SELCO

C6200 GENCONTROLLER

Configuration Manual

Revision: 14-04-2008

Firmware: 071115

Table of Contents

1 Preface

The SELCO C6200 GENCONTROLLER module provides integrated frequency stabilization, voltage stabilization, check/automatic synchronization, active/reactive load sharing, integrated protection, basic and programmable I/O and data acquisition. Finally, the C6200 module will operate as an interface between the optional SELCO SIGMA S6500 User Interface Module.

The SELCO C6200 GENCONTROLLER also provides Programmable Inputs/Outputs. The C6200 emphasizes on user customization which allows better implementation of SELCO products in a rapidly changing industry where switchboards are becoming more and more integrated. The C6200 can operate in full automatic mode or semi-automatic mode which allows external control of all functions.

2 System Preparation

2.1 CAN Bus Address

The 4-point (+2 for Mod and Can bus terminator) dip-switch located on the right hand side of the C6200 module is used to set the CAN bus address. The CAN bus address is set as a binary value on 4 ON/OFF switches. Valid CAN bus addresses are 1 to 15.

The CAN bus address should be set according to the generator reference number. Optional S6500 user interface modules should be configured with the same CAN address 1 as the generator they are related to. In case there is only one user interface, the CAN address should be set to 1. It is advisable to assign address 1 to the first C6200 module, number 2 to the second C6200 etc. A unique CAN bus address must be assigned to each C6200 module.

The binary system works on the principle described below.

- Switch 1 represents the decimal value 1

- Switch 2 represents the decimal value 2

- Switch 3 represents the decimal value 4

- Switch 4 represents the decimal value 8

As an example, the address 1 is assigned by setting switch 1 to ON and the remaining switches to OFF. Address 10 is assigned by setting switches 2 and 4 to ON and switches 1 and 3 to OFF. The decimal value corresponds to the sum of the ON switch values.

3 Configuration

The C6200 module can be configured in three different ways. This section describes the configuration by RS232.

The C6200 module is delivered with a default configuration.

3.1 Console Password

By default, the RS232 console will operate in read-only mode. The console can be switched to read/write mode by the enable command.

> ENABLE

Enable mode will prompt for a pin code. The default pin code is 0000.

The console can be switched back to read-only mode by the disable command.

> DISABLE

Please note that the RS232 console pin code is unique for each module. Also, the RS232 pin code is independent from the menu pin code of the User interface module.

The RS232 console pin code can be changed by the following command, followed by the new 4 digit pin code:

> WRITE RS232 PASSWORD

The RS232 pin code can be any number in the range of 0000 to 9999.

3.2   Protection

The protection functions are typically set up by a set point (trip level) and a delay. The trip level is expressed as a percentage of the nominal value, so it is important to understand how the 100% reference is calculated. This is described in the function section of this manual.

Each of the protection functions can be enabled or disabled as desired. The parameters of a given protection function has no influence on the system if the function is disabled.

All protection functions will trip the circuit breaker.

3.2.1   Under Voltage Trip

The under voltage protection function can be enabled or disabled by the following command. The choice can be either YES or NO. Default is YES.

WRITE PROTECT UV ENABLED <Choice>

The trip level of the under voltage trip function is expressed as a percentage of the nominal voltage of the generator. The level is set by the following command. The level can be set between 50 and 150 %. Resolution is 1 %. Default is 70%.

WRITE PROTECT UV LEVEL [50 - 150] (70)

The delay is expressed in seconds and can be set between 2.0 and 20.0 s. Resolution is 100 ms. Default is 2.0s.

WRITE PROTECT UV DELAY [2.0 – 20.0] (2.0)

3.2.2   Over Voltage Trip

The over voltage protection function can be enabled or disabled by the following command. The choice can be either YES or NO. Default is YES.

WRITE PROTECT OV ENABLED <Choice>

The trip level of the over voltage trip function is expressed as a percentage of the nominal voltage of the generator. The level is set by the following command. The level can be set between 50 and 150 %. Resolution is 1 %. Default is 130%.

WRITE PROTECT OV LEVEL [50 - 150] (130)

The delay is expressed in seconds and can be set between 2.0 and 20.0 s. Resolution is 100 ms. Default is 2.0s.

WRITE PROTECT OV DELAY [2.0 – 20.0] (2.0)

3.2.3   Under Frequency Trip

The under frequency protection function can be enabled or disabled by the following command. The choice can be either YES or NO. Default is YES.

WRITE PROTECT UF ENABLED <Choice>

The trip level of the under frequency trip function is expressed as a percentage of the nominal frequency of the generator. The level is set by the following command. The level can be set between 50 and 150 %. Resolution is 1 %. Default is 70%.

WRITE PROTECT UF LEVEL [50 - 150] (70)

The delay is expressed in seconds and can be set between 2.0 and 20.0 s. Resolution is 100 ms. Default is 2.0s.

WRITE PROTECT UF DELAY [2.0 – 20.0] (2.0)

3.2.4   Over Frequency Trip

The over frequency protection function can be enabled or disabled by the following command. The choice can be either YES or NO. Default is YES.

WRITE PROTECT OF ENABLED <Choice>

The trip level of the over frequency trip function is expressed as a percentage of the nominal frequency of the generator. The level is set by the following command. The level can be set between 50 and 150 %. Resolution is 1 %. Default is 130%.

WRITE PROTECT OF LEVEL [50 - 150] (130)

The delay is expressed in seconds and can be set between 2.0 and 20.0 s. Resolution is 100 ms. Default is 2.0s.

WRITE PROTECT OF DELAY [2.0 – 20.0] (2.0)

3.2.5   Reverse Power Trip

The reverse power protection function can be enabled or disabled by the following command. The choice can be either YES or NO.

WRITE PROTECT RP ENABLED <Choice>

The trip level of the reverse power function is expressed as a percentage of the nominal active current in a single phase of the generator. The 100 % reference is the generator's maximum current in one phase (GENMAXCUR) x rated power factor (COSPHI).

The level is set by the following command. The level can be set between 0 and -20 %. Resolution is 1 %.

WRITE PROTECT RP LEVEL <Level>

The delay is expressed in seconds and can be set between 2.0 and 20.0 s. Resolution is 100 ms.

WRITE PROTECT RP DELAY <Delay>

3.2.6   Excitation Loss Trip

The excitation loss protection function can be enabled or disabled by the following command. The choice can be either YES or NO.

WRITE PROTECT EL ENABLED <Choice>

The excitation loss function reacts on a negative reactive current. The trip level of the excitation loss protection function is expressed as a percentage of the nominal re-active current in a single phase of the generator. The 100 % reference is the generator's maximum current in one phase (GENMAXCUR) x rated sinPHI.

The level is set by the following command. The level can be set between 0 and -150 %. Resolution is 1 %.

WRITE PROTECT EL LEVEL <Level>

The delay is expressed in seconds and can be set between 2.0 and 20.0 s. Resolution is 100 ms.

WRITE PROTECT EL DELAY <Delay>

3.2.7 Frequency Deviation Protection

The frequency deviation protection can be enabled or disabled. This is done by the following command. The choice can be set to either *YES* or *NO*.

WRITE PROTECT FD ENABLED <Choice>

The trip level is expressed in hertz per second with one decimal. The trip level is set by the following command. The range is 0.0 to 20.0 Hz/s. Resolution is 0.1 Hz/s.

WRITE PROTECT FD LEVEL <Level>

3.2.8 Vector Shift Protection

The Vector Shift protection can be enabled or disabled. This is done by the following command. The choice can be set to either *YES* or *NO*.

WRITE PROTECT VS ENABLED <Choice>

The trip level is expressed in ° (phase angle). The trip level is set by the following command. The range is 0 to 90 °. Resolution is 1°. Default is 15°.

WRITE PROTECT VS LEVEL [0 - 90] (15)

3.3 Alarms

The alarm functions are typically set up by a set point (alarm level) and a delay. The alarm level is expressed as a percentage of the nominal value, so it is important to understand how the 100% reference is calculated. This is described in the function section of this manual.

