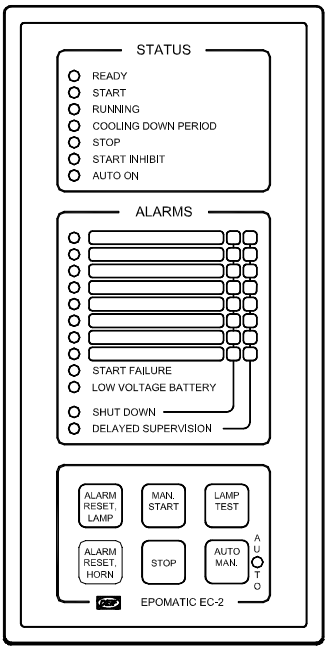
DEIF A/S

Technical Manual

Type EC-2

Engine Control Unit

4189340232D



Technical Manual

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EPOMATIC-2

The association of MS-2 and EC-2 forms the “EPOMATIC-2” system for supervision of the mains and of the engine. It carries out an automatic changeover from the mains to emergency generator at mains failure and from emergency generator to the mains when the mains has been restored.

For full information regarding Main Supervision Unit MS-2: See technical manual for MS-2 No. 4189340233.

Changes made to EC-2 compared with EC-1

The EC-2 is an upgraded version of EC-1 but can in most applications replace this with minor changes. The most important changes made to EC-2 are:

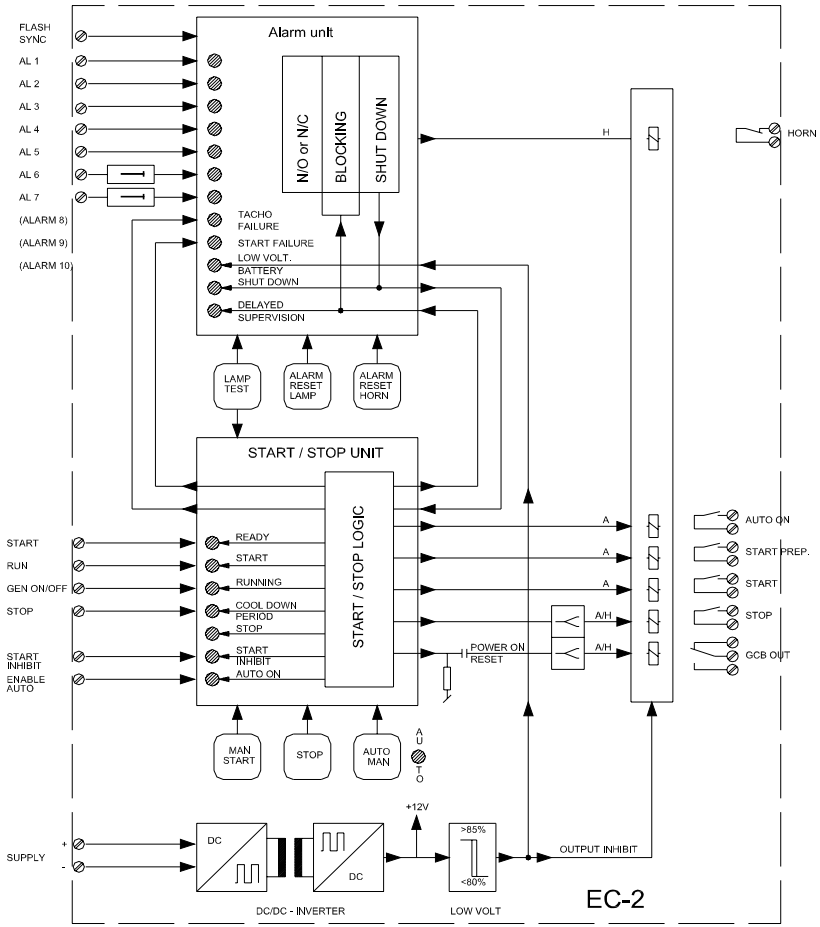
Relay output PRIMING has been removed
- Relay output START TRANSFER has been removed
- Relay output for AUTO/MANUAL operation has been added
- Relay output for disconnection of the generator circuit breaker has been added
- Applicable for “running coil” and “stop coil”

Construction

The EC-2 is in principle built up of 3 function modules:

- Supply Unit
- Alarm Unit (for supervision of the engine)
- Start/Stop Unit (for start and stop of the engine)

Of these the two last-mentioned units are controlled manually by means of 6 push-buttons on the common control panel.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Supply Unit

The EC-2 is supplied over a transformer coupled DC/DC inverter, adapting the "Supply" voltage to the internal stabilized supply voltage, at the same time providing a galvanic separation between all inputs and the "Supply" voltage.

The EC-2 can be connected to 12, 24 or 48V DC according to the specifications on the rear of unit. Consumption: approx. 6W.

Functional range during start of engine: 12V DC: 6 – 16V
24V DC: 12 – 32V
48V DC: 24 – 64V

Functional range after start of engine: 12V DC: 10 – 16V
24 V DC: 20 – 32V
48V DC: 40 – 64V

The unit is protected against wrong polarizing of the "Supply" voltage.

