BRODERSEN

INTRODUCTION

The GC-10 is a compact remote SMS alarm unit with built-in GSM dual band modem. The unit has data logging facilities and is designed for use in the industrial environment.

The unit is designed in a very compact 162 mm wide module for DIN-rail mounting (35 mm symmetrical). Dimensions conform to DIN 43880 (used for circuit breakers) thus insuring easy installation in standard installation panels and boxes widely available in the electrical industry.

The GC-10 can be delivered with a range of different power supply versions.

The GC-10 has 10 integral I/O, covering digital inputs and outputs, and analogue inputs as process signal or temperature sensor inputs.

The GC-10 Wireless Control Box performs simple remote control functions, data logging and communication via SMS messages using the integrated modem. The main features are:

- Sending of SMS messages prompted by:
  - Change of digital input.
  - Reaching a predefined setpoint on an analogue value – such as temperature, level and flow.
  - Cyclic.

- Remotely setting of On and Off by controlling outputs via SMS messages from your mobile telephone.

- Reporting in and output status on SMS request.

- Real time alarm scheduling with sets of profiles.

- Simple control functions including a timer.

- Local data logging with time stamp.
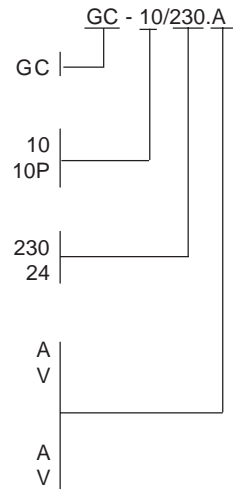
GC-10
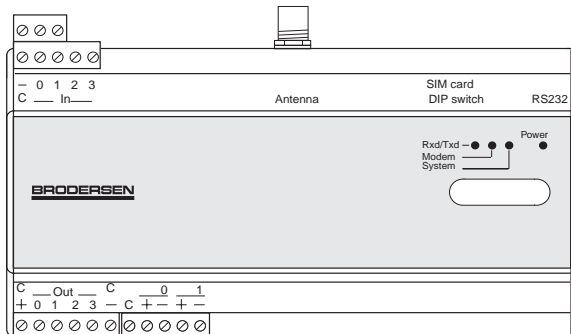
VERSIONS/ORDERING CODES

GC - 10/230.A

Type	
GC-10	GC
Input/output	
4 dig. in./4 dig.out./2 analogue input	10
4DI/4DO/1AI/1 Pt100 input	10P
Power supply	
Mains PS 110-240V	230
PS 24-60VDC/external PS 24V DC	24
Analogue input range (10 type)	
4-20mA	A
0-10V	V
Analogue input range (10P type)	
4-20mA/Pt100 -50-100°C	A
0-10V/Pt100 -50-100°C	V

GC-10 Wireless Control Box

CONTENT

TECHNICAL DESCRIPTION

Input/output

The GC-10 basic I/O fit can include up to 10 input/output terminals. Serial I/O options are available:

Version GC -	10....	10P......
Digital inputs (10-30V DC)	4	4
Digital outputs (PNP o. c.)	4	4
Analogue inputs (0-10V/4-20mA)	2	1
Pt100 input	0	1

All digital I/O´s are equipped with opto-couplers. The analogue inputs have galvanic isolation between the individual channels. Solid state relays are used for multiplexing the analogue inputs. Pt100 input is not isolated.

Wiring diagram
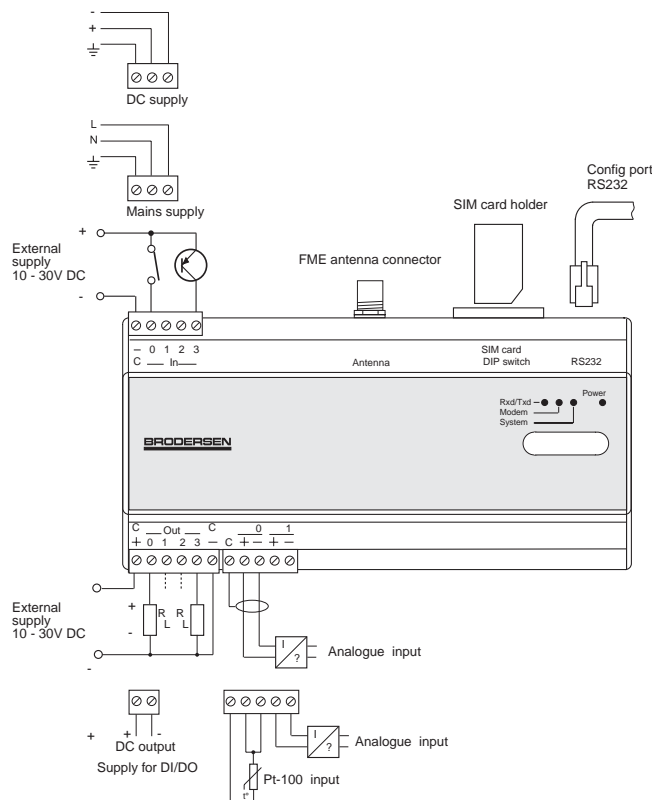
See the installation manual enclosed with the module, for more wiring details.

