Biene Electronics
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GSM Controller BR160SM-4A-A / BR161SM-4A-A

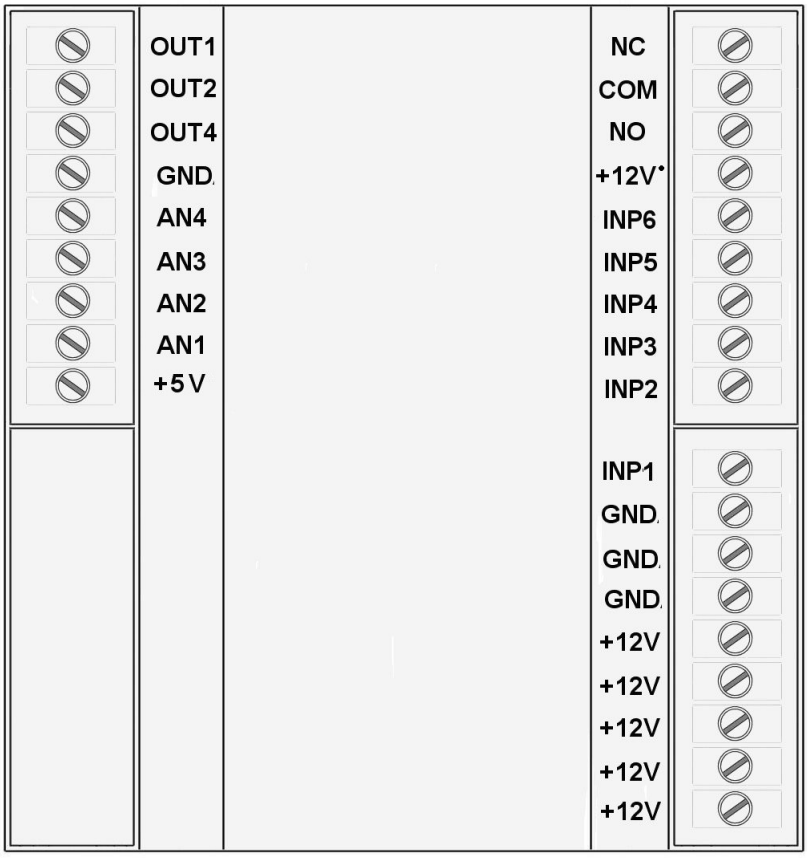
Version for analog and digital signal monitoring
GSM module for SMS remote monitoring and control applications

Features

- Internal 2-band GSM900/1800 (BR160SM) or 4-band GSM850/900/1800/1900 (BR161SM) GSM-modem: SIM900R or SIM900
- 6 digital input (0-1 or 1-0 event)
- 3 analog inputs (AN1,2,3) for 0-10V, 0-5V, 0-20mA, 4-20mA, ACS712 +/-5A, +/-20A , +/-30A DC current sensor module, universal 0-10V and 4-20mA to real units conversion (selectable)
- 1 analog inputs (AN4) for battery voltage monitoring (up to 15VDC via external resistor) or internal BR160SM supply voltage (Jumper J0)
- 3 Open-Drain MOSFET output
- 1 Power Relay output (timer function available; activation for from 1 to 240 min)
- Notification, control and configuration with SMS
- Timer output (relay output 3); relay activation for from 1 to 240 min
- Internal control from digital and analog events (activation relay for default time duration)
- Operates from a 12VDC power source. It draws less then 40mA standby, 2A peak typ. 12VDC/1.2A minimum switching stabilized power supply is recommended. Power supply input has reverse polarity and over voltage protection.

Inputs and Outputs

Input	Name	
Digital inputs	Inp 1,2,3,4,5,6	Digital Inputs 1,2,3,4,5,6 Positive/negative level selectable with jumpers for all inputs; not individual. Individual selectable with pull-up jumpers for resistor - set open input from 0 to 1 Digital Inputs 6 with inversion event
Analog inputs	AN1,AN2, AN3	- custom 0-10V mode (default 0-120dB - custom 4-20mAV mode (default 40-120dB - custom 4-20mAV mode - Current sensor ACS712 +/-5A, +/-20A or +/-30A, result in A - 0-5V analog signal, (5V = 100%), result in % - 0-10V analog signal, (10V = 100%), result in %
Analog inputs	AN4	Battery voltage (15V maximum, via resistor 27k), result in V; or internal jumper (see Jumper J0)



Preparation of SIM card

1) ***Disable PIN code*** *request so it will not prompt for a PIN code on turning on.*
2) *Small SIM-card with 3V / 1,8V technology*
3) *SIM card change if power turn off.*

LED indicators

- Module status indication - RED LED (LED1)
- GSM Modem status indication - GREEN LED (LED2)

Module LED indication (**Red LED**)

LED status	**Modem status**
Permanently off	Device off
Short blinking after power on and after - periodic blinking	SIM card read process
Short blinking	Module in work
Permanently on	Module work with modem

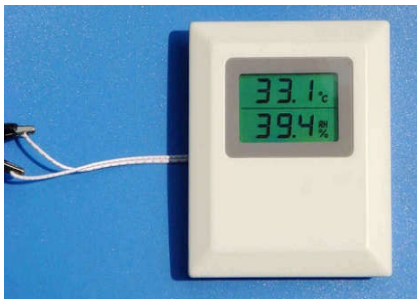
GSM Modem LED indication (**Green LED**)

LED status	**Modem status**
Permanently off	Device off
Fast blinking (period 1s, ton 0,5s)	Net search / Not registered / Turning off
Slow blinking (period 3s, ton 0,3s)	Registered full service

Applications with

Analog inputs

Temperature and humidity sensor Aw3005 and Aw3105



Output for Humidity: 0..5VDC
Accuracy of humidity:
+-2%RH(10-95%RH, 25Celsius); <+-5%RH(-40..80Celsius)
Hysteresis: +-0.3%RH
Temperature sensor: DS18B20
Accuracy for temperature: +-0.2Celsius(at 25Celsius)
Output for Temperature: 0..5VDC
Measuring temperature range: Customer can select measuring temperature range by dialing switches on PCB board:
0~50Celsius, -20~80Celsius, -40~60Celsius
Electrical connection: Screw connector Max1.5mm^2

DC Current sensors

DC Current Sensor Module 30A Range ACS712T ELC-30A Module
DC Current Sensor Module 20A Range ACS712T ELC-20A Module
DC Current Sensor Module 5A Range ACS712T ELC-5A Module

AC and DC Current sensor with 0-10V / 0-5V or 4-20mA output

AC current sensors CTA, CTV and CS Series current sensors monitor the current flowing to electrical equipment or buildings. Self-powered inducing the supply from the monitored conductor. of these sensors have jumper selectable input ranges **0-10, 0-20, 0-50A** or **0-100, 0-200, 0-250A.**

All

DC Current sensor with 0-5V output

DC current sensor CYHCT-C2TV Chen Yang Technologies GmbH & Co KG
http://www.hallsensors.de/CYHCT-C2TV.pdf
-50A...+50A … -500A...+500A range.

