratedX pwr* value and it won't go lower for higher input values.
The setpoint actual physical dimension is given by the related analog input and the value assigned to it.
Step: 1 X
Range: ± 32000 X
Force value possibility: Yes
Hint:

To record the power derating activity into the History:
-Configure the binary output Derating X act to a virtual periphery input.
-Configure either "History record" or "Warning"-type alarm to this input to record power derating activity in History and optionally to indicate it in Alarmlist.

Derated1 pwr [%] (FV)

Derated2 pwr [%] (FV)

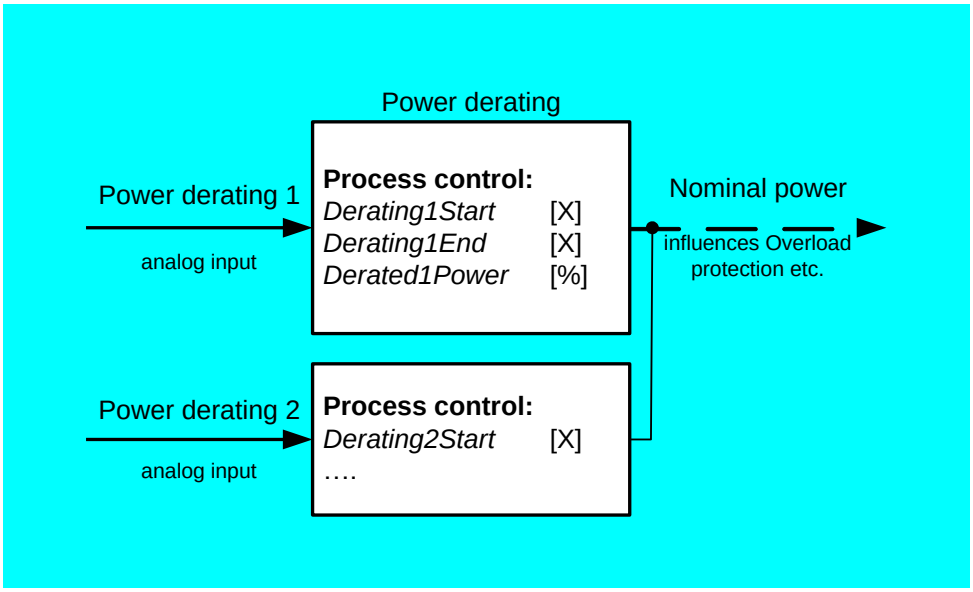
The ratio of decreasing of the gen-set nominal power at *DeratingX end* level.
Step: 1 % of *Nomin power*
Range: 0 - 100 % of *Nomin power*
Force value possibility: Yes
Hints:

DeratedX pwr = 90% means the nominal power reduction **to** 90%, not by 90%.

Derating ratio is set to zero and functions are not active when Analog inputs PowerDeratingX are not configured (e.g. in default configuration).

When Power derating function is active, the generator nominal power is decreased to *DeratedX pwr* and so Overload protection (BOC Overload) is based on this Derated power!

The generator nominal power is reduced according to the bigger restriction – the more reduced channel out of the two.



TempByPwr Treq [°C] (FV)

Requested temperature value for temperature control by generator power.
Before use, you have to configure the analog input LdCtrl:TbyPwr.
Step: 1 °C
Range: ± 32000 °C
Force value possibility: Yes

TempByPwr gain [%]

Gain factor for Temperature by generator power control loop.
Step: 0,01 %
Range: 0,00 – 100,0 %

TempByPwr int [%]

Integration factor for Temperature by generator power control loop.
Step: 0,01 %
Range: 0,00 – 100,0 %

Overheat prot [ENABLED / DISABLED] (FV)

ENABLED: If the temperature measured from analog input "LdCtrl:TbyPwr" exceeds the value *TbyPwr Treq* the gen-set power is decreased gradually to *Min Power PtM*. If the temperature decreases below *TbyPwr Treq* the gen-set increases the power gradually to the original requested value (Baseload, Imp/Exp....).
DISABLED: Overheat protection function is disabled. No power change if the temperature measured from analog input "LdCtrl:TbyPwr" exceeds the value *TbyPwr Treq*.
Force value possibility: Yes

Island enable [NO / YES] (FV)

NO, YES: Enables or disables island operation.
Force value possibility: Yes

ParallelEnable [NO / YES] (FV)

NO, YES: Enables or disables Mains parallel operation.
Force value possibility: Yes

Synchro enable [NONE / FORWARD / REVERSE / BOTH] (FV)

Enable or disable forward/reverse synchronization.
NONE: No synchronizing is enabled.

FORWARD: GCB synchronizing is enabled.
REVERSE: MCB synchronizing is enabled.
BOTH: GCB and MCB synchronizing are enabled.
Force value possibility: Yes

MFStart enable [NO / YES] (FV)

NO, YES: Enables or disables automatic Mains failure start.
Force value possibility: Yes

Examples of settings:

MFStart enable	Parallel Enable	ForwSync Enable	RevSync Enable	Island enable	Description
-	OFF	-	-	-	Not Ready - ParalDisabled
OFF	ON	OFF	-	-	Gen-set starts after Rem start/stop is closed, doesn't close GCB
OFF	ON	ON	-	OFF	Gen-set starts after Rem start/stop is closed, synchronizes, closes GCB, at Mains fail both MCB and GCB are opened
OFF	ON	OFF	ON	OFF	Gen-set starts after Rem start/stop is closed, doesn't close GCB, if the Mains fails, MCB is opened, gen-set keeps running
OFF	ON	OFF	OFF	ON	Gen-set starts after Rem start/stop is closed, GCB is not closed, if Mains fails, MCB openes and GCB closes
OFF	ON	ON	OFF	ON	Gen-set starts after Rem start/stop is closed, synchronizes, closes GCB, if Mains fails, opens MCB, stays in Island
OFF	ON	ON	ON	ON	Gen-set starts after Rem start/stop is closed, synchronizes, closes GCB, if Mains fails, MCB is opened, gen-set runs in Island, reverse synchr., MCB closes
ON	ON	ON	OFF	OFF	Gen-set starts after Mains fail, doesn't close GCB - Island operation disabled
ON	ON	OFF	OFF	ON	Gen-set starts after Mains fail, goes to Island, if Mains returns, GCB is opened, MCB is closed
ON	ON	ON	OFF	ON	Gen-set starts after Mains fail, opens MCB, closes GCB, if Mains returns, opens GCB, closes MCB, synchronizes GCB, closes GCB
ON	ON	OFF	ON	ON	Gen-set starts after Mains fail, opens MCB, closes GCB, if the Mains returns, synchronizes, closes MCB
ON	ON	ON	ON	ON	Gen-set starts after Mains fail, synchronizes, closes GCB, if Mains fails, MCB is opened, gen-set runs in Island, reverse synchr., MCB closes

#Neutral cont. [EACH / COMMON]

Setpoint changes behavior of binary output Neutral CB C/O which is used for Neutral contactor control.
EACH: Four pole GCB's are supposed on the engine.

a) When GCB is opened (after start, before stop):
Binary output Neutral CB C/O (Neutral contactor) closes when Generator voltage is higher than 75% of Nominal voltage.
Binary output Neutral CB C/O (Neutral contactor) opens when Generator voltage is lower than 50% of Nominal voltage.

b) Binary output Neutral CB C/O (Neutral contactor) is opened when gen-set is running in parallel to the mains (MCB is closed) .

COMMON: Three pole GCB's are supposed for the gen-set.

a) When MCB is opened Neutral contactor closes when Generator voltage (at least one phase) is higher than 75% of Nominal voltage.
b) When MCB is opened Neutral contactor opens when all phases of Genset voltage are lower than 50% of Nominal voltage.
c) When MCB is closed Neutral contactor opens.

Hint:

Configure Binary output Neutral CB C/O and Binary input Neutral CB fdb Prior to Neutral contactor function is used.
Neutral contactor fail is detected when no feedback comes within 400ms or when MCB and Neutral contactor are closed for more than 400 ms.

WatchedContr

This setpoint defines the address of the controller which is the master one in the redundancy controller system. Master controller has this setpoint adjusted to 0. The redundant controller has this setpoint adjusted to address of it's master. The slave evaluates the activity of the master via CAN bus. In case there is detected any problem with master, BO:CtrlHBeat FD on the slave controller is activated.

Basic settings

Gen-set name

User-defined name, used for controller identification at remote connections. *Gen-set name* is max 15 characters long and has to be entered using PC software.

Hint:

The setpoint can be changed using PC SW only (e.g. InteliMonitor). Gen-set name isn't affected by GenConfig SW.

Nomin power [kW – MW*] (FV)

Nominal power of the generator.

Step: 0,1 kW / 1 kW / 0,01 MW*

Range: 0,1 kW – 320,00 MW*

Force value possibility: Yes

**Note:*

The actual setpoint units and range depend on setting of the Power format (see GenConfig manual).

Nomin current [A] (FV)

This is the current limit for the generator. IDMT over current and short current protections are based on this setpoint. See **Generator protections**: *2Inom del, Ishort* setpoints*. Nominal current* can be different from generator rated current value.

Step: 1 A

Range: 1 - 10000 A

Force value possibility: Yes

!!! VERY IMPORTANT !!!

- The maximum input current to the controller current terminals is 11 Amps. Higher value is displayed as measured limit, e.g. 15 Amps from CT is measured and displayed as 11 Amps.
- Take special care when selecting CT's. All available 5 Amp CT's do not have a range up to 11 Amps.

CT ratio prim [A]

Gen-set phases Current Transformers ratio – primary side.

Step: 1 A

Range: 1 – 10000 A

CT ratio sec [/5A / /1A]

Gen-set phases Current Transformers ratio – secondary side selection /5A or /1A. Available in IG-xxC and IS-NT versions. In standard IG-EE/NT units only 5 A range available.

Hint:

Do not switch to 1A range unless you have IG-NTC/EEC or IS-NT hardware.

Im3/ErFlCurCTp [A]

Mains current phase 3 or Earth Fault protection Current Transformer ratio – primary side.

Mains CT ratio for single phase Import / Export power and PF measuring. Single phase power value is internally multiplied by three.

Step: 1 A

Range: 1 – 10000 A

Hint:

Im3 controller terminals have to be connected to mains L3 phase for Import/Export measuring!!!
Balanced mains power is expected.

Im3/ErFlCurCTs [/5A / /1A]

Mains current phase 3 or Earth Fault protection Current Transformer ratio – secondary side selection /5A or /1A. Available in IG-xxC and IS-NT versions. In standard IG-EE/NT units only 5 A range available.

Hint:

Do not switch to 1A range unless you have IG-NTC/EEC or IS-NT hardware.

VT ratio [/1]

Gen-set Voltage Transformers ratio.
Step: 0,1 V / V
Range: 0,1 – 500,0 V / V

Vg InpRangeSel [277 V / 120 V]

Gen-set voltage sensing inputs range selection. Available in IG-xxC and IS-NT versions. In standard IG-EE/NT units only 277 V range available.

Hint:

The range 277 V is suitable for both European (230 V) and American (277 V) measurement.
The range 120 V is intended for high-voltage applications where voltage transformers with output range 100 V are used, or for alternative American (120 V) measurement.
Do not switch to 120V range unless you have IG-NTC/EEC or IS-NT hardware.

Vm VT ratio [/1]

Mains Voltage Transformers ratio.
Step: 0,1 V / V
Range: 0,1 – 500,0 V / V
Hint:

Set VT ratio to 1,0 if no Voltage Transformers are used.

Vm InpRangeSel [277 V / 120 V]

Mains voltage sensing inputs range selection. Available in IG-xxC and IS-NT versions. In standard IG-EE/NT units only 277 V range available – the setpoint setting is not important.

