CRH Series Mod-Bus Single Phase Voltage Regulator

Product Description

- RS 485 Bus Control
- Modbus RTU Communication Protocol
- Dielectric Strength: 3000Vrms
- LED Indicator
- Real-time Current Detection
- Anomoly Alert Function
- Stablized Voltage Output



Product Selection

CRH	380	D	40	-C	S	W	(XXX)	-B
CRH Series	Load Voltage 240: Suitable for 120VAC/208VAC 220VAC 380: Suitable for 220VAC/380VAC	Auxiliary Power Supply D: 15-32VDC	Load Current 25: 25Amp 40: 40Amp 60: 60Amp 80: 80Amp	Function C: Current Detection	Function S: Stablized Voltage	Control Type W: 0-10VDC / 4-20mA / RS 485	Customer Code	Heat Sink B: KHS-90J IF24DC: KHS-I93 -B24DC

Technical Specifications

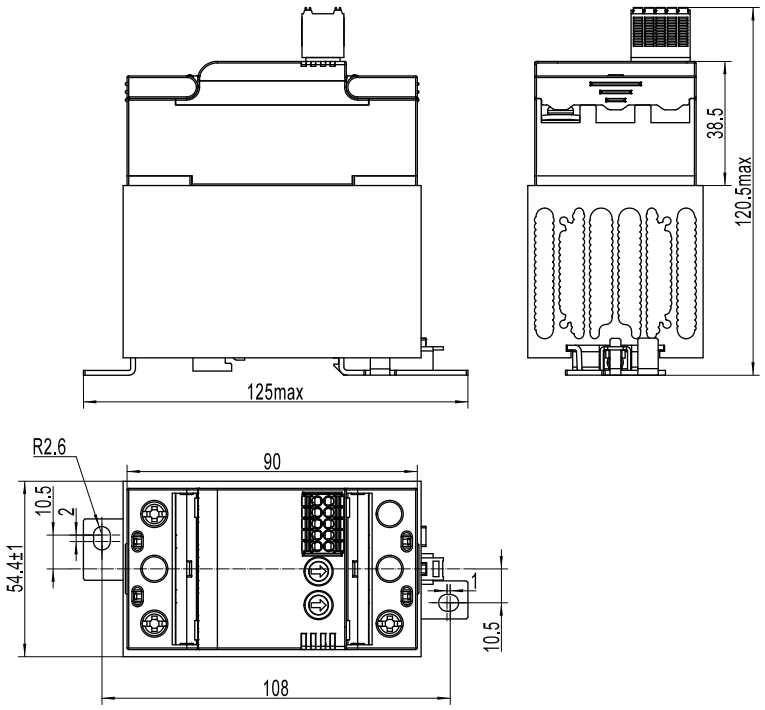
Input Specifications (Ta=25°C)	Condition	Symbol	Model	Min	Typ	Max	Unit
Auxiliary Power Supply Voltage Range		U_c		15	24	32	VDC
Auxiliary Power Supply Current	@24VDC	I_c				100	mA
Input Control			Voltage Analog	0		10	VDC
			Current Analog	4		20	mA
			Bus	RS 485 ((2 Connections)			
Module Output Switching Port Level			High Level	15		32	VDC
			Low Level	0		5	VDC
Module Output Switching Port Current	@24VDC					5	mA
Alert Interface Rated Current						50	mA

Output Specifications (Ta=25°C)	Condition	Symbol	Model	Min	Typ	Max	Unit
Load Voltage		U_e	240	96		280	VAC
			380	176		440	VAC
Load Current		I_e	25A	0.1		25	A
			40A	0.1		40	A
			60A	0.1		60	A
			80A	0.1		80	A
Off-State Leakage Current	@220VAC	I_{lk}				5	mA
Transient Overvoltage		U_p			1200		Vpk
Non-repetitive Surge Current	@10ms	I_{TSM}	25A		250		Apk
			40A		400		Apk
			60A		600		Apk
			80A		800		Apk
I^2t for Fusing	@10ms	I^2t	25A		312		A^2s
			40A		1250		A^2s
			60A		1800		A^2s
			80A		3250		A^2s