Further information:
- Supervision of the "Supply" voltage, see page 21
- Function of EC-2 at connection of the "Supply" voltage, see page 24
- Function of EC-2 at drop-out of the "Supply" voltage, see page 24

Alarm Unit

The alarm unit is provided with the following 8 inputs for external signals plus 1 relay output:

Input	***Function***	***Contact type***
"AL 1...7"	Activation of alarm channels 1...7	N/O – N/C
"Flash Sync"	Connection of external flash signal	(Opto coupler)

Output	***Function***	***Contact type***
"Horn"	Relay is de-energized/contact closes at alarm	N/C

Alarm Channels

The alarm unit is provided with a total of 10 alarm channels, of which:

Alarm Channels 1...5: a) are activated by external contacts connected to inputs "AL 1...5"
b) can be activated by N/O or N/C potential free contacts
c) can be inhibited at start and stop of the engine
d) can carry out shutdown of the engine and disconnection of the generator circuit breaker

Alarm Channels 6 + 7: a) are activated by external contacts connected to inputs "AL 6+7"
b) can be activated by N/O or N/C potential free contacts
c) can be inhibited during start and stop of the engine
d) can carry out shutdown of the engine and disconnection of the generator circuit breaker
e) can be provided with individual delays (2 to 10 sec)

Alarm Channel 8: "TACHO FAILURE"
Activated by an internal signal from the START/STOP unit at failure in the tacho generator.
Inhibited during start/stop of the engine.

Alarm Channel 9: "START FAILURE"
Activated by an internal signal from the START/STOP unit if the engine is not running at the present number of start attempts.

Alarm Channel 10: "LOW VOLTAGE BATTERY"
Activated by an internal signal if the battery voltage drops below 80% of U_{nom} – after start of the engine.
Inhibited during start of the engine.

Control Panel

The alarm unit can be controlled by means of 3 push-buttons on the front:

"ALARM RESET HORN": Reset of audible alarm signal

"ALARM RESET LAMP": Reset of visual alarm signals

"LAMP TEST": Test of all LEDs on the front

Protection of Front Panel

To replace the bezel the EC-2 (and MS-2) may be equipped with a transparent protective cover with hinges at the upper edge of the cover. The cover may be locked with a coded key to prevent unwanted operation of the units. At the same time the cover provides mechanical protection of the front plate.

Activation of Alarm Inputs

Alarm channels 1 to 7 can be connected to external potential free contacts or potential free opto couplers (NPN transistor with open collector). The input circuits can be set individually to activate an alarm channel at closed or open contact position (N/O or N/C) by means of internal switches.

Alarm channels 1 to 5 have to be activated for at least 0.2 sec. to be registrated by the alarm unit. (See page 26: “Internal Switches and Jumpers”).

Delayed Alarm Function

Alarm channels 6 and 7 are provided with a time delay (2 to 10 secs) for delayed registration of alarm by means of the two timers “DELAY AL 6” and “DELAY AL 7”, accessible on the rear of the unit.

Inhibit of Alarms

Alarm channels 1 to 7 can be connected individually to the inhibit function of the alarm unit by means of internal switches (see page 26: “Internal Switches and Jumpers”).

This function is applied to suppress unwanted alarms in connection with start and stop of the engine, e.g. alarm for too low lubricating oil pressure.

During start the inhibit function remains activated for 2 to 10 secs. after a running signal has been detected. The LED “DELAYED SUPERVISION” is lit when the running signal is received till the inhibit is cancelled.

During stop of the engine the inhibit function is activated when the LED “STOP” is lit, and the inhibit function remains activated till the next start of the engine as described above.

NOTE! Already registered alarms remain unaffected by the inhibit function.

Alarm channel 8 “TACHO FAILURE” is always connected to this inhibit function.

Shutdown Function

Alarm channels 1 to 7 can be connected individually to the stop circuit of the START/STOP unit by means of internal switches (see page 26: “Internal Switches and Jumpers”).

Upon receipt of the first shutdown alarm, the generator circuit breaker is disconnected and the engine is stopped immediately.

Marking of Alarm Channels

Alarm channels 1 to 8 can be provided with the following information:

- Text against each channel
- Indication of inhibit function (if any)
- Indication of shutdown function (if any)

The bezel is removed by inserting a small screwdriver between the bezel and the housing. The texts can be selected from the standard texts (approx. 30) supplied with the unit, to be fixed to the yellow plastic card, or the texts may be printed direct on the card by means of a typewriter.

Shutdown and/or inhibit functions are indicated by deleting the NOT applied functions by means of a black pen (China ink).

The card is then placed in the pocket on the rear of the front panel, and the bezel is mounted.

Alarm Functions

As most types of alarms either provoke reactions of the START/STOP unit, or the alarms are caused by signals from this unit, the various alarm functions are stated in the description of the START/STOP unit wherever relevant.

Normal alarm:	See page 17 Normal Alarm
Shutdown alarm:	See page 25 Shutdown Stop
Failure in tacho generator/relay:	See page 24 Tacho Failure
Start failure:	See page 24 Start Failure
Battery alarm:	See page 24 Low Voltage Battery

START/STOP Unit

The START/STOP unit is provided with the following 6 inputs for external signals and 5 relay outputs:

Input	*Function*	*Contact Type*
"START"	Automatic start signal	N/O or MS-2 (opto coupler)
"RUN"	RPM > RPM_{ign} from external tacho relay	N/O
"GEN VOLT"	V_{gen} > 80% V_{nom} from external voltage relay	N/O or MS-2 (opto coupler)
"STOP"	Automatic stop signal	N/O or MS-2 (opto coupler)
"START INHIBIT"	Inhibit of all start attempts	N/O
"ENABLE AUTO"	Condition for automatic start and stop	N/O

Output	*Function*	*Contact Type*
AUTO ON	Remote signalling of AUTO mode	N/O
START PREP.	Preparation of engine before start	N/O
START	Activation of the start relay/motor	N/O
GCB OUT	Disconnection of gen. circuit breaker at stop	C/O
STOP	Activation of "running" or "stop" coil	N/O

Control Panel

The START/STOP unit can be controlled by means of 4 push-bottons on the front:

"MAN-START": Manual start of the engine in MANUAL MODE
"STOP": Manual stop of the engine in MANUAL or AUTO MODE
"AUTO/MAN": Selection of AUTO or MANUAL MODE (toggle switch)
"LAMP TEST": Test of all LEDs on the front

The below mentioned circuits carry out the sequences for stop and start of the engine.