Hint:

The range 277 V is suitable for both European (230 V) and American (277 V) measurement.
The range 120 V is intended for high-voltage applications where voltage transformers with output range 100 V are used, or for alternative American (120 V) measurement.
Do not switch to 120V range unless you have IG-NTC/EEC or IS-NT hardware.

GenNomV [V – kV*] (FV)

Nominal generator voltage (phase to neutral).
Step: 1 V / 0,01 kV*
Range: 80 V – 300,00 kV*
Force value possibility: Yes
**Note:*

The actual setpoint units and range depend on setting of the Power format (see GenConfig manual).

Hint:

The nominal value can be externally changed using Force value function. However, it is intended for changes between standard nominal voltages only (230 / 120 V) using *ForceValueInXX* source setpoints.
It is prohibited to use another controller values as a source for Force value in this case!!!
Both Gen and Mains nominal voltages must be set to the same value when no VT is used.

GenNomVph-ph [V – kV*]

Nominal generator voltage (phase to phase).
Step: 1 V / 0,01 kV*
Range: 130 V – 600,00 kV

Note:
The actual setpoint units and range depend on setting of the Power format (see GenConfig manual).
Hint:
If one of the nominal voltages is changed, the other is automatically adjusted to correspond with the new value. E.g. if GenNomV is changed to 220 V, the GenNomVph-ph is changed to 220*1,73 = 381 V.
Both Gen and Mains nominal voltages must be set to the same value when no VT is used.

MainsNomV [V – kV*] (FV)

Nominal mains voltage (phase to neutral).
Step: 1 V / 0,01 kV*
Range: 80 V – 300,00 kV*
Force value possibility: Yes
Note:
The actual setpoint units and range depend on setting of the Power format (see GenConfig manual).
Hint:
The nominal value can be externally changed using Force value function. However, it is intended for changes between standard nominal voltages only (230 / 120 V) using *ForceValueInXX* source setpoints.
It is prohibited to use another controller values as a source for Force value in this case!!!
Both Gen and Mains nominal voltages must be set to the same value when no VT is used.

MainsNomVph-ph [V – kV*]

Nominal mains voltage (phase to phase).
Step: 1 V / 0,01 kV*
Range: 130 V – 600,00 kV*
Note:
The actual setpoint units and range depend on setting of the Power format (see GenConfig manual).
Hint:
Both Gen and Mains nominal voltages must be set to the same value when no VT is used.

FixVoltProtSel [PHASE-NEUTRAL / PHASE-PHASE]

PHASE-NEUTRAL: The generator and mains/bus fixed voltage protections are based on phase-to-neutral voltages.
PHASE-PHASE: The generator and mains/bus fixed voltage protections are based on phase-to-phase voltages.
Hint:
Values in user configurable voltage protection have to be changed manually (e.g. V L1-N for V L1-L2 or vice versa)

Nominal freq [Hz] (FV)

Nominal generator frequency (usually 50 or 60 Hz).
Step: 1Hz
Range: 45 – 65 Hz
Force value possibility: Yes
Hint:
The nominal value can be externally changed using Force value function. However, it is intended for changes between standard nominal frequencies only (50 / 60 Hz) using *ForceValueInXX* source setpoints.
It is prohibited to use another controller values as a source for Force value in this case!!!

Gear teeth [ ]

This setpoint was added for request of customers, GeCon sw doesn't need and doesn't use information about RPM for its functionality.
This setpoint was added for case, when the customers want to connect pick-up sensor to the controller and e.q. show RPM value on the display.
Number of teeth on the engine's flywheel for the pick-up sensor.
Step: 1

Range: 1 – 500

ControllerMode [OFF / MAN / AUT / TEST] (FV)

Equivalent to Controller mode changes by MODE→ or ←MODE buttons.
Force value possibility: Yes
Hint:
Mode change can be separately password protected.

FltRes GoToMAN [DISABLED / ENABLED] (FV)

DISABLED: Controller stays in AUT mode after Fault reset .
ENABLED: Automatic switch from AUT / TEST to MAN mode after Fault reset to avoid automatic engine start. This function is active for all 2nd-level protections (Shut down, Slow stop, ElProt, Off-load).
Force value possibility: Yes
Hint:
It is not possible to reset a Fault when Binary input Remote TEST is closed or another mode forcing function is active.
Set to ENABLED to avoid automatic engine start when Fault reset button is pressed after shut down in automatic mode.

Local buttons [PANEL / EXTBUTTONS / BOTH]

PANEL: Only the buttons on the controller front panel are enabled.
EXTBUTTONS: Only the external signals (copies of the panel buttons) are enabled.
BOTH: Both controller buttons and external signals are enabled.

Hint:
This switch is valid for these signals: GCBButton, MCBButton, FaultResButton, HornResButton, StartButton, StopButton.

DispBaklightTO [min] (FV)

Timeout after which the display backlight is switched off.
OFF = the backlight is off all the time, NO TIMEOUT = the backlight is on all the time.
Step: 1 min
Range: OFF (= 0), 1 – 240 min, NO TIMEOUT (= 241)
Force value possibility: Yes

DispBklStrtOff [DISABLED / ENABLED] (FV)

This setpoint determines if display backlight is switched on/off during the gen-set start. This parameter is effective for all the displays not only for the internal one.
Force value possibility: Yes

Contr. addr [ ]

Controller CAN bus and RS-485 identification number. Each controller in the group has to have its own unique number.
Step: 1
Range: 1 to 32
Hint:
When opening Direct or Modem connection to the controller (using PC monitoring/control SW), the *Contr. address* has to correspond to the Gen-set setting in PC SW.

RS232(1) mode [DIRECT / MODEM (HW) / MODEM (SW) / MODBUS-DIRECT / MODBUS-MDM(HW) / ECU LINK]

Communication protocol selection for RS232(1) line.
DIRECT: Connection to a local PC running InteliMonitor. RS232 or RS485 (with internal or external converter) lines can be used. Set this also for IG-IB connected via RS232 line.

MODEM (HW): Analog/GSM/ISDN modem connection. Select this for standard modems with HW flow control. If selected and no CTS signal is detected, communication may not work correctly.

MODEM (SW): Analog/GSM/ISDN modem connection. Select this for modems without HW flow control – controller will use SW flow control signals XOn, Xoff, so only TxD and RxD signals need to be connected between the controller and the modem.

MODBUS-DIRECT: Modbus protocol for direct connection to PLC / external SCADA terminal. Communication speed can be selected via setpoint *RS232(1)MBCSpd*.

MODBUS-MDM(HW):Modbus protocol for modem (remote) connection to PLC / external SCADA terminal. Communication speed can be selected via setpoint *RS232(1)MBCSpd*.

ECU LINK: Port redirected to connect the ECU with special (not J1939) interface, e.g. Cummins Modbus.

Hint:

Detail description of Modbus protocol see in Communication guide.
ECU LINK mode can be selected only at RS232(1) port.

RS232(2) mode [DIRECT / MODEM (HW) / MODEM (SW) / MODBUS-DIRECT / MODBUS-MDM(HW) / ECU LINK]

Communication protocol selection for RS232(2) line.
Description is the same like for *RS232(1) mode*.
Available only in IS-NT and in IG-xxC versions.

Hint:

Detail description of Modbus protocol see in Communication guide.
ECU LINK mode can be selected only at RS232(1) port.

RS232(1)MBCSpd [9600 bps / 19200 bps / 38400 bps / 57600 bps]

Defines the communication speed on RS232(1) line when ModBus mode is selected.

RS232(2)MBCSpd [9600 bps / 19200 bps / 38400 bps / 57600 bps]

Defines the communication speed on RS232(2) line when ModBus mode is selected. Available only in IS-NT and in IG-xxC versions.

RS485(1) conv. [DISABLED / ENABLED]

If set to ENABLED, the communication RS232(1) port is redirected to the built-in RS485 converter. That means the remote display RS485 line (for IG-Display connection) is blocked and the converter is used for communication with superior system or ECU.
Available in all controllers except of IS-NT.

Hint:

Applicable only for DIRECT, MODBUS-DIRECT and ECU LINK modes.
This converter is not isolated!

RS485(2) conv. [DISABLED / ENABLED]

If set to ENABLED, the communication RS232(2) port is redirected to the built-in isolated RS485 converter.
Available only in IS-NT and in IG-xxC versions.

Hint:

Applicable only for DIRECT, MODBUS-DIRECT and ECU LINK modes.

RS232(1)MdmIni [ ]

Auxiliary modem initialization string – executed after the default modem initialization string. Used with modem connected to the RS232(1) communication port.

Hint:

Applicable only for MODEM(HW), MODEM(SW) and MODBUS-MDM(HW) modes.
Use for special AT command setting of your modem if default string does not initiate the modem properly. AT commands must be separated using semicolon ";", max. length 31 characters.
The setpoint can be changed only using PC SW when configuring IG-EE/NT.

RS232(2)MdmIni [ ]

Auxiliary modem initialization string – executed after the default modem initialization string. Used with modem connected to the RS232(2) communication port.
Available only in IS-NT and in IG-xxC versions.
Hint:
Applicable only for MODEM(HW), MODEM(SW) and MODBUS-MDM(HW) modes.
Use for special AT command setting of your modem if default string does not initiate the modem properly. AT commands must be separated using semicolon ";", max. length 31 characters.
The setpoint can be changed only using PC SW when configuring IG-EE/NT.

CAN bus mode [32C / 8C]

CAN bus speed selection.
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.
Hint:
Low speed use for long distance connection only. Set all connected controllers to the same speed.
If having problems with needed CAN bus length, see Communication guide / I-CR module.

CAN2emptDetect [DISABLED / ENABLED] (FV)

Enables the detection of missing intercontroller CAN connection. If enabled and no other controllers are detected on the CAN bus (the complete bus, not only within the logical group), this protection activates.
Force value possibility: Yes

ResetActAlarms [DISABLED / ENABLED]

DISABLED: If Fault reset is activated (from any source), only inactive (normally displayed) alarms are reset. So only inactive alarms can be cleared from the Alarmlist.
ENABLED: If Fault reset is activated (from any source), all currently present (including inverse displayed = active) alarms are reset (asterisk in Alarmlist disappears for all present alarms). I.e. after an active (inverse displayed) alarm later on becomes inactive (normally displayed), it is cleared automatically from the Alarmlist if previously reset.
Hint:
ENABLED mode corresponds to the way that IG and IS controllers (previous generation) handled the alarms.

ECU Diag [DISABLED / ENABLED] (FV)

When set to disabled, the ECU advanced diagnostics is disabled to allow the cooperation with external diagnostics tool.
Alarm list indication "ECU Diag disabled" is indicated when ECU diagnostics is disabled.
Force value possibility: Yes

SHxOcol detect [DISABLED / ENABLED]

This setpoint is dedicated for virtual peripheries; it can enable / disable error messages when more then one master (source) is configured.

