SELCO

C6200.0100 GENCONTROLLER

Installation Manual

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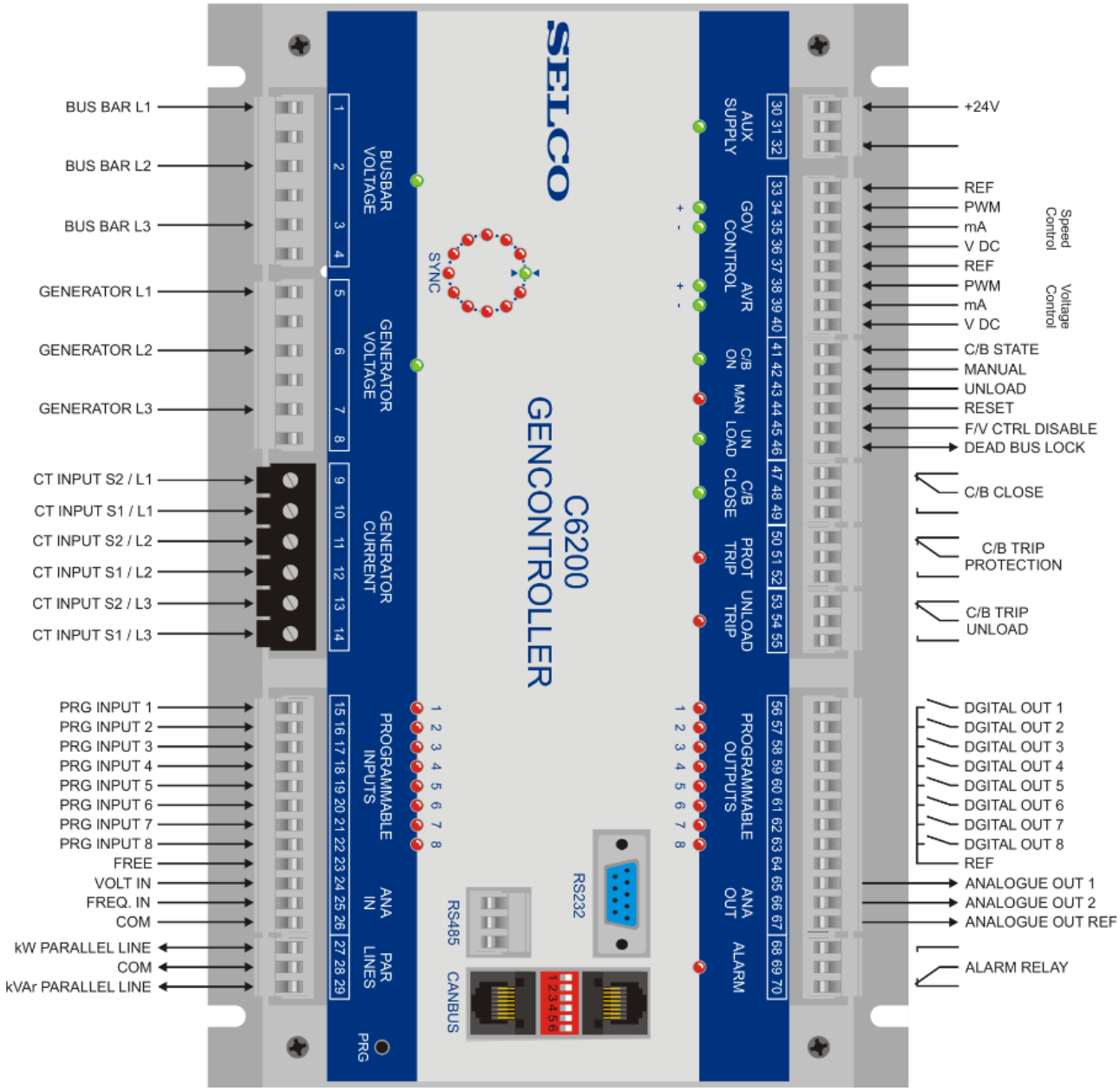
1 Preface

The SELCO C6200 module provides integrated frequency stabilization, voltage stabilization, check/automatic synchronisation, active/reactive load sharing, integrated protection, basic and programmable I/O and data acquisition. Finally, the C6200 module can operate with other C6200 modules and interface with the SIGMA S6500 User Interface Module via the CANbus or SCADA designed power management system via MOD bus.

