

# **ZigBee 安防 IAS 设备 Enroll 登记分析**

(shaozhong.liang)

ZigBee 安防设备，因为安防系统的特殊性，在系统设备构成上较其他子系统有特殊要求。这些设备在划分为 ZigBee 三种基本设备类型的基础上，还做了进一步的分类。具体可以分为：安防系统指示设备(IAS Control and Indicating Equipment)、安防系统辅助控制设备(IAS Ancillary Control Equipment)、安防系统区域(IAS Zone)和安防系统区域报警设备(IAS Warning Devices)

## **安防系统控制指示设备(IAS CIE)**

IAS CIE 是安防警报系统的中央控制器和指示设备。它辅助接收传感器(Zones)发出的信号并控制设备(ACE)，同时还想报警设备(WD)发送信号。它是整个安防系统的大脑是安防设备不可或缺的一部分，一个 ZigBee 安防系统必须拥有至少一个或以上的具备 IAS CIE 功能的设备。一般情况下，IAS CIE 功能集成在 ZigBee Coordinator 协调器中。

## **安防系统辅助控制设备(IAS ACE)**

IAS ACE 是安防报警系统的遥控装置。在取得相应权限的情况下，附带 ACE 功能的 ZigBee 设备能够访问 IAS CIE 设备并控制 IAS 系统。常见的 IAS ACE 设备有遥控器、开关等等。

## **安防系统区域(IAS Zone)**

IAS Zone 设备能够探测某个区域的报警条件，并给 CIE 设备发送信号。IAS Zone 设备支持二种报警模式：低电量报告和安防系统报告。常见的 IAS Zone 设备有动作探测器、烟感器等。

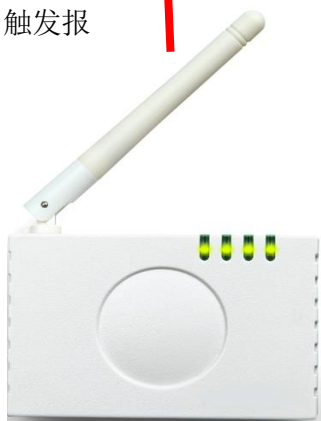
## **安防报警系统区域报警设备(IAS WD)**

当 IAS CIE 的报警条件被触发，IAS 报警设备能够发出音频或可视的报警指示(警报声、闪光灯等)。常见的 IAS WD 设备有报警器，扬声器等等。



Warning Device 报警设备

当 CIE 判定 Zone 设备探测到的数值到达报警阈值，即向报警设备发送控制信号，触发报警、撤销警报



CIE 设备

当用户通过遥控器控制安防系统是，如布防、撤防、设置报警条件等操作，ACE 设备向 CIE 发送相应的控制信号



ACE 设备

CIE 向 Zone 设备发送控制信号，如布防、撤防、设置报警条件等。Zone 设备向 CIE 发送探测到的数值。



Zone 设备

## IAS 登记(Enrolment)

IAS Zone 设备在加网后有自动登记(Enroll)功能，会自动与具有 CIE 功能的设备进行匹配，并登记到 CIE 中。一般情况下，ZigBee 的 IAS Zone 设备在加网后有自动登记(Enroll)功能。在加入网络后，如果 CIE 存在，IAS 设备将会在加网后自动登记到与之匹配的 CIE 设备上。若加网后的 IAS Zone 设备没有自动登记，也可以采用手动登记。

#### 8.2.2.2.2 Zone Settings Attribute Set

The Zone Settings attribute set contains the attributes summarized in Table 8.7.

**Table 8.7** Attributes of the Zone Settings Attribute Set

Identifier	Name	Type	Range	Access	Default	Mandatory / Optional
0x0010	<i>IAS_CIE_Address</i>	IEEE address	Valid 64bit IEEE address	Read/Write	-	M

#### 8.2.2.2.2.1 *IAS\_CIE\_Address* Attribute

The *IAS\_CIE\_Address* attribute specifies the address that commands generated by the server shall be sent to. All commands received by the server must also come from this address.

It is up to the zone's specific implementation to permit or deny change (write) of this attribute at specific times. Also, it is up to the zone's specific implementation to implement some auto-detect for the CIE (example: by requesting the ZigBee cluster discovery service to locate a Zone Server cluster.) or require the intervention of a CT in order to configure this attribute during installation.

