Fan-Drive Controller
ESLF101/ELLF101

- Fan speed is controlled to match system requirements
- Any target value for temperature can be set
- For reversible and non-reversible fan motors

1 Description

1.1 General
The ESLF electronic unit is designed to provide fan control in any make of equipment. The fan motor operates in a hydraulic circuit with a bypass function. Its primary field of application is engine cooling in mobile machines. The plug-in card is therefore available in an encapsulated version for harsh environments. The fan control is not an on/off type, but is based on a microcontroller. A maximum of 3 temperature sensors, type PTC or NTC, can be connected. Any target temperature can therefore be adjusted individually by the user.

1.2 Models
The card can be ordered with a 31-pin edge connector to DIN 41617 or with screw terminals. For applications in high air humidity, or in equipment with high vibration levels, a fully encapsulated version is available.

1.3 Application example
- Fan control system for the only-as-needed cooling of internal combustion engines in mobile machines.

2 Technical data

2.1 Plug-in card

<table>
<thead>
<tr>
<th>General characteristics</th>
<th>Description, value, unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>12 V ... 28 V DC</td>
</tr>
<tr>
<td>Reference voltage (V_{ref})</td>
<td>8 V DC max. 20 mA</td>
</tr>
<tr>
<td>Temperature inputs</td>
<td>3 (P1, P2, P3)</td>
</tr>
<tr>
<td>Temperature: sensor processing (V_{Sensor})</td>
<td>all PTC or all NTC (pay attention to the sensor-selection input)</td>
</tr>
<tr>
<td>Temperature: target value</td>
<td>can be set to suit choice of temperature</td>
</tr>
<tr>
<td></td>
<td>minimum resistance at target temperature: R_{min} = 500 Ω</td>
</tr>
<tr>
<td></td>
<td>maximum resistance at target temperature: R_{max} = 2000 Ω</td>
</tr>
<tr>
<td></td>
<td>(condition: V_{TP} = 3.5 V)</td>
</tr>
<tr>
<td>Temperature: diagnostics range</td>
<td>max: target temperature + approx. 160 °C</td>
</tr>
<tr>
<td></td>
<td>min: target temperature - approx. -40 °C</td>
</tr>
<tr>
<td></td>
<td>Pay attention to the working range of the sensors!</td>
</tr>
<tr>
<td>Setting: the sensor type</td>
<td>input for sensor definition (PTC or NTC), can be altered online</td>
</tr>
<tr>
<td>the setup adjustment</td>
<td>trimming potentiometer for each sensor, can be altered online</td>
</tr>
<tr>
<td>Proportional solenoid output for fan motor</td>
<td>max. output current I_{max} = 2.1 A</td>
</tr>
<tr>
<td></td>
<td>with minimum current I_{min} = 0.2 A</td>
</tr>
<tr>
<td></td>
<td>with set maximum current I_{max} = 1.4 A ... 2.1 A via potentiometer P4</td>
</tr>
</tbody>
</table>

Reference: 100-P-700063-EN-01
2.2 Fan PCB

### General characteristics

<table>
<thead>
<tr>
<th>Description, value, unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Diagnostics</strong></td>
</tr>
<tr>
<td><strong>Reverse mode</strong></td>
</tr>
</tbody>
</table>

#### Connection

- Multi-pin connector to DIN 41612 type D, or screw terminals
- Connecting cable for temperature sensor: LIYY 2 x 0.5 cm², max. length 10 m

#### Protection

- Non-encapsulated and encapsulated versions

#### Dimensions

- 100 mm x 100 mm x 25 mm (W x H x D)

#### Temperature range of the electronics

- -20 °C ... +50 °C

2.3 Enclosure

### General characteristics

<table>
<thead>
<tr>
<th>Description, value, unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Connection</strong></td>
</tr>
<tr>
<td><strong>Protection class</strong></td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
</tr>
</tbody>
</table>

3 Block diagram

- **Adjustment S1**: Analog input
- **Adjustment S2**: Analog input
- **Adjustment S3**: Analog input
- **Temperature sensors**
- **Min. fan speed**
- **On/off out**
- **Control block for reverse operation**
- **Option**
- **Sensor type**: NTC / PTC
- **Switch**: Reverse
- **Fan motor**
- **Prop. out**
- **RAM**: Data memory
- **EPROM**: Data memory
4 Function and dimensions

4.1 Card

Trim potentiometer - max. 20 turns

TP1 - TP5 = test points
P1 - P3 = trim potentiometers for sensors 1 - 3
4.2 Reverse mode

In reverse mode, the fan changes its direction of rotation and then operates at full speed. To do this, the speed is first slowly reduced (10 s) to the minimum. The on/off output is energised and the speed is continuously increased to the maximum and then held there until the button is released. This function can be used to blow debris out of the radiator.