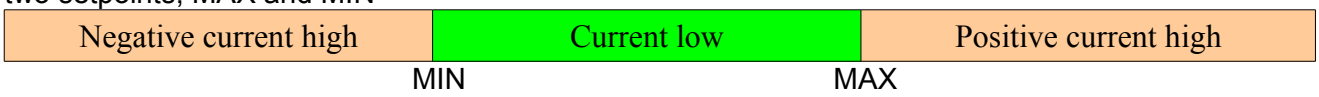
Other sensors with 0-10V, 0-5V, 0-20mA, 4-20mA

Setpoints

Analog inputs

1) for current sensor

two setpoints, MAX and MIN

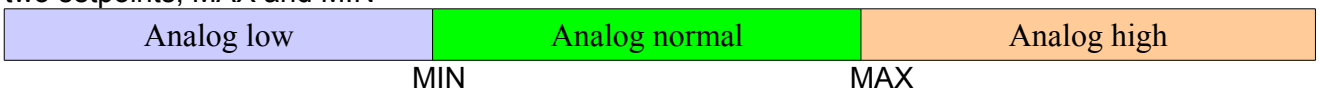


setpoint only MAX

setpoints only MIN

2) for analog signal 0-10V, 0-5V, 0-20mA

two setpoints, MAX and MIN



setpoint only MAX

setpoints only MIN

Analog signal mode

Analog mode (SMS command 2345w,abc)
a - for AN1, b for AN2, c - for AN3,
a,b,c - analog mode for analog AN1,AN2,AN3
0 - 0-5V / 0-20mA in %,
1 - 0-10V in %,
2 – 20A DC current sensor ACS712,
3 – 30A DC current sensor ACS712,
5 – 5A DC current sensor ACS712,
4 – 4-20mA in %
8 – 0-10V in custom units (see SMS command 2345M, 2345Y, 2345G); 0 – 120dB as default
9 – 4-20mA in custom units (see SMS command 2345M, 2345Y, 2345G)

Analog signal table

Example

4-20mA input (analog mode 9)

Signal	mA (4-20V)	Measurement area (example)
MIN (SMS command 2345M)	4	0000
MAX (SMS command 2345Y)	20	1200

0-10V input (analog mode 8)

Signal	V (0-10V)	Measurement coefficient / 1000	%
MAX (SMS command 2345Y)	10	1000 (default)	100
MAX (SMS command 2345Y)	10	2000	200

Setpoints

Analog input mode 0-10V

V (analog.inp)	%	Setpoint
0	0,0	
1,0	10,0	0100
2,5	25,0	0250
5	50,0	0500
7,5	75,0	0750
9,9	99,0	0990
10,0	100,0	

Battery voltage (Analog input 4), connection via serial resistor 51k (or internal voltage – set internal jumper J0)

Battery voltage V	V (analog.inp)	Setpoint in V	Setpoint minimum	Setpoint maximum
0	0	0000	disable	disable
9V	6	0900		
10,2V	6,8	0102	< 10,2V	
10,5	7	0105	< 10,5V	
11,4	7,6	0114	< 11,4V	
12	8	0120		
13,2	8,8	0132		
14,4	9,6	0144		> 14,4V
14,7	9,8	0147		> 14,7V
15	10	0150		> 15,0V

Note: if set jumper J0 – AN4 = internal voltage; B = real voltage – 0,3V; AN4 = 8V

DC Current sensors or 0-5V analog signal (analog input AN1, AN2, AN3)

analog.input V (current sensor or 0-5V mode)	+/-5A sensor 185mV/1A	+/-20A sensor 100mV/1A	+/-30A sensor 66mV/1A	%	Setpoint minimum for 20A sensor	Setpoint maximum for 20A sensor	Setpoint minimum for 30A sensor	Setpoint maximum for 30A sensor
0		-25A	-37,9A	0				
0,5		-20A	-30,3A	10				
0,52			30A					
1		-15A	-22,7A	20	< -15A	> -15A	< -22,7A	> -22,7A
1,5	-5,4A	-10A	-15,1A	30	< -10A	> -10A	< -15,1A	> -15,1A
1,58	-5A							
2	-2,7A	-5A	-7,6A	40	< -5A	> -5A	< -7,6A	> -7,6A
2,4	-0,5A	-1A	-1,5A	48	< -1A	> -1A	< -1,5A	> -1,5A
2,45	-0,3A	-0,5A	-0,5A					
2,5	0	0	0	50	< 0A	> 0A	< 0A	> 0A
2,55	0,3A	0,5A	1,A		< +0,5A	> +0,5A	< +1A	> +1A
2,6	0,5A	1A	1,5A	52	< +1A	> +1A	< +1,5A	> +1,5A
3	2,7A	5A	7,6A	60	< +5A	> +5A	< +7,6A	> +7,6A
3,43	5A							
3,5	5,4A	10A	15,1A	70	< +10A	> +10A	< +15,1A	> +15,1A
4		15A	22,7A	80	< +15A	> +15A	< +22,7A	> +22,7A
4,48			30A					
4,5		20A	30,3A	90				
5		25A	37,9A	99				

Offset table

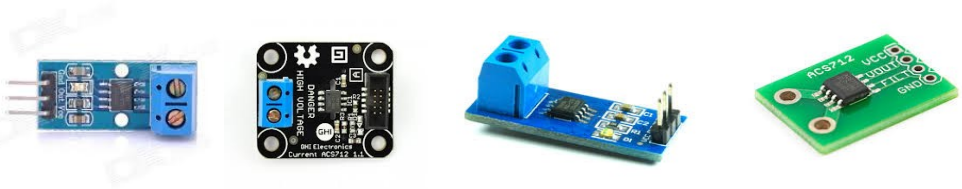
for fine zero level calibration (common for all current sensors)

SMS command 2345QNN, NN = 00..99	Offset	Zero level in ADC	Offset in Amp for 20A sensor
	51	257	0,1
default	50	256	0
	49	255	-0,1