Each of the alarm functions can be enabled or disabled as desired. The parameters of a given alarm function have no influence on the system if the function is disabled.

Alarm functions will not trip the breaker but only be indicated on the optional display. It is also possible to program the programmable outputs to activate for alarms (see chapter).

3.3.1 Under Voltage Alarm

The under voltage alarm function can be enabled or disabled by the following command. The choice can be either YES or NO. Default is NO.

<p align="center">WRITE ALARM UV ENABLED <Choice></p>

The alarm level of the under voltage alarm function is expressed as a percentage of the nominal voltage of the generator. The level is set by the following command. The level can be set between 50 and 150 %. Resolution is 1 %. Default is 70%.

<p align="center">WRITE ALARM UV LEVEL [50 - 150] (70)</p>

The delay is expressed in seconds and can be set between 2.0 and 20.0 s. Resolution is 100 ms. Default is 2.0s.

<p align="center">WRITE ALARM UV DELAY [2.0 – 20.0] (2.0)</p>

3.3.2 Over Voltage Alarm

The over voltage alarm function can be enabled or disabled by the following command. The choice can be either YES or NO. Default is NO.

<p align="center">WRITE ALARM OV ENABLED <Choice></p>

The alarm level of the over voltage alarm function is expressed as a percentage of the nominal voltage of the generator. The level is set by the following command. The level can be set between 50 and 150 %. Resolution is 1 %. Default is 130%.

<p align="center">WRITE ALARM OV LEVEL [50 - 150] (130)</p>

The delay is expressed in seconds and can be set between 2.0 and 20.0 s. Resolution is 100 ms. Default is 2.0s.

<p align="center">WRITE ALARM OV DELAY [2.0 – 20.0] (2.0)</p>

3.3.3 Under Frequency Alarm

The under frequency alarm function can be enabled or disabled by the following command. The choice can be either YES or NO. Default is NO.

<center>WRITE ALARM UF ENABLED <Choice></center>

The alarm level of the under frequency alarm function is expressed as a percentage of the nominal frequency of the generator. The level is set by the following command. The level can be set between 50 and 150 %. Resolution is 1 %. Default is 70%.

<center>WRITE ALARM UF LEVEL [50 - 150] (70)</center>

The delay is expressed in seconds and can be set between 2.0 and 20.0 s. Resolution is 100 ms. Default is 2.0s.

<center>WRITE ALARM UF DELAY [2.0 – 20.0] (2.0)</center>

3.3.4   Over Frequency Alarm

The over frequency alarm function can be enabled or disabled by the following command. The choice can be either YES or NO. Default is NO.

<center>WRITE ALARM OF ENABLED <Choice></center>

The alarm level of the over frequency alarm function is expressed as a percentage of the nominal frequency of the generator. The level is set by the following command. The level can be set between 50 and 150 %. Resolution is 1 %. Default is 130%.

WRITE ALARM OF LEVEL [50 - 150] (130)

The delay is expressed in seconds and can be set between 2.0 and 20.0 s. Resolution is 100 ms. Default is 2.0s.

<center>WRITE ALARM OF DELAY [2.0 – 20.0] (2.0)</center>

3.3.5   Reverse Power Alarm

The reverse power alarm function can be enabled or disabled by the following command. The choice can be either YES or NO. Default is NO.

<center>WRITE ALARM RP ENABLED <Choice></center>

The alarm level of the reverse power function is expressed as a percentage of the nominal active current in a single phase of the generator. The 100 % reference is the generator's maximum current in one phase (GENMAXCUR) x rated power factor (COSPHI).

The level is set by the following command. The level can be set between 0 and -20 %. Resolution is 1 %. Default is 2%.

<center>WRITE ALARM RP LEVEL [0.0 - -20.0] (-2.0)</center>

The delay is expressed in seconds and can be set between 2.0 and 20.0 s. Resolution is 100 ms. Default is 5.0s

<center>WRITE ALARM RP DELAY [2.0 – 20.0] (5.0)</center>

3.3.6   Excitation Loss Alarm

The excitation loss alarm function can be enabled or disabled by the following command. The choice can be either YES or NO. Default is NO.

WRITE ALARM EL ENABLED <Choice>

The excitation loss function reacts on a negative reactive current. The trip level of the excitation loss alarm function is expressed as a percentage of the nominal re-active current in a single phase of the generator. The 100 % reference is the generator's maximum current in one phase (GENMAXCUR) x rated sinPHI.

The level is set by the following command. The level can be set between 0 and -150 %. Resolution is 1 %. Default is -50%.

WRITE ALARM EL LEVEL [0 - -150] (-50)

The delay is expressed in seconds and can be set between 2.0 and 20.0 s. Resolution is 100 ms. Default is 5.0s

WRITE ALARM EL DELAY [2.0 – 20.0] (5.0)

3.4 Frequency Stabilization

The frequency stabilization feature ensures that the generator frequency is kept at a fixed level. The frequency control facility uses the rated frequency as its reference. The frequency stabilization feature will compensate for frequency deviations caused by change in active load.

3.4.1 Gain

The Gain parameter determines the response of the frequency stabilization. A low setting will result in slow accurate stabilization, high setting provide fast regulation with the risk of overshoot and instability. Gain is expressed as a number without decimals. Resolution is 0,1. Range is 1,0 - 20,0.

WRITE FREQSTAB GAIN <Value>

3.4.2 Delay

The Delay parameter works as a delay that provides the "patience" of the system as it allows the system to wait for a response (change in the actual value) before it proceeds to step up the control signal. A high delay will slow down the response of the system, but it may be necessary if the response of the speed control or voltage regulator is slow. The delay is expressed in ms. The range is 0ms – 5000ms. Resolution is 1ms.

WRITE FREQSTAB DELAY <Factor>

3.5   Auto Synchronizing

The configuration of the auto synchronizing function depends on whether the speed control is done by the speed relay (increase/decrease contacts) or by analogue output 1.

3.5.1   Dead Bus Closure

The dead bus closure function provides the possibility of closing the circuit breaker when no voltage exists on the bus bar. The dead bus closure function can be disabled or enabled. Choice can be YES or NO.

> WRITE AUTOSYNC DBCLOSE <Choice>

3.5.2   Gain

The auto synchronizer alters the frequency through control of the speed governor in order to obtain the permitted frequency and phase deviation. Too much gain provides accurate but slow synchronization, while too little gain introduces the risk of overshoot and instability. Gain is expressed as a number without decimals. Gain is set by the following command. Resolution is 0,1. The range is 1,0 – 20,0.

> WRITE AUTOSYNC GAIN <Value>

3.5.3   Delay

The delay parameter works as a delay that provides the "patience" of the system as it allows the system to wait for a response (change in the actual value) before it proceeds to step up the control signal. A large delay will slow down the response of the system, but it may be necessary if the response of the speed control or voltage regulator is slow. The delay is expressed in ms. The range is 0ms – 5000ms. Resolution is 1ms.

> WRITE AUTOSYNC DELAY <Factor>

3.5.4   Synctime

The synctime parameter determines how long the C6200 will try to synchronize a generator, before it issues a Synchronisation error. The synctime parameter is expressed in seconds. Resolution is 1 second. The range is 1s – 1000s.

> WRITE AUTOSYNC SYNCTIME <Seconds>

3.5.5   Circuit Breaker Close Time

The circuit breaker close time (circuit breaker make time) is only used when the speed control is configured to the speed relay. Auto synchronization by relay control is done according to the dynamic synchronization principle. Therefore it requires the existence of a small positive frequency deviation. The circuit breaker close time must be set according to the specification of the circuit breaker. The circuit breaker close time is expressed in milliseconds without decimals. Resolution is 1 ms. The range is 1ms – 1000ms.

