

PRELIMINARY VERSION

# H2000 ENGINE CONTROLLER

PRELIMINARY VERSION

## Users Manual

Version 1.5

# SELCO

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## PRELIMINARY VERSION

Compact unit for switchboard front panel mounting with standard instrument dimensions of 96 x 96mm.  
Quick installation by means of clamping fittings and plug-in terminal blocks for easy service.  
Noise and radio interference immunity according to EN50081-1, EN50082-1, EN50081-2 and EN50082-2  
Microprocessor-based controller

### 1. Description

The H2000 Engine Controller has been designed to take care of the complete control of a diesel Generator. It provides control features for automatic or manual starting, monitoring and protection of the engine during start and operation. Simultaneously the status and faults are indicated on front panel. The H2000 is a microprocessor-based controller, giving of programmability of timers, relay functions and auxiliary inputs. The unit includes a tacho-detector. It determines the engine revolutions for crank-disconnect-, over-, and under-speed by the frequency of the generator voltage. Therefore an external tacho-relay is not required. Additionally it is possible to use external contact signals for all three tacho levels.

Operation



#### 1.1. Auto / Off / Man. function change over

The rotary selector switch for Auto / Off / Man. function is situated on the front panel of the H2000. At "Man." the start sequence is set for 1 start attempt and start signal is only accepted from the push-button on the front panel of the H2000.

At "Off" the start function of the unit is disabled. Should the engine be started without the controller, monitoring will become active when changing to either "Man " or "Auto".

At "Auto" the start sequence is set for 3 start attempts and start signal is only accepted from the input terminal pin3 for remote start.

## 1.2. Manual start

Turning the selector switch into MAN position and pressing the push-button on the front panel activates manual start.

Manual start gives one start attempt and the start attempt continues until either:

The engine RPM pass crank disconnect level.

The programmed starting time has expired.

The supply voltage on the emergency input terminal pin-29 is disconnected.

## 1.3. Automatic start

Automatic start is activated with a signal on the input terminal pin1 for remote start and provides 3 start attempts with intermediate pauses.

The attempt continues until:

The engine RPM pass crank disconnect level.

The programmed starting time and number of attempts have expired.

Stop signal on input terminal pin4 for remote stop.

The supply voltage on the emergency input terminal pin29 is disconnected.

## 1.4. Stop

If the rotary selector switch for Auto / Off / Man is set to "AUTO", stop is activated with signal on input terminal pin4 for remote stop or by switching the rotary switch to "OFF".

If the rotary switch for Auto / Off / Man is set to "Man" stop is activated by switching the rotary switch to "OFF".

## 1.5. Auto-stop (stop in case of failure)

Auto-stop occurs when:

- A. Supply voltage on emergency input terminal pin29 is disconnected.
- B. Starting time has expired and engine RPM has not reached crank disconnect level.
- C. Overspeed RPM achieved.
- D. Underspeed RPM achieved in "safety on" period and under-speed programmed for auto-stop.
- E. Signal for low lubrication oil pressure activated in "safety on" period.
- F. Signal for high water temperature activated in "safety on" period.
- G. Auxiliary signals activated and inputs programmed for auto-stop.
- H. Tacho failure when engine is running.

## 1.6. Monitoring of rpm

The engine rpm is monitored on 3 levels:

- A. Crank disconnect
- B. Underspeed
- C. Overspeed

Signal can be received from the generator frequency or contact signals from an external tacho relay.

## 1.7. Monitoring of lubrication oil

The lubrication oil pressure of the engine is monitored through contact signal from the oil pressure switch of the engine to the input terminal pin5 for oil pressure.

## 1.8. Monitoring of water temperature

The water temperature of the engine is monitored through contact signal from the water thermostat of the engine to the input terminal pin6 for high water temperature.

### 1.9. Monitoring of optional functions

The H2000 has inputs for 3 optional input signals, which can be connected to the input terminals pin8, pin9 and pin10.

