TROUBLESHOOTING

ADVICES FOR TROUBLESHOOTING

Before starting any troubleshooting operation on the system, please always first check if the system is operating in the right conditions.

This manual shows how to troubleshoot your system according to the error message and symptoms of the system.

Document describes possible reasons of the failure and actions to perform.

Once you have identified the device in fault and exchanged it, test system again to make sure that everything is going on normally and that your system is completely fixed.

Please note that QUANTEL cannot be considered responsible if a breakdown appears due to a faulty exchange following a troubleshooting done by a customer or a representative thanks to this manual.

TRAINING TOOLS

To perform the maintenance tasks described in the troubleshooting, you will need the following tools:

- 1 pole
- 1 tuning screwdriver
- 1 cross screwdriver
- 1 flat screwdriver
- 1 multimeter
- 1 oscilloscope
- 1 x10 probe
- 1 x100 probe
- 1 antistatic bracelet
- 1 torque wrench 5Nm
- 1 Soldering Iron

- 1 powermeter
- 1 photodiode
- Pieces of photosensitive paper
- Pieces of polaroïd paper
- 1 flash light
- 1 dentist mirror
- 1 set of Allen keys metric
- 1 Allen key 1/16" (imperial)
- 1 set of open end wrenches
- 1 thermometer

Senior

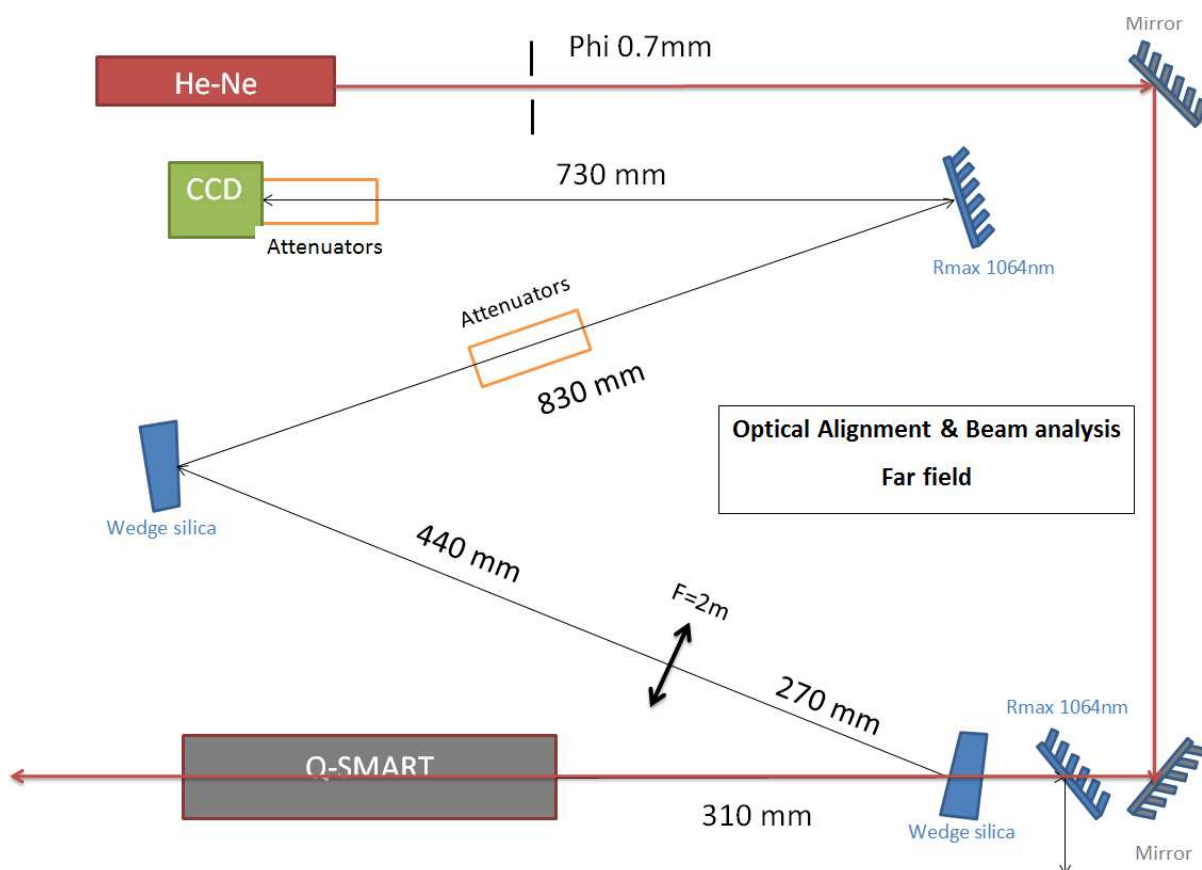|	
RE150002	Outillage contrôle sat phodiode PSHG
RP100016	Outillage sécu capot
SM020006A	OUTILLAGE UPGRADE SOFT Q-SMART