Indicators

The GC-10 is equipped with 4 status LEDs.

Indicator	Status
Rxd/Txd	Indicate serial communication to the built-in modem
System	On: OK ⎍⎍⎍⎍ : Controller error Off: General fault or no power
Power	On: OK Off: No power
Modem	GSM On: Searching for network ⎍⎍⎍ : Connected to provided network Off: Modem off

Data logging

The GC-10 can log events and process values for later analysis. The data logging process can be divided into 3 sections:

- Defining the events and the selection of values to be logged.
- Storage of data, with time stamp, in the log buffer (max. 480k bytes).
- Upload of the data from the module via Programmer port/RS232 or modem to a PC for analysis.

Logged GC-10 Status Data

Below is a list covering the pre-defined log IDs used.

Event	Log ID
Power ON and/or micro processor reset	130
Program download or change of set-up	131
Errors detected by the controller. (Status error/communication error, etc.)	150
The log memory has been up-loaded (the PC will request this log to take place)	170
Log buffer overflow	171
Log ID in application out of range	172
Clock has been updated	180

In normal use the log memory will never be erased, even though data has been uploaded. When the log memory is full the oldest data is over-written.
The log function includes registration of the log record last uploaded.

Uploading data

The logged process values can be transferred to a PC for analysis, by a direct RS232 connection. The upload procedure is fully controlled by the PC by the GC-10 Configuration tool. The logged data is stored on your PC in a text file (format *.CSV), which can be imported in e.g. MS Excel.

Programmer port / serial interface RJ11
The GC-10 programming interface includes a driver which is able to handle both the Modbus protocol (RTU slave) and special Brodersen RAC commands.
The RS232 port (6 pole modular jack RJ11) is equipped with hardware handshake signals. See section Internal serial interface how to configure the handshake signals.

RS232 programmer port (6 pole RJ11)

Pin no	Signal	Description/Remarks
1	SG	Signal ground
2	RTS	Ready to send
3	RX	Receive data (in)
4	TX	Transmit data (out)
5	CTS	Clear to send
6	GND	Ground (Earth)

Internal serial interface to COM device
The GC-10 internal serial interface includes a driver which is able to handle also both the Modbus protocol (RTU slave) and the special Brodersen RAC commands. Hayes compatible modem control is implemented in the GC-10 to serve the built-in GSM modem.

DIP switch settings
The DIP switches on the GC-10 is set to a fixed setting. See figure below.

Default settings

At delivery the switches are covered by a transparent label which is recommended NOT to remove. The switches are used for optional settings which in general is not supported by the GC-10 configuration tool.

Switch 10 do however offer you the possibility to get direct access to the built-in GSM modem. If you set switch 10=ON, you will get direct serial access to the modem via the GC-10 programmer port. If required a standard terminal program can be used to change internal modem settings. Require extended knowledge about Hayes commands and modem configuration.

Power consumption
Power consumption is directly related to the actual application, i.e. number of I/O´s active on the GC-10 etc.
Below are examples for the standard GC-10 versions. All figures are typical consumption at 12V.

GC-10 version	UCR-10IO (AI)		UCR-10IOA (AI)	
	min.	max.	min.	max.
Controller/electronics/ LEDs/IO (DI)	50	70	50	70
Analogue IO	5	10	5	15
GSM modem idle	5	10	5	10

Real Time Clock
The GC-10 has a built-in real time clock used in the application programme to start /stop or do any other time function related to the control of the application.

SMS Messages
The GC-10 with built-in GSM modem offers the possibility to send SMS alarm messages (with or without variables).

The pre-stored SMS text messages are defined in the GC-10 Configuration Tool. Up to 160 characters can be stored in each of the 20 messages. Note: only 7-bit ASCII chars can be used, i.e. no special national characters are supported.

SMS Service Center telephone no. can be entered in the Configuration Tool. Often the number is not required as the GSM provider take care of this automatically.

You can also control outputs and get status messages from the GC-10 by sending it SMS requests.