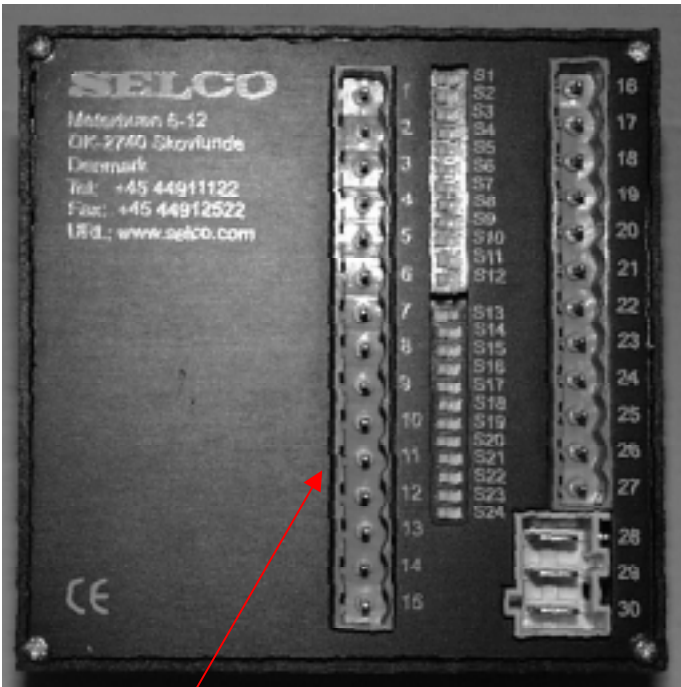
### 1.10. Monitoring of the battery charger

The engine battery charger is monitored from the D+ of the battery charger to the input terminal for charging.

### 1.11. Fail reset (lamp test)

With the selector switch in off and activation of the start push button, auto-stop and alarms are reset. All LED's on the front panel of the controller will light on fail reset (lamp test).

## 2. Inputs



Terminal		
1	DC Power supply +	
2	DC Power supply -	
3	Remote Start	
4	Remote Stop	
5	Low oil pressure	
6	High Engine Temperature	
7	Battery D+	
8	Auxiliary 1	
9	Auxiliary 2	
10	Auxiliary 3	
11	Crank disconnect	
12	Underspeed	
13	Overspeed	
14	N	Tacho Frequency
15	L	

Input\_connector

### 2.1. Power supply -

Terminal 1 and 2 are the power supply terminals. Nominal voltage is 12V or 24V. However, the unit will accept voltage from 9V to 36V.

A yellow LED on the front panel will indicate the controller receiving correct supply voltage.

### 2.2. Power supply -

Terminal 2 is ground reference for power supply.

### 2.3. Remote start

Terminal 3 is the input for the remote start signal. It activates the Horn relay, the fuel relay and the crank relay. Start is activated by impulse or constant signal.

The input is active when the changeover switch is in pos. AUTO.

## 2.4. Remote stop

Terminal 4 is the input for the remote stop signal. It will deactivate the fuel and the crank relay. Stop is activated by impulse or constant signal. The input is active when the changeover switch is in pos. AUTO.

## 2.5. Low lubrication oil pressure

Terminal 5 is the input terminal for the low oil pressure signal. This input will always activate auto-stop. It is enabled after safety on timer has expired. Red LED is active when low oil pressure input signal is received and the input terminal is active. Setting the change over switch on the front to OFF and activating start makes reset. High input → activate auto-stop function. Low input → no action.

## 2.6. High water temperature

Terminal 6 is the input terminal for the “high water temperature” signal. This input will always activate auto-stop. It is enabled after safety on timer has expired. Red LED is active when high water temperature input signal is received and the input terminal is active. Setting the change over switch on the front to OFF and activating start makes reset. High input → activate auto-stop function. Low input → no action.

## 2.7. Battery charger

Terminal 7 is the input for the D+ signal from the battery charger. This input can be programmed to activate the alarm or auto-stop relay. Red LED is active when the battery charger is not charging. Setting the change over switch on the front to OFF and activating start makes reset. When programmed to alarm only, reset can be performed in auto by activating start button. The input is disabled until the “safety on” timer has expired. Open input → no action. High input → no action. Low input → activate programmed function.

## 2.8. Auxiliary functions

Signal inputs for optional functions are done as contact signal to the input terminals pin8, pin9, pin10 for optional functions. The input can be programmed constantly enabled or disabled until the “safety on” timer has expired. Input signal can be programmed to activate alarm or auto-stop. High input → activate programmed function. Low input → no action.

## 2.9. Crank disconnect level

Terminal 11 is input for an external signal, indicating that the engine has reached the crank disconnect rpm. It will disconnect the crank relay. Enabled in Manual or Auto mode.