Compatible current sensors

ACS712: Fully Integrated, Hall-Effect-Based Linear Current Sensor IC

with 2.1 kVRMS Voltage Isolation and a Low-Resistance Current Conductor
http://www.allegromicro.com/en/Products/Current-Sensor-ICs/Zero-To-Fifty-Amp-Integrated-Conductor-Sensor-ICs/ACS712.aspx



DC Current Sensor Module 30A Range ACS712T ELC-30A Module
DC Current Sensor Module 20A Range ACS712T ELC-20A Module
DC Current Sensor Module 5A Range ACS712T ELC-5A Module

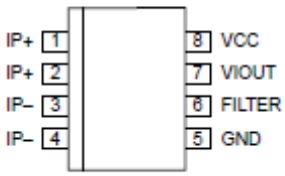
DC Current Sensor Module 20A Range ACS712T ELC-20A Module

1, the current sensor chips: ACS712ELC-20A;
2, pin 5V power supply, on-board power indicator;
3, the module can measure the positive and negative 20 amps,
corresponding to the analog output 100mV / A;
4, no test current through the output voltage is VCC / 2;
5, PCB board size: 33 (mm) x14 (mm);
Note: ACS712 is based on the principle of the Hall test, please use this field to avoid impact

ACS712 Breakout x05B (5 Amp) version

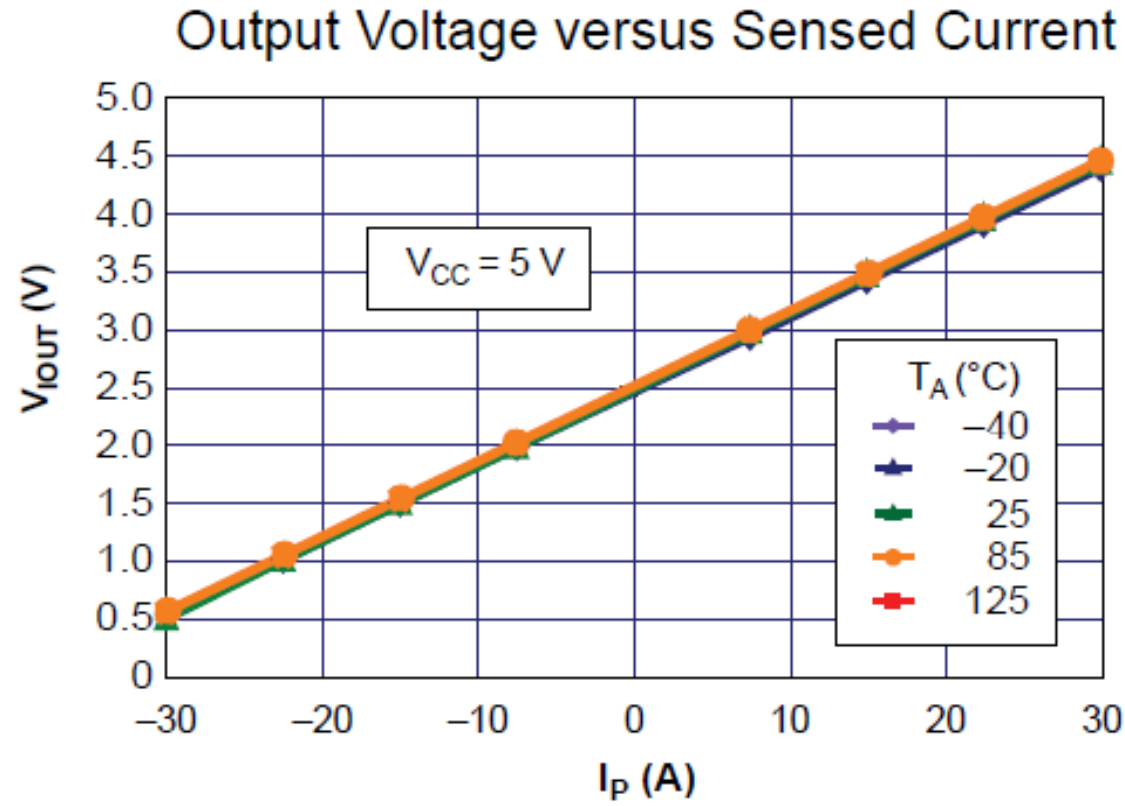
https://www.sparkfun.com/products/8882
This is a breakout board for the fully integrated Hall Effect based linear ACS712 current sensor. The sensor gives precise current measurement for both AC and DC signals. Thick copper conductor and signal traces allows for survival of the device up to 5 times overcurrent conditions.