Starting Circuit

Consists of the following components:

1 timer,	“START PREP”:	Determines the start preparation time, 2 to 10 secs.
1 relay,	“START PREP”:	Energized for the present period of time
1 counter,	“START ON”:	Counts the number of start attempts (2 to 8), standard: 3 attempts
1 timer,	“START ON”:	Determines the operating time of the start motor, 2 to 10 secs.
1 timer,	“START OFF”:	Determines the waiting time of the start motor, 2 to 10 secs.
1 relay,	“START”:	The relay pulsates for the present periods of time
1 LED,	“START”:	Lit (intensity: 50/100%) during the start sequence

The 3 timers can be set on the rear of the unit.

The counter circuit can be set by means of an internal rotary switch.

Cooling Down Circuit

Consists of the following components:

1 timer,	“COOL DOWN PERIOD”:	Determins the duration of the cooling down period
1 LED,	“COOLING DOWN PERIOD”:	Lit for the preset period of time

The timer can be set on the rear of the unit (range: 2 to 10 min.).

Stopping Circuit

Consists of the following components:

1 timer,	"STOP TIME EXTENDED":	Determines the duration of the stop signal
1 LED,	"STOP":	Lit when a stop signal is transmitted
1 relay,	"STOP":	Controls a RUNNING or STOP coil
1 relay,	"GCB OUT":	Disconnects the generator circuit breaker, GCB
2 jumpers,	"S4...S7":	Selection of running or stop coil mode (See page 26, "Internal Switches and Jumpers")

Logic Functions and Sequences

The following functions are conditioned by the "SUPPLY" voltage of the EC-2 being within the specified limits: 12V (10 to 16V), 24V (20 to 32V) or 48V (40 to 64V).

Inhibit of Start

Inhibit of both manual and automatic start of the engine is possible if:

- The input "START INHIBIT" has been activated
- The LED mrk. "START INHIBIT" is lit if this condition is fulfilled.

NOTE! If the input "START INHIBIT" is activated while the engine is running, the inhibit of the engine is NOT activated until the input "RUN" is de-activated during a stop of the engine.

Start Preparation

The EC-2 is provided with a relay output, "START PREP", for activation of e. g. the preglowing system and/or the lubricating pump.

For full information re the Starting Circuit, see page 11 and "START SEQUENCES" on page 14.

Manual Start

Can be carried out by pressing the push-button mrk. “MAN START”, provided that:

1. The LED to the right of the push-button mrk. “AUTO/MAN” is switched off.
2. The input “START INHIBIT” has NOT been activated
   AND
3. No “SHUTDOWN” alarm are received (See note 1 below)
   AND
4. The LED mrk. “STOP” is switched off, i. e. the stop sequence is NOT being executed

The LED mrk. “READY” is lit when conditions 2 + 3 + 4 are fulfilled.

NOTE 1: Activated alarms are NOT inhibited at stop of the engine.

Automatic Start

Can be carried out by activation of the input “START” for min. 0.2 sec, provided that:

1. The LED to the right of the push-button mrk. “AUTO/MAN” is lit
   AND
2. The input “START INHIBIT” has NOT been activated
   AND
3. No “SHUTDOWN” alarms are received (See note 1 below)
   AND
4. The LED mrk. “STOP” is switched off, i. e. the stop sequence is NOT being executed
   AND
5. The input “AUTO ENABLE” is activated

The LED mrk. “READY” in the status section is lit when conditions 2 + 3 + 4 are fulfilled.

The LED mrk. “AUTO ON” in the status section is lit when conditions 1 + 5 are fulfilled.

NOTE 1: Activated alarms are NOT inhibited at stop of the engine.

Start Sequence

At activation of the start circuit the counter and the 3 timers are reset to zero, and the following start sequence will be executed:

1.	The relay	"STOP"	is activated if RUNNING coil is used
2.	The timer	"START PREP"	is started
3.	The relay	"START PREP"	is energized (the relay contact closes)
4.	The LED mrk.	"START"	is lit (half intensity)
5.	The timer	"START PREP"	expires after 2 to 10 secs.
6.	The relay	"START PREP"	is de-energized and the contact opens
7.	The counter	for number of start attempts	is increased by 1
8.	The timer	"START ON"	is started
9.	The relay	"START"	is energized (the relay contact closes)
10.	The LED mrk.	"START"	is lit (full intensity)
11.	The timer	"START ON"	expires after 2 to 10 secs.
12.	The timer	"START OFF"	is started
13.	The relay	"START"	is de-energized
14.	The LED mrk.	"START"	is switched off
15.	The timer	"START OFF"	expires after 2 to 10 secs.

