PPEB075 Operating Guide

Application note: ICR operating board

The PPEB075 is developed to work with the Neophotonics ICR / micro-ICR and the Neophotonics daughterboard. It provides a serial programming interface to control the ICR from within automated test setups.

Included features:

- Individual power supply for each TIA with enable/disable
- Read out of current on each photo-diode (9)
- Auto-ranging or manual ranging of the photo-current detection

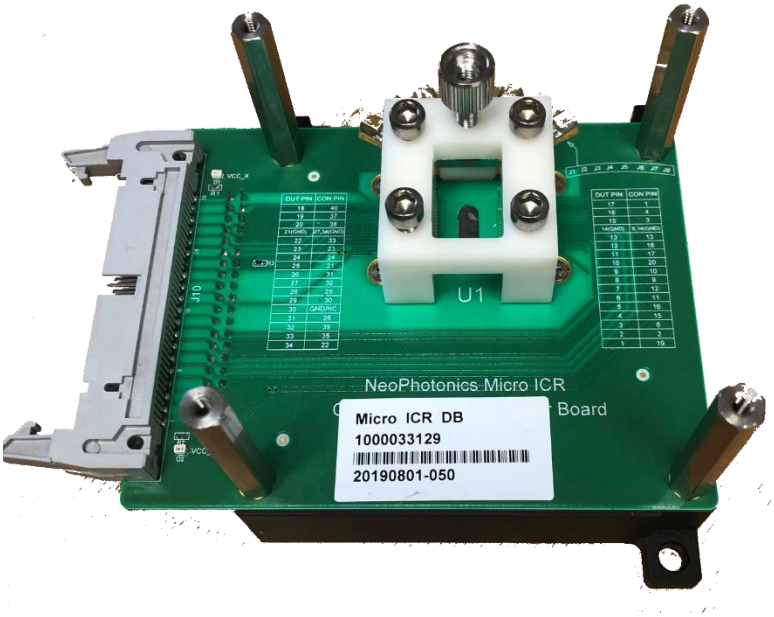
1. Contents

2. Installation procedure for PPEB075

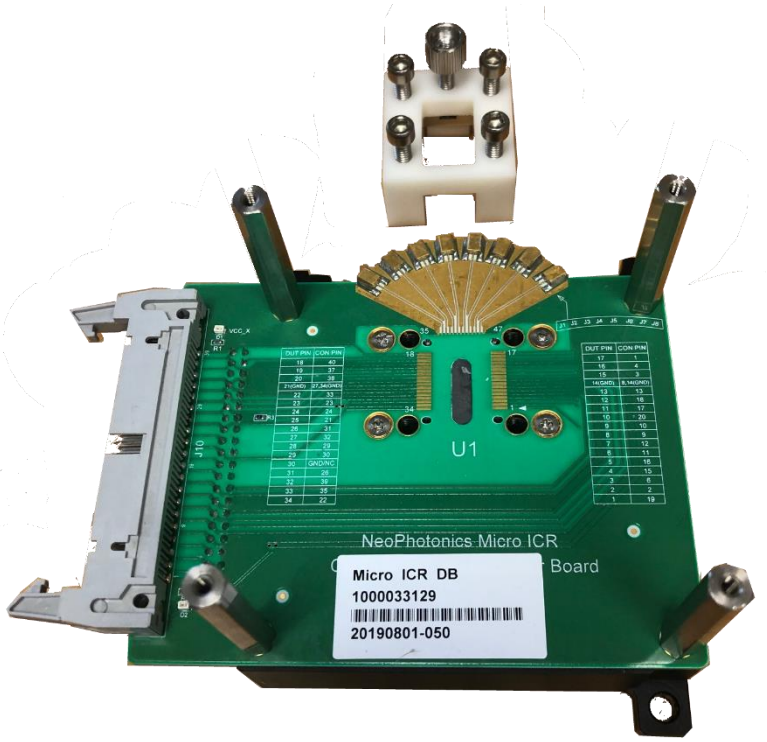
The original Neophotonics daughterboard is shown below (micro-ICR).

- Remove the 4 hex screws on the top of the board and keep them

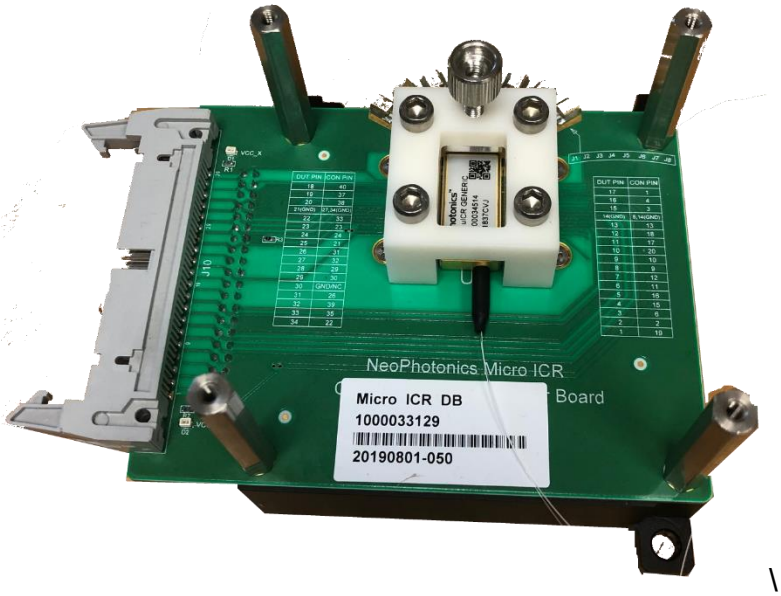
- Replace them with the 1.5 inch long hex standoffs



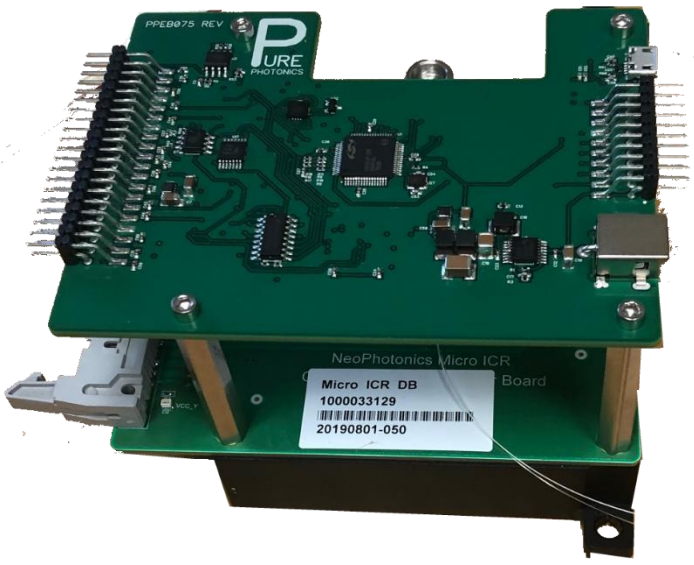
- Remove the pyrex holder for the (micro-ICR)



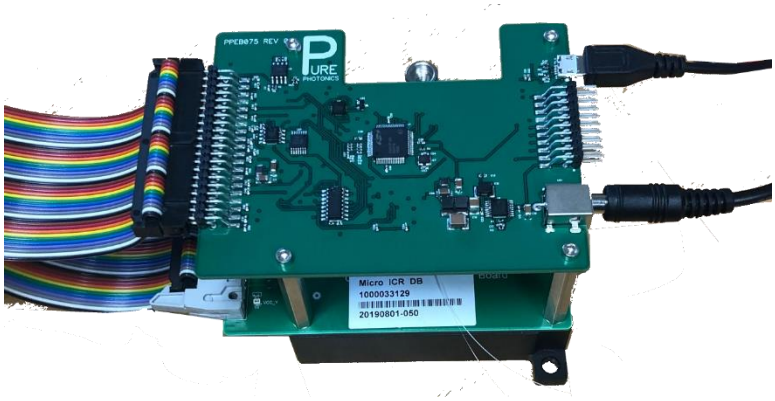
- Install the (micro-)ICR



- Install the PPEB075 board on the stand-offs and use the 4 hex screws that were removed in the first step

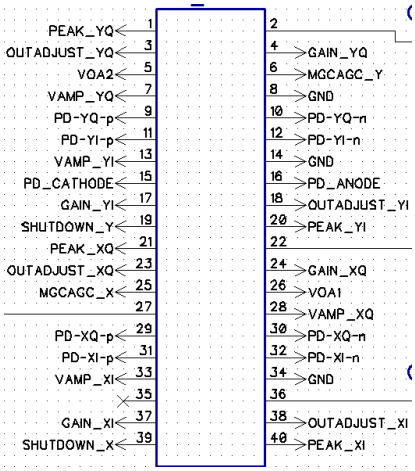


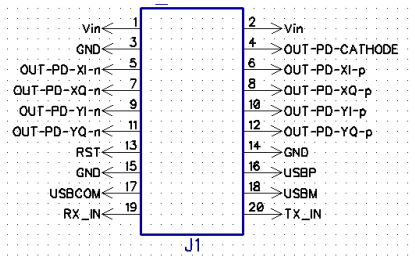
- Install the ribbon cable, USB connector (needs to be done before the power plug is inserted) and the power plug



3. Electrical Connectors

The board has 2 IDC connectors

- 40 pin connector to connect to ICR
  - 

- 20 pin connector to connect to customer system (operation possible without using this)
  - 

In addition, there is a barrel plug power supply (**make sure that either the pins on the 20 pin connector are connected or this barrel plug. Never connect two power supplies**) with input voltage requirement 10-25V. Typical power consumption is less than 2W.

And there is a micro-USB communications port.

4. Communications Port

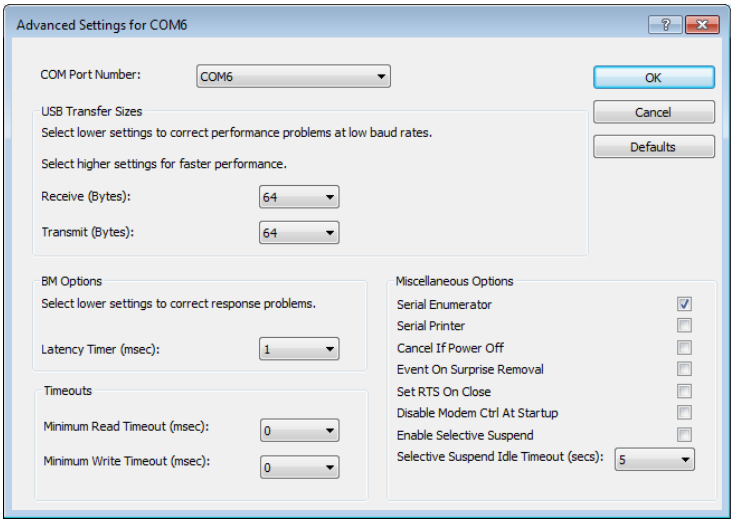
The ICR communications goes over the micro-USB interface. When connected to a computer the interface will install as a serial port (FTDI VCP – Virtual COM Port - driver required, if not already installed on computer).

The USB interface can be alternatively controlled through the pins on the input connector or can be overruled completely by a LVTTL RS-232 interface through the input connector. In either case, care needs to be taken that only 1 interface is connected at any time, to prevent contention.

The standard USB interface is not optimized for serial communications on the RS-232 interface. Due to differences in protocol and optimization algorithms for the USB port, it installs with non-optimal settings. For most operations, this is not a problem, however for a firmware upgrade a proper configuration is required.

We recommend to make the below changes when the USB interface gets registered. On every computer this is only needed once for each USB interface/device.

a. Open the ‘Windows Control Manager’
b. Open ‘Hardware and Sound’
c. Open ‘Device Manager’
d. Find the COM ports
e. Right-click the USB serial port and select ‘Properties’
f. Select the tab ‘Port Settings’ and click the ‘Advanced’ button
g. **Set the latency timer value to 1msec.**
    a. You can also select the COM-port designation here (we recommend port # <10).
    b. We recommend to set the ‘USB transfer sizes’ to the lowest possible setting (do this for both receive and transmit)
h. Close the windows and start using the device



5. Communications Protocol

The communication with the device follows the definition from the OIF MSA for tunable lasers. Basically 4 bytes are sent per command and 4 bytes are returned (a strict handshake model).

The OIF document can be found at https://www.oiforum.com/wp-content/uploads/2019/01/OIF-ITLA-MSA-01.3.pdf.

The user to module command is defined as below (more details in MSA, section 8 and 9):

31	30	29	28	27	Bits 26:0
Checksum				LstRsp	Command packet being framed

Inbound Byte 0

31	30	29	28	27	26	25	24
0x0 (To be defined by transport layer)					0x0		RW (R=0, W=1)

Inbound Byte 1

23	22	21	20	19	18	17	16
Register Number (0x00 – 0xff)							

Inbound Byte 2

15	14	13	12	11	10	9	8
Data 15:8							

Inbound Byte 3

7	6	5	4	3	2	1	0
Data 7:0							

The module to user command is defined as below (more details in MSA, section 8 and 9)

31	30	29	28	27	26	Bits 25:0
Checksum				CE	1	Response packet being framed

Outbound Byte 0

31	30	29	28	27	26	25	24
0x0 (To be defined by transport layer)						Status	

Outbound Byte 1

23	22	21	20	19	18	17	16
Register Number (0x00 – 0xff)							

Outbound Byte 2

15	14	13	12	11	10	9	8
Data 15:8							

Outbound Byte 3

7	6	5	4	3	2	1	0
Data 7:0							

6. Registers

The following ‘tunable laser’ registers are available on the PPEB075

- 0x01 DevType
- 0x02 MFGR
- 0x03 Model
- 0x04 SerNo
- 0x06 Release
- 0x08 GenCfg
- 0x09 AEA-EAC
- 0x0A AEA-EA
- 0x0B AEA-EAR
- 0x0d IOCap
- 0x0E EAC
- 0x0F EA
- 0x10 EAR
- 0x13 LstResp
- 0x14 DLConfig
- 0x15 DLStatus
- 0x33 MCB

The following Registers are specific for the ICR Control

- 0x80 Enable/Disable TIA
- 0x81 Photo-diode mode (automatic/manual)
- 0x82 Photo-diode reading
- 0x83 ACG-MCG
- 0x84 Output Adjust setting
- 0x85 Gain Setting
- 0x86 Shutdown
- 0x87 Peak Voltage
- 0x88 VOA Setting
- 0x89 TIA current

The registers are described in more detail on the next page:

		SEND																				
		WRITE																READ				
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
TIA_Enable	0x80												TIA3	TIA2	TIA1	TIA0																		0 = Disable ; 1 = Enable
PD_Mode	0x81								PD	Yqp	Yqn	Yip	Yin	XQp	XQn	Xip	Xin																0 = Manual; 1= Auto
PD_Value	0x82	Not writeable																CHANNEL															
MGC_AGC	0x83														Y	X																		0 = MGC; 1 = AGC
Output_Adjust	0x84	CHANNEL							Value									CHANNEL							Value								0 - 255 for (0V - 3.3V)
Gain	0x85	CHANNEL							Value									CHANNEL							Value								0 - 255 for (0V - 3.3V)
Shutdown	0x86														Y	X																		0 = Disable; 1 = Enable
Peak_Value	0x87	Not writeable																CHANNEL																
VOA_Voltage	0x88	Value																																0.01V (0 - 5V)
TIA_Current	0x89	Not writeable																TIA#																TIA 0-3

		RESPONSE																				
		WRITE																READ				
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
TIA_Enable	0x80												TIA3	TIA2	TIA1	TIA0																		0 = Disable ; 1 = Enable
PD_Mode	0x81								PD	Yqp	Yqn	Yip	Yin	XQp	XQn	Xip	Xin																0 = Auto; 1 = Manual
PD_Value	0x82	Not writeable																Value																microAmp
MGC_AGC	0x83														Y	X																		0 = MGC; 1 = AGC
Output_Adjust	0x84	CHANNEL							Value									Value																0 - 255 for (0V - 3.3V)
Gain	0x85	CHANNEL							Value									Value																0 - 255 for (0V - 3.3V)
Shutdown	0x86														Y	X																		0 = Disable; 1 = Enable
Peak_Value	0x87	Not writeable																Value																mV (2.5V on input corresponds to 900mV pkpk out)
VOA_Voltage	0x88	Value																Value																0.01V (0 - 5V)
TIA_Current	0x89	Not writeable																Value																0.01mA

Don't care

Value required

7. Command Line Interface

The CLI is available for download on the Pure Photonics webside (under support). This program allows for command line communication with the ICR evaluation board. A special script is made available to implement the specific ICR command

The specific commands for the ICR can be loaded by saving the ‘ICR.py’ file in the CLI directory and then running the command execfile(‘ICR.py’). The code for the file is in the next section.

8. Execfile code

```
readpacket=None
writepacket=None
connected=False

def ICRConnect(port=1,baudrate=9600):
    global readpacket,writepacket,connected
    it.connect(port,baudrate)
    it.mcb()
    readpacket=it.toModulePacket()
    it.mcb()
    writepacket=it.toModulePacket()
    writepacket.buffer('\x11\x81\x00\x00')
    connected=True

def ICRDisconnect():
    global connected
    it.disconnect()
    connected=False

def ICRTIA(value=-1):
    if not(connected):
        print 'Not connected'
        return
    if value==-1:
        readpacket.register(0x80)
        test=it.packet(readpacket)
        return test.data()
    else:
        writepacket.register(0x80)
        writepacket.data(value&0x000f)
        it.packet(writepacket)

def ICRPDMode(value=-1):
    if not(connected):
        print 'Not connected'
        return
    if value==-1:
        readpacket.register(0x81)
        test=it.packet(readpacket)
        return test.data()
    else:
        writepacket.register(0x81)
        writepacket.data(value&0x01ff)
        it.packet(writepacket)
```

```
def ICRPDValue(ch=0):
    if not(connected):
        print 'Not connected'
        return
    readpacket.register(0x82)
    readpacket.data(ch&0x0f)
    test=it.packet(readpacket)
    return test.data()

def ICRMGCAGC(value=-1):
    if not(connected):
        print 'Not connected'
        return
    if value==-1:
        readpacket.register(0x83)
        test=it.packet(readpacket)
        return test.data()
    else:
        writepacket.register(0x83)
        writepacket.data(value&0x0003)
        it.packet(writepacket)

def ICROutputAdjust(ch=0,volts=-1):
    if not(connected):
        print 'Not connected'
        return
    if volts==-1:
        readpacket.register(0x84)
        readpacket.data(ch*256*16)
        test=it.packet(readpacket)
        return test.data()*3.3/256
    else:
        if volts>3.3:volts=3.3
        writepacket.register(0x84)
        writepacket.data(ch*256*16+int(256*volts*1.0/3.3))
        it.packet(writepacket)

def ICRGain(ch=0,volts=-1):
    if not(connected):
        print 'Not connected'
        return
    if volts==-1:
        readpacket.register(0x85)
        readpacket.data(256*16*ch)
        test=it.packet(readpacket)
        return test.data()*3.3/256
```

```
    else:
        writepacket.register(0x85)
        if volts>3.3:volts=3.3
        writepacket.data(ch*256*16+int(256*volts*1.0/3.3))
        it.packet(writepacket)

def ICRShutdown(value=-1):
    if not(connected):
        print 'Not connected'
        return
    if value==-1:
        readpacket.register(0x86)
        test=it.packet(readpacket)
        return test.data()
    else:
        writepacket.register(0x86)
        writepacket.data(value&0x03)
        it.packet(writepacket)

def ICRPeakV(ch=0):
    if not(connected):
        print 'Not connected'
        return
    readpacket.register(0x87)
    readpacket.data(ch*256*16)
    test=it.packet(readpacket)
    return test.data()

def ICRVOA(value=-1):
    if not(connected):
        print 'Not connected'
        return
    if value==-1:
        readpacket.register(0x88)
        test=it.packet(readpacket)
        return test.data()
    else:
        writepacket.register(0x88)
        writepacket.data(value)
        it.packet(writepacket)
```

9. Firmware Upgrade

The Command Line Interface is a tool to directly access the registers of the tunable laser. The CLI is available for download on the Pure Photonics website, under the download section. The zip file needs to be downloaded and extracted to a separate directory. In the directory there will be a .exe file to run the program.

Use the following sequence to perform firmware upgrade:

- it.connect(1,9600)
  - The first parameter is the COM port number. This may vary dependent on your configuration
  - The second parameter is the current baudrate of the device. Most devices start up with baudrate 9600
- it.release()
  - make sure that you get a response here. If not, something is seriously wrong and more trouble shooting is required. Contact Pure Photonics.
  - If the response is FW 0.0.0, then the temporary firmware version is active, indicating that the previous firmware upgrade did not terminate as intended.
- it.baudrate(115200)
  - 115200 is the highest available baudrate, resulting in the fastest upgrade
- it.upgrade('application',r'c:\.....\.....ray')
  - The item within parenthesis is the path to the .ray file that you wish to upload

After completion of the upgrade the interface will say: '*Seconds elapsed 140. Init_Run OK'.*