6 Communication Protocol

This IMD provides a Modbus RTU protocol interface, utilizing Modbus RTU 0x03/0x06 commands. Baud rate, communication address, and parity can be set using DIP switches, with 1 stop bit and 8 data bits. The time interval between each byte in the transmitted frame must not exceed 20ms; otherwise, the frame will be reset.

The module operates in slave mode.

Read Operation: Function code 0x03: Read Holding Registers (can read multiple register addresses at once)

Request Command	Response Command
BYTE[0] Device Address	BYTE[0] Device Address
BYTE[1] Function Code 0x03	BYTE[1] Function Code 0x03
BYTE[2] Register Start Address High Byte	BYTE[2] Register Byte Length
BYTE[3] Register Start Address Low Byte	BYTE[3] Register High Byte
BYTE[4] Register Length High Byte	BYTE[4] Register Low Byte
BYTE[5] Register Length Low Byte	BYTE[5] Register High Byte
BYTE[6] CRC Check Low Bit	… …
BYTE[7] CRC Check High Bit	BYTE[n] CRC Check Low Bit
	BYTE[n+1] CRC Check High Bit

Write Operation: Function code 0x06 - Write Single Register (can set only one register address at a time)

Request Command	Response Command
BYTE[0] Device Address	BYTE[0] Device Address
BYTE[1] Function Code 0x06	BYTE[1] Function Code 0x06
BYTE[2] Register Address High Byte	BYTE[2] Register Address High Byte
BYTE[3] Register Address Low Byte	BYTE[3] Register Address Low Byte
BYTE[4] Register Parameter High Byte	BYTE[4] Register Parameter High Byte
BYTE[5] Register Parameter Low Byte	BYTE[5] Register Parameter Low Byte
BYTE[6] CRC Check Low Bit	BYTE[6] CRC Check Low Bit
BYTE[7] CRC Check High Bit	BYTE[7] CRC Check High Bit

■CRC-16 Algorithm (RS485):

Generates a check data based on the CRC polynomial rule, with the result added to the command as a check code.

Polynomial: X^16+X^15+X^2+1

1. Set the CRC register and initialize it to 0Xffff.

2. XOR the first 8-bit character of the data with the lower 8 bits of the 16-bit CRC register, and store the result in the CRC register.

3. Shift the CRC register right by one bit. MSB is replaced with 0, and the LSB is shifted out and checked.

4. If the LSB is 0, repeat step 3; if the LSB is 1, XOR the CRC register with the polynomial code.

5. Repeat steps 3 and 4 until all 8 shifts are completed. This completes the processing of one 8-bit data

Table 6: Register Address Definitions

Function Code	**Register ADD**	**Content**	**Send Example (Address 01)**	**Remarks**
03 Read Register	0x0010	Bus Voltage	01 03 00 10 00 01 85 CF	Unit 0.1V, voltage between positive and negative bus
	0x0012	Positive Pole-to-Ground Insulation Resistance	01 03 00 12 00 01 24 0F	Unit KΩ, rounded to the nearest integer (0xFFFF indicates invalid value; 0xEA60 indicates resistance >10MΩ)
	0x0013	Negative Pole-to-Ground Insulation Resistance	01 03 00 13 00 01 75 CF	
	0x0014	Status Bits	01 03 00 14 00 01 C4 0E	See Table 7 below
06 Write Register	0x0102	Activate Insulation Monitoring	01 06 01 02 00 11 E9 FA	Ground switch K closes
		Deactivate Insulation Monitoring	01 06 01 02 00 00 29 F6	Ground switch K is disconnected
0xFF	0x 66	Master Broadcast Read Slave Address	Master sends FF 66 A5 AA 2B Slave replies FF 66 add CRClo CRCHi add is the slave's communication address	Example of slave reply: FF 66 01 AB 90 Slave address is 0x01

Table 7: 0x0014 Register Bit Definitions

Register ADD	**Bit**	**Read/Write**	**Definition**	
0x0014	bit15~bit8	Blank	Blank	
	bit7	R	Bus Voltage Reverse Connection Alarm	0: No reverse connection of DC voltage or reverse voltage <100V
				1: Reverse DC voltage ≥100V
	bit6	R	Negative Pole Insulation Fault	0: No fault in negative pole insulation
				1: Fault in negative pole insulation, i.e., negative pole insulation resistance less than the set threshold
	bit5	R	Positive Pole Insulation Fault	0: No fault in positive pole insulation
				1: Fault in positive pole insulation, i.e., positive pole insulation resistance less than the set threshold
	bit2	R	Insulation Monitoring Function Status	0: IMD Deactivate, Ground switch K is disconnected
				1: IMD Activate, Ground switch K closed

	bit1	R	Insulation Resistance Monitoring Validity	0: Insulation resistance monitoring incomplete, resistance value invalid
				1: Insulation resistance monitoring valid, resistance value can be read

Examples:

1. Activate IMD: 01 06 01 02 00 11 E9 FA

Return frame: 01 06 01 02 00 11 E9 FA

2. Deactivate IMD: 01 06 01 02 00 00 29 F6

Return frame: 01 06 01 02 00 00 29 F6

3. Read Bus Voltage and Positive/Negative Pole-to-Ground Resistances

(Read 4 registers): 01 03 00 10 00 04 45 CC

Return frame: 01 03 08 07 D0 02 58 EA 60 02 58 11 4F

Reading DC voltage 0X07D0 (200V), reading positive pole insulation resistance 0XEA60 (infinitely large), reading negative pole insulation resistance 0X0258 (600KΩ).

4. Read Status Bits: 01 03 00 14 00 01 C4 0E

Return frame: 01 03 02 00 06 B9 EB

0x06=0000 0110， Bit2=1insulation monitoring function is activated, Bit1 = 1 insulation resistance value is valid.