Enter telephone number in the Telphone no list via SMS.
Up to five telephone numbers in the telephone list in the configuration table can be entered with a SMS message. This is done by using the SMS format;
Cmdpno "phone no 0", "phone no 1", "phone no 2 ","... etc. - up to 5 numbers.

Example: Cmdpno "+45123456" - will write +45123456 into telephone no 0 in the list.

Existing number in the actual entry will be overwritten. If you do not enter any number but just define ""the entry will be overwritten with blanks.

If you need more functionality
If you require more functionality on your remote site, the unit can be programmed by a EN/IEC1131-3 software supporting instruction list, function block and ladder. It gives you extended control functions and offer you remote configuration, data log upload and monitoring. See the data on RTU-COM, RTU8 and IOTOOL32Pro on our homepage www.brodersencontrols.com.

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TECHNICAL DATA

INTERFACE

Internal serial interface / modem interface:

Signal level:	RS232C/TTL.
Hardware handshake:	DCD, DTR, DSR, RTS, CTS, RI
Baud Rate:	300, 600, 1200, 2400, 4800, 9600, 19200 - fixed set to 9600.
Format (default):	8 bit (binary), 1 start bit. No parity, 1 stop bit.
Protocol:	Modbus slave (RTU mode).
Error Check:	CRC (16).
Modem control:	Hayes compatible.
Dial-up (modem):	Optional: DTMF or pulse dialling to pre-stored telephone numbers. Up to 20 pre-stored numbers. Each number can be up to 20 digits.

Serial interface / programmer port:

Signal level:	RS232C/v.24.
Hardware handshake:	RTS, CTS
Baud Rate:	Fixed 9600
Format (default):	8 bit (binary), 1 start bit. No parity, 1 stop bit.
Protocol:	Modbus slave (RTU mode).
Error Check:	CRC (16).

CONTROL AND DATA LOGGING

IEC 1131-3 (B-CON)

Program memory (Flash):	23 Kbytes.
Memory usage per instruction line:	6-24 bytes.
Typical maximum program size:	1500 instruction lines.
Scan interval:	50-250 ms.
Internal registers (BM):	2048.

NOTE: Program generated by the GC-10 Configuration tool.

Real time clock

Automatic correction for leap years.

Accuracy:	25°C:	Better than +/- 1 second per day.
	-20 + 50°C:	Better than +/- 5 seconds per day.
Adjustment accuracy:		±1s.
Back-up battery:		Internal Lithium battery (800 mAh).
Back-up time:		min. 2 years (without external battery or mains supply).

Data logging

Cyclic log interval:	0.1, 1, 10 seconds. 1, 10 minutes. 1, 10 hours.
Log memory:	up to 480 kBytes.
Time stamp:	Time, date, year (compressed format).
Resolution:	0.1 second.
Number of log elements:	max. 32.
Log record:	ID, time stamp, process values (max. 120 words), see note 1.

Back-up battery:	Internal Lithium battery (800 mAh).
Back-up time:	min. 2 years (without external battery or mains supply).
Log upload time:	typically 5 seconds per 1k byte @9600 Baud.

POWER SUPPLY/CHARGER

Supply Versions:

	230	24
Supply voltage nominal	110-240V AC/DC	24-48VDC
Supply voltage absolute maximum input range	100-265	20-60V
Mains frequency	40-60 Hz	DC only
Max Power	18W	14W
Outputs:		
Output current, total	0,9 A	2A
Output	12V	12V
external output	+/- 1,5V	+/- 0,5V
Max. current	400mA	400mA
Isolation:		
Input/mains (primary) to electronics	3,75kV	

MODEM

GSM Dual band modem

Standards:	GSM 1800/1900 Class1(1W),GSM phase2.
AT command set:	Based on V.25ter and GSM 07.05 & 07.07. No auto-framing available.
SMS:	Mobile Originated (MO) and Mobile Terminated (MT). Mode Text & PDU point to point.
Cell broadcast:	In accordance with GSM 07.05
Data mode:	Asynchronous 2400, 4800, 9600 bits/s. Transparent / Non-Transparent mode. Mode 3.1 KHz (PSTN) and V110 (ISDN)
Antenna:	External antenna via FME conn.
SIM Card:	Voltages: 3 and 5V supported.
Approvals:	CTR19 and CTR20

GC-10 Wireless Control Box

DIGITAL INPUT/OUTPUT

Inputs:

Input voltage activated:	10-30V DC (note 2,3).
Input voltage deactivated:	Max. 3V DC.
Input current: 12V DC:	Typical 3mA.
24V DC:	Typical 6mA.
Input delay:	Typical 1ms.