Items 7 to 15 are repeated until one of the following reactions is registered:

a.	The input "RUN" is activated:	See Normal Start page 15
b.	The input "GEN VOLT" is activated:	See Normal Start page 15
c.	The number of start attempts is exceedes:	See Start Failure page 15
d.	A shutdown alarm is registered:	See Shutdown Stop page 17
e.	The push-button mrk. "STOP" is activated:	See Manual Stop page 17

If one of the mentioned events occur, then:

1.	The relay	"START"	is de-energized (the relay contact opens)
2.	the LED mrk.	"START"	is switched off

Normal Start

Normal start is indicated by:

1.	The LED mrk.	“RUNNING”	is lit
2.	The LED mrk.	“READY”	is switched off
3.	The timer	“DELAYED SUPERVISION”	is started
4.	The LED mrk.	“DELAYED SUPERVISION”	is lit
5.	The timer	“DELAYED SUPERVISION”	expires after 2 to 10 secs.
6.	The LED mrk.	“DELAYED SUPERVISION”	is switched off

At this time one or more of the following events may occur:

7a.	If none of the alarm inputs (AL 1...9) are activated:	See Normal Running page 16
7b.	If the input “RUN” has NOT been activated:	See Tacho Failure page 16
7c.	If an alarm input (AL 1...7) connected to the inhibit function of the alarm unit has been activated:	See Normal Alarm page 17
7d.	If an alarm input (AL 1...7) connected to the inhibit function AND the shutdown function of the alarm unit has been activated:	See Shutdown Stop page 17

NOTE: If an alarm input (AL 1...7) connected to the shutdown function only is activated during the “DELAYED SUPERVISION” period, then see Shutdown Stop p. 17

Start Failure

Start failure is indicated by:

1.	The LED mrk.	“START FAILURE”	is lit
2.	The relay	“HORN”	is de-energized (the relay contact closes)
3.	The STOP SEQUENCE		is executed (See page 19)

By activating the push-button mrk. “ALARM RESET – HORN”, the horn is reset.
By activating the push-button mrk. “ALARM RESET – LAMP” , the “START FAILURE” alarm is reset.

Normal Running

Normal running is indicated by:

1. The LED mrk. “RUNNING” is lit
2. No alarm LEDs in the alarm section are lit.

This condition will be interrupted if one of the following events occur:

1. A failure in the tacho generator arises: See Tacho Failure page 16
2. Normal alarm signals are received: See Normal Alarm page 17
3. Shutdown alarm signals are received: See Shutdown Stop page 17
4. The push-button mrk. “STOP” is activated: See Manual Stop page 17
5. An automatic “STOP” signal is received: See Automatic Stop page 18

Tacho Failure

This failure is indicated by:

1. The LED mrk. “TACHO FAILURE” is flashing
2. The relay “HORN” is de-energized (the relay contact closes)

By activating the push-button mrk. “ALARM RESET – HORN”, the horn is reset.

By activating the push-button mrk. “ALARM RESET – LAMP” :
The LED mrk. “TACHO FAILURE” is switched off, if the alarm is no longer activated

a. The LED mrk. “TACHO FAILURE” is lit constantly if the alarm is still activated – but is switched off when the alarm later on is de-activated.
The alarm is activated if:
   - The timer “DELAYED SUPERVISION” has expired
     AND
   - The input “GEN ON/OFF” is activated
     AND
   - The input “RUN” is NOT activated

NOTE: If only one of the two signals “RUN” and “GEN ON/OFF” is applied to indicate that the engine is running, this signal has to be connected to both the inputs “RUN” and “GEN ON/OFF”. In this case the alarm “TACHO FAILURE” in NOT available.

Normal Alarm

The normal alarm is indicated by:

1. The LED for the relevant alarm (AL 1...7) is flashing.
2. The relay “HORN” is de-energized (the relay contact closes).

   By activating the push-button mrk. “ALARM RESET – HORN”, the horn is reset.

   By activating the push-button mrk. “ALARM RESET – LAMP” :
   a. The LED for the relevant alarm is switched off, if the alarm is no longer activated.
   b. The LED for the relevant alarm is now lit constantly if the alarm is still activated - but is switched off when the alarm later on is de-activated.

Shutdown Stop

If an alarm connected to the shutdown system is activated, then:

1. The LED for the relevant alarm is flashing.
2. The LED mrk. “SHUTDOWN” is lit.
3. The relay “HORN” is de-energized (the relay contact closes).
4. The Stop Sequence is executed (See page 19).

   By activating the push-button mrk. “ALARM RESET – HORN”, the horn is reset.

   By activating the push-button mrk. “ALARM RESET – LAMP” :
   a. The LED mrk. “SHUTDOWN” is switched off, if no shutdown alarms are activated.
   b1. The LED for the relevant alarm is switched off, if the alarm is no longer activated.
   b2. The LED for the relevant alarm is now lit constantly, if the alarm is still activated - but is switched off when the alarm later on is de-activated.
   c. The LED mrk. ”READY” is lit when the alarm is de-activated.

Manual Stop

If the push-button mrk. ”STOP” is activated, then:

1. The STOP SEQUENCE is executed (See page 19)

Automatic Stop

Can be carried out by activation on input ”STOP” for min. 0.2 sec., provided that:

1. The input ”AUTO ENABLE” is activated
   AND
2. The LED mrk. ”AUTO” to the right of the push-button mrk. ”AUTO/MAN” is lit.
   AND
3. The input ”START” is NOT activated.

The LED mrk. ”AUTO ON” in the status section is lit when conditions 1 + 2 are fulfilled (See Note 2 – page 20).

Cooling Down Sequence

1. The timer	”COOL DOWN PERIOD”	is started
2. The LED mrk.	”COOLING DOWN PERIOD”	is lit
3. The timer	”COOL DOWN PERIOD”	expires after 2 to 10 min.
4. The LED mrk.	”COOLING DOWN PERIOD”	is switched off

This sequence will be interrupted if one of the following events occur:

The push-button mrk. ”MAN START” is activated:

a. After MANUAL MODE has been selected (See Note 3 – page 20)
b. The input ”START” is activated (See Note 4 – page 20)
c. Shutdown alarm signals are received (See Shutdown Stop – page 17)
d. The push-button mrk. ”STOP” is activated (See Manual Stop – page 17)

Otherwise the STOP SEQUENCE will be executed.