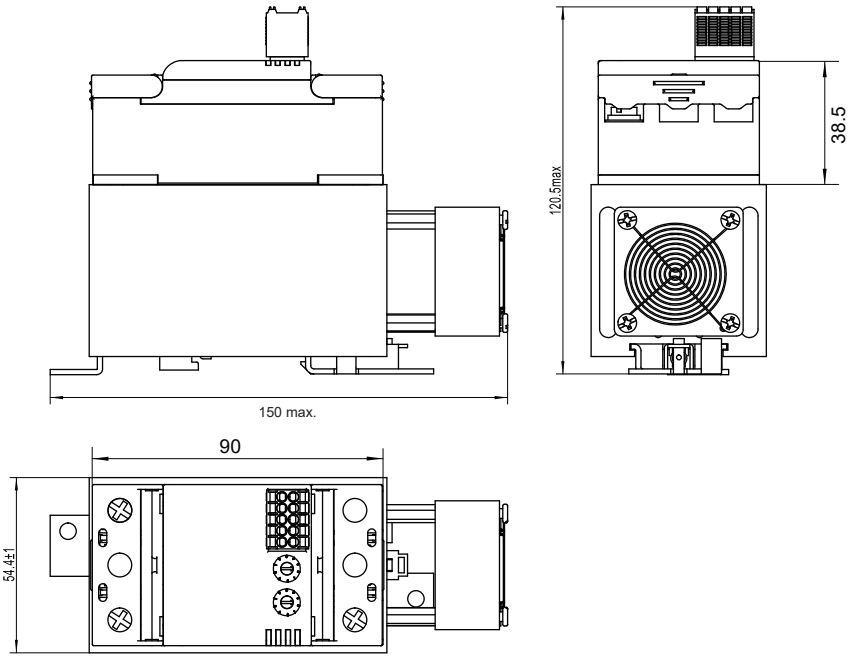
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General Specifications (Ta=25°C)	Condition	Symbol	Model	Min	Typ	Max	Unit
Slave Station Address Range				1		99	
Max. Station Nodes						99	
Data Bit Rate				9600, 19200, 38400, 57600, 115200			
Communication Protocol				Modbus RTU			
Dielectric Strength		V_{ISO}			3000		Vrms
Insulation Resistance	@500VDC	R_{ISO}			1000		MΩ
Operating Temperature		T_{OPR}		-30		+70	℃
Storage Temperature		T_{SPR}		-30		+100	℃

Outline Dimensions



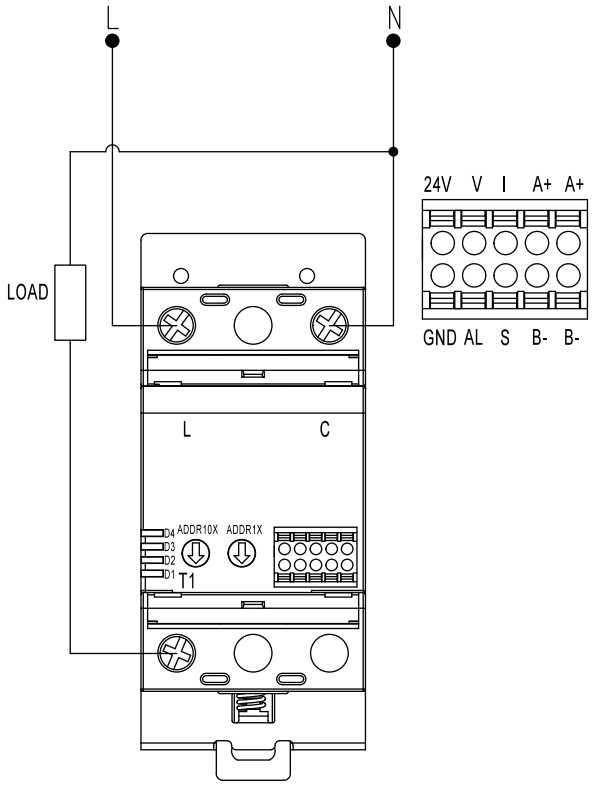
25A、40A



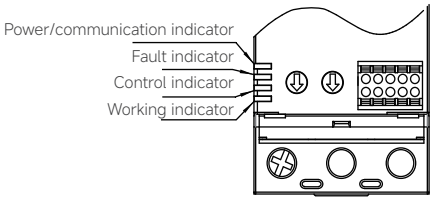
60A、80A

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Wiring Diagram



24V: Connect the positive end of the 24VDC supply power to power the module.
GND: Public ground end
V: Connect the 0-10VDC analog;
I: Connect the 4-20mA analog;
A+: Connect the positive end of RS 485.
B- : Connect the negative end of RS 485.
AL: Module alert output port
S: Module output switching port
L: Connect the live wire of the load power supply
C: Connect the zero line when the load power supply is 220VAC, and connect another live line when the load power supply is 380VAC.