Expert

RE150002	Outillage contrôle sat phodiode PSHG
RP100016	Outillage sécu capot
SM020006A	OUTILLAGE UPGRADE SOFT Q-SMART
RM100004	SEMELLE MISE A HAUTEUR
3/OUT/0478	OUTILLAGE ALIGNEMENT GAUSSIEN

Please wear the antistatic bracelet (connected to the ground) before attempting any manipulation on the boards. If you do not, you might damage it irremediably.

IMAGING set up for Near field beam profile:

Optical Alignment & Beam analysis
Near field
1 m from laser output
G=1/2
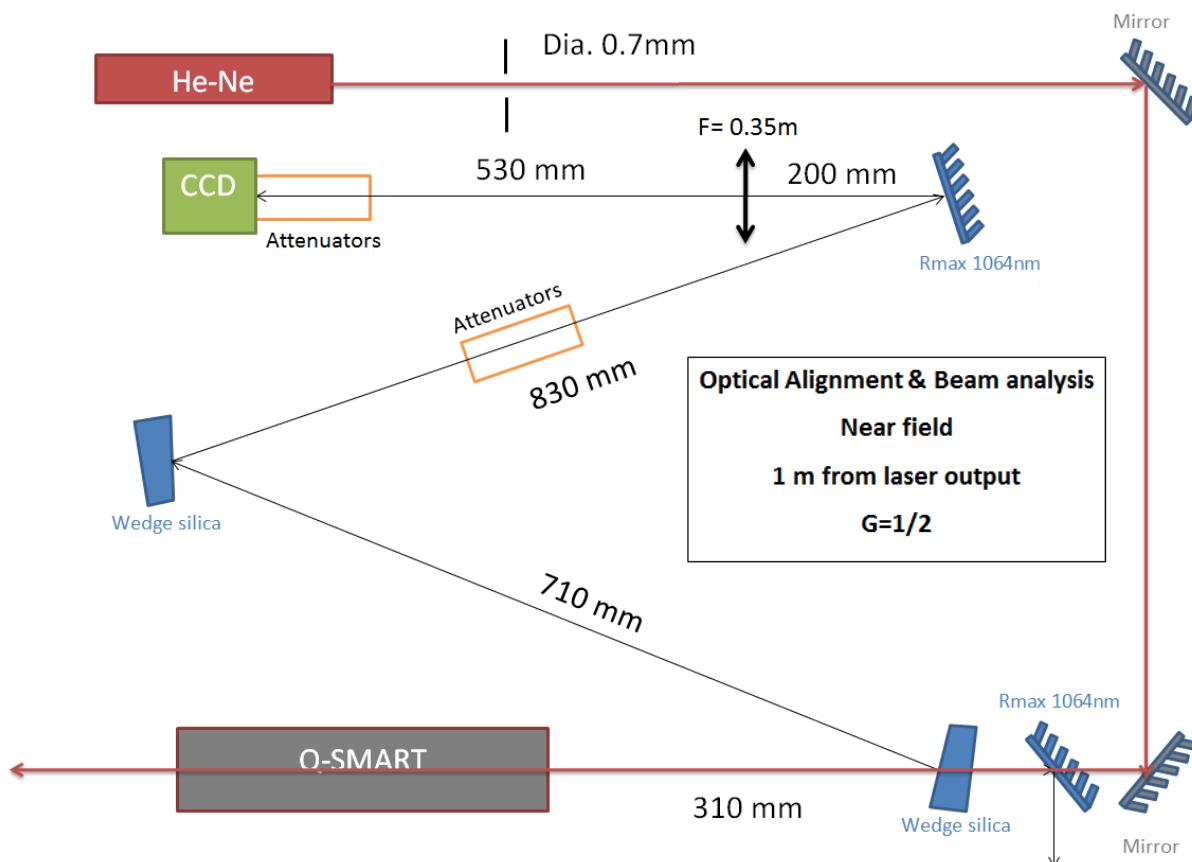
IMAGING set up for Far Field beam profile:

Optical Alignment & Beam analysis
Far field

TROUBLESHOOTING

User troubleshooting

Cover interlock
Coolant flow
Coolant temperature
Coolant level
Fans
Error: Unknown
Laser head over temp
Current driver over temp
HG over temperature
Charge error
Control communication
Internal communication

ELECTRONICS TROUBLESHOOTING

To obtain more precise information about laser status, it is possible to use different way to communicate with laser.
The first solution is to use freeware PuTTY (see install procedure).
On window, command VSTATUS or STATUS need to be entered in to PuTTY to get laser status.

Answer is as below:
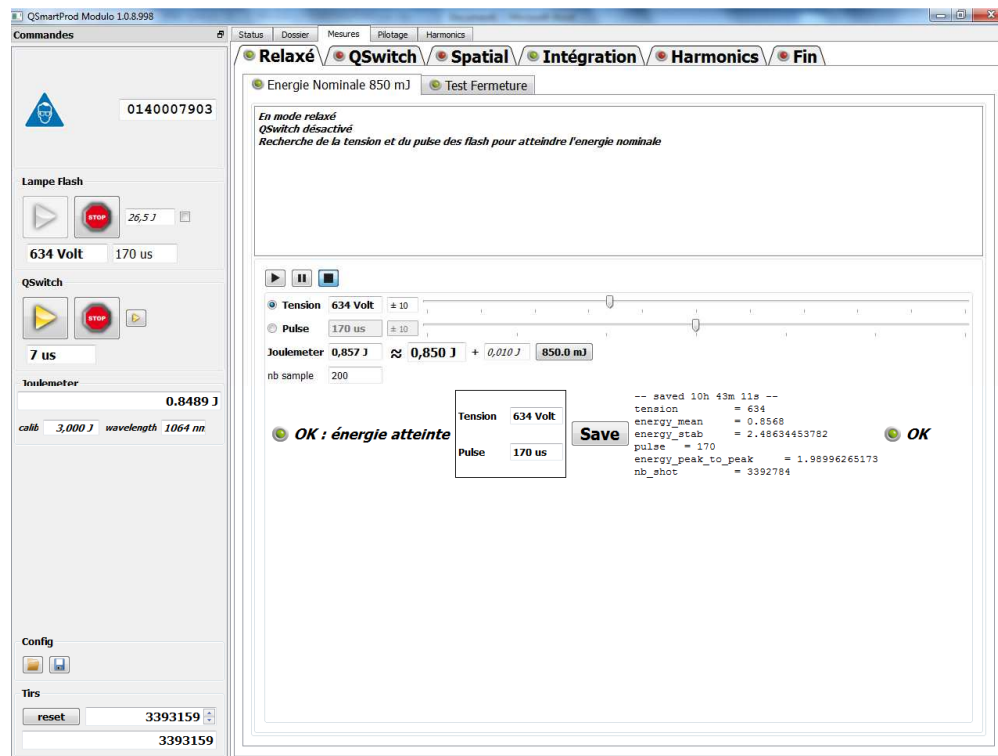**VSTATUS ?**
FAULT
ALARM
WARNING
OK: 0060 04 200000 6D 40 0000

Service menu is protected by password. To access factory mode type
PASSWORD H

Within maintenance training, production software will be provided and give you access to factory setting of QSMART laser.
This software also allows you to query STATUS command from the laser.