> WRITE AUTOSYNC CBCLOSETIME <Duration>

3.5.6   Check Synchronizer function

This function enables the C6200 to work as a check synchronizer. In case the generator is synchronized manually, the C6200 will issue a closure signal to the circuit breaker as soon as frequency, voltage and phase deviation between the incoming generator and the bus bar are within acceptable limits. The function can be enabled or disabled. The choice can be YES or NO.

WRITE AUTOSYNC CHKSYNC <CHOICE>

3.6 Active Load Sharing

The active load balance is communicated through a set of "parallel lines" that operates with a pre-configured DC voltage. The active load sharer includes a bonus feature of de-loaded trip together with programmable ramp-up and ramp-down of active load.

3.6.1 Gain

Gain defines the response of the active load sharer. The active load sharer will alter the active load through the governor in order to obtain the required load balance. Too much gain provides accurate but slow load sharing. Too little gain introduces risk of overshoot and instability. Gain is expressed as a number without decimals. Resolution is 1. The range is 1,0 – 20,0.

WRITE ACTLS GAIN <Value>

3.6.2 Delay

The Delay parameter works as a delay that provides the "patience" of the system as it allows the system to wait for a response (change in the actual value) before it proceeds to step up the control signal. A high delay will slow down the response of the system, but it may be necessary if the response of the speed control or voltage regulator is slow. The delay is expressed in ms. The range is 0ms – 5000ms. Resolution is 1ms.

WRITE ACTLS DELAY <Factor>

3.6.3 Ramp Time

Ramp time defines how quickly the load sharer takes or releases active load after synchronization or after the unload signal has been activated. The parameters define the time to go from zero to full load (nominal load), or opposite. The ramp time parameter is expressed in seconds without decimals. Resolution is 1 s. The range is 1s – 100s.

WRITE ACTLS RAMPTIME <Duration>

3.6.4 Load Deviation

The load deviation parameter can be used to fine-tune the balance of the active load sharing. The load deviation is set according to ideal zero deviation. The parameter is expressed as a percentage without decimals. The parameter has reference to perfect balance. Resolution is 1%.
The range is -100% - +100%.

WRITE ACTLS LOADDEV <Percentage>

3.6.5 CB Trip Level

When a generator must be taken out of service, it is necessary first to unload the generator (by the unload command). After the C6200 has received the unload command it will decrease the load of the generator until the load reaches the unload CB trip level. After this the C6200 will trip the circuit breaker. The CB Trip Level is expressed as a percentage of the nominal active current of the generator (GENMAXCURRENT x COSPHI). Resolution is 1%. The range is 1% - 50%.

WRITE ACTLS CBTRIPLEVEL <Percentage>

3.6.6   Parallel Lines

The load of the generator is communicated as an analogue voltage signal between the load sharers of all generators in an installation. The range of this analogue voltage signal can be programmed in order to match load sharers of different types (e.g. SELCO T4400 or T4800 load sharers). In case all generators are equipped with C6200 units, this parameter does not need to be changed. Resolution is 0.1 V DC. The range is -6,0V - +6,0V.

> WRITE ACTLS PARLINES VOLTMIN <Voltage>

> WRITE ACTLS PARLINES VOLTMAX <Voltage>

For parallel operation with **SELCO S6100** load sharers the parallel lines must be programmed to +/-6V (default setting).

For parallel operation with **SELCO T4800** load sharers the parallel lines must be programmed to +/-1V.

For parallel operation with **SELCO T4400** load sharers the parallel lines must be programmed to +/-3V.

For parallel operation with **LK-NES/ NESELCO/ SELCO B6000** load sharers the parallel lines must be programmed to +/-1V.

3.7   Voltage Matcher

The module includes voltage matching. Voltage matching will automatically bring the voltage within the range specified by the Voltage ok window. If enabled, voltage matching will be conducted before automatic synchronization is initiated. The voltage matching function is configured with stability and deadband.

3.7.1   Gain

The gain parameter determines how much signal is provided to the AVR and thereby how quickly the voltage is brought into the permitted operational area. A low setting will result in slow but accurate correction. A high setting provides fast correction with a potential risk of overshoot and instability. Gain is expressed as a number without decimals. Resolution is 1. The range is 1,0 – 20,0.

> WRITE VOLTMATCH GAIN <Value>

3.7.2   Delay

The Delay parameter works as a delay that provides the "patience" of the system as it allows the system to wait for a response (change in the actual value) before it proceeds to step up the control signal. A high delay will slow down the response of the system, but it may be necessary if the response of the speed control or voltage regulator is slow. The delay is expressed in ms. Resolution is 1ms. The range is 0ms – 5000ms.

> WRITE VOLTMATCH DELAY <Factor>

3.8   Reactive Load Sharing

The reactive load balance is communicated to a set of "parallel lines" that operates with a pre-configured DC voltage. The load sharer includes a bonus feature of programmable ramp-up and ramp-down of reactive load.

3.8.1   Gain

Gain defines the response of the reactive load sharer. The reactive load sharer will alter the reactive load through the AVR (automatic voltage regulator) in order to obtain the required reactive load balance. Too much gain provides accurate but slow load sharing. Too little gain introduces risk of overshoot and instability. Gain is expressed as a number without decimals. Resolution is 1. The range is 1,0 – 20,0.

> WRITE REACTLS GAIN <Value>

3.8.2   Delay

The Delay parameter works as a delay that provides the "patience" of the system as it allows the system to wait for a response (change in the actual value) before it proceeds to step up the control signal. A high delay will slow down the response of the system, but it may be necessary if the response of the voltage regulator is slow. The delay is expressed in ms. Resolution is 1ms. The range is 0ms – 5000ms

> WRITE REACTLS DELAY <Factor>

3.8.3   Ramp Time

Ramp time defines how quickly the load sharer takes or releases reactive load after synchronization or after the unload signal has been released. The parameters defines the time to go from zero to full load (nominal load), or opposite. The ramp time parameter is expressed in seconds without decimals. Resolution is 1 s. The range is 1s – 100s.

> WRITE REACTLS RAMPTIME <Duration>

3.8.4   Load Deviation

The load deviation parameter can be used to fine-tune the balance of the active load sharing. The load deviation is set according to ideal zero deviation. The parameter is expressed as a percentage without decimals. The parameter has reference to perfect balance. Resolution is 1%. The range is -100% - +100%.

> WRITE REACTLS LOADDEV <Percentage>

3.8.5   CB Trip Level

When a generator must be taken out of service, it is necessary first to unload the generator (by the unload command). After the C6200 has received the unload command it will decrease the load of the generator until the load reaches the unload CB trip level. After this the C6200 will trip the circuit breaker. The CB Trip Level is expressed as a percentage of the nominal reactive current of the generator (GENMAXCURRENT x SINPHI). Resolution is 1%. The range is 1% - 50%.

> WRITE REACTLS CBTRIPLEVEL <Percentage>

3.8.6   Parallel Lines

The reactive load of the generator is communicated as an analogue voltage signal between the load sharers of all generators in an installation. The range of this analogue voltage signal can be programmed in order to match reactive load sharers of different types (e.g. SELCO T4900). In case all generators are equipped with C6200 units, this parameter does not need to be changed. Resolution is 0.1 V DC. The range is -6,0V - +6,0V.

WRITE REACTLS PARLINES VOLTMIN <Voltage>

WRITE REACTLS PARLINES VOLTMAX <Voltage>

For parallel operation with **SELCO S6100** reactive load sharers, the parallel lines must be programmed to +/-6V (default setting).

For parallel operation with **SELCO T4900** reactive load sharers, the parallel lines must be programmed to +/-1V.

3.9   Active load (kW) sharing schemes

In case the generator should be operated in parallel with the grid, it is necessary to choose the load sharing scheme. The load sharing scheme defines the load reference for the generator.

Following load sharing schemes are available:

- Fixed import

- Peak import

- Fixed export

- Excess export

3.9.1   Fixed import

Fixed import means that the installation imports a fixed load level from the grid. In case the installation requires more load than the pre- defined import load level (configured as a percentage of the grid capacity), the diesel generators will supply the rest of the load demand.