Stop Sequence

1. The LED mrk. ”STOP” is lit

If running coil:

2a.	The relay	”GCB OUT”	is de-energized (GCB OUT signal is transmitted, see Note 1 – page 20)
3a.	The relay	”STOP”	is de-energized (the relay contact opens)

If stop coil:

2b.	The relay	”GCB OUT”	is energized (GCB OUT signal is transmitted, see Note 1 – page 20)
3b.	The relay	”STOP”	is energized (the relay contact closes)

4.	The LED mrk.	”RUNNING”	is switched off when input ”RUN” or ”GEN ON/OFF” is de-activated

5. The timer ”STOP TIME EXTENDED” is started

6. The timer ”STOP TIME EXTENDED” expires after 6 to 60 secs.

If running coil:

7a.	The relay	”GCB OUT”	is energized (GCB OUT signal is reset see Note 1 – page 20)

(The relay ”STOP” is de-energized until the next start of the engine)

If stop coil:

7b.	The relay	”GCB OUT”	is de-energized (GCB OUT signal is reset, see Note 1 – page 20)

8.	The relay	”STOP”	is de-energized (the relay contact opens)
9.	The LED mrk.	”STOP”	is switched off

NOTE 1: The relay ”GCB OUT” is supplied with a changeover contact.

NOTE 2: If MS-2 is used:
Automatic change to MAINS MODE has been carried out.

If MS-2 is NOT used:
The GCB has to be disconnected by an external signal.

NOTE 3: If MS-2 is used:
the GCB and MCB are controlled by the MS-2

If MS-2 is NOT used:
the GCB has to be re-connected by an external signal.

NOTE 4: If MS-2 is used:
Automatic change to GENERATOR MODE will be carried out.

If MS-2 is NOT used:
The GCB has to be re-connected by an external signal.

FURTHER INFORMATION:

Regarding the relay ”STOP”: See page 28
Regarding selection of RUNNING COIL and STOP COIL: See page 28

Supplementary Information

Supervision of the Battery Voltage

The EC-2 is provided with a detector for too low ”SUPPLY” voltage which is activated in case the ”SUPPLY” voltage drops below 80% of U_{nom} after the engine has been started.

NOTE: If the ”SUPPLY” voltage during start of the engine drops below 50% of U_{nom}, the output relay ”START” cannot be activated.

During start of the engine the detector is inhibited, and even though the ”SUPPLY” voltage drops below 80% of U_{nom}, an alarm will NOT be released.

If the ”SUPPLY” voltage drops below 80% of U_{nom} after the engine has been started:

1. The LED mrk. ”LOW VOLTAGE BATTERY” is lit, provided that the voltage does not drop below 35% of U_{nom}.

2. All output relays are de-activated

3. An audible alarm is released, provided that the voltage to the horn suffices.

If running coil:
4a. A ”STOP” signal will be transmitted

5b. A ”GCB OUT” signla will be transmitted

If stop coil:
4b. A ”STOP” signal will NOT be transmitted
5b. A ”GCB OUT” signal will NOT be transmitted

If the ”SUPPLY” voltage then reaches a value above 85% of U_{nom}:

6. The LED mrk. ”LOW VOLTAGE BATTERY” is switched off.

7a. Provided that the jumper ”S8” is set to ”AUTO” mode, the engine will be controlled automatically by means of the signals ”START”, ”STOP” and ”ENABLE AUTO”. The LED mrk. ”AUTO” to the right of the push-button ”AUTO/MAN” will be lit.

7b. If the jumper ”S8” is set to ”MAN” mode, only direct manual control of the engine will be possible – by means of the push-button ”MAN START” and ”STOP”.

8. The engine will continue running – being supervised as always – if STOP COIL has been selected. See page 26: ”Internal Switches and Jumpers”.

Start and Stop Signals

The inputs ”START” and ”STOP” have to be activated for at least 0.2 sec. before the signals will be registered by the START/STOP UNIT.

If inputs ”START” and ”STOP” are activated simultaneously, the start signal has first priority.

If the push-button ”MAN START” is pressed in MANUAL MODE while the input ”STOP” is activated, the engine will be started.

Control of Generator Circuit Breaker (GCB)

If MS-2 is used: The MCB and the GCB are fully controlled by the MS-2 unit – but as an additional safety the ”GCB OUT” signal is always transmitted at the beginning of the STOP SEQUENCE.

If MS-2 is NOT used: The GCB has to be closed by an external control signal. The ”GCB OUT” signal is always transmitted at the beginning of the STOP SEQUENCE.

As the STOP SEQUENCE is not executed until the ”COOLING DOWN PERIOD” has expired, an external control signal has to be transmitted for disconnection of the GCB.

It is recommended to connect the external stop signal to the input ”STOP” via a N/C auxiliary contact of the GCB. This coupling ensures that the engine is NOT stopped until the GCB has been disconnected.

When are the LEDs Lit?

The LEDs can only be lit if the ”SUPPLY” voltage exceeds 35% of U_{nom}.

