

RoboMaster Referee System

Speed Monitor Modules SM01 & SM11

User Guide

使用说明

v1.0 2018.11

Disclaimer

Thank you for purchasing the ROBOMASTER™ Speed Monitor Module. Please read this disclaimer carefully before using this product. By using this product, you hereby signify that you have read and agree to all content herein. Please install and use this product properly and in strict accordance with the User Manual and product instructions, as well as any relevant laws, regulations, and policies. Users shall be responsible for the consequences resulting from their behavior while using this product. DJI™ will not bear any legal responsibilities for any damages due to improper use, installation or modification.

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Product Usage Precautions

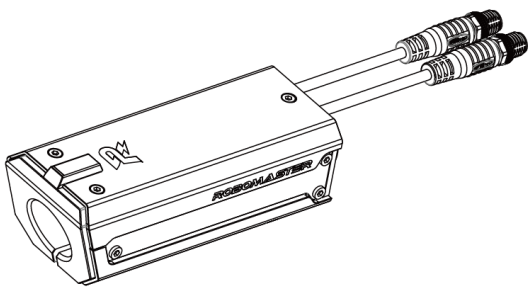
1. Before using the product, make sure that there are no short circuits, and that all interfaces are correctly connected.
2. Before using the product, please download the RoboMaster 2019 Referee System User Manual from the official RoboMaster website to learn more about the product.

Introduction

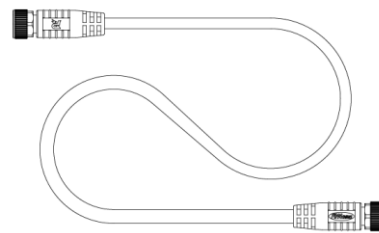
The RoboMaster Referee System Speed Monitor Module is equipped with sensors that monitor the

speed and frequency at which projectiles are launched from the barrel. Its CAN interface (i.e. aviation connector) transmits the data about the speed and frequency of projectiles launched to the Main Control Module of the Referee System according to the communication protocol of the Referee System. When the Speed Monitor Module detects a projectile, the LED light will turn on

Inventory List



Speed Monitor Module* × 1



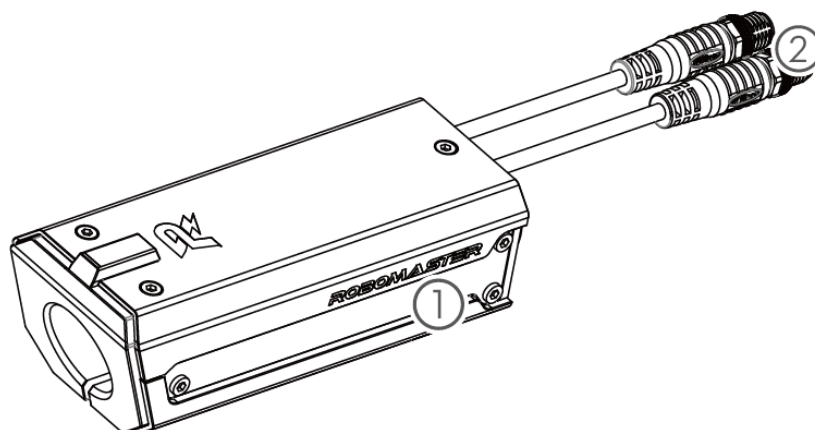
Aviation Connector Cable × 1

*The RoboMaster Referee System Speed Monitor Module is available as two models: SM01 and SM11.

The inventory list for SM01 is provided as an example. The product shall be as provided to you at the time of your purchase.

Description of Components

SM01:



1. LED indicator

It is used to indicate the status of the module. See the LED Light Status Display section for details.

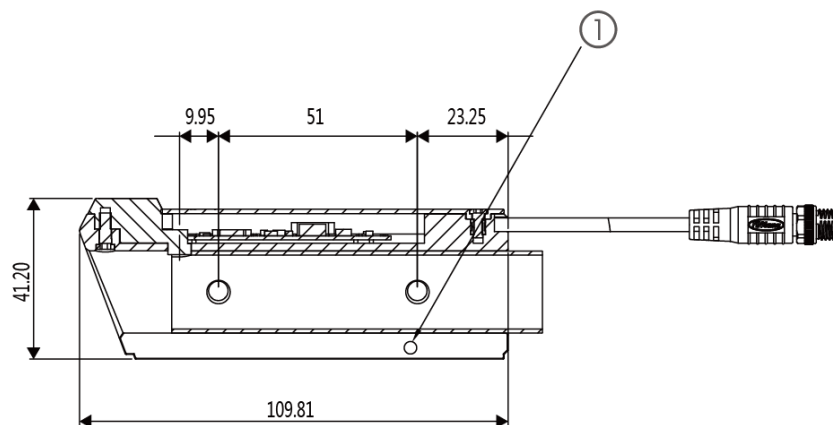
2. Aviation connectors

The CAN interface needs to be connected to an external 12 V power supply, and is used for communication between the Speed Monitor Module and the Power Management Module. The two aviation connectors have the same function.

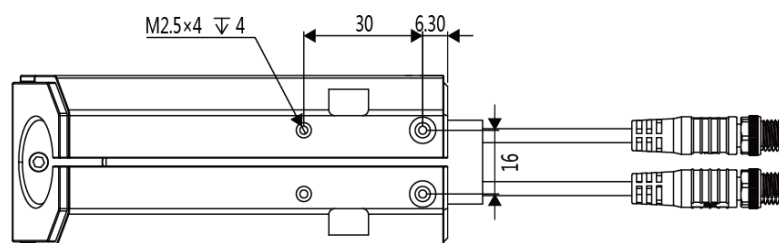
Mounting and Connection

Properly mount the Speed Monitor Module according to its dimensions and the dimensions of the barrel that comes with it.

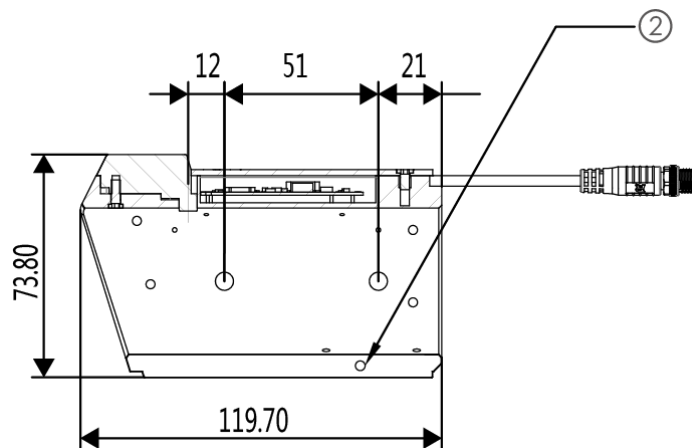
Dimensions of the Speed Monitor Module SM01:



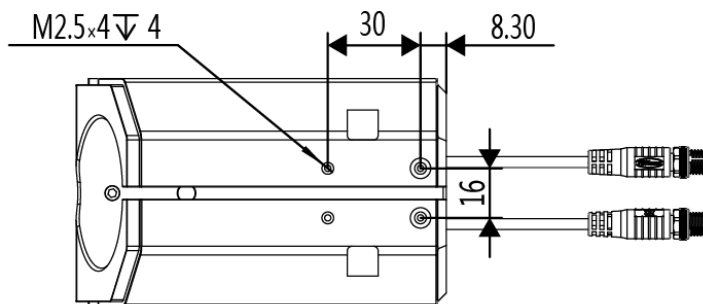
1. Use the screw hole to clamp the barrel



Dimensions of the Speed Monitor Module SM11:

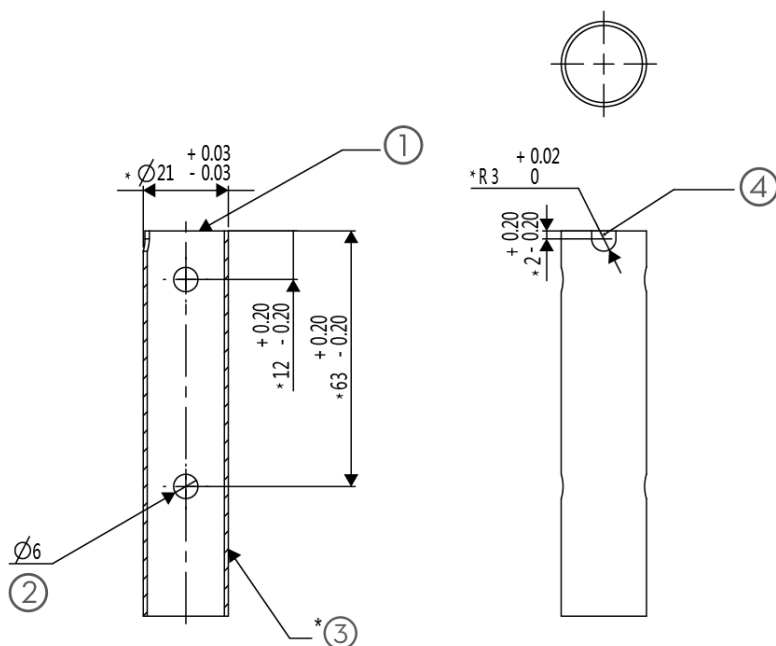


2. Use the screw hole to clamp the barrel

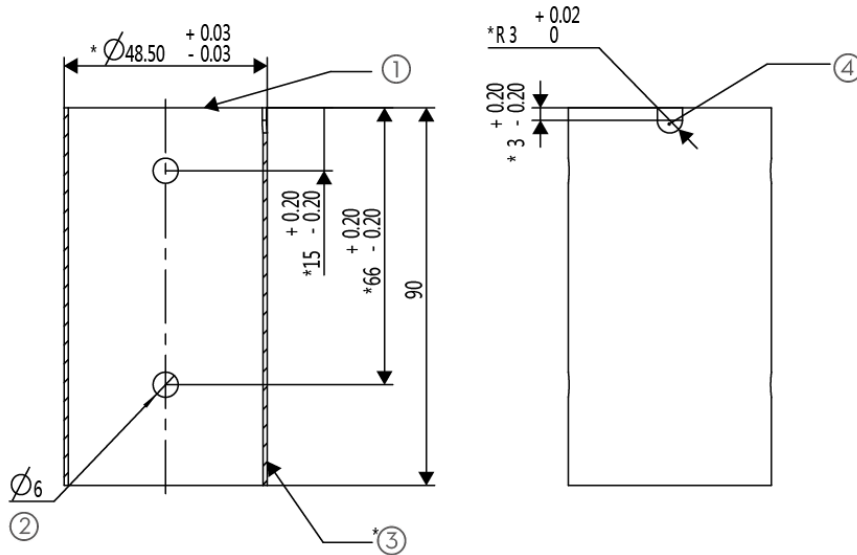


Unit: mm

Dimensions of the barrel for the Speed Monitor Module SM01:



Dimensions of the barrel for the Speed Monitor Module SM11:



Unit: mm

1. Muzzle
2. Advice: 6 mm < diameter < 8 mm
3. The wall thickness must not be smaller than 1 mm.
4. The U-shaped groove must face upward after mounting the barrel.

The mounting and connection methods for the two models are the same. Below follows an explanation of how to mount and connect SM01:

1. Place the Speed Monitor Module on the barrel so that the U-shaped groove of the barrel is aligned with the projection of the module.
2. Drive a M3 screw through the screw hole at the rear of the Speed Monitor Module to fasten the barrel so that it will not shift during use.
3. Connect the aviation connector of the Speed Monitor Module to the aviation connector of the Power Management Module of the Referee System.

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- ⚠ • During installation, make sure that there is no obstruction between the sensors which may affect their function of monitoring speed.
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- After installation, check whether the Speed Monitor Module and the barrel are firmly fastened. Otherwise, relative displacement may occur between the barrel and the module under the action of an external force.
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Working Principle

1. Speed Measurement

(1) The Speed Monitor Module is equipped with 2 sensors. When a projectile passes through the barrel, it will trigger the 2 sensors in the module successively. The average speed at which the projectile passes through the module can be obtained from the difference in the time the 2 sensors are triggered.

(2) As projectiles are constantly launched, the Speed Monitor Module records the time intervals between the launch of projectiles to obtain the frequency of launch.

(3) The module transmits the data about the speed and frequency of launch of projectiles to the Main Control Module of the Referee System through the CAN interface according to the communication protocol of the Referee System. The Main Control Module of the Referee System then makes a corresponding decision according to the rules of the Referee System.

2. LED Light Status Display

When the Speed Monitor Module detects a projectile, the LED light will produce a "waterfall" effect.

LED indicator of module status:

LED Light Status	Module Status	Description
All LEDs flash red and blue slowly and alternately after the module is powered on.	Self-diagnosis failed.	There is an obstruction between the sensors equipped with the module or a sensor is damaged.

All LEDs turn and remain green for 500 ms after the module is powered on.	Self-diagnosis successful.	This status will be displayed if the module has been successfully initialized.
The LEDs flash green slowly.	There is a problem with the communication between the module and the main controller.	It is necessary to check the connection between the modules.
The LED lights flash red and blue quickly and alternately after the module has been successfully initialized.	There is a problem with a sensor.	There is an obstruction between the sensors equipped with the module or a sensor is damaged during use.

3. IMU angle

The Speed Monitor Module is equipped with an IMU that measures the relative directional angle of the module. Please calibrate the magnetometer as follows before using it:

- (1) Connect the Speed Monitor Module to the Referee System via the aviation connector cable.
- (2) Select the magnetometer calibration mode through the UI of the Main Control Module of the Referee System and rotate the Speed Monitor Module 360° horizontally.

If the calibration is successful, the text "Calibration successful" will be displayed on the screen of the Main Control Module. If the calibration fails, please perform the calibration again until it is successful.

After the Speed Monitor Module is successfully calibrated, the data about the directional angle of the module will be transmitted to the Main Control Module of the Referee System at a frequency of 20 Hz

to indicate the direction of the Speed Monitor Module.

Product Parameters

Model	SM01	SM11
Power Supply Voltage	12 V	12 V
Maximum Power	17 W	17 W
Dimensions	110.4 × 43.5 × 38.9 mm	119.6 × 74.2 × 69.3 mm
Weight	175 g	383 g
Speed Measurement Range	1-50 m/s	1-30 m/s
Frequency Measurement Range	1-35 Hz	1-35 Hz
Output Angle Error	±3°	±3°
Number of LEDs	120	200

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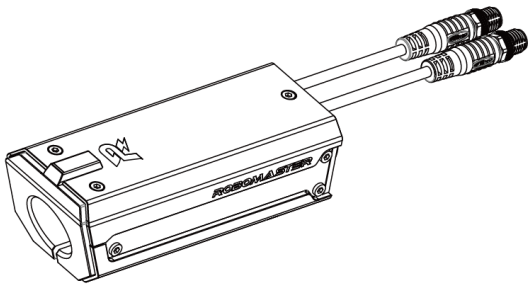
产品使用注意事项

3. 使用时请确保电路无短路、接口按照要求正确连接。
4. 使用前请前往 RoboMaster 官网下载《RoboMaster 2019 裁判系统用户手册》了解产品的详细功能。

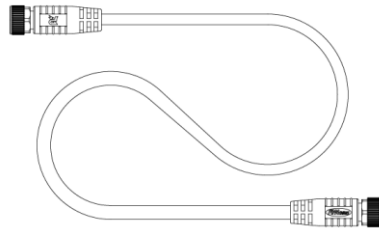
简介

RoboMaster 测速模块内置传感器，可实时测量枪管处所经过的弹丸速度及频率。其 CAN 接口（即航空线接头）根据裁判系统通信协议，将获取的弹丸的射速和射频数据实时发送给裁判系统主控模块。当测速模块检测到弹丸经过时，LED 灯将会点亮进行提示，增加比赛的趣味性。

物品清单



测速模块* × 1

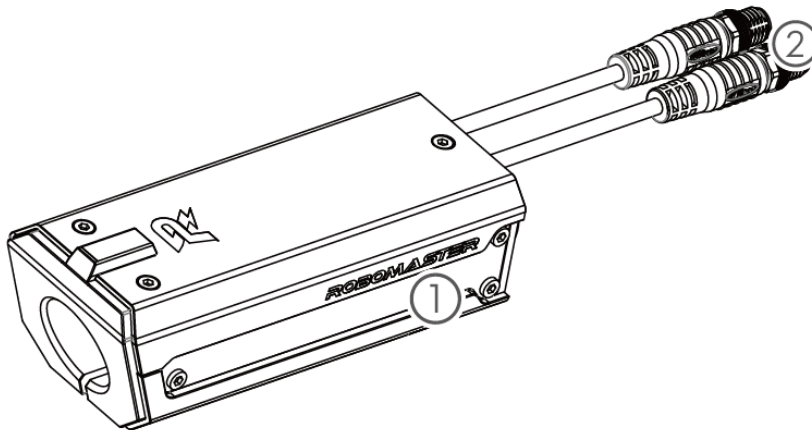


航空转接线 × 1

*RoboMaster 裁判系统测速模块共有两个型号：SM01 及 SM11，物品清单以 SM01 为例。具体实物以您购买时为准。

部件说明

以 SM01 为例：



1. LED 指示灯

对模块工作状态进行指示，详情请查阅 [LED 灯效显示](#) 章节。

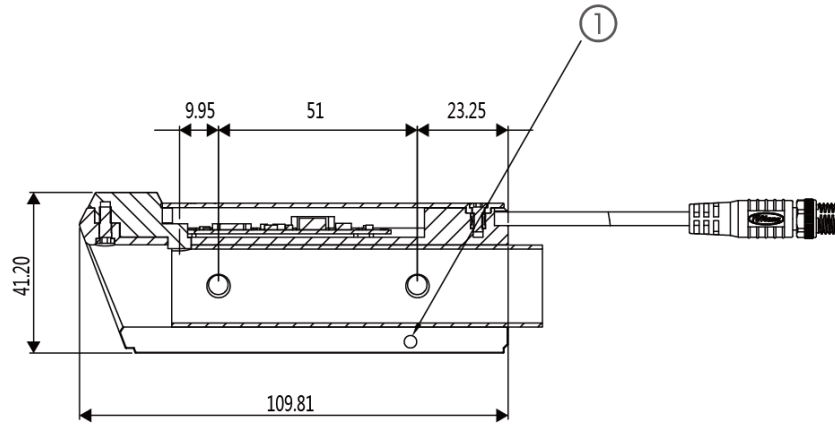
2. 航空线接头

接头类型为 CAN 接口，需外接电压为 12V 的电源进行供电，用于进行测速模块和电源管理模块之间的通信。两根航空线接头功能相同。

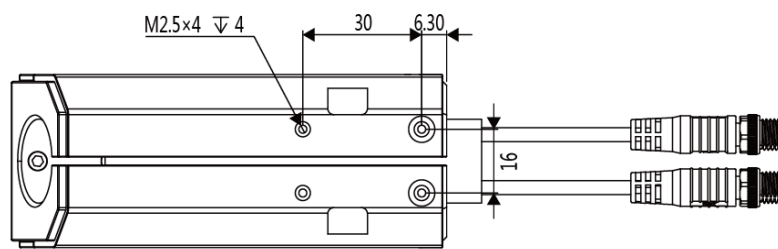
安装连线

请根据测速模块尺寸及其适配枪管尺寸将测速模块安装于合适位置。

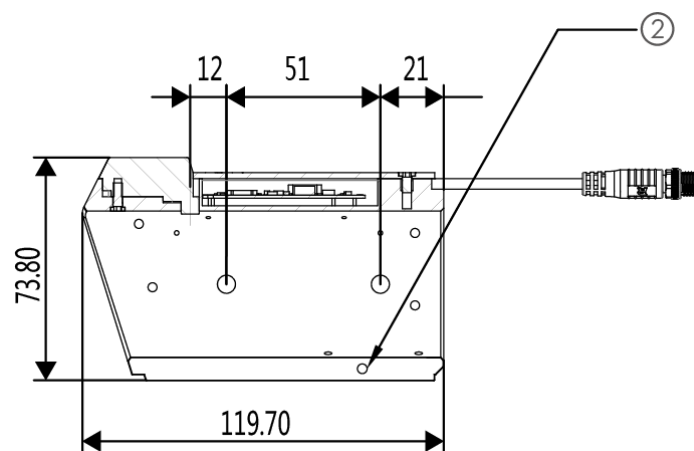
测速模块 SM01 尺寸：



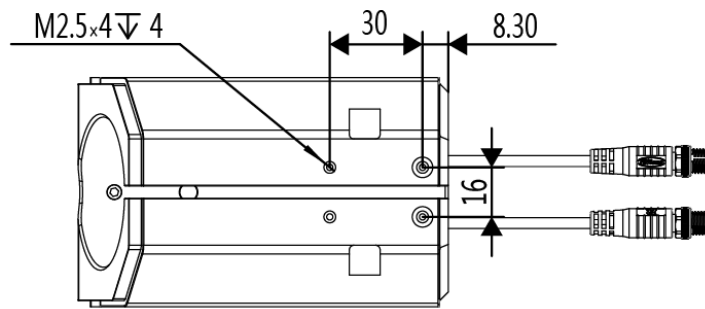
1. 使用该螺丝孔夹紧枪管



测速模块 SM11 尺寸：

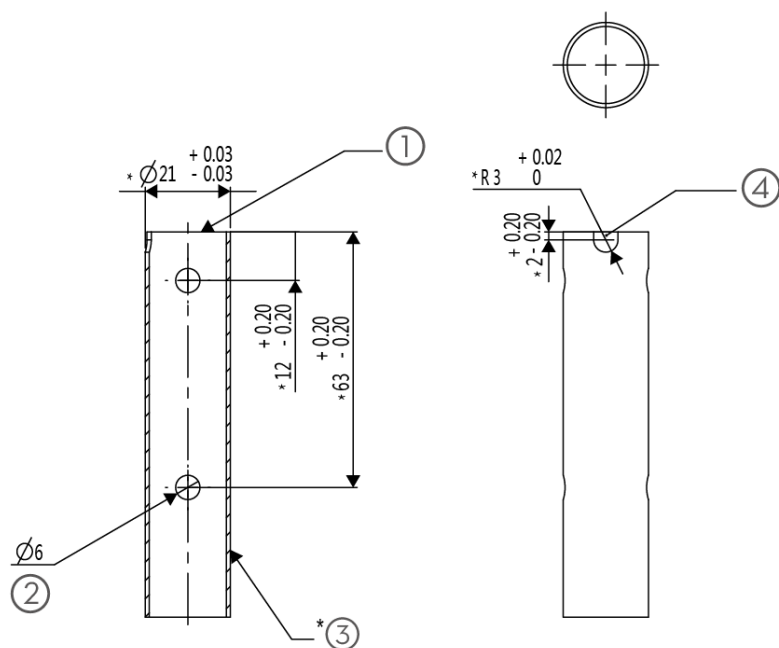


2. 使用该螺丝孔夹紧枪管

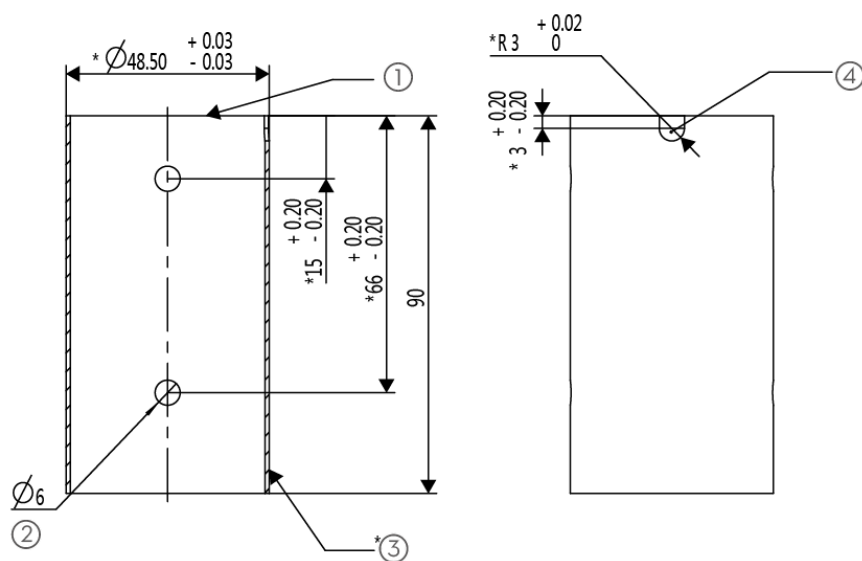


单位：mm

测速模块 SM01 适配枪管尺寸图：



测速模块 SM11 适配枪管尺寸图：



单位：mm

1. 枪口

2. 建议：直径大于6mm，小于8mm

3. 厚壁不得小于 1mm

4. 枪管安装后，此 U 型槽方向向上。

两个型号测速模块安装与连线方式相同，下面以 SM01 为例进行说明：

1. 将测速模块套于枪管上，确保枪管 U 形台阶卡在模块内径的凸台上。
2. 使用 M3 螺丝穿过测速模块后部的螺丝孔，夹紧枪管，确保使用中枪管不会发生偏移。
3. 连接测速模块的航空接头至裁判系统电源管理模块航空接头。

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- ⚠
- 安装时，请确保传感器之间无任何遮挡，以免影响其测速的基本功能。
 - 安装完毕后，请检查是否测速模块和枪管已完全固定。否则，当受到外力作用时，枪管和模块有可能会发生相对位移。
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工作原理

1.测速

(1) 测速模块内置 2 个传感器。使用时，弹丸经过枪管，先后触发模块中的 2 个传感器。通过 2 个传感器被触发的时间差可获得弹丸经过模块时的平均速度。

(2) 伴随弹丸的不断射出，测速模块可以记录弹丸发射的时间间隔从而获得发射频率。

(3) 通过 CAN 接口，按照裁判系统通信协议，模块将测量到的弹丸发射速度及发射频率数据实时发送至裁判系统主控模块。然后裁判系统主控模块根据裁判系统规则进行相应裁决。

2.LED 灯效显示

当测速模块检测到有弹丸经过时，其侧板处 LED 灯将会出现一次流水灯效。

模块状态 LED 指示灯：

LED 灯效	模块状态	说明
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模块上电后所有 LED 呈红蓝灯交替慢闪。	模块自检不通过。	模块内红外对管间有异物持续遮挡传感器或传感器损坏。
模块上电后所有 LED 呈现 500ms 绿色。	模块自检通过。	若模块自检不通过，清除异物遮挡后自检通过仍会有此灯效
LED 灯绿灯慢闪	模块和主控通信异常。	检查模块和主控的 CAN 接头以及对接航空线。
模块自检通过后 LED 灯呈红蓝灯交替快闪。	模块传感器异常。	模块内红外对管间有异物持续遮挡传感器或传感器损坏。

3.IMU 角度

测速模块内置 IMU，可实时测量模块的相对方向角度。使用前请对磁力计进行校准，具体校准流程为：

- (1) 首先将测速模块通过航空转接线接入裁判系统。
- (2) 通过裁判系统主控模块上的 UI 交互进入测速模块磁力计校准模式，将测速模块水平旋转 360 度。

若校准成功，主控模块上的屏幕会出现校准成功提示；若失败，请重新校准直至校准成功。在测速模块校准成功后，会以 20HZ 的频率定时将方向角度数据发送给裁判系统主控模块，以指示测速模块的方向。

产品参数

型号	SM01	SM11
供电电压	12 V	12 V
最大功率	17 W	17 W
尺寸	110.4 × 43.5 × 38.9 mm	119.6 × 74.2 × 69.3 mm
重量	175 g	383 g

测速范围	1-50 m/s	1-30 m/s
测频范围	1-35 Hz	1-35 Hz
输出角度误差	$\pm 3^\circ$	$\pm 3^\circ$
LED 灯珠个数	120	200

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