Outputs:

External voltage:	10 - 30V DC (note 2,3).
Output voltage drop:	Max. 1.5V (output activated).
Output current:	Max. 0.5A.
Output peak current:	Max. 5A in 1 second (note 2,3).
Output leakage current (off):	Max. 0.5mA.
Output delay:	Max. 1ms.

Isolation
(input or output to electronics,
input to output): 1kV AC.

ANALOGUE INPUT

Inputs: 1 or 2 multiplexed analogue channels with solid state multiplexer (note 1, 5).

Input configuration: Differential (+/ -), flying capacitor type.

Input measuring ranges:

Type no. code	Voltage input	Current input
.V	0-10V	
.A		4-20mA

Resolution:	12 bit, 0-4095.

Input impedance:	Voltage:	V:	100 kOhm.
	Current:	A:	100 Ohm.

Absolute maximum
ratings: Voltage: ±40V DC.
Current: ±30mA DC.

Sampling interval: Min. 100 ms (note 5).
Measuring accuracy:
25°C: ±0.2%±6LSB (typically 0.05%±3LSB).
-10°-55°C: ±0.3%±8LSB (typically 0.1%±4LSB).

Linearity: Better than ± 1LSB.
Temperature stability: Better than ± 50ppm/°C (typical).

Common mode input voltage: Max. ±80V DC (note 1).
Common mode rejection
ratio: Min. 60dB (typical 72dB).
Series mode rejection: Min. 30dB (50-120Hz)

Isolation (input to input): 500V (note 1).

PT100 INPUT

Input: 1 analogue channel for Pt100 temperature sensor.

Input configuration: 3 wires (or 2 wires).

Input measuring ranges: Pt-100
P1: -50 - + 100°C.
Optional Pt1000 and other ranges.

Resolution: 12 bit.

Measuring accuracy: Better than ± 0.5% of FSR.
Linearity: Better than ± 0.1% of FSR (note 16).
Temperature stability: Better than ± 100ppm/°C (typical).
Isolation: No isolation input to electronic.

GENERAL

Indicators:

System:	Indicating GC-10 OK (green)
Power:	Indicating power OK (green)
Rxd/Txd	Indicating serial communication on modem.
Modem:	Indicating modem status (green).

Current consumption / typical values (12V):
UCR-10IO: max. 105 mA.
Modem GSM idle: max. 10mA.

Isolation: IEC class II, 3,75 kV.
(mains supply versions)
Safety earth required.

Ambient temperature: -10 - +55°C.

EMC: EN 50081-1/EN50082-2.

Climatic:

Dry heat:	IEC 68-2-2, Test Bd, Temp. +55°C, Duration 8h.
Cold:	IEC 68-2-1, Test Ad, Temp. -10°C, Duration 8h.
Damp heat:	IEC 68-2-3, Test Ca, Temp. 40°C, RH 95%, Duration 8h.

Mechanical:

Vibration:	IEC 68-2-6, Test Fc (sinusoidal), Freq. 10-150Hz, Amp. 4g, 5 sweeps in 3 orthogonal axes.
Shock:	IEC 68-2-27 (half sine), Acc. 15g, Pulse time 11msec., 3 x 6 shocks.

Protection: IP20.

Mounting: 35 mm DIN-rail, EN50022.

Terminals: Max. 1.5 mm² wire.
Housing: Anodized aluminium with plastic ends.
According to DIN 43880.

Dimensions: HxWxD: 80(+connectors)x162x62 mm.

Brodersen Controls A/S * **Industrivej 3** * **DK-4000 Roskilde** * **Denmark** * **Tel (+45) 4674 0000** * **Fax (+45) 4675 7336**

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TABLE ANALOGUE INPUTS

Integer (binary value) = $\dfrac{\text{Input - range MIN.}}{R}$

where R is the resolution (LSB).

| Input range				Integer (Binary-code)
0-10V	0-5V	0-20mA	4-20mA	
Input [V]		Input [mA]		
<0	<0	<0	<4.0	0
0	0	0	4.0	0
1	0.5	2	5.6	410
2	1.0	4	7.2	819
3	1.5	6	8.8	1229
4	2.0	8	10.4	1638
5	2.5	10	12.0	2048
6	3.0	12	13.6	2457
7	3.5	14	15.2	2867
8	4.0	16	16.8	3276
9	4.5	18	18.4	3686
10	5.0	20	20.0	4095
>10	>5.0	>20	>20.0	4095
2.442mV	1.221mV	4.884uA	3.907uA	Resolution

