MULTI-LINE 2
DESCRIPTION OF OPTIONS



Option T2
Digital AVR: DEIF DVC 310 - Leroy Somer D510C

- Description of option
- Functional description

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1. Delimitation

1.1 Scope of option T2

This description of options covers the following products:

AGC-4	SW version 4.50.x or later
AGC 200	SW version 4.51.x or later
GPC-3	SW version 3.10.x or later
DVC 310	SW version 2.50 or later
DEIF EasyReg	SW version 2.20 or later
Leroy Somer D510C	SW version 2.50 or later
Leroy Somer EasyReg	SW version 2.20 or later

2. General information

2.1 Warnings, legal information and safety

2.1.1 Warnings and notes

Throughout this document, a number of warnings and notes with helpful user information will be presented. To ensure that these are noticed, they will be highlighted as follows in order to separate them from the general text.

Warnings

Warnings indicate a potentially dangerous situation, which could result in death, personal injury or damaged equipment, if certain guidelines are not followed.

Notes

Notes provide general information, which will be helpful for the reader to bear in mind.

2.1.2 Legal information and disclaimer

DEIF takes no responsibility for installation or operation of the generator set. If there is any doubt about how to install or operate the engine/generator controlled by the Multi-line 2 unit, the company responsible for the installation or the operation of the set must be contacted.

The Multi-line 2 unit is not to be opened by unauthorised personnel. If opened anyway, the warranty will be lost.

Disclaimer

DEIF A/S reserves the right to change any of the contents of this document without prior notice.

2.1.3 Safety issues

Installing and operating the Multi-line 2 unit may imply work with dangerous currents and voltages. Therefore, the installation should only be carried out by authorised personnel who understand the risks involved in working with live electrical equipment.

Be aware of the hazardous live currents and voltages. Do not touch any AC measurement inputs as this could lead to injury or death.

2.1.4 Electrostatic discharge awareness

Sufficient care must be taken to protect the terminals against static discharges during the installation. Once the unit is installed and connected, these precautions are no longer necessary.

2.1.5 Factory settings

The Multi-line 2 unit is delivered from factory with certain factory settings. These are based on average values and are not necessarily the correct settings for matching the engine/generator set in question. Precautions must be taken to check the settings before running the engine/generator set.

3. Functional description - DVC 310 and Leroy Somer (LS) D510C

3.1 Start modes

The option T2 is able to handle two start modes:

- Normal start
- Close before excitation (CBE)

3.1.1 Normal start

Excitation is activated at start-up. Normal start is obtained when close before excitation is disabled in menu 2254. During a normal start, the start-on threshold function will be used, and the soft-start function will also be used.

3.1.2 Close before excitation (CBE)

Excitation is applied after the genset is started up and the breaker is closed. Close before excitation is enabled in menu 2254.

Normally with an analogue AVR, switching on/off the excitation is controlled by a relay output from the AGC to the AVR. When excitation is switched on, the rate of voltage build-up is controlled solely by the AVR. Using the DVC 310 or the LS D510C provides the possibility of switching the excitation on/off without the use of a relay output. Furthermore, the rate of voltage build-up is automatically configured via menu 2262 as part of the existing setup of close before excitation.

The settings for close before excitation are described in the AGC Designer's Reference Handbook. When doing close before excitation with the DVC 310 or the LS D510C, it is possible to apply a little excitation current before voltage build-up. The excitation will be applied after the breaker is closed.

The purpose of applying the excitation current is to couple the generators tighter together before initiating the voltage build-up. Note that if the excitation current reference is set to high, and voltage generated at that state in the close before excitation sequence exceeds 30 % of nominal voltage, the close before excitation sequence will be aborted. During a CBE sequence, the start-on threshold function will be used and the soft-start function will also be used. The soft-start timer is not the same for the CBE sequence and a normal start. These are two separate timers/angles, which can be adjusted individually.

Menu	Description	Comment
7792	Iexc Ref. CBE	Excitation current reference for close before excitation

It is recommended to have zero or a low value in this parameter when doing CBE.

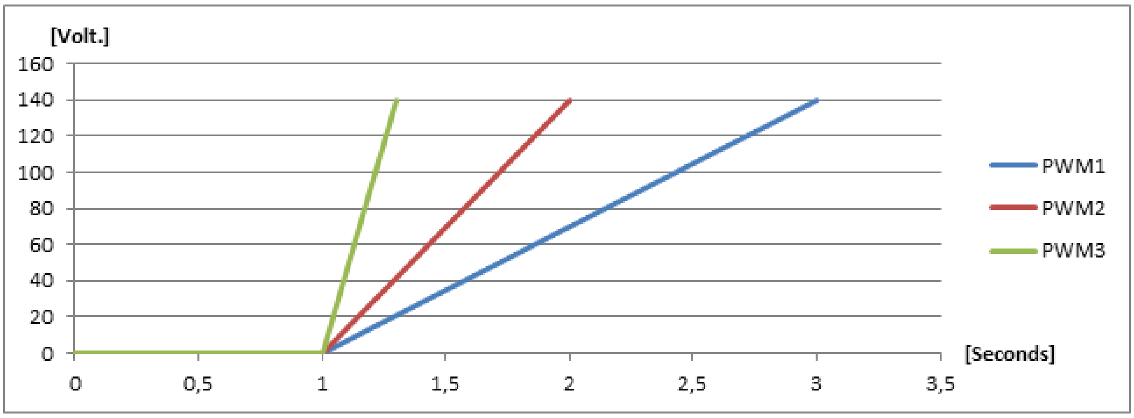
CBE is not possible for GPC-3.

3.2 Excitation ramp

During start-up of a generator, the curve can have different characteristics. During each start, the start-on threshold function and the soft-start function will make a part of the characteristic for the excitation. If the generator is used with CBE, the characteristics will be different from a normal start. But in the normal start as well as the CBE start, the start-on threshold and soft-start is used. Be aware that there are different soft-start timers for normal start and for CBE start.

3.2.1 Start-on threshold

The first part of the excitation ramp is called the start-on threshold. The relevant parameters for start-on threshold are located in menus 7751 and 7752. Here it is possible to set the upper limit and a PWM output. The upper limit determines when the soft-start function takes over. As a default, this value is set to 100 V. This means that the start-on threshold is the excitation ramp from 0 V_{ac} to default 100 V_{ac}. The PWM output decides how steep the slope for the excitation is. When setting the PWM higher, the excitation slope will be steeper/more aggressive. The graph below shows an upper limit for the start-on threshold of 140 V_{ac}. Only the PWM is changed:



When the upper limit for the start-on threshold is changed, the start point for the soft-start is also changed. The upper limit for start-on threshold is always the start point for soft-start.

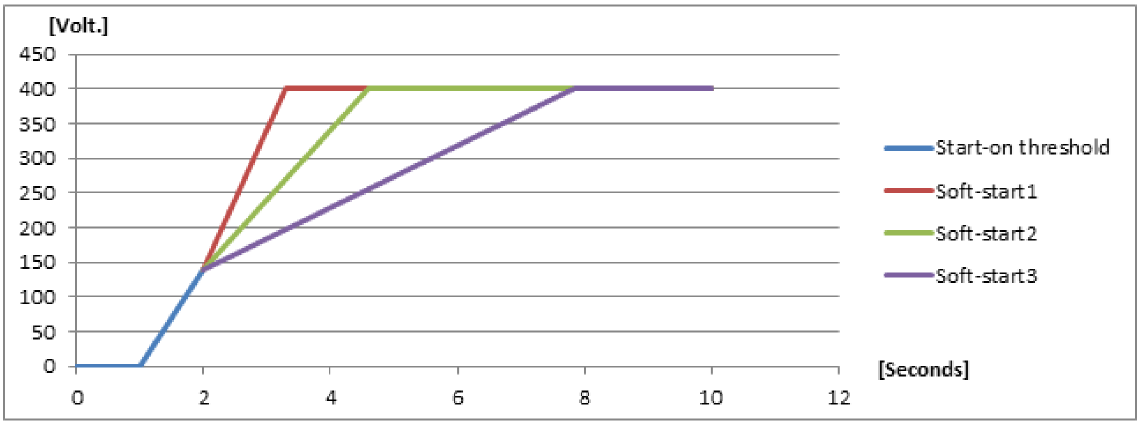
The relevant parameters for start-on threshold are shown in the table below:

Menu	Description	Comment
7751	PWM	This setting defines the slope of excitation during start-on threshold
7752	Start-on threshold set point	This setting defines the upper limit for the start-on threshold

3.2.2 Soft-start

When the upper limit of the start-on threshold function has been reached, the soft-start function will be initiated. The soft-start is used from the point of the upper limit of start-on threshold until the nominal voltage has been reached. In the soft-start function, only a timer is available; this is found in parameter 7753. The timer defines how long time it should take for the soft-start to increase the voltage from 0 to nominal voltage. So, if the timer is set to 5 seconds, for example, and the start-on threshold is set to 120 V_{ac} and the nominal voltage is 400 V_{ac}, the soft-start will be active for 3.5 seconds. The calculation will be like this:

$$Duration\ of\ soft-start = \frac{(Nominal\ voltage) - (Start-on\ threshold\ voltage)}{Nominal\ voltage} * timer\ for\ soft-start$$



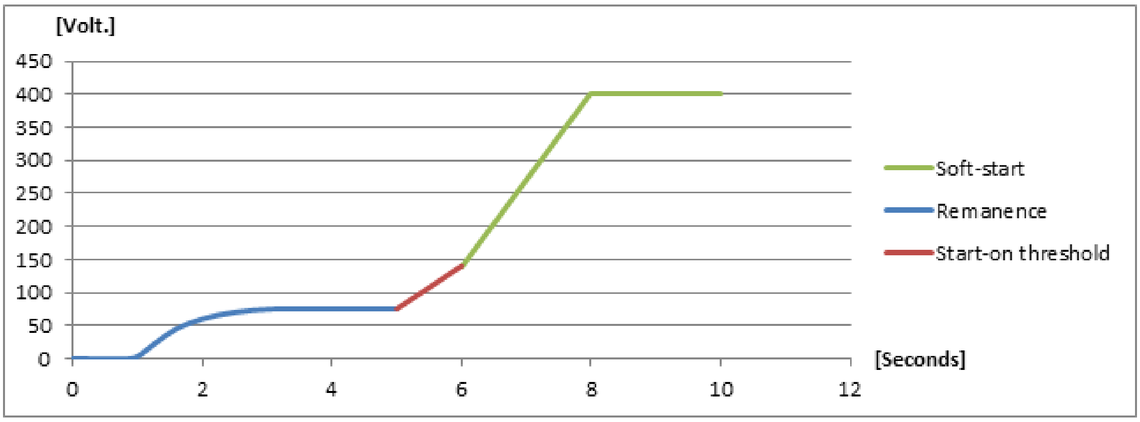
The graph above shows three different settings in the soft-start. The first timer is set to 2 seconds, the second to 4 seconds and the last to 9 seconds. Since the start-on threshold stops at 140 V_{ac}, the duration of soft-start is not corresponding to the timer set in the soft-start parameter. The timer will instead indicate an angle for the soft-start. In this case, the duration for the first soft-start will be 1.3 seconds, the second will be 2.6 seconds and the last will be 5.85 seconds. If the wanted duration of the soft-start is known, the timer to set in the parameter can be calculated instead:

$$Timer\ for\ soft-start = \frac{Nominal\ voltage}{(Nominal\ voltage) - (Start-on\ threshold\ voltage)} * Duration\ of\ soft-start$$

Menu	Description	Comment
7753	Soft-start timer	Defines the angle of the excitation during soft-start in a normal start

3.2.3 Excitation during CBE

During a CBE sequence, the excitation ramp will look different from the curves in the normal start. The start-on threshold will be inhibited until the timer in parameter 2252 has run out. The timer in 2252 decides how long it should take before the excitation from the AVR begins. The generator is able to build up some voltage because of the remanence in the rotor of the alternator. The CBE excitation curve will have a characteristic as shown below:



The soft-start timer in CBE is not the same as the soft-start timer in normal start, but the start-on threshold parameters are the same as in the normal start. Having different settings for the soft-start gives the possibility to have for example a more aggressive excitation ramp for CBE sequences. The timer for the soft-start in CBE is located in parameter 2262. Note that this timer is different from the one in normal start.

Menu	Description	Comment
2252	Timer for initiation of the start-on threshold	This timer is started when a running feedback is detected
2262	Soft-start timer for CBE	Defines the angle of the excitation during a CBE sequence. Only used in CBE, not during normal start

3.3 Stator current limitation

DVC 310 and LS D510C provide the possibility of limiting the stator current. This can be used when applying inductive loads drawing large in-rush currents such as transformers and inductive motors. The function can be controlled through the Multi-line 2 unit. At normal operation, the AVR will have the voltage as set point. When stator current limitation is active, the AVR will instead keep the current as reference and let the voltage drop, until the voltage will rise to a certain point again.