Status word is divided into several bits set to 0 and 1 for inactive or inactive fault, alarms, warning…

First 12 bits are coding status on CPU.MOD: **0060 04 200000** 6D 40 0000

BYTE	Bit	Description	State	
			0	1
STATE	S7	Run	Stop	Run
	S6	Lamp Trigger Source	Internal	External
	S5	Q-Switch Trigger Source	Internal	External
	S4	Q-Switch (If applicable)	Disabled	Enabled
	S3	*Reserved*		
	S2	*Water temp.*	*OK*	*Heating*
	S1	*Reserved*	Disabled	Enabled
	S0	*Reserved*	Disabled	Enabled
LASER STATE	L7	NLO Oven 3 (5w)	Not connected	Connected
	L6	NLO Oven 2 (3w | 4w)	Not connected	Connected
	L5	NLO Oven 1 (2w)	Not connected	Connected
	L4	APM oven 1	Off	On
	L3	APM oven 2	Off	On
	L2	APM oven 3	Off	On
	L1	APM	*Enable*	*Disable*
	L0	Shutter	Close	Open
WARNING	A7	CAN Bus Warning	No	Yes
	A6	System Power Cycle Detected	No	Yes
	A5	*Reserved*		
	A4	Automatic Phase Matching condition	OK	Not ok
	A3	NLO Oven 3 out of tolerance of setpoint	No	Yes
	A2	NLO Oven 2 out of tolerance of setpoint	No	Yes
	A1	NLO Oven 1 out of tolerance of setpoint	No	Yes
	A0	*Reserved*	*OK*	*Warning*

HARDWARE INTERLOCK (FAULT #1)	B7	T+L over temp	ok	Over temp
	B6	Charger Over temp	ok	Over temp
	B5	Heat exchanger over temp	ok	Over temp
	B4	IGBT over temp	ok	Over temp
	B3	Coolant Level Interlock	OK	Low Level
	B2	Coolant Flow Interlock	OK	Low Flow
	B1	Remote Interlock	OK	Open
	B0	Laser Head Interlock	OK	Open
FAULT #2	C7	Laser/Charger Voltage	OK	Fault
	C6	Simmer sense 1	OK	Fault
	C5	Simmer sense 2	OK	Fault
	C4	NLO Oven 3 Fault	OK	Fault
	C3	NLO Oven 2 Fault	OK	Fault
	C2	NLO Oven 1 Fault	OK	Fault
	C1	Laser Head Temperature Fault	OK	Fault
	C0	*Reserved*	*OK*	*Fault*
FAULT #3	D7	Laser Brain Memory Self Test	OK	Fault
	D6	Laser Brain Internal Runtime Fault	OK	Fault
	D5	Laser Brain Self Test	OK	Fault
	D4	Laser Brain Internal Runtime Fault	OK	Fault
	D3	CAN Bus Fault	OK	Fault
	D2	I2C Bus	OK	Fault
	D1	CPU Watchdog Timer Time Out	No	Yes
	D0	LB Watchdog Timer Time Out	No	Yes