To activate this scheme use following command:

WRITE IMPORTEXPORTSCHEME FIXEDIMPORT

The load level that should be imported can be set with following command:

WRITE IMPORTEXPORTSCHEME VALUE 25

The 25% means 25% of rated power (the rated power programmed in the grid C6200 unit).

3.9.2   Peak import

Peak import means the installation will load the connected generators up to a pre- programmed load level. In case the load demand increases above this limit, the remaining power will be imported from the grid.

To activate this scheme use following command:

WRITE IMPORTEXPORTSCHEME PEAKIMPORT

The maximum load level of the generators can be set with following command:

WRITE IMPORTEXPORTSCHEME VALUE 25

The 25% means 25% of rated power programmed in the generator C6200 unit.

3.9.3   Fixed export

Fixed export means a certain amount of capacity will be exported to the grid. The 6200 of the grid forces the C6200 modules of the auxiliary generators to produce a certain amount of power into the grid C6200.

To activate this scheme use following command:

WRITE IMPORTEXPORTSCHEME FIXEDEXPORT

The load level that should be exported to the grid can be set with following command:

WRITE IMPORTEXPORTSCHEME VALUE 25

The 25% means 25% of rated power (the rated power programmed in the grid C6200 unit).

3.9.4   Excess export

Excess export means that the generator will run with a fixed power. Power that is not used in the installation will be exported to the grid.

 To activate this scheme use following command:

WRITE IMPORTEXPORTSCHEME EXCESSEXPORT

The load level that the generator should run with can be set with following command:

WRITE IMPORTEXPORTSCHEME VALUE 25

The 25% means 25% of rated power programmed in the generator C6200 unit.

3.9.5   Power factor control

In case the generator is running in parallel with the grid it is necessary to define a power factor.

For this the Power Factor Control Mode has to be activated:

WRITE SYS VOLTCTRL MODE PF

The choice can be PF for power factor control mode when running the generator in parallel with the grid or LS for reactive load sharing mode when running in island mode or in parallel with other generators.

In case Power Factor Control Mode is activated, a set point for the power factor must be defined:

WRITE SYS VOLTCTRL PFLEVEL 0.80

The range is 0.00 to 1.00, default is 0.80.

3.10 Load depending start and stop

A load depending start and stop function can be programmed with C6200.

WRITE LOADSTARTSTOP ENABLED NO

The choice is YES or NO. Default is NO.

For this function a generator priority, a start level, a start delay, a stop level and a stop delay must be programmed

It is also necessary to define the start and stop outputs (see).

3.10.1 Start

The conditions for starting the next generator in line (according to the priority setup) are determined by the start level and the start delay. The start level is expressed as a percentage of the on-line capacity. The start delay is initiated as soon as the total load exceeds the start level. However, the C6200 module will not signal the generator to start until the start level has been exceeded continuously for the duration defined by the start delay.

The on-line capacity is calculated from the generator max current parameters (in C6200 Module) multiplied with the rated cosphi parameter (in C6200 Module). The total load is calculated as the sum of the active loads on generators running.

Generators that are failed or switched to manual will not be started automatically. These generators are simply disregarded in the start/stop algorithm.

WRITE LOADSTARTSTOP STARTLEVEL 80

The start level can be programmed between 20% and 120% of rated load (Range 20-120). Default is 80%.

WRITE LOADSTARTSTOP STARTDELAY 10

The start delay can be adjusted between 2s and 32000s. Default is 10s.

3.10.2 Stop

The conditions for stopping the last generator in line (according to the priority setup) are determined by the stop level and the stop delay. The stop level is expressed as a percentage of the on-line capacity, minus the capacity of the generator which is about to be stopped. The stop delay is initiated as soon as the total load decreases below the stop level. However, the C6200 module will not signal the generator to stop until the stop level has been passed continuously for the duration defined by the stop delay.

The on-line capacity is calculated from the generator max current parameters (in C6200 Module) multiplied with the rated cosphi parameter (in C6200 Module). The total load is calculated as the sum of the active loads on generators running.

Generators that are failed or switched to manual will not be started automatically. These generators are simply disregarded in the start/stop algorithm.

WRITE LOADSTARTSTOP STOPLEVEL 60

The stop level can be programmed between 20% and 120% of rated load (Range 20-120). Default is 60%.

WRITE LOADSTARTSTOP STOPTDELAY 10

The stop delay can be adjusted between 2s and 32000s. Default is 10s.

3.11 IO & Relays

The properties of the inputs, outputs and relays can be configured by the following parameters.

3.11.1 Alarm Relay Function

The alarm relay can be configured to signal either system alarm (internal faults of C6200 or communication errors) or system and protection alarms.

The relay function is set by the following command. The choice can be either SYS or SYSPROT.

> WRITE RELAYS ALARMFUNC <Choice>

3.11.2 Protection Trip Relay

The Protection Trip relay can be configured for normally de-energized or normally energized operation. The default setting is normally energized operation, as this setting would cause a C/B trip if the power supply is lost.

The relay function is set by the following command. The choice can be either ND or NE.

> WRITE RELAYS PROTTRIP CONTACT <Choice>

3.11.3 Unload trip

When the unload input is activated it will ramp down the load. The Unload Trip function will trip the breaker when the load is below trip level.

The relay function is set by the following command. The choice can be either ND or NE.

> WRITE RELAYS UNLOADTRIP CONTACT <Choice>

3.12 Programmable functions

The programmable functions can be controlled via user programmable inputs and outputs or by triggering the functions by Modbus.

3.12.1 Control of user defined function via inputs and outputs

Inputs and outputs can be used for a range of user defined functions. Programming these inputs and outputs can be done by either HyperTerminal or User Interface module. This manual shows programming via HyperTerminal.

A function consists of an Input (In), Output (Out) and Error Output (Err)
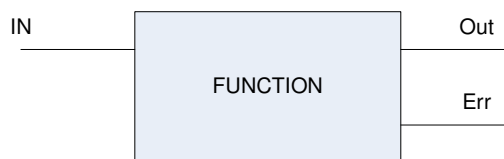
Each of these user defined functions consists of an input for activating the function, an output that activates in case the function has been completed successfully and an error output in case the function has not been completed successfully.

Input

The inputs activate the user defined function.

Output

The outputs works as an acknowledge signal or flag. It is a feedback that the requested function has been completed successfully. The flag can be used in a process overview to indicate the C6200 current status or it can be used to trigger the next stage in a PLC program.

Error Output

The error output can be assigned to any of the 8 user defined outputs or the common alarm output relay. The error output is activated if the function is not completed successfully (i.e. auto synchronization is not met within the specified time frame).

Programming

Each function can be assigned an input, output and an error output. When configuring a C6200 function an input and output must be assigned in the same command line.

A word of caution: there are no fail safes in regard to assigning incompatible functions to the same input/output

The command for assigning a function is.

<p style="text-align:center">WRITE IOFUNC <Choice> <Choice> <Choice></p>

The first choice defines the input used for the function. It can be OFF, IN1, IN2,IN3, IN4, IN5, IN6, IN7 OR IN8.

The second choice defines which output will be used for the acknowledge signal. The choice can be OFF, OUT1, OUT2, OUT3, OUT4, OUT5, OUT6, OUT7 or OUT8.

The third choice defines which output should be used for the error signal. The choice can be OFF, OUT1, OUT2, OUT3, OUT4, OUT5, OUT6, OUT7, OUT8 or ALARM.

Not all choices are applicable for all functions. In case a choice is not applicable, it can be ignored in the RS232 command.

3.12.2 Control of governor by increase decrease pulse signals

In case increase decrease pulse signals should be used for speed control, it is possible to use the programmable inputs and outputs for that.

The input can be used for manual speed control (only active with C6200 in manual mode (terminal 41 MANUAL CONTROL connected to COM).

