



Troubleshooting Guide

for PSk2-7 to PSk2-40 pump systems

NOTE

The trouble shooting of the PSk2-7 – PSk2-40 Controller should be done directly on the field when all cables are still connected (PV Generator, PV Disconnect, sensors, motor cables, etc.).

The easiest way to do a trouble shooting of the new PSk2 Controller is with PumpScanner. Therefore, it is always recommended to connect to PumpScanner first even if the LEDs of the Controller housing are not flashing.



WARNING – All electrical inspections must be performed by qualified experts only.

WARNING – Do not dismantle the Controller when it is connected to the power supply! Before doing any maintenance or inspection work disconnect the Controller from the power supply and wait at least 5-10 minutes!

This trouble shooting guide serves as quick support when you are on site and do the installation of a PSk2 system. It provides an explanation of the electrical installation including the handling of electrical instruments.

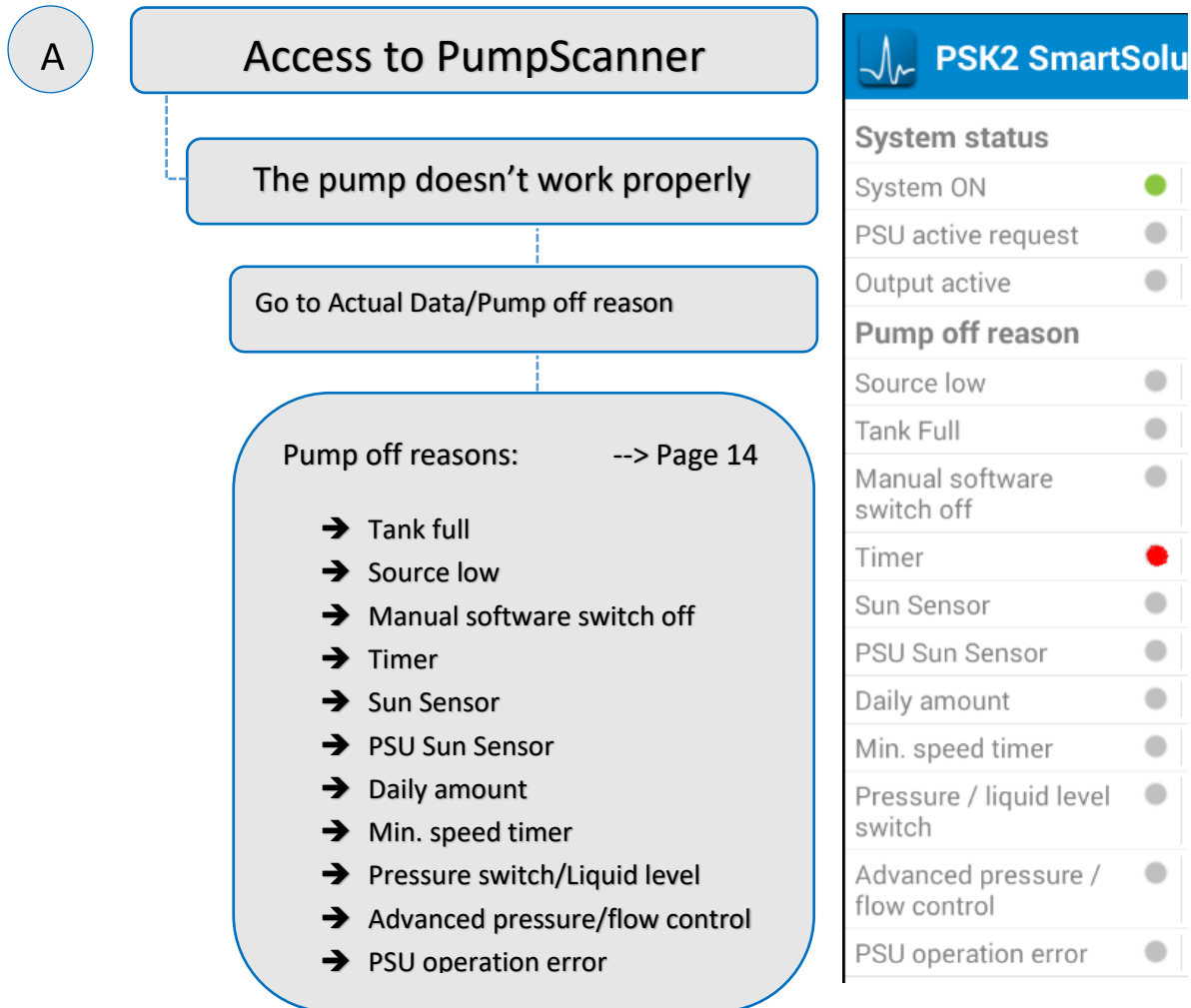
With the help of this document a diagnosis for the PSk2 Controllers can be done more easily and quickly. PartnerNET and the LORENTZ Support Team are available in case of further questions.