Last 8 bits are coding status on LB.MOD: **0060 04 200000 6D 40 0000**

BYTE	Bit	Description	State	
			0	1
STATE	S7	NLO Oven 3 Detected	No	Yes
	S6	NLO Oven 2 Detected	No	Yes
	S5	NLO Oven 1 Detected	No	Yes
	S4	NLO Oven 3 Running	OFF	ON
	S3	NLO Oven 2 Running	OFF	ON
	S2	NLO Oven 1 Running	OFF	ON
	S1	shutter	Closed	Open
	S0	Ready for operation	wait	Ready
WARNING	W7	NLO Oven 3 out of tolerance of setpoint	No	Yes
	W6	NLO Oven 2 out of tolerance of setpoint	No	Yes
	W5	NLO Oven 1 out of tolerance of setpoint	No	Yes
	W4	Ambient temperature (PCB sensor) high	OK	High
	W3	*Reserved*	*No action*	*No action*
	W2	*Power cylce*	*OK*	*YES*
	W1	CAN BUS illegal message ID or Data	No	Yes
	W0	CAN BUS Overrun	OK	Warning
FAULT #1	A7	NLO Oven 3 Overtemp, timeout or other fault	ok	Fault
	A6	NLO Oven 2 Overtemp, timeout or other fault	ok	Fault
	A5	NLO Oven 1 Overtemp, timeout or other fault	ok	Fault
	A4	NLO Oven 3 open sensor	ok	Fault
	A3	NLO Oven 2 open sensor	ok	Fault
	A2	NLO Oven 1 open sensor	ok	Fault
	A1	*Reserved*	*No action*	*No action*
	A0	*Reserved*	*No action*	*No action*

FAULT #2	B7	Self test fault (Flash, rate or other peripheral)	OK	Fault
	B6	Non volatile write fault	OK	Fault
	B5	CAN BUS fault	OK	Fault
	B4	Internal Bus fault	OK	Fault
	B3	Ambient overtemp (PCB sensor)	OK	Fault
	B2	Main EEPROM Corrupt	OK	Fault
	B1	Module EEPROM Corrupt (see also A5-A7)	OK	Fault
	B0	Reset due toi watchdog timeotu	OK	Fault

FOR INTERNAL USE:

You can also use the WORD translator in order to decode STATUS:

See photo below for URL link.
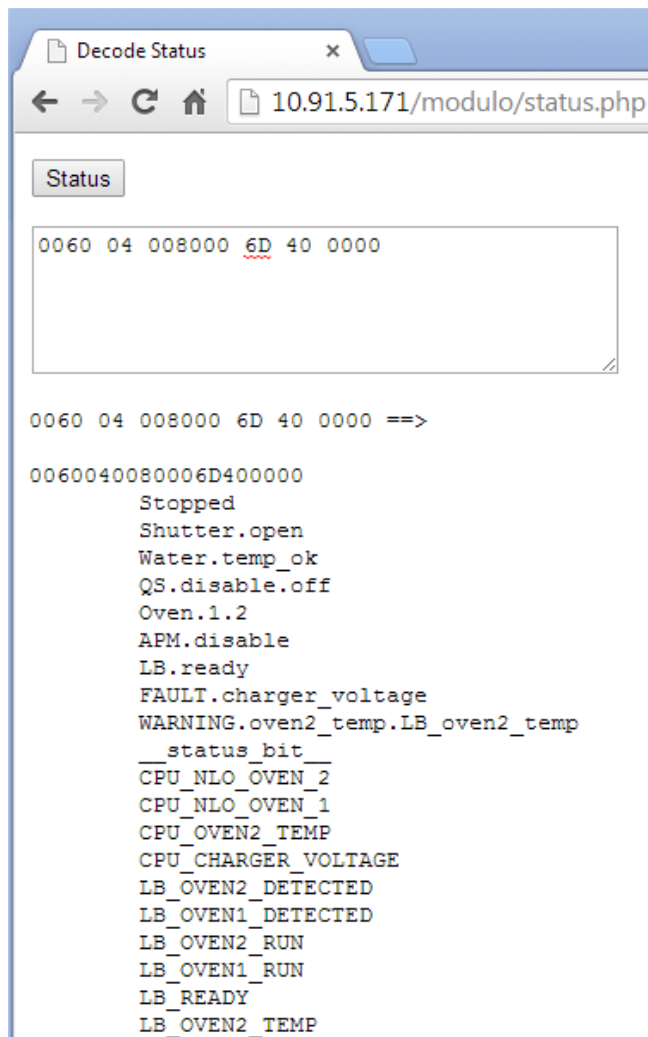
Faults/Alarms on COOLING GROUP

Au niveau du CG

FAULT = [COOLANT OVERTEMP]
ALARM = None
WARNING = None
OK: 0000 00 200000 00 00 0000

Schematics: CG OV TEMP

Description: water temperature in the cooling group is over 60°C. Temp sensor (4/CAP/0046) located on heater assembly is open.