The output can be used as speed control output instead of the analogue speed setting output (terminal 33, 34, 35). This function is available in both manual and automatic mode (regardless of connection of terminal 41).

Example: Manual speed control input programmed to IN1 (raise speed) and IN2 (lower speed). Pulse speed control output programmed to OUT1 (raise speed) and OUT2 (lower speed).

Program command	Function	Input	Output
WRITE IOFUNC	SPEEDINC	IN1	OUT1
WRITE IOFUNC	SPEEDDEC	IN2	OUT2

An error output is not applicable for this function. Therefore the third choice will be ignored (it simply remains empty.

3.12.3 Control of AVR by increase decrease pulse signals

In case increase decrease pulse signals should be used for voltage control, it is possible to use the programmable inputs and outputs for that.

The input can be used for manual voltage control (only active with C6200 in manual mode (terminal 41 MANUAL CONTROL connected to COM).

The output can be used as voltage control output instead of the analogue voltage setting output (terminal 37,38,39)). This function is available in both manual and automatic mode (regardless of connection of terminal 41).

Example: Manual voltage control input programmed to IN3 (raise voltage) and IN4 (lower voltage). Pulse voltage control output programmed to OUT3 (raise voltage) and OUT3 (lower voltage).

Program command	Function	Input	Output
WRITE IOFUNC	VOLTINC	IN3	OUT3
WRITE IOFUNC	VOLTDEC	IN4	OUT4

An error output is not applicable for this function. Therefore, the third choice will be ignored (it simply remains empty).

3.12.4 Output for under voltage alarm and trip

An alarm output for the under voltage alarm and trip can be programmed to any of the programmable outputs.

In following example the under voltage alarm and trip output is programmed to output 1:

Program command	Function	Input
WRITE IOFUNC	UV	OUT1

Input or error output functions are not applicable for this function. Therefore, the first and third choices will be ignored (they simply remain empty).

3.12.5 Output for over voltage alarm and trip

An alarm output for the over voltage alarm and trip can be programmed to any of the programmable outputs.

In following example the under voltage alarm and trip output is programmed to output 1:

Program command	Function	Input
WRITE IOFUNC	OV	OUT1

Input or error output functions are not applicable for this function. Therefore, the first and third choices will be ignored (they simply remain empty).

3.12.6 Output for under frequency alarm and trip

An alarm output for the under frequency alarm and trip can be programmed to any of the programmable outputs.

In following example the under frequency alarm and trip output is programmed to output 1:

Program command	Function	Input
WRITE IOFUNC	UF	OUT1

Input or error output functions are not applicable for this function. Therefore, the first and third choices will be ignored (they simply remain empty).

3.12.7 Output for over frequency alarm and trip

An alarm output for the over frequency alarm and trip can be programmed to any of the programmable outputs.

In following example the over frequency alarm and trip output is programmed to output 1:

Program command	Function	Input
WRITE IOFUNC	OF	OUT1

Input or error output functions are not applicable for this function. Therefore, the first and third choices will be ignored (they simply remain empty).

WRITE IOFUNC RP *[OFF, OUTx - OFF, OUTx] (OFF OFF)*

WRITE IOFUNC EL *[OFF, OUTx - OFF, OUTx] (OFF OFF)*

WRITE IOFUNC FD *[OFF, OUTx - OFF, OUTx] (OFF OFF)*

WRITE IOFUNC VS *[OFF, OUTx - OFF, OUTx] (OFF OFF)*

3.12.8 Output for reverse power alarm and trip

An alarm output for the reverse power alarm and trip can be programmed to any of the programmable outputs.

In following example the reverse power alarm and trip output is programmed to output 1:

Program command	Function	Input
WRITE IOFUNC	RP	OUT1

Input or error output functions are not applicable for this function. Therefore, the first and third choices will be ignored (they simply remain empty).

3.12.9 Output for excitation loss alarm and trip

An alarm output for the excitation loss alarm and trip can be programmed to any of the programmable outputs.

In the following example the excitation loss alarm and trip output is programmed to output 2:

Program command	Function	Input

WRITE IOFUNC	EL	OUT2

Input or error output functions are not applicable for this function. Therefore, the first and third choices will be ignored (they simply remain empty).

3.12.10 Output for the frequency deviation trip

An alarm output for the frequency deviation trip can be programmed to any of the programmable outputs.

In the following example the frequency deviation trip output is programmed to output 2:

Program command	Function	Input
WRITE IOFUNC	FD	OUT2

Input or error output functions are not applicable for this function. Therefore, the first and third choices will be ignored (they simply remain empty).

3.12.11 Output for the vector shift trip

An alarm output for the vector shift trip can be programmed to any of the programmable outputs.

In the following example the vector shift trip output is programmed to output 2:

Program command	Function	Input
WRITE IOFUNC	FD	OUT2

Input or error output functions are not applicable for this function. Therefore, the first and third choices will be ignored (they simply remain empty).

3.12.12 Remote control of frequency and voltage stabilization

In case the C6200 should not start frequency stabilization immediately after it detects voltage on the generator, it is possible to configure a start frequency stabilization command. With this function activated, the C6200 will only start frequency stabilization after the start frequency stabilization command has been activated and the generator voltage is within the Voltage ok window. This command can be activated either by one of the programmable inputs or RS485.

Often this function is used together with the start command for the voltage stabilization. It is possible to trigger both start commands from the same input.

Example: The start command for frequency and voltage stabilization can be configured to use the same inputs and outputs.

Program command	Function	Input	Output	Alarm
WRITE IOFUNC	FREQSTAB	IN4	OUT4	Alarm

WRITE IOFUNC	VOLTSTAB	IN4	OUT4	Alarm

In above example the frequency and voltage stabilization will start after input 4 has been connected to COM. After frequency and voltage stabilization have been accomplished, output 4 will activate. In case frequency or voltage stabilization cannot be done, the common alarm relay will be triggered.

3.12.13 Remote control of synchronization

In case the C6200 should not start synchronizing immediately after it detects voltage on bus bar and generator, it is possible to configure a start synchronizing command. With this function activated C6200 will first start synchronizing after the start synchronizing command has been activated and generator and bus bar are within the voltage ok window. This command can be activated either by one of the programmable inputs or RS485.

Example: Configuring Synchronization to Input 1, Output 1 and Alarm relay

Program command	Function	Input	Output	Alarm
WRITE IOFUNC	SYNC	IN1	OUT1	ALARM

Above settings mean that the synchronization of the generator will start after the input 1 has been activated. As soon as the generator is synchronized, C6200 will activate output 1 for indicating that the synchronization has been completed. In case C6200 fails to synchronize, the common alarm relay will be triggered.

3.12.14 Remote control of voltage matching

In case the C6200 should not start voltage matching immediately after it detects voltage on bus bar and generator, it is possible to configure a start voltage matching command. With this function activated, the C6200 will only start voltage matching after the start voltage matching command has been activated and generator and bus bar are within the voltage ok window. This command can be activated either by one of the programmable inputs or RS485.

Example: Configuring voltage matching to Input 1, Output 1 and Alarm Relay

Program command	Function	Input	Output	Alarm
WRITE IOFUNC	VOLTMATCH	IN1	OUT1	ALARM

Above settings mean that voltage matching of the generator will start after the input 1 has been activated. As soon as the voltage of the generator and the bus bar correspond, C6200 will activate output 1 for indicating that voltage matching has been completed. In case C6200 fails voltage matching, the common alarm relay will be triggered.

3.12.15 Remote control of active and reactive load ramp up

Usually, C6200 ramps up active and reactive load as soon as the circuit breaker is closed. In case this is not wanted a start ramp up command can be configured. With this function activated, the C6200 will wait for the start ramp up command before loading the generator.

Example: Start command for active RampUp & Reactive RampUp configured to use the same inputs and outputs.