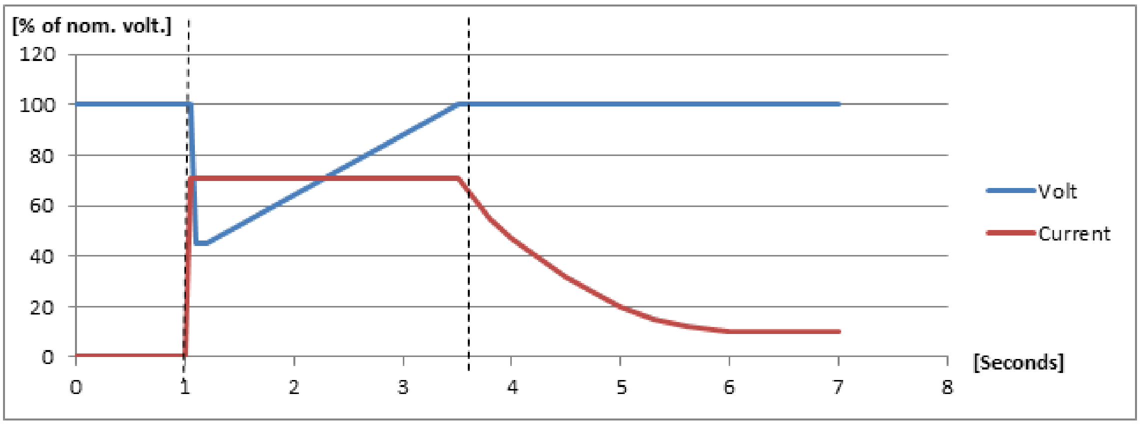
Activating current limitation in the Multi-line 2 unit is done in menu 7795 where you have the following three possibilities:

- Off
- Transformer magnetisation
- Inductive motor starting

The selection of stator current limitation is also available through M-Logic. When transformer magnetisation is selected, the inductive motor starting function is also enabled.

3.3.1 Transformer magnetisation

If transformer magnetisation is activated, it will be active every time the generator breaker is opened. When the breaker closes, the current will rise fast. When the function is enabled, the current will only rise to a point defined in parameter 7793. The AVR will regulate with the current as set point. This parameter indicates a percentage of the nominal current for the genset. The AVR will then let the voltage drop and keep the current at a constant level. The voltage will then start to rise, and when it reaches its nominal voltage the AVR will instead regulate with the voltage as set point again. The current will then decrease again. When the current has decreased to a level of 5 % below the current limitation, the transformer magnetisation function is not active any more. The transformer magnetisation will not be activated again until the generator breaker has been opened. If the genset is closing the breaker towards a busbar with live voltage, the transformer magnetisation function will be deactivated as soon as the breaker is closed, because then the transformer will already be magnetised. A typical passage with the transformer magnetisation function can look like this:



The first dotted line shows when the generator breaker closes. The second dotted line shows when the transformer magnetisation function will be deactivated. (5 % below the current limitation set point set in menu 7793).

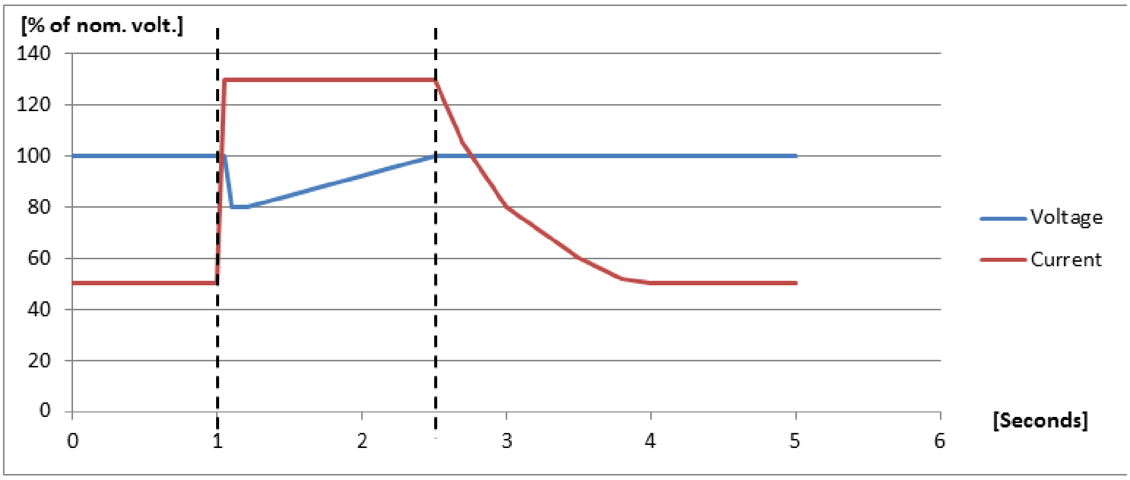
Menu	Description	Comment
7793	Current limitation for transformer magnetisation	This setting is in percentage of the nominal current of the generator which is set in the AGC menu 6003, 6013, 6023 or 6033. This depends on which of the nominal sets of values is activated
7795	Enable	Activating transformer magnetisation function

AGC only: Settings in the menus 7793 and 7795 are treated as a common set point among the AGC DG units in power management applications.

3.3.2 Inductive motor starting

The inductive motor starting function is very similar to the transformer magnetisation function. The main difference is that the transformer magnetisation is only active when the generator breaker has just been closed, whereas the inductive motor starting function is active all the time the genset is running and the generator breaker is closed, and the function is enabled. If a heavy inductive load is turned on, the current from the generator will rise, which gives a risk of tripping an over-current protection. To avoid tripping the over-current protection, the DVC 310 and LS D510C are capable of limiting the current by dropping the voltage instead. By lowering the voltage, the power produced from the genset is also reduced, which means a lower risk of tripping from an over-power protection.

A typical passage with the inductive motor starting function is shown below:



When the inductive load is turned on, the current will rise. The inductive motor starting function will limit the current to the predefined level set in parameter 7794. The AVR will change to have the current as set point and let the voltage drop. When the voltage reaches the nominal value again, the AVR will change to regulate with the voltage as set point again.

Menu	Description	Comment
7794	Current limitation for the inductive motor starting	This setting is in percentage of the nominal current of the generator which is set in the AGC menu 6003, 6013, 6023 or 6033. This depends on which of the nominal sets of values is activated
7795	Enable	Activating inductive motor starting function

AGC only: Settings in the menus 7794 and 7795 are treated as a common set point among the AGC DG units in power management applications.

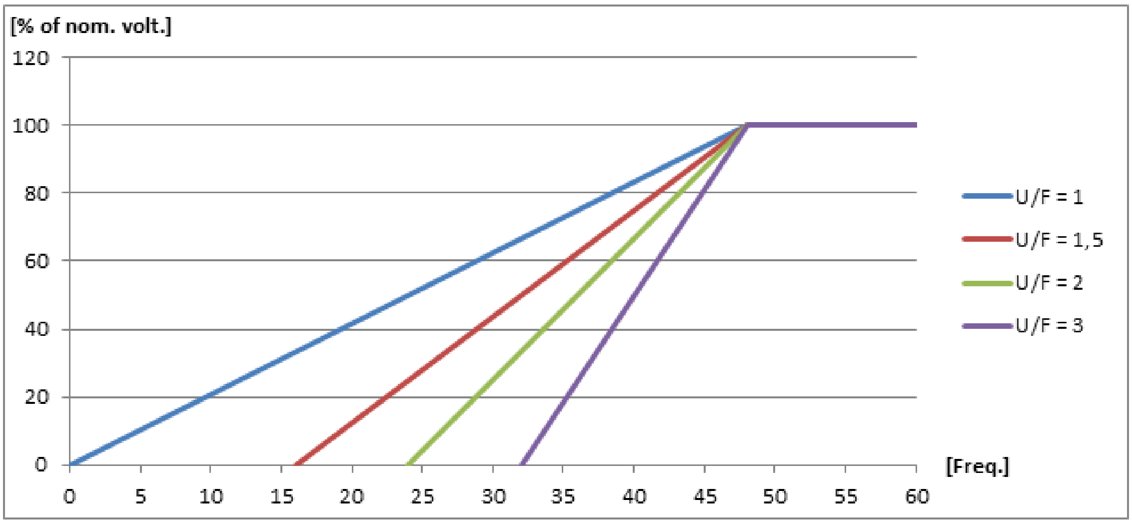
The inductive motor starting function is not active when the generator is parallel to the mains.

3.4 Operation modes

3.4.1 U/f (knee function)

The U/f law determines the voltage reference/set point used by the DVC 310 and LS D510C depending on the frequency. The knee function is used to ensure that the genset does not reach its cutout limit. Some gensets are restricted to cut out when reaching 40 Hz, for example. This limit can be reached at heavy loads. If the dive in frequency is below the genset's cutout limit, the genset will be forced to stop. The knee function allows the voltage to droop and by this reduce the torque on the engine, so the frequency can be kept above the cutout limit. This function will not work with load that determines constant power, such as frequency converters and UPS installations. But it will work with for example electrical motors and electrical heaters where the voltage can be reduced. The knee function determines how much the AVR should droop the voltage compared to the frequency drop at big loads. It is possible to configure at which frequency the knee point should be, and this is set in parameter 7771. Below the knee point, the AVR will let the voltage drop. The slope of how much the voltage should drop compared to the frequency can be set in parameter 7772.

The changes on the U/f slope are shown in the graph below. The knee point is held constant in all of them. The graph shows how much the AVR will regulate down in nominal voltage:



The knee point determines when the knee function is active. When the frequency goes below the knee point, the U/f law defines a temporary voltage set point for the AVR.

The U/f can also be calculated instead. This is best explained by an example:

A genset has the nominal voltage of 400 V_{ac}, the knee set point is set to 48 Hz. The genset will cut out at 40 Hz, and the breaker will open at 350 V_{ac}. The calculation for the U/f slope will be like this:

$$U/F = \frac{100 - \left(\frac{Minimum\ voltage}{Nominal\ voltage} * 100\right)}{Knee\ setpoint - Cutout\ limit}$$

For this example, the calculation will be like this:

$$U/F = \frac{100 - \left(\frac{350}{400} * 100\right)}{48 - 40} = 1{,}56$$

So the U/f can now be set to either 1.5 or 1.6.

The knee function is set up in the parameters shown below:

Menu	Description	Comment
7771	Knee set point	This setting is in percentage of the nominal frequency of the generator, which is set in the Multi-line 2 unit menu 6001
7772	U/f var. slope	Variable slope for U/f

The voltage regulator of the Multi-line 2 unit is forced into manual mode in case frequency drops below knee set point.

Voltage reference is limited by U/f law at any time.

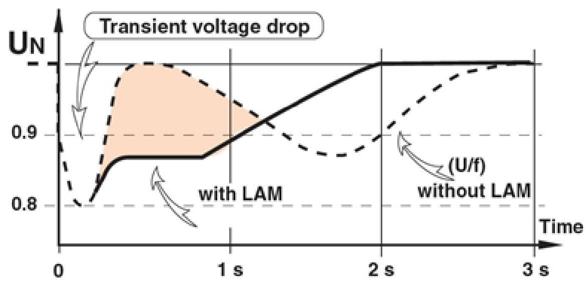
AGC only: Settings in the menus 7771 and 7772 are treated as a common set point among the AGC DG units in power management applications.

The functionality is automatically disabled by the Multi-line 2 unit when operating parallel to mains.

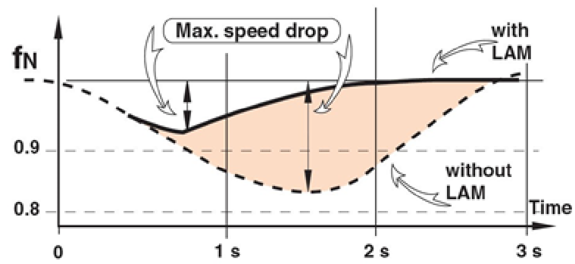
3.4.2 Load acceptance module (LAM)

The DVC 310 and LS D510C support LAM, which is a functionality to optimise transient performance of frequency when high load steps are applied. This is achieved by dropping the voltage reference momentarily when the frequency drops below the knee point. In this way the torque demand on the engine is reduced momentarily. Afterwards, the voltage is raised slowly (according to the soft voltage recovery setting) towards the voltage reference defined by the U/f law. The LAM function can be used to gain more stability in the regulation when a big load impact has been experienced. The percentage set in the LAM function defines how many percent the voltage is allowed to drop, as soon as the knee point is reached.