Action:
Check ambient temperature of the laser is under correct condition.
Check coolant level.
Check continuity function on thermal sensor in the cooling group: J1-2 and J1-11.
Malfunction on Q-SMART CG HEATER TEMP SENSOR (pn: 4/CAP/0046)

FAULT = [COOLANT FLOW]
ALARM = None
WARNING = None
OK: 0000 00 040000 00 00 0000

Schematics: FLOW+

Description: Water flow is below 2L/minute: flow sensor is open.

Action:
Check if coolant lines are not bent or pinched
Check continuity function on flow sensor in the cooling group: J1-7 and J1-16.
Malfunction on Q-SMART CG FLOW SENSOR (pn: RE030006A)

FAULT = [COOLANT LEVEL]
ALARM = None
WARNING = None
OK: 0000 00 080000 00 00 0000

Schematics: LEVEL+

Description: coolant level is too low. Q-SMART CG LEVEL SENSOR is open.

Action:
Check coolant level.
Check continuity function on flow sensor in the cooling group: J1-6 and J1-15.
Malfunction on Q-SMART CG LEVEL SENSOR (pn: RE03000A)

FAULT = None
ALARM = [COOLING GROUP TEMP]
WARNING = None
OK: 0000 00 000200 00 00 0000
System warm up

Schematics: CG-SCG < 2°C

Description: Cooling groups is warming up the coolant (SCGTEMP = 38°C)

Action: wait for warm up

FAULT = None
ALARM = [COOLING GROUP TEMP]
WARNING = None
OK : 0460 04 000200 6D 40 0000
system overwarm up

Schematics : CG-SCG > 2°C

Check ambient temperature of the laser is under correct condition.
Check coolant level.
Make sure fans are working.

Action: Heat exchanger in fault

Faults/Alarms on PB.MOD board

FAULT = [CHARGER OVERTEMP]
ALARM = None
WARNING = None
OK : 0000 00 400000 00 00 0000

Schematics: CHGR OV TEMP

Description: HIGH temperature for PS charger > 70°C

Action: PB.MOD in fault (SM010358).

FAULT = [CURRENT DRIVER TEMP]
ALARM = None
WARNING = None
OK : 0000 00 100000 00 00 0000

Schematics: IGBT OV TEMP

Description: HIGH temperature for IGBT > 70°C

Action: PB.MOD in fault (SM010358).

FAULT = [BRIDGE OVERTEMP]
ALARM = None
WARNING = None
OK : 0000 00 800000 00 00 0000

Schematics: BRIDGE_0V_TEMP
Description: HIGH temperature for diode bridge > 80°C

Action: PB.MOD in fault (SM010358).

FAULT = [PUMP FANS]
ALARM = None
WARNING = None
OK: 0000 00 000100 00 00 0000

Schematics: PUMP/FAN HS (TP66)

Description: 24V power supply doesn't supply pump and fans.

Action
Check fuses F3 (2.5AT) and F4 (3AT) on PB.MOD for fans.
Check fuse F6 (2AT) on PB.MOD for pump.

FAULT = None
ALARM = [CHARGE_ERROR]
WARNING = None
OK: 0000 00 008000 00 00 0000

Schematics: CHGVERR

Description: Problem of charge for flashlamps.

On previous revisions PB.MOD (revA and revB): there is an issue of mechanical stress on resistance R35 and R34.
See procedure *Procedure for PB.MOD troubleshooting R34 R35 test - rework*
Soldering rework on R34 and R35 needs to be done.