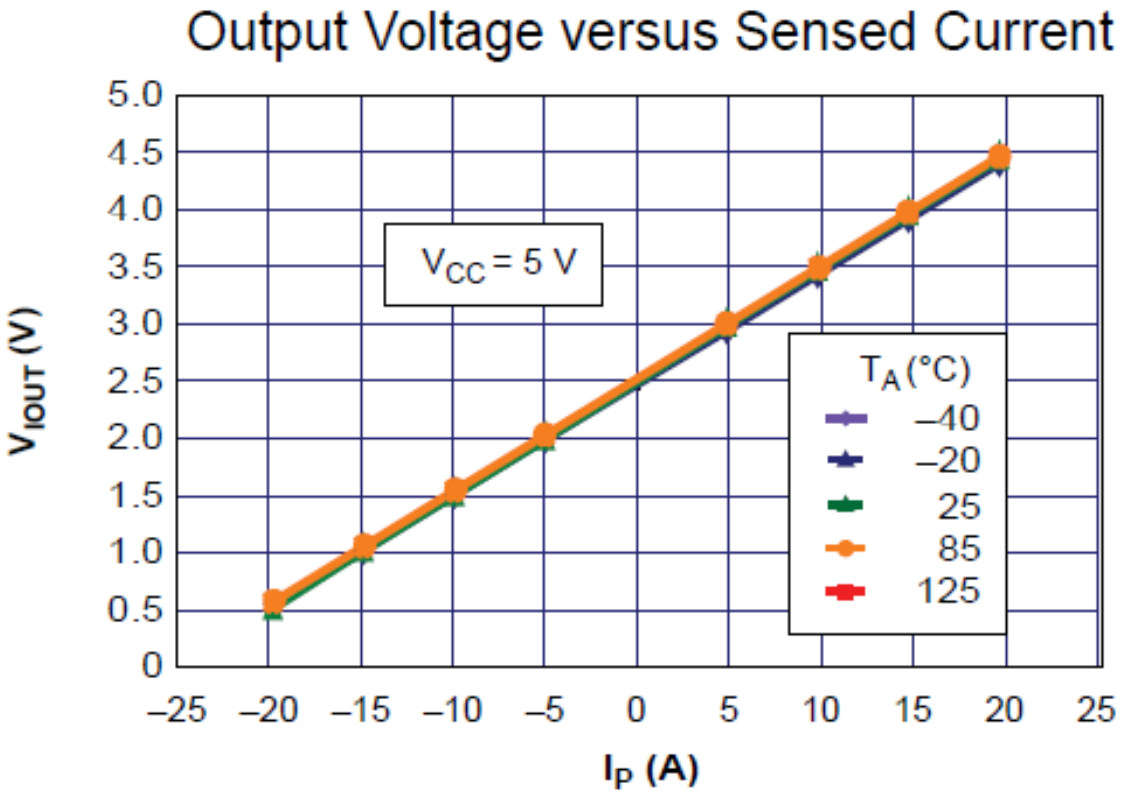
Pin-out Diagram

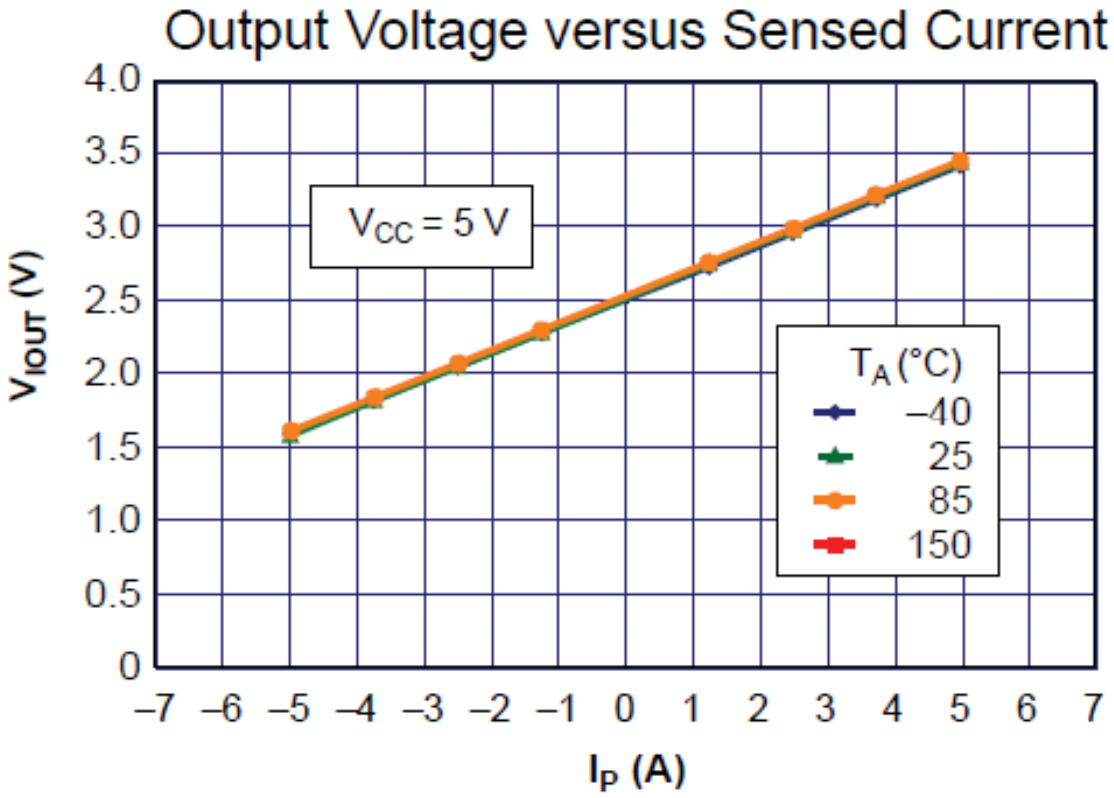


Terminal List Table

Number	Name	Description
1 and 2	IP+	Terminals for current being sampled; fused internally
3 and 4	IP–	Terminals for current being sampled; fused internally
5	GND	Signal ground terminal
6	FILTER	Terminal for external capacitor that sets bandwidth
7	VIOUT	Analog output signal
8	VCC	Device power supply terminal


Output Voltage versus Sensed Current
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
VIOUT (V)
VCC = 5 V
TA (°C)
–40
–20
25
85
125
–30
–20
–10
0
10
20
30
IP (A)

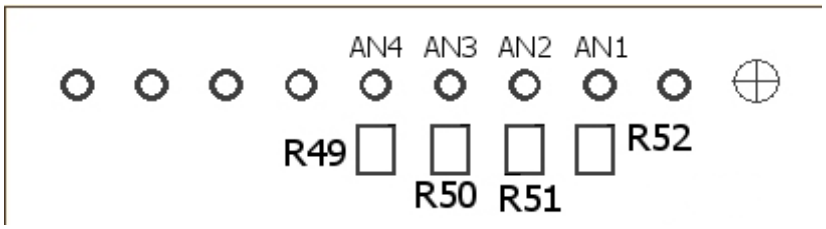

Output Voltage versus Sensed Current
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
VIOUT (V)
VCC = 5 V
TA (°C)
–40
–20
25
85
125
–25
–20
–15
–10
–5
0
5
10
15
20
25
IP (A)



For 0-10V, 0-5V, 0-20mA mode
(see SMS command 2345W)

You can set 0-10V or 0-5V or 0-20mA input AN1, AN2, AN3:separately.
For 0-20mA mode required change resistor.

See Figure bellow (bottom PCB side)



For this mode need add 249om resistor on bottom PCB side.