## 2.10. Underspeed

Terminal 12 is the input terminal for the under speed signal. The input is disabled until the “safety on” timer has expired. It can be programmed to activate the alarm or the auto-stop relay. A red LED on the front panel will be active, in case under speed rpm level has been obtained. If this signal is completely lost while the engine is running, the LED on the front panel will flash and shut down will be activated. Setting the change over switch on the front to OFF and activating start makes reset. In case an external tachometer-relay with two levels only is in use, terminal 11 and 12 must be bridged. Underspeed can be programmed to activate either alarm or auto-stop. High input → no action. Low input → activate programmed function.

### 2.11. Overspeed

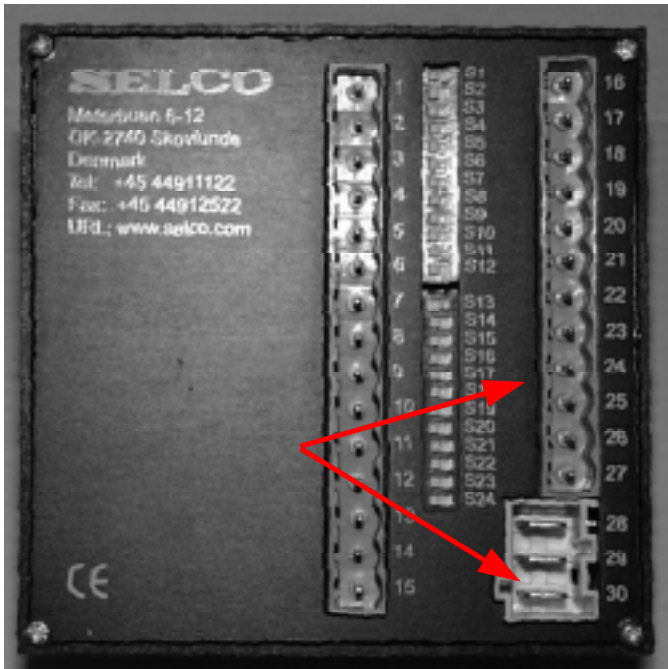
Terminal 13 is the input terminal for the over speed signal. It will always activate the auto-stop relay. A red LED on the front panel will be active, in case over speed rpm level has been obtained. Setting the change over switch on the front to OFF and activating start makes reset. High input → activate autostop function. Low input → no action.

### 2.12. Tacho frequency

Signal for tacho frequency is done as AC signal to the input terminal for tacho frequency. The input is enabled when the rotary selector is in "MAN" or "AUTO".

Nominal freq.	=	50/60 Hz programmable
Crank disconnect	=	40%
Under speed	=	90%
Over speed	=	115%

## 3. Outputs



Pin		
16	NO	Horn relay
17	Change-over contact	
18	NC	
19	NO	Auto stop relay
20	Change-over contact	
21	NC	
22	NO	Alarm relay
23	Change-over contact	
24	NC	
25	NO	Auxiliary relay
26	Change-over contact	
27	NC	
28	NO	Crank relay
29	+DC supply input From Emergency stop switch	
30	NO	Fuel relay

#### 3.1. Acoustic relay

**Terminals 16-18:** When activating start (local or automatic) the acoustic alarm relay is energized until the acoustic alarm timer has expired or stop signal is received. It has 1 potential free change over contact.

#### 3.2. Auto-stop relay

**Terminals 19 – 21:** The auto-stop functions of the H2000 are hard wire connected to this relay. It has 1 potential free change over contact. Auxiliary functions of the controller can be programmed to activate this relay.

#### 3.3. Alarm relay

**Terminals 22-24:** Alarm functions of the H2000 are hard wire connected to this relay. The relay can be programmed to normally de-activated or normally activated position. It has 1 potential free change over contact. The auxiliary functions of the engine can be programmed to activate this relay.

### 3.4. Auxiliary relay

**Terminals 25-27:** All auxiliary functions of the H2000 can be connected to this relay. The relay is normally de-activated. It has 1 potential free change over contact.

### 3.5. Relay for starter motor (crank relay)

**Terminal 28:** When activating start (local or automatic) the starter motor relay is energized after the acoustic alarm timer has expired and as long as crank disconnect rpm level has not been obtained. The relay is normally de-activated. The normally open contact of the relay supplies voltage to the output terminal pin28. Terminal 29 is the input for the supply voltage for both, crank and fuel relay. Therefore an emergency stop circuitry should disconnect the supply voltage to terminal 29.