Power/communication indicator:
LED lights up when there is an auxiliary power supply, and will be brighter when the module is communicating.
Fault indicator: LED lights up when anomaly happens.
Control indicator: LED lights up when the product is turned on.
Working indicator: LED flashes every 1.5s when the module is operating normal.

Interface function description

1. Anolog control

V control voltage range is 0-10VDC, so the output voltage is 0-100%.
I control voltage range is 4-20mA, so the output voltage is 0-100%.

2. Alert output

When the module is operating normal, the alert output is on high resistance state to the floor. But when any channel of the module has following question, the alert output to the floor will turn on.
A) SCR channel through: no control signal, but there has current in the loop.
B) SCR disconnection: having control signal, but there has not current in the loop.
C) Load connection break.
D) No load supply power.

3. Module output switching port

Used to switch the output state of module:
When the port level switches from low voltage (voltage less than 5VDC) to high voltage (voltage greater than 15VDC), the module enters the welding state and outputs three welding voltages in sequence: welding voltage 1 (maintenance time 1), welding voltage 2 (maintenance time 2), welding voltage 3 (maintenance time 3), and then re-enters the standby state.

4. RS 485 A+ & B

Used for 485 communication, write or read the corresponding control values.

5. Address set

Set the address encoder to the corresponding location. Each time the address is reset, the module needs power off and then restarts with 24VDC before switching new address. When the address is set 99, the communication parameter of module is fixed to 9600 8BIT parity check 1 stop bit.

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Register Description

CRH has input and holding registers, their definition and address shown as below:

Input Register				
Address	Definition	Unit	Value Range	Whether to save when power is off
0	Alert register	-	-	No
1	Current register	0.01A	-	No
3	Power half cycle time register	μs	-	No
Holding registers				
Address	Definition	Unit	Value Range	Whether to save when power is off
50	Standby voltage register	-	0-1000	Yes
51	Welding voltage 1 register	-	0-1000	Yes
52	Welding voltage 2 register	-	0-1000	Yes
53	Welding voltage 3 register	-	0-1000	Yes
58	Welding maintenance time 1 register	ms	0-60000	Yes
59	Welding maintenance time 2 register	ms	0-60000	Yes
60	Welding maintenance time 3 register	ms	0-60000	Yes
61	Communication anomaly turn off register	s	0-100	Yes
62	Communication parameters setting register	-	-	Yes
63	Standby on/off control register	-	0-1	No
64	Soft start setting register	-	0-60	Yes
65	Load voltage setting register 240	-	120	Yes
	Load voltage setting register 380	-	220	Yes
66	Output switching register	-	0-1	No
67	Output mode register	-	0-3	Yes
68	Channel 1 over-current setting register	0.1A	0-200	Yes
71	Alarm shielding register	-	0-3	Yes
74	Control signal gain setting register	-	0-1000	Yes

Definition and instruction of input register:

1. Output alert register REG_ALARM（Address: 0）
   Data format: 16 bits unsigned integer
   This is output alert register.When the module is operating normal, the register is 0 with corresponding location is 1. But when the module has following question, we judge the channel is abnormal with corresponding location is 1.
   A)SCR channel through: no control signal, but there has current in the loop.
   B)SCR disconnection: having control signal, but there has not current in the loop.
   C)Load connection break.
   Definition of output alert register:

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
-	-	Over temperature	-	Over current	-	Module Anomaly	Load supply power anomaly

2. Current register REG_CURR（Address: 1）
   Data format: 16 bits unsigned integer
   This register stores the current in the load loop, its unit is 0.01A.

3. Power half cycle time register REG_CYCLE（Address: 3）
   Data format: 16 bits unsigned integer
   This register stores the power half cycle time of load, its unit is μs.

