ZZ6-5 型船舶气象仪安装使用手册

Installation and Operation Manual TO ANEMOSCOPE MODEL ZZ6-5

中国　　上海气象仪器厂有限公司

Shanghai Meteorology Instrument Factory Co.,Ltd

仪器清单	**List of the instrument**
仪器配套清单	**List of the whole set of the instrument**
主仪器 1 台	**Main instrument 1 pcs.**
风速风向传感器 1 台	**Wind direction and velocity sensor 1 pcs.**
控制器	**Control box 1pcs.**
分显示器	**Repeater indicator 1 pcs.**
《ZZ6-5 船舶气象安装使用手册》1 份	**Technical service manual to anemoscope model ZZ6-5 1 pcs**
备品盒 1 只	**Spare parts box 1 pcs**

90 天备件清单   List of Spare Parts（90 days）

编 号 (No.)	名 称 （Name）	单位 (Unit)	数量 (Quantity)	备注 (Remarks)
1	保险丝 FUSE	只 PCS	4	
2	螺丝刀 SCREWDRIVER	把 PCS	1	
3	尖嘴钳 SHARP NOSE PINCER	把 PCS	1	

目　　录

1. 总论

1.1 仪器用途

气象状况对于海上船舶航行安全及舰艇武器命中率极为重要。ZZ6-5 型船舶气象仪(风向风速仪)是适用于各类大中型舰船测量所在海域气象数据的仪器。

ZZ6-5 船舶气象仪(风向风速仪)是以单片机为核心的智能化仪器。该仪器由主仪器、传感器、控制器、分显示器四大部分组成。它能测量合成(视)风向、合成(视)风速等气象要素，并能解算出 120 秒滑动平均风速、120 秒内的最大风速；根据 120 秒滑动平均风速定出风级；根据 120 秒内采集到的风向值求得最多风向角值。配上分显示器并通过 RS-422 口向外系统输出所测气象信息，可以远距离显示出一些主要气象要素。

1.2 技术性能

1) 风向测量: 0°~360° ≤±5°

2) 风速测量: 1.5m/s ~ 60m/s ≤±(0.5+V$_{测}$×5％)m/s

3) 风速风向传感器启动风速: ≤1.5m/s

4) 风速风向传感器最大抗风能力:60m/s

5) 设有一个标准 RS-422 串行通讯接口

6) 分显示器复示主仪器的显示内容，并且每三秒更新一次

7) 分显示器采用八位 LED 显示数据。

分显示器可手动显示三种状态，六种数据，面板对照表如下：

状 态 码 MODE NO.	显示内容　　　　　　INDICATIONS	
1	A(m/s)合成风速 COMP.WIND V.	W(°) 合成风向(视)　　　　COMP. WIND DIR.
2	M(m/s)平均风速 MEAN WIND V.	F(°) 最多风向角　PREVAILING WIND DIR.
3	G　　　风级　　　WIND SCALE	M(m/s) 最大风速　　　　　MAX. WIND V.

亦可选择自动显示，每间隔三秒轮番显示上表三种状态的六个数据。

1.3 仪器的配套组成

1) 主仪器

2) 风向风速传感器

3) 分显示器

4) 控制器

2. 使用

2.1 电源

主仪器：~220V±10%，50Hz，功耗≤35VA

2.2 使用环境

室外部分：

温度：-30°C~+55°C　　　　　　湿度：0%~100%RH

室内部分：

温度：-10°C~+55°C　　　　　　湿度：0%~93%RH

2.3 仪器的操作使用

2.3.1 主仪器操作

见附图 1

2.3.2 控制器操作

打开控制盒电源开关，主仪器即进入工作状态。控制盒上共有二个旋钮，1 个控制背光亮度，1 个控制显示风速数码管亮度。亮度调节为无级调光。见附图 2

2.3.3 分显示器操作

分显示器采用八位 LED 显示数据。一位为状态码， 中间的三位数字和右边的四位数字指出在该状态下显示的内容，其具体意义可查面板上的对照表。分显示器可手动显示三种状态，六种数据。亦可选择自动显示,每间隔三秒轮番显示上表三种状态的六种数据。正常工作时，状态码的小数点以 3 秒间隔一明一暗地闪烁。见图 3

3 工作原理

3.1 概述

如原理图所示，该仪器将风向、风速二个非电量转换为数字量信号，并通过单片及迅速、准确、可靠地进行一系列的处理。最后、将手动或自动选择的数据在数码管上显示。数据包括：平均风速、最多风向角；风级、最大风速；合成(视)风向、合成(视)风速共三种状态、六种数据。它可通过标准 RS-422 串行通讯口与远距离分显示器或外系统计算机进行通讯。

3.2 传感器

风向风速传感器是连成一体的，外形结构象飞机式，其风速传感器是四个叶片螺旋桨式，风向传感器是尾叶状。见图 4

3.2.1 风速

当螺旋桨在风力作用下带动转轴，使安装在转轴上的带 28 槽码盘随之转动，由光电转换电路将机械转动转换成脉冲电信号输出，由于螺旋桨旋转的转速与风速成正比例关系，因此输出的脉冲频率也是同风速成正比例的关系

3.2.2 风向

当风标尾叶随风向的变化带动转轴，使安装在转轴上的七位格雷码盘随之转动，由于码盘旋转一周在 360°范围内分成 72 个方位，每转动一个方位就出现 5°的变化，每一个方位都设定一组"0"、"1"编码，经中央微处理器处理后，在显示器上显示出对应的值。
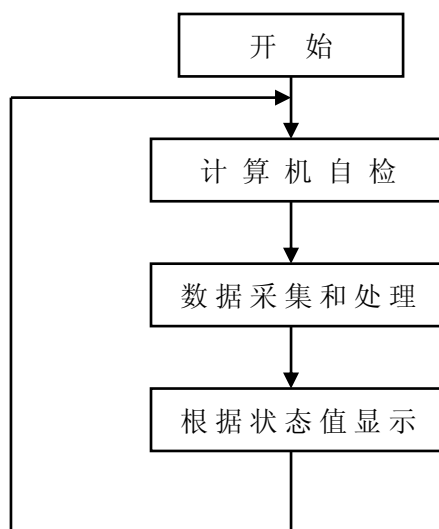
3.3 微型计算机

3.3.1 硬件结构

本仪器采用高集成度的 MCS-51 系列单片机，自动采集各个传感器送来的气象要素的电信号，进行一系列计算后显示，并通过 RS-442 串行通讯口传送至分显示器和外系统计算机。

3.3.2 软件结构

开机后首先进入自检程序，以检查计算机的主要芯片是否正常工作。若正常就是其进入状态 1，以后就进入主程序运行，可任意显示各种气象要素。主程序运行一周的

时间为 3 秒钟(可从状态码的小数点一明一暗反映出来)。主程序流程如图。

```
┌──────────────┐
│   开  始      │
└──────┬───────┘
       │
  ┌────┴─────────────┐
  │   ┌──────────────┴──┐
  │   │  计 算 机 自 检  │
  │   └──────┬──────────┘
  │          │
  │   ┌──────┴──────────┐
  │   │ 数 据 采 集 和 处 理 │
  │   └──────┬──────────┘
  │          │
  │   ┌──────┴──────────┐
  │   │ 根 据 状 态 值 显 示 │
  │   └──────┬──────────┘
  │          │
  └──────────┘
```

3.4 分显示器

由主仪器算出来的合成风向、合成风速等数据，通过 RS-422 串行口送给分显示器。分显示器从中选择需要的数据进行显示。

分显示器开机后， 首先进行自检，完成自检后进入显示状态。有数据送来时，分显示器轮流显示所有数据，每组数据停留 3 秒。如果只需要显示一组数据，可在显示屏显示该数据时拨动暂停开关至暂停位置。这样可使机器只显示该组数据，且该数据仍然每隔更新一次。如果 RS-422 串行口的数据由于前面提到过的原因而中断，显示屏的状态码的小数点不再每隔 3 秒变换一下明暗状态，显示的数据也不再更新。此时应暂停读数，直至小数点恢复变换。

4 一般故障维修

故障现象	故障原因	故障分析处理
无数据显示	交流电源中断	1. 船电没有接通。 2. 检查控制盒电源输出。 3. 电源开关损坏及相关连线问题。
	计算机显工作不正常	1. 调换相关集成块。 2. 送厂维修。
分显示器态码小数点不闪烁	未收到主仪器发来的数据	1. 主仪器未接通。 2. 检查与主仪器的连线。

5 仪器安装

5.1 风速风向传感器的安装

a)螺旋桨应安装于较高处，周围空旷，无大的障碍物，同时还应便于平时的维修保养。

b)焊接后传感器安装基座应保持水平。

c)安装传感器的方法：首先将它放到基座上，令传感器的首尾线与舰船艏艉线一致，并使螺旋桨指向舰船艏方向。保持机座不动，用三只固定螺栓与安装基座锁紧固定。

5.2 安装尺寸及连接

安装支架尺寸及仪器的安装连接，电缆接线等技术要求可参照安装图。

TECHNICAL SERVICE MANUAL TO ANEMOSCOPE MODEL CZ-5

Contents

1   General

1.1   Function

Meteorological states are very important to sailing safety of ships on the sea and the rate of hitting the target of weapons on the ships. SHIP METEOROLOGICAL INSTRUMENT MODEL ZZ6-5(ANEMOMETER & ANEMOSCOPE) is an instrument suitable for all sorts of large-scale and medium-sized ships to measure meteorological parameters of sea area where ships are.

The ANEMOSCOPE is intellectualized by the eight-digit single-chip microcomputer.

The instrument is composed of the main instrument and sensors and control instrument and repeater indicator. It can measure some meteorological key elements such as composite (apparent) wind direction, composite (apparent) wind velocity. It can calculate average sliding wind velocity in 120 seconds and maximum wind velocity in 120 seconds. The wind scale is determined according to average sliding wind velocity in 120 seconds. The maximum wind direction angle value is evaluated from the wind direction values collected in 120 seconds. With the repeater indicator equipped, the instrument can output the meteorological information measured to outside system through RS-422 port, and thus it can indicate distantly some main meteorological key elements above.

1.2 Technical   Performance

1)   **Measurement of wind Direction:0° ～ 360° ≤±5°**

2)   **Measurement of wind Velocity 1.5M/s～60m/s ≤±（0.5+Vmeasurement×5%）m/s**

3)   **Starting Wind Velocity of the Wind Direction and WIND Velocity Sensor ≤1.5m/s**

4)   **Maximum Wind-Resistant Ability of the Wind Direction and Wind Velocity sensor: 60m/s**

5)   **The repeater indicator displays the data adopting eight-digit LED.**

The repeater indicator displays the three states and six kinds of data. See the

following contrast table on the panel for details.

状 态 码 MODE NO.	显示内容　　　　INDICATIONS	
1	A(m/s) 合 成 风 速 （ 速 ） COMP.WIND V.	W(°) 合成风向(视) COMP.WIND DIR
2	M(m/s) 平 均 风 速 　　MEAN WIND V.	F(°) 最多风向角 PREVAILING WIND DIR.
3	G　　　风级　　　　WIND SCALE	M(m/s) 最大风速　MAX.WIND V.

The 6 data of 3 modes on the table are shown in return every 3 seconds under automatic display state

1.3　　Composition　of　the　Instrument

1)　　Main Instrument

2)　　Wind Direction and Velocity Sensor

3)　　Repeater Indicator

4)　　Control Instrument

2　Usage

2.1　　Power Supply

　　Main Instrument:　～220V±10%, 50Hz, Power Assumption:　≤35VA

2.2　　Using Environment

　　Outdoors:

　　Temperature: -30℃～+55℃　　Humidity: 0%～100%RH

　　Indoors:

　　Temperature: -10℃～+55℃　　Humidity: 0%～93%RH

2.3   Operation of Instrument

2.3.1   Main Instrument Operation：

2.3.2   Control Instrument Operation：

After switching on the power supply, the instrument will enter the normal measuring and running state. There are two keys on the control instrument. One for background light , the other for LED brightness.

2.3.3   Repeater Indicator Operation：

There are 8 digits on it. The one-digit window in left is for Mode Code. The data displayed in the middle 3-digit window and the right 4-digit window is to indicate the contents displayed under the current mode. You can see the contrast table on the panel to know what does the data means. You can select the data to display according to the indicating content contrast table. If the working Mode-Selected button is pressed. The working state is the automatic state. The data in each mode will be displayed alternately in Main Instrument, and each data will stay for three seconds in display. If the mode switch is pushed up, the data of current mode will be always displayed. You can observe if the decimal point of Mode Code in the indicator flashed from brightness to darkness of from darkness to brightness at intervals of 3 seconds, that means the computer is not working normally.

3. Working Principles

3.1 General

As shown in the frame diagram (Diagram), the 2 non-electrical signals of the instrument such as wind direction, wind velocity are changed into analog voltage signals and go though the buffer and successively go through the multiple route switches and input into A/D transformer, where the analog signals which represent various meteorological key elements into digital signals. These digital signals were processed

rapidly, accurately and reliably by the single-chip microcomputer. At last manually or automatically selected data are displayed on the numeral tube. There are three kinds of states and six kinds of data including mean wind velocity, maximum wind direction angle, wind scale, maximum wind velocity, combined (apparent) wind velocity, combined (apparent) wind direction. It can communicate with far-distance repeater indicator or outer system computers through standard RS-442 serial interface.

3.2 Sensors

The wind direction sensor and the wind speed sensor are connected as one. The contour of the combined sensor looks like an aeroplane. The wind speed sensor is a propeller type sensor with four vanes and wind direction sensor is of a tail-vane type one.

2.3.1 Wind Speed:

The 28-groove coding mask fitted on the rotation shaft is rotated accordingly when the rotation shaft is driven by the propeller under the action of the wind force, and the mechanical rotation is converted into the electrical pulse signal output by the opto-electronic conversion circuit. The pulse frequency of the output is proportional to the wind speed because the rotating speed of the propeller is in proportion to the wind speed.

2.3.2 Wind Direction:

When the 7-digit Gray encoding mask fitted on the rotating shaft is rotated with the rotating shaft which is driven by the tail vane due to variations in wind direction. Since the encoding mask has 72 positions in a revolution, i.e. within 360°, position change of 5° will occur when it shift from one position to the next. Each position is assigned to a set of 0 or 1 code after being processed by the central micro control unit, the value corresponding to the position change is display on the display screen.
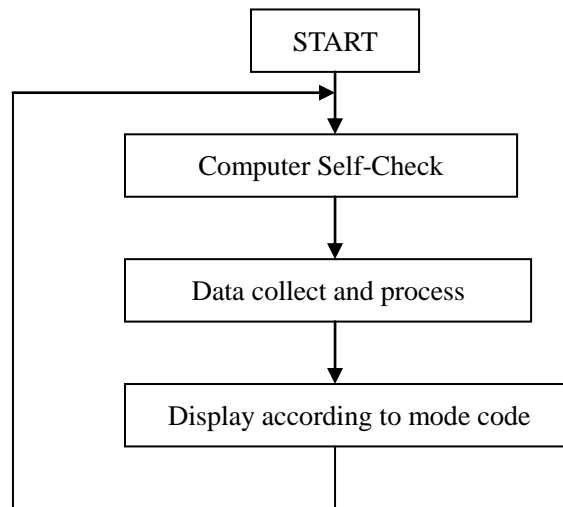
3.3 Micro-computer

3.3.1 Structure of hardware

High-integrated single-chip microcomputer serial MCS is adopted in this instrument. It can collect automatically the electric signals of the meteorological element sent from various sensors and carry on series transformations and calculations whose results are sent to the Main Instrument for display. It also be transmitted through RS-442 serial interface to repeater indicator and outer system computer.

3.3.2 Software structure

This program first sets up self-test to inspect whether the main chips are working normally. If it is working normally, make it enter mode 1, then the main program will be running and various meteorological elements will be displayed. The period of the main program is 3 seconds (which is reflected by the brightening and darkening of the decimal point of the mode codes). The flow chart of the main program is as Diagram.

```
                    ┌──────────────┐
                    │    START     │
                    └──────┬───────┘
          ┌────────────────┤
          │         ┌──────▼───────────────┐
          │         │ Computer Self-Check  │
          │         └──────┬───────────────┘
          │         ┌──────▼───────────────┐
          │         │ Data collect and process │
          │         └──────┬───────────────┘
          │         ┌──────▼───────────────┐
          │         │ Display according to mode code │
          │         └──────┬───────────────┘
          └────────────────┘
```

3.4 Repeater Indicator

The (apparent) wind velocity and (apparent) wind direction calculated by the main instrument will be sent to the Repeater Indicator through RS-442 serial interface. Repeater Indicator will select required data to display.

The Repeater Indicator will do self-test first, after it is switched on. With the self-test finished, the Repeater Indicator enters "Display" state. If there is data sent from the Main Instrument, Repeater Indicator will display all the data alternately. Each

group of data will stay for 3 seconds. To display the certain group of data, push the pause switch to pause the display-cycle. Then only this group of data is displaying in the indicator, and the group of data will still be refreshed at interval of 3 seconds. If the transmitting of data from RS-442 serial interface be interrupted for the above-mentioned reasons, then the decimal point of Mode Code does not change from brightness to darkness at the interval of 3 seconds and the data displayed will not be refreshed. In this case, stop reading the data until the decimal point restore the change.

4. Analysis and Treatment of Ordinary Trouble

Phenomenon of Ordinary Trouble	Reason of Ordinary Trouble	Treatment of Ordinary Trouble
No display	Power off	Inspect the relative connection or power supply
	Micro control unit wrong	1. Change the relative micro control unit 2. Contact the manufacture factory for maintenance
The Repeater Indicator's mode code does not change from brightness to darkness at the interval of 3 seconds	Does not receive the data sent from the Main Instrument	1. Switch on the Main Instrument 2. Inspect the connection with the Main Instrument

5. Installation of the instrument

5.1 Wind Direction and Wind Velocity Sensor(Small Plane)

a) Small Plane is installed at a high and open place where there are no big obstacles. It is also convenient for ordinary maintenance.

b) After the welding of Small Plane, the installation surface of the Small Plane should be horizontal.

c) When you are installing the Small Plane, put it on the base-plate male the fuselage of the Small Plane point to the same direction of the bow line of the ship, and make the head of Small Plane point at the direction of the bow of the ship. Then hold the fuselage unmoved, tight up and fix with the base-plate of installation using three fixed bolts.

5.2   Installation   size   and   connection

The technical demands for the size of installation shelf and connection shelf and connection of the instrument, the cable connection can refer to the installation Diagram
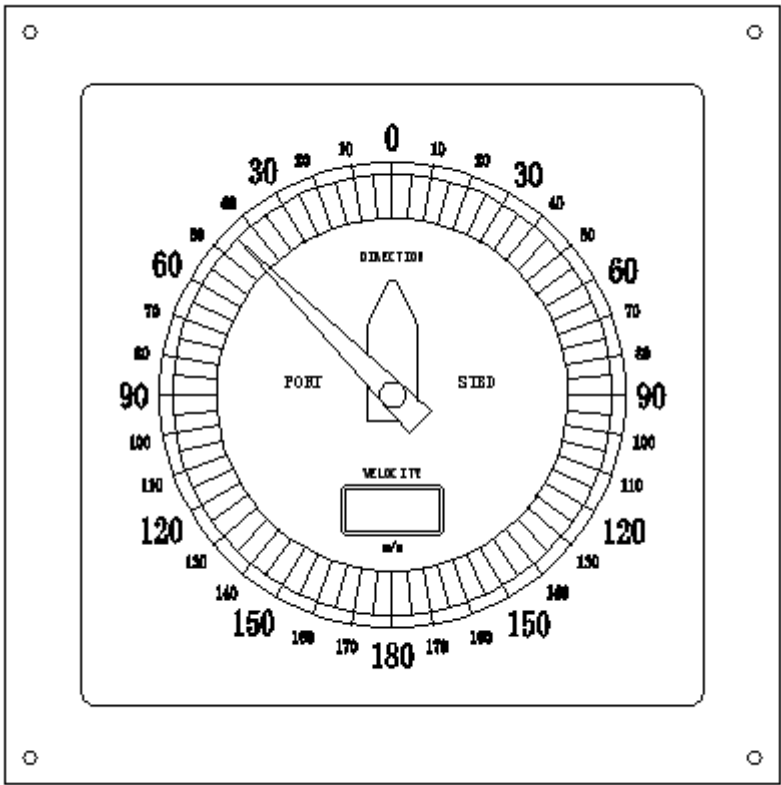
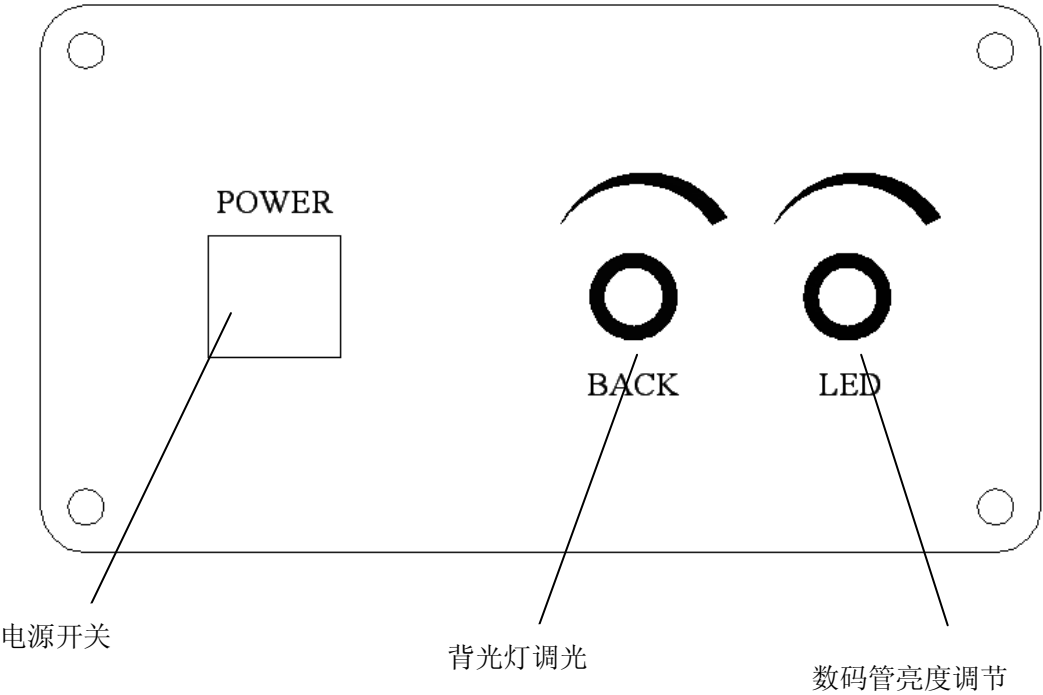# 附图(Attached Diagrams)

图 1 主仪器面板 **Panel of the Instrument**

POWER

BACK   LED

电源开关

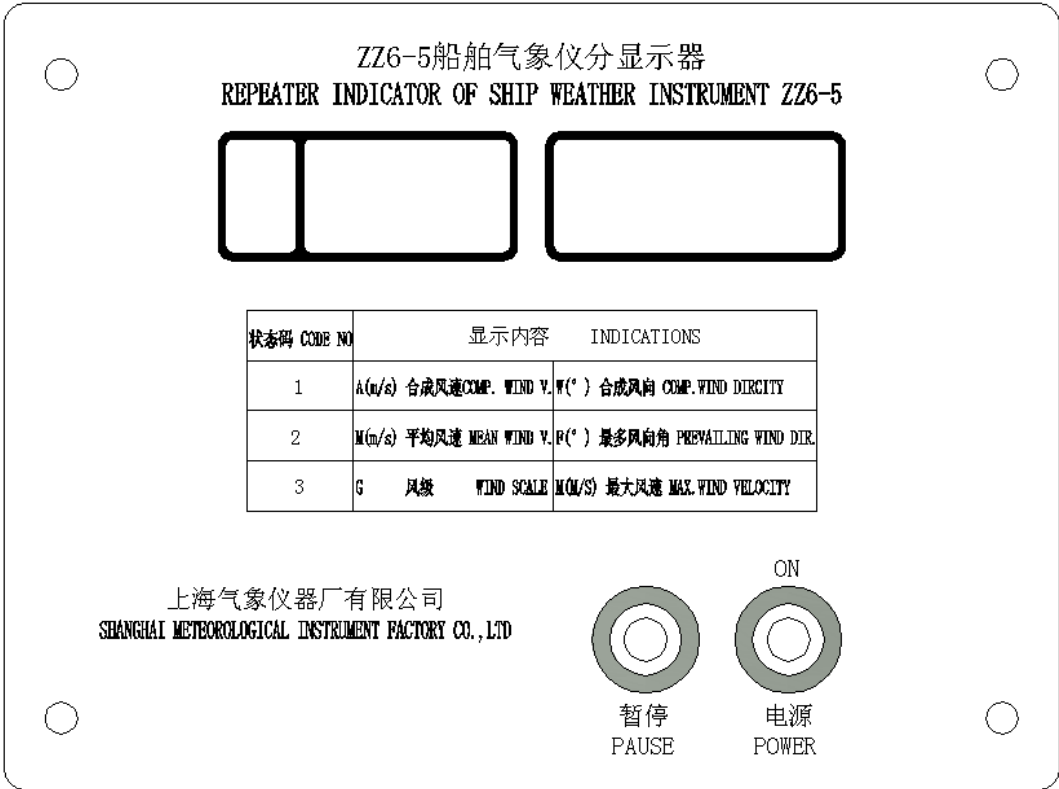背光灯调光

数码管亮度调节

图 2 控制盒面板 **operating regulations**

图 3 分显示器面板
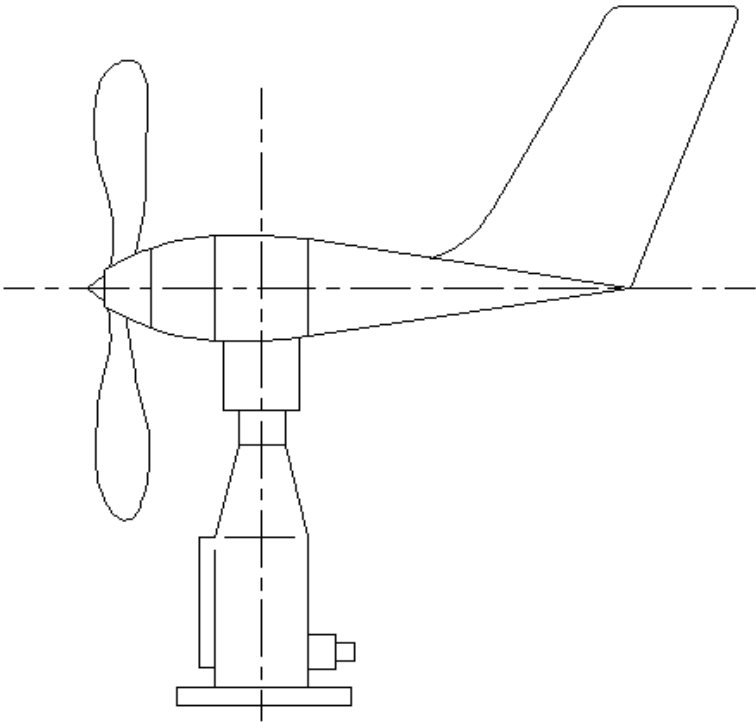

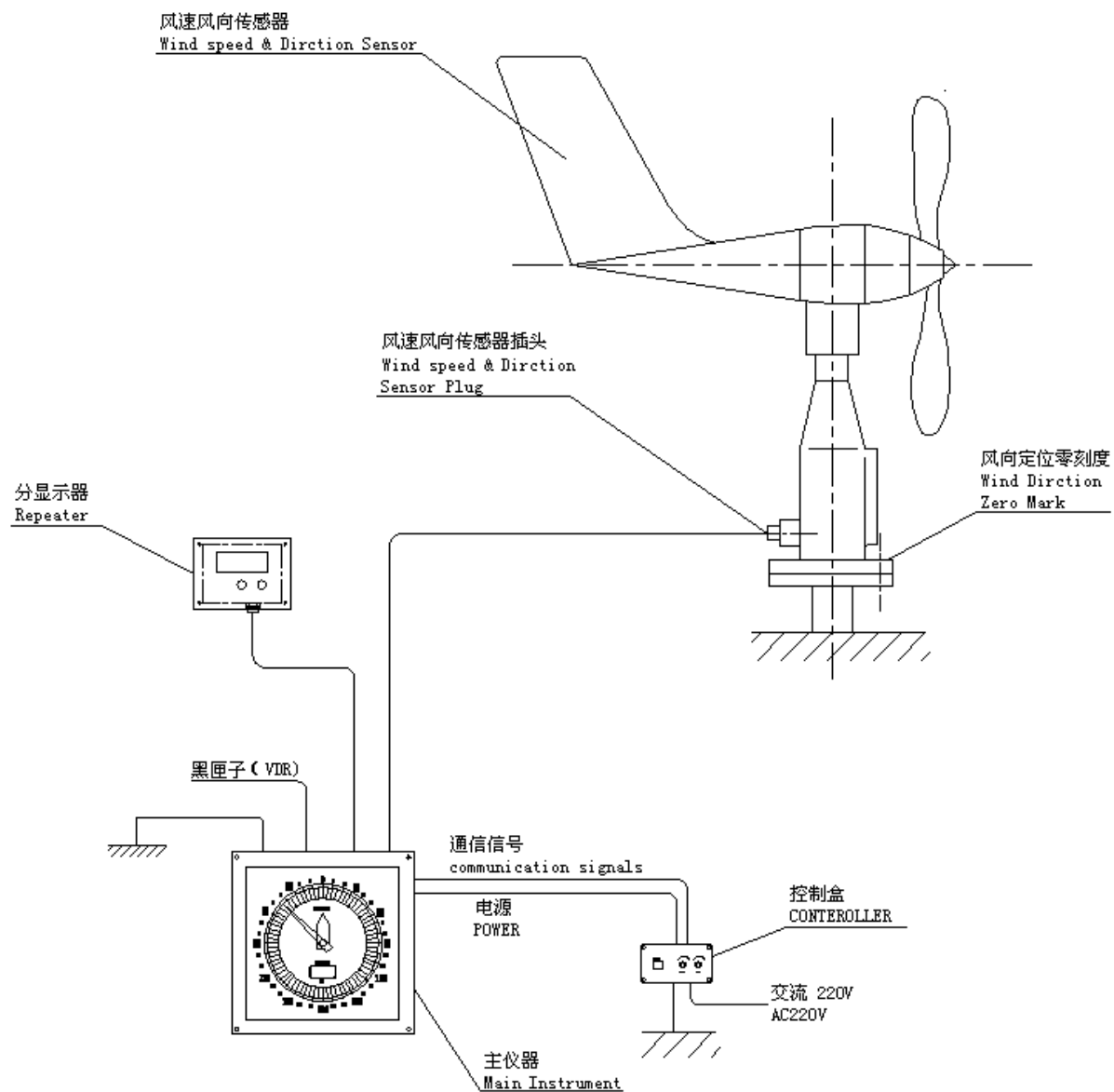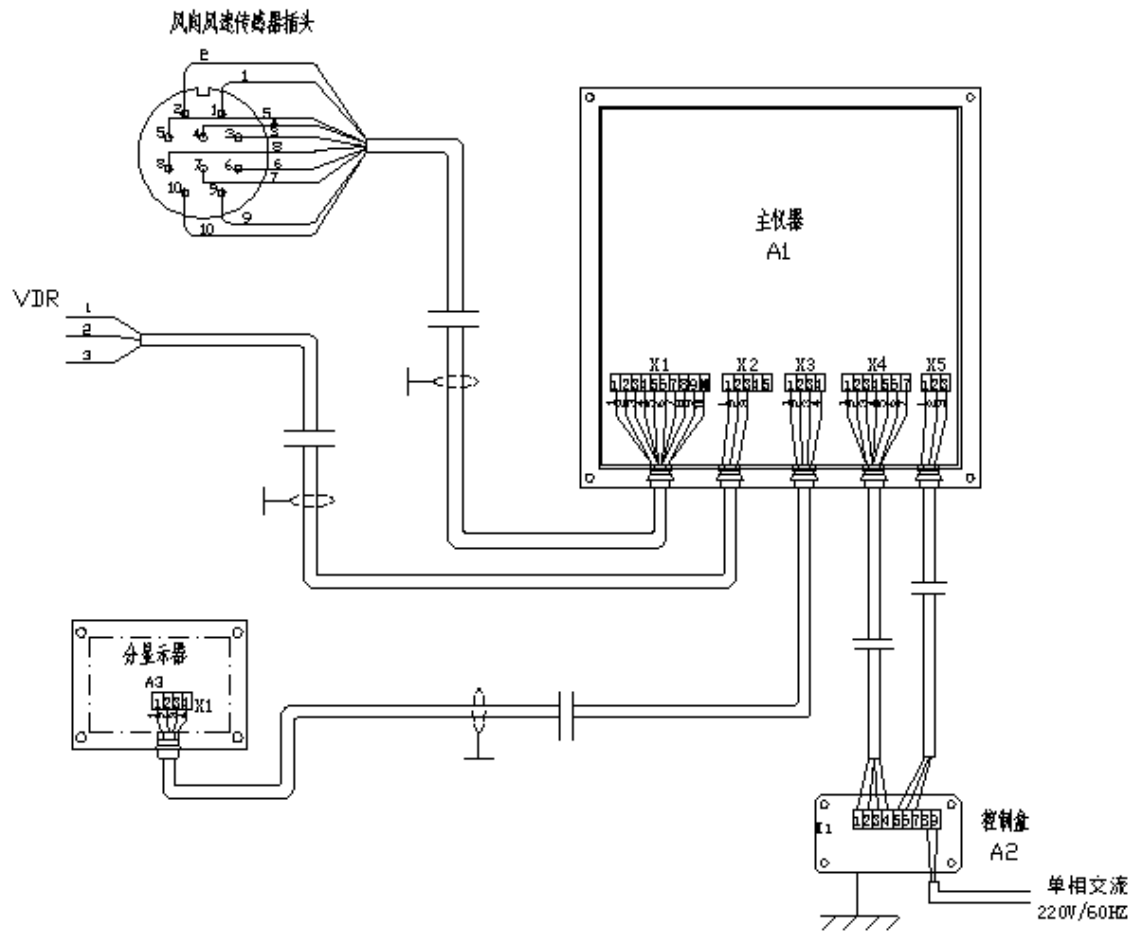图 4 风向风速传感器 **wind direction and speed senser**

图 5 整套设备安装连接图

Installation & Connecting Diagram of the Whole Set of Equipment

风向风速传感器插头

VDR

主仪器
A1

分显示器
A3

控制盒
A2

单相交流
220V/60HZ

VDR	1	2	3
	TX+	TX-	SGND

分显示器(REPEATER)	1	2	3	4
A3-X1	+12	GND	TX+	TX-

控制盒(CONTROLLER)	1	2	3	4	5	6	7	8	9
A2-X2	B2	B1	A	+12V	GND	~220 OUT	~220 OUT	~220 IN	~220 IN

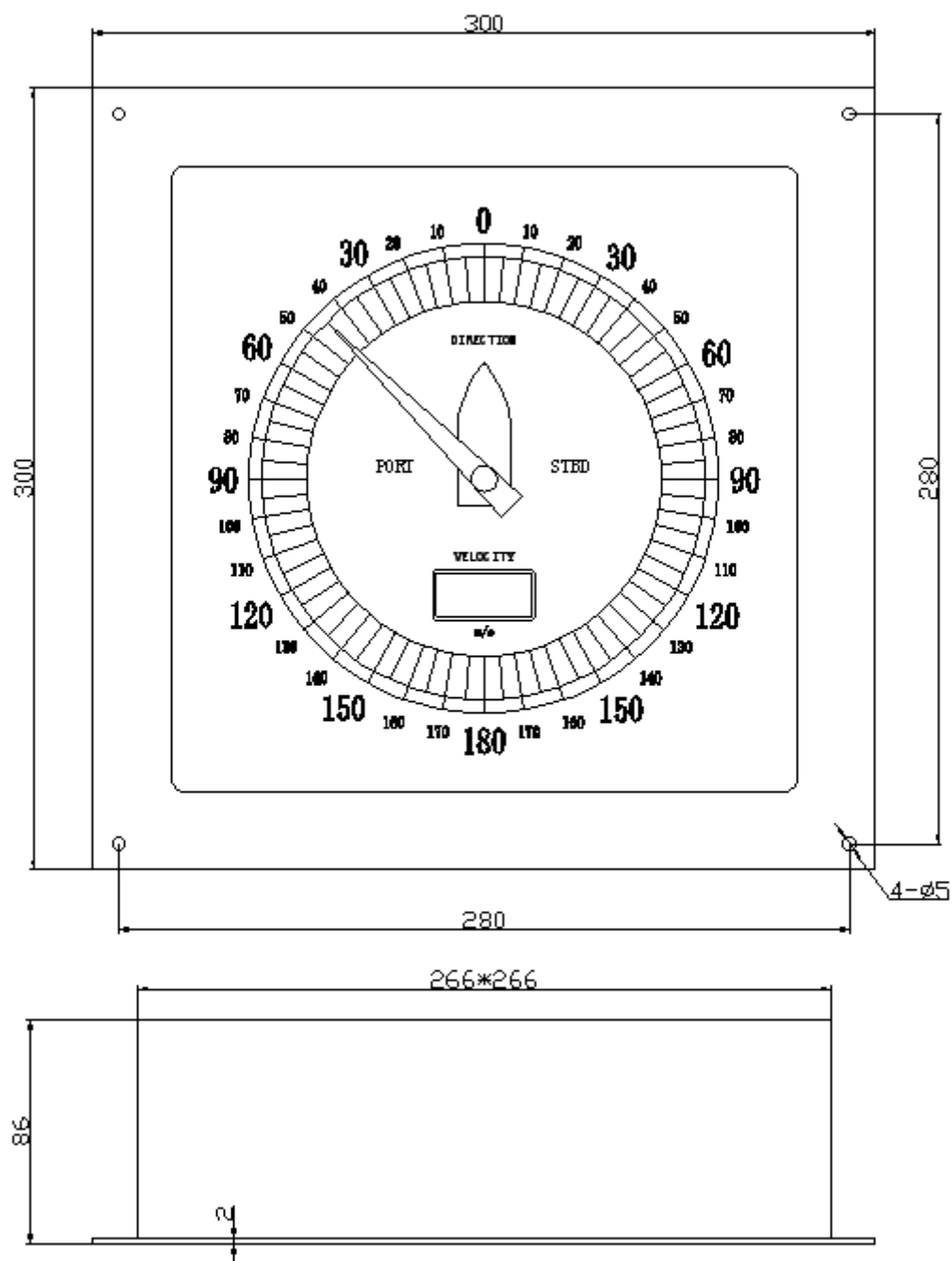图 6 电缆连接图

Connecting Diagram of Cable

图 7　主仪器安装尺寸图

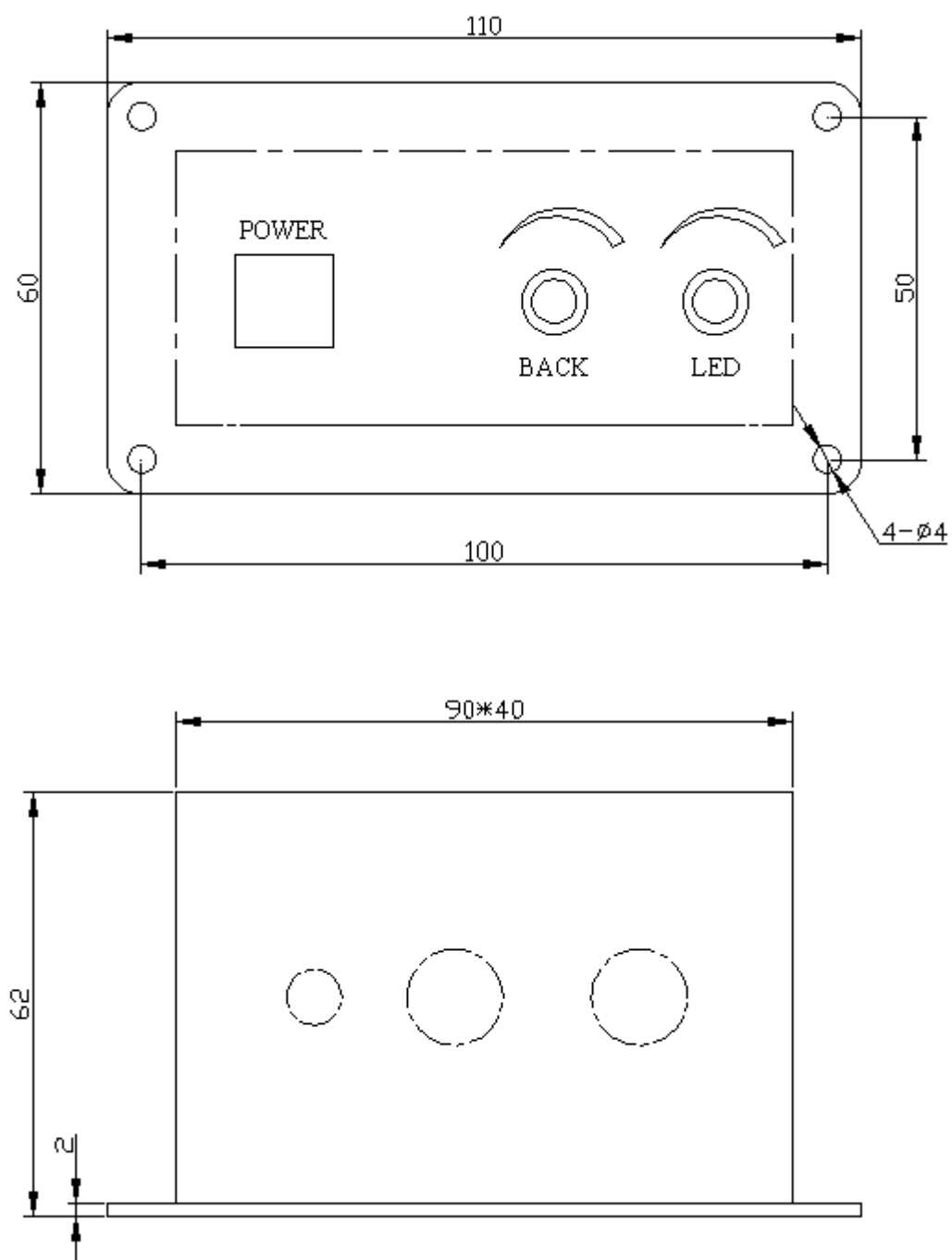**Diagram for Installation Main Indicator**

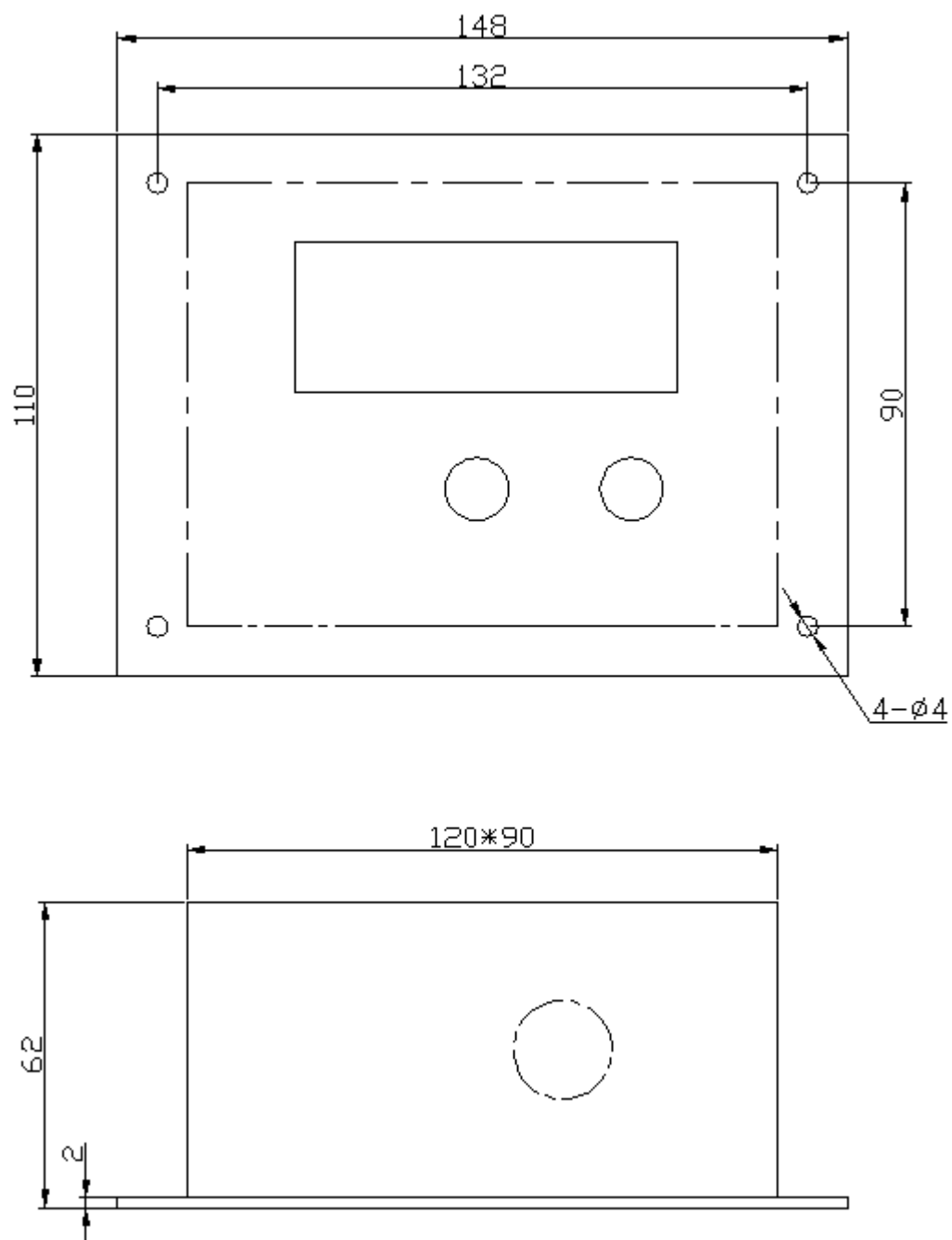图 8　控制器安装尺寸图

Diagram for Installation Control Instrument

图 9 分显示器安装尺寸图

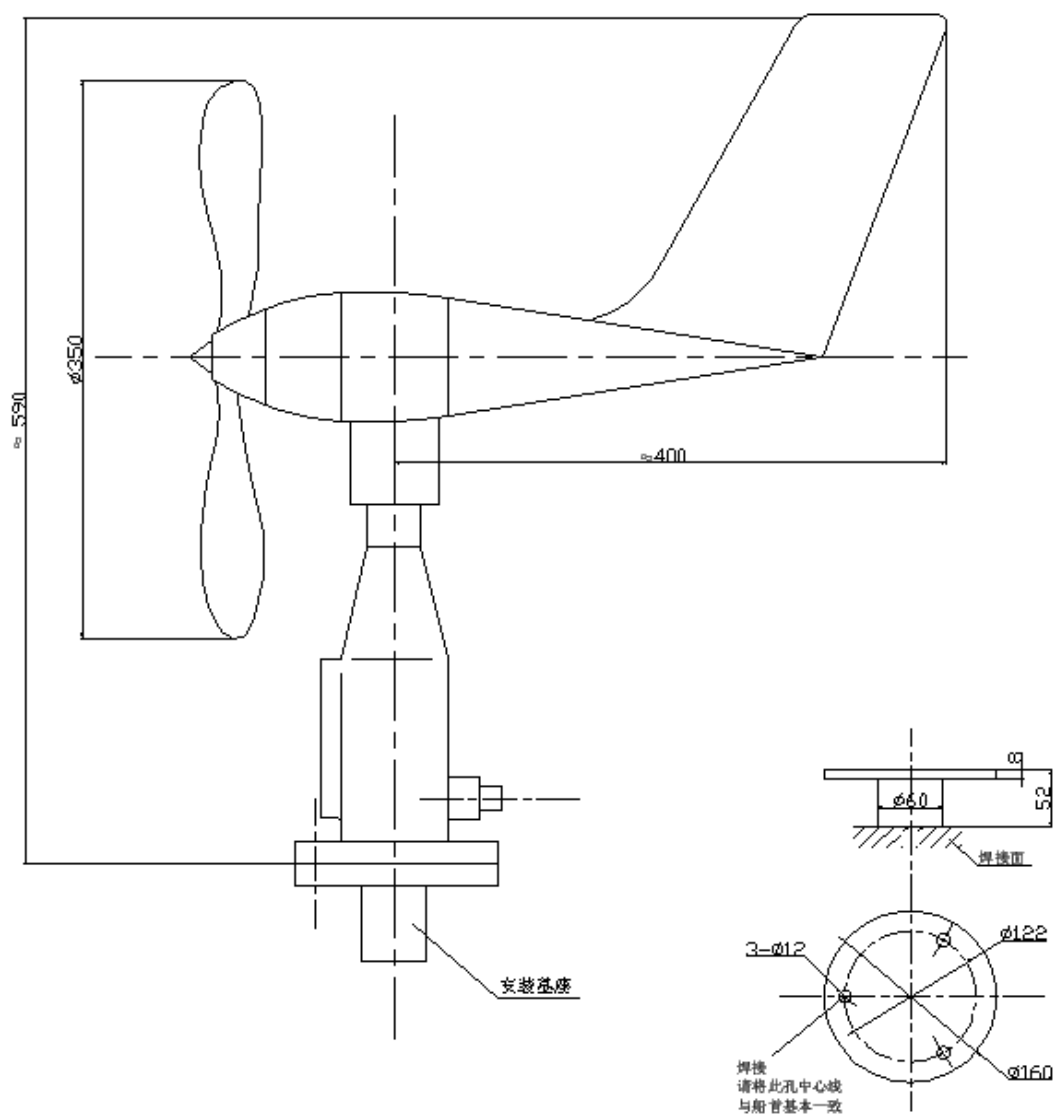**Diagram for Installation Repeater Indicator**
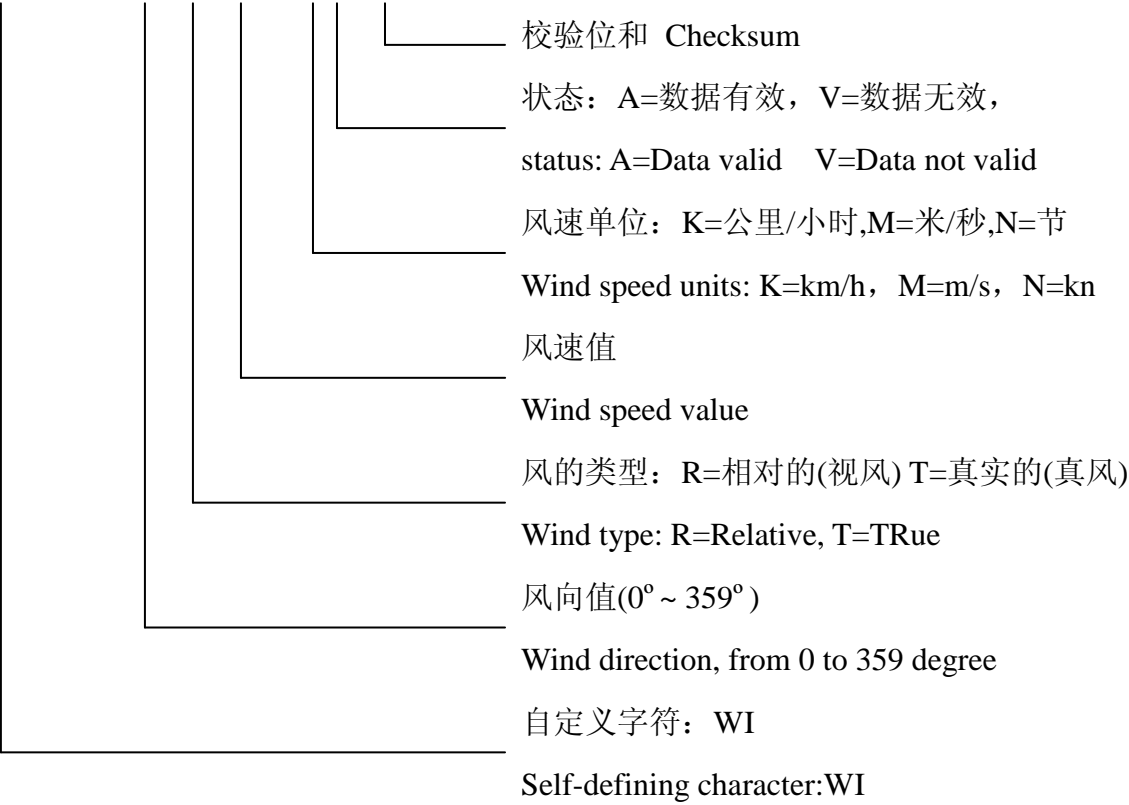
图 10

风向风速传感器安装尺寸图

Dimension Diagram for Installing Wind Direction & Speed Sensor

NMEA 0183--电子海图装置(VMS)及黑匣子装置(VDR)的接口标准

NMEA 0183—Standard For Interfacing Marine Electronic Devices And Black Box

MWV--Wind Speed and Angle

$--MWV, X. X, a, X. X, a, A* hh <CR> <LF>

校验位和 Checksum

状态：A=数据有效，V=数据无效，

status: A=Data valid   V=Data not valid

风速单位：K=公里/小时,M=米/秒,N=节

Wind speed units: K=km/h，M=m/s，N=kn

风速值

Wind speed value

风的类型：R=相对的(视风) T=真实的(真风)

Wind type: R=Relative, T=TRue

风向值(0º ~ 359º)

Wind direction, from 0 to 359 degree

自定义字符：WI

Self-defining character:WI

NMEA0183 通信串行接口：RS-422 　　NMEA0183 Communication Seerial Interface:RS422

波特率：4800 Bps 　　　　　　　　Baud Rate: 4800 Bps

起始位：1 位 　　　　　　　　　　Origin Bits: 1

数据位：8 位 　　　　　　　　　　Data Bits: 8

奇偶校验位：无 　　　　　　　　　 Parity: None(Disabled)

停止位：1 位 　　　　　　　　　　Stop Bits: 1

连接线						备注
项目代号	电缆颜色	定义	项目代号	电缆标号	定义	
A1-X1			风向风速传感器			主仪器连接风向风速传感器
	棕色	D0		1	D0	
	灰色	D1		2	D1	
	橙色	D2		3	D2	
	黄色	D3		4	D3	
	绿色	D4		5	D4	
	蓝色	D5		6	D5	
	紫色	D6		7	D6	
	白色	FS		8	FS	
	红色	+12V		9	+12V	
	黑色	GND		10	GND	
A1-X2			VDR 设备			主仪器连接 VDR 设备
	红色	Tx+			Rx+	
	绿色	Tx−			Rx−	
	淡绿色	SGND			SGND	
A1-X3			A3-X1			主仪器连接分显示器
	蓝色	Tx+		1	Rx+	
	黄色	Tx−		2	Rx−	
	红色	+12V		3	+12V	
	黑色	GND		4	GND	
A1-X4			A2-X1			主仪器连接控制盒
	白色	B2		1		
	蓝色	B1		2		
	黄色	A		3		
	红色	+12V		4		
	黑色	GND		5		
A1-X5			A2-X1			主仪器连接控制盒
	黑色	220VAC		6	220VAC	
	红色	220VAC		7	220VAC	
电源输入	红色	220VAC	A2-X1	8	220VAC	
	黑色	220VAC		9	220VAC	