Program command	Function	Input	Output	Alarm
WRITE IOFUNC	ACTRAMPUP	IN3	OUT3	Alarm
WRITE IOFUNC	REACTRAMPUP	IN3	OUT3	Alarm

With above settings the active and reactive load will be ramped up as soon as the circuit breaker is closed and input 3 is connected to COM. After the load has been ramped up, output 3 will activate. If load ramp up fails, the common alarm relay will be triggered.

3.12.16 Remote control of active and reactive load sharing

In case C6200 should not start load sharing immediately after the circuit breaker has been closed, it is possible to configure a start load sharing command. With this function activated C6200 will wait for the start load sharing command before loading the generator.

Example: Start command for active and reactive load sharing configured to use the same inputs and outputs.

Program command	Function	Input	Output	Alarm
WRITE IOFUNC	ACTLS	IN3	OUT3	Alarm
WRITE IOFUNC	REACTLS	IN3	OUT3	Alarm

With above settings the active and reactive load sharing will be started as soon as the circuit breaker is closed and input 3 is connected to COM. After the load balance has been obtained, output 3 will activate. If load balance cannot be obtained, the common alarm relay will be triggered.

3.12.17 Activation of power factor control mode via programmable inputs

In case a generator is running in parallel with the grid and it is necessary to define a power factor.

In case the generator sometimes works in island mode and sometimes in parallel with the grid it is possible to send a start command for the power factor control mode by one of the programmable inputs. In case the input is open the unit would run reactive loadsharing (generator in island mode or in parallel with other generators). In case the input is connected to COM power factor control mode is enabled (generator in parallel with the grid).

The input is defined by following command:

Program command	Function	Input	Output	Alarm
WRITE IOFUNC	PFCTRL	IN1	OUT1	Alarm

3.12.18 Definition of start/ stop in and out outputs for generators

C6200 offer the possibility of sending start and stop commands to the generators. This can be done either via manual start/ stop inputs or depending on load. For enabling this function the start and stop terminals must be defined. This can be done by following command:

Program command	Function	Input	Output	Alarm
WRITE IOFUNC	GENSTARTIO	IN1	OUT1	Alarm
WRITE IOFUNC	GENSTOPIO	IN2	OUT2	Alarm

Above example means that input 1 is the manual start input for the generator, output 1 is the start output for the generator. In case the engine fails to start the alarm relay would be activated.

3.12.19 Load depending start and stop

The load depending start and stop function can be enabled by following command:

Program command	Function	Input	Output	Alarm
WRITE IOFUNC	LOADSTARTSTOPENABLE	IN1		

3.12.20 Generator priority selection for load depending start and stop

In case the load depending start and stop function is enabled, automatically the programmable inputs 5, 6, 7 and 8 (terminals 19, 20, 21 and 22) are used for the priority selection.

Priority 1 → Input 5 connected to COM

Priority 2 → Input 6 connected to COM

Priority 3 → Input 7 connected to COM

Priority 4 → Input 8 connected to COM

Priority 5 → Inputs 5 and 8 connected to COM

Priority 6 → Inputs 6 and 8 connected to COM

Priority 7 → Inputs 7 and 8 connected to COM

Etc.

Priority 1 means that this generator will be started first and stopped last.

3.12.21 Indication of 1st standby generator

It is possible to use one of the programmable outputs for indication of the first standby generator. When activated, this output will activate as soon as the respective generator becomes the first standby generator. Use following command for activation of this function:

Program command	Function	Input	Output	Alarm
WRITE IOFUNC	1STANDBYINDICATION		OUT1	

3.12.22 Light Load Cancel Mode

In some cases it is necessary to disable the load depending stop function, while having load depending start still activated.

This can be achieved by following command:

Program command	Function	Input	Output	Alarm
WRITE IOFUNC	LIGHTLOADCANCEL	IN1		

3.12.23 Light Load Indication

The programmable outputs can be used for indication that the load of the generator is lower than the load depending stop level:

Program command	Function	Input	Output	Alarm
WRITE IOFUNC	LIGHTLOADINDICATION		OUT1	

3.12.24 High Load Indication

The programmable outputs can be used for indication that the load of the generator is lower than the load depending stop level:

Program command	Function	Input	Output	Alarm
WRITE IOFUNC	HIGHLOADINDICATION		OUT1	

3.12.25 Activation of load sharing schemes via programmable inputs

When running diesel generators in parallel with the grid, it is necessary to define a load set point for the diesel generators. This is done by choosing the load sharing scheme.

In case the generators are sometimes running in parallel with the grid and sometimes alone, it is required to activate and deactivate the load sharing scheme accordingly. This can be done either via RS485 or the programmable inputs.

Program command	Function	Input
WRITE IOFUNC	FIXEDIMPORT	IN1
WRITE IOFUNC	PEAKIMPORT	IN2
WRITE IOFUNC	FIXED EXPORT	IN3
WRITE IOFUNC	EXCESSEXPORT	IN4

Above example works as follows:
In case input 1 is activated, the generators will work in fixed import scheme.
In case input 2 is activated, the generators will work in peak import scheme.
In case input 2 is activated, the generators will work in fixed export scheme.
In case input 2 is activated, the generators will work in excess export scheme.

Output or error output functions are not applicable for this function. Therefore the second and third choices will be ignored (they simply remain empty).

3.12.26 Frequency Control Disable Output

In case a C6200 shall remote control the speed and/ or voltage of diesel generators through their respective C6200 units it is possible to send this command from one of the programmable outputs of the grid/ breaker C6200 unit:

Program command	Function	Input	Output	Alarm
WRITE IOFUNC	FVDISABLE		OUT1	

3.12.27 Control of user defined function via Modbus

It is possible to control the user defined functions by an assigned MODbus address via the MODbus protocol. This feature can be used with a PLC and other systems via the RS485 protocol

Basic block functionality:

Each Block has an Input (or Modbus Input), Output and an Error Output.
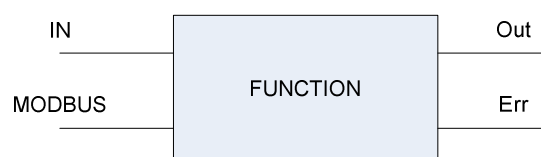
The C6200 MODbus memory map can be downloaded from www.selco.com

3.12.28 Function List

Description shows the name of the function.

Command text shows the command used in RS232 configuration to activate the function.

 In shows the default input choice.

Out shows the default output choice (note: for some functions it is not possible to program an output. For those function the table shows N/A (not applicable)).

Error shows the default error output choice (note: for some functions it is not possible to program an alarm output. For those function the table shows N/A (not applicable)).

Description	Command text	In	Out	Error
Speed Increase Input/ Output	SPEEDINC	OFF	OFF	N/A
Speed Decrease Input/ Output	SPEEDDEC	OFF	OFF	N/A
Volt Increase Input/ Output	VOLTINC	OFF	OFF	N/A
Volt Decrease Input/ Output	VOLTDEC	OFF	OFF	N/A
Reverse Power	RP	N/A	OFF	N/A
Excitation Loss	EL	N/A	OFF	N/A
Frequency Stabilization	FREQSTAB	OFF	OFF	OFF
Synchronizing	SYNC	OFF	OFF	OFF
Active Load ramp up	ACTRAMPUP	OFF	OFF	OFF
Active Load Sharing	ACTLS	OFF	OFF	OFF
Voltage Stabilization	VOLTSTAB	OFF	OFF	OFF
Voltage Matching	VOLTMATCH	OFF	OFF	OFF
Reactive Load ramp up	REACTRAMPUP	OFF	OFF	OFF
Reactive Load Sharing	REACTLS	OFF	OFF	OFF
Power Factor Control	PFCTRL	OFF	OFF	OFF
Start Input	GENSTARTIO	OFF	OFF	OFF
Stop Input	GENSTOPIO	OFF	OFF	OFF
Load depending start/ stop	LOADSTARTSTO PENABLE	OFF	N/A	N/A

Indication 1ˢᵗ standby generator	1STANDBYINDICATION	N/A	OFF	N/A
Light Load Cancel	LIGHTLOADCANCEL	OFF	N/A	N/A
Light Load Indication	LIGHTLOADINDICATION	N/A	OFF	N/A
High Load indication	HIGHLOADINDICATION	N/A	OFF	N/A
Fixed Import Mode	FIXEDIMPORT	OFF	OFF	N/A
Peak Import Mode	PEAKIMPORT	OFF	OFF	N/A
Fixed Export Mode	FIXEDEXPORT	OFF	OFF	N/A
Excess Export Mode	EXCESSEXPORT	OFF	OFF	N/A
WRITE IOFUNC	FVDISABLE	N/A	OFF	N/A

3.13 Analogue Outputs

The analogue outputs are used like measurement converter outputs. Any of the C6200 measurements can be provided on these outputs as a voltage signal.