AN1 - Analog Input 1 - R52 (249om added for 0/4-20mA mode)
AN2 - Analog Input 2 - R51 (249om added for 0/4-20mA mode)
AN3 - Analog Input 3 - R50 (249om added for 0/4-20mA mode)
AN4 - Analog Input 4 - R49 (249om added for 0/4-20mA mode)

SMS command

SMS command	Answer SMS	Function
Analog setpoints		
2345L1,0400 2345L2,0000 2345L3,0000 2345L4,0100	(setpoints info)	Set minimum analog level **default:** A1:0 A2:0 A3:0 A4:100 0100 = 10% or 10V (for internal voltage)
2345H1,0800 2345H2,0000 2345H3,0000 2345H4,0150		Set maximum analog level **default:** A1:0 A2:0 A3:0 A4:150 0150 = 15% or 15V (for internal voltage)
Enable alarm SMS / disable alarm SMS (for digital inputs)		
2345E	PROTECTED	Enable alarm SMS for digital inputs, **default** enable; after restart enable
2345B	UNPROTECTED	Disable alarm SMS for digital inputs
2345A7	Eneble-disable analog inputs alarm SMS	7 = 111 - for AN1,AN2,AN3 0 – all disable
Get information		
2345i	(Information) A1=0% A2=0% A3=0% B= 12.0V I1=0 I2=0 I3=0 I4=0 I5=0 I6=0 O1 OFF, O2 OFF, O3 OFF, O4 OFF T: 15 ON	Read information – analog inputs battery voltage inputs outputs output timer status
Set/Reset Outputs; Timer Outputs; only for Output 3 (relay)		
2345S1 … 2345S4	(Information)	Set output
2345R1 … 2345R4	(Information)	Reset output
2345V,030	(information)	set duration for timeout = 30 min Maximum 240 min. (default 15 min)
2345T,060 2345T	(information)	set output for timeout = 60 min default timeout = 15 min Maximum 240 min. set output for timeout = default ***)
2345jO,S (optional)	(information)	Pulse for output O – output number S – pulse duration S=0 – 1sec S=1 – 3sec … S=9 - 19sec
Internal control		
2345K,DA	A1:400 800 A2:0,0 A3:0 0, B:100 150 A.md:111 A.msk:7 O3ctr: 00 T3: 15	Internal control from digital inputs 1,2,3,4; internal control enable, then if event on digital input, start Relay ON on default time (see SMS command T) D,A = 0,1,2...9,A...F,a..f; D – for digital inputs 1,2,3,4 A – for analog inputs 1,2,3,4 (table on page 14)

Phone Numbers for alarm SMS		
2345N1 … 2345N4	OK	Set number for alarm SMS
2345C1 … 2345C4	OK	Clear number at position 1..4
Alarm SMS text setting		
2345X01,Input 01 2345X01	1:Input 01	Set text message for 6 digital, analog 1 … 4 inputs event Text up to 18 characters (Text SMS message table on page 13) Clear text
Analog Inputs (AN1,AN2,AN3 – analog mode)		
2345W,111	(setpoints info)	Set current sensor for AN1,AN2,AN3 0 – 0-5V analog input (5V = 100%) or 0-20mA input (20mA = 100%) 1 – 0-10V analog input (10V = 100%) 2 – +/-20A current sensor 3 – +/-30A current sensor 4 – 4-20mA (4mA = 0%, 20mA = 100%) 5 – +/-5A current sensor 8 – 0-10V selectable for 10V value - see SMS command 2345Y 9 – 4-20mA selectable for 4 and 20mA value - see SMS command M,Y (default 111)
2345M,0000 2345M,0400	(setpoints info)	Set minimum value for measurement area (for analog mode 9), if M=0400, 40.0
2345Y,1200 2345Y,2000	(setpoints info)	Set maximum value for measurement area (for an.mode 8,9); Y=0000..9999 mode 8: Y / 1000, Y=2000, 200.0 mode 9: Analog=M+(Y-M)/800
2345M? Or 2345Y?	0 1200	Get min and max setting
2345G,unit 2345G,V ,	Measurement unit	Measurement unit (**= 4 char**); only for analog mode 8 and 9
2345U	(setpoints info) A1:400 800 A2:0,0 A3:0 0, B:100 150 A.md:111 A.msk:7 O3ctr: 00 T3: 15	Get setpoints analog setpoints MIN MAX battery voltage setpoints MIN MAX an.inputs mode (Amd) and an.mask; Internal control, Output.3 timer (in min)
2345Q51	(information)	Set zero offset for current sensor (mode 2,3,5) 00..99 (see offset table on page 7)
2345O+200	(information)	Set offset for 4mA (only mode 9) from -240 to +240
Password change		
2345P2013	Psw:2013	Change password; use only 0,1,2,3,4,5,6,7,8,9 **deault password 2345** if you forgot password, use jumper for restore default password 2345 (see paragraph JUMPERS)

***) You can set Output 3 (on board RELAY output) for time from 1 to 240 min.

Text SMS message

	For Analog Inputs (AN1, AN2, AN3)	For current sensors (AN1, AN2, AN3)
SMS command	**Text** (length 18 char)	**Text** (length 18 char)
2345X01,	Input 1	Input 1
2345X02,	Input 2	Input 2
2345X03,	Input 3	Input 3
2345X04,	Input 4	Input 4
2345X05,	Input 5	Input 5
2345X06,	Input 6	Input 6
2345X07,	Analog 1 high	I1 pos. high
2345X08,	Analog 1 low	I1 neg. high
2345X09,	Analog 1 normal	
2345X10,	Analog 2 high	I2 pos. high
2345X11,	Analog 2 low	I2 neg. high
2345X12,	Analog 2 normal	
2345X13,	Analog 3 high	I3 pos. high
2345X14,	Analog 3 low	I3 neg. high
2345X15,	Analog 3 normal	
2345X16,	Battery high	Battery high
2345X17,	Battery low	Battery low
2345X18,	Battery normal	Battery normal

Numbers

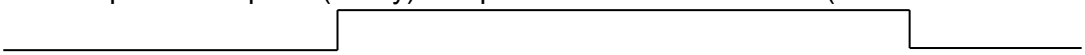
Example for numbers in EEPROM (with SMS command 2345N and 2345C)

Nr in EEPROM	numbers
1	+37122842913
2	+37122842914
3	+37122842915
4	+37122832798

Number consist + and country code before phone number

Timer Output

Timer output for Output 3 (Relay). Output 3 ON for time duration (SMS command 2345T).