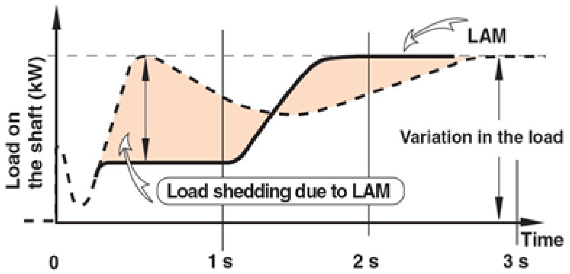
A comparison of U/f and LAM system performance is shown below:



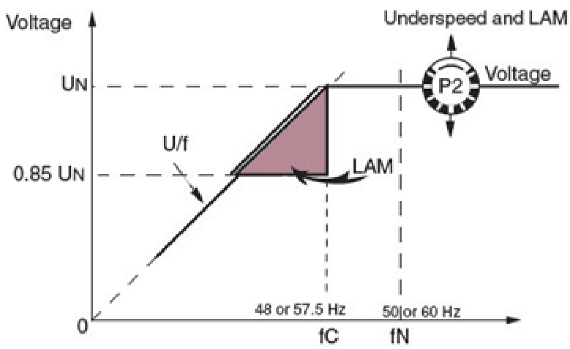
In the graph above, a comparison is made with and without the LAM function. Without the LAM function, the voltage may get unstable at load impacts. Here it is only the U/f law from the knee set point function that determines the voltage set point. With the LAM function, it is allowed to drop the voltage for a short time. The LAM function will start to ramp up the voltage when the frequency is starting to ramp up again. The slope of the ramp up of the voltage is controlled by the soft voltage recovery function, which will be described later.



The graph above shows that with the LAM function, the frequency will rise and stabilise faster after a big load impact. This is because the LAM function will drop the voltage and by this lower the torque on the engine.



The graph above shows a comparison of the load on the shaft of the engine, with the LAM function enabled and disabled. When the LAM function drops the voltage, the torque on the shaft is lightened, which makes it possible for the engine to rise faster in RPM after a load impact. This also gives the possibility to steadily reach nominal values faster after the load impact, since the LAM function will give more stability.



The graph above is very similar to the U/f law graph. The difference is that a triangle is marked here. When the LAM function is enabled, the genset is allowed to be inside the marked area. When having the U/f law, the AVR will never cross the U/f law line in the graph, but will always seek to be near it. When the genset is above the knee set point, the AVR will regulate up to the nominal voltage instead. But as long as it is in the marked area (triangle), the AVR will have the U/f law to determine the voltage set point.

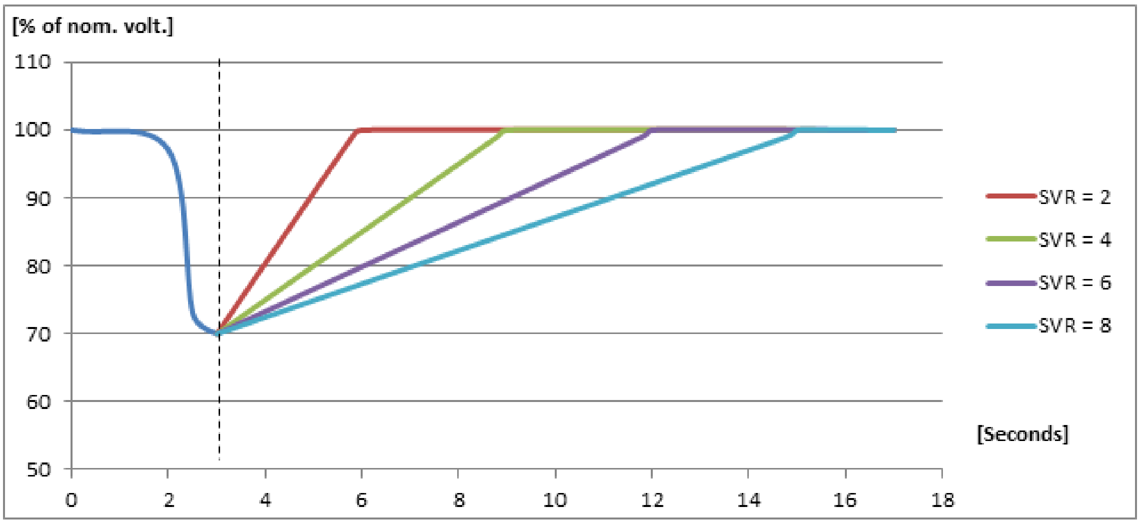
Menu	Description	Comment
7775	Adjust LAM	How much the voltage is dropped immediately when below the knee set point
7776	Enable	Activating LAM

AGC only: Settings in the menus 7775 and 7776 are treated as a common set point among the AGC DG units in power management applications.

The functionality is automatically disabled by the Multi-line 2 unit when operating parallel to mains.

3.4.3 Soft voltage recovery (SVR)

Soft voltage recovery (SVR) is a function that helps the genset return to its rated speed after experiencing a load impact. This is done by gradually increasing the voltage towards the voltage defined by the U/f law. The SVR is activated when the frequency drops below the knee point and an increase in frequency is detected. The setting for the SVR function defines the slope for the voltage recovery after a load impact. The SVR setting in parameter 7773 defines how many seconds the voltage should take to recover to nominal voltage from a 10 Hz load impact.



In the graph above, different SVR settings are shown at 15 Hz load impact. The dotted line represents the point where the frequency is starting to recover again. When the frequency starts to recover, the SVR function will be activated. When the genset is exposed to a 15 Hz load impact and the SVR setting is 4 s/Hz, the voltage will be recovered in 6 seconds. But the U/f law can still not be passed, which can make the SVR longer than for example 6 seconds. This can happen if the engine is not fast to recover in RPM from a load impact.

Menu	Description	Comment
7773	Soft voltage recovery	Time in seconds for recovery of voltage after a 10 Hz downstep
7774	Enable	Activating SVR

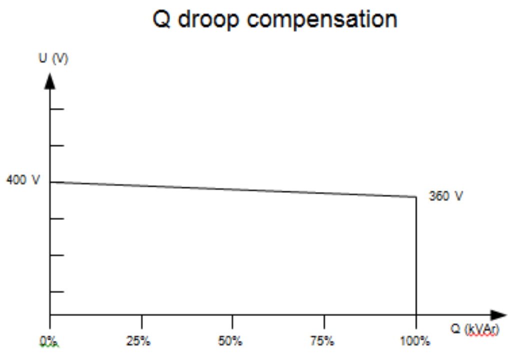
The voltage regulator of the Multi-line 2 unit is forced into manual mode in case SVR activates. Regulation is activated again when the SVR timer runs out.

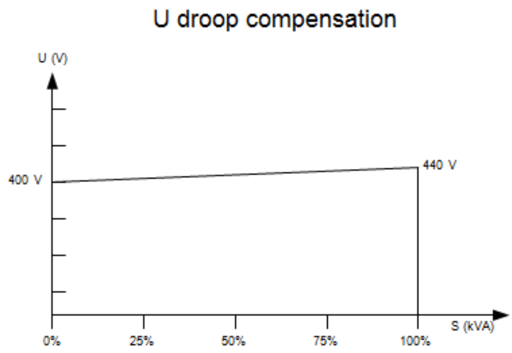
AGC only: Settings in the menus 7773 and 7774 are treated as a common set point among the AGC DG units in power management applications.

The functionality is automatically disabled by the Multi-line 2 unit when operating parallel to mains.

3.4.4 Droop compensation

Two types of droop compensation are supported by the DVC 310 and LS D510C: Reactive droop and voltage line droop. They can be controlled via the Multi-line 2 unit.





The droop compensation decides how much the voltage is allowed to droop if the regulation is turned off in the Multi-line 2 unit. The regulation can be turned off by setting the Multi-line 2 unit into MANUAL. The regulation can also be off if the CAN bus cables should break. With the droop, it is possible to give the AVR a set point for the voltage if an error in the CAN bus lines should occur. This makes it possible for the genset to share the reactive load when no interfacing is available.

It is recommended that the U droop compensation is not turned on when interfacing the AVR with a Multi-line 2 unit. These functions will try to work in opposite directions, which may cause instability.

All settings for droop are found in menu 7780 - DAVR Droop.

Menu	Description	Comment
7781	Q droop comp.	The Q droop value in percent
7782	U droop comp.	The U droop value in percent
7783	Droop comp. type	Select the type of droop: OFF Q droop compensation U droop compensation

AGC only: All settings in the menu 7780 are treated as a common set point among the AGC DG units in power management applications.

The functionality is automatically disabled by the Multi-line 2 unit when operating parallel to mains.

Only one of the droop functions can be active.

3.5 Genset modes

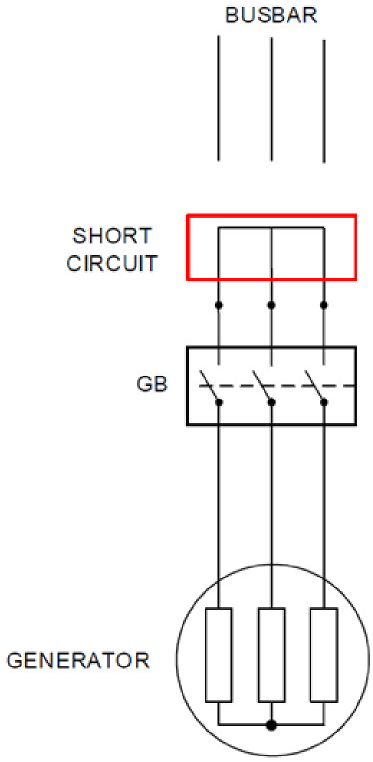
The option T2 gives two new genset modes, which are available in menu 6070 - Genset mode:

- Dry alternator
- Ventilator

3.5.1 Dry alternator

The purpose of the dry alternator is to dry the windings in the generator before use. The reason for drying the windings is to prevent the winding insulation from being degraded due to moisture in the generator. External heat sources can be used to vaporise the moisture, but the DVC 310 provides the possibility of using the engine to dry the windings instead. It is done in this way:

1. Make a short circuit of the busbar, meaning that when the GB closes, the generator will supply a short circuit. In menu 7791 it is possible to type in a set point for excitation current, meaning that if the set point is set to 0.1 A, the DVC 310 will supply 0.1 A excitation current. This will result in much higher current in the stator, and the heating from the stator current will dry the windings.



2. Choose Dry alternator mode in menu 6071. Start the genset in semi-auto mode and close the GB. When the windings are dried out, open the GB and stop the genset.

3. Now the latest genset mode should be selected again in menu 6071. Start the generator again and close the GB. Now the DVC 310 will slowly raise the excitation current. If the voltage is not raised, the Multi-line 2 unit will make a shutdown, because it means that the short circuit is not removed.

Menu	Description	Comment
7791	Iexc Ref. DA	In this menu the excitation current reference for dry alternator is set

If the generator is not supplied with a PMG, AREP or shunt for the power input on the DVC 310, another power supply is needed.

3.5.2 Ventilation

The purpose of ventilation is to remove humidity before use. It is done in this way:

1. Select Ventilation mode in menu 6071.
2. Start the genset in semi-auto mode with open GB, and the generator will be ventilated by fan air. The excitation current will be 0 A.
3. Now the latest genset mode should be selected again in menu 6071.

Ventilation mode and Dry alternator mode is not possible for GPC.

4. Protections

4.1 Alternator protections

The DVC 310 features some protections for the alternator. The protections are set up from the EasyReg software. The following chapters will provide functional descriptions of the protections.

4.1.1 Voltage loss detection

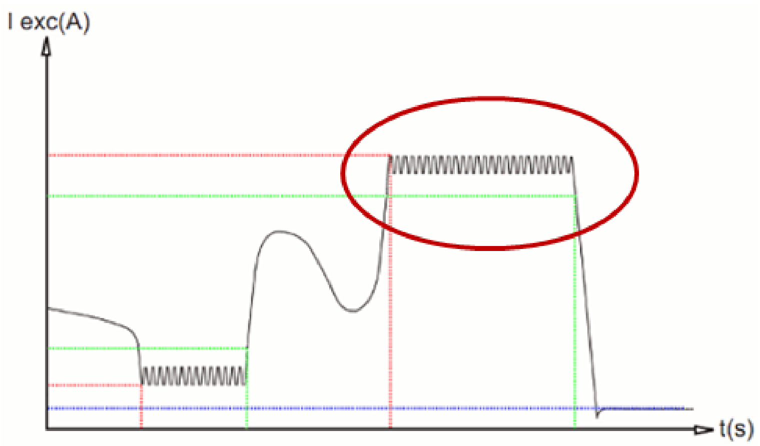
The DVC 310 is able to shut down the excitation if a loss of voltage sensing is detected in 1 second. The reason for shutdown of the excitation is that the DVC 310 does not have a voltage reading to regulate by. This is to protect the alternator from overheating the windings, and also to protect the equipment from overvoltage when operating in island mode.

The loss of voltage detection alarm will be triggered when the measured voltage is below 40 % of the set point. Note that the set point may vary, following the U/f rule.

This detection is made in configuration 1ph as well as 3ph. If configured in 3ph, the voltage considered for the alarm is the average global voltage.

4.1.2 Excitation current run limitation/shutdown excitation

This protection is to ensure that the excitation of the alternator does not exceed the upper limit. The upper limit is shown in the graph below.

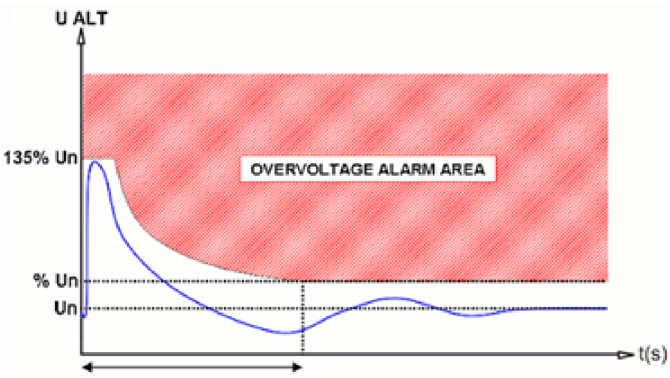


If the genset is supporting a very inductive load, the voltage on the alternator windings can be very high, even though nominal voltage is measured on the terminals. This protection contains three parameters, which can all be found in the EasyReg software.

The first parameter (Iexc run limitations) determines how much excitation is allowed before a timer starts. The second parameter (Iexc reset limitation) determines how much the excitation has to drop to stop the timer. By default, the timer is 10 seconds and cannot be changed. If the timer expires, the excitation will be turned down to the current set in the third parameter (Iexc shutdown). This protection is used for thermal protection of the windings in the alternator. These settings can all be found in the EasyReg software, which will be described later.

4.1.3 Over-voltage protection

This protection is to prevent the alternator from running with high voltage over a long period of time. The timer and the limit are set in the EasyReg software. The curve for over-voltage characteristic can only be changed when customised configuration is chosen. The mentioned curve for the over-voltage protection is shown below.



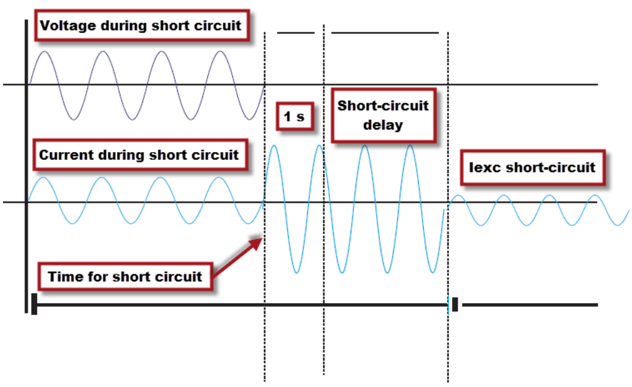
4.1.4 Diode fault

The DVC 310 is able to:

- measure on the excitation circuit in the alternator and thus ensure that all diodes are working normally
- measure the ripples for the excitation and thus detect faulty diodes
- switch off the excitation if it detects a diode fault
- send alarms through the CAN bus communication when it detects a diode fault

4.1.5 Short circuit

If the DVC 310 detects that the voltage disappears and the phase current exceeds 2 times nominal, the DVC 310 will see this as a short circuit. From the point when the voltage disappears, a one second timer is started. The DVC 310 has a short-circuit protection, which uses two parameters. The first parameter (short-circuit delay) determines how long a new timer should be active, before the excitation is shut down to a predefined level (Iexc short circuit). The short-circuit protection is shown in the graph below.



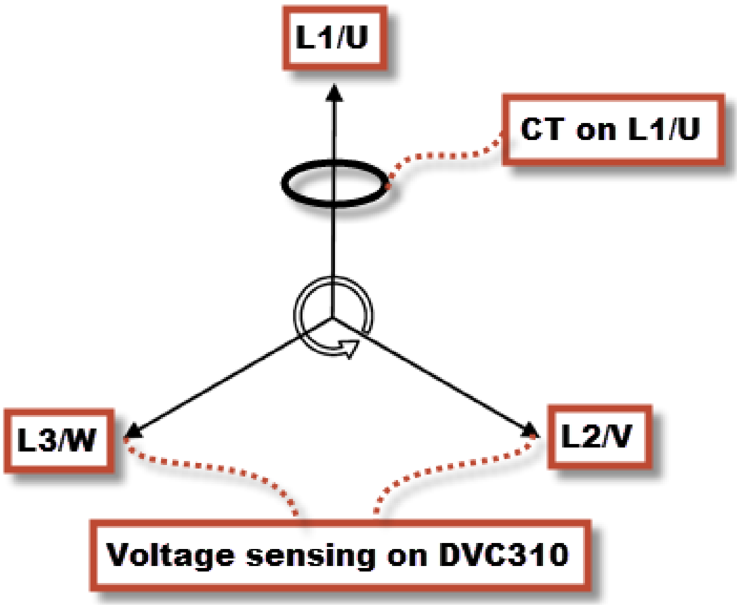
5. Options

5.1 DVC 310 options

The DVC 310 features some options that do not necessarily have to be activated. These options are described in the following chapters.

5.1.1 Single phase operation/CT phase correction

The DVC 310 is able to perform single phase operation, which means that it is able to measure the voltage on two of the phases and the current on only one phase. The DVC 310 will need some information to do this. The voltage sensing will have to be done with L2 and L3. The current transformer will then have to be mounted on L1, with P1 facing the AVR. The vector diagram of the installation looks like this:



The DVC 310 will need to know the correction in degrees between the voltage sensing and the current measurement. In this example, the correction will be 90 degrees, which can be set in the EasyReg software.

5.1.2 IN, IN/2 or IN/4 sensing

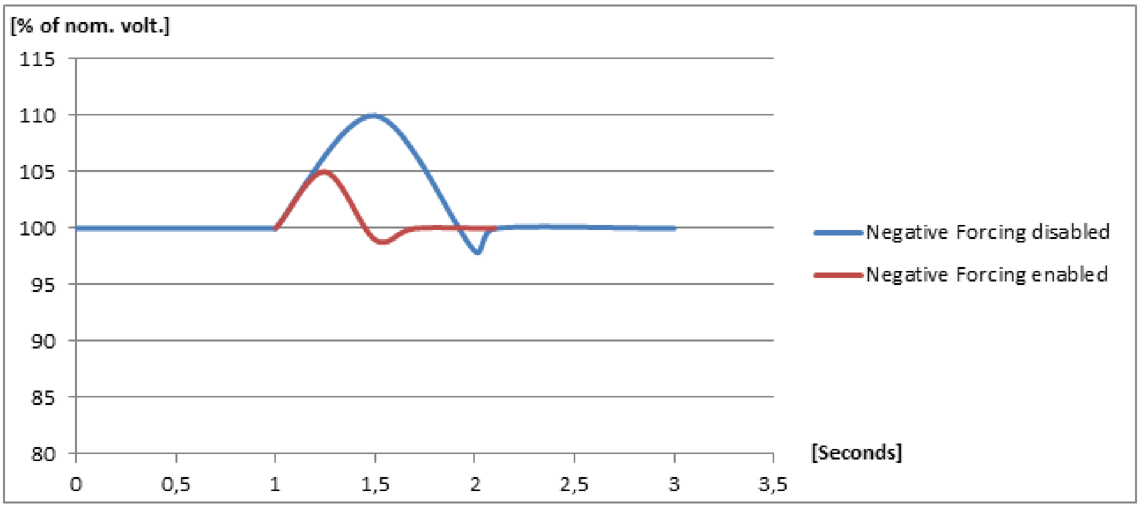
On some Leroy Somer alternators, the current transformers can be mounted inside the alternators. The DVC 310 will need to be programmed for this configuration. The DVC 310 can be set to IN, IN/2 or IN/4 sensing from the options menu, in a new configuration. When IN is selected, it means that the CT measures the full current; when IN/2 is selected, it means that the CT measures half of the full current; and when IN/4 is selected, the CT measures one fourth of the full current.

5.1.3 External power module

This function will allow the DVC 310 to regulate on an inverter or a bigger AVR. If the external power module is activated, the excitation power supply circuit will be shut off. This function is not finished yet, and if it is switched off, the excitation will be shut off.

5.1.4 Negative forcing

The negative forcing function enables the DVC 310 to reverse the excitation because of the principle with two transistors instead of one. It allows to have reversed voltage at the output (field excitation), because the two transistors are in parallel and upside down. This function can be useful if the DVC 310 is placed in an application where big loads are turning off. When shutting off a big load, the voltage may increase. By reversing the excitation for a moment, the nominal voltage will be recovered faster. In the graph below it is shown with the negative forcing function enabled and disabled.



5.1.5 VBus compensation

This function is used to compensate for the deviations in voltage, to which the excitation circuit can be exposed. If the excitation circuit's supply voltage is lower for a moment, the excitation current will also be lower at this time. The PID controller must then be slightly more aggressive to raise the excitation current again. On the other hand, if the excitation circuit's supply voltage is higher than normal, the PID controller must be passive to make sure the excitation will match the nominal voltage.

6. Regulation

6.1 DVC 310 regulation functions

6.1.1 Average and true RMS regulation

In the DVC 310, it is possible to make a selection between Average and True RMS regulation. This makes it possible to choose how the DVC 310 should manage the voltage readings. If the DVC 310 is mounted in applications with much harmonic distortion, the regulation should be switched to True RMS regulation. Otherwise, the setting should be Average regulation.

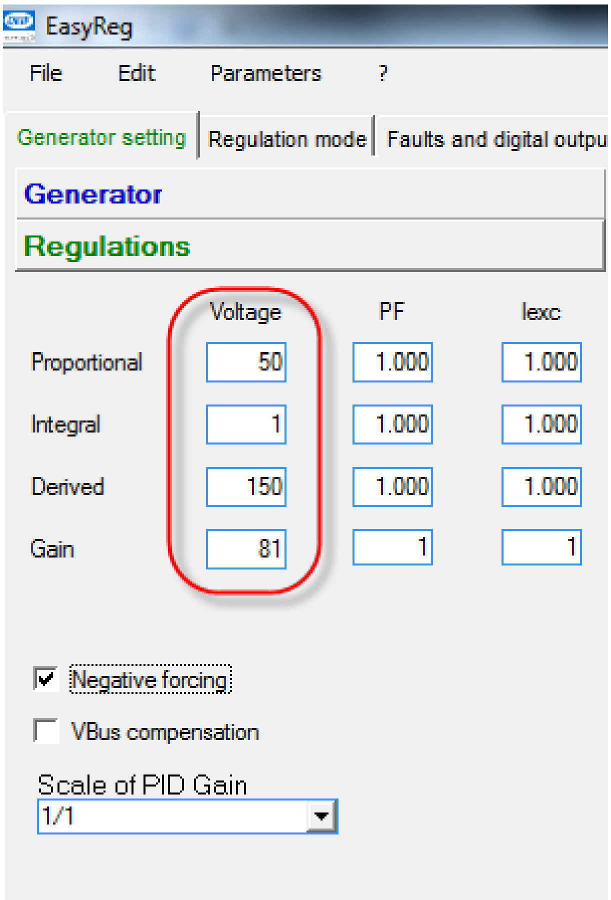
True RMS can only be used with 1-phase measurement.

6.1.2 PID settings

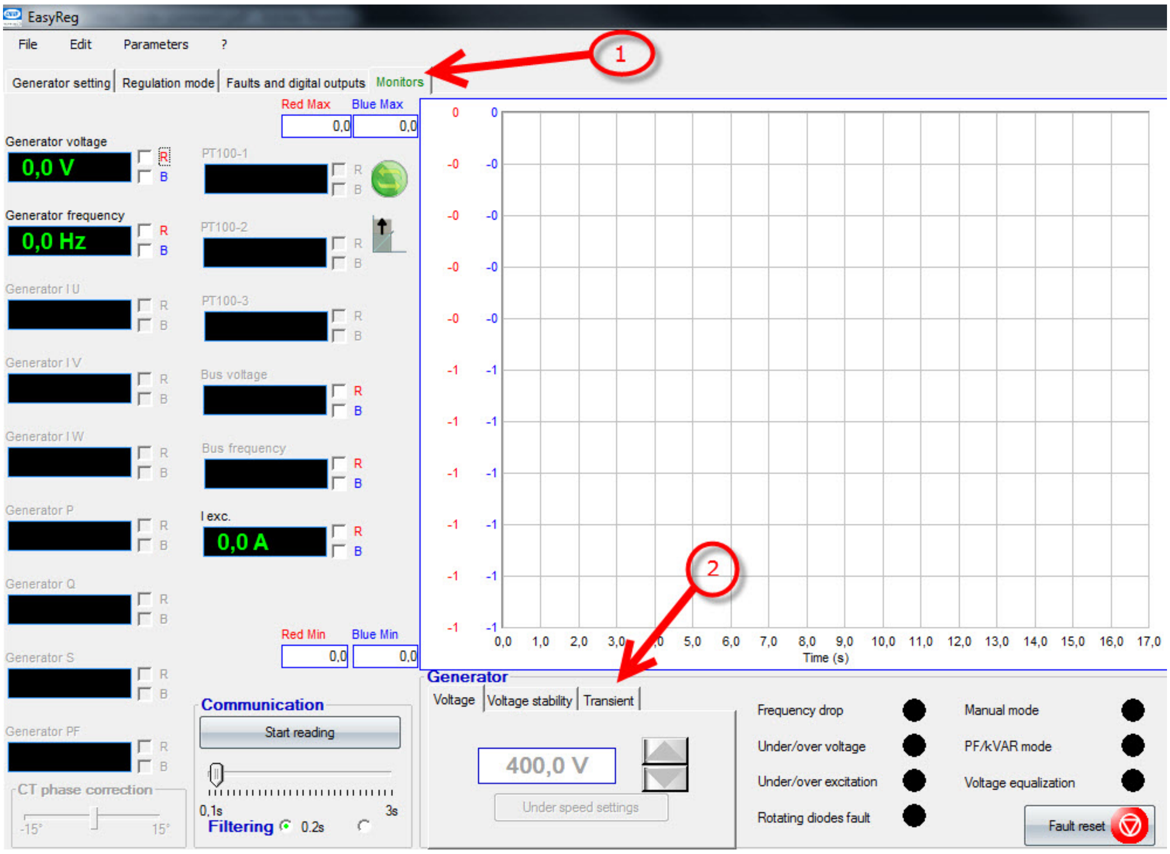
Access to PID settings is added in the Multi-line 2 unit menu 7800.