ConvCoefPulse1 - 4 [ ]

This setpoint adjusts the rate of increasing of the PulseCounter1 – 4 (integrating internal counters that can be seen at PulseCounter1-4). The setpoint assigns number of pulses (BI:PulseCounter1 – 4) to increase the PulseCounter integrating value by 1.
Step: 1/X
Range: 1 – 65000 1/X

Example:
Number of pulses on the physical input BI: PulseCounter1: 10
ConvCoefPulse1 = 2

Value of the PulseCounter1 integrating counter: 5

Delays/Timers

Horn timeout [s] (FV)

The maximum amount of time the Binary output Horn is closed (horn, buzzer will sound). OFF = the output won't be activated, NO TIMEOUT = the output stays closed until the alarm has been reset.
Step: 1s
Range: OFF, 1 – 3600 s, NO TIMEOUT
Force value possibility: Yes

RunOnlyBlkDel1 [s]

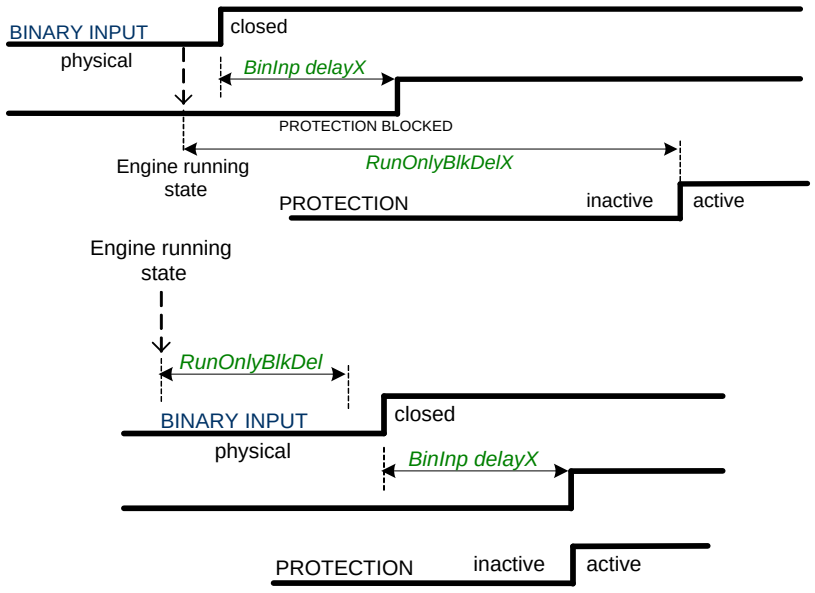
Delay for Engine running Alarms activation – group 1 – see drawing below.
Step: 0,1s
Range: 0,0 – 3000,0 s

RunOnlyBlkDel2 [s]

Delay for Engine running Alarms activation – group 2.
Step: 0,1s
Range: 0,0 – 3000,0 s

RunOnlyBlkDel3 [s] (FV)

Delay for Engine running Alarms activation – group 3.
Step: 0,1s
Range: 0,0 – 3000,0 s
Force value possibility: Yes



BinInp delay 1 [s]

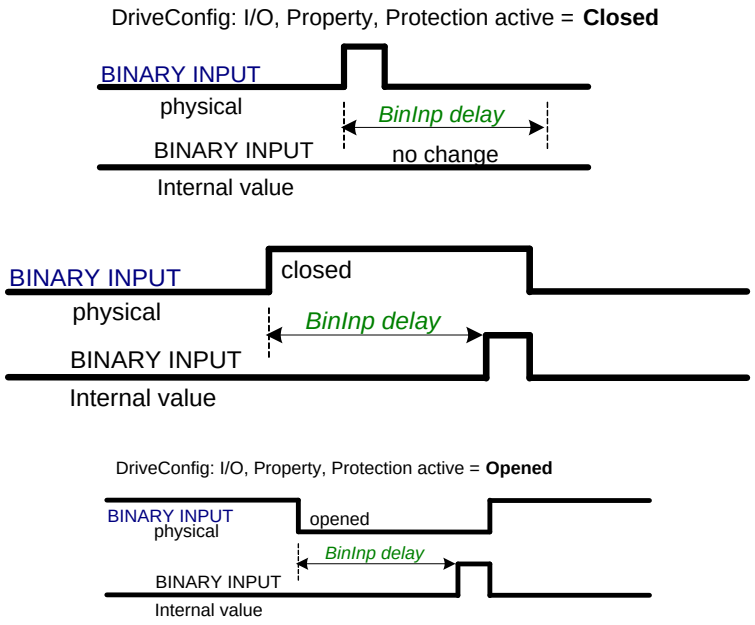
Binary input protection is activated when input is closed for longer time than *BinInp delay 1*. To use this delay, Binary input must be configured in GenConfig for Property – Delay = BinInp delay 1.
Step: 0,1s
Range: 0,0 – 600,0 s

BinInp delay 2 [s]

Binary input protection is activated when input is closed for longer time than *BinInp delay 2*. To use this delay Binary input must be configured in GenConfig for Property – Delay = BinInp delay 2.
Step: 0,1s
Range: 0,0 – 600,0 s

BinInp delay 3 [s] (FV)

Binary input protection is activated when input is closed for longer time than *BinInp delay 3*. To use this delay Binary input must be configured in GenConfig for Property – Delay = BinInp delay 3.
Step: 0,1s
Range: 0,0 – 600,0 s
Force value possibility: Yes
Hint:
BinInp delay is active only for Binary inputs configured as protection.
If these setpoints are not used, default BI delay is 0,5s.



ForceBlock1Del [s] (FV)

ForceBlock2Del [s] (FV)

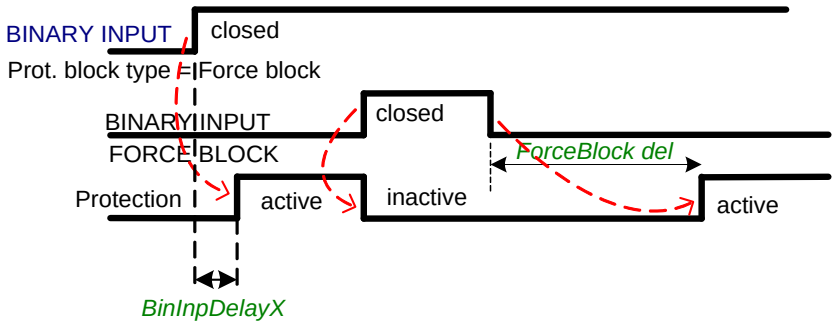
ForceBlock3Del [s] (FV)

ForceBlockDel4 [s] (FV)

ForceBlockDel5 [s] (FV)

ForceBlockDel6 [s] (FV)

Delays for Force block protection activation after the corresponding Binary input Force block is opened. Protection deactivation is without delay. Protection is activated/deactivated independent on engine running or not running state – it depends only on the corresponding Force block X input.
Step: 0,1s
Range: 0,0 – 60,0 s
Force value possibility: Yes



Service time 1 **[h]**

Service time 2 **[h]**

Service time 3 **[h]**

Service time 4 **[h]**

Running hours down counters are decremented when engine is running. Service alarm is indicated in Alarm list and History record is activated when at least one of the counters reaches zero. *Service time X* setpoints are actual counter values.

Step: 1 h

Range: 0 – 65535 h

Hint:

Once a service time has elapsed the corresponding *Service time X* setpoint must be adjusted again to a non-zero value to clear the alarm and begin a new countdown.

You can rename the particular timers using Translator in GenConfig to indicate specific service intervals – e.g. “OilChange time”, “SparkPlug time”, ...

Analog protect

The content depends on programmable protections settings. This list contains pre-set protections from default archives:

Batt >V [V]

Warning level for battery over voltage.
Step: 0,1 V
Range: 8,0 – 40,0 V

Batt <V [V]

Warning level for low battery voltage.
Step: 0,1 V
Range: 8,0 – 40,0 >V

Batt volt del [s]

Delay for battery voltage alarms.
Step: 1 s
Range: 0 – 600,0 s

Max+CylDifPmin [°C]

Max+CylDifPmin = Maximum positive Cylinder temperature Difference at minimal gen-set Power level. Maximum positive deviation of one cylinder temperature from the average at the *PminCylDifEval* load. Alarm can be activated depending on Block type (set in GenConfig ->Software configuration->Analog inputs) – all the time or after some time after start (depends on *RunOnlyBlkDelX* time).
Step: 1 °C
Range: ± 32000 °C

Max-CylDifPmin [°C]

Max-CylDifPmin = Maximum negative Cylinder temperature Difference at minimal gen-set Power level. Maximum negative deviation of one cylinder temperature from the average at the *PminCylDifEval.* load. Alarm can be activated depending on Block type (set in GenConfig ->Software configuration->Analog inputs) – all the time or after some time after start (depends on *RunOnlyBlkDelX* time).
Step: 1 °C
Range: ± 32000 °C

Max+CylDifPnom [°C]

Max-CylDifPnom = Maximum positive Cylinder temperature Difference at nominal gen-set Power level. Maximum positive deviation of one cylinder temperature from the average at the *Nomin power*. Alarm can be activated depending on Block type (set in GenConfig ->Software configuration->Analog inputs) – all the time or after some time after start (depends on *RunOnlyBlkDelX* time).
Step: 1 °C
Range: ± 32000 °C

Max-CylDifPnom [°C]

Max-CylDifPnom = Maximum negative Cylinder temperature Difference at nominal gen-set Power level. Maximum negative deviation of one cylinder temperature from the average at the *Nomin power*. Alarm can be activated depending on Block type (set in GenConfig ->Software configuration->Analog inputs) – all the time or after some time after start (depends on *RunOnlyBlkDelX* time).
Step: 1 °C
Range: ± 32000 °C

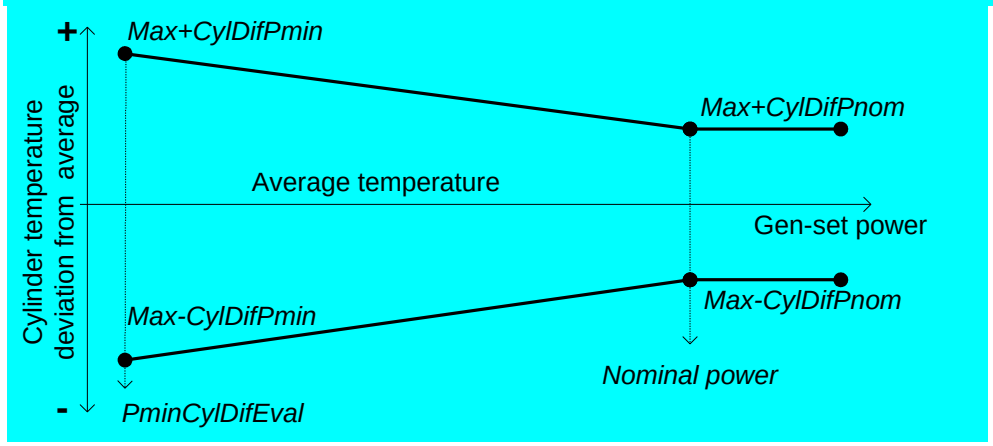
PminCylDifEval [kW – MW*]

Minimum gen-set Power for Cylinder temperature Difference evaluation. The protection is not evaluated, if the gen-set power is lower than this limit.

Step: 0,1 kW / 1 kW / 0,01 MW*
Range: 0,0 kW – *Nominal power**
Note:
The actual setpoint units and range depend on setting of the Power format (see GenConfig manual).

CylDifEvalDel [s]

Cylinder temperature Difference Evaluation Delay.
Step: 1s
Range: 0 – 600 s
Cylinder temperature deviation protection type: warning



Gener protect

The content depends on programmable protections settings. This list contains pre-set protections from default archives + fixed protections, which are always present:

OverldStrtEval [%] (FV)

Specifies the overload level, where the protection evaluation starts (see figure at *2PovrldStEvDel*). Under this level the protection is not active.
Step: 1 % of *Nomin power*
Range: 100 – 200 %
Force value possibility: Yes

2POvrldStEvDel [s]

IDMT curve shape selection. *2PovrldStEvDel* is the Reaction time of IDMT protection for 200% overload Pgen = 2* *OverldStrtEval*.
Step: 0,1 s
Range: 0,0 - 600,0 s
Protection: BreakerOpen.
IDMT is inverse proportional to the generator overload. The higher the overload gets the less time will elapse before the protection activates.

When the IDMT protection is activated the GCB is opened, the event is recorded in the Alarmlist and History.

$$\text{Reaction time} = \frac{\textit{2POvrldStEvDel} * \textit{OverldStrtEval}}{\text{Pgen} - \textit{OverldStrtEval}}$$

Where Reaction time is the amount of time from IDMT detection to the opening of the GCB.
Hint:
The maximum allowable Reaction time is 3600 sec.

Reaction time is the amount of time from IDMT detection to the opening of the GCB.

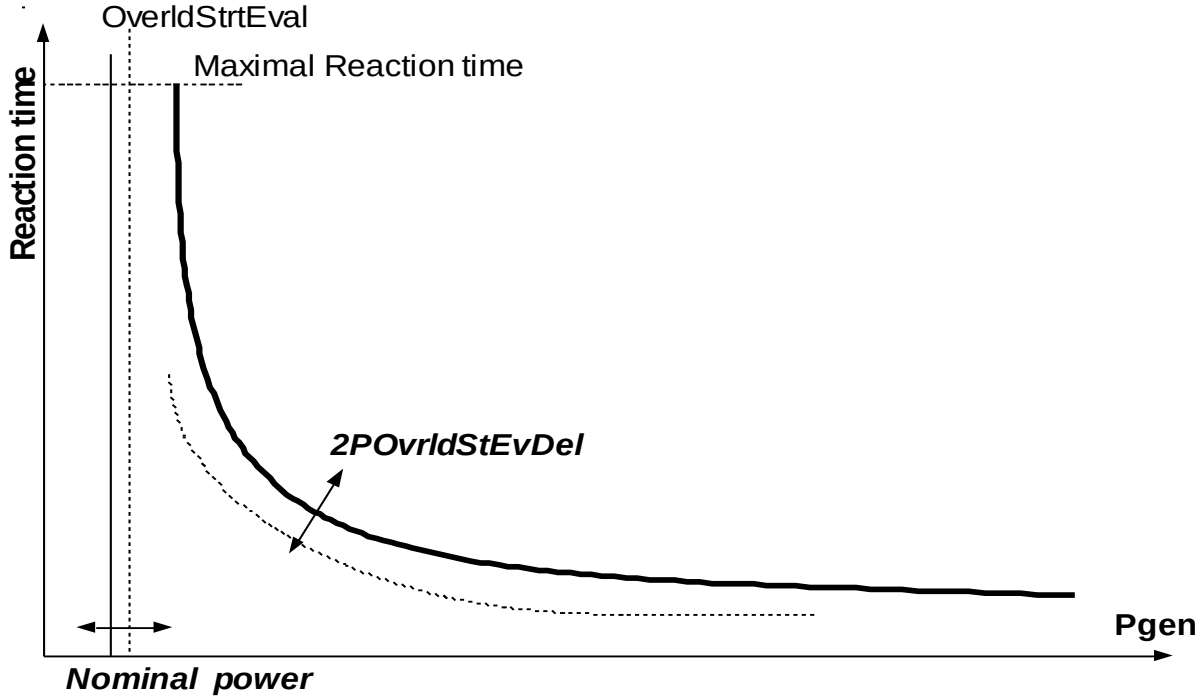
Following example shows reaction times for *OverldStrtEval* = 100% in dependence on generator power and setpoint *2PovrldStEvDel* value:

	Pgen [%]	<=100	101	102	105	110	120	150
2POvrldStEvDel [s]								
0,1		No action	10	5	2	1	0,5	0,2
0,2		No action	20	10	4	2	1	0,4
0,5		No action	50	25	10	5	2,5	1
1,0		No action	100	50	20	10	5	2
1,5		No action	150	75	30	15	7,5	3
2,0		No action	200	100	40	20	10	4
2,5		No action	250	125	50	25	12,5	5
5,0		No action	500	250	100	50	25	10
10,0		No action	1000	500	200	100	50	20
20,0		No action	2000	1000	400	200	100	40
50,0		No action	No action	2500	1000	500	250	100

Following example shows reaction times for *OverldStrtEval* = 110% in dependence on generator power and setpoint *2PovrldStEvDel* value:

	Pgen [%]	<=110	111	112	115	120	150	200

2POvrldStEvDel [s]								
0,1		No action	11	5,5	2,2	1,1	0,275	0,123
0,2		No action	22	11	4,4	2,2	0,55	0,245
0,5		No action	55	27,5	11	5,5	1,375	0,612
1,0		No action	110	55	22	11	2,75	1,223
1,5		No action	165	82,5	33	16,5	4,125	1,834
2,0		No action	220	110	44	22	5,5	2,445
2,5		No action	275	137,5	55	27,5	6,875	3,056
5,0		No action	550	275	110	55	13,75	6,112
10,0		No action	1100	550	220	110	27,5	12,223
20,0		No action	2200	1100	440	220	55	24,445
50,0		No action	No action	2750	1100	550	137,5	61,112



Min Power PtM [%] (FV)

Minimum Power in Parallel to the Mains is the minimal value of the gen-set power in parallel to the mains. Gen-set is never loaded below this level (even if the active load control loop requests a lower level). There is no indication or alarm when *Min Power PtM* level is reached.
Step: 1 % of *Nomin power*
Range: 0 – 100 % of *Nomin power*
Force value possibility: Yes

Hint:
If the setpoint *Base load* is lower than setpoint **Gener protect**: *Min power PtM*, the gen-set requested load is set to **Gener protect**: *Min power PtM*.
The value of *Min Power PtM* is ignored during Warming procedure.
The setpoint is used as a limit for **Low power** protection: if it becomes active, the load is ramped-down using setpoint **Sync/Load strl:** *Load ramp*, to *Min power PtM*. After protection becomes inactive, the power limitation is automatically terminated.

Ishort [%]

If the level set in this setpoint is reached, the GCB is opened with delay defined in *Ishort del*. Intended for shortcurrent detection.
Step: 1 % of *Nomin current*

Range: 100 - 500 % of *Nomin current*
Protection: BreakerOpen.

Ishort del [s]

Delay for generator shortcurrent protection.
Step: 0,02 s
Range: 0,00 – 10,00 s
Hint:
Ishort del can be set in GenConfig to 0,01 s, but this value is rounded to the proximate controller evaluation period, which is 0,02 s when the frequency is 50Hz.

2Inom del [s]

IDMT curve shape selection. *2Inom del* is the Reaction time of IDMT protection for 200% overcurrent Igen = 2* *Nominal current*.
Step: 0,1 s
Range: 0,0 - 60,0 s
Protection: BreakerOpen.
IDMT is inversely proportional to the generators overcurrent. The higher the overcurrent gets the less time will elapse before the protection is activated.

When the IDMT protection is activated the GCB is opened, the event is recorded in the Alarmlist and History.

$$\text{Reaction time} = \frac{\textit{2Inom del} * \textit{Nomin current}}{\text{Igen} - \textit{Nomin current}}$$

Where Reaction time is the amount of time from IDMT detection to the opening of the GCB.
Hint:
The maximum allowable Reaction time is 900 sec.

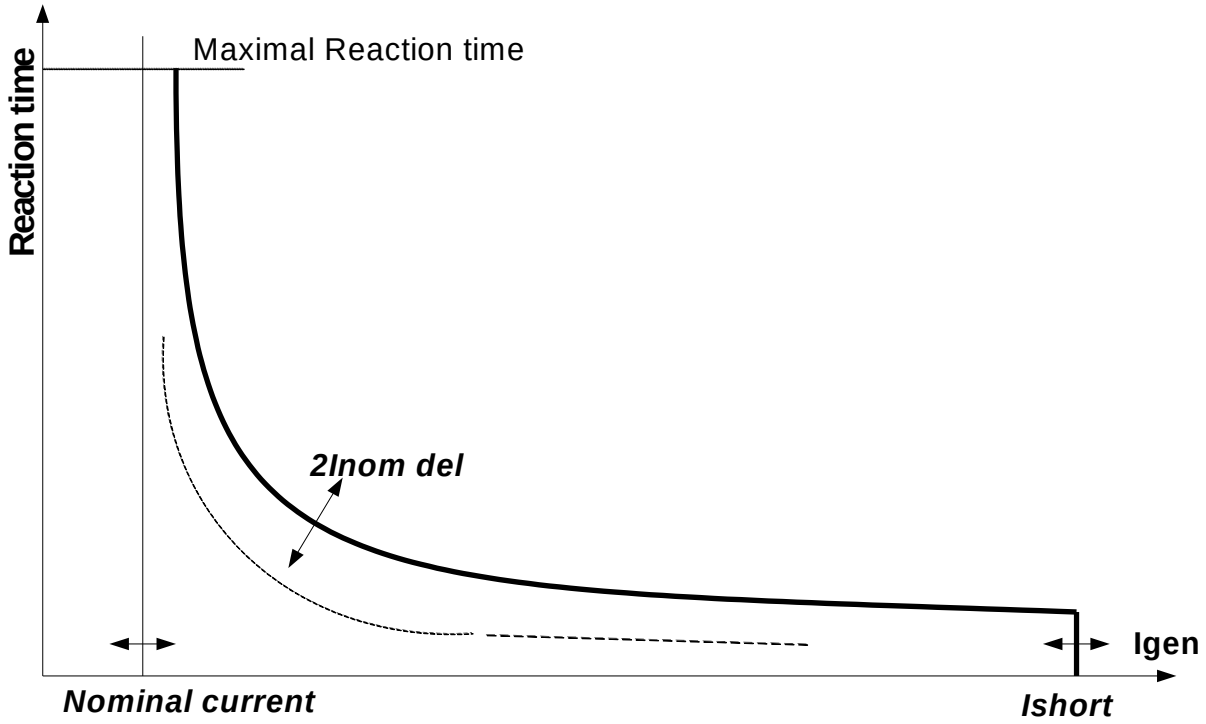
Reaction time is the amount of time from IDMT detection to the opening of the GCB.
Igen is the maximum current of the three phases of generator current.

EXAMPLE of Reaction time for different over current levels.

	Igen [%]	<=100	101	102	105	110	120	150	200
2Inom del									
0,1		No action	10	5	2	1	0,5	0,2	0,1
0,2		No action	20	10	4	2	1	0,4	0,2
0,5		No action	50	25	10	5	2,5	1	0,5
1,0		No action	100	50	20	10	5	2	1
2,0		No action	200	100	40	20	10	4	2
5,0		No action	500	250	100	50	25	10	5
10,0		No action	No action	500	200	100	50	20	10
20,0		No action	No action	No action	400	200	100	40	20
50,0		No action	No action	No action	No action	500	250	100	50

!!! VERY IMPORTANT !!!

- The maximum input range of the controller current terminals is 11 Amps. Anything over this value is displayed as measured limit, e.g. 15 Amps from CT is measured and displayed as 11 Amps.
- Take special care when selecting CT's. All available 5 Amp CT's do not have a range up to 11 Amps.



Gen >V BO [%] (FV)

Threshold for generator over voltage in % of nominal voltage.
Step: 1 % (0=OFF)
Range: *Gen <V BO* – 150 % of *GenNomV* or *GenNomVph-ph* respectively
Protection: BreakerOpen.

Gen <V BO [%] (FV)

Threshold for generator under voltage in % of nominal voltage.
Step: 1 % (0=OFF)
Range: 50 – *Gen >V BO* % of *GenNomV* or *GenNomVph-ph* respectively
Protection: BreakerOpen.
Hint:
All three phases are checked for generator voltage protection. Minimum or maximum out of three is used.

Gen V del [s]

Delay for generator under and over voltage protection.
Step: 0,02 s
Range: 0,00 – 600,00 s

Gen >f [%] (FV)

Threshold for generator over frequency in % of nominal frequency.
Step: 0,1 % (0=OFF)
Range: *Gen<f* – 150,0 % of *Nominal freq*
Protection: BreakerOpen.

Gen <f [%] (FV)

Threshold for generator under frequency in % of nominal frequency.
Step: 0,1 % (0=OFF)
Range: 50,0 – *Gen>f* % of *Nominal freq*
Protection: BreakerOpen.
Hint:
The generator frequency is evaluated from the L3 phase.

Gen f del [s]

Delay for generator under frequency and over frequency protection.
Step: 0,02 s
Range: 0,00 – 600,00 s

IDMTCurrEval [ENABLED / DISABLED]

In case enabled, the IDMT Current protection is evaluated. In case Disabled is chosen, the current IDMT protection is not evaluated.

