

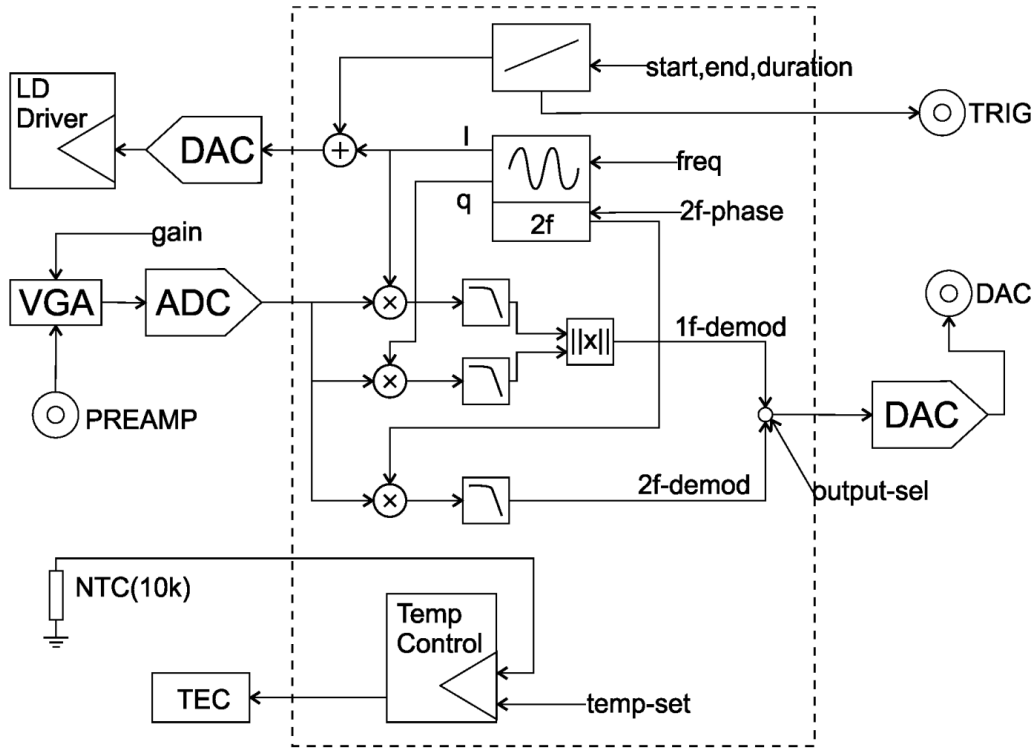
QCL integrated drive modulation module DFB-QCL OPERATING instruction



Brief Introduction:

The DFB-QCL is a drive/modem module for low power quantum cascade laser (QCL). Its main functions include: digital laser drive for generating superposition of sine wave and triangular wave, adjustable gain amplifier, 1f/2f digital lock-in amplifier, analog output, and temperature control unit. All operating parameters and waveforms can be set and read by the computer. The module is suitable for gas absorption spectrum detection, compound analysis and other applications.

Its functional diagram is as follows:



Its main parameters are as follows:

Characteristics	Min	Max	Unit	Notes
Power supply voltage	12	18	VDC	
Power	10	30	W	
Laser driving current	0	250	mA	
Laser driving voltage	12	20	V	@250mA
Triangular wave duration	20	500	ms	
Sine wave frequency	20	50	kHz	
Demodulation mode	1f	2f		
Temperature control range	0	50	°C	
NTC	9.7	10.3	kohm	@25°C
TEC output current	-1.5	1.5	A	
TEC output voltage	-5	+5	V	
Signal input	0	5	V	AC coupling, peak-to-peak
Analog output	0	2.5	V	

Laser Installation:

The instrument supports TO-CAN packaged laser. Remove the two M2.5 screws on the front of the instrument and insert the laser pin into the connecting seat. Check whether the bottom of the laser is completely in contact with the panel, and the pins are stably inserted into the connector. In certain cases, it is necessary to adjust the length of the laser pins. Remove the laser, evenly apply a proper amount of thermal conductive silica gel to its bottom, insert it into the connecting seat again, and tighten it with M2.5 screws.



Please refer to the laser manual first to make sure that the laser pin definition is compatible with the instrument. Incorrect line sequence will lead to laser damage!

Rear Panel:

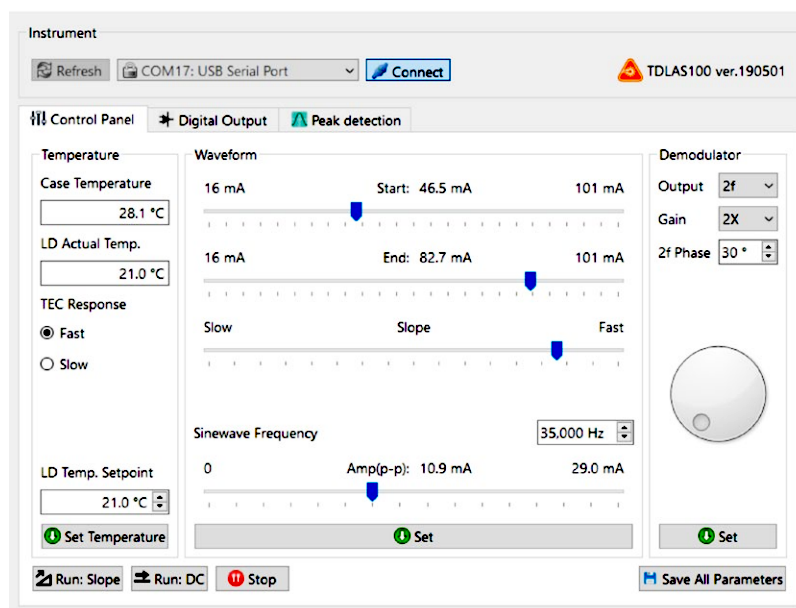


- ① Input;
- ② Power supply indication;
- ③ Work instructions;
- ④ Signal input;
- ⑤ Analog output;
- ⑥ Trigger output;
- ⑦ USB communication interface

Software Usage:

Connect the instrument to a special power supply, ⑦ Connect the computer with USB cable. WIN7 and above systems will prompt you to install USB drivers automatically. When using other systems or cannot be connected to the Internet, please download the corresponding drivers at <http://www.ftdichip.com/Drivers/VCP.htm>. After the driver is installed, the virtual serial device will appear in the Device Manager.