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Definition and instruction of holding register:

1. Standby voltage register（Address: 50）
   Data format: 16 bits unsigned integer
   This register used to set the output voltage during standby, its value range is 0-1000.

2. Welding voltage register（Address: 51~53）
   Data format: 16 bits unsigned integer
   This register used to set the output voltage during welding, its value range is 0-1000.

3. Welding time register（Address: 58~60）
   Data format: 16 bits unsigned integer
   This register used to set the maintenance time for 3 welding phases,its unit is ms and the value range is 0-60000.

4. Communication anomaly turn off register REG_OFF（Address: 61）
   Data format: 16 bits unsigned integer
   This register used to set the turn-off output time automatically when the communication is cut off, it unit is s. The value of the register range from 0 to 100, with o indicating that the function is turned off and the default value is 0. The rest valves indicate that the output will be turned off when the module doesn't receive the communication information with the local address within the time.
   Example: when the register value is 8, then the output will be turned off if the module doesn't receive the communication information with the local address within 8s.

5. Communication parameters setting register REG_TX（Address: 62）
   Data format: 16 bits unsigned integer
   This register used to set the communication parameters, the default value is 300, the value definition shown as below:

Register value	Baud rate	Data bit	Check bit	Stop bit
300	9600	8 Bit data bits	No check	2 stop bits
301	19200	8 Bit data bits	No check	2 stop bits
302	38400	8 Bit data bits	No check	2 stop bits
303	57600	8 Bit data bits	No check	2 stop bits
304	115200	8 Bit data bits	No check	2 stop bits
310	9600	8 Bit data bits	Even parity check	1 stop bit
311	19200	8 Bit data bits	Even parity check	1 stop bit
312	38400	8 Bit data bits	Even parity check	1 stop bit
313	57600	8 Bit data bits	Even parity check	1 stop bit
314	115200	8 Bit data bits	Even parity check	1 stop bit
320	9600	8 Bit data bits	Odd parity check	1 stop bit
321	19200	8 Bit data bits	Odd parity check	1 stop bit
322	38400	8 Bit data bits	Odd parity check	1 stop bit
323	57600	8 Bit data bits	Odd parity check	1 stop bit
324	115200	8 Bit data bits	Odd parity check	1 stop bit
330	9600	8 Bit data bits	No check	1 stop bit
331	19200	8 Bit data bits	No check	1 stop bit
332	38400	8 Bit data bits	No check	1 stop bit
333	57600	8 Bit data bits	No check	1 stop bit
334	115200	8 Bit data bits	No check	1 stop bit

Note: After writing the new value to this register, the auxiliary power supply 24VDC needs to be powered on again before switching to the new communication parameters.

6. Standby on/off control register REG_ST_ON_OFF（Address: 63）
   Data format: 16 bits unsigned integer
   This register is used to control the turn on/off of the output.
   If the register value is 1, turn on the output; If the register value is 0, turn off the output.

7. Soft start setting register（Address: 64）
   Data format: 16 bits unsigned integer
   This register used to control the slope of soft start (standby control only), the value range is 0-60 and the default value is 0.
   When the value is 0, the soft start is turned off. When this value is n, the output control rises at a rate of 8/(n×50ms).

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8. Load voltage setting register（Address: 65）
Data format: 16 bits unsigned integer
CRH380 series register default value is 220. when the load voltage is 220VAC, it is set to 220.
CRH240 series register default value is 120. when the load voltage is 120VAC, it is set to 120.
If the load voltage is not the default condition, it needs to be reset.

9. Output switching register（Address: 66）
Data format: 16 bits unsigned integer
This register used to switch the output voltage. When the register value changes from 0 to 1, the module output switches from standby state to welding sate.

10. Output mode register (address: 67)
Data format: 16 bit unsigned integer
This register is used to switch output modes, with a value range of 0-3 and a default value of 0. The corre sponding pattern of register values is as follows:

Register value	Mode
0	Stable power ratio
1	Power ratio
2	Stable voltage ratio
3	Voltage ratio

11. Over-current setting register（Address: 68）
Data format: 16 bits unsigned integer
This register used to set the max. Value of the output current. When the load current is over this value, the product will output alarm signal and keep the alert in the corresponding position 1. Once the register is set to 0, the alert function will be closed.