Min stab time

This is the minimum time the controller will wait, after switching the engine to nominal RPM, to close the GCB (the delay ensures that the GCB is closed with correct generator frequency).
Step: 1s
Range: 1 – *Max stab time* s
Force value: Yes

Max stab time

This is the maximum time the controller will wait for generator voltage to build up, after switching the engine to nominal RPM.
Step: 1s
Range: *Min stab time* – 3600 s
Force value: Yes
Hint:
When generator voltage in *Max stab time* does not reach defined limits (see **Gener protect** group), an alarm occurs and the warning will be displayed.

Reverse power [%]

Threshold for generator reverse (back) power alarm in % of nominal power.
Step: 1%
Range: 0 – 50 % of *Nomin power*
Protection: BreakerOpen.

ReversePwr del [s]

Delay for generator back (reverse) power alarm.
Step: 0,1 s
Range: 0 – 600,0 s

EarthFaultCurr [A]

Threshold for generator Earth fault current protection. The value is measured via the 4th current terminal In / Im3.
Step: 1 A
Range: 0 – 10000 A
Protection: BreakerOpen.

EthFltCurr del [s]

Delay for generator Earth fault current protection.
Step: 0,1 s
Range: 0– 600,0 s
Hint:
Earth fault current protection based on limits above is active only if *I/E-Pm meas* = ANALOG INPUT or NONE.

Gen V unbal [%]

Threshold for generator voltage unbalance alarm in % of nominal voltage. The voltage unbalance is calculated as a maximum difference between phase voltages.
Step: 1%
Range: 0 – 200% of *GenNomV* or *GenNomVph-ph* respectively

Gen V unb del [s]

Delay for generator voltage unbalance alarm.
Step: 0,1s
Range: 0 – 600,0 s
Protection: BreakerOpen.

Gen I unbal [%]

Threshold for generator current asymmetry (unbalance) in % of nominal current. The current unbalance is calculated as a maximum difference between phase currents.
Step: 1%
Range: 0 – 200% of *Nomin current*

Gen I unb del [s]

Delay for generator current asymmetry (unbalance).
Step: 0,1 s
Range: 0 – 600,0 s
Protection: BreakerOpen.

Mains protect

The content depends on programmable protections settings. This list contains pre-set protections from default archives + fixed protections, which are always present:

Mains >V MP [%] (FV)

Threshold for mains over voltage.
Step: 1%
Range: *Mains<V MP* – 150 % of *MainsNomV* or *MainsNomVph-ph* respectively
Protection: Mains protection.
Force value possibility: Yes

Mains <V MP [%] (FV)

Threshold for mains under voltage.
Step: 1 %
Range: 50 – *Mains>V MP* % of *MainsNomV* or *MainsNomVph-ph* respectively
Protection: Mains protection.
Force value possibility: Yes

Hint:
All three phases are checked for mains voltage protection. Minimum or maximum out of three is used.

For high voltage applications, the *MainsNomVph-ph* can be used for nominal voltage setting.

Mains V del [s]

Delay for mains under and over voltage protection.
Step: 0,02 s
Range: 0,00 – 600,00 s

Mains >f [%] (FV)

Threshold for mains over frequency in % of nominal frequency.
Step: 0,1%
Range: *Mains<f* - 150,0 % of *Nominal freq*
Protection: Mains protection.
Force value possibility: Yes

Mains <f [%] (FV)

Threshold for mains under frequency in % of nominal frequency.
Step: 0,1%
Range: 50,0 - *Mains>f* % of *Nominal freq*
Protection: Mains protection.
Force value possibility: Yes

Hint:
The mains frequency is evaluated from the L3 phase.

Mains f del [s]

Delay for mains under frequency and over frequency protection.
Step: 0,02 s
Range: 0,00 – 600,00 s

VectorS prot [DISABLED / PARALLEL ONLY / ENABLED] (FV)

DISABLED: Vector shift protection is disabled.
PARALLEL ONLY: Vector shift protection is enabled only if the gen-set is running in parallel with mains (= MCB+GCB status active).
ENABLED: Vector shift protection is enabled if MCB status is active.

Force value possibility: Yes
Hint:
If ENABLED is selected, it is likely that Vector shift protection will trip the MCB before other mains protections. It senses the fast changes in mains voltage angle position, which occur with every mains failure, even if the gen-set is not running in parallel with mains.

VectorS CB sel [MCB / GCB] (FV)

MCB: MCB is tripped if Vector shift protection gets active.
GCB: GCB is tripped if Vector shift protection gets active.
Force value possibility: Yes
Hint:
If GCB is selected and mains failure comes up, it is likely that MCB trips as well later on because of other mains protections.

VectorS limit [°]

Vector shift protection threshold level.
Step: 1°
Range: 1 – 45°
Hint:
To be sure of proper adjusting of *VectorS limit,* check *Max VectorS* value on the controller or PC software screen. *Max VectorS* value is set to zero when transiting to parallel, and then accumulates the maximum reached value (positive only) during parallel operation. Thus, during the normal operation, only the "background noise" is accumulated (usually max 3°), and the protection level should be set to approximately twice the value of this "noise".

Mains V unbal [%]

Threshold for mains voltage unbalance alarm in % of nominal voltage. The voltage unbalance is calculated as a maximum difference between phase voltages.
Step: 1%
Range: 0 – 200% of *MainsNomV* or *MainsNomVph-ph* respectively

Mains Vunb del [s]

Delay for mains voltage unbalance alarm.
Step: 0,1s
Range: 0 – 600,0 s
Protection: Mains protection

ROCOF df/dt [Hz/s]

Threshold for activation of Rate of Change of Frequency (ROCOF) protection.
Step: 0,1 Hz/s
Range: 0,1 – 10 Hz/s (0 = OFF)
Hint:
ROCOF protection can be deactivated by settings *ROCOF df/dt* = 0 = OFF). Default value is OFF. ROCOF protection is active only in parallel with mains. If measured value of df/dt exceed ROCOF df/dt, ROCOF protection is activated. ROCOF protection trips mains circuit breaker (MCB). The message ROCOF is writen in history of controller. Value of df/dt is evaluated from mains voltage.

AMF settings

EmergStart del [s] (FV)

Delay between the mains failure and the emergency start of the gen-set.
Step: 1 s
Range: 0 – 600 s
Force value possibility: Yes

MCB close del [s] (FV)

Delay after mains return to MCB closing, if gen-set is not running.
Step: 0,1 s
Range: 0 – 60,0 s
Force value possibility: Yes

MCB opens on [MAINSFAIL / GEN RUNNING] (FV)

Adjusting of condition when MCB opens after Mains fail:
MAINSFAIL: Controller opens the MCB when Mains fail is detected (24 VDC controlled circuit breaker or contactor expected).
GEN RUNNING: Controller opens the MCB only after the gen-set start, i.e. the generator voltage is present to open the MCB (230 VAC controlled breaker expected). In OFF mode, this means MCB stays closed all the time, regardless of the mains condition.
Force value possibility: Yes

ReturnWithIntr [ENABLED / DISABLED] (FV)

ENABLED: Enables break transfer of the load back to the mains if reverse synchronizing is not successful = opens GCB and after *FwRet break* delay closes MCB.
DISABLED: Gen-set stays running loaded in island when reverse synchronizing is not successful, even if mains is OK again.
Force value possibility: Yes

BreakerOverlap [s] (FV)

When limited time of running in parallel with mains is required, *BreakerOverlap* defines max time of running in parallel with mains. During this time soft transfer of load is activated. Used in AUT and TEST modes.
Step: 0,1 s
Range: 0,0 – 300,0 s
Force value possibility: Yes

RetFromIsland [MANUAL / AUTO] (FV)

MANUAL: Controller is automatically switched to MAN mode on each transition to Island operation. To activate the load transfer back to mains, the controller must be switched back to AUT mode.
AUTO: Load is automatically transferred in AUT mode after Mains return.
Hint:
Select *Ret fromIsland* = MANUAL when it is important at what time the load is transferred back to the mains.
Force value possibility: Yes

ReturnTo mains [DISABLED / ENABLED] (FV)

The setpoint influences the behavior of the TEST mode. If mains fail occurs during test (or is simulated using Test on load function), the controller opens the MCB and switches the load to generator.
DISABLED: Now if the mains recovers, the generator stays running loaded until TEST mode is abandoned, typically to AUT mode where reverse synchronizing and generator soft unloading follows.
ENABLED: After the mains recovers, the generator will reverse synchronize back to the mains, unloads and remains running without load until TEST mode is abandoned or another mains failure occurs.
Force value possibility: Yes

FwRet break [s] (FV)

Delay between GCB opening and MCB closing during the return to mains when reverse synchronizing is not enabled.
Delay between MCB opening and GCB closing in TEST Mode, when *Return To mains* = ENABLED and power cut comes.
Step: 0,1 s
Range: 0 – 60,0 s
Force value possibility: Yes

Mains ret del [s] (FV)

Delay after the mains return to the start of synchronizing of MCB (SPtM) or GCB (SPI).
Step: 1 s
Range: 0 – 3600 s
Force value possibility: Yes

Sync/Load ctrl

SpeedRegChar [POSITIVE / NEGATIVE]

Switch between speed governor characteristic.
POSITIVE: When the controller Speed governor output voltage increases – engine speed increases.
NEGATIVE: When the controller Speed governor output voltage decreases – engine speed increases.
Hint:
When set to NEGATIVE, Binary outputs Speed Up and Speed Dn still work without inversion.

Voltage window [%] (FV)

Maximum difference between generator and mains/bus voltage.
Step: 0,1 % of *GenNomV*
Range: 0,0 – 100,0 % of *GenNomV*
Force value possibility: Yes
Hint:
See Voltage phases match indication on the controller Synchronizing screen.

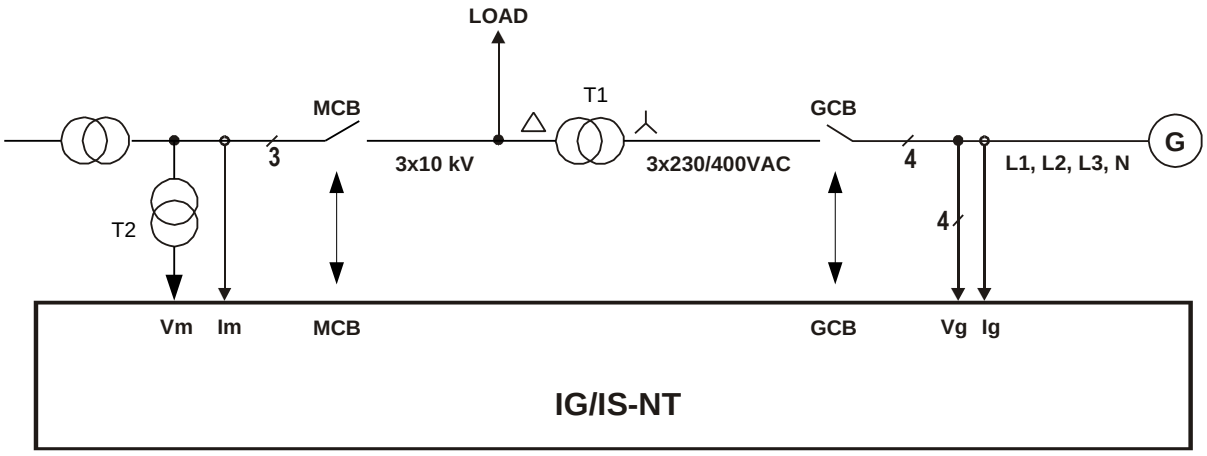
Example 1.
Voltage match 1 2 3 Note:
1 1 0 Phase L3 is out of voltage window

Example 2.
Voltage match 1 2 3 Note:
1 1 1 All phases are in voltage window

GtoM AngleReq [°]

Requested phase difference between generator and mains voltage during synchronizing. Use this setpoint for phase correction of potential transformers connection.
Step: 1°
Range: -45° to +45°

Following is an example of the controller connection to a high voltage system.
T1 shifts phase +30° and no shift is on T2. *GtoM AngleReq* = +30° for this example.