### 方法一：Auto-Enrol-Response

IAS CIE 通过 Write Attribute 的方法设置 IAS Zone 的 IAS\_CIE\_Address 属性。当 Zone Device 收到这条命令后，将运行状态设置为“E\_IAS\_DEV\_STATE\_READY\_TO\_ENROLL”。紧接着 IAS CIE 将会主动发送“Zone Enroll Response”设置 Zone ID。从而 IAS Zone 节点完成登记过程。

Stack	Layer	Packet Information	PAN Src.	PAN Dst.	MAC Src.	MAC Dst.	Frame Information: (61 bytes)
ZigBee	MAC	Acknowledgement					<ul style="list-style-type: none"> <li>MAC Header: (9 bytes)</li> <li>MAC Payload: (50 bytes) <ul style="list-style-type: none"> <li>NWK Header: 0x321E0000C3730248</li> <li>NWK Aux Header: (14 bytes)</li> <li>MAC Payload: (24 bytes) <ul style="list-style-type: none"> <li>APS Header: 0xE1010405000100</li> <li>APS Payload: (16 bytes) <ul style="list-style-type: none"> <li>ZCL Header: 0x020510</li> <li>Frame Control: 0x10</li> <li>Transaction Sequence Number: 5</li> <li>General Command Frame: [0x02] Write Attributes</li> <li>ZCL Payload: (13 bytes) <ul style="list-style-type: none"> <li>Attribute 0: (11 bytes) <ul style="list-style-type: none"> <li>Attribute ID: [0x0010] IAS CIE Address</li> <li>Data Type: [0x0F] IEEE Address</li> <li>Value: 0x00158D00015F5257</li> <li>IAS CIE Address: 00:15:8D:00:01:5F:52:57</li> </ul> </li> </ul> </li> </ul> </li> </ul> </li> </ul> </li> </ul>
ZigBee	ZCL	IAS Zone: Write Attributes		0x6EC7	0x0000	0xC373	
ZigBee	MAC	Acknowledgement					
ZigBee	ZCL	IAS Zone: Write Attributes Response		0x6EC7	0xC373	0x0000	
ZigBee	MAC	Acknowledgement					
ZigBee	MAC	Data Request		0x6EC7	0xC373	0x0000	
ZigBee	MAC	Acknowledgement					
ZigBee	ZCL	IAS Zone: Zone Enroll Response		0x6EC7	0x0000	0xC373	
ZigBee	MAC	Acknowledgement					
ZigBee	ZCL	IAS Zone: Default Response		0x6EC7	0xC373	0x0000	

Stack	Layer	Packet Information	PAN Src.	PAN Dst.	MAC Src.	MAC Dst.	Frame Information: (50 bytes)
ZigBee	MAC	Data Request		0x6EC7	0xC373	0x0000	<ul style="list-style-type: none"> <li>MAC Header: (9 bytes)</li> <li>MAC Payload: (39 bytes) <ul style="list-style-type: none"> <li>NWK Header: 0x331E0000C3730248</li> <li>NWK Aux Header: (14 bytes)</li> <li>MAC Payload: (13 bytes) <ul style="list-style-type: none"> <li>APS Header: 0xE2010405000100</li> <li>APS Payload: 0x0200000601</li> <li>ZCL Header: 0x000601</li> <li>ZCL Payload: 0x0200</li> <li>Enroll Response Code: [0x00] Success</li> <li>Zone ID: 0x02</li> </ul> </li> </ul> </li> </ul>
ZigBee	MAC	Acknowledgement					
ZigBee	ZCL	IAS Zone: Zone Enroll Response		0x6EC7	0x0000	0xC373	
ZigBee	MAC	Acknowledgement					

方法二：IAS Zone 主动请求 Zone-Enroll-Request

当 IAS Zone 入网成功后，可以通过 Match Descriptor Request 寻找 IAS CIE。如果找到合适的 IAS CIE 后，将会主动向 CIE 请求 Zone Enroll Request 进行登记。

CIE	IAS
	Join network
	Send Match Description Request to find IAS Zone cluster client
	Send Zone Enroll Request
Send Zone Enroll Response	
Send IAS_CIE_address attribute	

Stack							ZDP - Match Descriptor Request	
Layer							Frame Information: (56 bytes)	
Packet Information							MAC Header: (9 bytes)	
ZigBee	NWK	Command	PAN Src.	PAN Dst.	MAC Src.	MAC Dst.	NWK	MAC Payload: (45 bytes)
ZigBee	ZDP	Match Descriptor Request		0x77FB	0x0000	0xFFFF	0x0	MAC Header: 0x1D1E0F3AFFFD0208
ZigBee	MAC	Acknowledgement		0x3CFB	0x0000	0xFFFF	0x0	NWK Aux Header: (14 bytes)
ZigBee	ZDP	Match Descriptor Request		0x3CFB	0x0F3A	0x0000	0x0	NWK Payload: (19 bytes)
ZigBee	MAC	Data Request		0x3CFB	0x0F3A	0x0000	0x0	APS Header: 0x0300000000000008
ZigBee	ZDP	Acknowledgement		0x3CFB	0x0000	0x0F3A	0x0	APS Payload: (11 bytes)
ZigBee	ZDP	Match Descriptor Response		0x3CFB	0x0000	0x0F3A	0x0	Match Descriptor Request: (11 bytes)
ZigBee	MAC	Acknowledgement		0x3CFB	0x0F3A	0x0000	0x0	ZDP Transaction Sequence Number: 2
ZigBee	MAC	Data Request		0x3CFB	0x0F3A	0x0000	0x0	NWK Address of Interest: 0xFFFF
ZigBee	MAC	Acknowledgement		0x3CFB	0x0F3A	0x0000	0x0	Profile ID: [0x0104] ZigBee Home Automation
ZigBee	ZCL	IAS Zone: Zone Enroll Request		0x3CFB	0x0F3A	0x0000	0x0	Input Clusters Count: 0
ZigBee	MAC	Acknowledgement		0x3CFB	0x0F3A	0x0000	0x0	Output Clusters Count: 2
ZigBee	ZDP	Match Descriptor Request		0x3CFB	0x0000	0xFFFF	0x0	Output Clusters List: 0x05020500
ZigBee	MAC	Data Request		0x3CFB	0x0F3A	0x0000	0x0	Cluster 0: [0x0500] Security and Safety: IAS Zone
ZigBee	MAC	Acknowledgement		0x3CFB	0x0F3A	0x0000	0x0	Cluster 1: [0x0502] Security and Safety: IAS MD
ZigBee	ZCL	IAS Zone: Zone Enroll Response		0x3CFB	0x0000	0x0F3A	0x0	NWK MIC: 0x219E6097
ZigBee	MAC	Acknowledgement		0x3CFB	0x0F3A	0x0000	0x0	MAC Footer: 0x9A16
ZigBee	ZCL	IAS Zone: Default Response		0x3CFB	0x0F3A	0x0000	0x0	