”READY”

Lit, if: The engine is ready for start, i. e.:

The input ”START INHIBIT” is NOT activated
AND
No ”SHUTDOWN” alarms are activated (See Note 1 below)

Switched off, if: The input ”START INHIBIT” is activated
OR
The input ”GEN VOLT” is activated during start of the engine
OR
The input ”RUN” is activated during start of the engine
OR
The ”START FAILURE” alarm is activated during start of the engine
OR
A ”SHUTDOWN” alarm is activated

NOTE 1: Activated alarms are NOT inhibited during stop of the engine.

”START”

Lit, if: (half intensity) The output ”START PREP” is activated

Lit, if: (full intensity) The output ”START” is activated

”RUNNING”

Lit, if: The engine is running, i. e. the internal running signal is activated:
The input ”GEN VOLT” is activated
OR
The input ”RUN” is activated

”COOLING DOWN PERIOD”

Lit, if: The engine is being cooled down, i. e. an automatic ”STOP” signal has been received.

Switched off, if: The timer ”COOL DOWN PERIOD” expires:
OR
An automatic ”START” signal is received
OR
The push-button ”STOP” is pressed
OR
The push-button ”MAN START” is pressed in MANUAL MODE
OR
A ”Shutdown” alarm is received

"STOP"

Lit, if: The STOP SEQUENCE is being carried out.

"START INHIBIT"

Lit, if: All attempts at starting the engine are inhibited, i. e. the input "START INHIBIT" has been activated

"AUTO ON"

Lit, if: "AUTO MODE" has been selected, i. e.
The LED to the right of the push-button "AUTO/MAN" is lit
AND
The input "ENABLE AUTO" is activated

"ALARMS 1 – 8"

Flash, if: The input "TEXT..." has been activated

Lit, if: The push-button "ALARM RESET – LAMP" is pressed
AND
The input "TEXT..." is still activated

Switched off, if: The push-button "ALARM RESET – LAMP" has been pressed
AND
The input "TEXT..." is de-activated

"TACHO FAILURE" (Alarm 8)

Flashes, if: The input "GEN VOLT" is activated
AND
The timer "SUPERVISION DELAY" has expired
AND
The input "RUN" is NOT activated

"START FAILURE"

Lit, if: The engine does NOT start at the last attempt

Switched off, if: The push-button "ALARM RESET – LAMP" is pressed

"LOW VOLTAGE BATTERY" (Alarm 10)

Lit, if: The "SUPPLY" voltage after the engine has been started drops below 80% of U_{nom}

Switched off, if: The "SUPPLY" voltage again exceeds 85% of U_{nom}

"SHUTDOWN"

Lit, if: A shutdown alarm signal has been received, i. e. an alarm connected to the shutdown function has been activated

Switched off, if: The push-button "ALARM RESET – LAMP" is pressed
AND
No shutdown alarms are still activated

"DELAYED SUPERVISION"

Lit, if: The LED mrk. "RUNNING" is lit
AND
The timer "DELAYED SUPERVISION" has not yet expired

Switched off, when: The timer "DELAYED SUPERVISION" expires

"AUTO" (to the right of the push-button "AUTO/MAN")
The push-button "AUTO/MAN" will when pressed transmit a pulse causing an electronic "toggle" switch to change position. The actual position of this switch is indicated by the above mentioned LED – not to be confused with the LED mrk. "AUTO ON" in the status section.

The position of this switch can after connection of the "SUPPLY" voltage be determined by means of the jumper "S8" (See page 26 "Internal Switches and Jumpers").

Functions at "SUPPLY" Voltage Drop-Out

All LEDs	will be switched off		
The "START PREP"	signal will be interrupted,	if any:	(The relay contact opens)
The "START"	signal will be interrupted,	if any:	(The relay contact opens)
The "HORN"	signal will be transmitted:		(The relay contact closes)
The "AUTO ON"	signal will be interrupted,	if any:	(The relay contact opens)
The "STOP"	signal will be transmitted,	if RUNNING COIL is selected	
The GCB OUT"	signal will be transmitted,	if RUNNING COIL is selected	

Upon Connection/Restoration of ”SUPPLY” Voltage

If the jumper ”S8” is set to position ”AUTO”:
The engine will start/run in AUTO MODE,
if the LED mrk. ”AUTO ON” (status) is lit.

If the jumer ”S8” is set to position ”MAN”:
The engine will start/run in MANUAL MODE.

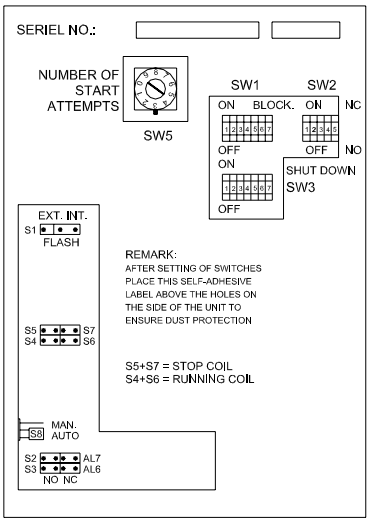
Any mode selected by pressing the push-button ”AUTO/MAN” before the ”SUPPLY” voltage drop-out is consequently of no importance, as the mode of the engine after reconnection/restoration of the ”SUPPLY” voltage is determined solely by the position of the jumper ”S8”.

Internal Switches and Jumpers

These are accessible through holes in the right side of the case. It may be necessary to pull out the EC-2 unit from the panel. The two-piece terminals are separated – further dismounting of the cables is not necessary – and the mounting clamps of the housing are removed.

Setting on Delivery

The unit will on delivery be set to the functions marked ”*” – unless otherwise specified in the customer’s order.



Inhibit of Alarms during Start and Stop of the Engine

If SW1...7 are OFF – the alarm signals will NOT be inhibited.*
If SW1...7 are ON – the alarm signals will be inhibited.