2 Front view of C6200



3 Installation

The C6200 module is secured to the rear of the switch board using four 5 mm screws. DIN rail mounting is not advisable due to the weight of the module.

Please ensure that enough space is given around the module so that the plug-in terminals can be removed and reinserted. The length of the cables should also allow for the easy removal and insertion of the plug-in terminals.

4 Isolation and Grounding

In marine installations ground and common reference (COM) should not be connected together. In a ship installation the hull is the "ground". Connecting any of the COM connections on the C6200 module to ground (hull) or switchboard chassis may cause instability within the system.

As a general rule:

1. COM terminals should **not** be connected to ground (hull) or switchboard chassis.

2. Negative poles of the power supplies should **not** be connected to ground (hull) or switchboard chassis.

5 Connection

The C6200 module is connected using plug-in terminals. The plug-in terminals provide safe and durable connection without sacrificing ease of installation and servicing.

5.1 Power Supply

The electronics of the C6200 module are powered by one power supply. The supply operates on a nominal voltage of +24 V DC and the supply will tolerate wide variations in the supply voltage. The aux supply occupies terminal 29 and 31 of the AUX SUPPLY plug-in connectors.

Terminal	Description	Signal	Connection
30	AUX SUPPLY +	+24 V DC	Positive terminal of primary supply
31	FREE		FREE
32	AUX SUPPLY -	-24 V DC	Negative terminal of primary supply

The auxiliary power supply is not isolated from the remaining electronics of the module with the exception of the GOV and AVR controller. This means that the supply reference terminal (terminal 31) has connection to the module's COM terminal.

The front AUX SUPPLY LED illuminates with a steady green light to indicate that the supply voltage is OK and within the limits of safe operation.

5.2 Voltage Inputs

The AC voltages connect to the BUS BAR VOLTAGE & GENERATOR VOLTAGE INPUTS plug-in terminals.

The voltage inputs can operate with high voltage (up to 690 VAC nominal), so precaution must be taken to avoid electrical shock and personal injury. Do not touch the VOLTAGE INPUTS plug-in terminal unless you are absolutely sure that power source is off (e.g. the generator is stopped and blocked against starting).

Voltages above 690 VAC are supported through use of external transformers (PT). When using PT it is important to ensure that the PT does not affect the phase of the voltage measurement. Phase shift in the PT will directly affect the calculation of the power factor, and thereby the calculation of active and reactive current/load.

The phases L1, L2 and L3 of the bus bar and generator source should be connected to L1, L2 and L3 of the bus bar/generator VOLTAGE INPUTS plug-in terminals. Intermediate 2 A slow-blow fuses should be inserted between the individual phases and the related voltage inputs. It is very important that the phases are connected in the correct order. Interchanging the phases will result in an incorrect power factor calculation and thereby incorrect calculation of active/reactive current/load. It is very important that the phases are connected to the corresponding terminals (phase 1 to L1, phase 2 to L2, phase 3 to L3).

Terminal	**Description**	**Signal**	**Connection**
1	VOLTAGE INPUTS L1	AC voltage	Bus bar phase L1
2	VOLTAGE INPUTS L2	AC voltage	Bus bar phase L2
3	VOLTAGE INPUTS L3	AC voltage	Bus bar phase L3
Terminal	**Description**	**Signal**	**Connection**
5	VOLTAGE INPUTS L1	AC voltage	Generator phase L1
6	VOLTAGE INPUTS L2	AC voltage	Generator phase L2
7	VOLTAGE INPUTS L3	AC voltage	Generator phase L3

The GENERATOR VOLTAGE LED shows whether or not the voltage levels measured between the phases are within limits. The reference is the nominal phase-phase voltage (NOMVOLT). The voltage levels are compared to the limits defined by the voltage OK window (VOLTOKWND) of the configuration.

5.3 Current Inputs

The C6200 module measures current through external current transformers (CT). The C6200 module is available in two different variants; one is for 5 A CTs and one for 1 A CTs. Please ensure that you have the correct variant of the module before proceeding with the installation.

The CT ratio should cover maximum current of the generator.