Open the PC-specific software, as shown in the figure below:



Find the corresponding virtual serial port in the Communication Port. Click the Connect button, the console will light up after a normal handshake, and the current setting value of the controller will be read. Set each parameter in the Settings interface, and click Set Parameters below to synchronize the parameters to the controller. Click Save All Parameters to save all parameters in the controller.



Before starting the laser, please carefully check whether the parameters are within the allowable working range of the installed laser.

Simple Work:

Adjust the appropriate working temperature. After setting, observe that the real laser temperature has stabilized at this value. Set the Start slider to be higher than the initial working current of the laser, set the appropriate sine wave amplitude and frequency, and click "Set" to set it. Click the Run: DC button in the lower right corner, and the icon in the upper right corner will turn orange. The laser will start working with a constant current and superimpose the set sine wave.

Observe the Output of Lock-In Amplifier with Oscilloscope.

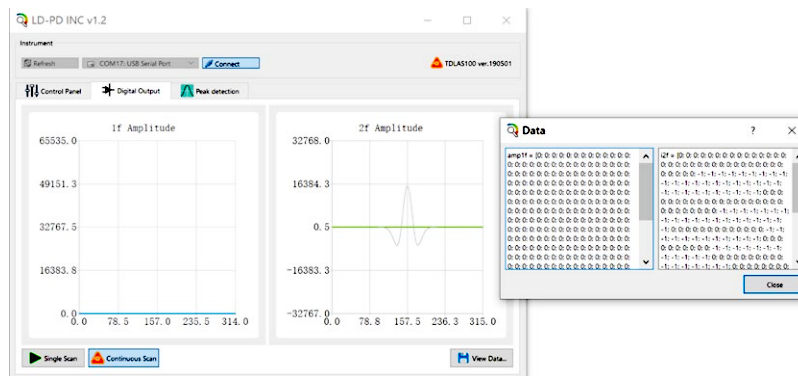
Set the Demodulator to 1f demodulation, connect the preamplifier output to the ④ signal input port, and connect the ⑤ analog output to the oscilloscope. Make the laser work in Run: DC mode, observe the waveform on the oscilloscope, and adjust the optical path.

Note: Demodulator only demodulates the set sine wave signals with the same frequency or double frequency, so the Sinewave Amplitude in the panel must be set to a value greater than 0 before it can be output.

After adjusting the DC working mode, the triangular wave mode can be further operated. Connect the ⑥ trigger output to another port of oscilloscope, and set it as trigger. Set the appropriate triangle wave Start, End and Slope, and click Run: Slope. In the triangular wave scanning stage, ⑥ Trigger output will output high level; There is a 10ms interval between each scan, ⑥ indicates low level. It is recommended to connect ⑥ to channel 2 of oscilloscope and take its rising edge as synchronous trigger; Connect ⑤ to channel 1 of oscilloscope. Adjust the vertical and horizontal scaling and panning of the oscilloscope to display the complete scanning waveform.

Acquire Waveforms through PC Software:

After all the parameters are set, and the controller is not in the running stage, you can enter the Digital Output page, which is shown in the figure below:



Click the Single Scan button below, the controller will perform a single scan, and the 1f and 2f demodulation results will be displayed in the figure. The specific data can be seen in the pop-up box by clicking View Data.

Click Continue Scan to start continuous scanning, and the waveform will be uploaded after each scanning. As USB communication takes a certain amount of time, there is an interval between each scan, and the specific interval varies according to the computer configuration. Click again to stop running.

On the 2f page, the gray straw hat curve represents an ideal WMS second harmonic absorption peak. If a similar waveform can be obtained when measuring the substance to be measured after optimizing the instrument parameters, the built-in WMS algorithm can work and provide good accuracy. Otherwise, it is difficult to use the built-in WMS algorithm properly.

Use Built-in WMS Algorithm:

Enter the Peak detection page, click start in WMS measurement below, and the controller will automatically scan for many times and try to analyze the amplitude information of the absorption peak in the waveform, which takes about 6-15 seconds. The analytical effect is related to the selection of laser, optical path setting and experimental parameters. The result ranges from 0 to 50000, which is a unitless value and only represents the peak height of the data curve. However, if the instrument parameters are not changed, the value will be proportional to the concentration of the gas to be measured (0-5000 is a guaranteed linear range). Users can set a linear coefficient in Linear Factor to make the indicated value match the experimental conditions.

Other Communication Modes:

The software uses ASCII plaintext to communicate with the instrument. After directly connecting the instrument through USB virtual serial port, you can use all the functions of the software by serial communication. Please refer to USB Communication Protocol for details.

In addition, the instrument has built-in Modbus RTU protocol and can be accessed through RS-485 cable. (It is not provided by default, and needs to be explained when ordering), please refer to the Industrial Edition Instructions.

Additional Lens:

The front panel of the instrument has four 4-40UNC screw holes with a spacing of 30mm, which is compatible with 30mm cage system. A variety of lenses or components can be connected by using the standard cage guide rod, which is shown in the following figure:

