

FLD-6U laser power supply
(THALES' reference - MOD-PUISS-720J-0.2HZ-2000V-X4)

User Manual



Specification

Module is manufactured in accordance with THALES' technical task. Brief electrical and mechanical specifications are given below. Other parameters and characteristics can be found in original documents (USL-09-0127-JA rev A and GUY-041856 rev A).

ELECTRICAL SPECIFICATION

Input:	
Input voltage	1 phase, 230VAC (-20% / +10%), 50/60 Hz
Max. current	8 A
Type:	multichannel; 4 independent channels
Output (for each channel):	
Discharge type	complete discharge
Capacitor battery	360 uF
Max. voltage (Vmax)	2000 V
Voltage accuracy and stability	0.2% Vmax
Rated flashlamp	K0 – 19.7 Ohm A ^{1/2} ; arc length – 200 mm
Pulse width (with rated flashlamp)	300-350 us
Max. repetition rate (at max. output voltage)	0.2 Hz
Max. output power	150 W
Triggering	external triggering; module doesn't contain any triggering circuits; it just <u>waits</u> while external triggering occurs
Simmer current	600 mA
Simmer current stability	5%
Interface:	RS-485
Hardware protections:	from overvoltage, from overheating, from flashlamp breakdown, 10 A fuse
Environment:	
Operation temperature	0...+40 C
Storage temperature	-20...+60 C
Humidity	90%, non-condensing

MECHANICAL SPECIFICATION

Size (LxWxH)	481x474x264 mm
Weight	15 kg

Overview

FLD is a laser power supply designed for driving of pulsed flashlamp-pumped solid-state lasers such as Nd:YAG.

Module contains all necessary to drive flashlamp, i.e. capacitor charger, simmer supply, capacitor bank, computer interface etc. Water cooling system is not included.

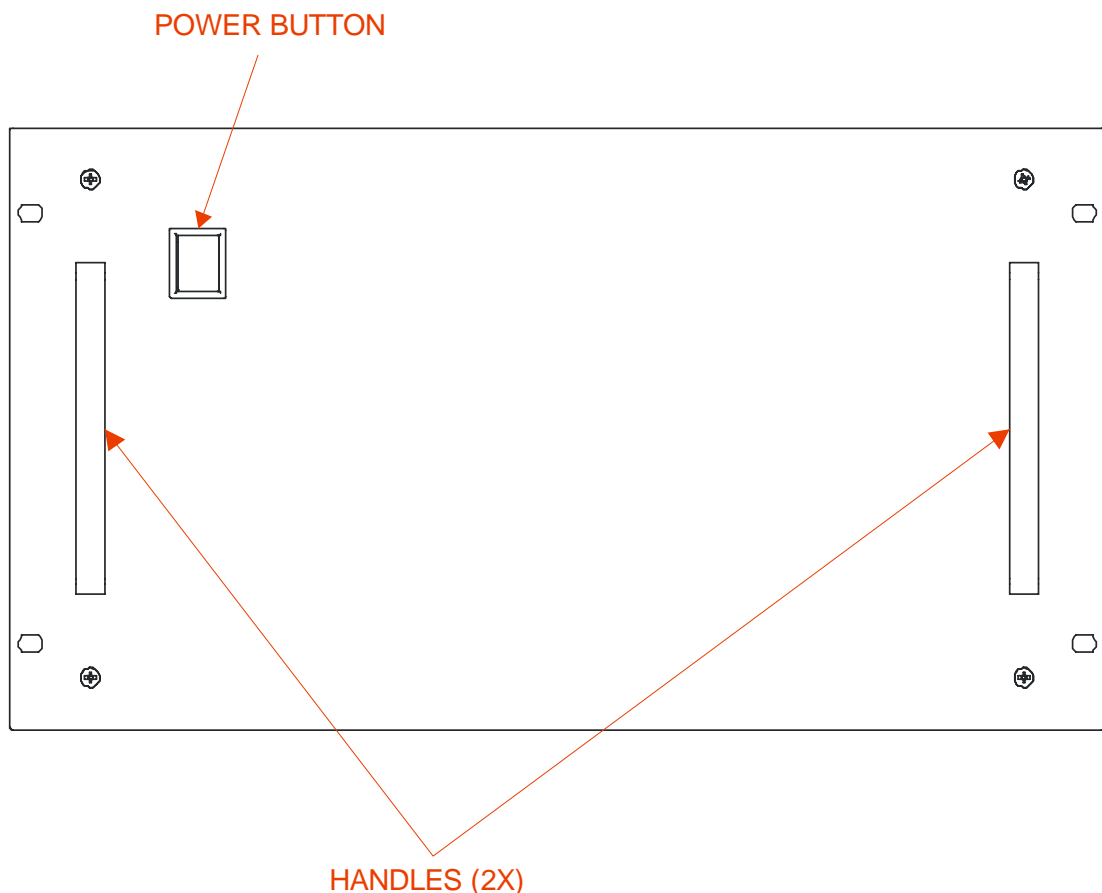
Module consists of four independent channels, i.e. up to four flashlamps may be operated by the module at the same time.

Module is driven via RS-485 user interface only.

Description

FRONT PANEL DESCRIPTION

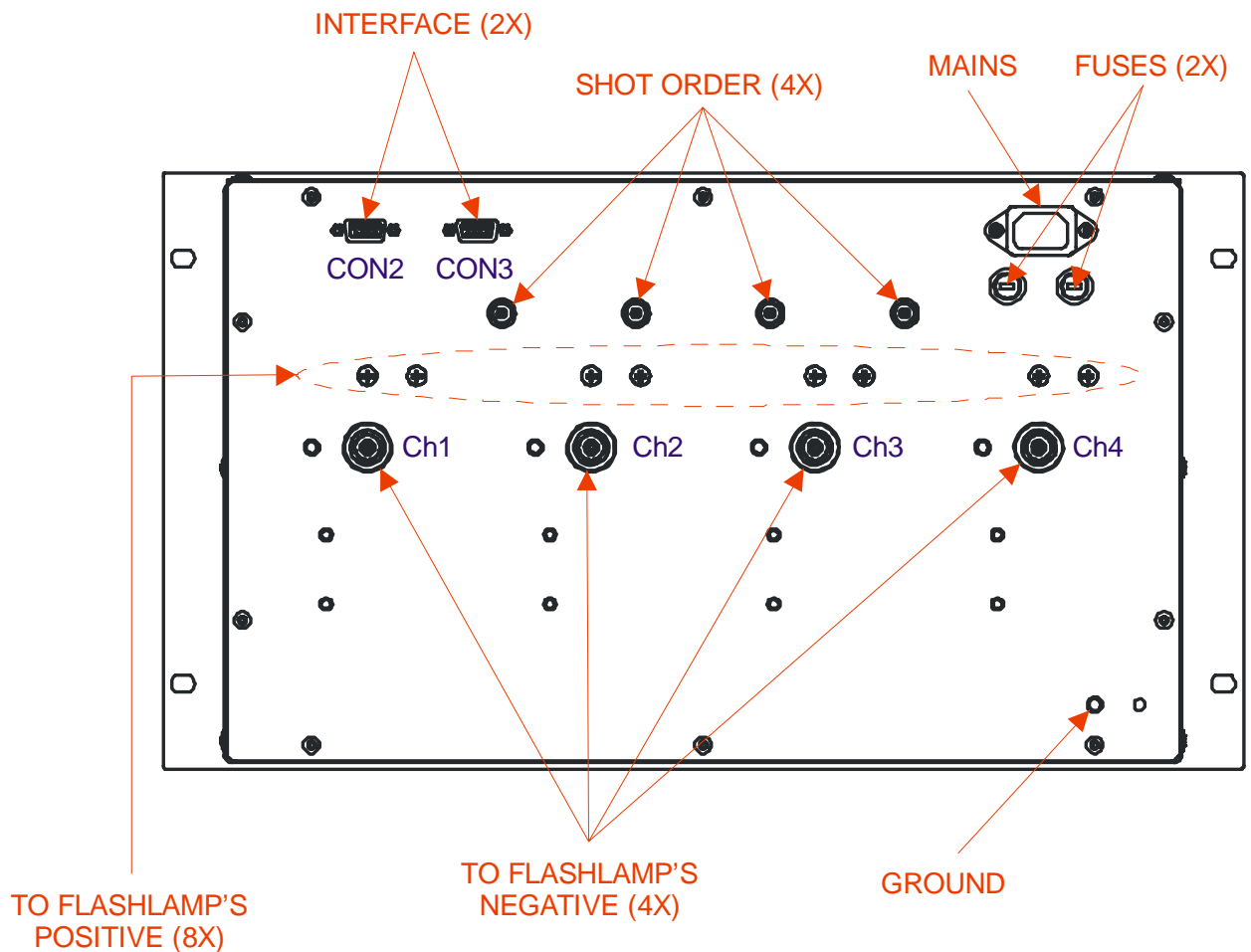
Front panel consist of just a few elements:



POWER switch – turns power supply on and off

HANDLES – two handles

BACK PANEL DESCRIPTION



MAINS – standard computer power socket; should be used to connect module to the mains

FUSES – two 10A fuses

GROUND – M6 threaded stud; should be used for module's grounding

FLASHLAMP POSITIVE – eight screws (two for each channel; one or two screws in each channel may be used for connections); flashlamp anodes should be connected to these screws

FLASHLAMP NEGATIVE – four high voltage connectors (manufacturer Fisher Connectors; type High-Voltage Receptacle D 105 A049; ordering code FP01.684/104186); flashlamp cathodes should be connected to these connectors

SHOT ORDER – four BNC-type connectors; synchronization pulse applied to some SHOT ORDER connector causes high voltage pulse in the corresponding channel

INTERFACE – two D-sub type connectors; are used to connect modules to each other and to the control unit; in THALES' terms the left one is CON2 connector, the right one is CON3 connector

Channels are aligned from the left to the right. First channel is the left one, fourth channel is the right one.

SOFTWARE DESCRIPTION

see APPENDIX 1. SOFTWARE DESCRIPTION

Safety

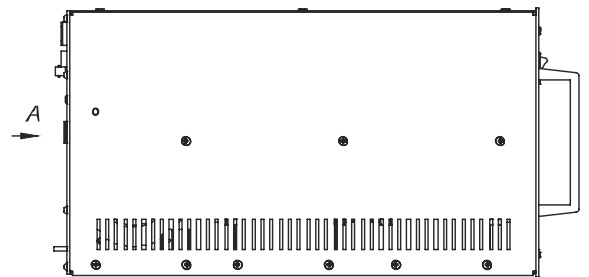
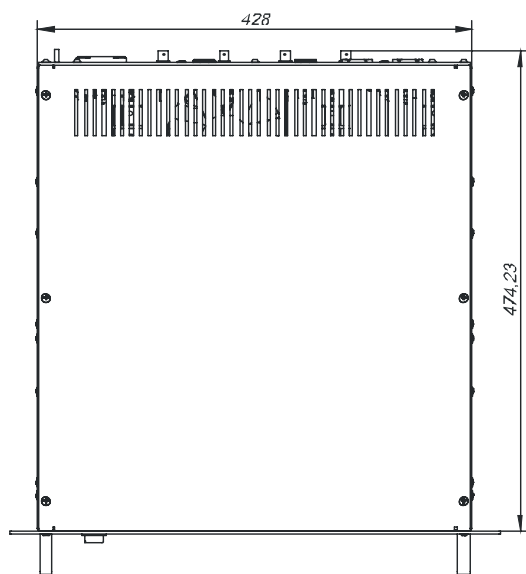
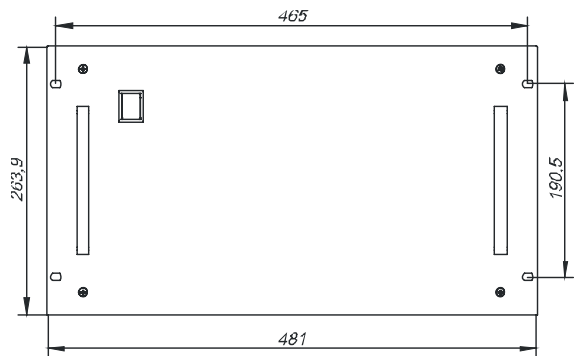
**Warning! This equipment produces high voltages that can be very dangerous.
Don't be careless around this equipment**

- During operation the protective covers of the equipment must be securely in place and all electrical connections must be properly attached
- Do not operate with disconnected load
- The FLD laser power supply is designed to be properly grounded
- It is the user's responsibility to ensure that personnel are prevented from accidentally contacting the power supply high voltage connectors and cables.
Casual contact could be fatal!
- **After shutdown, do not handle the system output until internal capacitor battery has been completely discharged.** Use an appropriate meter to check for complete discharge
- Disconnect the power supply from the mains before making or changing electrical or mechanical connections
- **Don't remove protective covers!** There are no user serviceable parts inside this equipment. Do not self-repair the driver
- Do not turn the driver on if it was already damaged with water, chemicals, mechanical or electrical shock

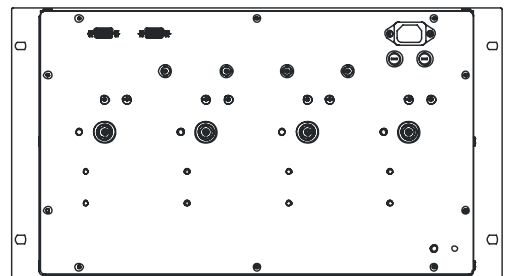
Operations (free-running)

1. Ensure both power supply and conjugated devices are turned off
2. Connect flashlamps to the power supply. Connect INTERFACE, SHOT ORDER connectors with conjugated devices
3. Connect power supply to the mains
4. Turn on the power supply, turn on other equipment you need for operations
5. Run operating software (HyperTerminal software or any else)
6. Operate (for example send to the module "[START]" command, then send "[STOP]" command)
7. To turn power supply off send there "[STOP]" command. Then turn power supply off

DRAWINGS



A



APPENDIX 1. SOFTWARE DESCRIPTION

rev. 1.04 dated 10.01.2011

States of operation.

Each channel of power supply can be put into one of several states: **stop**, **ignition**, **standby**, **run** or **failure**. If channel is disabled, it can be only in **stop** mode.

stop state: channel is deactivated;

ignition state: simmer supply is on and waits for external triggering; after turning on, channel switches into **run** or **standby** state.

standby state: simmer and capacitor charger are on, but shots are forbidden;

run state: the same as **standby**, but shots are allowed

failure state: channel automatically switches to **failure** state from **run** or **standby** states in case of overvoltage, low charge current or no simmer current, and from **run**, **standby** and **ignition** states in case of overheat. Transition to STOP mode takes off **failure** state and turns channel into **stop** state.

state	simmer	charger	pulses
stop	off	off	off
ignition	on (waiting external triggering)	off	off
standby	on	on	off
run	on	on	on

In order to achieve channel state, one can use S1..T2 commands.

Modes

Each channel can be set into one of several modes (see commands S0-T3)

STOP: channel turns off

STANDBY: turns on simmer and charges capacitors; pulses are forbidden. During turning on the system is in **ignition** state, then switching into **standby** state. If fault condition is met, then system switches into **failure** state

RUN: the same as STANDBY, but pulses are allowed, and system switching into **run** state

System commands

SAY command. Device answers *READY=int*, where *int* is a error code

START command. Tries to set all *enabled* channels to the RUN mode.

STOP command. Stops the power supply. All channels are turning into STOP mode

NAME sets name of a device

GNAME sets group name of a device

VER returns software version information

SN returns hardware version information

General commands

U0, U1, V0, V1 – sets/gets channel (1-4 resp.) voltage. Allowed range is 500-2000 (V), other values are ignored.

U2, U3, V2, V3 – gets channel (1-4 resp.) monitor voltage.

C1, C3, B1, B3 – enables or disables channel (1-4 resp.). If running channel is disabled, it turns off, otherwise no extra actions are performed. Allowed values are 0 (disable) and 1 (enable).

S0, S3, T0, T3 – sets the channel (1-4 resp.) into certain mode of operation. Allowed values are 0 (STANDBY), 1 (STOP), 2 (RUN).

S1, S2, T1, T2 – gets channel (1-4 resp.) state. Possible values are 0 (standby), 1 (ignition), 2 (stop), 3 (run), 4 (failure).

P0, P1, P2, P3 – channel pulse counter

All keys (SA?P) are supported

Dummy commands (provides no actions)

D0, D1, E0, E1 – sets channel trig delay

D2, D3, E2, E3 – sets sync out delay

A number of special commands used for manufacturer purposes (calibration, turning charger and simmer separately, etc) also realized.

Error masks occuring in case of fault condition:

0x0020, 0x0040, 0x0021, 0x0041 – overvoltage in channel (1-4 resp.)

0x0080, 0x100, 0x0081, 0x0101 – overheat in channel (1-4 resp.)

0x0200, 0x0400, 0x0201, 0x0401 – no simmer current in channel (1-4 resp.)

0x2000, 0x4000, 0x2001, 0x4001 – low charge current in channel (1-4 resp.)

All other error masks are not used and never occurs. User can obtain error code using ***SAY*** command

Possibility of broadcast commands

User can use group name for as to send broadcast commands targeting to several devices. Group name can be set up by command ***GNAME***. No answer is returning after broadcast command.

Examples

Master's commands are written in **black**, module's response in **blue**, comments and description of user's actions – in **green**

1/ First example (common)

[START] simmer supplies wait for external triggering
then we manually trigger the 1st channel only
[S1/?][MS:S1/S3\\PS] 1st channel is ok
[T1/?][MS:T1/S1\\PS] 3rd channel still waits for external triggering
then we manually disconnect cap. charger of the 1st channel, then we
make pulse in the 1st channel, since cap. charger is disconnected real voltage
on capacitor is zero
[S1/?][MS:S1/S4\\PS] failure
[SAY][MS:READY=8192\\PS] i.e. low charge current in channel 1 error
then we try to start 1st channel again
[START] (or [S0/S2]) and manual triggering of the 1st channel
[S1/?][MS:S1/S3\\PS]
[P0/?][MS:P0/S1000\\PS] pulse in the 1st channel
[P0/?][MS:P0/S1001\\PS][STOP]

2/ Second example (inhibition)

[START] manual triggering of the 1st channel
[S1/?][MS:S1/S3\\PS] we set manually inhibition to "0",
immediately all simmer supplies stop working,
in a few seconds we set manually inhibition to "1" again
[S1/?][MS:S1/S4\\PS]
[SAY][MS:READY=512\\PS] no simmer error