DATA SHEET
DC Leakage Current Sensor

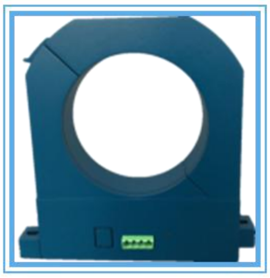
PN: CHD_CRS912D5-RS485	IPN=10~200mA

Feature

- DC Leakage Current Sensor develops on base of magnetic modulation closed loop principle
- Apply unique patented technology for measure tiny current (mA level)
- Supply voltage: DC ±12V

Advantages

- High accuracy
- Easy installation
- Wide current measuring range
- Optimized response time
- Low power consumption
- High immunity to external interference
- Very good linearity
- Can be customized



Applications

- The current detection of the lift
- DC panel detection
- The signal system
- Current differential detection
- UPS and Inverter applications

CE RoHS ISO 14001 ISO 9001

Electrical data:（Ta=25°C，Vc= ±15VDC,RL=10KΩ）

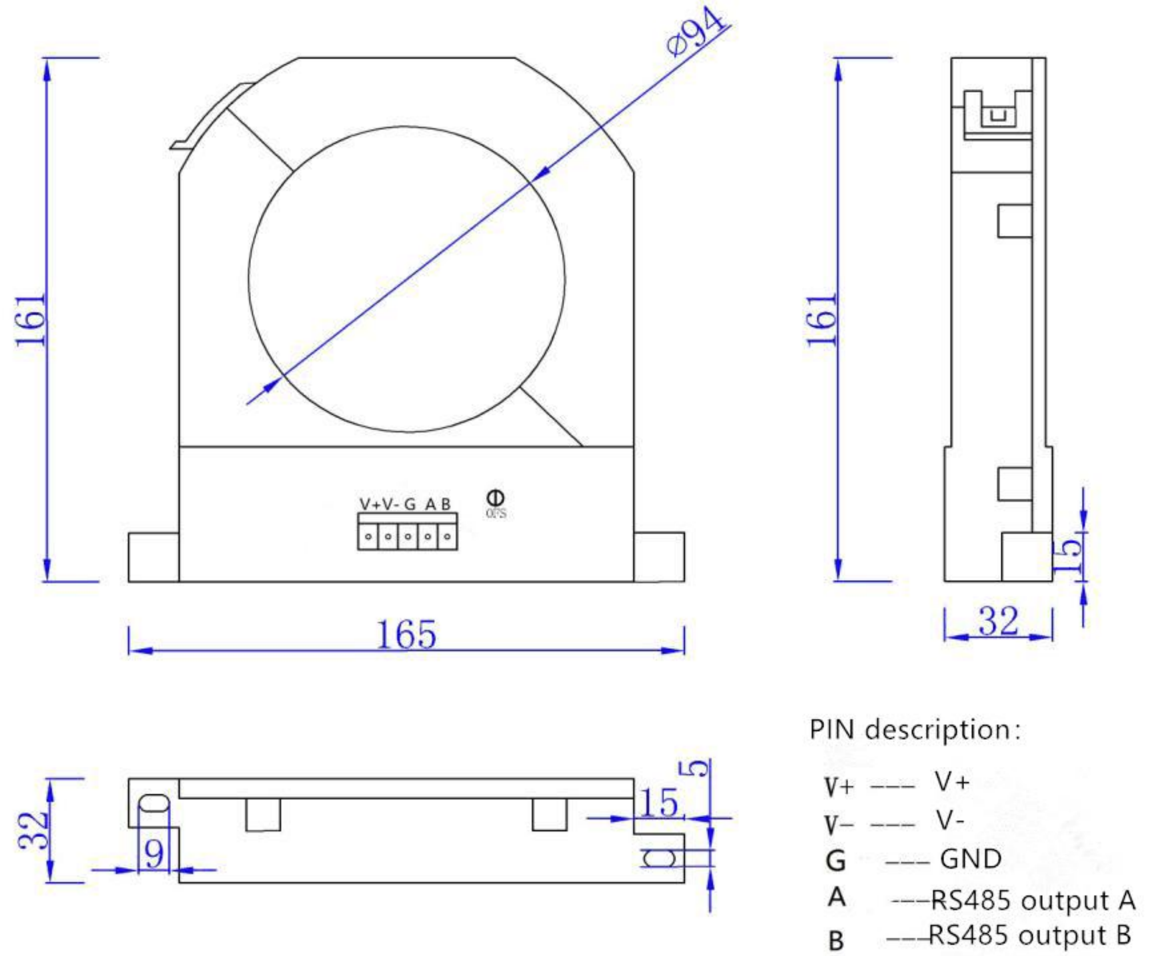
Parmeter Ref	CHD10 CRS912D5- RS485	CHD20 CRS912D5- RS485	CHD50 CRS912D5- RS485	CHD100 CRS912D5- RS485	CHD200 CRS912D5- RS485
Rated input Ipn (mA DC)	±10	±20	±50	±100	±200
Measuring range Ip (mA DC)	0～±20	0～±50	0～±100	0～±200	0～±300
Communication interface			RS485		
Supply voltage VC(V)			DC ±12V~±15V (±5%)		
Current consumption I_C (mA)			<35		
Accuracy XG(%)	@IPN,T=25°C		≤±1		
Offset voltage V_{OE}(mV)	@IP=0,T=25°C		<±100		
Offset voltage drift V_{OT}(mV/°C)	@IP=0,10 ~ +60°C		≤±5.0		
Linearity error εr(%FS)			≤1.0		
Insulation voltage （KV）	@50/60Hz, 1min		2.5		

General data:

Parameter	Value
Operating temperature TA(°C)	-10+60

Storage temperature TS(°C)	-20～+70
Load resistance (R_L)	⩾10K
Mass (g)	480g
Plastic material	PBT G30/G15, UL94- V0;
Standards	IEC60950-1:2001
	EN50178:1998
	SJ20790-2000

Dimensions(mm):



Remarks:

- During the installation process, on the sensor, close attention should be paid to side core interface is aligned, not forcibly closed.
- When the current goes through the primary pin of a sensor, the voltage will be measured at the output end.
- Custom design is available for the different rated input current and the output voltage.
- The dynamic performance is the best when the primary hole if fully filled with.
- The primary conductor should be <100°C.

WARNING : Incorrect wiring may cause damage to the sensor.

Modbus Communication Protocol

1 物理接口 Physical interface

串口通信口采用 RS485。本协议中使用奇校验；通讯传输方式定义和 Modbus RTU 通讯规约相兼容：

RS485 is used as serial communication port. Odd check is used in this protocol; The definition of communication transmission mode is compatible with Modbus RTU communication protocol.

编码 Code	8 位二进制 8-bit binary
起始位 Starting bit	1 位 1 bit
数据位 Data bit	8 位 8 bits
奇偶校验位 Parity bit	无校验 No verification
停止位 Stop bit	1 位 1 bit
错误校验 Error checking	CRC

地址码：地址码位通讯传送的第一个字节，这个字节表明由用户设定地址码的从机将接收主机发送过来的信息，每个从机具备唯一的地址码（广播地址码位 0xFA）。

Address code: The first byte of the communication transmission of the address code bit. This byte indicates that the slave with the address code set by the user will receive the information sent by the host. Each slave has a unique address code (broadcast address code bit). 0xFA).

功能码：通讯传送的第二个字节，作为主机请求发送，通过功能码告知从机需要执行什么动作。

Function code: The second byte of communication transmission is sent as a request by the master, and the function code is used to inform the slave what action needs to be performed.

数据区：数据区是根据不同的功能码而不同。

Data area: The data area is different according to different function codes.

CRC：二字节的错误检测码。 CRC: Two-byte error detection code.

信息帧结构 Information frame structure：

地址码 address code	功能码 function code	数据区 Data area	CRC 高位字节 CRC high byte	CRC 地位字节 CRC low byte
8 位 8 bits	8 位 8 bits	N * 8 bit	8 位 8 bits	8 位 8 bits

功能码：03 读取数据，06 写寄存器

Function code: 03 read data, 06 write register

2 命令介绍 Command introduction

读取命令 Read command：

下发格式 Issue format：

地址码 address code	功能码 function code	寄存器地址 Register address	读取寄存器个数 Read the number of registers	CRC 校验码 CRC check code
ADD_N	0X03	16 位 16 bits	16 位 16 bits	16 位 16 bits

返回格式 Return format：

地址码 address code	功能码 function code	字节数 Number of bytes	数据 Data	CRC 校验码 CRC check code
ADD_N	0X03	8 位 8 bits	N*8 bit	16 位 16 bits

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3 寄存器地址定义 Register address definition

寄存器 Register	描述 Description	单位 Unit	读写 Read	说明 Explaination
0055H	内部保留数据 Internal retention data		只读 Read-only	
0056H	漏电流值 Leakage current value	0.01mA	只读 Read-only	最高位符号位，1 表示负数 Highest sign bit, 1 for negative
0057H	软件版本号 Software version number		只读 Read-only	softH=0 ， softL=100, The representative software version number is 1.00 softH=0， softL=255， The representative software version number is 2.55
0058H	零点值 Zero Value		只读 Read-only	
0059H	斜率值 Slope value		只读 Read-only	
005AH	高电平零点 High level zero		只读 Read-only	
005BH	低电平零点 Low level zero		只读 Read-only	
005CH	高电平上限 High level upper limit		只读 Read-only	
005DH	高电平下限 Lower limit of high level		只读 Read-only	
005EH	低电平上限 Low level upper limit		只读 Read-only	
005FH	低电平下限 Low level lower limit		只读 Read-only	
0060H	高电平 High level		只读 Read-only	
0061H	低电平 Low level		只读 Read-only	
033EH	零点校正 zero calibration		只写 Write only	06 命令，数据值：0D0DH，使用广播地址 0xFA。 06 command, data value: 0D0DH, use the broadcast address 0xFA.
0340H	斜率校正 Slope correction		只写 Write only	06 命令，数据值：0D0DH，使用广播地址 0xFA。通过标准 8.96mA 06 command, data value: 0D0DH, use the broadcast address 0xFA. Pass standard 8.96Ma

举例 For example：
发送命令 Sending of command：
ADD，0x03，0x00，0x56，0x00，0x02, CRC-H，CRC-L，
RETURN：(返回信息)
ADD，0x03，0x04，LDLH，LDLL，softH，softL，CRC-H，CRC-L
其中：LDLH=漏电流数据的高 8 位，LDLL=漏电流数据的低 8 位，
LDLH = upper 8 bits of leakage current data, LDLL = lower 8 bits of leakage current data,
例如 For example：
LDLH=0x84，LDLL=0XB0，那么合成为十六进制数据=84B0H。16 位二进制数据=1000 0100 1011 0000
这 16 位数据中的最高位=0 代表电流为正，16 位数据中的最高位=1 代表电流为负。16 位数据中的低 15 位代表电流的具体数据。那么，84B0H 的低 15 位数据=000 0100 1011 0000 相当于十进制数据=1200，因为最高位=1 所以电流为负，漏电流= -1200÷100= -12.00(mA)。

If LDLH=0x84，LDLL=0XB0, then the resultant hexadecimal data = 84B0H. 16 bit binary data = 1000 0100 1011 0000 The highest bit of the 16-bit data = 0 represents the current is positive, and the highest bit of the 16-bit data = 1 represents the current is negative. The lower 15 bits of the 16-bit data represent the specific data of the current. Then, the low 15-bit data of 84B0H=000 0100 1011 0000 is equivalent to decimal data=1200, because the highest bit = 1, the current is negative, and the leakage current = - 1200 ÷ 100= -12.00(mA)。

又例如 Another example：
LDLL=0x00 LDLH=0x00，那么合成为十六进制数据=0000H，漏电流=0。
LDLL=0x00 LDLH=0x00，then the composite is hexadecimal data =0000H, leakage current = 0.

又例如 Another example：
LDLH=0x01，LDLL=0x82 那么合成为十六进制数据=0182H，低 15 位数据=0000 0001 1000 0010 的十进制数据=386，因为 16 位二进制数据最高位=0 所以电流为正，漏电流=386÷100= 3.86(mA)。
其余情况依此类推。
LDLH=0x01，LDLL=0x82, then the synthesized hexadecimal data = 0182H, the 15th bit data = 0000 0001 1000 001, the decimal data= 386, because the highest bit of 16 bit binary data = 0, the current is positive, and the leakage current = 386 ÷ 100= 3.86(mA)。

And so on.

注 Remark：

凡是有两字节的数据或地址都是高字节在前!!

Any data or address that has two bytes is high byte first!!