The CT must also be capable of coping with short-circuit currents over short periods without going into saturation (Protection Transformers).

The external CTs are connected to the CT INPUT terminals. It is important to ensure that the direction of the current flow is correct. The current flow is indicated by the S1 and S2 notations on the CT. S1 of the CT connects to terminal 14 and S2 of the CT connects to terminal 13.

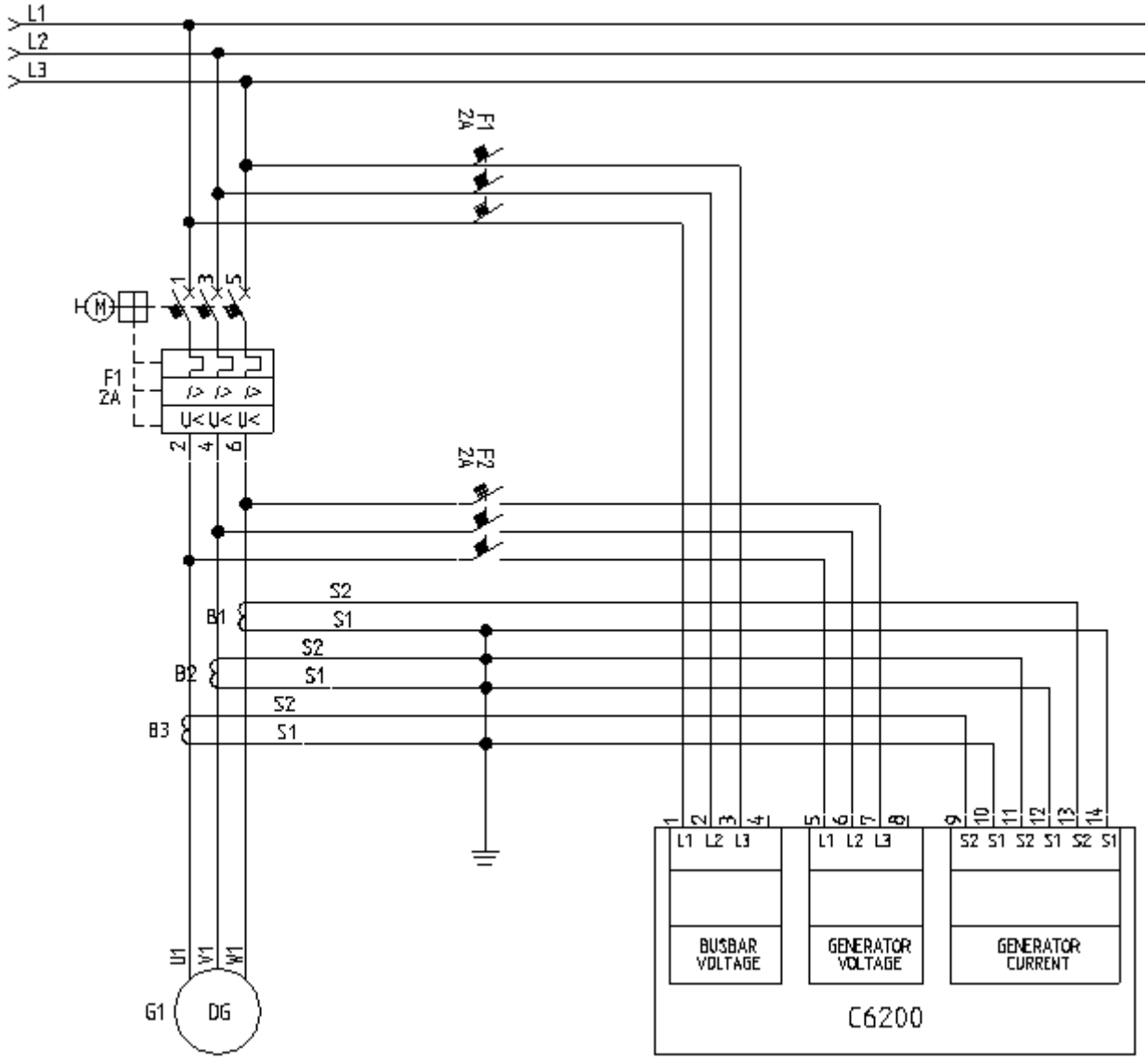
Terminal	Description	Signal	Connection
9	CT INPUT L1	AC current	S2 of the CT on phase L1
10	CT INPUT L1	AC current	S1 of the CT on phase L1
11	CT INPUT L2	AC current	S2 of the CT on phase L2
12	CT INPUT L2	AC current	S1 of the CT on phase L2
13	CT INPUT L3	AC current	S2 of the CT on phase L3
14	CT INPUT L3	AC current	S1 of the CT on phase L3

Make sure that the secondary side of the CT is shorted (make a connection between S1 and S2) before disconnection of the CT INPUT connector. Failure to do so may cause damage to the CT.