IAS Zone 可以通过 CIE 的短地址获得 IAS\_CIE\_address 地址。当有事件发生后，IAS Zone 通过 Zone Status Change Notification 通知 CIE 报警事件。

Stack							ZCL - IAS Zone: Zone Status Change Notification	
Layer							Frame Information: (54 bytes)	
Packet Information							MAC Header: (9 bytes)	
ZigBee	ZDP	NWK Address Request		0x3CFB	0x0000	0xFFFF	0x0F3A	MAC Payload: (43 bytes)
ZigBee	MAC	Data Request		0x3CFB	0x0F3A	0x0000	0x0	NWK Header: 0x221E0F3A00000248
ZigBee	MAC	Acknowledgement		0x3CFB	0x0000	0x0F3A	0x0000	NWK Aux Header: (14 bytes)
ZigBee	ZDP	NWK Address Response		0x3CFB	0x0000	0x0F3A	0x0000	NWK Payload: (17 bytes)
ZigBee	MAC	Acknowledgement		0x3CFB	0x0000	0xFFFF	0x0F3A	APS Header: 0x0001010405000100
ZigBee	ZDP	NWK Address Request		0x3CFB	0x0000	0xFFFF	0x0F3A	APS Payload: (9 bytes)
ZigBee	MAC	Data Request		0x3CFB	0x0F3A	0x0000	0x0	ZCL Header: 0x000209
ZigBee	MAC	Acknowledgement		0x3CFB	0x0F3A	0x0000	0x0	ZCL Payload: 0x000100000011
ZigBee	ZCL	IAS Zone: Zone Status Change		0x3CFB	0x0F3A	0x0000	0x0F3A	Zone Status: 0x0011
ZigBee	ZCL	IAS Zone: Zone Status Change		0x3CFB	0x0F3A	0x0000	0x0F3A	...1 = Alarm1 Opened: [0x1] Yes
ZigBee	ZCL	IAS Zone: Zone Status Change		0x3CFB	0x0F3A	0x0000	0x0F3A	...0 = Alarm2 Opened: [0x0] No
ZigBee	ZCL	IAS Zone: Zone Status Change		0x3CFB	0x0F3A	0x0000	0x0F3A	...0 = Tamper: [0x0] No
ZigBee	ZCL	IAS Zone: Zone Status Change		0x3CFB	0x0F3A	0x0000	0x0F3A	...0 = Battery: [0x0] Battery OK
ZigBee	ZCL	IAS Zone: Zone Status Change		0x3CFB	0x0F3A	0x0000	0x0F3A	...1 = Supervision Reports: [0x1] Yes
ZigBee	ZCL	IAS Zone: Zone Status Change		0x3CFB	0x0F3A	0x0000	0x0F3A	...0 = Restore Reports: [0x0] No
ZigBee	ZCL	IAS Zone: Zone Status Change		0x3CFB	0x0F3A	0x0000	0x0F3A	...0 = Trouble: [0x0] No
ZigBee	MAC	Acknowledgement		0x3CFB	0x0F3A	0x0000	0x0	...0 = AC Mains: [0x0] OK
ZigBee	MAC	Data Request		0x3CFB	0x0F3A	0x0000	0x0	...0 = Test: [0x0] Sensor is in Test
ZigBee	MAC	Acknowledgement		0x3CFB	0x0000	0x0F3A	0x0000	...0 = Battery Defect: [0x0] Sensor Battery is
ZigBee	ZCL	IAS Zone: Default Response		0x3CFB	0x0000	0x0F3A	0x0000	0000 0000 ... = Extended Status: 0x00
ZigBee	MAC	Acknowledgement		0x3CFB	0x0F3A	0x0000	0x0	Reserved Cluster: 0x000100