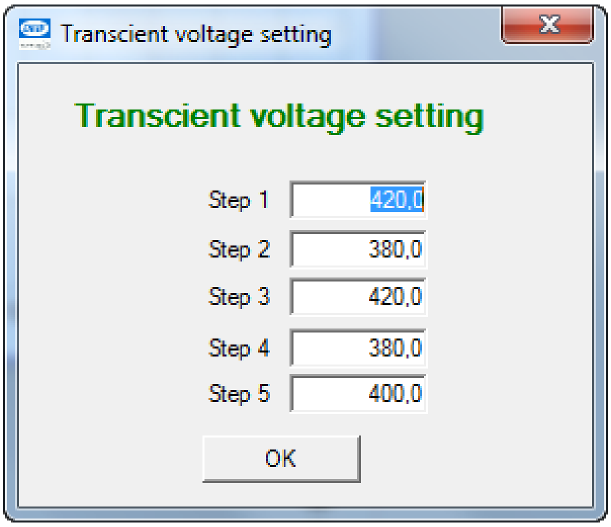
Menu	Description	Comment
7801	PID factor	This is a gain factor for the PID regulator in the DVC 310
7802	PID average/RMS	In this menu you can choose which measurements are used in the PID regulator (DVC 310): - Average - RMS
7803	Wr All settings	This menu sends all settings to the digital AVR (this is a pulse command, by default the parameter returns to OFF state after use)

The PID regulators can only be changed with the EasyReg software; when the Multi-line 2 unit has the control, only the voltage regulators are used. The gain for voltage regulator is set from the Multi-line 2 unit in menu 7801.

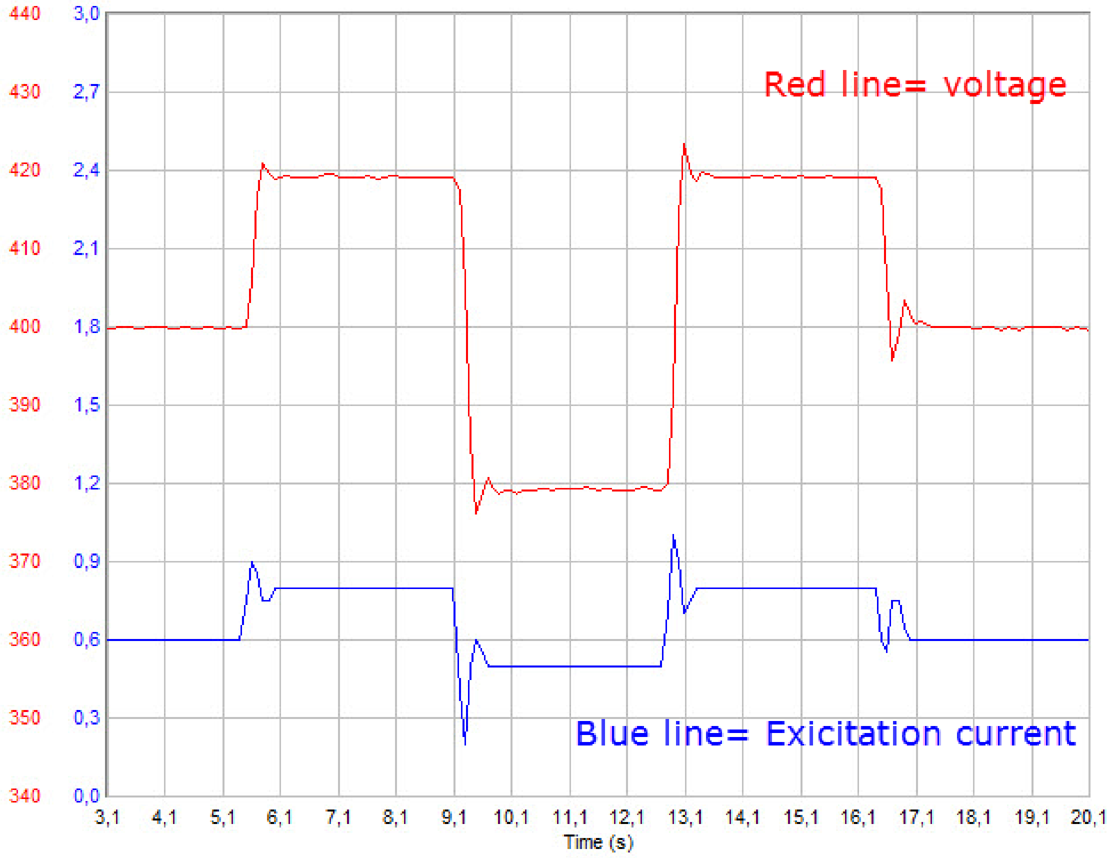


The EasyReg software has a feature called transient test, which is really useful for tuning in the voltage regulators.


EasyReg
File
Edit
Parameters
?
Generator setting
Regulation mode
Faults and digital outputs
Monitors
1
Red Max
Blue Max
Generator voltage
0,0 V
Generator frequency
0,0 Hz
Generator I U
Generator I V
Generator I W
Generator P
Generator Q
Generator S
Generator PF
CT phase correction
PT100-1
PT100-2
PT100-3
Bus voltage
Bus frequency
I exc.
0,0 A
Red Min
Blue Min
Communication
Start reading
Filtering
2
Time (s)
Generator
Voltage
Voltage stability
Transient
400,0 V
Under speed settings
Frequency drop
Under/over voltage
Under/over excitation
Rotating diodes fault
Manual mode
PF/kVAR mode
Voltage equalization
Fault reset


Transcient voltage setting
Transcient voltage setting
Step 1 420,0
Step 2 380,0
Step 3 420,0
Step 4 380,0
Step 5 400,0
OK

When using transient test, it is possible to choose five steps and the DVC 310 will change the voltage set point according to the five steps. The diagram below shows an example of how the voltage and excitation current could look in a transient test.



6.1.3 PID start settings

In the table below, a list of PID settings have been collected from different sizes of generators. These settings can be used as a starting point.

Generator size [kVA]	P	I	D	GAIN	Scale	Voltage [V]
15	230	25	320	100	0	400
30	55	4	400	40	1	400
50	35	3	220	100	1	400
70	60	4	350	40	1	400
110	60	4	350	100	1	400
150	40	3	220	100	1	400
240	70	5	400	100	1	400
400	60	4	350	100	1	400
580	70	5	400	100	1	400
820	70	5	400	100	1	400
1060	85	4	490	100	1	400
1360	55	3	350	60	1	400
1860	100	3	1000	100	1	400
2250	60	3	1200	100	1	400
2500	60	3	1200	100	1	400
1300	60	2	1200	70	1	6600
1700	60	2	1200	70	1	6600
2100	60	2	1200	70	1	6600
2800	60	2	1200	80	1	6600

7. LEDs

7.1 DVC 310 LEDs

The DVC 310 has numerous LEDs that can be used for indication and information. The LEDs are placed in the upper left corner, as shown below.

Hz: Glows red if the speed has dropped below the knee set point and the U/f law is active.

Volt: Glows red if the voltage is high or low compared to the nominal voltage.

Exc.: Glows red if the alternator is exposed to either over- or under-excitation.

Fault: Glows red if the DVC 310 has detected a diode fault.

Manu: Glows yellow when a Multi-line 2 unit is ready for a CBE start. Can be used to indicate that all conditions are present for a CBE start.

PF/kVAR: Glows yellow when PF or kvar regulation mode is active. (PF and kvar regulation cannot be activated when interfacing with a Multi-line 2 unit).

U = U: Glows yellow when voltage matching is active. (Not available when interfacing with a Multi-line 2 unit).

Power ON: Glows green when a 24 V_{dc} supply is present on the DC supply terminals of the DVC 310.

USB: Glows blue when the DVC 310 is connected to a PC.

8. Setup

8.1 Setting up the DVC 310 for the first time

By default, the DVC 310 expects the interfacing to be done via CAN bus. In the following chapters it is described how to set up the DVC 310 with the Multi-line 2 unit and the present alternator.

Some settings in the DVC 310 can be sent from the Multi-line 2 product, whereas other settings must be made from the DEIF EasyReg software. The EasyReg software can be downloaded at DEIF's wesite, www.deif.com. The first time a DVC 310 is set up, and if it is set up from the EasyReg software, the CAN bus communication between the Multi-line 2 unit and the DVC 310 should not be connected.

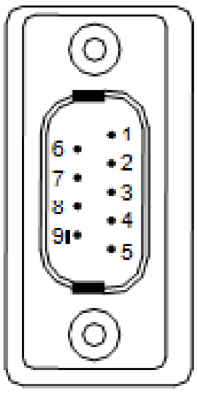
The wiring for the DVC 310 can be seen in the EasyReg software. The picture/animation will change as the changes in settings are made.

Always used shielded cables!

8.1.1 Communication/wiring between Multi-line 2 unit and DVC 310

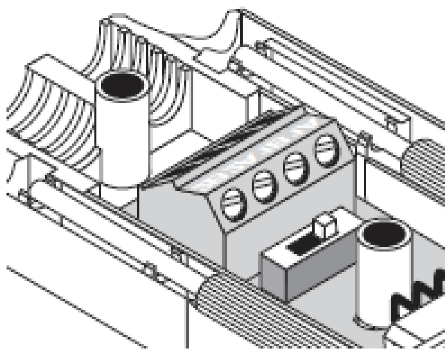
The communication between the DVC 310 and a Multi-line 2 unit with either option H5 or H7 is done via CAN bus. To facilitate the wiring, the different ports and terminal numbers are shown below.

Communication port on DVC 310 and LS D510C:



In the included CAN connector, the wiring to the terminals should be as shown in the table below.

Term.	Function
1C+	CAN-H
1C-	CAN-L
GND	CAN-GND



When the wiring is done, be aware whether the terminal resistor is ON or OFF. The terminal resistor can be set to on or off on the switch close to the terminals in the included CAN connector.

The communication port on the Multi-line 2 unit depends on the option selected; the options are shown below.