Phase window [°] (FV)

Maximum phase angle (mains/bus x generator voltage) ±difference between requested and actual angle for synchronizing.
Step: 1°
Range: 0° – 90°
Force value possibility: Yes

Hint:

If you want to lock out the GCB (or MCB) closing during synchronizing loop test, set *Phase window* = 0. This allows the control loop to be tested while actual GCB (or MCB) closing is blocked.
If force value function is used with this setpoint, it is strongly recommended to use only another setpoint as the source of an alternative value (preferably from group Force value). Measured values are not optimal for this purpose.

Dwell time [s] (FV)

The period of time that the phase angle must be within *Phase window* and voltage differece within *Voltage window* before a breaker (GCB/MCB) is closed.
Step: 0,1 s
Range: 0,0 – 25,0 s
Force value possibility: Yes

Freq gain [%]

Gain of frequency control loop.
Step: 0,1 %
Range: 0,0 % - 200,0 %

Freq int [%]

Relative integration factor of frequency control loop.
Step: 1 %
Range: 0 % – 100 %

Freq reg loop [ALL THE TIME / SYNC ONLY] (FV)

ALL THE TIME: Frequency control is active in island operation, running unloaded period and synchronizing.
SYNC ONLY: Frequency control is active during synchronizing only.
Force value possibility: Yes

Angle gain [%]

Gain of angle control loop.
Step: 0,1%
Range: 0,0 % to +200,0 %

Speed gov bias [V] (FV)

Speed control DC output bias level of SPEED GOVERNOR voltage output.
Step: 0,01 V
Range: *SpeedGovLowLim* to *SpeedGovHiLim* V
Force value possibility: Yes

SpdGovPWM rate [Hz]

Pulse-Width Modulation rate of the Speed Regulator pulse output.
Step: 1 Hz
Range: 500 – 3000 Hz
Hint:

This adjusting can be used for some Cummins and CAT engines speed governor interfaces. We recommend to keep the default setting (1200 Hz) for all other speed governor types (coming out through the analog interface +/- 10V).

SpeedGovLowLim [V]

Low limit for voltage on analog output of Speed Regulator.
Step: 0,01 V
Range: -10,00 V – *SpeedGovHiLim*

SpeedGovHiLim [V]

High limit for voltage on analog output of Speed Regulator.
Step: 0,01 V

Range: *SpeedGovLowLim* - 10,00 V

TauSpeedActuat [s]

Time constant of the speed actuator connected to the binary Up/Down outputs. This is to match the reaction of the controller's regulator with the actual reaction time of the actuator.
Step: 0,1 s
Range: 1,0 - 300,0 s

Load ramp [s] (FV)

Increasing or decreasing load rate. In seconds / *Nomin power*.
Step: 1 s
Range: 0 – *GCB open del* s
Force value possibility: Yes

Load gain [%]

Gain of power control loop.
Step: 0,1 %
Range: 0 – 200,0 %

Load int [%]

Relative integration factor of power control loop.
Step: 1 %
Range: 0 – 100 %
Hint:
Load gain and *Load int* setpoints are active only when gen-set operates in parallel to the mains, when GCB and MCB are closed. This is valid for both single and multiple applications.

SpeedRegOut behavior for single-gen-set applications

Operation mode	Island		Parallel to mains	
Gen-set state	**Running GCB opened**	**Loaded island GCB closed MCB opened**	**Synchronizing**	**Loaded in parallel GCB closed MCB closed**
Sync/Load ctrl: *Freq reg loop* =SYNC ONLY	Output value = Speed gov bias		Active loop: Freq gain, int; Angle gain	Active loop: Load gain, int
Sync/Load ctrl: *Freq reg loop* = ALL THE TIME	Active loop: Freq gain, int			

RampStartLevel [%]

Value of initial load, on which starts the load ramping according to *Load ramp* setting in % of nominal load.
Step: 1 %
Range: 0 – 100 %
Hint:
In case of higher value of this setpoint and closing the GCB with no load on the mains/bus, an overswing may occur.

GCB open level [%]

Power level for opening the GCB while soft unload is in progress. If this level isn't reached, the GCB opens after *GCB open del* time.
Step: % of *Nomin power*
Range: 0 to 100 %

GCB open del [s] (FV)

The timeout to unload the gen-set. Should the load ramp fail to bring the gen-set power down to *GCB open level* to allow the opening of GCB, the breaker will open after *GCB open del*.

Step: 1 s
Range: *Load ramp* – 1800 s
Force value possibility: Yes

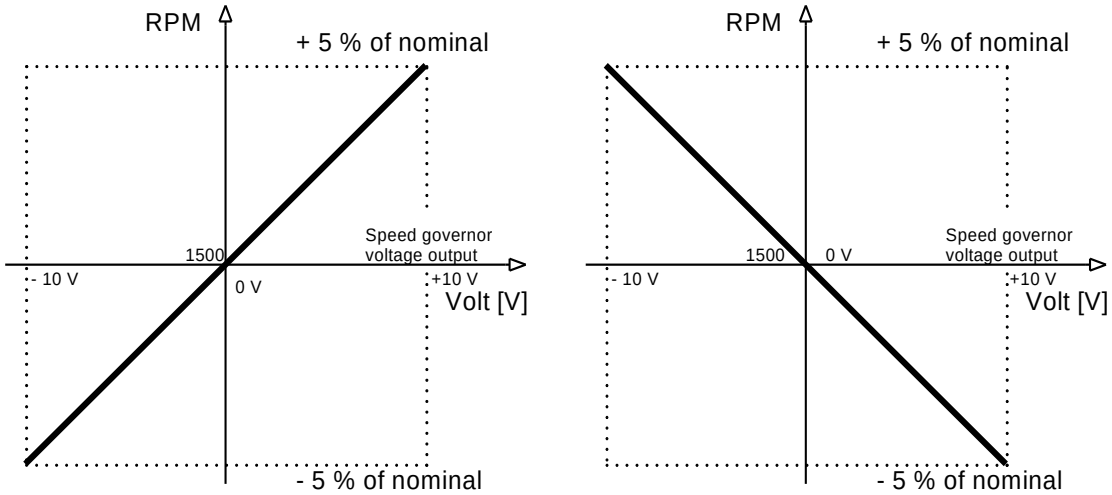
Sync timeout [s]

Maximum allowed time for forward or reverse synchronization.
Step: 1 s
Range: 1 – 1800 s, NO TIMEOUT
Hint:
If the synchronizing does not succeed within (*Sync timeout* / 10, but minimum 60) s, the speed regulator output is reset and synchronisation is automatically started again. So if you set the Sync timeout to sufficiently high value, the synchronizing cycle can be internally repeated up to 10 times.
If NO TIMEOUT is selected, then the time for synchronizing has no limitation and can only be interrupted by pressing the GCB or STOP button in MAN mode or removing a corresponding request input in AUT mode. In the NO TIMEOUT case, the synchronization is restarted every 1800 / 10 = 180 s.

Sync/load control adjustment

Hint:
Use isochronous speed governor.
Two wire shielded connection from IGS-NT SPEED GOVERNOR output (SG OUT, SG COM) to Speed governor auxiliary input is recommended.
A full range change of the IGS-NT speed governor output (from *SpeedGovLowLim* to *SpeedGovHiLim*) should cause 5-10% change of the engine speed (*SpeedGovLowLim* ~ 95% RPM_{nom}, *Speed gov bias* ~ 100% RPM_{nom}, *SpeedGovHiLim* ~ 105% RPM_{nom}.

IMPORTANT
Speed governor has to be adjusted for optimum performance before Sync / load control adjusting.
Check generator phase sequence before the first GCB connection.



SpeedRegChar = POSITIVE *SpeedRegChar* = NEGATIVE

Before optimal Sync/load setpoints adjusting disconnect GCB OPEN/CLOSE output or set *Phase window* = 0 to avoid paralleling.

Synchronizer adjustment

1) Start the engine in MAN Mode.
2) Set the engine RPM by speed trim on speed governor or by *Speed gov bias* and *SpeedGovLowLim* and *SpeedGovHiLim* to Nominal frequency.
3) To start synchronizing press GCB ON/OFF button. GCB LED starts to flash to indicate synchronization. To stop synchronization press again GCB ON/OFF.

Slip control adjusting:
4) Adjust *Freq gain* to unstable speed control and decrease value by 30 % to insure stable performance.

5) Adjust *Freq int* to stable (fast and smooth) slip control. Synchroscope movement on the controller measure screen should slow down and stop (in any position, because Angle control is off).

Angle control adjusting:

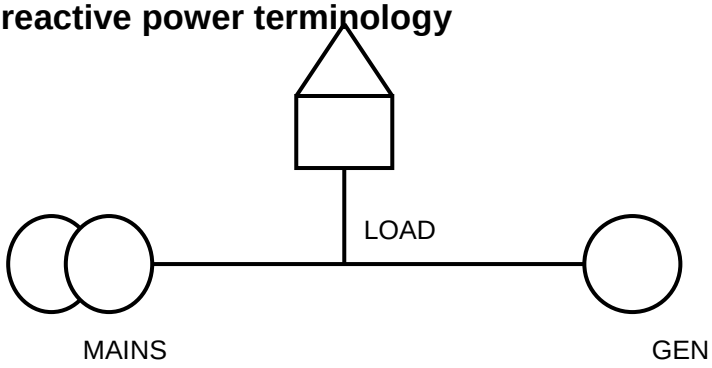
6) Set *Angle gain*. Synchroscope on the controller measure screen should move slowly and stop in "up" position. Set *Angle gain* to unstable value (synchroscope swings) and decrease value by 30 % to insure stable performance.

Load control adjustment

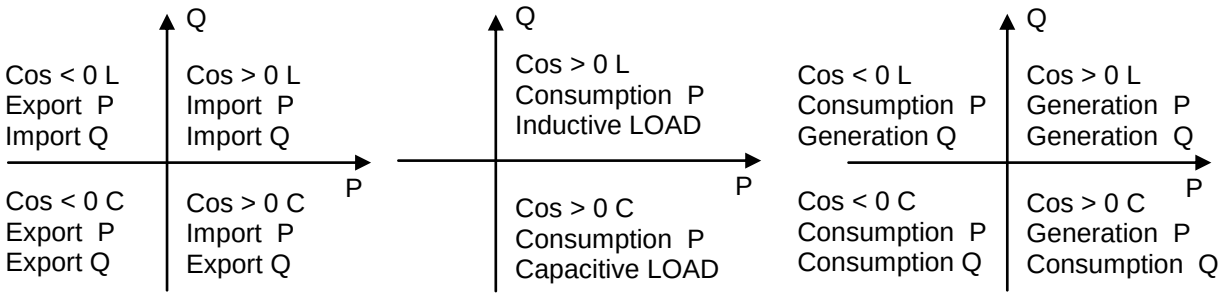
Prior to Sync/Load control adjustment, the Volt/PF control has to be adjusted! Load control loop is active in parallel to mains mode only (MCB feedback closed). Switch off other engines while adjusting.

1) Set *Load control* = Baseload, set *Base load* value to 30 % of Nominal power.
2) Set *Load gain* to the same value as *Slip freq gain*. Set *Load int* to zero.
3) Start the gen-set in MAN Mode, press GCB ON/OFF button to synchronize and close gen-set to mains.
4) When GCB is closed, gen-set load slowly increases to *Base load* value. Check that gen-set power is positive (CT polarity!).
5) Increase *Load gain* to unstable load control and decrease value by 30 % to insure stable performance. When *Load int* factor is set to zero gen-set load can differ from required Baseload.
6) To adjust and optimize *Load int* change several times *Base load* between 30 and 70 % of Nominal power. Usually setting *Load int* to 100% gives optimal performance.
7) When gen-set is running full load check if
   a. Speed governor output voltage value is not limited (not reached *SpeedGovLowLim* or *SpeedGovHiLim*)
   b. Speed governor actuator isn't mechanically limited or operates in small section of throttle range.

