

## Test Protocol Commissioning

Laser System: ORS II

Check all installed System Components:

IL: ORS II - IL

PSL-PC: PSL - PC

PS1: 100 41 613

DB1: ORS II - DB1

PS2: 100 41 608

DB2: ORS II - DB2

PS3: 100 41 604

DB3: ORS II - DB3

PS4: 100 41 614

DB4: ORS II - DB4

TEC1: 100 41 606

TEC2: 100 41 611

CB: ORS II - CB

FE-DB: ORS II - FE-DB

LH: ORS II

### Test after Rack installation:

Switch ON the PSL computer, the fiber switches, the interlock box, the control box and the frontend box.

first comm.. re-comm.

First functionality check

Go to Stat> and check Beckhoff-COM (all boxes green)



VISU showing updated values



Safety Logic running

Check key lock switch and emergency stop (IL)



Check key lock switch and emergency stop (CB)



Check laser pushbutton



Safety Interlock checking procedure:

All interlocks must be green before starting this procedure. Make sure that the diode boxes are still short cut protected. Check System Status for Interlock checking by open the individual circuits. To include cabling and connectors open the circuits at the described position.

		first comm..	re-comm.
DB1 (open on DB side)	Interlock open	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
DB2 (open on DB side)	Interlock open	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
DB3 (open on DB side)	Interlock open	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
DB4 (open on DB side)	Interlock open	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
FE-DB (open on DB side)	Interlock open	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Chiller x-tal (open on chiller side)	Interlock open	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Chiller diode (open on chiller side)	Interlock open	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
TEC (Switch off TEC 1)	Interlock open	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
TEC (Switch off TEC 2)	Interlock open	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
External interlock	Interlock open	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Safety Switch @ IL	Interlock open	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Safety Switch @ CB	Interlock open	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Switch ON all components (this includes running chillers, make sure that the horses are connected properly and check for water leakage) and RESET all errors. After Reset the interlock relay should be switched ON, ATTENTION this allows Laser operation. If all interlock inputs working properly check the function of the interlock if all critical components will be switched off.

Choose an interlock event and check stopping the system:

		first comm..	re-comm.
NPRO	System stopped	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
DB-FE	Laser Diodes stopped	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
PSI-4	Power Supply Stopped	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Test laser diode control (DB needs to be bridged)

Test laser diode drive by set 1 A to DB 1-4 and readout the current

Test laser diode temperature control for DB 1-4

Comments:

Diode chiller 1000h, xtal chiller 991h  
prior shipment diode chiller 3490h, xtal chiller 3461h  
operating hours - 11213/4 - 971h/972h 1971h/971h // FE - 1465h

Controller:

Date:

mf

04.01.11

LW

27.06.11

mf

11.10.11

**Test Protocol Laser-Head**

	first comm..	re-comm.
Frontend		
Lid Functionality	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Lid Override	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Check Frontend water flow sensors	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Oscillator		
Lid Functionality	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Lid Override	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Check water flow sensors laser head	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Check water flow power meter	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
LRA functionality test	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
LRA range warning	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Check Externer Shutter functionality	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Check Interner Shutter functionality	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Temperatursensors	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Temp-/ Humidity	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Fiber switch (checked with test tool first)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Fiber switch (checked with switch)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
PD Power distribution	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Power Meter 1-3 functionality	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Photo Diode functionality	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Fieldbox interface	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Comments:

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Controller:

LLW, MF

Date:

27.6.11 / 14.10.11

**Prepare for shipping**

Measure diode slopes and compare to first measurement

(values needs to be in +/-5% range)

Check is diodes are shorted

Empty water circuit

OP, 30.6.11

**First Commissioning:**

Comments:

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Controller:

Date:

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**RE-commissioning:**

Comments:

*Change Chiller OP MRS to 185 (from X-val (y. ltr.) (10/13/11)*  
*Change PD Distribution of laserhead*

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Controller:

Date:

*mf*

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## Test Protocol Interlock-Box

Interlock Box SN: 0125 II JL

Power Supply (24V)

Voltage at IL\_X1 (24V):

Voltage at IL\_X2 (24V):

Voltage at IL\_X3 (24V):

Voltage at IL\_X4 (24V):



### Safety configuration:

Serial Nr. of KL6904: 002 1143 1

Start test program: Start System Manager + TwinCAT and open IL test programm make sure that program is running. Go to Twin Safe Logic (KL2), tab: TwinSAFE Logic and Press: Prüfe, Press: upload (in the file user name: "Administrator" show up).

Go to TwinSAFE Verifier, Press: Upload (new window will appear) wait for "Bereit" Press: Speichern. Type: User name: Administrator, Serial Nr. (see above), Password: TwinSAFE Window with project details will appear, Press: Starten, Password: TwinSAFE Press mapping, checking, start twin cat etc. to compile the new hardware configuration.

Switch off and on the interlock box.

Go to PLC\_Control and let the IL test program run. Check the control signals when doing the following procedure:

### Interlock in:

Bridge DBI-4 (display is green, if all 4 inputs are bridged)

Bridge TECI-2 (display is green, if all 4 inputs are bridged)

Bridge ext. (display: green)

Bridge frontend (display: green)

Bridge diode chiller (display: green)

Bridge xtal chiller (display: green)

Press Emergency Button (display: red)

Pull Emergency Button (display: green)

Keylock Position. 0 (display: red)

Keylock Position. 1 (display: green)



Test Protocol Interlock-Box

**Interlock out:**

The interlock in procedure should switch all inputs to green.

Press: Reset to switch on the output interlock channels

Relais K1 + K2 switched on

Connection between PSI-4 (pin 1-2)  
 TEC1-2 (pin 1-2)  
 frontend (pin 3-4)  
 frontend (pin 5-6)  
 NPRO (pin 1-2)

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Press button for red LED, LED is lightning red

Press button for green LED, LED is lightning green

Press button for diode and xtal chiller and measure:

D-SUB diode: 24V zw. pin 9(+) and pin 8(GND) ?

D-SUB xtal: 24V zw. pin 9(+) and pin 8(GND) ?

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- 
- 
- 
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Perform Geräteprüfung

Used: SECUTEST

Test für Schutzklasse I (SKI) starten, Anweisungen folgen

	Messwerte inkl. Gebr. Fehler	Grenzwerte
R <sub>SL</sub> max	0,089	< 0.300 Ohm
R <sub>ISO</sub> min	3.70,0	> 1.000 Mohm
U <sub>ISO</sub> SPG.	538	500 V
I <sub>EA</sub> max	7,97	3.5 mA

Comments:

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Controller:

M.J. de J.

Date:

28/10/2010

## Test Protocol Diode-Box

Diode-Box SN: DB1 - OBSII

Connect the TEC high current cable to a TEC power supply and the interlock cable (test tool) between TEC PS and DB. Use the power supply TEC1 for DB1 and DB2 and TEC 2 for DB3 and DB4.

TEC Power Supply SN : 10041606

Named: TEC1 OBSII

Change the dip code on the back side of the power supply (SW1) to the following:

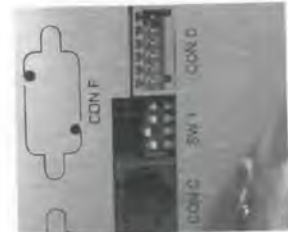
SW1 (down to top) 1: off, 2: on, 3: off, 4: off

Set TEC supply voltage setting to 20V and limit to 25V.

Set TEC supply current setting and limit to max (~67A)

Press Output On.

Press both Settings-Buttons for 3 sec to lock the power supply.



All TEC Power Supply Parameter settings are made



Connect 24V DC to a power supply and Ether Cat IN to the Test PC

Check 24V DC, supply (needs to be below 0.5A) 0.5 A, OK



## Test Protocol Diode-Box

Start the DB Test program

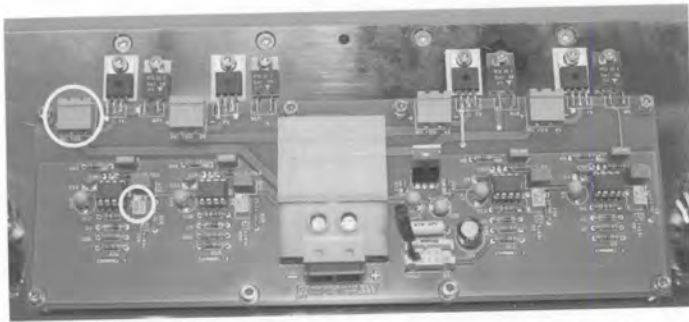
Check proper read out of all (LD 1-7 and 2 x heat sink) temperature sensors

(temperature is in the room temperature range, 20-30°C)

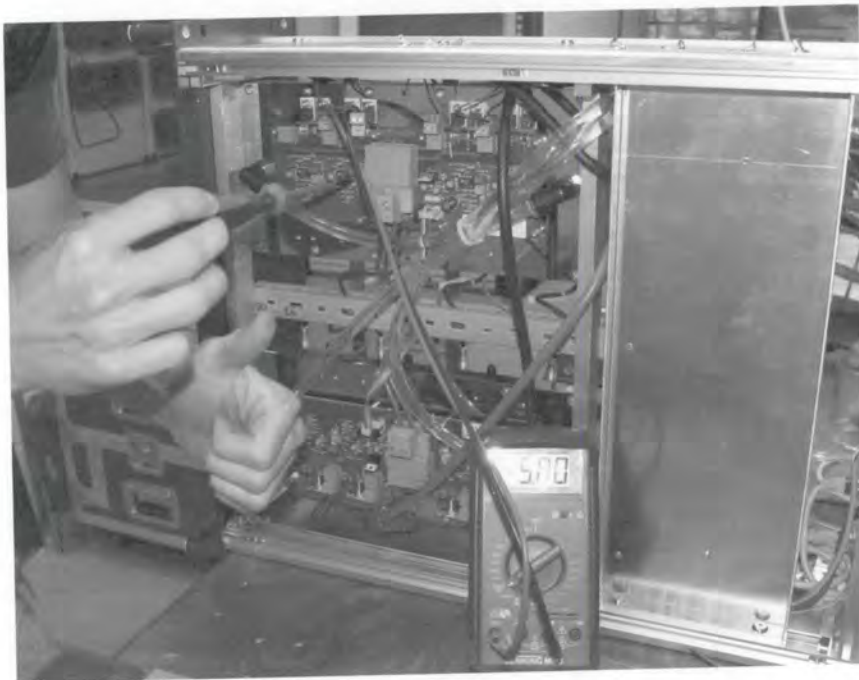


Start TEC calibration procedure (example for one channel)

Use a current meter and connect (test tool) to the TEC OUT on the TEC board.



Press TEST (software) on the diode number connected to the current meter and calibrate (by turning the poti on the board) to 5A.





## Test Protocol Diode-Box

Use the "polarity-change" connector (test tool) between TEC (diode) and the board. Press TEST and heat up the diode up to 40°C. The interlock should around 40°C (+/-5°C) and will shut down the TEC power supply. Reconnect to the laser TEC (diode) to the board on the normal way and press TEST to cool down the diode.

Redo procedure for all 7 channels:

LD1: calibrate to 5A - Interlock OK - Cooling OK



LD2: calibrate to 5A - Interlock OK - Cooling OK



LD3: calibrate to 5A - Interlock OK - Cooling OK



LD4: calibrate to 5A - Interlock OK - Cooling OK



LD5: calibrate to 5A - Interlock OK - Cooling OK



LD6: calibrate to 5A - Interlock OK - Cooling OK



LD7: calibrate to 5A - Interlock OK - Cooling OK



Start diode power supply checking.

Connect the laser diode current cable to the laser diode power supply and bridge the power supply interlock.

Diode Power Supply SN : 10041673

Named: PS7 OBS2

Change the dip code on the back side of the power supply (SW1) to the following:

## Test Protocol Diode-Box

SW1 (down to top) 1: off, 2: on, 3: off, 4: on

Set laser diode supply voltage setting to 18V and limit to 18V.

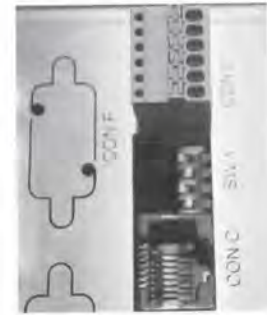
Set laser diode supply current setting to 0A and limit to max (~67A)

Press Output Off

Set to Remote CC

Press Output On

Press both Settings-Buttons for 3 sec to lock the power supply.



All Laser Diode Power Supply settings are made.



Make sure that the DB lasers diode short cut is connected red and black. Type 3A into the software program and press enable (current is set as long as button is pressed).

Check current readout and current display at the power supply. (Value fits to the setting, +/- 0.1A)



Check diode voltage readout (has to be 0V, due to short cut)



Switch DB short cut to black/black position and make sure that all diode short cuts are set to red/red. Press enable the check voltage (around 10V)



Switch DB short cut back to red/black



Use the photo diode test system and check the diode voltage readout.

## Test Protocol Diode-Box

Photodiode readout of all 7 diodes OK



Fill the diode box with distilled water. Connect the pressure measurement tool and test the system with 5bar for &gt;5h.

Pressure and leakage test OK



Laser Diode SN:

LD1: 10798LD2: 10796LD3: 10793LD4: 10795LD5: 10797LD6: 10808LD7: 101227

Diode characterization from: \_\_\_\_\_, add diode datasheets to this document.

Comments:

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Controller:

178 M. J. J.

Date:

22/12/2010



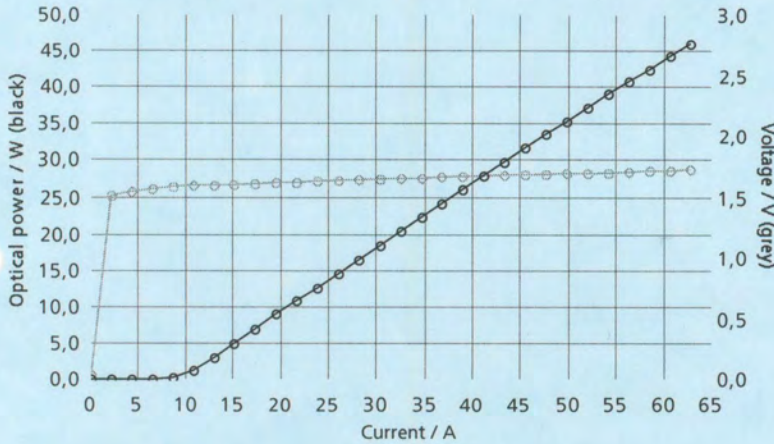
# Measurement Data Sheet



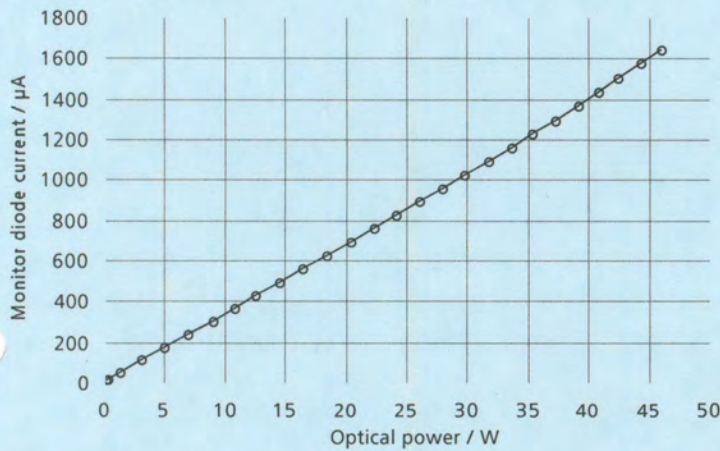
## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_10798  
 Date: August 13, 2010  
 Operator: D.Trebs

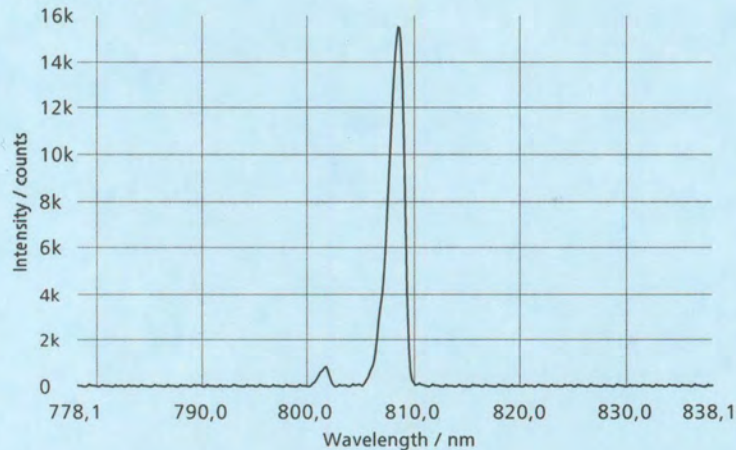
## Electro-Optical Data



## Monitor Diode Data



## Spectral Data



## Technical Specifications

Operation mode:	cw
Nominal output power:	45 W
Module temperature*:	25 °C
Temperature sensor:	PT1000
Fiber core diameter:	400 µm
Fiber numerical aperture:	0.22
Fiber connector type:	F-SMA 905, free

## Specification Tests

Electro-optical test:	passed
Spectral test:	passed

## Electro-Optical Parameters

Operation current at n.p.:	61.6 A
Operation voltage at n.p.:	1.72 V
Threshold current:	9.63 A
Slope:	0.87 W/A
Efficiency at nominal power:	42.5 %
Series resistance:	2.8 mOhm
Monitor diode current at n.p.:	1606 µA

## Spectral Parameters

Center wavelength:	808.1 nm
Spectral bandwidth (FWHM):	1.7 nm
Measurement temperature*:	25.0 °C
Measurement current:	61.6 A

0600

808,6

57.7

\* at temperature sensor  
 n.p. = nominal power

20100813-073628-RC\_10798-E1 - SPK29643 - MCM - SW 1.8.5



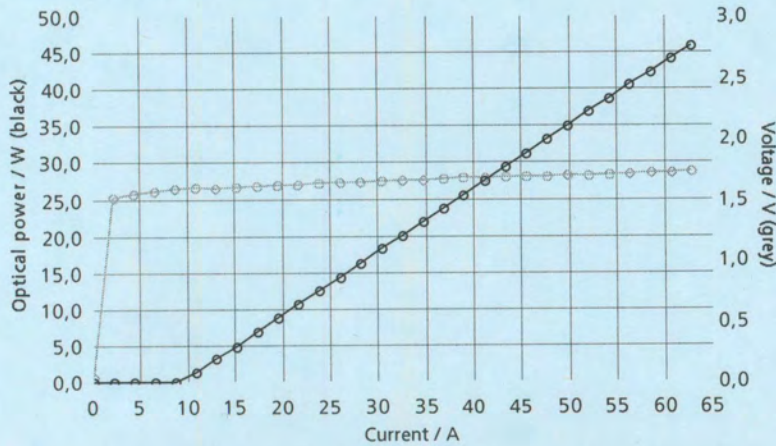
# Measurement Data Sheet



## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_10796  
 Date: August 12, 2010  
 Operator: D.Trebs

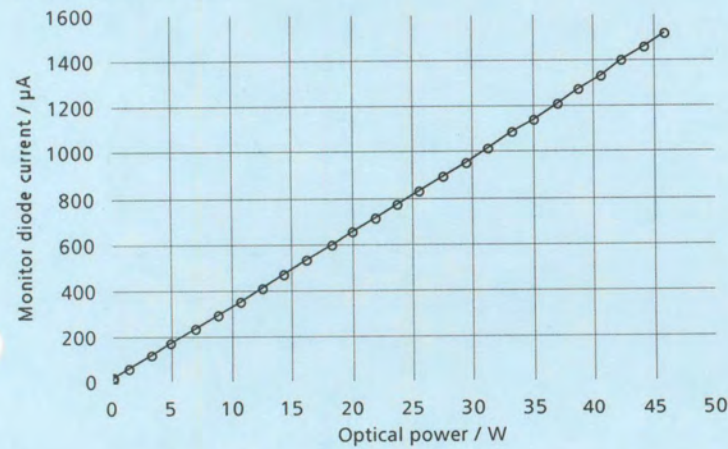
## Electro-Optical Data



## Technical Specifications

Operation mode:	cw
Nominal output power:	45 W
Module temperature*:	25 °C
Temperature sensor:	PT1000
Fiber core diameter:	400 µm
Fiber numerical aperture:	0.22
Fiber connector type:	F-SMA 905, free

## Monitor Diode Data



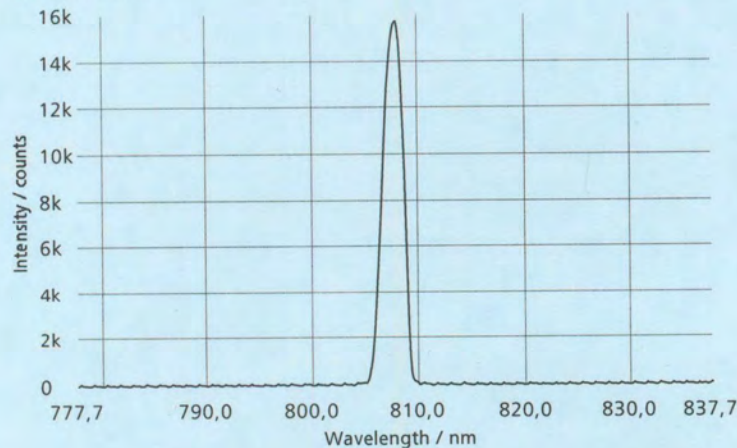
## Specification Tests

Electro-optical test:	passed
Spectral test:	passed

## Electro-Optical Parameters

Operation current at n.p.:	61.7 A
Operation voltage at n.p.:	1.72 V
Threshold current:	9.01 A
Slope:	0.85 W/A
Efficiency at nominal power:	42.3 %
Series resistance:	2.9 mOhm
Monitor diode current at n.p.:	1488 µA

## Spectral Data



## Spectral Parameters

Center wavelength:	807.7 nm	807.2
Spectral bandwidth (FWHM):	2.2 nm	
Measurement temperature*:	25.0 °C	
Measurement current:	61.7 A	57.5

\* at temperature sensor  
 n.p. = nominal power

20100812-132929-RC\_10796-E1 - SPK25843 - MOMA - SW 1.8.5



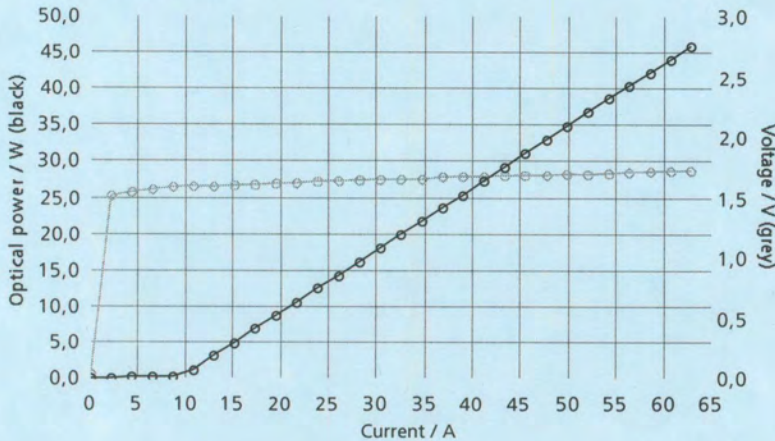
# Measurement Data Sheet



## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_10793  
 Date: August 13, 2010  
 Operator: D.Trebs

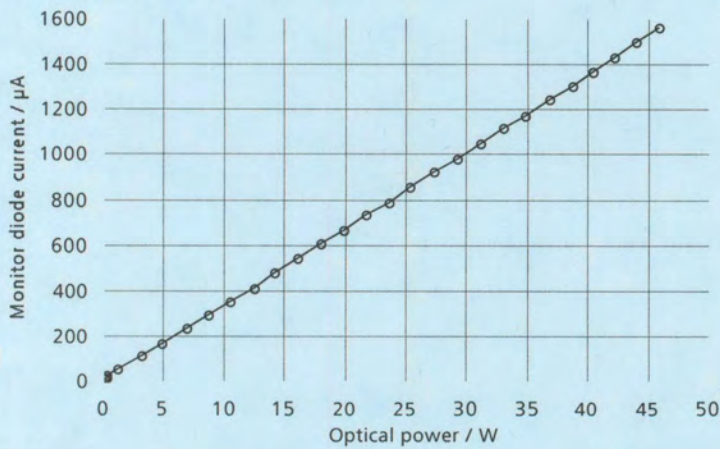
## Electro-Optical Data



## Technical Specifications

Operation mode: cw  
 Nominal output power: 45 W  
 Module temperature\*: 25 °C  
 Temperature sensor: PT1000  
 Fiber core diameter: 400 µm  
 Fiber numerical aperture: 0.22  
 Fiber connector type: F-SMA 905, free

## Monitor Diode Data



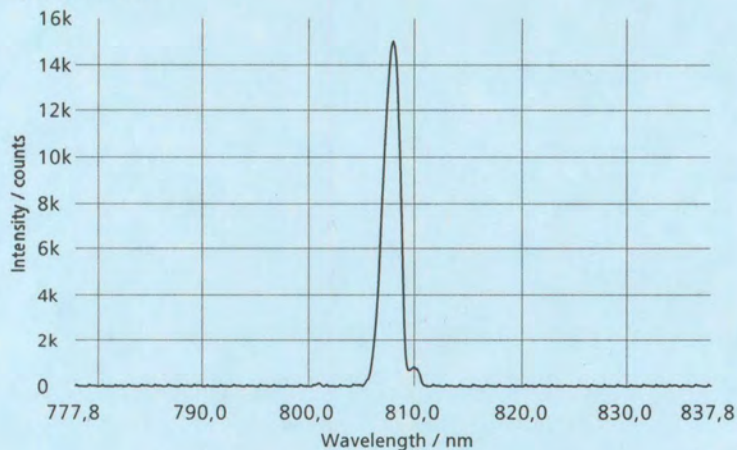
## Specification Tests

Electro-optical test: passed  
 Spectral test: passed

## Electro-Optical Parameters

Operation current at n.p.: 61.8 A  
 Operation voltage at n.p.: 1.72 V  
 Threshold current: 9.68 A  
 Slope: 0.86 W/A  
 Efficiency at nominal power: 42.2 %  
 Series resistance: 2.9 mOhm  
 Monitor diode current at n.p.: 1533 µA

## Spectral Data



## Spectral Parameters

Center wavelength: 807.8 nm  
 Spectral bandwidth (FWHM): 1.8 nm  
 Measurement temperature\*: 25.0 °C  
 Measurement current: 61.8 A