12. Alarm shielding register (address: 71)
Data format: 16 bit unsigned integer
This register is used to mask the alarm function, default value of 0. The definitions of each bit in the register are as follows:

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
-	-	-	-	Over current	-	Module Anomaly	Load supply power anomaly

When it is necessary to block a certain abnormal alarm function, the corresponding position is 1.
For example, when BIT1 is set to 1, module anomalies will be blocked.

13. Control signal gain setting register (address: 74)
Data format: 16 bit unsigned integer
The input control signal value is: current set gain value x input control signal value/100. If the control value is set to 500 and the gain is set to 200, the output power is 100%; When the gain is set to 50, the output power is 25%. The default value for this register is set to 100, which means the gain is 1.00.

Output Control Mode

Mode 1: Adopt voltage analog port control
Apply the corresponding voltage value(0~10VDC) to the control terminal(V) as required, then the module outputs corresponding voltage.

Mode 2: Adopt current analog port control
Apply the corresponding current value(4~20mA) to the control terminal(I) as required, then the module outputs corresponding current.

Mode 3: Adopt RS 485 control
Sending the standby voltage, welding voltage 1,welding voltage 2, welding voltage 3, welding maintenance time 1, welding maintenance 2, welding maintenance 3 to the module through 485, and opening the corresponding channel (register address:63)(1), let the module enter in standby state at the moment. When welding required, apply a rising edge to the module output switching port (from low voltage to high voltage), then the module enter the welding state: output welding voltage 1, welding voltage 2 and welding voltage 3 in turn, it will return to standby state automatically when welding finished.

Note: (1) If welding is not required, just set the standby voltage (register address: 50) and standby switch register (register address: 63).

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Communication Protocol

The CRH communication protocol adopts standard Modbus and supports 0x03 and 0x06 commands.

Read Variables

Request	Slave Address	Function Code	Starting Address	Number of Registers	CRC Checksum
	1 Byte	0x03	2 Bytes	2 Bytes	2 Bytes

Response	Slave Address	Function Code	Number of Data Bytes	Data	CRC Checksum
	1 Byte	0x03	1 Byte	Data	2 Bytes

Error (Register Address Out of Range)	Slave Address	0x83	Error Code	CRC Checksum
	1 Byte	0x83	1 Byte	2 Bytes

Example: Read Channel 1 Current					
Request Command	01	03	00 01	00 01	D5 CA
Response	01	03	02	00 00	B8 44
Read Error	01	83	03	01 31	

Write Single Variable

Request	Slave Address	Function Code	Register Address	Value	CRC Checksum
	1 Byte	0x06	2 Bytes	2 Bytes	2 Bytes

Response	Slave Address	Function Code	Register Address	Value	CRC Checksum
	1 Byte	0x06	2 Bytes	2 Bytes	2 Bytes

Error (Value Out of Specified Register Range)	Slave Address	0x86	Error Code	CRC Checksum
	1 Byte	0x86	1 Byte	2 Bytes

Example: Write Value 100 to Channel 1 Standby Voltage Register					
Request Command	01	06	00 32	00 64	29 EE
Response	01	06	00 32	00 64	29 EE
Read Error	01	86	04	43 A3	

CRC Check

CRC check complies with Modbus,the following is a C language CRC check function:

The function uses two parameters:
unsigned char *puchMsg; Pointer to the buffer containing binary data messages for generation;
unsigned short usDstsLen; The number of bytes in the message buffer。

CRC generating function:

```
unsigned short CRC16(puchMsg,usDatalen)          /*function returns CRC as an unsigned short type*/
unsigned char *puchMsg;                          /*Message used to calculate CRC*/
unsigned short usDataLen;                        /*The number of bytes in the message*/
{
    unsigned char uchCRCHI=0xFF;                 /*High byte initialization of CRC*/
    unsigned char uchCRCLo=0xFF;                 /*Low byte initialization of CRC */
    unsigned uIndex;                             /*CRC query table index*/
    while (usDataLen--)                          /*completes the entire message buffer*/
        {
          uIndex=uchCRCLo^*puchMsgg++;           /*Calculate CRC*/
          uchCRCLo=uchCRCHi^auchCRCHi[uIndex];
          uchCRCHi=uchCRCLo[uIndex];
        }
   return(uchCRCHi<<8|uchCRCLo);
}
```

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High-Order Byte Table

```
static unsigned char auchCRCHi[] = {
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81,
0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0,
0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01,
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0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81,
0x40
};
```

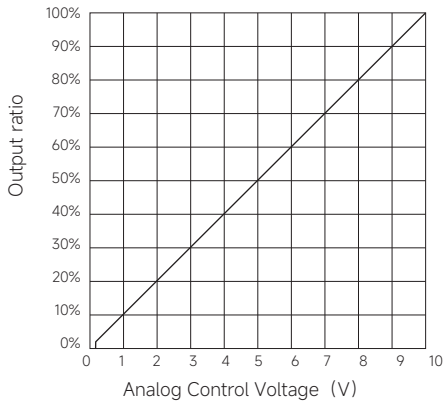
Low-Order Byte Table

```
static char auchCRCLo[] = {
0x00, 0xC0, 0xC1, 0x01, 0xC3, 0x03, 0x02, 0xC2, 0xC6, 0x06, 0x07, 0xC7, 0x05, 0xC5, 0xC4,
0x04, 0xCC, 0x0C, 0x0D, 0xCD, 0x0F, 0xCF, 0xCE, 0x0E, 0x0A, 0xCA, 0xCB, 0x0B, 0xC9, 0x09,
0x08, 0xC8, 0xD8, 0x18, 0x19, 0xD9, 0x1B, 0xDB, 0xDA, 0x1A, 0x1E, 0xDE, 0xDF, 0x1F, 0xDD,
0x1D, 0x1C, 0xDC, 0x14, 0xD4, 0xD5, 0x15, 0xD7, 0x17, 0x16, 0xD6, 0xD2, 0x12, 0x13, 0xD3,
0x11, 0xD1, 0xD0, 0x10, 0xF0, 0x30, 0x31, 0xF1, 0x33, 0xF3, 0xF2, 0x32, 0x36, 0xF6, 0xF7,
0x37, 0xF5, 0x35, 0x34, 0xF4, 0x3C, 0xFC, 0xFD, 0x3D, 0xFF, 0x3F, 0x3E, 0xFE, 0xFA, 0x3A,
0x3B, 0xFB, 0x39, 0xF9, 0xF8, 0x38, 0x28, 0xE8, 0xE9, 0x29, 0xEB, 0x2B, 0x2A, 0xEA, 0xEE,
0x2E, 0x2F, 0xEF, 0x2D, 0xED, 0xEC, 0x2C, 0xE4, 0x24, 0x25, 0xE5, 0x27, 0xE7, 0xE6, 0x26,
0x22, 0xE2, 0xE3, 0x23, 0xE1, 0x21, 0x20, 0xE0, 0xA0, 0x60, 0x61, 0xA1, 0x63, 0xA3, 0xA2,
0x62, 0x66, 0xA6, 0xA7, 0x67, 0xA5, 0x65, 0x64, 0xA4, 0x6C, 0xAC, 0xAD, 0x6D, 0xAF, 0x6F,
0x6E, 0xAE, 0xAA, 0x6A, 0x6B, 0xAB, 0x69, 0xA9, 0xA8, 0x68, 0x78, 0xB8, 0xB9, 0x79, 0xBB,
0x7B, 0x7A, 0xBA, 0xBE, 0x7E, 0x7F, 0xBF, 0x7D, 0xBD, 0xBC, 0x7C, 0xB4, 0x74, 0x75, 0xB5,
0x77, 0xB7, 0xB6, 0x76, 0x72, 0xB2, 0xB3, 0x73, 0xB1, 0x71, 0x70, 0xB0, 0x50, 0x90, 0x91,
0x51, 0x93, 0x53, 0x52, 0x92, 0x96, 0x56, 0x57, 0x97, 0x55, 0x54, 0x94, 0x54, 0x9C, 0x5C,
0x5D, 0x9D, 0x5F, 0x9F, 0x9E, 0x5E, 0x5A, 0x9A, 0x9B, 0x5B, 0x99, 0x59, 0x58, 0x98, 0x88,
0x48, 0x49, 0x89, 0x4B, 0x8B, 0x8A, 0x4A, 0x4E, 0x8E, 0x8F, 0x4F, 0x8D, 0x4D, 0x4C, 0x8C,
0x44, 0x84, 0x85, 0x45, 0x87, 0x47, 0x46, 0x86, 0x82, 0x42, 0x43, 0x83, 0x41, 0x81, 0x80,
0x40
};
```