### 3.6. Emergency input terminal

**Terminal 29:** This terminal is the power supply to the fuel and the crank relay. Therefore an emergency shut down switch should be connected as a normally closed switch to this terminal.

### 3.7. Fuel Relay

**Terminal 30:** When activating start (local or automatic) the fuel relay is energized after the acoustic alarm timer has expired and until normal stop signal or emergency stop is received. The relay is normally de-activated. The normally open contact of the relay supplies voltage to the output terminal pin30. Terminal 29 is the input for the supply voltage for both, fuel and crank relay. Therefore an emergency stop circuitry should disconnect the supply voltage to terminal 29.

## 4. Indication

### 4.1. Power on

Yellow LED that lights when the controller receives correct supply voltage.

### 4.2. Safety on

Green LED, which lights when the controller is operating and the "safety on" timer has expired so inputs are free for total monitoring.

### 4.3. Start failure

Red LED, which lights when start sequence has expired without the engine running. Setting the rotary switch on the front panel to OFF and press start (Fail reset) makes reset.

### 4.4. Overspeed

Red LED, which lights when overspeed rpm level has been obtained. Setting the rotary switch on the front to OFF and press start (Fail reset) makes reset.

### 4.5. Underspeed

Red LED, which lights when the engine has been running normally and the tacho signal goes below the limit.

In "AUTO" reset is made by pressing start (fail reset) when programmed for alarm only or setting the rotary switch to "OFF" and press start (fail reset) when programmed for auto-stop.

In "MAN" reset is performed by setting the rotary switch to "OFF" and press start (Fail reset).

Note! If the red LED is flashing the tacho signal input is disconnected either on pin11 or pin14/pin15 (analog tacho signal).

#### **4.6. Aux-1**

Red LED, which lights when AUX-1 receives input signal and the input terminal is active.

In "AUTO" reset is made by pressing start (fail reset) when programmed for alarm only or setting the rotary switch to "OFF" and press start (fail reset) when programmed for auto-stop.

In "MAN" reset is performed by setting the rotary switch to "OFF" and press start (Fail reset).

#### **4.7. Aux-2**

Red LED, which lights when AUX-2 receives input signal and the input terminal is active.

In "AUTO" reset is made by pressing start (fail reset) when programmed for alarm only or setting the rotary switch to "OFF" and press start (fail reset) when programmed for auto-stop.

In "MAN" reset is performed by setting the rotary switch to "OFF" and press start (Fail reset).

#### **4.8. Aux-3**

Red LED, which lights when AUX-3 receives input signal and the input terminal is active.

In "AUTO" reset is made by pressing start (fail reset) when programmed for alarm only or setting the rotary switch to "OFF" and press start (fail reset) when programmed for auto-stop.

In "MAN" reset is performed by setting the rotary switch to "OFF" and press start (Fail reset).

#### **4.9. Acoustic alarm**

Green LED on the front panel will flash when the timer has not expired and light constant when the start sequence is initiated. After start sequence expired, it will be deactivated.

#### **4.10. Battery**

Red LED, which lights when the battery charger is not charging.

In "AUTO" reset is made by pressing start (fail reset) when programmed for alarm only or setting the rotary switch to "OFF" and press start (fail reset) when programmed for auto-stop.

In "MAN" reset is performed by setting the rotary switch to "OFF" and press start (Fail reset).

#### **4.11. High water temperature**

Red LED, which lights when high water temperature input signal is received and the input terminal is enabled by the safety on timer.

Reset is made by setting the rotary switch on the front to OFF and activate start (Fail reset).

#### **4.12. Low lubrication. Oil pressure**

Red LED, which lights when low lubrication oil input signal is received and the input terminal is enabled by the safety on timer.

Reset is made by setting the rotary switch on the front to OFF and activate start (Fail reset).