H5.8:

Term.	Function
128	CAN-L
129	CAN-GND
130	CAN-H
131	CAN-L
132	CAN-GND
133	CAN-H

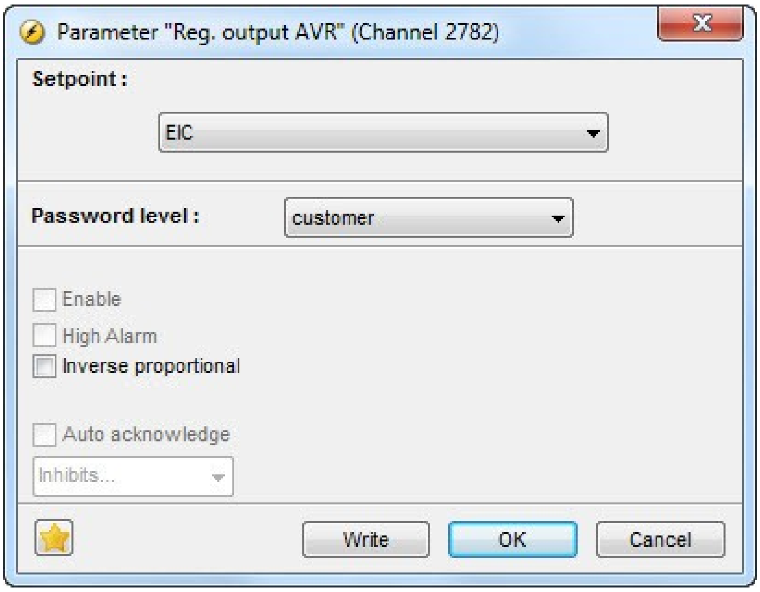
H7:

Term.	Function
A1	CAN-H
A2	CAN-GND
A3	CAN-L

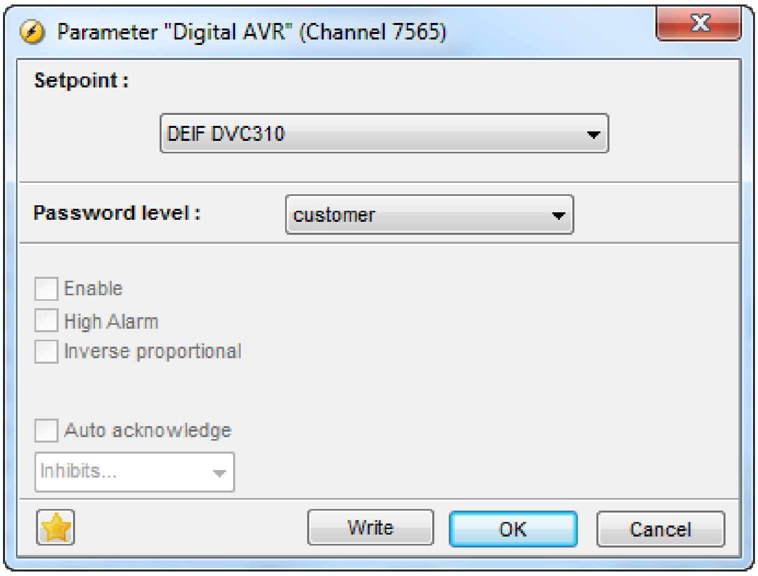
8.1.2 Setting up communication

To be able to communicate with a DVC 310, three settings must be made.

First, select the regulation output AVR to be EIC in menu 2782.

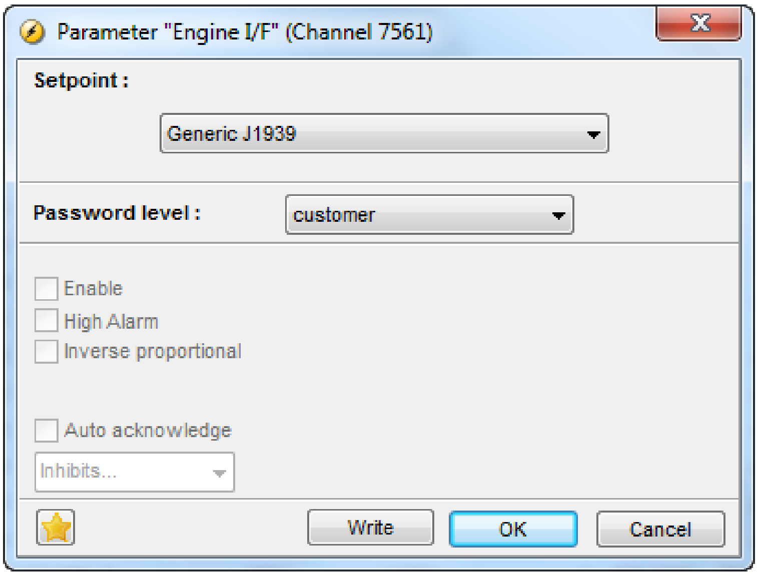


Then select the AVR type in menu 7565.



At last the engine interface must be set; this is done in menu 7561. It must be set even though relay or analogue regulation is used for governor control, and it must be set to anything else than off.

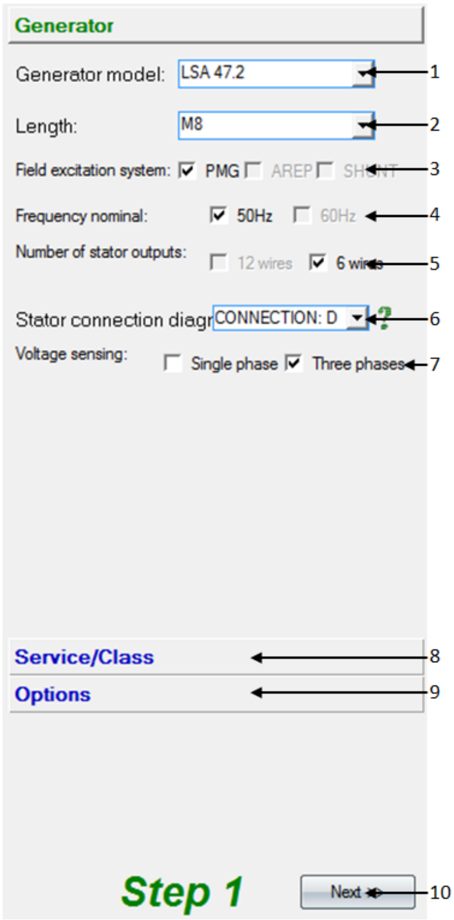
AGC 200: The engine interface must be set to anything else than off and IOM.



When the DVC 310 is set up with the EasyReg software, it is recommended not to have the CAN bus connected to the DVC 310.

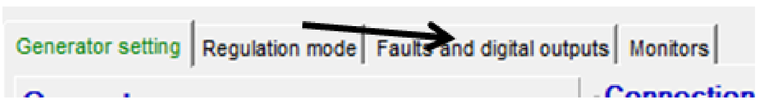
8.1.3 Setup with a Leroy Somer alternator

Connect the USB cable between the PC and the DVC 310. Open the EasyReg software. Press File at the top of the window and then New Configuration, and the window shown below will appear.

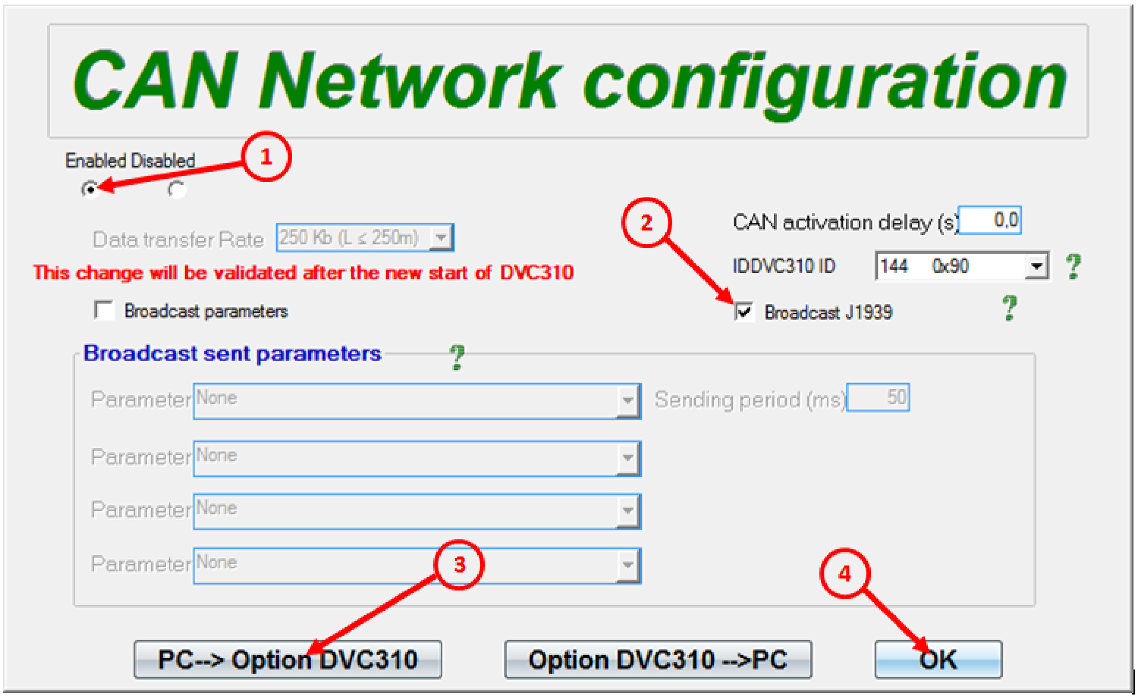


1. The Leroy Somer alternator type is set here.
2. The length of the alternator is set in this parameter.
3. The type of field excitation system of the alternator is selected here.
4. The nominal frequency of the alternator is set here.
5. The number of stator outputs is selected here.
6. The stator connection type is selected here. Press the question mark to see a picture of the type selected. This can be helpful if the user is in doubt.
7. The type of voltage measurement on the DVC 310 is selected here.
8. The maximum temperature of the windings is selected in this menu, and also the nominal power.
9. The following is selected in this menu: Temperature sensing - the options are Pt100 sensors or thermo couplers; CTs - be aware of setting the CT ratio correctly; voltage transformers, if these are used - both for alternator and the busbar; step-up transformer, if this is present in the application.
10. When the settings 1 to 9 above have been made, push the Next button.

To make sure that the DVC 310 is expecting the interfacing to be done via CAN bus, press the Faults and digital outputs tab.

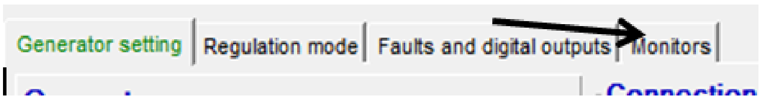


A new window will appear. Press the CAN Network Configuration button in the lower right corner, and the window below will appear.

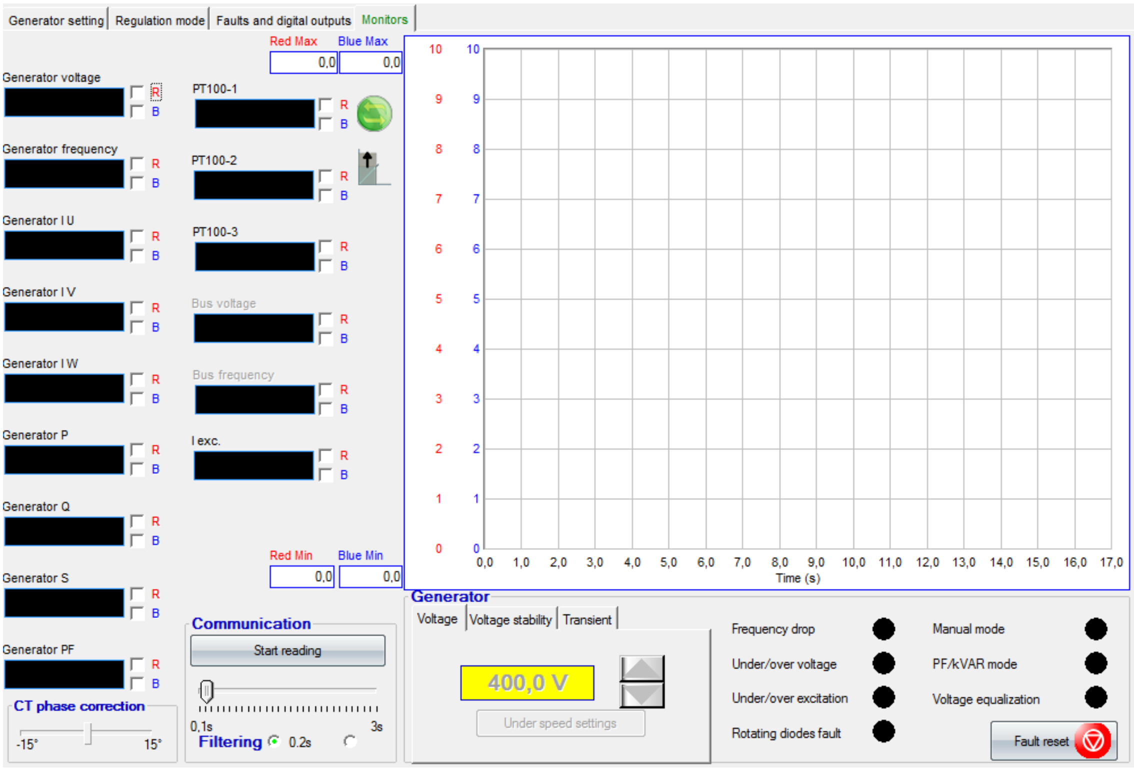


The buttons and check boxes marked with arrows must be checked. The regulators in the DVC 310 can now be tuned in.

The monitor function can be used when tuning in the regulation and the functions. Press the Monitors tab at the top of the EasyReg software.



The window below will appear.



In this window it is possible to trend for example the voltage and the frequency at the same time. The monitor is limited to trending max. two different things at a time. The trending window can be helpful when tuning in the regulators. A transient test can be started in the monitor window. When the transient test is started, the voltage set point will be changed. The set points for the transient test are set by the user.

Using the transient test makes tuning in of the regulators user-friendly.

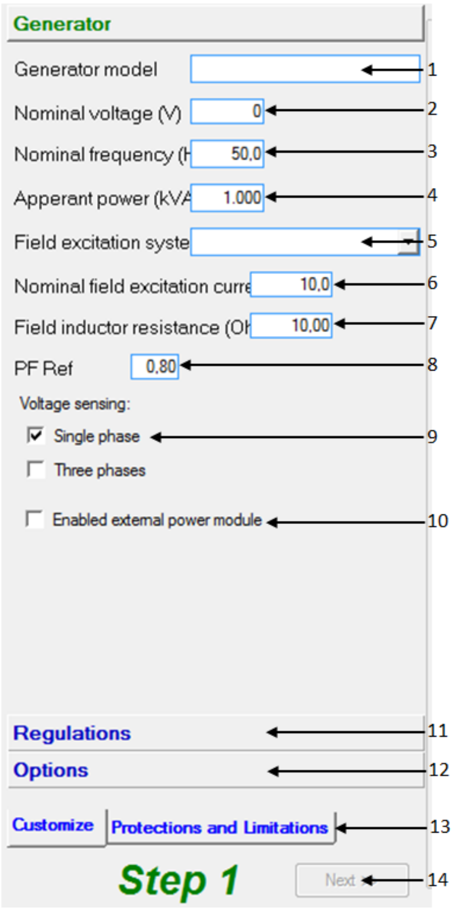
To protect against over-voltage and over-current, make a shutdown alarm in the Multi-line 2 unit before tuning in the regulators.

When the regulators and functions have been tuned in, the CAN bus cable between the Multi-line 2 unit and the DVC 310 can be connected. Subsequently, it is recommended to go to parameter 7805 and set this to ON. Then the Multi-line 2 unit will be in control of the DVC 310, which makes it possible for example to switch regulation modes.

Before the CAN bus line on the DVC 310 is set, make sure that the gain factor in the EasyReg and the gain factor parameter 7801 are the same.

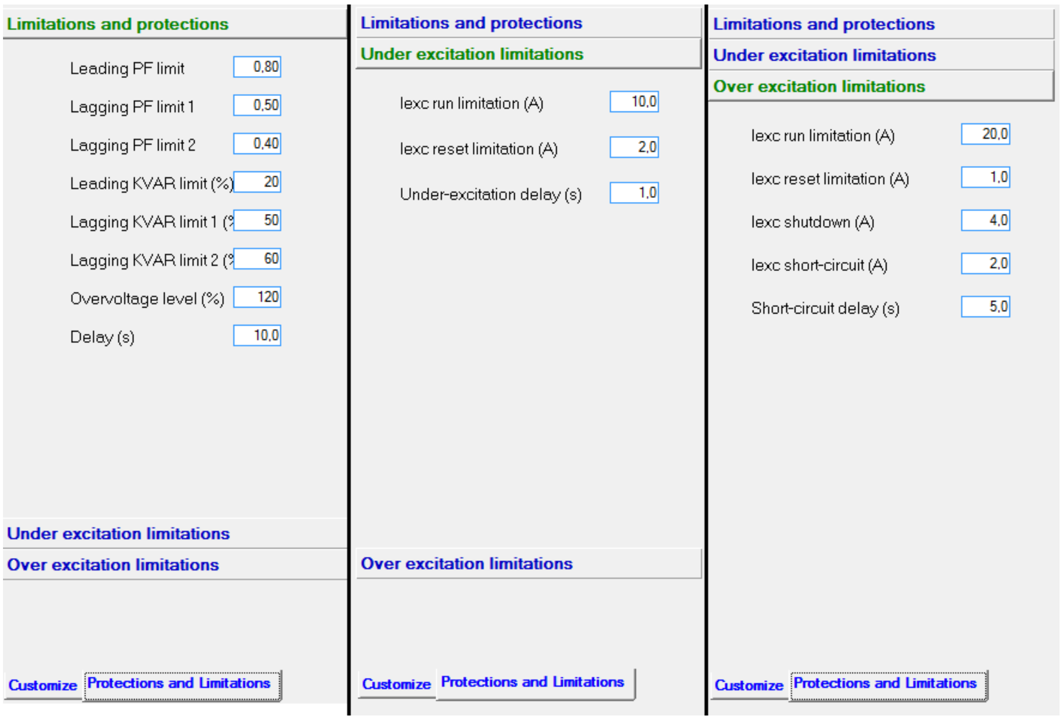
8.1.4 Setup with another alternator than Leroy Somer

Connect the USB cable between the PC and the DVC 310. Open the EasyReg software. Press File at the top of the window and then New Customised Configuration, and the window shown below will appear.



1. A name for the generator can be given here.
2. The nominal voltage of the generator is set here.
3. The nominal frequency is set here.
4. The apparent power of the alternator is set here.
5. The type of field excitation system is set here.
6. The nominal field excitation is set here.
7. The resistance of the excitation circuit is entered here. This can be measured with a multimeter: Take the F+ and F- wires of the terminals and measure the resistance through the excitation circuit on the alternator.
8. This value indicates at which power factor the alternator can give the apparent power that has been set earlier (no. 4).
9. The voltage sensing for the DVC 310 on the alternator is selected here.
10. The DVC 310 is not ready for this function yet. If the function is enabled, the excitation supply circuit will be switched off.
11. Some PID settings must be set here. Refer to the chapter "PID start settings" in this document for a table listing PID settings collected from different sizes of generators.
12. Temperature sensing and current transformers are set in this menu. It is also set whether there is a step-up transformer present in the application. If voltage transformers are present in the application, these can also be set here.

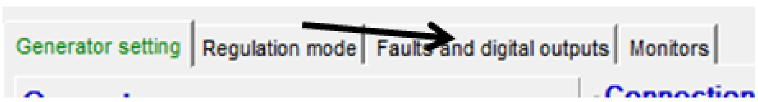
13. This menu consists of three different windows, as shown below:



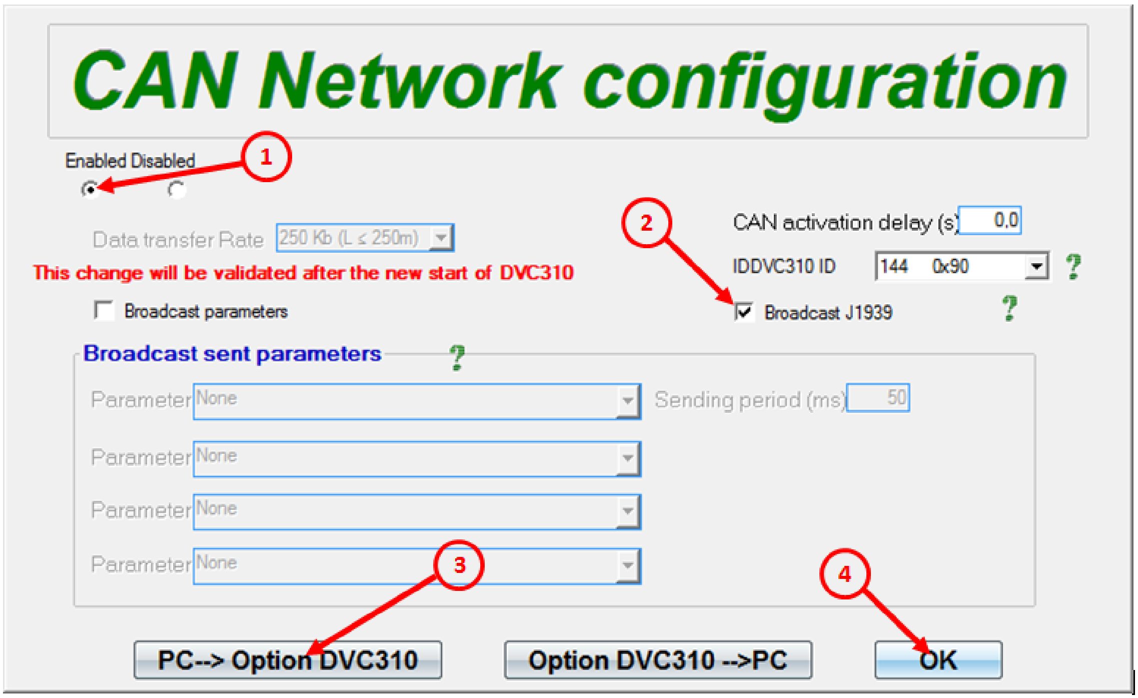
The three windows contain different settings. Some of them are used when the DVC 310 is interfaced with a Multi-line 2 unit. In the first window, only over-voltage and delay are used. None of the settings in the second window are used. In the third window, all settings are used. In the settings that are not used, a proper value must be entered. Proper values can be seen in mouse-over texts for each of them. Refer to the chapter "Protections" for a description of all protections.

14. When all the settings above have been made correctly, push the Next button.

To make sure that the DVC 310 is expecting the interfacing to be done via CAN bus, press the Faults and digital outputs tab.



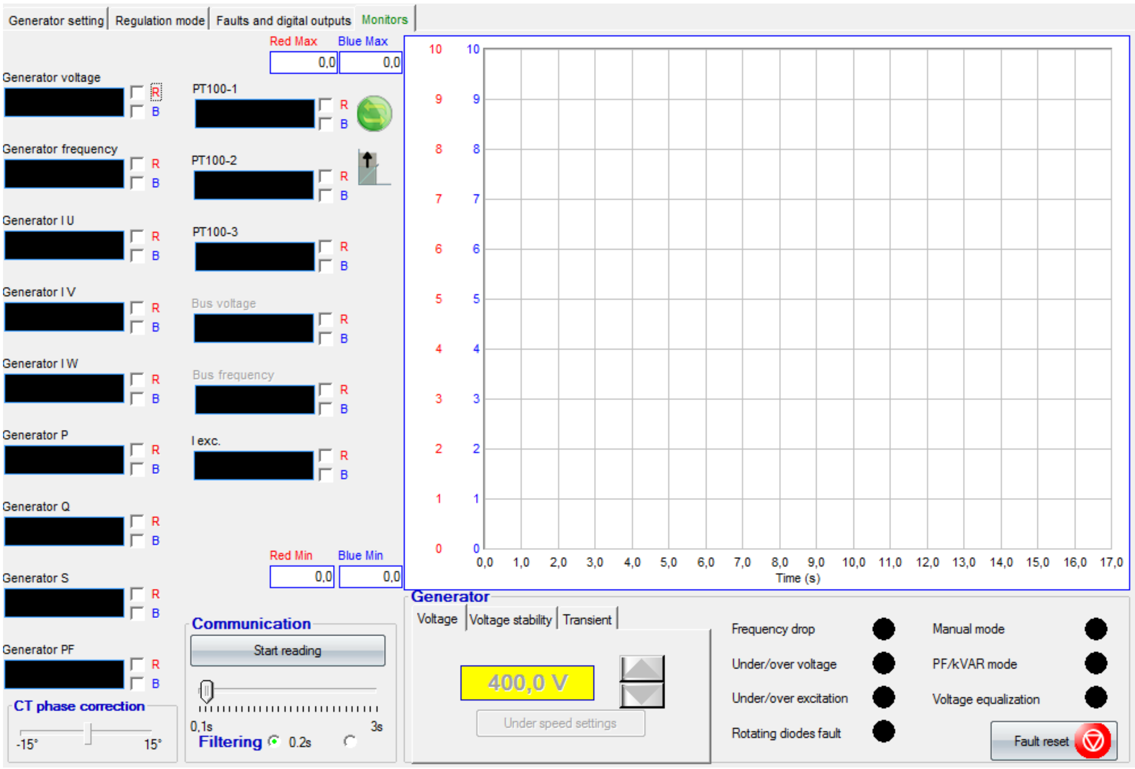
A new window will appear. Press the CAN Network Configuration button in the lower right corner, and the window below will appear.



The buttons and check boxes marked with arrows must be checked. The regulators in the DVC 310 can now be tuned in.

The monitor function can be used when tuning in the regulation and the functions. Press the Monitors tab at the top of the EasyReg software.

The window below will appear.



In this window it is possible to trend for example the voltage and the frequency at the same time. The monitor is limited to trending max. two different things at a time. The trending window can be helpful when tuning in the regulators. A transient test can be started in the monitor window. When the transient test is started, the voltage set point will be changed. The set points for the transient test are set by the user.

Using the transient test makes tuning in of the regulators user-friendly.

To protect against over-voltage and over-current, make a shutdown alarm in the Multi-line 2 unit before tuning in the regulators.

When the regulators and functions have been tuned in, the CAN bus cable between the Multi-line 2 unit and the DVC 310 can be connected. Subsequently, it is recommended to go to parameter 7805 and set this to ON. Then the Multi-line 2 unit will be in control of the DVC 310, which makes it possible for example to switch regulation modes.

Before the CAN bus line on the DVC 310 is set, make sure that the gain factor in the EasyReg and the gain factor parameter 7801 are the same.

9. M-Logic

9.1 Events, outputs and commands

In M-Logic there are additional possibilities with the option T2.