807.3  
 574

\* at temperature sensor  
 n.p. = nominal power



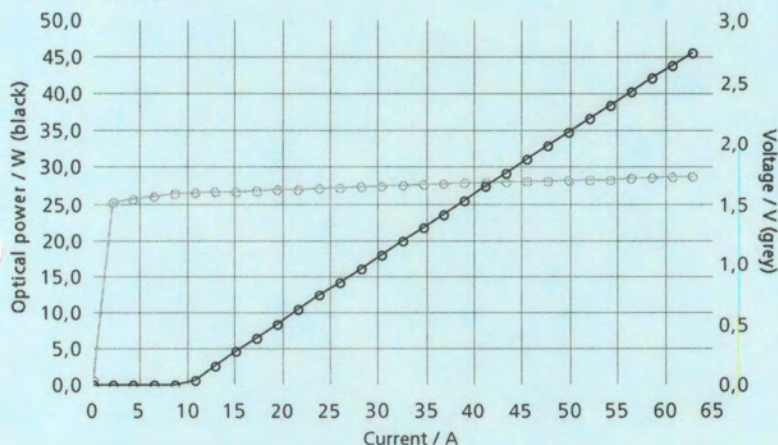
# Measurement Data Sheet



## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_10195  
 Date: March 12, 2010  
 Operator: D.Kirsch

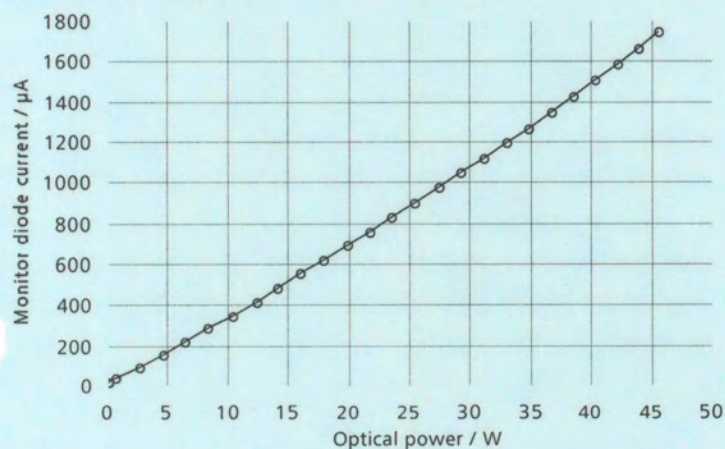
## Electro-Optical Data



## Technical Specifications

Operation mode: cw  
 Nominal output power: 45 W  
 Module temperature\*: 25 °C  
 Temperature sensor: PT1000  
 Fiber core diameter: 400 µm  
 Fiber numerical aperture: 0.22  
 Fiber connector type: F-SMA 905, free

## Monitor Diode Data



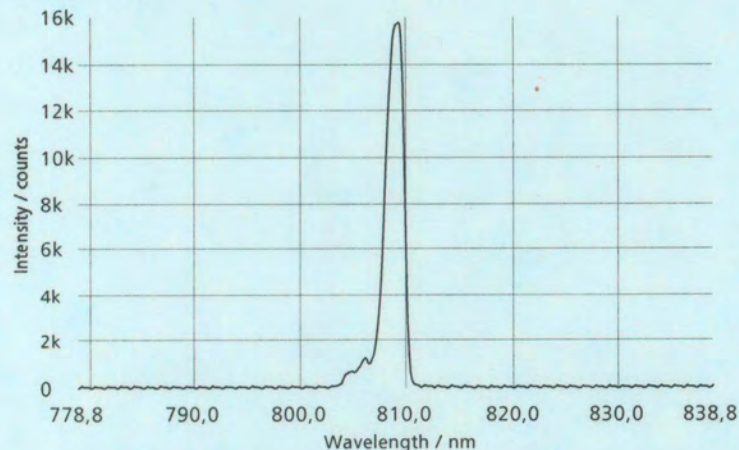
## Specification Tests

Electro-optical test: passed  
 Spectral test: passed

## Electro-Optical Parameters

Operation current at n.p.: 62.1 A  
 Operation voltage at n.p.: 1.72 V  
 Threshold current: 10.29 A  
 Slope: 0.87 W/A  
 Efficiency at nominal power: 42.0 %  
 Series resistance: 2.9 mOhm  
 Monitor diode current at n.p.: 1719 µA

## Spectral Data



## Spectral Parameters

Center wavelength: 808.8 nm  
 Spectral bandwidth (FWHM): 1.9 nm  
 Measurement temperature\*: 25.0 °C  
 Measurement current: 62.1 A

808.3

578

\* at temperature sensor  
 n.p. = nominal power



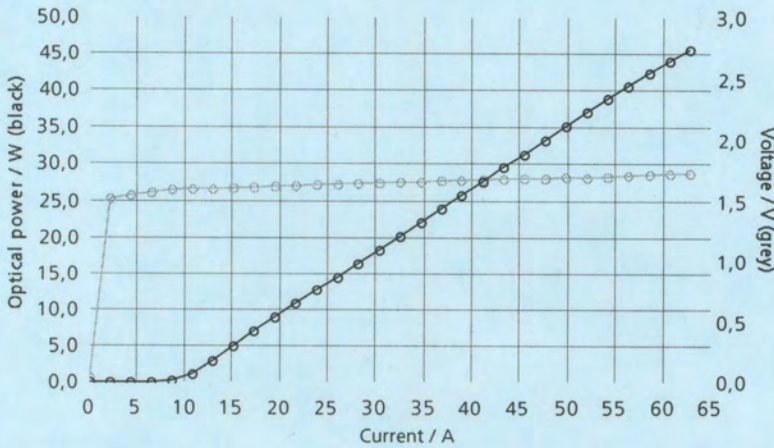
# Measurement Data Sheet



## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_10797  
 Date: August 13, 2010  
 Operator: D.Trebs

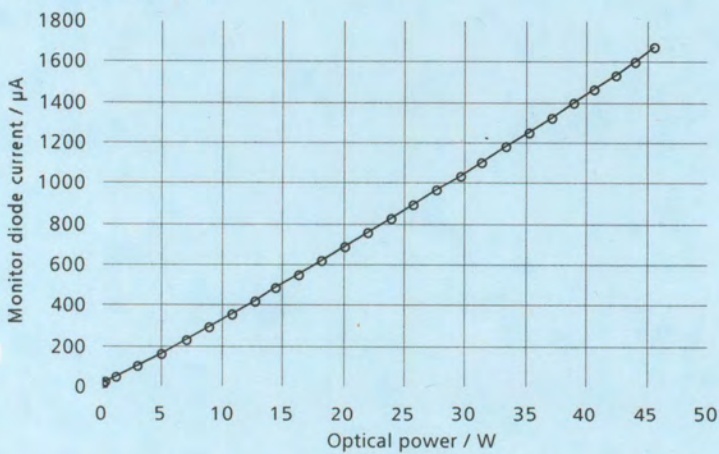
## Electro-Optical Data



## Technical Specifications

Operation mode: cw  
 Nominal output power: 45 W  
 Module temperature\*: 25 °C  
 Temperature sensor: PT1000  
 Fiber core diameter: 400 µm  
 Fiber numerical aperture: 0.22  
 Fiber connector type: F-SMA 905, free

## Monitor Diode Data



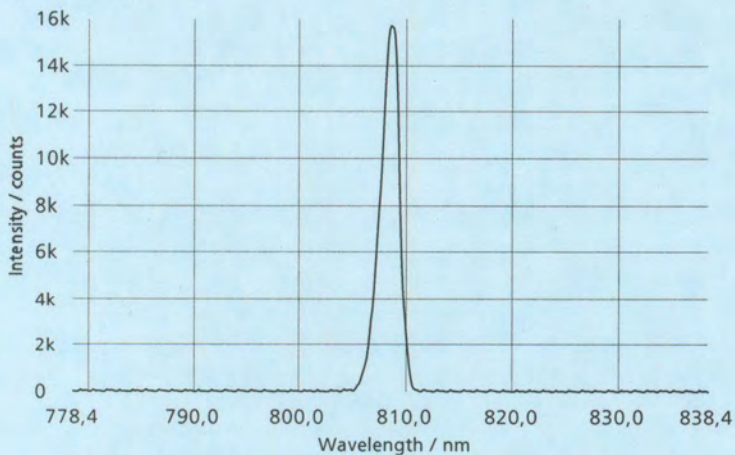
## Specification Tests

Electro-optical test: passed  
 Spectral test: passed

## Electro-Optical Parameters

Operation current at n.p.: 62.1 A  
 Operation voltage at n.p.: 1.72 V  
 Threshold current: 10.06 A  
 Slope: 0.87 W/A  
 Efficiency at nominal power: 42.1 %  
 Series resistance: 2.8 mOhm  
 Monitor diode current at n.p.: 1648 µA

## Spectral Data



## Spectral Parameters

Center wavelength: 808.4 nm **807.9**  
 Spectral bandwidth (FWHM): 1.9 nm  
 Measurement temperature\*: 25.0 °C  
 Measurement current: 62.1 A **57.2**

\* at temperature sensor  
 n.p. = nominal power

20100813-072952-RC\_10797-E1 - SPK29843 - MONIA - SW 1.8.5



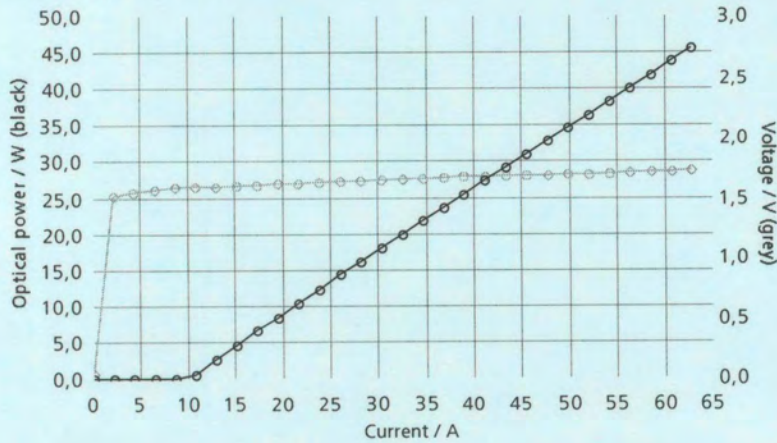
# Measurement Data Sheet



## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_10808  
 Date: August 06, 2010  
 Operator: D.Kirsch

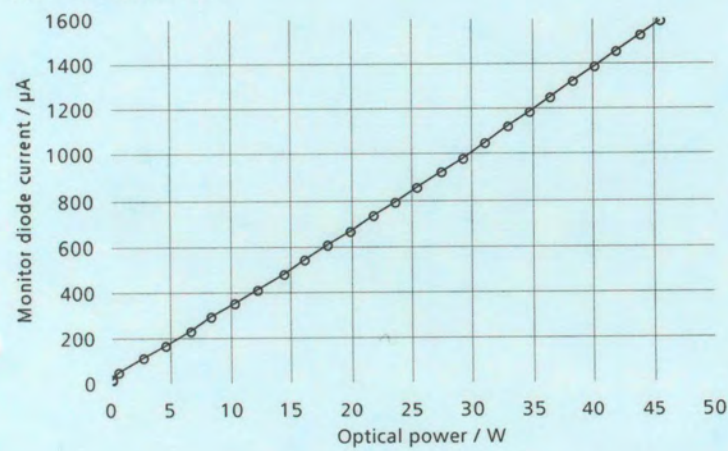
## Electro-Optical Data



## Technical Specifications

Operation mode: cw  
 Nominal output power: 45 W  
 Module temperature\*: 25 °C  
 Temperature sensor: PT1000  
 Fiber core diameter: 400 µm  
 Fiber numerical aperture: 0.22  
 Fiber connector type: F-SMA 905, free

## Monitor Diode Data



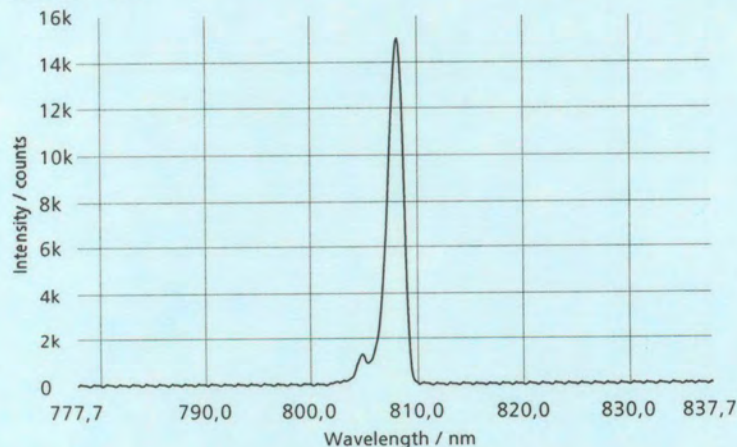
## Specification Tests

Electro-optical test: passed  
 Spectral test: passed

## Electro-Optical Parameters

Operation current at n.p.: 62.1 A  
 Operation voltage at n.p.: 1.73 V  
 Threshold current: 10.40 A  
 Slope: 0.87 W/A  
 Efficiency at nominal power: 42.0 %  
 Series resistance: 2.9 mOhm  
 Monitor diode current at n.p.: 1570 µA

## Spectral Data



## Spectral Parameters

Center wavelength: 807.7 nm  
 Spectral bandwidth (FWHM): 1.7 nm  
 Measurement temperature\*: 25.0 °C  
 Measurement current: 62.1 A

807.2

57.8

\* at temperature sensor  
 n.p. = nominal power

20100606-093401-RC\_10808-E1 - SPK29643 - MCMA - SW 1.8.2



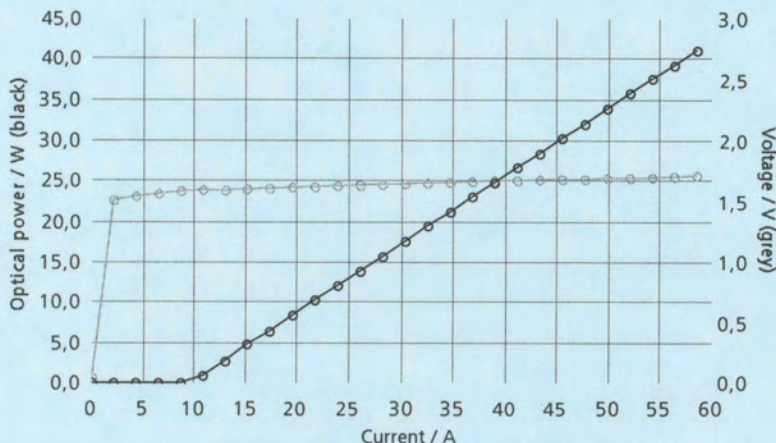
# Measurement Data Sheet



## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_101288  
 Date: December 16, 2010  
 Operator: H.Walther

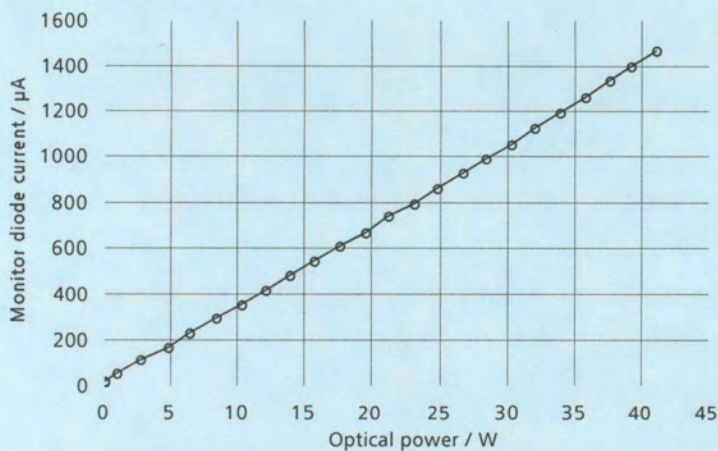
## Electro-Optical Data



## Technical Specifications

Operation mode: cw  
 Nominal output power: 40 W  
 Module temperature\*: 25 °C  
 Temperature sensor: PT1000  
 Fiber core diameter: 400 µm  
 Fiber numerical aperture: 0.22  
 Fiber connector type: F-SMA 905, free

## Monitor Diode Data



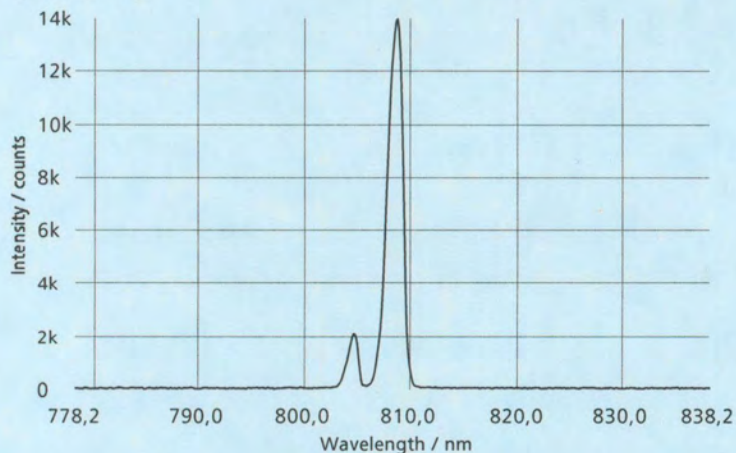
## Specification Tests

Electro-optical test: passed  
 Spectral test: passed

## Electro-Optical Parameters

Operation current at n.p.: 57.3 A  
 Operation voltage at n.p.: 1.71 V  
 Threshold current: 10.06 A  
 Slope: 0.85 W/A  
 Efficiency at nominal power: 40.9 %  
 Series resistance: 2.8 mOhm  
 Monitor diode current at n.p.: 1431 µA

## Spectral Data



## Spectral Parameters

Center wavelength: 808.2 nm  
 Spectral bandwidth (FWHM): 1.6 nm  
 Measurement temperature\*: 25.0 °C  
 Measurement current: 57.3 A

\* at temperature sensor  
 n.p. = nominal power

## Test Protocol Diode-Box

Diode-Box SN: DB2 - 01311

Connect the TEC high current cable to a TEC power supply and the interlock cable (test tool) between TEC PS and DB. Use the power supply TEC1 for DB1 and DB2 and TEC 2 for DB3 and DB4.

TEC Power Supply SN : 10041606

Named: TEC1

Change the dip code on the back side of the power supply (SW1) to the following:

SW1 (down to top) 1: off, 2: on, 3: off, 4: off  
Set TEC supply voltage setting to 20V and limit to 25V.

Set TEC supply current setting and limit to max (~67A)

Press Output On.

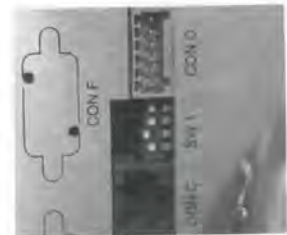
Press both Settings-Buttons for 3 sec to lock the power supply.

All TEC Power Supply Parameter settings are made



Connect 24V DC to a power supply and Ether Cat IN to the Test PC

Check 24V DC, supply (needs to be below 0.5A) 0.5 A, OK





## Test Protocol Diode-Box

Start the DB Test program

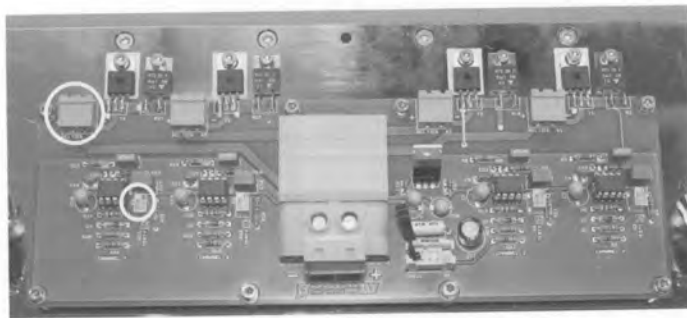
Check proper read out of all (LD 1-7 and 2 x heat sink) temperature sensors

(temperature is in the room temperature range, 20-30°C)

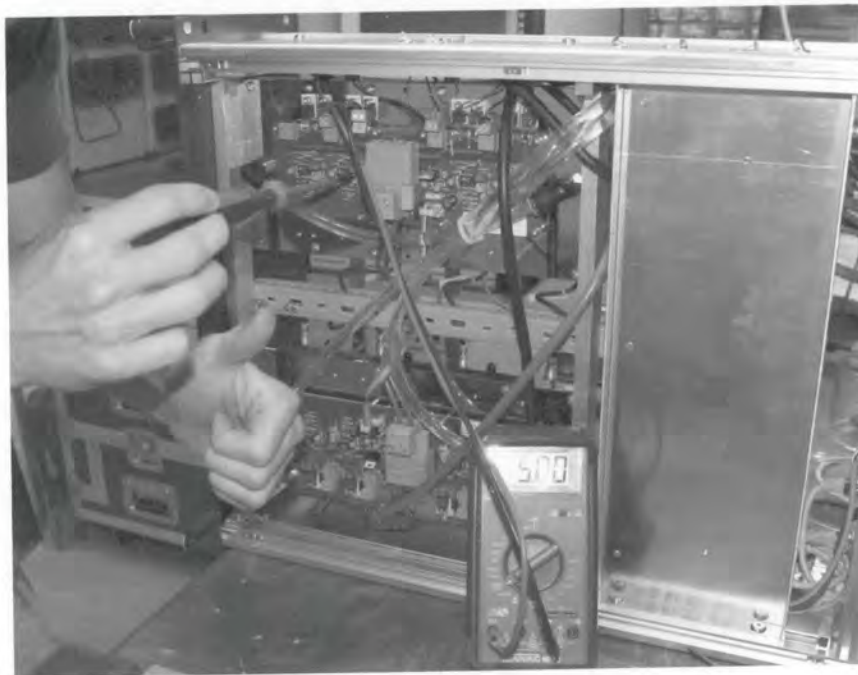


Start TEC calibration procedure (example for one channel)

Use a current meter and connect (test tool) to the TEC OUT on the TEC board.



Press TEST (software) on the diode number connected to the current meter and calibrate (by turning the poti on the board) to 5A.



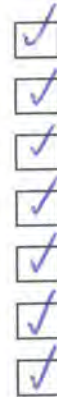


Test Protocol Diode-Box

Use the "polarity-change" connector (test tool) between TEC (diode) and the board. Press TEST and heat up the diode up to 40°C. The interlock should around 40°C (+/-5°C) and will shut down the TEC power supply. Reconnect to the laser TEC (diode) to the board on the normal way and press TEST to cool down the diode.

Redo procedure for all 7 channels:

LD1: calibrate to 5A - Interlock OK - Cooling OK  
LD2: calibrate to 5A - Interlock OK - Cooling OK  
LD3: calibrate to 5A - Interlock OK - Cooling OK  
LD4: calibrate to 5A - Interlock OK - Cooling OK  
LD5: calibrate to 5A - Interlock OK - Cooling OK  
LD6: calibrate to 5A - Interlock OK - Cooling OK  
LD7: calibrate to 5A - Interlock OK - Cooling OK



Start diode power supply checking.

Connect the laser diode current cable to the laser diode power supply and bridge the power supply interlock.

Diode Power Supply SN : 10041608  
Named: PS2 OBSII

Change the dip code on the back side of the power supply (SW1) to the following:

## Test Protocol Diode-Box

SW1 (down to top) 1: off, 2: on, 3: off, 4: on

Set laser diode supply voltage setting to 18V and limit to 18V.

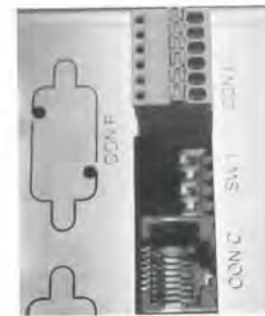
Set laser diode supply current setting to 0A and limit to max (~67A)

Press Output Off

Set to Remote CC

Press Output On

Press both Settings-Buttons for 3 sec to lock the power supply.



All Laser Diode Power Supply settings are made.



Make sure that the DB lasers diode short cut is connected red and black. Type 3A into the software program and press enable (current is set as long as button is pressed).

Check current readout and current display at the power supply.

(Value fits to the setting, +/- 0.1A)



Check diode voltage readout (has to be 0V, due to short cut)



Switch DB short cut to black/black position and make sure that all diode short cuts are set to red/red. Press enable the check voltage (around 10V )



Switch DB short cut back to red/black



Use the photo diode test system and check the diode voltage readout.

## Test Protocol Diode-Box

Photodiode readout of all 7 diodes OK



Fill the diode box with distilled water. Connect the pressure measurement tool and test the system with 5bar for &gt;5h.

Pressure and leakage test OK



Laser Diode SN:

LD1: 10-12-18LD2: 10-12-15LD3: 10-11-99LD4: 10-12-22LD5: 10-12-09LD6: 10-12-10LD7: 10-12-17

Diode characterization from: \_\_\_\_\_, add diode datasheets to this document.