Please note that incorrect connection of the current transformers could result in wrong current, power and power factor readings.

Correct measurement of the current is extremely important, as the C6200 module relies upon the current measurements for the calculation of power factors, active currents/loads, reactive currents/loads, integrated protection functions and load sharing.

Connection of bus /generator voltages and current:

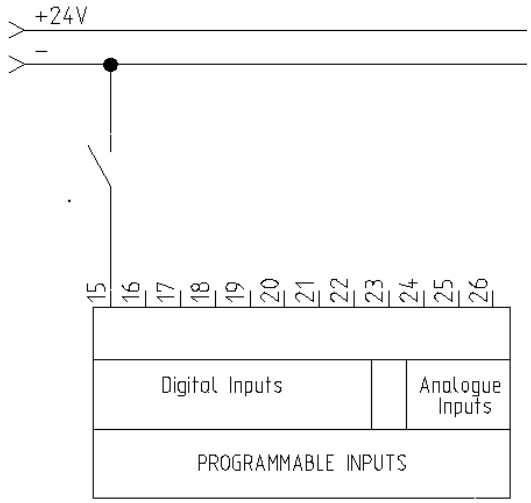


5.4 Programmable Inputs

The programmable input connector houses a number of digital inputs. The digital inputs work with negative reference, meaning the inputs are considered active when at COM level and inactive when left open (disconnected). The inputs are used for external activations of regulation and other functions. The functions are described in the C6200 Configuration Manual.

Terminal	Description	Signal	Connection
15	PROGRAM INPUT 1	NO contact to COM	Function request
16	PROGRAM INPUT 2	NO contact to COM	Function request
17	PROGRAM INPUT 3	NO contact to COM	Function request
18	PROGRAM INPUT 4	NO contact to COM	Function request
19	PROGRAM INPUT 5	NO contact to COM	Function request
20	PROGRAM INPUT 6	NO contact to COM	Function request
21	PROGRAM INPUT 7	NO contact to COM	Function request
22	PROGRAM INPUT 8	NO contact to COM	Function request
23	FREE	FREE	

Example for connection of a digital input:



5.5 Analogue Inputs

The analogue inputs are used for external control of voltage, frequency and load of the generator. For example they can be used when two busbar sections should be synchronized with each other or with the grid. They can also be used in case the load of the generator should be remotely controlled in grid parallel applications.

5.5.1 Volt. In

The VOLT. IN input is an analogue input. The input can be used for external control of the generator voltage, provided that the F/V CTRL. DISABLE input is active (connected to COM). The analogue control signal must be a voltage between -5 and 5 V DC. The VOLT. IN input uses the

COM terminal as reference. If not used, the VOLT. IN input should be connected to COM. This is especially important while the F/V CTRL. DISABLE input is active.

5.5.2 Freq. In

The FREQ. IN input is an analogue input. The input can be used for external control of the generator frequency provided that the F/V CTRL. DISABLE input is active (connected to COM). The analogue control signal must be a voltage between -5 and 5 V DC. The FREQ. IN input uses the COM terminal as reference. If not used, the FREQ. IN input should be connected to COM. This is especially important while the F/V CTRL. DISABLE input is active.