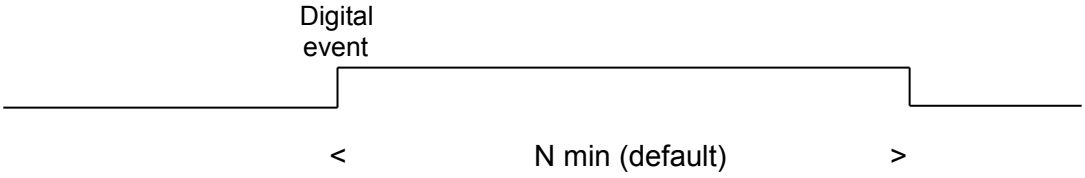
T30 < 30 min >

Internal Control

Internal control for set Output 3 (Relay) ON on duration time
if event digital input.1,2,3,4 or analog inputs 1,2,3,4 > MAX

	Digital Input				Analog >MAX				Internal control with Out.3 for default time
	4	3	2	1	4	3	2	1	
SMS command									
2345K,00	0	0	0	0	0	0	0	0	disable
2345K,10	0	0	0	1	0	0	0	0	Out.3 ON if event digital input 1
2345K,20	0	0	1	0	0	0	0	0	Out.3 ON if event digital input 2
2345K,30	0	0	1	1	0	0	0	0	Out.3 ON if event digital input 1,2
2345K,40	0	1	0	0	0	0	0	0	Out.3 ON if event digital input 3
...									
2345K,F0	1	1	1	1	0	0	0	0	Out.3 ON if event digital input 1,2,3,4
2345K,00	0	0	0	0	0	0	0	0	disable
2345K,01	0	0	0	0	0	0	0	1	Out.3 ON if Analog Input 1 high
2345K,02	0	0	0	0	0	0	1	0	Out.3 ON if Analog Input 2 high
2345K,03	0	0	0	0	0	1	0	0	Out.3 ON if Analog Input 3 high
2345K,04	0	0	0	0	1	0	0	0	Out.3 ON if Analog Input 4 high

Out.3 OFF after default timeout (SMS command 2345V, 2345T)

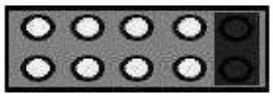


< N min (default) >

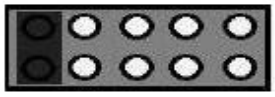
For example – if motion detector active – Out.3 ON for N min (N = 001..240 min). To Out.3 (relay) you can connect car DVR or Siren.

Jumpers

Jumper J1

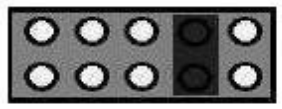


Change event 0-1 / 1-0 for digital input
(jumper set - 0-1 event)
Inp.6 – with inversion event



Set password default (2345) -

set jumper, power on; after 5 sec power off, remove jumper.

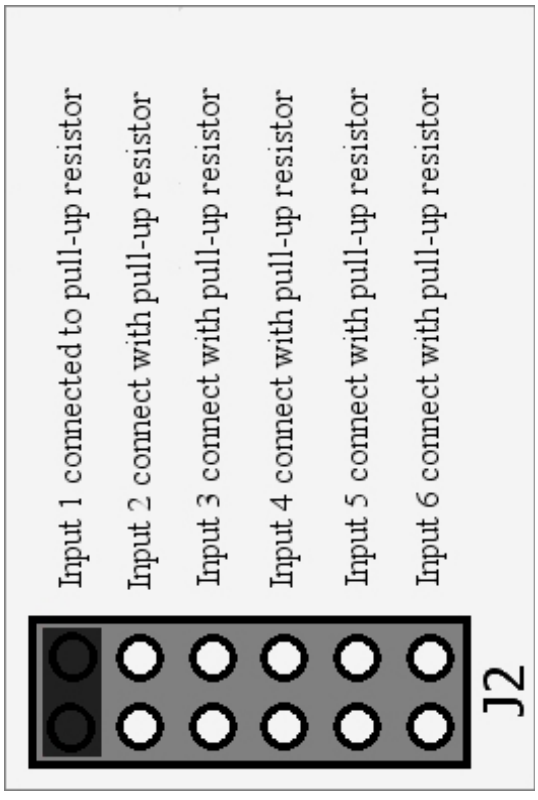


Inp.6 inversion (only in last version)

Set jumper for Inp.6 inversion for event 0-1 / 1-0

Jumper 2

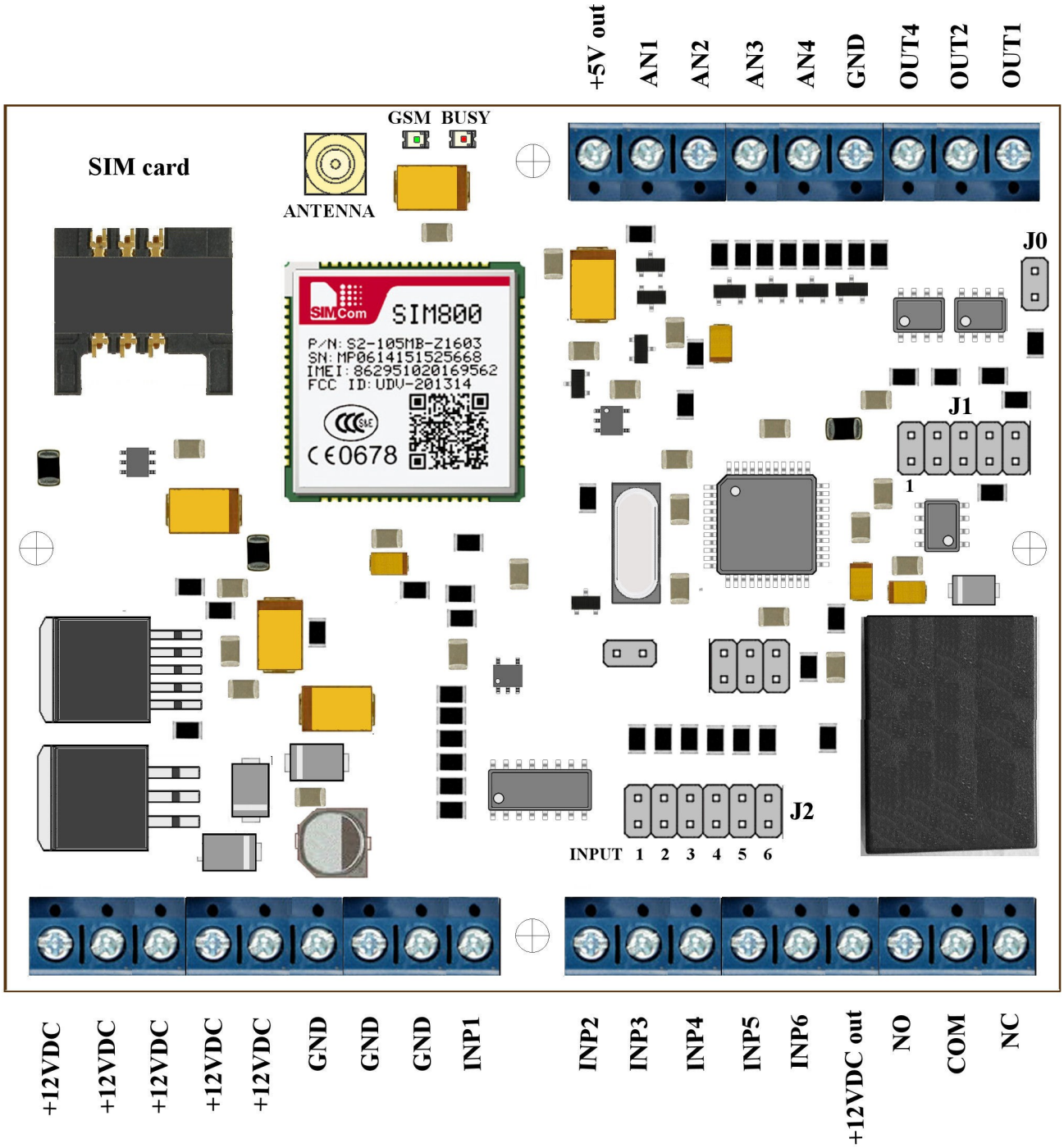
Jumpers for pull-up resistor setting
only for digital inputs 1,2,3,4,5,6



Jumper 0 (see figure next page)

Connection to analog input 4 internal supply voltage.
If Jumper J0 set, on AN4 = 8V.

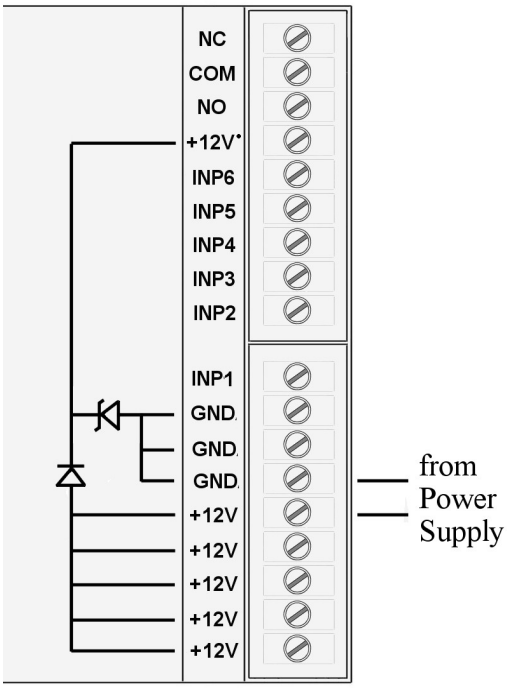
BR160SM board



Power Supply connection

+12VDC stabilised Power Supply must be connected with screw terminal block.
We recommend use stabilised 1,7...2.5A 12VDC power supply.
Power supply input has negative voltage and over voltage protection.

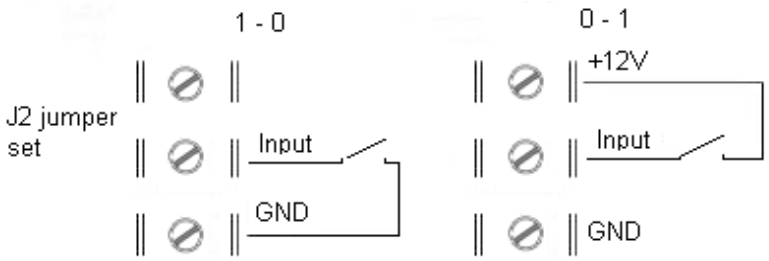
Internal +12VDC connection and Power Supply connection schematic.



Connection Example

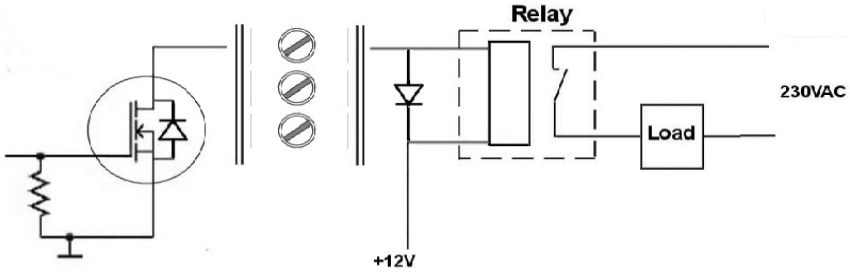
Connection example to Input Driver (Input 1-5)

1-0 and 0-1 event notification
You can use J2 pin header for in-board pull-up resistor connection.

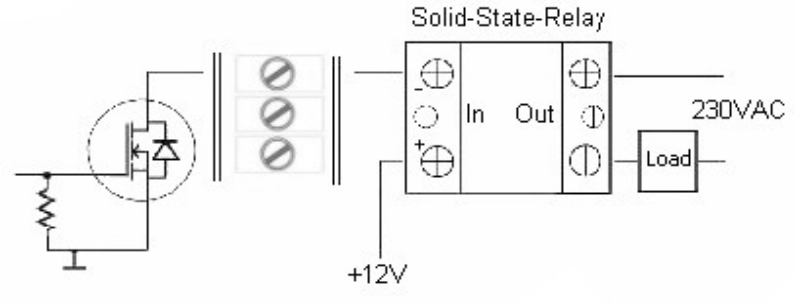


Relay connection example to Output Driver (Output 1, 2 and 4)

Electromechanical relay connection.



Solid-state-relay (SSR) connection.