Comments:

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Controller:

MJ

Date:

22/12/2010



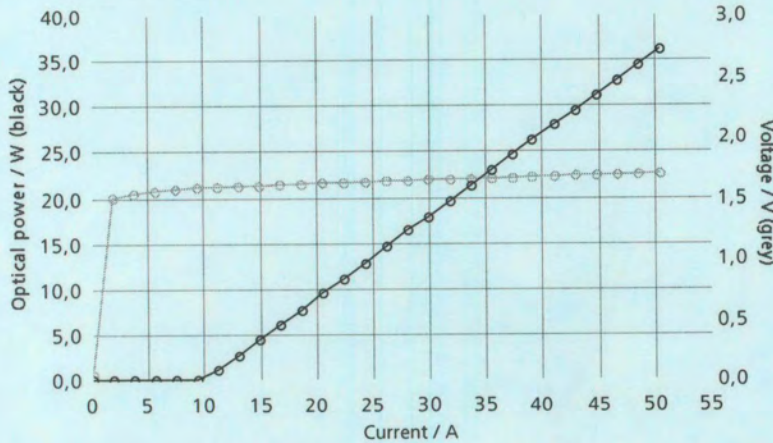
# Measurement Data Sheet



## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_101218  
 Date: November 24, 2010  
 Operator: D.Kirsch

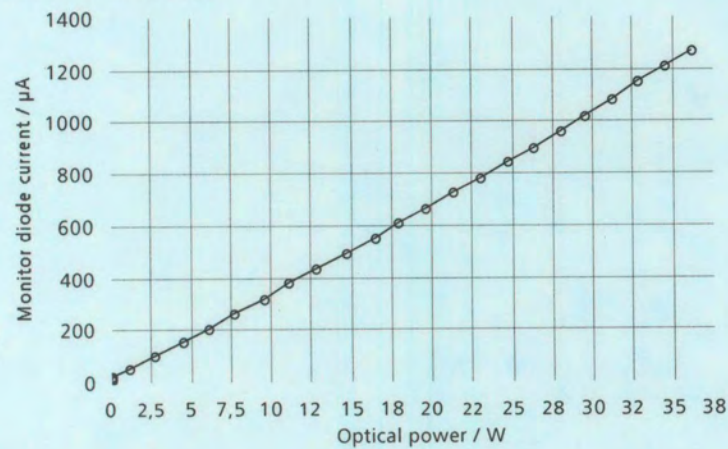
## Electro-Optical Data



## Technical Specifications

Operation mode: cw  
 Nominal output power: 35 W  
 Module temperature\*: 25 °C  
 Temperature sensor: PT1000  
 Fiber core diameter: 400 µm  
 Fiber numerical aperture: 0.22  
 Fiber connector type: F-SMA 905, free

## Monitor Diode Data



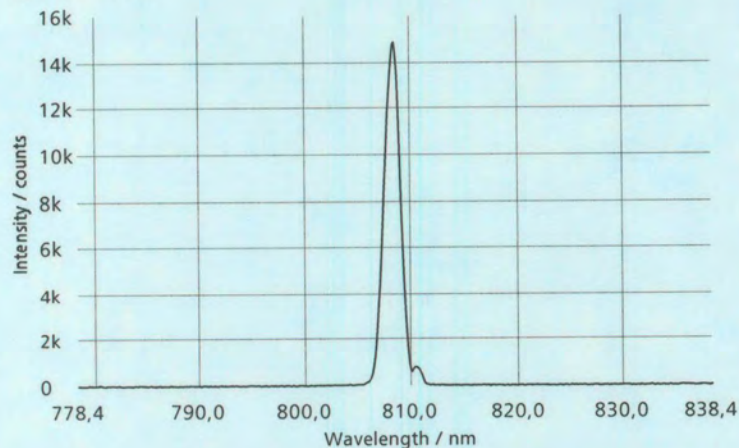
## Specification Tests

Electro-optical test: passed  
 Spectral test: passed

## Electro-Optical Parameters

Operation current at n.p.: 49.1 A  
 Operation voltage at n.p.: 1.69 V  
 Threshold current: 9.90 A  
 Slope: 0.89 W/A  
 Efficiency at nominal power: 42.2 %  
 Series resistance: 3.0 mOhm  
 Monitor diode current at n.p.: 1228 µA

## Spectral Data



## Spectral Parameters

Center wavelength: 808.4 nm **808,9**  
 Spectral bandwidth (FWHM): 1.7 nm  
 Measurement temperature\*: 25.0 °C  
 Measurement current: 49.1 A **53,5**

\* at temperature sensor  
 n.p. = nominal power

20101124-124821-RC\_101218-E1 - SPK30277 - MONA - SW 1.9.1



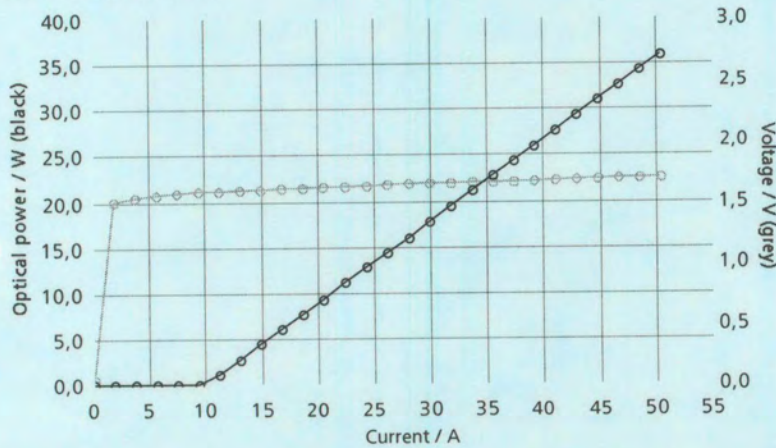
# Measurement Data Sheet



## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_101215  
 Date: November 24, 2010  
 Operator: D.Kirsch

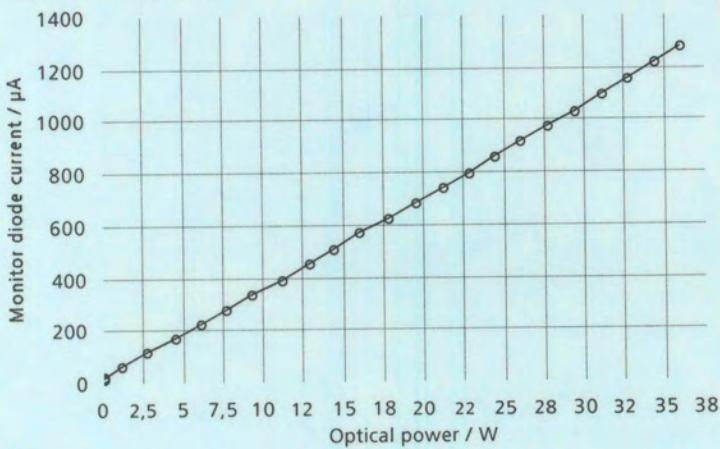
## Electro-Optical Data



## Technical Specifications

Operation mode:	cw
Nominal output power:	35 W
Module temperature*:	25 °C
Temperature sensor:	PT1000
Fiber core diameter:	400 µm
Fiber numerical aperture:	0.22
Fiber connector type:	F-SMA 905, free

## Monitor Diode Data



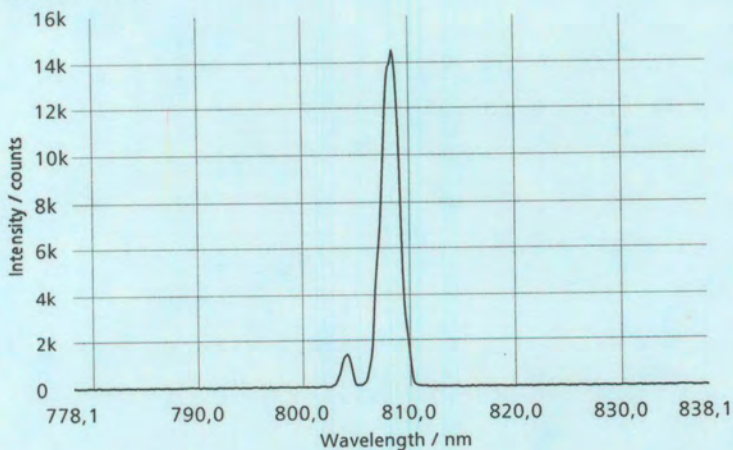
## Specification Tests

Electro-optical test:	passed
Spectral test:	passed

## Electro-Optical Parameters

Operation current at n.p.:	49.2 A
Operation voltage at n.p.:	1.69 V
Threshold current:	9.90 A
Slope:	0.89 W/A
Efficiency at nominal power:	42.1 %
Series resistance:	3.0 mOhm
Monitor diode current at n.p.:	1243 µA

## Spectral Data



## Spectral Parameters

Center wavelength:	808.1 nm	808,6
Spectral bandwidth (FWHM):	2.0 nm	
Measurement temperature*:	25.0 °C	
Measurement current:	49.2 A	53,7

\* at temperature sensor  
 n.p. = nominal power

20101124-143904-RC\_101215-E1 - SPS30277 - MOWP - SW 1.9.1



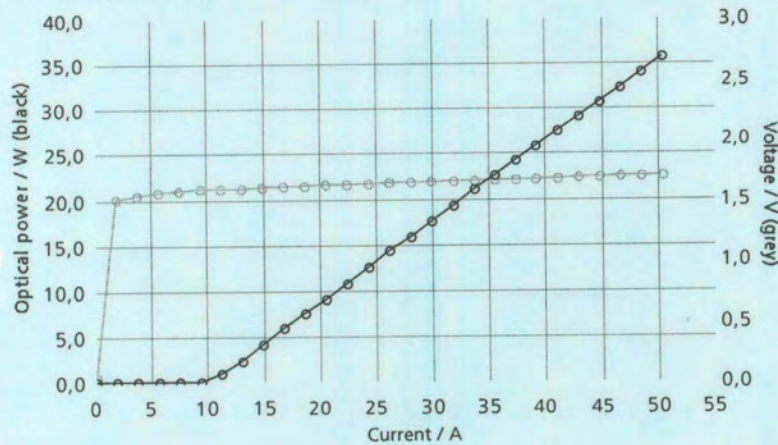
# Measurement Data Sheet



## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_101199  
 Date: November 25, 2010  
 Operator: K.Weymar

## Electro-Optical Data



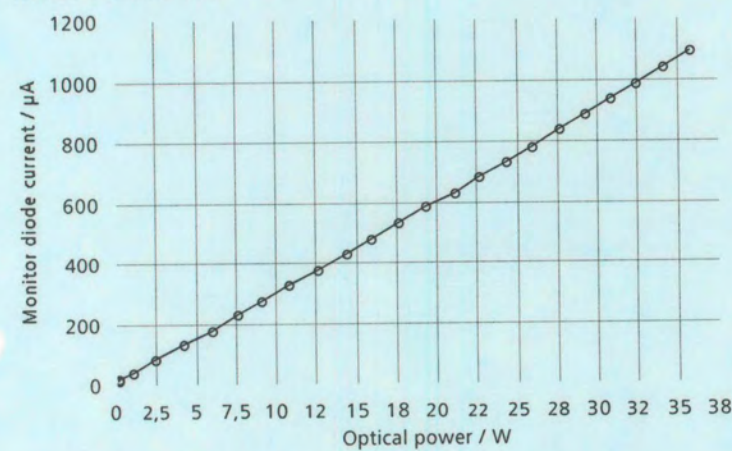
## Technical Specifications

Operation mode: cw  
 Nominal output power: 35 W  
 Module temperature\*: 25 °C  
 Temperature sensor: PT1000  
 Fiber core diameter: 400 µm  
 Fiber numerical aperture: 0.22  
 Fiber connector type: F-SMA 905, free

## Specification Tests

Electro-optical test: passed  
 Spectral test: passed

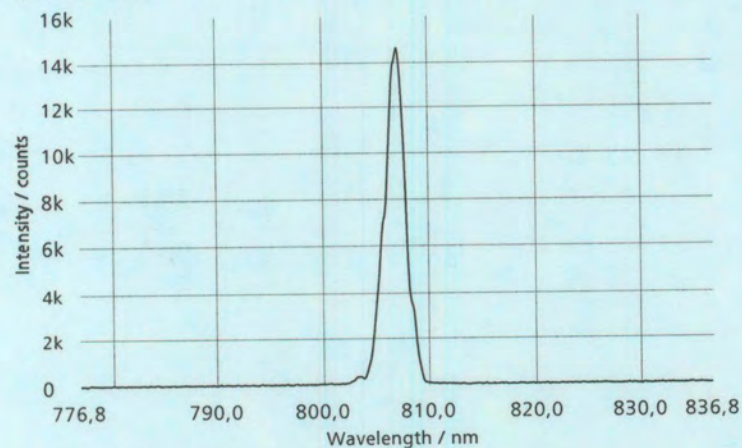
## Monitor Diode Data



## Electro-Optical Parameters

Operation current at n.p.: 49.5 A  
 Operation voltage at n.p.: 1.69 V  
 Threshold current: 10.29 A  
 Slope: 0.89 W/A  
 Efficiency at nominal power: 41.8 %  
 Series resistance: 2.9 mOhm  
 Monitor diode current at n.p.: 1069 µA

## Spectral Data



## Spectral Parameters

Center wavelength: 806.8 nm **807,3**  
 Spectral bandwidth (FWHM): 2.0 nm  
 Measurement temperature\*: 25.0 °C  
 Measurement current: 49.5 A **54**

\* at temperature sensor  
 n.p. = nominal power



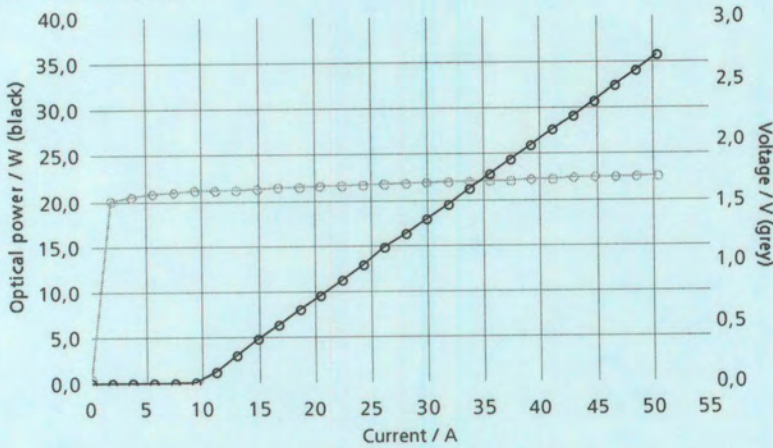
# Measurement Data Sheet



## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_101222  
 Date: November 25, 2010  
 Operator: D.Kirsch

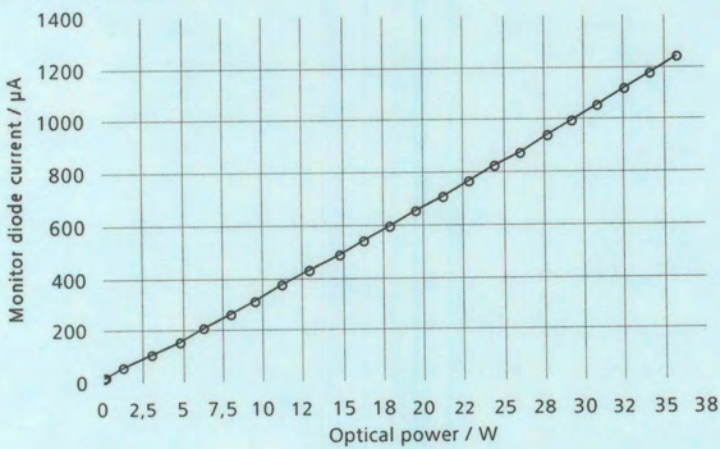
## Electro-Optical Data



## Technical Specifications

Operation mode: cw  
 Nominal output power: 35 W  
 Module temperature\*: 25 °C  
 Temperature sensor: PT1000  
 Fiber core diameter: 400 µm  
 Fiber numerical aperture: 0.22  
 Fiber connector type: F-SMA 905, free

## Monitor Diode Data



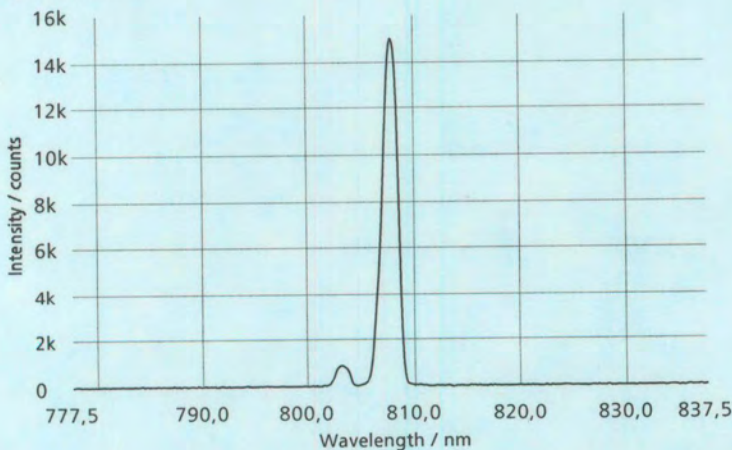
## Specification Tests

Electro-optical test: passed  
 Spectral test: passed

## Electro-Optical Parameters

Operation current at n.p.: 49.5 A  
 Operation voltage at n.p.: 1.69 V  
 Threshold current: 9.87 A  
 Slope: 0.88 W/A  
 Efficiency at nominal power: 41.8 %  
 Series resistance: 3.0 mOhm  
 Monitor diode current at n.p.: 1211 µA

## Spectral Data



## Spectral Parameters

Center wavelength: 807.5 nm **808**  
 Spectral bandwidth (FWHM): 1.6 nm  
 Measurement temperature\*: 25.0 °C  
 Measurement current: 49.5 A **54**

\* at temperature sensor  
 n.p. = nominal power



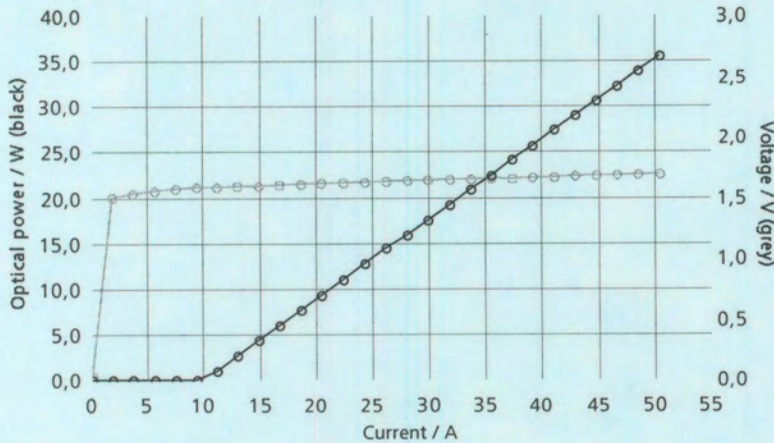
# Measurement Data Sheet



## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_101209  
 Date: November 24, 2010  
 Operator: D.Kirsch

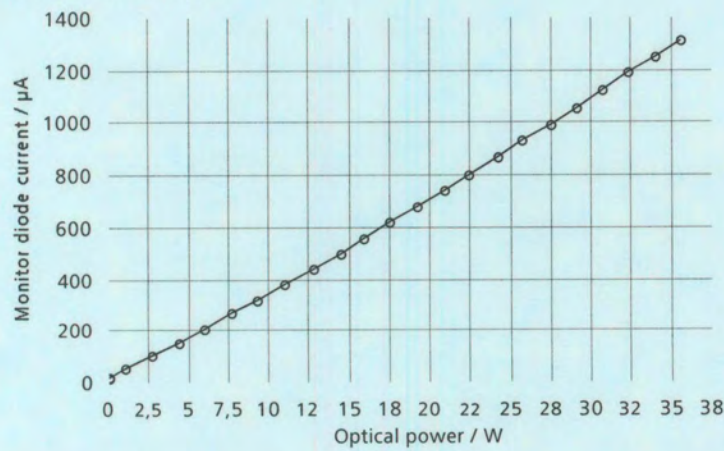
## Electro-Optical Data



## Technical Specifications

Operation mode: cw  
 Nominal output power: 35 W  
 Module temperature\*: 25 °C  
 Temperature sensor: PT1000  
 Fiber core diameter: 400 µm  
 Fiber numerical aperture: 0.22  
 Fiber connector type: F-SMA 905, free

## Monitor Diode Data



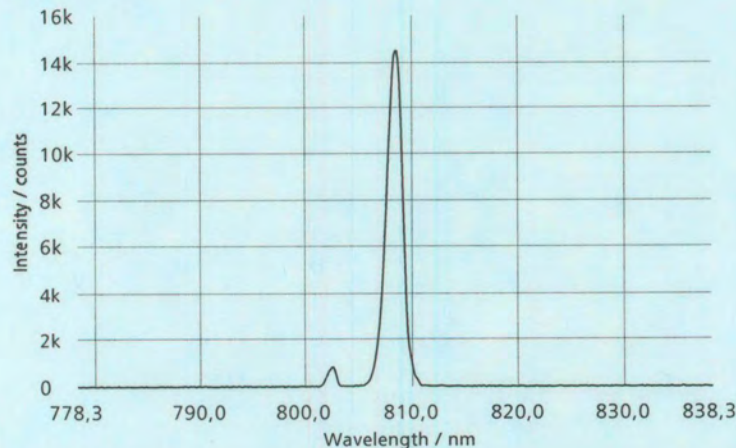
## Specification Tests

Electro-optical test: passed  
 Spectral test: passed

## Electro-Optical Parameters

Operation current at n.p.: 49.7 A  
 Operation voltage at n.p.: 1.69 V  
 Threshold current: 10.01 A  
 Slope: 0.88 W/A  
 Efficiency at nominal power: 41.6 %  
 Series resistance: 3.0 mOhm  
 Monitor diode current at n.p.: 1290 µA

## Spectral Data



## Spectral Parameters

Center wavelength: 808.3 nm  
 Spectral bandwidth (FWHM): 1.7 nm  
 Measurement temperature\*: 25.0 °C  
 Measurement current: 49.7 A

\* at temperature sensor  
 n.p. = nominal power

20101124-110621-RC\_101209-E1 - SPIC0277 - MOMA - SW 1.9.1



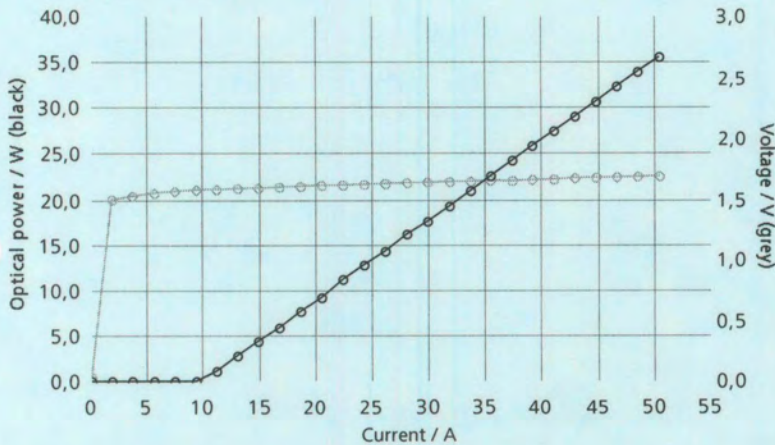
# Measurement Data Sheet



## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_101210  
 Date: November 24, 2010  
 Operator: D.Kirsch

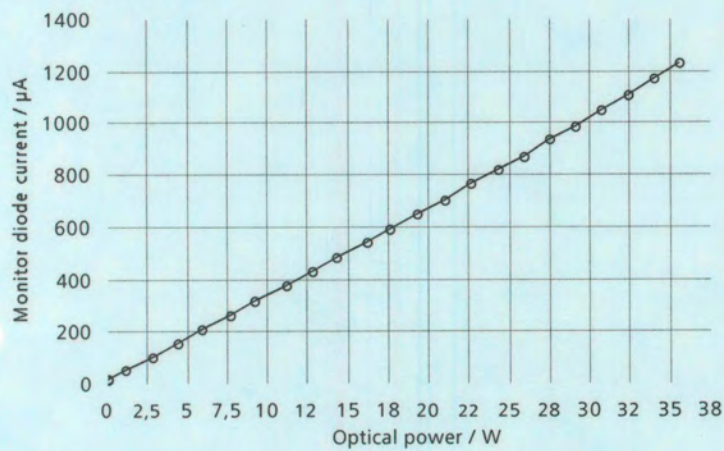
## Electro-Optical Data



## Technical Specifications

Operation mode: cw  
 Nominal output power: 35 W  
 Module temperature\*: 25 °C  
 Temperature sensor: PT1000  
 Fiber core diameter: 400 µm  
 Fiber numerical aperture: 0.22  
 Fiber connector type: F-SMA 905, free

## Monitor Diode Data



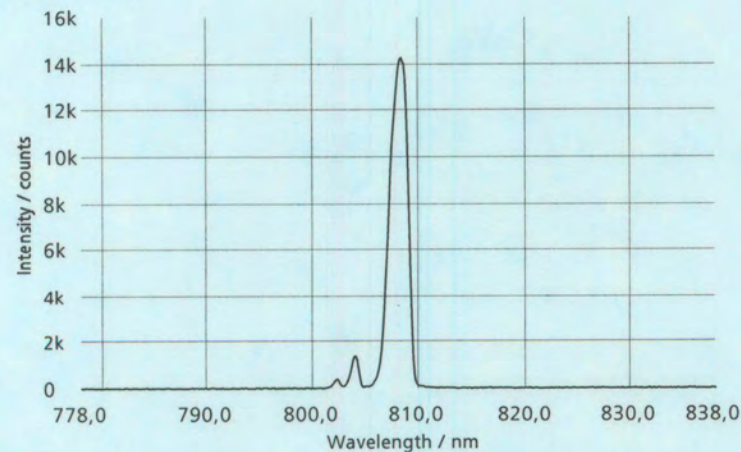
## Specification Tests

Electro-optical test: passed  
 Spectral test: passed

## Electro-Optical Parameters

Operation current at n.p.: 49.7 A  
 Operation voltage at n.p.: 1.69 V  
 Threshold current: 9.79 A  
 Slope: 0.88 W/A  
 Efficiency at nominal power: 41.6 %  
 Series resistance: 3.0 mOhm  
 Monitor diode current at n.p.: 1209 µA

## Spectral Data



## Spectral Parameters

Center wavelength: 808.0 nm **808,5**  
 Spectral bandwidth (FWHM): 1.9 nm  
 Measurement temperature\*: 25.0 °C  
 Measurement current: 49.7 A **54**

\* at temperature sensor  
 n.p. = nominal power



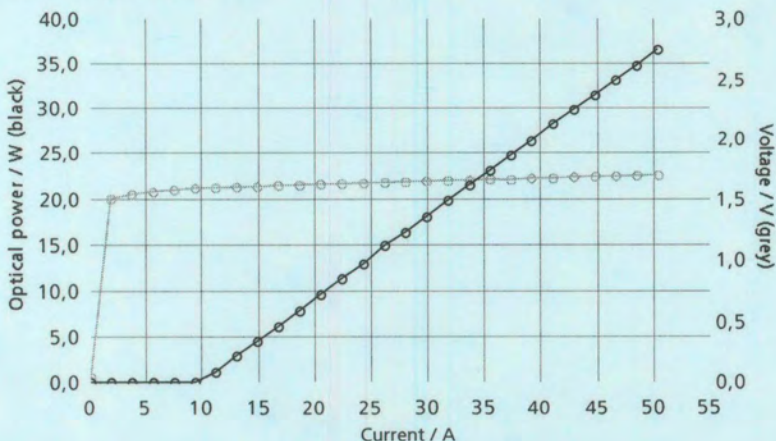
# Measurement Data Sheet



## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_101217  
 Date: November 24, 2010  
 Operator: D.Kirsch

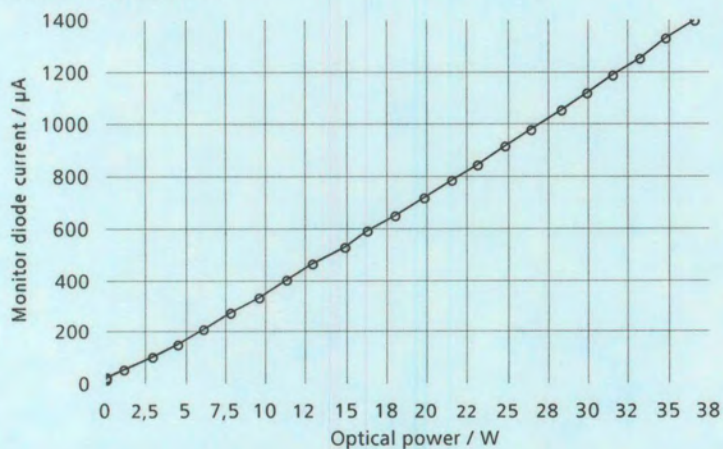
## Electro-Optical Data



## Technical Specifications

Operation mode: cw  
 Nominal output power: 35 W  
 Module temperature\*: 25 °C  
 Temperature sensor: PT1000  
 Fiber core diameter: 400 µm  
 Fiber numerical aperture: 0.22  
 Fiber connector type: F-SMA 905, free

## Monitor Diode Data



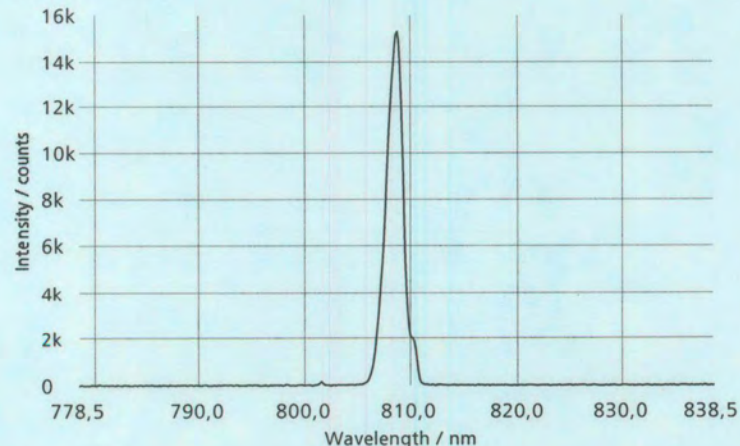
## Specification Tests

Electro-optical test: passed  
 Spectral test: passed

## Electro-Optical Parameters

Operation current at n.p.: 48.7 A  
 Operation voltage at n.p.: 1.69 V  
 Threshold current: 9.82 A  
 Slope: 0.90 W/A  
 Efficiency at nominal power: 42.5 %  
 Series resistance: 3.0 mOhm  
 Monitor diode current at n.p.: 1336 µA

## Spectral Data



## Spectral Parameters

Center wavelength: 808.5 nm  
 Spectral bandwidth (FWHM): 1.7 nm  
 Measurement temperature\*: 25.0 °C  
 Measurement current: 48.7 A

809

532

\* at temperature sensor  
 n.p. = nominal power

## Test Protocol Diode-Box

Diode-Box SN: DB3 - OBS II

Connect the TEC high current cable to a TEC power supply and the interlock cable (test tool) between TEC PS and DB. Use the power supply TEC1 for DB1 and DB2 and TEC 2 for DB3 and DB4.