#### **4.13. Emergency stop**

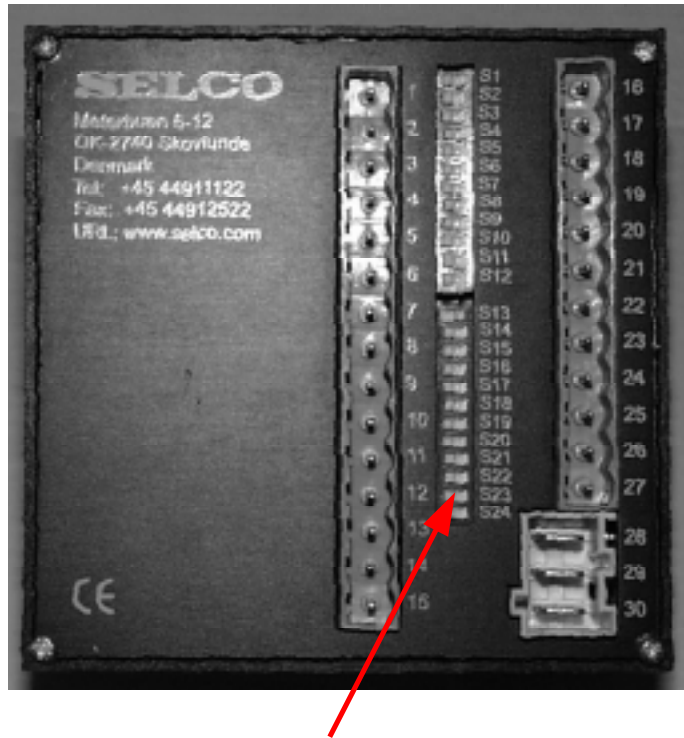
Red LED, which lights when external emergency stop signal is received (No supply voltage on Terminal 29).

Reset is made by setting the rotary switch on the front to OFF and activate start (Fail reset).

## 5. Programming

Programming the unit is done by use of switches placed on the rear side. These switches are placed in 2 groups S1-S12 and S13-S24.

Note! Any change in the settings will first be updated during next power up only !.



Programming switches

### 5.1. Programming switches S1-S12

This group is used for programming the output action for each auxiliary input.

#### 5.1.1. S1

Used to enable or disable the Auto-stop relay for the AUX-1 input.  
The table shows all the available settings.

Switch/function	Alarm	Auto stop
S1	OFF	ON

#### 5.1.2. S2

Used to set AUX-1 to be constantly active or active after lapse of "safety on" timer.  
The table shows all the available settings.

Switch/function	Const.	Safety on delay
S2	OFF	ON

**5.1.3. S3-S4**

Used to program the output relay action for AUX-1.  
The table shows all the available settings.

Switch/relay	Off	Alarm	Aux.	Alarm + Aux.
S3	OFF	ON	OFF	ON
S4	OFF	OFF	ON	ON

**5.1.4. S5**

Used to enable or disable the Auto stop relay for the AUX-2 input  
The table shows all the available settings.

Switch/function	Alarm	Auto stop
S5	OFF	ON

**5.1.5. S6**

Used to set the AUX-2 to be constantly active or active after lapse of “safety on” time.  
The table shows all the available settings.

Switch/function	Const.	Safety on delay
S6	OFF	ON

**5.1.6. S7-S8**

Used to program the output relay action for AUX-2.  
The table shows all the available settings.

Switch/relay	Off	Alarm	Aux.	Alarm + Aux.
S7	OFF	ON	OFF	ON
S8	OFF	OFF	ON	ON

**5.1.7. S9**

Used to enable or disable the Auto stop relay for the AUX-3 input  
The table shows all the available settings.

Switch/function	Alarm	Auto stop
S9	OFF	ON

**5.1.8. S10**

Used to set the AUX-3 to be constantly active or active after lapse of “safety on” time. The table shows all the available settings.

switch/function	Const.	Safety on delay
S10	OFF	ON

**5.1.9. S11-S12**

Used to set the output relay action for AUX-3. The table shows all the available settings.

Switch/relay	Off	Alarm	Aux.	Alarm + Aux.
S11	OFF	ON	OFF	ON
S12	OFF	OFF	ON	ON

**5.2. Programming switches S13-S24**

This group of switches is used to set the horn, start, start pause, safety on timer, nominal tacho frequency, alarm/ auto stop function for specified inputs and the normal function of the output relays (nd/ne).

**5.2.1. S13-S14**

Setup of activation time for the horn.

HORN time is the time between pressing the start bottom until the CRANK- and FUEL-relay is activated.