Active and reactive power terminology



MAINS	LOAD	GEN
P > 0 Import	P > 0 Consumption	P> 0 Generation
Q> 0 Import	Q> 0 Consumption	Q> 0 Generation



Mains

Exported active power is supplied to the mains. It is displayed in negative numbers e.g. –20kW.
Imported active power is consumed from the mains. It is displayed in positive numbers e.g. +20kW.
When reactive power is imported (>0) InteliMains-NT displays L (inductive) character of the load.
When reactive power is exported (<0) InteliMains-NT displays C (capacitive) character of the load.

Load

Active power consumed by Load is displayed in positive numbers e.g. 20kW.
When reactive power is positive (>0) InteliMains-NT displays L (inductive) character of the load.
When reactive power is negative (<0) InteliMains-NT displays C (capacitive) character of the load.

Genset

Generated active power is displayed in positive numbers e.g. 20kW.
When reactive power is positive (>0) IGS-NT displays L (inductive) character of the load.
When reactive power is negative (<0) IGS-NT displays C (capacitive) character of the load.

Volt/PF ctrl

AVRRegChar [POSITIVE / NEGATIVE]

Switch between AVR characteristic.
POSITIVE: When the controller and AVRi output voltage increases – generator voltage increases.
NEGATIVE: When the controller and AVRi output voltage decreases – generator voltage increases.
Hint:
When set to NEGATIVE, Binary outputs AVR Up and AVR Dn still work without inversion.

Voltage gain [%]

Gain of voltage control loop.
Step: 0,1 %
Range: 0,0 to +200,0 %

Voltage int [%]

Relative integration factor of voltage control loop. Increasing of integration value causes quicker response.
Step: 1 %
Range: 0 – 100 %
Hint:
Voltage gain and *Voltage int* setpoints are active (adjust AVR) when GCB is open to maintain the Nominal voltage or to match voltage during synchronizing. Voltage loop operates as well in single island operation.

PF gain [%]

Gain of power factor control loop.
Step: 0,1 %
Range: 0,0 – 200,0 %

PF int [%]

Relative integration factor of power factor control loop. Increasing of integration value causes quicker response.
Step: 1 %
Range: 0 – 100 %
Hint:
When any gain setpoint is set to zero, the corresponding control loop is switched OFF.
PF gain and *PF int* setpoints are active only when the gen-set runs parallel to mains.

VoltRegOut behavior in single-gen-set applications

Operation mode	Island		Parallel to mains	
Gen-set state	**Running, GCB opened**	**Loaded island GCB closed MCB opened**	**Synchronizing**	**Loaded in parallel GCB closed**
	Active loop: Volt gain, int;	Active loop: Volt gain, int;	Active loop: Volt gain, int;	Active loop: PF control

AVR DCout bias [%] (FV)

AVRi voltage output bias level. This is a basic voltage level of the output if there is no regulation loop active.
Step: 0,1 %
Range: 0 – 100,0 %
Force value possibility: Yes
Hint:
Real voltage level depends on AVRi outputs connection and output level potentiometer setting. Maximum range is ± 10 V.

TauVoltActuat [s]

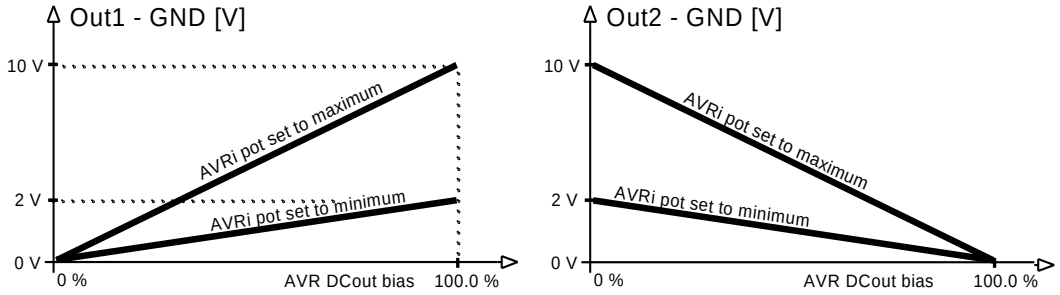
Time constant of the voltage regulator connected to the binary Up/Down outputs. This is to match the reaction of the controller‘s regulator with the actual reaction time of the voltage regulator.
Step: 0,1 s
Range: 1,0 - 300,0 s
Hint:
Use this for older generators where motorised potentiometer is used for voltage adjust to the AVR.

Volt/PF control adjustment

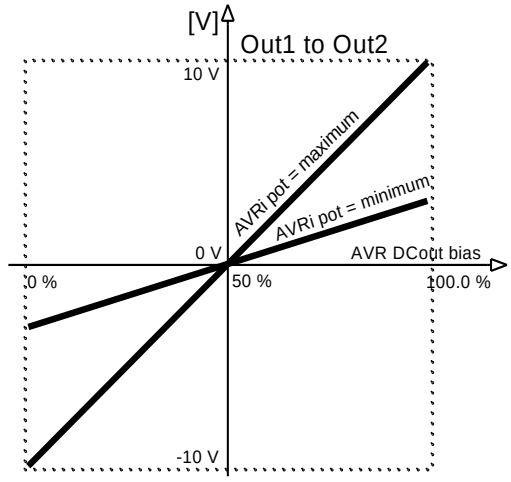
IG-AVRi output connection

Every time refer to corresponding AVR manual before interface connecting. Use no droop AVR.
IG-AVRi-TRANS (AC power supply for AVRi) has to be supplied from gen-set voltage.
AVRi outputs can be connected as symmetrical: OUT1-OUT2 or unsymmetrical OUT1-GND or OUT2-GND.

- Potentiometer on the AVRi defines maximal OUT1, OUT2 voltage range.
- Use symmetrical (OUT1,OUT2) AVRi output to connect the AVRi to AVR auxiliary voltage input.
- Use unsymmetrical output if an external AVR potentiometer has to be replaced with AVRi.
- AVRi output voltage should change generator voltage typically in range ± 10 % of Nominal voltage.
- For more details please refer to Application guide – chapter AVR interface examples.



AVRi Out1 or Out 2 to GND output voltage depends on AVRi trim setting



AVRi Out1 to Out 2 output voltage

AVRi output voltage

	Out1 - GND		Out2 - GND		Out1 – Out2	
Bias \ Pot	Min	Max	Min	Max	Min	Max
0 %	0	0	2	10	- 2 V	-10 V
50 %	1	5	1	5	0 V	0 V
100 %	2	10	0	0	+ 2 V	10 V

Voltage control adjustment

1) Set *Voltage gain*, *Voltage int* to zero and *AVR DCout bias* to 50%.
2) Start always with AVRi pot min adjustment (fully counterclockwise).
3) Start the gen-set in MAN Mode to nominal speed, without load.
4) Adjust generator voltage to nominal value by the potentiometer present on the AVR. If there is no potentiometer on the AVR, use *AVR DCout bias* to adjust the nominal voltage.
5) Change *AVR DCout bias* to 0% and 100% to check generator voltage control range (typically ± 10 % of nominal voltage). Adjust voltage control range by AVRi trim.
6) Set *AVR DCout bias* to be Nominal voltage on generator (50%).

7) When gen-set is running unloaded increase carefully *Voltage gain* to unstable point and then decrease value by 30 % to insure stable performance.
8) Adjust *Voltage int* (usually setting to 100% gives optimal performance).

Hint:
To judge optimal adjusting induce generator voltage jumps by *AVR DCout bias* change or by *Nominal voltage* change .

PF control adjustment

The genset should be cca 30 % loaded in parallel to mains and baseload mode.
1) Set the same values *PF gain, PF int* as in voltage control loop.
2) Set **Process control**: *Load ctrl PtM* = BASELOAD, *Base load* = 30 % of Nominal load, *PF ctrl PtM* = BASEPF, *Base PF* = 1.0.
3) Start and synchronize the gen-set in MAN Mode by pressing GCB ON/OFF
4) When running in parallel 30% loaded increase slowly *PF gain* to unstable point and then decrease value by 30 % to insure stable performance.
5) Adjust *PF int* (usually setting to 100% gives optimal performance).

Hint:
To judge optimal adjusting induce generator power jumps by *Base load* change or by soft changes of *AVR DCout bias*.

Force value

Force value 1-16 [X]

„Source“ setpoints containing the alternative values for selected „target“ setpoints. The setpoint with index X corresponds to the *ForceValueInXX*th function.

Hint:

As the “source” for Force value channel can be used any compatible value in the controller (in general all values and setpoints of types integer8,16,32). In that case the corresponding *ForceValueInXX* setpoint is unused on that channel.

ExtValue1LoLim [X]

ExtValue2LoLim [X]

ExtValue3LoLim [X]

ExtValue4LoLim [X]

ExtValueX low limit. The value is not decreased under this limit, even if the request still exists (via binary input ExtValueX down).

Step: 1 X

Range: -32000 – *ExtValueXHiLim* X

ExtValue1HiLim [X]

ExtValue2HiLim [X]

ExtValue3HiLim [X]

ExtValue4HiLim [X]

ExtValueX high limit. The value is not increased above this limit, even if the request still exists (via binary input ExtValueX up).

Step: 1 X

Range: *ExtValueXLoLim* – 32000 X

ExtValue1 rate [X/s] (FV)

ExtValue2 rate [X/s] (FV)

ExtValue3 rate [X/s] (FV)

ExtValue4 rate [X/s] (FV)

ExtValueX rate of change per second. If the binary input ExtValueX down or ExtValueX up is active, the value is changed according to this rate.

Step: 1 X/s

Range: 1 – 10000 X/s

Hint:

If binary input ExtValueXreset is active, the corresponding *ExtValueX* is held at its default value, regardless of the activity of inputs Up and Down and regardless of incoming external set commands.

Using this function in combination with Force value you can externally control selected setpoints’ values and achieve some special behaviour of the controller.

ExtValue1deflt [X] (FV)

ExtValue2deflt [X] (FV)

ExtValue3deflt [X] (FV)

ExtValue4deflt [X] (FV)

ExtValueX default (starting) value. If *ExtValueX* is changed from this default value using Modbus command, the new value is kept in *ExtValueX* until another command arrives or until the controller has been switched off. If the binary input ExtValueXreset is active, the *ExtValueX* is held at this value regardless of other conditions.
Step: 1 X
Range: -32000 – 32000 X

Load shedding

CurLdShedAct [DISABLED / ISLAND ONLY / ISL+TRIP PARAL / ALL THE TIME] (FV)

DISABLED Current Load shedding is switched off at all
ISLAND ONLY Current Load shedding is active only in island operation; before GCB closing all the LdShed outputs get closed; in parallel operation with mains is always switched off
ISL+TRIP PARAL The same functionality as ISLAND ONLY, but in additional it closes all the LdShed outputs during the power failure (=change from parallel to island operation); according to the Load in island operation it can be potentially reconnected beck
ALL THE TIME Current Load Shedding works only according to gen-set Power, it works without reference to operation type (island, parallel or any transitions)
Force value possibility: Yes

CurLdShedLvl [%] (FV)

When generator current in any phase exceeds this level for more than *Shed delay* time, controller proceeds to the next Load shedding stage - the next binary output Load shed x is closed.
Step: 1 % of *Nomin Current*
Range: *Ld recon level* - 200 % of *Nomin current*
Force value: Yes

CurLdRecLvl [%] (FV)

When gen-set current in all phases drops under this level for more than *Recon delay* time, controller proceeds to the lower Load shedding stage. The binary output for higher stage is opened (Load shed x). Automatic load reconnection works only when *AutoLd recon* = ENABLED.
Step: 1 % of *Nomin current*
Range: 0 - *Ld shed level*
Force value: Yes

FreqLdShedAct [DISABLED / ISLAND ONLY / ISL+TRIP PARAL / ALL THE TIME] (FV)

DISABLED Frequency Load shedding is switched off at all
ISLAND ONLY Frequency Load shedding is active only in island operation; before GCB closing all the LdShed outputs get closed; in parallel operation with mains is always switched off
ISL+TRIP PARAL The same functionality as ISLAND ONLY, but in additional it closes all the LdShed outputs during the power failure (=change from parallel to island operation); according to the Load in island operation it can be potentially reconnected beck
ALL THE TIME Frequency Load Shedding works only according to gen-set Power, it works without reference to operation type (island, parallel or any transitions)
Force value possibility: Yes

FreqLdShedLvl [%] (FV)

When generator frequency drops below this level for more than *Shed delay* time, controller proceeds to the next Load shedding stage - the next binary output Load shed x is closed.
Step: 1 % of Nomin freq
Range: 0 % of Nomin freq - Ld recon level
Force value: Yes

FreqLdRecLvl [%] (FV)

When generator frequency exceeds this level for more than *Recon delay* time, controller proceeds to the lower Load shedding stage. The binary output for higher stage is opened (Load shed x). Automatic load reconnection works only when *AutoLd recon* = ENABLED.
Step: 1 % of Nomin freq
Range: Ld shed level - 200 % of Nomin freq
Force value: Yes

Ld Shed delay [s] (FV)

Time delay for both current and frequency *LD shed level* limit.
Step: 0,1 s
Range: 0,0 – 600,0 s
Force value possibility: Yes

Ld recon delay [s] (FV)

The amount of time that the current/frequency has to be under/above *recon level* before the next part of the load is reconnected.
Step: 1 s
Range: 0 - 600 s
Force value: Yes

AutoLd recon [DISABLED / ENABLED] (FV)

Switch between manual and automatic reconnection of shedded load.
DISABLED Rising edge on this input resets controller to the lower stage, but only if the load is under the *Ld recon level*. *Ld recon delay* is not important in this case.
ENABLED Load reconnection is automatic and depends on setpoints *Ld recon level* and *Ld recon delay*. Binary input MAN load recon has no function.

Hint:
Load shadding contains 10 levels for connect/disconnect of Loads. Now only configured Load shedding levels are used in system. In case of configure Load shedding levels 2,3,4 – system will operate with Load shedding levels 1,2,3 and 4 only. Important is the highest number of configured level of Load shedding.

Timer settings

Timer channel 1-16

Defines the setting of particular timer channel.

There is 16 channels, each defines occurrence date and time (year, month, day, hour, minute), duration time (in minutes, maximum is 24*60), repeating period (day, week, month, once). In case of week – day of the week selection, when should be executed + selection of repeating (every 1st, 2nd, 3rd or 4th week); In case of month – day of the month selection (e.g. every 3rd day or every 2nd Monday)

Every channel can be disabled by blocking input. If blocking input is active then the timer is not activated even if it should be, according to it's other settings.
The channels are divided into groups of 4. Each group has independent binary output, which activates if any of the 4 channels within the group is active (1-4, 5-8,...). There is also one common output for all 16 channels.

Act. calls/SMS

History record [DISABLED / ENABLED] (FV)

Enables or disables active calls/SMS/mails to selected phone, mobile or mail address when a History record type “protection” occurs.
Force value possibility: Yes
Hint:
If enabled for an SMS type active call, an empty Alarmlist is sent, as this type of protection does not appear there.

Alarm only [DISABLED / ENABLED] (FV)

Enables or disables active calls/SMS/mails to selected phone, mobile or mail address when an Alarm only type protection occurs.
Force value possibility: Yes

Warning [DISABLED / ENABLED] (FV)

Enables or disables active calls/SMS/mails to selected phone, mobile or mail address when a Warning type protection occurs.
Force value possibility: Yes

Off load [DISABLED / ENABLED] (FV)

Enables or disables active calls/SMS/mails to selected phone, mobile or mail address when an Off load type protection occurs.
Force value possibility: Yes
Hint:
If enabled for an SMS type active call, an empty Alarmlist is sent, as this type of protection does not appear there.

BrkOpen&CoolDn [DISABLED / ENABLED] (FV)

Enables or disables active calls/SMS/mails to selected phone, mobile or mail address when a BrkOpen&CoolDn type protection occurs.
Force value possibility: Yes

Mains protect [DISABLED / ENABLED] (FV)

Enables or disables active calls/SMS/mails to selected phone, mobile or mail address when a Mains protect type protection occurs.
Force value possibility: Yes
Hint:
If enabled for an SMS type active call, an empty Alarmlist is sent, as this type of protection does not appear there.

Slow stop [DISABLED / ENABLED] (FV)

Enables or disables active calls/SMS/mails to selected phone, mobile or mail address when a Slow stop type protection occurs.
Force value possibility: Yes

Shutdown [DISABLED / ENABLED] (FV)

Enables or disables active calls/SMS/mails to selected phone, mobile or mail address when a Shutdown type protection occurs.
Force value possibility: Yes

AcallCH1..3-Type(FV)

Up to three separate channels are available for any of the following types of messages:
DISABLED: Channel is disabled.

DATA-ANA: Standard analog modem connection to monitoring SW.
DATA-GSM: Standard GSM modem connection to monitoring SW.
DATA-ISDN: Standard ISDN modem connection to monitoring SW.
DATA-CDMA: CDMA modem connection to monitoring SW.
SMS-GSM: Channel sends SMS message via GSM network. Only with GSM modem connected.
SMS-CDMA: Channel sends SMS message via CDMA network. Only with CDMA modem connected.
IB-E-MAIL: Channel sends E-mail. Only when IG-IB connected.
IB-EML-SMS: Channel sends E-mail in short format (SMS). Only when IG-IB connected.
Force value possibility: Yes

An Email contains
- header with serial number and application info
- Alarm list contents
- latest 20 History records (reason, date, time)

Example of EML-SMS:
```
AL=(Sd Water Temp,Wrn Water Temp,!Emerg Stop,ActCallCH1Fail)
```

Hint:
GSM modem must be connected to controller for Active GSM call or SMS.
IG-IB does not support direct SMS, just as an email.
Connected device type (Analog / GSM / ISDN / CDMA modem) is recognized automatically.

AcallCH1..3-Addr

Address for channel 1...3 active call. Each above message type has either a phone number or an e-mail address associated to it.

For more details see PC software guide chapter IG-IB Internet communication.

Hint:
To receive active call run InteliMonitor – Type of connection = Active call. Active call window contains list of received ANT files. Each list item contains *Gen-set name*, Date, Time, controller serial number.

NumberRings AA [ ]

Number of rings prior to answering the modem connection from PC to controller.
Step: 1
Range: 1 – 30
Hint:
NumberRings AA change is not accepted immedately but after controller is switched on or when modem is connected to controller.

ActCallAttempt [1 to 250]

When an active call is issued, this setpoint defines the number of attempts to deliver the message.
Step: 1
Range: 1 to 250
Hint:
Timeout for connection is 90 sec and after 120 sec controller starts the next attempt. During the time the controller is trying to issue an active call, incoming calls are blocked.

Date/Time

Time stamp act [DISABLED / ENGINE RUNNING / ALWAYS] (FV)

Defines the activity of time stamp function:
DISABLED No periodic records are made.
ENGINE RUNNING Records are made with period given by *Time stamp per* only if engine is running.
ALWAYS Records are made with period given by Time stamp per regardless of the engine state.
Force value possibility: Yes

Time stamp per

Time interval for periodic history records.
Step: 1 min
Range: 1 - 240 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.

#Time [HHMMSS]

Real time clock adjustment.

#Date [DDMMYYYY]

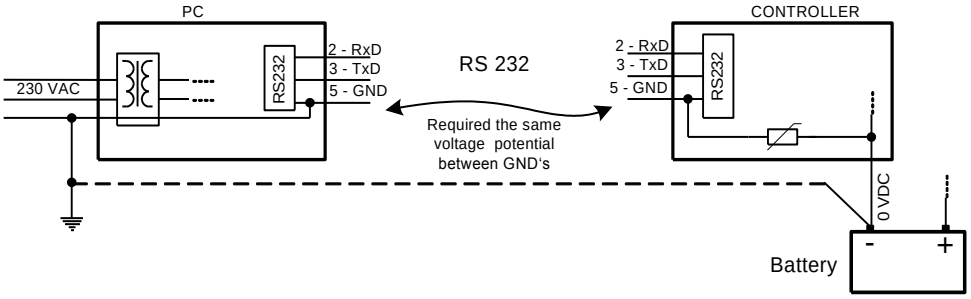
Actual date adjustment.
Hint:
#*Time* and #*Date* setpoints are synchronized via CAN bus each hour with the lowest address controller. #*Time* or #*Date* change in any controller changes Time or Date in all controllers on CAN bus.

Controller configuration and monitoring

IGS-NT istallation pack contains separate PC software tools: GenConfig (GC) and InteliMonitor (IM).
GC and IM is based on Windows 95/98/NT/ME/2000/XP or higher platform and requires approximately 5 Mbyte of hard disc free space.

Direct connection to the PC

IGS-NT controller can be connected directly with PC via RS232 or USB interface. Use the crossed RS232 or USB cable to connect PC with controller.
Hint:
Make sure the grounding system on controller and PC – COM port (negative of the PC DC supply) are identical – before the first direct connection. There must not be any voltage between these two points otherwise the internal PTC protection activates and interrupts RS232 communication. In such case disconnect RS232 line wait a minute for PTC recovery and try again. The simple solution is to assure, that the PC supply 240/20V is ground free (GND terminal is not connected).



GenConfig functions

- Extension modules addressing
- All I/O function or protection configuration
- Setpoints adjusting
- Sensor characteristics modification
- History record modification
- Password level protection modification (password value must be changed in DriveMonitor)
- Controller firmware (mhx file) upgrade
- Controller application file Up/Down load
- Language translator enables
  - Create Dictionary between two languages (Dictionary can be used repeatedly)
  - Translate current text in Controller (in any language)
  - Add new language (up to five)

Configuration steps

Following configuration steps are available in GenConfig software:
- Select Extension modules when more inputs and outputs are required
- Configure J1939 interface when Electronic engine is connected
- Configure Binary inputs as Protection or Function
- Configure Binary outputs
- Configure Analog inputs as Protection or Function
- Define user sensors
- Configure History record
- Configure password protection
- Add/Translate the language

InteliMonitor

Functions

- On-line direct, Modem or Internet single or multiple engine monitoring
- Active Modem or Internet call from the controller to PC (activated by selected Alarm)
- On-line or Off-line History record listing
- Setpoints listing and adjusting (password protected)
- Statistics value (e.g. Running hours) Set/Reset
- Password and Access code change

Modbus protocol

Standard protocol enables receive/transmit any data or command from a Master system:

- Direct connection: RS232, RS422, RS485
- Modem connection
- 9600, 19200, 38400 or 57600 bps, 8 data bits, 1 stop bit, no parity
- Transfer mode RTU
- Function 3 (Read Multiply Registers)
- Function 6 (Write Single Register)
- Function 16 (Write Multiply Registers)
- The response to an incoming message depends on the communication speed. The delay is not shorter than the time needed to send/receive 3 and ½ characters.

The complete description of Modbus communication protocol can be found in *Modbus Protocol Reference Guide PI-MBUS-300* and *Open Modbus Specification Release 1.0*. Both documents are available from web site at http://www.modicon.com/openmbus/ .

Hint:
Detail Modbus command description see in ComAp InteliCommunication guide.

Value and setpoint codes

Hint:
It is possible to export actual values, setpoints and history file on-line from the controller or off-line from the archive using InteliMonitor – Monitor – Export data… function.

Technical data

Hint:
Technical data of the controller and extension modules find in the IGS-NT-Installation guide-x.y.pdf.