”AL 1”	(Alarm Channel 1)	SW1.1
”AL 2”	(Alarm Channel 2)	SW1.2
”AL 3”	(Alarm Channel 3)	SW1.3
”AL 4”	(Alarm Channel 4)	SW1.4
”AL 5”	(Alarm Channel 5)	SW1.5
”AL 6”	(Alarm Channel 6)	SW1.6
”AL 7”	(Alarm Channel 7)	SW1.7

Activation of Alarm Input at N/O Contact Function

If SW2.1...5 are OFF – alarm is released when the external contact closes (N/O).*
If SW2.1...5 are ON – alarm is released when the external contact opens (N/C).
If S2/S3 are set to position ”NO” - alarm is released when the ext. contact closes (N/O).*
If S2/S3 are set to position ”NC” – alarm is released when the ext. contact opens (N/C).

”AL 1”	(Alarm Channel 1)	SW2.1
”AL 2”	(Alarm Channel 2)	SW2.2
”AL 3”	(Alarm Channel 3)	SW2.3
”AL 4”	(Alarm Channel 4)	SW2.4
”AL 5”	(Alarm Channel 5)	SW2.5
”AL 6”	(Alarm Channel 6)	S3-NO/NC
”AL 7”	(Alarm Channel 7)	S2-NO/NC

Shutdown Function for Alarms

If the SW3.1...7 are OFF
- the engine will NOT be stopped upon receipt of an alarm signal.*

If the SW3.1...7 are ON
- the engine will be stopped upon receipt of an alarm signal.

”AL 1”	(Alarm Channel 1)	SW3.1
”AL 2”	(Alarm Channel 2)	SW3.2
”AL 3”	(Alarm Channel 3)	SW3.3
”AL 4”	(Alarm Channel 4)	SW3.4
”AL 5”	(Alarm Channel 5)	SW3.5
”AL 6”	(Alarm Channel 6)	SW3.6
”AL 7”	(Alarm Channel 7)	SW3.7

Stop Coil or Running Coil

If STOP COIL is required, the jumpers are set to positions ”S5” and ”S7”.

NOTE: The signal ”STOP” and ”GCB OUT” will NOT be transmitted at ”SUPPLY” voltage drop-out.

If RUNNING COIL is required, the jumpers are set to positions ”S4” and ”S6”.

NOTE: The signals ”STOP” and ”GCB OUT” will be transmitted at ”SUPPLY” voltage drop-out.

Number of Start Attempts

The rotary switch SW5 is set to the required number of start attempts +1.
Can be set to 2 to 8 start attempts. Is set to 3 start attempts (position 4).*

External Flash Relay

If ”S1” is set to position ”INT”: The flash frequency is controlled by the internal flash generator.*

If ”S1” is set to position ”EXT”: The flash frequency has to be controlled by an external flash signal, connected to terminals 1 to 2.
Flash signal: (0 to 8...60V), input resistance: approx. 3kΩ

Auto Mode or Manual Mode – Upon Connection of the ”SUPPLY” Voltage

If ”S8” is set to position ”AUTO”: The LED mrk. ”AUTO” to the right of the push-button ”AUTO/MAN” will be lit.*
The LED mrk. ”AUTO ON” in the ”STATUS” section will only be lit if the input ”AUTO ENABLE” is activated as well.

If ”S8” is set to position ”MAN”: The EC-2 will be set to MANUAL MODE.

Setting of Timers

All timers are adjustable from the rear of the EC-2 unit by means of a 3 mm screwdriver.

ADJUSTMENT RANGES: ”COOL DOWN PERIOD” timer:
Adjustment range: 2 to 10 min.

”STOP TIME EXTENDED” timer:
Adjustment range: 6 to 60 secs.

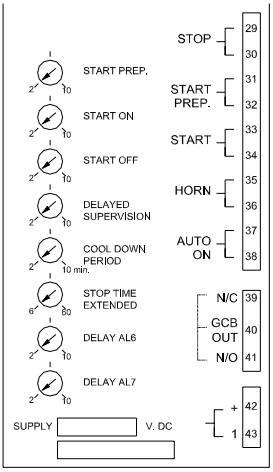
All other timers:
Adjustment range: 2 to 10 secs.[1]

[1] Can be increased to 20 to 100 secs. by changing internal capacitors.
Tolerance from one unit to another: ±20% of set time.

”START PREP”: Preparation period before start of engine. The LED mrk. ”START” will be lit (half intensity), the output relay ”START PREP” will be energized and the relay contact wil remain closed for the preset period of time.

”START ON”: Operation time of the start relay. After the preparation period the LED mrk. ”START” will be lit with full intensity, the output relay ”START” will be energized and the relay contact will remain closed for the preset period of time.

”START OFF”:	Waiting time of the start relay. After the operation time the LED mrk. ”START” will be switched off, the output relay ”START” will be de-energized and the relay contact will remain open for the preset period of time.
”DELAYED SUPERVISION”:	Prolonged inhibit of alarm signals after the engine has been started. When the LED mrk. ”RUNNING” is lit, the timer is started and the LED mrk. ”DELAYED SUPERVISION” will remain lit for the preset period of time.
”COOL DOWN PERIOD”:	Cooling down of the engine. Upon receipt of an automatic ”STOP” signal, the timer is started and the LED mrk. ”COOLING DOWN PERIOD” will remain lit for the preset period of time.
”STOP TIME EXTENDED”:	Extended duration of the STOP procedure. The LED mrk. ”STOP” remains lit for the preset period of time after the LED mrk. ”RUNNING” has been switched off. NOTE: If RUNNING COIL is used, it is recommended to set this timer to 6 secs.
”DEALY AL 6”:	Alarm channel 6 will NOT be activated until the preset time is up.
”DELAY AL 7”:	Alarm channel 7 will NOT be activated until the preset time is up.