ANALOGUE TABLE (Pt-100)

Temperature	Range
	-50 - 100°C
	Integer (binary code)
<-50	0
-50	0
-25	683
0	1365
25	2048
50	2730
75	3413
100	4095
125	4095
150	:
200	:
250	:
300	:
300	:

CIRCUIT CONFIGURATION (DIGITAL)
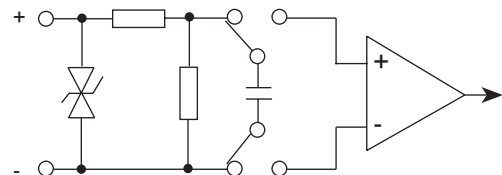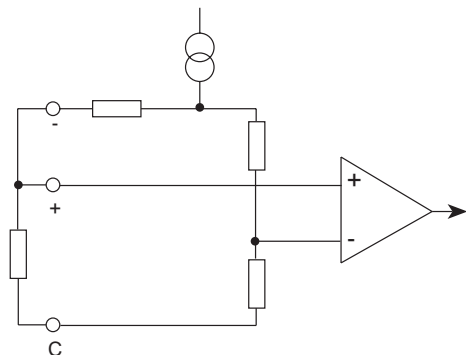
Input
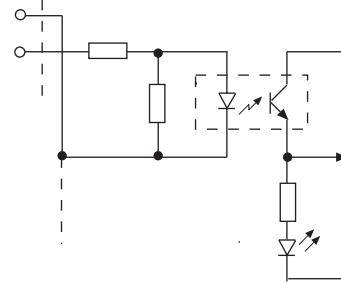
Output (PNP)
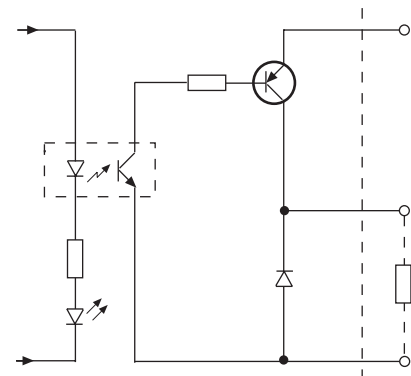
CIRCUIT CONFIGURATION (ANALOGUE)

## CIRCUIT CONFIGURATION (Pt-100)

CONFIGURATION

The GC-10 Configuration tool is used to configure the GC-10 and to pre-define telephone numbers, SMS texts and other alarm and control settings. Refer to separate description in the GC-10 Configuration Tool manual.

NOTES/REMARKS

1) Section A, B and C are isolated from each other. The individual analogue inputs are isolated from each other. Due to protection devices in the analogue inputs the voltage measured from the common (C) terminals to any other terminals must not exceed ±80V.

2) The polarity at the input must be positive. The common terminal must be connected to the negative.

3) Input signals exceeding the maximum values **MAY CAUSE PERMANENT DAMAGE** to the module.

4) Only one analogue input channel is active at a time, the multiplexing is automatic via the built-in micro-controller.
   The actual scan time for the analogues relates to the CPU load and hence the selected interval for the application program. If the application program is executed with a short interval there might not be sufficient time to perform the analogue multiplexing thus resulting in a slow sampling rate (worst case 2 seconds).

Select channel   0 | 1   0

Convert

Sampling time (100-2000 ms)
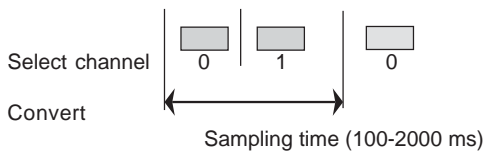
The analog input is represented by an integer (binary number) from 0 to 4095 depending on the input signal, see table above.

5) Depending on the noise level versus signal level, shielded cables and/or twisted pairs might be necessary. The shield of the cable should normally be connected to common (C) of the I/O modules.

6) The 12V external supply is not isolated from the circuit supplying the electronics. It is therefore recommended to use an external source for the I/O if the I/O signals are influenced by electrical noise, e.g. from long cables or inductive load.

7) The external output is short circuit protected and overload protected. The maximum current is limited at high ambient temperature. The maximum load current should be de-rated approximately 1% per °C above 25°C.

Appendix A

TYPICAL LOG UPLOAD TIME

In general the log upload time depend on the size of log and if full log is uploaded at every log upload.
Log upload time can be reduced by only uploading data since last upload.

The typical value given below is just to give an idea of the log upload time.

Application	Speed (baud)	Type	Time
Null Modem/ direct RS232 cable	9600	Full upload	30 minutes.