PR-40G-M User's Manual

40 Gb/s Photo Receiver Module

Caution: The user must read this manual before operating the PR-40G-M unit. Operations other than those described in this manual may result in personal injury and damage to the unit.

Note that any attempt to open or fix the equipment without prior approval by Optilab, LLC voids the warranty.

Ver. 1.2
Oct. 25th, 2021

Revision History

VERSION	DATE	SUMMARY
1.0	08/10/17	Manual introduced.
1.1	3/11/18	Manual revision.
1.2	10/25/21	Logo and Format Update

Table of Contents

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1. General Information

1.1 Introduction

This manual contains information on the installation and operation of the PR-40G-M photo receiver unit.

1.2 Product Overview

The Optilab PR-40G-M is a 40 Gb/s linear photo receiver module designed for analog or digital applications. This cost-effective receiver module operates under a single +5V power supply and can provide users with a turn-key solution for linear analog applications. With a single linear trans-impedance/ variable gain amplifier (TIA/VGA), PR-40G-M offers two gain control modes: manual and automatic. In manual mode, PR-40G-M provides a linear conversion gain of up to 1500 V/A. In automatic mode, the gain is automatically adjusted to deliver a constant differential output voltage up to 700 mV.

Contact www.oequest.com or email sales@optilab.com for more information.

1.3 Features

- Differential RF output
- External DC block for AC coupling
- Low equivalent input noise density
- Automatic / Manual gain control modes
- Input protection
- Remote monitoring via USB 2.0

1.4 User Safety

1. The PR-40G-M unit receives high intensity invisible light at the optical input receptacle. Avoid direct exposure to skin and eyes.

2. The equipment case is fully certified for EMS protection. The user should never open the equipment case; any attempt will void the warranty and may result in electric shock and EMS attack to equipment in the vicinity.

3. The user should avoid using any solvent or vaporizing chemical to clean the equipment panel or case. It may result in damage to the surface and internal circuits.

2. Operation

2.1 Introduction

This chapter describes how to operate the PR-40G-M unit, and discusses the location and function of the controls and connectors.

2.2 Initial Inspection

Your PR-40G-M module was carefully inspected before it left the manufacturer. It should be in proper working order upon receipt. You should, however, inspect the unit for any damage that may have occurred in transit. If the shipping container or the packing material is damaged, keep it until the contents of the shipment have been checked to be free of mechanical and electrical damages. Notify Optilab, LLC promptly if any notable damage is found.

Each PR-40G-M shipment should include the following:

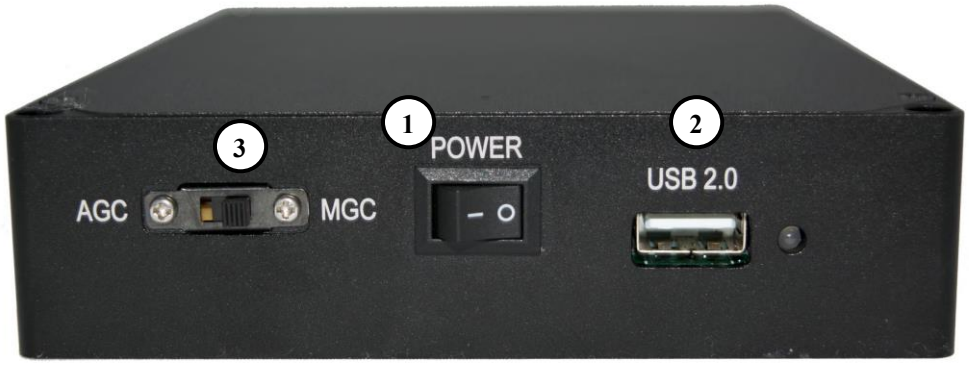
- PR-40G-M receiver module unit
- User manual
- Test datasheet
- AC/DC Power Adapter and USB Cable

2.3 Controls

PR-40G-M Module – Front Panel

Feature	Function
① Optical Input Port	This receptacle accepts the indicated fiber-optic connector for optical input. This particular receptacle is FC/APC type. Observe a maximum optical input of 4 dBm to ensure safety of the PR-40G-M!!!
② LED Indicators	These LED indicators provide the status of the PR-40G-M: POW – Off = No DC power present, Blue = Power On OPT – Red = Low Optical Signal (< -10 dBm), Green = Nominal Signal for Optical Input Port 1
③ RF Output Ports, Differential	These receptacles accept an electrical SMA connection for the RF output, which provides differential signal output, and is DC coupled, 50Ω termination. Use DC blocks on the output for proper AC coupling, otherwise damage may occur! If only using one RF output port, it is strongly recommended to use a 50Ω terminator on the unused port for optimum performance.
④ Output Amplitude Knob	Adjusting this knob allows for the output adjustment of the PR-40G-M, when in AGC mode. Turning it counter-clockwise (CCW) decreases the amplitude, with clockwise (CW) increasing the gain
⑤ Gain Control Knob	Adjusting this knob allows for the output adjustment of the PR-40G-M, when in MGC mode. Turning it counter-clockwise (CCW) decreases the gain, with clockwise (CW) increasing the gain

PR-40G-M Module – Rear Panel



Feature	Function
① **Main Power Switch**	Toggling this switch will enable or disable the electrical power to the PR-40G-M unit.
② **USB Terminal**	This port provides both the power supply and the RS232 data communication protocol for remote monitoring. The end user may connect directly to a 2.0 USB port on a control PC, or directly to an AC socket using the provided adapter. Note that if using the AC socket adapter, no remote monitoring will be available.
③ **Gain Control Mode Switch**	This switch allows for the end user to control the PR-40G-M in either Automatic Gain Control (AGC) or Manual Gain Control (MGC) mode. **Ensure unit is in the OFF position when switching modes to avoid internal damage.** When in AGC mode, keep the Gain Control knob in the maximum (CW) setting, adjusting the Output Amplitude knob to the desired setting. Likewise, when in MGC mode, keep the Output Amplitude knob in the maximum (CW) setting, adjusting the Gain Control knob to the desired setting.

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2.4 Operation Instructions

Start-up Procedure

1. Connect the appropriate cable(s) to the desired RF Output Port.
2. Connect the included USB cord into either the appropriate AC power socket converter, or directly into a 2.0 USB port on a PC.
3. Connect the other end of the USB cord into the USB port on the PR-40G-M unit.
4. Ensure the appropriate DC Blocks are added onto the RF output ports. If only using one RF port, then install a 50Ω terminator on the unused port.
5. Once all proper connections are made, turn the Main Power switch to the On position. The PR-40G-M module will be enabled, as indicated by the POW LED turning blue.
6. Connect the appropriate optical cable to the desired Optical Input. To avoid permanent damage to the PR-40G-M, observe the maximum optical input of 4 dBm!!!
7. The PR-40G-M provides differential RF output ports, and if only using one port, it is recommended to terminate the unused port with a 50Ω load.

Patchcord Swapping Procedure

1. Turn the Main Power switch to the Off position to disable the PR-40G-M module output.
2. Swap patchcords as desired. Only connect the indicated connector patchcords to the optical input/output receptacles, cleaning them as necessary.
3. Turn the Main Power switch back to the On position; normal operation will resume after a few seconds.

Operation in Automatic or Manual Gain Control

1. To alternate between Automatic Gain Control (AGC) or Manual Gain Control (MGC), use the rear panel switch to select the desired gain type. **Before switching mode ensure unit is in the OFF position to avoid internal damage.**
2. For AGC mode, turn the Gain Control knob to the maximum (CW) setting, while adjusting the Output Amplitude knob to the desired level.

   In AGC mode, the TIA gain is automatically adjusted to maintain constant RF output amplitude.

3. For MGC mode, turn the Output Amplitude knob to the maximum (CW) setting, while adjusting the Gain Control knob to the desired level.

In MGC mode, the TIA gain is fixed to the setting level (GC knob), and the RF output will vary depending on the input optical power and its modulation depth.

2.5 PC Connection Mode

The unit begins the PC connection mode when the USB port is connected to a PC. The user can then monitor the unit through a proper RS232 control software interface on the PC.

For proper communication, please observe the following RS232 serial port settings:

- Bit Rate = 9600
- Data Bits = 8
- Stop Bits = 1
- Parity = None
- Flow Control = None

The only command for the PR-40G-M unit is as follows:

READ – Displays the current parameters of the PR-40G-M unit

3. Troubleshooting

Symptom	Possible Cause and Solution
RF output power not high enough.	**C:** Optical input connector is dirty. **S:** Disable unit and clean optical connectors.
	C: Use of incorrect optical adapter or connector. **S:** Use only the indicated optical adapter and connector. If measurement instruments accept different connector type, then use a hybrid patchcord.
	C: Unused RF port is not properly terminated. **S:** For the unused RF port, apply a proper 50Ω load / terminator for optimum performance.
	C: Improper OA and GC knob settings. **S:** Refer to section 2.3 Controls for proper AGC/MGC settings and corresponding knob adjustments. In general, for maximum RF output, both OA and GC knobs can be adjusted to full clockwise (CW) position.
	C: Optical input connector damaged. **S:** Measure optical input power with power meter and compare with original test data. Return to Optilab for repair if the difference is high (>4 dB) and cannot be corrected by cleaning or replacing the optical connectors. Always apply dust cover plugs to unused optical receptacles to prevent the damage of internal optical connectors.
	C: Modulated signal outside of frequency bandwidth. **S:** Ensure that received modulated signal is between the bandwidth range of 0.01 – 40 Gb/s
	C: Photodiode damaged by high optical input signal (> 4 dBm). **S:** Contact Optilab, LLC for repair.
Unit does not power up.	**C:** Damaged VDC power adaptor. **S:** Contact Optilab, LLC to replace power adaptor.
	C: Insufficient electrical voltage. **S:** Check that the electrical supply is 5 VDC.
	C: Loose USB connection. **S:** Ensure that both USB connections are firmly in place.
Unit resets or blinks on and off.	**C:** Insufficient electrical voltage. **S:** Check that the electrical supply is 5 VDC.

4. Technical Specifications

Optimized Operating Wavelength	1280 nm to 1620 nm
Optical Input Level	4 dBm max. (7 dBm absolute max)
S21 3 dB Bandwidth	29 GHz min., 32 GHz typ.
Output Return Loss	10 dB @ 11 GHz, 7 dB @ 22.5 GHz
Photodiode Responsivity	0.8 A/W @ 1550nm
Conversion Gain	800 V/W typ.
Optical Return Loss	-30.00 dB typ.
Optical PDL @ 1550 nm	0.5 dB max.
PD Bias Voltage	+3.3V
Differential Voltage Swing	700mV max.
Coupling	AC-Coupled (with external DC Blocks)
Impedance	50 Ω
Pulse Width	22 ps typ., 25 ps max.

5. Mechanical Specifications

Temperature Range	-10º C to +50º C (operation), -20º C to +80º C (storage)
Power Supply Requirements	+5 V DC, 500 mA max.
Accessories Included	110 V - 240 V AC/DC Adaptor and USB Cable
Optical Connector	SMF-28 FC/APC, SC/APC Optional
RF Input Connector	K-Connector Female, 50 Ω
DC Connector	USB 2.0
RS 232 Connector	via USB 2.0
Local Alarm	LED: Input Power, DC Power
Remote Alarm	RS-232 Interface
Dimensions	150 mm x 115 mm x 30 mm
Housing	Precision Machined Aluminum, Anodized

6. Service and Support

6.1 Warranty

Optilab, LLC guarantees its PR-40G-M unit to be free of defects for 1 year from the date of shipment. The guarantee does not cover any damages resulting from the misuse or improper handling of the equipment, or any incidental or consequential loss. Note that the warranty will be void upon any attempt to open or to fix the equipment by the user without prior approval of Optilab, LLC

6.2 Service and Calibration

Your PR-40G-M unit has been designed to provide years of trouble-free operation. No internal maintenance is required provided that the equipment is properly handled, operated and kept away from contamination. For any questions regarding the operation and performance of the unit, please contact Optilab, LLC at:

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6.3 Care of Fiber-optic Connectors

Damage to optical connectors account for more than 70 percent of equipment performance degradation. To avoid such damage, the user should use only industrial grade 99% pure isopropyl alcohol and follow the procedures below to keep the connectors, adaptors and receptacles clean.

Cleaning Optical Connector End-face with Wipe and Alcohol

To properly clean optical connectors utilizing lens tissue grade wipes and alcohol follow the procedure below. The moist wipe removes dust particles, oil and contaminants that may damage or blot the end-face of the connector during connection. The dry wipe removes residual alcohol that may be ignited by optical emission.

1. Disable the optical output and turn off unit to prevent accidental exposure or damage to the optical connector by optical emission.
2. Moisten a wipe with alcohol by placing on top of the alcohol dispenser and push down to saturate the wipe.
3. Place the moist wipe on a work surface, and place a second dry wipe next to it.
4. Wipe the optical connector, end-face down on the moist wipe 3 times and then repeat on the dry wipe.
5. Visually inspect the end-face of the optical connector with an optical microscope to verify cleanliness. Repeat steps 2 to 5 as needed.

Cleaning Optical Connector Sides, Receptacles, Adaptors with Swab and Alcohol

Dust or particles can adhere to the insides of receptacles and adaptors or the sides of the optical connector ferrule. Their presence can affect the alignment of the optical fiber connectors and increase connection loss. To properly clean optical connectors, receptacles, and adaptors utilizing a swab and alcohol follow the procedure below:

1. Disable the optical output and turn off unit to prevent accidental exposure or damage to the optical connector by optical emission.
2. Moisten the swab by placing it on top of the alcohol dispenser and push down to saturate the swab.
3. For receptacles, adapters, or other connection points, insert the moistened swab and rotate the tip 1/2 turn clockwise and counter-clockwise 6 times while applying light but firm pressure.
4. For fiber connectors, rotate the tip of the moistened swab 5 revolutions around the connector while applying light but firm pressure.
5. Visually inspect the end face of the connector with an optical microscope to verify cleanliness. Clean end-face as needed.