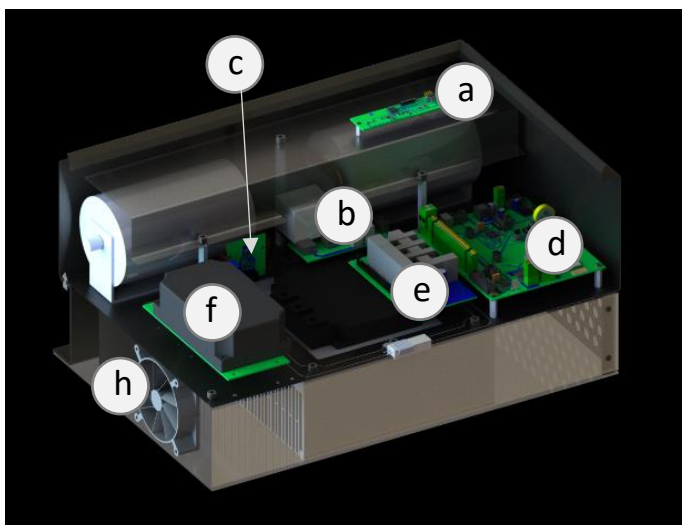
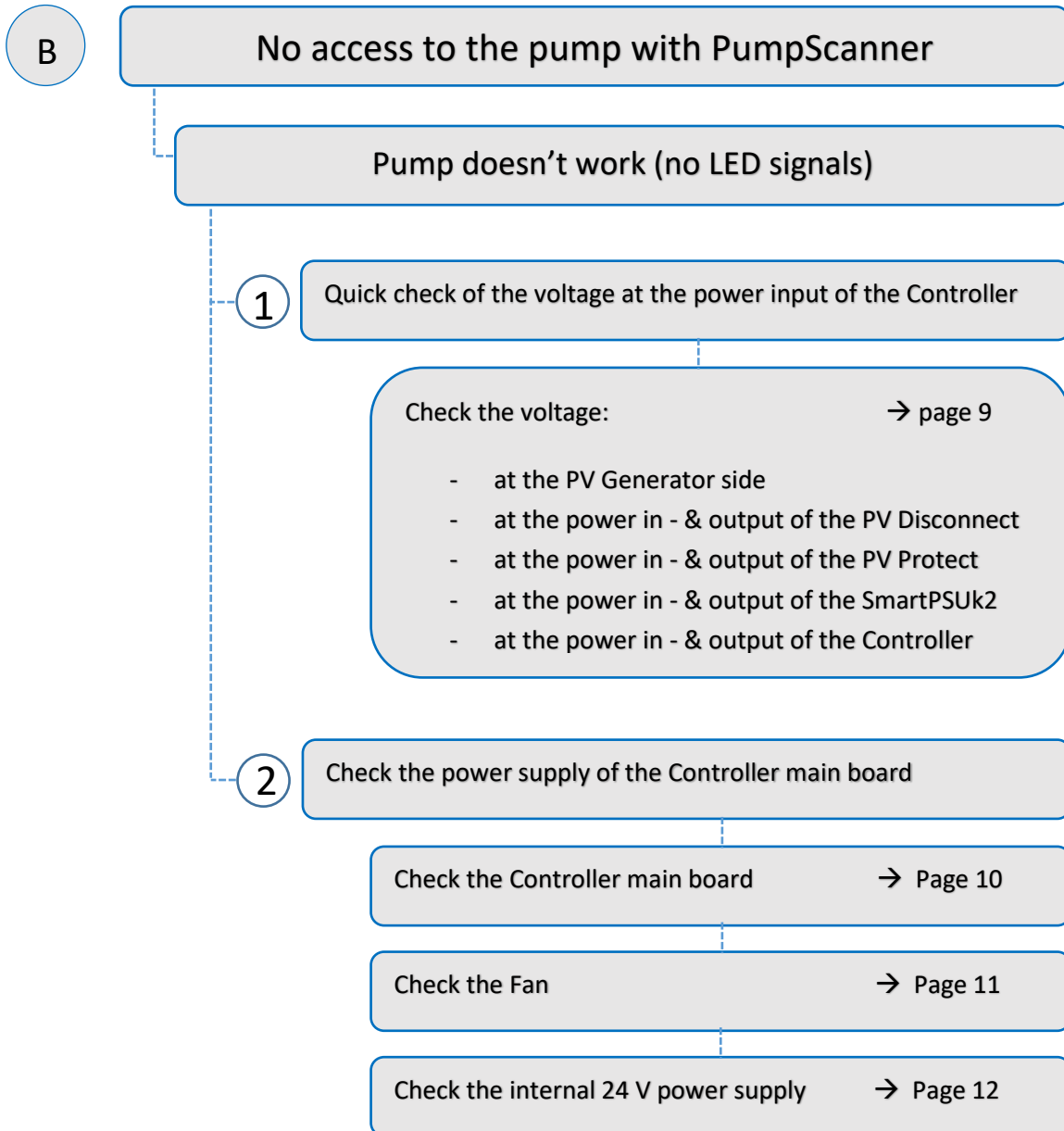
This document also refers to other explanatory documents on partnerNET which are necessary for the further diagnosis of the issue and the replacement of specific boards.

