Read this manual before operation

➢ The content include of electric connections and operating steps

➢ Read the manual to operate the systems

# RDEncLas400G

## intelligent laser control module

## RuiDa Technology Co., Ltd

Addr:    2th    floor,Technology    Building,NO.,1057    Nanhai
         Avenue,Nanshan    District,Shenzhen    city,Guangdong
         Province,P.R.China
Tel:     0755--26066687
Fax:     0755--26982287
E-mail:    sales@rd-acs.com
Web:    www.rd-acs.com

# COPYRIGHT

# CERTIFICATION DECLARATION

## CE

The product has been certified by the CE (Commutate European) safety certification.    It has passed the corresponding conformity assessment procedure and the manufacturer's declaration of conformity, in accordance with the relevant EU directive.

## ROHS

This product has been certified by EU legislation (Restriction of Hazardous Substances) Safety certification; comply with relevant EU environmental regulations.

## FCC

This product has been certified by the Federal Communications Commission for safety, Comply with us electronic safety regulations.

# SAFETY INFORMATION

When using this system, please make sure the operation is correct and the usage is safe. Some signs or text will be used to remind you to pay attention to the dangerous matters and some important information.

### Dangerous：

Indicates a serious danger. In the process of use, if the operation is improper or the way of use is wrong, it may cause serious injury or even death to the user. Please do not operate it easily until you have made sure that the operation method is correct and the way of use is correct.

### Warning：

Danger.n the process of use, if the operation is improper or the use is wrong, which may lead to the injury of the personnel, please do not operate the personnel and related personnel easily, until ensure the correct operation method and use method is correct before use.

### Cautious：

Represents the potential risk of the product. In the process of use, if the use method is wrong or improper operation, it may cause damage to the product or some parts. Please do not use it until you have made sure that the operation method is correct and the usage is correct.

### Important：

Represents important information to be paid attention to during the use of the product.Please do not ignore this information, this information will provide effective operational help.

This sign indicates laser radiation, which is usually posted on products with laser output. Please be careful with laser and pay attention to safety when using this kind of equipment.

# Sign in、Devanning、Examine cargo

The product itself with plastic or metal shell, can protect the external electrical components from damage. The products are packed in foam bags and anti-static bags. If there is any external damage to the package, check the equipment and notify the carrier and carrier in writing of the damage.

**Inportant:**
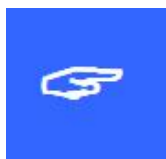
After receiving the product, please check whether the outer package is intact, check whether the product is complete after unpacking and whether all parts are intact. If any damage is found, please contact ruida immediately.

Remove all cargo from package and keep packing material and wiring parts. Please take care of the safety of the goods when unpacking them.After taking out the goods, please check whether the parts are complete and intact. If any missing parts or damaged parts are found, please contact ruida technology immediately.Do not install or debug the equipment if any obvious damage is found.

# Accessories:

| Part | Quantity | Note |
|---|---|---|
| LCM controller | 1 | Main controller |
| DB9 Serial connection line | 1 | RS232 Serial communication connection line |
| 2-P green connectors | 1 | |
| 3-P green connectors | 1 | |
| 4-P green connectors | 3 | |
| 6-P green connectors | 4 | |

# Contents

# Section 1　Introduction

## CONTENTS:

## 1.1 Specifications

| NN | Characteristics | Min. | Typ. | Max. | Unit |
|----|-----------------|------|------|------|------|
| 1 | PSP high width | 0.01 | 0.2 | 50.00 | mm |
| 2 | PSP low width | 0.01 | 0.2 | 50.00 | mm |
| 3 | PSV frequency | 1.0 | 20.0 | 300.0 | KHz |
| 4 | PSV resolution | 0.1 | 1 | 100.0 | % |
| 5 | Laser on delay | 0.00 | -- | 100.00 | ms |
| 6 | Laser off delay | 0.00 | -- | 100.00 | ms |
| 7 | Power for fiber laser | 0.1 | -- | 100 | % |
| 8 | Standby frequency | 1.0 | 10.0 | 300.0 | KHz |
| 9 | FPS delay | -30.000 | 0 | 30.000 | ms |
| 10 | FPS width | 0 | 0 | 50.000 | ms |
| 11 | Encoder frequency | 1 | -- | 50000 | KHz |
| 12 | Input pulse frequency | 1 | | 50000 | KHz |
| 13 | BPS for RS232 | | 115200 | | bps |

# 1.2 Outside dimensions of LCM
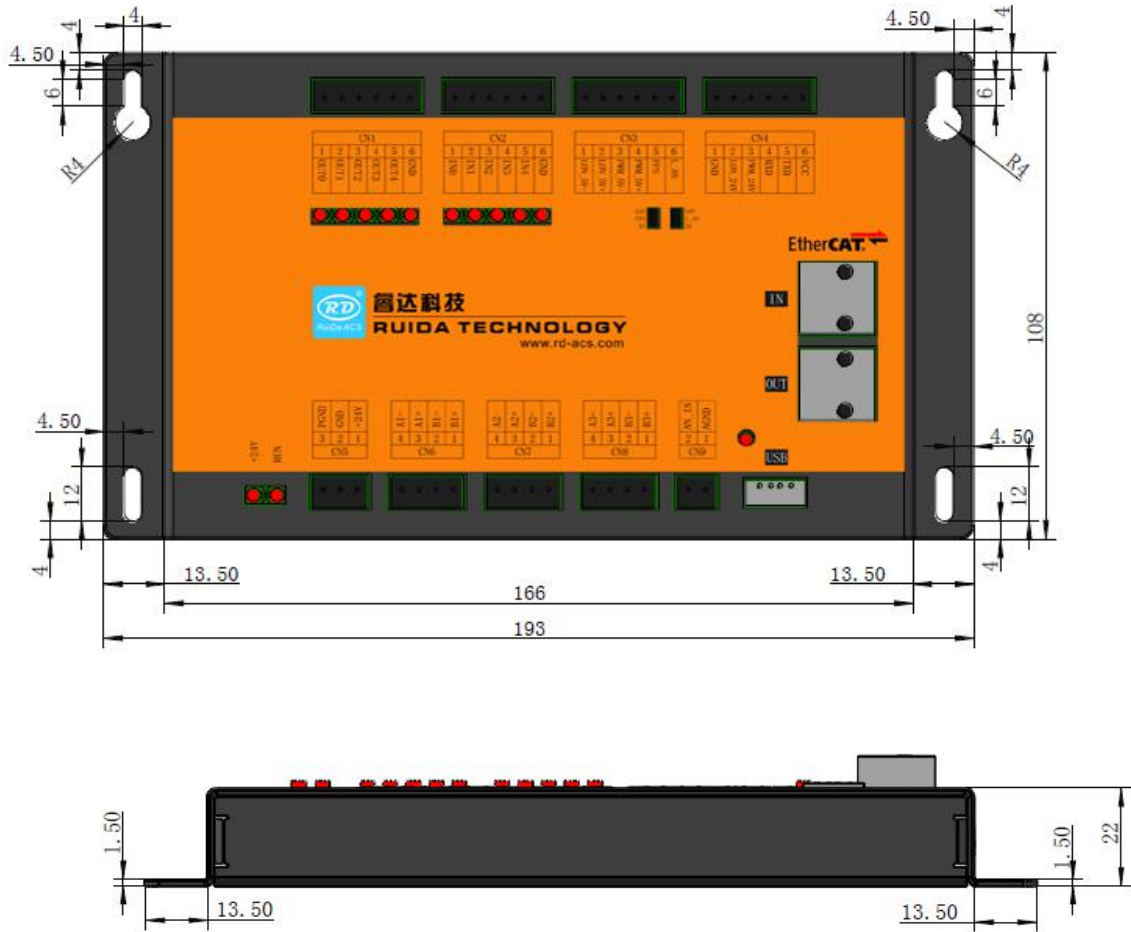
# Section 2　Control interface

## CONTENTS:

- Electrical wiring diagram
- Universal output (CN1)
- Universal input (CN2)
- Laser control interface (CN3, CN4)
- RS232 communication interface (CN4)
- Power supply (CN5)
- Encoder or pulse input interface (CN6、CN7、CN8)
- Analog input (CN9)
- Encode switch
- EtherCAT
- USB interface
- LED indicators

# 2.1 Electrical wiring diagram

Sample 1: laser source is RF CO2 laser. Control pulse from motion controller are the feedback signals for calculation. This is shown as picture 2.1.1.
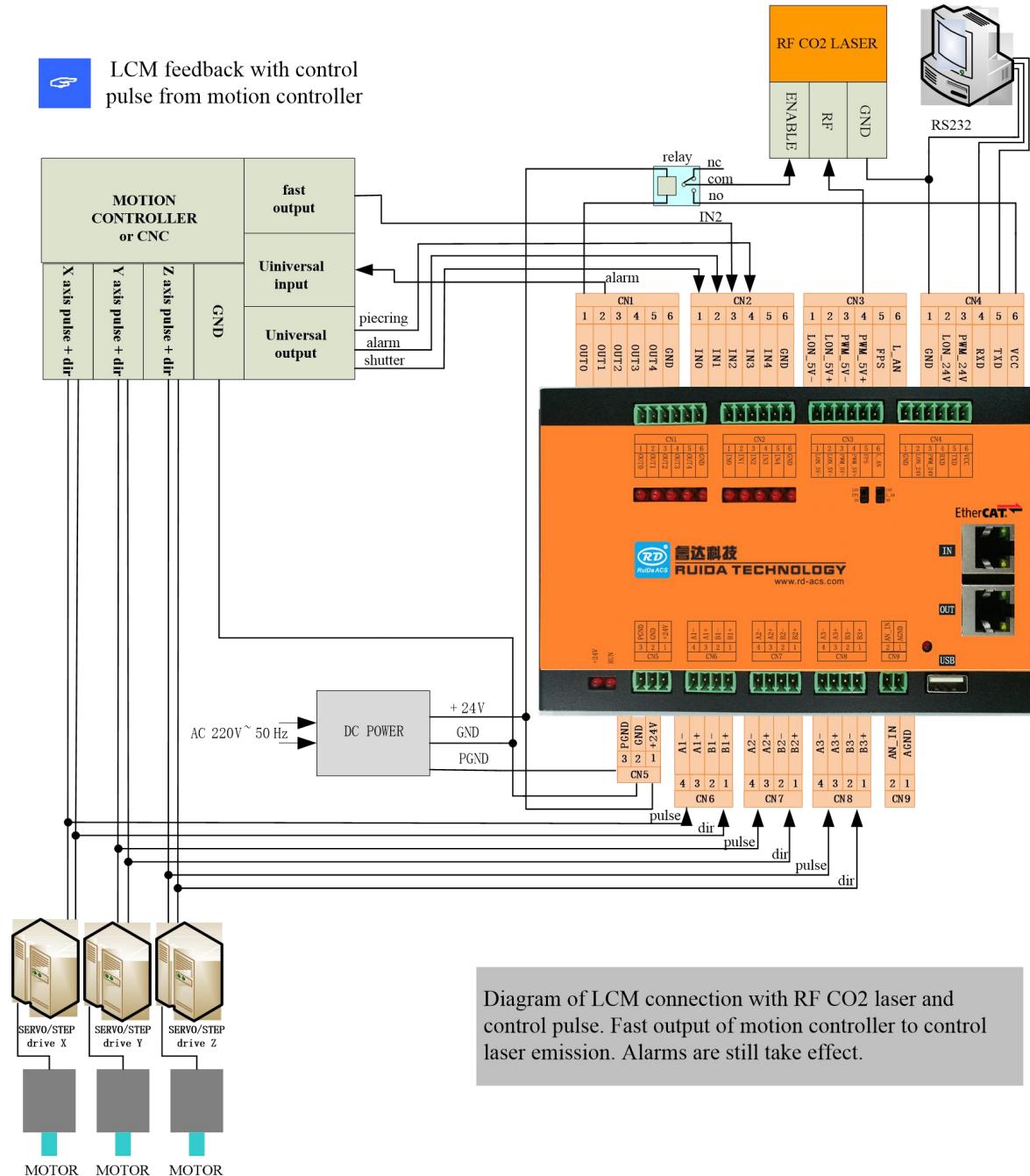


Picture 2.1.1 electrical wiring diagram

Sample 2: laser source is FIBER laser. AB signals from encoder are the feedback signals for calculation. This is shown as picture 2.1.2.
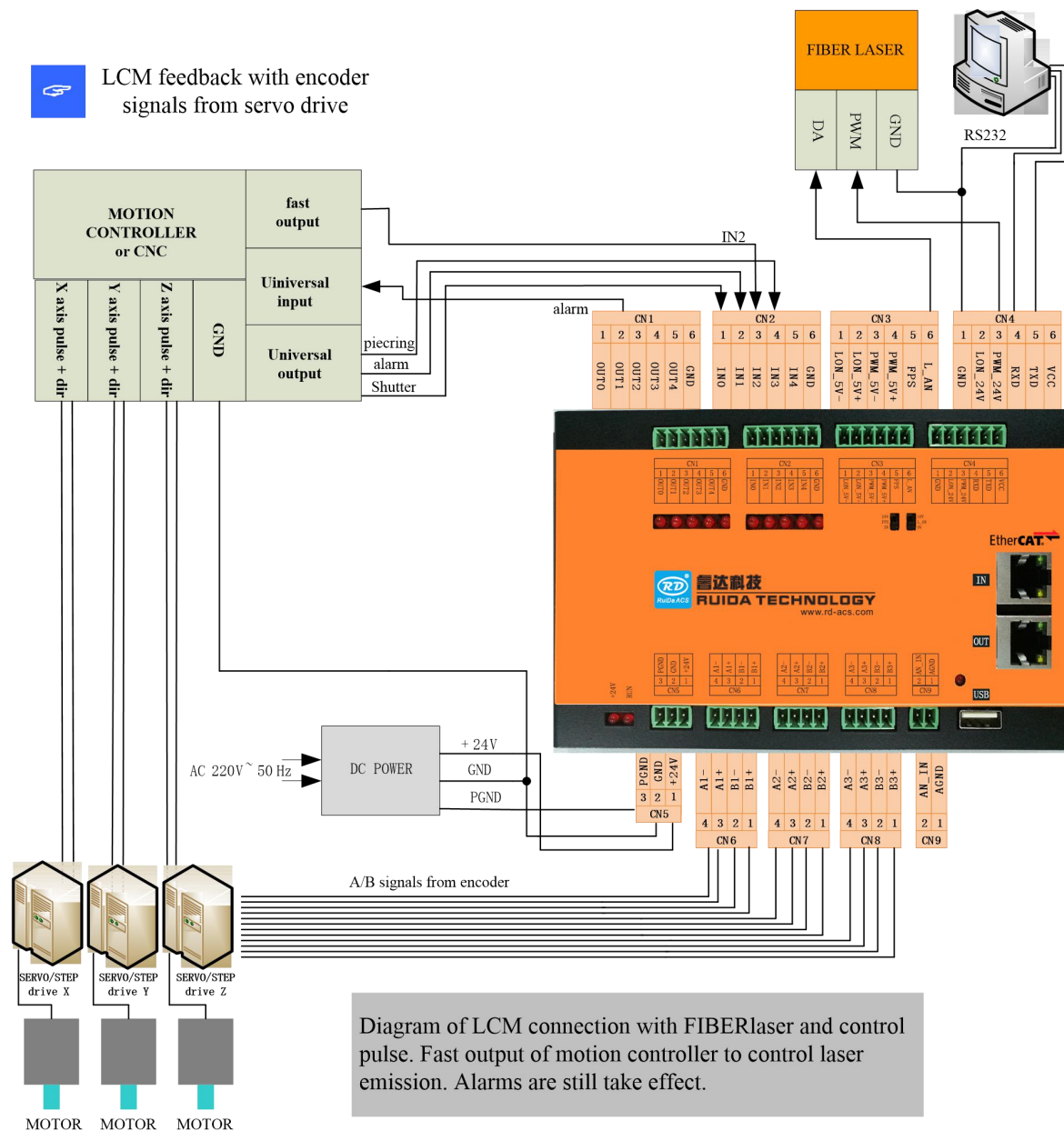


Picture 2.1.2 electrical wiring diagram

## 2.2 Universal output (CN1)

The output definition is shown as table 2.1

| PIN | Signal | Definition | Description |
|---|---|---|---|
| PIN1 | OUT0 | Shutter control output | Control the shutter or enable of laser.<br><br>Open collector output. Able to drive relays |
| PIN2 | OUT1 | Alarm output | Output alarm signal to motion controller. When LCM detects the alarm of external devices and internal error, the signal is activated.<br><br>Open collector output. Able to drive relays |
| PIN3 | OUT2 | Reserved | — |
| PIN4 | OUT3 | Reserved | — |
| PIN5 | OUT4 | Reserved | — |
| PIN6 | GND | — | — |

# 2.3 Universal input (CN2)

LCM outputs laser gate signal in real time by detecting the laser control signals from the motion controllers. This is shown as picture 2.2. Active low is in default. But user can change the active level by change the parameter[1].

When a laser piercing is needed, there is another signal specialized for laser piercing.

It is active low. If a low level is active, the LCM will output a piercing power for laser piercing.
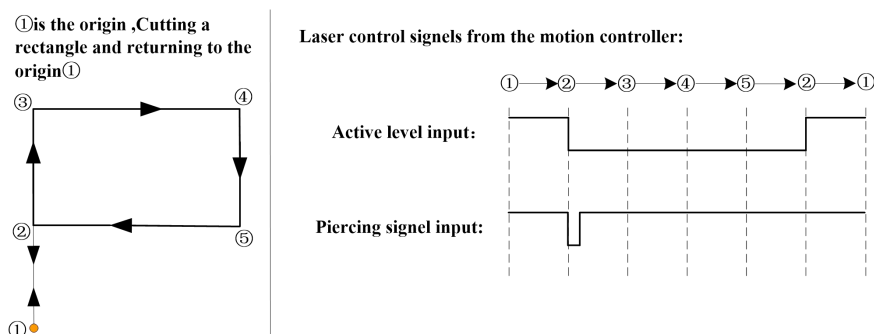


Picture 2.2 laser control principle

**NOTICE:**

*Parameter in the laser item names input active level. Change it to "High" level when the external input is high valid level. Otherwise select "Low".*
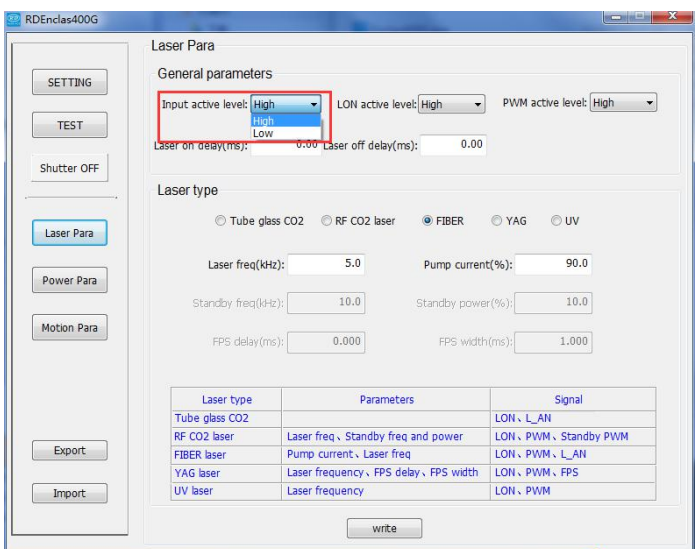
The input definition is shown as table 2.2.

| PIN | Signal | Definition | Description |
|---|---|---|---|
| 1 | IN0 | Shutter control input[2] | Connect to laser shutter control signals or enable signal from the motion controllers. Active low. OUT0 signal is synchronized with this input. |
| 2 | IN1 | Alarm input[3] | External alarm input. Active low. OUT1 signal is synchronized with this input. |
| 3 | IN2 | Laser control input | Connect to laser control signals from the motion controllers. Active low in default. Active level can be redefined. Compatible with 24V or 5V. |
| 4 | IN3 | Piercing signal input | If the external controller support laser piercing function, this is input for this signal. During the laser piercing, the LCM output laser piercing power. Compatible with 24V or 5V. |
| 5 | IN4 | Reserved | -- |
| 6 | GND | Reserved | -- |

**NOTICE:**

*(2) , (3)Compatible with 24V or 5V.*
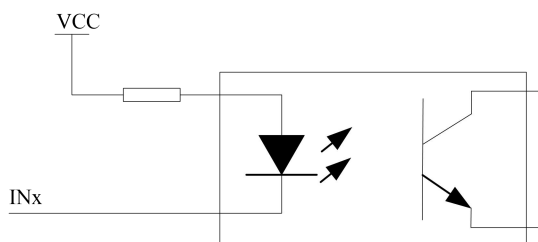
## 2.4　Laser control interface (CN3, CN4)

Laser control interface gives laser control signals that include of laser gate, PWM, FPS, and analog. With these signals, different laser sources can be supported such as UV laser, FIBER laser YAG laser, CO2 laser. The signals for laser are defined as table 2.3.

Notice: LON, PWM and FPS can compatible with 24V or 5V. Active level of LON signal can be redefined with parameter[4]. User can changed it with configuration software based on RS232. LON, PWM at 5V level support differential output. This is shown as picture 2.3. FPS signal level can be selected 5V or 24V[5]. L_AN analog signal output scale can be selected from 0~5V to 0~10V[6].
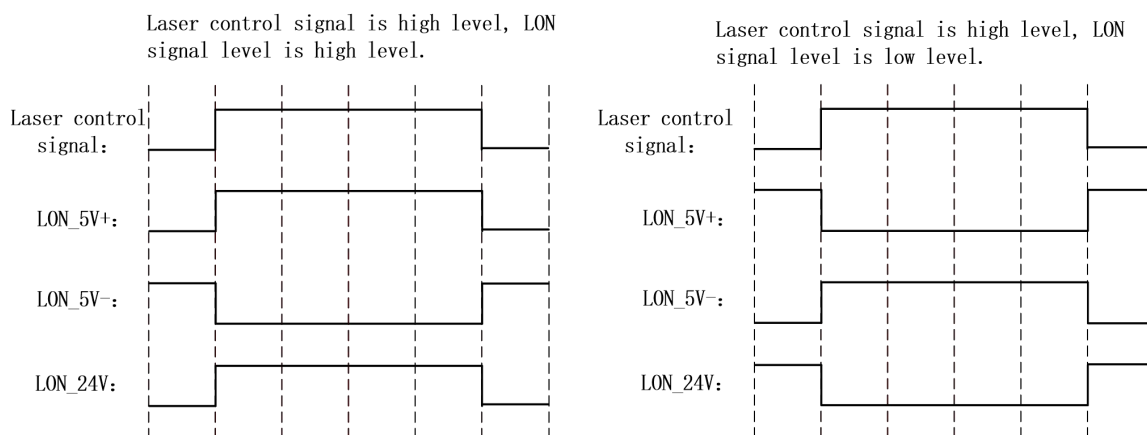
Picture 2.3 LON signal

Table 2.3 Definition for LCM laser control.

| PIN | Signal | Definition | Description |
|---|---|---|---|
| CN3    connector | | | |
| PIN1 | LON_5V- | Differential output. | Laser emission control signal. Active low. TTL level. Compatible with TIA/EIA-422-B. |
| PIN2 | LON_5V+ | Differential output. | Laser emission control signal. Active high. TTL level, Compatible with TIA/EIA-422-B. |
| PIN3 | PWM_5V- | Differential output. | Laser modulation signal. Active low. TTL level. Compatible with TIA/EIA-422-B. |
| PIN4 | PWM_5V+ | Differential output. | Laser modulation signal. Active high. TTL level. Compatible with TIA/EIA-422-B. |
| PIN5 | FPS | FPS | First pulses killer. Active level can be defined by an encoder on board. |
| PIN6 | L_AN | Analog | Voltage scale can be defined by an on board encoder. 5V or 10V can be changed. |
| CN4    connector | | | |
| PIN2 | LON_24V | LON | Laser gate control signal,24V. |
| PIN3 | PWM_24V | PWM | Laser modulation signal, 24V. |
| PIN6 | VCC | +5V or 24V | Support +5V and 24v. +5V in default |
| PIN1 | GND | Referenced ground | — |

*NOTICE:*

*Parameter in the laser item names input active level. Change it to "High" level when the external input is high valid level. Otherwise select "Low".*

*(5) FPS signal level can be selected 5V or 24V*

| | |
|---|---|
| 24V | 24V |
| FPS | FPS |
| 5V | 5V |
| 5V logic signal level | 24V logic signal level |

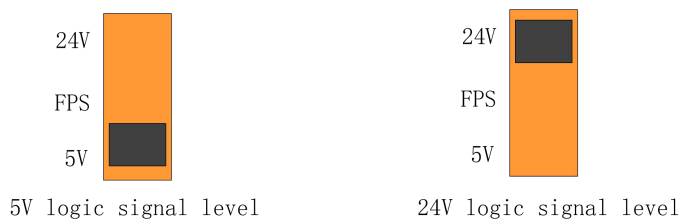*(6)L_AN analog signal output scale can be selected from 0~5V to 0~10V*
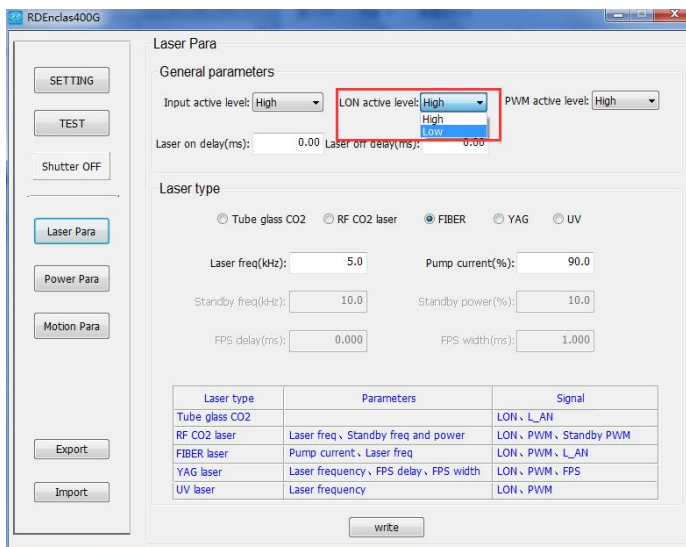
| | |
|---|---|
| 10V | 10V |
| L_AN | L_AN |
| 5V | 5V |
| L_AN analog signal output scale from 0 to 5V. | L_AN analog signal output scale from 0 to 10V. |
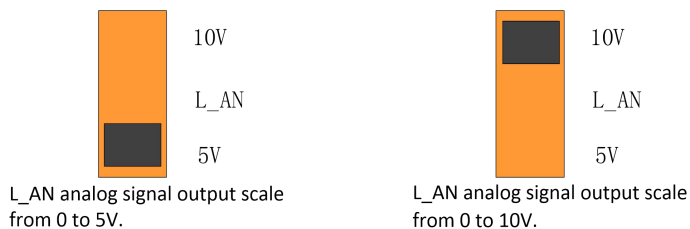
# 2.5 RS232 communication interface (CN4)

RS232 communication interface is specialized for parameters configuration by software running on it. Table 2.4 is the definition of the interface.

Table 2.4 Definition of RS232 communication interface

| PIN | Signal | Definition | Description |
|---|---|---|---|
| PIN1 | GND | Referenced ground | — |
| PIN4 | RXD | RXD | To RXD of computer |
| PIN5 | TXD | TXD | To TXD of computer |
| PIN6 | VCC | +5V or 24V | Support +5V and 24v. +5V in default |

Picture 2.4 shows the wiring of RS232 communication.

| LCM | CN4 | 4 | RXD | gray | DB9 | RXD | 2 | PC |
|---|---|---|---|---|---|---|---|---|
| | | 5 | TXD | orange | | TXD | 3 | |
| | | 1 | GND | white | | GND | 5 | |
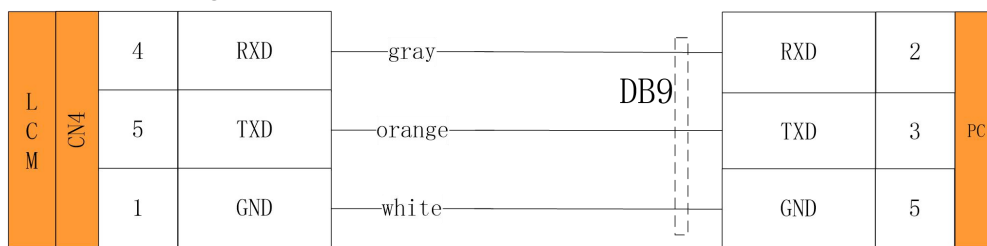
Picture 2.4 wiring of RS232 communication

# 2.6 Power supply (CN5)

Table 2.5 shows the definition of the power supply.

| PIN | Signal | Definition | Description |
|------|--------|-----------------|-------------|
| PIN1 | VCC | +24V | +24V, > 2A |
| PIN2 | GND | Referenced ground | — |
| PIN3 | PGND | Shield ground | To the earth |

# 2.7 Encoder or pulse input interface (CN6、CN7、CN8)

LCM support AB quadrate encoder input or pulse+direction input. This can be selected with parameters in the LCM. This can be done by a software for LCM. Table 2.6 shows the definition of the signals of CN6, CN7, CN8.

Table 2.6

| PIN | Signal | Definition | Description |
|------|--------|-----------------------------------------------------|-------------|
| PIN1 | B+ | B+ from encoder or<br>Dir+ from motion controller | A+,A- and B+,B- are differential signals from rotary encoder or linear encoder.<br>Pulse+,Pulse- and Dir+,Dir- are differential signals from motion controller. |
| PIN2 | B- | B- from encoder or<br>Dir+ from motion controller | |
| PIN3 | A+ | A+ from encoder or<br>Pulse + from motion controller | |
| PIN4 | A- | A- from encoder or<br>Pulse - from motion controller | |

Picture 2.7 shows the wiring from LCM to encoder or motion controller.
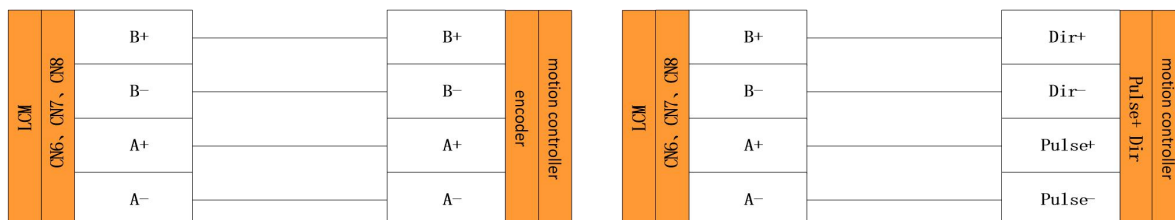


Picture 2.7 wiring of encoder or pulse input interface

# 2.8 Analog input (CN9)

LCM support analog input for analog voltage detecting. This interface gives much more flexible usage for users. The definition is shown in table 2.7.

Table 2.7

| PIN | Signal | Definition | Description |
|------|--------|---------------|-------------|
| PIN1 | AGND | Analog ground | |
| PIN2 | AN_IN | Analog input | 0-10V |

# 2.9 Encode switch

🟧 **FPS active level configuration**

FPS signal support 5V and 24V. This can be select according different encoder status. In default, the FPS is 5V logic level. Encoder switch configuration is shown as picture 2.9.
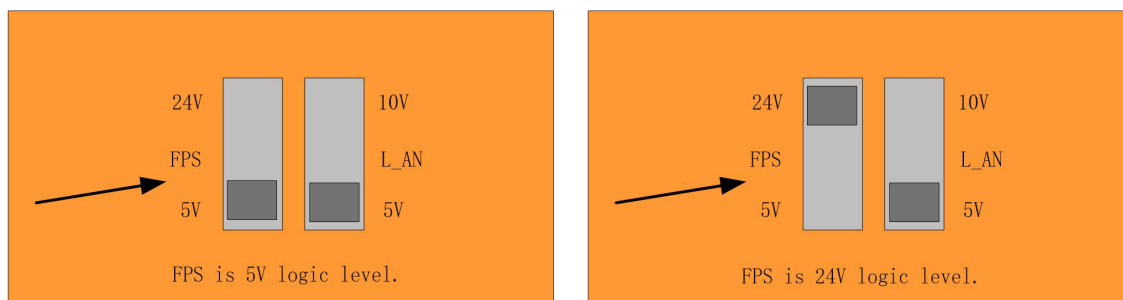


🟧 **Analog output configuration**

L_AN is an analog output signal. The scale of the voltage output can be 0~5V or 0~10V. The scale that should be selected is up to the laser source requirement. In default, it is 0~5V. Encoder switch configuration is shown as picture 2.10.
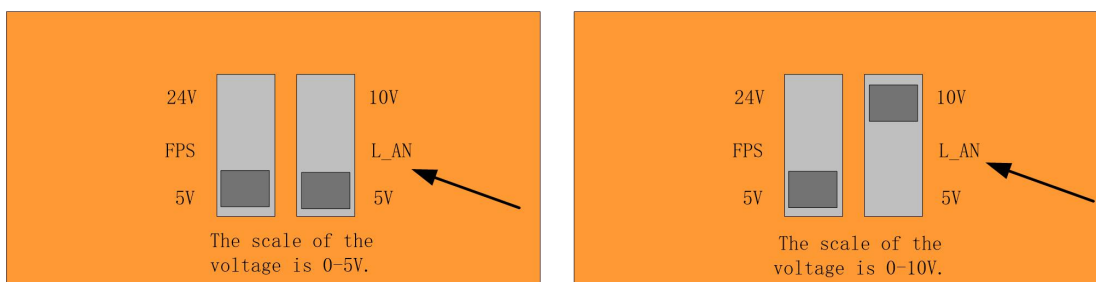
## 2.10    EtherCAT

EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany. If RDEncLas400G do not support EtherCAT. Only RDEncLas400N support the EtherCAT.

## 2.11    USB interface

USB interface is specialized for U disk. This interface is usually for firmware upgrading. Never connect this to the USB interface on the computer.

## 2.12    LED indicators

| LED | Description |
|-----|-------------|
| +24V | Power indicator for 24V |
| RUN | System running indicator. Twinkle once every 1second. Under test mode, twinkle once every 3 seconds. |
| OUT0 | Shutter signal indicator |
| OUT1 | Alarm signal indicator |
| OUT2 | Signal Indicator for OUT2 |
| OUT3 | Signal Indicator for OUT3 |
| OUT4 | Signal Indicator for OUT4 |
| IN0 | Shutter signal indicator of the input from motion controller |
| IN1 | Laser control signal indicator of the input from motion controller |
| IN2 | Laser piercing signal indicator of the input from motion controller |
| IN3 | Alarm signal indicator of the input from motion controller |
| IN4 | Indicator for IN4 |
| USB | USB indicator when upgrading the firmware. |

# Section3　Wiring diagram for lasers

## CONTENTS:

# 3.1 Glass CO2 laser

Glass tube CO2 laser has 2 control inputs such as laser gate and laser power. Laser power is controlled by analog input. The scale of the analog input is from 0V to 5V. Picture 3.1 is the diagram for LCM connecting with glass tube CO2 laser.
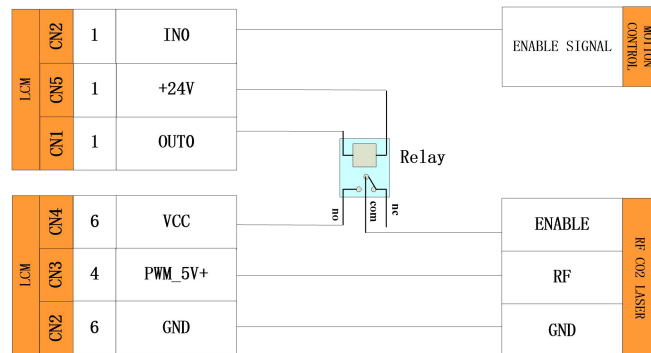
| LCM | CN3 | 2 | LON_5V+ | | LASER ON | Glass CO2 Laser |
| | | 6 | L_AN | | LASER POWER | |
| | CN2 | 6 | GND | | GND | |

Picture 3.1

# 3.2 RF CO2 laser

RF CO2 laser has 2 control inputs such as enable and PWM. ENABLE of laser should be activated first before control the laser. Once the enable is activated, the PWM can control the power of laser and the laser emission. Shown as Picture 3.2.

**RF CO2 laser need an enable signal，enable of laser should be activated first at least 100ms before control the laser. The whole process is valid until the end of the work. Of course, it can also be directly connected to 5V**.

| LCM | CN2 | 1 | IN0 | | ENABLE SIGNAL | MOTION CONTROL |
| | CN5 | 1 | +24V | | | |
| | CN1 | 1 | OUT0 | Relay | | |
| LCM | CN4 | 6 | VCC | | ENABLE | RF CO2 LASER |
| | CN3 | 4 | PWM_5V+ | | RF | |
| | CN2 | 6 | GND | | GND | |

Picture 3.2

# 3.3 Fiber laser control

For a basic fiber laser control, there are 2 control signals. L_AN is used to control the power of fiber laser. PWM_24V is used to control the laser emission. And also there are some auxiliary control signals such as shutter, alarm. User can connect the other IO on LCM with these.

There are the same connections for fiber laser control. One method only controls the laser emission signal. And another connects the PWM on LCM to control the laser emission on laser source. They have different method to control the power of laser source. Shown as the picture 3.3-1 and picture 3.3-2.

**PWM control the laser power of laser source and laser emission. L_AN only control the peak pump current for laser source.**
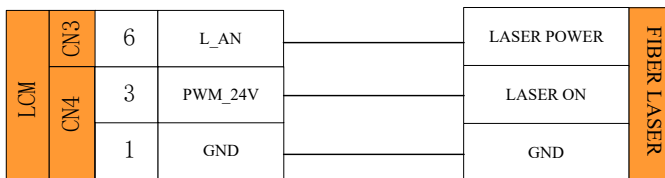
| LCM | CN3 | 6 | L_AN | | LASER POWER | FIBER LASER |
|-----|-----|---|------|---|-------------|-------------|
| | CN4 | 3 | PWM_24V | | LASER ON | |
| | | 1 | GND | | GND | |
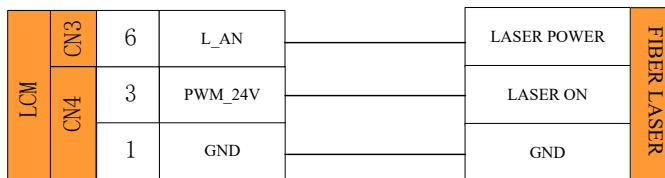
Picture 3.3-1

**LON_24V control the laser emission of laser source. L_AN only control the peak pump current for laser source.**

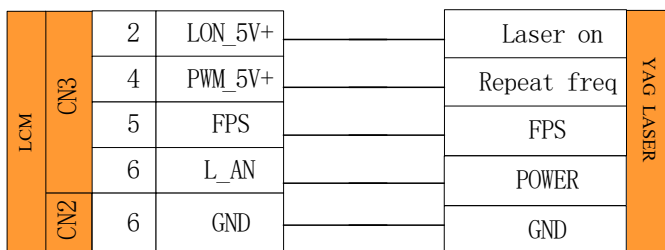| LCM | CN3 | 6 | L_AN | | LASER POWER | FIBER LASER |
|-----|-----|---|------|---|-------------|-------------|
| | CN4 | 3 | PWM_24V | | LASER ON | |
| | | 1 | GND | | GND | |

Picture 3.3-2

*We recommend users to use this connection shown as picture 3.3-2. Especially in PSP mode, the laser on time is short and the laser spots are scattered evenly. Laser power for single laser spot is neglected.*

# 3.4 Fiber laser control

YAG laser should have several control signals that include of laser emission, repeat frequency, pump current and FPS. The connection is shown as picture 3.4.

**YAG has a complex control mode. The laser emission signal used to control the laser emission or not. Repeat frequency is used to send the modulate pulse to the laser source. FPS is to kill the first pulses and L_AN is to control the pump current.**
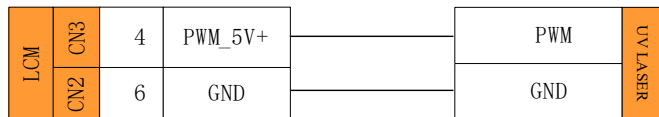
| LCM | CN3 | 2 | LON_5V+ | | Laser on | YAG LASER |
|-----|-----|---|---------|---|----------|-----------|
| | | 4 | PWM_5V+ | | Repeat freq | |
| | | 5 | FPS | | FPS | |
| | | 6 | L_AN | | POWER | |
| | CN2 | 6 | GND | | GND | |

Picture 3.4

## 3.5 UV laser

For UV laser, the most popular wiring of LCM and laser source are shown as picture 3.5-1, picture 3.5-2.

**UV laser source has only one control input. Laser emission is controlled. PSP mode is much more suitable for the UV lasers.**

| LCM | CN3 | 4 | PWM_5V+ | | PWM | UV LASER |
|-----|-----|---|---------|---|-----|----------|
| | CN2 | 6 | GND | | GND | |

Picture 3.5-1

**UV laser source has only one control input. Laser emission is controlled. PSP mode is much more suitable for the UV lasers.**

| LCM | CN3 | 4 | PWM_5V+ | | PWM | UV LASER |
|-----|-----|---|---------|---|-----|----------|
| | CN2 | 6 | GND | | GND | |
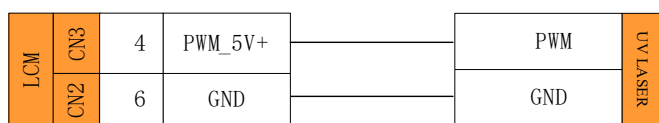
Picture 3.5-2.

☞ **If there are some laser source that is not included in the laser source above, please contact us. We will give you the solution.**

# Section 4   Commissions

## CONTENTS:

■  **Preparation for use**

■  **Parameters configuration software**

■  **Trouble shooting**

# 4.1　Preparation for use

■ **Correct wiring for use**

Make a correct conection among LCM and laser ource and motion controller. If something is not sure,please contact Ruida technology.

■ **Parameters configuration**

Before the laser source is connected to LCM, make sure the parameters have been configured correctly. If it is the first time to use LCM, user should build up a correct connection via RS232 between computer and LCM to configure the parameters. Open the software and set the correct parameters to LCM. When power on the LCM, the led indicator will turn on. Check the status of the LED and make sure that the LCM is working normally. Parameters configuration, Please refer to chapter 4.2 in detail.

■ **Function test**

When the parameters have been set, user can test the module with the software. Press "TEST" button to go to test mode. Before testing, please make sure the machine is idle. And check the "RUN" led indicator; twinkle once every 3 seconds, indicate the LCM is in the test mode.

**When escape from test mode, please ensure that there is no valid signal input to IN2 interface. Please refer to chapter 4.2 to get more information for test mode.**

■ **Start working**

## 4.2    Parameters configuration software

Parameters configuration software set the parameters to LCM via RS232. users should set the correct parameters to LCM according to the laser source.

Picture 4.2-1 shows main interface of the software. There are 7 items named setting, test, shutter off/on, laser para, power para, motion para, Load to file and load from file. In the "setting" item, language and RS232 can be modified.

■ **SETTING**

Picture 4.2-1

**Click the "SETTING", and then pop up the dialog. User can change the language. Chinese is default. In the COM configuration, port number can be changed according different hardware. Click "OPEN", COM port is enabled. In the open status, user can click "CLOSE" to close the COM port.**
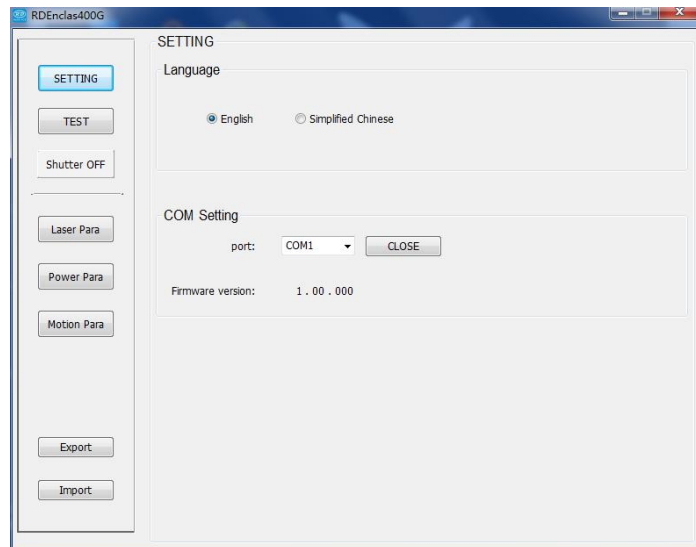


■ **TEST**

Before LCM start working, it is necessary to do some test firstly. User can do some hardware test and laser emission by software included in the product. When do testing, user should set the LCM to 'TEST' mode. In the test mode, the running LED will flash for every 3 seconds. The interface of test is shown as picture4.2-2. Press 'Pulse' button can enable laser emission. The function of 'pulse' support pulse mode and CW mode. User can select the work mode of 'pulse'. In the pulse mode, there is a parameter named pulse time should be set to a non-zero value. The value determine the laser emission time. Laser emission power of pulse can be modified also. In the CW mode, if user press the 'pulse 'button, laser emission enabled until the button is released.

Picture 4.2-2

**Hardware test include of universal input and universal output. The inputs can display the external status of the hardware ports. Select the out ports and there will be logical '1' or '0' to be output.**

**When finished the testing, user can press 'write' to save the parameters to LCM.**
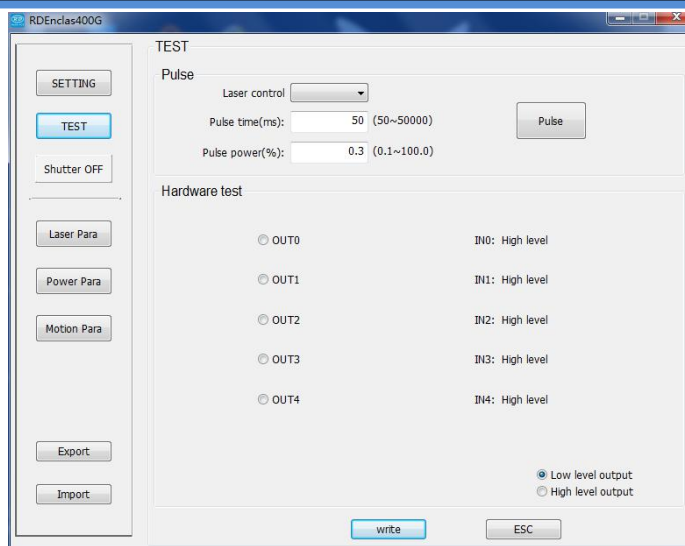


The parameter's specification is shown in table 4.2-1

Table 4.2-1

| Parameter | Description | Data scale (unit) |
|---|---|---|
| Pulse control | Select the mode of laser emission. CW mode and pulse mode | — |
| Pulse time | In pulse mode, the time of laser emission | 50—50000(ms) |
| Pulse power | Laser power of laser emission | 0.1—100.0(%) |
| pulse | Enable or disable laser emission | — |
| HW test | Universal input and output test | — |

**Before going to TEST mode, please ensure the machine is idle.**
**When escape from the TEST mode, please ensure there is no valid signal in the IN2 port. Otherwise there may cause a mistake to laser emission. Before any testing, protection glass should be wear firstly.**

## ■ Shutter ON/OFF

There are some auxiliary control signals such as shutter. OUT0 interface gives laser shutter control signals or enable signal to laser. User can control through the IN0 interface or through the software.

## Laser Para

Laser parameters define the function of LCM according to the laser source. There are laser type and universal parameters. Different laser source has different parameters.

Picture 4.2-1

**Click the "Laser Para", and then pop up the laser parameters setting dialog. Universal parameters include of active level of laser emission of laser source, laser on delay and laser off delay. Laser type includes of CO2 FIBER, RF CO2, YAG and UV lasers. There are different parameters according to different laser source.**
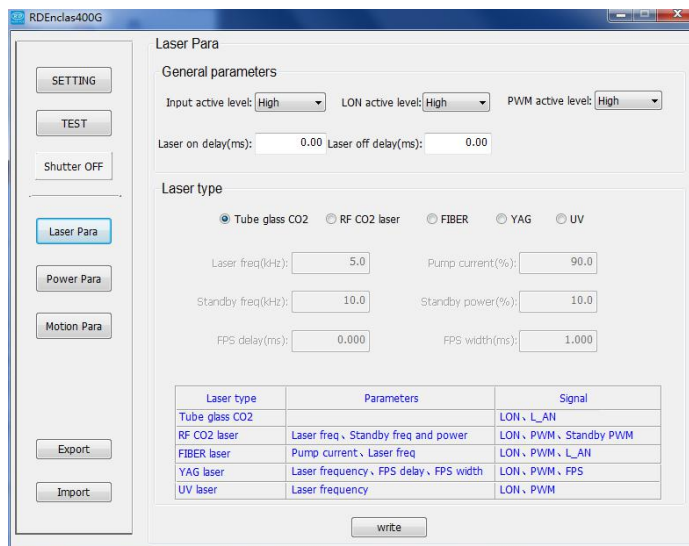
The parameter's specification is shown in table 4.2-2

Table 4.2-2

| Parameter | Description | Data scale(unit) |
|---|---|---|
| Laser control level | The active level for LCM to work. It is from the motion controllers to LCM. The level can be high or low. | — |
| LON signal level | The active level for laser emission. It is different according to different laser source. This parameter will influence the LON port output. | — |
| PWM active level | The active level for PWM signal. | — |
| Laser on delay | Delay for laser starting emission | 0.00—100.00 (ms) |
| Laser off delay | Delay laser off | 0.00—100.00 (ms) |
| Laser type | The type of laser source | — |
| Laser freq | Frequency of PWM | 1.0—300.0(KHz) |
| Pump current | For fiber laser. Control the pump current to laser source. Analog output by L_AN port. 0~10V or 0~5V can be selected by changing the status of the encoder switch | 0.1—100.0 (%) |
| Standby freq | For RF CO2 laser. The frequency of the standby PWM | 1.0—300.0(KHz) |
| Standby power | For RF CO2 laser. The width of the standby PWM | 0.1—100.0 (%) |

| FPS delay | For YAG laser. Parameters for first pulses killer | -30.000—30.000(ms) |
| FPS width | For YAG laser. Parameters for first pulses killer | 0.000-50.000(ms) |

LCM support several kinds of laser source. According to the laser source, the parameters should be set correctly. Only correct parameters can ensure the correct signal to laser source. Table 4.2-3 is shown the parameters for laser source.

Table 4.2-3

| Laser type | Parameters | Signals |
|---|---|---|
| CO2 glass | Laser on, laser power | LON, L_AN |
| RF CO2 laser | Laser freq, standby frequency, standby width | LON, PWM, standby PWM |
| Fiber laser | Pump current, frequency | LON, PWM, L_AN |
| YAG laser | Frequency, FPS delay, FPS width | LON, PWM, FPS |
| UV laser | Laser freq | LON, PWM |

## Power Para

Laser power control include of the laser control mode and the laser power control mode. In principle, we have PSP, PSV and PSS mode to control laser emission and the power of laser. Specialy for laser power control, according to the non-linear relationship between the given power and the actual power, LCM have a laser power table for users to define their own powe-speed curve ingorder to get a better cutting result.

Picture 4.2-3
**The first item is the laser work mode. It is very important. Different laser mode should be focus on different cutting task. There are PSP,PSV, PSS mode.**
**There are 10 sample data for build up the power-speed curve.**
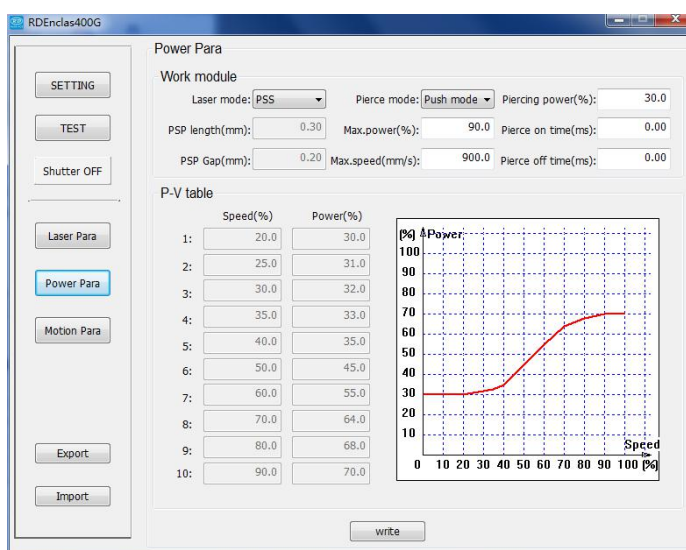
PSP, PSV and PSS mode should focus on different applications. For some CW laser such as tube glass CO2 laser. PSV mode may be suitable. But if the laser is pulse laser, PSP mode can get a better cutting result. So the laser mode is up to the laser type.

Table 4.3-4 shows the parameter's specification.

Table 4.2-4

| Parameter | Description | Data scale(uint) |
|---|---|---|
| Laser mode | Laser control mode during motion | PSS,PSV,PSP |
| PSP length | In PSP, the length of laser emission during motion | 0.01—50.00(mm) |
| PSP gap | In PSP, the gap between 2 laser line spot | 0.01—50.00(mm) |
| Pierce mode | Support CW mode and Pulse mode | — |
| Max. speed | Referenced speed for P-V table | 0.1—1000.0(mm/s) |
| Max. power | Referenced power for P-V table | 0.1—100.0(%) |
| Pierce power | Laser power for piercing | 0.1—100.0(%) |
| Pierce on time | In Pulse pierce mode, time of each laser emission | |
| Pierce off time | In Pulse pierce mode, the time interval between two times of laser emission | |
| P-V table | For PSV, PSP laser mode. The relationship between the speed and the laser power. | 0.1—100.0(%) |

P-V table is valid in PSP and PSV mode. The speed should increase from low to high and the laser parameters should also increase from low to high. No decreasing progressively is allowed.

The function of 'Pierce' support pulse mode and CW mode. User can select the work mode of 'Pierce'. In the pulse mode, there is 2 parameters named should be set. The value determines the laser emission time and delay time. In the CW mode, if pierce signal is active, laser emission enabled until the pierce signal is inactive.

```
Parameters
Input active level: High          IN2:
Pierce mode: pulse mode           IN3:
Pierce on time: Ton        Laser emission:
Pierce off time: Toff                  Ton  Toff
```
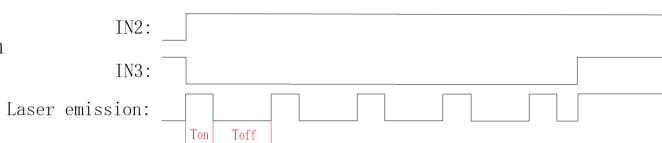
LCM has 3 laser control modes. They are static laser power mode (PSS mode), power following with speed (PSV mode) and laser synchronized with pulse mode (PSP mode).

In PSS mode, the laser power will not be changed whatever the speed is.

**During the cutting process, laser power is Max.power. the speed of the two sides in the cutting is slow, the middle speed is fast, so the middle energy density is small, the cutting trace is weak, the energy density on both sides is large, and the cutting marks are deep.**
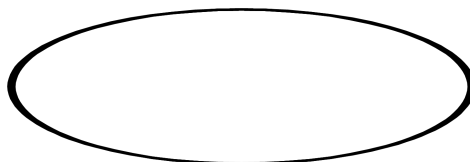
In the PSV mode, LCM will regulate the laser power in real time The laser power will be controlled based on the P-V table.

**During the cutting LCM will regulate the laser power according to the changes of the motion speed. When the speed is smaller that the minimum speed in the table, the laser power will output the minimum power. When the speed is bigger that the maximum speed in the table, the laser power will output the maximum value.**
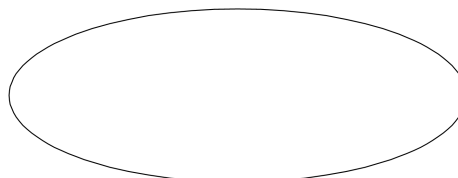
In PSP mode, LCM will control the laser length and gap according to the motion speed.

**Whatever the speed is, the length and the gap is the same. This can ensure the laser spots are well distributed along the motion path.**

The control principle of PSP is shown as the picture 4.2-4.

**Picture 4.2-4.**
**Principle of PSP. The distance of laser on and the distance of laser off are controlled by the parameters. This function can get a well distributed laser spot along the cutting path.**
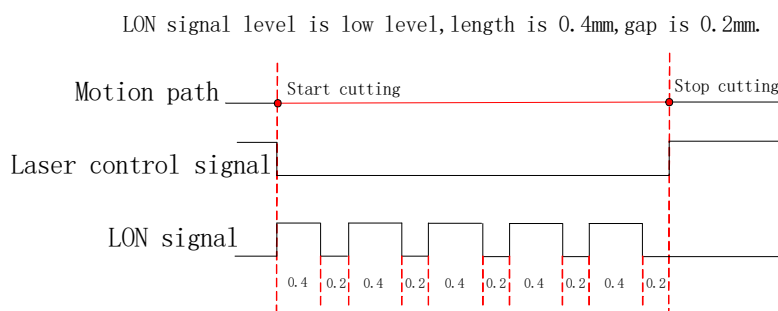
Picture 4.2-4

When using the PSV or PSP mode to configure the P-V table, Please follow the steps:

■ Test reference value

To set laser mode as PSS, the motion controller with the maximum speed of $V_{max}$, and LCM with the maximum power of $P_{max}$. Try to cut when finished, and then check the cutting effect. If cutting power is too small then increase the $P_{max}$ and try again. If cutting power is too large then decrease $P_{max}$ and try again until to meet your needs. Record $P_{max}$ and $V_{max}$ value.

■ Test sample data

Based on the maximum speed of $V_{max}$, to set the speed of motion controller V1 as $V_{max}$ * $X_1$% (0.1 ≤ X ≤ 100.0). To set the maximum power, the maximum power P1 of LCM is $P_{max}$*$Y_1$%(0.1 ≤ Y ≤ 100.0). Try to cut when finished, and then check the cutting effect. If cutting power is too small then increase the $Y_1$ and try again.If cutting power is too large then decrease $Y_1$ and try again until to meet your needs. Recording speed percentage $X_1$ corresponding to the percentage of power $Y_1$.Repeat the operation, to increase the X and test the sample data until 10 sets of sample data done.The data must include the maximum data that can be achieved during the cutting process.

■ Fill in the data

Make sure that the intelligent laser control module in the PSV or PSP.Fill in the 10 sets of sample data in the P-V table.

Remarks：

1. When setting $V_{max}$ and $P_{max}$, users can increase the value in a certain range to prevent the actual movement speed exceeds to the maximum speed, otherwise the cutting effect may be not satisfactory.

2. When testting the sample data, users can increase the low-speed measurement of sample density to get better cutting.

3. If user would like to change materials or material thickness, the maximum power $P_{max}$ and fine-tuning the P-V table can be adjusted,.if the cutting is not good, user need to remeasure the parameters

4. If the motion speed be changed in a large value,users need to remeasure the parameters.

■ **Motion Para**

Motion parameters include of the signal type of speed and position feedback. There are 2 feedback signals that are used in LCM. One is the pulse of motor position control. Another is the quadrate feedback signals from rotary encoder or linear encoder. the resolution of the pulse or the encoder should be set. If the feedback is the motor position control pulse, then the PPR and the lead screw pitch should be configured. If the feedback of LCM is rotary encoder, the resolution of encoder and lead screw pitch should be configured. The parameters are shown as picture 4.2-5.

**Picture 4.2-5.**

**The LCM support 3 axes pulse or encoder signal feedback. That means totally support the feedback of 3 axes interpolation motion control system.**

**LCM will calculate the composition velocity based on the other axis.**
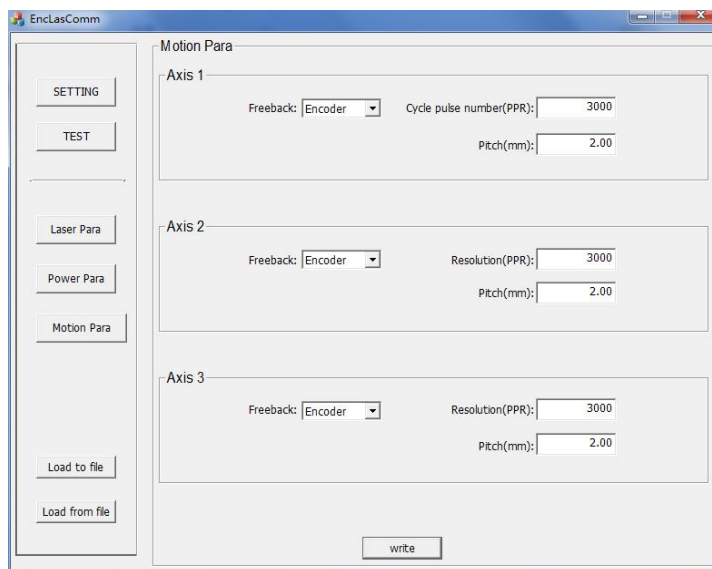


The parameters of motion control are shown as table 4.2-5

Table 4.2-5

| Parameter | Description | Data scale |
|---|---|---|
| feedback | Feedback support control pulse and encoder | -- |
| resolution | Resolution of encoder or the pulse per round of a motor. | 1000—50000 (PPR) |
| pitch | The distance when the motor rotate one round | 0.0—100.00 (mm) |

## ■ Export

Save setting parameters to files，please do not change the format of the file.

## ■ Import

Read data from a file.

## 4.3 Trouble shooting

Please refer to table 4.2-6

| Fault | Reason | Solution |
|---|---|---|
| Please open COM firstly | RS232 do not connect to computer or the wiring failed | Check the cable and the RS232 interface. Go to 'setting'→'RS232 setting'→open |
| Failed to open COM | Port selection error | Change the port selection and open again |
| | COM port is occupied | Change the port or close the software of taking up the COM port |
| Write parameters failed | Wrong wiring | Check the wire cable |
| | Communication failed | Check the cable and write again |
| | BPS for RS232 setting error | Set the BPS for RS232 to 115200 |
| | LCM disable the writing parameter function in work mode | Check the status of LCM |
| Read parameters failed | Wrong wiring | Check the wire cable |
| | BPS for RS232 setting error | Set the BPS for RS232 to 115200 |
| Enter "TEST" failed | RS232 do not connect to computer or the wiring failed | Check the cable and the RS232 interface. |
| | LCM disable the Enter "TEST" mode function in work mode | Check the status of LCM |
| Laser emission failed | Wrong wiring | Check the cable. In test mode, check the laser control function is ok or not. |
| | Wrong parameters | Check the parameters, In test mode, check the laser control function is ok or not. |
| | Alarm happened | Check the alarm type and clear the alarm |
| | No laser control input or port IN2 failed. | In test mode, check the universal input and output control function is ok or not. |
| Laser control error | Active level of laser control signal error | Modify the parameter |
| Unexpected laser power | Unsuitable parameters | Set correct laser parameters and power parameters. |
| Alarm | LCM internal error | Power on again or contact Ruida |
| | Extern alarm input | Check the alarm and clear it |

Finished the parameters configuration and function test, LCM can work normally. PSP and PSV mode can be applied to laser cutting to get a perfect result.Thank you for your selection of our production!

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Tel：(086)0755-26066687

Fax：(086)0755-26982287

Adress： 2th floor,Technology Building,NO.,1057 Nanhai Avenue,Nanshan district, Shenzhen, Guangdong , China.

Website：www.rd-acs.com