![Diagram showing reverse mode functionality]

~ = "Reverse" switch is released

5 Connection diagram
5.1 Connection diagram for ESLF101 card
5.1.1 Note

- With PTC, every free temperature-measurement channel must be closed with a wire jumper. With NTC the measurement channel remains open.
- The input for recognition of the type of sensor in use must be connected.
- PTC and NTC sensors must not be mixed.
- If reverse operation is not needed, the input and the output do not need to be connected.

- Potentiometer P4 can be used to set the card's maximum output current to the proportional solenoid.
- The "Option" potentiometer is not used.
- If the processor is not encapsulated with the rest of the card, it is possible to exchange the processor, and thus the software. The software is noted on the lettering; appearing after "LF101", it is shown as "Vx".

5.2 Connection diagram for ELLF101 enclosure

View A (AMP connector)

The terminals of the plug-in card (see Section 5.1) and the contacts of the AMP connector are connected 1:1.

6 Initial start-up

Connect the ESLF101 / ELLF101 in accordance with the connection diagram. Select the sensor type by connecting terminal 2 (pins 3, 4). For PTC sensors, connect the reference voltage output (Vref) at terminal 9 (pins 17, 18) to terminal 2. For NTC sensors, connect terminal 10 (pins 19, 20) to terminal 2.

If no sensor type is selected, the fan speed will be set to maximum.

After the sensor type has been selected, all unused sensor inputs must be connected as follows:

Unused PTC sensor inputs are short-circuit. With NTC sensors, unused inputs are left open.

7 Setup procedure

1. Set the required target value (from the sensor data sheet) with a reference resistor (e.g. potentiometer), alternatively bring the sensor itself to the required target temperature. Then repeat for all sensors.

2. Connect the potentiometer/sensor to the first sensor input, terminal 8 (pins 15, 16) and terminal 7 (pins 13, 14). With a voltmeter, measure the voltage V1 at TP1 relative to ground (terminal 10) and use the trimming potentiometer P1 to set the voltage as follows:

   For PTC: V1 = 3.5 V  
   For NTC: V1 = 1.5 V

3. Connect the potentiometer/sensor to the second sensor input, terminal 6 (pins 11, 12) and terminal 5 (pins 9, 10). With a voltmeter, measure the voltage V2 at TP2 relative to ground (terminal 10) and use the trimming potentiometer P2 to set the voltage as follows:

   For PTC: V2 = 3.5 V  
   For NTC: V2 = 1.5 V

4. Connect the potentiometer/sensor to the third sensor input, terminal 4 (pins 7, 8) and terminal 3 (pins 5, 6). With a voltmeter, measure the voltage V3 at TP3 relative to ground (terminal 10) and use the trimming potentiometer P3 to set the voltage as follows:

   For PTC: V3 = 3.5 V  
   For NTC: V3 = 1.5 V

5. Set the minimum fan speed with the potentiometer P4. When the system is cold i.e. the fan speed is not being controlled by the electronics, the solenoid valve current after switch-on is at maximum (1.4 A < Imax < 2.1 A). By means of the hydraulic bypass, this current determines the minimum fan speed.
8 Ordering code

8.1 ESLF101 (plug-in card without enclosure)

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan controller, encapsulated</td>
<td>screw terminals</td>
<td>ESLF101-81***</td>
</tr>
<tr>
<td>Fan controller, non-encapsulated</td>
<td>screw terminals</td>
<td>ESLF101-91***</td>
</tr>
<tr>
<td>Fan controller, encapsulated</td>
<td>multi-pin connector</td>
<td>ESLF101-80***</td>
</tr>
<tr>
<td>Fan controller, non-encapsulated</td>
<td>multi-pin connector</td>
<td>ESLF101-90***</td>
</tr>
</tbody>
</table>