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Quick Guide





- (a) - LED board
- (b) - Filter board
- (c) - Current board
- (d) - Main board
- (e) - Interface board
- (f) - Power supply 24 V
- (h) - Fan

1. No access to the Controller device with PumpScanner

1.1 The pump is working (water coming out of the pump)

1.1.1 Bluetooth connection

1.1.1.1 Mobile device

In most cases the Bluetooth connection issue is related to the mobile device.

Cause:

- ✘ Lost connection
- ✘ Device/pump recognition issue

Solution:

- ✘ Stop all background applications and turn Bluetooth off and on again
- ✘ Remove the pump (name/serial number) from the pump list by holding the finger for a few seconds on the pump name/serial number
- ✘ Close the PumpScanner application or restart the mobile device
- ✘ Relaunch PumpScanner and rescan the pump

1.1.1.2 Datamodule already connected with another mobile device

Cause:

- ✘ Datamodule can only enable one Bluetooth connection at a time

Solution:

- ✘ Check if one of the Controller LEDs is showing a solid blue light
 - In this case another mobile device is already connected with the Bluetooth device of the Datamodule
- ✘ Disconnect the first mobile device and try again with the second one

1.1.2 Restricted permissions

Could be the case where accessing the controller is not possible even when the device is present.

Cause:

- ✘ Request for credentials is activated
- ✘ Controller not registered in the partner's account

Solution:

- ✘ Introduce the default credentials or the new established credentials
- ✘ Make sure to register the Controller serial number to a Site in partnerNET

1.1.3 Malfunction of the Controller main board

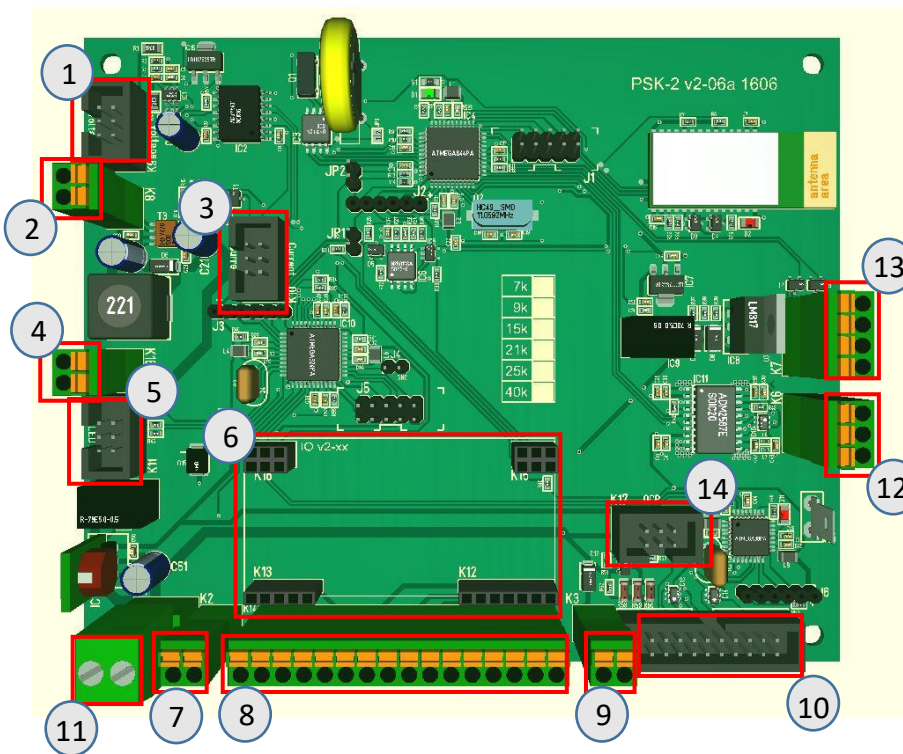
Cause:

- ✘ Defective component on the Controller main board

Solution:

- ✘ The Controller main board has to be replaced

PSk2-7 – PSk2-40 Controller main board



Position	Name
1	Plug for the filter board
2	Plug for the Fan
3	Plug for the current board
4	Plug for the ON/OFF Switch
5	Plug for the LED board
6	Plug for the IO board
7	Plug for the heat sink
8	Plugs for sensors, Sun Sensor
9	Plug for the 24 V (service)
10	Plug for the interface board
11	Plug for the 24 V
12	Plug for the SmartPSUk2
13	Plug for the SmartStart
14	Plug for the filter board

Figure 1: main board



CAUTION – Follow the repair guide of the PSk2 Main Board for correct replacement.

1.2 The pump is not working (no LED signals)

1.2.1 Check the open circuit voltage of the solar generator

- Inspect (with a multimeter) the open circuit voltage of the solar generator
- Make sure there is no broken cable or loose connection
 - Make sure the system is voltage-free before pulling the cables (Danger of a life-threatening arc)
- No voltage drops and the expected open circuit voltage is available

1.2.2 Check the voltage at the power input and power output of the PV Disconnect

- Make sure there is no broken cable or loose connection
 - Make sure the system is voltage-free before pulling the cables (Danger of a life-threatening arc)
- Make sure there is no voltage drop between the solar generator and the PV Disconnect

1.2.3 Check the voltage at the power input and power output of the SmartPSUK2

- Make sure the PV Disconnects are switched off
- Make sure there is no broken cable or loose connection
- Make sure there is no voltage drop between the PV Disconnect and the SmartPSUK2
- Make sure the SmartPSUK2 is working properly

1.2.4 Check the voltage at the power input of the PSk2 Controller

- Make sure the PV Disconnects are switched off
- Check the cable connections (no loose connection) and polarity
- Make sure the expected VOC is available (solar direct)

1.2.5 Check if the PSk2 Controller has a short circuit

1.2.5.1 Indication of short circuit in the PSk2 Controller

- VOC available on the PV Generator side
- Voltage break down at the power input of the Controller (the multimeter shows a voltage value around zero)

1.2.5.2 Actions before checking the boards of the PSk2 Controller

- Switch OFF the PV Disconnects
- Wait at least 5 minutes or use a multimeter and keep a watch on the voltage at the power input of the Controller until it drops below 20 V before disconnecting cables
- Work in a dry environment protected against rain/humidity

1.2.5.3 Inspection of the PSk2 Controller boards for short circuit

- Use an external power supply and set the current limit at 500 mA and the voltage at 24 V
- Connect the external power supply output to the Controller terminals 17 and 18 (use of batteries is not recommended due to the missing current limitation which can cause several damages)



Figure 2: Setting the external power supply

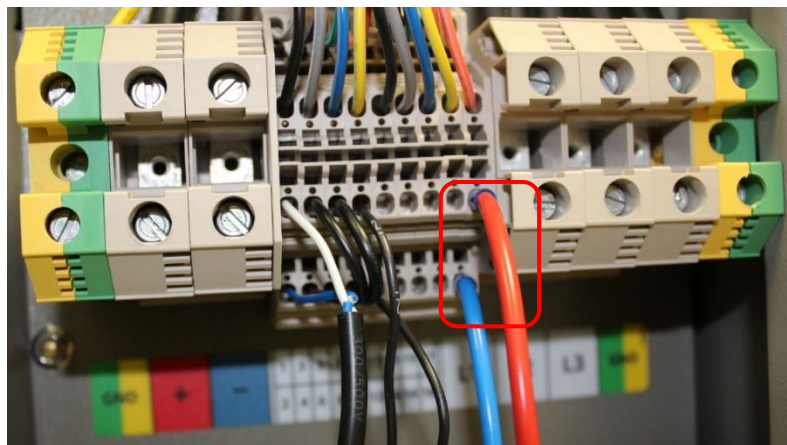


Figure 3: Connect the external power supply to terminals 17 & 18 of the PSk2 Controller

1.2.5.4 Inspection of the Controller main board for short circuit

- Unplug the internal 24 V power supply board
- Switch the power output of the external power supply on
- Check the PSk2 Controller main board for any LED signal
 - In case there are LED signals visible on the Controller main board, the internal power supply 24 V is defective
 - In case there is a voltage break down, the PSk2 Controller main board has a short circuit