Faults/Alarms on CPU.MOD board

FAULT = NONE
ALARM = [LH CONNECTION]
WARNING = None
OK: 0000 00 010000 00 00 0000

Schematics: LH CONNECTION

Description
I/O cable is not plugged.

Action:
Plug I/O cable (00249500-10) between laser head and power supply.

FAULT = None
ALARM = [REMOTE INTERLOCK]
WARNING = None
OK: 0000 00 020000 00 00 0000

Schematics: BNC – INTLK_PS

Description: BNC jumper on INTERLOCK BNC is not plugged.

Action: Plug jumper on INTERLOCK BNC on power supply.

FAULT = None
ALARM = [COM WATCHDOG]
WARNING = None
OK: 0000 05 000000 00 00 0000
If CHKSERIAL = 1

Schematics: RS232

Description: system is losing for communication.

Action: CPU.MOD in fault
If customer is controlling laser by RS232 (ie Ethernet cable), this alarm may appear if customer is not sending commands for long time.
Default setting is CHKSERIAL = 1, you need to set to 0.

Faults/Alarms on LB.MOD board

FAULT = None
ALARM = [COVER INTERLOCK]
WARNING = None
OK: **0000 00 000000 00 00 0200**

Schematics: COVER

Description
Laser head cover is correctly set: Q-SMART COVER SWITCH (pn: 4/INT/0010) is open.

Action:
Check that the laser head cover is correctly set on laser.
Check continuity function of the cover switch on LB.MOD between J3-8 and J3-7.
Malfunction on Q-SMART CG FLOW SENSOR (pn: 4/INT/0010).
Check laser head harness (pn : 4/300/1071A)

FAULT = [LH OVERTEMP]
ALARM = [LH TEMP]
WARNING = None
OK: 0000 00 000000 00 50 0000

Schematics: HEAD CTN DCT

Description: temperature in the laser is larger than 45°C.

Action:
Check ambient temperature of the laser is under correct condition.
Q-SMART TEMP SENSOR ASSY has failed.

FAULT = None
ALARM = None
WARNING = [SHUTTER CLOSED]
OK: 0001 00 000000 00 00 0000

Schematics: SHUTTER

Description: Shutter is closed

Action:
Open shutter

Faults/Alarms on CPU.MOD + PB.MOD board

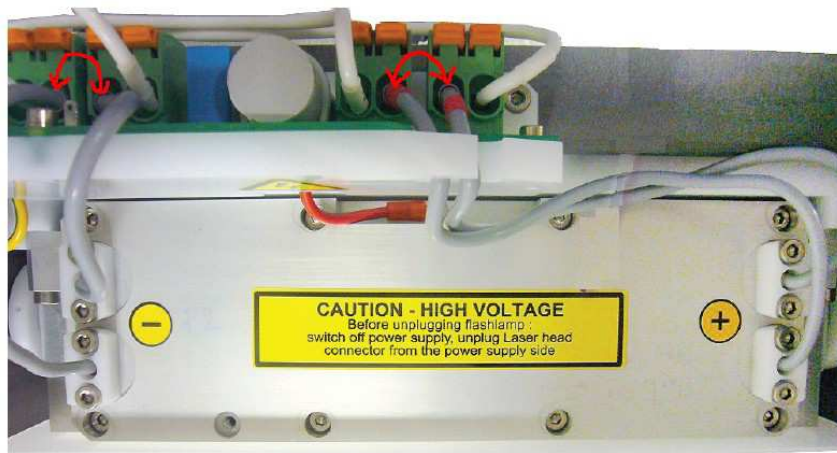**FAULT = None**
ALARM = [SIMMER1]
WARNING = None
OK: 0000 00 004000 00 00 0000

Schematics: SIMMER1

Description: simmer in flashlamp 1 not initiated

Action:
-Check wires connection on the laser head. Make sure they are correctly inserted.
-Swap wires between flash lamps 1 and 2 and then send STATUS command. Then you can deduce if problem comes from the flash or electronic.