The analogue outputs are configured with the following parameters.

3.13.1 Analogue Output 1

The first parameter to set is the measurement that should be connected to the output.

The indicated parameter is set by the following command. The choice can be any one of the following parameters: BusU12 (voltage between L1 and L2 of the bus bar), GenU12 (voltage between L1 and L2 of the generator), I3 (current of L3 of the generator), P (Power of the generator), Q (reactive power of the generator), PF (power factor), VA (apparent power of the generator), F (frequency), Off (analogue output disabled). Default is P.

> WRITE ANAOUT OUT1 SRC <Choice>

The next two commands scale the chosen parameter. Default is -10 and 100% of the measured value in relation to the nominal value.

> WRITE ANAOUT OUT1 SRCMIN <value>

> WRITE ANAOUT OUT1 SRCMAX <value>

Finally, the output signal must be scaled. This can be done for either voltage or current, depending on the choice made for the signal parameter. Default settings are -1 to 10 VDC.

> WRITE ANAOUT OUT1 VOLTMIN <value>

> WRITE ANAOUT OUT1 VOLTMAX <value>

3.13.2 Analogue Output 2

The first parameter to set is the "indicated" parameter (among all the available measured and calculated parameters).

The indicated parameter is set by the following command. The choice can be any one of the following parameters: BusU12 (voltage between L1 and L2 of the bus bar), GenU12 (voltage between L1 and L2 of the generator), I3 (current of L3 of the generator), P (Power of the generator), Q (reactive power of the generator), PF (power factor), VA (apparent power of the generator), F (frequency), Off (analogue output disabled). Default is P.

> WRITE ANAOUT OUT2 SRC <Choice>

The next two commands scale the chosen parameter. Default is -10 and 100% of the measured value in relation to the nominal value.

> WRITE ANAOUT OUT2 SRCMIN <value>

> WRITE ANAOUT OUT2 SRCMAX <value>

Finally, the output signal must be scaled. This can be done for either voltage or current, depending on the choice made for the signal parameter. Default settings are -1 to 10 VDC.

WRITE ANAOUT OUT2 VOLTMIN <value>

WRITE ANAOUT OUT2 VOLTMAX <value>

3.14 Generator specification

The first thing to do is to configure the C6200 module to fit the generator.

3.14.1 Voltage

The C6200 module must know the nominal voltage of the generator as well as the primary voltage. The nominal voltage is the nominal voltage that will be present on the *VOLTAGE INPUTS* plug-in connector of the module (actual voltage between L1-L2 terminals). Please note that voltage settings are phase-phase voltages.

The nominal voltage is set by the following command. Resolution of the nominal voltage is 100 mV AC. The range is 63,0V – 690,0V

WRITE SYS NOMVOLT <nominal voltage>

The actual voltage might not be the same as the nominal voltage in case the C6200 is connected via external voltage transformers. The actual voltage could be higher (e.g. in medium voltage installations), in which case the power source primary voltage is transformed down by external PT (voltage transformer). In order to scale the measurements so that they fit to the primary voltage, following command is used. Resolution is 1 V AC. The range is 63V – 32000V.

WRITE SYS PRIMVOLT <primary voltage>

The primary voltage should be set to the same value as the nominal voltage when no intermediate PTs are used.

The voltage settings will affect the indication of phase-phase and phase-neutral voltages, as well as all parameters based on voltage (e.g. active/reactive loads, VA, generator capacity etc.). The nominal voltage is used for reference by the voltage stabilization function of the partner C6200 module (if installed).

3.14.2 Generator Maximum Current

The C6200 must be able to determine the capacity of the power source. The capacity is calculated through use of the primary voltage and the maximum current in one phase (the nominal current of the generator).

The nominal current of the generator can be calculated based on the following formula.

The formula is based on the kVA og kW rating and the primary phase-phase voltage.

$$GENCAP = 3 \cdot \left(\left(\frac{PRIMVOLT}{\sqrt{3}} \right) \cdot GENMAXCUR \cdot \cos\varphi \right)$$

$$GENMAXCUR = \frac{GENCAP}{3 \cdot \left(\left(\frac{PRIMVOLT}{\sqrt{3}} \right) \cdot \cos\varphi \right)}$$

The default settings are done using a power source of 42 kVA with a primary phase-phase voltage of 400 V AC. In this case the power factor (PF) is set to 1.00. The calculations would be as follows.

$$GENMAXCUR = \frac{GENCAP}{3 \cdot \left(\left(\frac{PRIMVOLT}{\sqrt{3}} \right) \cdot \cos \varphi \right)}$$

$$GENMAXCUR = \frac{42000}{3 \cdot \left(\left(\frac{400}{\sqrt{3}} \right) \cdot 1.00 \right)} = 60.6 A$$

The example above illustrates that the maximum current in one phase (at full load at PF = 1.00) is 60.6 A. The generator maximum current could also have been derived from the generators kW rating (33.6 kW at PF = 0.8).

Another example is a generator defined by a capacity of 3 x 130 kW at PF = 0.8.

$$GENMAXCUR = \frac{130000}{3 \cdot \left(\left(\frac{400}{\sqrt{3}} \right) \cdot 0.8 \right)} = 234.54 A$$

The maximum current is set by the following command. Resolution is 100 mA. The range is 0,5A – 30000,0A.

WRITE SYS GENMAXCUR <generator maximum current>

The maximum current is used as 100% reference for short-circuit and over current protection. The parameter is also used to calculate 100% reference for load (active and reactive) function, as well as the maximum capacity of the power source.

3.14.3 CT Primary Current

The C6200 module conducts its current measurements through an external current transformer CT). Two different versions of the C6200 module are available, one for 5 A secondary current and one for 1 A secondary current.

It is a requirement that the secondary rated current of the CT is either 5 A or 1 A. However the primary current depends on the choice of the designer. In order to convert the measured secondary current to primary current, the C6200 module must know the primary rated current of the current transformer.

The CT primary rated current is set by the following command. Resolution is 100 mA. The range is 5,0A – 30000,0A.

WRITE SYS CTPRIMCUR <CT primary rated current>

The CT primary current is simply used to scale the measured current to the actual current.

3.14.4 Rated Frequency

The rated frequency must be set in order for the C6200 module to know the 100% reference for the frequency dependent trip functions (e.g. for trip of Non-Essential loads).

The rated frequency is set by the following command. Resolution is 0.1 Hz. The range is 35Hz – 500Hz.

WRITE SYS RATEDFREQ <Rated frequency>

On a system equipped with the C6200, the generator speed will change when the rated frequency is altered provided that frequency stabilization is active.

3.14.5 Voltage ok window

The C6200 module needs to verify whether or not the generator voltage is OK.

The voltage window defines the boundaries around (+/-) the nominal voltages which the module regards are acceptable for safe operation. The VOLTAGE OK LED will be lit provided that voltage measurements are within the limits defined by the voltage window.

The voltage window is configured by the following command. Resolution is 1 %. The range is 0% - 20%.

