User Manual

V1.2

Picomeasure PM-2

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1. Part Description

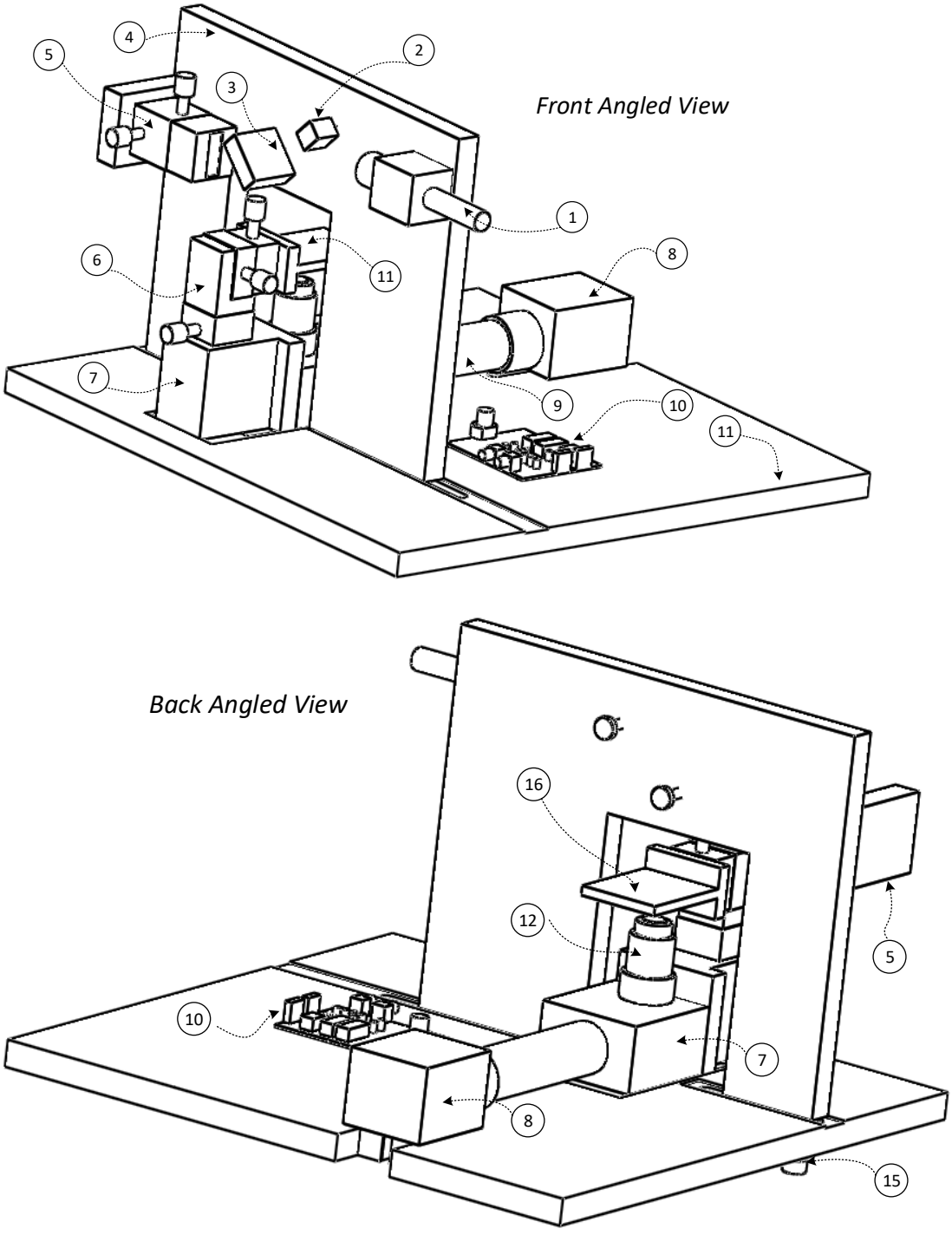


Figure 1-1. Angled view of Picomeasure PM-2

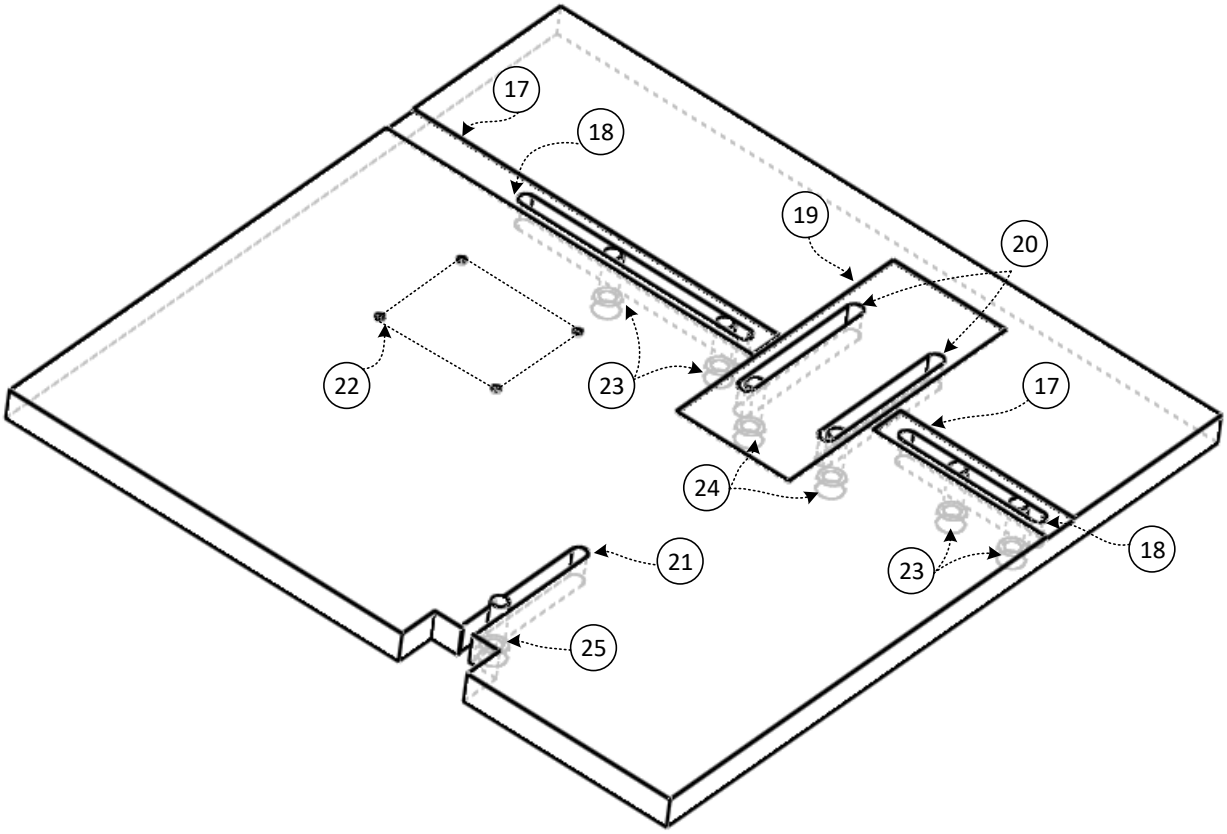


Figure 1-2. Baseboard of Picomeasure PM-2

1. Laser focusing assembly	2. Laser beam steering mirror
3. Reflected beam steering mirror	4. Optical head
5. Position sensitive detector (PSD) with XZ translation stage	6. XYZ translation stage for chip holder
7. Optics holder	8. Digital camera
9. Tube connecting camera and objective	10. Signal conditioning circuit board
11. Baseboard	12. Microscope objective
13. Rotation control for mirror (3)	14. Rotation control for mirror (2)
15. Nuts to attached optical head with base board	16. Holder of microfluidic cantilever chips
17. Alignment groove for optical head (4)	18. Slot to screw optical head (4)
19. Alignment groove for optics holder (7)	20. Slot to screw optics holder (7)
21. Slot to screw Digital camera (8)	22. Screws to attach signal conditional circuit board (10)
23. Screws to attach optical head (4) to baseboard (11)	24. Screws to attach optics holder (7)
25. Screw to attach digital camera (8)	

2. Assembly

Picomeasure PM-2 needs an assembly of different parts before a successful operation. The parts such as optical head (4), optics holder (7) and digital camera with tube (8,9) and baseboard (11) are shipped separately. A user needs to carefully assembly these parts.

Following is the sequence of assembly.

2.1. Mount Optics Holder (4): Using the provided screws, the optics holder (7) should be placed on the baseboard in the slot (19). Then insert screws from the bottom of the baseboard in the slots (20). Do not fully tighten the screws as there would be further adjustment required in the following steps. While mounting, keep the XYZ translation stage (6) towards the edge of the baseboard.

2.2. Mount Digital Camera (7): In the designated slot (21), insert a screw to mount the digital camera. Gently insert the camera tube (9) in the slot, located on the side of the optics holder (7), facing the camera. Gently tight the screws of the optics holder as well as the camera. This steps completes finishing the construction of the microscope (figure 2-1) for the Picomeasure PM-2.

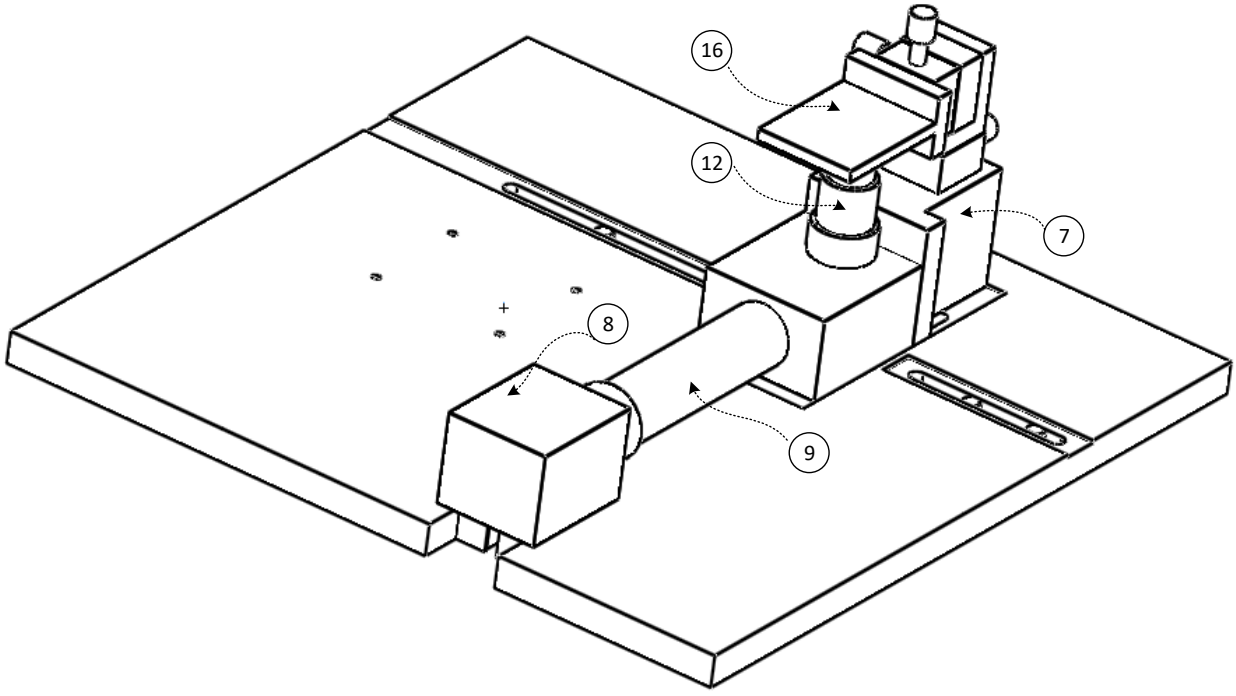


Figure 2-1. Microscope mounted on baseboard

2.3. Mount Optical Head (6): The optical head (6) is shipped preassembled with the laser module (1), mirrors (2,3) and position sensitive detector (PSD, 5). Place the optical head on the baseboard (11) in the designated slots. In order to firmly attach the optical head on the baseboard, use the provided screws (23). Insert the screws (23) from the bottom of the baseboard and then then tight them.

2.4. Mount Signal conditioning circuit board (10): Mount the circuit board (10) in the designated slots (22) using the provided screws.

3. Required instrumentation

It is assumed that in order to operate the Picomeasure PM-2, the user would have following instrumentation available.

3.1. Power Supply: A power supply with designated terminal of +12 V, -12 V and ground is required. Generally a current capacity of 200mA is enough.

3.2. Spectrum Analyzer: A spectrum analyzer with a measurement range of 1kHz to 50kHz is recommended to acquire a considerable FFT from a noisy sine wave, coming from the signal conditioning circuit of the Picomeasure. A feature of averaging a signal is strongly recommended to be present in the spectrum analyzer.

3.3. Oscilloscope: A two channel oscilloscope is required to monitor the voltage level of the Sum and Deflection signals from the signal conditioning circuit.

3.4. Stereo Microscope: A microscope with a long focal length is highly recommended to be used during the initial setup of a Picomeasure PM-2. A stereo microscope is generally sufficient for this purpose.

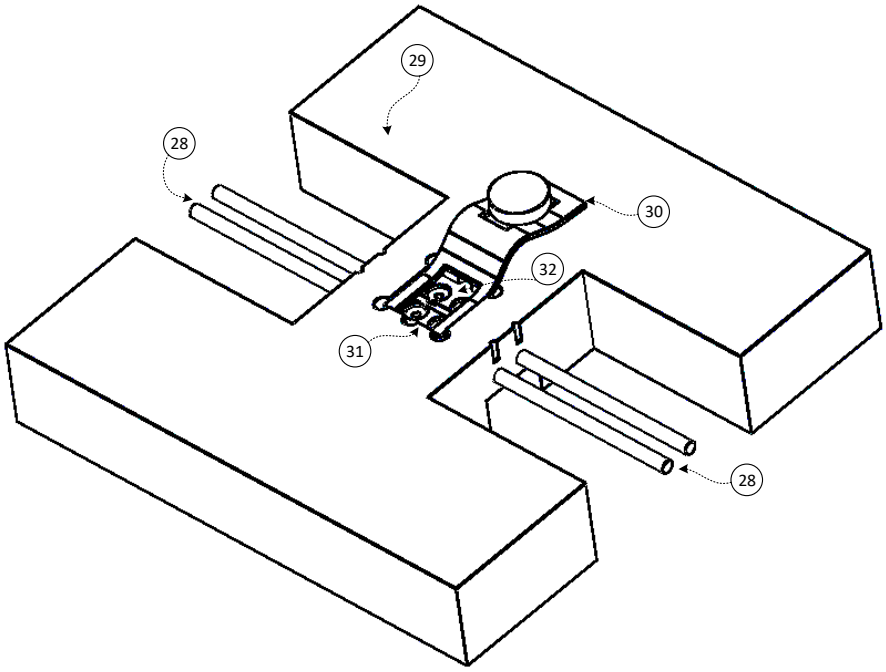
4. Getting Started

4.1. Mount Chip: Microfluidic cantilever needs to be properly placed in the chip holder (29) (figure 4-1), compatible with Picomeasure PM-2. In order to load a chip, unscrew the chip clamp (30) only to a level that it can be rotated around its screw. Remove the clamp from the chip pocket (32). Using a tweezer, properly place orings in the designated grooves (33). It is helpful to use a microscope for this step. Then place a microfluidic cantilever chip on the orings. The chip should be placed in a way that the cantilever on the chip should be in parallel to the slot (34). Then place the chip clamp (30) on the chip and screw it. Do not over tight the screw otherwise over time, the threading or the clamp may get damaged. Once the chip is loaded, mount the chip holder in the designated point on the Picomeasure PM-2.

4.2. Power the circuit: In order to power up the circuit, connect the white wire to -12V, black to ground and red to +12 V of an appropriate power supply. Once all connections have been made, turn ON the power supply. If the circuit is properly powered up, the laser as well as the LED would lit. The intensity of the LED light can be controlled by rotating the black knob, located on the signal conditioning circuit board (10).

4.3. Connection to oscilloscope: In order to acquire image of the microfluidic cantilever, install the software of the digital camera (from the CD provided with the instrument) on an appropriate computer. Connect the camera to the computer and select MU300 in the software. One the screen, they may be unfocused or blur image. Using XYZ translation stage for chip holder (6), align the middle of the microfluidic cantilever chip with the central axis of the microscope objective. The image quality is highly dependent upon the amount of illumination on the cantilever. Therefore, place the LED (with full intensity) at a few different locations to achieve best proximity light for the camera.

4.4. Chip holder and laser beam alignment: In order to pass the laser through the slot (34), it is important to align the chip holder (29) with the laser beam coming from the optical head. For rough alignment, use loosen the screws (24, 25) and slightly move the whole microscope assembly along the line (27) (figure 4-2). Do not use the XYZ translation stage for chip holder (6) to achieve the rough alignment. Once the laser beam seems to be passing through the slot (34) on the chip holder, use the XYZ translation stage (6) to get fine alignment. This step may remove the cantilever from the field of view of the microscope. Therefore, it is important to not use the XYZ translation stage (6) for larger displacements.



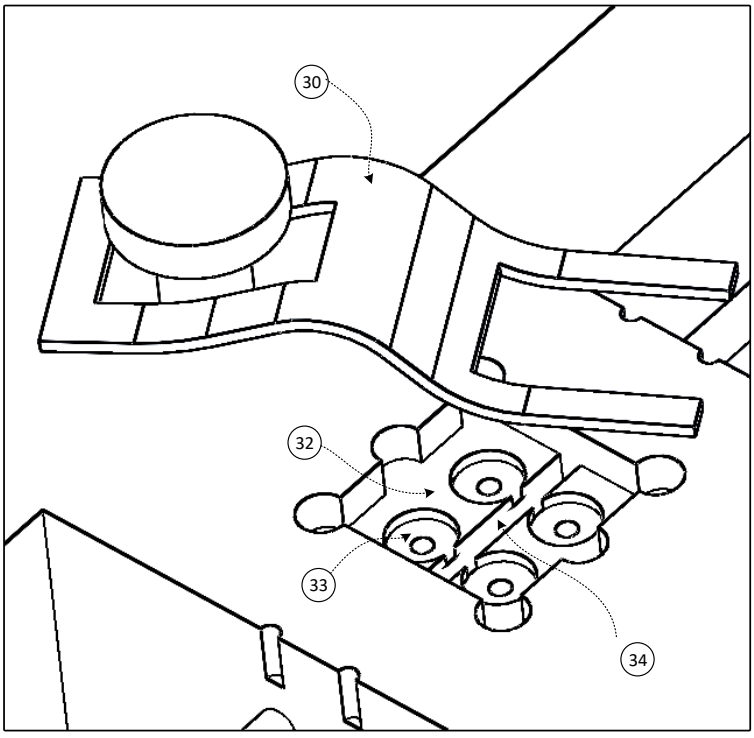


Figure 4-1. Chip holder

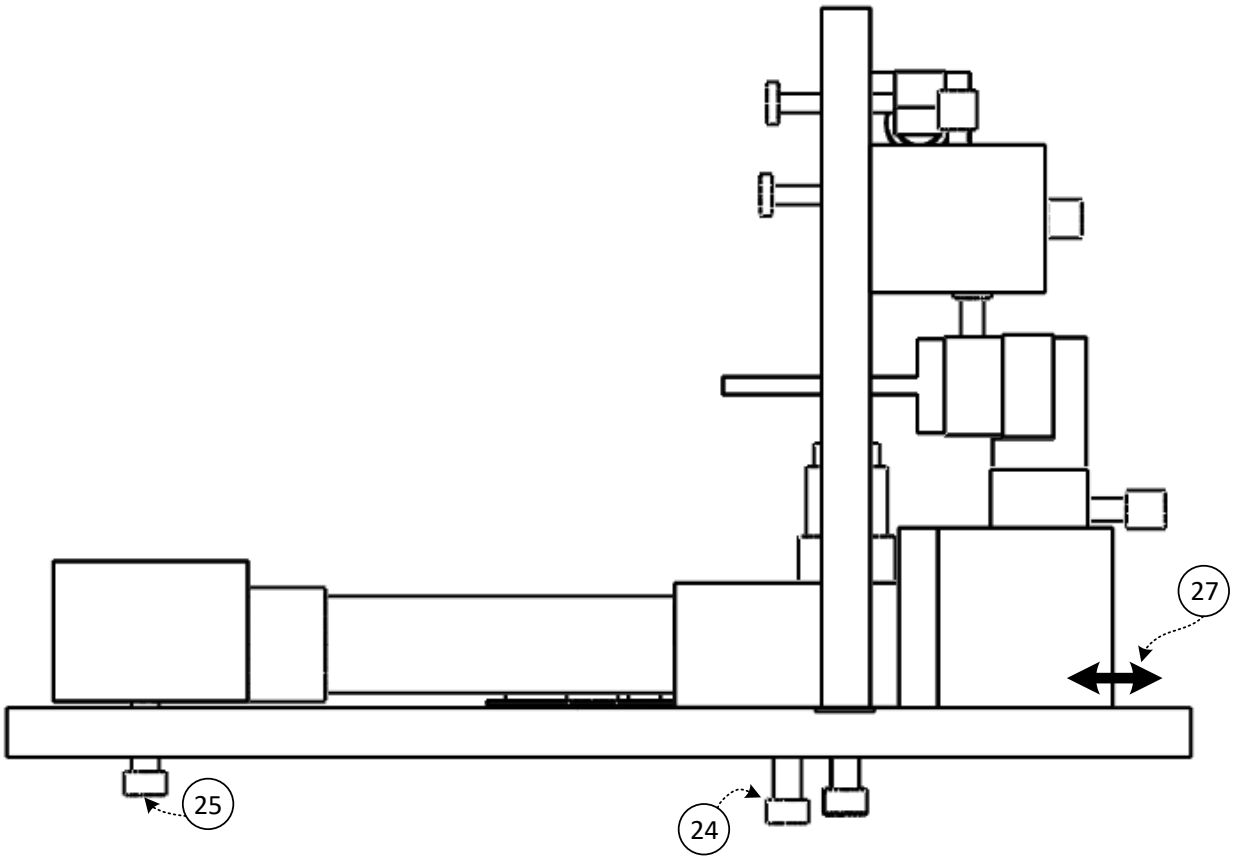


Figure 4-2. Side view of Picomeasure PM-2

4.5. Laser beam focus: Focus the laser on the cantilever through the slot (34). In order to steer the laser beam towards the mirror, use the mirror (2). To achieve a rough focus, change the position of the laser focusing assembly (1) along the provided grooves by loosening the screws from backside of the optical head (4). Use an external microscope to find the state of the focus. Once a rough focus is achieved, rotate the lens tube (located at front of the laser focusing assembly (1)) to further refine the focus.

4.6. Laser beam alignment: Once the laser beam is sufficiently focused on a microfluidic cantilever, it should be steered properly towards the position sensitive detector – PSD (5). To achieve this, it is critical that the reflected beam falls as close as possible to the middle of the mirror (3). If this is not the case (solid red line in figure 4-3), slightly change the position of the optical head (4) along the line (26) by loosening the screws (23). Translate the optical head right or left, focus the laser and find the reflected beam can be reflected across the length of the PSD.

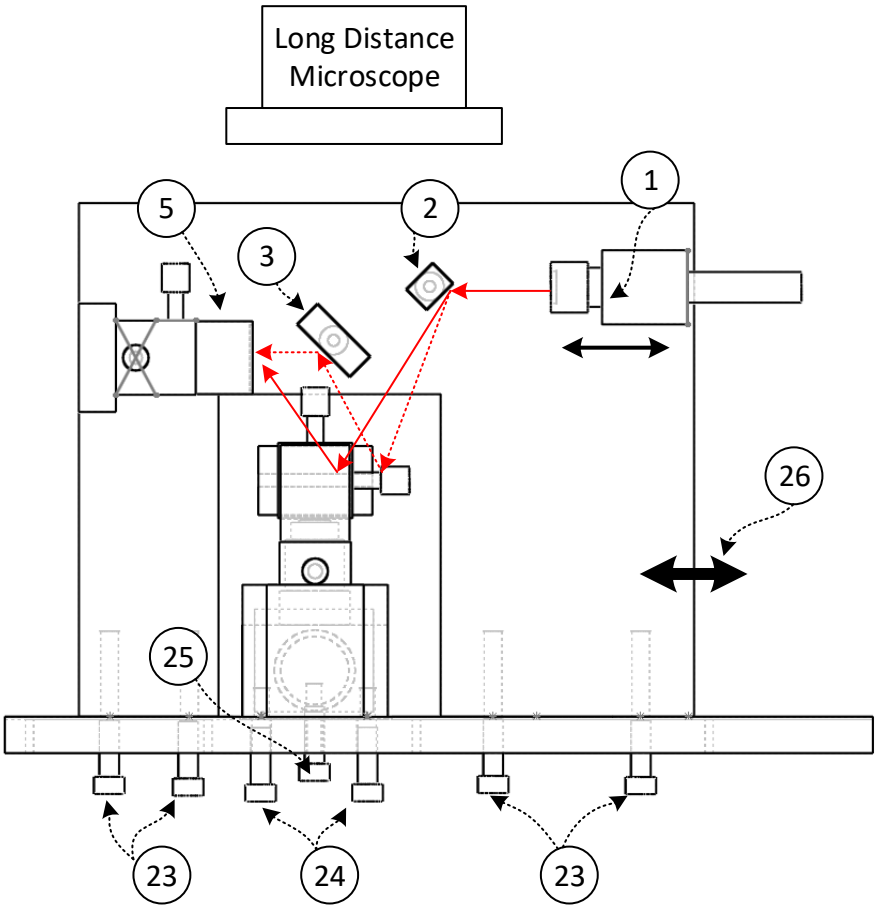


Figure 4-3. Front view of Picomeasure PM-2

4.7. Connecting oscilloscope: The electrical response of the PSD can be visualized on a two channel oscilloscope. From the signal conditioning circuit board (10), using SMA/BNC cables, connect the DEFLECTION and SUM signals, directly to an oscilloscope. If the laser is properly focused and falling in the middle of the PSD, the SUM signal should be around 5V. Using the vertical translation of the PSD, keep the DEFLECTION signal to around 0V.