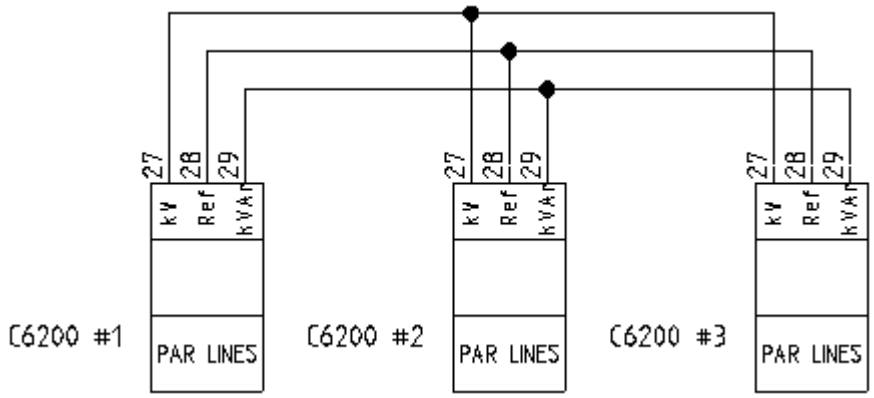
Terminal	Description	Connection
24	VOLT IN	External voltage input, +/- 5V
25	FREQ IN	External voltage input, +/- 5V
26	COM	Common reference

5.6 Parallel Lines

The signals of the parallel lines plug-in connector are used for balancing the active and reactive current/load between multiple C6200 modules. The signal level of the parallel lines can also be adapted to suit other types of SELCO load sharers (e.g. the SELCO T-series).

In case the automatic voltage regulator (AVR) is not controlled by the C6200, it is not necessary to connect the kVAr balance line.

Terminal	Description	Signal	Connection
27	kW BALANCE	DC voltage	kW BALANCE of other C6200 modules
28	COM	Common reference	COM of the other C6200 modules
29	kVAr BALANCE	DC voltage	kVAr BALANCE of other C6200 modules



5.7 GOV/AVR Control

Two sets of analogue outputs are provided by the C6200 module. The analogue outputs are intended for direct control of electronic speed governor and AVR. Each analogue output can be configured to provide a DC voltage within the range of -10 to +10 V DC, a DC current within the range of 0 to 20 mA or a PWM signal with a default base frequency of 500 Hz. The outputs are isolated from each other and from the remaining electronics of the module. This means that the references of the outputs have no connection to each other or to the common reference (COM) of the module.

Terminal	Description	Signal	Connection
33	ANALOG OUTPUT 1 REF	reference (isolated)	Governor reference
34	ANALOG OUTPUT 1 PWM	PWM signal	Governor PWM input
35	ANALOG OUTPUT 1 mA	DC current	Governor current input
36	ANALOG OUTPUT 1 VDC	DC voltage	Governor voltage input
37	ANALOG OUTPUT 2 REF	reference (isolated)	AVR reference
38	ANALOG OUTPUT 2 PWM	PWM signal	AVR PWM input
39	ANALOG OUTPUT 2 mA	DC current	AVR current input
40	ANALOG OUTPUT 2 VDC	DC voltage	AVR voltage input

It is important to note that each analogue output is protected against short circuit by an internal 10 kΩ resistor. The resistor is placed in series on the output terminal. The output resistor might affect the magnitude of the output signal if the internal resistance of the driven equipment is low. The principle of voltage division applies between the output resistor and the internal resistance of the driven equipment.

Example: equipment with an internal resistance of only 10 kΩ would reduce a +10 VDC output voltage to +5 VDC. The two 10 kΩ resistors in series would make a 1:2 voltage divider. Likewise, the amplitude of the PWM signal is limited to +8 V DC.

5.8 Inputs

The *Inputs* plug-in connector houses a number of digital and analogue inputs. The digital inputs work with negative reference, meaning the inputs are considered active when at COM level and inactive when left open (disconnected). The analogue signals use negative reference as well, which means that the analogue voltages (e.g. 0 - 1 VDC signals) must have COM as reference.

Terminal	Description	Signal	Connection
41	C/B	NO contact to COM	External switch, output or relay
42	Manual Control	NO contact to COM	External switch, output or relay
43	Unload	NO contact to COM	External switch, output or relay
44	Reset Alarm	NO contact to COM	External switch, output or relay
45	Freq Ctrl disable	NO contact to COM	External switch, output or relay
46	DB Lock	Dead bus interlock	To be interconnected with the DB lock terminals of each C6200 module in the system

5.8.1 C/B

The C/B input provides feedback from the generator circuit breaker and is used by the C6200 module to determine if the breaker is open or closed. C/B is typically connected to COM through an auxiliary contact of the breaker. The breaker is considered closed by the C6200 module when the C/B input is at COM level.

5.8.2 Manual Control

When switched to manual control, C6200 will only interfere with speed and voltage of the generator in case it gets a command to do so via the programmable inputs (terminals 15 to 22). Such commands could for example be start synchronizing, start load sharing or speed increase (for complete list of programmable functions please refer to the configuration manual). The input is active when at COM level and inactive if left open.

5.8.3 Unload

The UNLOAD input is used to do a ramped unload of the generator before the breaker is tripped. UNLOAD is typically initiated from an external switch. Unload starts once the UNLOAD signal is put to COM level. Disconnecting the UNLOAD signal causes reconnection of the generator, where after the load ramp up again.

5.8.4 Reset Alarm

Reset Alarm is used to reset the alarm relay. Reset Alarm is active when the input is at COM level.

5.8.5 F/V Ctrl. Disable

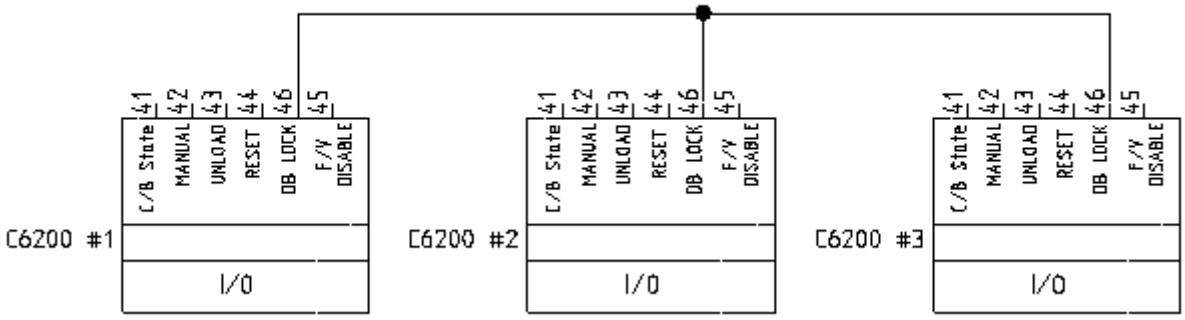
The F/V CTRL. DISABLE input is used to deactivate the voltage and frequency stabilization of the C6200 module. The signal is considered active when the input is connected to COM level, and inactive when left open. The signal is typically used when the generator is operated in parallel with a shaft generator or the grid (power sources that determine the voltage and frequency), or when the voltage and frequency are controlled by external equipment (through the VOLT. IN and FREQ. IN analogue inputs).

5.8.6 Dead Bus lock

The dead bus lock signal is used to prevent more than one generator to connect simultaneously to a dead bus bar in case of black out.

It should be interconnected between all generators that connect to the same bus bar.

Wiring of Dead bus Lock signal



5.9 C/B Close

This connector includes the terminals of the changeover relay for closure of the circuit breaker. The C/B close relay has two contact sets and is normally de-energized by default. Note that this relay can be reconfigured to normally energized operation.

Terminal	Description	Signal	Connection
47	C/B CLOSE 1	Relay de-energized position	Breaker remote close
48	C/B CLOSE 2	Relay contact	Signal source
49	C/B CLOSE 3	Relay energized position	Breaker remote close

5.10 Protection Trip

The terminals of this relay are intended for tripping the circuit breaker in case of protection trips (e.g. by the reverse power protection function). The built-in protection trip relay has two contact sets and is normally energized by default. Note that the protection trip relay can be reconfigured to normally energized operation.

Terminal	Description	Signal	Connection
50	PROT TRIP	Relay de-energized position	Breaker remote trip
51	PROT TRIP	Relay contact	Signal source
52	PROT TRIP	Relay energized position	Breaker remote trip

The protection trip relay connects to the remote trip input of the generator circuit breaker. Terminal 1 and 3 are typically not connected at the same time. Only one of these signals is taken to the breaker, depending on whether the Protection Trip relay is configured for normally energized or de-energized operation.

5.11 Unload Trip

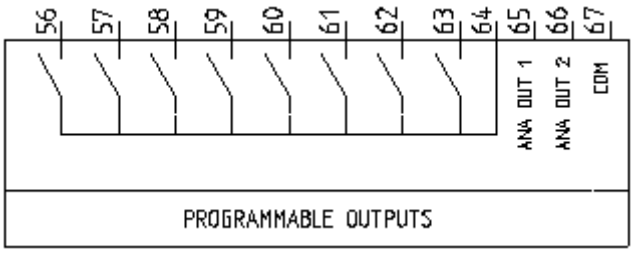
The unload trip relay connects to the remote trip input of the generator circuit breaker. Terminal 1 and 3 are typically not connected at the same time. Only one of these signals is taken to the breaker, depending on whether the unload trip relay is configured for normally energized or de-energized operation. The unload trip relay disconnects the circuit breaker after the generator has been unloaded by the unload function.

Terminal	Description	Signal	Connection
53	Unload Trip	Relay de-energized position	Breaker remote trip
54	Unload Trip	Relay contact	Signal source
55	Unload Trip	Relay energized position	Breaker remote trip

5.12 Programmable Outputs

The programmable outputs are normally open relay outputs outputs. The reference of all programmable outputs is terminal 64 REF. The outputs are used for indication and control signals (e.g. common alarms or speed and voltage control pulses). The functions are described in the C6200 Configuration Manual.

Terminal	Description	Signal	Connection
56	PROGRAM OUTPUT 1	Normally open relay output	External output
57	PROGRAM OUTPUT 2	Normally open relay output	External output
58	PROGRAM OUTPUT 3	Normally open relay output	External output
59	PROGRAM OUTPUT 4	Normally open relay output	External output
60	PROGRAM OUTPUT 5	Normally open relay output	External output
61	PROGRAM OUTPUT 6	Normally open relay output	External output
62	PROGRAM OUTPUT 7	Normally open relay output	External output
63	PROGRAM OUTPUT 8	Normally open relay output	External output
64	REFERENCE	Relay Reference	



5.13 Analogue Outputs

Two analogue outputs are provided by the C6200 module. The analogue outputs are intended for use with third party meters or measuring equipment. Each of the two outputs can be individually configured in relation to any one of the measured or calculated parameters provided by the C6200 module.

Each analogue output can be configured to provide a DC voltage within the range of -10 to +10 V DC. The two outputs are not isolated from each other or from the remaining electronics of the module. This means that the reference of the outputs has the same common reference (COM) as the module.

The analogue outputs can be used for external indication on meters or to provide analogue readings to e.g. a PLC.

Terminal	Description	Signal	Connection
65	ANALOG OUTPUT 1 VDC	DC voltage	External voltage input
66	ANALOG OUTPUT 2 VDC	DC voltage	External voltage input
67	ANALOG OUTPUT REF	Reference (COM)	Internal reference

It is important to note that each analogue output is protected against short-circuit by an internal 10 kΩ resistor. Resistors are placed in series on the output terminal. The output resistor might affect the magnitude of the output signal if the internal resistance of the driven equipment is low. The principle of voltage division applies between the output resistor and the internal resistance of the driven equipment. Example: equipment with an internal resistance of only 10 kΩ would reduce a +10 VDC output voltage to +5 VDC. The two 10 kΩ resistors in series would make a 1:2 voltage divider.

5.14 Alarm

The ALARM includes two contact sets. The alarm relays can only operate as normally energized relays. This is to ensure that the ALARM relay will trip in case both supplies fail.

Terminal	Description	Signal	Connection
68	Alarm Contact	Relay de-energized position	Alarm system
69	Alarm Contact	Relay contact	Signal source
70	Alarm Contact	Relay energized position	Alarm system

5.15 RS485

The C6200 module includes an isolated RS485 interface.