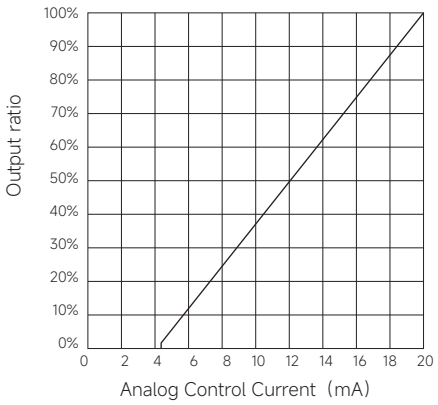

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Output / Proportional Control Features

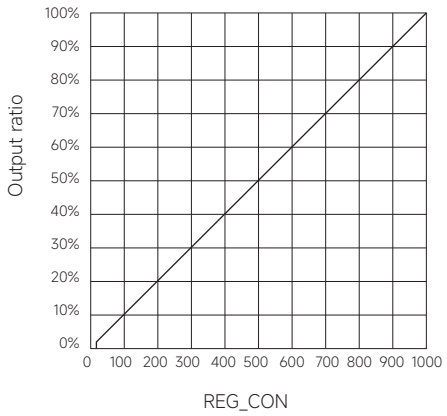
Voltage Analog Control



Current Analog Control

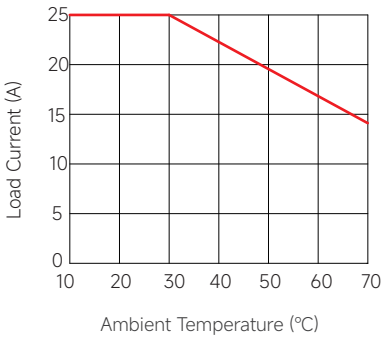


Bus Control

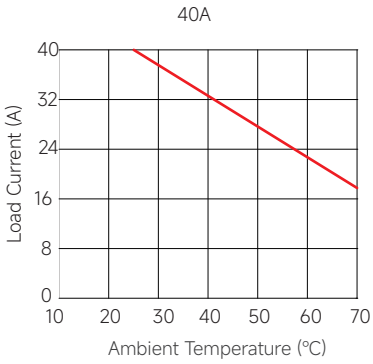


Thermal Derating Curve

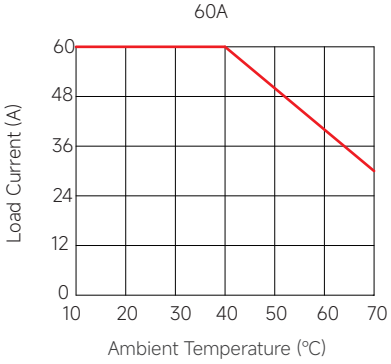
25A



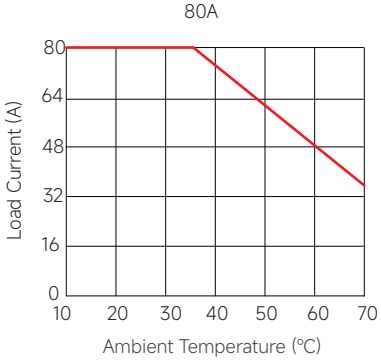
40A



60A



80A



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Note: The curve above shows the heatsink capability under the worst case (100% continuous operation) for a solid state relay. If your application involves intermitent operation, please contact us with your actual operating conditions (load current, on/off time, ambient temperature, etc.), and we will recommend the most suitable solution for you.

General Notes

1. When connection wiring to SSR please ensure screws are torqued down properly.The recommended installation torque for the M4 terminal is (0.98~1.37) N·m.
2. When ambient temperature is above 25°C see thermal derating curve.

! Warnings

1. The product may be hot, allow the product to cool before touching.
2. Disconnect all power before installing or working with this equipment.
3. Verify all connections and replace all covers before turning on power.

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