TEC Power Supply SN : 10041611

Named: TEC2 OBS II

Change the dip code on the back side of the power supply (SW1) to the following:

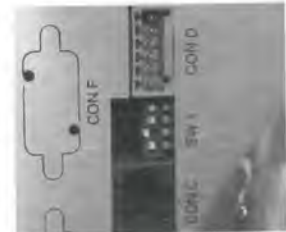
SW1 (down to top) 1: off, 2: on, 3: off, 4: off

Set TEC supply voltage setting to 20V and limit to 25V.

Set TEC supply current setting and limit to max (~67A)

Press Output On.

Press both Settings-Buttons for 3 sec to lock the power supply.



All TEC Power Supply Parameter settings are made



Connect 24V DC to a power supply and Ether Cat IN to the Test PC

Check 24V DC, supply (needs to be below 0.5A) 0.5 A, OK





## Test Protocol Diode-Box

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Start the DB Test program

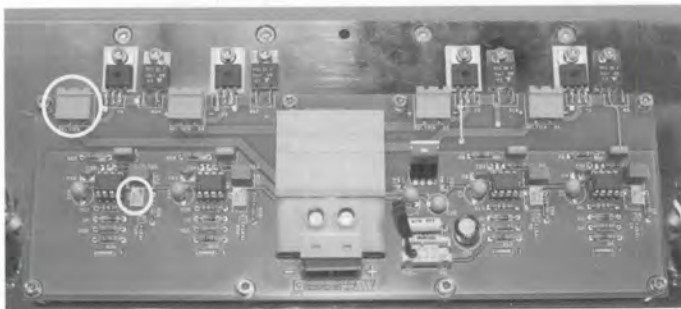
Check proper read out of all (LD 1-7 and 2 x heat sink) temperature sensors

(temperature is in the room temperature range, 20-30°C)

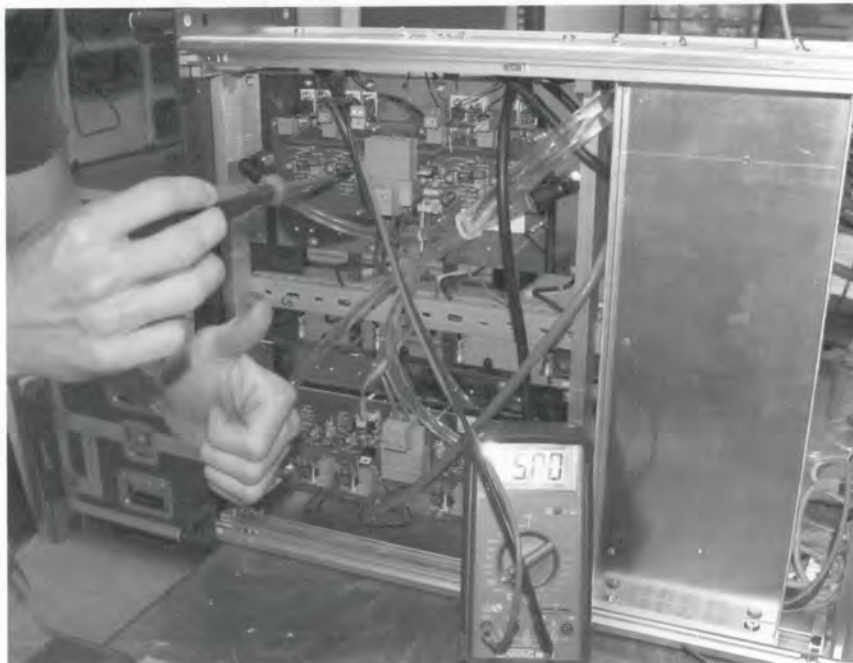


Start TEC calibration procedure (example for one channel)

Use a current meter and connect (test tool) to the TEC OUT on the TEC board.



Press TEST (software) on the diode number connected to the current meter and calibrate (by turning the poti on the board) to 5A.



Test Protocol Diode-Box

Use the "polarity-change" connector (test tool) between TEC (diode) and the board. Press TEST and heat up the diode up to 40°C. The interlock should around 40°C (+/-5°C) and will shut down the TEC power supply. Reconnect to the laser TEC (diode) to the board on the normal way and press TEST to cool down the diode.

Redo procedure for all 7 channels:

LD1: calibrate to 5A - Interlock OK - Cooling OK



LD2: calibrate to 5A - Interlock OK - Cooling OK



LD3: calibrate to 5A - Interlock OK - Cooling OK



LD4: calibrate to 5A - Interlock OK - Cooling OK



LD5: calibrate to 5A - Interlock OK - Cooling OK



LD6: calibrate to 5A - Interlock OK - Cooling OK



LD7: calibrate to 5A - Interlock OK - Cooling OK



Start diode power supply checking.

Connect the laser diode current cable to the laser diode power supply and bridge the power supply interlock.

Diode Power Supply SN : 10041604

Named: PS3 OBS2

Change the dip code on the back side of the power supply (SW1) to the following:

SW1 (down to top) 1: off, 2: on, 3: off, 4: on

Set laser diode supply voltage setting to 18V and limit to 18V.

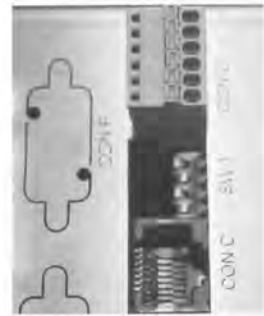
Set laser diode supply current setting to 0A and limit to max (~67A)

Press Output Off

Set to Remote CC

Press Output On

Press both Settings-Buttons for 3 sec to lock the power supply.



All Laser Diode Power Supply settings are made.



Make sure that the DB lasers diode short cut is connected red and black. Type 3A into the software program and press enable (current is set as long as button is pressed).

Check current readout and current display at the power supply.

(Value fits to the setting, +/- 0.1A)



Check diode voltage readout (has to be 0V, due to short cut)



Switch DB short cut to black/black position and make sure that all diode short cuts are set to red/red. Press enable the check voltage (around 10V )



Switch DB short cut back to red/black



Use the photo diode test system and check the diode voltage readout.

## Test Protocol Diode-Box

Photodiode readout of all 7 diodes OK



Fill the diode box with distilled water. Connect the pressure measurement tool and test the system with 5bar for >5h.

Pressure and leakage test OK



Laser Diode SN:

LD1: 101219LD2: 101196LD3: 101198LD4: 101221LD5: 101197LD6: 101211LD7: 101223

Diode characterization from: \_\_\_\_\_, add diode datasheets to this document.

Comments:

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Controller: 179 M. J. LeeDate: 22/12/2010



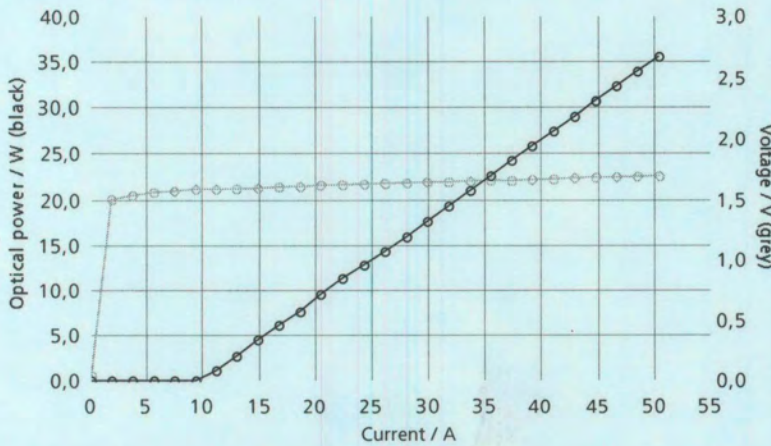
# Measurement Data Sheet



## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_101219  
 Date: November 24, 2010  
 Operator: D.Kirsch

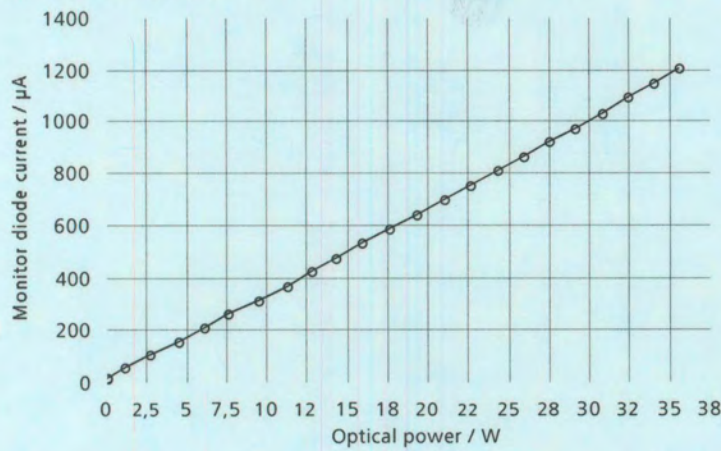
## Electro-Optical Data



## Technical Specifications

Operation mode: cw  
 Nominal output power: 35 W  
 Module temperature\*: 25 °C  
 Temperature sensor: PT1000  
 Fiber core diameter: 400 µm  
 Fiber numerical aperture: 0.22  
 Fiber connector type: F-SMA 905, free

## Monitor Diode Data



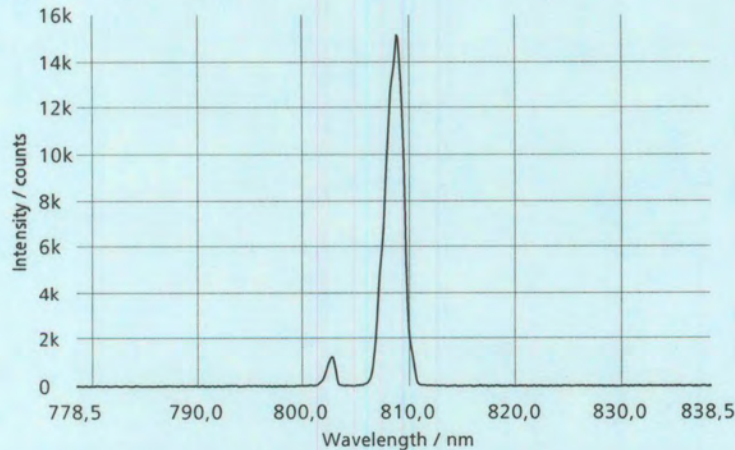
## Specification Tests

Electro-optical test: passed  
 Spectral test: passed

## Electro-Optical Parameters

Operation current at n.p.: 49.7 A  
 Operation voltage at n.p.: 1.69 V  
 Threshold current: 9.90 A  
 Slope: 0.88 W/A  
 Efficiency at nominal power: 41.6 %  
 Series resistance: 3.0 mOhm  
 Monitor diode current at n.p.: 1184 µA

## Spectral Data



## Spectral Parameters

Center wavelength: 808.5 nm  
 Spectral bandwidth (FWHM): 1.9 nm  
 Measurement temperature\*: 25.0 °C  
 Measurement current: 49.7 A

809

S4

\* at temperature sensor  
 n.p. = nominal power



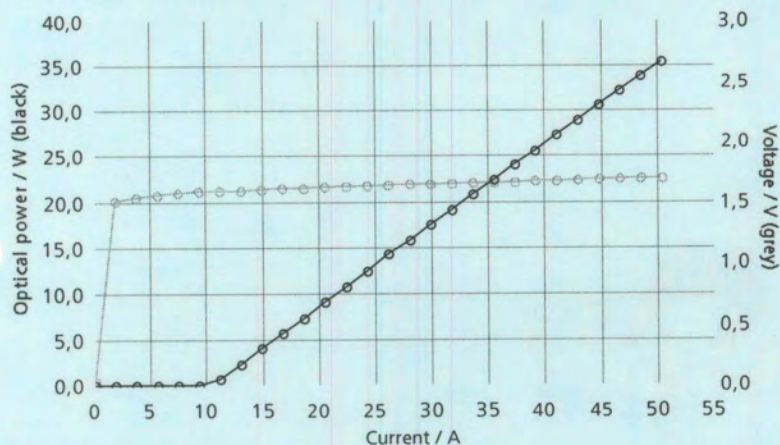
# Measurement Data Sheet



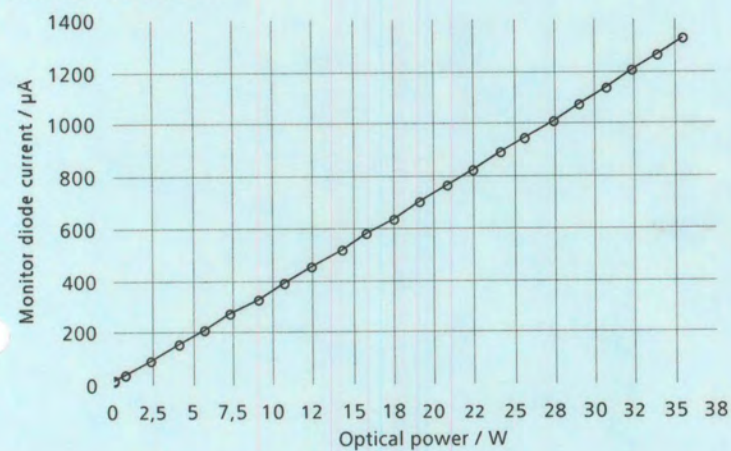
## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_101196  
 Date: November 24, 2010  
 Operator: D.Kirsch

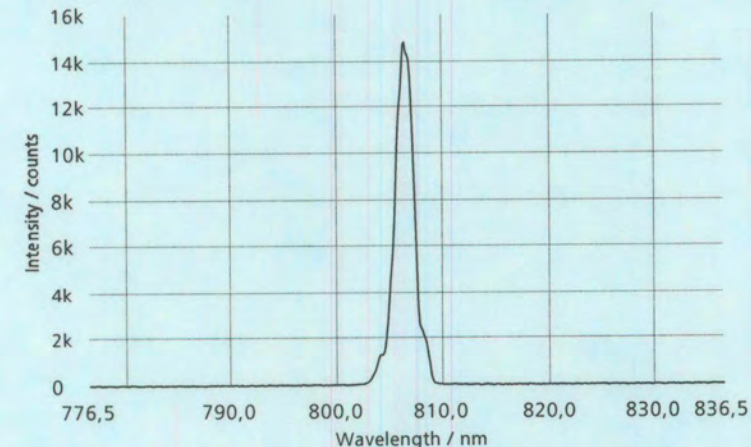
## Electro-Optical Data



## Monitor Diode Data



## Spectral Data



## Technical Specifications

Operation mode: cw  
 Nominal output power: 35 W  
 Module temperature\*: 25 °C  
 Temperature sensor: PT1000  
 Fiber core diameter: 400 µm  
 Fiber numerical aperture: 0.22  
 Fiber connector type: F-SMA 905, free

## Specification Tests

Electro-optical test: passed  
 Spectral test: passed

## Electro-Optical Parameters

Operation current at n.p.: 49.8 A  
 Operation voltage at n.p.: 1.69 V  
 Threshold current: 10.64 A  
 Slope: 0.89 W/A  
 Efficiency at nominal power: 41.5 %  
 Series resistance: 3.0 mOhm  
 Monitor diode current at n.p.: 1309 µA

## Spectral Parameters

Center wavelength: 806.5 nm **807**  
 Spectral bandwidth (FWHM): 1.9 nm  
 Measurement temperature\*: 25.0 °C  
 Measurement current: 49.8 A **54.3**

\* at temperature sensor  
 n.p. = nominal power



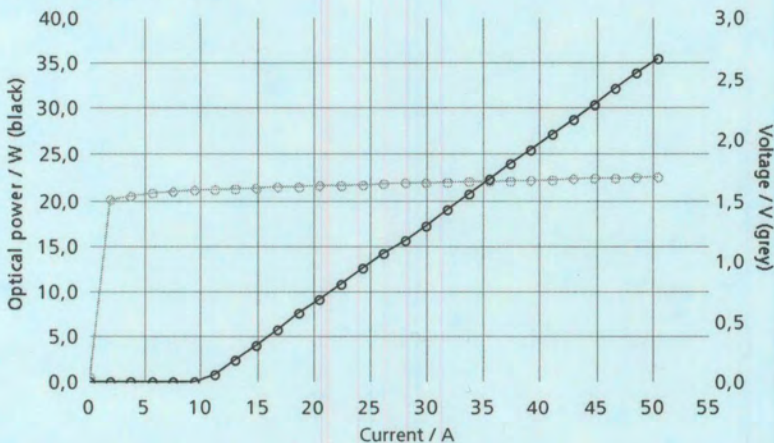
# Measurement Data Sheet



## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_101198  
 Date: November 25, 2010  
 Operator: D.Kirsch

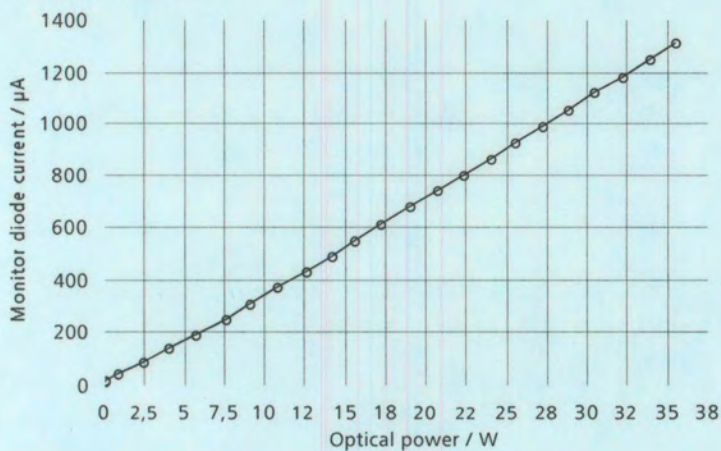
## Electro-Optical Data



## Technical Specifications

Operation mode: cw  
 Nominal output power: 35 W  
 Module temperature\*: 25 °C  
 Temperature sensor: PT1000  
 Fiber core diameter: 400 µm  
 Fiber numerical aperture: 0.22  
 Fiber connector type: F-SMA 905, free

## Monitor Diode Data



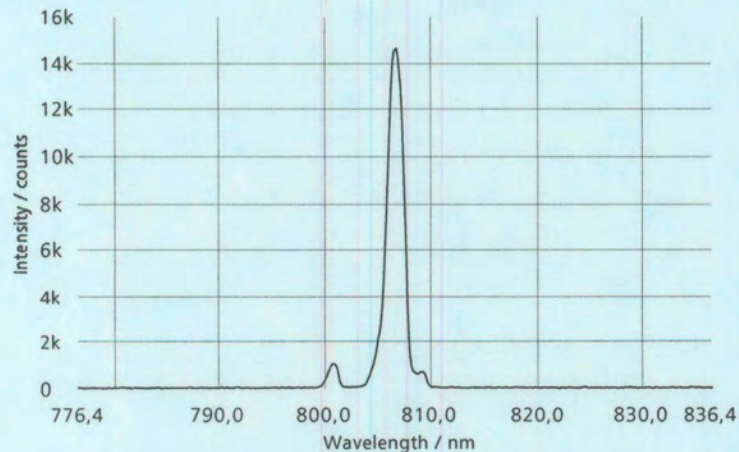
## Specification Tests

Electro-optical test: passed  
 Spectral test: passed

## Electro-Optical Parameters

Operation current at n.p.: 49.9 A  
 Operation voltage at n.p.: 1.69 V  
 Threshold current: 10.29 A  
 Slope: 0.88 W/A  
 Efficiency at nominal power: 41.5 %  
 Series resistance: 2.9 mOhm  
 Monitor diode current at n.p.: 1294 µA

## Spectral Data



## Spectral Parameters

Center wavelength: 806.4 nm **806,3**  
 Spectral bandwidth (FWHM): 1.8 nm  
 Measurement temperature\*: 25.0 °C  
 Measurement current: 49.9 A **54,3**

\* at temperature sensor  
 n.p. = nominal power



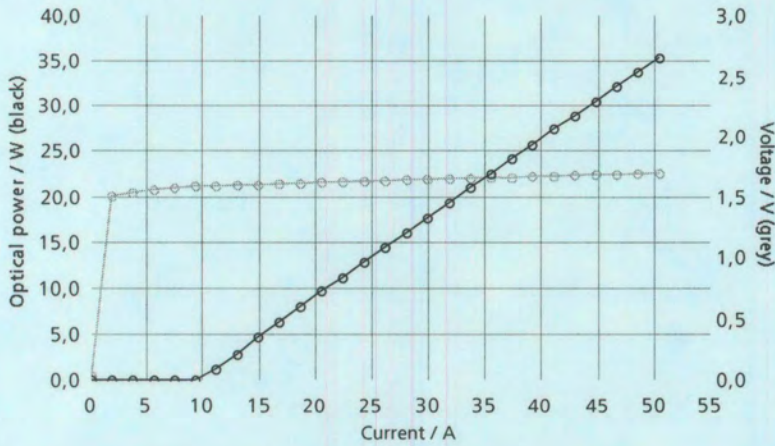
# Measurement Data Sheet



## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_101221  
 Date: November 25, 2010  
 Operator: D.Kirsch

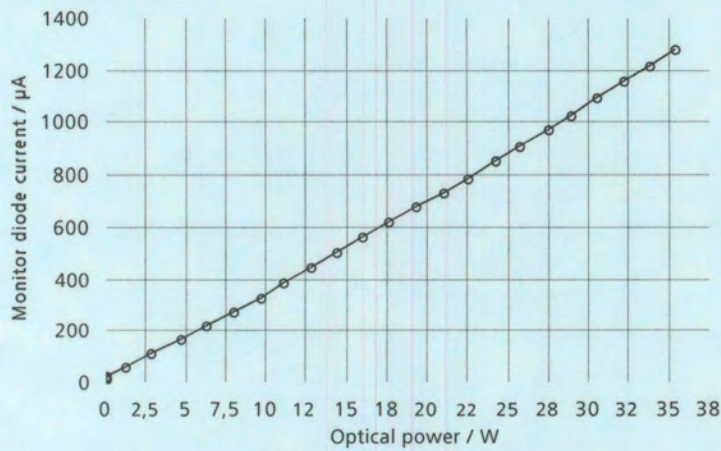
## Electro-Optical Data



## Technical Specifications

Operation mode: cw  
 Nominal output power: 35 W  
 Module temperature\*: 25 °C  
 Temperature sensor: PT1000  
 Fiber core diameter: 400 µm  
 Fiber numerical aperture: 0.22  
 Fiber connector type: F-SMA 905, free

## Monitor Diode Data



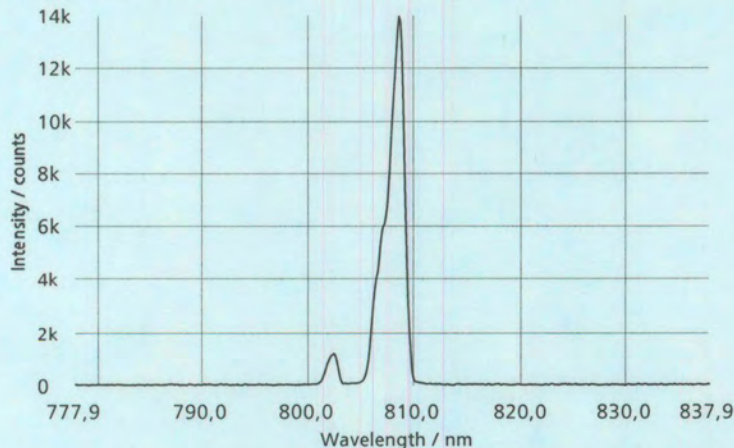
## Specification Tests

Electro-optical test: passed  
 Spectral test: passed

## Electro-Optical Parameters

Operation current at n.p.: 50.0 A  
 Operation voltage at n.p.: 1.69 V  
 Threshold current: 9.80 A  
 Slope: 0.87 W/A  
 Efficiency at nominal power: 41.4 %  
 Series resistance: 3.0 mOhm  
 Monitor diode current at n.p.: 1264 µA

## Spectral Data



## Spectral Parameters

Center wavelength: 807.9 nm *808,4*  
 Spectral bandwidth (FWHM): 1.7 nm  
 Measurement temperature\*: 25.0 °C  
 Measurement current: 50.0 A *54,4*