-Check Fuse F10 (2A – 450VDC) to check on PB.MOD

FAULT = None
ALARM = [SIMMER2]
WARNING = None
OK: 0000 00 002000 00 00 0000

Schematics: SIMMER2

Description: simmer in flashlamp 2 not initiated

Action:
-Check wires connection on the laser head. Make sure they are correctly inserted.
-Swap wires between flash lamps 1 and 2 and then send STATUS command. Then you can deduce if problem comes from the flash or electronic.

-Check Fuse F10 (2A – 450VDC) to check on PB.MOD

FAULT = None
ALARM = [LAMP TRIG EXT]
WARNING = None
OK: 0000 20 000000 00 00 0000

Schematics: default horloge exterieur

Description: there is a default on external flashlamps trigger signal.

Action:
Check signal parameters (pulse width, amplitude, frequency) plugged into the flash in BNC.

ISSUE: FLASHLAMPS DO NOT START

Description: there is a default on trigger or charge

Action:
Open laser head cover and check flashlamps
Verify flashlamps connection
Check R240 resistance value (0.025 Ohms)

OPTICS TROUBLESHOOTING

ISSUE: LOW ENERGY

- ✓ Verify Qs delay to be set to the nominal value written on production file
- ✓ Verify Lamp Pulse Width and voltage
- ✓ Check the state of flashlamps
- ✓ With a flash light check the state of all the optics. If one is damaged please refer to replacement procedure of the damaged optics:
  - Q-SMART850 ROD ASSY
  - Q-SMART850 FLASHLAMP SET
  - Q-SMART BACK MIRROR ASSY
  - Q-SMART 1/4 WAVEPLATE ASSY
  - Q-SMART POLARIZOR ASSY
  - Q-SMART POCKELS CELL ASSY
  - Q-SMART GRM ASSY

Do not forget to order Q-SMART SET OF O-RINGS.

- ✓ Check the alignment of the laser head.
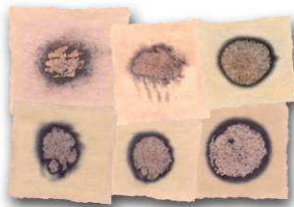
ISSUE: BEAM PROFILE IS NOT CORRECT

On a piece of photosensitive paper, realize an impact and compare it to the pictures below:

   The laser is aligned.

   The rear mirror is misaligned. Refer to the procedure BACK MIRROR ALIGNMENT to realign it.

   There is an optical problem. You may also observe a combination of these beam shapes. With a small torch, check the state of all the optics and find out the damaged one:

- Q-SMART850 ROD ASSY
- Q-SMART850 FLASHLAMP SET
- Q-SMART BACK MIRROR ASSY
- Q-SMART 1/4 WAVEPLATE ASSY
- Q-SMART POLARIZOR ASSY
- Q-SMART POCKELS CELL ASSY
- Q-SMART GRM ASSY

Do not forget to order Q-SMART SET OF O-RINGS.

With the imaging set up, you can also observe beam profile at Far Field and Near field.

ISSUE: LOW ENERGY AT HARMONIC GENERATORS WAVELENGHTS

First you need to verify energy at the oscillator and make sure laser reaches energy specifications.
- ✓ Verify Qs delay to be set to the nominal value written on production file
- ✓ Verify Lamp Pulse Width and voltage
- ✓ Check the state of flashlamps
- ✓ Measure output energy at 1064nm

With Harmonics generator plugged into the laser head:
- ✓ Start au AUTO PHASE MATCHING and verify the output energy
- ✓ Check optics in HG module
  - ▪ Crystal
  - ▪ Dichroic mirrors
  - ▪ Windows
- ✓ Check photodiode saturation on production software
- ✓ On production software or PuTTY, check the parameters on the harmonic generator and compare with production file:
  - ○ PD2W   ;Photodiode signal
  - ○ TEMP1S   ;Setpoint temperature
  - ○ TEMP1F   ;Feedback temperature
  - ○ TEMP2W   ;reading of the temperature