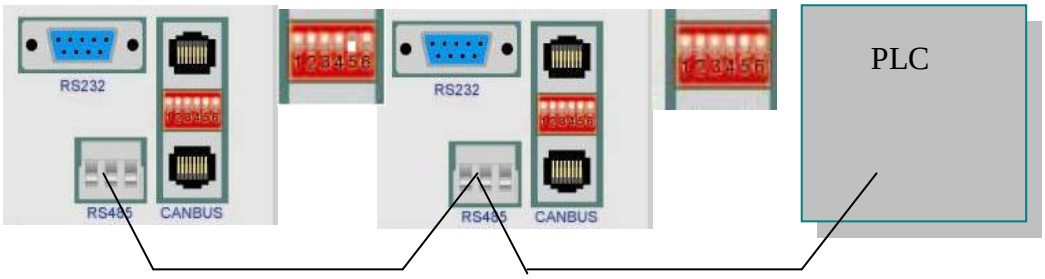
Terminal	Description	Signal	Connection
Left	B -	RS485 B	B signal of the RS485 bus
Middle	A +	RS485 A	A signal of the RS485 bus
Right	REF	Reference (isolated)	Reference of the RS485 bus

It is important to note that the RS485 reference is isolated from the common COM of the module.

The 3-wire RS485 bus is connected from module to module.

The first and the last module on the RS485 bus need a termination resistor (150Ω) between lines A and B. It is not necessary to connect external resistors. The C6200 contains internal end of line resistors for the RS485 bus. They can be activated by DIP switch 5 on the front of the C6200. Therefore, on the first and on the last unit on the RS485 bus DIP switch 5 has to be switched to ON. The maximum cable length for RS485 is 1000 meters. The cable type must be twisted (twisted pair) for A and B. The cable must be shielded. One end of the shield (and only **one** end) must be connected to switchboard chassis.

Cable 2-LiYCY TP shielded 2x2x0,75 can be used



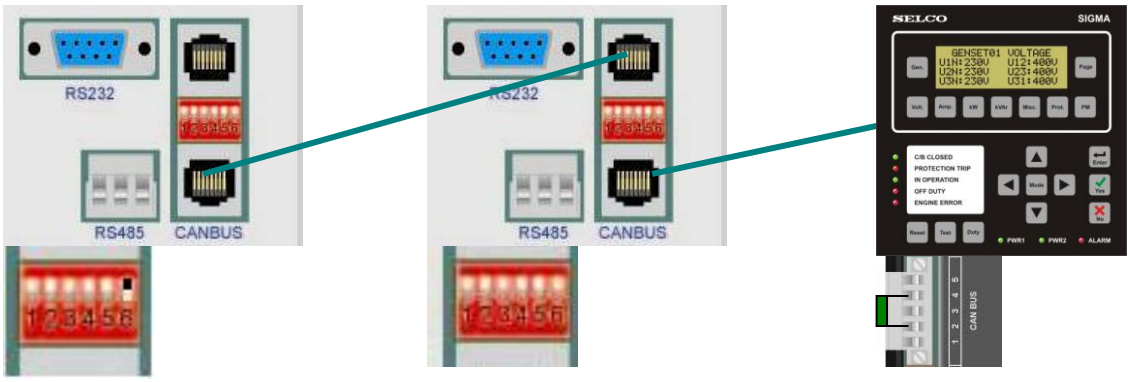
It is sometimes necessary to fix the potential of the RS485 + and – lines due to interference from other sources. This is done using two 1 kΩ resistors. One is fixed between RS485 + and +5 VDC, the other is fixed between RS485 – and the reference of the +5 VDC supply. The reference of the +24 VDC supply must then be connected to terminal 1 of the RS485 plug on each and every module.

5.16 CANbus

The CANbus is only used in connection with a S6500 User Interface. S6500 is only for display and programming purposes. Thus the C6200 is independent of the CANbus for its operation.

The CANbus terminals are located on the front plate in the right side. The terminals are module standard used in Data communication equipment. Therefore, use standard twisted pair patch cable for CANbus wiring. The maximum cable length is 40 meters. The cable type should be 0.25 - 0.34 mm^2 (AWG23/AWG22). Cable resistance should be less than 26 mΩ per meter.

The first and the last module on the CANbus need a termination resistor (150Ω) between lines A and B. It is not necessary to connect external resistors. The C6200 contains internal end of line resistors for the CANbus that can be activated by dip switch 6 on the front of C6200. Therefore, on the first and on the last unit on the CANbus, dip switch 6 has to be switched to ON. Every C6200 module of the installation must be connected to the same CANbus network. Third party CAN nodes may not be connected to the C6200 CANbus.



150Ω resistor via dip switch

150Ω resistor

RJ45 Connector for CAN bus: