



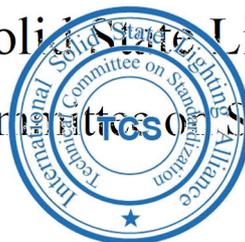
# ISA Recommendation

## Requirements for On-site Assembly and Commissioning of Multifunctional Smart Pole Functional Modules

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International Solid State Lighting Alliance  
Technical Committee on Standardization



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## Foreword

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# Requirements for On-site Assembly and Commissioning of Multifunctional Smart pole Functional Modules

## 1 Scope

This specification stipulates the basic requirements for the functional devices that can be mounted on the multifunctional smart pole when they are assembled on the project site.

This specification is only applicable to new projects of multi-functional smart pole (here in after referred to as smart pole).

## 2 Normative references

The following documents are essential for the application of this document. For dated references, only the dated versions are applicable to this document. For undated references, the latest versions (including all amendments) are applicable to this document.

CIE 180-2007 Road transport lighting for developing countries.

IEC 60598-1-2017 Luminaire -Part 1: General requirements and tests.

IEC 60755-2017 General safety requirements for residual current operated protective devices.

IEC 61557 "Electrical safety in low voltage distribution systems up to 1000 V AC and 1500 V DC - Equipment for testing, measuring or monitoring of protective measures".

IEC 61439-4-2012 Low-voltage switchgear and control gear assemblies - Part 4: Particular requirements for assemblies for construction sites (ACS)

ISO 3864-2-2016 Graphical symbols. Safety colours and safety signs. Part 2: Design principles for product safety labels

ISO 3864-3-2012 Graphical symbols -- Safety colours and safety signs -- Part 3: Design principles for graphical symbols for use in safety signs

ISO 6935-3-1992 Steel for the reinforcement of concrete -- Part 3: Welded fabric

ISO 9597-2008 Cement -- Test methods -- Determination of setting time and soundness

ISO 17660-1-2006 Welding -- Welding of reinforcing steel

## 3 Terms and definitions

The following terms and definitions apply to this document.

### 3.1 Multifunction street lighting

Under the premise of meeting the basic lighting function, the smart pole is used as the carrier,

which integrates the intelligent one-button calling, security monitoring, new-energy vehicle charging and other functional modules in one pole, and realizes the interconnection and intercommunication of street lights among the IOT devices by collecting various data.

### **3.2 Intelligent lighting**

Manage and control street lights finely to realize remote light on/off and dimming; set scheduled tasks according to latitude, longitude, illuminance environment, time zone, etc. to control the turn on/off, dim, and receive failure alarm, etc.

### **3.3 Security monitoring**

By attaching the camera, the scene can be viewed remotely, and a certain amount of video data can be stored for backtracking afterwards

### **3.4 Public Wi-Fi**

In urban administrative areas, the adoption of high-speed broadband wireless technology can enable wireless access, wireless location, wireless payment, video services and other functions of the wireless local area network.

### **3.5 Public broadcasting**

The public broadcasting system can not only provide audio broadcasting according to regions and functions, but also can remotely regulate the broadcast content, such as government announcements and emergency information, etc.

### **3.6 Environmental monitoring**

The environmental parameters, such as wind speed, wind direction, temperature, humidity, illuminance, etc. are monitored by the mounted sensors.

### **3.7 One button call**

One button key device can quickly transfer the information.

### **3.8 Multimedia information release**

The LED display can remotely and uniformly manage and publish the information, such as weather conditions, noncommercial advertisements, and environmental information, etc.

### **3.9 New energy vehicle charging**

The AC charging pile can be equipped with different charging interfaces, to satisfy different charging needs of various electric vehicles.

Note: the charging piles can be divided into AC charging piles and DC charging piles according to the charging methods. This specification only specifies the requirements for the assembly of AC charging piles on site.

### **3.10 Micro base station**

Compared with the macro base station, the micro base station is of lower power, which consists of split micro base station and integrated micro base station.

## **4 On-site assembly requirements**

### **4.1 General requirements**

**4.1.1** Before entry, the site inspection shall be carried out to ensure that the construction environment, safe power supply, mechanical and electrical equipment and other installation conditions to meet the entry construction requirements.

**4.1.2** Before assembly, the equipment, materials and devices should be checked in terms of specification and quantity, and visually inspected.

— check the equipment carton's number, sealing sticker and appearance free from impact and collision marks; confirm the sealing sticker is intact, and the carton numbers are consistent with the delivery list;

— open the carton to check the equipment quality; the equipment should be free from damp, rust, deformation, collision, and falling-off surface coat, etc.;

— check the equipment specification; check the equipment nameplate with reference to the packing list, to make sure the equipment name, model and specification be consistent with the engineering drawing; the equipment parts' specification and quantity should be consistent with the packing list;

— The equipment shall be qualified with the ex-factory quality inspection report, and the license issued by the related department;

— The specification and quantity of equipment parts shall be consistent with the requirements of the engineering contract;

— The qualification test reports in regard to the electrical performance of equipment / apparatus should be provided to indicate its performance index meets the technical requirements;

— Unqualified equipment and devices cannot be adopted in project construction; when the device model does not meet the original engineering design requirements and requires significant change, it is necessary to obtain the approval of the design and construction department and go through the design alternation procedure.

**4.1.3** The temporary power consumption during on-site assembly and commissioning should meet the requirements of IEC 61557.

### **4.2 Assembly requirements**

#### **4.2.1 Requirements for Cable Laying inside the pole**

**4.2.1.1** Before cable laying, check the inside of the pole pipe to make sure it is dry and clean; a piece of five-meter cable should be used for simulated traction and observe the cable surface, and any cable wear-down should be within tolerance.

**4.2.1.2** The laying cable shall be pulled into the pole tube by the wire threading device, a steel wire at the diameter of 1.2-2.0 mm is generally used as the threading wire. One end of the steel

wire shall be bent into an unsealed circle, and a margin of 10-15 cm shall be reserved at the inlet and outlet of the pole tube.

**4.2.1.3** When AC power supply is adopted, the cables and communication cables inside the smart pole shall be laid separately to ensure the separation of strong and weak current; when DC power supply is adopted, the weak current cables and communication cables shall be laid separately for maintenance.

**4.2.1.4** The cables and communication cables inside the pole shall be free of branches and joints.

**4.2.1.5** The cables inside the pole shall be labeled with the functional modules indicating the power supply or signal transmission of the line to distinguish. The label shall be durable and not easy to fall off, and the font shall be clear, neat and not easy to fade.

**4.2.1.6** The exposed cable outside the pole shall be covered with cable case.

## **4.2.2 Assembly requirements for functional module**

### **4.2.2.1 Assembly requirements for intelligent lighting module**

Intelligent lighting module includes lighting equipment and intelligent management equipment. The wiring of lighting equipment shall meet the requirements of IEC 60598-1-2017. Intelligent management equipment should be installed adjacent to lighting equipment.

### **4.2.2.2 Assembly requirements for security monitoring module**

The security monitoring module includes monitoring equipment and storage equipment. In the procedure of the monitoring equipment assembly, the camera should be protected properly; if the monitoring equipment is a dome camera, the waterproof cable on the top of the camera cannot not be pulled directly.

The storage equipment should be placed in the control room, security room or other 24-hour duty patrol places for real-time monitor and replay.

### **4.2.2.3 Assembly requirements for public WIFI module**

Assembly requirements for public Wi-Fi modules include:

(a) Wi-Fi service module includes outdoor wireless access point and wireless access control equipment. The wireless access point equipment is fixed on the surface of the smart pole. When it is connected with the power cable, optical cable and signal antenna, the exclusive waterproof joint should be used for connection. The independent surge protection device should be installed adjacent to the power supply module of the equipment; the position of the smart pole where the access point is installed should be free of any hidden dangers that may affect the wireless communication signal, such as strong electricity, strong magnetism and strong corrosion;

(b) Wireless access control equipment shall be placed in the control room, machine room and other network deployment centralized places or cloud deployment.

### **4.2.2.4 Assembly requirements of public broadcasting**

It is advised to use exclusive fittings to fix the broadcasting equipment. The sound reinforcement holes should be in the direction of the passengers; if with drainage holes, the holes should be downwards to protect the equipment from accumulating water outdoors.

### **4.2.2.5 Assembly requirements of environmental monitoring module**

The assembly requirements of environmental monitoring module include:

- (a) If the equipment is with wind direction monitoring function, it is necessary to coordinate it with the compass, adjust the wind meter to point to the north, and arrange the sensors northwards;
- (b) Each sampling area should be equipped with a set of environmental monitoring equipment, which should be installed at a place without shelter on the light pole. There should be no branch air flow, no turning, no obstacle and no change of cross section within 10 meters before and after the light pole; the location of wind cross section can be accurately calculated.

#### **4.2.2.6 One key call module assembly requirements**

Assembly requirements of one key call module include:

- (a) The one key call module includes a help terminal and a call terminal. It is advised to fix the help terminal with the fastening accessories with anti-theft function; the height of the help button should be 1.3m-1.5m from the ground.
- (b) The call terminal shall be placed in the control room, security room and other 24-hour duty patrol places to realize real-time reception.

#### **4.2.2.7 Assembly requirements of multimedia information release module**

In the installation of the multimedia information release module, the display surface of the screen should be well protected; the aviation-grade waterproof connector should be used for cable connection; the anti-corrosion and anti-rust fastening accessories should be used for fixing. The display surface should be oriented according to the engineering drawings.

#### **4.2.2.8 Assembly requirements for charging modules of new energy vehicles**

The charging pile of new energy vehicles shall be installed at the bottom of the smart pole, the charging module shall be installed inside the smart pole, and the charging socket, display screen and card swiping sensor shall be installed on the outer surface of the smart pole.

#### **4.2.2.9 Assembly requirements of micro base station module**

The assembly requirements of the micro base station module include:

- (a) It is advisable to add installation position and install micro base station module on the top of the smart pole, where is without any metal barrier.
- (b) After the installation of the directional micro base station module, the angle of the equipment shall be adjusted so that its antenna is facing the direction of the passengers.

### **4.2.3 Requirements for safety measures**

**4.2.3.1** The leakage protector shall be installed and wired according to the requirements of IEC 60755-2017; the neutral line at the load side of the leakage protector cannot be shared with other circuits.

**4.2.3.2** The pole should be equipped with electricity warning signs, in consistent with the provisions of ISO 3864-3-2012 and ISO 3864-2-2016.

**4.2.3.3** Metal lamp posts and electrical equipment supporting lighting should be protected by ground wire or zero wire.

**4.2.3.4** Lightning protection and grounding of smart pole should meet the requirements of CIE 180-2007.

**4.2.3.5** It should be ensured that all mounted equipment is within the protection range of the air-termination device, the air-termination device and the down-conductor should be well connected, and the fasteners should be embalmed for anti-corrosion.

#### **4.2.4 Commissioning requirements for functional modules**

After the assembly of functional modules, the functional commissioning of each equipment should be carried out through the management platform to detect the operation status and performance of each equipment. The commissioning index parameters of each equipment include but are not limited to table 1.

**Table 1 Equipment commissioning index**

<b>Item</b>	<b>Functional Module</b>	<b>Index</b>
1	Intelligent lighting module	<ul style="list-style-type: none"> <li>a. When luminaire is powered on, the luminaire is on, and the management platform displays the controller status online.</li> <li>b. There is no flicker and the luminance is even when the luminaire is on.</li> <li>c. According to the instructions sent through the management platform, the luminaire can be turn on/off, and the power and colour temperature can be adjusted.</li> </ul>
2	Security monitoring module	<ul style="list-style-type: none"> <li>a. When the camera is powered on, self-inspection is automatically carried out and the infrared light of the camera lens is always on.</li> <li>b. The camera (dome camera) lens can rotate 360 ° horizontally and 90 ° vertically smoothly.</li> <li>c. Camera doesn't flutter when shooting, and the live video and image can be clearly displayed on the management platform.</li> </ul>
3	Public Wi-Fi module	<ul style="list-style-type: none"> <li>a. When the AP device is powered on, the power indicator light and signal light are on.</li> <li>b. Wi-Fi signal can be detected by mobile PC and handheld terminal, and the terminal can connect to Wi-Fi network through authentication connection.</li> </ul>
4	Public broadcast module	<ul style="list-style-type: none"> <li>a. When the device is powered on, audio files can be played with clear and noise-free.</li> </ul>
5	Environmental monitoring module	<ul style="list-style-type: none"> <li>a. When the power is on and the management platform is uploaded with device data, the real-time data collected by the device on the platform page can be reviewed on the platform.</li> <li>b. Compare with the official data of the Internet to check the accuracy of the data.</li> </ul>

Item	Functional Module	Index
6	One-button call module	a. When the terminal equipment is powered on, the indicator light of the help terminal is on, and the display of the intercom terminal is on. b. Press the help terminal button, the clear ring of call request can be sent out through the horn hole, and the telephone ring of the intercom terminal rings at the same time. c. When the intercom terminal is connected, the audio is clear and free of noise.
7	Multimedia information release module	a. When the display is powered on, the screen lights up, to display in white screen or display built-in program. b. When the display is lit, there is no colour difference among modules in the white screen state, and there is no shadow, colour difference, worm phenomenon (string light) or other abnormal phenomenon. c. According to the instructions sent through the management platform, the display plays and switches programs.
8	New-energy vehicle charging module	a. When the device is powered on, the display lights up.

## 5 Commissioning requirements

Generally, the commissioning process includes smart pole hoisting, pole erecting, joint debugging and testing, etc.

### 5.1 Requirements for pole hoisting

**5.1.1** Before the hoisting, recheck the smart pole foundation. The position, elevation, dimension, surface flatness and perpendicularity of the foundation should meet the requirements of engineering design. The quality of the reinforcing steel bar used in the foundation should meet the requirements of ISO 6935-3-1992 and ISO 17660-1-2006.

**5.1.2** Before the smart pole is hoisted, a horizontal line shall be drawn at 500mm upward the bottom flange plate to facilitate rechecking the plane elevation datum before and after hoisting and fixing.

**5.1.3** Before the smart pole is hoisted, the mounted functional modules should be inspected to ensure that the modules are installed firmly and free from mistakes and omissions; the appearance of the smart pole should be inspected to confirm the integrity of the coating, any damaged coating area should be dealt with anti-corrosion treatment and repair; the cables laid in the lighting pole should be inspected to confirm that the wiring of all cables is correct and free from mistakes and omissions.

**5.1.4** Before the smart pole is hoisted, safety measures should be carried out within the hoisting area as follows:

——Before the smart pole is hoisted, a fully closed security cordon should be set up in the hoisting area, with obvious warning signs, and no irrelevant personnel is allowed to enter insides. The fully closed security cordon should be greater than the maximum turning radius distance and the extension distance of the crane.

——Before the smart pole is hoisted, all personnel should leave the area under within the turning radius of the crane and the area under the lifted objects.

——In the process of hoisting, anti-falling protection measures for the smart pole should be taken, and the surface coating and mounted equipment of the smart pole should be protected.

——In the process of hoisting, the safety management personnel should be arranged at the blind spot intersection within the fully closed security cordon, and except in special circumstances, the safety personnel should fulfill the supervision outside the security cordon.

**5.1.5** After the hoisting preparation is ready, the hoisting trial shall be carried out first to check the firmness of the rigging and the stability of the crane.

## **5.2 Requirements for pole erecting**

**5.2.1** During the operation, the construction personnel should adjust the inclination angle of the smart pole by using a horizontal ruler.

**5.2.2** Before the smart pole and foundation are completely fixed, the construction personnel should take measures to prevent the pole from tilting or collapsing.

**5.2.3** After the pole is fixed, the installation of the internal electrical device of the pole should meet the requirements of IEC 61439-4-2012.

## **5.3 Requirements for joint debugging and testing**

When all the hoisting is finished and the construction site is qualified to be powered on and interconnected in network, the functional index debugging and testing for the whole project should be carried out. The index parameters include but are not limited to table 2.

**Table 2 debugging and testing indexes of multifunctional smart pole**

Item	Functional Module	Index
1	Intelligent lighting module	<p>a. When luminaire is powered on, the luminaire is on, and the management platform displays the controller status online.</p> <p>b. There is no flicker and the luminance is even when the luminaire is on, and the color temperature and illumination meet the requirement of the engineering design.</p> <p>c. According to the instructions send through the management platform, the luminaire in one group can be on/off, adjust the power and color temperature, and the delay time is not more than 10s.</p> <p>d. The luminaire can be on/off automatically according to the specified time, and adjust the power and color temperature.</p>
2	Security monitoring module	<p>a. When the camera is powered on, self-inspection is automatically carried out and the infrared light of the camera lens is always on.</p> <p>b. The camera (dome camera) lens can rotate 360 ° horizontally and 90 ° vertically smoothly.</p> <p>c. Camera doesn't flutter when shooting, and the live video and image can be clearly displayed on the management platform.</p> <p>d. Adjust the focal length of the camera through the management platform to zoom in or out the currently displayed scene.</p> <p>e. It can be realized via the management platform to add, delete or query camera information.</p>
3	Public WiFi module	<p>a. When the AP device is powered on, the power indicator light and signal light are on.</p> <p>b. Within the Wi-Fi network coverage area, the mobile PC terminal and the hand-held terminal can detect Wi-Fi signals, and through the authentication, the terminal can be connected to the Wi-Fi network and get online normally.</p> <p>c. The management platform can displays the Wi-Fi device information, connection status, user's internet speed, Gbyte and other information data.</p>
4	Public broadcasting module	<p>a. When the device is powered on, audio files can be played with clear and noise-free.</p> <p>b. The audio column device can play the audio files automatically and circularly according to the specified time.</p> <p>c. Connect the microphone device and broadcast the emergency notice in real time through the audio column device.</p>
5	Environmental monitoring module	<p>a. When the power is on, the real-time monitoring data can be transferred to the management platform, and can be displayed in the form of chart.</p> <p>b. Compare with the official data of the Internet to check the accuracy of the data.</p>

Item	Functional Module	Index
6	One-button call module	<p>a. When the terminal equipment is powered on, the indicator light of the help terminal is on, and the display of the intercom terminal is on.</p> <p>b. The help terminal and intercom equipment can realize two-way call with clear audio and no noise.</p> <p>c. The management platform facilitates the query function of alarm record, call record and spot video recording.</p> <p>d. Through the management platform, scenes of different angles can be captured via the linked cameras.</p> <p>e. The management platform has a call reminder.</p>
7	Multimedia information release module	<p>a. When the display is powered on, the screen body is lit up. HTML web pages and dynamic web pages (including pictures, text and videos) can be displayed normally.</p> <p>b. According to the instruction sent through the management platform, it can be realized to supervise the display content, control the illumination level, restart, shut down, etc.</p> <p>c. The management platform can show the real-time display content, and realize the functions of program addition, deletion, modification, query, production / editing and release.</p> <p>d. Compatible image format includes BMP, JPG, GIF, WMF, ICO; compatible text format includes TXT, RTF; compatible video format includes MP4, AVI.</p>
8	New energy vehicle charging module	<p>a. When the device is powered on, the display lights up.</p> <p>b. New-energy vehicles can be charged by swiping cards, scanning codes, etc.</p> <p>c. The management platform can display the vehicle charging status and the status of charging pile.</p> <p>d. It has the emergency stop function to cut off the output power in the charging process.</p>

**Appendix A**

**(Informative appendix)**

**Functional configuration requirements, assembly tool requirements and construction equipment requirements of multifunctional smart pole**

**A.1 Functional configuration requirements.**

The function should be added reasonably regarding the combination of the actual deployment scenario of the smart pole and the user's requirements. See table a.1 for the configuration relationship between the smart pole deployment scenario and the functions.

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**Table A.1 configuration relationship between smart pole deployment scenario and functions**

Deployment scenario	(Function configuration)								
	Intelligent lighting	Security surveillance	Public Wi-Fi	Public broadcasting	Environmental monitoring	One-button call	Multimedia Information release	New-energy vehicle charging	Micro Base station
Expressway service area	○	○	○	○	○	○	○	-	○
Expressway	●	○	○	○	○	○	○	-	○
Main road	●	○	○	○	○	○	○	-	○
Secondary road	●	○	○	○	○	○	○	○	○
Access Rd	●	○	○	○	○	○	○	○	○
Interchange node, tunnel, bridge	●	○	○	○	○	○	○	-	○
Parking lot	●	○	○	○	○	○	○	●	○
Square, school, Park	●	●	○	●	○	○	○	○	○
Financial business district, pedestrian street	●	●	○	○	○	○	●	-	○
Tourist hot spot	●	●	○	●	○	○	●	○	○
industrial park	●	●	○	○	●	○	○	○	○
Note: ● Recommended configuration; ○ Selective configuration adopted based on specific requirement of the proprietor; - Not recommended configuration;									

## A.2 Assembly tool requirements

Before the assembly of functional modules, the tools for assembly should be complete; the tools should meet the requirements of relevant national certification standards. Refer to table A.2 for the list of required tools. Before construction, the tools in table A.2 can be selected according to the assembly requirements.

**TableA.2 Tool list**

No.	Tool	No.	Tool	No.	Tool
1	Electric hand drill	7	Diagonal pliers	13	Soldering iron
2	Electric drill bit (set)	8	vice	14	Drill bit (set)
3	Socket wrench (set)	9	Screwdriver (set)	15	Adjustable wrench
4	Hexagon wrench (set version)	10	Threading device	16	Glue gun
5	Ratchet wrench (set)	11	Cable Smart pole	17	Platoon
6	Wire stripper	12	Network cable tester		

## A.3 Requirements for construction equipment

The construction equipment should be prepared in steps according to the construction stage, and the equipment should meet the requirements of relevant national certification standards. Refer to table A.3 for the list of required equipment. Before construction, the equipment in table A.3 can be selected according to the assembly requirements.

**TableA.3 Tool list**

No.	Tool	No.	Tool	No.	Tool
1	On board crane	6	Luminaires digital mustimeter	11	guardrail
2	Crane	7	Electric welding machine	12	Reflective clothing
3	Earth truck	8	alternator	13	safety hat
4	wheelbarrow	9	Angle grinder	14	Cordon / warning sign
5	Grounding resistance tester	10	multimeter	5	Grounding resistance tester