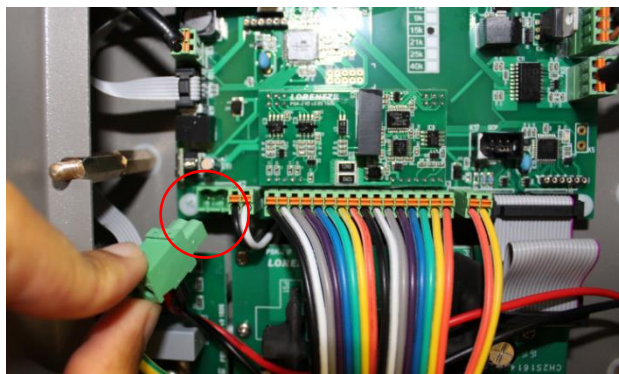


Figure 4: Unplug the internal 24 V power supply

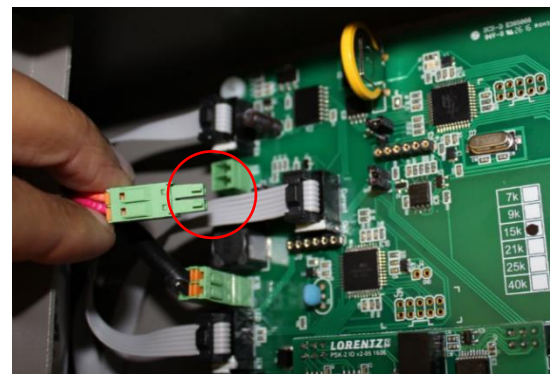


Figure 5: Unplug the Fan

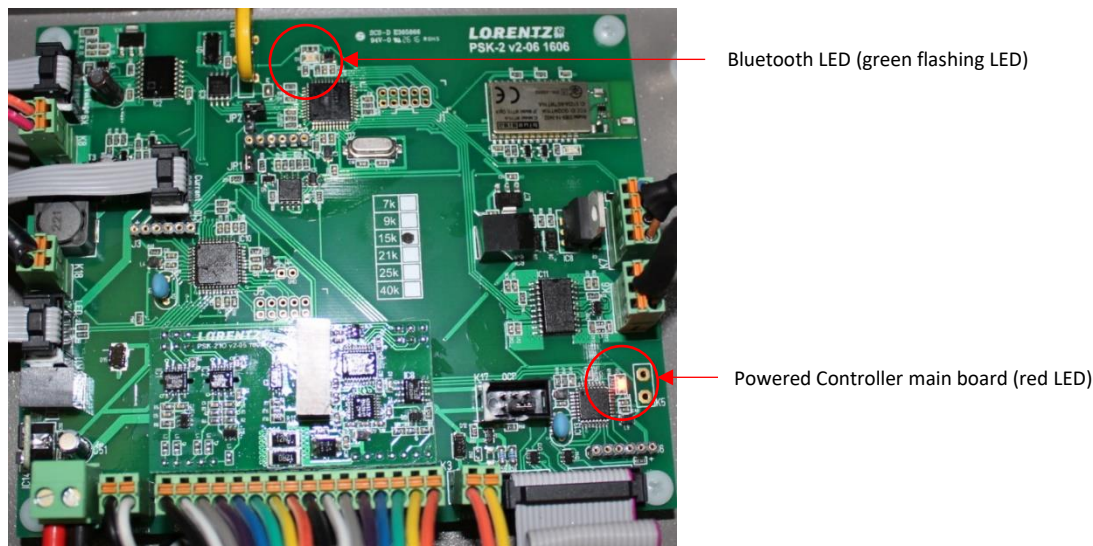


Figure 6: LED signals on the PSk2 Controller main board

Two LED signals should be visible on the PSk2 Controller main board in case there is no short circuit. The red LED on the bottom right (**Figure 6**) shows when the PSk2 Controller main board is supplied with power. The upper green flashing LED shows the Bluetooth operation.

Cause

- ✗ Defective internal 24 V power supply
- ✗ Defective or shorted fan
 - Burned traces at the plug area of the fan (on the Controller main board)
 - Burned traces on the fan plug
- ✗ Defective component on the Controller main board

Solution

- ✗ Switch the PV Disconnects off and disconnect the PSk2 Controller
- ✗ Replace the Controller main board and the fan if there are burnt traces at the fan plug area
- ✗ Reconnect the Controller, switch on the PV Disconnects and the Controller

1.2.5.5 Inspection of the fan for short circuit

The fan can also be tested separately with the external power supply (settings 24 V/12 V; 500 mA). In case the voltage breaks down, the fan has a short circuit.

Cause

- ✗ Moisture
- ✗ Blocked fan
 - Insects
 - foreign bodies
- ✗ Defective fan

Solution

- ✘ Switch the PV Disconnect off and disconnect the PSk2 Controller
- ✘ Replace the fan following the guide for replacing the DC brushless fan in a PSk2 series pump controller
- ✘ Reconnect the Controller to the PV Disconnect and switch the power on



Figure 7: PSk2 cooling fan



CAUTION – Follow the guide for replacing the DC brushless fan in a PSk2 series pump controller.

1.2.5.6 Inspection of the internal 24 V Power Supply Board

A quick test of the internal PSk2 Controller power supply (when the PSk2 Controller is still connected to the solar generator) can be done by measuring the voltage at the terminal clamps 15 (+) or 9 (+) or 11 (+) and 16 (-). Any voltage well under 24 V or around 0 V would be an indication of the malfunction of the internal 24 V power supply of the PSk2 Controller.

Before checking the internal 24 V power supply, make sure the internal 24 V power supply cable is unplugged from the Controller Main Board (**Figure 4**). An external 24 V power supply should be connected to the Controller terminals 17 & 18. In case LEDs on the Controller Main Board go on after switching on the external power supply, the internal 24 V power supply has a short circuit.

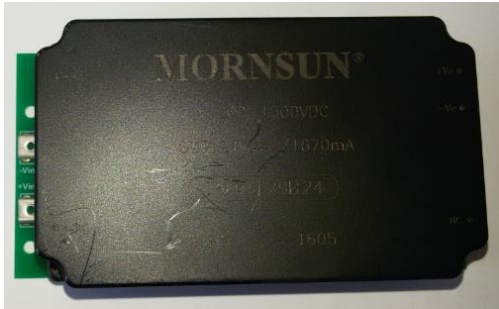
Cause

- ✘ Short circuit of the analog input
- ✘ Overvoltage at the power input of the PSk2 Controller
- ✘ Defective fan/ defective connection cable of the fan
 - Burned traces at the plug area of the fan cable on Controller main Board
 - Burned traces on the fan plug

Solution

- ✘ Switch the PV Disconnects off and disconnect the PSk2 Controller
- ✘ Check the fan for short circuit
- ✘ Replace the internal 24 V power supply
- ✘ Reconnect the power input to the Controller, switch the PV Disconnects on and switch the Controller on

- ✘ In case the Controller still does not show any LED signals the Controller Main Board might be defective/ shorted



CAUTION – Follow the repair guide of the PSk2 DC-DC Power supply for correct replacement.