4 校验方式 Verification method

冗余循环码（CRC）包含 2 个字节，即 16 位二进制。CRC 码由发送设备计算，放置于发送信息的尾部。接收信息的设备再重新计算接收到信息的 CRC 码，比较计算得到的 CRC 码是否与接收到的相符，如果两者不相符，则表明出错。Redundant cyclic code (CRC) contains two bytes, that is, 16 bit binary. The CRC code is calculated by the transmitting device and placed at the end of the transmitting message. The device receiving the information recalculates the CRC code of the received information and compares whether the calculated CRC code is consistent with the received one. If not, it indicates an error.

CRC 码的计算方法是，先预置 16 位寄存器全为 1。再逐步把每 8 位数据信息进行处理。在进行 CRC 码计算时只用 8 位数据位，起始位及停止位，如有奇偶校验位的话也包括奇偶校验位，都不参与 CRC 码计算。CRC code is calculated by setting all 16 bit registers to 1. Then every 8 bits of data information is processed step by step. In CRC code calculation, only 8 data bits, start bit and stop bit are used. If there are parity bits, they also include parity bits, and they are not involved in CRC code calculation.

在计算 CRC 码时，8 位数据与寄存器的数据相异或，得到的结果向低位移一字节，用 0 填补最高位。再检查最低位，如果最低位为 1，把寄存器的内容与预置数相异或，如果最低位为 0，不进行异或运算。When calculating CRC code, 8-bit data is different (exclusive OR) from the data of register, the result is shifted to the low position by one byte, and 0 is used to fill the highest position. Check the lowest position again. If the lowest level is 1, make exclusive OR operation for the contents of the register and the preset number, if the lowest level is 0, no exclusive OR operation will be performed.

这个过程一直重复 8 次。第 8 次移位后，下一个 8 位再与现在寄存器的内容相相异或，这个过程与以上一样重复 8 次。当所有的数据信息处理完后，最后寄存器的内容即为 CRC 码值。CRC 码中的数据发送、接收时低字节在前。This process has been repeated eight times. After the 8th shift, the next 8 bits are exclusive OR from the contents of the current register, this process is repeated 8 times as above. When all the data information is processed, the content of the last register is the CRC code value. When sending and receiving data in CRC code, the low byte comes first.

计算 CRC 码的步骤为 The steps to calculate CRC code are as follows：

（1）预置 16 位寄存器为十六进制 FFFF（即全为 1）。称此寄存器为 CRC 寄存器； Preset 16 bit register as hexadecimal FFFF (that is, all 1). This register is called CRC register;

（2）把第一个 8 位数据与 16 位 CRC 寄存器的低位相异或，把结果放于 CRC 寄存器；Make exclusive OR operation for the first 8-bit data and the low bit of 16 bit CRC register, the result is put in CRC register;

（3）把寄存器的内容右移一位(朝低位)，用 0 填补最高位，检查最低位； Move the contents of the register one bit to the right (toward the low position), fill the highest position with 0, and check the lowest position;

（4）如果最低位为 0：重复第 3 步(再次移位)；如果最低位为 1：CRC 寄存器与多项式 A001 （1010 0000 0000 0001）进行异或； If the lowest position is 0: repeat step 3 (shift again); If the lowest bit is 1: make exclusive OR operation for the CRC register with the polynomial A001 (1010 0000 0001);

（5）重复步骤 3 和 4，直到右移 8 次，这样整个 8 位数据全部进行了处理； Repeat steps 3 and 4 until the 8-bit data are processed;

（6）重复步骤 2 到步骤 5，进行下一个 8 位数据的处理； Repeat steps 2 to 5 to process the next 8-bit data;

(7）最后得到的 CRC 寄存器即为 CRC 码。 The last CRC register is CRC code.

计算 crc 的函数如下(步骤 2 到步骤 5) The function to calculate CRC is as follows (step 2 to step 5)：

```
UINT crc = 0xFFFF;
void calccrc(BYTE crcbuf)
{
      BYTE I , TT;
      crc = crc ^ crcbuf;
      for( I = 0; I < 8; i++)
      {
                    TT = crc&1;
          crc = crc>>1;
          crc = crc&0x7FFF;
          If (TT == 1)
                              crc = crc^0xA001;
          crc = crc&0xFFFF;
       }
   }
```


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