\* at temperature sensor  
 n.p. = nominal power



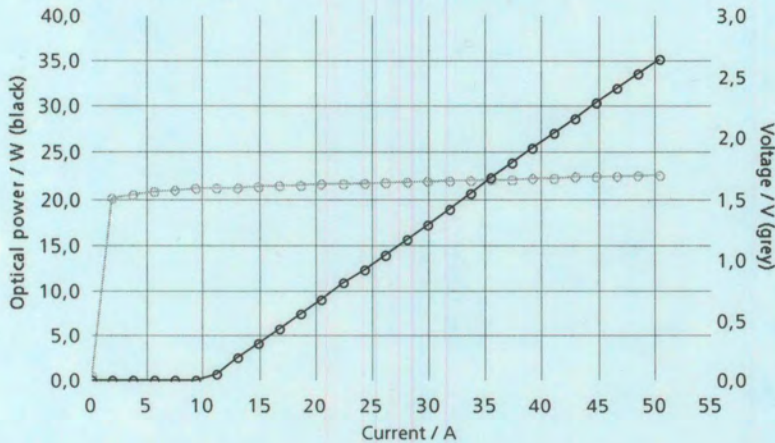
# Measurement Data Sheet



## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_101197  
 Date: November 24, 2010  
 Operator: D.Kirsch

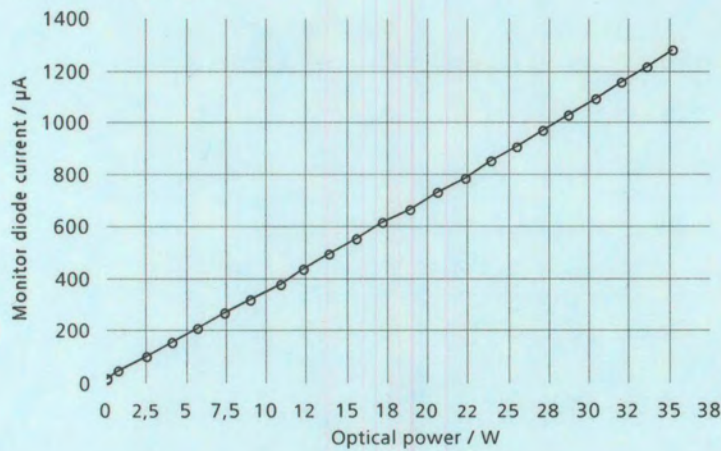
## Electro-Optical Data



## Technical Specifications

Operation mode: cw  
 Nominal output power: 35 W  
 Module temperature\*: 25 °C  
 Temperature sensor: PT1000  
 Fiber core diameter: 400 µm  
 Fiber numerical aperture: 0.22  
 Fiber connector type: F-SMA 905, free

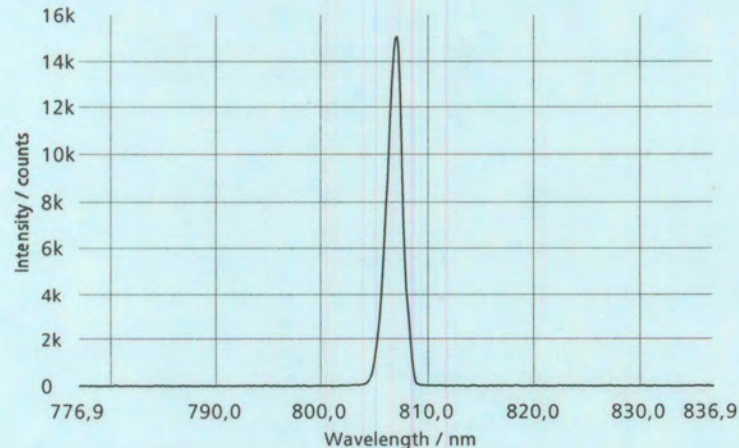
## Monitor Diode Data



## Specification Tests

Electro-optical test: passed  
 Spectral test: passed

## Spectral Data



## Electro-Optical Parameters

Operation current at n.p.: 50.2 A  
 Operation voltage at n.p.: 1.69 V  
 Threshold current: 10.44 A  
 Slope: 0.88 W/A  
 Efficiency at nominal power: 41.2 %  
 Series resistance: 3.0 mOhm  
 Monitor diode current at n.p.: 1272 µA

## Spectral Parameters

Center wavelength: 806.9 nm **807.4**  
 Spectral bandwidth (FWHM): 1.6 nm  
 Measurement temperature\*: 25.0 °C  
 Measurement current: 50.2 A **54.6**

\* at temperature sensor  
 n.p. = nominal power



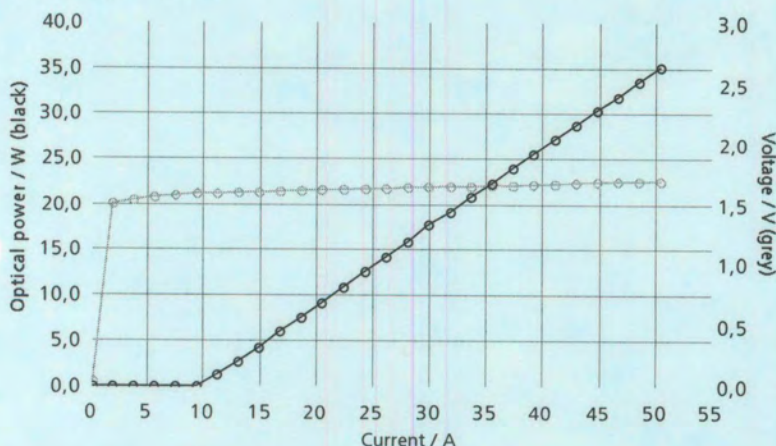
# Measurement Data Sheet



## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_101211  
 Date: November 24, 2010  
 Operator: D.Kirsch

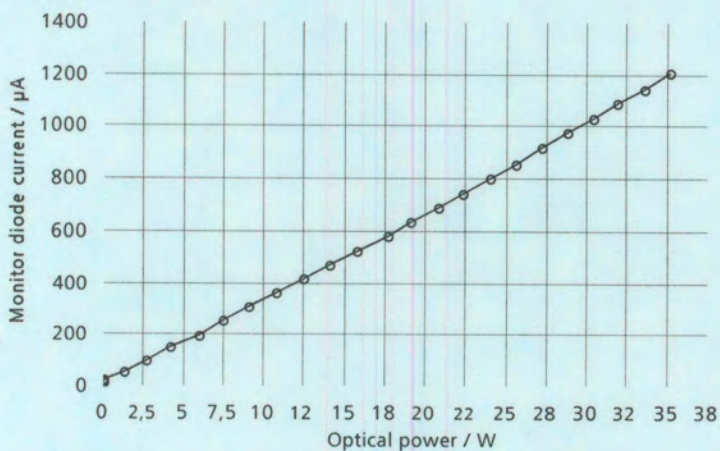
## Electro-Optical Data



## Technical Specifications

Operation mode: cw  
 Nominal output power: 35 W  
 Module temperature\*: 25 °C  
 Temperature sensor: PT1000  
 Fiber core diameter: 400 µm  
 Fiber numerical aperture: 0.22  
 Fiber connector type: F-SMA 905, free

## Monitor Diode Data



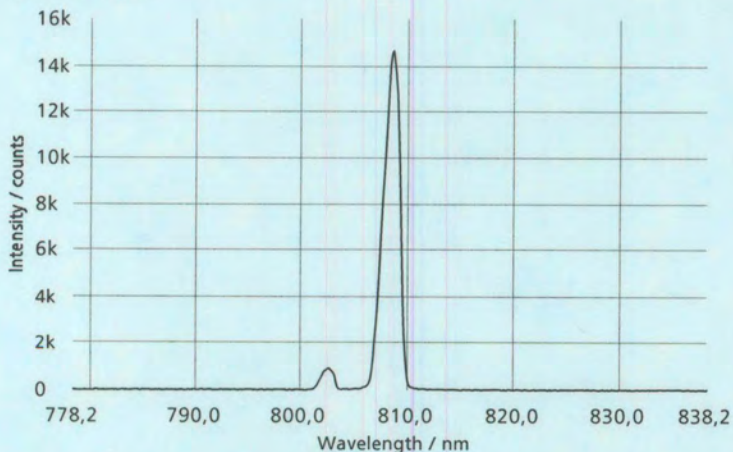
## Specification Tests

Electro-optical test: passed  
 Spectral test: passed

## Electro-Optical Parameters

Operation current at n.p.: 50.2 A  
 Operation voltage at n.p.: 1.69 V  
 Threshold current: 9.45 A  
 Slope: 0.86 W/A  
 Efficiency at nominal power: 41.2 %  
 Series resistance: 3.0 mOhm  
 Monitor diode current at n.p.: 1198 µA

## Spectral Data



## Spectral Parameters

Center wavelength: 808.2 nm **808,7**  
 Spectral bandwidth (FWHM): 1.8 nm  
 Measurement temperature\*: 25.0 °C  
 Measurement current: 50.2 A **54,5**

\* at temperature sensor  
 n.p. = nominal power



29.11.2010

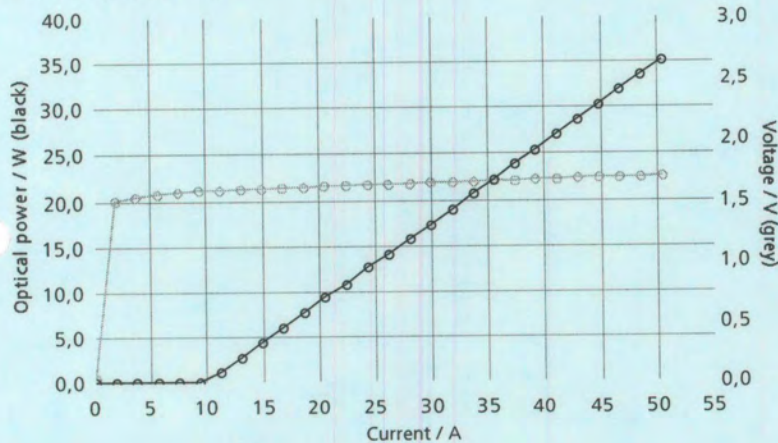
# Measurement Data Sheet



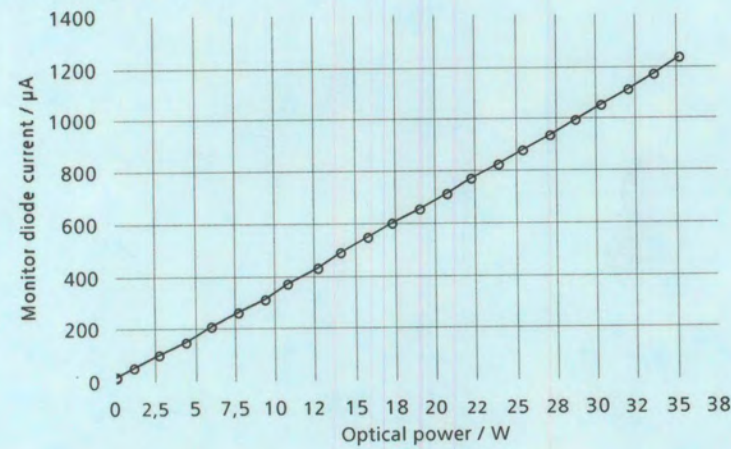
## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_101223  
 Date: November 25, 2010  
 Operator: D.Kirsch

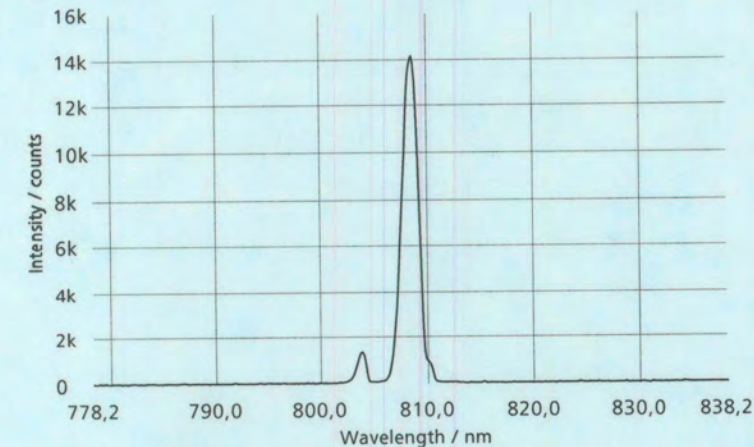
## Electro-Optical Data



## Monitor Diode Data



## Spectral Data



## Technical Specifications

Operation mode: cw  
 Nominal output power: 35 W  
 Module temperature\*: 25 °C  
 Temperature sensor: PT1000  
 Fiber core diameter: 400 µm  
 Fiber numerical aperture: 0.22  
 Fiber connector type: F-SMA 905, free

## Specification Tests

Electro-optical test: passed  
 Spectral test: passed

## Electro-Optical Parameters

Operation current at n.p.: 50.2 A  
 Operation voltage at n.p.: 1.69 V  
 Threshold current: 9.82 A  
 Slope: 0.87 W/A  
 Efficiency at nominal power: 41.2 %  
 Series resistance: 3.0 mOhm  
 Monitor diode current at n.p.: 1228 µA

## Spectral Parameters

Center wavelength: 808.2 nm **808.4**  
 Spectral bandwidth (FWHM): 1.8 nm  
 Measurement temperature\*: 25.0 °C  
 Measurement current: 50.2 A **54.5**

\* at temperature sensor  
 n.p. = nominal power

20101125-084335-RC\_101223-E1 - SPK30277 - MOMA - SW 1.9.1



## Test Protocol Diode-Box

Diode-Box SN: DB4-OBSII

Connect the TEC high current cable to a TEC power supply and the interlock cable (test tool) between TEC PS and DB. Use the power supply TEC1 for DB1 and DB2 and TEC 2 for DB3 and DB4.

TEC Power Supply SN : 10041677

Named: TEC2 OBSII

Change the dip code on the back side of the power supply (SW1) to the following:

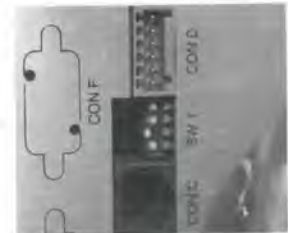
SW1 (down to top) 1: off, 2: on, 3: off, 4: off

Set TEC supply voltage setting to 20V and limit to 25V.

Set TEC supply current setting and limit to max (~67A)

Press Output On.

Press both Settings-Buttons for 3 sec to lock the power supply.



All TEC Power Supply Parameter settings are made



Connect 24V DC to a power supply and Ether Cat IN to the Test PC

Check 24V DC, supply (needs to be below 0.5A) 0.5 A, OK



## Test Protocol Diode-Box

Start the DB Test program

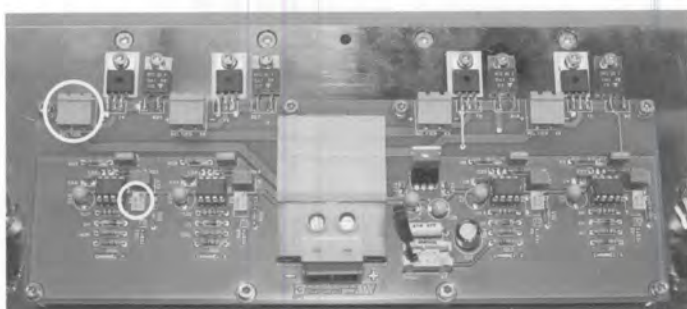
Check proper read out of all (LD 1-7 and 2 x heat sink) temperature sensors

(temperature is in the room temperature range, 20-30°C)

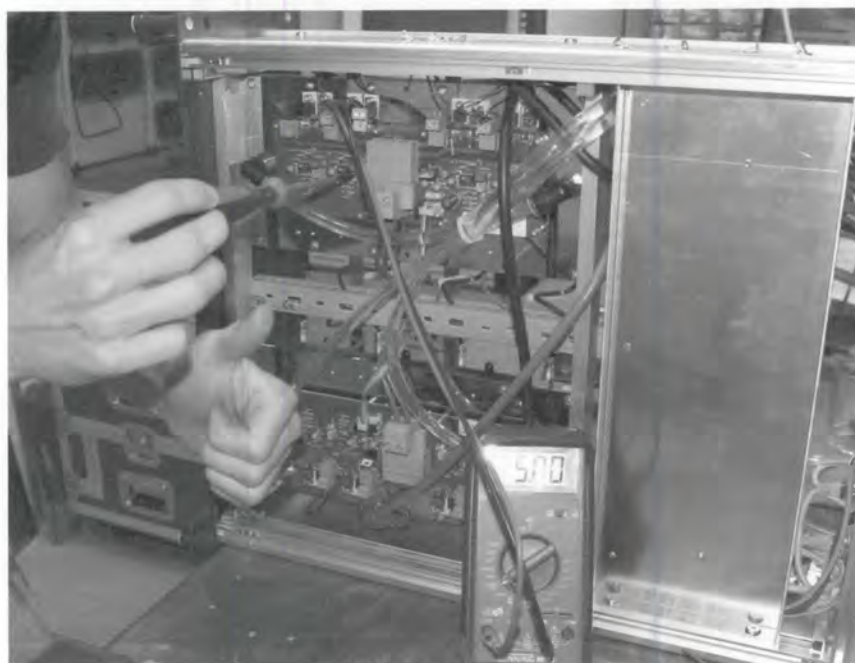


Start TEC calibration procedure (example for one channel)

Use a current meter and connect (test tool) to the TEC OUT on the TEC board.



Press TEST (software) on the diode number connected to the current meter and calibrate (by turning the poti on the board) to 5A.





Test Protocol Diode-Box

Use the "polarity-change" connector (test tool) between TEC (diode) and the board. Press TEST and heat up the diode up to 40°C. The interlock should around 40°C (+/-5°C) and will shut down the TEC power supply. Reconnect to the laser TEC (diode) to the board on the normal way and press TEST to cool down the diode.

Redo procedure for all 7 channels:

LD1: calibrate to 5A - Interlock OK - Cooling OK



LD2: calibrate to 5A - Interlock OK - Cooling OK



LD3: calibrate to 5A - Interlock OK - Cooling OK



LD4: calibrate to 5A - Interlock OK - Cooling OK



LD5: calibrate to 5A - Interlock OK - Cooling OK



LD6: calibrate to 5A - Interlock OK - Cooling OK



LD7: calibrate to 5A - Interlock OK - Cooling OK



Start diode power supply checking.

Connect the laser diode current cable to the laser diode power supply and bridge the power supply interlock.

Diode Power Supply SN : 10041677

Named: PS4 OBSII

Change the dip code on the back side of the power supply (SW1) to the following:

## Test Protocol Diode-Box

SW1 (down to top) 1: off, 2: on, 3: off, 4: on  
Set laser diode supply voltage setting to 18V and limit to 18V.

Set laser diode supply current setting to 0A and limit to max (~67A)

Press Output Off

Set to Remote CC

Press Output On

Press both Settings-Buttons for 3 sec to lock the power supply.



All Laser Diode Power Supply settings are made.



Make sure that the DB lasers diode short cut is connected red and black. Type 3A into the software program and press enable (current is set as long as button is pressed).

Check current readout and current display at the power supply.  
(Value fits to the setting, +/- 0.1A)



Check diode voltage readout (has to be 0V, due to short cut)



Switch DB short cut to black/black position and make sure that all diode short cuts are set to red/red. Press enable the check voltage (around 10V )



Switch DB short cut back to red/black



Use the photo diode test system and check the diode voltage readout.



Test Protocol Diode-Box

---

Photodiode readout of all 7 diodes OK



Fill the diode box with distilled water. Connect the pressure measurement tool and test the system with 5bar for &gt;5h.

Pressure and leakage test OK



Laser Diode SN:

LD1: 10 12 12LD2: 10 12 25LD3: 10 12 26LD4: 10 12 28LD5: 10 12 13LD6: 10 12 95LD7: 10 12 89

Diode characterization from: \_\_\_\_\_, add diode datasheets to this document.

Comments:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Controller:

MS M. Jan

Date:

23/12/2010

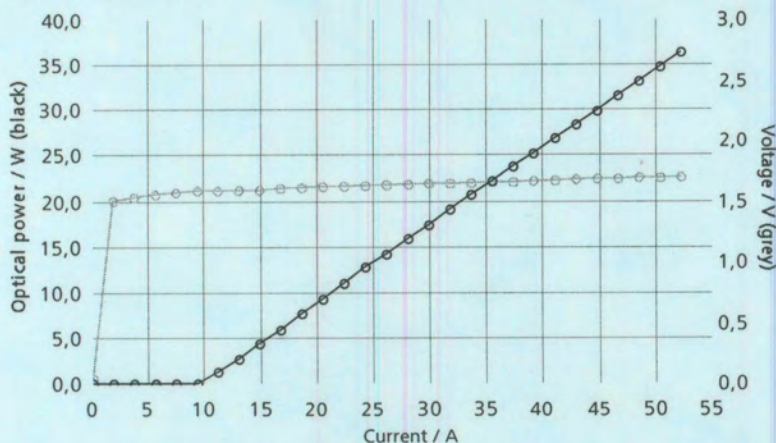
# Measurement Data Sheet



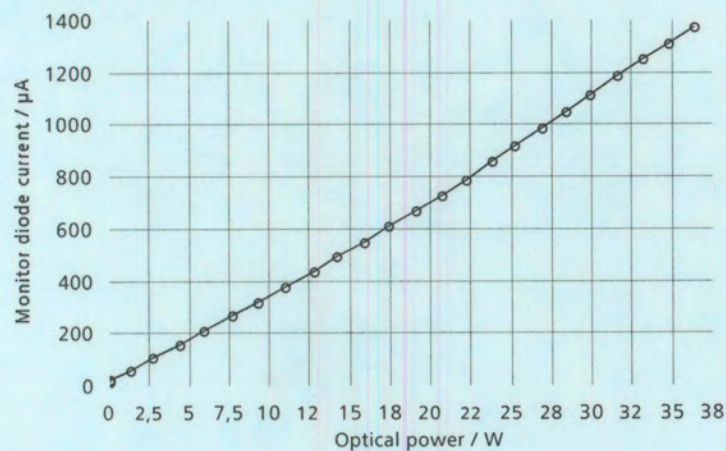
## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_101212  
 Date: November 24, 2010  
 Operator: D.Kirsch

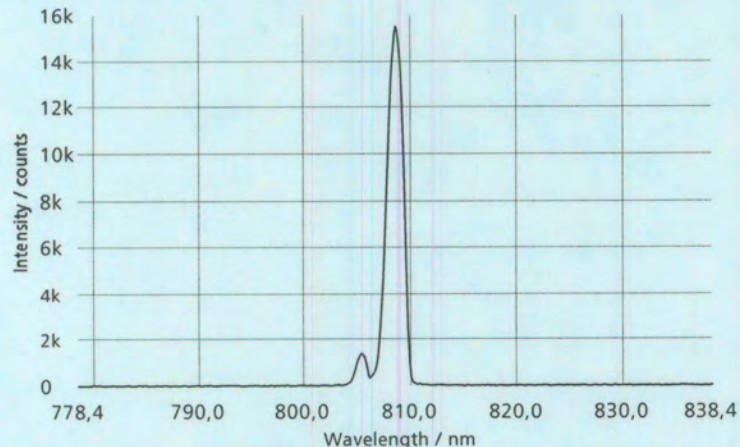
## Electro-Optical Data



## Monitor Diode Data



## Spectral Data



## Technical Specifications

Operation mode:	cw
Nominal output power:	35 W
Module temperature*:	25 °C
Temperature sensor:	PT1000
Fiber core diameter:	400 µm
Fiber numerical aperture:	0.22
Fiber connector type:	F-SMA 905, free

## Specification Tests

Electro-optical test:	passed
Spectral test:	passed

## Electro-Optical Parameters

Operation current at n.p.:	50.6 A
Operation voltage at n.p.:	1.69 V
Threshold current:	9.54 A
Slope:	0.85 W/A
Efficiency at nominal power:	40.9 %
Series resistance:	3.0 mOhm
Monitor diode current at n.p.:	1317 µA

## Spectral Parameters

Center wavelength:	808.4 nm	808.9
Spectral bandwidth (FWHM):	1.8 nm	
Measurement temperature*:	25.0 °C	
Measurement current:	50.6 A	54.9

\* at temperature sensor  
 n.p. = nominal power



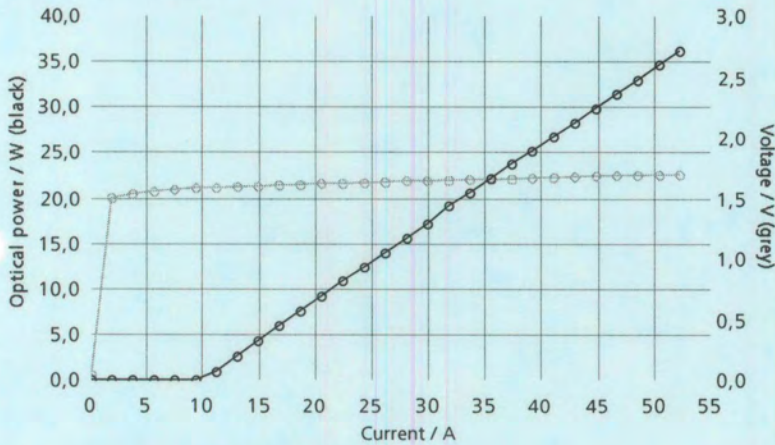
# Measurement Data Sheet



## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_101225  
 Date: November 24, 2010  
 Operator: D.Kirsch

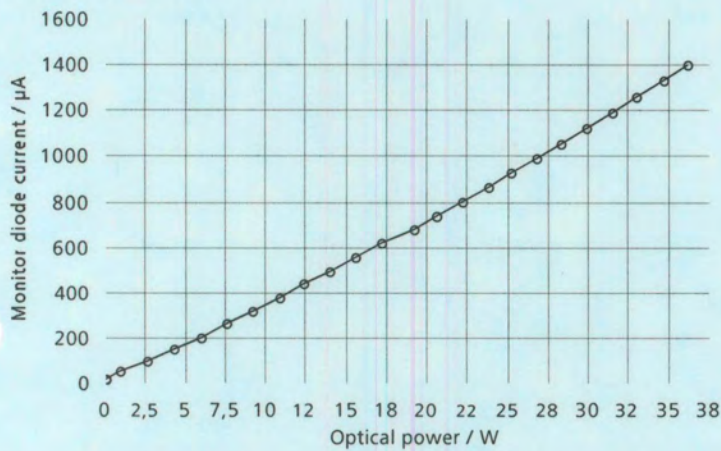
## Electro-Optical Data



## Technical Specifications

Operation mode: cw  
 Nominal output power: 35 W  
 Module temperature\*: 25 °C  
 Temperature sensor: PT1000  
 Fiber core diameter: 400 µm  
 Fiber numerical aperture: 0.22  
 Fiber connector type: F-SMA 905, free

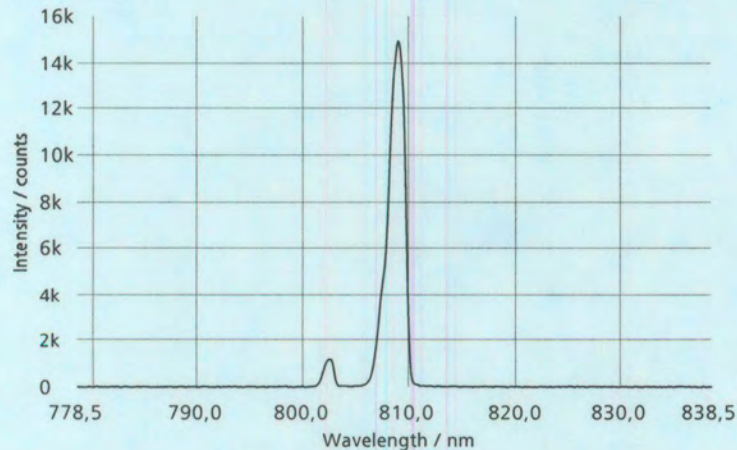
## Monitor Diode Data



## Specification Tests

Electro-optical test: passed  
 Spectral test: passed

## Spectral Data



## Electro-Optical Parameters

Operation current at n.p.: 50.8 A  
 Operation voltage at n.p.: 1.69 V  
 Threshold current: 10.18 A  
 Slope: 0.86 W/A  
 Efficiency at nominal power: 40.7 %  
 Series resistance: 3.0 mOhm  
 Monitor diode current at n.p.: 1347 µA

## Spectral Parameters

Center wavelength: 808.5 nm **809**  
 Spectral bandwidth (FWHM): 1.7 nm  
 Measurement temperature\*: 25.0 °C  
 Measurement current: 50.8 A **SS,1**

\* at temperature sensor  
 n.p. = nominal power



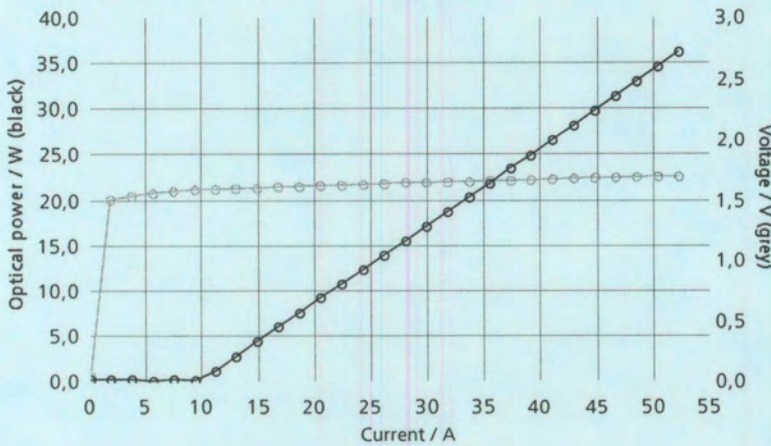
# Measurement Data Sheet



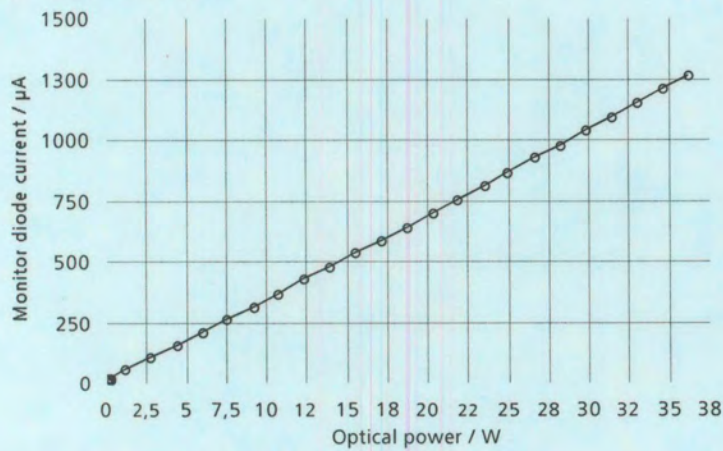
## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_101226  
 Date: November 25, 2010  
 Operator: D.Kirsch

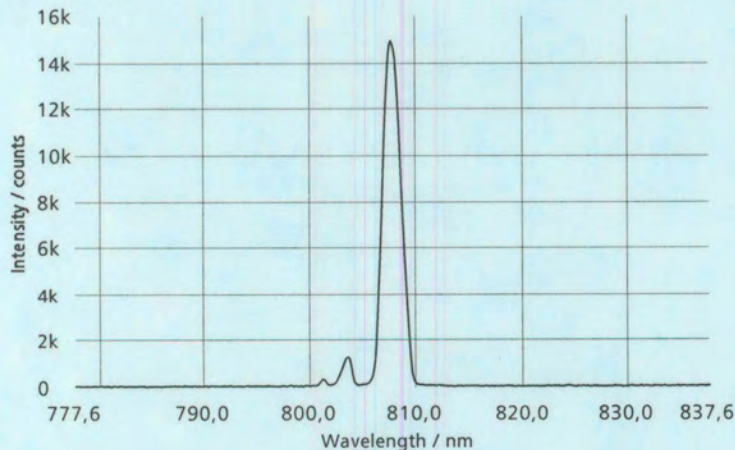
## Electro-Optical Data



## Monitor Diode Data



## Spectral Data



## Technical Specifications

Operation mode: cw  
 Nominal output power: 35 W  
 Module temperature\*: 25 °C  
 Temperature sensor: PT1000  
 Fiber core diameter: 400 µm  
 Fiber numerical aperture: 0.22  
 Fiber connector type: F-SMA 905, free

## Specification Tests

Electro-optical test: passed  
 Spectral test: passed

## Electro-Optical Parameters

Operation current at n.p.: 50.9 A  
 Operation voltage at n.p.: 1.69 V  
 Threshold current: 10.18 A  
 Slope: 0.86 W/A  
 Efficiency at nominal power: 40.7 %  
 Series resistance: 3.0 mOhm  
 Monitor diode current at n.p.: 1225 µA

## Spectral Parameters

Center wavelength: 807.6 nm **808,1**  
 Spectral bandwidth (FWHM): 2.0 nm  
 Measurement temperature\*: 25.0 °C  
 Measurement current: 50.9 A **55,2**

\* at temperature sensor  
 n.p. = nominal power



29.11.2010

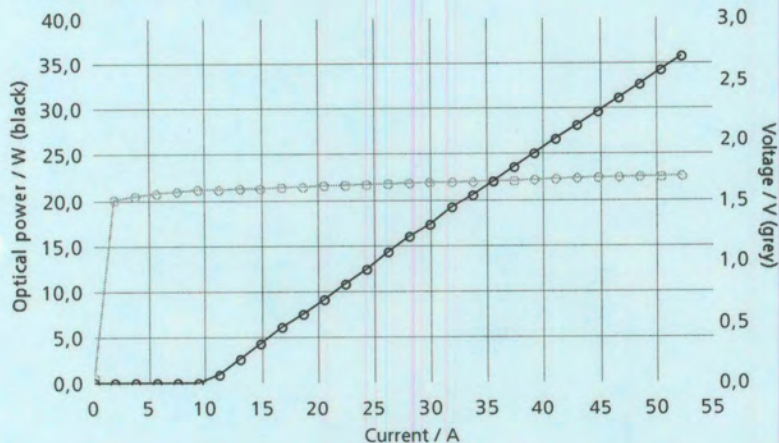
# Measurement Data Sheet



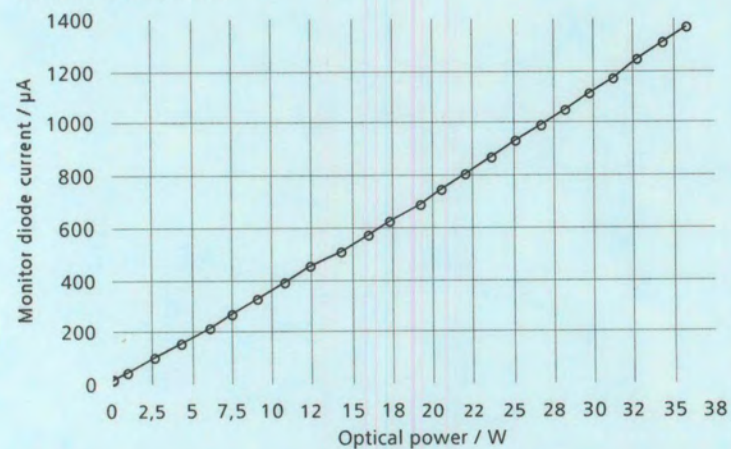
## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_101228  
 Date: November 24, 2010  
 Operator: D.Kirsch

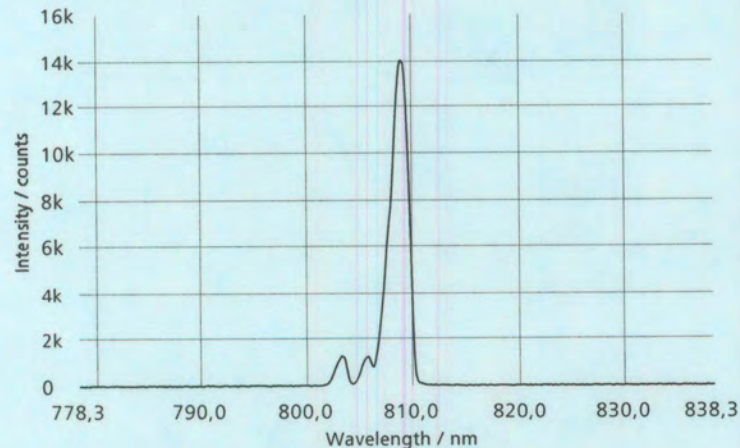
## Electro-Optical Data



## Monitor Diode Data



## Spectral Data



## Technical Specifications

Operation mode: cw  
 Nominal output power: 35 W  
 Module temperature\*: 25 °C  
 Temperature sensor: PT1000  
 Fiber core diameter: 400 µm  
 Fiber numerical aperture: 0.22  
 Fiber connector type: F-SMA 905, free

## Specification Tests

Electro-optical test: passed  
 Spectral test: passed

## Electro-Optical Parameters

Operation current at n.p.: 51.3 A  
 Operation voltage at n.p.: 1.69 V  
 Threshold current: 10.17 A  
 Slope: 0.85 W/A  
 Efficiency at nominal power: 40.3 %  
 Series resistance: 3.0 mOhm  
 Monitor diode current at n.p.: 1336 µA

## Spectral Parameters

Center wavelength: 808.3 nm **808.8**  
 Spectral bandwidth (FWHM): 2.0 nm  
 Measurement temperature\*: 25.0 °C  
 Measurement current: 51.3 A **55.6**

\* at temperature sensor  
 n.p. = nominal power

20101124-134825-RC\_101228-E2 - SPIC0277 - MOMA - SW 1.9.1



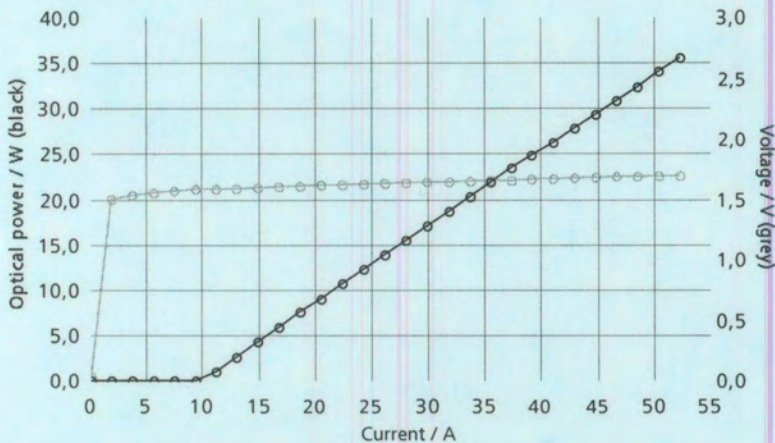
# Measurement Data Sheet



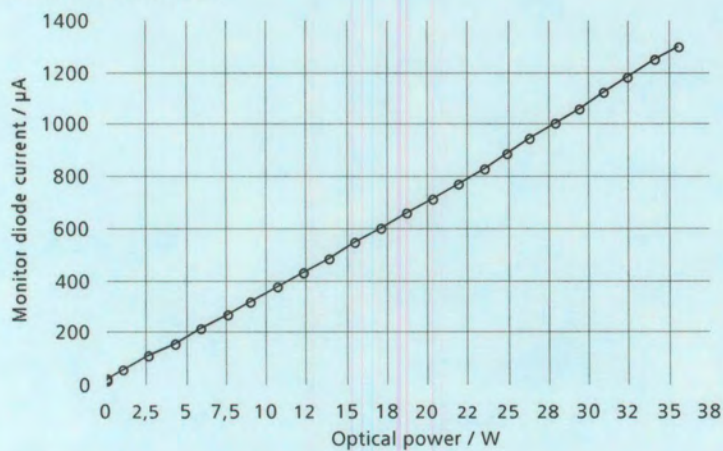
## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_101213  
 Date: November 24, 2010  
 Operator: D.Kirsch

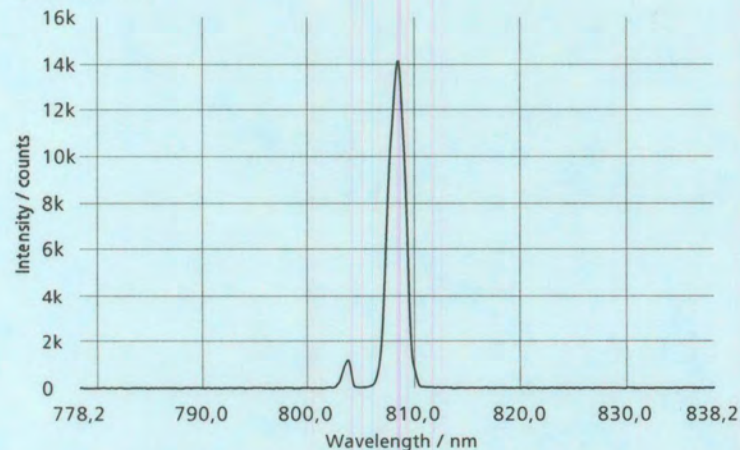
## Electro-Optical Data



## Monitor Diode Data



## Spectral Data



## Technical Specifications

Operation mode: cw  
 Nominal output power: 35 W  
 Module temperature\*: 25 °C  
 Temperature sensor: PT1000  
 Fiber core diameter: 400 µm  
 Fiber numerical aperture: 0.22  
 Fiber connector type: F-SMA 905, free

## Specification Tests

Electro-optical test: passed  
 Spectral test: passed

## Electro-Optical Parameters

Operation current at n.p.: 51.6 A  
 Operation voltage at n.p.: 1.69 V  
 Threshold current: 9.99 A  
 Slope: 0.84 W/A  
 Efficiency at nominal power: 40.1 %  
 Series resistance: 3.0 mOhm  
 Monitor diode current at n.p.: 1280 µA

## Spectral Parameters

Center wavelength: 808.2 nm **808.7**  
 Spectral bandwidth (FWHM): 1.9 nm  
 Measurement temperature\*: 25.0 °C  
 Measurement current: 51.6 A **55,8**

\* at temperature sensor  
 n.p. = nominal power



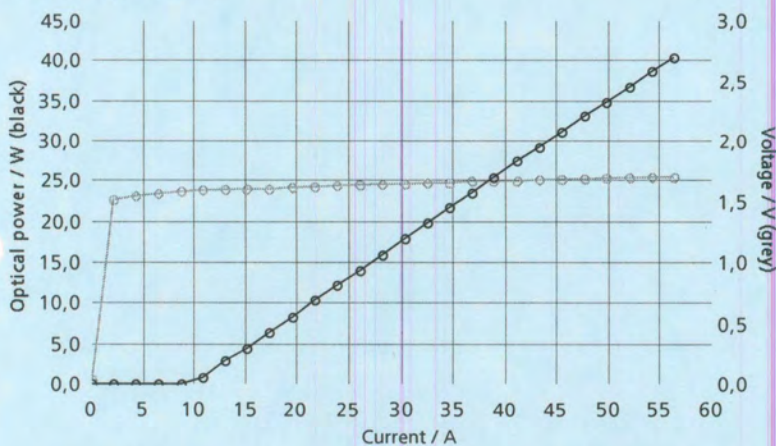
## Measurement Data Sheet



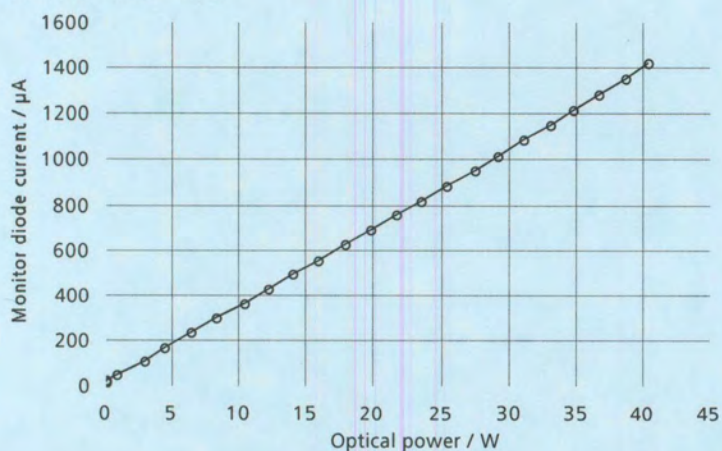
## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_101295  
 Date: December 16, 2010  
 Operator: H.Walther

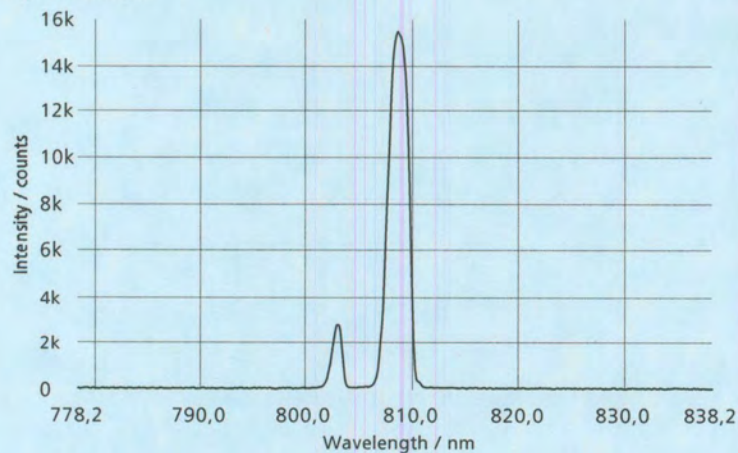
## Electro-Optical Data



## Monitor Diode Data



## Spectral Data



## Technical Specifications

Operation mode:	cw
Nominal output power:	40 W
Module temperature*:	25 °C
Temperature sensor:	PT1000
Fiber core diameter:	400 µm
Fiber numerical aperture:	0.22
Fiber connector type:	F-SMA 905, free

## Specification Tests

Electro-optical test:	passed
Spectral test:	passed

## Electro-Optical Parameters

Operation current at n.p.:	55.9 A
Operation voltage at n.p.:	1.70 V
Threshold current:	9.70 A
Slope:	0.87 W/A
Efficiency at nominal power:	42.2 %
Series resistance:	2.8 mOhm
Monitor diode current at n.p.:	1405 µA

## Spectral Parameters

Center wavelength:	808.2 nm
Spectral bandwidth (FWHM):	2.2 nm
Measurement temperature*:	25.0 °C
Measurement current:	55.9 A

\* at temperature sensor  
 n.p. = nominal power



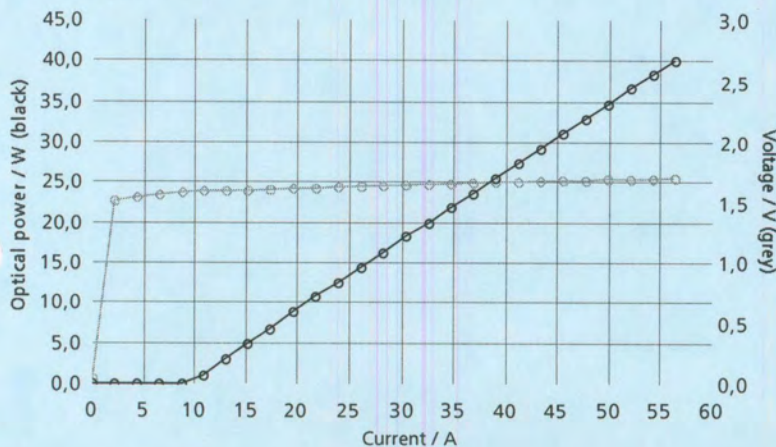
# Measurement Data Sheet



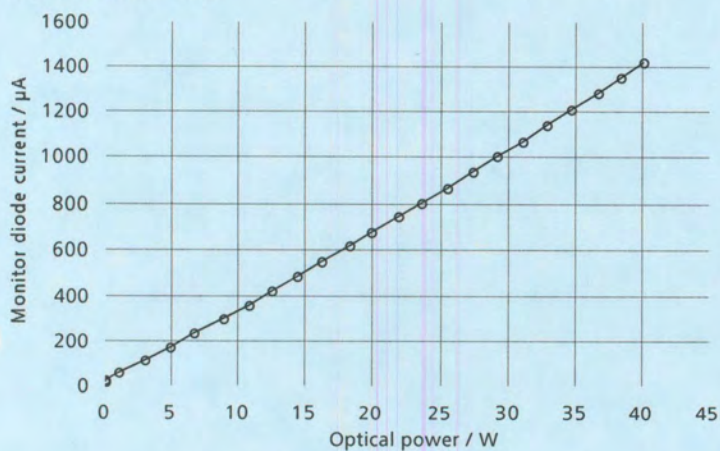
## General Information

Product: JOLD-45-CPXF-1L  
 Design: 215415624  
 S/N: RC\_101289  
 Date: December 16, 2010  
 Operator: H.Walther

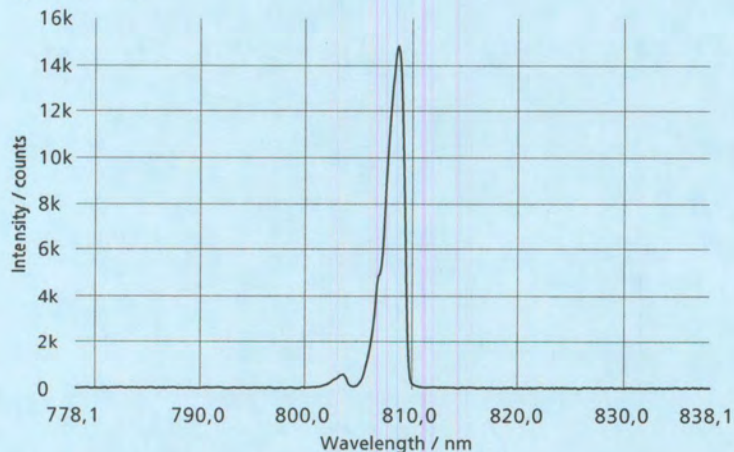
## Electro-Optical Data



## Monitor Diode Data



## Spectral Data



## Technical Specifications

Operation mode:	cw
Nominal output power:	40 W
Module temperature*:	25 °C
Temperature sensor:	PT1000
Fiber core diameter:	400 µm
Fiber numerical aperture:	0.22
Fiber connector type:	F-SMA 905, free

## Specification Tests

Electro-optical test:	passed
Spectral test:	passed

## Electro-Optical Parameters

Operation current at n.p.:	56.2 A
Operation voltage at n.p.:	1.70 V
Threshold current:	9.69 A
Slope:	0.86 W/A
Efficiency at nominal power:	41.8 %
Series resistance:	2.8 mOhm
Monitor diode current at n.p.:	1417 µA

## Spectral Parameters

Center wavelength:	808.1 nm
Spectral bandwidth (FWHM):	1.9 nm
Measurement temperature*:	25.0 °C
Measurement current:	56.2 A

\* at temperature sensor  
 n.p. = nominal power



Laser system: ODS II - Hanford H2

Laser diodes (new;old)

Fiber:

LD1: 08838 ; LD1: \_\_\_\_\_  
 LD2: 08846 ; LD2: \_\_\_\_\_  
 LD3: 08834 ; LD3: \_\_\_\_\_  
 LD4: 08832 ; LD4: \_\_\_\_\_

D2  
SP1  
SP2  
SP3

Check fibers

D3 broken at amplifier side. D1 and D4 (comp side) ok after polishing. All others ok

Laser diode slopes:

I (A)	LD1 (W)	LD2 (W)	LD3 (W)	LD4 (W)
10	0,1	0,1	0	0,1
15	3,9	3,7	3,7	3,9
20	8,3	7,8	7,8	7,9
25	12,4	11,8	11,7	12
30	16,7	15,9	15,9	16,1
35	21	20	20,1	20,2
40	25	24,7	24,3	24,3
45	29,4	28,2	28,4	28,3
50	33,7	32,4	32,5	32,3
55	37,6	36,6	36,6	36,5
60	42	40,7	40,7	40,5

Check Fiber plug temperature: all cool

Temp. / Current LD1: 23°C / 50A

Temp. / Current LD2: 23°C / 50A

Temp. / Current LD3: 26°C / 50A

Temp. / Current LD4: 25°C / 50A

Pickups calibrated:

Comments:

**NPRO**

I (A)	Output power (W)
0,9	0,1
1,1	0,3
1,3	0,54
1,5	0,92
1,7	1,28
1,8	1,45
1,9	1,62
2	1,75
2,1	1,9
2,365	2,14

before EOM

**MOPA Operation:**

Operation Settings:

NPRO: D1 30,37 °C, D2 24,57 °C, 2 A. xtal 29,64 °C

LD1: 23 °C, 50 A

LD2: 23 °C, 50 A

LD3: 26 °C, 50 A

LD4: 25 °C, 50 A

Output Power: 35,5 (measured in front of HPL)

Date: 10/14/11

Signature: BS

Comments:

Front End operating hours: 1473  
EOM + HOM aligned



## Test Protocol

Frontend Diode-Box SN: ORSI DB-TEFormer eLIGO name / system: SPAREI operating hours: 0LD1: S/N: RC-08838LD2: S/N: RC-08846LD3: S/N: RC-08832LD4: S/N: RC-08834Diode characterization date: 19/09/08, please attach!Lumina Power Supply 1: S/N: 43078Lumina Power Supply 11: S/N: 4307424V Power Supply: S/N: 07130879

## Perform Geräteprüfung

Used Tool: SECUTEST 0707/07025

Start Test vor Schutzklasse 1 (SK1)

	Measured Value	Max. Values
R <sub>SL</sub> max	<u>0,044 Ω</u>	< 0.300 Ohm
R <sub>ISO</sub> min	<u>&gt; 310,01 Ω</u>	> 1.000 MOhm
U <sub>ISO</sub> SPG.	<u>0538V</u>	500 V
I <sub>EA</sub> max	<u>07.12 mA</u>	3.5 mA

Test Schutzklasse OK



Start the FE-DB Test program

† neue Prüfung  
 20.07.10 13:17  
 Laser Zentrum Hannover  
 Hollerithallee 8  
 30419 Hannover  
 0511 2788-0  
 Reparatur: Das Gerät ist neu an-  
 fertigt  
 Prüflings: an Prüfdose SK I  
 Heizen. od. Entstör-C  
 Meßwerte Grenzwerte  
 R<sub>SL</sub> 0,044Ω <0,300Ω  
 R<sub>ISO</sub> >310,01Ω >1,000MΩ  
 U<sub>ISO</sub> 0538V >500V  
 I<sub>EA</sub> 07,12mA <03,50mA  
 VDE 701-1 bestanden  
 Sichtprüfung bestanden

Test Protocol

---

Check proper read out of all temperature sensors, OK



(LD 1–4 and 1 x heat sink)

Start TEC calibration procedure (example for one channel)

Use a current meter and connect (test tool) to the TEC OUT on the TEC board. Press TEST on the diode number connected to the current meter and calibrate (by turning the poti on the board) to 5A on the current meter.

Use the “polarity-change” connector (test tool) between TEC (diode) and the board. Press TEST and heat up the diode up to 40°C. The interlock should open below 40°C, check opening of the temperature guard.

Reconnect the laser TEC (diode) to the board on the normal way and press TEST to check cooling the diode.

Redo procedure for all 4 channels:

LD1: calibrate to 5A – Interlock OK – Cooling OK



LD2: calibrate to 5A – Interlock OK – Cooling OK



LD3: calibrate to 5A – Interlock OK – Cooling OK



LD4: calibrate to 5A – Interlock OK – Cooling OK



Start diode power supply checking.

Connect the laser diode current cable to the laser diode power supply and bridge the power supply interlock (FE-DB\_X6).

Make sure that the laser diode short cuts are connected red and black. Type 1A into the software program and press enable (current is set as long as button is pressed).

Check current readout and current display at the power supply.

(Value fits to the setting)





Test Protocol

---

Check diode voltage readout (has to be 0V, due to short cut)



Switch DB short cut to black/black position and make sure that all diode short cuts are set to red/red. Press enable the check voltage (around 4V )



Switch Diode short cut back to red/black



Check to proper work of the power supply interlock by taking out the interlock bridge, no current can be set.



Fill the diode box with distilled water. Connect the pressure measurement tool and test the system with 5bar for >5h.

Pressure and leakage test OK



Comments:

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Controller:

M.J. de P.

Date:

20/07/2010



26 Ward Hill Avenue, Bradford, MA 01835 (978) 241-8260 FAX (978) 241-8262

<b>Model Number</b>		<b>Serial Number</b>	<b>Customer</b>
LDY-600-70-8-GFAN-CE-ROHS		43074	Schulz-Electronic GmbH
Unit: 11001188F Rev.	5		
PCB: 15001007-01FR8 Rev.	8H		

Model Specifications			
$I_{out\_Max}$	70 Amps	Input Voltage Range	115-240 VAC
$V_{out\_Max}$	8 Vdc	Input Current Max.	A

Accuracy Measurements				
Iprogram (± 10mV)	Iout	Imonitor ( $(10 / I_{out\_Max}) * I_{out} \pm 50mV$ )	Vout	Vmonitor = Vout ±50mV
0 VDC	0.00 A	0.00 Vdc		
5.00 VDC	35.01 A (35 ± 350mA)	4.99 Vdc		
10.00 VDC	70.00 A (70 ± 350mA)	10.00 Vdc	7.89 Vdc	7.89 Vdc

Ripple Measurements	
$I_{out\_Max}$	70.0A
Iripple	<input checked="" type="checkbox"/> (<350mA)



Aux. Supply Measurements	
+5V ± 0.25VDC	5.01 Vdc
+15V ± 0.75VDC	15.00 Vdc
-15V ± 0.75VDC	-15.02 Vdc

Interlock Function Test
<input checked="" type="checkbox"/> OK

Isoftstart on Enable (10V Iprogram)
<input checked="" type="checkbox"/> OK (<50ms rise)
<input checked="" type="checkbox"/> OK (No Overshoot)

Power-Up Test (Enable at 10V Iprogram)
<input checked="" type="checkbox"/> OK (250 VAC Input)
<input checked="" type="checkbox"/> OK (90 VAC Input)

Crowbar Status
<input checked="" type="checkbox"/> Enable OFF: Crowbar ON, J3-Pin 2=LOW
<input checked="" type="checkbox"/> Enable ON/with Load: Crowbar OFF, Pin 2=HI
<input checked="" type="checkbox"/> Enable ON/No Load: Crowbar ON, Pin 2=LOW, Open Circuit Voltage=0V

LED Function Test
<input checked="" type="checkbox"/> OK (AC LED D8)

Temp. Warning Switch
<input checked="" type="checkbox"/> J3-Pin 11: LOW=Normal; HI (5V)=O.T. Fault

Current Limit Switch Test	
SW1 <input checked="" type="checkbox"/> OK (≈74% of MAX current)	
SW2 <input checked="" type="checkbox"/> OK (≈88% of MAX current)	
SW3 <input checked="" type="checkbox"/> OK (≈98% of MAX current)	
SW4 <input checked="" type="checkbox"/> OK (≈103% of MAX current)	
All OFF <input checked="" type="checkbox"/> OK (≈110% of MAX current)	
Quiet Fans (56-1024)	<input type="checkbox"/> OK

Pulse Control Function	
<input checked="" type="checkbox"/> Pulsing OK (J3-Pin 8: LOW=no output; HI=output)	
Rise Time (<1mS) 556 μS	Fall Time(<1.5mS) 582 μS

Tester		Leakage Current Test @ 250VAC		
Name:	Bonifant	Low	Actual	High
Date:	2/19/08	Normal	150 μA	180 μA
		Reversed	150 μA	177 μA
		SGL Fault	300 μA	335 μA





26 Ward Hill Avenue, Bradford, MA 01835 (978) 241-8260 FAX (978) 241-8262

<b>Model Number</b>		<b>Serial Number</b>	<b>Customer</b>
LDY-600-70-8-GFAN-CE-ROHS		 *50203*	Schulz-Electronic GmbH
Unit: 11001188F Rev.	6		TDV-1140
PCB: 15001007-01FR8 Rev.	EH		

Model Specifications			
I <sub>out</sub> Max	70 Amps	Input Voltage Range	115-240 VAC
V <sub>out</sub> Max	8 Vdc	Input Current Max.	A

Accuracy Measurements				
I <sub>program</sub> (± 10mV)	I <sub>out</sub>	I <sub>monitor</sub> (((10 / I <sub>out</sub> (max)) * I <sub>out</sub> ) ± 50mV)	V <sub>out</sub>	V <sub>monitor</sub> = V <sub>out</sub> ± 50mV
0 VDC	0 A	0 Vdc		
5.00 VDC	35.0 A (35 ± 350mA)	4.99 Vdc		
10.00 VDC	70.0 A (70 ± 350mA)	10.00 Vdc	8.56 Vdc	8.56 Vdc

Ripple Measurements	
I <sub>out</sub> Max	70.0A
I <sub>ripple</sub>	<input checked="" type="checkbox"/> (<350mA)

Aux. Supply Measurements		
+5V ± 0.25VDC	504	Vdc
+15V ± 0.75VDC	14.99	Vdc
-15V ± 0.75VDC	15.02	Vdc

Interlock Function Test
<input checked="" type="checkbox"/> OK

ISoftstart on Enable (10V I <sub>program</sub> )
<input checked="" type="checkbox"/> OK (<50ms rise)
<input checked="" type="checkbox"/> OK (No Overshoot)

Power-Up Test (Enable at 10V I <sub>program</sub> )
<input checked="" type="checkbox"/> OK (250 VAC Input)
<input checked="" type="checkbox"/> OK (90 VAC Input)

Crowbar Status
<input checked="" type="checkbox"/> Enable OFF: Crowbar ON, J3-Pin 2=LOW
<input checked="" type="checkbox"/> Enable ON/with Load: Crowbar OFF, Pin 2=HI
<input checked="" type="checkbox"/> Enable ON/No Load: Crowbar ON, Pin 2=LOW, Open Circuit Voltage=0V

LED Function Test
<input checked="" type="checkbox"/> OK (AC LED D8)

Temp. Warning Switch
<input checked="" type="checkbox"/> J3-Pin 11: LOW=Normal; HI (5V)=O.T. Fault

Current Limit Switch Test	
SW1 <input checked="" type="checkbox"/> OK (≈74% of MAX current)	
SW2 <input checked="" type="checkbox"/> OK (≈88% of MAX current)	
SW3 <input checked="" type="checkbox"/> OK (≈98% of MAX current)	
SW4 <input checked="" type="checkbox"/> OK (≈103% of MAX current)	
All OFF <input checked="" type="checkbox"/> OK (≈110% of MAX current)	
Quiet Fans (56-1024)	<input checked="" type="checkbox"/> OK

Pulse Control Function			
<input checked="" type="checkbox"/> Pulsing OK (J3-Pin 8: LOW=no output; HI=output)			
Rise Time (<1mS)	555 μS	Fall Time (<1.5mS)	700 μS

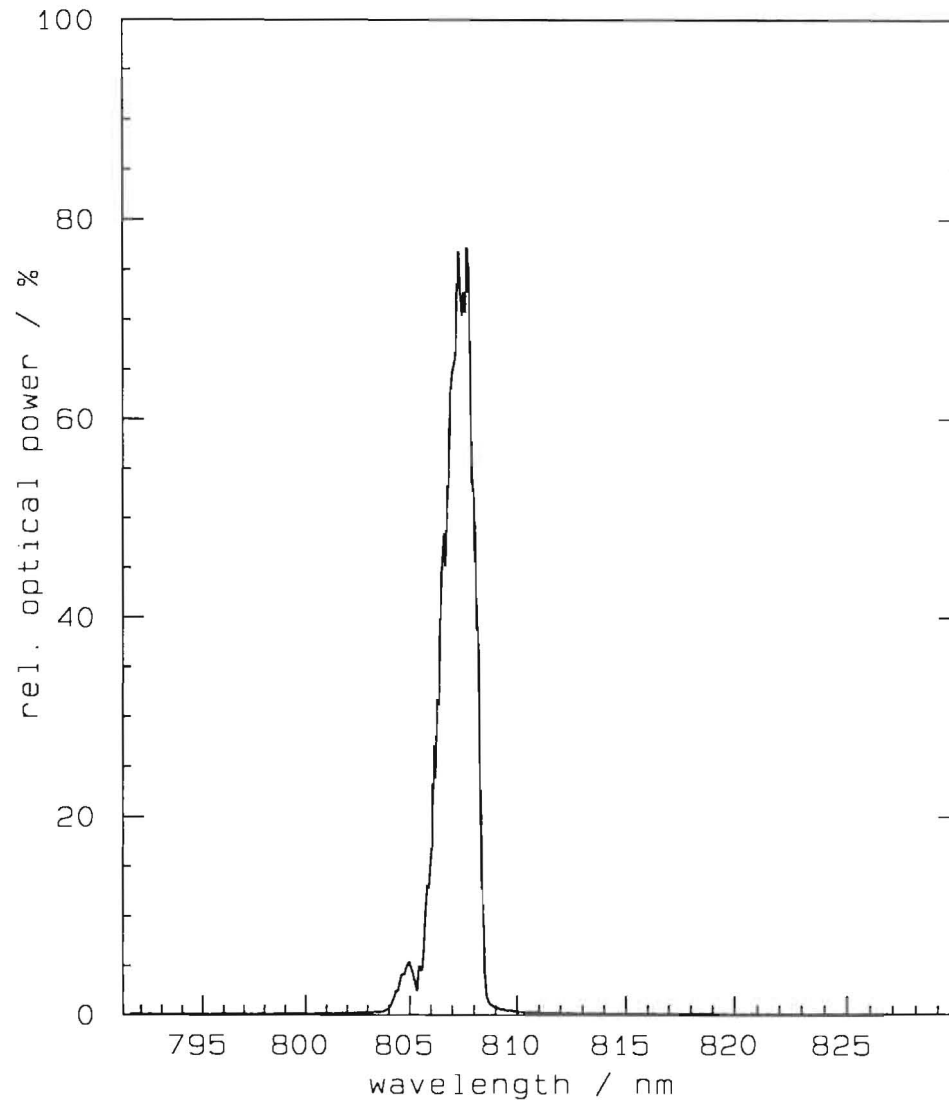
Tester	
Name:	Jane Lopez
Date:	12/2/08

Leakage Current Test @ 250VAC			
	Low	Actual	High
Normal	150 μA	180 μA	200 μA
Reversed	150 μA	178 μA	200 μA
SGL Fault	300 μA	339 μA	400 μA



37-LDY-600-70-8-GFAN-CE-ROHS

## Spectrum



Device No. : RC\_08838

Heatsink temperature : 25 deg C

pulse length : cw

wavelength (90%-width) : 807.3(3.1) nm

spectral FWHM : 1.8 nm

threshold current : 10.3 A

slope efficiency : 0.95 W/A

operating current for 45W : 57.5 A

series resistance : 4.3 mOhm

efficiency at 45 W : 42.4 %

photodiode voltage at 8W : 0.873 V

photodiode voltage at 16W : 1.698 V

laserdiode voltage at 45W : 1.845 V

laserdiode voltage at 15W : 1.709 V

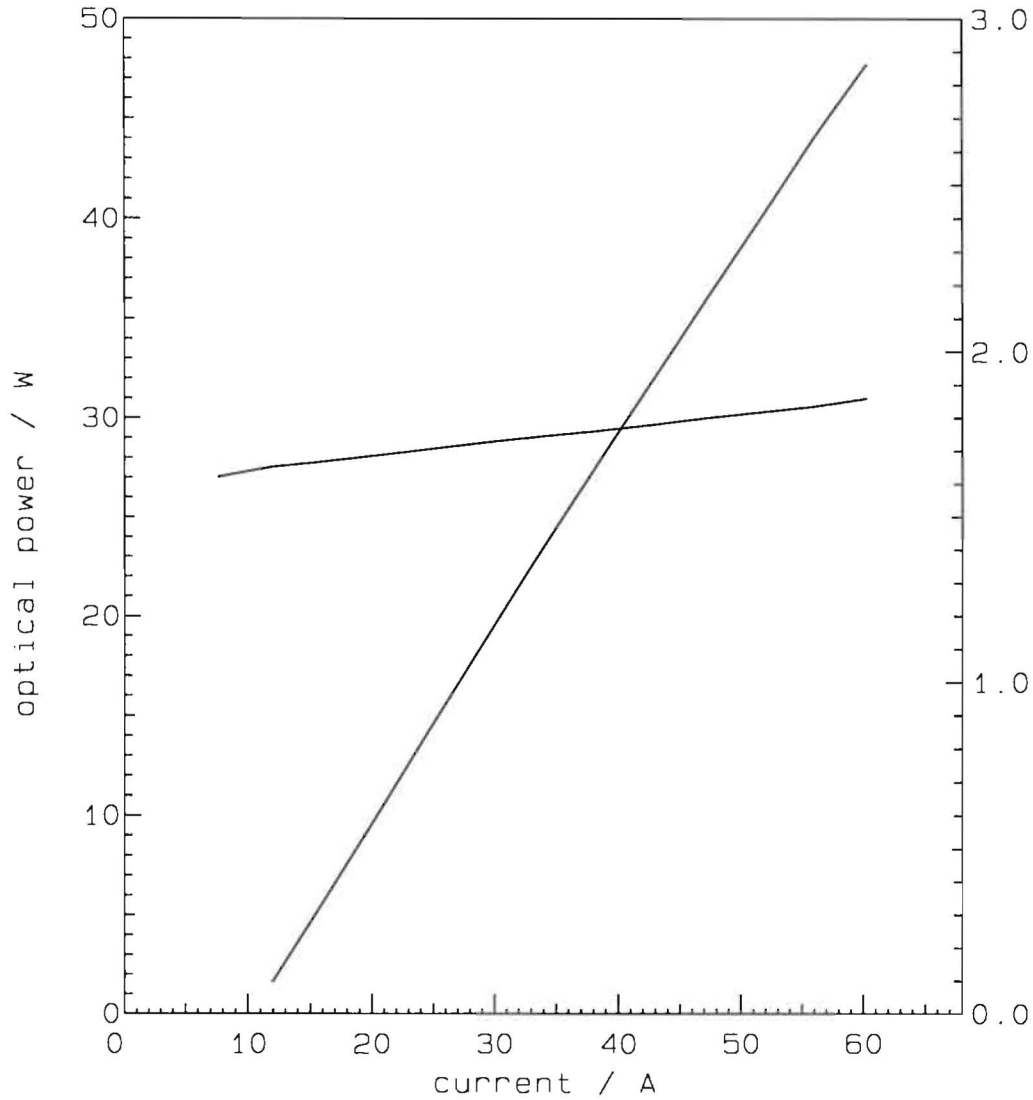
final inspection : ... *A. J. S.* ...

(gemessen auf RGB-Messplatz)

JENOPTIK Laserdiode GmbH



LI-Curve



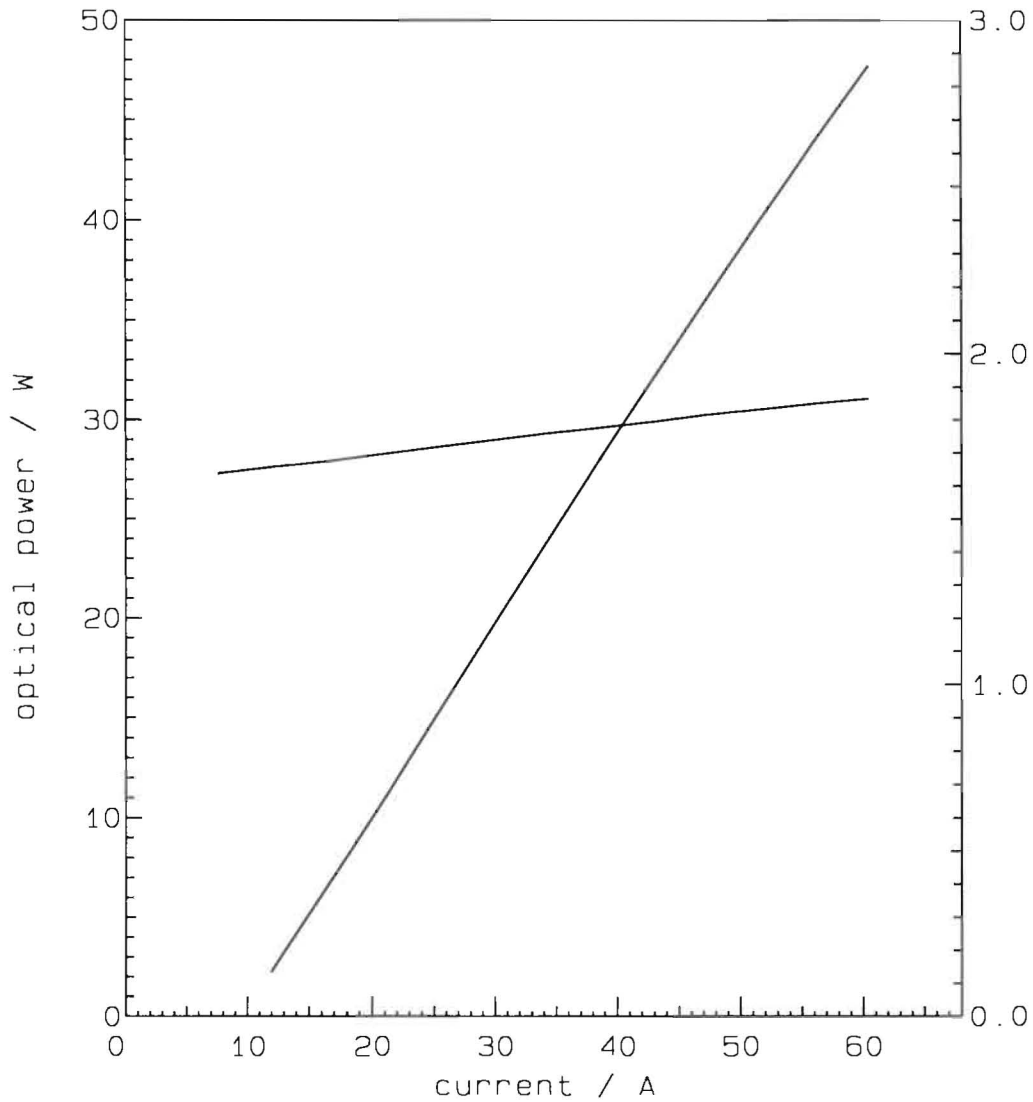
Device No. : RC\_08838  
 Heatsink temperature : 25 deg C  
 pulse length : cw  
 wavelength (90%-width) : 807.3(3.1)nm  
 spectral FWHM : 1.8 nm  
 threshold current : 10.3 A  
 slope efficiency : 0.95 W/A  
 operating current for 45W : 57.5 A  
 series resistance : 4.3 mOhm  
 efficiency at 45 W : 42.4 %  
 photodiode voltage at 8W : 0.873 V  
 photodiode voltage at 16W : 1.698 V  
 laserdiode voltage at 45W : 1.845 V  
 laserdiode voltage at 15W : 1.709 V

final inspection : ... *A. J.* ...

(gemessen auf RGB-Messplatz)

JENOPTIK Laserdiode GmbH

LI-Curve



Device No. : RC\_08846

Heatsink temperature : 25 deg C

pulse length : cw

wavelength (90%-width) : 808.6(3.6) nm

spectral FWHM : 1.4 nm

threshold current : 9.7 A

slope efficiency : 0.94 W/A

operating current for 45W : 57.6 A

series resistance : 4.4 mOhm

efficiency at 45 W : 42.1 %

photodiode voltage at 8W : 0.891 V

photodiode voltage at 16W : 1.763 V

laserdiode voltage at 45W : 1.857 V

laserdiode voltage at 15W : 1.718 V

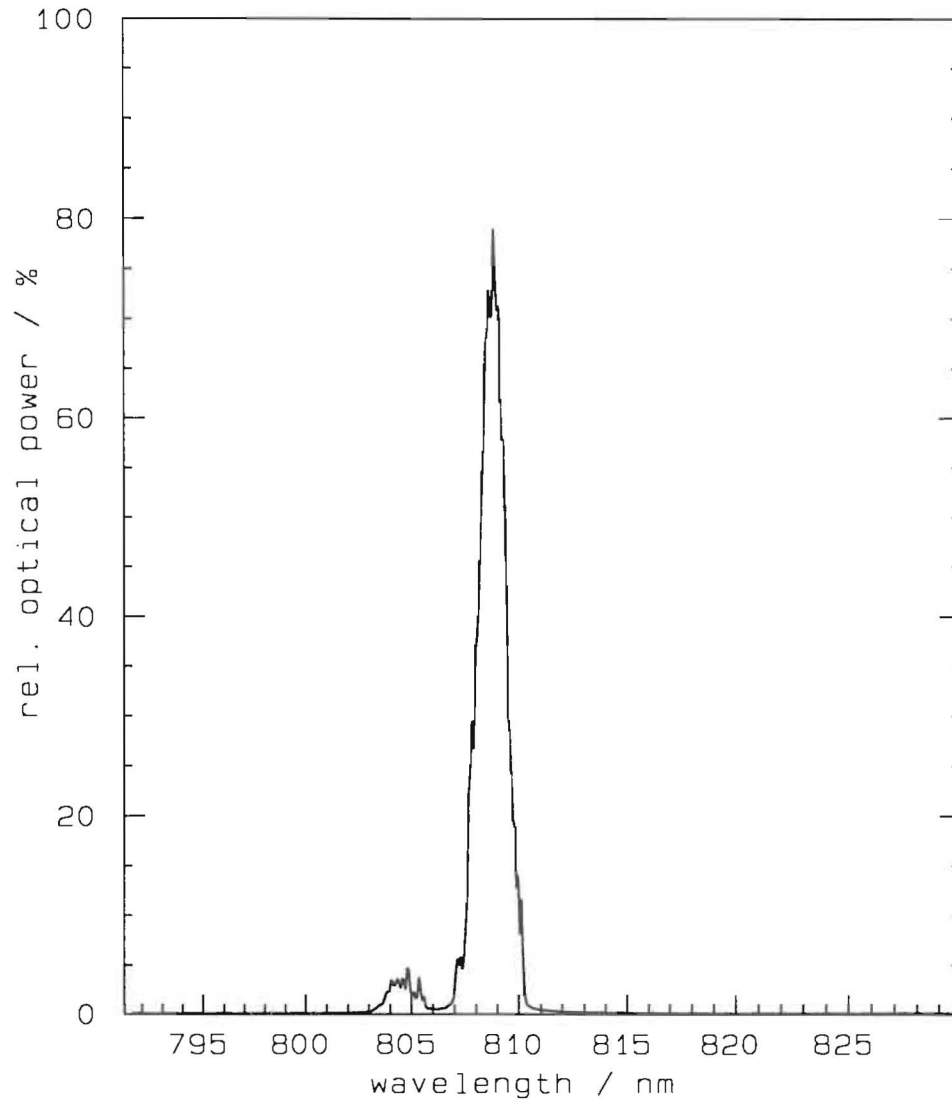
final inspection : *A. Yu*

(gemessen auf RGB-Messplatz)

JENOPTIK Laserdiode GmbH



## Spectrum



Device No. : RC\_08846

Heatsink temperature : 25 deg C  
pulse length : cw

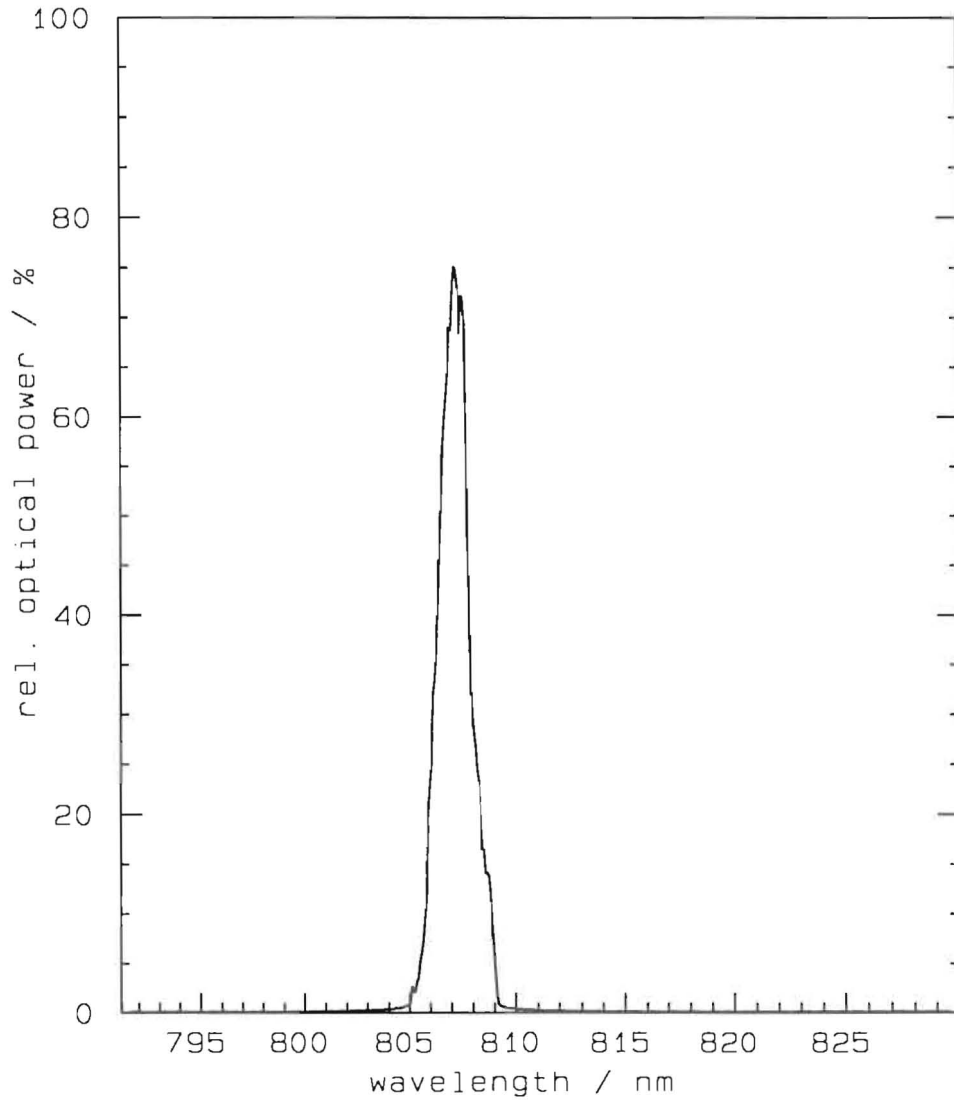
wavelength (90%-width) : 808.6 (3.6) nm  
spectral FWHM : 1.4 nm  
threshold current : 9.7 A  
slope efficiency : 0.94 W/A  
operating current for 45W : 57.6 A  
series resistance : 4.4 mOhm  
efficiency at 45 W : 42.1 %  
photodiode voltage at 8W : 0.891 V  
photodiode voltage at 16W : 1.763 V  
laserdiode voltage at 45W : 1.857 V  
laserdiode voltage at 15W : 1.718 V

final inspection : ... *AJS* ...

(gemessen auf RGB-Messplatz)

JENOPTIK Laserdiode GmbH

### Spectrum

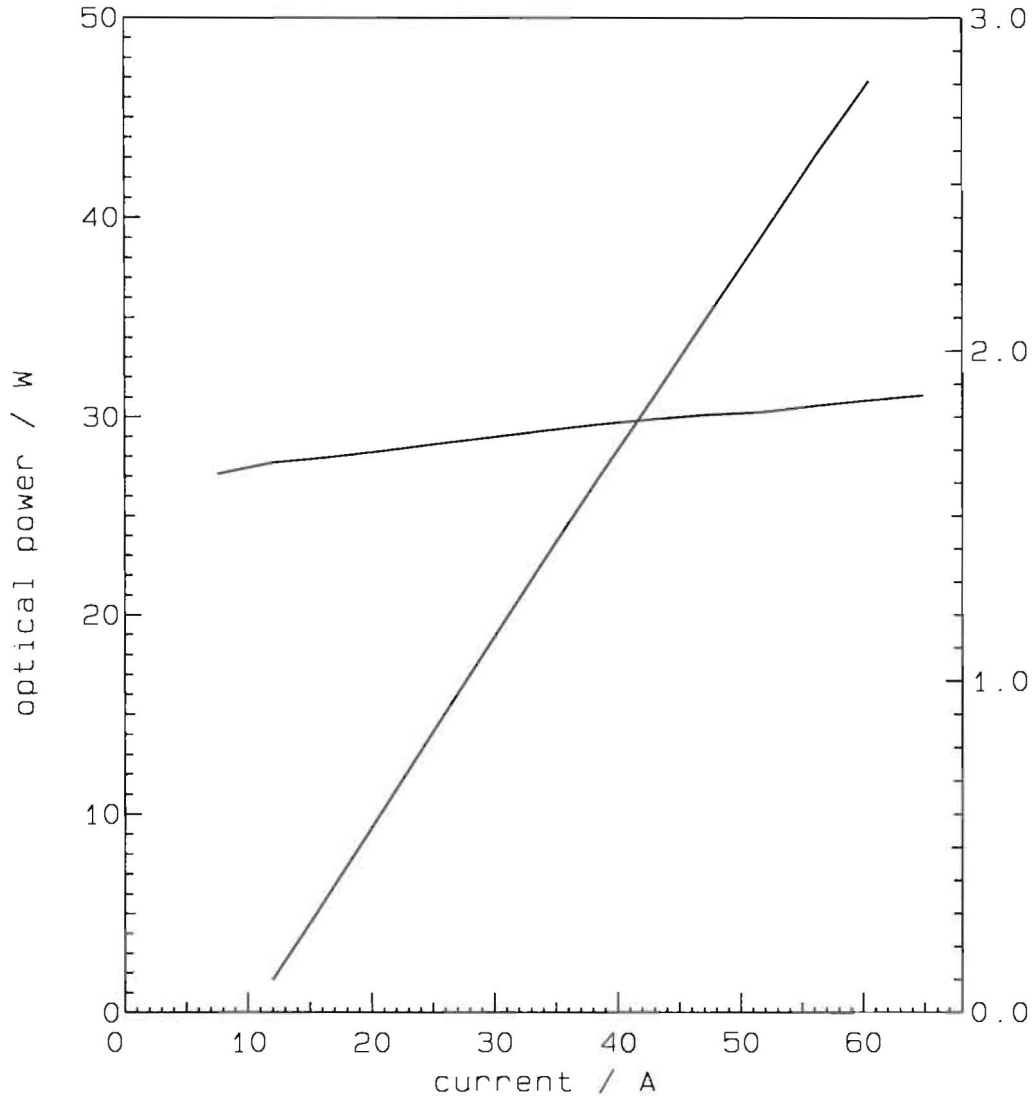


Device No. : RC\_08832  
Heatsink temperature : 25 deg C  
pulse length : cw  
  
wavelength (90%-width) : 807.3(2.9) nm  
spectral FWHM : 1.5 nm  
threshold current : 10.2 A  
slope efficiency : 0.92 W/A  
operating current for 45W : 59.0 A  
series resistance : 4.0 mOhm  
efficiency at 45 W : 41.3 %  
photodiode voltage at 8W : 0.955 V  
photodiode voltage at 16W : 1.905 V  
laserdiode voltage at 45W : 1.849 V  
laserdiode voltage at 15W : 1.719 V

final inspection : ... *APUS* ...



LI-Curve

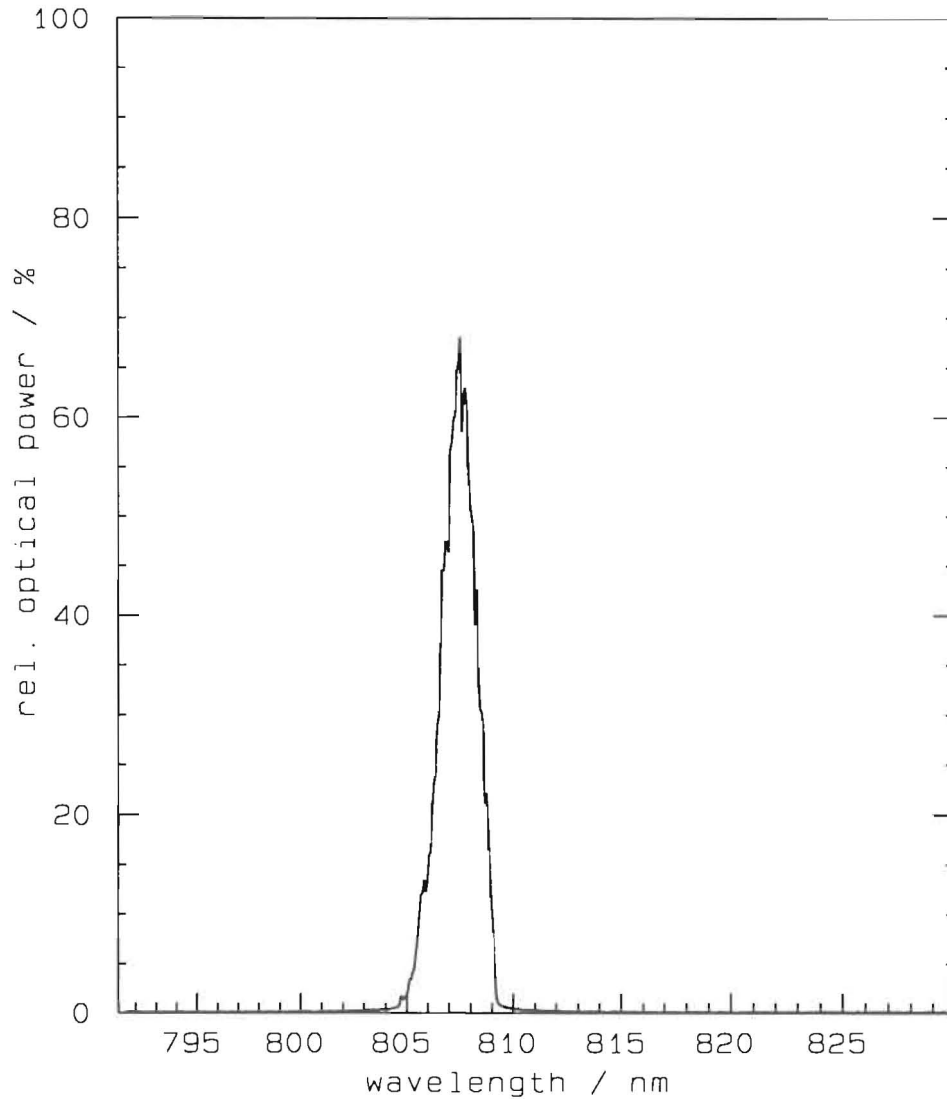


Device No. : RC\_08832  
 Heatsink temperature : 25 deg C  
 pulse length : cw  
 wavelength (90%-width) : 807.3(2.9) nm  
 spectral FWHM : 1.5 nm  
 threshold current : 10.2 A  
 slope efficiency : 0.92 W/A  
 operating current for 45W : 59.0 A  
 series resistance : 4.0 mOhm  
 efficiency at 45 W : 41.3 %  
 photodiode voltage at 8W : 0.955 V  
 photodiode voltage at 16W : 1.905 V  
 laserdiode voltage at 45W : 1.849 V  
 laserdiode voltage at 15W : 1.719 V

final inspection : *A. J. S.*

5-20-08 11:47

### Spectrum



Device No. : RC\_08834

Heatsink temperature : 25 deg C

pulse length : cw

wavelength (90%-width) : 807.5 (3.3) nm

spectral FWHM : 1.8 nm

threshold current : 10.2 A

slope efficiency : 0.92 W/A

operating current for 45W : 58.9 A

series resistance : 4.4 mOhm

efficiency at 45 W : 41.2 %

photodiode voltage at 8W : 0.949 V

photodiode voltage at 16W : 1.869 V

laserdiode voltage at 45W : 1.856 V

laserdiode voltage at 15W : 1.713 V

final inspection : .....

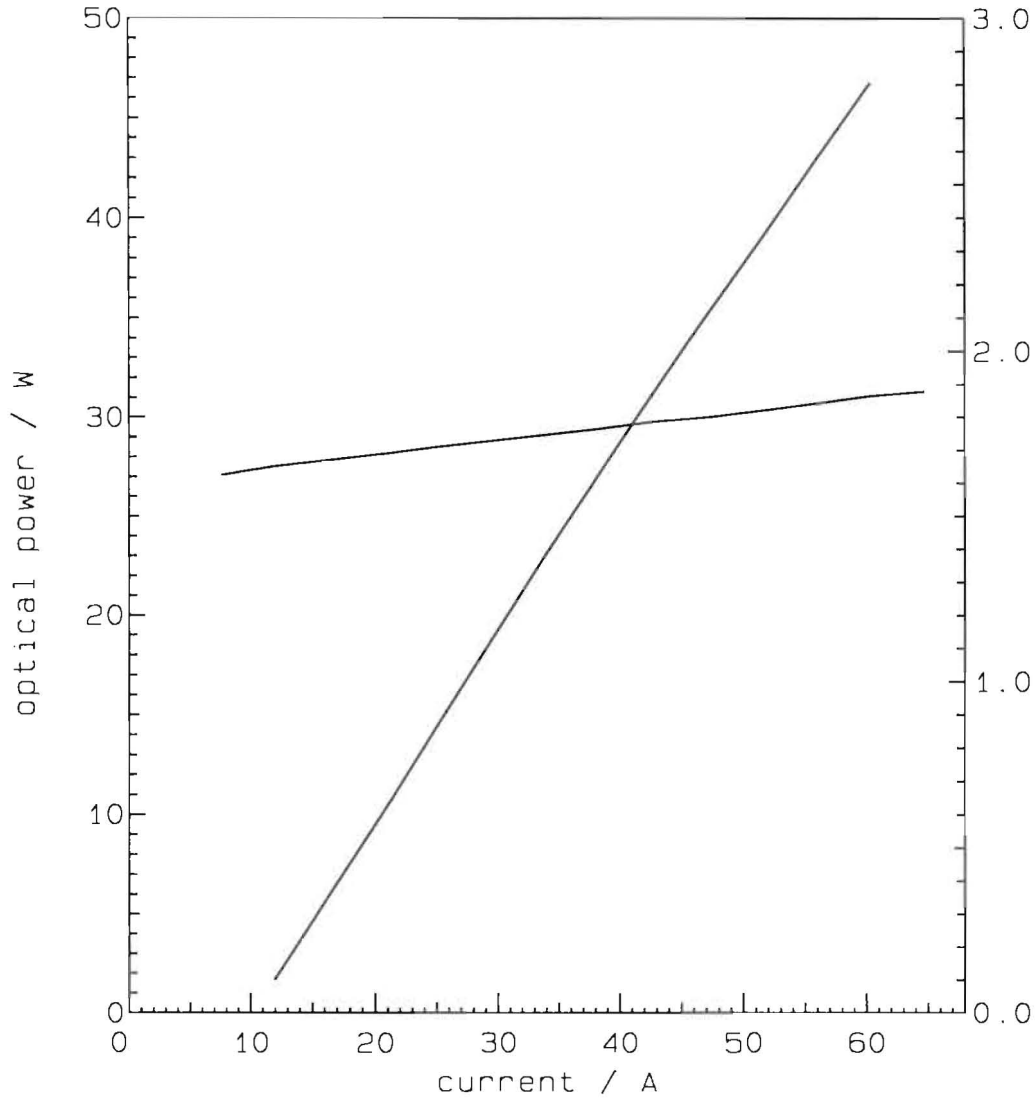
*A. H.*

(gemessen auf RGB-Messplatz)

JENOPTIK Laserdiode GmbH



LI-Curve



Device No. : RC\_08834  
 Heatsink temperature : 25 deg C  
 pulse length : cw  
 wavelength (90%-width) : 807.5(3.3) nm  
 spectral FWHM : 1.8 nm  
 threshold current : 10.2 A  
 slope efficiency : 0.92 W/A  
 operating current for 45W : 58.9 A  
 series resistance : 4.4 mOhm  
 efficiency at 45 W : 41.2 %  
 photodiode voltage at 8W : 0.949 V  
 photodiode voltage at 16W : 1.869 V  
 laserdiode voltage at 45W : 1.856 V  
 laserdiode voltage at 15W : 1.713 V

final inspection : ..... *Ahr* .....

(gemessen auf RGB-Messplatz)

JENOPTIK Laserdiode GmbH

### Test Protocol Control-Box

Control-Box SN: ORS II - C13

DC-Motor Driver: C-863K002-110016987

Connect a 24V power supply to the control box on switch on the box.

Check 24V DC, supply (needs to be below 0.5A)	<u>0.5</u>	A, OK	<input checked="" type="checkbox"/>
Frontend shutter output (~12V)	<u>17.9</u>	V	<input checked="" type="checkbox"/>

Checking of all cable connections

DC-Motor driver configured?

All functionality checking's will be done on system commissioning.

Comments:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Controller: mj

Date: 01.11.10



**Test Protocol Laser-Head**

	first comm..	re-comm.
Frontend		
Lid Functionality	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Lid Override	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Check Frontend water flow sensors	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Oscillator		
Lid Functionality	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Lid Override	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Check water flow sensors laser head	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Check water flow power meter	<input checked="" type="checkbox"/>	<input type="checkbox"/>
LRA functionality test	<input checked="" type="checkbox"/>	<input type="checkbox"/>
LRA range warning	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Check Externer Shutter functionality	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Check Interner Shutter functionality	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Temperatursensors	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Temp-/ Humidity	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Fiber switch (checked with test tool first)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Fiber switch (checked with switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
PD Power distribution	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Power Meter 1-3 functionality	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Photo Diode functionality	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Fieldbox interface	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Comments:

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Controller:

LLW

Date:

27.6.11

**Prepare for shipping**

- Measure diode slopes and compare to first measurement (values needs to be in +/-5% range)
- Check is diodes are shorted
- Empty water circuit

CP, 30.6.11





Comments:

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Controller:

Frede

Date:

29.10.10

**aLIGO Laser Electronic**

**Interlock Concept**

**LIGO-T1000005-v2**

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**neo**LASE



# I Interlock Concept

The PSL safety concept is based on Beckhoffs 'Safety over EtherCAT protocol'. This allows an easy integration of safety relevant signals and components at different locations.

## I.1 Safety over EtherCAT

The concept benefits from the decentralized topology of the Beckhoff terminals to collect/distribute inputs/outputs via the standard EtherCAT bus system. The I/Os are linked to an intelligent logic terminal that exclusively deals with the safety logic. Further information about this can be found in the following document:

[http://download.beckhoff.com/download/press/2007/english/Industrial\\_Ethernet\\_Book\\_092007.pdf](http://download.beckhoff.com/download/press/2007/english/Industrial_Ethernet_Book_092007.pdf)

The 'Safety over EtherCAT protocol' is specified to meet the safety standards of IEC 61508 SIL 3 and EN 954 Cat. 4.

## I.2 Safety relevant input devices

An overview of the safety devices and all components connect to the system can be found in Figure I PSL control overview with safety devices.

The **interlock box IL** collects the status of the following interlock-relevant components (Fig. I, red symbols). For proper function all contacts must be closed (wire break safe):

- LDR facilities interlock (external interlock input)
- LDR emergency pushbutton
- LDR safety key lock
- TEC power supplies (TEC1 + TEC2 needs to be switched ON)
- Frontend diode temperature (the temperature of each diode must be below 40°C)
- DBI-4 diode temperature (the temperature of each diode must be below 40°C)
- Chiller flow (flow of both chillers need to be between 5 and 40 l/min)

In addition the **control box CB** collects the status of the following safety-relevant components:

- LAE emergency pushbutton mounted in proximity to the laser table
- LVEA facilities interlock
- LVEA safety key lock

### 1.3 Safety relevant output devices

If one of the above mentioned inputs will open the following subsystems will be shut down or their outputs will be set to zero (Fig. I, green symbols).

- NPRO interlock (will switch off the NPRO output)
- Frontend interlock (will switch off diode power supply output)
- Oscillator diode power supply interlock (will switch off diode power supply output)
- TEC power supply interlock (will switch off TEC power supply output)
- Chillers remote control (will switch off the chillers)

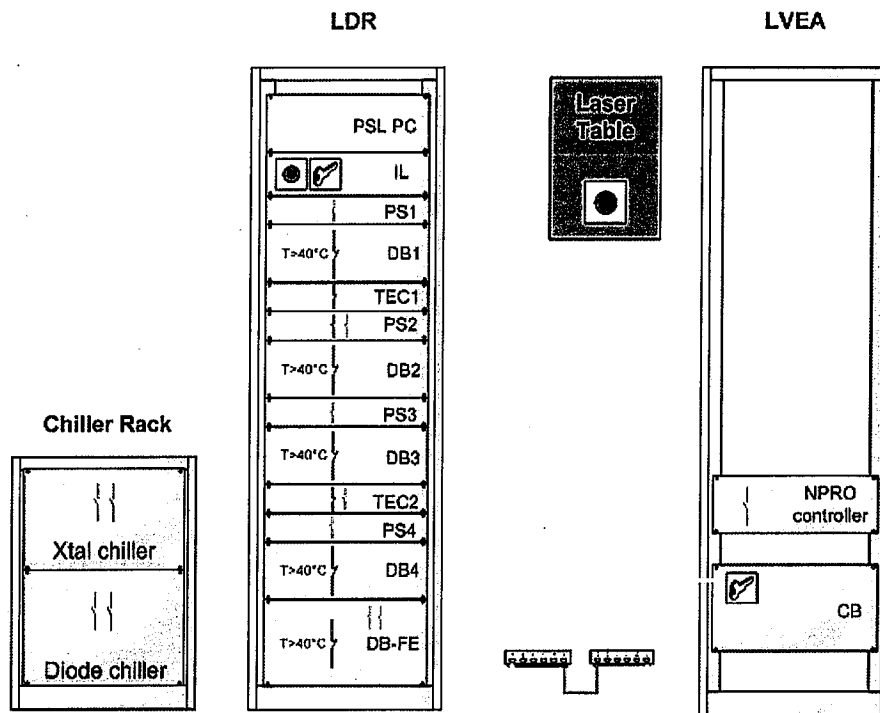


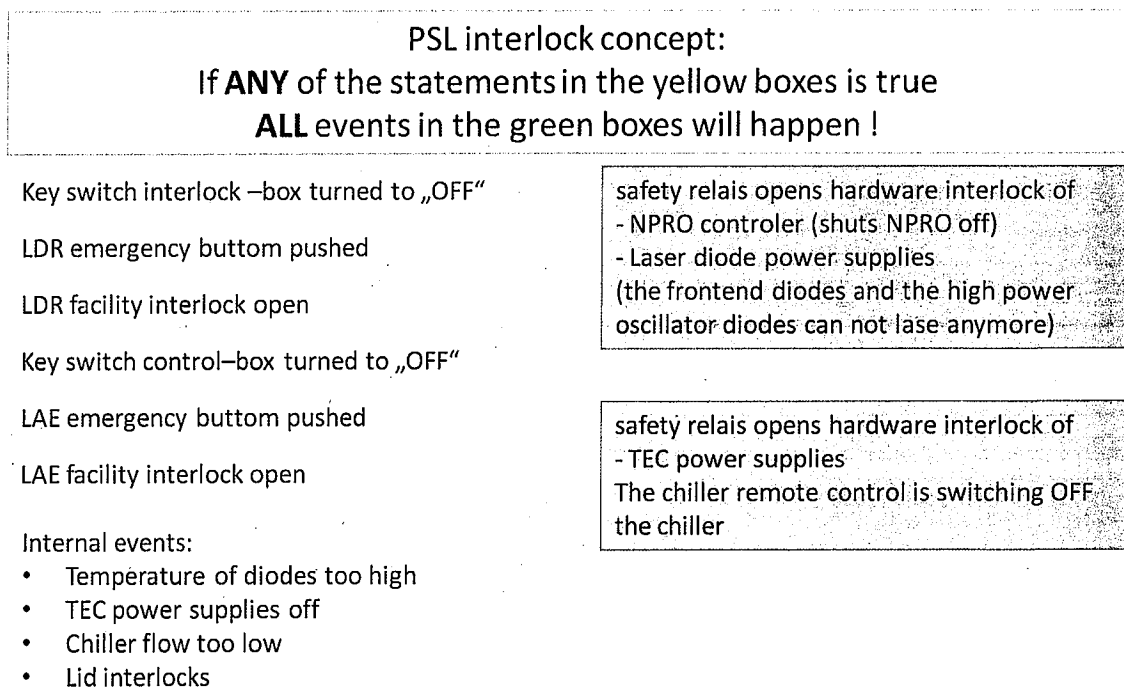
Figure I PSL control overview with safety devices



## 1.4 Functionality

The mentioned interlock inputs are connected to the input terminals (Beckhoff Twin-Safe ELI904). During normal operation all inputs are supposed to be closed and an output terminal (Beckhoff TwinSafe EL2904) will actuate a safety relay (DOLD LG5929.60). This relay will close the hardware interlock inputs of safety relevant or light emitting subsystems.

In case of an error or safety shut down the relay contacts will open and ensures that the laser diode current from the different power supplies (PSI-4 and DB-FE) as well as the NPRO is turned off. Thus, no light can be emitted from the lasers. In addition the chillers and the TEC power supplies are turned off. To restart the laser the user needs to reset the system manually.



**Figure 2 PSL interlock concept**

### 1.5 Test procedure

Switch ON all components and RESET all errors. After Reset the interlock relay should be switched ON, ATTENTION this allows Laser operation. Check the interlock events and make sure that they will be displayed on the control screen (corresponding interlock and main interlock indicator).

Status checked:

Check key lock switch (IL)

RLS

Check push button (IL)

RLS

Check Facility interlock (IL)

RLS

Check key lock switch (CB)

RLS

Check laser pushbutton (LAE)

RLS

Check Facility interlock (CB)

RLS

Check that in case the main interlock indicator is switched to red the following components will be switched off:

NPRO System stopped (LED Interlock)

RLS

FE-DB Laser Diodes stopped

RLS

PSI-4 Power Supplies Stopped (RSD, LED)

RLS

TECI-2 Power Supplies Stopped (RSD, LED)

RLS

Chiller Chillers switched off

X-tal only RLS

Check internal system relevant safety signals:

Diode chiller tested

Check for DB overtemp. signal

13 Oct 2011

DB1 (open on DB side)

RLS

DB2 (open on DB side)

RLS

DB3 (open on DB side)

RLS

DB4 (open on DB side)

RLS

FE-DB (open on DB side)

RLS

Check for chiller interlock

Chiller x-tal (open on chiller side)

RLS

Chiller diode (open on chiller side)

RLS

TEC (Switch off TEC 1)

RLS

TEC (Switch off TEC 2)

RLS

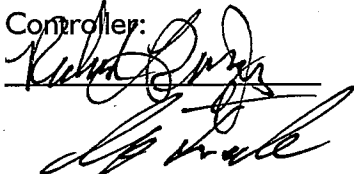
Lid Interlock Frontend

RLS

Lid Interlock High Power Oscillator

RLS

Comments: Tested w/ M. Frede Oct. 11, 2011

Controller: 

Date: Oct 11, 2011

13. Oct 2011 K. Hüb  
10/13/11 M. Frede