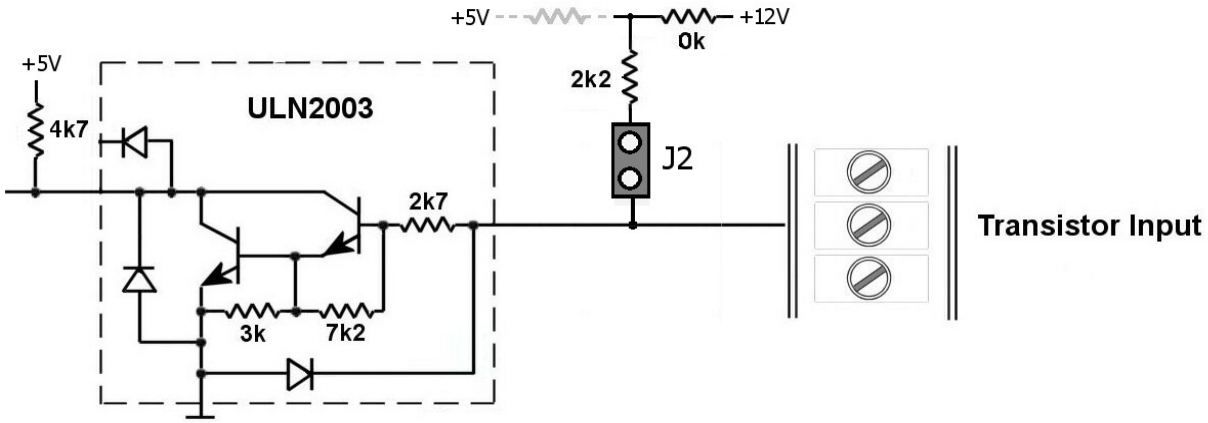


Inputs / Outputs Schematic

Inputs

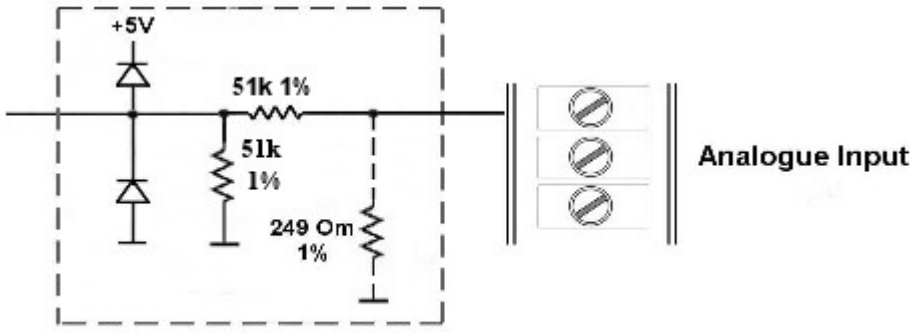
Digital Transistor Inputs

Connector: Screw terminal block
Inversion: Yes
Protection: Yes
Max input voltage: +12V without external limited resistor.
Free Input: logic "0"
Logic "0": 0V…+1V
Logic "1": +1.5V…+12V
J2 jumper – for pull-up resistor connections to +12V (+5V optional)



0-10V / 0-5V Analog Inputs

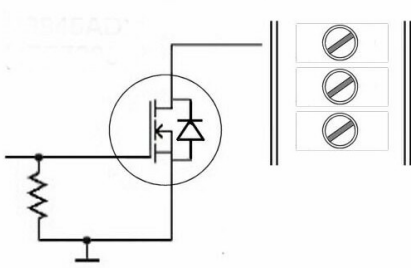
Connector: Screw terminal block
Input type: CMOS
Input Voltage: 0 to +10V
Maximum input voltage: 10VDC
Input impedance: 100 KOm.
ADC resolution: 10-bit
249 Om resistor – optional for 0-20/4-20mA applications



Outputs

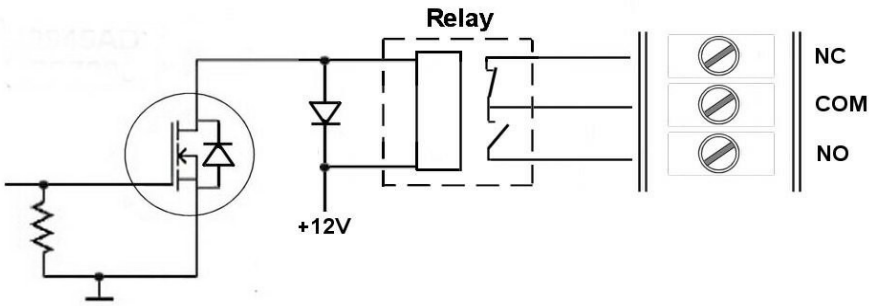
MOSFET Open Drain Outputs

Connector: Screw terminal block
MOSFET transistor: IRF7103
Max. Voltage: 50V



Relay Output

Connector: Screw terminal block
Outputs: NO/COM/NC
Relay: SPDT power relay LEG-12F
Min load: 0.1 A, 5VDC



Technical Specification

Hardware Specification

	BR160SM-4A-A
GSM band support	GSM850/900/1800/1900
Internal GSM modem	SIM800
RF Transmit Power	Class 4 (2W) 900Mhz, Class 1 (1W) 1800Mhz, 1900Mhz
Command and data transmission	SMS
SIM card reader	Yes
SIM card type	Phase 1 and phase 2+; SIM 3V / 1.8V
Antenna Connection	50Ω SMA (f) Connector
Firmware	Yes
Digital inputs	
Digital inputs type	Voltage-free, transistor ("0": 0...+1V; "1": +1.5…+12V without external limited resistor); Optional: +12V/+5V pull-up resistor for each input
- Number of digital inputs	6
- Events digital inputs	6
- Digital inputs event	0-1 or 1-0 (Inp.6 with inversion)
- Protection	Yes
Analog inputs	
Number of analog inputs	3+1
- Maximum voltage	10VDC
- Analog input event	min / norm / max
- ADC resolution	10-bit
Outputs	
Number of outputs	4
- MOSFET Open Drain outputs	3 (50V max)
- Relay outputs	1 (NO/COM/NC), 28VDC / 5A
- Digital output control	On-Off, pulse
Timer output	Yes, Output 3
Wiring	
Wiring Connections	Screw terminal blocks
Power Supply	
Required Power supply	External +12 VDC stabilized 1,2A minimum 12VDC (14.5VDC max.)
Power requirement	1.2A minimum, 2A peak during transmission (14.5VDC max.)
Power consumption	40mA in idle mode, 100mA peack in SMS transmit mode
Voltage regulator	Internal voltage regulator
Power protection	Reverse-polarity and overvoltage protection
Environmental Conditions	
Operating temperature range	-30…+85°C
Humidity	0-95% non-condensing
Physical parameter	
Board dimension	103 x 86.5 mm
Enclosure dimension	106 x 100 x 58 mm
Box	DIN-rail mounting
Weight	75 g

Firmware Specification

	BR160SM-4A-A / BR161SM-4A-A
Number of controlled outputs	4
Timer output	Output 3
Maximum timer duration	240 min
Digital event inputs	6
Setpoints	0-1 or 1-0 (Inp.6 with inversion)
Analog event inputs	3+1
Events cell phone numbers	4
SMS events format	Text message
SMS message format for analog data	In A,V, %, … (custom with SMS command 2345G,unit)