Figure 8: PSk2-xx, Power supply 24 V

1.2.5.7 Inspection of the IO Board

In some cases, a short circuit of the IO Board can lead to a complete shutdown of the Controller. The Controller Main Board and the Internal 24 V power supply should be checked first and the IO Board thereafter.

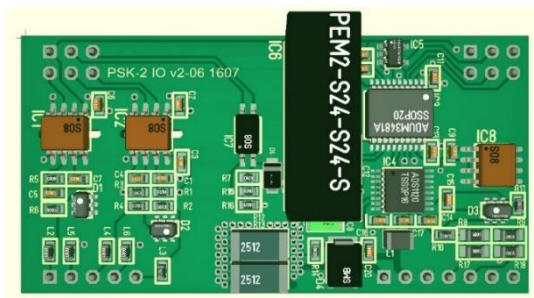
1. Remove the IO Board from its socket first
2. Connect the external power supply to the Controller (terminals 17 & 18)
3. Unplug the internal 24 V power supply and switch the external power supply on
4. In case LEDs on the main board go on, the IO Board could be faulty.

Cause

- ✘ Short circuit of the analog input or water sensor input
- ✘ Defective pressure or liquid level sensor
- ✘ Damage due to voltage spike through a sensor cable
- ✘ Wrong insertion of the IO Board

Solution

- ✘ Replace the IO Board
- ✘ Check each single sensor before connecting to the Controller
- ✘ Check the recommended surge protector of each input (if used)



CAUTION – Follow the repair guide of the PSk2 IO board for correct replacement.

Figure 9: IO board

2. Access to the Controller device with PumpScanner

2.1 The pump doesn't work properly (water coming out of the pump)

2.1.1 No LED signals on the front side of the Controller when the pump is running

The system is connected to the PumpScanner App and pumping water out of the well even though there are no LED signals on the front side of the Controller.

Causes

- ✘ Defective LED board
- ✘ Unplugged or broken cable of the LED board

Solution

- ✘ Switch the PV Disconnects off and disconnect the Controller
- ✘ Plug the LED board cable correctly
- ✘ Or replace the LED board

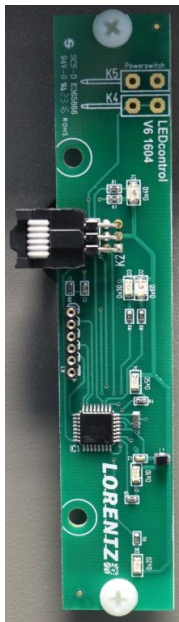


Figure 10: LED board



CAUTION – Follow the repair guide of the PSk2 LED board for correct replacement.

2.2 Pump status indicator light is solid red (pump stops running)

The red solid LED “Pump stopped” appears when there is an error or a failure causing the Controller to stop the system. Each error will be displayed in PumpScanner under “actual data”. Therefore, check in first place the pump off reason in PumpScanner.

The following events are mostly related to a given settings in PumpScanner or just showing the status of the system.

Pump off reasons:

- Tank full – Remote Switch
- Source low
- Water sensor
- Manual software switch off
- Wrong input voltage
- Timer
- Sun Sensor
- PSU Sun Sensor
- Daily amount
- Min. speed timer
- Pressure / liquid level sensor
- Constant pressure/flow control
- PSU operation error

2.2.1 Pump off reasons (PumpScanner)

2.2.1.1 Source low (wrong signal/wrong operation of the sensor)

A wrong signal of a source low sensor can only be addressed if the water level in the well is obviously above the Well Probe. A wrong “Source low” signal can have different root causes.

Causes:

- ✗ Loose connection
- ✗ Broken cable
- ✗ Bad cable splice
- ✗ Defective Well Probe
- ✗ Defective I/O Board

Solution

- ✗ Measure the voltage at the terminal clamps 1 & 2 (the voltage should be around 5 V)
- ✗ Set a jumper at the terminals 1 & 2 (in case the failure persists the I/O board is defective)
- ✗ Test the Well Probe (continuity test using a digital multimeter)
- ✗ Replace the Well Probe
- ✗ Replace the I/O Board (if the malfunction is not due to the Well Probe)

2.2.1.2 Remote Switch (wrong signal/wrong operation of the sensor)

A wrong signal of the Remote Switch can only be addressed if the signal does not truly reflect the real situation on site. A wrong signal of the Remote Switch can have many root causes.

Causes:

- ✗ Loose connection
- ✗ Broken cable

- ✘ Defective Remote Switch
- ✘ Defective I/O Board

Solutions:

- ✘ Measure the voltage at the terminal clamps 3 & 4 (the voltage should be around 5 V)
- ✘ Set a jumper at the terminals 3 & 4 (if the pump still does not run then the I/O is defective)
- ✘ Replace the defective Remote Switch
- ✘ Replace the I/O Board (in case the malfunction is not due to the Remote Switch)

2.2.1.3 Water Sensor

A Water Sensor error can be directly related to the sensor itself, the cable or to a low water situation in the pipe.

Causes:

- ✘ Low water level in the well
- ✘ Air present in the suction pipe
- ✘ Broken cable (open loop)

Solution:

- ✘ Check the water level in the well
- ✘ Check the pipe for leakage
- ✘ Check the functionality of the Water Sensor

2.2.1.4 Manual software switch off

The pump system has been stopped due to a software setting. The setting has to be changed in PumpScanner (Operational Settings -> Pump Speed -> Pump OFF) in order to run the pump system again.

2.2.1.5 Wrong input voltage

This alarm will occur when a high or a low DC voltage level is detected at the power input of the Controller.

The voltage should be under the maximal allowed level (850 V) and at least 450 V at the power input of the PSk2 Controller.

2.2.1.6 Timer

The pump system has been stopped due to a software setting. The timer setting has to be configured / changed in PumpScanner (Operational Settings) in term to run the system again.

2.2.1.7 Sun Sensor

A Sun Sensor error can be due to the following root causes.

Causes:

- ✘ Low irradiation
- ✘ Loose connection
- ✘ Broken cable
- ✘ Defective Sun Sensor
- ✘ Wrong serial number of the Sun Sensor
- ✘ Defective I/O board

Solution:

- ✘ Check the irradiation level (cloudy or sunny conditions)
- ✘ Check the setting in PumpScanner
- ✘ Check the cable connections and polarity
- ✘ Check if the serial number of the Sun Sensor Module has been entered correctly
- ✘ Check the Sun Sensor terminal clamps (the voltage at the terminal clamps 7 and 8 should be below 2 V)
- ✘ Test the Sun Sensor separately with a multimeter ($V_{oc} = 10.2 \text{ V}$)
- ✘ Replace the defective Sun Sensor
- ✘ Replace the I/O Board (if the malfunction is not due to the Sun Sensor)

2.2.1.8 PSU Sun Sensor

The PSU Sun Sensor alarm occurs when the measured irradiation by the Sun Sensor is lower than the minimum irradiation configured in PumpScanner in terms to run the pump in PSU blending mode. The irradiation parameters can be changed in PumpScanner (Feature Settings -> SmartPSU).

2.2.1.9 Daily amount

The pump has been stopped due to a software setting. The daily amount of water set has been reached causing the Controller to stop the pump.

The pump will automatically restart the next day. A setting change can be done in PumpScanner under "Feature Settings" -> "Control Pump by Water Meter" -> "Daily amount".

2.2.1.10 Min. speed timer

The Min. speed timer error occurs when the minimum required motor speed set to protect the motor could not be reached.

Causes:

- ✘ Low irradiation
- ✘ Low power

Solution:

- ✘ Check the irradiation level (cloudy or sunny conditions)
- ✘ Check the wiring of the PV generator
- ✘ Check the voltage and the current at the power input of the PSk2 Controller

2.2.1.11 Pressure / liquid level sensor

The pump has been stopped due to a software setting (Feature Settings). The pressure or the water level exceeded the set max. or min. limit. Generally, the pump will automatically restart when the measured pressure or liquid level value in the sensor drops below or jumps above the fixed value or the set timer in PumpScanner has expired.

In case the pump off reason is not related to the settings in PumpScanner, the I/O Board and the functionality of the Liquid Level/ Liquid Pressure sensor should be tested.

2.2.1.12 Constant pressure / flow control

The pump been stopped due to a software setting (Feature Settings). The pressure or the flow rate exceeded the min. or max. set limit in PumpScanner causing the Controller to stop the pump. The Controller will automatically restart and try to resume constant pressure or flow rate.

2.2.1.13 PSU switching power source

The pump has been stopped temporarily by the Controller to perform a smooth transition between solar-only and hybrid power operation or vice versa. The system should restart automatically after the transition. This transition can take up to half a minute or less.

2.2.2 Advanced information (PumpScanner)

2.2.2.1 Analog Input 1 Error & Analog Input 2 Error

A wrong value “out of range” of the analog input (e.g. Pressure Sensor) is very often due to either a defective / shorted analog input or a defective I/O Board. Testing each of them can help determine which component is defective.

- ✘ Measure the current of the connected Pressure Sensor (this should be between 4 mA – 20 mA). Anything outside this range means that the analog sensor is defective and needs to be replaced. The I/O Board may need to be replaced as well.

- ✘ 24 V should be measured at the terminals 9 and 14 or 11 and 14 after disconnecting the Pressure Sensor. If there is no voltage or a voltage below 24 V then the I/O Board is defective and needs to be replaced.
- ✘ Check the condition of the Surge Protector for the specific input if used.

2.2.2.2 Overtemperature

The Controller stops or run at a reduced power level when the device temperature gets extremely high. This happens when the ventilation is insufficient (encased Controller for e.g.) or if the fan is broken. The Controller will go back to normal operation when the temperature level drop below the max allowed ambient temperature 50°C.

2.2.2.3 igt overtemperature

The Controller stops or reduced the power level when the heatsink temperature get too high. This happens when the ventilation is insufficient (encased Controller for e.g.) or if the fan is broken. The Controller will go back to normal operation when the temperature level of the heatsink drop below 70°C.

2.2.2.4 mmpt overtemperature

The controller stops the pump because the main board temperature gets too high. This happens when the ventilation is insufficient (encased Controller for e.g.) or if the fan is defective. The Controller will go back to normal operation when the temperature drops back to normal.

2.2.2.5 PSU overtemperature

The PSk2 Controller stops the SmartPSU operation due to a high device temperature detected in the PSU. In this case the system will continue to run from solar only. This happens when the ventilation is insufficient (encased SmartPSU for e.g.) or if the fan is broken. The system will run again from PSU when the temperature drops back to normal.

2.2.2.6 PSU not ready

This error occurs when the SmartPSU is not able to connect the auxiliary AC power successfully to the PSk2 Controller. The error can be related and be result of a temporarily bad or unstable AC power quality. When the SmartPSU permanently runs into this error, it may need repair.

As first testing the AC source quality should be inspected, an inefficient grid will frequently end in this error. A “Weak Grid Mode” option can be activated for specific situations, please contact LORENTZ support.

2.2.2.7 PSU Phase Missing

The PSk2 Controller detected that at least one of the three AC phases that are connected to the SmartPSU has a problem. The grid status needs to be checked.

2.2.2.8 PSU input frequency low

The PSk2 Controller has detected a too low frequency (below 50 Hz or 60 Hz) at the AC input of the SmartPSU. This can be related to a temporarily bad or unstable AC power quality.

2.2.2.9 No communication with the PSU

The PSk2 Controller cannot communicate successfully with the SmartPSU. This can be the case when the SmartPSU is not supplied with AC power or if the communication cable between the SmartPSU and the PSk2 Controller is not correctly installed or defective.

2.2.2.10 Internal comm error (mmpt)

The PSk2 Controller stops due to a problem in the Controller main board and need to be replaced.

2.2.2.11 Internal comm error (Bt)

The PSk2 Controller main board is defective and need to be replaced.

2.2.2.12 PSU ext Temp Sensor

The heatsink temperature sensor of the SmartPSU has failed and need to be repaired. In this case the pump system will run on solar power only.

2.2.2.13 igbt overcurrent

The PSk2 Controller stopped the pump due to a high current detected at the Controller output. This can be related to multiples root causes:

Causes:

- ✘ Bad cable splicing
- ✘ Loose phase
- ✘ Short circuit
- ✘ Blocked motor / pump
- ✘ Overtemperature

Solution

- ✘ Check the motor cable connection
- ✘ Switch the PV Disconnects off and on
- ✘ Switch the PV Disconnects off and disconnect the motor cables from the Controller then switch PV Disconnect and Controller on again:
 - In case the error persists, the Controller might be completely damaged
 - In case the failure disappears, the disconnected motor cable should be checked
 - Isolation test (1000 V testing voltage)
 - Any value below 0,5 MΩ would mean a bad splice or a broken cable and should be consequently replaced
 - Check the pump (dirt, debris, broken impeller)
 - Check the motor (short circuit, broken bearing, jammed motor shaft)
 - Measure resistance between phases (low and balanced values expected)
 - Replace the old splicing

2.2.2.14 mmpt overcurrent

The PSk2 Controller detected a too high current consumption by the pump and stopped the motor. The Controller will resume normal operation after 4 minutes.

2.2.2.15 Internal comm error (LED)

A problem has been detected with the LED board. This happens when the LED board cable is broken or not correctly connected.

The error can also be related to a malfunction of the Controller main board.

In this case the LED cable, LED board and the PSk2 Controller main board must be checked.

2.2.2.16 mmpt temp sensor error

The heatsink temperature sensor of the PSk2 Controller has failed and needs to be repaired.

2.2.2.17 PSU error detected

The PSk2 Controller detected a critical error in the SmartPSUk2 and will continue to operate from solar only until the problem is fixed or the system is reset by disconnecting all power sources. This can also be a result of AC power quality temporarily bad or unstable. A broken SmartPSU IGBT module can also lead to the error. The SmartPSU may need repair.

2.3 Malfunction of the interface board / filter board

2.3.1 Malfunction of the interface board

A malfunction of the interface board could lead to sporadic run/stops of the system or in some cases to a complete detention of the pump.

Causes:

- ✘ Burned traces on the interface board
- ✘ Broken connection cable of the interface board

Solution:

- ✘ Replace the interface board



CAUTION – Follow the repair guide of the PSk2 interface board for correct replacement.

Figure 11: PSk2-xx, IF Board

2.3.2 Malfunction of the filter board

In case there is a discrepancy between the value of the input voltage measured at the Controller terminal clamps and the ones displayed in PumpScanner, the filter board might be defective. Filter boards are hardly susceptible to malfunction. However, in such case change the filter board.

3. Spare parts for PSk2-7 to PSk2-40

For further information on replacement parts please check the document, "Spare parts for PSk2-XXX series (blue cover)" in partnerNET -> Resources.