The table shows all the available settings.

Switch/time	0 sec.	5sec	7sec.	10sec.
S13	OFF	ON	OFF	ON
S14	OFF	OFF	ON	ON

**5.2.2. S15-S16**

Programming of the maximal START time.

START time is the time the CRANK relay is maximal activated in one start attempt.

The table shows all the available settings.

Switch/time	5 sec.	7sec	10sec.	15sec.
S15	OFF	ON	OFF	ON
S16	OFF	OFF	ON	ON

### 5.2.3. S17-S18

Programming the START PAUSE time.

START PAUSE is the time between two start attempts. This function is only active in AUTO mode. The table shows all the available settings.

Switch/time	5 sec.	7sec	10sec.	15sec.
S17	OFF	ON	OFF	ON
S18	OFF	OFF	ON	ON

### 5.2.4. S19-S20

Programming the SAFETY ON time.

SAFETY ON is the time between start rotation speed (crank disconnect) has been reached until inputs are released for monitoring. Remember that some inputs are constantly monitored.

The table shows all the available settings.

switch/time	5 sec.	7sec	10sec.	15sec.
S19	OFF	ON	OFF	ON
S20	OFF	OFF	ON	ON

### 5.2.5. S21

Used to set the 100% tacho frequency reference.

The table shows all the available settings.

switch/frequency	50Hz	60Hz
S21	OFF	ON

### 5.2.6. S22

Used to set the output relay action for the UNDERSPEED condition.

The table shows all the available settings.

switch/Function	Alarm	Auto stop
S22	OFF	ON

### 5.2.7. S23

Used to set the output relay action for the BATTERY condition.

The table shows all the available settings.

Switch/ Function	Alarm	Auto stop
S23	OFF	ON

**5.2.8. S24**

Used to set the ALARM -relay normal operation condition.

The table shows all the available settings. (ND- normally de-energized, NE- normally energized)

Switch/position	ND	NE
S24	OFF	ON

**6. Specification**

The H2000 is flush mounted in a 96 x 96mm norm cabinet. The depth from mounting plane is 90mm inclusive connectors.

**Power Supply:**

The H2000 is to be designed for normal function in the supply area from 8V - 36V DC. The controller can be supplied from battery or external DC supply.

**Inputs:**

Battery input:

U (input)	=	8-36V
R (input)	=	560Ohm
td (input delay)	=	0,2 s.

All other inputs:

U (input)	≥	8VDC
R (input)	=	3,3 Kohm
td (input delay)	=	0,2 s.

Tacho Input

U (input min.)	=	5 VAC RMS
U (input max.)	=	300 VAC RMS

**Output Relays:**

Crank and Fuel relay:

U (max.)	=	36Vdc
I (max)	=	16Adc
16ADC and 29VDC (UN + 20%)		
8ADC and 36VDC		
Resistive load, $\cos.\phi \geq 0,9$		

Auto Stop, Horn, Alarm and Aux. Relay:

U (max.)	=	36VDC
I (max)	=	5ADC

**Environment:**

Temperature:

Environment temperature during operation:	-20°C - +70°C
Temperature during storage:	-40°C - +85°C

Humidity:

Max. 95% relative humidity at 40°C

Height:

The controller is demanded to function up to 3050 meters (10.000 ft.) above sea level.