A list of the events is shown below:

- DAVR event
  - LED: Power On
  - LED: U=U
  - LED: PFkVAR
  - LED: Manual
  - LED: Fault
  - LED: Exc.
  - LED: Exc. blink
  - LED: Volt
  - LED: Hz
  - General trip
  - Short circuit
  - Loss of voltage sensing
  - Under excitation
  - Over excitation (level)
  - Over excitation (curve)
  - Over voltage
  - High temperature PT100_1
  - High temperature PT100_2
  - High temperature PT100_3
  - High temperature PTC
  - Stator over current
  - Stator over current U
  - Stator over current V
  - Stator over current W
  - Imbalance Stator current
  - Diode fault
  - Shutdown diodes
  - Stator current limitation off
  - Stator current limitation TM
  - Stator current limitation IM
  - Stator current limitation Active

For outputs, these four are possible:

- DAVR commands
  - Set stator current limitation off
  - Set stator current limitation TM
  - Set stator current limitation IM
  - Reset trip alarms

Furthermore, two lines have been added in the command window in M-Logic: Dry alternator and Ventilation mode.

- Command
  - Island
  - AMF
  - Peak shaving
  - Fixed power
  - Mains power export
  - Load take over
  - Power management
  - Dry alternator
  - Ventilation
  - Semi_Auto Mode
  - Test Mode
  - Auto Mode

10. Common settings

10.1 Overview of shared parameters

This chapter is made to give the user an overview of parameters that are shared between the Multi-line 2 units, and between a Multi-line 2 unit and a DVC 310.

Parameter	Menu no.	ML-2 unit to ML-2 unit	ML-2 unit to DVC 310
CBE setpoint	2251	X	
CBE delay	2252	X	
CBE enable	2254	X	
CBE breaker sequence	2261	X	
CBE soft-start timer	2262	X	X
CBE RPM excite	2263	X	
Generator nominal voltage - nominal set 1	6004		X
Generator nominal voltage - nominal set 2	6014		X
Generator nominal voltage - nominal set 3	6024		X
Generator nominal voltage - nominal set 4	6034		X
Generator voltage transformer primary side	6041		X
Generator voltage transformer secondary side	6042		X
Busbar voltage transformer primary side - busbar nominal set 1	6051		X
Busbar voltage transformer secondary side - busbar nominal set 1	6052		X
Busbar voltage transformer primary side - busbar nominal set 2	6061		X
Busbar voltage transformer secondary side - busbar nominal set 2	6062		X
DVC310 generator primary voltage	7741		X
DVC310 generator secondary voltage	7742		X
DVC310 busbar primary voltage	7743		X
DVC310 busbar secondary voltage	7744		X
DVC310 voltage transformer enable	7745		X
Start-on threshold PWM	7751		X
Start-on threshold voltage limit	7752		X
Soft-start timer (Normal start)	7753		X
Knee setpoint	7771		X
U/f law slope	7772		X
Soft voltage recovery timer	7773		X
Soft voltage recovery enable	7774		X

Parameter	Menu no.	ML-2 unit to ML-2 unit	ML-2 unit to DVC 310
LAM setpoint	7775		X
LAM enable	7776		X
Q droop compensation setpoint	7781		X
U droop compensation setpoint	7782		X
Droop compensation type	7783		X
Excitation current for Dry alternator mode	7791		X
Excitation current for CBE during remanence phase	7792		X
Transformer excitation setpoint for current	7793		X
Inductive motor starting setpoint for current	7794		X
Stator current limitations enable	7795		X
PID factor	7801		X
PID average/True RMS	7802		X
Write all settings to DVC310	7803		X
DVC310 bias range	7804		X
DVC310 controls	7805		X
DVC310 bias analogue type	7806		X
PT100_1 threshold setpoint	7811		X
PT100_2 threshold setpoint	7812		X
PT100_3 threshold setpoint	7813		X
Voltage loss detection enable	7821		X
Excitation current protection enable	7822		X
Overvoltage protection enable	7823		X
Diode fault protection enable	7824		X
Shutdown diode protection enable	7825		X

11. Parameters

11.1 Parameters related to option T2

Menu	Description	Min. value Max. value	Default value	Comment
2262	Soft-start timer for CBE	0.0 s 999.0 s	5.0 s	This setting determines the slope of the soft-start during a CBE start.
6004	Generator nominal voltage - nominal set 1	100 V 160 kV	400 V	The nominal voltage for the generator. Nominal set 1.
6014	Generator nominal voltage - nominal set 2	100 V 160 kV	480 V	The nominal voltage for the generator. Nominal set 2.
6024	Generator nominal voltage - nominal set 3	100 V 160 kV	480 V	The nominal voltage for the generator. Nominal set 3.
6034	Generator nominal voltage - nominal set 4	100 V 160 kV	480 V	The nominal voltage for the generator. Nominal set 4.
6041	Generator voltage transformer primary side	100 V 160 kV	400 V	The nominal voltage for the voltage transformers primary side. Placed on generator side of breaker.
6042	Generator voltage transformer secondary side	100 V 690 V	400 V	The nominal voltage for the voltage transformers secondary side. Placed on generator side of breaker.
6051	Busbar voltage transformer primary side - busbar nominal set 1	100 V 160 kV	400 V	The nominal voltage for the voltage transformers primary side. Placed on busbar side of breaker. Busbar nominal set 1.
6052	Busbar voltage transformer secondary side - busbar nominal set 1	100 V 160 kV	400 V	The nominal voltage for the voltage transformers secondary side. Placed on busbar side of breaker. Busbar nominal set 1.
6061	Busbar voltage transformer primary side - busbar nominal set 2	100 V 160 kV	400 V	The nominal voltage for the voltage transformers primary side. Placed on busbar side of breaker. Busbar nominal set 2.
6062	Busbar voltage transformer secondary side - busbar nominal set 2	100 V 690 V	400 V	The nominal voltage for the voltage transformers secondary side. Placed on busbar side of breaker. Busbar nominal set 2.

Menu	Description	Min. value Max. value	Default value	Comment
7564	EIC Auto view	OFF ON	OFF	Enables a Multi-line 2 unit to display readings from the digital AVR. If a reading is not available, the unit will display N.A. When this setting has been set to ON, the setting will be set to OFF afterwards. This is only a pulse that has been sent, but the Multi-line 2 unit will still display the readings, if any readings are available.
7565	Digital AVR	OFF DEIF DVC 310	OFF	Selects the CAN bus protocol for interfacing between a digital AVR and a Multi-line 2 unit.
7741	DAVR primary voltage	100 V 25000 V	400 V	Decides the primary side of a voltage transformer for the DVC. (This is the transformer side that is in contact with the generator voltage).
7742	DAVR secondary voltage	100 V 690 V	400 V	Decides the secondary side of a voltage transformer for the DVC. (This is the transformer side that is in contact with the DVC 310).
7743	DAVR busbar primary voltage	100 V 25000 V	400 V	Decides the primary side of a voltage transformer to the busbar. (This is the transformer side that is in contact with the busbar).
7744	DAVR busbar secondary voltage	100 V 690 V	400 V	Decides the secondary side of a voltage transformer to the busbar. (This is the transformer side that is in contact with the DVC 310).
7745	DAVR enable	OFF ON	OFF	When set to ON, the DVC 310 expects voltage measurements on the busbar.
7751	PWM Threshold	0.00 % 100.00 %	10.00 %	Decides the output of the start-on threshold function. A higher number will give a steeper slope on the start-on threshold function.
7752	Activation threshold	0.00 % 100.00 %	35.00 %	Decides the upper limit of the start-on threshold function. When this limit has been reached, the soft-start function will take action. The percentage is of nominal voltage.
7753	Softstart ramp	0.1 s 120.0 s	2.0 s	This parameter decides the slope of the soft-start function.
7761	DAVR Warning	OFF ON	OFF	Enables the Multi-line 2 to receive warnings from the DVC 310.
7762	DAVR Warning Failclass	Warning Trip GB	Warning	Decides the fail class if a warning is sent from the DVC 310.
7763	DAVR Trip	OFF ON	OFF	Enables the Multi-line 2 to receive trip alarms from the DVC 310.
7764	DAVR Trip failclass	Warning Trip GB	Warning	Decides the fail class if a trip alarm is sent from the DVC 310.

Menu	Description	Min. value Max. value	Default value	Comment
7771	Knee setpoint percent of nominal frequency	70.0 % 100.0 %	96.0 %	Sets the knee set point, from which the DVC 310 will lower the voltage set point.
7772	U/F Slope	1.0 3.0	1.0	Decides the slope for the U/F. A higher value will make the slope steeper.
7773	SoftVoltage recovery adjustment	0.1 s/10 Hz 30.0 s/10 Hz	2.0 s/10 Hz	Decides how fast the voltage should recover from a load impact. It is required to have the Load Acceptance Module activated to use this. A lower value will make a steeper slope.
7774	Softvoltage recovery	OFF ON	OFF	Enables the soft voltage recovery.
7775	Adjustment of Load Acceptance Module	70 % 100 %	90 %	Decides how much the voltage is allowed to drop instantaneously when a load impact is applied. A lower value allows a bigger voltage drop.
7776	Load Acceptance Module	OFF ON	OFF	Enables the Load Acceptance Module.
7781	Q droop compensation	0.0 % 10.0 %	2.0 %	Decides the slope of the Q droop compensation. A higher value allows more droop.
7782	U droop compensation	0.0 % 10.0 %	2.0 %	Decides the slope of the U droop compensation. A higher value allows more droop.
7783	Droop compensation type	Q droop compensation OFF	Q droop compensation	Only one of the droop types can be enabled.
7791	I excitation reference for Dry Alternator mode	0.0 A 20.0 A	1.5 A	Decides the excitation current in Dry Alternator mode.
7792	I excitation reference for Close Before Excitation	0.0 A 0.5 A	0.0 A	Decides how much excitation is allowed in a Close Before Excitation sequence. This is during the remanence phase.
7793	Transformer magnetisation	0.0 % 300.0 %	100.0 %	Current maximum during transformer magnetisation sequence. The value is percentage of nominal current.
7794	Inductive motor starting current limit	0.0 % 300.0 %	100.0 %	Current maximum during an inductive motor starting sequence. The value is percentage of nominal current.
7795	I stator limitation function enable	OFF Magnetisation	OFF	Makes it possible to have the stator current limitation functions disabled, only inductive motor starting, or both inductive motor starting and transformer magnetisation.
7801	PID gain	1 100	80	Makes it possible to make the AVR regulation faster or slower.

Menu	Description	Min. value Max. value	Default value	Comment
7802	PID average or True RMS	Average RMS	Average	Decides whether the DVC 310 should make the voltage readings as average or true RMS values.
7803	Write all settings to DVC310	OFF ON	OFF	When set to ON, the Multi-line 2 unit will send all the relevant parameters to the DVC 310.
7804	DAVR bias range	1.0 % 30.0 %	10.0 %	This setting defines the outer limits for the regulation. 10 % on a 400 V generator means that voltage can be regulated from 360 to 440 V.
7805	DAVR controls	OFF ON	ON	Decides who has the control. When set to ON, the DVC 310 is allowed to change regulator mode, and the DVC 310 will not receive any parameters from the Multi-line 2 unit.
7806	DAVR bias analogue range	4 to 20 mA -10 to 0 to 10 V	4 to 20 mA	If the DVC 310 uses analogue bias for regulation, this defines the type of analogue interfacing for the DVC 310. The analogue input on the DVC 310 is hardcoded to be at terminal AI1.
7811	PT100_1 threshold	50 °C 200 °C	160 °C	Determines the maximum temperature of the winding in phase 1 of the alternator.
7812	PT100_2 threshold	50 °C 200 °C	160 °C	Determines the maximum temperature of the winding in phase 2 of the alternator.
7813	PT100_3 threshold	50 °C 200 °C	160 °C	Determines the maximum temperature of the winding in phase 3 of the alternator.
7821	Voltage loss detection enable	OFF ON	OFF	Enables the voltage loss protection.
7822	Excitation current protection	OFF ON	OFF	Enables the excitation current protection.
7823	Overvoltage protection	OFF ON	OFF	Enables the over-voltage protection.
7824	Diode fault	OFF ON	OFF	Enables the diode fault protection.
7825	Shutdown diodes	OFF ON	OFF	Enables the shutdown diodes function.
7831	DAVR communication error timer	0.0 s 100.0 s	0.0 s	A timer for an alarm for communication error to the DVC 310.
7832	DAVR communication error output A	Not used Relay 63	Not used	If the DAVR communication fails it is possible to activate a relay.
7833	DAVR communication error output B	Not used Relay 63	Not used	If the DAVR communication fails it is possible to activate a relay.
7834	DAVR communication error alarm enable	OFF ON	OFF	Enables/disables the alarm for communication error between the DVC 310 and the Multi-line 2 unit.

Menu	Description	Min. value Max. value	Default value	Comment
7835	DAVR communication error alarm fail-class	Warning Trip GB	Warning	Decides what the Multi-line 2 unit should do if the DAVR communication alarm occurs.