8.2 ELLF101 (plug-in card with enclosure)

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan controller in an enclosure</td>
<td>encapsulated</td>
<td>ELLF101-01***</td>
</tr>
<tr>
<td>Fan controller in an enclosure</td>
<td>non-encapsulated</td>
<td>ELLF101</td>
</tr>
</tbody>
</table>

IMPORTANT!
- Software can be modified for particular applications and customers - please contact us.
- The type of sensor to be used (PTC, NTC), non-connected temperature channels, and the target temperature of each channel must be specified in the order.
- Standard setting: PTC: P1 = not connected  P2 = 90 °C   P3 = 70 °C

9 Accessories

9.1 Plug-in card

<table>
<thead>
<tr>
<th>Item</th>
<th>Ordering code</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plug: Phoenix Contact, MSTB 2.5/16-STF-5.08</td>
<td></td>
<td>connection to 16-pin male connector</td>
</tr>
<tr>
<td>Bosch PTC temperature sensor 0538009203</td>
<td></td>
<td>measurement of air temperature (sensor type 1)</td>
</tr>
<tr>
<td>Bosch PTC temperature sensor 0538009252</td>
<td></td>
<td>measurement of oil/water temperature (sensor type 2)</td>
</tr>
<tr>
<td>IFM PT1000 temperature sensor TS 2051</td>
<td></td>
<td>measurement of liquid and gaseous media</td>
</tr>
<tr>
<td>IFM PT1000 temperature sensor TT 1050</td>
<td></td>
<td>measurement of liquid and gaseous media</td>
</tr>
</tbody>
</table>

9.2 Enclosure

<table>
<thead>
<tr>
<th>Accessories for plug base</th>
<th>Ordering code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protective cap</td>
<td>100609804</td>
<td>AMP CPC Serie 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>16-pole cable connection</th>
<th>Ordering code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable connector (crimp)</td>
<td>100609807</td>
<td>AMP CPC Serie 1</td>
</tr>
<tr>
<td>Cable strain relief</td>
<td>100609808</td>
<td>AMP for CPC 1 cable connector</td>
</tr>
<tr>
<td>Crimp contact (socket)</td>
<td>100609809</td>
<td>AWG 24-20 (d = 0.5 - 0.8 mm²)</td>
</tr>
<tr>
<td>Crimp contact (socket)</td>
<td>100609810</td>
<td>AWG 18-16 (d = 1.0 - 1.3 mm²)</td>
</tr>
<tr>
<td>Cable entry seal</td>
<td>100609811</td>
<td>AMP for CPC 1 cable connector</td>
</tr>
</tbody>
</table>
10 Fault finding

10.1 Fault finding by no hydraulic function

- Power supply at terminals 12 (+12V/24V) and terminal 11 (ground) - is polarity correct?
  - No
  - Yes

- Check power supply and wires for polarity and continuity.

- Temperature sensors: is voltage at terminals 8, 6 and 4 U > 0V?
  - No
  - Yes

- Disconnect temperature sensor. Is a voltage of approx. 7.8 V in each case present?
  - Yes
  - No

- Is 8 V reference voltage present at terminal 9?
  - Yes
  - No

- Card is faulty.

- Temperature control:
  - Is the solenoid current adjustable in the range: approx. 0.7 A - 1.8 A for 12 V?
  - approx. 0.3 A - 0.9 A for 24 V?
  - No current
  - Max. current

- Check hydraulic system.

- Is output voltage for solenoids between terminals 14 and 13 approx. 12 V / 24 V?
  - Yes
  - No

- Solenoid lead is broken or solenoid is faulty.

- Disconnect solenoid. Is voltage present now?
  - Yes
  - No

- Short circuit in solenoid leads or solenoid.

- Eliminate short circuit.

- Card is faulty.

- Is minimum fan speed reached before reverse mode is activated?
  - No
  - Yes

- Check the switch wiring.

- Card is faulty.

- Check the temperature control (see at left).

- Check the solenoid output (see at left).

* If not specified, the reference point for voltage measurements is the negative side of the supply voltage

10.2 Fault finding for incorrect temperature control

- Incorrect temperature control: fan speed goes to min. or max.

- Check temperature sensors, see above

- Is the wiring for the switch type PTC / NTC in place?

- Is the fan motor in a hydraulic circuit that has bypass control?

- Check all installation aspects for the sensors (see above)

- Check setup/adjustment for the sensors