Index of protection:  
 From the front : IP54.  
 From rear : IP20

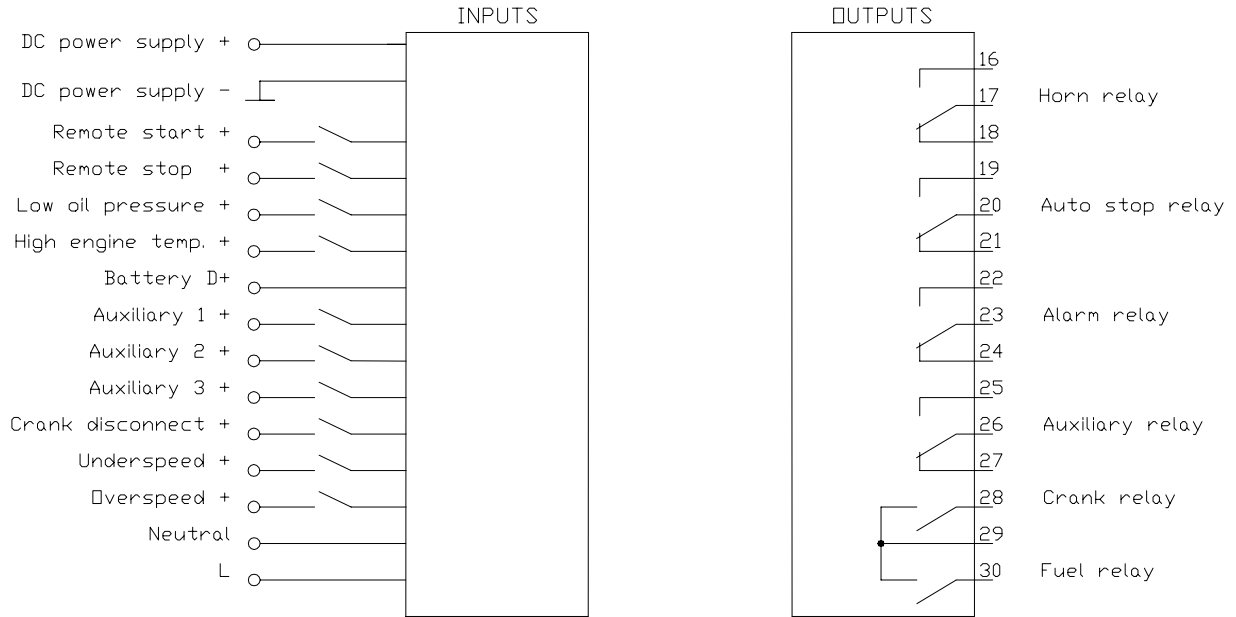
**Options:**

Serial communication

The controller has external connection possibility for serial communication on 3 conductors.

The controller has internal connection possibility for hardware for optional RS232, RS485 and MODBUS communication.

**7. Overview of in- and outputs and programming scheme**



PRELIMINARY VERSION

**Switch Function**

S1	Auto stop relay for AUX. 1	Alarm		Auto stop	
		OFF		ON	
S2	AUX. 1 const. active/ safety timer	Const		Safety	
		OFF		ON	
S3	Output relay action for AUX. 1	Off	Alarm	AUX.	Alarm + AUX.
		OFF	ON	OFF	ON
S4	Output relay action for AUX. 1	OFF	OFF	ON	ON
S5	Auto stop relay for AUX. 2	Alarm		Auto stop	
		OFF		ON	
S6	AUX. 2 const. active/ safety timer	Const		Safety	
		OFF		ON	
S7	Output relay action for AUX. 2	Off	Alarm	AUX.	Alarm + AUX.
		OFF	ON	OFF	ON
S8	Output relay action for AUX. 2	OFF	OFF	ON	ON
S9	Auto stop relay for AUX. 3	Alarm		Auto stop	
		OFF		ON	
S10	AUX. 3 const. active/ safety timer	Const		Safety	
		OFF		ON	
S11	Output relay action for AUX. 3	Off	Alarm	AUX.	Alarm + AUX.
		OFF	ON	OFF	ON
S12	Output relay action for AUX. 3	OFF	OFF	ON	ON
S13	Horn activation time	0 sec.	5 sec.	7 sec.	10 sec.
		OFF	ON	OFF	ON
S14	Horn activation time	OFF	OFF	ON	ON
S15	Max. activation time of start relay	5 sec.	7 sec.	10 sec.	15 sec.
		OFF	ON	OFF	ON
S16	Max. activation time of start relay	OFF	OFF	ON	ON
S17	Time between two start attempts	5 sec.	7 sec.	10 sec.	15 sec.
		OFF	ON	OFF	ON
S18	Time between two start attempts	OFF	OFF	ON	ON
S19	SAFETY ON time	5 sec.	7 sec.	10 sec.	15 sec.
		OFF	ON	OFF	ON
S20	SAFETY ON time	OFF	OFF	ON	ON
S21	Setup of 100% Tacho frequency	50Hz		60Hz	
		OFF		ON	
S22	Output relay action for UNDERSPEED	Alarm		Auto stop	
		OFF		ON	
S23	Output relay action for BATTERY CONDITION	Alarm		Auto stop	
		OFF		ON	
S24	Alarm relay operation condition	Normally de-energized		Normally energized	
		OFF		ON	