WRITE SYS VOLTOKWND <Voltage Window>

3.14.6 Power Factor

The power factor is used for calculation of the 100% references for active power (kW) and reactive power (kVAr) related settings. The typical power factor is 0.8. The range is 0,00 to 1,00.

The power factor is configured by the following command. Resolution is 0,1.

WRITE SYS COSPHI <Power Factor>

3.15 Restoring to factory default configuration

The factory default configuration can be restored at any time by issuing the command

        WRITE SYS SETUPDEFAULT YES.

The default configuration is restored when power to the module has been turned off and on again.

3.16 Speed Control

Speed control can be done using either increase/decrease pulse signals or analogue output 1. The pulse signals are well suited for control of either a conventional governor or a motorized/electronic potentiometer through an external relay. The pulse outputs are open collector outputs.

Alternatively, speed control can be done by analogue output 1 using a voltage, current or PWM signal. The analogue speed output is intended for direct control of an electronic speed governor.

The C6200 speed control output can be reconfigured to operate as a frequency control signal (e.g. for remote control of other C6200 modules through the FREQ IN input). This function is commonly used in case two bus bar sections should be synchronized with each other.

3.16.1 Speed control signal

The speed control function can be enabled or disabled by the following command. The choice can be either YES or NO.

> WRITE SYS SPEEDCTRL ENABLED <Choice>

3.16.2 Analogue output signal for speed control

The speed control by analogue output 1 can be configured to operate with either a DC voltage, current or a PWM signal. The type of output signal is set by the following command. Choice can be VOLT, CUR or PWM.

> WRITE SYS SPEEDCTRL ANAOUT SIGNAL <Choice>

3.16.3 Pulse output signals for speed control

This function is only available with the user defined function Speed Increase/ Decrease Output activated.

The minimum pulse duration determines the duration of the shortest possible speed control pulse. The pulse duration setting is only in use when speed control is done by relays. Resolution is 1 ms. The range is 10ms to 10000ms.

> WRITE SYS SPEEDCTRL MINPULSE <Duration>

Setting the parameter too low will result in slow regulation, while a high setting will result in overshoot on the speed regulation.

3.16.4 Duty Cycle

The duty cycle parameter is only used when the speed control is done by pulse outputs. The duty cycle defines the sum of the minimum duration of the pulse and the rest time until the next pulse is issued. Resolution is 0.1 s. Range is 0,0s to 25,5s.

> WRITE SYS SPEEDCTRL DUTYCYCLE <Duration>

Setting the duty cycle too low might result in overshoot and instability with a slow reacting (lagging) governor. A high setting might slow down the regulation.

3.16.5 Voltage Range

The voltage minimum and maximum references define the lower and upper limits of the voltage output signal. These parameters are only used when speed control is done by analogue output and when the analogue signal has been set to voltage. Resolution is 0.001 V DC. The range is -10,000V to +10,000V.

WRITE SYS SPEEDCTRL ANAOUT VOLTMIN <Voltage>

WRITE SYS SPEEDCTRL ANAOUT VOLTMAX <Voltage>

3.16.6 Current Range

The current minimum and maximum references define the lower and upper limits of the current output signal. These parameters are only used when speed control is done by analogue output and when the analogue signal has been set to current. Resolution is 0.001 mA. The range is 0,000mA to 20,000mA.

WRITE SYS SPEEDCTRL ANAOUT CURMIN <Current>

WRITE SYS SPEEDCTRL ANAOUT CURMAX <Current>

3.16.7 PWM Settings

The PWM settings describe the properties of the pulse-width modulated (PWM) output signal. These settings are only used when speed control is done by analogue output and when the analogue signal has been set to PWM.

Resolution of the PWM base frequency is 1 Hz. The range is 100Hz to 32000Hz

WRITE SYS SPEEDCTRL PWMOUT FREQ <Frequency>

3.17 Voltage Control

Voltage control can be done using either increase/decrease pulse signals or analogue output 2. The pulse signals are well suited for control of either a conventional automatic voltage regulator (AVR) or a motorized/electronic potentiometer.

Alternatively, voltage control can be done by analogue output 2 using a voltage, current or PWM signal. The analogue voltage output is intended for direct control of an electronic AVR.

The C6200 voltage control output can be reconfigured to operate as a voltage control signal (e.g. for remote control of other C6200 modules through the VOLT IN input).

A minimum pulse time defines the minimum closure time for the relay contacts; likewise min/max references define the operational range of analogue output. The C6200 voltage regulator is configured using the following commands.

3.17.1 Voltage control signal

The voltage control function can be enabled or disabled by the following command. The choice can be either YES or NO.

WRITE SYS VOLTCTRL ENABLED <Choice>

In case the AVR is not controlled by C6200 this function must be disabled.

3.17.2 Analogue output signal for voltage control

The voltage control by analogue output 2 can be configured to operate with either a DC voltage, current or a PWM signal. The type of output signal is set by the following command. Choice can be VOLT, CUR or PWM.

WRITE SYS VOLTCTRL ANAOUT SIGNAL <Choice>

3.17.3 Pulse output signals for voltage control

The minimum pulse duration determines the duration of the shortest possible voltage control pulse. The pulse duration setting is only in use when voltage control is done by pulse signals. Resolution is 1 ms. The range is 10ms to 10000ms.

WRITE SYS VOLTCTRL MINPULSE <Duration>

Setting the parameter too low will result in slow regulation, while a high setting will result in overshoot on the voltage regulation.

3.17.4 Duty Cycle

The duty cycle parameter is only used when the voltage control is done by pulse outputs. The duty cycle defines the minimum duration of the pulse and the rest time until the next pulse is issued. Resolution is 0.1 s.

WRITE SYS VOLTCTRL DUTYCYCLE <Duration>

Setting the duty cycle too low might result in overshoot and instability with a slow reacting (lagging) AVR. A high setting might slow down the regulation.

3.17.5 Voltage Range

The voltage minimum and maximum references define the lower and upper limits of the voltage output signal. These parameters are only used when voltage control is done by analogue output and when the analogue signal has been set to voltage. Resolution is 0.001 V DC. The range is -10,000V to +10,000V.

WRITE SYS VOLTCTRL ANAOUT VOLTMIN <Voltage>

WRITE SYS VOLTCTRL ANAOUT VOLTMAX <Voltage>

3.17.6 Current Range

The current minimum and maximum references define the lower and upper limits of the current output signal. These parameters are only used when voltage control is done by analogue output and when the analogue signal has been set to current. Resolution is 0.001 mA. The range is 0,000mA to 20,000mA.

WRITE SYS VOLTCTRL ANAOUT CURMIN <Current>

WRITE SYS VOLTCTRL ANAOUT CURMAX <Current>

3.17.7 PWM Settings

The PWM settings describe the properties of the pulse-width modulated (PWM) output signal. These settings are only used when voltage control is done by analogue output and when the analogue signal has been set to PWM.

Resolution of the PWM base frequency is 1 Hz.

WRITE SYS VOLTCTRL PWMOUT FREQ <Frequency>

The PWM maximum reference defines the amplitude of the PWM signal (0 VDC being the minimum reference). Resolution is 0.001 V DC. The range is 100Hz to 32000Hz

WRITE SYS VOLTCTRL PWMOUT VOLTMAX <Voltage>

3.18 RS485

The RS485 communication interface can be configured with regard to MODBUS slave address, baud rate, data bit, parity and stop bits. It is important to ensure that the address is unique on the bus and that the remaining parameters are set according to specifications.

The MODBUS slave address is set by the following command.

> WRITE RS485 ADDRESS <Addr>

The data transmission rate is defined by the baud rate, which is set as follows.

> WRITE RS485 BAUDRATE <Baudrate>

The parity can be set by the following command.

> WRITE RS485 PARITY <Parity>

The number of data bits is set as follows.

> WRITE RS485 DATABITS <Databits>

The number of stop bits is set as follows.

> WRITE RS485 STOPBITS <Stopbits>