Technical Specifications

AMBIENT TEMPERATURE: -25°C to +70°C, working. -40°C to +70°C, storage.

GALVANIC SEPARATION:

Between Digital Inputs Mutually	None
Between Digital Inputs & Other Circuits	2kV-50Hz-1min.
Between Input ”FLASH SYNC” & Other Circuits	2kV-50Hz-1min.
Between Relay Outputs Mutually	2kV-50Hz-1min.
Between Relay Outputs & Other Circuits	2kV-50Hz-1min.
Between ”SUPPLY” Voltage & Other Circuits	2kV-50Hz-1min.

INPUT CIRCUITS: 2kΩ ”pull up” resistors form internal +12V DC voltage.

INPUT ”FLASH SYNC”: Opto coupler diode input, input resistance approx. 3kΩ.

Signal: 0 to 8...60V DC from external flash relay.

RELAY OUTPUTS: 1 changeover contact on the ”GCB OUT” relay.
1 break contact on ”HORN” relay.
1 make contact on all other relays.

Max. 250V-2A-400VA (AC) or max. 250V-2A-50W (DC):
At resistive load: 2 mill. operations
Mechanical life: 20 mill. operations

TIME DELAYS: ”COOL DOWN PEROD” timer:
Adjustment range: 2 to 10 min.

”STOP TIME EXTENDED” timer:
Adjustment range: 6 to 60 secs.

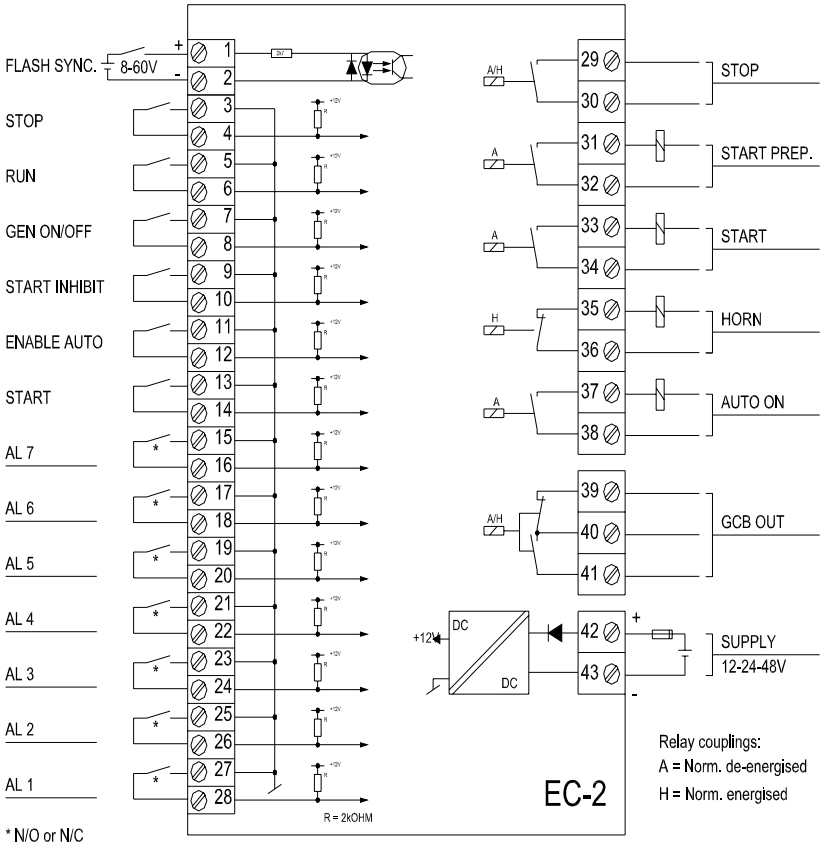
All other timers:
Adjustment range: 2 to 10 secs.*

*Can be increased to 20 to 100 secs. by changing internal capacitors tolerance.

Tolerance: ±20% of set time.

SUPPLY VOLTAGE:	Rated voltage: 12, 24 or 48V DC according to specification
	Functional range during start of engine: 50 to 133% of rated voltage.
	Functional range after start of engine: 80 to 133% of rated voltage.
	Transformer coupled DC/DC inverter.
	Protected against wrong polarizing.
	Comsumption: Max. 6W.
CLIMATE:	Class HSE, according to DIN 40040.
EMC:	To EN 50081-1/2, EN 50082-1/2, SS 4361503 (PL4) and IEC 255-22-1 (class 3).
VIBRATIONS:	5 to 50Hz: 20mm/sec., 3 directions for 3x2 hours, according to DNV Class A.
SHOCK:	5 attempts with 15g in 3 directions, according to VDE 0410/3.68.
PROTECTION:	Front: IP40. Terminal: IP00, according to EN 60529 and IEC 529.
MATERIALS:	Self-extinguishing plastic materials, according to UL94-VO.
TERMINALS:	Two-piece terminals with screws. Max. 1.5mm^2, single/multi-stranded.
DIMENSIONS:	Bezel: 192 x 96 mm. Cut-out: 186 x 92 mm according to DIN 43700.
	Depth behind panel: 165 mm inclusive of cables.
WEIGHT:	Approx. 1.5 kgs.

Connection Diagram



Typical Applications